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Groundwater Impact Assessment Report for the 216-T-4-2 Ditch

D. J. Alexander
S. D. Evelo
V. G. Johnson
M. D. Sweeney

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Westinghouse Hanford Company P.O Box 1970 Richland, Washington

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EXECUTIVE SUMMARY

As required by the *Hanford Federal Facility Agreement and Consent Order*[1] (Tri-Party Agreement Milestone M-17-00A), this report assesses the impact of wastewater discharged to the 216-T-4-2 Ditch on groundwater quality. This assessment expands on the initial analysis conducted between 1989 and 1990 for the *Liquid Effluent Study Final Project Plan*.[2]

Facility Description

The 216-T-4-2 Ditch and accompanying 216-T-4B Pond, located in the northern 200 West Area, were excavated in 1972. They replaced the 216-T-4-1D Ditch and 216-T-4A Pond, which had become radioactively contaminated. The 216-T-4-2 Ditch has been used since 1972 to dispose of liquid effluents from the 221-T Facility. The 216-T-4-2 Ditch occupies the first 15 m (50 ft) of the old 216-T-4-1D Ditch, so both ditches' effluent history were examined in this assessment. The wastewater currently discharged to the 216-T-4-2 Ditch is a mixture of sanitary water, raw water, and steam condensate. The average flow rate, as of July 1994 was 6.54×10^5 liters/month (1.73×10^5 gallons/month) or 15.1 liters/minute (4.0 gallons/minute). Discharges to the ditch are scheduled to cease by June 1995.

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[1]Ecology, EPA, and DOE, 1990, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

[2]WHC, 1990, *Liquid Effluent Study Final Project Plan*, WHC-EP-0367, Westinghouse Hanford Company, Richland, Washington.

Impact Assessment

Based on interpretations of soil column, perched water, and groundwater analytical results from this study, as well as existing groundwater contaminant plume data, the 216-T-4-2 Ditch has little impact on groundwater quality in the northern 200 West Area. Groundwater contaminants near the 216-T-4-2 Ditch include arsenic, gross beta, carbon tetrachloride, chloroform, nitrate, technetium-99, and tritium, which are attributed to upgradient past-practice sources other than the 216-T-4-2 Ditch. The most likely sources for upgradient groundwater contamination are the 241-T Tank Farm, 216-T-32 Crib, 216-T-7TF Crib, 216-T-5 Trench, 216-T-36 Crib, and the Z Plant Complex, which are located to the south/southwest of the 216-T-4-2 Ditch. Potential sources for downgradient contamination are the 216-T-14, -15, -16, and -17 Trenches and the 218-W-3A-E Burial Ground, located to the north/northeast of the 216-T-4-2 Ditch.

Travel time calculations suggest breakthrough to groundwater should have occurred beneath the 216-T-4-2 Ditch for the following constituents of interest: chloride, fluoride, nitrate, potassium, sodium, sulfate, technetium-99, and uranium. These mobile constituents, associated with effluent discharges between 1944 and 1972, should have migrated several kilometers (miles) downgradient in the past 22 years. They may contribute to the residual contaminant plumes in the northeast corner of the 200 West Area.

The other constituents of interest (americium-241, plutonium-238, plutonium-239/240, strontium-90, cesium-137, and others) should still be retained on the soil column. The sediment and water samples taken during drilling of monitoring well 299-W10-22, located approximately 7.6 m (25 ft) from the head end of the ditch, show essentially no evidence of significant soil column contamination. However, very low but detectable concentrations of plutonium-238 (<0.3 pCi/g) and traces of americium-241 and plutonium-239/240 were found in split-spoon sediment samples down to a depth of approximately 15 m (50 ft). This observation, together with the absence of contaminants in the first perched water zone (15.5 m [51 ft]), suggests that if significant soil column contamination exists, it must be located at relatively shallow depths and near the center line of the ditch. Test borings or drive points placed near the center of the 216-T-4-2 Ditch would be needed to establish the actual location and depth of penetration of the potential/expected soil column contaminants. A second possibility for the apparent absence of significant contaminant levels at this site is that, when the ditch was excavated in 1972, the contaminated sediments in it may have been removed and sent to a burial ground for disposal. It is recommended that a few test borings be included along the center of the ditch as part of remediation activities at this site. These test borings should be made to confirm the presence or absence of soil column contaminants after liquid waste discharges have ceased and the "pond" at the head end of the ditch has dried out.

Conclusions

Continued short-term operation of the 216-T-4-2 Ditch will have little effect on groundwater quality in the northern 200 West Area. The new groundwater monitoring well installed at the 216-T-4-2 Ditch as part of this study is adequate under current operating conditions (December 1994) until discharges to the ditch cease in June 1995. If discharges to the 216-T-4-2 Ditch continue beyond June 1995, installation of additional groundwater monitoring wells for this site should be considered.

CONTENTS

CONTENTS (cont)

FIGURES

FIGURES (cont)

TABLES

TERMS

AMU	aqueous makeup unit
CBRG	Columbia River Basalt Group
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
GIA	Groundwater impact assessments
HEIS	Hanford Environmental Information System
HEPA	high-efficiency particulate air (filter)
ICP/AA	inductively-coupled plasma/atomic absorption
LLBG	low-level burial grounds
PWR	Pressurized Water Reactor
PVC	polyvinyl chloride
RCA	Radioactively Controlled Area
RL	U.S. Department of Energy, Richland Operations Office
SCA	surface contamination area
SVOA	semivolatile organics
TC	total carbon
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TOC	total organic carbon
TRU	transuranic
TRUSAF	Transuranic Waste Storage and Assay Facility
VOA	volatile organics
WIPP	Waste Isolation Pilot Project

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GROUNDWATER IMPACT ASSESSMENT REPORT FOR THE 216-T-4-2 DITCH

1.0 INTRODUCTION

Groundwater impact assessments (GIAs) are required for a number of liquid effluent receiving sites in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Milestones M-17-00A and M-17-00B, as agreed on by the U.S. Department of Energy (DOE), Washington State Department of Ecology (Ecology), and U.S. Environmental Protection Agency (EPA) (Ecology et al. 1991). This report assesses the impacts to groundwater from the disposal of effluent to the 216-T-4-2 Ditch (T-4-2 Ditch) in the 200 West Area.

1.1 BACKGROUND

In response to public comments on the original Tri-Party Agreement and at the request of the Tri-Party Agreement signatories, the U.S. Department of Energy, Richland Operations Office (RL) assessed the impact of liquid effluents discharged to the ground at the Hanford Site (WHC 1990b, 1990c). The EPA and Ecology expressed concerns about uncertainties in RL's evaluations. Foremost among these concerns were the lack of site-specific data, the need to consider interactions with adjacent liquid discharge facilities, and the need for more rigorous models of contaminant transport. Therefore, RL, Ecology, and EPA (the three parties) created a series of Tri-Party Agreement Milestones, including M-17-00A, M-17-00B, M-17-13, and M-17-13A, which pertain to GIAs.

Tri-Party Agreement Milestones M-17-00A and M-17-00B require impact assessments for Phase I and II waste streams (Stordeur and Flyckt 1988). Effluents discharged to the T-4-2 Ditch were defined as a Phase I waste stream. Tri-Party Agreement Milestone M-17-13 required a methodology for assessing the impact of liquid effluent discharge on groundwater, which is documented in *A Methodology for Assessing Impacts to Groundwater from Disposal of Liquid Effluent to the Soil at the Hanford Site* (Tyler 1991). Thirty days after regulatory approval of the methodology document, as required by Tri-Party Agreement Milestone M-17-13A, a schedule for performing assessments at 13 receiving sites was completed. The T-4-2 Ditch is one of the receiving sites to undergo a GIA.

The T-4-2 Ditch is scheduled to cease receiving effluent discharges in June of 1995. After that date, all effluent from the T-4-2 Ditch waste stream will be routed to the 200 Areas effluent collection system as part of Hanford Environmental Compliance Subproject W-049H (WHC 1990b).

1.2 METHODOLOGY

The methodology presented in Tyler (1991) was followed in preparing the GIA for the T-4-2 Ditch. Tyler (1991) placed each receiving site into one of three categories based on the effort needed to perform the assessment. A

Level 1 receiving site GIA relies on available information. A Level 2 receiving site GIA may require nonintrusive field work to verify existing contamination. A Level 3 site may require intrusive field work. If existing information proves inadequate during a Level 1 GIA, the level may be raised to 2 or 3.

Tyler (1991) outlines several tasks to be conducted as part of the GIA for Level 1 receiving sites:

- Prepare and present a plan describing how the GIA will be conducted
- Characterize the liquid effluent stream
- Evaluate the site-specific hydrogeology
- Develop a site conceptual model
- Assess the hydrologic impact of the liquid effluent stream
- Assess the contaminant impact of the liquid effluent stream
- Evaluate the adequacy of the existing monitoring well network
- Prepare a written report of the results.

The tasks required for Level 2 and 3 receiving sites are similar to those outlined above, but also include field work-related activities. The T-4-2 Ditch is categorized as a Level 3 receiving site because no monitoring well is located near the ditch and site-specific information related to potential contaminants and contaminant migration is lacking.

Several key assumptions inherent to all GIAs are explained in Tyler (1991). For this GIA, the following assumptions are relevant.

- The expected level of impact from the receiving site determines how well the chemistry, geology, and hydrology need to be understood.

- Modeling sophistication is tailored to available information and the expected level of impact to the receiving site.

- Historical data are fully useable.

2.0 FACILITIES DESCRIPTION

2.1 LOCATION

The Hanford Site is a 1,450-km^2 (560-mi^2) tract of land located in Benton, Franklin, and Grant Counties in south-central Washington State. The 200 West Area is located in the west-central part of the Hanford Site, approximately 37 km (23 mi) northwest of the city of Richland (Figure 1). The T-4-2 Ditch and the T Plant facility (source of the wastewater to the ditch) are located in the north-central to northeast portion of the 200 West Area (Figure 2). No groundwater monitoring wells were associated with the ditch before beginning this GIA. One groundwater monitoring well (299-W10-22) was installed immediately adjacent to and on the downgradient side of the head end of the ditch (Figure 2).

2.2 HISTORY

The T-4-2 Ditch and accompanying 216-T-4B Pond were excavated in 1972, replacing the 216-T-4-1D Ditch (T-4-1D Ditch) and 216-T-4A Pond (T-4A Pond). Several leaks within the 221-T Plant Canyon Building (221-T Building) resulted in radionuclide contaminated effluent being discharged into the original ditch and pond system. The T-4-1D Ditch became contaminated to a maximum level of 20,000 cpm and could no longer be used for effluent disposal. A portion of the T-4-1D Ditch and all of the T-4A Pond were stabilized by backfilling in May 1972. The radionuclide inventory for the ditch is reported as the T-4A Pond system.

The first 15.2 m (50 ft) of the T-4-2 Ditch share the original T-4-1D Ditch location. The ditch then turns 90 degrees to the northeast for approximately 4.6 to 6.1 m (15 to 20 ft), turns to the northwest again and runs parallel to the original T-4-1D Ditch, finally ending in the T-4B Pond (Figure 3). The T-4-2 Ditch is 533.4 by 1.8 by 1.2 m (1,750 by 6 by 4 ft) and has a slope of 1:1.5. Currently, the ditch does not receive enough effluent to reach the T-4B Pond, with only the first 15.2 to 30.5 m (50 to 100 ft) of the ditch consistently getting wet. Standing water can be found within the first 15.2 m (50 ft) of the ditch during most of the year. Also, a large amount of both aquatic and terrestrial vegetation is found within the first 30.5 m (100 ft) of the ditch, which suggests that the effluent occasionally spreads down the ditch at least that far. Beyond the wetted portion of the ditch are signs that the effluent once made it further down the ditch, namely a couple of small trees, shrubs lining the edges of the ditch, and some scattered stands of cattails. Most of this vegetation is dead or dying from lack of a sustained source of water.

2.3 FACILITIES

This section provides a brief description of the T Plant facilities that contribute or contributed effluent to the T-4-2 Ditch. Figure 4 is an aerial view of the T Plant facilities.

Figure 1. Location of the 200 West Area on the Hanford Site.

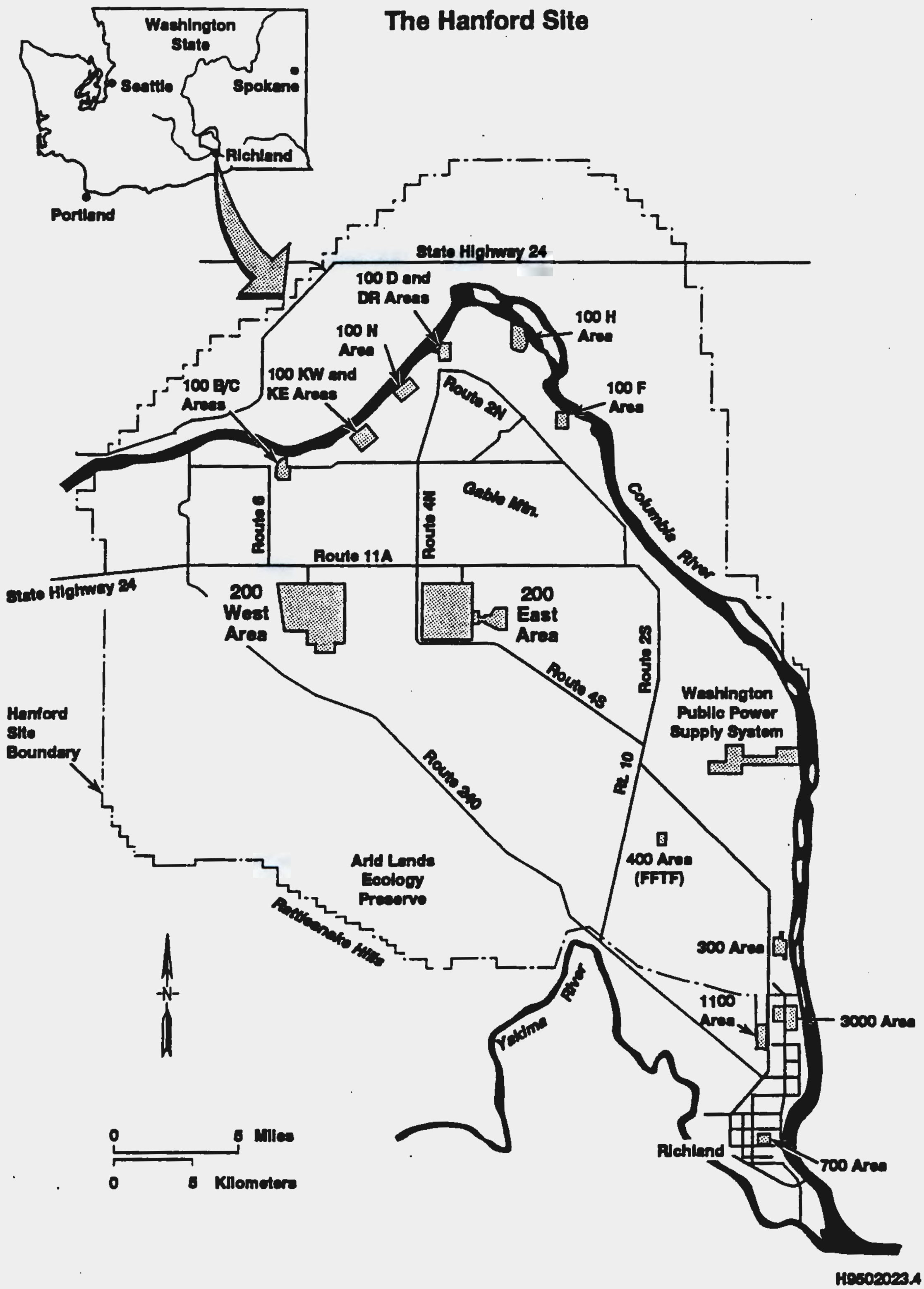


Figure 2. Location of the 221-T Facility and 216-T-4-2 Ditch in the 200 West Area.

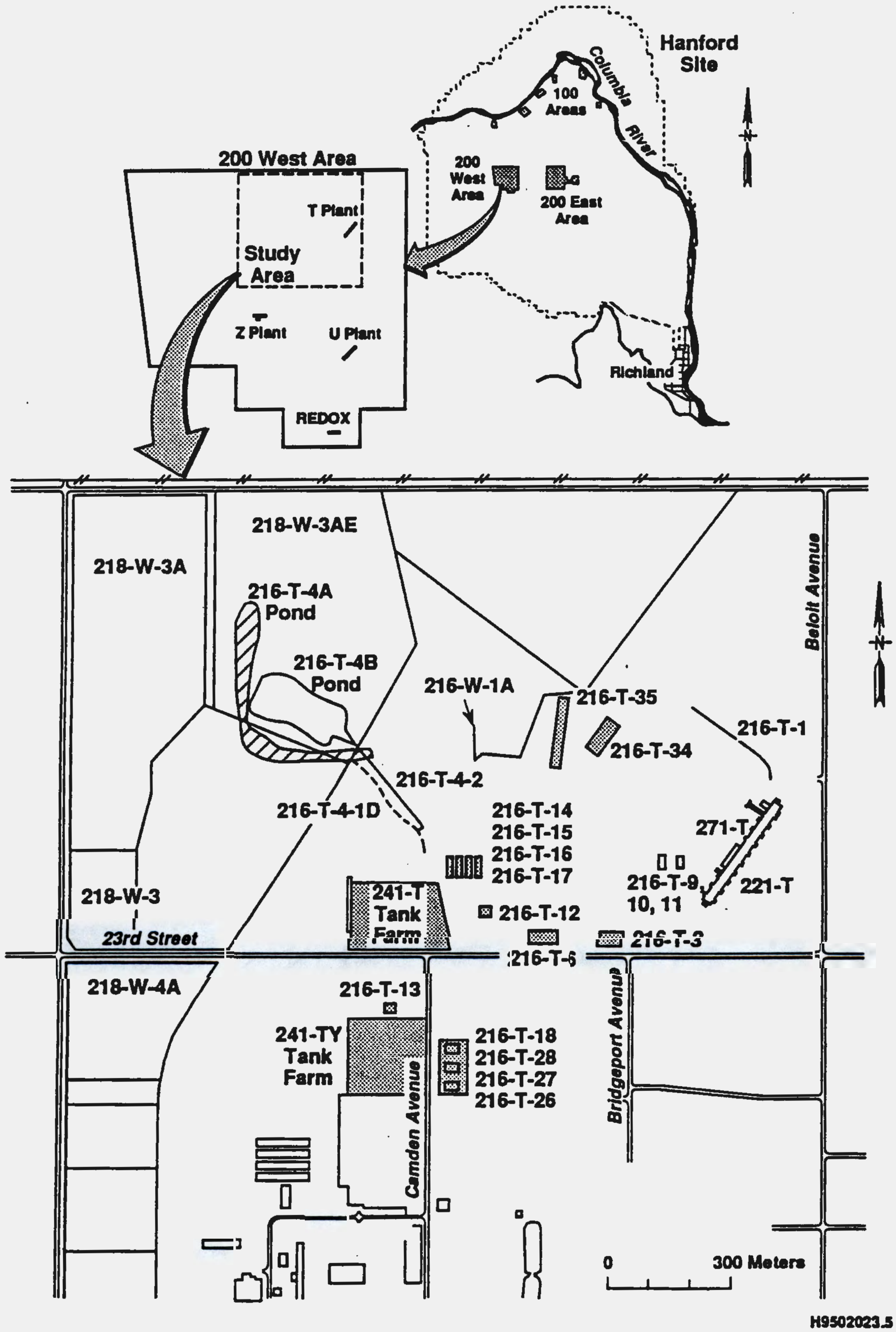
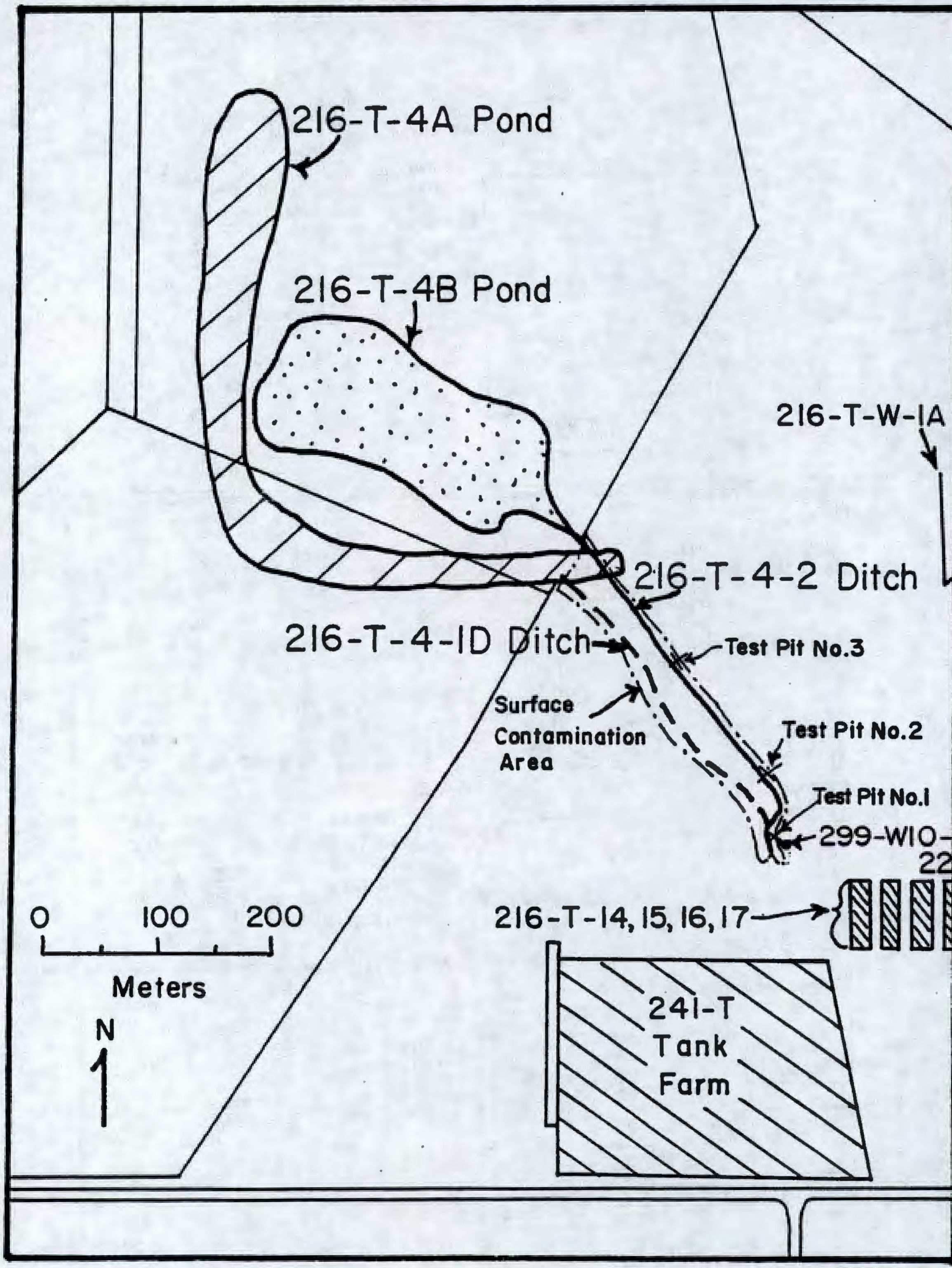


Figure 3. The 216-T-4 Ditch and Pond System.



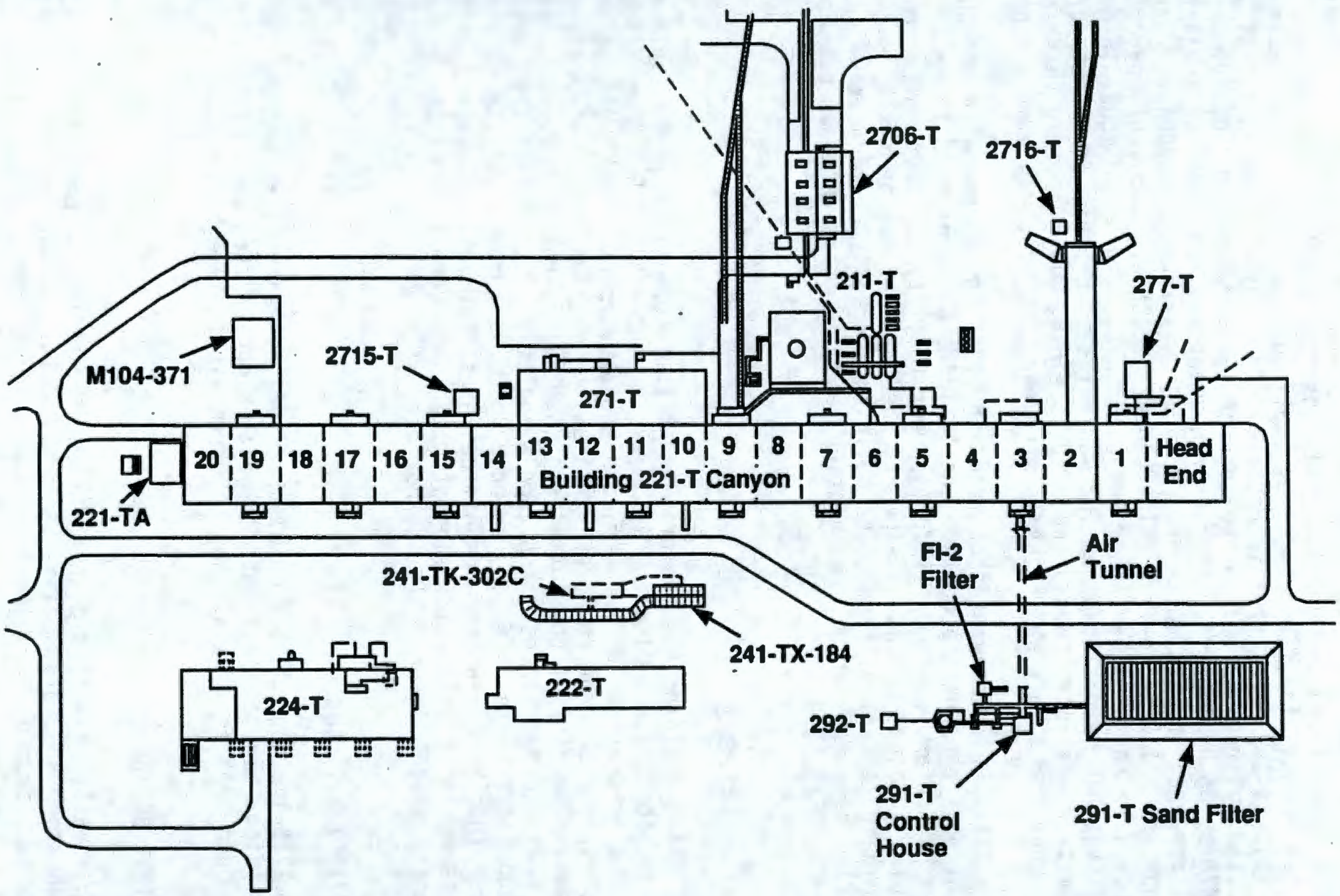


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Figure 4. Aerial View of the T Plant Facilities (WHC 1992).

2.3.1 221-T Building

The 221-T Building is the original bismuth phosphate process separation plant built in 1943 and 1944. The facility was used to chemically extract plutonium from irradiated uranium fuel rods from Hanford Site reactors located in the 100 Areas. The first batch of fuel rods was dissolved on December 26, 1944. This is the first of five Hanford Site "canyon" buildings. It is constructed entirely of reinforced concrete, with dimensions of 266 by 26 by 31 m (875 by 85 by 102 ft). Process equipment was contained in small rooms (cells) arranged in rows in an area spanned by a travelling crane. The cells are topped with 1.2-m- (4-ft-) thick blocks, which are removable by crane to gain access to the cell beneath. Above the blocks, a space equal in height to the cell depth provides headroom for manipulating process equipment during maintenance operations. Heavy concrete shielding walls enclose this space up to the crane level, giving the whole structure the appearance of a canyon.

The 221-T Building was deactivated in 1956, concurrent with the phase-out of the bismuth phosphate process. The building was converted to a decontamination and equipment refurbishment facility in 1957. After removing most of the original process equipment, the head end was partially decontaminated and stabilized. The building currently provides services in radioactive decontamination, reclamation, and decommissioning of process equipment (DOE/RL 1992).

2.3.2 271-T Building

The 271-T Building was the original bismuth phosphate process plant offices and support facility and is adjacent to the 221-T Building. The 271-T Building consists of three floors and a basement. The basement contains the compressor room, fan room for ventilation, various shops, offices, and storerooms. The first floor contains a chemical makeup room where three storage tanks, a maintenance shop, and a health physics office are located. The second floor houses offices, a lunch room, restrooms, and the service elevator. The third floor houses offices, restrooms, the elevator, and storage tanks for nitric acid. The storage tanks were part of the aqueous makeup unit (AMU) and currently are not used.

2.3.3 2715-T Building

The 2715-T Building is a metal shed located adjacent to and west of the 221-T Building. The building was originally constructed as a welding shop and also has been used as a paint shop. Currently, it is used to store equipment.

2.3.4 211-T Building

In the past, bulk liquid chemicals were received in tank cars and stored in four aboveground storage tanks at this building. The tanks stored nitric acid, sodium hydroxide, and low-level radioactive waste. A new sodium hydroxide system replaced the old tank system. The new system's storage tank is located in a concrete area that is bermed to collect all effluent. The 211-T Building also contains a bermed cement pad for less-than-90-day storage of nonradioactive hazardous waste drums.

2.3.5 221-TA Building

The 221-TA Building houses two supply ventilation fans for the 221-T Building. A preheater, an air filter, an evaporative cooler, and a reheat coil are also located in the building to condition the air supply flowing into the canyon.

2.3.6 224-T Building

Originally, the 224-T Building was used to purify plutonium nitrate by the lanthanum fluoride process. It remained inactive until the 1970s, following phase-out of the bismuth phosphate plants. The building was then modified to store plutonium scrap in liquid and solid forms and served this purpose until 1984 when the scrap was removed so the building could be prepared for a new operation. In 1985, the building was designated as the Transuranic Waste Storage and Assay Facility (TRUSAF). The TRUSAF operation consists of nondestructive examination of newly generated, contact-handled, transuranic solid waste to ensure that the packages meet the Waste Isolation Pilot Project (WIPP) criteria.

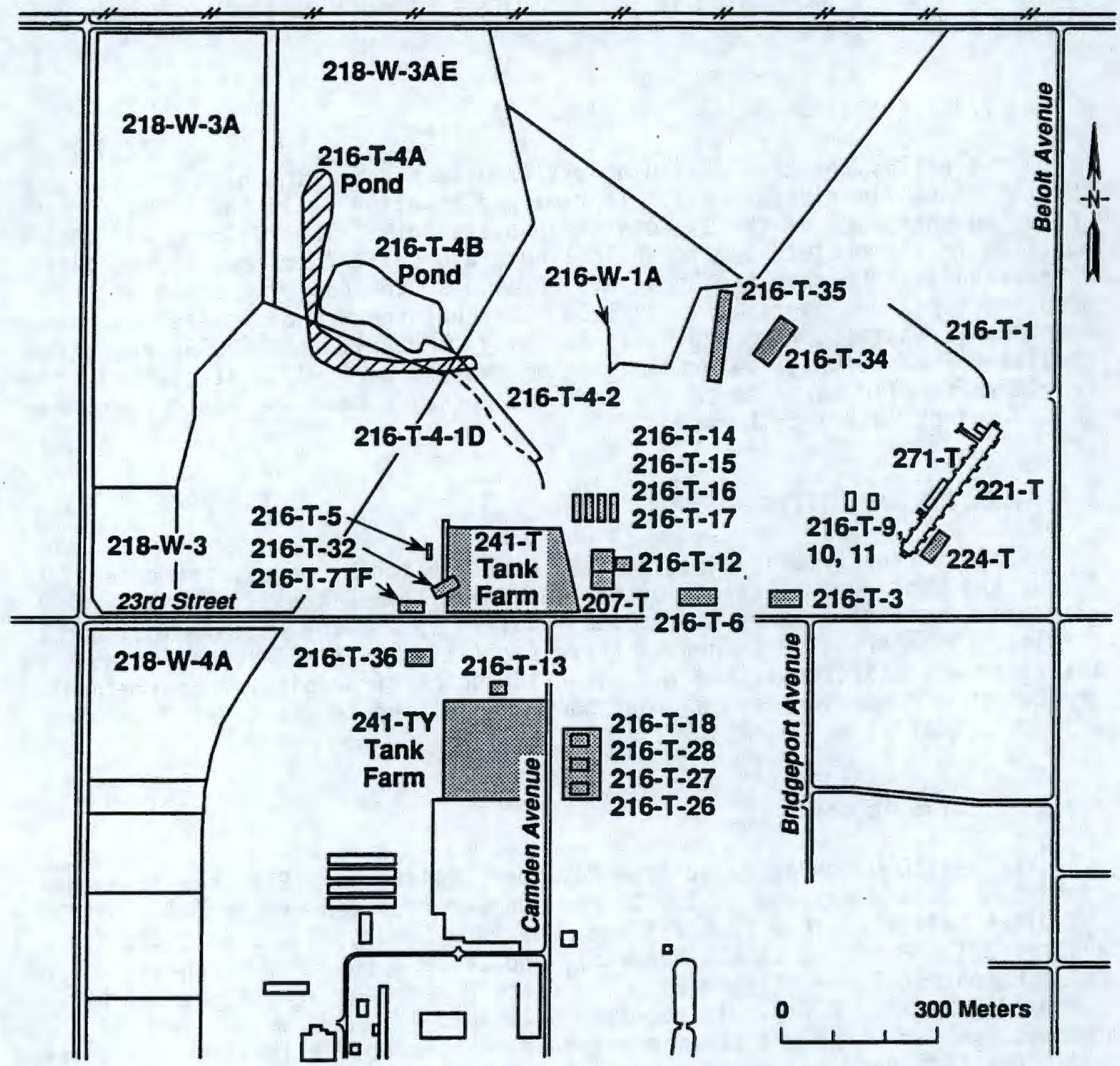
2.4 ADJACENT FACILITIES

This section briefly describes the cribs, ditches, ponds, trenches, tank farms, and unplanned releases located near the T-4-2 Ditch (Figure 5). It also provides estimates of the volume received by and the radiological and chemical inventories contained in these facilities. This information aids in assessing and differentiating the potential point of origin for contaminants present in groundwater, and whether they are related to the T-4-2 Ditch or adjacent facilities (DOE-RL 1992).

2.4.1 216-T-4-1D Ditch

The T-4-1D Ditch operated from November 1944 to May 1972 when it became contaminated to a maximum of 20,000 cpm and was replaced by the T-4-2 Ditch. The ditch begins 231.6 m (760 ft) north of 23rd Street, 741.3 m (2,432 ft) west of 221-T Building at the headwall, and 182.9 m (600 ft) northwest of the 207-T Retention Basin (Figure 5). The ditch dimensions are 259 by 2.4 by 1.2 m (850 by 8 by 4 ft). It received 4.25×10^{10} L (1.12×10^{10} gal) of process cooling water and steam condensate. Radionuclide inventory is covered under the T-4A Pond system in reporting documents and is summarized in Section 2.4.2.

Figure 5. Location of the 216-T-4-2 Ditch in Relation to Adjacent Facilities.



2.4.2 216-T-4A Pond

The T-4A Pond is an inactive site associated with the T-4-1D Ditch. The pond was in service from November 1944 to May 1972, and received 4.25 x 10^{10} L (1.12 x 10^{10} gal) of effluent. The pond is L-shaped and covers 6.5 ha (16 acres) at the northwest end of the T-4-1D Ditch (Figure 5). A number of leaks in the 221-T Building resulted in the release of radionuclide contamination to the pond. Radiation readings taken along the shoreline after the shutdown of the 221-T Building (bismuth phosphate process) ranged from 2,000 to 15,000 cpm (WHC 1991). The pond was stabilized in 1972 by backfilling. In 1973, the pond site was remediated by removing 15 to 23 cm (6 to 9 in.) of soil, which was put into the 218-W-2A Burial Ground. The pond site was then covered with clean soil and seeded with grass to restabilize the area. The radionuclide inventory for the T-4A Pond system includes 3.7 g of plutonium, 27.8 Ci of gross beta, <4.84 Ci of strontium-90, 8.75 Ci of cesium-137, 1.16 Ci cobalt-60, and 695 kg of uranium (Anderson 1976).

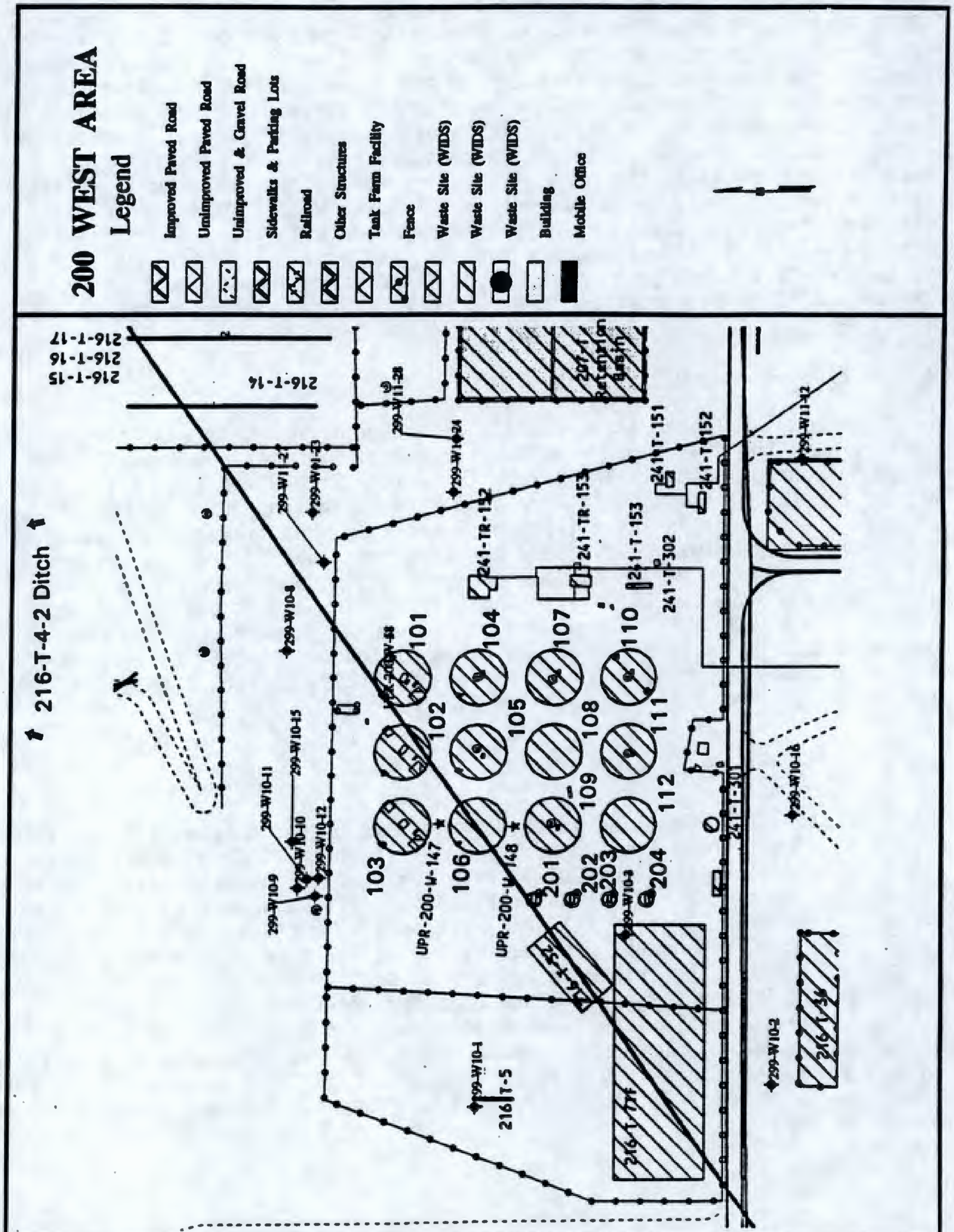
2.4.3 216-T-5 Trench

The 216-T-5 Trench is a specific retention trench that was taken out of service when the prescribed liquid waste volume was attained 1 month after it began operating in 1955. The trench is 15.2 by 3 by 3.7 m (50 by 10 by 12 ft) and is located 91.4 m (300 ft) north of 23rd Street and 305 m (1,000 ft) west of the 207-T Retention Basin (Figures 5 and 6). When it was deactivated, the aboveground piping was removed and the trench was backfilled. It received 2.6 x 10^6 L (6.87 x 10^5 gal) of second-cycle supernatant waste from the 221-T Building via the 241-T-112 Single-Shell Tank. This waste included 3.45 x 10^5 kg (7.6 x 10^5 lb) of inorganic chemical compounds (WHC 1991). The radionuclide inventory includes 180 g plutonium, 0.00152 Ci uranium-238, 31.1 Ci cesium-137, 0.42 Ci of strontium-90, 0.0899 Ci cobalt-60, 10.3 Ci plutonium-239, and 2.77 Ci plutonium-240.

2.4.4 216-T-32 Crib

The 216-T-32 Crib is an inactive unit that operated from November 1946 to May 1952. The crib is located 76.2 m (250 ft) north of 23rd Street and 228.6 m (750 ft) west of the 207-T Retention Basin within the 241-T Tank Farm boundary (Figures 5 and 6). The crib consists of two wooden sumps 3.7 by 3.7 by 1.2 m (12 by 12 by 4 ft) deep, placed 12.2 m (40 ft) apart (Maxfield 1979). The crib dimensions are 20.7 by 4.3 by 7.9 m (68 by 14 by 26 ft), with a slope of 1.5:1. The crib received 2.9 x 10^7 L (7.66 x 10^6 gal) of transuranic (TRU)-contaminated waste from the 224-T Building via the 241-T-201 Single- Shell Tank. The waste contained 2.62 x 10^6 kg (5.77 x 10^6 lb) of inorganic chemical compounds and a radionuclide inventory including 3,200 g plutonium (total), 0.0076 Ci uranium-238, 9.71 Ci cesium-137, 10.9 Ci strontium-90, 0.00827 Ci cobalt-60, 1.83 Ci plutonium-239, and 49.3 Ci plutonium-240.

Figure 6. Layout of the 241-T Tank Farm, Nearby Facilities, and Unplanned Releases.



2.4.5 216-T-14, 216-T-15, 216-T-16, and 216-T-17 Trenches

The 216-T-14, 216-T-15, 216-T-16, and 216-T-17 Trenches are inactive units located 610 m (2,000 ft) west of the 224-T Building and 45.7 m (150 ft) north of the 207-T Retention Basin (Figure 5) (Maxfield 1979). The trenches operated for less than one year (1954). The trenches were deactivated when they reached the prescribed liquid waste volume for their specific retention capacity. The aboveground piping was removed and the units backfilled. The trenches are 83.8 x 3 x 3 m (275 x 10 x 10 ft) and all received first-cycle supernatant waste from 221-T Building via the 241-T-104, 105, and 106 Single-Shell Tanks. The 216-T-14, 216-T-15, and 216-T-16 Trenches received 1 x 10^6 L (2.64 x 10^5 gal) of waste each. The 216-T-17 Trench received 7.85 x 10^5 L (2.07 x 10^5 gal) of waste. The radionuclide inventory for the trenches is given in Table 1.

Table 1. Radionuclide Inventory for the 216-T-14, 216-T-15, 216-T-16, and 216-T-17 Trenches (DOE-RL 1992).

Trench	Pu (g)	^{238}U (Ci)	^{137}Cs (Ci)	^{90}Sr (Ci)	^{60}Co (Ci)	^{239}Pu (Ci)	^{240}Pu (Ci)
216-T-14	0.88	0.0102	204	2.46	0.236	0.05	0.14
216-T-15	0.94	0.00911	450	8.62	0.188	0.05	0.01
216-T-16	0.65	0.00743	227	3.28	0.204	0.04	0.10
261-T-17	0.53	0.0068	162	1.23	0.016	0.30	0.008

2.4.6 241-T Tank Farm

The 241-T Tank Farm is located northwest of the Camden Ave and 23rd Street intersection (Figure 5). The tanks in the T Tank Farm were constructed in 1943 to 1944 using two different designs; in both designs the tanks are vertical cylinders with domed tops and are constructed of reinforced concrete with carbon steel liners on the base and sides of the vessel. The tank farm contains 16 single-shell tanks; 12 of which have a 23-m (75-ft) diameter with a capacity of 2.02 x 10^6 L (5.33 x 10^5 gal) and four of which have a 6.1-m (20-ft) diameter with a capacity of 208,000 L (55,000 gal) (Figure 6). Table 2a lists the tank contents and the volume of waste received for the 16 tanks in the farm. Table 2b lists the tank inventory as of 1992 and summarizes the condition of the tanks.

2.4.7 UPR-200-W-147 and UPR-200-W-148

Unplanned releases UPR-200-W-147 and -148 are described in Table 3.

Table 2a. Tank Contents and Waste Received for the 241-T Tank Farm Single-Shell Tanks (DOE-RL 1992).

Tank	Source Description/Type	Waste Volume Received - L (gals)
241-T-101	Bismuth phosphate metal waste, tributyl phosphate, supernatant containing coating waste, REDOX ion exchange waste, REDOX HLW, PNL, decontamination waste, evaporator, bottom 224-U waste/MW	504,000 (133,143)
241-T-102	Bismuth phosphate metal waste, REDOX coating supernatant containing REDOX HLW, evaporator bottoms, B Plant ion exchange, and B Plant LLW from tank farms/MW	122,000 (32,229)
241-T-103	Bismuth phosphate metal waste, coating waste, and supernatant containing B Plant LLW, REDOX ion exchange, REDOX HLW, and evaporator bottoms/MW	103,000 (27,210)
241-T-104	Bismuth phosphate first-cycle waste/MW	445,000 (117,557)
241-T-105	Bismuth phosphate first-cycle and second-cycle waste, REDOX coating, decontamination waste, Hanford Laboratory operations waste, supernatant containing LLW, and ion exchange waste from tanks/MW	371,000 (98.008)
241-T-106	Bismuth phosphate first-cycle and supernatant containing coating waste, B Plant LLW, and ion exchange waste from tank farms/MW	80,000 (21,134)
241-T-107	Bismuth phosphate first-cycle, tributyl phosphate, supernatant containing bismuth phosphate first-cycle, ion exchange, and coating waste from tank farms/MW	682,000 (180,166)
241-T-108	Tributyl phosphate, bismuth phosphate first-cycle, Hanford Laboratory operations waste, supernatant tributyl phosphate, B Plant LLW, ion exchange, and evaporator bottoms from tank farm/MW	167,000 (44,117)
241-T-109	Bismuth phosphate first-cycle, tributyl phosphate, and supernatant containing tributyl phosphate, ion exchange, evaporator bottoms, and PNL waste from tank farm/MW	220,000 (58,118)
241-T-110	Bismuth phosphate second-cycle and 224-U Building waste/MW	1,435,000 (379,088)
241-T-111	Bismuth phosphate second-cycle and 224-U Building waste/MW	1,734,000 (458,076)
241-T-112	Bismuth phosphate second-cycle waste, PNL waste, and supernatant containing B Plant LLW, ion exchange from 241-T tanks, and decontamination waste/MW	254,000 (67,100)
241-T-201	224-U Building waste/MW	110,000 (29,059)
241-T-202	224-U Building waste/MW	80,000 (21,134)
241-T-203	224-U Building waste/MW	133,000 (35,135)
241-T-204	224-U Building waste/MW	144,000 (38,041)

Waste Type: HLW - high-level waste
LLW - low-level waste
MW - mixed waste

PNL Pacific Northwest Laboratory
REDOX Reduction Oxidation (S Plant)

Table 2b. 241-T Tank Farm Waste Inventory and Tank Status (DOE-RL 1992).

Tank	Condition/ Integrity	Interim Stabilized	Isolated	Total Waste Volume Remaining L (gal)	Drainable Waste Volume L (gal)
241-T-101	Sound	No	PI	504,000 (133,143)	132,500 (35,003)
241-T-102	Sound	Yes	II	121,200 (32,018)	49,200 (12,997)
241-T-103	Assumed Leaker	Yes	II	102,200 (26,998)	15,100 (3,989)
241-T-104	Sound	No	PI	1,684,400 (444,973)	189,300 (50,008)
241-T-105	Sound	Yes	II	370,900 (97,982)	87,100 (23,009)
241-T-106	Assumed Leaker	Yes	II	79,500 (21,002)	7,600 (2,008)
241-T-107	Assumed Leaker	No	PI	681,300 (179,981)	83,300 (22,006)
241-T-108	Assumed Leaker	Yes	II	166,500 (43,985)	0
241-T-109	Assumed Leaker	Yes	II	219,500 (57,986)	0
241-T-110	Sound	No	PI	1,434,500 (378,956)	159,000 (42,003)
241-T-111	Assumed Leaker	No	PI	1,733,500 (457,944)	193,000 (50,985)
241-T-112	Sound	Yes	II	253,600 (66,994)	26,500 (7,001)
241-T-201	Sound	Yes	II	109,800 (29,006)	15,100 (3,989)
241-T-202	Sound	Yes	II	79,500 (21,002)	7,600 (2,008)
241-T-203	Sound	Yes	II	132,500 (35,003)	15,100 (3,989)
241-T-204	Sound	Yes	II	143,800 (37,988)	15,100 (3,989)

PI = Partially interim isolated. II = Interim isolated.

Table 3. Unplanned Releases in the Vicinity of the 216-T-4-2 Ditch (DOE/RL 1992).

Unplanned Release Number	Location	Date	Reported Waste-Related History
UPR-200-W-147	Southeast side of the 241-T-103 Single-Shell Tank (200-TP-6)	1973	• Contamination encountered while monitoring wells were being drilled to track tank leak. • Leak possibly resulted from a failed grout seal in a spare entry line. • Spill was approximately 5 m^3 (177 ft^3) of liquid.
UPR-200-W-148	7 m (23 ft) from 241-T-106 Single-Shell Tank	4/20/73	• Leak suspected to have started during a routine filling operation, but not detected until June 8, 1973. • 435,321 L (115,000 gal) of fluid released to ground. • Fluid contained approximately 40,000 Ci of cesium-137, 14,000 Ci of strontium-90, and 4 Ci of plutonium, along with various other fission products. • Leak contaminated over 25,000 m^3 (882,862 ft^3) of soil. • Leak possibly resulted from corrosion of aging (29 to 30 years old) carbon steel tank by the caustic waste solution.

3.0 EFFLUENT CHARACTERISTICS

This section focuses on the physical and chemical characteristics of the wastewater effluent discharged to the T-4-2 Ditch from 1944 to the present (this includes the entire T-4 ditch and pond system). The entire system is covered because the T-4-2 Ditch and the T-4-1D Ditch share the first 15.2 m (50 ft). Historical discharges are also considered to assess potential effects on or characteristics of the soil column beneath the ditch. In addition, these discharges enter into the determination of contaminant migration to groundwater (which is discussed further in later sections).

3.1 LAYOUT AND SYSTEM OPERATION

The T-4-2 Ditch waste stream is commonly referred to as the "chemical sewer" in most T Plant effluent documents. The following describes the locations of the discharge points to the chemical sewer system for the buildings that contribute to the waste stream. Figure 7 has two parts that illustrate the general wastewater flow schematic for (a) buildings into manholes and (b) the manhole configuration to the T-4-2 Ditch. Figure 8 shows the piping diagram for the T Plant/T-4-2 Ditch effluent system.

Building 221-T effluents are discharged to two manholes. The headers in Sections 3 to 13 empty to Manhole 1 and the headers in Sections 14 to 18 and 20 empty to Manhole 3. Floor drains located throughout the pipe and operating galleries collect safety shower water and nonradioactive liquids used for housekeeping and maintenance activities. The electrical gallery has sumps at each of the 18 sections. These sumps collect liquids used for housekeeping and maintenance. Full sumps must be tested for radioactivity; if none is detected, they are pumped out and the contents transferred to the chemical neutralization system at Section 12 (WHC 1990a).

The 221-TA Building steam condensate from the preheater and reheater coils drains to Manhole 5 (WHC 1990a).

The 224-T Building has two outlets to the chemical sewer; steam condensate and cooling water from the fan room on the first floor empty into Manhole 5 and steam condensate and overflow from the hot water tank empty into Manhole 6 (WHC 1990a).

The 271-T Building discharges to Manholes 2 and 3. Manhole 2 receives effluent from the floor drains on the first and third floors. Manhole 3 receives effluent from a sump that collects effluent from all the floor drains and sinks in the basement; cooling water from air compressors and the heating, ventilation, and air conditioning unit; and steam condensate from the second floor (WHC 1990a).

The 291-T Stack drains effluents from the bottom of the stack and steam condensate from the heating coil for the FI-2 filter unit into Manhole 8 (WHC 1990a).

The remainder of Section 3.1 is a facility/waste stream-specific discussion that explains in detail the three types of discharges to the chemical sewer system and the individual components of each.

Figure 7. General Wastewater Flow Schematic for (a) Buildings into Manholes, and (b) Manhole Configuration to the T-4-2 Ditch (WHC 1990a).

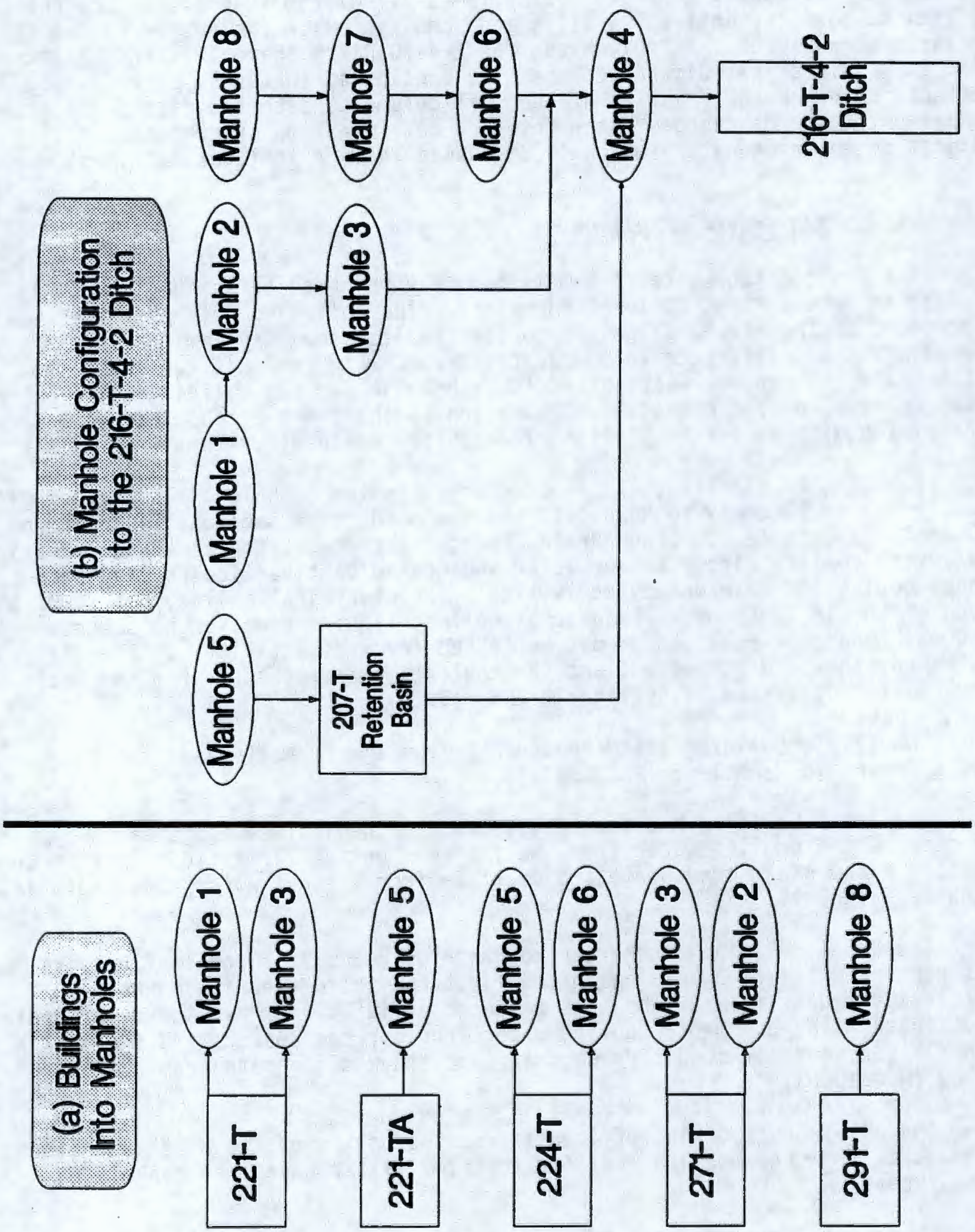
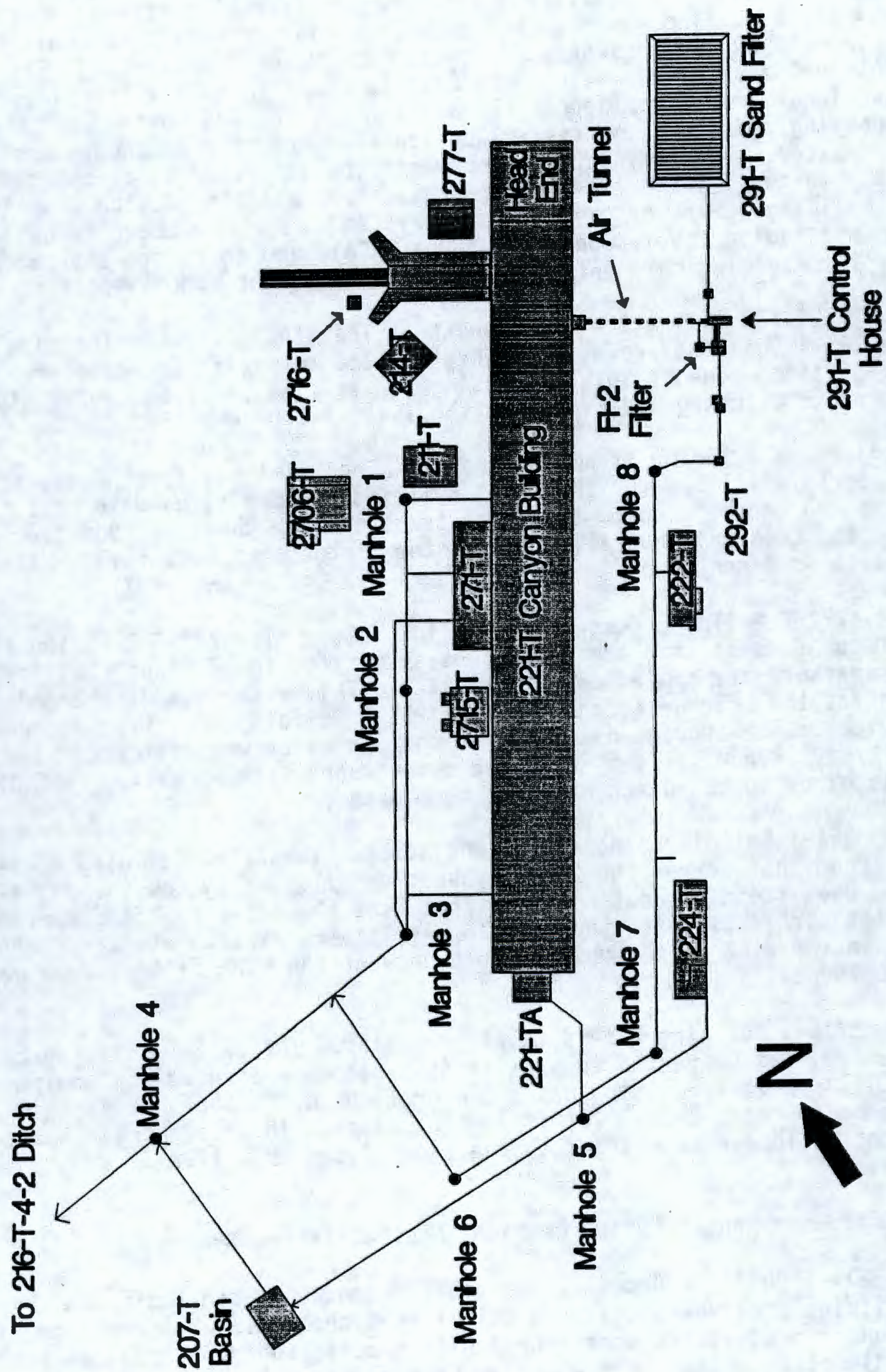


Figure 8. Piping Diagram for the T Plant/216-T-4-2 Ditch Effluent Disposal System (WHC 1990a).



3.1.1 Effluents Routed Directly to the T-4-2 Ditch

3.1.1.1 221-T Building Spent Fuel Storage Secondary System Cooling Water. The 221-T Building pipe gallery houses the refrigeration system, which dumps heat to waste cooling water on the secondary side. The system cools the pool water in Cell 2R, which stores 76 Pressurized Water Reactor (PWR) Core 2 blanket fuel assemblies, which were used to power the DOE's Shippingport Reactor located in Shippingport, Pennsylvania. The pool water and accompanying refrigeration system are isolated from the secondary system waste cooling water. The secondary system waste cooling water is discharged directly to the T-4-2 Ditch through a header located in Section 3 of the 221-T Building. Part of the secondary system is open in the pipe gallery, which is a Radioactively Controlled Area (RCA), and therefore the potential exists for radiological contamination to the effluent (WHC 1992).

3.1.1.2 221-T Building Steam Condensate. The steam lines in the pipe gallery of the 221-T Building are used for heating and to assist in transferring (steam-jetting) aqueous solutions using jumper lines. Steam condensate collected is discharged directly to the T-4-2 Ditch (WHC 1992).

3.1.1.3 271-T Building Steam Condensate. The 271-T Building houses offices and support facilities for the 221-T Building. Steam is used to heat the building and can be used to steam-jet transfer from the 271-T Building basin sump to the chemical neutralization system if the sump pump fails. Steam condensate is discharged directly to the T-4-2 Ditch (WHC 1992).

3.1.1.4 271-T Building Compressor Cooling Water. The 271-T Building contains two air compressors that supply compressed air for the T Plant facility. The air compressors are cooled using raw water. This water was discharged through a header at the southwest corner of the 271-T Building directly to the T-4-2 Ditch. The average discharge of cooling water was estimated at 32,554 L/day (8,600 gal/day) when the compressors were operating (WHC 1992). This discharge to the ditch has been terminated.

3.1.1.5 291-T Building Sand Filter and Stack. The 291-T Building houses the control room that serves the 291-T exhaust ventilation system. The 291-T Building uses steam in heating coils that heat the 221-T Building canyon air before the air is filtered through high-efficiency particulate air (HEPA) filters in the FI-2 filter unit to help prevent the HEPA filters from getting wet (WHC 1990a).

3.1.1.6 2715-T Building Liquid to Floor Drains. The 2715-T Building housed a welding shop, was converted to a paint shop, and now is used for equipment storage. The 2715-T Building has a center floor drain that drains into 15.2- and 30.5-cm (6- and 12-in.) vitrified clay pipes. The floor drain has been capped and no longer discharges to the T-4-2 Ditch (WHC 1992).

3.1.2 Effluents Routed to the Chemical Neutralization System

3.1.2.1 211-T Building Chemical Storage Effluent. In the past, the 211-T Building received and stored bulk liquid chemicals. It contained four aboveground storage tanks that stored nitric acid, sodium hydroxide, and low-level radioactive waste. A new sodium hydroxide system was installed in a concrete area that is bermed to collect all effluent. The 211-T Building also contains a cement pad with a berm, for less-than-90-day storage of nonradioactive hazardous waste drums. The effluent collected under normal conditions is storm water, which is manually transferred to the 271-T Basin Sump, then to the chemical neutralization system, and finally discharges to the T-4-2 Ditch through the header in Section 13 of the 221-T Building (WHC 1992).

3.1.2.2 Concrete Loading Area Next to Door 13 of 271-T Building. Storm water is collected and flows to the 271-T Basin Sump and is discharged to the chemical neutralization system for disposal to the T-4-2 Ditch (WHC 1992).

3.1.2.3 Liquid from 221-T Building Electrical Gallery Sumps. The 221-T Building electrical gallery has sumps at each of its 18 sections. These sumps collect liquids from the floor that result from housekeeping and maintenance activities. When the sumps are full they are sampled and analyzed for radioactive material; if none is detected, the liquid is manually pumped to the 271-T Basin Sump and discharged to the chemical neutralization system for disposal to the T-4-2 Ditch. Because the electrical gallery is a RCA, the potential for radioactive contamination in T-4-2 Ditch effluent exists (WHC 1992).

3.1.2.4 271-T Building Swamp Coolers. The 271-T Building is swamp cooled during the summer. The swamp cooler uses sanitary water; therefore, effluent is not likely to contain either radioactive or hazardous material. The effluent flows to the 271-T Building Basin Sump, where it is routed to the chemical neutralization system, and then discharged to the T-4-2 Ditch (WHC 1992).

3.1.2.5 Liquid from Floor Drains in 271-T Building. Maintenance activities in the 271-T Building result in the infrequent discharge to the floor drains. These floor drains are routed directly to the chemical neutralization system catch tank via a 7.6-cm (3-in.) stainless steel and polyvinyl chloride (PVC) pipe. The effluent is not expected to be either radioactive or hazardous. However, the floor drains are in a RCA, therefore the potential exists for radioactive contamination of the effluent (WHC 1992).

3.1.2.6 Liquid from Floor Drains Located Beneath the AMU Storage Tanks in 271-T Building. Liquid from the floor drains located beneath the AMU storage tanks is routed directly to the chemical neutralization system catch tank via PVC and stainless steel piping. The storage tanks are located on the first and third floors. The third-floor tanks are scheduled to be removed and are currently empty; the first-floor tanks contain caustic and permanganate. The floor drains are in a RCA, so the potential for radioactive contamination of the effluent exists (WHC 1992).

3.1.2.7 Liquid from Floor Drains in 221-T Building Pipe and Operating Galleries. Most of the floor drains located in the 221-T operating gallery have been plugged. The others are routed to the pipe gallery via 7.6-cm (3-in.) stainless steel lines. The liquid collected from the pipe gallery floor drains is routed to the chemical neutralization system catch tank via 7.6-cm (3-in.) PVC and stainless steel lines for discharge to the T-4-2 Ditch. Most of the liquid is from the routine testing of the safety showers, which use sanitary water. The drains are located in an RCA; therefore the potential for radioactive contamination of the effluent exists (WHC 1992).

3.1.2.8 221-T Building Electrical Gallery Sink and Floor Sump. The south end of the electrical gallery in the 221-T Building has a utility sink that drains to a floor sump. A sump pump transfers liquid into lines from the pipe and operating gallery floor drains, which drain into the chemical neutralization system catch tank. The south end of the electrical gallery once contained an electrical maintenance laboratory. The laboratory is no longer at this location. No activities associated with radioactive or hazardous materials are performed in the area. However, the electrical gallery is a RCA, so the potential for radioactive contamination of the effluent exists. Effluent from this source is composed of housekeeping and maintenance liquids (WHC 1992).

3.1.3 Effluents Routed to the 207-T Retention Basin

The 207-T Retention Basin is a concrete retention pool divided into two parts. Its outer dimensions are 75.3 by 37.5 m (247 by 123 ft). The two inner portions have equal dimensions of 32.3 by 32.0 m (106 by 105 ft). Liquid can be contained in the basin up to a depth of 2.0 m (6.5 ft), which is a capacity of approximately 3,785,400 L (1,000,000 gal). From 1944 to 1976, the basin received process or evaporative cooling water from the 221-T, 224-T, and 242-T Buildings. Since 1976, the basin has only received steam condensate from the 221-TA Building and steam condensate and cooling water from the 224-T Building. Discharge to the T-4-2 Ditch from the 207-T Retention Basin is performed by manually operating a valve. Since 1976, the amount of effluent sent to the T-4-2 Ditch from the retention basins has been substantially reduced.

3.1.3.1 221-TA Building Steam Condensate. Steam is used for the preheater and reheater coil that heat the 221-T Building canyon area. Steam condensate from the building is discharged directly to the 207-T Retention Basin (WHC 1992).

3.1.3.2 224-T Building Steam Condensate and Cooling Water. Steam is used for building heating; sanitary water is used for the hot water heater and for cooling water in the fan room. The steam condensate and cooling water are discharged to the 207-T Retention Basin (WHC 1992).

3.2 DISCHARGE VOLUME AND FLOW RATE

Presently the effluent wastewater stream is mostly a mixture of sanitary water, raw water, and steam condensate. The flow or amount being discharged to the T-4-2 Ditch varies significantly because the flow rate depends on the amount of steam being used and the volume of steam condensate being generated (e.g. in colder months the volume is greater). Currently no flow meters monitor the T-4-2 Ditch, so discharge volume is estimated based on historical documentation and process knowledge. The volume released to the T-4-2 Ditch from 1944 to 1975 was 4.24×10^{10} L (1.12×10^{10} gal) (Anderson 1977) and from 1976 to 1984 the volume discharged was estimated to be 8×10^8 L (2×10^8 gal). All discharge to the T-4-2 Ditch is scheduled to cease in June 1995. Figure 9 is a flow diagram of contributors to the T-4-2 Ditch. Table 4 lists the facilities that contribute and gives general information on effluent composition and estimated flow rates.

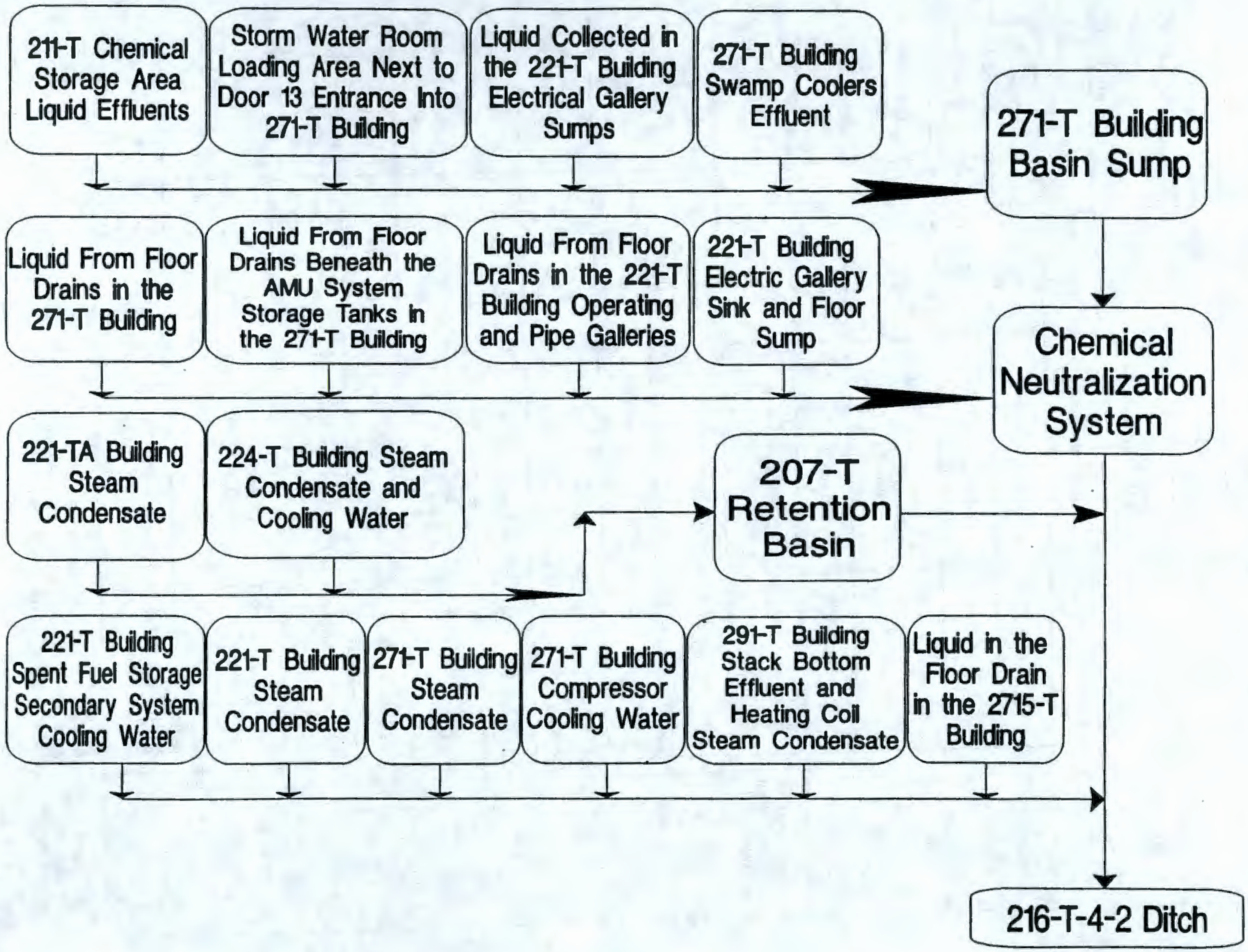


Figure 9. Contributors to the T-4-2 Ditch.

Table 4. Contributors and General Flow Rates for the 216-T-4-2 Ditch.

Type of Discharge	Facility	Effluent	Past flow rate L/day (gal/day)	Present flow rate L/day (gal/day)
Direct	221-T Building	Cooling water from the spent fuel storage secondary system	32,554 (8,600)	Currently off-line, no discharge
	221-T Building	Steam condensate	0 to 379 (0 to 100)	same
	271-T Building	Steam condensate	7,192 to 7,571 (1,900 to 2,000)	0 to 1,893 (0 to 500)
	271-T Building	Compressor cooling water	32,554[1] (8,600)[1]	Discharge terminated
	291-T Building	Effluents from bottom of stack and steam condensate from heating coil	8,706 to 9,464 (2,300 to 2,500)	Estimate not available
	2715-T Building	Floor drains	Estimate not available	No effluent generated[2]
Monitored by Chemical Neutralization	211-T Building	Chemical storage effluent	0 to 7.6 (0 to 2)	Storm water, estimate not available
	Concrete pad next to door 13 of 271-T Building	Storm runoff	Storm water, estimate not available	Storm water, estimate not available
	221-T Building	Liquid from electrical gallery sump	0 to 76 (0 to 20)	same
	271-T Building	Swamp cooler effluent	M - 568 (150) A - 0 to 379 A - (0 to 100)	0 to 39 (0 to 10)
	271-T Building	Floor drains	0 to 379 (0 to 100)	0 to 39 (0 to 10)
	271-T Building	1st and 3rd floor drains beneath AMU system	No effluent generated[3]	No effluent generated[3]
	221-T Building	Operating and pipe galleries floor drains	0 to 114 (0 to 30)	0 to 39 (0 to 10)
	221-T Building	Sink to floor sump south end of electrical gallery	Effluent volume varies, estimate not available	Effluent volume varies, estimate not available
207-T Retention Basin	221-T, 224-T, and 242-T Building 221-T, 224-T, and 242-T Building	Process and evaporator cooling water	0 to 76 (0 to 20)	Same
	221-TA and 224-T Building	Steam condensate and cooling water	0 to 1,968 (0 to 520) A - 39 (10)	M - 946 (250) A - 0 to 189 A - (0 to 50)

[1]Estimated flow when compressors are operating.
[2]Floor drain is capped and discharge to the system can no longer occur.
[3]Under normal conditions, no effluent would be generated.

AMU = aqueous make up
ENA = estimate not available
ESW = effluent--storm water
EVV = effluent volume varies
NEG = no effluent generated (under normal conditions).

3.3 EFFLUENT HISTORY AND CONSTITUENTS

The T-4-2 Ditch began receiving effluent wastewater in 1972. However, the T-4-1D Ditch (the predecessor to the T-4-2 Ditch), shared the first 15.2 m (50 ft) of the present ditch. Therefore, we will consider the effluent characteristics for both ditches. Historical releases of radiological constituents to the ditch are summarized in Table 5, and include the years since the start up of the T Pond system in 1944 through 1975 (Anderson 1976). Additional radiological information on standing water in the ditch, aquatic vegetation, and surface sediment samples can be obtained from the Westinghouse Hanford Company Operation Environmental Monitoring Annual Reports. According to DOE/RL (1992), the total radionuclide inventory for the T-4-2 Ditch (summarized in the T-4B Pond system) contains the following:

- 3.71 g of plutonium
- 0.232 Ci of uranium-238
- 6.23 Ci of cesium-137
- 3.37 Ci of strontium-90.

Because records of chemical constituents were not kept until 1985, we must rely on process knowledge to determine what chemicals had the potential to enter the T Pond System (T-4-1D Ditch/T-4A Pond and T-4-2 Ditch/T-4B Pond). We know that from 1944 to 1956 the bismuth phosphate process operated at the T Plant facilities that discharged to the T Pond System. Table 6 lists the chemicals that were used in the bismuth phosphate process and estimates of their quantities. For a more detailed description of the bismuth phosphate process and T Plant history see WHC-MR-0452 (Gerber 1994). According to the *Facility Environmental Monitoring Plan* (Nickels, et al. 1991), which is currently under revision, the following chemicals could have entered the effluent wastewater:

- acetone
- acetic acid
- ammonium citrate
- ammonium hydroxide
- mercury
- methanol
- nitric acid
- phosphoric acid
- potassium permanganate
- sodium
- sodium hydroxide
- sodium nitrite
- zinc.

These chemicals have been phased out at the facility and are no longer able to enter the effluent stream. Known contaminants in the effluent are shown in Figures 10 through 16. The figures are time series plots of annual average concentrations for those constituents detected in the effluent from 1985 to the present. The only constituent that appears to be elevated with respect to Hanford Site background averages is total organic carbon (TOC) (Johnson 1993a). A comparison of the total carbon (TC), which is the sum of the inorganic carbon plus the organic carbon and the alkalinity, which is used to determine inorganic carbon, indicates that some carbon is unaccounted for. The data shown in Table 7a is reported in the *T Plant Wastewater Stream-Specific Report* (WHC 1990a) and was used to determine the carbon mass balance.

The report did not indicate how the alkalinity results were reported, therefore the assumption was made that the alkalinity was reported as $CaCO_3$ or as HCO_3^-. Table 7b shows the values that correspond to this assumption.

Table 5. Radiological Input to the T Pond System (Anderson 1976). (2 sheets)

Year	Volume (L)	Pu (gm)	Beta (Ci)	Sr-90 (Ci)	Ru-106 (Ci)	Cs-137 (Ci)	Co-60 (Ci)	U (Kg)
1944	1.72 E+09	NR	NR	NR	NR	NR	NR	31
1945	2.07 E+10	<0.01	NR	NR	NR	NR	NR	37
1946	2.07 E+10	<0.01	NR	NR	NR	NR	NR	37
1947	2.07 E+10	<0.01	NR	NR	NR	NR	NR	37
1948	2.07 E+10	<0.01	NR	NR	NR	NR	NR	37
1949	2.07 E+10	<0.01	NR	NR	NR	NR	NR	37
1950	3.46 E+10	<0.01	1.0	NR	NR	NR	NR	37
1951	3.46 E+10	<0.01	1.0	NR	NR	NR	NR	62
1952	2.07 E+10	<0.01	2.0	NR	NR	NR	NR	62
1953	2.47 E+10	<0.01	50	0.3	240	0.4	NR	27
1954	3.26 E+10	<0.01	58	0.3	280	0.4	NR	44
1955	3.86 E+10	NR	76	0.4	360	0.5	NR	59
1956	2.00 E+10	NR	27	NR	130	0.2	NR	69
1957	1.08 E+08	NR	NR	NR	NR	NR	NR	36
1960	9.56 E+09	NR	NR	NR	NR	NR	NR	0.2
1961	9.66 E+09	NR	NR	NR	NR	NR	NR	17
1962	9.66 E+09	NR	NR	NR	NR	NR	NR	17
1963	9.66 E+09	NR	NR	NR	NR	NR	NR	17
1964	9.66 E+09	NR	NR	NR	NR	NR	NR	17
1965	9.66 E+09	NR	NR	NR	NR	NR	NR	17

Table 5. Radiological Input to the T Pond System (Anderson 1976). (2 sheets)

Year	Volume (L)	Pu (gm)	Beta (Ci)	Sr-90 (Ci)	Ru-106 (Ci)	Cs-137 (Ci)	Co-60 (Ci)	U (Kg)
1966	9.66 E+09	NR	NR	NR	NR	NR	NR	17
1967	7.72 E+09	<1.2	20	<2.8	2	4.2	<2.2	1.6
1968	7.70 E+09	1.7	22	<2.3	<3	5.0	<1.2	1.7
1969	7.15 E+09	<0.6	0.6	0.04	NR	0.2	<0.02	<0.5
1970	5.03 E+09	<0.09	0.2	NR	NR	NR	NR	<0.6
1971	4.82 E+09	<0.004	<0.08	NR	NR	NR	NR	<1.4
1972	4.69 E+09	<0.003	0.1	NR	NR	NR	NR	<2.5
1973	2.96 E+09	<0.005	<0.03	NR	NR	NR	NR	<2.8
1974	2.81 E+09	<0.01	0.04	NR	NR	NR	NR	<2.6
1975	2.37 E+09	<0.02	0.04	0.005	NR	NR	NR	<2.1
TOTAL	4.24 E+11	<3.7	258	<6.2	106	11	<3.4	695

L = liter
gm = gram
Ci = curies
Kg = kilogram
NR = not reported

Table 6. Chemicals Used in the Bismuth Phosphate Process (Jones 1993).

Chemical	kg Chemical used/kg uranium
HNO_3	3.00
H_2SO_4	0.397
$NaNO_2$	0.091
$BiONO_3$	0.063
H_3PO_4	0.985
$NaBiO_3$	0.016
$Na_2Cr_2O_7$	0.0073
$(NH_4)_2Ce(NO_3)_6$	0.0015
H_2O_2	0.014
$(NH_4)_2SiF_6$	0.116
$FeSO_4 \bullet (NH_4)_2SO_4 \bullet 6H_2O$	0.210
$La(NO_3)_3 \bullet 2NH_4NO_3 \bullet 2H_2O$	0.0112
$H_2C_2O_4 \bullet 2H_2O$	0.0041
HF	0.0052
KOH	0.122
$KMnO_4$	0.0087
$(NH_4)_2SO_4$	0.0005
$(NH_4)_2SO_3$	0.0001
$ZrO(NO_3)_2$	0.0015
NaOH	2.95
Na_2CO_3	1.94

Figure 10. Time Series Plots of Detected Chemical Constituents--(a) Total Organic Carbon, (b) Total Organic Halides, (c) Total Dissolved Solids, and (d) pH.

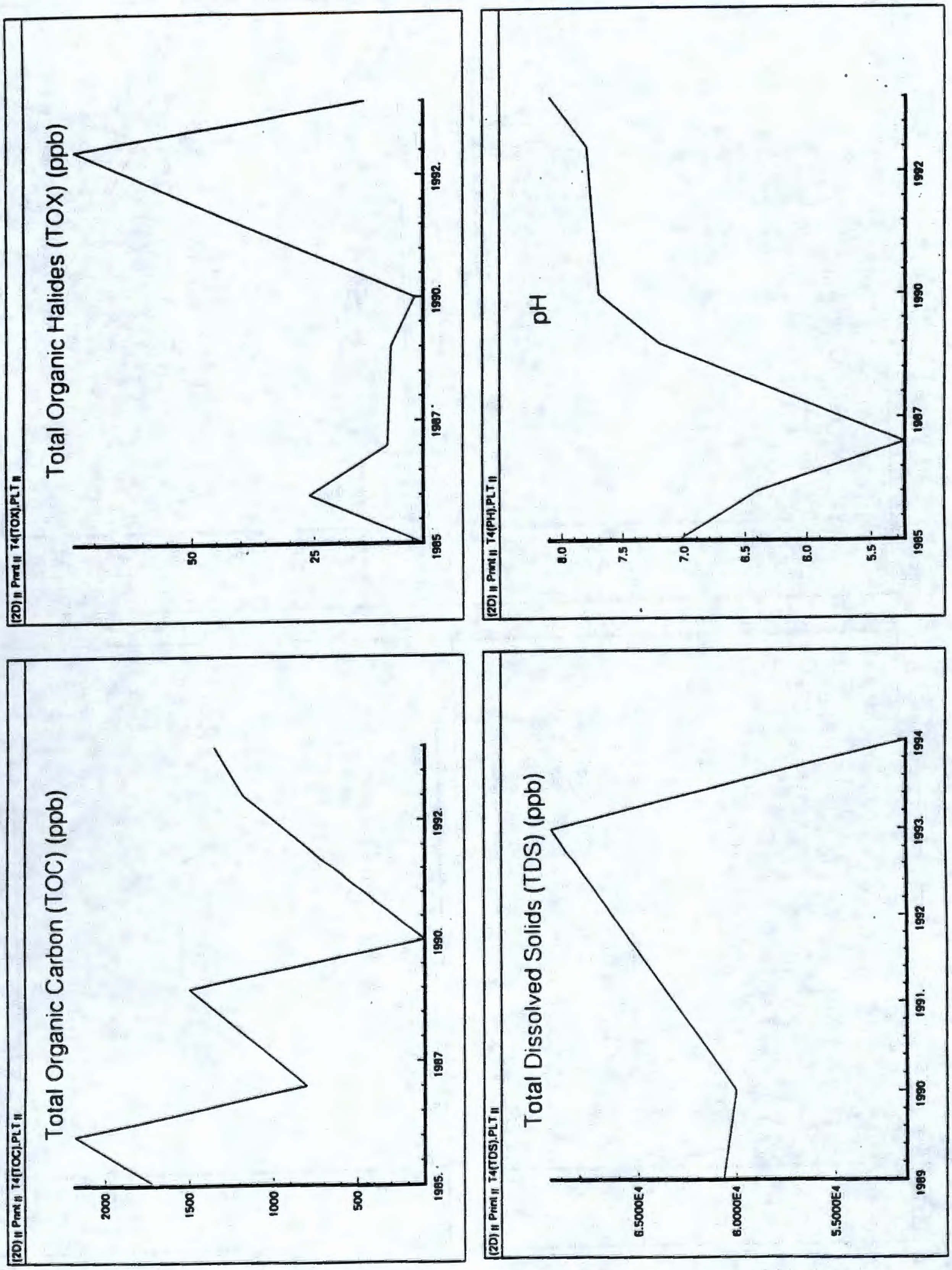


Figure 11. Time Series Plots of Detected Chemical Constituents--
(a) Aluminum, (b) Copper, (c) Cadmium, and (d) Iron.

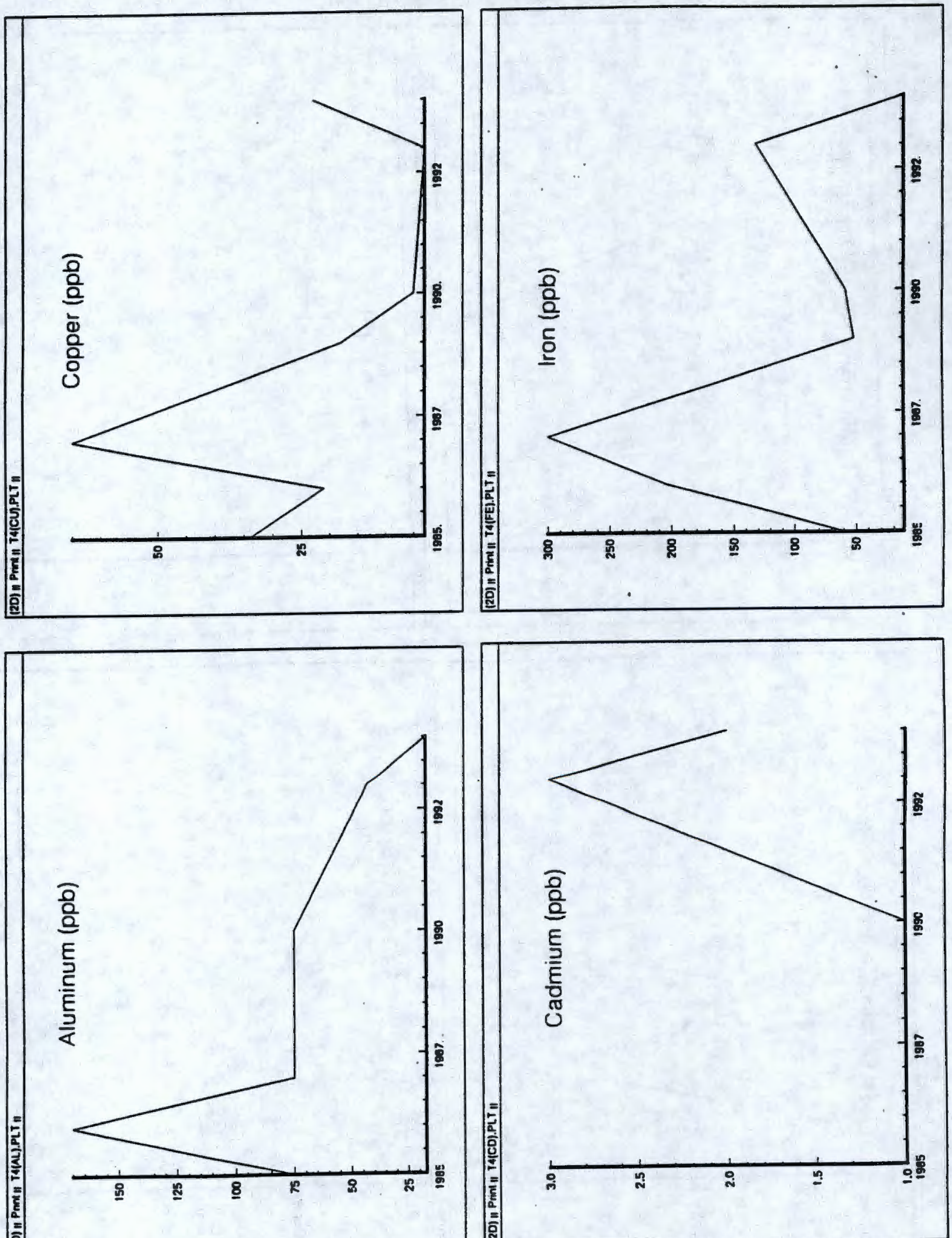


Figure 12. Time Series Plots of Detected Chemical Constituents--
(a) Zinc, (b) Barium, (c) Manganese, and (d) Strontium.

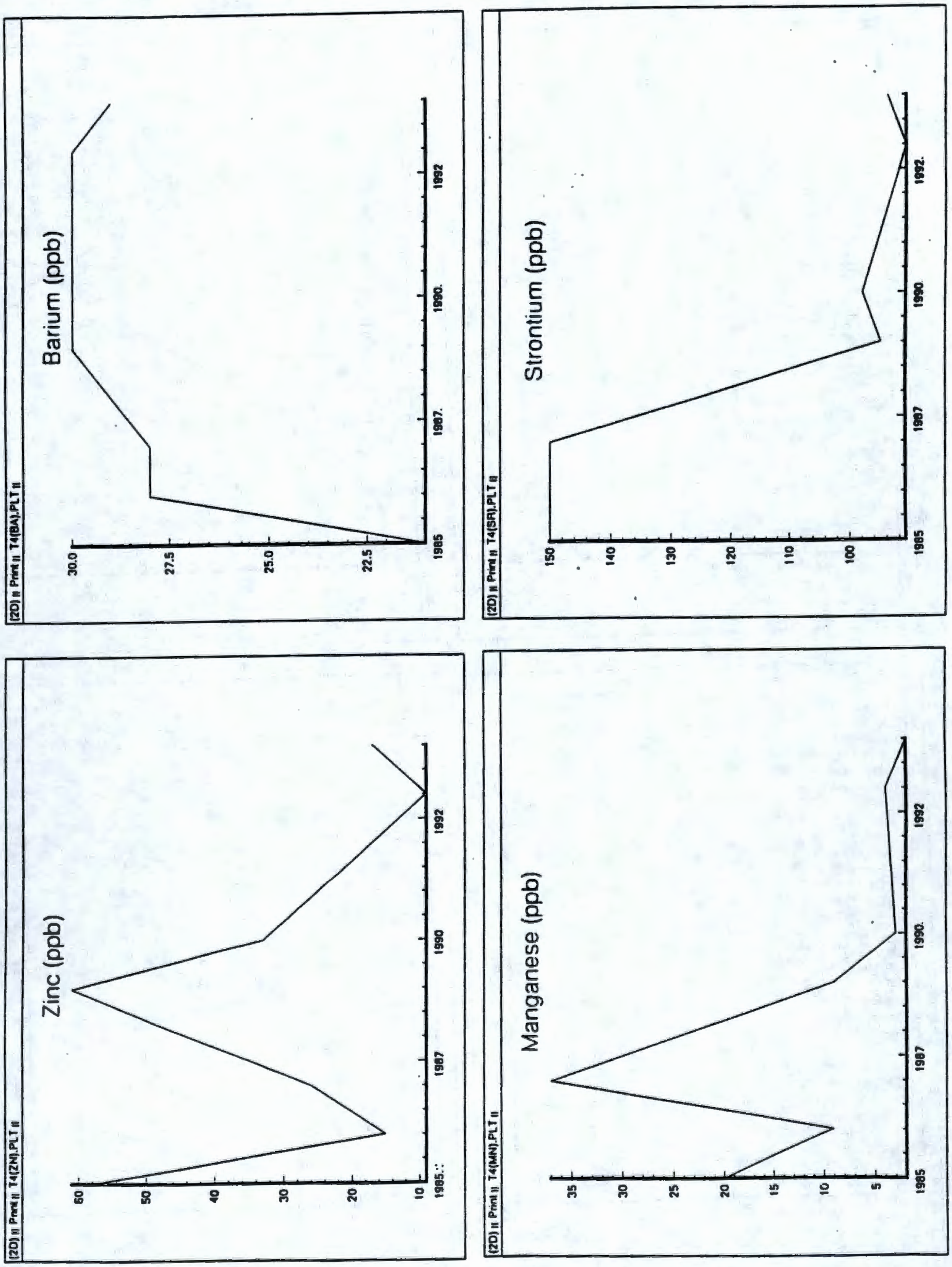


Figure 13. Time Series Plots of Detected Chemical Constituents--
(a) Calcium, (b) Magnesium, (c) Sodium, and (d) Potassium.

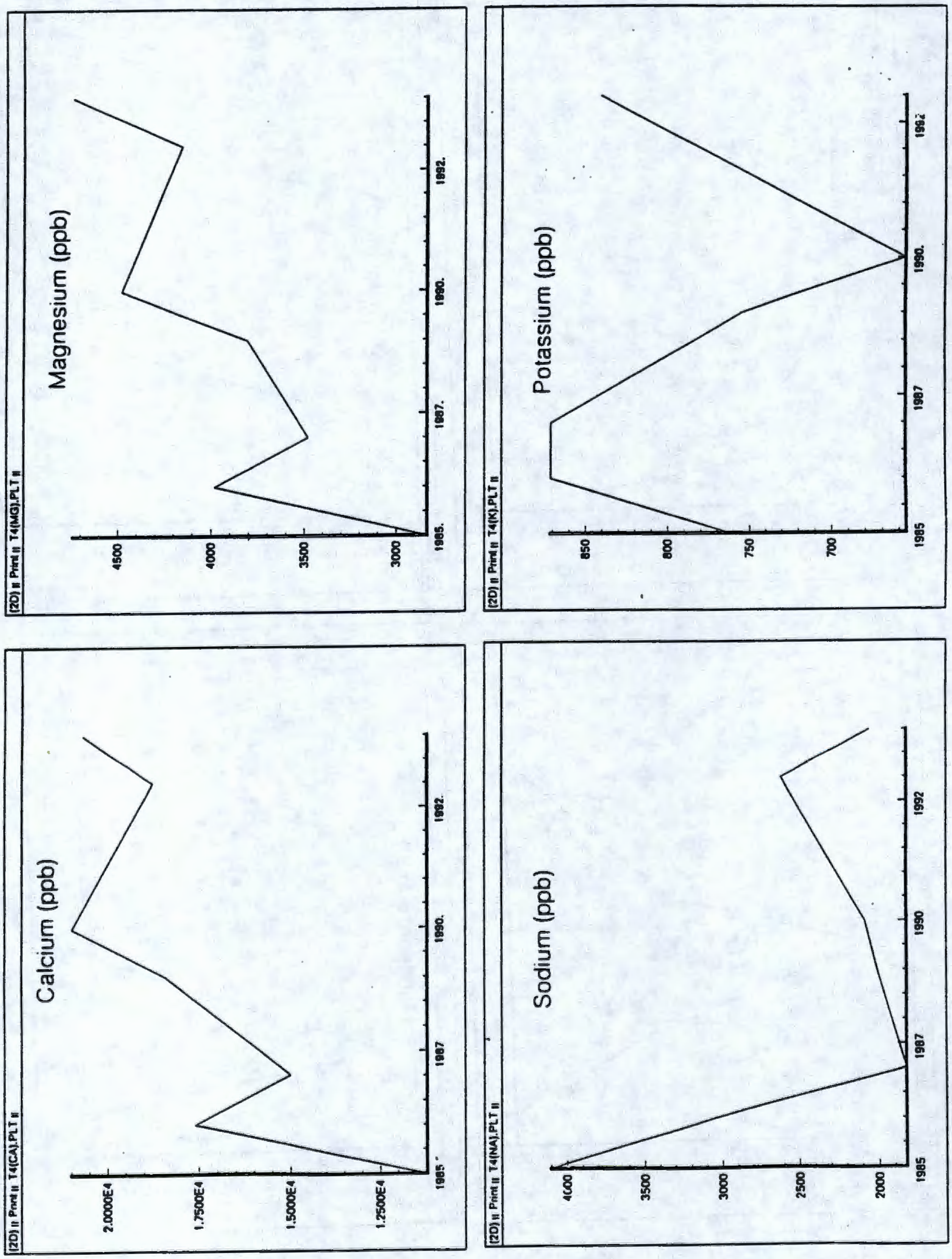


Figure 14. Time Series Plots of Detected Chemical Constituents--
(a) Nitrate, (b) Sulfate, (c) Chloride, and (d) Fluoride.

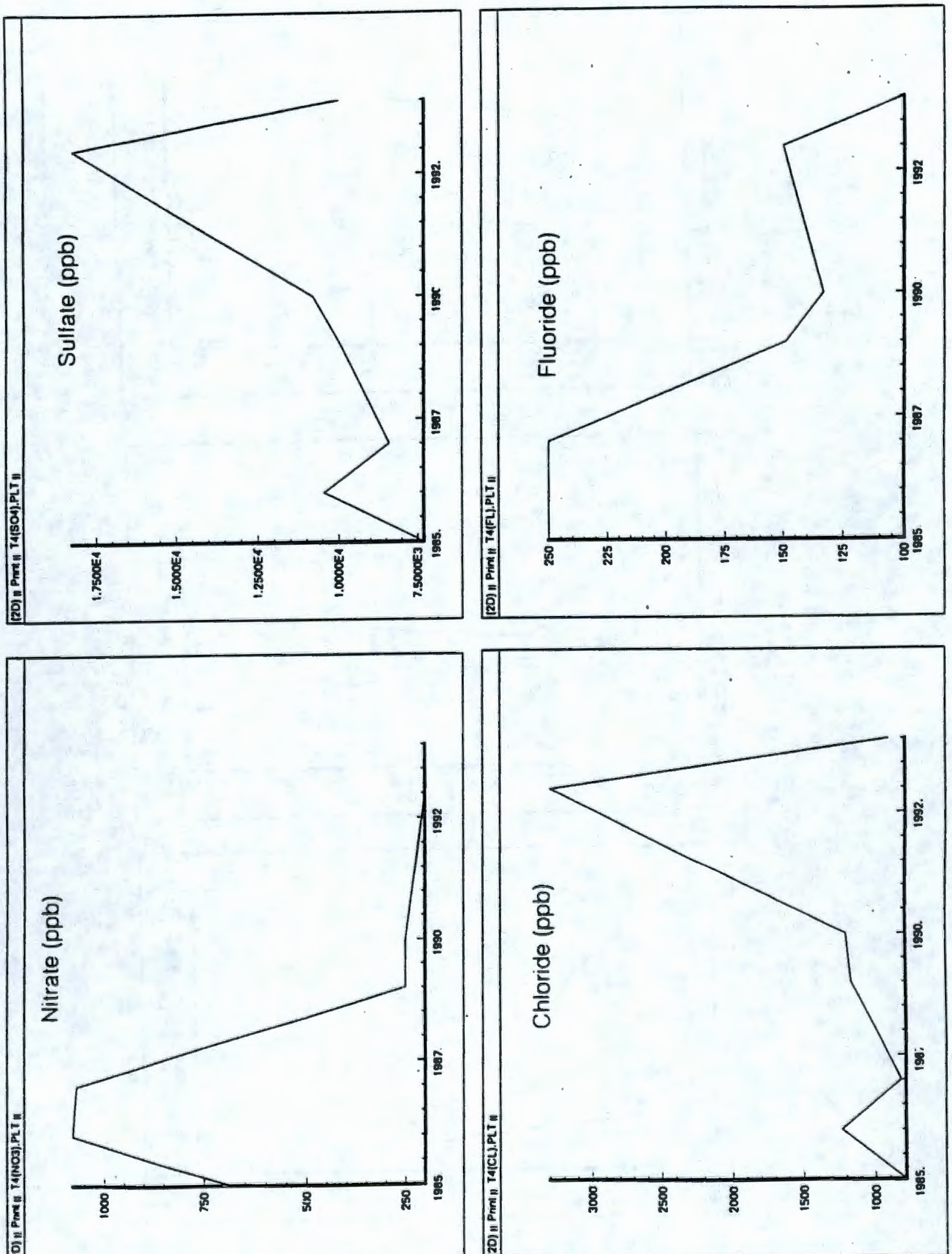


Figure 15. Time Series Plots of Detected Chemical Constituents--
(a) Boron, (b) Ammonia, and (c) Silicon.

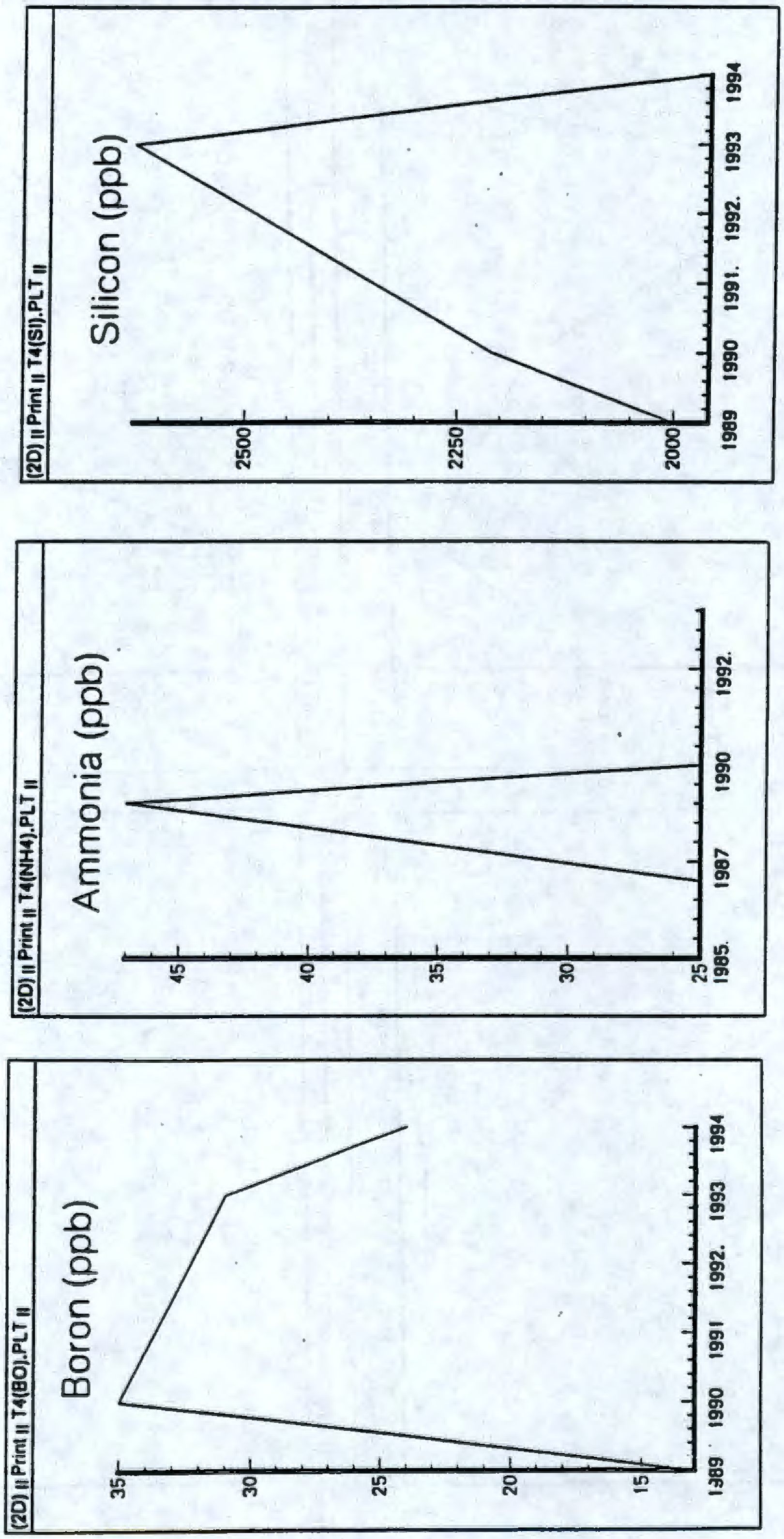


Figure 16. Time Series Plots of Detected Chemical Constituents--(a) Cesium-137, (b) Uranium, (c) Total Radium, (d) Gross Alpha, and (e) Gross Beta.

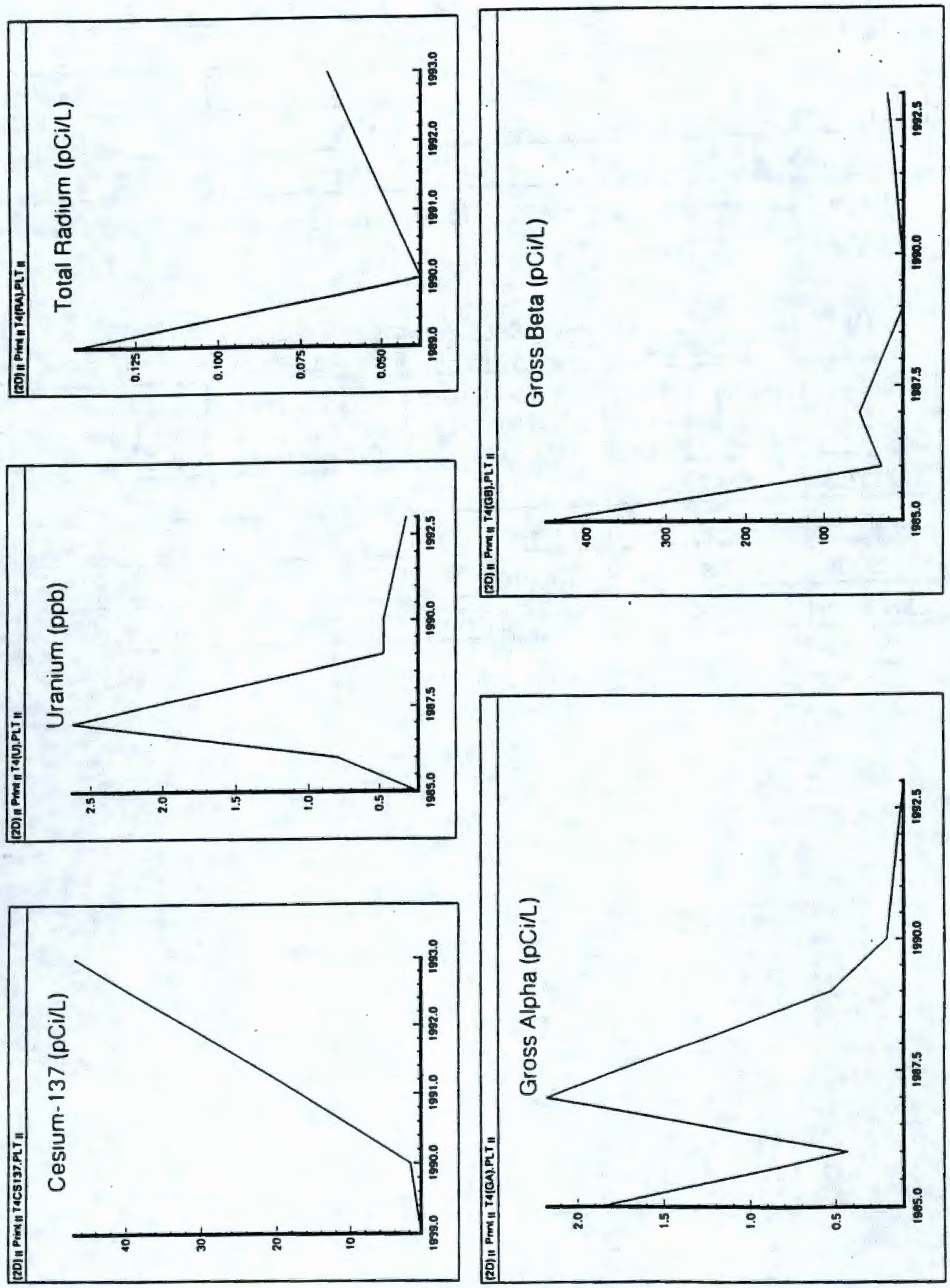


Table 7a. T Plant Effluent Data for Total Organic Carbon, Total Carbon, and Alkalinity (adapted from WHC 1992).

Date	TOC (mg/L)	Total Carbon (mg/L)	Alkalinity (mg/L)
10/13/89	1.8	15	58
10/17/89	1.5	16	58
11/28/89	1.2	15	53
03/09/90	1.0	15	59

TOC = Total Organic Carbon, TC = Total Carbon, mg/L = milligrams per liter

Table 7b. T Plant Effluent Data for Alkalinity - Calculated as $CaCO_3$ and HCO_3^- (adapted from WHC 1992).

Date	Inorganic Carbon as $CaCO_3$ (mg/L)	Inorganic Carbon as HCO_3^- (mg/L)	Unaccounted for Carbon as $CaCO_3$ (mg/L)	Unaccounted for Carbon as HCO_3^- (mg/L)
10/13/89	7	11	6.2	2.2
10/17/89	7	11	7.5	3.5
11/28/89	6	10	7.8	3.8
03/09/90	7	12	7.0	2.0

Table 8 summarizes the effluent chemistry data that are available through 1994, however, data are not available for all constituents and/or years. This is because the facilities had erratic sampling schedules in the past and recent results are not yet available for use in this report.

Table 8. Summary of the Results for 216-T-4-2 Ditch Effluent Chemistry.[1] (2 sheets)

Constituent	1985	1986	1987	1989	1990	1993	1994
Aluminum (ppb)	75	170	75	75	75	43	17.1
Barium (ppb)	21	28	28	30	30	30	29
Boron (ppb)	NM	NM	NM	13	35	31	23.6
Cadmium (ppb)	1	1	1	1	1	3.25	1.7
Calcium (ppb)	11,200	17,600	15,000	18,400	21,000	18,775	20,700
Chloride (ppb)	789	1,232	822	1,167	1,200	3,300	900
Copper (ppb)	34	21	65	18	5	3.1	22.7
Fluoride (ppb)	250	250	250	149	133	150	100
Iron (ppb)	58	204	300	52	59	133	12.3
Magnesium (ppb)	2,830	3,980	3,480	3,807	4,480	4,153	4,740
Manganese (ppb)	20	8.5	37	8.7	2.5	3.5	1.5
Nitrate (ppb)	683	1,079	1,070	250	250	200	200
Potassium (ppb)	762	871	871	755	656	841	NM
Silicon (ppb)	NM	NM	NM	2,000	2,210	2,628	1,960
Sodium (ppb)	4,100	3,053	1,830	2,013	2,090	2,618	2,060
Strontium (ppb)	150	150	150	95	98	91	94.1
Sulfate (ppb)	7,300	10,460	8,390	9,933	10,800	18,250	10,000
Uranium (ppb)	0.224	0.8	2.63	0.47	0.47	0.31	NM

Table 8. Summary of the Results for 216-T-4-2 Ditch Effluent Chemistry.[1] (2 sheets)

Constituent	1985	1986	1987	1989	1990	1993	1994
Zinc (ppb)	58	15	26	61	33	9	16.6
Ammonia (ppb)	25	25	25	47	25	25	25
Alkalinity (ppb)	NM	NM	NM	56,333	59,000	NM	NM
Gross Alpha (pCi/L)	1.87	0.428	2.18	0.525	0.206	0.11	NM
Gross Beta (pCi/L)	451	28	55	2.25	3.63	22	NM
pH	7.05	6.4	5.24	7.2	7.7	7.8	8.1
TDS (ppb)	NM	NM	NM	60,667	60,000	6,9500	51,500
TOC (ppb)	1690	2,177	801	1,500	1,000	1175	1,350
Total Carbon (ppb)	NM	NM	NM	15,467	15,400	NM	NM
TOX (as Cl) (ppb)	2.8	26	10	9.3	4.5	74	14.7
Cs-137 (pCi/L)	NM	NM	NM	0.4	1.86	47	NM
Radium Total (pCi/L)	NM	NM	NM	0.1435	0.0379	0.067	NM

[1] No data available for 1988, 1991, or 1992.
NM = not measured
pCi/L = picocuries per liter
ppb = parts per billion (or milligrams per liter).

3.4 CONSTITUENTS OF INTEREST AND KEY INDICATORS

In the original work done for the T-4-2 Ditch and reported in the *Liquid Effluent Study Final Project Report* (WHC 1990b), only aluminum and iron were listed as constituents of interest. To perform an assessment of groundwater quality for the T-4-2 Ditch, the following more comprehensive list of constituents of interest was compiled.

- Aluminum
- Barium
- Calcium
- Cesium-137
- Chloride
- Copper
- Fluoride
- Iron
- Magnesium
- Manganese
- Nitrate
- Plutonium-239
- Potassium
- Radium
- Sodium
- Strontium
- Strontium-90
- Sulfate
- Technetium-99
- Uranium
- Zinc.

These constituents will be examined in the effluent, in the perched and groundwater at the T-4-2 Ditch, and in the groundwater at facilities in the vicinity of the T-4-2 Ditch (upgradient and downgradient).

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4.0 CONCEPTUAL MODEL OF HYDROLOGIC RESPONSE AND CONTAMINANT MIGRATION

4.1 HYDROGEOLOGIC FRAMEWORK

4.1.1 Regional and Hanford Site Geology

The discussion in this section was taken from *Geologic Setting of the Low-Level Burial Grounds* (Lindsey et al. 1994a, 1994b). Because the burial grounds are located adjacent to the T-4-2 Ditch site to the west, north, and east, and the regional geology of both areas is similar.

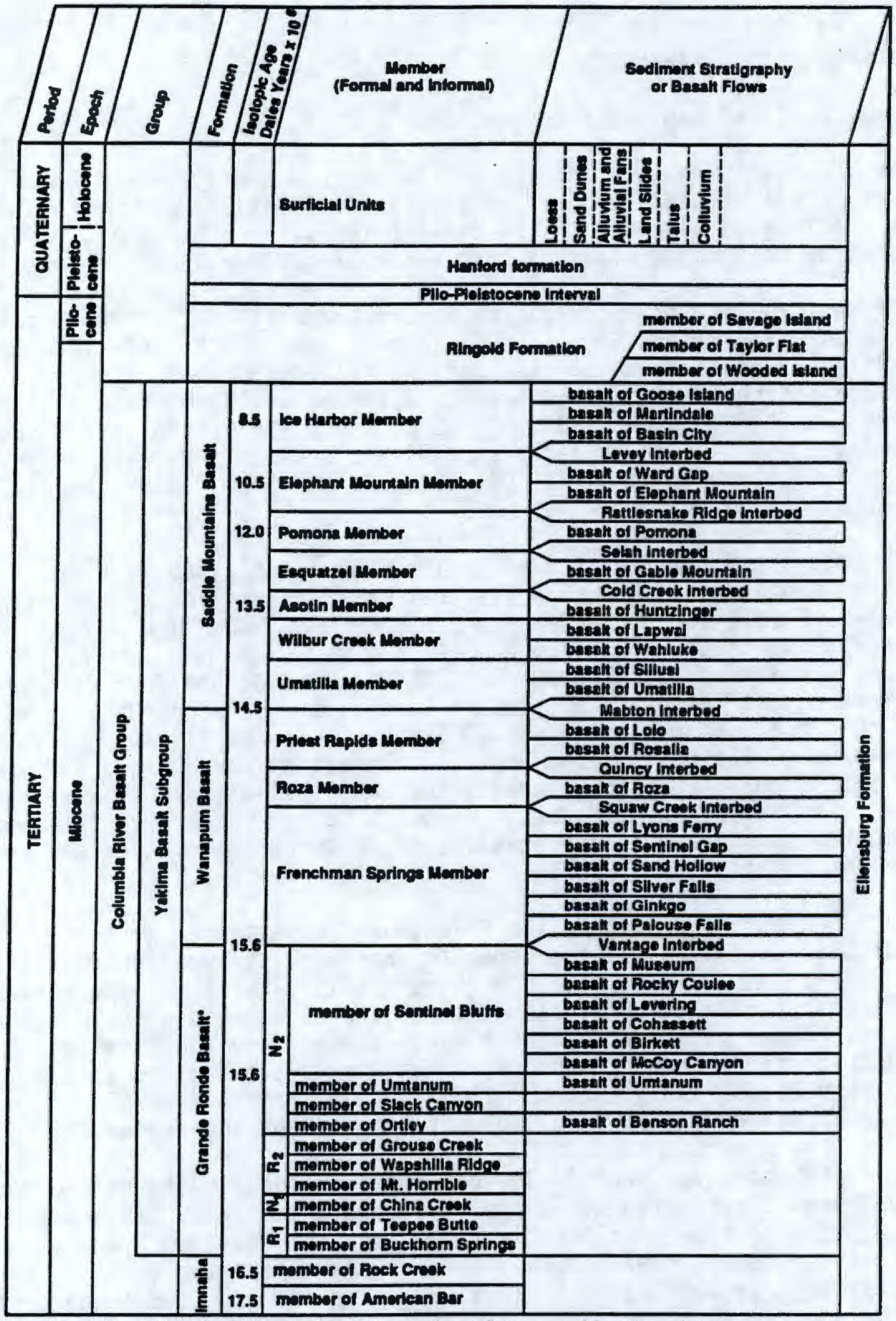
The Hanford Site is underlain by Miocene-aged (17.5 to 6 Ma) basalts of the Columbia River Basalt Group (CRBG) (Myers et al. 1979; Reidel and Fecht 1981; DOE 1988; Tolan et al. 1989; Reidel et al. 1989, 1992), sedimentary interbeds within the basalts assigned to the Miocene Ellensburg Formation (Reidel and Fecht 1981; DOE 1988; Smith 1988), and late Miocene to Holocene-aged (<8.5 Ma to present) suprabasalt sedimentary units (Myers et al. 1979; Tallman et al. 1981; DOE 1988; Smith et al. 1989; Lindsey 1991; Reidel et al. 1992) (Figure 17).

4.1.1.1 Columbia River Basalt Group. The CRBG is an assemblage of tholeiitic, continental flood basalts that cover an area of more than 163,157 km^2 (63,000 mi^2) in Washington, Oregon, and Idaho and have an estimated volume of about 174,356 km^3 (40,800 mi^3) (DOE 1988, Reidel and Hooper 1989, Tolan et al. 1989). The CRBG is divided into four formations, listed from oldest to youngest: Imnaha Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountains Basalt (DOE 1988, Tolan et al. 1989) (Figure 17). The Saddle Mountains Basalt (the uppermost basalt at the Hanford Site) is divided into (from oldest to youngest) the Umatilla, Wilbur Creek, Asotin, Esquatzel, Pomona, Elephant Mountain, and Ice Harbor Members (Reidel and Fecht 1981). Descriptions and interpretations of CRBG characteristics and evolution are compiled in Reidel and Hooper (1989).

4.1.1.2 Ellensburg Formation. The Ellensburg Formation consists of volcaniclastic and siliciclastic deposits that occur between CRBG basalt flows (Swanson 1979; DOE 1988; Smith 1988) (Figure 17). The three uppermost units of the Ellensburg Formation at the Hanford Site (from oldest to youngest) are the Selah interbed, the Rattlesnake Ridge interbed, and the Levy interbed. A detailed discussion of the Ellensburg Formation at the Hanford Site is given in Reidel and Fecht (1981). Smith (1988) and Smith et al. (1989) discuss the Ellensburg Formation and correlative units throughout the region.

4.1.1.3 Suprabasalt Sediments. The uppermost geologic units at the Hanford Site are generally referred to as the suprabasalt sediments. Discussions of various aspects of suprabasalt sediment geology are found in Myers et al. (1979), Tallman et al. (1979, 1981), PSPL (1982), Bjornstad (1984), Fecht et al. (1987), DOE (1988), Smith et al. (1989), Last et al. (1989), Baker et al. (1991), Delaney et al. (1991), Lindsey (1991, 1992), Lindsey et al. (1991, 1992, 1994a, 1994b), and Reidel et al. (1992). Delaney et al. (1991), Lindsey (1991), and Reidel et al. (1992) provide the most recent synopsis of suprabasalt sediment geology for the Hanford Site. The following discussion is summarized from these recent reports as well as from field data.

Figure 17. Neogene Stratigraphy of the Pasco Basin.



*The Grande Ronde Basalt consists of at least 120 major basalt flows comprising 17 members.
N_2, R_2, N_1, and R_1 are magnetostratigraphic units.

H9102029.6b

The suprabasalt sedimentary sequence (Figures 17 and 18) is up to 229 m (750 ft) thick at the Hanford Site. It is dominated by the laterally extensive late-Miocene to Pliocene Ringold Formation and the Pleistocene Hanford formation. Laterally discontinuous units, referred to as the Plio-Pleistocene unit, separate the Hanford formation and Ringold Formation locally. Holocene-aged alluvial and eolian deposits cap the suprabasalt sequence.

4.1.1.3.1 Ringold Formation. The Ringold Formation is up to 183 m (600 ft) thick beneath the Hanford Site. It consists of uncemented to locally well-cemented clay, silt, fine- to coarse-grained sand, and pebble to cobble gravel. Ringold deposits are grouped into five facies associations that are defined on the basis of lithology, petrology, stratification, and pedogenic alteration (Lindsey 1991, Reidel et al. 1992). Descriptions and characteristics of the facies associations, fluvial gravel, fluvial sand, overbank-paleosol, lacustrine, and basaltic alluvium are summarized in Table 9.

The distribution of facies associations within the Ringold Formation forms the basis for a stratigraphic subdivision (Lindsey 1991; Reidel et al. 1992, and Lindsey et al., 1994a, 1994b). The lower half of the Ringold Formation is informally referred to as the member of Wooded Island. It is divided into several subunits, designated as units A, B, C, D, and E (Figure 18) that are characterized by strata typical of the fluvial gravel and fluvial sand facies association. (See Figures 4 and 5 in Lindsey et al. 1994 for more information.) Grain-size analysis of core and surface exposures indicates that the gravel facies association typically has a bimodal grain-size distribution with the dominant sizes being pebble-to-cobble gravel and medium- to fine-grained sand. These distributions differ from those reported for the low-level burial grounds (LLBG) by Last et al. (1989). Data presented in that report, which indicated that Ringold gravels were sand rich, were based on driven split-spoon and drive barrel samples. Samples acquired with driven sampling techniques probably are not intact (Reynolds and Lindsey 1994) and the grain-size data based on them should be used with caution. (For more detailed information on Ringold Formation grain-size analyses, see Lindsey et al. 1991, Section 2.3.1, Tables 2-6).

Units A, B, C, D, and E are interbedded with fine-grained deposits typical of the overbank-paleosol and lacustrine facies association. The lowest of these fine-grained intervals is designated the lower mud unit (Figure 18). (See Figures 4 and 5 in Lindsey et al. [1994] for more information.) Interstratified deposits of the fluvial sand and overbank-paleosol facies association, informally referred to as the member of Taylor Flat, and strata dominated by the lacustrine facies association, informally referred to as the member of Savage Island, form the upper half of the Ringold Formation (commonly referred to as the upper unit). Sand beds from the member of Taylor Flat have grain size ranges similar to those found in the underlying member of Wooded Island. The 200 Areas are underlain by a combination of units A, D, and E and the lower mud unit of the member of Wooded Island and the lowermost part of the member of Taylor Flat.

Ringold stratigraphic units present beneath the 200 West Area are unit A, the lower mud unit, and unit E of the member of Wooded Island and erosional remnants of the member of Taylor Flat (Figure 19). (See Figures 9 and 10 in Lindsey et al. [1994] for more information.) Unit B/D also is present, but

Figure 18. Generalized Suprabasalt Stratigraphy of the Pasco Basin and Hanford Site.

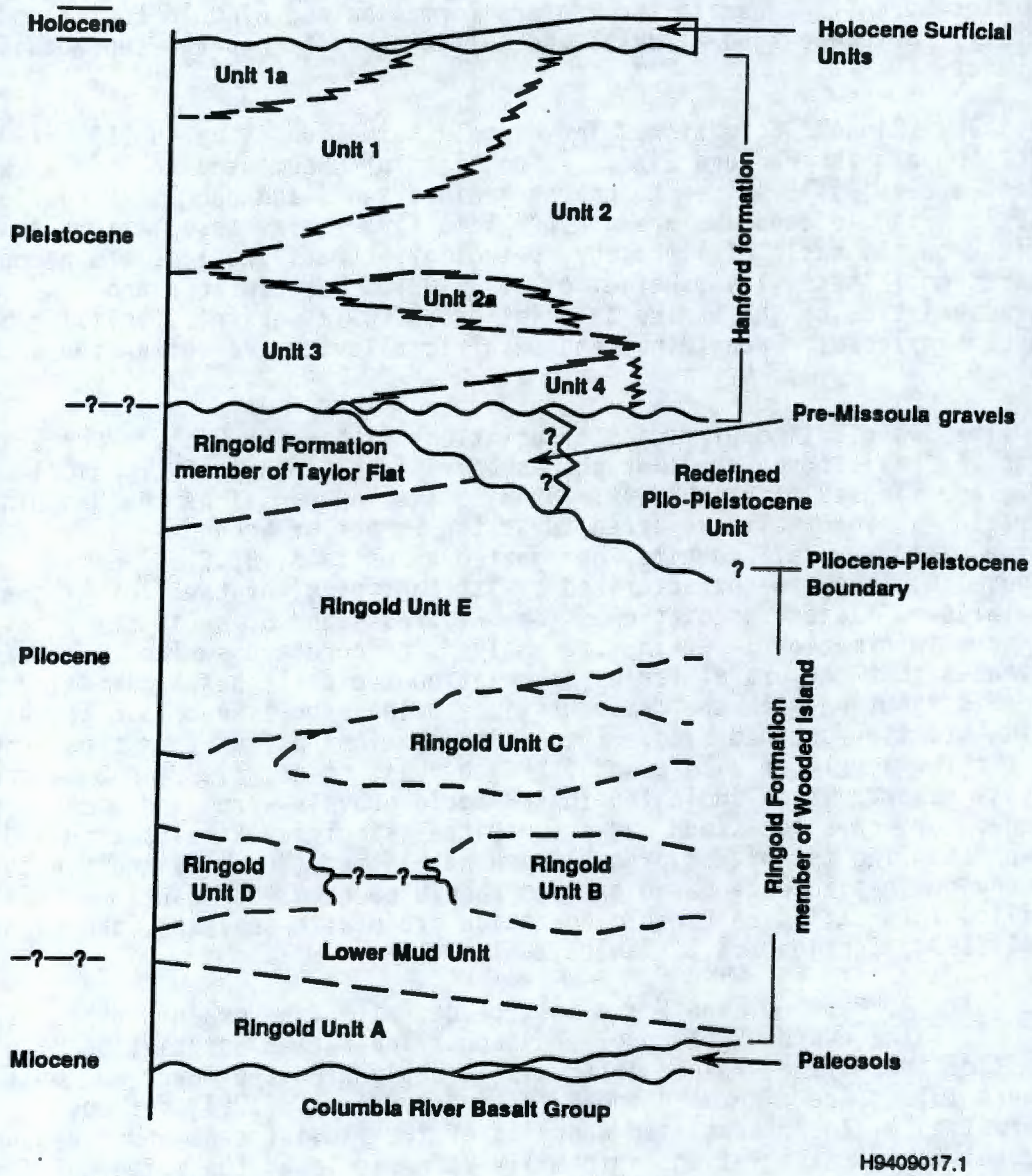
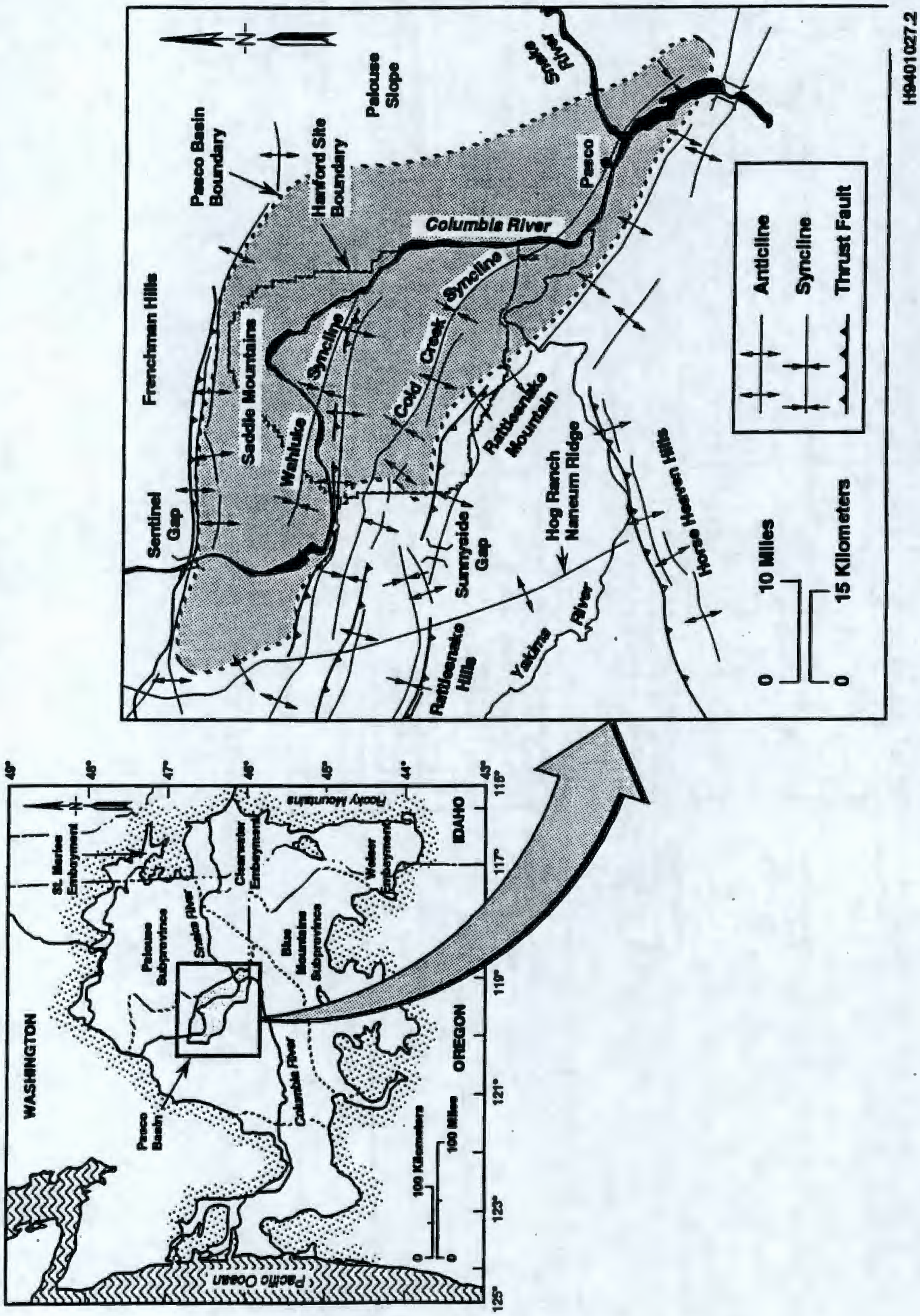


Table 9. Summary of Ringold Formation Facies Associations, Characteristics, and Depositional Setting.

Facies association	Lithology	Sedimentary structure	Bedding geometry and contacts	Depositional environments
Fluvial gravel	Pebble to cobble gravel dominated, clast and lesser matrix support, sand matrix dominant, lenticular silt and sand interbeds <2 m thick	Massive bedding, planar and trough cross-bedding, low angle plane beds, minor deep (2-4 m) scours	Lenticular to low-angle tabular gravel beds, low-angle (<20°) bounding surfaces dominate, deeply scoured contacts rare	Gravelly fluvial braidplain characterized by shallow, shifting channels
Fluvial sand	Fine- to coarse-grained sand dominates, lenses of gravel (<0.5 m thick) and silt (<3 m thick) present	Planar and trough cross-bedding, ripple cross-lamination, plane bedding, and massive bedding	Lenticular beds combine to form large tabular sand bodies with scoured bases, sand bodies are multi-story, fining upwards into silts present	Sandy, low-sinuosity channels on low-relief flood plain
Overbank-paleosol	Silty fine-grained sand, silt, and clay, pedogenic $CaCO_3$ encountered locally	Massive bedding, plane bedding, ripple cross-lamination, and mottled disrupted bedding, burrow and root fills, soil peds and slickensides present	Laterally continuous sheets, flat to gradational contacts	Proximal to distal overbank, crevasse splay
Lacustrine	Clay, silt, and fine-grained sand, minor medium-grained sand	Planar bedding and lamination, normal grading, ripple cross-lamination, minor soft sediment deformation	Laterally extensive sheets, sharp basal contacts, upwards fining common, minor low-angle packages	Lacustrine basin plain to proximal distributary
Alluvial fan	Basaltic gravel, matrix support dominates	Massive bedding dominates, minor planar bedding and planar cross-bedding	Sheets, planar contacts	Debris flow dominated deposition on alluvial fans

Figure 19. Structure Contour Map, Top of the Basalt, Cold Creek Syncline.



the limited distribution of silty marker horizons at the site makes determining its lateral continuity difficult. Unit C also may be present but the absence of any marker strata necessary to differentiate it from unit E makes its identification impossible.

Unit A and the lower mud unit, the two lowest Ringold units in the 200 West Area, display similar trends. Unit A thickens to the south and southwest towards the axis of the Cold Creek syncline. The top of the unit is relatively flat, dipping to the west and southwest (Figure 20). Intercalated lenticular sand and silt is common in unit A in the western and southern parts of the area. The overlying overbank and lacustrine deposits of the lower mud unit also thicken and dip to the south and southwest. However, unlike unit A, the top of the lower mud sequence is irregular and the interval pinches out along the northeast edge of the 200 West Area (Figure 21).

At least locally throughout the 200 West Area, gravelly strata of unit B/D overlies the lower mud unit. These gravels are similar in composition to unit A below and unit E above. Unit B/D is differentiated from the other gravelly Ringold units by its stratigraphic position overlying the lower mud unit and below paleosols underlying unit E. Where the paleosols underlying unit E are absent, unit B/D is not identified.

Unit E generally thins from the north-northwest to the east-southeast. The top of the unit is irregular, displaying highs in the northern and southern parts of the area, lows in the central part of the area, and generally dipping to the southeast (Figure 22). Intercalated lenticular beds of sand and silt occur throughout the 200 West Area, although predicting where they will occur is difficult.

The member of Taylor Flat (Figures 23 and 24) is discontinuous across the 200 West Area because of post-Ringold erosion. It only is found in the northern, western, and southern parts of the 200 West Area. In these areas the top of the unit generally dips to the south-southwest. The member of Taylor Flat in the 200 West Area consists of interstratified deposits of the overbank-paleosol facies and the fluvial sand facies. Figure 25 shows the boreholes used for geologic interpretations in the 200 West Area.

4.1.1.3.2 Plio-Pleistocene Unit. The Plio-Pleistocene unit includes all material overlying the Ringold Formation and underlying the Hanford formation. This interval formerly was divided into three units: the Plio-Pleistocene unit (found only in the 200 West Area), early Palouse soil, and pre-Missoula gravels (Myers et al. 1979; Tallman et al. 1979, 1981; DOE 1988; Last et al. 1989; Lindsey et al. 1991; Reidel et al. 1992). Recent core logging, borehole sampling, and outcrop studies indicate that a unified Plio-Pleistocene unit consisting of two subunits (locally derived and distally derived) better represents this interval because of uncertainties in stratigraphic relationships among the three formerly used units.

Sediments deposited by the Columbia, Yakima, and Snake Rivers, local sidestreams, and wind-deposited sediments make up the Plio-Pleistocene-aged alluvium in the Pasco Basin. Differentiating the two subunits of the Plio-Pleistocene unit is based on recognizing deposits from these different sources. Major rivers transported clastic detritus from the northern Rocky Mountains, Okanagen highlands, Idaho Batholith, Cascade Range, and Wallowa

Figure 20. General Surface Map, Top of Ringold Unit A, Beneath the Central Hanford Site.

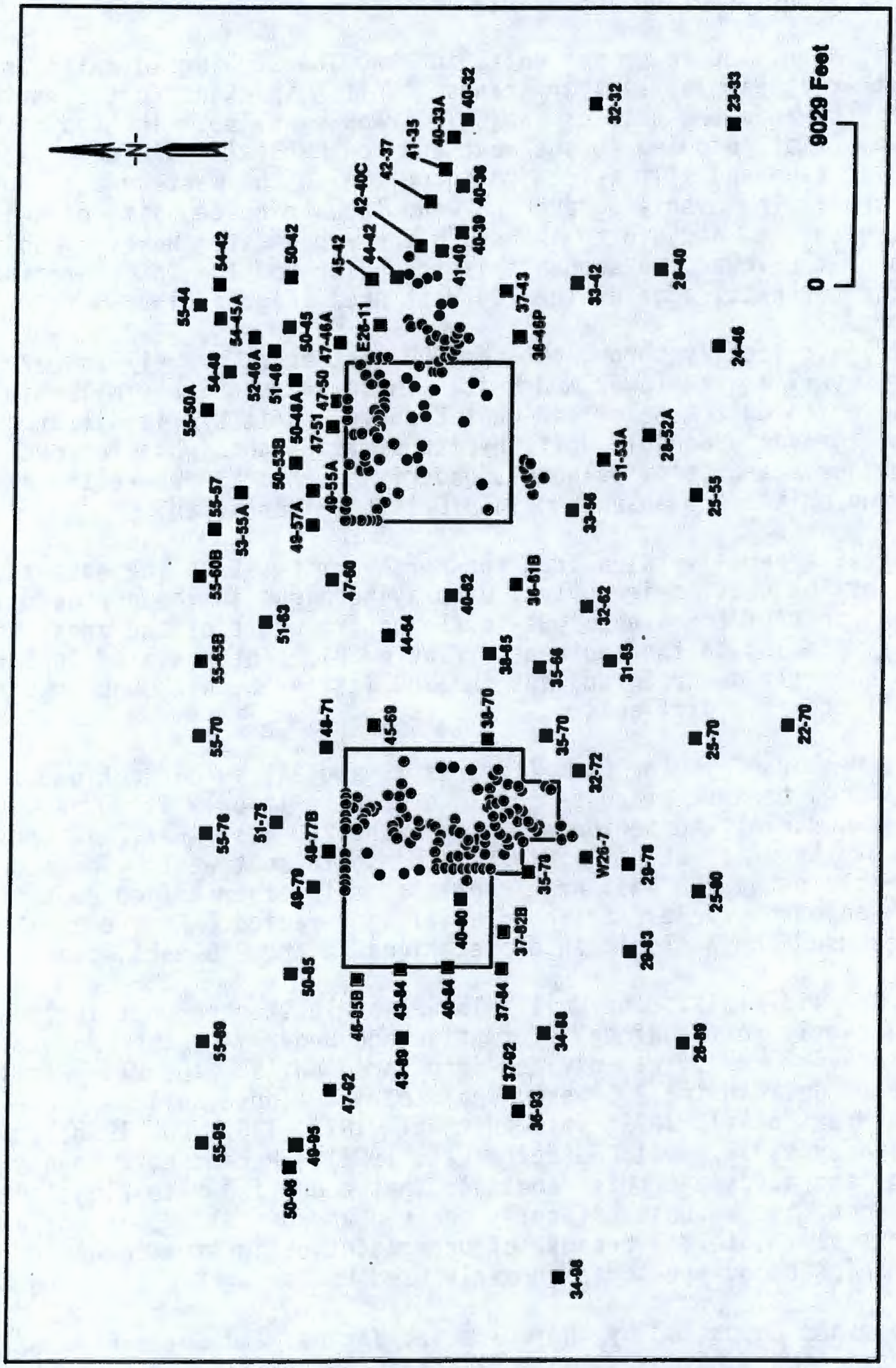


Figure 20. General Surface Map, Top of Ringold Unit A, Beneath the Central Hanford Site.

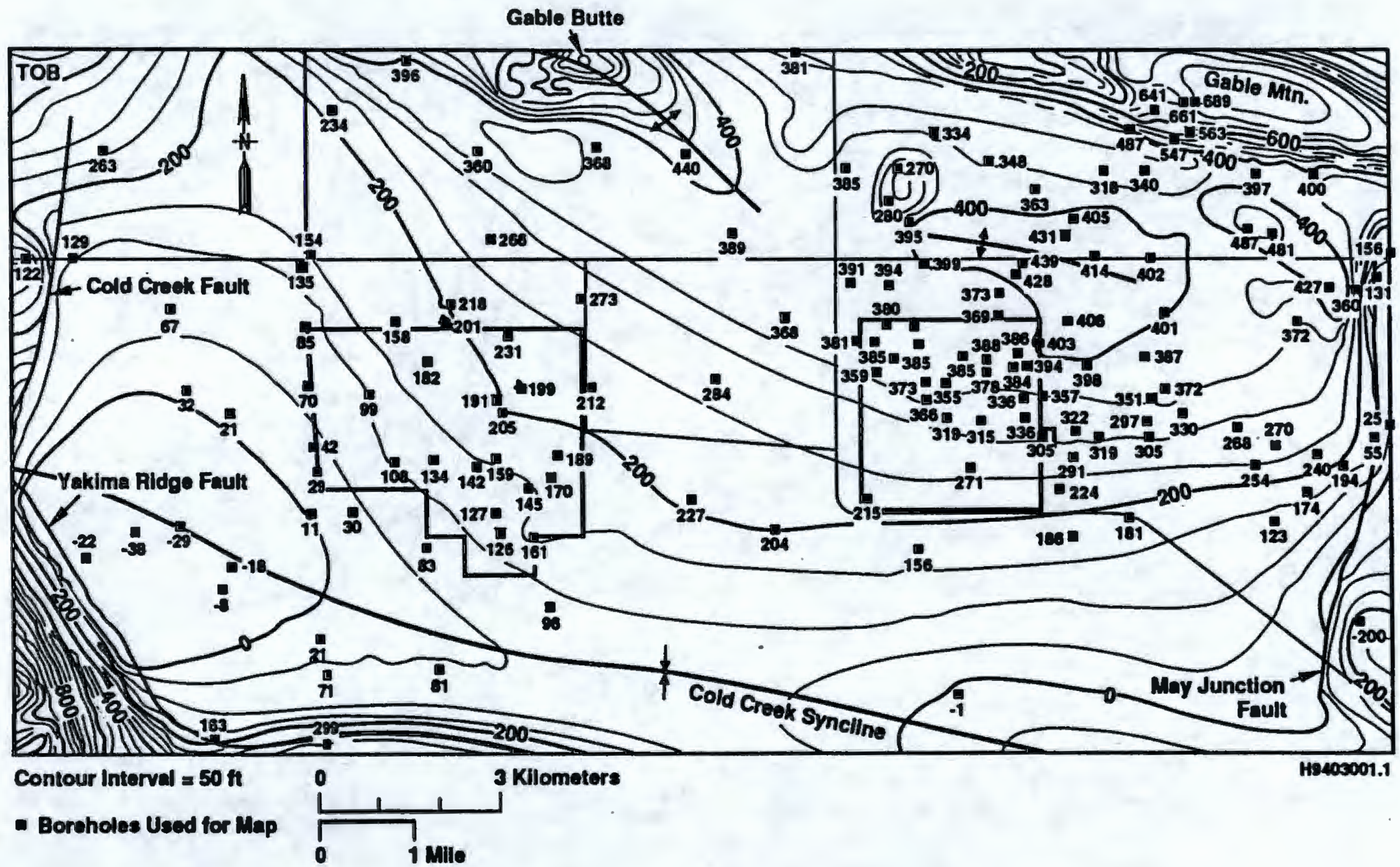


Figure 21. General Surface Map, Top of Ringold Lower Mud Unit, Beneath the Central Hanford Site.

Figure 22. General Surface Map, Top of Ringold Unit E, Beneath the Central Hanford Site.

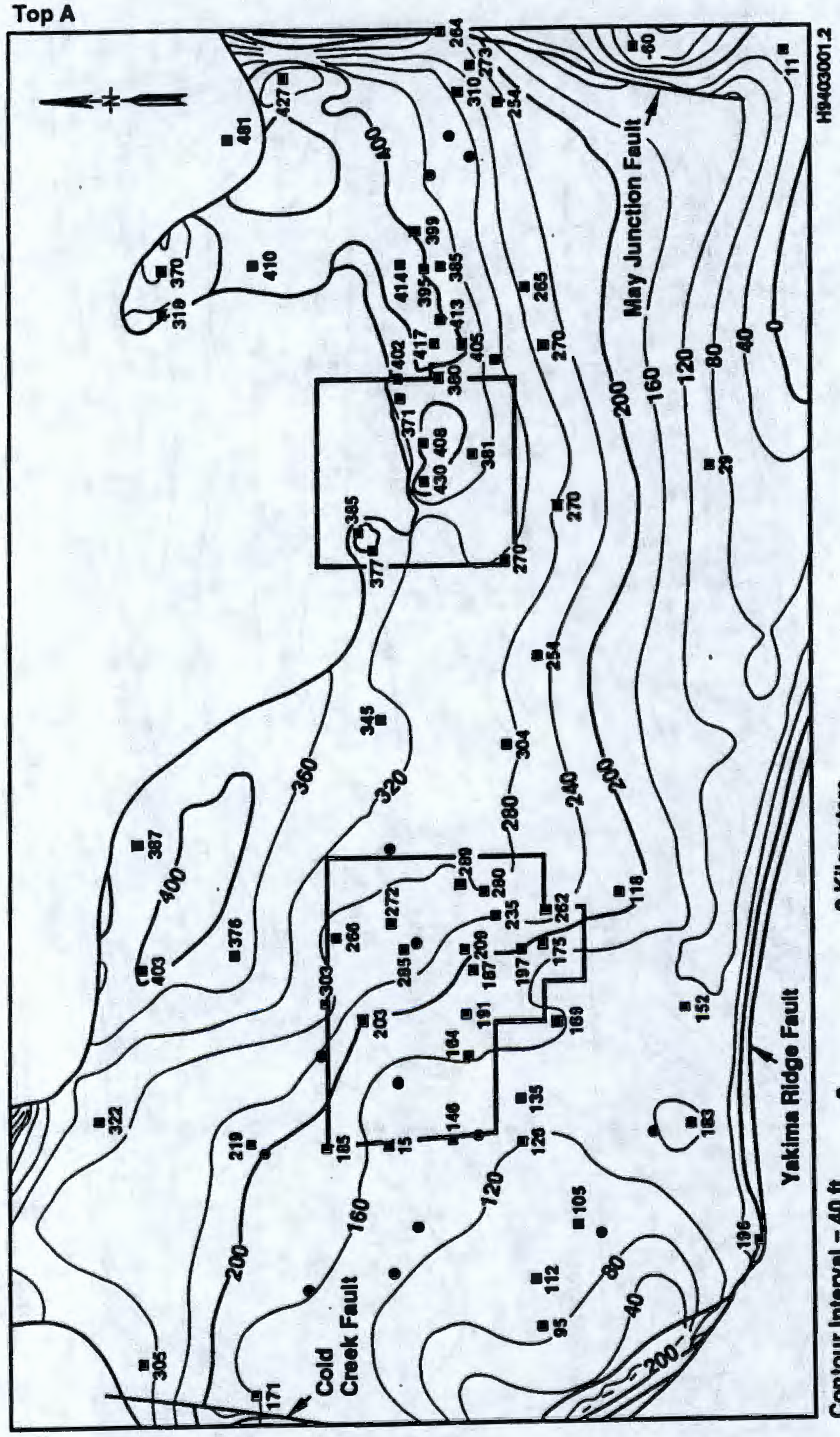


Figure 23. General Surface Map, Top of Member of Taylor Flat, Ringold Formation, Beneath the Central Hanford Site.

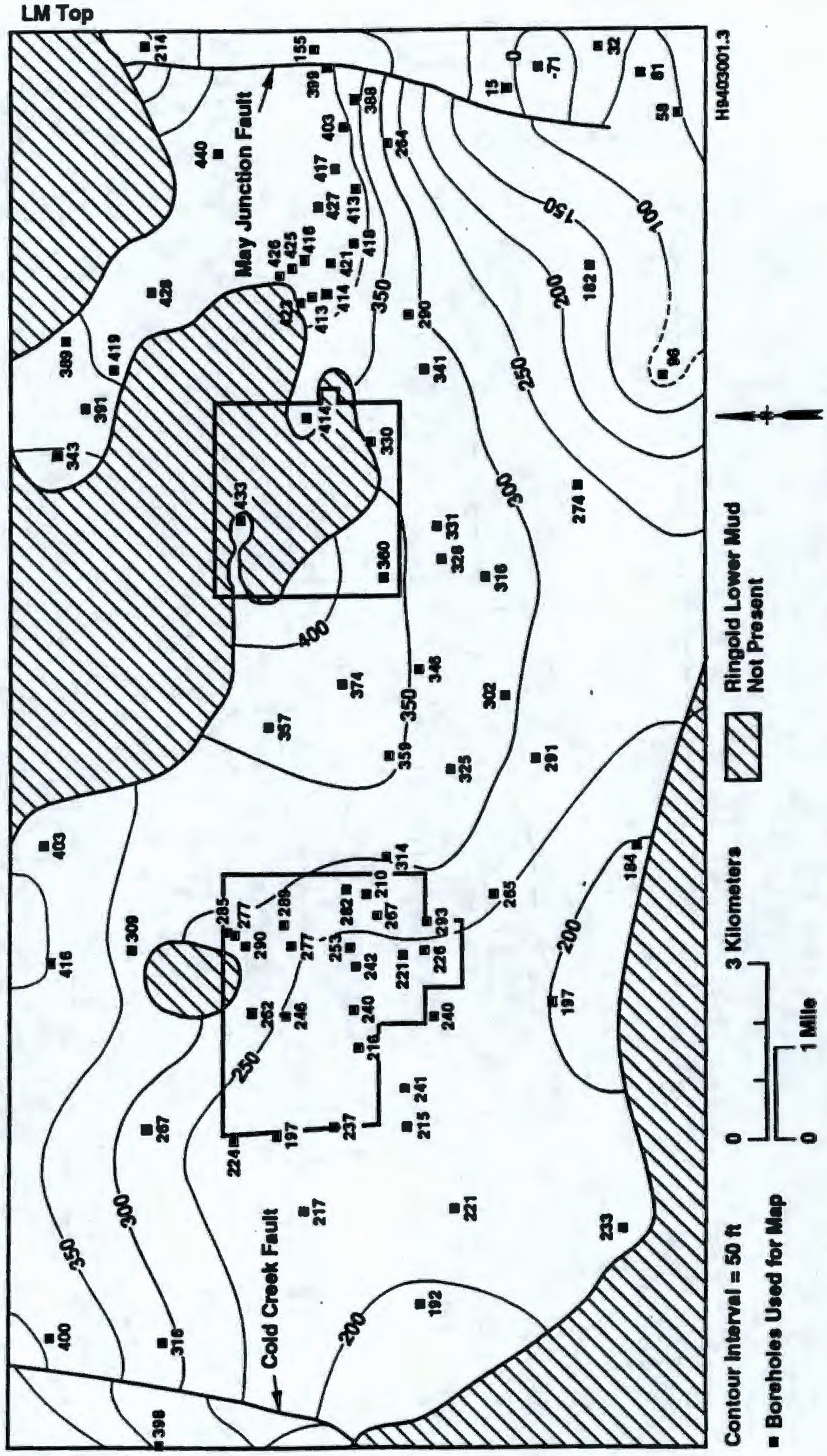


Figure 24. Index Map to Boreholes Used for Geologic Interpretations in this Report in the 200 West Area.

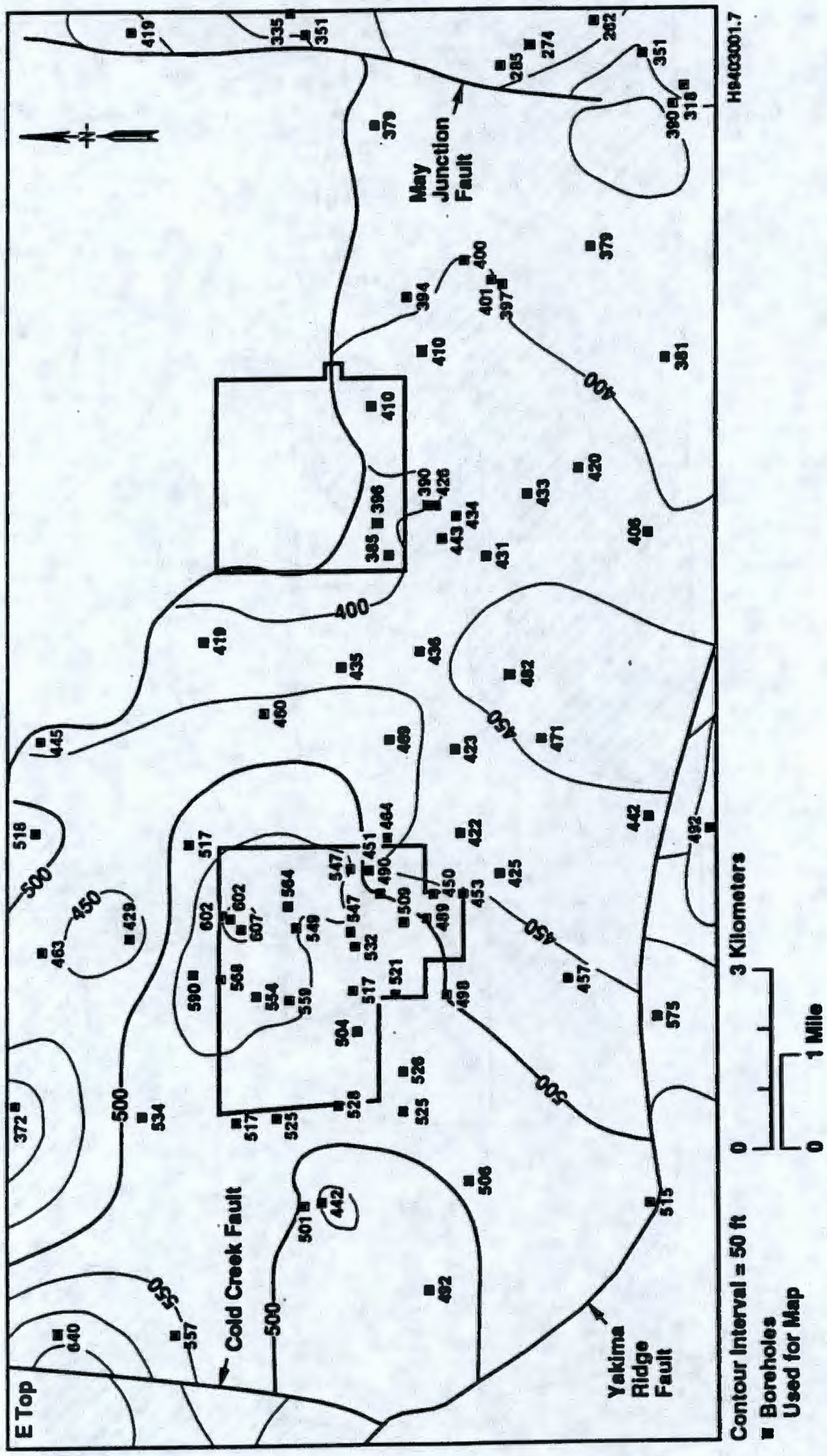
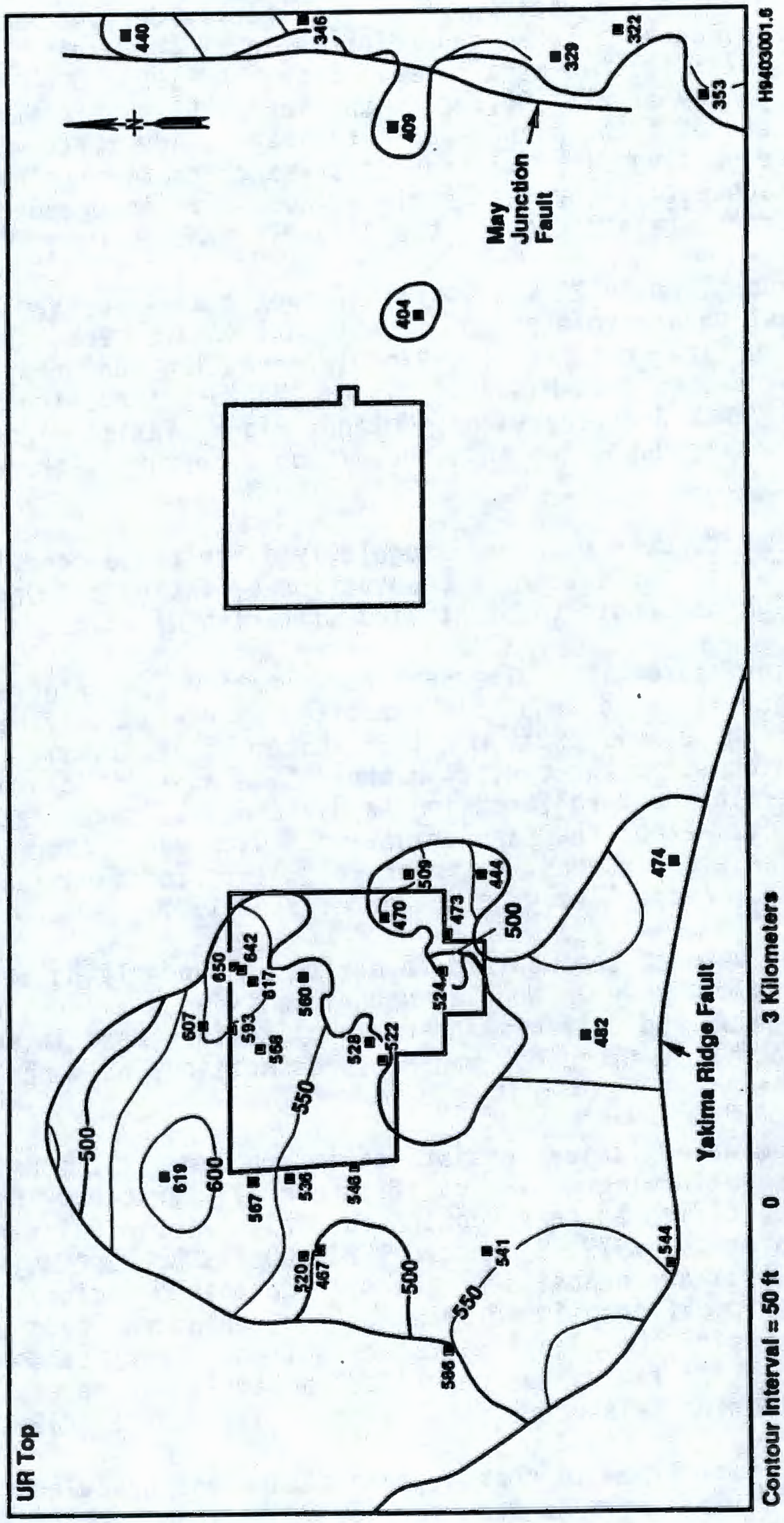


Figure 25. Isopach Map, Member of Taylor Flat, Ringold Formation, 200 West Area.



Terrane that consist predominantly of quartzite, gneiss, basalt, andesite, rhyolite, and low-grade metamorphics.

Silt and sand in the upper part of the locally derived subunit has been previously described as a loess and referred to as the early Palouse soil (Myers et al. 1979; Tallman et al. 1981; Bjornstad 1984; DOE 1988; Last et al. 1989; Lindsey et al. 1991; Last and Rohay 1993). In fact, this interval consists of thin, planar-laminated fine sandy silts with little evidence of the bedding disruption and massive character typical of loess deposits. Consequently, the term early Palouse soil is dropped and these laminated deposits are assigned to the Plio-Pleistocene unit.

The thickness (up to 20 m [66 ft]) of the locally derived subunit and facies distribution are related to depositional environment, the topography of the erosional surface on top of the Ringold Formation, and post-depositional erosion by the catastrophic Missoula floods (Hanford formation). Cold Creek, Dry Creek, and unnamed drainages off Umtanum Ridge, Yakima Ridge, and Rattlesnake Mountain deposited this subunit on a northwest-trending channel or fan complex.

The Plio-Pleistocene unit is irregularly distributed beneath the 200 West Area (Figure 26); it consists of a combination of facies ranging from pedogenic calcium carbonate to stratified silt-rich deposits.

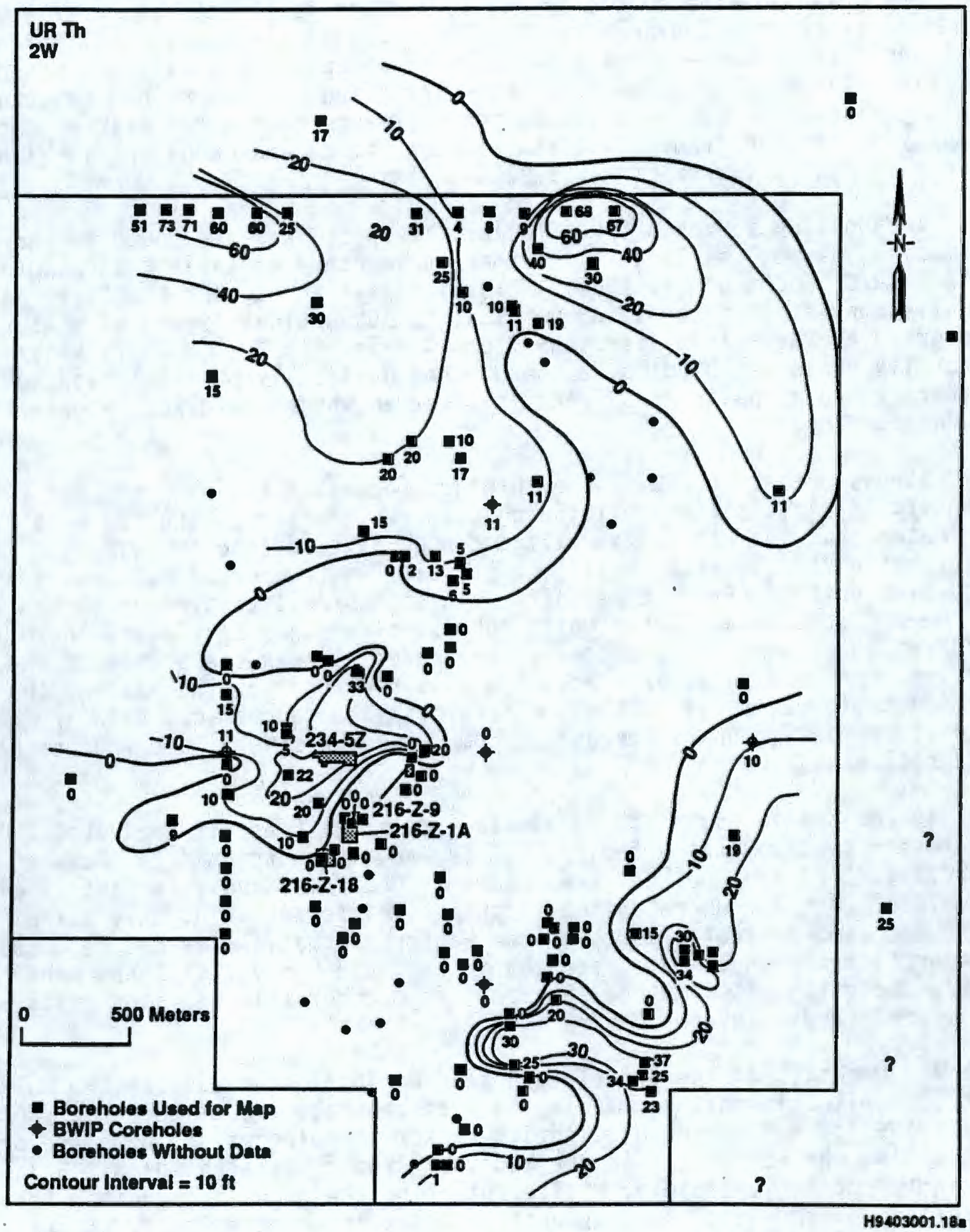
4.1.1.3.3 Hanford formation. The Hanford formation (see Figure 18) consists of uncemented gravel, sand, and silt deposited by Pleistocene cataclysmic flood waters (Fecht et al. 1987, DOE 1988, Baker et al. 1991). The Hanford formation is thickest in the central Hanford Site where it can be up to 107 m (350 ft) thick. The Hanford formation is divided into three facies (gravel, sand, and silt dominated) that are gradational with each other (Lindsey et al. 1991, 1992). These correspond to the gravel, laminated sand, and graded rhythmites facies, respectively, of Baker et al. (1991).

The contact between the Hanford formation and underlying strata is a disconformity and commonly an angular unconformity in all locations. This contact is irregular and reflects an erosional surface associated with Pleistocene cataclysmic flooding, pre-Hanford incision, or a combination of the two.

The silt-dominated facies consists of interbedded silt and fine- to coarse-grained sand forming well-stratified normally graded rythmites. Some of the strata identified as loess-dominated early Palouse soil in previous studies (Tallman et al. 1979, Bjornstad 1984, DOE 1988, Last et al. 1989, and Last and Rohay 1993) are deposits of the silt-dominated facies. The silt-dominated facies is differentiated from massive, unbedded loess and the lacustrine deposits of the Plio-Pleistocene unit by the presence of interbedded sand. The facies was deposited in backflooded areas during high stands of cataclysmic Pleistocene flood events (Baker et al. 1991).

Well-stratified, fine- to coarse-grained sand and granule gravel form the sand-dominated facies. Silt content varies. Open framework texture is common where the silt content is low. Small pebbles and rip-up clasts may be present in addition to lenticular, pebble-gravel interbeds and silty interbeds. Deposits making up this facies accumulated in areas transitional from low-energy backflooded areas to main high-energy channel tracts and, as flood

Figure 26. Surface Map, Top of Plio-Pleistocene Unit, 200 West Area.



flows waned, in areas adjacent to channelways and downstream of flow constrictions (Baker et al. 1991).

The gravel-dominated facies consists of cross-stratified, coarse-grained sand and granule to boulder gravel. Intercalated, lenticular silt-rich horizons that commonly display evidence of pedogenic activity are found locally. Interbedded, gravelly, well-stratified coarse-grained to granular sands are present. This facies is generally uncemented and matrix poor, displaying an open framework texture. The facies was deposited in high-energy main channelways (Baker et al. 1991).

In addition to these three facies, clastic dikes are found in the Hanford formation, as well as locally in other sedimentary units in the Pasco Basin (Black 1979, Fecht et al. 1994). Clastic dikes throughout the Pasco Basin usually consist of alternating vertical to subvertical layers of silt, sand, and granule gravel from less than 1 cm (0.4 in.) to 2 m (6.6 ft) thick. They generally cross cut bedding, although they do locally parallel bedding. A feature known as patterned ground is observed where the dikes intersect the ground surface.

Studying the distribution of Hanford formation facies types and identifying similarities in lithologic succession across the 200 West Area indicates that the Hanford formation can be divided into two widely distributed stratigraphic units: a gravelly unit referred to as unit 1 and a sand-rich unit referred to as unit 2. Also, three localized units are found in the 200 West Area. These units consist of a sandy unit overlying unit 1, referred to as unit 1a; a second gravel interval near the bottom of the section, referred to as unit 3; and a silt-rich unit at the base of the section, referred to as unit 4. Mineralogic and geochemical data are not used in differentiating units because no comprehensive mineralogic and geochemical data set exists.

Unit 4. Unit 4 is dominated by strata typical of the silt-dominated facies and lesser sand-dominated facies. It is largely restricted to the west-central part of the 200 West Area where it underlies and interfingers with gravels of unit 3. Where unit 3 is absent, differentiating unit 4 from other silt- and sand-dominated parts of the Hanford formation may not be possible. However, some borehole data reported in Last and Rohay (1993) and Rohay et al. (1993) indicate unit 4 may be separable from other silt and sand units on the basis of decreased grain size.

Unit 3. Deposits of the gravel- and sand-dominated facies form the bulk of unit 3. Unit 3 is most common in the west-central part of the area (Rohay et al. 1993). Because no distinctive marker lithologies and beds are present, determining whether unit 3 in the 200 West Area correlates to unit 3 in the 200 East Area is impossible. Differentiating the gravels of unit 3 from other gravelly Hanford units, such as unit 1, where intervening sandy strata are absent also is impossible.

Unit 2. Unit 2 consists dominantly of silt, silty sand, and sand typical of the silt-dominated facies interbedded with coarser sands like those making up the sand-dominated facies. Thin (<3 m [<9.8 ft]) intervals dominated by the gravel facies are found locally. The distribution of facies within the unit is variable, although the unit generally fines to the south where silt-dominated facies become more common. Unit 2 pinches out in the northern part of the 200 West Area and generally thickens to the south (Figures 27 and 28).

Unit 1. Unit 1 consists of interstratified gravel facies, sand facies, and lesser silt facies. At some localities deposits typical of the sand-dominated facies dominate. This is especially common in the west-central 200 West Area where a sandy interval, referred to as unit 1a, gradationally overlies unit 1 gravels (Rohay et al. 1993). Minor, laterally discontinuous silty deposits like those that form the silt facies are found locally. The thickness and distribution of individual facies within unit 1 is variable. Fining upward sequences of coarse to fine gravel and gravel to gravelly sand are present at some locations. The base of unit 1 is incised into underlying strata. However, where the unit thins to the south, the contact is less well defined as unit 1 interfingers with the sand and silt of unit 2 (Figure 29).

4.1.1.3.4 Holocene Deposits. Holocene surficial deposits consist of a mix of silt, sand, and gravel deposited by a combination of eolian and alluvial processes. These Holocene deposits form a thin (4.9 m [<16 ft]) veneer across much of the Hanford Site.

Holocene deposits in the 200 West Area consist of thin (<3 m [<9.8 ft]) eolian sheet sands. These sands are very fine to medium grained and occasionally silty. These deposits have been removed from much of the area by construction activities.

4.1.1.4 Structural Geology. The Hanford Site is located in the eastern Yakima Fold Belt near its junction with the Palouse subprovince (DOE 1988). A series of segmented, narrow, asymmetric, and generally east-west-trending anticlines that separate broad, low-amplitude structural basins characterizes the Yakima Fold Belt (Reidel 1984, Reidel et al. 1989, Tolan and Reidel 1989). One of the largest structural basins within the Yakima Fold Belt is the Pasco Basin. The Hanford Site is situated in the Pasco Basin, which is bounded on the north by the Saddle Mountains anticline, on the west by the Hog Ranch-Naneum Ridge anticline, and on the south by the Rattlesnake Mountain anticline (Figure 30) (DOE 1988). The Palouse slope, a west-dipping monocline, bounds the Pasco Basin on the east (Figure 30) (DOE 1988). The Pasco Basin is divided into the Wahluke and Cold Creek synclines by the Gable Mountain anticline, the easternmost extension of the Umtanum Ridge anticline (Figure 30) (DOE 1988).

The 200 West Area is situated on the generally southward-dipping north limb of the Cold Creek syncline approximately 1 to 5 km (0.6 to 3.1 mi) north of the syncline axis (see Figure 30). The Gable Mountain-Gable Butte segment of the Umtanum Ridge anticline lies approximately 4 km (2.5 mi) north of the 200 West Area. The axes of the anticline and syncline are 9 to 10 km (5.6 to 6.2 mi) apart, with structural relief of over 250 m (820 ft).

The Elephant Mountain Member of the Saddle Mountains Basalt is the uppermost basalt unit beneath the 200 West Area. It is continuous beneath the entire area. The top of the Elephant Mountain Member dips to the southwest and south into the Cold Creek syncline, reflecting the structure of the area (Figures 30 and 31). There is little evidence of significant erosion into the top of the Elephant Mountain Member and no indication of erosional "windows" through the basalt into the underlying Rattlesnake Ridge interbed of the Ellensburg Formation.

Figure 27. Isopach Map of Hanford Formation, Unit 2, 200 West Area.

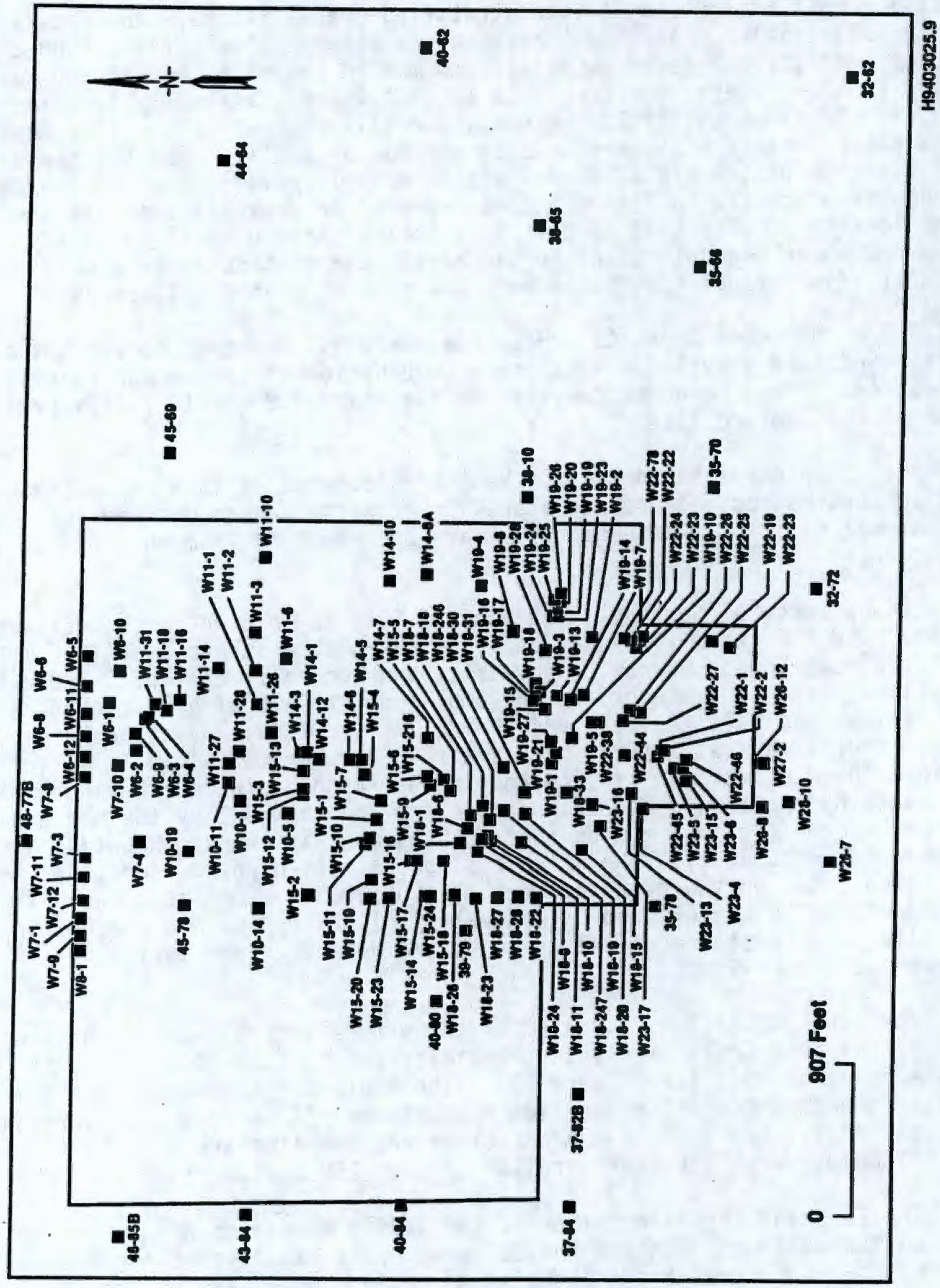
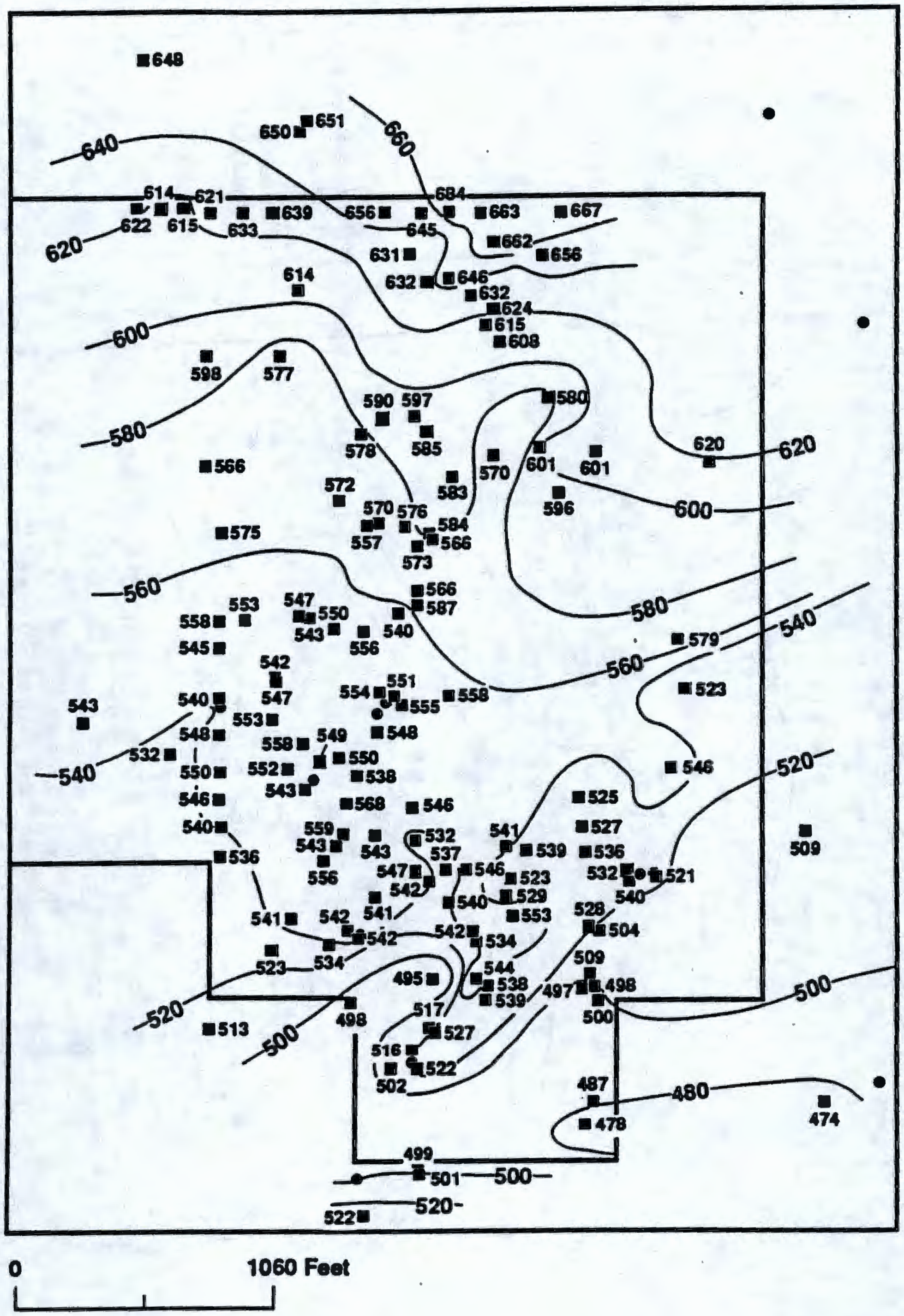


Figure 28. Surface Map, Top of Hanford Formation, Unit 2, 200 West Area.



H9407003.2

Figure 29. Isopach Map of Hanford Formation, Unit 1, 200 West Area.

Hf Th 2W

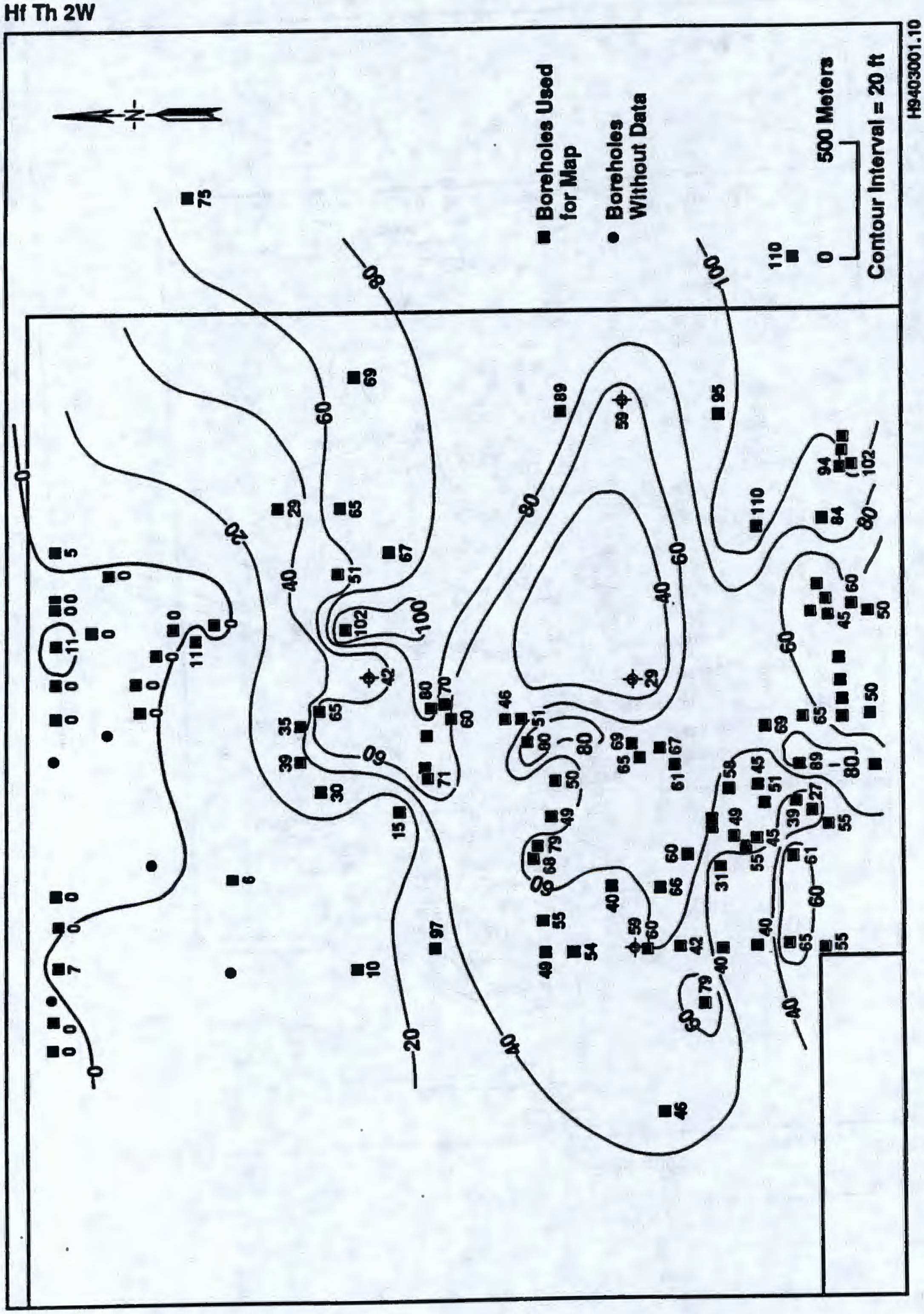


Figure 30. Structural Geologic Setting of the Pasco Basin and Surrounding Area.

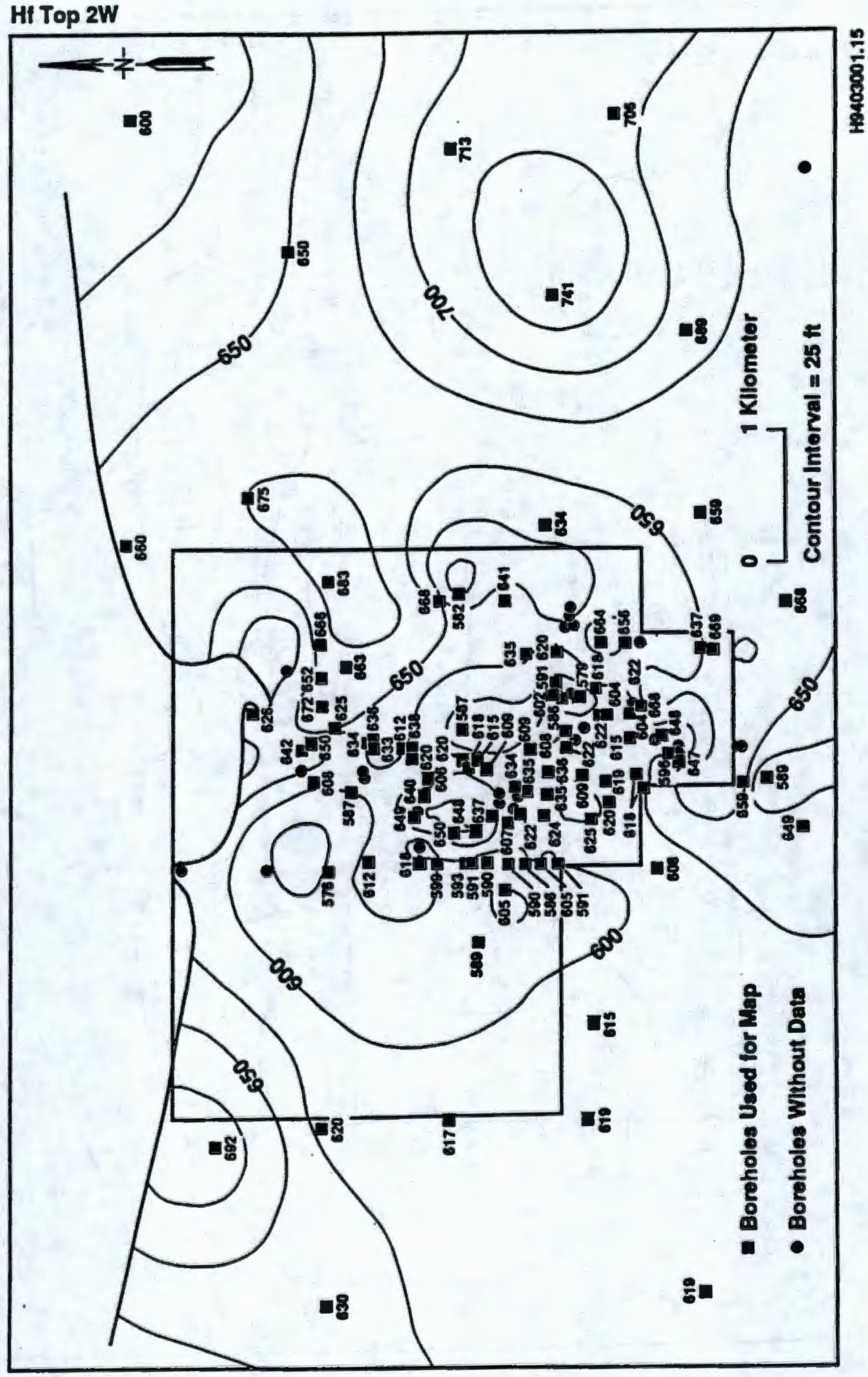
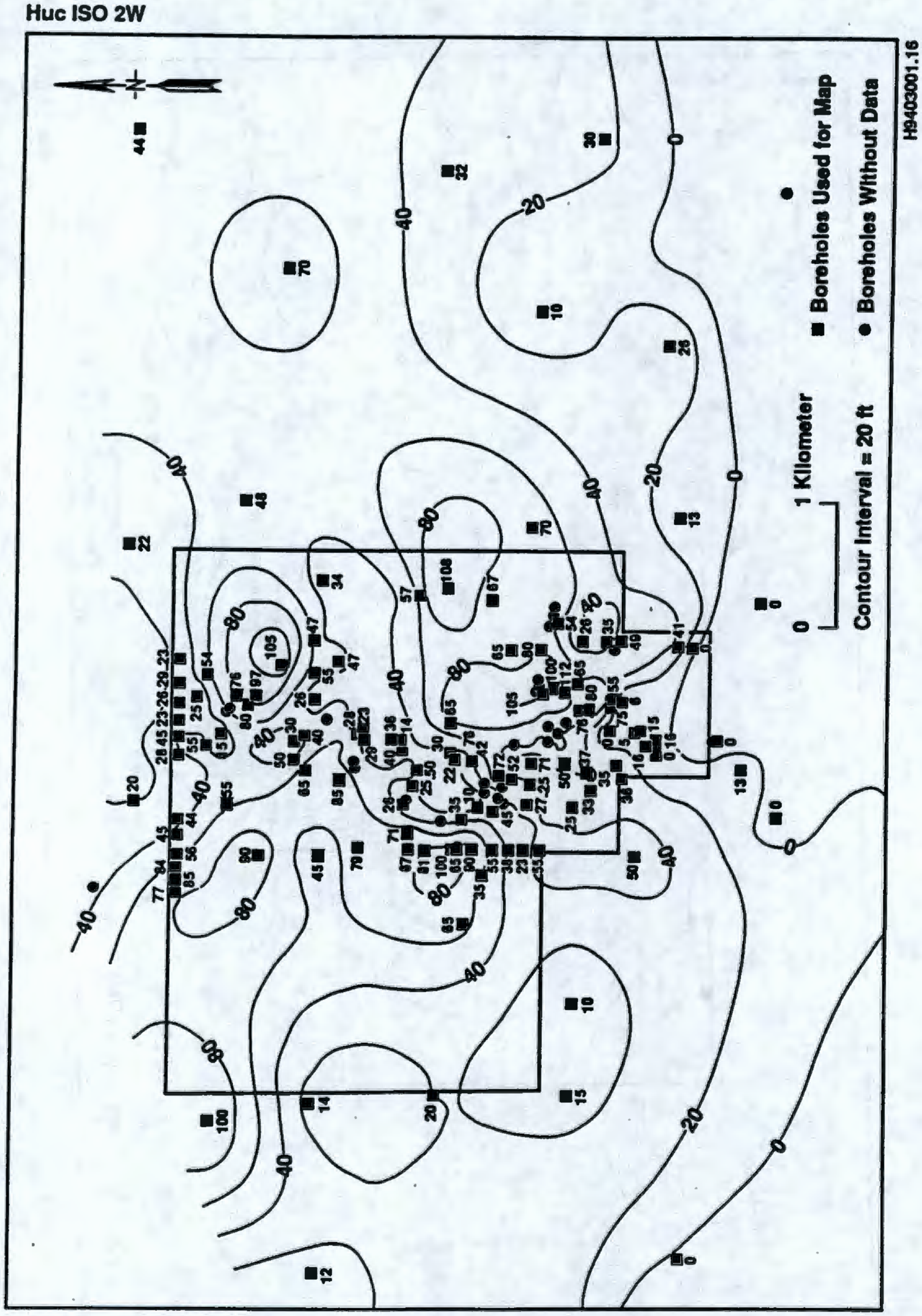


Figure 31. Index Map to Boreholes Used for Geologic Interpretations in this Report Outside of the 200 East and 200 West Areas.



4.1.3 Regional and 200 West Area Hydrology

4.1.3.1 Surface Hydrology. Primary surface water features near the Hanford Site are the Columbia and Yakima Rivers. The free-flowing stretch of the Columbia River adjacent to the Hanford Site is known as the Hanford Reach. It extends from Priest Rapids Dam to the headwaters of Lake Wallula (the reservoir behind McNary Dam) at about the 300 Area. Flow along the Hanford Reach is controlled by Priest Rapids Dam. Approximately one-third of the Hanford Site is drained by the Yakima River system. West Lake, about 4 ha (10 acres) in area and less than 1 m (3 ft) deep, is the only natural lake on the Hanford Site (DOE 1988). Wastewater ponds, cribs, and ditches associated with nuclear fuel reprocessing and waste disposal activities are also present on the site.

4.1.3.2 Subsurface Hydrology.

4.1.3.2.1 Saturated Zone. The Hanford Site is underlain by a multiaquifer system consisting of four hydrogeologic units that correspond to the upper three formations of the CRBG (Grande Ronde, Wanapum, and Saddle Mountains Basalt) and the suprabasalt sediments (DOE 1988, Delaney et al. 1991). The basalt aquifers generally are confined and found within sedimentary interbeds of the Ellensburg Formation and permeable zones that occur between flows.

Recharge to the shallow basalt aquifers in the Saddle Mountains and upper Wanapum Basalts is from infiltration of precipitation and runoff along the margins of the Pasco Basin. Recharge of the deep basalt aquifers in the lower Wanapum and Grande Ronde Basalts is inferred to occur northeast and northwest of the Pasco Basin in areas where the Wanapum and Grande Ronde Basalts crop out extensively (DOE 1988). Groundwater discharge from shallow basalt aquifers is probably to overlying aquifers and to the Columbia River. Discharge areas for the deeper aquifers are uncertain, but are inferred to be south of the Hanford Site (DOE 1988). Erosional "windows" through dense basalt flow interiors at the top of the basalt aquifer system allow direct interconnection between the suprabasalt aquifer system and the uppermost basalt aquifers (Graham et al. 1984).

The suprabasalt sediment aquifer is contained within the Hanford formation and the Ringold Formation. The top of this aquifer lies at depths ranging from less than 30 cm (1 ft) near West Lake and the Columbia and Yakima Rivers, to greater than 107 m (350 ft) near the center of the Hanford Site. The base of the uppermost aquifer system is the top surface of the underlying basalt. Beneath the western part of the Hanford Site, the water table generally is within gravels of Ringold unit E. In the northern and eastern portions of the Hanford Site, the water table is generally at or near the Hanford-Ringold contact. In the east-central part of the Hanford Site, the water table lies up to 24 m (80 ft) above the top of the Ringold Formation. Widespread intervals dominated by the paleosol-overbank and lacustrine facies associations form at least partially confining layers between the main Ringold gravel-bearing units (A, B/D, C, and E). The uppermost aquifer system is bounded laterally by anticlinal basalt ridges and is approximately 152 m (500 ft) thick near the center of the basin. Hydraulic conductivities for the Hanford formation are much greater than those of the gravel facies of the Ringold Formation (Connelly et al. 1992a, 1992b).

Natural recharge to the uppermost aquifer system consists of rainfall and runoff from the hills bordering the Hanford Site, water infiltrating from small ephemeral streams, river water along influent reaches of the Yakima and Columbia Rivers, and water rising from underlying confined basalt aquifers along faults and fractures. The movement of moisture from precipitation through the unsaturated (vadose) zone varies. Gee (1987) and Routson and Johnson (1990) indicate that the downward movement of moisture from surface recharge is nonexistent across much of the Hanford Site, while Rockhold et al. (1990) suggest that downward water movement below the root zone is common in the 300 Area. Artificial recharge occurs from the disposal of wastewater on the Hanford Site (principally in the 200 Areas) and from large irrigation projects surrounding the Site.

4.1.3.2.2 Unsaturated Zone. Strata in the vadose zone across the Hanford Site show variations similar to those displayed in the uppermost aquifer system. The Hanford formation, Plio-Pleistocene unit, and Ringold Formation all are present in the vadose zone in the 200 West Area. In the 200 East Area the vadose zone is situated almost entirely within the Hanford formation. The distribution of fine-grained layers, cemented zones, and clastic dikes within these units probably have the greatest influence on vadose zone flow and transport properties.

Van Genuchten curve-fitting parameters for the major stratigraphic units beneath the 200 East and West Areas are summarized in Connelly et al. (1992a, Table 3-1; 1992b, Table 3-1), respectively. Close examination of the values in these tables reveals a large amount of variability. Because of this high degree of variation, known heterogeneities in the geology of the area, borehole sampling techniques inappropriate for intact sediment sampling, and the limited number of data points, these data are not representative of vadose conditions.

4.1.3.3 200 West Subsurface Hydrology. The surface of the unconfined aquifer in the 200 West Area is situated entirely within partially cemented fluvial gravels of Ringold unit E (Connelly et al. 1992b). Transmissivity and hydraulic conductivity values summarized in Connelly et al. (1992b, Table 3-2) indicate ranges of 1.7 to 4,738 m^2/day and 0.3 to 1,554 m/day (18 to 51,000 ft^2/day and 1 to 5,100 ft/day), respectively. The vadose zone beneath the 200 West Area is situated in the Hanford formation, the Plio-Pleistocene unit, the Ringold member of Taylor Flat, and the upper part of Ringold unit E. Van Genuchten curve-fitting parameters for lithologies that typically make up these units are listed in Connelly et al. (1992a, Table 3-1; 1992b, Table 3-1).

Clastic dikes also are common in the vadose zone in the 200 West Area. Data describing the physical characteristics and hydrologic properties of clastic dikes are not available. However, some empirical observations have been made that allow the following general conclusions to be made.

- Clastic dikes are most common within strata typical of the sand- and silt-dominated facies. However, the dikes are very difficult to detect in the subsurface.

- Clastic dikes can potentially act either as barriers or as pathways to fluid transport. Their behavior depends on the content of the dike and the type of sediment the dike transects.

- The lateral extent of the spreading of individual perched water zones is limited where dikes appear to form pathways for vertical fluid transport.

4.1.4 T-4-2 Ditch Area Geology and Hydrology

4.1.4.1 T-4-2 Ditch Geology. The T-4-2 Ditch (Figure 32) is underlain, from the surface to the bottom of monitoring well 299-W10-22, by the following:

- Eolian sand
- Hanford formation gravel (unit 1) and sand facies (unit 2)
- The Plio-Pleistocene unit
- The lower part of the member of Taylor Flat (Ringold Formation)
- Unit E of the member of Wooded Island (Ringold Formation).

Figure 33 shows the location of the lines of cross section through the T-4-2 area. Figure 34 is a line of cross section running northwest to southeast; Figure 35 is a line of cross section running southwest to northeast through the T-4-2 Ditch site. The suprabasalt stratigraphy beneath the T-4-2 Ditch is summarized as follows:

- The upper 3 m (10 ft) is composed of eolian sands (Figures 34 and 35).

- The Hanford formation is 24 m (77 ft) thick. Open-framework gravel of the gravel facies forms unit 1, which is 7 m (24 ft) thick. Unit 2, consisting of sand, silty sand, silt, and local lenses of gravel of the sand facies, is 16 m (53 ft) thick. Unit 2 pinches out in the northern part of the 200 West Area, but is continuous beneath the T-4-2 Ditch (Figures 34 and 35).

- The Plio-Pleistocene unit is continuous beneath the T-4-2 Ditch (Figures 34 and 35), is 8 m (25 ft) thick, and dips to the south. Beneath the ditch the unit is a combination of all its sediment types except laminated silt. Consequently, a complex vadose zone transport system should be expected. The Plio-Pleistocene unit commonly grades downward into underlying Ringold strata, and the top of the Plio-Pleistocene unit generally is placed at the base of the lowest calcium carbonate-rich layer, which is more than 8 cm (0.25 ft) thick.

- Erosional remnants of the member of Taylor Flat (Ringold Formation) are present beneath the Plio-Pleistocene unit. These strata are 10 m (34 ft) thick and dip to the south just like the overlying Plio-Pleistocene unit. Beneath the T-4-2 Ditch, the member contains deposits of the fluvial sand facies, the overbank-paleosol facies, and fluvial gravel facies.

- Unit E of the member of Wooded Island (Ringold Formation) underlies the member of Taylor Flat strata (Figures 34 and 35). The total thickness of unit E drilled at the T-4-2 Ditch was 47 m (155 ft). Unit E is dominated by the fluvial gravel facies, with minor laterally discontinuous occurrences of the fluvial sand and

Figure 32. Stratigraphic Column for Monitoring Well 299-W10-22, Located at the Head-End of the 216-T-4-2 Ditch.

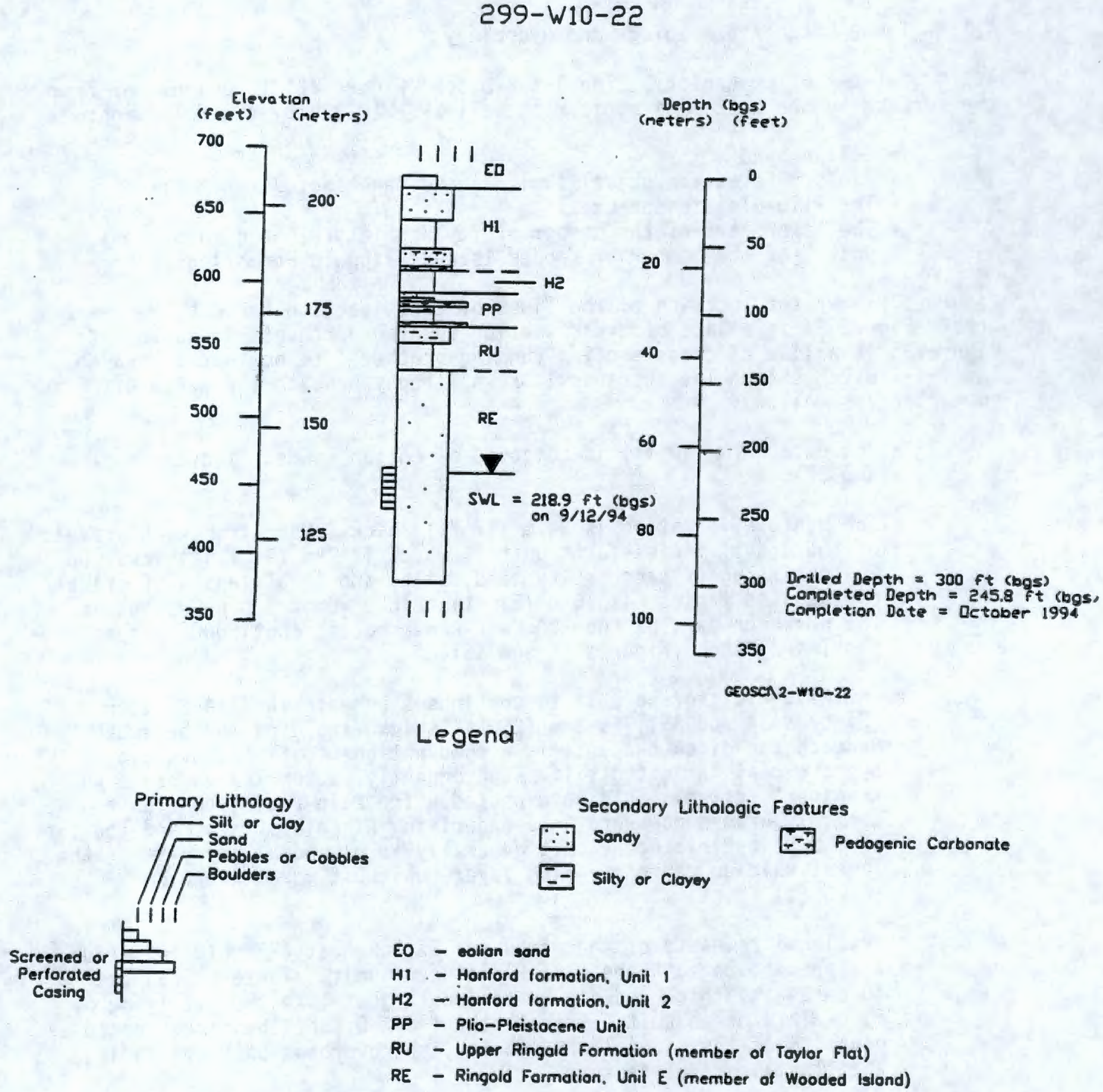


Figure 33. Location of the Lines of Cross Section Through the 216-T-4-2 Ditch Site, Including Monitoring Well 299-W10-22.

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Figure 34. Line of Cross Section Running Northwest to Southeast (A to A') Through the 216-T-4-2 Ditch Site, Including Monitoring Well 299-W10-22 (Lindsey et al 1994).

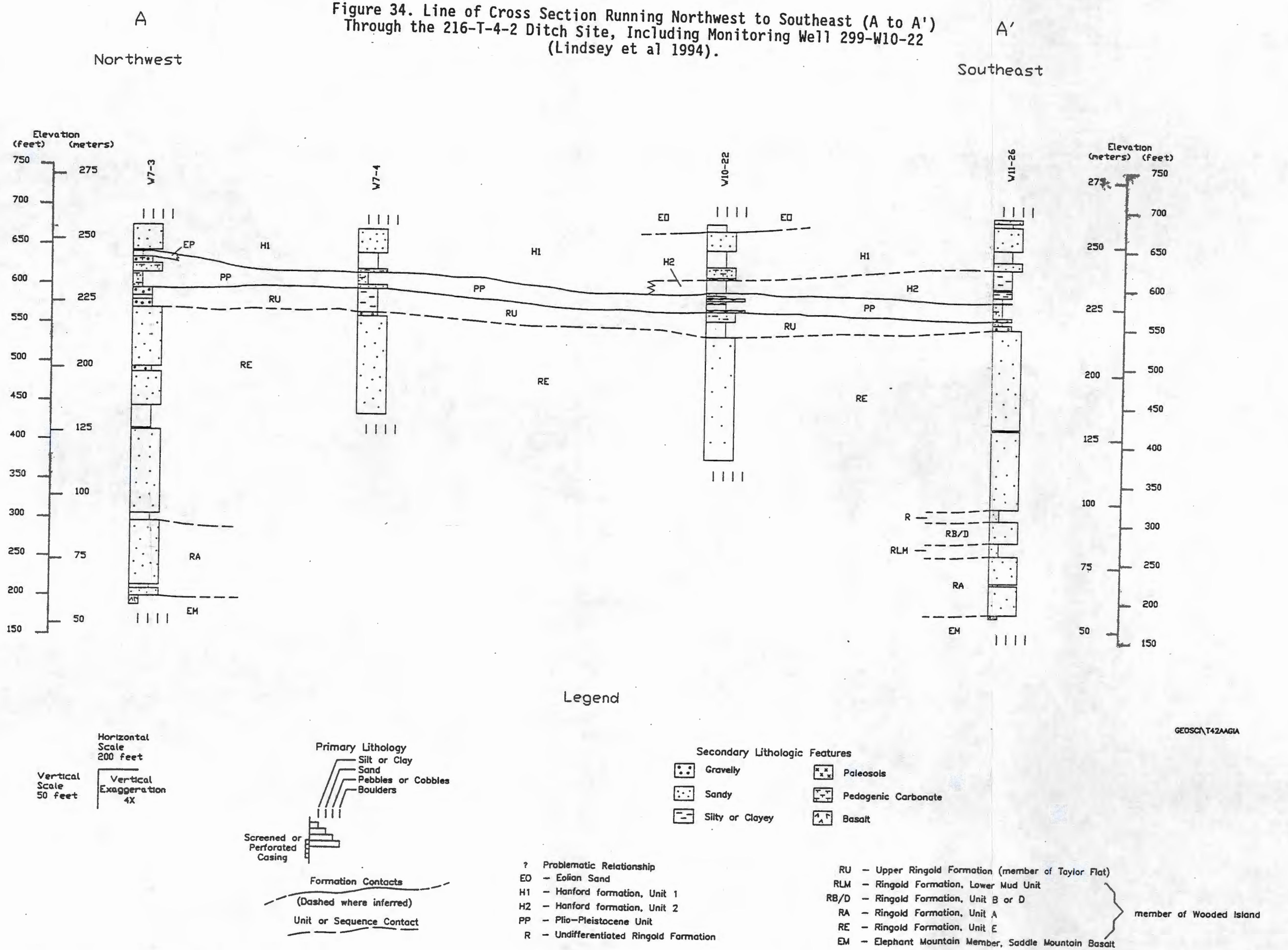
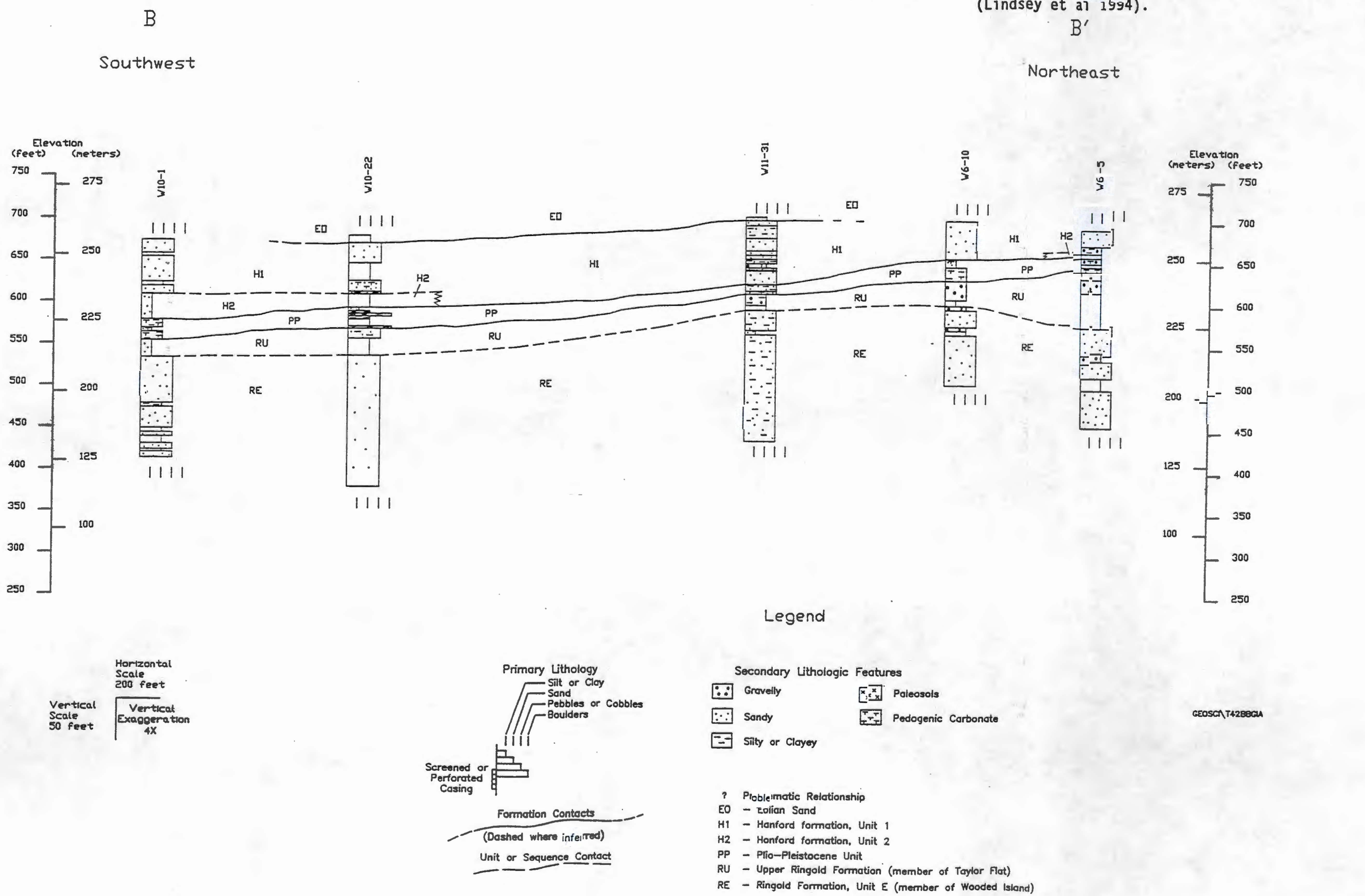


Figure 35. Line of Cross Section Running Northwest to Southeast (B to B') Through the 216-T-4-2 Ditch Site, Including Monitoring Well 299-W10-22 (Lindsey et al 1994).



overbank-paleosol facies. Strata of unit E dip generally to the south at this location.

4.1.4.2 T-4-2 Ditch Area Hydrology. The hydrostratigraphic units of concern in the vicinity of the T-4-2 Ditch are the Ringold Formation, the Plio-Pleistocene, and the Hanford formation.

- In the immediate vicinity of the T-4-2 Ditch, the water table is within the unit E member of Wooded Island gravel (Figure 32). The borehole drilled at the T-4-2 Ditch (299-W10-22), which was drilled to a total depth of 91.4 m (300 ft) below ground surface, penetrated the unit E gravel 25 m (82 ft).

- The unsaturated zone beneath the T-4-2 Ditch is 66 m (218 ft) thick and consists of the upper portion of the unit E gravels (Ringold Formation), the member of Taylor Flat (Ringold Formation), the Plio-Pleistocene unit, the Hanford formation units 2 and 1, and eolian sands.

- Pedogenic $CaCO_3$-cemented horizons in the Plio-Pleistocene Unit probably create local perched water conditions. Perched water was first encountered during drilling of well 299-W10-22 at 16 m (51 ft) below ground surface, while still in the Hanford formation unit 2. The soil column was very wet beneath this perched water zone all the way down to the second perched water zone encountered at 26 m (86 ft). Lateral spreading of the perched water is likely to occur on and in the Plio-Pleistocene, which has significant $CaCO_3$ cementing and dips to the south in this area. Lateral discontinuities such as pinchouts and dikes can occur within this interval, and will limit the spread of the perched water.

4.2 HYDROLOGIC RESPONSES TO EFFLUENT DISPOSAL

The water table east/northeast (downgradient) of the T-4-2 Ditch is a relatively uniform surface dipping to the east (Figure 36). No irregularities exist near the T-4-2 Ditch. Furthermore, the water level in well 299-W10-22 (the well adjacent to the head end of the T-4-2 Ditch) is consistent with the regional water table. This indicates that the amount of wastewater discharged to the T-4-2 Ditch is insufficient to form a discernable mound.

Wastewater discharge to the T-4-2 Ditch is decreasing with time and will cease in 1995. Therefore, the formation of a future groundwater mound at the T-4-2 Ditch site is unlikely assuming the continued decrease in the quantities of wastewater being discharged into the ditch.

Several wells exist in the vicinity of the T-4-2 Ditch and their water level measurements are consistent with those seen in the monitoring well at the head end of the ditch (299-W10-22). Consequently, it is possible to speculate on the nature of the groundwater conditions beneath the ditch. Based on experience elsewhere at the Hanford Site, the following is a general conceptualization of water movement through the ground beneath the ditch.

Wastewater from the T-4-2 Ditch is sufficient to saturate at least part of the soil column beneath the ditch. Wastewater is trapped and held in the

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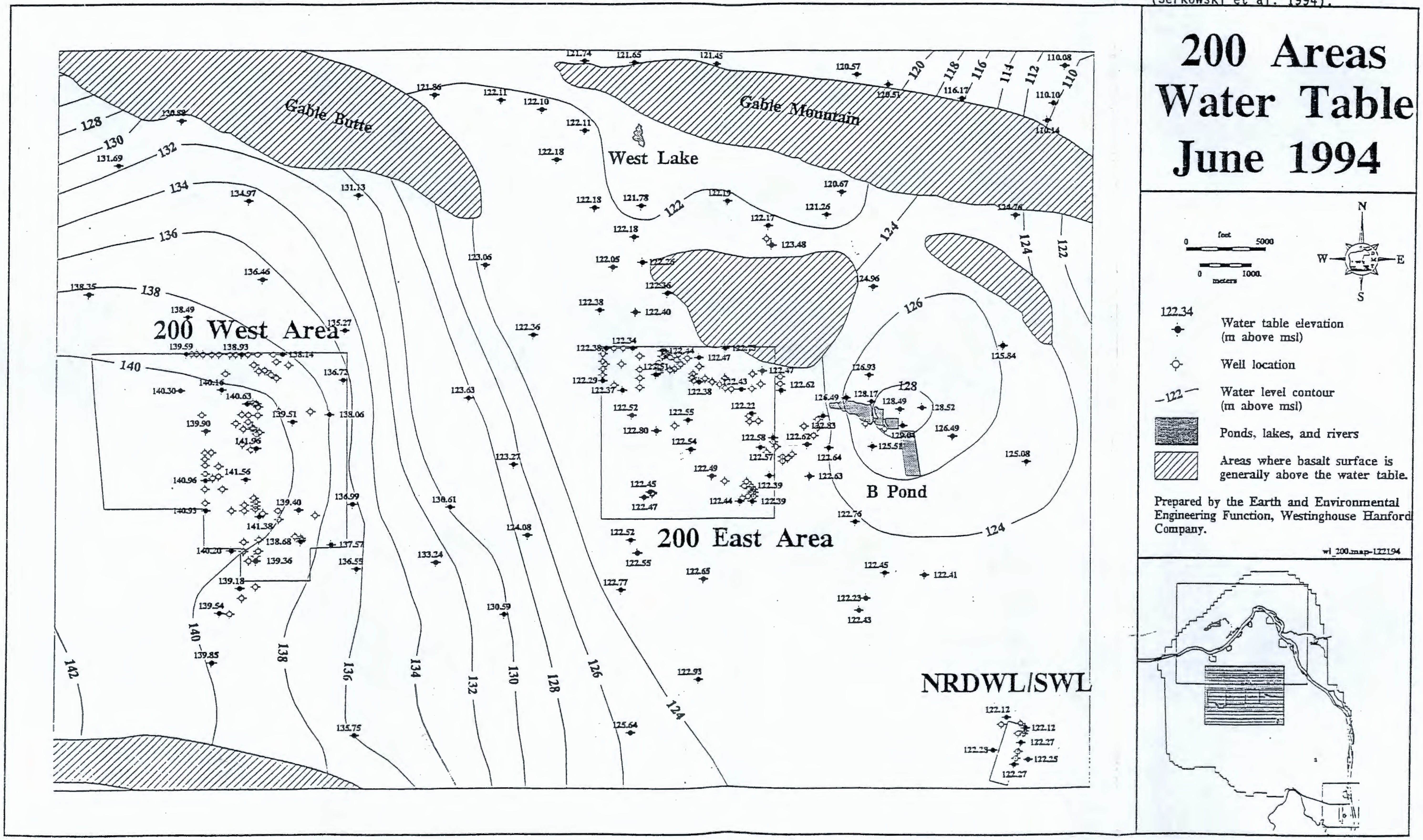
Figure 36. 200 Areas Water Table Elevation, June 1994 (Serkowski et al. 1994).



first 16 m (50 ft) of ditch, forming a pond that contains standing water most of the year; the wastewater slowly seeps through or around the fine sediments in the bottom of the ditch. Once past these fine sediments, it moves through the open-framework gravels of unit 1 of the Hanford formation. When the wastewater reaches the silt/silty sand/sands and interfingered gravel lenses of unit 2 of the Hanford formation, it percolates more slowly through the soil column. The wastewater spreads laterally (perches) on top of the Plio-Pleistocene unit and semisaturates part of the overlying Hanford formation unit 2. Perched water was first encountered at approximately 16 m (50 ft) of depth. The soil column beneath this point was very moist and perched water was detected again at approximately 26 m (86 ft). Perched water can occur at many depths/horizons within unit 2 of the Hanford formation and the Plio-Pleistocene Unit. Lateral spreading of water within unit 2 of the Hanford formation and/or on the Plio-Pleistocene interval is very likely in this area, because $CaCO_3$ cementing is present within both intervals and a large amount of water flows into the soil column. Determining the extent of the spreading is not possible because all the wells in the vicinity are cased off through this interval and are completed in the top of the unconfined aquifer. However, perched water is most likely to flow to the south/southwest because the Plio-Pleistocene layer dips in that direction at this location (see Figure 35).

4.3 GROUNDWATER QUALITY

4.3.1 216-T-4-2 Ditch Groundwater Quality

Perched water and groundwater analytical data from well 299-W10-22 (at the head end of the T-4-2 Ditch) give an indication of the local groundwater quality, as well as potential local influences from the T-4-2 Ditch. Appendix A-1 lists results of perched water and groundwater analyses for all samples collected from well 299-W10-22 during drilling and well installation (1994).

Tables 10 and 11 summarize the perched water and groundwater data, respectively, from Appendix A-1 by listing the constituents detected in the analyses. The tables list the concentration measured for the parameters listed. These tables list both field and laboratory analytical results. Where a conflict exists between values, the value considered least accurate is shown in parentheses. If no parentheses are used, both values are considered valid. Complete lists of values measured for the sample sets are given in Appendix A-1.

The constituents that were detected at levels above analytical detection limits were compared to background values for the unconfined aquifer on the Hanford Site (DOE-RL 1992d). The naturally occurring constituents detected in the perched water (Table 10) were all below the provisional threshold values or the upper 95% confidence limits for natural background at the Hanford Site (Johnson 1993a). None of the constituents detected in the perched water exceeded a regulatory limit. Of the naturally occurring constituents detected in the groundwater samples (Table 11), only manganese clearly exceeded the upper 95% confidence limit for natural background. One gross beta result from a set of duplicate samples exceeded natural background, the other did not. Carbon tetrachloride and chloroform were detected at concentrations above regulatory standards in some of the samples. Chloroform and carbon

Table 10. Constituents Analyzed - Perched Water Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Alkalinity	---	---	ppb	137,000 ± 33,656	--	---	--
Aluminum (f)	---	31.1	ppb	<200	N	---	--
Americium-241	---	0.0543	pCi/L	---	--	1.2 (1/25 DCG)	N
Antimony (f)	---	19.5	ppb	---	--	---	--
Arsenic (f)	---	<3.0	ppb	<5	N	---	--
Barium (f)	---	32.6	ppb	41 ± 20	N	1,000 (WWQS)	N
Beryllium (f)	---	<7.0	ppb	<5	N	---	--
Cadmium (f)	---	<20	ppb	<10	?	10 (WWQS)	?
Calcium (f)	---	35,500	ppb	38,352 ± 11,023	Y	---	--
Carbon Tetrachloride	---	<5	ppb	---	--	5 (MCL)[e]	N
Cesium-137	---	2.60	pCi/L	---	--	120 (1/25 DCG)	N
Chloride	---	4,800 7,500[f]	ppb	5,302 ±1,774 (low) to 23,296 ±2,463 (high)	Y	250,000 (WWQS)	N
Chloroform	---	<5	ppb	---	--	7 (WWQS)	N
Chromium, total (f)	--- 40[f]	(3.0) 40[f]	ppb	<30	Y[g]	50 (WWQS)	N
Chromium, hexavalent (f)	--- 30[f]	--- 40[f]	ppb	---	--	---	--
Cobalt (f)	---	2.9	ppb	---	--	---	--
Cobalt-60	---	-1.28	pCi/L	---	--	200 (1/25 DCG)	N
Copper (f)	---	8.7	ppb	<30	N	1,000 (WWQS)	N

Table 10. Constituents Analyzed - Perched Water Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
DO	---	+8.35[f]	mg/L	---	--	---	--
Fluoride	---	180	ppb	437 ± 131	N	4,000 (WWQS)	N
Gross alpha	---	5.74	pCi/L	2.5 ± 1.5	--	15 (WWQS)	N
Gross beta	---	8.42	pCi/L	7.1 ± 2.6	N	50 (WWQS)	N
Iron, total (f)	--- 0.0[f]	33.8 10[f]	ppb	<50 (low) to 494 ± 118 (high)	N	300 (WWQS)	N
Iron, ferrous (f)	--- 0.0[f]	--- 10[f]	ppb	---	--	---	--
Lead (f)	---	<3.0	ppb	<5	N	50 (WWQS)	N
Magnesium (f)	---	7,550	ppb	11,190 ± 2,578	N	---	--
Manganese (f)	---	91.2	ppb	<20 (low) to 118 ± 17 (high)	Y	50 (WWQS)	Y
Mercury (f)	---	<0.2	ppb	<0.1	?	2 (WWQS)	N
Nickel (f)	---	<40.0	ppb	30<30	?	---	--
Nitrate	--- 1,000[f]	390 1,100[f]	ppb	5,170 ± 3,576	N	10,000 (WWQS)	N
Nitrite	--- 28[f]	<20 4[e]	ppb	---	--	---	--
ORP	---	-0.2[f]	mV	---	--	---	--
pH	7.67[f]	8.42[f]	---	7.57 ± 0.29	Y	6.5 to 8.5 (WWQS)	N
Phosphate	---	<1000	ppb	<1,000	N	---	--
Plutonium-238	---	0.00	pCi/L	---	N	1.6 (1/25 DCG)	N

Table 10. Constituents Analyzed - Perched Water Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Plutonium-239/40	---	0.00	pCi/L	---	N	1.2 (1/25 DCG)	N
Potassium (f)	---	5,150	ppb	4,993 ± 1,453	Y	---	--
Ruthenium-106	---	---	pCi/L	---	--	240 (1/25 DCG)	--
Selenium (f)	---	<3.0	ppb	<5	N	10 (WWQS)	N
Silver (f)	---	<200	ppb	<10	N	50 (WWQS)	N
Sodium (f)	---	5,180	ppb	15,774 ± 6,784	N	---	--
Specific Conductance	527[f]	233[f]	µmhos/cm	344 ± 83	Y	---	--
Strontium (f,nr)	---	---	ppb	164 ± 37	--	---	--
Strontium-90	---	---	pCi/L	---	--	8 (WWQS)	--
Sulfate	--- 25,000[f]	22,700 27,000[f]	ppb	30,605 ± 22,611	Y	250,000 (WWQS)	N
Sulfide	--- 13[f]	<200 8[f]	ppb	---	--	---	--
Technetium-99	---	0.00	pCi/L	---	N	4,000 (1/25 DCG)	N
Temperature	6.5[f]	18.6[f]	°C	---	--	---	--
Thallium (f)	---	<3.0	ppb	---	N	---	--
Tritium	---	-15.8	pCi/L	400[g]	N	20,000 (WWQS)	N
Uranium (nr)	---	---	ppb	1.7 ± 1.2	--	---	--
Uranium-234	---	---	pCi/L	---	--	20 (1/25 DCG)	--
Uranium-235	---	---	pCi/L	---	--	24 (1/25 DCG)	--

Table 10. Constituents Analyzed - Perched Water Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Uranium-238	---	---	pCi/L	---	--	24 (1/25 DCG)	--
Vanadium (f)	---	<20.0	ppb	9 ± 4	N	---	--
Zinc (f)	---	<20.0	ppb	<50 (low) to 247 ± 165 (high)	?	5000 (WWQS)	N

[a] Results from samples taken on 8-11-94 at a depth of 15.5 m (51 ft), (Sample No. HT-94-7, [no HEIS Number. formal samples not taken]).
[b] Results from samples taken on 8-12-94 at a depth of 26.2 m (86 ft), (HEIS Sample No. B09TH9).
[c] Johnson 1993a.
[d] WWQS = Washington Water Quality Standards, Washington Administrative Code 173-200; 1/25 DCG = 1/25 Derived Concentration Guidelines, WHC 1988, Section 8.0.
[e] MCL = maximum contamination limit; (DOE 1990 b).
[f] Field analytical measurement.
[g] The field value is considered valid, because the analyses were performed on a real-time basis, and are more likely to be a true indication of field conditions.

EB = Exceed background.
f = Filtered.
pCi/L = Picocuries per liter.
DO = Dissolved oxygen.
? = Background value below detection limit, unable to determine.
EL = Exceed limit.
nr = Nonradiological.
ppb = Parts per billion.
ORP = Oxidation-Reduction Potential.

Detection limits for radionuclides are as follows:

Gross alpha = 0.58 pCi/L
cesium-137 = 9.6 pCi/L
Strontium-90 = 0.56 pCi/L
Plutonium-239/240 = 0.011 pCi/L
Tritium = 360 pCi/L.
Gross beta = 3.5 pCi/L
Radium = 0.1 pCi/L
Plutonium-238 = 0.018 pCi/L
Technetium-99 = 2.0 pCi/L

Table 11. Constituents Analyzed--Groundwater Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Alkalinity	---	109,000[e]	ppb	137,000 ± 33,656	N	---	--
Aluminum (f)	34.5/19.0	34.5/57	ppb	<200	N	---	--
Americium-241	0.277/0.175	0.110/0.08	pCi/L	---	--	1.2 (1/25 DCG)	N
Antimony (f)	32.8/1.5	30.5/46	ppb	---	--	---	--
Arsenic (f)	<3.0/<3.0	<3.0/<3.0	ppb	<5	N	---	--
Barium (f)	25.4/24.9	29.5/27	ppb	41 ± 20	N	1,000 (WWQS)	N
Beryllium (f)	<7.0/<7.0	<7/<1	ppb	<5	?	---	--
Cadmium (f)	<20/<20	<20/<20	ppb	<10	?	10 (WWQS)	?
Calcium (f)	27,500/28,000	25,600/24,000	ppb	38,352 ± 11,023	N	---	--
Carbon Tetrachloride	<5/<5	25/21	ppb	---	--	5 (MCL)[e]	Y
Cesium-137	-0.688/2.66	2.92/-0.8	pCi/L	---	--	120 (1/25 DCG)	N
Chloride	4,780/3,740 5,500[f]	4,000/3,900 7,250[f]	ppb	5,302 ± 1,774 (low) to 23,296 ± 2,463 (high)	Y	250,000 (WWQS)	N
Chloroform	<5/<5	17/13	ppb	---	Y	7 (WWQS)	Y
Chromium, total (f)	2.8/2.8 <10[f]	3.0/<5 15[f]	ppb	<30	N	50 (WWQS)	N
Chromium, hexavalent (f)	--- <10[f]	--- 10[f]	ppb	---	--	---	--
Cobalt (f)	2.9/2.9	3.2/<10	ppb	---	--	---	--
Cobalt-60	1.74/1.87	5.96/3.5	pCi/L	---	--	200 (1/25 DCG)	N
Copper (f)	4.5/4.5	11.7/<5	ppb	<30	N	1,000 (WWQS)	N
DO	3.86[f]	0.86[f]	mg/L	---	--	---	--

Table 11. Constituents Analyzed--Groundwater Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Fluoride	580/460	570/530	ppb	437 ± 131	Y	4,000 (WWQS)	N
Gross alpha	18.1/3.01	0.337/0.4	pCi/L	2.5 ± 1.5	--	15 (WWQS)	N
Gross beta	18.3/8.30	6.0/5.2	pCi/L	7.1 ± 2.6	Y	50 (WWQS)	N
Iron, total (f)	32.8/17.7 <10[f]	115/80 57.5[f]	ppb	<50 (low) to 494 ± 118 (high)	N	300 (WWQS)	N
Iron, ferrous (f)	--- <10[f]	--- <10[f]	ppb	---	--	---	--
Lead (f)	<3.0/<3.0	<3.0/<3.0	ppb	<5	N	50 (WWQS)	N
Magnesium (f)	8,250/8,540	9,360/8,300	ppb	11,190 ± 2,578	N	---	--
Manganese (f)	306/245	258/250	ppb	<20 (low) to 118 ± 17 (high)	Y	50 (WWQS)	Y
Mercury (f)	<0.2/<0.2	0.4/<0.2	ppb	<0.1	?	2 (WWQS)	N
Nickel (f)	<40.0/<40.0	<40.0/<40.0	ppb	<30	?	---	--
Nitrate	20/110 750[f]	2,200/2,100 3,075[f]	ppb	5,170 ± 3,576	N	10,000 (WWQS)	N
Nitrite	<20/<20 6.5[f]	28/26 27.8[f]	ppb	---	--	---	--
ORP	+75.3[f]	-75.3[f]	mV	---	--	---	--
pH	8.46[f]	8.42[f]	---	7.57 ± 0.29	Y	6.5 to 8.5 (WWQS)	N
Phosphate	<1,000/<1,000	<1,000/<20 <10[e]	ppb	<1,000	N	---	--
Plutonium-238	0.450/0.556	0.0/-0.04	pCi/L	---	--	1.6 (1/25 DCG)	N
Plutonium-239/40	0.075/0.396	-0.039/0.0	pCi/L	---	--	1.2 (1/25 DCG)	N

Table 11. Constituents Analyzed--Groundwater Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Potassium (f)	5,190/5,080	3,500/3,300	ppb	4,993 ± 1,453	N	---	--
Ruthenium-106	---	---	pCi/L	---	--	240 (1/25 DCG)	--
Selenium (f)	<3.0/<3.0	<3.0/<3.0	ppb	<5	N	10 (WWQS)	N
Silver (f)	<200/<200	<200/<10	ppb	<10	?	50 (WWQS)	?
Sodium (f)	14,100/14,100	18,500/16,000	ppb	15,774 ± 6.784	N	---	--
Specific Conductance	237[f]	269[f]	µmhos/cm	344 ± 83	N	---	--
Strontium (f,nr)	---	---	ppb	164 ± 37	--	---	--
Strontium-90	0.197/0.234	0.084/5.94	pCi/L	---	--	8 (WWQS)	--
Sulfate	16,200/13,600 14,000[f]	16,600/16,000 15,250[f]	ppb	30,605 ± 22,611	N	250,000 (WWQS)	N
Sulfide	670/<200 ND[f]	670/<1,000 ND[f]	ppb	---	--	---	--
Technetium-99	2.69/7.98	3.52/1.3	pCi/L	---	--	4,000 (1/25 DCG)	N
Temperature	21.3[f]	17.4[f]	°C	---	--	---	--
Thallium (f)	<3.0/<3.0	<3.0/<4.0	ppb	---	--	---	--
Tritium	-25.9/169.0	1,800/1,800	pCi/L	400[g]	Y	20,000 (WWQS)	N
Uranium (nr)	---	---	ppb	1.7 ± 1.2	--	---	--
Uranium-234	2.27/0.226	0.567/1.51	pCi/L	---	--	20 (1/25 DCG)	--
Uranium-235	0.119/0.156	0.108/0.18	pCi/L	---	--	24 (1/25 DCG)	--
Uranium-238	1.70/0.471	0.576/0.31	pCi/L	---	--	24 (1/25 DCG)	--
Vanadium (f)	<20.0/<20.0	<20.0/<14.0	ppb	9 ± 4	?	---	--

Table 11. Constituents Analyzed--Groundwater Monitoring Data for Well 299-W10-22. (4 sheets)

Constituent	Result[a]	Result[b]	Units	Background[c] (Mean ± 1σ)	EB	Limit[d]	EL
Zinc (f)	<20.0/<20.0	<20.0/<10.0	ppb	<50 (low) to 247 ± 165 (high)	?	5,000 (WWQS)	N

[a] Results from samples taken on 9-1-94 at a depth of 70.3 m (230.6 ft). Samples are listed as original sample set (HEIS Sample No. B09W13)/duplicate sample set (HEIS Sample No. B09W14).
[b] Results from samples taken on 9-15-94 at a depth of 83.8 m (275 ft). Samples are listed as original sample set (HEIS Sample No. B09W17)/split sample set (HEIS Sample No. B09W18).
[c] Johnson 1993a.
[d] WWQS = Washington Water Quality Standards, Washington Administrative Code 173-200; 1/25 DCG = 1/25 Derived Concentration Guidelines, WHC-CM-7-5, Section 8.0.
[e] MCL = maximum contamination limit; (DOE 1990b).
[f] Field analytical measurement.
[g] The field value is considered valid, because the analyses were performed on a real-time basis, and are more likely to be a true indication of field conditions.

EB = Exceed background.
f = Filtered.
pCi/L = Picocuries per liter.
DO = Dissolved oxygen.
? = Background value below detection limit, unable to determine.
EL = Exceed limit.
nr = Nonradiological.
ppb = Parts per billion.
ORP = Oxidation-Reduction Potential.
ND = Not detectable.

Detection limits for radionuclides are as follows:

Gross alpha = 0.58 pCi/L	Gross beta = 3.5 pCi/L
Cesium-137 = 9.6 pCi/L	Radium = 0.1 pCi/L
Strontium-90 = 0.56 pCi/L	Plutonium-238 = 0.018 pCi/L
Plutonium-239/240 = 0.011 pCi/L	Technetium-99 = 2.0 pCi/L
Tritium = 360 pCi/L.	

tetrachloride values were below the detection limit (<5 ppb for both) at the top of the unconfined aquifer (70.3 m [2.30.6 ft] below ground surface). Both constituents had elevated concentrations in the deeper unconfined aquifer sample (83.8 m [275 ft] below ground surface). Chloroform values were 17 ppb for the original sample and 13 ppb for the split sample, and carbon tetrachloride values were 25 ppb for the original sample and 21 ppb for the split sample. The chloroform samples exceeded the Washington State water quality standard (WAC 173-200, 1990) of 7 ppb.

Americium-241, strontium-90, plutonium-238, and plutonium-239/240 were reported at concentrations above their respective detection limits for the upper test zone sampled during drilling (Table 11, column 2). However, because they were not detected in the split-spoon sediment sample from the same depth (see Section 4.4), the apparent detections in the groundwater samples removed from the test zone are suspect. Cross-contamination of the samples with fine-grained particulate or fugitive dust particles from the drill site (i.e. surface contamination area (SCA) directly adjacent to the drill site to the west) may account for this anomalous occurrence. Additional sampling is needed to confirm these results.

4.3.2 Upgradient Groundwater Quality

4.3.2.1 200 West Area Groundwater Contaminant Plumes. Examination of contaminant plume maps and comparison to regulatory limits indicate seven major contaminant plumes in the vicinity of the T-4-2 Ditch (Connelly et al. 1992b, Ford 1993). They are arsenic, gross beta, carbon tetrachloride, chloroform, nitrate, technetium-99, and tritium. The apparent groundwater flow direction beneath the ditch is from the southwest to the northeast. The closest well immediately upgradient (299-W10-15) is approximately 76 m (250 ft) to the southwest. Several other wells that are part of the T Tank Farm monitoring network are located to the west and east of this well. Other than 299-W10-22 located at the ditch, the nearest well downgradient of the ditch (299-W6-2) is approximately 457 m (1,500 ft) to the northeast. The concentrations of the seven constituents forming plumes in the vicinity of the ditch site are as follows.

- Arsenic is found in two plumes within the 200 West Area (Figure 37). The northernmost plume is situated near the southwest side of the T-4-2 Ditch. This plume does not appear to extend as far north as the T-4-2 Ditch, as groundwater arsenic concentrations in well 299-W10-22 are at or below the detection limit for arsenic.

- Gross beta plumes are detected at several places in the 200 West Area (Figure 38), including a small one in the immediate vicinity of the T-4-2 Ditch. The plume concentration contour nearest the ditch is 8 pCi/L. Gross beta concentration in the groundwater at well 299-W10-22 range from 6 to 8 pCi/L. These concentrations are at or near the detection limit for gross beta, and do not indicate significant contamination.

- A carbon tetrachloride plume covers a large part of the 200 West Area (Figure 39). As drawn, the plume appears to underlie the T-4-2 Ditch. However, the first groundwater sample from well 299-W10-22, which was in the top of the unconfined aquifer (70 m [230 ft]) had

Figure 37. Arsenic Plume Map for the 200 West Area.

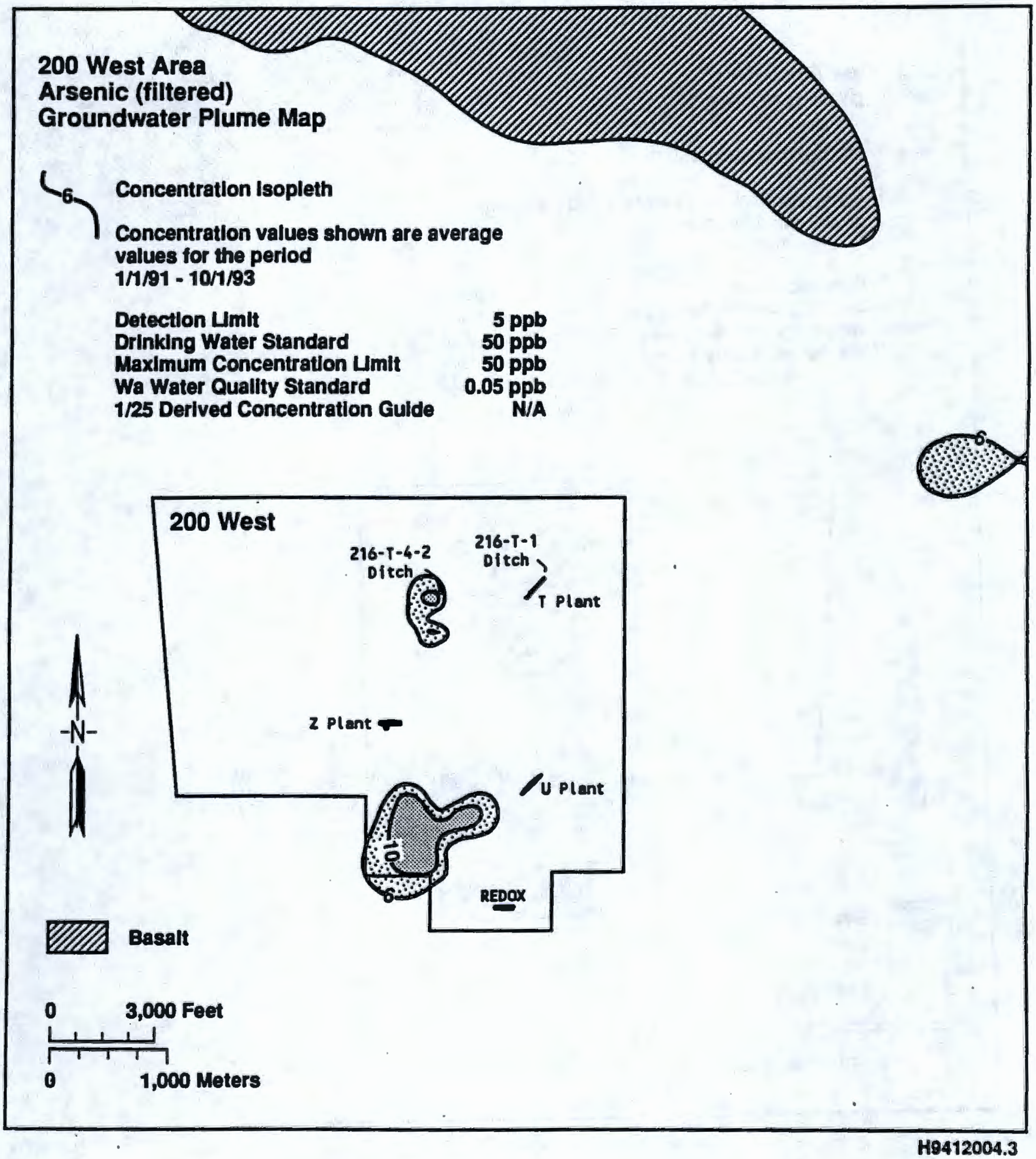
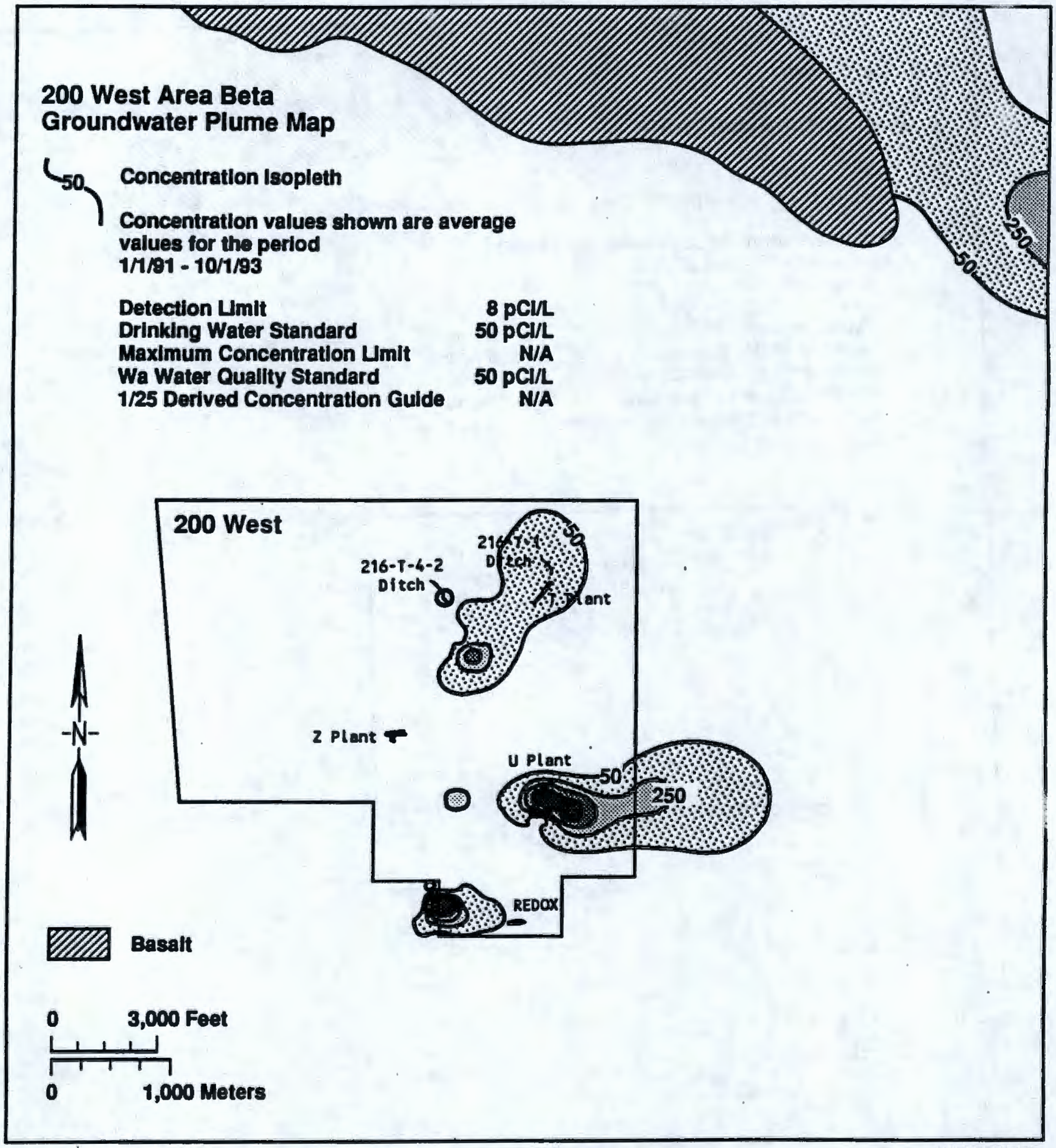
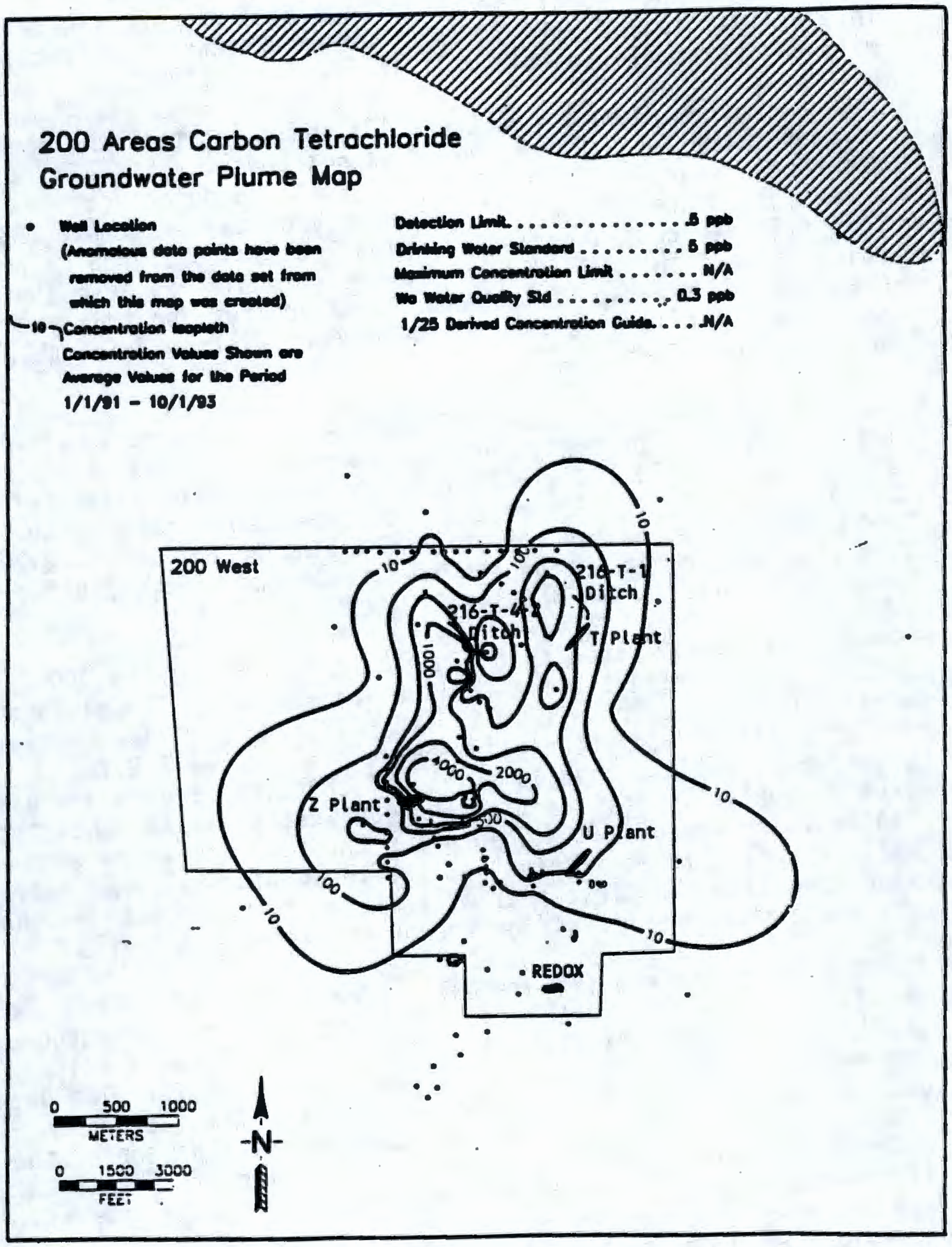


Figure 38. Gross Beta Plume Map for the 200 West Area.



H9412004.2

Figure 39. Carbon Tetrachloride Plume Map for the 200 West Area.



no detectable carbon tetrachloride. The second groundwater sample taken from the well, which was after the well reached total depth (91 m [300 ft], was sampled at 84 m ([275 ft) and had carbon tetrachloride concentrations of 21 to 25 ppb. Because the well was completed in the top of the unconfined aquifer, and the deeper interval was sealed off, it is uncertain if carbon tetrachloride will be detectable in this well in future samples.

- The chloroform plume map (Figure 40) indicates that the plume surrounds the T-4-2 Ditch, but does not underlie it. The shallow groundwater sample (70 m [230 ft]) exhibited no detectable chloroform concentration. The deeper groundwater sample (84 m [275 ft]) had concentrations ranging from 13 to 17 ppb. These values exceed the WWQS for chloroform (7 ppb). Because the well was completed in the top of the unconfined aquifer and this interval was sealed off, it is uncertain if chloroform will be detectable in this well in future samples.

- The nitrate plume, as drawn in Figure 41, appears to encroach on the T-4-2 Ditch, but probably does not underlie it. The shallow groundwater sample (70 m [230 ft]) had low concentrations of nitrate, ranging from 20 to 110 ppb. The deeper groundwater sample (84 m [275 ft]) had concentrations ranging from 2,100 to 2,200 ppb. These values are far below the lowest contour line (45,000 ppb) shown that passes near the T-4-2 Ditch.

- The technetium-99 plume in the northern portion of the 200 West Area appears to underlie the T-4-2 Ditch (Figure 42). The plume map shows the T-4-2 Ditch within the 50 pCi/L contour line. However, the concentration of technetium-99 within the T-4-2 Ditch groundwater is less than 10 pCi/L. Technetium-99 data are gathered from few wells in this part of the 200 West Area, so concentration contours are approximated when drawn through such areas with little well control. It is likely that the technetium-99 plume map should look more like the first four maps listed in this section; that is, the plume should split and go around the T-4-2 Ditch area.

- The tritium plume map (Figure 43) indicates that the plume underlies the T-4-2 Ditch. The ditch is within the 1,000-pCi/L contour. The shallow groundwater sample (70 m [230 ft]) exhibited a tritium concentration below the detection limit of 360 pCi/L. The deeper groundwater sample (84 m [275 ft]) had a concentration of 1,800 pCi/L. Because the well was completed in the top of the unconfined aquifer and this interval was sealed off, it is uncertain if tritium will be detectable in this well in future samples.

4.3.2.2 Upgradient Groundwater Quality and Sources of Contaminants.

Groundwater chemistry data from several wells located to the west, southwest, and south of the T-4-2 Ditch site were examined to determine the overall quality of groundwater upgradient of the ditch area. The Hanford

Figure 40. Chloroform Plume Map for the 200 West Area.

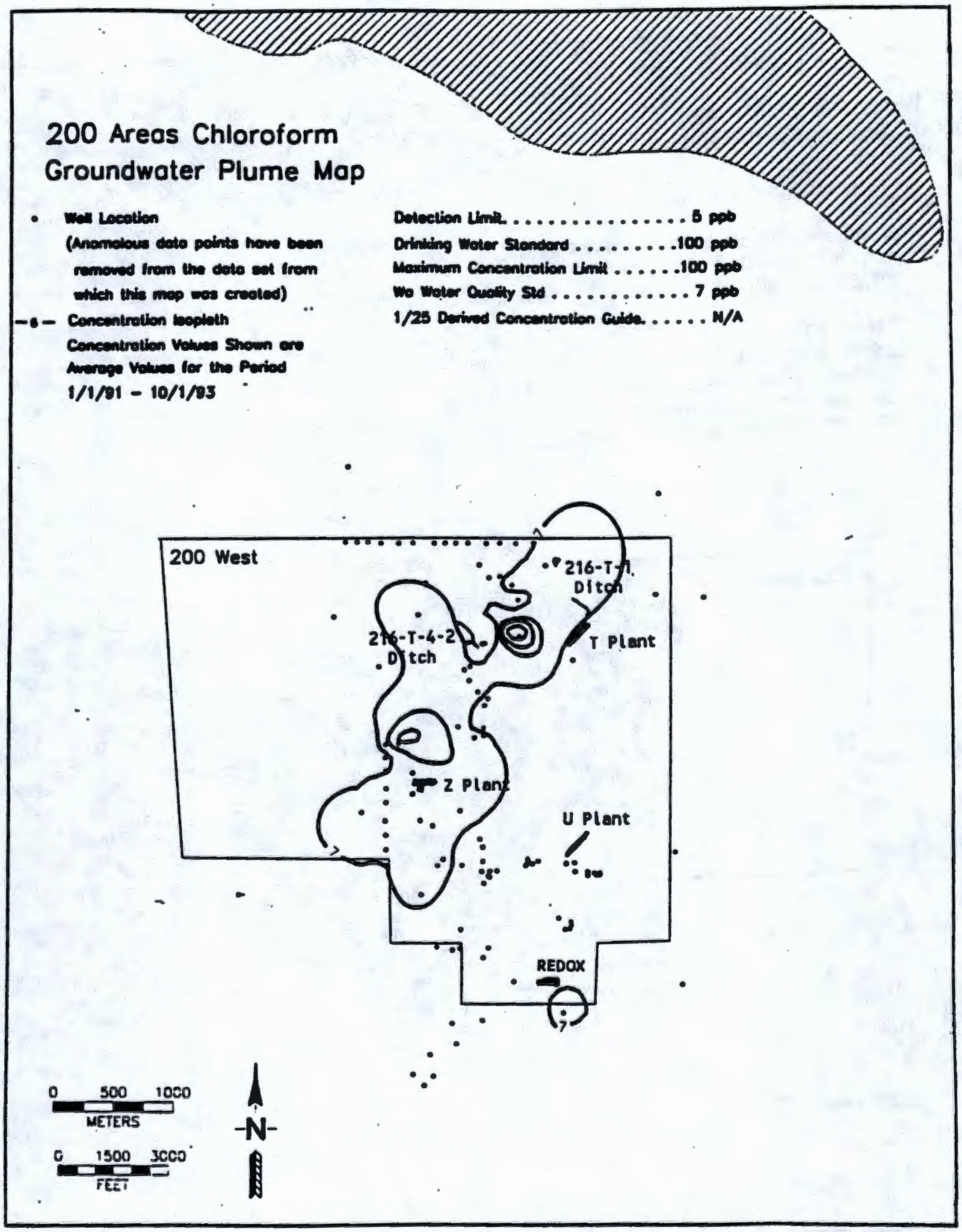
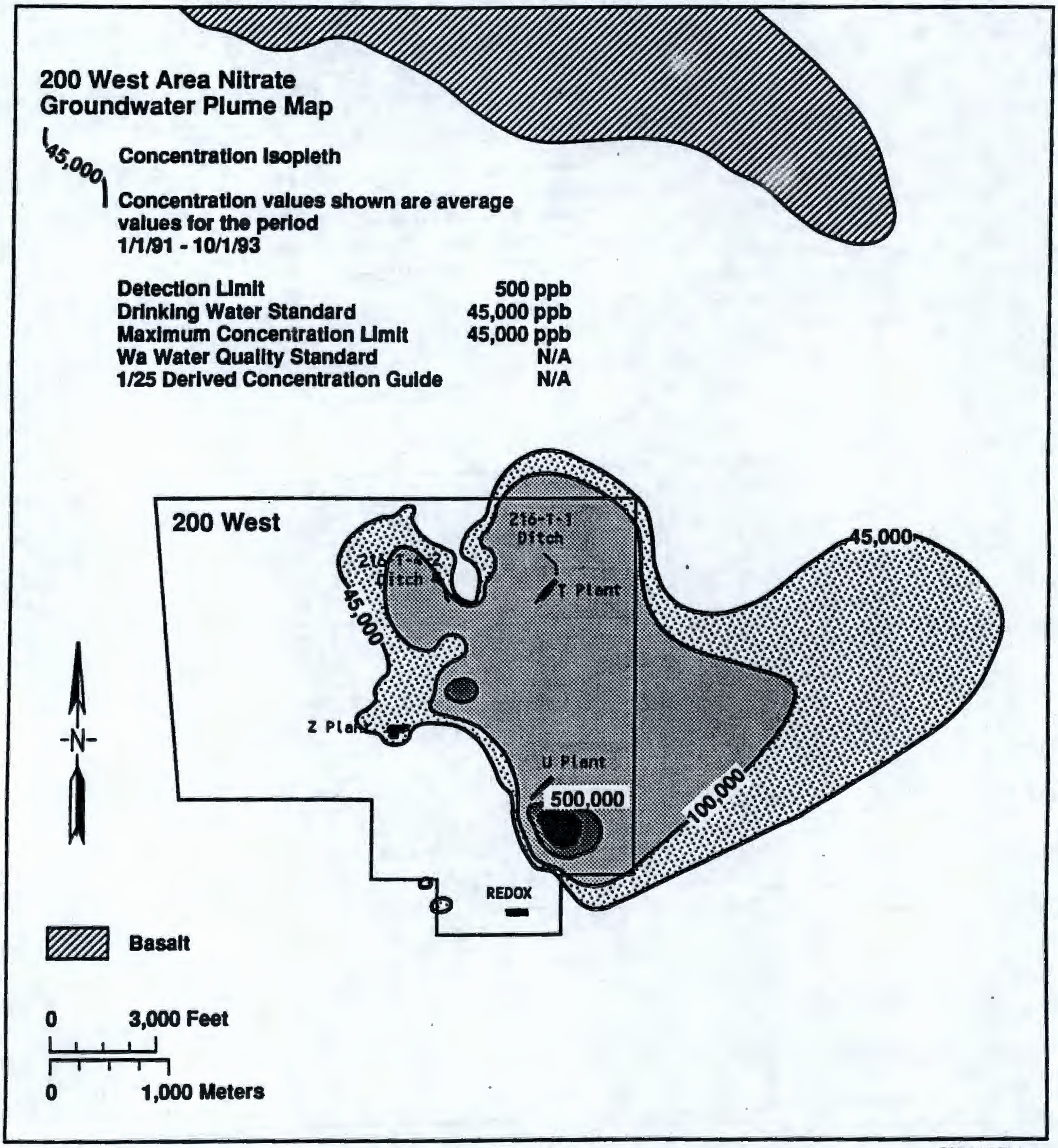
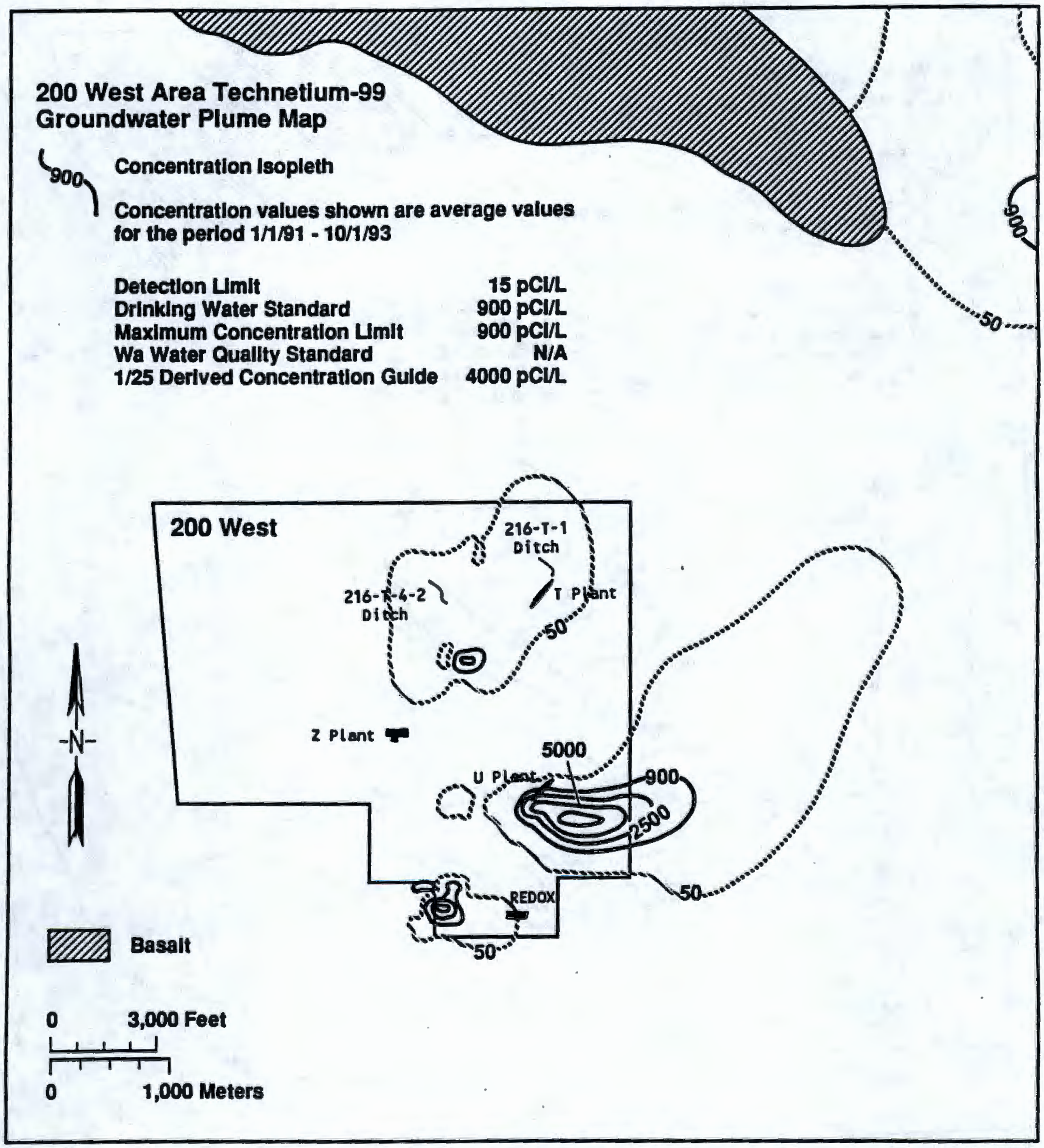


Figure 41. Nitrate Plume Map for the 200 West Area.



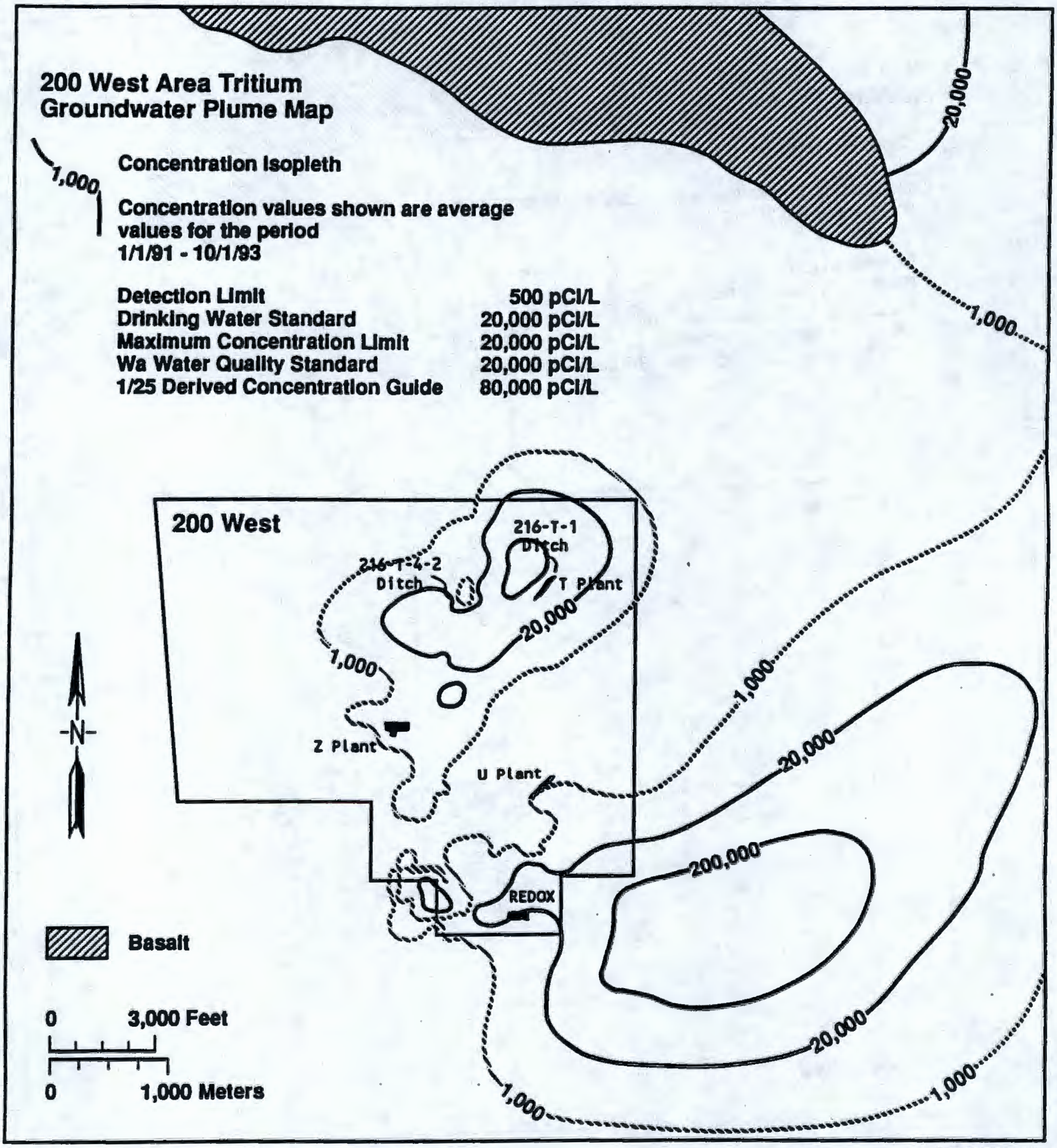
H9412004.4

Figure 42. Technetium-99 Plume Map for the 200 West Area.



H9412004.6

Figure 43. Tritium Plume Map for the 200 West Area.



H9412004.5

Environmental Information System (HEIS) database was queried for analytical results from the 1980s to February 1995, to give an indication of historical and current groundwater conditions. Appendix A-2 lists results of the groundwater analyses for selected upgradient groundwater monitoring wells from the 1980s through February 1995. Table 12 lists the potential contamination sources and accompanying wells that were examined. Figure 44 shows the well and disposal site locations.

Table 12. Potential Contamination Sources and Nearby Groundwater Monitoring Wells.

Potential contamination source	Nearby well
216-T-14, -15, -16, and -17 Trenches	299-W11-24
241-T Tank Farm	299-W10-9
Upgradient Groundwater Quality	299-W10-1
216-T-13	299-W10-16

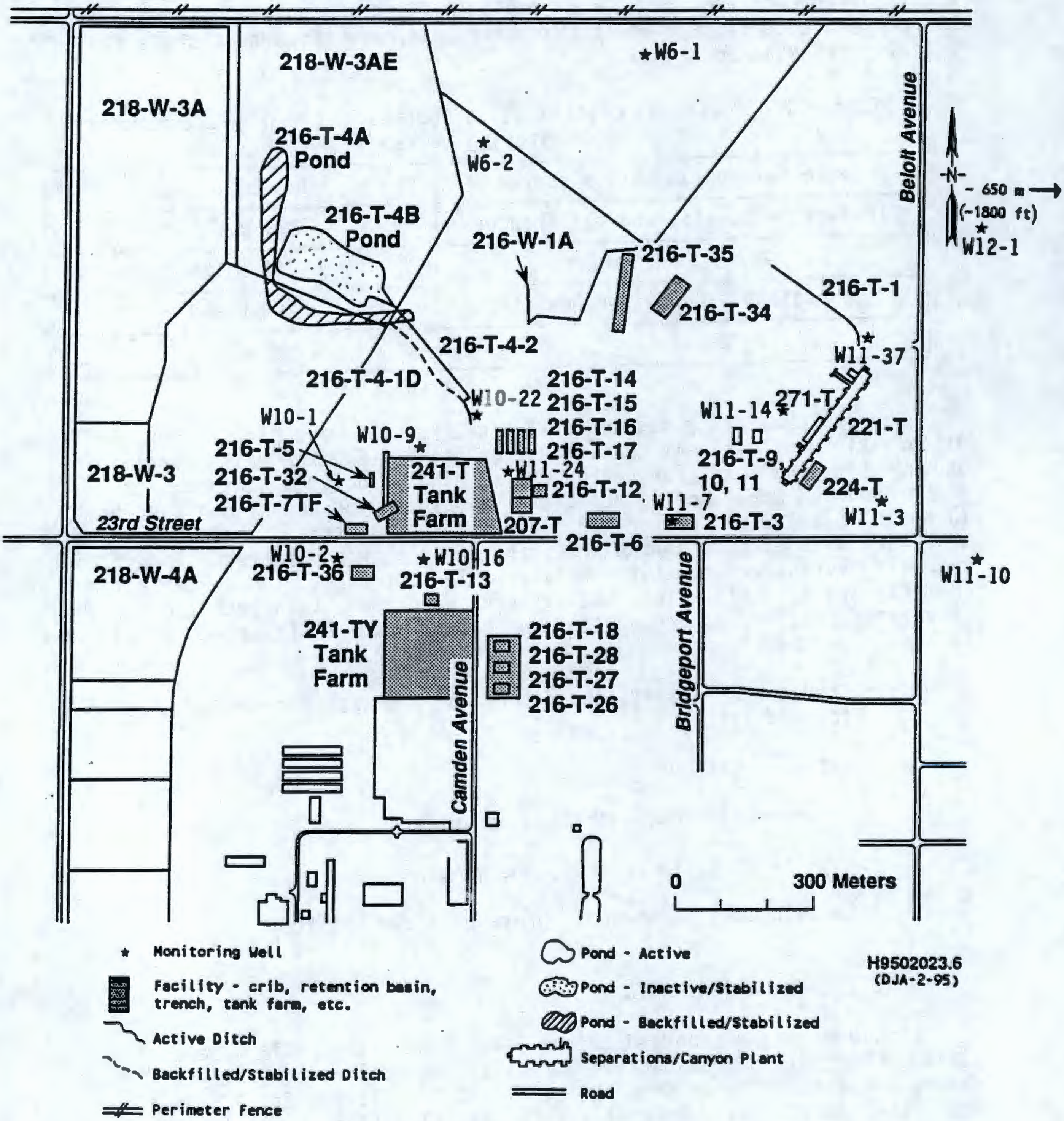
Several chemical parameter analytical results were plotted for the T-4-2 Ditch. Plots of effluent chemistry (for the T-4-2 Ditch waste stream), groundwater chemistry (for nearby wells), and associated Hanford Site Background 95% Upper Confidence Limit Values for the unconfined aquifer (Johnson 1993a) were created for several key parameters. These plots are shown and discussed in Appendix B. The plots show a difference in effluent chemistry versus groundwater chemistry. In most cases, the concentrations of chemical constituents within the effluent were lower than both the background unconfined aquifer and groundwater concentrations. Plots were created for the following parameters:

- Groundwater quality indicators--pH and specific conductance (conductivity)
- Cations--calcium
- Anions--chloride, nitrate, and sulfate
- Metals--chromium, cobalt, and manganese
- Radiological parameters--gross beta and tritium.

4.4 SOIL COLUMN CONTAMINANTS

Liquid wastes discharged to the T-4-2 Ditch since 1972 have contributed limited chemical and radioactive wastes to the soil column. These liquid wastes included effluent from the 211-T, 221-T, 221-TA, 271-T, 274-T, 291-T, and 2715-T facilities. Over the years several different missions were carried out in these facilities (see Figure 44).

Figure 44. Location of Nearby Facilities, Past-Practice Disposal Sites, and Selected Monitoring Wells in the Vicinity of the 216-T-4-2 Ditch.



4.4.1 Test Pit Excavations

Several sediment samples were taken from near-surface (0[3] to 3 m [0 to 10 ft]) test pits at the T-4-2 Ditch during June of 1994. Three test pits were excavated with a Caterpillar 245[4] track-hoe with a 1-m (3.25-yd) bucket (Figure 3). The ditch was located within an area posted as a SCA, so personnel in charge of the heavy equipment would not allow entry of the track-hoe into the controlled zone. The equipment was positioned as close to the edge of the control zone as possible. However, this administrative restriction limited the "reach" of the arm on the track-hoe to a position along the slope of the ditch rather than near the bottom, as originally planned and requested by the project scientist in charge of the study. The first test pit (number 1) was excavated well up on the side of the ditch because when the operator started the excavation he hit buried concrete and had to move up and back from the original location chosen for the pit. Test Pit Number 1 was located at the head end of the ditch, within 7.6 m (25 ft) of the effluent outfall pipe. Test Pit Number 2 was located approximately 58 m (191 ft) down the ditch from the first pit, on the sloped side of the ditch. Test Pit Number 3 was located 118 m (387 ft) down the ditch from the second pit, also on the sloped side of the ditch.

Samples were collected at four depth intervals and analyses performed on those samples as follows:

- 0 to 0.6 m (0 to 2 ft)--Appendix IX Constituents
- 0.6 to 1.2 m (2 to 4 ft)--Radionuclides
- 1.2 to 1.8 m (4 to 6 ft)--Appendix IX Constituents
- 3 m (10 ft)--Appendix IX Constituents.

Appendix IX constituents include ICP and AA metals, volatile organics (VOA), semivolatile organics (SVOA), herbicides, organophosphate pesticides, and PCBs and pesticides. The results for all the VOA, SVOA, herbicides, pesticides, and PCBs were below the detection limit for each analyte. Metal results varied within the test pits, so all the depth-interval results were averaged for inclusion in Table 13. Because only one depth interval was sampled for radionuclides, those results were reported as is.

4.4.1.1 Nonradioactive Constituents. Only two constituents, antimony and cadmium, exceeded the given background values. The antimony value was 3.1 mg/Kg, which is slightly above the detection limit of 2.8 mg/kg. No background value has been established for antimony on the Hanford Site, so the world average of 0.2 ppm was used (Bowen 1966). The cadmium result that exceeded the background value was flagged as a potential blank contamination; therefore, the data are suspect and will be disregarded. The rest of the test pit data were well within Hanford Site and world average background values. It appears that the near-surface soil column on the edge of the T-4-2 Ditch does not have any appreciable levels of nonradioactive contamination.

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[3] Zero is taken from the actual ground surface where the pit was excavated; in most cases, the pits were excavated from the sloped sides of the ditch, not the top of ground surface beside the ditch.

[4] Caterpillar is a trademark of Caterpillar, Inc. of Peoria, Illinois.

Table 13. Constituents Analyzed - Sediment Sampling Data for 216-T-4-2 Ditch Test Pits. (2 sheets)

Constituent	Pit No. 1[a]	Pit No. 2[b]	Pit No. 3[c]	Units	90PUCL[d]	EX	Background[e]	EX
Aluminum	5,593	5,738	4,877	mg/kg	13,400	N	82,000 ppm	N
Americium-241	ND[1]	0.004	0.00	pCi/g	---	--	---	--
Antimony	2.7 U	3.1	2.8 U	mg/kg	---	--	0.2 ppm	Y
Arsenic	3.2	3.2	2.8	mg/kg	7.27	N	1.8 ppm	N
Barium	70.2	103	64.7	mg/kg	148	N	425 ppm	N
Beryllium	0.43 B	0.39 B	0.42 B	mg/kg	1.58	N	2.8 ppm	N
Cadmium	0.25 B	0.67 B	0.19 U	mg/kg	---	--	0.2 ppm	Y
Calcium	9,453	7,743	8,327	mg/kg	19,500	N	41,500 ppm	N
Cesium-137	ND[1]	4.0	0.517	pCi/g	---	--	---	--
Chromium	7	9.0	6.1	mg/kg	22.2	N	100 ppm	N
Cobalt	8.2	17.4	7.5	mg/kg	17.5	N	25 ppm	N
Cobalt-60	ND[1]	U	0.011	pCi/g	---	--	---	--
Copper	15.3	20.2	13.9	mg/kg	24.5	N	55 ppm	N
Iron	17,500	21,925	15,633	mg/kg	35,150	N	56,300 ppm	N
Lead	4.4	4.2	4.0	mg/kg	11.88	N	12.5 ppm	N
Magnesium	4,877	5,200	3,997	mg/kg	7760	N	23,300 ppm	N
Manganese	278	328	284	mg/kg	549	N	950 ppm	N
Mercury	0.05 B	0.17	0.06 U	mg/kg	0.502	N	75 ppm	N
Nickel	11.2	14.3	10.3	mg/kg	21.6	N	75 ppm	N
Plutonium-238	ND[1]	0.007	0.006	pCi/g	---	--	---	--
Plutonium-239/40	ND[1]	0.048	0.002	pCi/g	---	--	---	--
Potassium	908	800	938	mg/kg	22,550	N	20,900 ppm	N
Radium-224	ND[1]	---	0.725	pCi/g	---	--	---	--

Table 13. Constituents Analyzed - Sediment Sampling Data for 216-T-4-2 Ditch Test Pits. (2 sheets)

Constituent	Pit No. 1[a]	Pit No. 2[b]	Pit No. 3[c]	Units	90PUCL[d]	EX	Background[e]	EX
Radium-226	ND[1]	0.32	0.561	pCi/g	---	--	---	--
Radium-228	ND[1]	0.41	0.702	pCi/g	---	--	---	--
Selenium	0.19 U	0.19 U	0.08 U	mg/kg	---	--	0.05 ppm	N
Silver	0.40 U	0.39 U	0.42 U	mg/kg	1.1	N	0.07 ppm	N
Sodium	174	195	157	mg/kg	721-887	N	23,600 ppm	N
Strontium-90	ND[1]	0.21	0.111	pCi/g	---	--	---	--
Technetium-99	ND[1]	0.26	0.338	pCi/g	---	--	---	--
Thallium	0.16 U	0.16 U	0.08 U	mg/kg	---	--	0.45 ppm	N
Uranium-234	ND[1]	0.82	0.571	pCi/g	---	--	---	--
Uranium-235	ND[1]	0.052	0.031	pCi/g	---	--	---	--
Uranium-238	ND[1]	0.77	0.737	pCi/g	---	--	---	--
Vanadium	28.7	43.7	23.7	mg/kg	94.9	N	135 ppm	N
Zinc	34.9	44.8	31.9	mg/kg	71.8	N	70 ppm	N
Gross alpha	ND[1]	9.4	4.83	pCi/g	---	--	---	--
Gross Beta	ND[1]	34	25.1	pCi/g	---	--	---	--

[a] Results from test pit number 1, HEIS Sample Numbers: B09GJ8, B09GK4, B09GL0, and B09GK1.
[b] Results from test pit number 2, HEIS Sample Numbers: B09GJ9/B09GY5(Duplicate), B09GK5, B09GK3, and B09GK2.
[c] Results from test pit number 3, HEIS Sample Numbers: B09GY6, B09GK0, B09GZ1, and B09GK6.
[d] 90th Percentile Upper Confidence Limit, reference: DOE/RL-92-24, Rev.1.
[e] Reference: Bowen, H. J. M., "Trace Elements in Biochemistry", 1966, Academic Press, Inc., New York, NY, 241 pp.
[1] No data; analyses canceled/never performed.
EX = Exceed 90th Percentile UCL or Background,
mg/kg = milligrams per kilogram, pCi/g = Picocuries per gram.

4.4.1.2 Radioactive Constituents. Most of the reported results for radiological constituents were near detection limits except for very low levels of cesium-137 and strontium-90 and the naturally occurring isotopes of uranium and radium. Concentrations of the latter were consistent with natural background levels (0.7 to 1.1 pCi/g) reported for Columbia River sediment collected from behind Priest Rapids Dam (located just upstream from the northern boundary of the Hanford Site) and within the Hanford Reach (Peterson and Johnson 1992). Cesium-137 was slightly elevated in Test Pit Number 2 (e.g., 4 pCi/g as compared to a Priest Rapids Dam mean value of 0.3 ± 0.02 pCi/g, n = 4 [Peterson and Johnson 1992]). A major percentage of the gross beta and gross alpha results can be accounted for with naturally occurring alpha- and beta-emitting radionuclides. For example, the mean potassium-40 concentration, a naturally occurring beta-gamma emitter, was reported as 13 pCi/g (mean, n = 27) for Columbia River sediments in the Hanford Reach (Peterson and Johnson 1992). This concentration is only a factor of 2 or 3 times lower than the gross beta concentrations of samples from Test Pit Numbers 3 and 2, respectively. Much of the difference can be accounted for by the natural decay series radionuclides associated with uranium and thorium. Thus, as an overall comparison, the sum of the concentrations of radioactive constituents of concern in the sediment or soil samples collected for this study were *less than* the total caused by naturally occurring alpha- and beta-emitters in the same samples.

These comparisons and considerations suggest that little if any significant radioactive contamination is present in the near-surface soil at locations near the edge of the T-4-2 Ditch.

4.4.2 Split-Spoon Samples

Several split-spoon samples were taken during drilling of the monitoring well (299-W11-37) at the T-1 Ditch. These samples were collected from specific intervals to aid in determining sediment properties, soil column characteristics, and geologic parameters. In addition, samples were submitted for chemical analysis. Table 14 lists the sample intervals, numbers, and corresponding analytical parameters.

Samples were collected at 11 depth intervals and analyzed for Appendix IX, inductively coupled plasma/atomic absorption (ICP/AA) metals, and radionuclides or just ICP/AA metals and radionuclides. Results of these analyses are summarized in Table 15.

4.4.2.1 Nonradioactive Constituents. Five constituents exceeded the given background values; the constituents were calcium, chromium, magnesium, manganese, and nickel.

- Calcium exceeds the background value of 19,500 mg/Kg in three intervals:
  - 23.5 to 24 m (77 to 79 ft)--21,800 mg/Kg
  - 28.2 to 28.8 m (92.5 to 94.5 ft)--157,000 mg/Kg
  - 30.6 to 31.4 m (100.5 to 103 ft)--57,000 mg/Kg.

The predicted depth of penetration of calcium for this site (Section 5.2.4) was approximately 20 m (66 ft) deep in the soil column.

Table 14. Split-Spoon Sediment Samples from Well 299-W10-22 at the 216-T-4-2 Ditch.

Sample number(s)	Depth sampled (ft)	Types of analyses
B0C8B2 (N1834)*	10 - 12	ICP & AA metals/radionuclides/Appendix IX
B0C8B3 (N1838)*	19.5 - 21.5	ICP & AA metals/radionuclides
B0C8B4 (N1839)*	30.5 - 32.5	ICP & AA metals/radionuclides
B0C8B5 (N1840)*	40.5 - 42.5	ICP & AA metals/radionuclides/Appendix IX
B0C8B6 (N1841)*	77 - 79	ICP & AA metals/radionuclides
B0C8B7 (N1904)*	92.5 - 94.5	ICP & AA metals/radionuclides/Appendix IX
B0C8B9 (N1907)*	100.5 - 103	ICP & AA metals/radionuclides/Appendix IX
B0C8C3 (N1963)*	125 - 127	ICP & AA metals/radionuclides/Appendix IX
B0C8C4 (N1964)*	140 - 142	ICP & AA metals/radionuclides
B0C8C5 (N1965)*	195 - 197	ICP & AA metals/radionuclides/Appendix IX
	197 - 199	ICP & AA metals/radionuclides/Appendix IX
B0C8C6 (N1966)**	230.5 - 231.5	ICP & AA metals/radionuclides/Appendix IX
	231.5 - 232.5	ICP & AA metals/radionuclides/Appendix IX
B0C8C7 (N1967)**	281.5 - 282.5	ICP & AA metals/radionuclides

* Vadose zone samples.
** Groundwater zone samples.
ICP = Inductively Coupled Plasma.
AA = Atomic Adsorption.

- Chromium exceeds the background value of 22.2 mg/Kg in three intervals:

  - 59.4 to 60.7 m (195 to 199 ft)--27.1 mg/Kg
  - 70.3 to 70.9 m (230.5 to 232.5 ft)--38.4 mg/Kg
  - 85.8 to 86.1 m (281.5 to 282.5 ft)--25.8 mg/Kg.

  The travel time for hexavalent chromium was not predicted for this site. However, hexavalent chromium would behave like chloride, and should have broken through to groundwater within a year. Elsewhere in the soil column, chromium is well below background concentrations.

- Magnesium exceeds the background value of 7,760 mg/kg in the 28.2 to 28.8 m (92.5 to 94.5 ft) interval and had a concentration of 14,700 mg/kg. The predicted depth of penetration of magnesium for this site (Section 5.2.4) was approximately 20 m (66 ft) into the soil column.

- Manganese exceeds the background value of 549 mg/kg in the 59.4 to 60.7 m (195 to 199 ft) interval and has a concentration of 581 mg/kg. The predicted depth of penetration of magnesium for this site (Section 5.2.4) was approximately 8 m (26 ft) into the soil column.

- Nickel exceeds the background value of 21.6 mg/kg in the 59.4 to 60.7 m (195 to 199 ft) interval and has a concentration of 25.5 mg/kg. The travel time and depth distribution for nickel were not determined for this site. However, nickel would behave like copper, and be retained on the soil column at an estimated depth of 13 m (43 ft) (see Section 5.2.4).

4.4.2.2 Radioactive Constituents. Most of the reported results for the radionuclides of interest in the split-spoon samples (Table 15) were either equal to natural background levels (e.g., uranium and thorium decay series radionuclides, gross alpha, and gross beta) (see Section 4.4.1.2 discussion) or were at or below detection limits. The few reported detections were transuranic radionuclides in the shallow-depth samples. For example, plutonium-238 was reported at trace levels (<0.3 pCi/g) in the four uppermost samples collected at depth intervals ranging from 3 to 13 m (10 to 42.5 ft) below ground surface. Lower concentrations (<0.06 pCi/g) of americium-241 and plutonium 239/240 were also detected in these shallow-depth samples (Figure 45).

While the concentrations of the detected radionuclides in these samples do not represent significant soil-column contamination, they may indicate the extent of vertical distribution of these slightly mobile radioactive contaminants that were associated with historical T Plant operations (e.g., bismuth phosphate process).

4.5 SUMMARY OF HYDROGEOLOGIC PARAMETERS

The following summarizes the geology, hydrology, and constituent-of-interest/effluent movement through the soil column at the T-4-2 Ditch.

Table 15. Constituents Analyzed - Sediment Sampling Data for Well 299-W10-22 Split-Spoon Samples. (2 sheets)

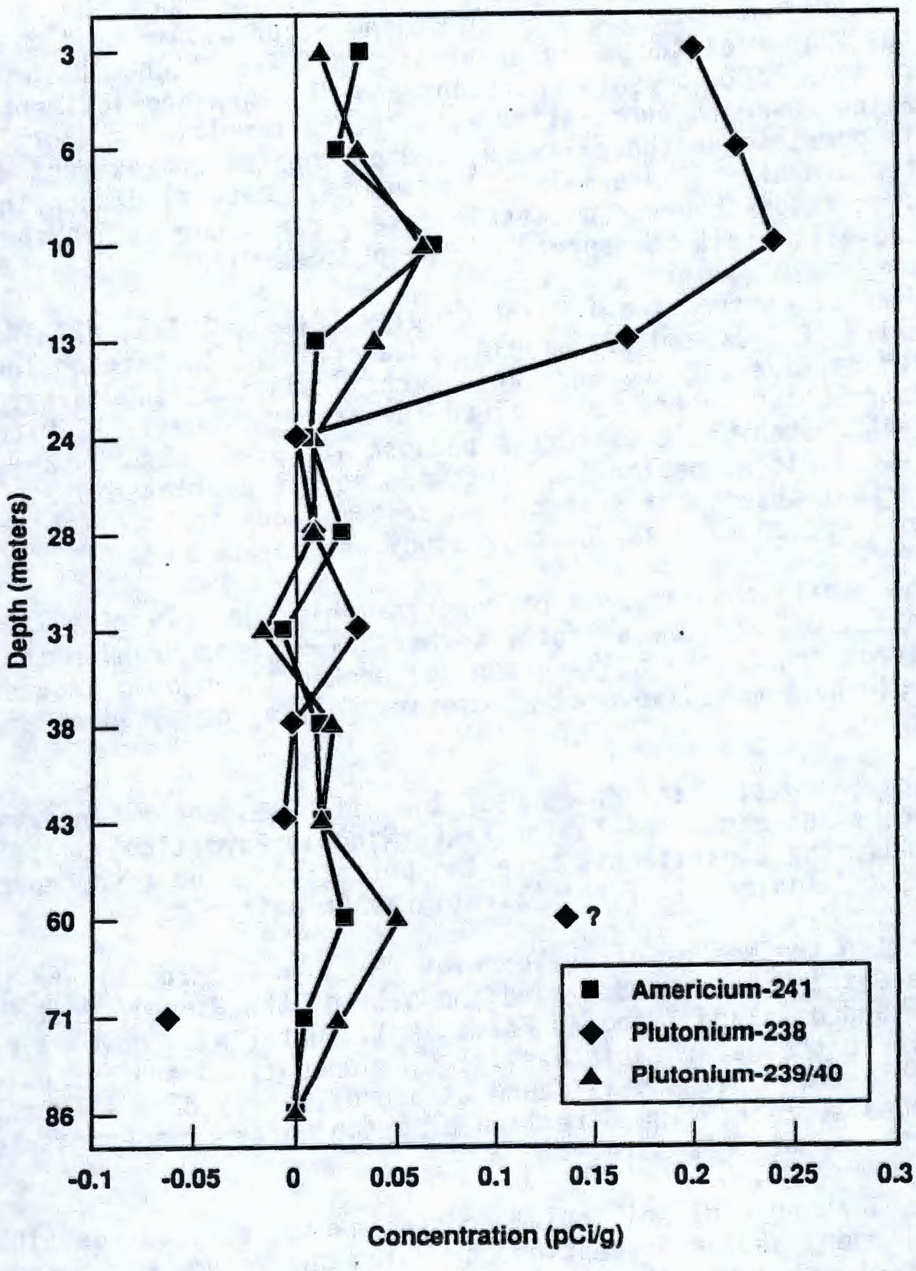
Constituent	No.1[a]	No.2[b]	No.3[c]	No.4[d]	No.5[e]	No.6[f]	No.7[g]	No.8[h]	No.8[i]	No.9[j]	No.10[k]	No.11[l]	Units
Aluminum	3,320	2,850	3,010	3,800	4,390	4,730	5,000	7,830	4150	4400	2850	4080	mg/kg
Americium-241	0.031	0.02	0.07	0.01	0.005	0.02	-0.006	0.01	0.01	0.023	0.004	ND[1]	pCi/g
Antimony	3.2 U	3.1 U	5.3 B	3.2 U	3.7 U	9.0 B	<10	3.7 U	3.39 B	3.3 U	3.8 U	2.0 U	mg/kg
Arsenic	1.8	1.0	1.5	2.0	2.2	3.9	3.8	4.8	1.2	0.74	0.53	0.66	mg/kg
Barium	59.4	55.4	60.3	52.8	54.5	80.7	66	71.9	45.1	96.2	32.7	43.1	mg/kg
Beryllium	0.41 B	0.35 B	0.30 B	0.26 B	0.35 B	0.47 B	<0.22	0.46 B	0.31 B	0.37 B	0.21 B	0.38 B	mg/kg
Cadmium	0.23 B	0.23 U	0.23 U	0.23 U	0.27 U	0.27 U	<0.88	0.26 U	0.24 U	0.24 U	0.26 U	0.60 B	mg/kg
Calcium	5,350	7,360	8,860	6,730	21,800	157,000	57,000	7,640	6,040	3,010	2,760	4,650	pCi/g
Cesium-137	---	---	---	---	-0.004	-0.004	-0.002	0.01	0.004	0.004	0.042	ND[1]	mg/kg
Chromium	8.6	4.8	5.1	5.9	5.7	7.5	9.7	10.7	6.0	27.1	38.4	25.8	mg/kg
Cobalt	7.9	8.1	4.9	4.7	5.6	4.9	4.4	7.8	5.5	7.5	4.1	5.4	pCi/g
Cobalt-60	-0.002	-0.0003	-0.028	-0.0007	-0.002	0.004	0.002	-0.007	0.005	0.013	0.007	ND[1]	mg/kg
Copper	15.1	14.6	10.9	11.1	13.2	13.3	9.6	22.3	13.7	12.2	8.6	8.8	mg/kg
Iron	23,500	18,400	16,000	14,800	18,100	9,910	9,600	15,300	12,200	12,500	7,820	12,000	mg/kg
Lead	2.8	2.1	3.1	3.2	3.1	2.7	3.0	5.4	1.6	4.9	2.3	1.9	mg/kg
Magnesium	3,110	2,590	2,390	3,070	3,820	14,700	4,000	5,550	3,250	3,620	1,780	2,240	mg/kg
Manganese	254	198	158	201	209	120	150	356	226	581	120	196	mg/kg
Mercury	0.05 U	0.05 U	0.07 B	0.06 U	0.10 B	0.08 B	<0.11	0.12	0.05 U	0.06 B	0.07 B	0.05 U	mg/kg
Nickel	8.2	5.5	6.0	8.6	6.7	9.1	11	11.9	7.3	25.5	20.6	9.6	mg/kg
Plutonium-238	0.198	0.221	0.240	0.165	0.00	0.006	0.029	-0.002	-0.006	0.136	-0.061	ND[1]	pCi/g
Plutonium-239/40	0.012	0.03	0.064	0.04	0.009	0.006	-0.013	0.02	0.012	0.05	0.02	ND[1]	pCi/g
Potassium	667	2,850	3,010	1,040	1,180	466 B	900	1,040	576	379 B	320 U	454 B	mg/kg
Radium-224	0.685	0.519	0.588	0.633	0.482	0.654	---	0.916	0.460	0.484	---	ND[1]	pCi/g
Radium-226	0.500	0.437	0.481	0.778	0.471	0.474	0.62	0.647	0.333	0.321	0.315	ND[1]	pCi/g
Radium-228	0.683	0.581	0.636	0.623	0.494	0.680	---	0.978	0.496	0.471	0.513	ND[1]	mg/kg
Selenium	0.15 U	0.14 U	0.15 U	0.15 U	0.17 U	0.17 U	<0.66	0.07 U	0.06 U	0.15 U	0.17 U	0.07 U	mg/kg
Silver	0.52 B	0.50 B	0.31 U	0.42 B	0.39 B	0.69 B	<1.5	0.36 U	0.32 U	0.32 U	0.35 U	0.42 U	mg/kg

Table 15. Constituents Analyzed - Sediment Sampling Data for Well 299-W10-22 Split-Spoon Samples. (2 sheets)

Constituent	No.1[a]	No.2[b]	No.3[c]	No.4[d]	No.5[e]	No.6[f]	No.7[g]	No.8[h]	No.8[i]	No.9[j]	No.10[k]	No.11[l]	Units
Sodium	480	227	150	150	116 B	193	490	118 B	147	187	172	203	mg/kg
Strontium-90	0.033	0.024	0.05	0.1	0.05	0.024	-0.02	0.09	0.012	0.111	0.07	ND[1]	pCi/g
Technetium-99	0.635	0.734	0.737	0.631	0.797	1.81	0.17	0.682	0.741	0.518	0.836	ND[1]	mg/kg
Thallium	0.11 U	0.10 U	0.10 U	0.11 U	0.12 U	0.12 U	<0.88	0.18 U	0.12 B	0.13 B	0.12 U	0.12 U	mg/kg
Uranium-234	0.672	0.469	0.536	0.851	0.984	0.915	0.73	0.552	0.538	0.369	0.390	ND[1]	pCi/g
Uranium-235	0.016	0.02	0.034	0.02	0.03	0.036	0.07	0.022	0.023	-0.003	0.02	ND[1]	mg/kg
Uranium-238	0.625	0.445	0.607	0.809	0.894	0.923	0.68	1.08	0.551	0.484	0.403	ND[1]	mg/kg
Vanadium	31.9	34.8	22.3	18.3	24.9	28.6	22	34.1	23.6	29.3	17.4	21.9	mg/kg
Zinc	31.0	29.1	21.5	23.2	25.8	20.8	21	44.0	31.6	27.9	22.4	26.9	mg/kg
Gross Alpha	11.6	3.89	14.0	11.3	15.8	10.3	11.1	10.6	9.97	4.71	3.17	ND[1]	mg/kg
Gross Beta	17.6	15.5	18.5	17.7	22.7	25.3	16.9	24.5	19.2	17.7	17.3	ND[1]	mg/kg

[a] Sample interval 10-12 ft; HEIS Sample No. B0C8B2.
[b] Sample interval 19.5-21.5 ft; HEIS Sample No. B0C8B3.
[c] Sample interval 30.5-32.5 ft; HEIS Sample No. B0C8B4.
[d] Sample interval 40.5-42.5 ft; HEIS Sample No. B0C8B5.
[e] Sample interval 77-79 ft; HEIS Sample No. B0C8B6.
[f] Sample interval 92.5-94.5 ft; HEIS Sample No. B0C8B7.
[g] Sample interval 100.5-103 ft; HEIS Sample No. B0C8B9.
[h] Sample interval 125-127 ft; HEIS Sample No. B0C8C3.
[i] Sample interval 140-142 ft; HEIS Sample No. B0C8C4.
[j] Sample interval 195-199 ft; HEIS Sample No. B0C8C5.
[k] Sample interval 230.5-232.5 ft; HEIS Sample No. B0C8C6.
[l] Sample interval 281.5-282.5 ft; HEIS Sample No. B0C8C7.
ND[1] No data available; laboratory dropped sample jar and destroyed all the sample.
mg/kg = Milligrams per kilogram.
pCi/g = Picocuries per gram.

Figure 45. Depth Distribution of Transuranics Based on Core Samples from Well 299-W10-22 at the 216-T-4-2 Ditch.



- Wastewater discharged to the T-4-2 Ditch "ponds" on top of and slowly seeps through or around the fine sediments in the bottom of the ditch. Once past these fine sediments, it moves through the open-framework gravels of unit 1 of the Hanford formation. Near-saturated conditions exist in unit 2 of the Hanford formation. Perched water and lateral spreading occur within unit 2 and along the Plio-Pleistocene interval at the T-4-2 Ditch. Both intervals contain $CaCO_3$-cemented portions and fine-grained sediments that allow downward percolating waters to accumulate. Lateral spreading is possible on these layers, and perched water movement would follow the dip of the intervals to the south. Lateral discontinuities, such as pinchouts and clastic dikes, can occur within these interval and will limit the spread of the perched water.

- Discharges from the T Plant Complex (211-T, 221-T, 221-TA, 224-T, 271-T, 291-T, and 2715-T) included effluent containing low-level radioactive liquids and various chemicals that should have contributed to the soil column inventory at the T-4-2 Ditch. The T-4-2 Ditch was constructed because its predecessor, the T-4-1D Ditch, became too contaminated for continued use. The virtual absence of soil column contaminants in both the test pit and split-spoon samples for this study was unexpected.

- The mobile constituents of concern, chloride, fluoride, nitrate, potassium, sodium, sulfate, technetium-99, and uranium should have moved through the soil column and broken through to groundwater and would have moved several kilometers (miles) downgradient from the ditch.

- Once the wastewater moves past the Plio-Pleistocene interval and enters the member of Taylor Flat (Ringold Formation) silts and sands, the constituents have the potential to be adsorbed by finer grained sediments of this stratigraphic unit.

- Beneath the member of Taylor Flat (Ringold Formation) are the gravels and interbedded sand and silt of the Ringold unit E, member of Wooded Island (Ringold Formation). Water will move through this unit to the water table easily. The unconfined aquifer occurs within this unit and is found at approximately 82 m (269 ft) below ground surface. The direction of groundwater movement is to the northeast at this site.

The virtual absence of soil column contaminants requires reevaluation of the conceptual model and/or assumptions on which this study was based. The impact assessment presented in the following section addresses this issue by using a combination of contaminant migration modeling, groundwater sampling and analysis results, and existing groundwater hydraulic data from other ongoing programs.

5.0 IMPACT ASSESSMENT

As required by the methodology document (Tyler 1991), both hydrologic and contaminant impacts are considered for each groundwater impact assessment. Accordingly, hydrologic factors relevant to the current status of the disposal facility are discussed first followed by contaminant transport analysis.

5.1 HYDROLOGIC IMPACTS

Based on the current average discharge rate to the T-4-2 Ditch (15 L/min [4 gal/min]), impact on the local groundwater flow regime is minimal. The groundwater flows northeast near the ditch and no irregularities occur in the water table elevations in that area.

The primary hydrologic impacts to this site are perched water layers within unit 2 of the Hanford formation and the Plio-Pleistocene interval. Wastewater discharged to the ditch percolates downward through a multilayered sequence of sediments. When less permeable sedimentary layers are encountered, saturated or near-saturated conditions occur that are referred to as "perched water" zones. Lateral spreading can occur along the perching layers to a variable extent. If older unsealed wells are located within the zone of influence of a perched zone, preferential pathways to groundwater can be formed.

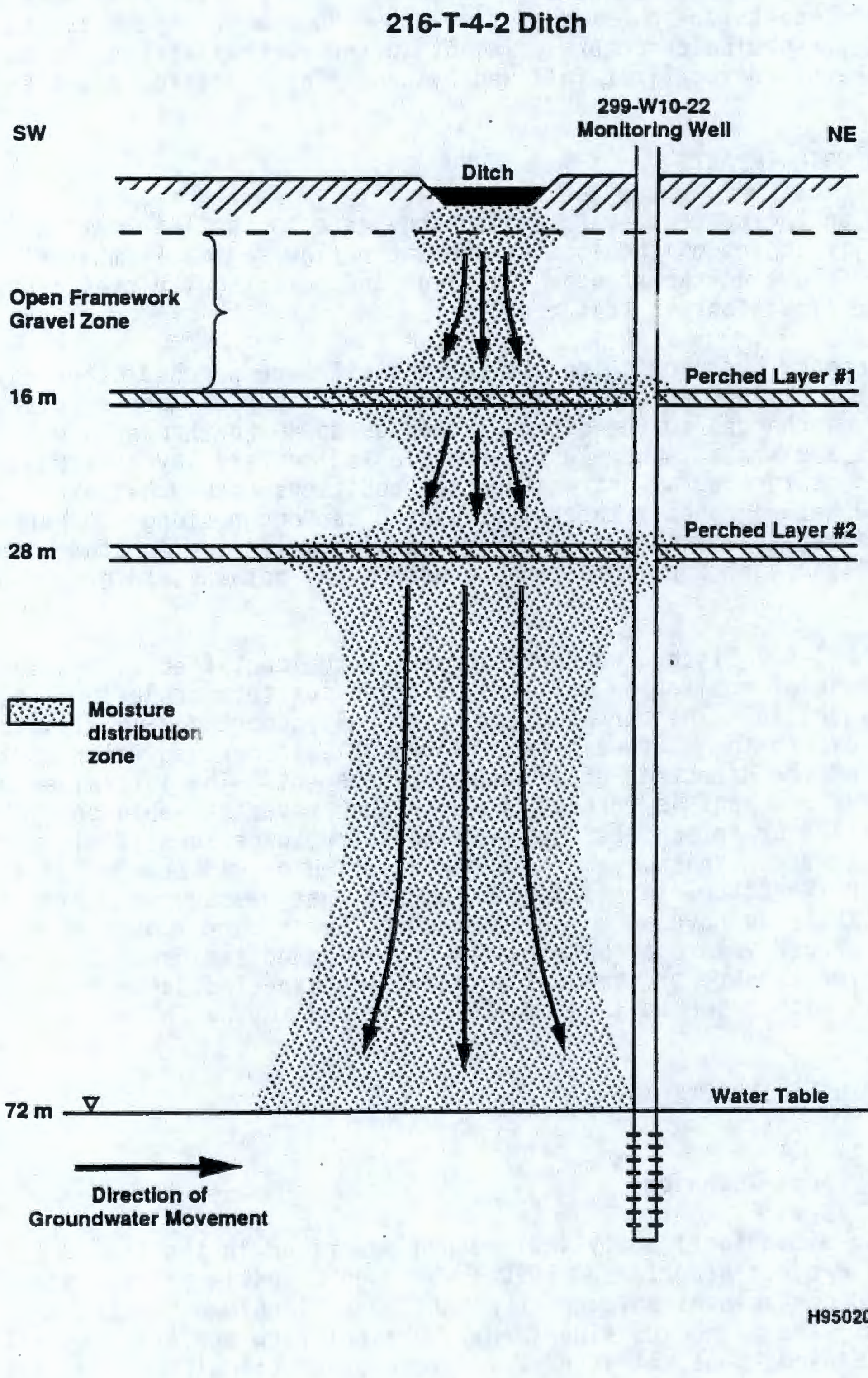
At the T-4-2 Ditch, two perched zones were identified during the drill-and-test phase of monitoring well installation for this project. They are shown in Figure 46. The perching layers (highly cemented Plio-Pleistocene intervals) dip to the southwest (see Figure 35), so perched water may move opposite from the direction of groundwater movement. The lateral extent of perched water movement is unknown, however such movement would be limited by discontinuities or "pinchouts" and vertical structures such as clastic dikes, which are common in this area. No older unsealed groundwater wells are located near the ditch, so the perched water zones discovered during this study are likely to have no adverse impact. The primary impact is the enlarged area and volume of potentially contaminated sediments that must be considered for closure or remedial action. The expected depth distribution of contaminants within the soil column is considered in the following section.

5.2 CONTAMINANT IMPACTS

5.2.1 Analytical Technique

The one-dimensional analytical method described in the *Liquid Effluent Study Final Project Report* (WHC 1990b) was used to estimate the rate of moisture and contaminant movement through the soil column beneath the T-4-2 Ditch. The method considers only vertical flow and does not allow for lateral spreading; thus, it is expected to provide calculated contaminant migration rates that are more conservative (faster) than those that occur under natural conditions.

Figure 46. Inferred Distribution of Moisture Beneath the T-4-2 Ditch.



The method used is based on steady-state flow conditions in the unsaturated zone and assumes a unit hydraulic gradient. The basic equation for any layer of sediments is:

$$t = L \times \theta / q \qquad (1)$$

where:

- t = time of travel through layer, seconds
- L = thickness of layer, centimeters
- θ = moisture content of sediment, related to hydraulic conductivity
- q = Darcy velocity or moisture flux in layer, centimeter/second.

The total travel time, T, is determined as the summation of the travel times for each of the "i" layers:

$$T = \sum_{i=1}^{n} L_i \times \theta_i / q_i \qquad (2)$$

where n is the number of sediment layers to model a particular disposal site. For transport calculations, the soil column beneath the ditch was treated as a four-layer system 61 m (200 ft) deep in the original and revised original solutions (Sections 5.2.2 and 5.2.3) and as a six-layer system 91.4 m (300 ft) deep in the new solution (Section 5.2.4). Figure 47 illustrates the soil column used in the original and revised original analytical solutions and Figure 48 illustrates the soil column used in the new analytical solution.

The relationship between hydraulic conductivity, K, and moisture content, θ, is described in Figure 49. The curves were derived empirically from laboratory tests on more than 20 different Hanford Site sediment types and established five major sediment types, as noted in the figure. The sixth sediment type, referred to as "F", was added to include a soil type designation for open-framework gravels, which occur in the vicinity of the T-4-2 Ditch.

The one-dimensional flow analysis embodied in Equation 2 was carried out on a Symphony[1] spreadsheet. The total travel time, T, obtained with Equation 2 is divided into the vadose zone thickness to provide an estimate of the rate of moisture migration from the disposal facility to the groundwater.

To obtain an estimate of the rate of contaminant migration, the computed moisture migration rate, V_w, was divided by the retardation factor, R_f, for each of the contaminants of concern. The R_f values were estimated using K_d values (or R_d values) selected from Ames and Serne (1991) for neutral pH, low-salt, and low-organic content effluent conditions and the following generalization for Hanford Site soils:

$$R_f = 1 + 5K_d \qquad (3)$$

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[1]Symphony is a registered trademark of the Lotus Development Corporation.

Figure 47. Lithology of Well 299-W7-4, Northwest of the 216-T-4-2 Ditch (WHC 1990b).

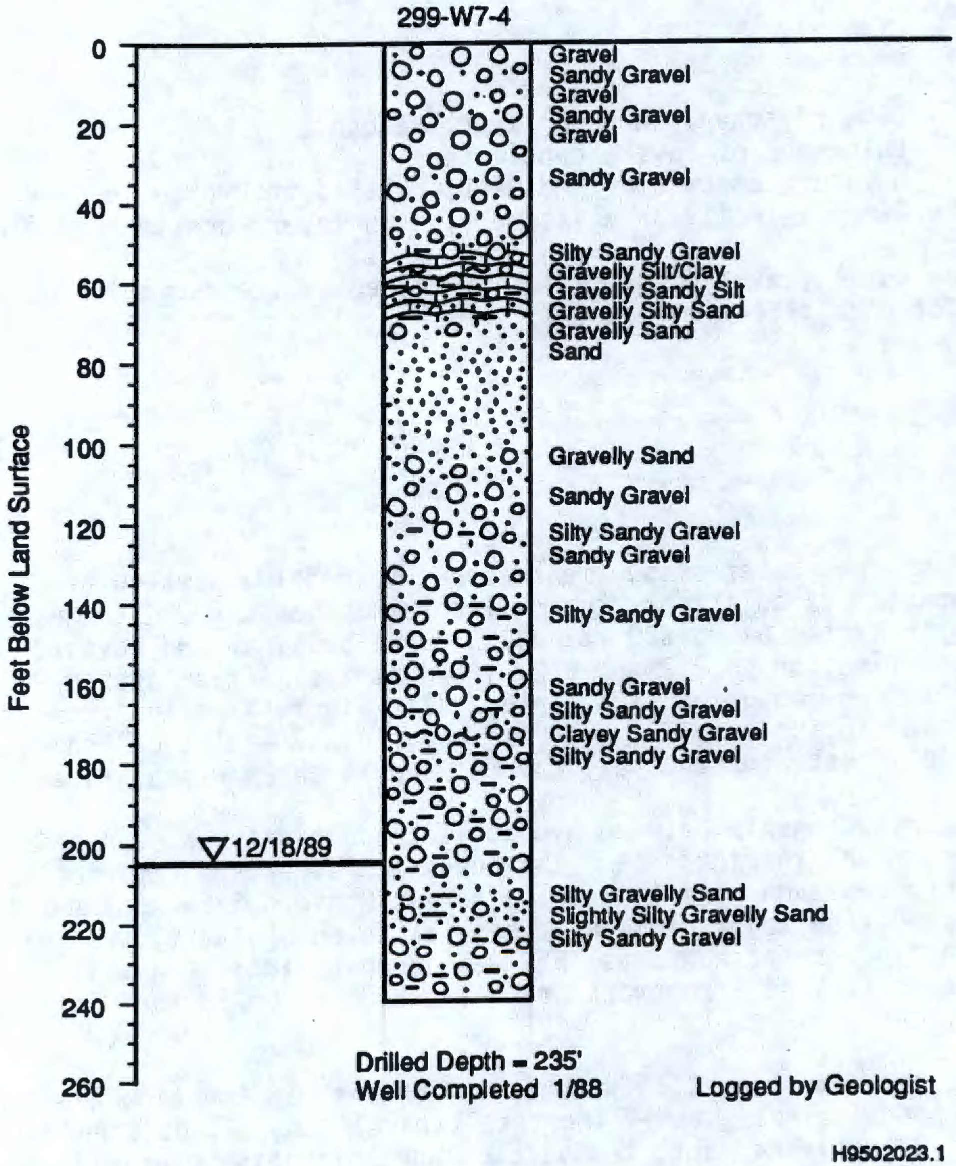
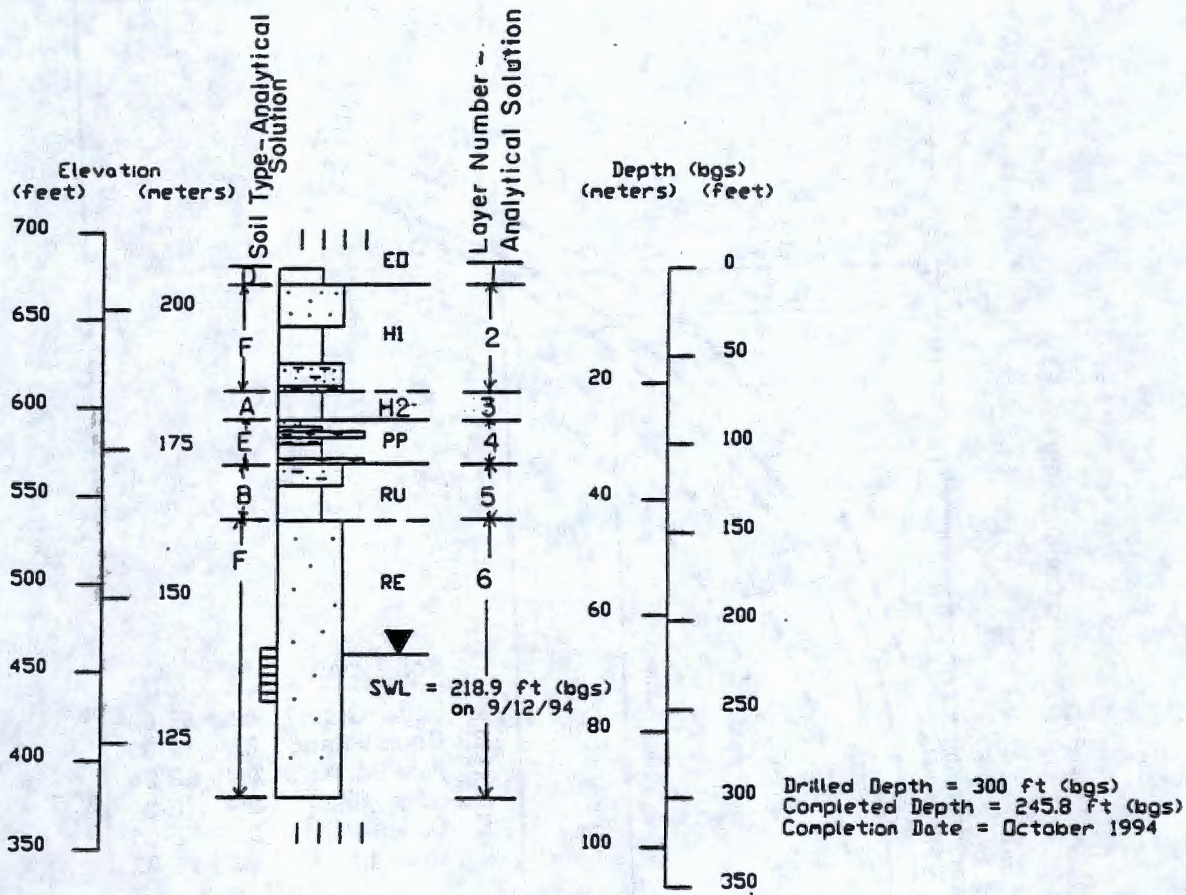


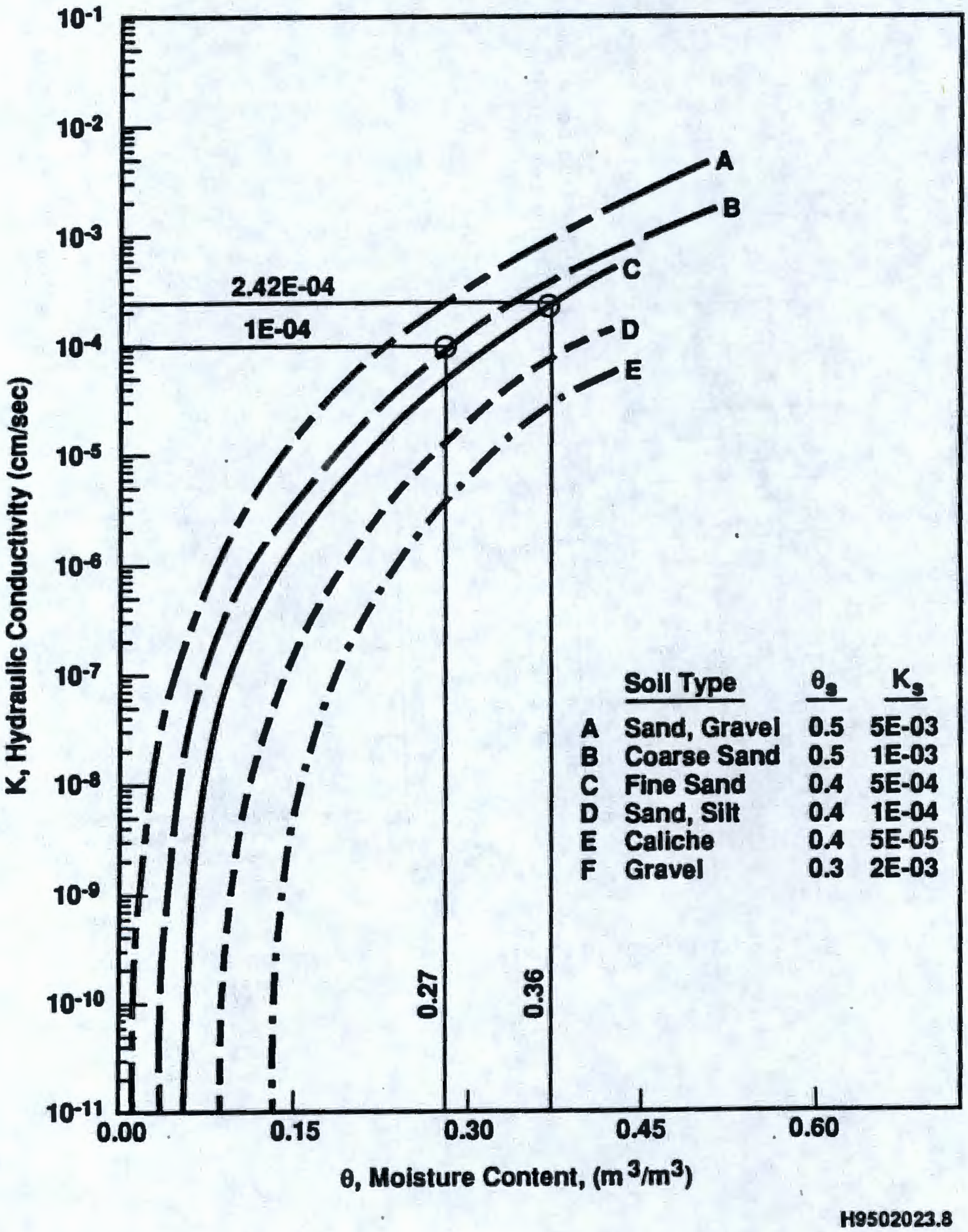
Figure 48. Lithology of Well 299-W10-22, Located at the 216-T-4-2 Ditch.



(See Figure 32 for Geology Description)

GEOSCI\2-W10-22
(DJA-2-95)

Figure 49. Hydraulic Conductivity Versus Moisture Content (adapted from WHC 1990b).



The constant, 5, in Equation 3 accounts for the average porosity and bulk density of Hanford Site soils. Where appreciable amounts of gravel are present, the second term in Equation 3 should be multiplied by:

$$(1 - \% \text{ gravel present})/100 \qquad (4)$$

to account for the reduced surface area (i.e., sorption tests on Hanford Site soils have been typically conducted on the sand-size fraction, <2 mm [<0.08 in]).

The effluent discharge rate, as described previously, was entered as liters per month in the spreadsheet computational program. Effluent volumes through 1987 listed in the *Waste Stream Characterization Report* (WHC 1989), were updated to include 1988 and 1989 data for the *Liquid Effluent Study Final Project Report* (WHC 1990b). The same average infiltration rate was assumed for the time after 1989). The total volume (liters) was divided by the corresponding operating period (months) to establish an average rate of inflow (liters/month). This effluent discharge rate was divided by the ditch area to obtain an estimate of the average infiltration rate. More details and an illustrative example for application of the overall computational approach are provided in the *Liquid Effluent Study Final Project Report* (WHC 1990b).

5.2.2 Results of Original Analytical Solution

The following discussion summarizes the results from the *Liquid Effluent Study Final Project Report* (WHC 1990b).

Based on general effluent characteristics and corresponding sorption parameters (Section 5.2.1) for the key constituents identified in Table 16, the calculated migration rates in the vadose zone (Table 17), listed most mobile to least mobile, are as follows:

- 0.22 cm/day (0.09 in./day) for aluminum
- 0.09 cm/day (0.04 in./day) for iron.

The analytical solution predicts that aluminum and iron will break through to groundwater in 76 and 191 years, respectively. Based on these results, both constituents would most likely still be retained on the soil column.

5.2.3 Results of Revised Original Analytical Solution

In the original work done for the T-4-2 Ditch (Section 5.2.2) only aluminum and iron were listed as constituents of interest. To perform a comprehensive assessment of groundwater quality for the T-4-2 Ditch, it was decided that the effluent disposal to the ditch should be considered in two solutions. The first solution (this section) covers the years 1944 through 1972 when the T-4-1D Ditch was operating; the second solution covers the years 1972 through 1994 after the T-4-2 Ditch was created and put into operation. This was necessary because excavating the T-4-2 Ditch greatly altered the original ditch configuration and changed its flow patterns. In addition, a larger list of constituents of interest was compiled (Table 18) for the effluent. This list was used for both solutions. The major differences between the solution discussed here and the new solution discussed in Section 5.2.4 are listed in Table 19.

Table 16. Effluent Stream Sampling Data for T Plant Wastewater (WHC 1990b).

Key Constituents	Detection Limit[a]	Detection/ Analyses	Sample Concentration (90% CI)[a]
12/85 to 01/87, during routine operation			
Aluminum	NA	1/5	360
Iron	30	4/5	400
10/89 to 03/90, during routine operation			
Aluminum	NA	ND	ND
Iron	30	4/4	77[b]

[a] Units: Chemical = parts per billion (ppb)
[b] Concentrations below Group A study guidelines (WHC 1990b, Appendix A); values given for comparison purposes.
CI = Confidence interval.
NA = Not available.
ND = Not detected.

Table 17. Original Analytical Solution for the 216-T-4-2 Ditch from the *Liquid Effluent Study Final Project Report* (WHC 1990b). (2 sheets)

Disposal Facility	Rate (L/month)	Area (m^2)	f, Infiltration Rate (cm/s)	Layer number
216-T-4-2 Ditch	1.37 E+06	975	5.35 E-05	1 2 3 4

Thickness (m)	Soil Type	θ_s	K_s	θ
14	A	0.5	5.0 E-03	0.18
8	D	0.4	1.0 E-04	0.33
9	C	0.4	5.0 E-04	0.26
30	A	0.5	5.0 E-03	0.18
61				

Moisture State	q (cm/s)	t (s)	T (d)	Estimated moisture migration (cm/d)
Unsaturated	5.35 E-05	4.71 E+06	279	21.8
Unsaturated	5.35 E-05	4.94 E+06		
Unsaturated	5.35 E-05	4.38 E+06		
Unsaturated	5.35 E-05	1.01 E+07		
		2.41 E+07		

Constituent	R_f (retardation factor)	Estimated contaminant migration (cm/day)[1]	Contaminant transport to water table (year)
Aluminum	100	0.22	76
Iron	250	0.09	191

[1]Considering the uncertainties in the input parameters for this solution, no more than one significant digit is justified in interpreting these results; additional digits are computer generated, but are included to show the small differences between numbers for given constituents.

Table 18. Revised List of Key Constituents.

Key Constituent	Key Constituent
Aluminum	Plutonium-239
Barium	Potassium
Calcium	Radium
Cesium-137	Sodium
Chloride	Strontium
Copper	Strontium-90
Fluoride	Sulfate
Iron	Technetium-99
Magnesium	Uranium
Manganese	Zinc
Nitrate	---

Table 19. Differences Between the Revised Original and New Analytical Solutions (Sections 5.2.3 and 5.2.4).

Parameter	Revised original analytical solution	New analytical solution
Effluent flow rate	1.37×10^6 L/month (3.62×10^5 gal/mo)	6.54×10^5 L/month (1.73×10^5 gal/mo)
Total surface area of the ditch	975 m^2 (10,495 ft^2)	70 m^2 (753 ft^2)
Infiltration rate	5.35×10^{-5} cm/s (2.10×10^{-5} in/s)	3.56×10^{-4} cm/s (1.40×10^{-5} in/s)
Layers of sediment in ditch soil column	4 layers (see Figure 45)	6 layers (see Figure 46)
Thickness of layers	based on well 299-7-4 (see Figure 45)	based on well 299-10-22 (see Figure 46)
Types of sediment in soil column	5 types: A,B,C,D,E (see Figure 47)	6 types: A,B,C,D,E,F (see Figure 47)

The original analytical solution was rerun using the general effluent characteristics and corresponding sorption parameters (Section 5.2.1) for the key constituents identified in Table 18. The results of the revised original solution are given in Table 20. The calculated migration rates in the vadose zone (which have been rounded up to the nearest centimeter or tenth of a centimeter, listed most mobile to least mobile, are as follows:

- 22 cm/day (8.7 in./day) for chloride, fluoride, nitrate, sulfate, and technetium-99
- 2.2 cm/day (0.87 in./day) for uranium
- 1.1 cm/day (0.08 in./day) for potassium and sodium
- 0.2 cm/day (0.1 in./day) for aluminum, barium, calcium, copper, magnesium, plutonium-239, radium, strontium, strontium-90, and zinc.
- 0.09 cm/day (0.04 in./day) for cesium-137, iron, and manganese.

The analytical solution predicts breakthrough of the constituents, listed first to last, as follows:

- 0.8 year for chloride, fluoride, nitrate, sulfate, and technetium-99
- 8 years for uranium
- 15 years for potassium and sodium
- 76 years for aluminum, calcium, and magnesium
- 98 years for barium, plutonium-239, radium, strontium, and strontium-90
- 111 years for copper and zinc
- 186 years for cesium-137, iron, and manganese.

Based on these results, the following constituents would most likely still be retained on the soil column: aluminum, barium, calcium, cesium-137, copper, iron, magnesium, manganese, plutonium-239, radium, strontium, strontium-90, and zinc.

5.2.4 Results of New Analytical Solution

This analytical solution was designed to reflect the actual field conditions encountered at the T-4-2 Ditch. Because the ditch is active only for the first 15 m (50 ft), the total surface area of the ditch used in the solution was reduced to 70 m^2 (753 ft^2). The effluent flow rate was changed to reflect the best estimate of recent effluent disposal to the ditch. The actual soil column and sediment types determined from drilling the new monitoring well (299-W10-22) were also used in the solution.

Table 20. Revised Original Analytical Solution Results for the 216-T-4-2 Ditch (Phase I--see Figure 49). (2 sheets)

Disposal Facility	Rate (L/month)	Area (m^2)	f, Infiltration Rate (cm/s)	Layer number
216-T-4-2 Ditch	1.37 E+06	975	5.35 E-05	1 2 3 4
Thickness (m)	**Soil Type**	θ_s	K_s	θ
14 8 9 30 61	A D C A	0.5 0.4 0.4 0.5	5.0 E-03 1.0 E-04 1.0 E-04 5.0 E-03	0.18 0.33 0.26 0.18
Moisture State	**q (cm/s)**	**t (s)**	**T (d)**	**Estimated moisture migration (cm/d)**
Unsaturated Unsaturated Unsaturated Unsaturated Unsaturated Unsaturated	5.35 E-05 5.35 E-05 5.35 E-05 5.35 E-05 5.35 E-05 5.35 E-05	4.71 E+06 4.94 E+06 4.38 E+06 1.01 E+07 2.41 E+07	279	21.8

Table 20. Revised Original Analytical Solution Results for the 216-T-4-2 Ditch (Phase I--see Figure 49). (2 sheets)

Constituent	R_f (retardation factor)	Estimated contaminant migration (cm/day)[1]	Contaminant transport to water table (year)
Aluminum	100	0.22	76
Barium	125	0.17	98
Calcium	100	0.22	76
Chloride	1	21.80	0.8
Copper	150	0.15	111
Fluoride	1	21.80	0.8
Iron	250	0.09	186
Magnesium	100	0.22	76
Manganese	250	0.09	186
Nitrate	1	21.80	0.8
Potassium	20	1.09	15
Sodium	20	1.09	15
Strontium	125	0.17	98
Sulfate	1	21.80	0.8
Uranium	10	2.18	8
Zinc	150	0.15	111
Cesium-137	250	0.09	186
Plutonium-239	125	0.17	98
Radium	125	0.17	98
Strontium-90	125	0.17	98
Technetium-99	1	21.80	0.8

[1]Considering the uncertainties in the input parameters for this solution, no more than one significant digit is justified in interpreting these results; additional digits are computer generated and are left to illustrate the small differences between numbers for given constituents.

The new solution results, based on general effluent characteristics and corresponding sorption parameters (Section 5.2.1) for the key constituents identified in Table 18, are given in Table 21. The calculated migration rates in the vadose zone, listed most mobile to least mobile, are as follows:

- 23 cm/day (9.1 in./day) for chloride, fluoride, nitrate, sulfate, and technetium-99
- 2.3 cm/day (0.91 in./day) for uranium
- 1.2 cm/day (0.47 in./day) for potassium and sodium
- 0.2 cm/day (0.08 in./day) for aluminum, barium, calcium, copper, magnesium, plutonium-239, radium, strontium, strontium-90, and zinc.
- 0.1 cm/day (0.04 in./day) for cesium-137, iron, and manganese.

Table 21. New Analytical Solution Results for the 216-T-4-2 Ditch (Phase II - see Figure 49). (2 sheets)

Disposal Facility	Rate (L/month)	Area (m^2)	f, Infiltration Rate (cm/s)	Layer number
216-T-4-2 Ditch	6.54 E+05	70	3.56 E-04	1
				2
				3
				4
				5
				6
Thickness (m)	**Soil Type**	**θ_s**	**K_s**	**θ**
2.7	D	0.4	1.0 E-04	0.4
7.3	F[1]	0.3	2.0 E-03	0.3
16.2	A	0.5	5.0 E-05	0.5
7.6	E	0.4	5.0 E-04	0.4
10.4	B	0.5	1.0 E-05	0.5
47.2	F[1]	0.3	2.0 E-03	0.3
91.4				
Moisture State	**q (cm/s)**	**t (s)**	**T (d)**	**Estimated moisture migration (cm/d)**
Saturated	1.0 E-04	1.08 E+06		
Saturated	1.0 E-04	2.19 E+06		
Saturated	1.0 E-04	8.10 E+06		
Saturated	1.0 E-04	3.04 E+06	391	23.4
Saturated	1.0 E-04	5.20 E+06		
Saturated	1.0 E-04	1.42 E+07		
		3.38 E+07		

Table 21. New Analytical Solution Results for the 216-T-4-2 Ditch (Phase II - see Figure 49). (2 sheets)

Constituent	R_f (retardation factor)	Estimated contaminant migration (cm/day)[2]	Contaminant transport to water table (year)
Aluminum	100	0.23	107
Barium	125	0.19	134
Calcium	100	0.23	107
Chloride	1	23.38	1
Copper	150	0.16	161
Fluoride	1	23.38	1
Iron	250	0.09	268
Magnesium	100	0.23	107
Manganese	250	0.09	268
Nitrate	1	23.38	1
Potassium	20	1.17	21
Sodium	20	1.17	21
Strontium	125	0.19	134
Sulfate	1	23.38	1
Uranium	10	2.34	11
Zinc	150	0.16	161
Cesium-137	250	0.09	268
Plutonium-239	125	0.19	134
Radium	125	0.19	134
Strontium-90	125	0.19	134
Technetium-99	1	23.38	1

[1] Soil Type F is a new type designation, and is in addition to the original five types discussed in WHC 1990b, Figure B-1. See Figures 48 and 49 for details.

[2] Considering the uncertainties in the input parameters for this solution, no more than one significant digit is justified in interpreting these results; additional digits are computer generated and are left here to illustrate the small differences between numbers for given constituents.

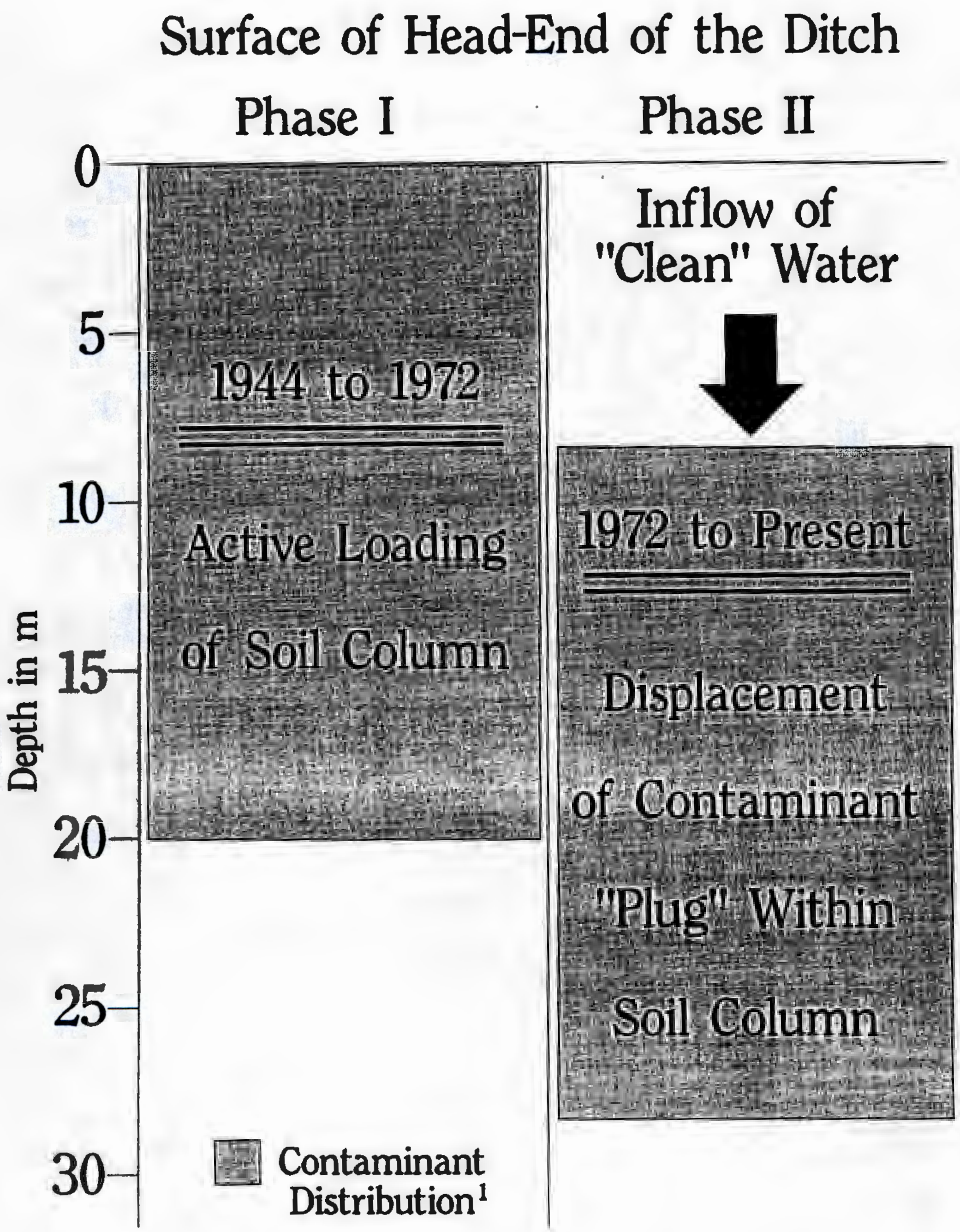
An interesting outcome of the revised original analytical solution and the new analytical solution calculations is that the computed migration rates for the new solution (Table 21) are nearly the same as for the revised original solution (Table 20). This occurs even though the calculated infiltration rates (f) for the two cases differ nearly sevenfold (Table 19). These results can be explained because the revised original solution rates are based on *unsaturated* flow conditions ($f < K_s$) and the new solution rates are based on *saturated* flow conditions ($f > K_s$). Physically this means that saturated flow results in greater lateral spreading than unsaturated flow; i.e., for the velocities to be the same in the two cases, the effective area through which the water is migrating for the saturated case must be seven times greater than the unsaturated case. The physical significance of the lateral spreading in relation to field observations during drilling of well 299-W10-22 is discussed further in Section 5.2.5.

5.2.5 Actual Field Conditions and Indications

5.2.5.1 Expected Depth Distribution of Contaminants. As discussed in Section 4.5, the most significant expected or potential contamination of the T-4-2 Ditch occurred during its early use (1944 to 1972) as part of the effluent conveyance system to the T-4A Pond. The condition of the sediments in the bottom of the ditch during that time is unknown. However, assuming that sorption conditions were similar to those at present and that flowing water in the ditch had the same infiltration rate as that calculated for 1972 to the present, the maximum penetration of the long-lived fission products and other heavy metals should have been between 0 and 10 to 20 m (0 and 32.8 to 65.6 ft) during the first 28 years. Assuming the same infiltration rate but greatly reduced effluent contaminant concentration levels after 1972 and to the present (i.e., use of the isolated ditch segment for an additional 22 years), the hypothetical residual contaminant zone should have been displaced downward by an additional 8 m (26.2 ft) or so (Figure 50). Greater downward migration than illustrated could have actually occurred because of the open-framework gravels present (see Figure 48). This prediction (Figure 50) contrasts to the ditch test pit and monitoring well (299-W10-22) split-spoon sample results discussed in Section 4.4, which showed only a trace of one of the expected contaminants (e.g., isotopes of plutonium). However, the upper perched water zone occurring at a depth of 16 m (51 ft) clearly demonstrates that the flow path from the ditch was intersected by well 299-W10-22. Based on the contaminant migration rate estimates (Table 21), and allowing for accelerated migration rates through this gravel zone because of lower effective K_ds (Equation 4), constituents such as strontium-90 and cesium-137 should have migrated down to and accumulated in the upper fine sediment perching layer (16 m [51 ft]). The absence of any contaminants in this zone or beneath it suggests at least two possibilities. Either the contaminants never penetrated beneath the shallow layer of ditch sediments or the most concentrated region of the expected contaminant zone lies above the upper perched zone and along or near the center line of the ditch. The latter explanation would be consistent with the field observations made during this study if the actual contaminant migration rates were slower than predicted or if the location of the well is at the very edge (low concentration fringe) of a vertical soil column contaminant plume. The latter condition has been observed for the distribution of plutonium beneath the 216-Z-12 Crib. (For more information on this topic, see Figure 40 in Johnson 1993b.) In this case, the plutonium spread laterally away from the center line of the V-shaped crib or trench and had a concentration of only a few pCi/g immediately beneath and along the center line of the crib. The apparent presence of only plutonium and not cesium-137 or strontium-90 may be caused by the greater sensitivity (lower detection limits) for the isotopic plutonium method and/or different effluent chemical conditions than expected (e.g., complexing agents) that altered the relative mobility of the constituents of interest.

5.2.5.2 Breakthrough to Groundwater. Based on the groundwater data for well 299-W10-22 (located at the head end of the T-4-2 Ditch) presented in Section 4.3, no breakthrough of constituents of interest to groundwater at the T-4-2 Ditch site seems to have occurred. The groundwater at this site appears relatively "clean" compared to other wells in the vicinity (e.g., wells near the north and east ends of the T Tank Farm). The T-4-2 Ditch is not adversely affecting the groundwater beneath it.

Figure 50. Simplified Plug-Flow Model of Contaminant Movement Beneath the Head End of the 216-T-4-2 Ditch.



[1] Based on computed contaminant migration rates of 0.1 to 0.2 cm/day, Table 20, 2nd sheet, column 3.

In addition, the contaminant plume maps for the 200 West Area were examined to determine if upgradient sites were influencing groundwater quality at the ditch. The seven contaminant plumes examined were as follows:

- The gross beta plume appears to affect the groundwater beneath the T-4-2 Ditch. The concentration of the plume contour near the ditch is 8 pCi/L. Concentration values of gross beta in the groundwater from well 299-W10-22 are 6 to 8 pCi/L.

- The carbon tetrachloride, chloroform, nitrate, and tritium plumes do not underlie the T-4-2 Ditch area. They appear to go around the ditch area to the northwest and northeast. It is possible that an area of low transmissivity exists near the T-4-2 Ditch, and the contaminated groundwater from upgradient sources is not flowing into the area. Alternatively, the relatively clean wastewater may create a zone of low groundwater contaminant concentrations within the existing contaminant plumes that surround the ditch. The latter possibility is supported by the observation that the specific conductivity of groundwater from the new well was 260 µmhos/cm as compared to over 700 µmhos/cm for groundwater immediately upgradient from the T-4-2 Ditch (Johnson, 1993a, Figure 5-37). Assuming an effluent specific conductance of 150 µmhos/cm, the value of 260 µmhos/cm implies a mixture of approximately 20 percent ambient upgradient groundwater and 80 percent T-4-2 wastewater. This level of dilution could account for the depressed contaminant concentrations in the vicinity and downgradient of the ditch.

- The arsenic plume appears to be on the edge of the T-4-2 Ditch area; arsenic results from the T-4-2 Ditch groundwater are below the detection limit.

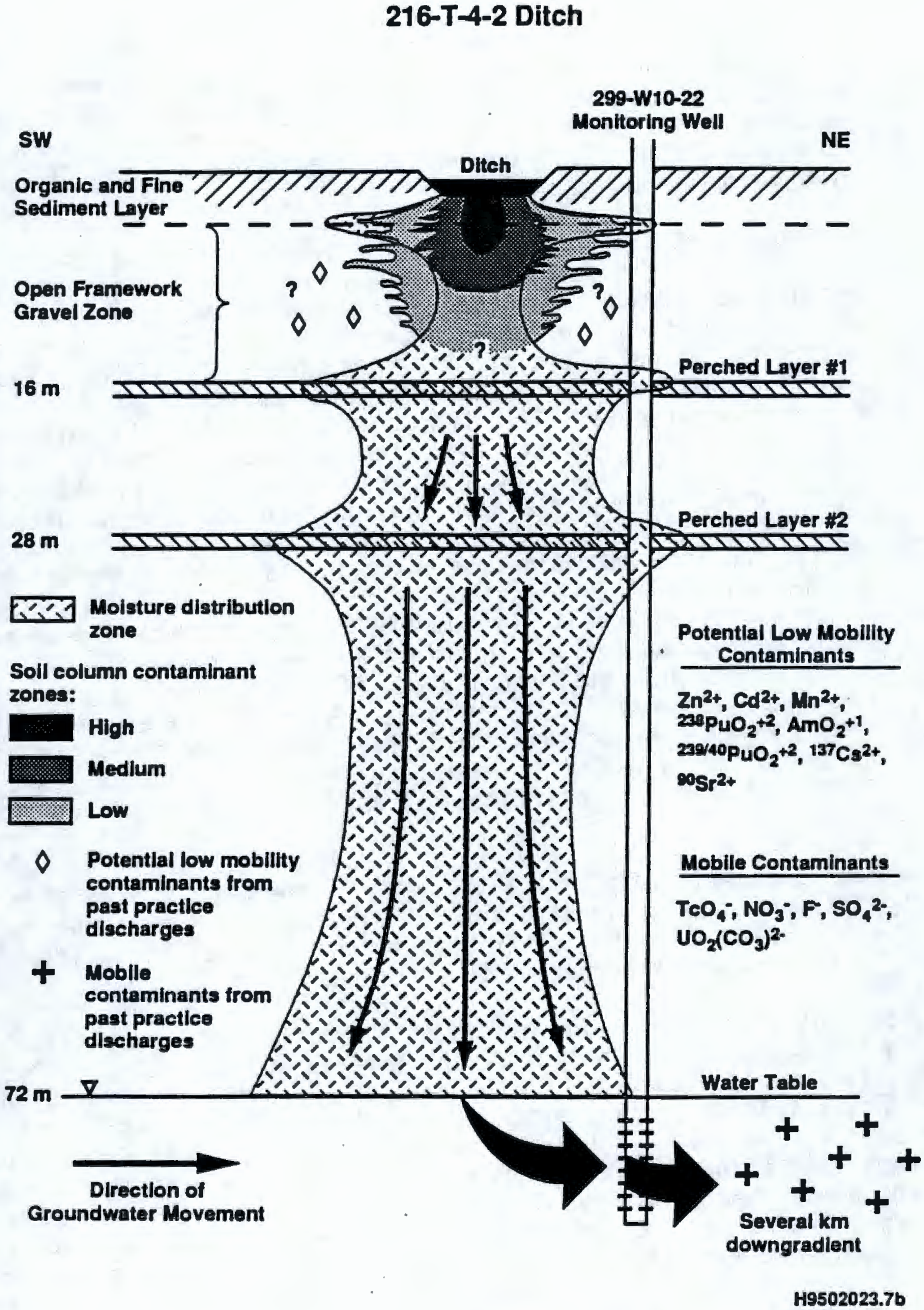
- The technetium-99 plume map shows the T-4-2 Ditch within the 50 pCi/L contour line. However, the concentration of technetium-99 within the T-4-2 Ditch groundwater is less than 10 pCi/L. This difference could be accounted for by dilution, as discussed under carbon tetrachloride and chloroform.

5.3 FINAL CONCEPTUAL MODEL

A revised model of expected contaminant distribution based on the foregoing discussion and inferences drawn from field observations during this study is illustrated in Figure 51 and summarized below:

- The fine sediment layer located just beneath the bottom of the ditch and extending downward a few meters is hypothesized to contain most of the expected soil contaminants that were not found in test pit or split-spoon samples. The organic-rich and fine-grained sediments include large amounts of decaying aquatic plant matter and underlying eolian sands (Figure 51).

Figure 51. Final Conceptual Model for the 216-T-4-2 Ditch.



- The "pond" created by excavating the T-4-2 Ditch and backfilling the T-4-1D Ditch in 1972 has accumulated a substantial amount of organic matter on its bottom. This "organic mat" has become an estimated 0.6 to 0.9 m (2 to 3 ft) deep in places and decay has surely introduced a thriving community of bacteria and microbes. It is possible that anaerobic conditions have developed in the deeper portions of the pond. Anaerobic conditions would be ideal for attenuation and/or complexing of contaminants and reduction of highly mobile oxidized species.

- Although test pit excavation work was done on the sides of the T-4-2 Ditch, it missed the potential contaminant zone present deeper within and beneath the ditch. The open-framework gravels (unit 1 of the Hanford formation) beneath the fine-grained near-surface sediments, do not restrict flow from beneath the ditch. Wastewater easily flows downward to the underlying sediments of unit 2 of the Hanford formation, as illustrated in Figure 51. If contaminants are present within or beneath the ditch and they are mobile, they would "flush" right through. If they are not mobile, they should remain in the ditch sediments and/or shallow zone beneath the ditch.

- Significant concentrations of contaminants were not detected in the split-spoon samples collected during drilling, even though perched water was encountered. This may be because of much slower actual infiltration and contaminant migration rates than originally assumed. As previously indicated, if slightly mobile contaminants had penetrated into the open-framework gravels, they would have easily moved downward and should have been observed in the perching horizons and in sediment samples collected from the adjacent well at depths of 16 and 28 m (Figure 51) and/or in the saturated zone sediments.

- Mobile constituents associated with effluent discharges from 1944 to 1972 should have migrated several kilometers (miles) downgradient in since 1972. They may contribute to the residual contaminant plumes in the northeast corner of the 200 West Area.

If soil column contamination exists at this site, it is most likely located in the bottom of or just below the head end of the ditch (first 15 m [50 ft]). This would also apply to the rest of the ditch that was used to transport low-level radioactive wastewater to the T Pond system. Work done in the mid-1980s at the 216-U-14 Ditch, 216-U Pond, and 216-Z-19 Ditch supports this assumption. As part of the 1980's study, transects were run across the ditches and pond. Sediment samples were taken on the tops and down the sides of the berms, and across the bottom of the ditches and pond. Analytical results showed that most of the contaminants within the pond, and especially the ditches, were located in the lowest point of the transect (i.e., the bottom of the ditches and pond) (Last et al. 1981). Similar conditions are likely to exist at the T-4-2 Ditch.

An alternative explanation for the lack of contaminants in the soil column beneath and immediately beside the T-4-2 Ditch is that the bottom of the T-4-2 Ditch may have been excavated and removed because of the contamination present in the original T-4-1D Ditch (20,000 cpm) (Section 2.2). In 1972, when the T-4-2 Ditch was excavated, 15 to 23 cm (6 to 9 in.) of contaminated soil in the entire T-4A Pond were removed and sent to the 218-W-2A Burial Ground. The pond area was then backfilled and stabilized. At this time, the T-4-1D Ditch was also backfilled and stabilized from the outlet to the T-4-A Pond to 15 m (50 ft) from the effluent outlet to the T-4 Ditches. The T-4-1D Ditch was replaced because of contaminated soil, so the upper 15 to 23 cm (6 to 9 in.) of soil from the first 15 m (50 ft) of the ditch may have been excavated and removed at the same time as the work was done on T-4A Pond. If excavation occurred, it may have been deep enough to remove most of the soil column contaminants that accumulated from 1944 to 1972. Analyzing shallow soil cores (0 to 3 m [0 to 9.8 ft]) would be sufficient to determine if this occurred.

The significance of the results of this study to future remedial action considerations is that if contamination exists, either it is near the surface or has been removed. When use of the T-4-2 Ditch ceases in June 1995, and the ditch "pond" has dried up, testing could be done to determine if contaminants are present in the near-surface soil column (above 3 m [10 ft]). If contaminants are present, they would be relatively easy to excavate and remediate.

5.4 EVALUATION OF MONITORING NETWORK ADEQUACY

5.4.1 Groundwater Monitoring Well Placement

No monitoring wells were located in the immediate vicinity of the T-4-2 Ditch, which necessitated drilling a monitoring well for the ditch as part of this GIA project. The monitoring well (299-W10-22) was located at the head end of the ditch, approximately 4.6 m (15 ft) downstream from the ditch outfall pipe, 1.5 m (5 ft) from the SCA control rope surrounding the ditch, and 6.1 to 7.6 m (20 to 25 ft) from the center of the "pond." The well was placed on the northeast side of the ditch, which is the downgradient groundwater flow direction. This location should be ideal for detecting any contaminants that might come from the ditch. Several other wells are located nearby, but were constructed for monitoring other nearby facilities (e.g., the T Tank Farm).

5.4.2 Reporting of Monitoring Data

All hydrochemical monitoring data are reported in the HEIS database, which is publicly accessible. Monitoring results for the wells in the T-4-2 Ditch area, were summarized and used to evaluate the groundwater quality and chemistry in Section 4.3 (see also Appendices A-1 and A-2).

6.0 SUMMARY AND CONCLUSIONS

6.1 GROUNDWATER QUALITY IMPACTS

This study supports earlier conclusions (WHC 1990b) that continuing operation of the T-4-2 Ditch until June 1995 would have little if any additional adverse impact on groundwater quality in the 200 West Area. The low anticipated effluent discharge rate (14 L/min [4 gal/min]), the limited time remaining before discharges cease (June 1995), and the apparent absence of significant quantities of mobile contaminants are the primary factors supporting this conclusion.

Minor levels of nitrate, technetium-99, and carbon tetrachloride found during this study were attributed to upgradient sources from past-practice waste disposal associated with the T Tank Farm and Z Plant operations. The single new monitoring well installed for this study is considered adequate for evaluating potential impact of this disposal site on groundwater quality.

6.2 HYDROLOGIC IMPACTS

Discharge of water to the T-4-2 Ditch, under current conditions (December 1994) does not substantially affect artificial recharge to the northern 200 West Area unconfined aquifer, as indicated by the smooth surface of the water table in the northeastern 200 West Area; i.e., there is no apparent localized groundwater mound created by wastewater from the ditch.

6.3 CONCLUSIONS

The absence of contaminants in the perching layers and saturated zone sediments beneath the ditch suggests that the zone of expected or potential soil contamination is the upper 15 m (50 ft). Test borings or drive points placed near the center of the T-4-2 Ditch would be needed to establish the actual location and depth of penetration of the expected soil column contaminants. It is recommended that as part of remediation activities at this site, a few such test borings be included along the center of the ditch, after liquid waste discharges have ceased and the pond has dried out.

Continued short-term operation of the T-4-2 Ditch will have little effect on groundwater quality in the northern 200 West Area. The groundwater monitoring well currently installed at the T-4-2 Ditch is adequate for use of the ditch under current operating conditions (December 1994) until June 1995. If discharges to the T-4-2 Ditch continue beyond June 1995, it would be advisable to install additional groundwater monitoring wells for this site, to provide better up- and downgradient monitoring capabilities.

7.0 REFERENCES

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APPENDIX A-1

PERCHED WATER AND GROUNDWATER DATA--FIELD AND LABORATORY RESULTS FOR WELL 299-W10-22 (MONITORING WELL FOR 216-T-4-2 DITCH)

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The following results are from samples collected during the summer and fall of 1994, during installation of the monitoring well for the 216-T-4-2 Ditch (299-W10-22). The results are given in table form as whole sample sets, in the following order of analysis type:

1. Field Analyses.

   a. Field parameters measured at the well head:

      - depth to water
      - pH
      - temperature
      - specific conductance (conductivity)
      - dissolved oxygen
      - oxidation-reduction potential.

   b. Field parameters measured in portable field laboratory:

      - sulfate
      - nitrate
      - total iron
      - total chromium
      - copper
      - chloride
      - sulfide
      - nitrite
      - ferrous iron
      - hexavalent chromium
      - phosphate
      - alkalinity.

2. Laboratory Analyses

   a. ICP metals--unfiltered and filtered: aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, magensium, manganese, nickel, potassium, silver, sodium, vanadium, and zinc

   b. AA metals--unfiltered and filtered: arsenic, lead, mercury, selenium, and thallium
   c. Anions--unfiltered: chloride, fluoride, nitrate, nitrite, ortho-phosphate, sulfate, and sulfide

   d. Volatile organics--unfiltered

   e. Semi-volatile organics--Unfiltered

   f. Herbicides--unfiltered

   g. Organophosphate pesticides--unfiltered

   h. Pesticides and polychlorinated biphenyls (PCBs)--unfiltered

   i. Radionuclides--unfiltered: total alpha, total beta, gamma spectroscopy, americium-241, strontium-90, plutonium-238, plutonium-239/240, uranium-234, uranium-235, uranium-238, tritium, and technetium-99

   j. Total activity screening--222-S Laboratory.

Table A1-1 lists all the samples taken at this well, and gives all of the identification numbers used for each sample set. The following explains three of the most common types of sample numbers these samples were given.

- HC Number - a number assigned to all samples collected by Hydrochemistry and Geochemistry personnel performing special projects. The numbers are assigned in consecutive order and have the following format:

  HC-94-xx

  where: HC = Hydrochemistry
  94 = Year sample was taken
  xx = Next consecutive number, starting with 1 and ending with last number used in a given year.

- HEIS Number - a number assigned by Hanford Analytical Services Management (HASM) and assigned by the project scientist/sampler for samples being submitted to an offsite laboratory. Numbers are generated using a special program (DOE-RL 1994a, 1994b). Usually has a six-digit format using a combination of letters and numbers.

- 222-S Laboratory Number - for total activity analysis. Number has the following format:

  N-xxxx

  where: N = 222-S Laboratory designation
  xxxx = next consecutive number in the 222-S Laboratory logbook.

Table A1-1. List of Samples Taken at Well 299-W10-22.

HC Number	Other Identifying Number(s) (HEIS/222-S)	Description of Sample
HC-94-7	N1901	Perched water at 299-W10-22; depth = 51 ft; date = 8-11-94
HC-94-8	B09TH9 N1962	Perched water at 299-W10-22; depth = 86 ft; date = 8-12-94
HC-94-11	B09W13 N2401	Groundwater at 299-W10-22; depth = 230.6 ft; date = 9-1-94
HC-94-12	B09W14 N2402	Duplicate sample-B09W13 Groundwater at 299-W10-22; depth = 230.6 ft; date = 9-1-94
HC-94-13	B09W17 N2405	Groundwater at 299-W10-22; depth = 275 ft; date = 9-15-94
HC-94-14	B09W18 N2406	Split sample-B09W17 Groundwater at 299-W10-22; depth = 275 ft; date = 9-15-94

Table A1-2. Field Results from Well Head and Portable Field Laboratory for Perched Water Sample HT-94-7.

Sample Number	HT-94-7	Depth	51 feet	Date	8-11-94
Location	299-W10-22	Sampling Method		Bailer	
Constituent (units)	Results	Constituent (units)		Results	
Well Head Measurments					
pH	7.67	DO (mg/L)		NM	
Temperature (°C)	6.5	ORP (mV)		NM	
SC (μmhos/cm)	527	---		---	
Portable Field Laboratory Measurments					
Nitrate (ppb)	1000	Nitrite (ppb)		28	
Sulfate (ppp)	25,000	Sulfide (ppb)		13	
Total Chromium (ppb)	40	Hexavalent Chromium (ppb)		30	
Total Fe (ppb)	ND	Ferrous Fe (ppb)		ND	
Chloride (ppb)	415,000	Alkalinity (ppb)		NM	

DO = Dissolved Oxygen
NM = not measured
ORP = Oxidation-Reduction Potential
SC = Specific Conductance or Conductivity
ppb = parts per billion (or μg/L)
mg/L = milligrams per liter
°C = degrees Centigrade
mV = millivolts
μmhos/cm = micromhos per centimeter
ND = not detected.

Table A1-3a. Field Results from Well Head and Portable Field Laboratory for Perched Water Sample HT-94-8.

Sample Number	HT-94-8	Depth	86 feet	Date	8-12-94
Location	299-W10-22	Sampling Method		Bladder Pump	
Constituent (units)	Results	Constituent (units)		Results	
Well Head Measurments					
pH	8.42	DO (mg/L)		8.35	
Temperature (°C)	18.6	ORP (mV)		-0.2	
SC (µmhos/cm)	233	---		---	
Portable Field Laboratory Measurments					
Nitrate (ppb)	1100	Nitrite (ppb)		4	
Sulfate (ppp)	27,000	Sulfide (ppb)		8	
Total Chromium (ppb)	40	Hexavalent Chromium (ppb)		40	
Total Fe (ppb)	10	Ferrous Fe (ppb)		10	
Chloride (ppb)	7,500	Alkalinity (ppb)		NM	

DO = Dissolved Oxygen
NM = not measured
ORP = Oxidation-Reduction Potential
SC = Specific Conductance or Conductivity
ppb = part per billion (or µg/L)
mg/L = milligrams per liter
°C = degrees Centigrade
µmhos/cm = micromhos per centimeter
mV = millivolts

Table A1-3b. ICP and AA Metals Laboratory Results for Perched Water Sample HT-94-8. (2 sheets)

ICP METALS (EPA Method 6010[1] and EPA CLP ICAP Metals[2]) AA METALS (EPA Methods 7060[3], 7421[4], 7470[5], 7740[6], 7841[7])			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
Aluminum[1] - Unfiltered (U)	7429-90-5	19000	200
Aluminum[2] - Filtered (F)	7429-90-5	31.1	200
Antimony[1] - U	7440-36-0	30.5	100
Antimony[2] - F	7440-36-0	19.5	100
Arsenic[3] - U	7440-38-2	22.4	3.0
Arsenic[3] - F	7440-38-2	2.9	3.0
Barium[1] - U	7440-39-3	447	200
Barium[2] - F	7440-39-3	32.6	200
Beryllium[1] - U	7440-41-7	1.9	7.0
Beryllium[2] - F	7440-41-7	1.2	7.0
Cadmium[1] - U	7440-43-9	31.1	20.0
Cadmium[2] - F	7440-43-9	1.8	20.0
Calcium[1] - U	7440-70-2	396000	5000
Calcium[2] - F	7440-70-2	35500	5000
Chromium[1] - U	7440-47-3	24.3	20.0
Chromium[2] - F	7440-47-3	3.0	2.0
Cobalt[1] - U	7440-48-4	23.5	20.0
Cobalt[2] - F	7440-48-4	2.9	2.0
Copper[1] - U	7440-50-8	64.5	20.0
Copper[2] - F	7440-50-8	8.7	2.0
Iron[1] - U	7439-89-6	29100	100
Iron[2] - F	7439-89-6	33.8	100
Lead[4] - U	7439-92-1	1.3	3.0
Lead[4] - F	7439-92-1	0.80	3.0
Magnesium[1] - U	7439-95-4	29300	5000
Magnesium[2] - F	7439-95-4	7550	5000
Manganese[1] - U	7439-96-5	1680	10.0
Manganese[2] - F	7439-96-5	91.2	10.0

Table A1-3b. ICP and AA Metals Laboratory Results for Perched Water Sample HT-94-8. (2 sheets)

ICP METALS (EPA Method 6010[1] and EPA CLP ICAP Metals[2]) AA METALS (EPA Methods 7060[3], 7421[4], 7470[5], 7740[6], 7841[7])			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
Mercury[5] - U	7439-97-6	0.12	0.2
Mercury[5] - F	7439-97-6	0.10	0.2
Nickel[1] - U	7440-02-0	46.5	40.0
Nickel[2] - F	7440-02-0	11.4	40.0
Potassium[1] - U	7440-09-7	9900	5000
Potassium[2] - F	7440-09-7	5150	1000
Selenium[6] - U	7782-49-2	0.80	3.0
Selenium[6] - F	7782-49-2	0.70	3.0
Silver[1] - U	7440-22-4	5.5	200
Silver[2] - F	7440-22-4	4.2	200
Sodium[1] - U	7440-23-5	7250	1000
Sodium[2] - F	7440-23-5	5180	1000
Thallium[7] - U	7440-28-0	1.2	3.0
Thallium[7] - F	7440-28-0	1.0	3.0
Vanadium[1] - U	7440-62-2	80.2	20.0
Vanadium[2] - F	7440-62-2	9.8	20.0
Zinc[1] - U	7440-66-6	78.3	20.0
Zinc[2] - F	7440-66-6	2.7	20.0

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-3c. Anion Laboratory Results for Perched Water Sample HT-94-8.

ANIONS (EPA Method 300.0[1] and Method 9030[2])			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
Chloride[1]	16887-00-6	4800	250
Fluoride[1]	16984-48-8	180	100
Nitrate[1]	14797-55-8	390	200
Nitrite[1]	7632-00-0	20	20
ortho-Phosphate[1]	7778-77-0	1000	1000
Sulfate[1]	14808-79-8	22,700	1000
Sulfide[2]	18496-25-8	200	200

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-3d. Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (2 sheets)

VOLATILES (Method EPA 8240)			
Constituent	CAS Number	Result (μg/L)	DL (μg/L)
Dichlorodifluoromethane	75-71-8	<5	5
Chloromethane	74-87-3	<10	10
Bromomethane	74-83-9	<10	10
Vinyl Chloride	75-01-4	<10	10
Chloroethane	75-00-3	<10	10
Acrolein	107-02-8	<100	100
Methylene Chloride	75-09-2	<5	5
Acetone	67-64-1	<100	100
Trichlorofluoromethane	75-69-4	<5	5
Allyl Chloride	107-95-1	<5	5
Carbon Disulfide	75-15-0	<5	5
trans-1,2-Dichloroethene	156-60-5	<5	5
1,1-Dichloroethene	75-35-4	<5	5
Acetonitrile	75-05-8	<100	100
Acrylonitrile	107-13-1	<100	100
Propionitrile	107-12-0	<100	100
1,1-Dichloroethane	75-34-3	<5	5
Iodomethane	74-88-4	<5	5
Chloroform	67-66-3	<5	5
1,2-Dichloroethane	107-06-2	<5	5
2-Chloro-1,3-butadiene	126-99-8	<5	5
Methacrylonitrile	126-98-7	<100	100
2-Butanone	78-93-3	<100	100
Isobutyl Alcohol	78-83-1	<500	500
1,1,1-Trichloroethane	71-55-6	<5	5
Carbon Tetrachloride	56-23-5	<5	5
Vinyl Acetate	108-05-4	<50	50
Bromodichloromethane	75-27-4	<5	5

Table A1-3d. Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (2 sheets)

VOLATILES (Method EPA 8240)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
1,2-Dichloropropane	78-87-5	<5	5
cis-1,3-Dichloropropene	10061-01-5	<5	5
Methyl methacrylate	80-62-6	<5	5
Trichloroethene	79-01-6	<5	5
Ethyl methacrylate	97-63-2	<5	5
1,1,2-Trichloroethane	79-00-5	<5	5
Benzene	71-43-2	<5	5
Dibromomethane	74-95-3	<5	5
trans-1,3-Dichloropropene	10061-02-6	<5	5
Bromoform	75-25-2	<5	5
1,2-Dibromomethane	106-93-4	<5	5
1,4-Dioxane	23-91-1	<500	500
4-Methyl-2-Pentanone	108-10-1	<50	50
2-Hexanone	591-78-6	<50	50
Tetrachloroethene	127-18-4	<5	5
1,1,2,2-Tetrachloroethane	79-34-5	<5	5
Dibromochloromethane	124-48-1	<5	5
Toluene	108-88-3	<5	5
Chlorobenzene	108-90-7	<5	5
Ethyl benzene	100-41-4	<5	5
Styrene	100-42-5	<5	5
trans-1,4-Dichloro-2-butene	764-41-0	<100	100
Xylenes (total)	1330-20-7	<5	5
Pentachloroethane	76-01-7	<10	10
1,2,3-Trichloropropane	96-18-4	<5	5
1,2-Dibromo-3-chloropropane	96-12-8A	<100	100

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-3e. Semi-Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
n-Nitrosodimethylamine	62-75-9	<10	10
Pyridine	110-86-1	<10	10
Phenol	108-95-2	15 (j)	10
Aniline	62-53-3	<10	10
bis(2-Chloroethyl) Ether	111-44-4	<10	10
2-Chlorophenol	95-57-8	<10	10
1,3-Dichlorobenzene	541-73-1	<10	10
1,4-Dichlorobenzene	106-46-7	<10	10
Benzyl Alcohol	100-51-6	<20	20
1,2-Dichlorobenzene	95-50-1	<10	10
2-Methylphenol	95-48-7	<10	10
bis(2-Chloroisopropyl) Ether	108-60-1	<10	10
4-Methylphenol	65794-96-9	<10	10
n-Nitroso-di-n-propylamine	621-64-7	8 (j)	10
Hexachloroethane	67-72-1	<10	10
Nitrobenzene	98-95-3	<10	10
Isophorone	78-59-1	<10	10
2-Nitrophenol	88-75-5	<10	10
2,4-Dimethylphenol	105-67-9	<10	10
bis(2-Chloroethoxy)Methane	111-91-1	<10	10
2,4-Dichlorophenol	120-83-2	<10	10
1,2,4-Trichlorobenzene	120-82-1	<10	10
Naphthalene	91-20-3	<10	10
4-Chloroaniline	106-47-8	<20	20
Hexachlorobutadiene	87-68-3	<10	10
4-Chloro-3-Methylphenol	59-50-7	<20	20
2-Methylnaphthalene	91-57-6	<10	10
Hexachlorocyclopentadiene	77-47-4	<10	10

Table A1-3e. Semi-Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
2,4,6-Trichlorophenol	88-06-2	<10	10
2,4,5-Trichlorophenol	95-95-4	<10	10
2-Chloronaphthalene	91-58-7	<10	10
2-Nitroaniline	88-74-4	<50	50
Dimethyl Phthlate	131-11-3	<10	10
Acenaphthylene	208-96-8	<10	10
2,6-Dinitrotoluene	606-20-2	<10	10
3-Nitroaniline	99-09-2	<50	50
Acenaphthene	83-32-9	<10	10
2,4-Dinitrophenol	51-28-5	<50	50
4-Nitrophenol	100-02-7	<50	50
Dibenzofuran	132-64-9	<10	10
2,4-Dinitrotoluene	121-14-2	<10	10
Diethylphthlate	84-66-2	<10	10
4-Chlorophenyl Phenyl Ether	7005-72-3	<10	10
Fluorene	86-73-7	<10	10
4-Nitroaniline	100-01-6	<20	20
4,6-Dinitro-2-Methylphenol	534-52-1	<50	50
n-Nitrosodiphenylamine	86-30-6	<10	10
4-Bromophenyl Phenyl Ether	101-55-3	<10	10
Hexachlorobenzene	118-74-1	<10	10
Pentachlorophenol	87-86-5	<50	50
Phenanthrene	85-01-8	<10	10
Anthracene	120-12-7	<10	10
di-N-Butylphthlate	84-74-2	<10	10
Fluoranthene	206-44-0	<10	10
Pyrene	129-00-0	<10	10
Butyl Benzyl Phthlate	85-68-7	<10	10

Table A1-3e. Semi-Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
3,3-Dichlorobenzidine	91-94-1	<20	20
Benzo(a)Anthracene	56-55-3	<10	10
Chrysene	218-01-9	<10	10
bis(2-Ethylhexyl)Phthlate	117-81-7	5 (j)	10
di-N-Octyl Phthlate	117-84-0	<10	10
Benzo(b)Fluoranthene	205-99-2	<10	10
Benzo(k)Fluoranthene	207-08-9	<10	10
Benzo(a)Pyrene	50-32-8	<10	10
Indeno(1,2,3-CD)Pyrene	193-39-5	<10	10
Dibenzo(a,h)Anthracene	53-70-3	<10	10
Benzo(g,h,i)Perylene	191-24-2	<10	10
Acetophenone	10383-88-7	<10	10
2-Acetylaminofluorene	53-96-3	<20	20
4-Aminobiphenyl	92-67-1	<20	20
Aramite I	140-57-8A	<20	20
Aramite II	140-57-8B	<20	20
Chlorobenzilate	510-15-6	<10	10
Diallate I	2303-16-4A	<20	20
Diallate II	2303-16-4B	<20	20
2,6-Dichlorophenol	87-65-0	<10	10
Dimethoate	60-51-5	<20	20
p-Dimethylaminoazobenzene	60-11-7	<10	10
7,12-Dimethylbenz(a)Anthracene	57-97-6	<10	10
3,3-Dimethylbenzidine	119-93-7	<10	10
a,a-Dimethylphenethylalamine	122-09-8	<10	10
1,3-Dinitrobenzene	99-65-0	<20	20
Dinoseb	88-85-7	<20	20
Disulfoton	298-04-4	<10	10

Table A1-3e. Semi-Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)			
Constituent	CAS Number	Result (μg/L)	DL (μg/L)
Ethyl Methanesulfonate	62-50-0	<20	20
Famphur	52-85-7	<50	50
Hexachloropropene	1888-71-7	<10	10
Isodrin	465-73-6	<20	20
Isosafrole	120-58-1	<10	10
D-Kepone	143-50-0	<50	50
Methapyrilene	91-80-5	<100	100
3-Methylcholanthrene	56-49-5	<10	10
Methyl Methanesulfonate	66-27-3	<10	10
Methyl Parathion	298-00-0	<10	10
1,4-Naphthoquinone	130-15-4	<10	10
1-Naphthylamine	134-32-7	<10	10
2-Naphthylamine	91-59-8	<10	10
5-Nitro-o-toluidine	99-55-8	<10	10
4-Nitroquinoline-1-oxide	56-57-5	<40	40
n-Nitroso-di-n-butylamine	924-16-3	<10	10
n-Nitrosodiethylamine	55-18-5	<20	20
n-Nitrosopiperdine	100-75-4	<20	20
n-Nitrosopyrrolidine	930-55-2	<40	40
Parathion	56-38-2	<10	10
Pentachlorobenzene	608-93-5	<10	10
Pentachloroethane	76-01-7	<10	10
Pentachloronitrobenzene	82-68-8	<20	20
Phenacetin	62-44-2	<20	20
1,4-Phenylenediamine	106-50-3	<100	100
n-Nitrosomethylethylamine	10595-95-6	<10	10
n-Nitrosomorpholine	59-89-2	<10	10
Pronamide	23950-58-5	<20	20

Table A1-3e. Semi-Volatile Organic Laboratory Results for Perched Water Sample HT-94-8. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)			
Constituent	CAS Number	Result (μg/L)	DL (μg/L)
Safrole	94-59-7	<10	10
1,2,4,5-Tetrachlorobenzene	95-94-3	<10	10
2,3,4,6-Tetrachlorophenol	58-90-2	<10	10
Sulfotepp	3689-24-5	<40	40
Thioazin	297-97-2	<20	20
o-Toluidine	95-53-4	<10	10
1,3,5-Trinitrobenzene	99-35-4	<50	50
o,o,o-triethyl Phosphorothioat	126-68-1	<20	20
Phorate	298-02-2	<10	10
2-Picoline	109-06-8	<10	10
Hexachlorophene	70-30-4	<100	100

CAS = Chemical Abstract Services
μg/L = micrograms per liter (or ppb)
DL = detection limit
(j) = value is estimated, because it is below a detection limit.

Table A1-3f. Herbicide Laboratory Results for Perched Water Sample HT-94-8.

HERBICIDES (Method SW 8150)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
Dalapon	75-99-0	<58	58
Dicamba	1918-00-9	<2.7	2.7
MCPA	94-74-6	<2500	2500
MCPP	93-65-2	<1900	1900
2,2-Dichloropropionic acid	120-36-5	<6.5	6.5
2,4-D	94-75-7	<12	12
2,4,5-TP (Silvex)	93-72-1	<1.7	1.7
2,4,5-T	93-76-5	<2.0	2.0
Dinoseb	88-85-7	<0.7	0.7
2,4-DB	94-82-6	<9.1	9.1

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-3g. Organophosphate Pesticide Laboratory Results for Perched Water Sample HT-94-8.

ORGANOPHOSPHATE PESTICIDES (Method EPA 8140)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
Demeton #1	298-03-3A	<1.2	1.2
Demeton #2	298-03-3B	<1.2	1.2
Diazinon	333-41-5	<2.0	2.0
Disulfoton	298-04-4	<0.7	0.7
Methyl Parathion	298-00-0	<1.2	1.2
Malathion	121-75-5	<1.1	1.1
Parathion	56-38-2	<0.6	0.6
Ethion	563-12-2	<0.6	0.6
Azinphos-methyl	86-50-0	<1.0	1.0

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-3h. Pesticides and Polychlorinated biphenyls (PCBs) Laboratory Results for Perched Water Sample HT-94-8.

PESTICIDES and PCBs (EPA Method 8080)			
Constituent	CAS Number	Result (µg/L)	DL (µg/L)
alpha-BHC	319-84-6	<0.03	0.03
beta-BHC	319-85-7	<0.06	0.06
delta-BHC	319-86-8	<0.09	0.09
gamma-BHC (Lindane)	58-89-9	<0.04	0.04
Heptachlor	76-44-8	<0.03	0.03
Aldrin	309-00-2	<0.04	0.04
Heptachlor Epoxide	1024-57-3	<0.83	0.83
Endosulfan I	959-98-8	<0.14	0.14
Dieldrin	60-57-1	<0.02	0.02
4,4-DDE	72-55-9	<0.04	0.04
Endrin	72-43-5	<0.06	0.06
Endosulfan II	33213-65-9	<0.04	0.04
4,4-DDD	72-54-8	<0.11	0.11
Endosulfan Sulfate	1031-07-8	<0.66	0.66
4,4-DDT	50-29-3	<0.12	0.12
Methoxychlor	72-43-5	<1.8	1.8
Endrin Aldehyde	7421-93-4	<0.23	0.23
Chlordane	57-74-9	<0.14	0.14
Toxaphene	8001-35-2	<2.4	2.4
Arochlor-1016	12674-11-2	<0.65	0.65
Arochlor-1221	11104-28-2	<1.0	1.0
Arochlor-1232	11141-16-5	<1.0	1.0
Arochlor-1242	53469-21-9	<0.65	0.65
Arochlor-1248	12672-29-6	<1.0	1.0
Arochlor-1254	11097-69-1	<1.0	1.0
Arochlor-1260	11096-82-5	<1.0	1.0

CAS = Chemical Abstract Services, µg/L = micrograms per liter (or ppb), DL = detection limit.

Table A1-3i. Radionuclide Laboratory Results for Perched Water Sample HT-94-8. (2 sheets)

RADIOISOTOPES (Method-Lab Specific)							
Constituent	Result	Counting Error (2σ)	Total Error (2σ)	MDA	Units	Yield (%)	Method Number
Am-241	0.0543	0.0109	0.0109	0.0147	pCi/L	66.9	RD3302
Pu-238	0.00	0.00	0.328	0.296	pCi/L	38.1	RD3209
Pu-239/40	0.00	0.00	0.328	0.296	pCi/L	38.1	RD3209
U-234	----	----	----	----	pCi/L	----	RD3234
U-235	----	----	----	----	pCi/L	----	RD3234
U-238DA	----	----	----	----	pCi/L	----	RD3234
Co-58	-3.13	4.69	4.70	7.19	pCi/L	N/A	RD3219
Co-60	-1.28	4.84	4.84	8.42	pCi/L	N/A	RD3219
Cs-137DA	2.60	4.02	4.03	8.05	pCi/L	N/A	RD3219
Eu-152	-3.58	9.55	9.56	16.6	pCi/L	N/A	RD3219
Eu-154	-1.84	10.8	10.8	20.6	pCi/L	N/A	RD3219
Eu-155	-2.63	7.93	7.93	13.5	pCi/L	N/A	RD3219
Fe-59	-4.79	9.04	9.05	15.2	pCi/L	N/A	RD3219
Alpha	5.74	3.85	3.89	4.74	pCi/L	100.0	RD3214
Beta	8.42	2.80	2.86	4.78	pCi/L	100.0	RD3214
Strontium	----	----	----	----	pCi/L	----	ITAS-IT-RS-001
Tc-99[1]	0.00	0.00	0.00	N/A	pCi/L	N/A	RD3205
Tritium	-15.8	99.9	190.0	236.0	pCi/L	97.3	RD4003

MDA = Minimum Detectable Activity

pCi/L = picoCuries per liter.

Table A1-4a. Field Results from Well Head and Portable Field Laboratory for Groundwater Samples HT-94-11 and HT-94-12-Duplicate.

Sample Numbers	HT-94-11 HT-94-12 (dupl.)	Depth	230.6 feet	Date	9-1-94
Location	299-W10-22	Sampling Method		Bladder Pump	
Constituent (units)	Results	Constituent (units)		Results	
Well Head Measurments					
pH	8.46	DO (mg/L)		3.86	
Temperature (°C)	21.3	ORP (mV)		+75.3	
SC (μmhos/cm)	237	---		---	
Portable Field Laboratory Measurments					
Nitrate (ppb)	750	Nitrite (ppb)		6.5	
Sulfate (ppp)	14,000	Sulfide (ppb)		ND	
Total Chromium (ppb)	<10	Hexavalent Chromium (ppb)		<10	
Total Fe (ppb)	<10	Ferrous Fe (ppb)		<10	
Chloride (ppb)	5,500	Alkalinity (ppb)		NM	

DO = Dissolved Oxygen
NM = not measured
ORP = Oxidation-Reduction Potential
μmhos/cm = micromhos per centimeter
ppb = parts per billion (or μg/L)
mg/L = milligrams per liter
°C = degrees Centigrade
mV = millivolts
SC = Specific Conductance or Conductivity
ND = not detected.

Table A1-4b. ICP and AA Metals Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (2 sheets)

ICP METALS (EPA Method 6010[1] and EPA CLP ICAP Metals[2]) AA METALS (EPA Methods 7060[3], 7421[4], 7470[5], 7740[6], 7841[7])				
Constituent	CAS Number	HT-94-11 Result (μg/L)	HT-94-12 Result (μg/L)	DL (μg/L)
Aluminum[1] - Unfiltered (U)	7429-90-5	30,700	9,780	200
Aluminum[2] - Filtered (F)	7429-90-5	34.5	19.0	200
Antimony[1] - U	7440-36-0	41.9	30.5	100
Antimony[2] - F	7440-36-0	32.8	1.5	100
Arsenic[3] - U	7440-38-2	5.1	3.4	3.0
Arsenic[3] - F	7440-38-2	0.9	2.6	3.0
Barium[1] - U	7440-39-3	289	122	200
Barium[2] - F	7440-39-3	25.4	24.9	200
Beryllium[1] - U	7440-41-7	0.64	0.20	7.0
Beryllium[2] - F	7440-41-7	0.67	0.67	7.0
Cadmium[1] - U	7440-43-9	95.8	15.5	20.0
Cadmium[2] - F	7440-43-9	2.3	1.8	20.0
Calcium[1] - U	7440-70-2	38,300	27,900	5000
Calcium[2] - F	7440-70-2	27,500	28,000	5000
Chromium[1] - U	7440-47-3	37.5	7.4	20.0
Chromium[2] - F	7440-47-3	2.8	2.8	2.0
Cobalt[1] - U	7440-48-4	20.5	4.5	20.0
Cobalt[2] - F	7440-48-4	2.9	2.9	2.0
Copper[1] - U	7440-50-8	59.9	14.4	20.0
Copper[2] - F	7440-50-8	4.5	4.5	2.0
Iron[1] - U	7439-89-6	148,000	25,200	100
Iron[2] - F	7439-89-6	32.8	17.7	100
Lead[4] - U	7439-92-1	20.6	4.2	3.0
Lead[4] - F	7439-92-1	0.9	0.9	3.0
Magnesium[1] - U	7439-95-4	17,400	10,200	5000
Magnesium[2] - F	7439-95-4	8,250	8,540	5000
Manganese[1] - U	7439-96-5	1,710	518	10.0

Table A1-4b. ICP and AA Metals Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (2 sheets)

ICP METALS (EPA Method 6010[1] and EPA CLP ICAP Metals[2]) AA METALS (EPA Methods 7060[3], 7421[4], 7470[5], 7740[6], 7841[7])				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
Manganese[2] - F	7439-96-5	306	245	10.0
Mercury[5] - U	7439-97-6	0.1	0.1	0.2
Mercury[5] - F	7439-97-6	0.1	0.1	0.2
Nickel[1] - U	7440-02-0	36.4	11.4	40.0
Nickel[2] - F	7440-02-0	7.1	4.9	40.0
Potassium[1] - U	7440-09-7	7,220	5,280	5000
Potassium[2] - F	7440-09-7	5,190	5,080	1000
Selenium[6] - U	7782-49-2	1.4	1.4	3.0
Selenium[6] - F	7782-49-2	0.7	0.7	3.0
Silver[1] - U	7440-22-4	3.0	3.0	200
Silver[2] - F	7440-22-4	4.2	4.2	200
Sodium[1] - U	7440-23-5	18,400	15,600	1000
Sodium[2] - F	7440-23-5	14,100	14,100	1000
Thallium[7] - U	7440-28-0	1.2	1.2	3.0
Thallium[7] - F	7440-28-0	1.0	1.0	3.0
Vanadium[1] - U	7440-62-2	95.8	31.9	20.0
Vanadium[2] - F	7440-62-2	9.8	9.8	20.0
Zinc[1] - U	7440-66-6	125	99.6	20.0
Zinc[2] - F	7440-66-6	3.7	1.3	20.0

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-4c. Anion Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate.

ANIONS (EPA Method 300.0[1] and Method 9030[2])				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
Chloride[1]	16887-00-6	4,780	3,740	250
Fluoride[1]	16984-48-8	580	460	100
Nitrate[1]	14797-55-8	20	110	200
Nitrite[1]	7632-00-0	20	20	20
o-Phosphate[1]	7778-77-0	1,000	1,000	1,000
Sulfate[1]	14808-79-8	16,200	13,600	1,000
Sulfide[2]	18496-25-8	670	200	200

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-4d. Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (3 sheets)

VOLATILES (Method EPA 8240)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
Dichlorodifluoromethane	75-71-8	<5	<5	5
Chloromethane	74-87-3	<10	<10	10
Bromomethane	74-83-9	<10	<10	10
Vinyl Chloride	75-01-4	<10	<10	10
Chloroethane	75-00-3	<10	<10	10
Acrolein	107-02-8	<100	<100	100
Methylene Chloride	75-09-2	3 (j)	<5	5
Acetone	67-64-1	7 (j)	<100	100
Trichlorofluoromethane	75-69-4	<5	<5	5
Allyl Chloride	107-95-1	<5	<5	5
Carbon Disulfide	75-15-0	<5	<5	5
trans-1,2-Dichloroethene	156-60-5	<5	<5	5
1,1-Dichloroethene	75-35-4	<5	<5	5
Acetonitrile	75-05-8	<100	<100	100
Acrylonitrile	107-13-1	<100	<100	100
Propionitrile	107-12-0	<100	<100	100
1,1-Dichloroethane	75-34-3	<5	<5	5
Iodomethane	74-88-4	<5	<5	5
Chloroform	67-66-3	<5	<5	5
1,2-Dichloroethane	107-06-2	<5	<5	5
2-Chloro-1,3-butadiene	126-99-8	<5	<5	5
Methacrylonitrile	126-98-7	<100	<100	100
2-Butanone	78-93-3	<100	<100	100
Isobutyl Alcohol	78-83-1	<500	<500	500
1,1,1-Trichloroethane	71-55-6	<5	<5	5
Carbon Tetrachloride	56-23-5	<5	<5	5
Vinyl Acetate	108-05-4	<50	<50	50
Bromodichloromethane	75-27-4	<5	<5	5

Table A1-4d. Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (3 sheets)

VOLATILES (Method EPA 8240)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
1,2-Dichloropropane	78-87-5	<5	<5	5
cis-1,3-Dichloropropene	10061-01-5	<5	<5	5
Methyl methacrylate	80-62-6	<5	<5	5
Trichloroethene	79-01-6	<5	<5	5
Ethyl methacrylate	97-63-2	<5	<5	5
1,1,2-Trichloroethane	79-00-5	<5	<5	5
Benzene	71-43-2	<5	<5	5
Dibromomethane	74-95-3	<5	<5	5
trans-1,3-Dichloropropene	10061-02-6	<5	<5	5
Bromoform	75-25-2	<5	<5	5
1,2-Dibromomethane	106-93-4	<5	<5	5
1,4-Dioxane	23-91-1	<500	<500	500
4-Methyl-2-Pentanone	108-10-1	<50	<50	50
2-Hexanone	591-78-6	<50	<50	50
Tetrachloroethene	127-18-4	<5	<5	5
1,1,2,2-Tetrachloroethane	79-34-5	<5	<5	5
Dibromochloromethane	124-48-1	<5	<5	5
Toluene	108-88-3	<5	<5	5
Chlorobenzene	108-90-7	<5	<5	5
Ethyl benzene	100-41-4	<5	<5	5
Styrene	100-42-5	<5	<5	5
trans-1,4-Dichloro-2-butene	764-41-0	<100	<100	100
Xylenes (total)	1330-20-7	<5	<5	5
Pentachloroethane	76-01-7	<10	<10	10
1,2,3-Trichloropropane	96-18-4	<5	<5	5

Table A1-4d. Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (3 sheets)

VOLATILES (Method EPA 8240)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
1,2-Dibromo-3-chloropropane	96-12-8A	<100	<100	100

CAS = Chemical Abstract Services
µg/L = micrograms per liter or ppb
DL = detection limit
(j) = value is estimated, because it is below a detection limit.

Table A1-4e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
n-Nitrosodimethylamine	62-75-9	<10	<10	10
Pyridine	110-86-1	<10	<10	10
Phenol	108-95-2	<10	<10	10
Aniline	62-53-3	<10	<10	10
bis(2-Chloroethyl) Ether	111-44-4	<10	<10	10
2-Chlorophenol	95-57-8	<10	<10	10
1,3-Dichlorobenzene	541-73-1	<10	<10	10
1,4-Dichlorobenzene	106-46-7	<10	<10	10
Benzyl Alcohol	100-51-6	<20	<20	20
1,2-Dichlorobenzene	95-50-1	<10	<10	10
2-Methylphenol	95-48-7	<10	<10	10
bis(2-Chloroisopropyl) Ether	108-60-1	<10	<10	10
4-Methylphenol	65794-96-9	<10	<10	10
n-Nitroso-di-n-propylamine	621-64-7	<10	<10	10
Hexachloroethane	67-72-1	<10	<10	10
Nitrobenzene	98-95-3	<10	<10	10
Isophorone	78-59-1	<10	<10	10
2-Nitrophenol	88-75-5	<10	<10	10
2,4-Dimethylphenol	105-67-9	<10	<10	10
bis(2-Chloroethoxy)Methane	111-91-1	<10	<10	10
2,4-Dichlorophenol	120-83-2	<10	<10	10
1,2,4-Trichlorobenzene	120-82-1	<10	<10	10
Naphthalene	91-20-3	<10	<10	10
4-Chloroaniline	106-47-8	<20	<20	20
Hexachlorobutadiene	87-68-3	<10	<10	10
4-Chloro-3-Methylphenol	59-50-7	<20	<20	20
2-Methylnaphthalene	91-57-6	<10	<10	10
Hexachlorocyclopentadiene	77-47-4	<10	<10	10

Table A1-4e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-11 Result (μg/L)	HT-94-12 Result (μg/L)	DL (μg/L)
2,4,6-Trichlorophenol	88-06-2	<10	<10	10
2,4,5-Trichlorophenol	95-95-4	<10	<10	10
2-Chloronaphthalene	91-58-7	<10	<10	10
2-Nitroaniline	88-74-4	<50	<50	50
Dimethyl Phthlate	131-11-3	<10	<10	10
Acenaphthylene	208-96-8	<10	<10	10
2,6-Dinitrotoluene	606-20-2	<10	<10	10
3-Nitroaniline	99-09-2	<50	<50	50
Acenaphthene	83-32-9	<10	<10	10
2,4-Dinitrophenol	51-28-5	<50	<50	50
4-Nitrophenol	100-02-7	<50	<50	50
Dibenzofuran	132-64-9	<10	<10	10
2,4-Dinitrotoluene	121-14-2	<10	<10	10
Diethylphthlate	84-66-2	<10	<10	10
4-Chlorophenyl Phenyl Ether	7005-72-3	<10	<10	10
Fluorene	86-73-7	<10	<10	10
4-Nitroaniline	100-01-6	<20	<20	20
4,6-Dinitro-2-Methylphenol	534-52-1	<50	<50	50
n-Nitrosodiphenylamine	86-30-6	<10	<10	10
4-Bromophenyl Phenyl Ether	101-55-3	<10	<10	10
Hexachlorobenzene	118-74-1	<10	<10	10
Pentachlorophenol	87-86-5	<50	<50	50
Phenanthrene	85-01-8	<10	<10	10
Anthracene	120-12-7	<10	<10	10
di-N-Butylphthlate	84-74-2	<10	<10	10
Fluoranthene	206-44-0	<10	<10	10
Pyrene	129-00-0	<10	<10	10

Table A1-4e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
Butyl Benzyl Phthlate	85-68-7	<10	<10	10
3,3-Dichlorobenzidine	91-94-1	<20	<20	20
Benzo(a)Anthracene	56-55-3	<10	<10	10
Chrysene	218-01-9	<10	<10	10
bis(2-Ethylhexyl)Phthlate	117-81-7	<10	<10	10
di-N-Octyl Phthlate	117-84-0	<10	<10	10
Benzo(b)Fluoranthene	205-99-2	<10	<10	10
Benzo(k)Fluoranthene	207-08-9	<10	<10	10
Benzo(a)Pyrene	50-32-8	<10	<10	10
Indeno(1,2,3-CD)Pyrene	193-39-5	<10	<10	10
Dibenzo(a,h)Anthracene	53-70-3	<10	<10	10
Benzo(g,h,i)Perylene	191-24-2	<10	<10	10
Acetophenone	10383-88-7	<10	<10	10
2-Acetylaminofluorene	53-96-3	<20	<20	20
4-Aminobiphenyl	92-67-1	<20	<20	20
Aramite I	140-57-8A	<20	<20	20
Aramite II	140-57-8B	<20	<20	20
Chlorobenzilate	510-15-6	<10	<10	10
Diallate I	2303-16-4A	<20	<20	20
Diallate II	2303-16-4B	<20	<20	20
2,6-Dichlorophenol	87-65-0	<10	<10	10
Dimethoate	60-51-5	<20	<20	20
p-Dimethylaminoazobenzene	60-11-7	<10	<10	10
7,12-Dimethylbenz(a)Anthracene	57-97-6	<10	<10	10
3,3-Dimethylbenzidine	119-93-7	<10	<10	10
a,a-Dimethylphenethylalamine	122-09-8	<10	<10	10
1,3-Dinitrobenzene	99-65-0	<20	<20	20

Table A1-4e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
Dinoseb	88-85-7	<20	<20	20
Disulfoton	298-04-4	<10	<10	10
Ethyl Methanesulfonate	62-50-0	<20	<20	20
Famphur	52-85-7	<50	<50	50
Hexachloropropene	1888-71-7	<10	<10	10
Isodrin	465-73-6	<20	<20	20
Isosafrole	120-58-1	<10	<10	10
D-Kepone	143-50-0	<50	<50	50
Methapyrilene	91-80-5	<100	<100	100
3-Methylcholanthrene	56-49-5	<10	<10	10
Methyl Methanesulfonate	66-27-3	<10	<10	10
Methyl Parathion	298-00-0	<10	<10	10
1,4-Naphthoquinone	130-15-4	<10	<10	10
1-Naphthylamine	134-32-7	<10	<10	10
2-Naphthylamine	91-59-8	<10	<10	10
5-Nitro-o-toluidine	99-55-8	<10	<10	10
4-Nitroquinoline-1-oxide	56-57-5	<40	<40	40
n-Nitroso-di-n-butylamine	924-16-3	<10	<10	10
n-Nitrosodiethylamine	55-18-5	<20	<20	20
n-Nitrosopiperdine	100-75-4	<20	<20	20
n-Nitrosopyrrolidine	930-55-2	<40	<40	40
Parathion	56-38-2	<10	<10	10
Pentachlorobenzene	608-93-5	<10	<10	10
Pentachloroethane	76-01-7	<10	<10	10
Pentachloronitrobenzene	82-68-8	<20	<20	20
Phenacetin	62-44-2	<20	<20	20
1,4-Phenylenediamine	106-50-3	<100	<100	100
n-Nitrosomethylethylamine	10595-95-6	<10	<10	10

Table A1-4e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
n-Nitrosomorpholine	59-89-2	<10	<10	10
Pronamide	23950-58-5	<20	<20	20
Safrole	94-59-7	<10	<10	10
1,2,4,5-Tetrachlorobenzene	95-94-3	<10	<10	10
2,3,4,6-Tetrachlorophenol	58-90-2	<10	<10	10
Sulfotepp	3689-24-5	<40	<40	40
Thioazin	297-97-2	<20	<20	20
o-Toluidine	95-53-4	<10	<10	10
1,3,5-Trinitrobenzene	99-35-4	<50	<50	50
o,o,o-triethyl Phosphorothioat	126-68-1	<20	<20	20
Phorate	298-02-2	<10	<10	10
2-Picoline	109-06-8	<10	<10	10
Hexachlorophene	70-30-4	<100	<100	100

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-4f. Herbicide Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate.

HERBICIDES (Method SW 8150)				
Constituent	CAS Number	HT-94-11 Result (μg/L)	HT-94-12 Result (μg/L)	DL1/DL2 (μg/L)
Dalapon	75-99-0	<62	<60	62/60
Dicamba	1918-00-9	<2.9	<2.8	2.9/2.8
MCPA	94-74-6	<2,000	<2,000	2000/2000
MCPP	93-65-2	<2,700	<2,600	2700/2600
2,2-Dichloropropionic acid	120-36-5	<7.0	<6.8	7.0/6.8
2,4-D	94-75-7	<13	<12	13/12
2,4,5-TP (Silvex)	93-72-1	<1.8	<1.8	1.8/1.8
2,4,5-T	93-76-5	<2.1	<2.1	2.1/2.1
Dinoseb	88-85-7	<0.7	<0.7	0.7/0.7
2,4-DB	94-82-6	<9.7	<9.5	9.7/9.5

CAS = Chemical Abstract Services
μg/L = micrograms per liter (or ppb)
DL1 = detection limit, first sample
DL2 = detection limit, second sample-duplicate.

Table A1-4g. Organophosphate Pesticide Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate.

ORGANOPHOSPHATE PESTICIDES (Method EPA 8140)				
Constituent	CAS Number	HT-94-11 Result (µg/L)	HT-94-12 Result (µg/L)	DL (µg/L)
Demeton #1	298-03-3A	<1.2	<1.2	1.2
Demeton #2	298-03-3B	<1.2	<1.2	1.2
Diazinon	333-41-5	<2.0	<2.0	2.0
Disulfoton	298-04-4	<0.7	<0.7	0.7
Methyl Parathion	298-00-0	<1.2	<1.2	1.2
Malathion	121-75-5	<1.1	<1.1	1.1
Parathion	56-38-2	<0.6	<0.6	0.6
Ethion	563-12-2	<0.6	<0.6	0.6
Azinphos-methyl	86-50-0	<1.0	<1.0	1.0

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL = detection limit.

Table A1-4h. Pesticides and Polychlorinated biphenyls (PCBs) Laboratory Results for Groundwater Samples HT-94-11 and HT-94-12-Duplicate.

PESTICIDES and PCBs (EPA Method 8080)				
Constituent	CAS Number	HT-94-11 Result (μg/L)	HT-94-12 Result (μg/L)	DL (μg/L)
alpha-BHC	319-84-6	<0.03	<0.03	0.03
beta-BHC	319-85-7	<0.06	<0.06	0.06
delta-BHC	319-86-8	<0.09	<0.09	0.09
gamma-BHC (Lindane)	58-89-9	<0.04	<0.04	0.04
Heptachlor	76-44-8	<0.03	<0.03	0.03
Aldrin	309-00-2	<0.04	<0.04	0.04
Heptachlor Epoxide	1024-57-3	<0.83	<0.83	0.83
Endosulfan I	959-98-8	<0.14	<0.14	0.14
Dieldrin	60-57-1	<0.02	<0.02	0.02
4,4-DDE	72-55-9	<0.04	<0.04	0.04
Endrin	72-43-5	<0.0[illegible]	<0.06	0.06
Endosulfan II	33213-65-9	<0.04	<0.04	0.04
4,4-DDD	72-54-8	<0.11	<0.11	0.11
Endosulfan Sulfate	1031-07-8	<0.66	<0.66	0.66
4,4-DDT	50-29-3	<0.12	<0.12	0.12
Methoxychlor	72-43-5	<1.8	<1.8	1.8
Endrin Aldehyde	7421-93-4	<0.23	<0.23	0.23
Chlordane	57-74-9	<0.14	<0.14	0.14
Toxaphene	8001-35-2	<2.4	<2.4	2.4
Arochlor-1016	12674-11-2	<1.0	<1.0	1.0
Arochlor-1221	11104-28-2	<1.0	<1.0	1.0
Arochlor-1232	11141-16-5	<1.0	<1.0	1.0
Arochlor-1242	53469-21-9	<1.0	<1.0	1.0
Arochlor-1248	12672-29-6	<1.0	<1.0	1.0
Arochlor-1254	11097-69-1	<1.0	<1.0	1.0
Arochlor-1260	11096-82-5	<1.0	<1.0	1.0

CAS = Chemical Abstract Services, μg/L = micrograms per liter (or ppb), DL = detection limit.

Table A1-4i. Radionuclide Laboratory Results for Groundwater Sample HT-94-11.

RADIOISOTOPES (Method-Lab Specific)							
Constituent	Result	Counting Error (2σ)	Total Error (2σ)	MDA	Units	Yield (%)	Method Number
Am-241	0.277	.260	0.265	0.290	pCi/L	62.5	RD3302
Pu-238	0.450	0.959	1.06	0.255	pCi/L	44.3	RD3209
Pu-239/40	0.0752	0.189	0.189	0.450	pCi/L	44.3	RD3209
U-234	2.27	1.31	1.39	1.27	pCi/L	23.9	RD3234
U-235	0.119	0.353	0.354	0.930	pCi/L	23.9	RD3234
U-238DA	1.70	1.10	1.16	0.869	pCi/L	23.9	RD3234
Co-58	2.64	4.11	4.11	8.63	pCi/L	N/A	RD3219
Co-60	1.74	3.62	3.62	8.04	pCi/L	N/A	RD3219
Cs-137DA	-0.688	4.13	4.13	7.20	pCi/L	N/A	RD3219
Eu-152	-4.24	8.82	8.83	15.1	pCi/L	N/A	RD3219
Eu-154	1.98	12.1	12.1	24.2	pCi/L	N/A	RD3219
Eu-155	0.733	7.34	7.34	12.3	pCi/L	N/A	RD3219
Fe-59	-3.05	6.75	6.75	11.4	pCi/L	N/A	RD3219
Alpha	18.1	6.35	6.68	4.72	pCi/L	100.0	RD3214
Beta	18.3	2.68	2.97	3.51	pCi/L	100.0	RD3214
Strontium	0.197	0.325	0.328	1.04	pCi/L	65.2	ITAS-IT-RS-001
Tc-99	2.69	0.925	3.98	2.05	pCi/L	95.1	RD3205
Tritium	-25.9	101.0	200.0	243.00	pCi/L	97.7	RD4003

MDA = Minimum Detectable Activity

pCi/L = picoCuries per liter.

Table A1-4j. Radionuclide Laboratory Results for Groundwater Sample HT-94-12-Duplicate.

RADIOISOTOPES (Method-Lab Specific)							
Constituent	Result	Counting Error (2σ)	Total Error (2σ)	MDA	Units	Yield (%)	Method Number
Am-241	0.175	0.186	0.188	0.232	pCi/L	78.2	RD3302
Pu-238	0.556	0.103	0.113	0.464	pCi/L	40.5	RD3209
Pu-239/40	0.396	0.412	0.418	0.464	pCi/L	40.5	RD3209
U-234	0.266	0.356	0.359	0.578	pCi/L	40.7	RD3234
U-235	0.156	0.292	0.293	0.607	pCi/L	40.7	RD3234
U-238DA	0.471	0.459	0.465	0.578	pCi/L	40.7	RD3234
Co-58	-5.36	4.96	4.99	7.67	pCi/L	N/A	RD3219
Co-60	1.87	4.61	4.61	9.40	pCi/L	N/A	RD3219
Cs-137DA	2.66	3.70	3.71	7.58	pCi/L	N/A	RD3219
Eu-152	7.17	9.41	9.43	18.4	pCi/L	N/A	RD3219
Eu-154	8.07	10.4	10.5	23.9	pCi/L	N/A	RD3219
Eu-155	4.16	9.13	9.14	16.5	pCi/L	N/A	RD3219
Fe-59	-2.07	11.5	11.5	20.5	pCi/L	N/A	RD3219
Alpha	3.01	1.57	1.62	1.62	pCi/L	100.0	RD3214
Beta	8.30	1.88	1.97	2.84	pCi/L	100.0	RD3214
Strontium	0.234	0.246	0.254	0.752	pCi/L	97.3	ITAS-IT-RS-001
Tc-99	7.98	1.01	4.41	2.05	pCi/L	95.1	RD3205
Tritium	169.0	107.0	210.0	243.0	pCi/L	97.7	RD4003

MDA = Minimum Detectable Activity

pCi/L = picoCuries per liter.

Table A1-5a. Field Results from Well Head and Portable Field Laboratory for Groundwater Samples HT-94-13 and HT-94-14-Split.

Sample Numbers	HT-94-13 HT-94-14 (split)	Depth	275 feet	Date	9-15-94
Location	299-W10-22	Sampling Method		Bladder Pump	
Constituent (units)	Results	Constituent (units)		Results	
Well Head Measurements					
pH	8.35	DO (mg/L)		0.86	
Temperature (°C)	17.4	ORP (mV)		-75.3	
SC (µmhos/cm)	269	---		---	
Portable Field Laboratory Measurements					
Nitrate (ppb)	3,080	Nitrite (ppb)		27.8	
Sulfate (ppp)	15,250	Sulfide (ppb)		ND	
Total Chromium (ppb)	15	Hexavalent Chromium (ppb)		<10	
Total Fe (ppb)	57.5	Ferrous Fe (ppb)		<10	
Chloride (ppb)	7,250	Alkalinity (ppb)		109,000	

DO = Dissolved oxygen
°C = degrees centigrade
mV = millivolts
µmhos/cm = micromhos per centimeter
ppb = parts per billion (or µg/L)
mg/L = milligrams per liter
ORP = Oxidation-reduction potential
SC = Specific Conductance or Conductivity
ND = not detected.

Table A1-5b. ICP and AA Metals Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (2 sheets)

ICP METALS (EPA Method 6010[1] and EPA CLP ICAP Metals[2]) AA METALS (EPA Methods 7060[3], 7421[4], 7470[5], 7740[6], 7841[7])				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Aluminum[1] - Unfiltered	7429-90-5	751	610	200/200
Aluminum[2] - Filtered	7429-90-5	34.5	<57	200/200
Antimony[1] - U	7440-36-0	63.4	<46	100/100
Antimony[2] - F	7440-36-0	30.5	<46	100/60
Arsenic[3] - U	7440-38-2	2.2	4	3.0/10
Arsenic[3] - F	7440-38-2	1.5	<3	3.0/10
Barium[1] - U	7440-39-3	36.5	38	200/200
Barium[2] - F	7440-39-3	29.5	27	200/200
Beryllium[1] - U	7440-41-7	0.33	<1	7.0/5.0
Beryllium[2] - F	7440-41-7	0.30	<1	7.0/5.0
Cadmium[1] - U	7440-43-9	2.2	<4	20.0/5.0
Cadmium[2] - F	7440-43-9	2.2	<4	20.0/5.0
Calcium[1] - U	7440-70-2	24,200	25,000	5000/5000
Calcium[2] - F	7440-70-2	25,600	24,000	5000/5000
Chromium[1] - U	7440-47-3	3.0	8.4	20.0/10.0
Chromium[2] - F	7440-47-3	3.0	<5	2.0/10.0
Cobalt[1] - U	7440-48-4	3.2	<10	20.0/50.0
Cobalt[2] - F	7440-48-4	3.2	<10	2.0/50.0
Copper[1] - U	7440-50-8	19.8	9	20.0/25.0
Copper[2] - F	7440-50-8	11.7	<5	2.0/25.0
Iron[1] - U	7439-89-6	4,300	4,300	100/100
Iron[2] - F	7439-89-6	115	80	100/100
Lead[4] - U	7439-92-1	0.9	2.3	3.0/3.0
Lead[4] - F	7439-92-1	0.9	<2	3.0/3.0
Magnesium[1] - U	7439-95-4	8400	8,400	5000/5000
Magnesium[2] - F	7439-95-4	9360	8,300	5000/5000
Manganese[1] - U	7439-96-5	299	300	10.0/10.0

Table A1-5b. ICP and AA Metals Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (2 sheets)

ICP METALS (EPA Method 6010[1] and EPA CLP ICAP Metals[2]) AA METALS (EPA Methods 7060[3], 7421[4], 7470[5], 7740[6], 7841[7])				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Manganese[2] - F	7439-96-5	258	250	10.0/10.0
Mercury[5] - U	7439-97-6	0.1	<0.2	0.2/0.2
Mercury[5] - F	7439-97-6	0.4	<0.2	0.2/0.2
Nickel[1] - U	7440-02-0	11.4	<12	40.0/40.0
Nickel[2] - F	7440-02-0	11.4	<12	40.0/40.0
Potassium[1] - U	7440-09-7	4350	3,900	5000/5000
Potassium[2] - F	7440-09-7	3500	3,300	1000/5000
Selenium[6] - U	7782-49-2	0.7	<3	3.0/5.0
Selenium[6] - F	7782-49-2	0.7	<3	3.0/5.0
Silver[1] - U	7440-22-4	3.0	<7	200/10.0
Silver[2] - F	7440-22-4	3.0	<7	200/10.0
Sodium[1] - U	7440-23-5	16,000	18,000	1000/5000
Sodium[2] - F	7440-23-5	18,500	16,000	1000/5000
Thallium[7] - U	7440-28-0	1.2	<4	3.0/10.0
Thallium[7] - F	7440-28-0	1.2	<4	3.0/10.0
Vanadium[1] - U	7440-62-2	25.7	<14	20.0/50.0
Vanadium[2] - F	7440-62-2	16.7	<14	20.0/50.0
Zinc[1] - U	7440-66-6	204	220	20.0/20.0
Zinc[2] - F	7440-66-6	5.5	<10	20.0/20.0

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL1 = detection limit, first sample
DL2 = detection limit, second sample-split.

Table A1-5c. Anion Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split.

ANIONS (EPA Method 300.0[1] and Method 9030[2])				
Constituent	CAS Number	HT-94-13 Result (μg/L)	HT-94-14 Result (μg/L)	DL1/DL2 (μg/L)
Chloride[1]	16887-00-6	4,000	3,900	250/20
Fluoride[1]	16984-48-8	570	530	100/50
Nitrate[1]	14797-55-8	2,200	2,100	200/20
Nitrite[1]	7632-00-0	28	26	20/10
o-Phosphate[1]	7778-77-0	<1,000	<20	1,000/100
Sulfate[1]	14808-79-8	16,600	16,000	1,000/100
Sulfide[2]	18496-25-8	670	<1000	200/3000

CAS = Chemical Abstract Services
μg/L = micrograms per liter or ppb
DL1 = detection limit, first sample
DL2 = detection limit, second sample-split.

Table A1-5d. Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (3 sheets)

VOLATILES (Method EPA 8240)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Dichlorodifluoromethane	75-71-8	<5	<5	5/5
Chloromethane	74-87-3	<10	<10	10/10
Bromomethane	74-83-9	<10	<10	10/10
Vinyl Chloride	75-01-4	<10	<10	10/10
Chloroethane	75-00-3	<10	<10	10/10
Acrolein	107-02-8	<100	<50	100/50
Methylene Chloride	75-09-2	<5	<5	5/5
Acetone	67-64-1	<100	<100	100/100
Trichlorofluoromethane	75-69-4	<5	<5	5/5
Allyl Chloride	107-95-1	<5	<20	5/20
Carbon Disulfide	75-15-0	<5	<5	5/5
trans-1,2-Dichloroethene	156-60-5	<5	<5	5/5
1,1-Dichloroethene	75-35-4	<5	<5	5/5
Acetonitrile	75-05-8	<100	<10	100/10
Acrylonitrile	107-13-1	<100	<15	100/15
Propionitrile	107-12-0	<100	<5	100/5
1,1-Dichloroethane	75-34-3	<5	<5	5/5
Iodomethane	74-88-4	<5	<5	5/5
Chloroform	67-66-3	17	13	5/5
1,2-Dichloroethane	107-06-2	<5	<5	5/5
2-Chloro-1,3-butadiene	126-99-8	<5	<10	5/10
Methacrylonitrile	126-98-7	<100	<20	100/20
2-Butanone	78-93-3	<100	<50	100/50
Isobutyl Alcohol	78-83-1	<500	<250	500/250
1,1,1-Trichloroethane	71-55-6	<5	<5	5/5
Carbon Tetrachloride	56-23-5	25	21	5/5
Vinyl Acetate	108-05-4	<50	<10	50/10
Bromodichloromethane	75-27-4	<5	<5	5/5

Table A1-5d. Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (3 sheets)

VOLATILES (Method EPA 8240)				
Constituent	CAS Number	HT-94-13 Result (μg/L)	HT-94-14 Result (μg/L)	DL1/DL2 (μg/L)
1,2-Dichloropropane	78-87-5	<5	<5	5/5
cis-1,3-Dichloropropene	10061-01-5	<5	<5	5/5
Methyl methacrylate	80-62-6	<5	<20	5/20
Trichloroethene	79-01-6	<5	<5	5/5
Ethyl methacrylate	97-63-2	<5	<20	5/20
1,1,2-Trichloroethane	79-00-5	<5	<5	5/5
Benzene	71-43-2	<5	<5	5/5
Dibromomethane	74-95-3	<5	<5	5/5
trans-1,3-Dichloropropene	10061-02-6	<5	<5	5/5
Bromoform	75-25-2	<5	<5	5/5
1,2-Dibromomethane	106-93-4	<5	<5	5/5
1,4-Dioxane	23-91-1	<500	<150	500/150
4-Methyl-2-Pentanone	108-10-1	<50	<50	50/50
2-Hexanone	591-78-6	<50	<50	50/50
Tetrachloroethene	127-18-4	<5	<5	5/5
1,1,2,2-Tetrachloroethane	79-34-5	<5	<5	5/5
Dibromochloromethane	124-48-1	<5	<5	5/5
Toluene	108-88-3	<5	<5	5/5
Chlorobenzene	108-90-7	<5	<5	5/5
Ethyl benzene	100-41-4	<5	<5	5/5
Styrene	100-42-5	<5	<5	5/5
trans-1,4-Dichloro-2-butene	764-41-0	<100	<5	100/5
Xylenes (total)	1330-20-7	<5	<5	5/5
Pentachloroethane	76-01-7	<5	<20	10/20
1,2,3-Trichloropropane	96-18-4	<5	<5	5/5
1,2-Dibromo-3-chloropropane	96-12-8A	<100	<5	100/5

Table A1-5d. Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (3 sheets)

VOLATILES (Method EPA 8240)				
Constituent	CAS Number	HT-94-13 Result (μg/L)	HT-94-14 Result (μg/L)	DL1/DL2 (μg/L)
1,1,1,2-Tetrachloroethane	630-20-6	---	<5	---/5

CAS = Chemical Abstract Services
μg/L = micrograms per liter (or ppb)
DL1 = detection limit, first sample
DL2 = detection limit, second sample-split.

Table A1-5e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
n-Nitrosodimethylamine	62-75-9	<10	<20	10/2
Pyridine	110-86-1	<10	<50	10/5
Phenol	108-95-2	<10	<20	10/2
Aniline	62-53-3	<10	<30	10/3
bis(2-Chloroethyl) Ether	111-44-4	<10	<20	10/2
2-Chlorophenol	95-57-8	<10	<40	10/4
1,3-Dichlorobenzene	541-73-1	<10	<5	10/
1,4-Dichlorobenzene	106-46-7	<10	<5	10/
Benzyl Alcohol	100-51-6	<20	<25	20/2
1,2-Dichlorobenzene	95-50-1	<10	<5	10/
2-Methylphenol	95-48-7	<10	<30	10/3
bis(2-Chloroisopropyl) Ether	108-60-1	<10	<20	10/2
4-Methylphenol	65794-96-9	<10	<100	10/10
n-Nitroso-di-n-propylamine	621-64-7	<10	<30	10/3
Hexachloroethane	67-72-1	<10	<20	10/2
Nitrobenzene	98-95-3	<10	<20	10/2
Isophorone	78-59-1	<10	<20	10/2
2-Nitrophenol	88-75-5	<10	<30	10/3
2,4-Dimethylphenol	105-67-9	<10	<30	10/3
bis(2-Chloroethoxy)Methane	111-91-1	<10	<30	10/3
2,4-Dichlorophenol	120-83-2	<10	<30	10/3
1,2,4-Trichlorobenzene	120-82-1	<10	<5	10/
Naphthalene	91-20-3	<10	<10	10/1
4-Chloroaniline	106-47-8	<20	<30	20/3
Hexachlorobutadiene	87-68-3	<10	<10	10/1
4-Chloro-3-Methylphenol	59-50-7	<20	<30	20/3
2-Methylnaphthalene	91-57-6	<10	<20	10/2
Hexachlorocyclopentadiene	77-47-4	<10	<10	10/1

Table A1-5e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
2,4,6-Trichlorophenol	88-06-2	<10	<30	10/3
2,4,5-Trichlorophenol	95-95-4	<10	<40	10/4
2-Chloronaphthalene	91-58-7	<10	<10	10/1
2-Nitroaniline	88-74-4	<50	<50	50/5
Dimethyl Phthlate	131-11-3	<10	<20	10/2
Acenaphthylene	208-96-8	<10	<10	10/1
2,6-Dinitrotoluene	606-20-2	<10	<10	10/1
3-Nitroaniline	99-09-2	<50	<50	50/5
Acenaphthene	83-32-9	<10	<10	10/1
2,4-Dinitrophenol	51-28-5	<50	<50	50/5
4-Nitrophenol	100-02-7	<50	<50	50/5
Dibenzofuran	132-64-9	<10	<10	10/1
2,4-Dinitrotoluene	121-14-2	<10	<10	10/1
Diethylphthlate	84-66-2	<10	<10	10/1
4-Chlorophenyl Phenyl Ether	7005-72-3	<10	<10	10/1
Fluorene	86-73-7	<10	<10	10/1
4-Nitroaniline	100-01-6	<20	<50	20/5
4,6-Dinitro-2-Methylphenol	534-52-1	<50	<50	50/5
n-Nitrosodiphenylamine	86-30-6	<10	---	10/-
4-Bromophenyl Phenyl Ether	101-55-3	<10	---	10/-
Hexachlorobenzene	118-74-1	<10	<10	10/1
Pentachlorophenol	87-86-5	<50	<50	50/5
Phenanthrene	85-01-8	<10	<10	10/1
Anthracene	120-12-7	<10	<10	10/1
di-N-Butylphthlate	84-74-2	<10	[b,j]4.8	10/1
Fluoranthene	206-44-0	<10	<10	10/1
Pyrene	129-00-0	<10	<10	10/1

Table A1-5e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-13 Result (μg/L)	HT-94-14 Result (μg/L)	DL1/DL2 (μg/L)
Butyl Benzyl Phthlate	85-68-7	<10	<10	10/1
3,3-Dichlorobenzidine	91-94-1	<20	<40	20/4
Benzo(a)Anthracene	56-55-3	<10	<10	10/1
Chrysene	218-01-9	<10	<10	10/1
bis(2-Ethylhexyl)Phthlate	117-81-7	<10	<30	10/3
di-N-Octyl Phthlate	117-84-0	<10	<10	10/1
Benzo(b)Fluoranthene	205-99-2	<10	<10	10/1
Benzo(k)Fluoranthene	207-08-9	<10	<10	10/1
Benzo(a)Pyrene	50-32-8	<10	<10	10/1
Indeno(1,2,3-CD)Pyrene	193-39-5	<10	<10	10/1
Dibenzo(a,h)Anthracene	53-70-3	<10	<10	10/1
Benzo(g,h,i)Perylene	191-24-2	<10	<10	10/1
Acetophenone	10383-88-7	<10	<15	10/1
2-Acetylaminofluorene	53-96-3	<20	<20	20/2
4-Aminobiphenyl	92-67-1	<20	<50	20/5
Aramite I	140-57-8A	<20	<30	20/3
Aramite II	140-57-8B	<20	<30	20/3
Chlorobenzilate	510-15-6	<10	<20	10/2
Diallate I	2303-16-4A	<20	<20	20/2
Diallate II	2303-16-4B	<20	<20	20/2
2,6-Dichlorophenol	87-65-0	<10	<30	10/3
Dimethoate	60-51-5	<20	<10	20/1
p-Dimethylaminoazobenzene	60-11-7	<10	---	10/-
7,12-Dimethylbenz(a)Anthracene	57-97-6	<10	<10	10/1
3,3-Dimethylbenzidine	119-93-7	<10	<160	10/16
a,a-Dimethylphenethylalamine	122-09-8	<10	<30	10/3
1,3-Dinitrobenzene	99-65-0	<20	<10	20/1
Dinoseb	88-85-7	<20	<30	20/3

Table A1-5e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Disulfoton	298-04-4	<10	<20	10/2
Ethyl Methanesulfonate	62-50-0	<20	<20	20/2
Famphur	52-85-7	<50	<20	50/2
Hexachloropropene	1888-71-7	<10	<10	10/1
Isodrin	465-73-6	<20	---	20/-
Isosafrole	120-58-1	<10	<10	10/1
D-Kepone	143-50-0	<50	---	50/-
Methapyrilene	91-80-5	<100	<100	100/10
3-Methylcholanthrene	56-49-5	<10	<10	10/1
Methyl Methanesulfonate	66-27-3	<10	<20	10/2
Methyl Parathion	298-00-0	<10	<20	10/2
1,4-Naphthoquinone	130-15-4	<10	<20	10/2
1-Naphthylamine	134-32-7	<10	<50	10/5
2-Naphthylamine	91-59-8	<10	<50	10/5
5-Nitro-o-toluidine	99-55-8	<10	<30	10/3
4-Nitroquinoline-1-oxide	56-57-5	<40	<20	40/2
n-Nitroso-di-n-butylamine	924-16-3	<10	<20	10/2
n-Nitrosodiethylamine	55-18-5	<20	<30	20/3
n-Nitrosopiperdine	100-75-4	<20	<20	20/2
n-Nitrosopyrrolidine	930-55-2	<40	<40	40/4
Parathion	56-38-2	<10	<20	10/2
Pentachlorobenzene	608-93-5	<10	<10	10/1
Pentachloroethane	76-01-7	---	---	10/-
Pentachloronitrobenzene	82-68-8	<20	<10	20/1
Phenacetin	62-44-2	<20	<30	20/3
1,4-Phenylenediamine	106-50-3	<100	<160	100/16
n-Nitrosomethylethylamine	10595-95-6	<10	<30	10/3
n-Nitrosomorpholine	59-89-2	<10	<40	10/4

Table A1-5e. Semi-Volatile Organic Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (5 sheets)

SEMI-VOLATILES (Method EPA 8270)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Pronamide	23950-58-5	<20	<20	20/2
Safrole	94-59-7	<10	<10	10/1
1,2,4,5-Tetrachlorobenzene	95-94-3	<10	<10	10/1
2,3,4,6-Tetrachlorophenol	58-90-2	<10	<30	10/3
Sulfotepp	3689-24-5	<40	---	40/-
Thioazin	297-97-2	<20	<20	20/2
o-Toluidine	95-53-4	<10	<30	10/3
1,3,5-Trinitrobenzene	99-35-4	<50	<10	50/1
o,o,o-triethyl Phosphorothioat	126-68-1	<20	<30	20/3
Phorate	298-02-2	<10	<20	10/2
2-Picoline	109-06-8	<10	<30	10/3
Hexachlorophene	70-30-4	<100	<160	100/16
Phthalic Anhydride	85-44-9	---	<1000	---/100
Diphenylamine	122-39-4	---	<30	---/3

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL1 = detection limit, first sample
DL2 = detection limit, second sample-split.
[b] result is from blank contamination.
[j] value is estimated, because it is below a detection limit

Table A1-5f. Herbicide Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split.

HERBICIDES (Method SW 8150)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Dalapon	75-99-0	<58	<2.0	58/2.0
Dicamba	1918-00-9	<2.7	<0.81	2.7/0.81
MCPA	94-74-6	<2500	<750	2500/750
MCPP	93-65-2	<1900	<570	1900/570
2,2-Dichloropropionic acid	120-36-5	<6.5	<2.0	6.5/2.0
2,4-D	94-75-7	<12	<3.6	12/3.6
2,4,5-TP (Silvex)	93-72-1	<1.7	<0.51	1.7/0.51
2,4,5-T	93-76-5	<2.0	<0.60	2.0/0.60
Dinoseb	88-85-7	<0.7	<0.80	0.7/0.80
2,4-DB	94-82-6	<9.1	<3.6	9.1/3.6

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
DL1 = detection limit, first sample
DL2 = detection limit, second sample-split.

Table A1-5g. Organophosphate Pesticide Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split.

ORGANOPHOSPHATE PESTICIDES (Method EPA 8140)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Demeton #1	298-03-3A	<1.2	---	1.2/--
Demeton #2	298-03-3B	<1.2	---	1.2/--
Diazinon	333-41-5	<2.0	<6.0	2.0/6.0
Disulfoton	298-04-4	<0.7	<2.0	0.7/
Methyl Parathion	298-00-0	<1.2	<3.0	1.2/
Malathion	121-75-5	<1.1	---	1.1/--
Parathion	56-38-2	<0.6	---	0.6/--
Ethion	563-12-2	<0.6	---	0.6/--
Azinphos-methyl	86-50-0	<1.0	<15	1.0/15
Dichlorvos	?	---	<3.0	--/3.0
Ronnel	?	---	<3.0	--/3.0
Fenthion	?	---	<3.0	--/3.0
Trichloronate	?	---	<2.0	--/2.0
Tokuthion	?	---	<5.0	--/5.0
Fensulfothion	?	---	<15	--/15
Mevinphos	?	---	<3.0	--/3.0
Coumaphos	?	---	<5.0	--/5.0
Naled	?	---	<3.0	--/3.0
Phorate	?	---	<2.0	--/2.0
Merphos	?	---	<3.0	--/3.0
Chlorpyrifos	?	---	<3.0	--/3.0
Bolstar	?	---	<3.0	--/3.0
Demeton-O	?	---	<3.0	--/3.0
Stirophos	?	---	<50	--/50

CAS = Chemical Abstract Services
? = unknown CAS Number
DL2 = detection limit, second sample-split
µg/L = micrograms per liter (or ppb)
DL1 = detection limit, first sample.

Table A1-5h. Pesticide and Polychlorinated biphenyls (PCBs) Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (2 sheets)

PESTICIDES and PCBs (EPA Method 8080)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
alpha-BHC	319-84-6	<0.03	<0.05	0.03/0.0
beta-BHC	319-85-7	<0.06	<0.05	0.06/0.0
delta-BHC	319-86-8	<0.09	<0.05	0.09/0.0
gamma-BHC (Lindane)	58-89-9	<0.04	<0.05	0.04/0.0
Heptachlor	76-44-8	<0.03	<0.05	0.03/0.0
Aldrin	309-00-2	<0.04	<0.05	0.04/0.0
Heptachlor Epoxide	1024-57-3	<0.83	<0.05	0.83/0.0
Endosulfan I	959-98-8	<0.14	<0.05	0.14/0.0
Dieldrin	60-57-1	<0.02	<0.1	0.02/0.
4,4-DDE	72-55-9	<0.04	<0.1	0.04/0.
Endrin	72-43-5	<0.06	<0.1	0.06/0.
Endosulfan II	33213-65-9	<0.04	<0.1	0.04/0.
4,4-DDD	72-54-8	<0.11	<0.1	0.11/0.
Endosulfan Sulfate	1031-07-8	<0.66	<0.1	0.66/0.
4,4-DDT	50-29-3	<0.12	<0.1	0.12/0.
Methoxychlor	72-43-5	<1.8	<0.5	1.8/0.
Endrin Aldehyde	7421-93-4	<0.23	<0.1	0.23/0.
Chlordane	57-74-9	<0.14	<1.0	0.14/1.
A-Chlordane	?	---	<0.05	--/0.0
G-Chlordane	?	---	<0.05	--/0.0
Toxaphene	8001-35-2	<2.4	<5.0	2.4/5.
Arochlor-1016	12674-11-2	<0.65	<1.0	0.65/1.6
Arochlor-1221	11104-28-2	<1.0	<2.0	1.0/2.
Arochlor-1232	11141-16-5	<1.0	<1.0	1.0/1.
Arochlor-1242	53469-21-9	<0.65	<1.0	0.65/1.
Arochlor-1248	12672-29-6	<1.0	<1.0	1.0/1.
Arochlor-1254	11097-69-1	<1.0	<1.0	1.0/1.

Table A1-5h. Pesticide and Polychlorinated biphenyls (PCBs) Laboratory Results for Groundwater Samples HT-94-13 and HT-94-14-Split. (2 sheets)

PESTICIDES and PCBs (EPA Method 8080)				
Constituent	CAS Number	HT-94-13 Result (µg/L)	HT-94-14 Result (µg/L)	DL1/DL2 (µg/L)
Arochlor-1260	11096-82-5	<1.0	<1.0	1.0/1.

CAS = Chemical Abstract Services
µg/L = micrograms per liter (or ppb)
? = unknown CAS Number
DL1 = detection limit, first sample
DL2 = detection limit, second sample-split.

Table A1-5i. Radionuclide Laboratory Results for Groundwater Samples HT-94-13.

RADIOISOTOPES (Method-Lab Specific)							
Constituent	Result	Counting Error (2σ)	Total Error (2σ)	MDA	Units	Yield (%)	Method Number
Am-241	0.110	0.156	0.157	0.149	pCi/L	66.1	RD3302
Pu-238	0.00	0.00	0.146	0.132	pCi/L	85.7	RD3209
Pu-239/40	-0.0389	0.0389	0.0394	0.334	pCi/L	85.7	RD3209
U-234	0.567	0.524	0.540	0.535	pCi/L	35.6	RD3234
U-235	0.108	0.235	0.236	0.471	pCi/L	35.6	RD3234
U-238DA	0.576	0.524	0.540	0.471	pCi/L	35.6	RD3234
Co-58	0.00	5.03	5.03	9.29	pCi/L	N/A	RD3219
Co-60	5.96	5.44	5.47	11.9	pCi/L	N/A	RD3219
Cs-137DA	2.92	4.08	4.09	8.28	pCi/L	N/A	RD3219
Eu-152	4.18	10.5	10.5	19.6	pCi/L	N/A	RD3219
Eu-154	-3.69	15.3	15.3	26.0	pCi/L	N/A	RD3219
Eu-155	-0.731	8.49	8.49	14.9	pCi/L	N/A	RD3219
Fe-59	-0.487	9.24	9.24	17.5	pCi/L	N/A	RD3219
Alpha	0.337	0.728	0.729	1.68	pCi/L	100.0	RD3214
Beta	6.00	1.72	1.78	2.82	pCi/L	100.0	RD3214
Strontium	0.0844	0.229	0.230	0.784	pCi/L	98.7	ITAS-IT-RS-001
Tc-99	3.52	1.45	6.28	2.91	pCi/L	95.1	RD3205
Tritium	1800.0	153.0	305.0	242.0	pCi/L	97.7	RD4003

MDA = Minimum Detectable Activity

pCi/L = picoCuries per liter.

Table A1-5j. Radionuclide Laboratory Results for Groundwater Sample HT-94-14-Split.

RADIOISOTOPES (Method-Lab Specific)				
Constituent	Result	Error	MDA	Report Units
Am-241	0.08	0.21	0.38	pCi/L
Pu-238	-0.04	0.18	0.29	pCi/L
Pu-239/40	0.00	0.15	0.25	pCi/L
U-233/4	1.51	0.63	0.33	pCi/L
U-235	0.18	0.21	0.22	pCi/L
U-238	0.31	0.30	0.29	pCi/L
Co-58	5.1	4.1	5.0	pCi/L
Co-60	3.5	4.9	10.0	pCi/L
Cs-137	-0.8	7.0	11.0	pCi/L
Eu-152	-2.0	13.0	51.0	pCi/L
Eu-154	6.0	20.0	40.0	pCi/L
Eu-155	-9.6	8.4	22.0	pCi/L
Fe-59	-5.3	8.0	21.0	pCi/L
Alpha	0.4	1.1	2.0	pCi/L
Beta	5.2	1.6	2.2	pCi/L
Strontium	5.94	0.97	0.81	pCi/L
Tc-99	1.3	3.4	6.0	pCi/L
Tritium	1800.0	320.0	260.0	pCi/L
Ac-228 (Ra-228)	-1.0	26.0	46.0	pCi/L
Pb-212	7.0	12.0	18.0	pCi/L
Pb-214 (Ra-226)	48.0	16.0	22.0	pCi/L
Ra-226 (Gamma)	0.00	130.0	200.0	pCi/L
U-235 (Gamma)	-12.0	33.0	53.0	pCi/L

MDA = Minimum Detectable Activity
pCi/L = picoCuries per liter.

APPENDIX A-2

GROUNDWATER DATA FOR SELECTED UPGRADIENT WELLS (NEAR THE 216-T-4-2 DITCH LOCATION)

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This appendix contains a Paradox[1] database print out of groundwater monitoring data for selected upgradient and downgradient wells. Analytical results for four upgradient monitoring wells and two downgradient monitoring well near the 216-T-4-2 Ditch location are listed by well number, constituent name, and sampling date on pages A2-2 through A2-xx. Results are reported in the Hanford Environmental Information System (HEIS) database, which was queried for results in February of 1995. The time period covered by these results goes from January of 1980 through February of 1995.

Data Qualifiers. Qualifiers concerning the data are indicated with a letter code in the seventh column and are defined as follows:

B - Blank assoiated with analyte is elevated in concentration

D - Sample was diluted before analysis

E - Concentration is out of instrument calibration range

J - Concentration is estimated

U - Analyte concentration is below contract required quantification limit

H - Laboratory holding time exceeded

R - Suspect data; currently under review

Q - Result associated with suspect quality control data

P - Potential problem.

It should also be noted that not all of the data in the table were reviewed at the time this report was prepared. Thus, some unflagged "suspect" data may exist in the table.

Significant Figures. No more than three significant figures are justified; any additional places are database format related.

Reference Levels. A summary of reference levels for constituents at the end of this appendix. Monitoring results listed on pages A2-2 through A2-115 can be compared with either:

- the average natural background concentrations or the provisional threshold values (Johnson 1993), Table A2-7, pages A2-116 to A2-118.
- the 95% Upper Confidence Interval/Bowen's Background Numbers (references on table), Table A2-8, page A2-119.
- the Maximum Contamination Levels (WHC 1988) and the 1/25 Derived Concentration Guideline (40 CFR 141), Table A2-9, pages A2-120 to A2-123.

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[1]Paradox is a trademark of the Borland Company.

Table A2-1. Downgradient Well 299-W6-1. (8 sheets)

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Alkalinity	6/10/87	114000	ppb		
299-W6-1	Aluminum	8/19/92	52			N
299-W6-1	Aluminum, filtered	8/19/92	49		Y	N
299-W6-1	Ammonium ion	6/10/87	165	ppb		
299-W6-1	Antimony	8/19/92	60			
299-W6-1	Antimony, filtered	8/19/92	60		Y	
299-W6-1	Arsenic	8/19/92	2			
299-W6-1	Arsenic, filtered	8/19/92	2		Y	
299-W6-1	Barium	8/19/92	69			
299-W6-1	Barium, filtered	6/10/87	46	ppb	Y	
299-W6-1	Barium, filtered	8/19/92	68		Y	
299-W6-1	Benzene	12/28/93	0	ppb		BL
299-W6-1	Beryllium	8/19/92	1			
299-W6-1	Beryllium, filtered	8/19/92	1		Y	
299-W6-1	Cadmium	8/19/92	7			
299-W6-1	Cadmium, filtered	8/19/92	7		Y	
299-W6-1	Calcium	8/19/92	86600			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Calcium, filtered	6/10/87	66700	ppb	Y	
299-W6-1	Calcium, filtered	8/19/92	88400		Y	
299-W6-1	Carbon tetrachloride	6/10/87	220	ppb		
299-W6-1	Carbon tetrachloride	12/28/93	550	ppb		D
299-W6-1	Cesium-137	4/27/81	24	pCi/L		
299-W6-1	Chloride	6/10/87	8750	ppb		
299-W6-1	Chloride	12/28/93	13000	ppb		D
299-W6-1	Chloroform	12/28/93	6	ppb		
299-W6-1	Chromium	8/19/92	112			
299-W6-1	Chromium, filtered	6/10/87	46	ppb	Y	
299-W6-1	Chromium, filtered	8/19/92	104		Y	
299-W6-1	Cobalt	8/19/92	9			
299-W6-1	Cobalt, filtered	8/19/92	9		Y	
299-W6-1	Cobalt-60	10/15/80	21	pCi/L		
299-W6-1	Cobalt-60	4/27/81	37	pCi/L		
299-W6-1	Cobalt-60	10/15/81	32	pCi/L		
299-W6-1	Cobalt-60	1/28/82	19	pCi/L		
299-W6-1	Cobalt-60	10/18/83	5	pCi/L		
299-W6-1	Cobalt-60	1/30/84	16	pCi/L		
299-W6-1	Cobalt-60	4/27/84	2	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Cobalt-60	1/18/85	5	pCi/L		
299-W6-1	Cobalt-60	4/22/85	4	pCi/L		
299-W6-1	Cobalt-60	9/07/85	8	pCi/L		
299-W6-1	Copper	8/19/92	8			
299-W6-1	Copper, filtered	8/19/92	8		Y	
299-W6-1	Cyanide	8/19/92				
299-W6-1	Cyanide	8/19/92	2000			
299-W6-1	Dissolved Oxygen	6/10/87	8	??		
299-W6-1	Dissolved Oxygen	6/10/87	9	??		
299-W6-1	Dissolved Oxygen	6/10/87	10	??		
299-W6-1	Dissolved Oxygen	6/10/87	10	??		
299-W6-1	Fluoride	12/28/93	800	ppb		
299-W6-1	Gross beta	2/07/80	75	pCi/L		
299-W6-1	Gross beta	4/30/80	75	pCi/L		
299-W6-1	Gross beta	7/22/80	75	pCi/L		
299-W6-1	Gross beta	10/15/80	75	pCi/L		
299-W6-1	Gross beta	2/05/81	75	pCi/L		
299-W6-1	Gross beta	4/27/81	75	pCi/L		
299-W6-1	Gross beta	8/19/81	75	pCi/L		
299-W6-1	Gross beta	10/15/81	75	pCi/L		
299-W6-1	Gross beta	6/10/87	20	pCi/L		
299-W6-1	Gross beta	12/28/93	34	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Iron	8/19/92	520			
299-W6-1	Iron, filtered	8/19/92	27		Y	
299-W6-1	Lead	8/19/92	2			W
299-W6-1	Lead, filtered	8/19/92	2		Y	
299-W6-1	Magnesium	8/19/92	30500			
299-W6-1	Magnesium, filtered	6/10/87	24400	ppb	Y	
299-W6-1	Magnesium, filtered	8/19/92	31200		Y	
299-W6-1	Manganese	8/19/92	24			
299-W6-1	Manganese, filtered	6/10/87	14	ppb	Y	
299-W6-1	Manganese, filtered	8/19/92	4		Y	
299-W6-1	Mercury	8/19/92	0			
299-W6-1	Mercury, filtered	8/19/92	0		Y	
299-W6-1	Nickel	8/19/92	20			
299-W6-1	Nickel, filtered	8/19/92	20		Y	
299-W6-1	Nitrate	2/07/80	170	ppm		
299-W6-1	Nitrate	4/30/80	160	ppm		
299-W6-1	Nitrate	7/22/80	150	ppm		
299-W6-1	Nitrate	10/15/80	150	ppm		
299-W6-1	Nitrate	2/05/81	120	ppm		
299-W6-1	Nitrate	4/27/81	140	ppm		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Nitrate	8/19/81	130	ppm		
299-W6-1	Nitrate	10/15/81	110	ppm		
299-W6-1	Nitrate	1/28/82	130	ppm		
299-W6-1	Nitrate	4/22/82	87	ppm		
299-W6-1	Nitrate	7/26/82	230	ppm		
299-W6-1	Nitrate	10/12/82	130	ppm		
299-W6-1	Nitrate	1/04/83	120	ppm		
299-W6-1	Nitrate	1/26/83	120	ppm		
299-W6-1	Nitrate	4/25/83	130	ppm		
299-W6-1	Nitrate	10/18/83	110	ppm		
299-W6-1	Nitrate	1/30/84	150	ppm		
299-W6-1	Nitrate	4/27/84	180	ppm		
299-W6-1	Nitrate	7/09/84	190	ppm		
299-W6-1	Nitrate	10/25/84	150	ppm		
299-W6-1	Nitrate	1/18/85	200	ppm		
299-W6-1	Nitrate	4/22/85	180	ppm		
299-W6-1	Nitrate	9/07/85	3200	ppm		
299-W6-1	Nitrate	3/26/86	240	ppm		
299-W6-1	Nitrate	11/06/86	187000	ppb		
299-W6-1	Nitrate	1/20/87	198000	ppb		
299-W6-1	Nitrate	6/10/87	205000	ppb		
299-W6-1	Nitrate	8/18/87	223000	ppb		
299-W6-1	Nitrate	2/25/88	224000	ppb		
299-W6-1	Nitrate	9/26/88	226000	ppb		
299-W6-1	Nitrate	12/28/93	250000	ppb		D
299-W6-1	Potassium	8/19/92	5430			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Potassium, filtered	6/10/87	4900	ppb	Y	
299-W6-1	Potassium, filtered	8/19/92	5170		Y	
299-W6-1	Ruthenium-106	1/20/87	60	pCi/L		
299-W6-1	Selenium	8/19/92	2			S
299-W6-1	Selenium, filtered	8/19/92	2		Y	W
299-W6-1	Silver	8/19/92	10			
299-W6-1	Silver, filtered	8/19/92	10		Y	
299-W6-1	Sodium	8/19/92	14800			
299-W6-1	Sodium, filtered	6/10/87	13200	ppb	Y	
299-W6-1	Sodium, filtered	8/19/92	15100		Y	
299-W6-1	Specific conductance	6/10/87	752	umhos		
299-W6-1	Specific conductance	6/10/87	754	umhos		
299-W6-1	Specific conductance	6/10/87	755	umhos		
299-W6-1	Specific conductance	6/10/87	756	umhos		
299-W6-1	Specific conductance	12/28/93	800	umhos		
299-W6-1	Sulfate	6/10/87	33100	ppb		
299-W6-1	Sulfate	12/28/93	41000	ppb		D
299-W6-1	Tetrachloroethene	12/28/93	0	ppb		L
299-W6-1	Thallium	8/19/92	2			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Thallium, filtered	8/19/92	2		Y	W
299-W6-1	Toluene	12/28/93	0	ppb		BL
299-W6-1	Total Organic Haloge	6/10/87	165	ppb		
299-W6-1	Trichloroethene	12/28/93	9	ppb		X
299-W6-1	Tritium	2/07/80	44000	pCi/L		
299-W6-1	Tritium	4/30/80	37000	pCi/L		
299-W6-1	Tritium	7/22/80	37000	pCi/L		
299-W6-1	Tritium	10/15/80	39000	pCi/L		
299-W6-1	Tritium	2/05/81	37000	pCi/L		
299-W6-1	Tritium	4/27/81	37000	pCi/L		
299-W6-1	Tritium	8/19/81	37000	pCi/L		
299-W6-1	Tritium	10/15/81	37000	pCi/L		
299-W6-1	Tritium	1/28/82	37000	pCi/L		
299-W6-1	Tritium	4/22/82	37000	pCi/L		
299-W6-1	Tritium	7/26/82	36000	pCi/L		
299-W6-1	Tritium	10/12/82	37000	pCi/L		
299-W6-1	Tritium	1/04/83	38000	pCi/L		
299-W6-1	Tritium	1/26/83	38000	pCi/L		
299-W6-1	Tritium	4/25/83	37000	pCi/L		
299-W6-1	Tritium	7/13/83	37000	pCi/L		
299-W6-1	Tritium	10/18/83	38000	pCi/L		
299-W6-1	Tritium	1/30/84	39000	pCi/L		
299-W6-1	Tritium	4/27/84	41000	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-1	Tritium	7/09/84	36000	pCi/L		
299-W6-1	Tritium	10/25/84	39000	pCi/L		
299-W6-1	Tritium	1/18/85	25000	pCi/L		
299-W6-1	Tritium	4/22/85	42000	pCi/L		
299-W6-1	Tritium	9/07/85	43000	pCi/L		
299-W6-1	Tritium	3/26/86	44000	pCi/L		
299-W6-1	Tritium	11/06/86	45900	pCi/L		
299-W6-1	Tritium	1/20/87	43200	pCi/L		
299-W6-1	Tritium	6/10/87	52300	pCi/L		
299-W6-1	Tritium	8/18/87	51800	pCi/L		
299-W6-1	Tritium	2/25/88	59600	pCi/L		
299-W6-1	Tritium	9/26/88	59700	pCi/L		
299-W6-1	Tritium	12/28/93	55100	pCi/L		
299-W6-1	Vanadium	8/19/92	51			
299-W6-1	Vanadium, filtered	6/10/87	17	ppb	Y	
299-W6-1	Vanadium, filtered	8/19/92	53		Y	
299-W6-1	Zinc	8/19/92	12			
299-W6-1	Zinc, filtered	6/10/87	6	ppb	Y	
299-W6-1	Zinc, filtered	8/19/92	7		Y	
299-W6-1	pH	6/10/87	8			
299-W6-1	pH	6/10/87	8			
299-W6-1	pH	6/10/87	8			

Table A2-2. Downgradient Well 299-W6-2. (37 sheets)

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Alkalinity	4/03/90	113000	ppb		
299-W6-2	Aluminum	5/18/93	220	ppb		
299-W6-2	Aluminum	8/13/93	84	ppb		L
299-W6-2	Aluminum	12/07/93	80	ppb		L
299-W6-2	Aluminum	8/19/94	970	ppb		
299-W6-2	Aluminum, filtered	5/18/93	140	ppb	Y	L
299-W6-2	Aluminum, filtered	8/19/94	26	ppb	Y	L
299-W6-2	Ammonium ion	8/07/92	100	ppb		
299-W6-2	Arsenic	5/18/93	2	ppb		L
299-W6-2	Arsenic	8/13/93	4	ppb		L
299-W6-2	Arsenic	12/07/93	2	ppb		L
299-W6-2	Arsenic, filtered	5/18/93	2	ppb	Y	L
299-W6-2	Arsenic, filtered	8/13/93	4	ppb	Y	L
299-W6-2	Arsenic, filtered	12/07/93	2	ppb	Y	L
299-W6-2	Arsenic, filtered	2/07/94	2	ppb	Y	L
299-W6-2	Barium	10/07/88	42	ppb		
299-W6-2	Barium	1/04/89	35	ppb		
299-W6-2	Barium	5/09/89	43	ppb		
299-W6-2	Barium	7/21/89	36	ppb		
299-W6-2	Barium	7/21/89	39	ppb		
299-W6-2	Barium	9/07/89	41	ppb		
299-W6-2	Barium	1/12/90	36	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Barium	8/12/91	39	ppb		
299-W6-2	Barium	11/13/91	35	ppb		
299-W6-2	Barium	2/27/92	39	ppb		
299-W6-2	Barium	2/27/92	40	ppb		
299-W6-2	Barium	5/21/92	34	ppb		
299-W6-2	Barium	8/07/92	38	ppb		
299-W6-2	Barium	12/08/92	40	ppb		
299-W6-2	Barium	2/05/93	40	ppb		
299-W6-2	Barium	5/18/93	40	ppb		
299-W6-2	Barium	8/13/93	38	ppb		
299-W6-2	Barium	12/07/93	39	ppb		B
299-W6-2	Barium	2/07/94	38	ppb		
299-W6-2	Barium	8/19/94	43	ppb		
299-W6-2	Barium, filtered	10/07/88	39	ppb	Y	
299-W6-2	Barium, filtered	1/04/89	35	ppb	Y	
299-W6-2	Barium, filtered	5/09/89	39	ppb	Y	
299-W6-2	Barium, filtered	7/21/89	36	ppb	Y	
299-W6-2	Barium, filtered	7/21/89	39	ppb	Y	
299-W6-2	Barium, filtered	9/07/89	37	ppb	Y	
299-W6-2	Barium, filtered	1/12/90	36	ppb	Y	
299-W6-2	Barium, filtered	4/03/90	37	ppb	Y	
299-W6-2	Barium, filtered	4/03/90	38	ppb	Y	
299-W6-2	Barium, filtered	8/12/91	36	ppb	Y	
299-W6-2	Barium, filtered	8/12/91	38	ppb	Y	
299-W6-2	Barium, filtered	11/13/91	36	ppb	Y	
299-W6-2	Barium, filtered	2/27/92	37	ppb	Y	
299-W6-2	Barium, filtered	2/27/92	39	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Barium, filtered	5/21/92	35	ppb	Y	
299-W6-2	Barium, filtered	8/07/92	39	ppb	Y	
299-W6-2	Barium, filtered	12/08/92	40	ppb	Y	
299-W6-2	Barium, filtered	2/05/93	40	ppb	Y	
299-W6-2	Barium, filtered	5/18/93	30	ppb	Y	
299-W6-2	Barium, filtered	8/13/93	37	ppb	Y	
299-W6-2	Barium, filtered	12/07/93	38	ppb	Y	B
299-W6-2	Barium, filtered	2/07/94	37	ppb	Y	
299-W6-2	Barium, filtered	8/19/94	37	ppb	Y	
299-W6-2	Beryllium, filtered	9/07/89	7	ppb	Y	
299-W6-2	Beryllium-7	8/12/91	58	pCi/L		
299-W6-2	Boron	1/04/89	13	ppb		
299-W6-2	Boron	5/09/89	15	ppb		
299-W6-2	Boron	7/21/89	13	ppb		
299-W6-2	Boron	7/21/89	15	ppb		
299-W6-2	Boron	9/07/89	16	ppb		
299-W6-2	Boron, filtered	1/04/89	12	ppb	Y	
299-W6-2	Boron, filtered	5/09/89	11	ppb	Y	
299-W6-2	Boron, filtered	7/21/89	12	ppb	Y	
299-W6-2	Boron, filtered	7/21/89	15	ppb	Y	
299-W6-2	Boron, filtered	4/03/90	15	ppb	Y	
299-W6-2	Boron, filtered	4/03/90	19	ppb	Y	
299-W6-2	Bromide	12/14/94	30	ppb		L

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Calcium	10/07/88	46100	ppb		
299-W6-2	Calcium	1/04/89	44800	ppb		
299-W6-2	Calcium	5/09/89	45600	ppb		
299-W6-2	Calcium	7/21/89	41200	ppb		
299-W6-2	Calcium	7/21/89	45100	ppb		
299-W6-2	Calcium	9/07/89	41800	ppb		
299-W6-2	Calcium	1/12/90	40200	ppb		
299-W6-2	Calcium	8/12/91	41000	ppb		
299-W6-2	Calcium	11/13/91	38000	ppb		
299-W6-2	Calcium	2/27/92	41000	ppb		
299-W6-2	Calcium	5/21/92	37000	ppb		
299-W6-2	Calcium	8/07/92	39000	ppb		
299-W6-2	Calcium	12/08/92	41000	ppb		
299-W6-2	Calcium	2/05/93	44000	ppb		
299-W6-2	Calcium	5/18/93	38000	ppb		
299-W6-2	Calcium	8/13/93	39000	ppb		
299-W6-2	Calcium	12/07/93	41000	ppb		B
299-W6-2	Calcium	2/07/94	40000	ppb		
299-W6-2	Calcium	2/07/94	41000	ppb		
299-W6-2	Calcium	8/19/94	39000	ppb		
299-W6-2	Calcium, filtered	10/07/88	44400	ppb	Y	
299-W6-2	Calcium, filtered	1/04/89	43600	ppb	Y	
299-W6-2	Calcium, filtered	5/09/89	43500	ppb	Y	
299-W6-2	Calcium, filtered	7/21/89	42700	ppb	Y	
299-W6-2	Calcium, filtered	7/21/89	45700	ppb	Y	
299-W6-2	Calcium, filtered	9/07/89	40500	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Calcium, filtered	1/12/90	40700	ppb	Y	
299-W6-2	Calcium, filtered	4/03/90	38800	ppb	Y	
299-W6-2	Calcium, filtered	4/03/90	39200	ppb	Y	
299-W6-2	Calcium, filtered	8/12/91	40000	ppb	Y	
299-W6-2	Calcium, filtered	8/12/91	41000	ppb	Y	
299-W6-2	Calcium, filtered	11/13/91	39000	ppb	Y	
299-W6-2	Calcium, filtered	2/27/92	41000	ppb	Y	
299-W6-2	Calcium, filtered	2/27/92	43000	ppb	Y	
299-W6-2	Calcium, filtered	5/21/92	37000	ppb	Y	
299-W6-2	Calcium, filtered	8/07/92	39000	ppb	Y	
299-W6-2	Calcium, filtered	12/08/92	40000	ppb	Y	
299-W6-2	Calcium, filtered	2/05/93	43000	ppb	Y	
299-W6-2	Calcium, filtered	5/18/93	38000	ppb	Y	
299-W6-2	Calcium, filtered	8/13/93	40000	ppb	Y	
299-W6-2	Calcium, filtered	12/07/93	41000	ppb	Y	B
299-W6-2	Calcium, filtered	2/07/94	40000	ppb	Y	
299-W6-2	Calcium, filtered	8/19/94	40000	ppb	Y	
299-W6-2	Carbon tetrachloride	10/07/88	100	ppb		
299-W6-2	Carbon tetrachloride	5/09/89	102	ppb		
299-W6-2	Carbon tetrachloride	7/21/89	99	ppb		
299-W6-2	Carbon tetrachloride	7/21/89	102	ppb		
299-W6-2	Carbon tetrachloride	9/07/89	113	ppb		
299-W6-2	Carbon tetrachloride	1/12/90	87	ppb		
299-W6-2	Carbon tetrachloride	4/03/90	114	ppb		
299-W6-2	Carbon tetrachloride	4/03/90	132	ppb		
299-W6-2	Carbon tetrachloride	5/10/90	102	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Carbon tetrachloride	8/12/91	87	ppb		
299-W6-2	Carbon tetrachloride	8/12/91	102	ppb		
299-W6-2	Carbon tetrachloride	8/12/91	110	ppb		
299-W6-2	Carbon tetrachloride	11/13/91	84	ppb		
299-W6-2	Carbon tetrachloride	2/27/92	95	ppb		
299-W6-2	Carbon tetrachloride	2/27/92	96	ppb		
299-W6-2	Carbon tetrachloride	5/21/92	99	ppb		
299-W6-2	Carbon tetrachloride	8/07/92	71	ppb		
299-W6-2	Carbon tetrachloride	12/08/92	130	ppb		
299-W6-2	Carbon tetrachloride	2/05/93	150	ppb		
299-W6-2	Carbon tetrachloride	5/18/93	170	ppb		
299-W6-2	Carbon tetrachloride	8/13/93	120	ppb		
299-W6-2	Carbon tetrachloride	12/07/93	110	ppb		D
299-W6-2	Carbon tetrachloride	2/07/94	160	ppb		D
299-W6-2	Carbon tetrachloride	2/07/94	190	ppb		D
299-W6-2	Carbon tetrachloride	8/19/94	66	ppb		D
299-W6-2	Chloride	10/07/88	5800	ppb		
299-W6-2	Chloride	1/04/89	5400	ppb		
299-W6-2	Chloride	5/09/89	5700	ppb		
299-W6-2	Chloride	7/21/89	5570	ppb		
299-W6-2	Chloride	7/21/89	5660	ppb		
299-W6-2	Chloride	9/07/89	3500	ppb		
299-W6-2	Chloride	1/12/90	5900	ppb		
299-W6-2	Chloride	4/03/90	5300	ppb		
299-W6-2	Chloride	4/03/90	6800	ppb		
299-W6-2	Chloride	5/10/90	6000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Chloride	8/12/91	5300	ppb		
299-W6-2	Chloride	11/13/91	5000	ppb		
299-W6-2	Chloride	2/27/92	5100	ppb		
299-W6-2	Chloride	5/21/92	5100	ppb		
299-W6-2	Chloride	8/07/92	4600	ppb		
299-W6-2	Chloride	12/08/92	5700	ppb		
299-W6-2	Chloride	2/05/93	5100	ppb		
299-W6-2	Chloride	5/18/93	5000	ppb		
299-W6-2	Chloride	8/13/93	4900	ppb		
299-W6-2	Chloride	12/07/93	5400	ppb		
299-W6-2	Chloride	2/07/94	5500	ppb		
299-W6-2	Chloride	8/19/94	5000	ppb		
299-W6-2	Chloride	12/14/94	4600	ppb		
299-W6-2	Chloroform	8/12/91	1	ppb		J
299-W6-2	Chloroform	11/13/91	2	ppb		
299-W6-2	Chloroform	2/27/92	2	ppb		
299-W6-2	Chloroform	2/27/92	2	ppb		
299-W6-2	Chloroform	5/21/92	2	ppb		
299-W6-2	Chloroform	12/08/92	2	ppb		
299-W6-2	Chloroform	5/18/93	2	ppb		L
299-W6-2	Chloroform	12/07/93	2	ppb		
299-W6-2	Chloroform	2/07/94	2	ppb		
299-W6-2	Chloroform	2/07/94	2	ppb		
299-W6-2	Chloroform	8/19/94	1	ppb		
299-W6-2	Chromium	10/07/88	103	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Chromium	1/04/89	88	ppb		
299-W6-2	Chromium	5/09/89	56	ppb		
299-W6-2	Chromium	7/21/89	44	ppb		
299-W6-2	Chromium	7/21/89	55	ppb		
299-W6-2	Chromium	9/07/89	44	ppb		
299-W6-2	Chromium	1/12/90	85	ppb		
299-W6-2	Chromium	8/12/91	84	ppb		
299-W6-2	Chromium	8/12/91	140	ppb		
299-W6-2	Chromium	11/13/91	74	ppb		
299-W6-2	Chromium	2/27/92	140	ppb		
299-W6-2	Chromium	2/27/92	170	ppb		
299-W6-2	Chromium	5/21/92	130	ppb		
299-W6-2	Chromium	8/07/92	83	ppb		
299-W6-2	Chromium	12/08/92	50	ppb		
299-W6-2	Chromium	2/05/93	70	ppb		
299-W6-2	Chromium	5/18/93	280	ppb		
299-W6-2	Chromium	8/13/93	150	ppb		
299-W6-2	Chromium	12/07/93	82	ppb		B
299-W6-2	Chromium	2/07/94	74	ppb		
299-W6-2	Chromium	2/07/94	76	ppb		
299-W6-2	Chromium	8/19/94	160	ppb		
299-W6-2	Chromium, filtered	10/07/88	36	ppb	Y	
299-W6-2	Chromium, filtered	1/04/89	33	ppb	Y	
299-W6-2	Chromium, filtered	5/09/89	39	ppb	Y	
299-W6-2	Chromium, filtered	7/21/89	32	ppb	Y	
299-W6-2	Chromium, filtered	7/21/89	36	ppb	Y	
299-W6-2	Chromium, filtered	9/07/89	41	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Chromium, filtered	1/12/90	29	ppb	Y	
299-W6-2	Chromium, filtered	4/03/90	26	ppb	Y	
299-W6-2	Chromium, filtered	4/03/90	59	ppb	Y	
299-W6-2	Chromium, filtered	8/12/91	27	ppb	Y	
299-W6-2	Chromium, filtered	8/12/91	29	ppb	Y	
299-W6-2	Chromium, filtered	11/13/91	31	ppb	Y	
299-W6-2	Chromium, filtered	2/27/92	24	ppb	Y	
299-W6-2	Chromium, filtered	2/27/92	27	ppb	Y	
299-W6-2	Chromium, filtered	5/21/92	23	ppb	Y	
299-W6-2	Chromium, filtered	8/07/92	26	ppb	Y	
299-W6-2	Chromium, filtered	12/08/92	20	ppb	Y	
299-W6-2	Chromium, filtered	2/05/93	30	ppb	Y	
299-W6-2	Chromium, filtered	5/18/93	50	ppb	Y	
299-W6-2	Chromium, filtered	12/07/93	28	ppb	Y	B
299-W6-2	Chromium, filtered	2/07/94	23	ppb	Y	
299-W6-2	Chromium, filtered	8/19/94	28	ppb	Y	
299-W6-2	Cobalt	5/18/93	5	ppb		L
299-W6-2	Cobalt-60	12/14/94	2	pCi/L		
299-W6-2	Coliforms	7/21/89	25	COL		
299-W6-2	Coliforms	7/21/89	30	COL		
299-W6-2	Copper	8/12/91	35	ppb		
299-W6-2	Copper	8/12/91	53	ppb		
299-W6-2	Copper	12/07/93	5	ppb		L

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Copper	8/19/94	6	ppb		L
299-W6-2	Copper, filtered	8/12/91	31	ppb	Y	
299-W6-2	Fluoride	8/12/91	520	ppb		
299-W6-2	Fluoride	11/13/91	900	ppb		
299-W6-2	Fluoride	2/27/92	400	ppb		
299-W6-2	Fluoride	5/21/92	300	ppb		
299-W6-2	Fluoride	8/07/92	400	ppb		
299-W6-2	Fluoride	12/08/92	600	ppb		
299-W6-2	Fluoride	2/05/93	500	ppb		
299-W6-2	Fluoride	5/18/93	400	ppb		
299-W6-2	Fluoride	8/13/93	400	ppb		
299-W6-2	Fluoride	12/07/93	500	ppb		
299-W6-2	Fluoride	2/07/94	400	ppb		
299-W6-2	Fluoride	8/19/94	900	ppb		
299-W6-2	Fluoride	12/14/94	500	ppb		
299-W6-2	Gross alpha	10/07/88	2	pCi/L		
299-W6-2	Gross alpha	5/09/89	2	pCi/L		
299-W6-2	Gross alpha	7/21/89	2	pCi/L		
299-W6-2	Gross alpha	7/21/89	3	pCi/L		
299-W6-2	Gross alpha	9/07/89	3	pCi/L		
299-W6-2	Gross alpha	1/12/90	2	pCi/L		
299-W6-2	Gross alpha	5/10/90	2	pCi/L		
299-W6-2	Gross alpha	8/12/91	1	pCi/L		
299-W6-2	Gross alpha	5/18/93	2	pCi/L		
299-W6-2	Gross alpha	12/07/93	2	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Gross alpha	2/07/94	1	pCi/L		
299-W6-2	Gross alpha	2/07/94	2	pCi/L		
299-W6-2	Gross alpha	8/19/94	2	pCi/L		
299-W6-2	Gross beta	10/07/88	14	pCi/L		
299-W6-2	Gross beta	1/04/89	12	pCi/L		
299-W6-2	Gross beta	5/09/89	13	pCi/L		
299-W6-2	Gross beta	7/21/89	12	pCi/L		
299-W6-2	Gross beta	7/21/89	16	pCi/L		
299-W6-2	Gross beta	9/07/89	16	pCi/L		
299-W6-2	Gross beta	1/12/90	10	pCi/L		
299-W6-2	Gross beta	5/10/90	11	pCi/L		
299-W6-2	Gross beta	8/12/91	7	pCi/L		
299-W6-2	Gross beta	8/12/91	9	pCi/L		
299-W6-2	Gross beta	8/07/92	8	pCi/L		
299-W6-2	Gross beta	2/05/93	8	pCi/L		
299-W6-2	Gross beta	5/18/93	9	pCi/L		
299-W6-2	Gross beta	8/13/93	9	pCi/L		
299-W6-2	Gross beta	12/07/93	11	pCi/L		
299-W6-2	Gross beta	2/07/94	8	pCi/L		
299-W6-2	Gross beta	2/07/94	13	pCi/L		
299-W6-2	Gross beta	8/19/94	12	pCi/L		
299-W6-2	Iron	10/07/88	368	ppb		
299-W6-2	Iron	1/04/89	350	ppb		
299-W6-2	Iron	5/09/89	102	ppb		
299-W6-2	Iron	7/21/89	68	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Iron	7/21/89	99	ppb		
299-W6-2	Iron	9/07/89	75	ppb		
299-W6-2	Iron	1/12/90	419	ppb		
299-W6-2	Iron	8/12/91	300	ppb		
299-W6-2	Iron	8/12/91	580	ppb		
299-W6-2	Iron	11/13/91	220	ppb		
299-W6-2	Iron	2/27/92	500	ppb		
299-W6-2	Iron	2/27/92	660	ppb		
299-W6-2	Iron	5/21/92	500	ppb		
299-W6-2	Iron	8/07/92	320	ppb		
299-W6-2	Iron	12/08/92	100	ppb		
299-W6-2	Iron	2/05/93	210	ppb		
299-W6-2	Iron	5/18/93	1100	ppb		
299-W6-2	Iron	8/13/93	770	ppb		
299-W6-2	Iron	12/07/93	240	ppb		B
299-W6-2	Iron	2/07/94	230	ppb		B
299-W6-2	Iron	2/07/94	260	ppb		B
299-W6-2	Iron	8/19/94	2500	ppb		
299-W6-2	Iron, filtered	10/07/88	47	ppb	Y	
299-W6-2	Iron, filtered	1/04/89	36	ppb	Y	
299-W6-2	Iron, filtered	5/09/89	35	ppb	Y	
299-W6-2	Iron, filtered	4/03/90	157	ppb	Y	
299-W6-2	Iron, filtered	8/12/91	46	ppb	Y	
299-W6-2	Iron, filtered	8/12/91	51	ppb	Y	
299-W6-2	Iron, filtered	11/13/91	46	ppb	Y	
299-W6-2	Iron, filtered	2/27/92	30	ppb	Y	
299-W6-2	Iron, filtered	5/21/92	50	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Iron, filtered	8/07/92	26	ppb	Y	
299-W6-2	Iron, filtered	5/18/93	20	ppb	Y	
299-W6-2	Iron, filtered	8/13/93	27	ppb	Y	
299-W6-2	Iron, filtered	12/07/93	12	ppb	Y	BL
299-W6-2	Iron, filtered	2/07/94	27	ppb	Y	B
299-W6-2	Iron, filtered	2/07/94	30	ppb	Y	B
299-W6-2	Iron, filtered	8/19/94	48	ppb	Y	
299-W6-2	Lead	2/07/94	1	ppb		BL
299-W6-2	Lead	2/07/94	35	ppb		B
299-W6-2	Lead	8/19/94	3	ppb		BL
299-W6-2	Lead, filtered	8/19/94	1	ppb	Y	BL
299-W6-2	Magnesium	10/07/88	19400	ppb		
299-W6-2	Magnesium	1/04/89	18100	ppb		
299-W6-2	Magnesium	5/09/89	18900	ppb		
299-W6-2	Magnesium	7/21/89	16400	ppb		
299-W6-2	Magnesium	7/21/89	18000	ppb		
299-W6-2	Magnesium	9/07/89	17700	ppb		
299-W6-2	Magnesium	1/12/90	16700	ppb		
299-W6-2	Magnesium	8/12/91	16000	ppb		
299-W6-2	Magnesium	8/12/91	17000	ppb		
299-W6-2	Magnesium	11/13/91	15000	ppb		
299-W6-2	Magnesium	2/27/92	16000	ppb		
299-W6-2	Magnesium	5/21/92	16000	ppb		
299-W6-2	Magnesium	8/07/92	16000	ppb		
299-W6-2	Magnesium	12/08/92	17000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Magnesium	2/05/93	19000	ppb		
299-W6-2	Magnesium	5/18/93	16000	ppb		
299-W6-2	Magnesium	8/13/93	16000	ppb		
299-W6-2	Magnesium	12/07/93	17000	ppb		
299-W6-2	Magnesium	2/07/94	17000	ppb		
299-W6-2	Magnesium	8/19/94	16000	ppb		
299-W6-2	Magnesium, filtered	10/07/88	19200	ppb	Y	
299-W6-2	Magnesium, filtered	1/04/89	17600	ppb	Y	
299-W6-2	Magnesium, filtered	5/09/89	18200	ppb	Y	
299-W6-2	Magnesium, filtered	7/21/89	17000	ppb	Y	
299-W6-2	Magnesium, filtered	7/21/89	18000	ppb	Y	
299-W6-2	Magnesium, filtered	9/07/89	17400	ppb	Y	
299-W6-2	Magnesium, filtered	1/12/90	16800	ppb	Y	
299-W6-2	Magnesium, filtered	4/03/90	17000	ppb	Y	
299-W6-2	Magnesium, filtered	4/03/90	17400	ppb	Y	
299-W6-2	Magnesium, filtered	8/12/91	16000	ppb	Y	
299-W6-2	Magnesium, filtered	11/13/91	16000	ppb	Y	
299-W6-2	Magnesium, filtered	2/27/92	17000	ppb	Y	
299-W6-2	Magnesium, filtered	5/21/92	16000	ppb	Y	
299-W6-2	Magnesium, filtered	8/07/92	16000	ppb	Y	
299-W6-2	Magnesium, filtered	12/08/92	17000	ppb	Y	
299-W6-2	Magnesium, filtered	2/05/93	18000	ppb	Y	
299-W6-2	Magnesium, filtered	5/18/93	16000	ppb	Y	
299-W6-2	Magnesium, filtered	8/13/93	17000	ppb	Y	
299-W6-2	Magnesium, filtered	12/07/93	17000	ppb	Y	
299-W6-2	Magnesium, filtered	2/07/94	17000	ppb	Y	
299-W6-2	Magnesium, filtered	8/19/94	17000	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Manganese	10/07/88	11	ppb		
299-W6-2	Manganese	1/04/89	6	ppb		
299-W6-2	Manganese	1/12/90	9	ppb		
299-W6-2	Manganese	8/12/91	12	ppb		
299-W6-2	Manganese	2/27/92	13	ppb		
299-W6-2	Manganese	5/18/93	20	ppb		
299-W6-2	Manganese	8/13/93	14	ppb		
299-W6-2	Manganese	12/07/93	4	ppb		L
299-W6-2	Manganese	2/07/94	4	ppb		L
299-W6-2	Manganese	2/07/94	5	ppb		L
299-W6-2	Manganese	8/19/94	37	ppb		
299-W6-2	Manganese, filtered	12/07/93	2	ppb	Y	L
299-W6-2	Manganese, filtered	8/19/94	2	ppb	Y	L
299-W6-2	Methylene chloride	8/12/91	16	ppb		B
299-W6-2	Methylene chloride	8/12/91	18	ppb		B
299-W6-2	Methylene chloride	11/13/91	0	ppb		J
299-W6-2	Methylene chloride	5/18/93	2	ppb		BL
299-W6-2	Methylene chloride	12/07/93	0	ppb		BL
299-W6-2	Nickel	10/07/88	38	ppb		
299-W6-2	Nickel	1/04/89	29	ppb		
299-W6-2	Nickel	5/09/89	14	ppb		
299-W6-2	Nickel	7/21/89	12	ppb		
299-W6-2	Nickel	1/12/90	28	ppb		
299-W6-2	Nickel	8/12/91	70	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Nickel	2/27/92	53	ppb		
299-W6-2	Nickel	2/27/92	72	ppb		
299-W6-2	Nickel	5/21/92	68	ppb		
299-W6-2	Nickel	5/18/93	120	ppb		
299-W6-2	Nickel	8/13/93	70	ppb		
299-W6-2	Nickel	12/07/93	30	ppb		L
299-W6-2	Nickel	2/07/94	32	ppb		
299-W6-2	Nickel	2/07/94	33	ppb		
299-W6-2	Nickel	8/19/94	69	ppb		
299-W6-2	Nickel, filtered	5/09/89	14	ppb	Y	
299-W6-2	Nickel, filtered	9/07/89	10	ppb	Y	
299-W6-2	Nickel, filtered	4/03/90	17	ppb	Y	
299-W6-2	Nickel, filtered	8/19/94	17	ppb	Y	L
299-W6-2	Nitrate	10/07/88	80700	ppb		
299-W6-2	Nitrate	1/04/89	71700	ppb		
299-W6-2	Nitrate	5/09/89	74900	ppb		
299-W6-2	Nitrate	7/21/89	73200	ppb		
299-W6-2	Nitrate	7/21/89	74500	ppb		
299-W6-2	Nitrate	9/07/89	24600	ppb		
299-W6-2	Nitrate	1/12/90	68200	ppb		
299-W6-2	Nitrate	4/03/90	71100	ppb		
299-W6-2	Nitrate	4/03/90	72100	ppb		
299-W6-2	Nitrate	5/10/90	69500	ppb		
299-W6-2	Nitrate	8/12/91	57500	ppb		
299-W6-2	Nitrate	8/12/91	58100	ppb		
299-W6-2	Nitrate	11/13/91	53000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Nitrate	2/27/92	53000	ppb		
299-W6-2	Nitrate	2/27/92	54000	ppb		
299-W6-2	Nitrate	5/21/92	54000	ppb		
299-W6-2	Nitrate	8/07/92	45000	ppb		
299-W6-2	Nitrate	12/08/92	49000	ppb		
299-W6-2	Nitrate	2/05/93	51000	ppb		
299-W6-2	Nitrate	5/18/93	56000	ppb		
299-W6-2	Nitrate	8/13/93	65000	ppb		
299-W6-2	Nitrate	12/07/93	57000	ppb		D
299-W6-2	Nitrate	2/07/94	61000	ppb		D
299-W6-2	Nitrate	8/19/94	51000	ppb		D
299-W6-2	Nitrate	12/14/94	52000	ppb		D
299-W6-2	Potassium	10/07/88	3250	ppb		
299-W6-2	Potassium	1/04/89	3450	ppb		
299-W6-2	Potassium	5/09/89	3410	ppb		
299-W6-2	Potassium	7/21/89	3110	ppb		
299-W6-2	Potassium	7/21/89	3410	ppb		
299-W6-2	Potassium	9/07/89	3520	ppb		
299-W6-2	Potassium	1/12/90	3270	ppb		
299-W6-2	Potassium	8/12/91	2900	ppb		
299-W6-2	Potassium	8/12/91	3500	ppb		
299-W6-2	Potassium	11/13/91	3900	ppb		
299-W6-2	Potassium	2/27/92	3500	ppb		
299-W6-2	Potassium	2/27/92	4000	ppb		
299-W6-2	Potassium	5/21/92	3100	ppb		
299-W6-2	Potassium	8/07/92	3100	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Potassium	12/08/92	3000	ppb		
299-W6-2	Potassium	2/05/93	3400	ppb		
299-W6-2	Potassium	5/18/93	3100	ppb		
299-W6-2	Potassium	8/13/93	2700	ppb		
299-W6-2	Potassium	12/07/93	3500	ppb		B
299-W6-2	Potassium	2/07/94	3000	ppb		
299-W6-2	Potassium	2/07/94	3500	ppb		
299-W6-2	Potassium	8/19/94	3100	ppb		
299-W6-2	Potassium, filtered	10/07/88	3610	ppb	Y	
299-W6-2	Potassium, filtered	1/04/89	3280	ppb	Y	
299-W6-2	Potassium, filtered	5/09/89	3230	ppb	Y	
299-W6-2	Potassium, filtered	7/21/89	3240	ppb	Y	
299-W6-2	Potassium, filtered	7/21/89	3460	ppb	Y	
299-W6-2	Potassium, filtered	9/07/89	3480	ppb	Y	
299-W6-2	Potassium, filtered	1/12/90	3260	ppb	Y	
299-W6-2	Potassium, filtered	4/03/90	3240	ppb	Y	
299-W6-2	Potassium, filtered	4/03/90	3260	ppb	Y	
299-W6-2	Potassium, filtered	8/12/91	3200	ppb	Y	
299-W6-2	Potassium, filtered	8/12/91	3600	ppb	Y	
299-W6-2	Potassium, filtered	11/13/91	4000	ppb	Y	
299-W6-2	Potassium, filtered	2/27/92	3200	ppb	Y	
299-W6-2	Potassium, filtered	2/27/92	3400	ppb	Y	
299-W6-2	Potassium, filtered	5/21/92	3000	ppb	Y	
299-W6-2	Potassium, filtered	8/07/92	3100	ppb	Y	
299-W6-2	Potassium, filtered	12/08/92	3200	ppb	Y	
299-W6-2	Potassium, filtered	2/05/93	3600	ppb	Y	
299-W6-2	Potassium, filtered	5/18/93	2800	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Potassium, filtered	8/13/93	2900	ppb	Y	
299-W6-2	Potassium, filtered	12/07/93	3500	ppb	Y	B
299-W6-2	Potassium, filtered	2/07/94	3200	ppb	Y	
299-W6-2	Potassium, filtered	2/07/94	3300	ppb	Y	
299-W6-2	Potassium, filtered	8/19/94	3900	ppb	Y	
299-W6-2	Potassium-40	8/12/91	51	pCi/L		
299-W6-2	Potassium-40	8/12/91	204	pCi/L		
299-W6-2	Potassium-40	8/19/94	88	pCi/L		
299-W6-2	Potassium-40	12/14/94	56	pCi/L		
299-W6-2	Radium	10/07/88	0	pCi/L		
299-W6-2	Radium	1/04/89	0	pCi/L		
299-W6-2	Radium	7/21/89	0	pCi/L		
299-W6-2	Radium	9/07/89	0	pCi/L		
299-W6-2	Radium	12/07/93	0	pCi/L		
299-W6-2	Radium	8/19/94	1	pCi/L		
299-W6-2	Selenium	5/18/93	2	ppb		L
299-W6-2	Selenium, filtered	5/18/93	1	ppb	Y	L
299-W6-2	Silicon	1/04/89	20100	ppb		
299-W6-2	Silicon	5/09/89	20100	ppb		
299-W6-2	Silicon	7/21/89	16100	ppb		
299-W6-2	Silicon	7/21/89	19900	ppb		
299-W6-2	Silicon	9/07/89	19900	ppb		
299-W6-2	Silicon	1/12/90	18200	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Silicon, filtered	1/04/89	19400	ppb	Y	
299-W6-2	Silicon, filtered	5/09/89	19200	ppb	Y	
299-W6-2	Silicon, filtered	7/21/89	18700	ppb	Y	
299-W6-2	Silicon, filtered	7/21/89	19900	ppb	Y	
299-W6-2	Silicon, filtered	9/07/89	19200	ppb	Y	
299-W6-2	Silicon, filtered	1/12/90	18200	ppb	Y	
299-W6-2	Silicon, filtered	4/03/90	19000	ppb	Y	
299-W6-2	Silicon, filtered	4/03/90	19300	ppb	Y	
299-W6-2	Sodium	10/07/88	10400	ppb		
299-W6-2	Sodium	1/04/89	11200	ppb		
299-W6-2	Sodium	5/09/89	11500	ppb		
299-W6-2	Sodium	7/21/89	9920	ppb		
299-W6-2	Sodium	7/21/89	10900	ppb		
299-W6-2	Sodium	9/07/89	10500	ppb		
299-W6-2	Sodium	1/12/90	10100	ppb		
299-W6-2	Sodium	8/12/91	10000	ppb		
299-W6-2	Sodium	8/12/91	11000	ppb		
299-W6-2	Sodium	11/13/91	9600	ppb		
299-W6-2	Sodium	2/27/92	9800	ppb		
299-W6-2	Sodium	2/27/92	10000	ppb		
299-W6-2	Sodium	5/21/92	10000	ppb		
299-W6-2	Sodium	8/07/92	9700	ppb		
299-W6-2	Sodium	12/08/92	9800	ppb		
299-W6-2	Sodium	2/05/93	11000	ppb		
299-W6-2	Sodium	5/18/93	9600	ppb		
299-W6-2	Sodium	8/13/93	9800	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Sodium	12/07/93	11000	ppb		
299-W6-2	Sodium	2/07/94	10000	ppb		
299-W6-2	Sodium	8/19/94	9700	ppb		
299-W6-2	Sodium, filtered	10/07/88	11200	ppb	Y	
299-W6-2	Sodium, filtered	1/04/89	10700	ppb	Y	
299-W6-2	Sodium, filtered	5/09/89	11000	ppb	Y	
299-W6-2	Sodium, filtered	7/21/89	10300	ppb	Y	
299-W6-2	Sodium, filtered	7/21/89	10900	ppb	Y	
299-W6-2	Sodium, filtered	9/07/89	10400	ppb	Y	
299-W6-2	Sodium, filtered	1/12/90	10200	ppb	Y	
299-W6-2	Sodium, filtered	4/03/90	10500	ppb	Y	
299-W6-2	Sodium, filtered	4/03/90	10700	ppb	Y	
299-W6-2	Sodium, filtered	8/12/91	10000	ppb	Y	
299-W6-2	Sodium, filtered	8/12/91	11000	ppb	Y	
299-W6-2	Sodium, filtered	11/13/91	10000	ppb	Y	
299-W6-2	Sodium, filtered	2/27/92	10000	ppb	Y	
299-W6-2	Sodium, filtered	2/27/92	11000	ppb	Y	
299-W6-2	Sodium, filtered	5/21/92	10000	ppb	Y	
299-W6-2	Sodium, filtered	8/07/92	9800	ppb	Y	
299-W6-2	Sodium, filtered	12/08/92	9600	ppb	Y	
299-W6-2	Sodium, filtered	2/05/93	11000	ppb	Y	
299-W6-2	Sodium, filtered	5/18/93	9500	ppb	Y	
299-W6-2	Sodium, filtered	8/13/93	10000	ppb	Y	
299-W6-2	Sodium, filtered	12/07/93	10000	ppb	Y	
299-W6-2	Sodium, filtered	2/07/94	10000	ppb	Y	
299-W6-2	Sodium, filtered	8/19/94	10000	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Specific conductance	10/07/88	353	umhos		
299-W6-2	Specific conductance	10/07/88	354	umhos		
299-W6-2	Specific conductance	10/07/88	441	umhos		
299-W6-2	Specific conductance	10/07/88	442	umhos		
299-W6-2	Specific conductance	10/07/88	444	umhos		
299-W6-2	Specific conductance	10/07/88	445	umhos		
299-W6-2	Specific conductance	1/04/89	416	umhos		
299-W6-2	Specific conductance	1/04/89	418	umhos		
299-W6-2	Specific conductance	1/04/89	420	umhos		
299-W6-2	Specific conductance	1/04/89	422	umhos		
299-W6-2	Specific conductance	1/04/89	423	umhos		
299-W6-2	Specific conductance	1/04/89	424	umhos		
299-W6-2	Specific conductance	1/04/89	426	umhos		
299-W6-2	Specific conductance	1/04/89	429	umhos		
299-W6-2	Specific conductance	5/09/89	332	umhos		
299-W6-2	Specific conductance	5/09/89	397	umhos		
299-W6-2	Specific conductance	5/09/89	400	umhos		
299-W6-2	Specific conductance	5/09/89	401	umhos		
299-W6-2	Specific conductance	7/21/89	375	umhos		
299-W6-2	Specific conductance	7/21/89	378	umhos		
299-W6-2	Specific conductance	7/21/89	380	umhos		
299-W6-2	Specific conductance	7/21/89	391	umhos		
299-W6-2	Specific conductance	7/21/89	392	umhos		
299-W6-2	Specific conductance	7/21/89	393	umhos		
299-W6-2	Specific conductance	7/21/89	395	umhos		
299-W6-2	Specific conductance	9/07/89	399	umhos		
299-W6-2	Specific conductance	9/07/89	404	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Specific conductance	9/07/89	405	umhos		
299-W6-2	Specific conductance	9/07/89	406	umhos		
299-W6-2	Specific conductance	9/07/89	410	umhos		
299-W6-2	Specific conductance	1/12/90	310	umhos		
299-W6-2	Specific conductance	1/12/90	395	umhos		
299-W6-2	Specific conductance	1/12/90	397	umhos		
299-W6-2	Specific conductance	1/12/90	401	umhos		
299-W6-2	Specific conductance	1/12/90	411	umhos		
299-W6-2	Specific conductance	1/12/90	413	umhos		
299-W6-2	Specific conductance	1/12/90	414	umhos		
299-W6-2	Specific conductance	4/03/90	389	umhos		
299-W6-2	Specific conductance	4/03/90	425	umhos		
299-W6-2	Specific conductance	4/03/90	445	umhos		
299-W6-2	Specific conductance	5/10/90	373	umhos		
299-W6-2	Specific conductance	5/10/90	375	umhos		
299-W6-2	Specific conductance	5/10/90	376	umhos		
299-W6-2	Specific conductance	5/10/90	378	umhos		
299-W6-2	Specific conductance	5/10/90	449	umhos		
299-W6-2	Specific conductance	5/10/90	453	umhos		
299-W6-2	Specific conductance	5/10/90	455	umhos		
299-W6-2	Specific conductance	5/10/90	456	umhos		
299-W6-2	Specific conductance	8/12/91	367	umhos		
299-W6-2	Specific conductance	8/12/91	380	umhos		
299-W6-2	Specific conductance	11/13/91	374	umhos		
299-W6-2	Specific conductance	11/20/91	380	umhos		
299-W6-2	Specific conductance	2/27/92	344	umhos		
299-W6-2	Specific conductance	3/26/92	377	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Specific conductance	5/21/92	353	umhos		
299-W6-2	Specific conductance	5/21/92	358	umhos		
299-W6-2	Specific conductance	5/21/92	359	umhos		
299-W6-2	Specific conductance	8/07/92	309	umhos		
299-W6-2	Specific conductance	12/08/92	388	umhos		
299-W6-2	Specific conductance	12/08/92	389	umhos		
299-W6-2	Specific conductance	2/05/93	396	umhos		
299-W6-2	Specific conductance	2/05/93	397	umhos		
299-W6-2	Specific conductance	2/05/93	398	umhos		
299-W6-2	Specific conductance	5/18/93	389	umhos		
299-W6-2	Specific conductance	5/18/93	390	umhos		
299-W6-2	Specific conductance	5/18/93	392	umhos		
299-W6-2	Specific conductance	5/18/93	393	umhos		
299-W6-2	Specific conductance	8/13/93	369	umhos		
299-W6-2	Specific conductance	12/07/93	403	umhos		
299-W6-2	Specific conductance	2/07/94	393	umhos		
299-W6-2	Specific conductance	2/07/94	396	umhos		
299-W6-2	Specific conductance	2/07/94	405	umhos		
299-W6-2	Specific conductance	2/07/94	410	umhos		
299-W6-2	Specific conductance	8/19/94	343	umhos		
299-W6-2	Specific conductance	8/19/94	345	umhos		
299-W6-2	Specific conductance	8/19/94	346	umhos		
299-W6-2	Specific conductance	8/19/94	347	umhos		
299-W6-2	Specific conductance	11/30/94	393	umhos		
299-W6-2	Specific conductance	11/30/94	394	umhos		
299-W6-2	Specific conductance	11/30/94	395	umhos		
299-W6-2	Specific conductance	11/30/94	396	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Specific conductance	11/30/94	397	umhos		
299-W6-2	Specific conductance	11/30/94	398	umhos		
299-W6-2	Specific conductance	12/14/94	370	umhos		
299-W6-2	Strontium	10/07/88	256	ppb		
299-W6-2	Strontium	1/04/89	254	ppb		
299-W6-2	Strontium	5/09/89	275	ppb		
299-W6-2	Strontium	7/21/89	234	ppb		
299-W6-2	Strontium	7/21/89	255	ppb		
299-W6-2	Strontium	9/07/89	251	ppb		
299-W6-2	Strontium	1/12/90	225	ppb		
299-W6-2	Strontium, filtered	10/07/88	251	ppb	Y	
299-W6-2	Strontium, filtered	1/04/89	246	ppb	Y	
299-W6-2	Strontium, filtered	5/09/89	258	ppb	Y	
299-W6-2	Strontium, filtered	7/21/89	241	ppb	Y	
299-W6-2	Strontium, filtered	7/21/89	256	ppb	Y	
299-W6-2	Strontium, filtered	9/07/89	244	ppb	Y	
299-W6-2	Strontium, filtered	1/12/90	227	ppb	Y	
299-W6-2	Strontium, filtered	4/03/90	235	ppb	Y	
299-W6-2	Strontium, filtered	4/03/90	236	ppb	Y	
299-W6-2	Sulfate	10/07/88	26800	ppb		
299-W6-2	Sulfate	1/04/89	25300	ppb		
299-W6-2	Sulfate	5/09/89	26500	ppb		
299-W6-2	Sulfate	7/21/89	27000	ppb		
299-W6-2	Sulfate	7/21/89	27200	ppb		
299-W6-2	Sulfate	9/07/89	25700	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Sulfate	1/12/90	27900	ppb		
299-W6-2	Sulfate	4/03/90	28000	ppb		
299-W6-2	Sulfate	4/03/90	28300	ppb		
299-W6-2	Sulfate	5/10/90	28000	ppb		
299-W6-2	Sulfate	8/12/91	24000	ppb		
299-W6-2	Sulfate	11/13/91	26000	ppb		
299-W6-2	Sulfate	2/27/92	26000	ppb		
299-W6-2	Sulfate	5/21/92	26000	ppb		
299-W6-2	Sulfate	8/07/92	24000	ppb		
299-W6-2	Sulfate	12/08/92	25000	ppb		
299-W6-2	Sulfate	2/05/93	22000	ppb		
299-W6-2	Sulfate	5/18/93	26000	ppb		
299-W6-2	Sulfate	8/13/93	26000	ppb		
299-W6-2	Sulfate	12/07/93	25000	ppb		D
299-W6-2	Sulfate	2/07/94	26000	ppb		D
299-W6-2	Sulfate	8/19/94	25000	ppb		D
299-W6-2	Sulfate	12/14/94	23000	ppb		D
299-W6-2	Technetium-99	10/07/88	107	pCi/L		
299-W6-2	Technetium-99	1/04/89	98	pCi/L		
299-W6-2	Technetium-99	5/09/89	79	pCi/L		
299-W6-2	Technetium-99	7/21/89	82	pCi/L		
299-W6-2	Technetium-99	7/21/89	83	pCi/L		
299-W6-2	Technetium-99	9/07/89	86	pCi/L		
299-W6-2	Technetium-99	1/12/90	69	pCi/L		
299-W6-2	Technetium-99	8/12/91	7	pCi/L		
299-W6-2	Technetium-99	8/12/91	14	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Technetium-99	11/13/91	28	pCi/L		
299-W6-2	Technetium-99	2/27/92	42	pCi/L		
299-W6-2	Technetium-99	2/27/92	53	pCi/L		
299-W6-2	Technetium-99	5/21/92	363	pCi/L		
299-W6-2	Technetium-99	8/07/92	23	pCi/L		
299-W6-2	Technetium-99	8/19/94	27	pCi/L		
299-W6-2	Technetium-99	12/14/94	28	pCi/L		
299-W6-2	Total Carbon	10/07/88	24200	ppb		
299-W6-2	Total Carbon	1/04/89	24000	ppb		
299-W6-2	Total Carbon	9/07/89	27200	ppb		
299-W6-2	Total Carbon	1/12/90	26500	ppb		
299-W6-2	Total Carbon	5/10/90	28900	ppb		
299-W6-2	Total Carbon	8/12/91	30000	ppb		
299-W6-2	Total Carbon	11/13/91	28000	ppb		
299-W6-2	Total Carbon	2/27/92	30000	ppb		
299-W6-2	Total Carbon	5/21/92	36000	ppb		
299-W6-2	Total Carbon	8/07/92	26000	ppb		
299-W6-2	Total Dissolved Soli	11/20/91	280	ppm		
299-W6-2	Total Dissolved Soli	8/19/94	220	ppm		
299-W6-2	Total Dissolved Soli	12/14/94	250	ppm		
299-W6-2	Total Organic Carbon	5/18/93	600	ppb		BL
299-W6-2	Total Organic Carbon	5/18/93	700	ppb		BL
299-W6-2	Total Organic Carbon	8/13/93	400	ppb		L
299-W6-2	Total Organic Carbon	12/07/93	400	ppb		L

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Total Organic Carbon	2/07/94	200	ppb		L
299-W6-2	Total Organic Carbon	2/07/94	300	ppb		L
299-W6-2	Total Organic Carbon	8/19/94	350	ppb		L
299-W6-2	Total Organic Carbon	12/14/94	200	ppb		L
299-W6-2	Total Organic Haloge	10/07/88	67	ppb		
299-W6-2	Total Organic Haloge	10/07/88	73	ppb		
299-W6-2	Total Organic Haloge	10/07/88	73	ppb		
299-W6-2	Total Organic Haloge	1/04/89	74	ppb		
299-W6-2	Total Organic Haloge	1/04/89	75	ppb		
299-W6-2	Total Organic Haloge	1/04/89	80	ppb		
299-W6-2	Total Organic Haloge	1/04/89	83	ppb		
299-W6-2	Total Organic Haloge	5/09/89	84	ppb		
299-W6-2	Total Organic Haloge	5/09/89	88	ppb		
299-W6-2	Total Organic Haloge	5/09/89	89	ppb		
299-W6-2	Total Organic Haloge	5/09/89	92	ppb		
299-W6-2	Total Organic Haloge	7/21/89	75	ppb		
299-W6-2	Total Organic Haloge	7/21/89	81	ppb		
299-W6-2	Total Organic Haloge	7/21/89	87	ppb		
299-W6-2	Total Organic Haloge	9/07/89	70	ppb		
299-W6-2	Total Organic Haloge	9/07/89	89	ppb		
299-W6-2	Total Organic Haloge	9/07/89	96	ppb		
299-W6-2	Total Organic Haloge	1/12/90	69	ppb		
299-W6-2	Total Organic Haloge	1/12/90	73	ppb		
299-W6-2	Total Organic Haloge	1/12/90	74	ppb		
299-W6-2	Total Organic Haloge	1/12/90	79	ppb		
299-W6-2	Total Organic Haloge	4/03/90	83	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Total Organic Haloge	5/10/90	70	ppb		
299-W6-2	Total Organic Haloge	5/10/90	71	ppb		
299-W6-2	Total Organic Haloge	5/10/90	80	ppb		
299-W6-2	Total Organic Haloge	8/12/91	74	ppb		
299-W6-2	Total Organic Haloge	8/12/91	78	ppb		
299-W6-2	Total Organic Haloge	11/13/91	60	ppb		
299-W6-2	Total Organic Haloge	2/27/92	70	ppb		
299-W6-2	Total Organic Haloge	5/21/92	80	ppb		
299-W6-2	Total Organic Haloge	5/21/92	90	ppb		
299-W6-2	Total Organic Haloge	8/07/92	80	ppb		
299-W6-2	Total Organic Haloge	12/08/92	50	ppb		
299-W6-2	Total Organic Haloge	12/08/92	60	ppb		
299-W6-2	Total Organic Haloge	12/08/92	70	ppb		
299-W6-2	Total Organic Haloge	12/08/92	90	ppb		
299-W6-2	Total Organic Haloge	12/08/92	100	ppb		
299-W6-2	Total Organic Haloge	12/08/92	100	ppb		B
299-W6-2	Total Organic Haloge	12/08/92	120	ppb		
299-W6-2	Total Organic Haloge	12/08/92	130	ppb		B
299-W6-2	Total Organic Haloge	2/05/93	70	ppb		
299-W6-2	Total Organic Haloge	2/05/93	80	ppb		
299-W6-2	Total Organic Haloge	2/05/93	90	ppb		
299-W6-2	Total Organic Haloge	2/05/93	100	ppb		
299-W6-2	Total Organic Haloge	2/05/93	110	ppb		
299-W6-2	Total Organic Haloge	5/18/93	80	ppb		B
299-W6-2	Total Organic Haloge	5/18/93	90	ppb		
299-W6-2	Total Organic Haloge	5/18/93	90	ppb		B
299-W6-2	Total Organic Haloge	5/18/93	100	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Total Organic Haloge	8/13/93	80	ppb		
299-W6-2	Total Organic Haloge	8/13/93	90	ppb		
299-W6-2	Total Organic Haloge	12/07/93	104	ppb		
299-W6-2	Total Organic Haloge	2/07/94	115	ppb		
299-W6-2	Total Organic Haloge	8/19/94	88	ppb		
299-W6-2	Total Organic Haloge	8/19/94	88	ppb		
299-W6-2	Total Organic Haloge	8/19/94	90	ppb		
299-W6-2	Total Organic Haloge	8/19/94	93	ppb		
299-W6-2	Total Organic Haloge	12/14/94	119	ppb		
299-W6-2	Trichloroethene	8/12/91	2	ppb		
299-W6-2	Trichloroethene	5/21/92	1	ppb		J
299-W6-2	Trichloroethene	8/13/93	1	ppb		L
299-W6-2	Trichloroethene	12/07/93	1	ppb		
299-W6-2	Trichloroethene	2/07/94	2	ppb		
299-W6-2	Trichloroethene	2/07/94	3	ppb		
299-W6-2	Trichloroethene	8/19/94	1	ppb		
299-W6-2	Tritium	10/07/88	15200	pCi/L		
299-W6-2	Tritium	1/04/89	10500	pCi/L		
299-W6-2	Tritium	5/09/89	13500	pCi/L		
299-W6-2	Tritium	7/21/89	14000	pCi/L		
299-W6-2	Tritium	7/21/89	14500	pCi/L		
299-W6-2	Tritium	9/07/89	14300	pCi/L		
299-W6-2	Tritium	1/12/90	14200	pCi/L		
299-W6-2	Tritium	5/10/90	15800	pCi/L		
299-W6-2	Tritium	8/12/91	11200	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Tritium	8/12/91	11400	pCi/L		
299-W6-2	Tritium	11/13/91	11400	pCi/L		
299-W6-2	Tritium	5/21/92	11900	pCi/L		
299-W6-2	Tritium	8/07/92	8540	pCi/L		
299-W6-2	Tritium	2/05/93	12100	pCi/L		
299-W6-2	Tritium	5/18/93	495	pCi/L		
299-W6-2	Tritium	8/13/93	8640	pCi/L		
299-W6-2	Tritium	12/07/93	9490	pCi/L		
299-W6-2	Tritium	2/07/94	9840	pCi/L		
299-W6-2	Tritium	2/07/94	9950	pCi/L		
299-W6-2	Tritium	8/19/94	6350	pCi/L		
299-W6-2	Tritium	12/14/94	7510	pCi/L		
299-W6-2	Turbidity	7/21/89	1	NTU		
299-W6-2	Turbidity	7/21/89	1	NTU		
299-W6-2	Turbidity	9/07/89	1	NTU		
299-W6-2	Turbidity	1/12/90	3	NTU		
299-W6-2	Turbidity	5/10/90	1	NTU		
299-W6-2	Turbidity	8/12/91	1	NTU		
299-W6-2	Turbidity	11/13/91	1	NTU		
299-W6-2	Turbidity	2/27/92	1	NTU		
299-W6-2	Turbidity	2/27/92	1	NTU		
299-W6-2	Turbidity	5/21/92	2	NTU		
299-W6-2	Turbidity	8/07/92	1	NTU		
299-W6-2	Turbidity	12/08/92	0	NTU		
299-W6-2	Turbidity	2/05/93	0	NTU		
299-W6-2	Turbidity	5/18/93	3	NTU		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Turbidity	8/13/93	3	NTU		
299-W6-2	Turbidity	12/07/93	1	NTU		
299-W6-2	Turbidity	2/07/94	2	NTU		
299-W6-2	Turbidity	2/07/94	2	NTU		
299-W6-2	Turbidity	8/19/94	25	NTU		
299-W6-2	Uranium	10/07/88	1	pCi/L		
299-W6-2	Uranium	1/04/89	1	pCi/L		
299-W6-2	Uranium	5/09/89	1	pCi/L		
299-W6-2	Uranium	7/21/89	1	pCi/L		
299-W6-2	Uranium	7/21/89	2	pCi/L		
299-W6-2	Uranium	9/07/89	1	pCi/L		
299-W6-2	Uranium	1/12/90	1	pCi/L		
299-W6-2	Uranium	8/12/91	2	ppb		
299-W6-2	Uranium	8/12/91	2	ppb		
299-W6-2	Uranium	11/13/91	1	ppb		
299-W6-2	Uranium	2/27/92	1	ppb		
299-W6-2	Uranium	2/27/92	2	ppb		
299-W6-2	Uranium	5/21/92	2	ppb		
299-W6-2	Uranium	8/07/92	2	ppb		
299-W6-2	Uranium	12/08/92	2	ppb		
299-W6-2	Uranium	2/05/93	1	ppb		
299-W6-2	Uranium	5/18/93	1	ppb		
299-W6-2	Uranium	8/13/93	2	ppb		
299-W6-2	Uranium	2/07/94	2	ppb		
299-W6-2	Uranium	2/07/94	2	ppb		
299-W6-2	Uranium	8/19/94	2	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Vanadium	10/07/88	28	ppb		
299-W6-2	Vanadium	1/04/89	28	ppb		
299-W6-2	Vanadium	5/09/89	30	ppb		
299-W6-2	Vanadium	7/21/89	24	ppb		
299-W6-2	Vanadium	7/21/89	30	ppb		
299-W6-2	Vanadium	9/07/89	21	ppb		
299-W6-2	Vanadium	1/12/90	24	ppb		
299-W6-2	Vanadium	2/27/92	35	ppb		
299-W6-2	Vanadium	2/27/92	37	ppb		
299-W6-2	Vanadium	8/07/92	30	ppb		
299-W6-2	Vanadium	12/08/92	30	ppb		
299-W6-2	Vanadium	5/18/93	26	ppb		L
299-W6-2	Vanadium	12/07/93	27	ppb		L
299-W6-2	Vanadium	2/07/94	30	ppb		
299-W6-2	Vanadium	2/07/94	32	ppb		
299-W6-2	Vanadium	8/19/94	33	ppb		
299-W6-2	Vanadium, filtered	10/07/88	23	ppb	Y	
299-W6-2	Vanadium, filtered	1/04/89	23	ppb	Y	
299-W6-2	Vanadium, filtered	5/09/89	29	ppb	Y	
299-W6-2	Vanadium, filtered	7/21/89	27	ppb	Y	
299-W6-2	Vanadium, filtered	7/21/89	31	ppb	Y	
299-W6-2	Vanadium, filtered	9/07/89	22	ppb	Y	
299-W6-2	Vanadium, filtered	1/12/90	25	ppb	Y	
299-W6-2	Vanadium, filtered	4/03/90	26	ppb	Y	
299-W6-2	Vanadium, filtered	4/03/90	27	ppb	Y	
299-W6-2	Vanadium, filtered	8/07/92	30	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	Vanadium, filtered	12/08/92	40	ppb	Y	
299-W6-2	Vanadium, filtered	5/18/93	27	ppb	Y	L
299-W6-2	Vanadium, filtered	12/07/93	24	ppb	Y	L
299-W6-2	Vanadium, filtered	2/07/94	29	ppb	Y	L
299-W6-2	Vanadium, filtered	2/07/94	30	ppb	Y	
299-W6-2	Vanadium, filtered	8/19/94	30	ppb	Y	
299-W6-2	Zinc	10/07/88	44	ppb		
299-W6-2	Zinc	1/04/89	60	ppb		
299-W6-2	Zinc	1/12/90	9	ppb		
299-W6-2	Zinc	8/12/91	12	ppb		
299-W6-2	Zinc	5/18/93	8	ppb		L
299-W6-2	Zinc	8/13/93	21	ppb		
299-W6-2	Zinc	12/07/93	5	ppb		L
299-W6-2	Zinc	2/07/94	5	ppb		BL
299-W6-2	Zinc	2/07/94	7	ppb		BL
299-W6-2	Zinc	8/19/94	16	ppb		B
299-W6-2	Zinc, filtered	10/07/88	24	ppb	Y	
299-W6-2	Zinc, filtered	1/04/89	6	ppb	Y	
299-W6-2	Zinc, filtered	7/21/89	5	ppb	Y	
299-W6-2	Zinc, filtered	8/07/92	19	ppb	Y	
299-W6-2	Zinc, filtered	5/18/93	8	ppb	Y	L
299-W6-2	Zinc, filtered	8/13/93	16	ppb	Y	
299-W6-2	Zinc, filtered	12/07/93	2	ppb	Y	L
299-W6-2	Zinc, filtered	2/07/94	4	ppb	Y	BL
299-W6-2	Zinc, filtered	2/07/94	5	ppb	Y	BL
299-W6-2	Zinc, filtered	8/19/94	10	ppb	Y	LB

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	pH	10/07/88	8			
299-W6-2	pH	10/07/88	8			
299-W6-2	pH	10/07/88	8			
299-W6-2	pH	10/07/88	8			
299-W6-2	pH	1/04/89	8			
299-W6-2	pH	1/04/89	8			
299-W6-2	pH	5/09/89	8			
299-W6-2	pH	5/09/89	8			
299-W6-2	pH	7/21/89	8			
299-W6-2	pH	7/21/89	8			
299-W6-2	pH	7/21/89	8			
299-W6-2	pH	7/21/89	8			
299-W6-2	pH	9/07/89	8			
299-W6-2	pH	9/07/89	8			
299-W6-2	pH	9/07/89	8			
299-W6-2	pH	9/07/89	8			
299-W6-2	pH	9/07/89	8			
299-W6-2	pH	1/12/90	8			
299-W6-2	pH	1/12/90	8			
299-W6-2	pH	1/12/90	8			
299-W6-2	pH	1/12/90	8			
299-W6-2	pH	4/03/90	8			
299-W6-2	pH	4/03/90	8			
299-W6-2	pH	5/10/90	8			
299-W6-2	pH	5/10/90	8			
299-W6-2	pH	5/10/90	8			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	pH	5/10/90	8			
299-W6-2	pH	5/10/90	8			
299-W6-2	pH	8/12/91	8			
299-W6-2	pH	8/12/91	8			
299-W6-2	pH	8/12/91	8	pH		
299-W6-2	pH	8/12/91	8			
299-W6-2	pH	8/12/91	8	pH		
299-W6-2	pH	11/13/91	8			
299-W6-2	pH	11/20/91	8			
299-W6-2	pH	2/27/92	8			
299-W6-2	pH	3/26/92	7			
299-W6-2	pH	5/21/92	8			
299-W6-2	pH	5/21/92	8			
299-W6-2	pH	5/21/92	8			
299-W6-2	pH	5/21/92	8			
299-W6-2	pH	8/07/92	8			
299-W6-2	pH	12/08/92	8			
299-W6-2	pH	12/08/92	8			
299-W6-2	pH	12/08/92	8			
299-W6-2	pH	2/05/93	8			
299-W6-2	pH	2/05/93	8			
299-W6-2	pH	5/18/93	8			
299-W6-2	pH	5/18/93	8			
299-W6-2	pH	5/18/93	8			
299-W6-2	pH	5/18/93	8			
299-W6-2	pH	8/13/93	8			
299-W6-2	pH	12/07/93	8			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W6-2	pH	2/07/94	8			
299-W6-2	pH	2/07/94	8			
299-W6-2	pH	8/19/94	6			
299-W6-2	pH	8/19/94	6			
299-W6-2	pH	8/19/94	6			
299-W6-2	pH	8/19/94	6			
299-W6-2	pH	11/30/94	8			
299-W6-2	pH	11/30/94	8			
299-W6-2	pH	12/14/94	6			

Table A2-3. Upgradient Well 299-W10-1. (7 sheets)

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Acetone	9/02/92	2			J
299-W10-1	Aluminum	9/02/92	49			
299-W10-1	Aluminum, filtered	9/02/92	49		Y	
299-W10-1	Antimony	9/02/92	60			
299-W10-1	Antimony, filtered	9/02/92	60		Y	
299-W10-1	Arsenic	9/02/92	2			
299-W10-1	Arsenic, filtered	9/02/92	2		Y	
299-W10-1	Barium	9/02/92	284			
299-W10-1	Barium, filtered	9/02/92	282		Y	
299-W10-1	Benzene	1/11/94	0	ppb		L
299-W10-1	Beryllium	9/02/92	1			
299-W10-1	Beryllium, filtered	9/02/92	1		Y	
299-W10-1	Cadmium	9/02/92	7			
299-W10-1	Cadmium, filtered	9/02/92	7		Y	
299-W10-1	Calcium	9/02/92	258000			
299-W10-1	Calcium, filtered	9/02/92	258000		Y	
299-W10-1	Carbon tetrachloride	9/02/92	1300			E

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Carbon tetrachloride	1/11/94	1400	ppb		D
299-W10-1	Chloride	1/04/91	27	ppm		
299-W10-1	Chloride	1/11/94	35000	ppb		D
299-W10-1	Chloroform	9/02/92	2			J
299-W10-1	Chloroform	9/02/92	16			
299-W10-1	Chloroform	1/11/94	10	ppb		
299-W10-1	Chromium	9/02/92	264			
299-W10-1	Chromium, filtered	9/02/92	263		Y	
299-W10-1	Cobalt	9/02/92	9			
299-W10-1	Cobalt, filtered	9/02/92	9		Y	
299-W10-1	Cobalt-60	11/01/87	6	pCi/L		
299-W10-1	Cobalt-60	5/19/88	9	pCi/L		
299-W10-1	Cobalt-60	11/17/88	8	pCi/L		
299-W10-1	Cobalt-60	3/09/89	11	pCi/L		
299-W10-1	Copper	9/02/92	8			
299-W10-1	Copper, filtered	9/02/92	8		Y	
299-W10-1	Cyanide	9/02/92				
299-W10-1	Fluoride	1/11/94	2300	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Gross alpha	1/11/94	4	pCi/L		
299-W10-1	Gross beta	1/14/80	75	pCi/L		
299-W10-1	Gross beta	4/01/80	75	pCi/L		
299-W10-1	Gross beta	10/15/80	5	pCi/L		
299-W10-1	Gross beta	2/05/81	14	pCi/L		
299-W10-1	Gross beta	4/27/81	30	pCi/L		
299-W10-1	Gross beta	8/19/81	12	pCi/L		
299-W10-1	Gross beta	10/15/81	17	pCi/L		
299-W10-1	Gross beta	3/09/82	59	pCi/L		
299-W10-1	Gross beta	7/26/82	32	pCi/L		
299-W10-1	Gross beta	10/12/82	40	pCi/L		
299-W10-1	Gross beta	1/05/83	20	pCi/L		
299-W10-1	Gross beta	1/27/83	35	pCi/L		
299-W10-1	Gross beta	4/26/83	28	pCi/L		
299-W10-1	Gross beta	7/13/83	26	pCi/L		
299-W10-1	Gross beta	10/24/83	41	pCi/L		
299-W10-1	Gross beta	1/30/84	26	pCi/L		
299-W10-1	Gross beta	4/25/84	45	pCi/L		
299-W10-1	Gross beta	7/17/84	40	pCi/L		
299-W10-1	Gross beta	10/26/84	37	pCi/L		
299-W10-1	Gross beta	1/30/85	26	pCi/L		
299-W10-1	Gross beta	5/28/85	23	pCi/L		
299-W10-1	Gross beta	8/30/85	29	pCi/L		
299-W10-1	Gross beta	3/03/86	16	pCi/L		
299-W10-1	Gross beta	5/16/86	130	pCi/L		
299-W10-1	Gross beta	7/31/86	24	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Gross beta	1/21/87	30	pCi/L		
299-W10-1	Gross beta	6/29/87	34	pCi/L		
299-W10-1	Gross beta	9/22/87	34	pCi/L		
299-W10-1	Gross beta	11/01/87	40	pCi/L		
299-W10-1	Gross beta	2/29/88	46	pCi/L		
299-W10-1	Gross beta	5/19/88	49	pCi/L		
299-W10-1	Gross beta	7/28/88	32	pCi/L		
299-W10-1	Gross beta	11/17/88	34	pCi/L		
299-W10-1	Gross beta	3/09/89	44	pCi/L		
299-W10-1	Gross beta	9/26/89	46	pCi/L		
299-W10-1	Gross beta	1/11/94	72	pCi/L		
299-W10-1	Iron	9/02/92	752			
299-W10-1	Iron, filtered	9/02/92	15		Y	
299-W10-1	Lead	9/02/92	2			NW
299-W10-1	Lead, filtered	9/02/92	2		Y	NW
299-W10-1	Magnesium	9/02/92	79000			
299-W10-1	Magnesium, filtered	9/02/92	78800		Y	
299-W10-1	Manganese	9/02/92	17			
299-W10-1	Manganese, filtered	9/02/92	4		Y	
299-W10-1	Mercury	9/02/92	0			
299-W10-1	Mercury, filtered	9/02/92	0		Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Nickel	9/02/92	20			
299-W10-1	Nickel, filtered	9/02/92	20		Y	
299-W10-1	Nitrate	1/21/87	425000	ppb		
299-W10-1	Nitrate	2/01/88	550000	ppb		
299-W10-1	Nitrate	7/28/88	456000	ppb		
299-W10-1	Nitrate	1/04/91	529	ppm		
299-W10-1	Nitrate	1/11/94	******	ppb		D
299-W10-1	Phosphate	1/04/91	0	ppm		
299-W10-1	Potassium	9/02/92	9780			
299-W10-1	Potassium, filtered	9/02/92	9650		Y	
299-W10-1	Ruthenium-106	3/03/86	46	pCi/L		
299-W10-1	Selenium	9/02/92	20			W
299-W10-1	Selenium, filtered	9/02/92	20		Y	W
299-W10-1	Silver	9/02/92	10			
299-W10-1	Silver, filtered	9/02/92	10		Y	
299-W10-1	Sodium	9/02/92	146000			
299-W10-1	Sodium, filtered	9/02/92	146000		Y	
299-W10-1	Specific conductance	1/04/91	1703	umhos		
299-W10-1	Specific conductance	1/11/94	2500	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Specific conductance	1/11/94	2520	umhos		
299-W10-1	Strontium-90	5/16/86	1	pCi/L		
299-W10-1	Sulfate	1/04/91	62	ppm		
299-W10-1	Sulfate	1/11/94	61000	ppb		D
299-W10-1	Technetium-99	2/01/88	514	pCi/L		
299-W10-1	Technetium-99	7/28/88	500	pCi/L		
299-W10-1	Tetrachloroethene	1/11/94	0	ppb		L
299-W10-1	Thallium	9/02/92	2			
299-W10-1	Thallium, filtered	9/02/92	2		Y	
299-W10-1	Trichloroethene	9/02/92	12			
299-W10-1	Trichloroethene	1/11/94	13	ppb		
299-W10-1	Tritium	1/21/87	48900	pCi/L		
299-W10-1	Tritium	9/22/87	57700	pCi/L		
299-W10-1	Tritium	2/01/88	54800	pCi/L		
299-W10-1	Tritium	7/28/88	53700	pCi/L		
299-W10-1	Tritium	1/04/91	41700	pCi/L		
299-W10-1	Tritium	1/11/94	33900	pCi/L		
299-W10-1	Uranium	1/21/87	2	pCi/L		
299-W10-1	Uranium	9/22/87	3	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-1	Uranium	2/01/88	2	pCi/L		
299-W10-1	Uranium	7/28/88	2	pCi/L		
299-W10-1	Vanadium	9/02/92	43			
299-W10-1	Vanadium, filtered	9/02/92	39		Y	
299-W10-1	Zinc	9/02/92	7			
299-W10-1	Zinc, filtered	9/02/92	18		Y	
299-W10-1	pH	1/04/91	6			
299-W10-1	pH	9/02/92	7			
299-W10-1	pH	1/11/94	7			

Table A2-4. Upgradient Well 299-W10-9. (19 sheeets)

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Alkalinity	5/18/87	170000	ppb		
299-W10-9	Alkalinity	8/19/87	176000	ppb		
299-W10-9	Alkalinity	12/06/87	170000	ppb		
299-W10-9	Alkalinity	3/21/88	169000	ppb		
299-W10-9	Alkalinity	8/23/88	165000	ppb		
299-W10-9	Arsenic	3/21/88	16	ppb		
299-W10-9	Arsenic	2/28/90	20	ppb		
299-W10-9	Arsenic	7/22/91	19	ppb		
299-W10-9	Arsenic	10/03/91	17	ppb		
299-W10-9	Arsenic, filtered	5/18/87	16	ppb	Y	
299-W10-9	Arsenic, filtered	8/19/87	16	ppb	Y	
299-W10-9	Arsenic, filtered	12/06/87	17	ppb	Y	
299-W10-9	Arsenic, filtered	3/21/88	16	ppb	Y	
299-W10-9	Arsenic, filtered	2/28/90	15	ppb	Y	
299-W10-9	Arsenic, filtered	7/22/91	17	ppb	Y	
299-W10-9	Arsenic, filtered	10/03/91	16	ppb	Y	
299-W10-9	Barium	3/21/88	60	ppb		
299-W10-9	Barium	2/28/90	55	ppb		
299-W10-9	Barium	7/22/91	75	ppb		
299-W10-9	Barium	7/22/91	78	ppb		
299-W10-9	Barium	10/03/91	71	ppb		
299-W10-9	Barium, filtered	5/18/87	59	ppb	Y	
299-W10-9	Barium, filtered	8/19/87	59	ppb	Y	
299-W10-9	Barium, filtered	12/06/87	59	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Barium, filtered	3/21/88	59	ppb	Y	
299-W10-9	Barium, filtered	8/23/88	56	ppb	Y	
299-W10-9	Barium, filtered	2/28/90	52	ppb	Y	
299-W10-9	Barium, filtered	10/03/91	67	ppb	Y	
299-W10-9	Barium, filtered	5/05/93	50	ppb	Y	
299-W10-9	Boron	2/28/90	55	ppb		
299-W10-9	Boron, filtered	2/28/90	37	ppb	Y	
299-W10-9	Calcium	3/21/88	43500	ppb		
299-W10-9	Calcium	2/28/90	40100	ppb		
299-W10-9	Calcium	7/22/91	59000	ppb		
299-W10-9	Calcium	7/22/91	60000	ppb		
299-W10-9	Calcium	10/03/91	54000	ppb		
299-W10-9	Calcium, filtered	5/18/87	44500	ppb	Y	
299-W10-9	Calcium, filtered	8/19/87	33900	ppb	Y	
299-W10-9	Calcium, filtered	12/06/87	46300	ppb	Y	
299-W10-9	Calcium, filtered	3/21/88	45500	ppb	Y	
299-W10-9	Calcium, filtered	8/23/88	39000	ppb	Y	
299-W10-9	Calcium, filtered	2/28/90	42100	ppb	Y	
299-W10-9	Calcium, filtered	10/03/91	55000	ppb	Y	
299-W10-9	Calcium, filtered	5/05/93	41000	ppb	Y	
299-W10-9	Carbon tetrachloride	5/18/87	1960	ppb		
299-W10-9	Carbon tetrachloride	8/19/87	1450	ppb		
299-W10-9	Carbon tetrachloride	12/06/87	1220	ppb		
299-W10-9	Carbon tetrachloride	3/21/88	1700	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Carbon tetrachloride	8/23/88	2300	ppb		
299-W10-9	Carbon tetrachloride	5/05/93	1100	ppb		D
299-W10-9	Carbon tetrachloride	5/05/93	1300	ppb		
299-W10-9	Cesium-137	10/15/80	16	pCi/L		
299-W10-9	Cesium-137	2/05/81	1	pCi/L		
299-W10-9	Cesium-137	4/27/81	0	pCi/L		
299-W10-9	Cesium-137	8/19/81	1	pCi/L		
299-W10-9	Cesium-137	10/15/81	1	pCi/L		
299-W10-9	Cesium-137	1/28/82	1	pCi/L		
299-W10-9	Cesium-137	4/22/82	0	pCi/L		
299-W10-9	Cesium-137	10/12/82	1	pCi/L		
299-W10-9	Cesium-137	1/05/83	17	pCi/L		
299-W10-9	Cesium-137	4/26/83	4	pCi/L		
299-W10-9	Cesium-137	7/28/83	3	pCi/L		
299-W10-9	Cesium-137	1/30/84	2	pCi/L		
299-W10-9	Cesium-137	4/25/84	1	pCi/L		
299-W10-9	Cesium-137	7/17/84	5	pCi/L		
299-W10-9	Cesium-137	10/22/84	2	pCi/L		
299-W10-9	Chloride	5/18/87	18900	ppb		
299-W10-9	Chloride	8/19/87	19900	ppb		
299-W10-9	Chloride	12/06/87	19500	ppb		
299-W10-9	Chloride	3/21/88	21700	ppb		
299-W10-9	Chloride	8/23/88	20600	ppb		
299-W10-9	Chloride	2/28/90	21100	ppb		
299-W10-9	Chloride	7/22/91	25000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Chloride	10/03/91	24000	ppb		
299-W10-9	Chloride	5/05/93	27000	ppb		
299-W10-9	Chloroform	5/18/87	16	ppb		
299-W10-9	Chloroform	8/19/87	24	ppb		
299-W10-9	Chloroform	12/06/87	14	ppb		
299-W10-9	Chloroform	3/21/88	16	ppb		
299-W10-9	Chloroform	8/23/88	14	ppb		
299-W10-9	Chloroform	5/05/93	10	ppb		L
299-W10-9	Chloroform	5/05/93	12	ppb		
299-W10-9	Chromium	3/21/88	157	ppb		
299-W10-9	Chromium	2/28/90	181	ppb		
299-W10-9	Chromium	7/22/91	180	ppb		
299-W10-9	Chromium	7/22/91	220	ppb		
299-W10-9	Chromium	10/03/91	200	ppb		
299-W10-9	Chromium, filtered	5/18/87	143	ppb	Y	
299-W10-9	Chromium, filtered	8/19/87	136	ppb	Y	
299-W10-9	Chromium, filtered	12/06/87	152	ppb	Y	
299-W10-9	Chromium, filtered	3/21/88	152	ppb	Y	
299-W10-9	Chromium, filtered	8/23/88	140	ppb	Y	
299-W10-9	Chromium, filtered	2/28/90	135	ppb	Y	
299-W10-9	Chromium, filtered	10/03/91	170	ppb	Y	
299-W10-9	Chromium, filtered	5/05/93	130	ppb	Y	
299-W10-9	Cobalt-60	1/14/80	47	pCi/L		
299-W10-9	Cobalt-60	4/01/80	25	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Cobalt-60	7/22/80	28	pCi/L		
299-W10-9	Cobalt-60	10/15/80	25	pCi/L		
299-W10-9	Cobalt-60	2/05/81	34	pCi/L		
299-W10-9	Cobalt-60	4/27/81	24	pCi/L		
299-W10-9	Cobalt-60	8/19/81	29	pCi/L		
299-W10-9	Cobalt-60	10/15/81	22	pCi/L		
299-W10-9	Cobalt-60	1/28/82	20	pCi/L		
299-W10-9	Cobalt-60	4/22/82	27	pCi/L		
299-W10-9	Cobalt-60	7/26/82	7	pCi/L		
299-W10-9	Cobalt-60	10/12/82	18	pCi/L		
299-W10-9	Cobalt-60	1/05/83	6	pCi/L		
299-W10-9	Cobalt-60	1/27/83	28	pCi/L		
299-W10-9	Cobalt-60	4/26/83	8	pCi/L		
299-W10-9	Cobalt-60	7/13/83	18	pCi/L		
299-W10-9	Cobalt-60	7/28/83	15	pCi/L		
299-W10-9	Cobalt-60	10/18/83	13	pCi/L		
299-W10-9	Cobalt-60	1/30/84	22	pCi/L		
299-W10-9	Cobalt-60	4/25/84	21	pCi/L		
299-W10-9	Cobalt-60	7/17/84	5	pCi/L		
299-W10-9	Cobalt-60	10/22/84	11	pCi/L		
299-W10-9	Cobalt-60	1/23/85	7	pCi/L		
299-W10-9	Cobalt-60	4/12/85	14	pCi/L		
299-W10-9	Cobalt-60	8/27/85	13	pCi/L		
299-W10-9	Cobalt-60	11/18/85	12	pCi/L		
299-W10-9	Cobalt-60	3/03/86	8	pCi/L		
299-W10-9	Cobalt-60	5/16/86	12	pCi/L		
299-W10-9	Cobalt-60	1/21/87	13	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Cobalt-60	5/18/87	7	pCi/L		
299-W10-9	Cobalt-60	12/06/87	14	pCi/L		
299-W10-9	Ethylbenzene	5/05/93	0	ppb		L
299-W10-9	Fluoride	7/22/91	4300	ppb		
299-W10-9	Fluoride	10/03/91	4200	ppb		
299-W10-9	Fluoride	5/05/93	4900	ppb		
299-W10-9	Fluorine	5/18/87	4720	ppb		
299-W10-9	Fluorine	8/19/87	4070	ppb		
299-W10-9	Fluorine	8/19/87	4700	ppb		
299-W10-9	Fluorine	12/06/87	4900	ppb		
299-W10-9	Fluorine	12/06/87	5380	ppb		
299-W10-9	Fluorine	3/21/88	5050	ppb		
299-W10-9	Fluorine	8/23/88	4730	ppb		
299-W10-9	Fluorine	8/23/88	5200	ppb		
299-W10-9	Fluorine	2/28/90	4200	ppb		
299-W10-9	Gross alpha	1/14/80	17	pCi/L		
299-W10-9	Gross alpha	4/01/80	17	pCi/L		
299-W10-9	Gross alpha	7/22/80	17	pCi/L		
299-W10-9	Gross alpha	10/15/80	3	pCi/L		
299-W10-9	Gross alpha	2/05/81	5	pCi/L		
299-W10-9	Gross alpha	4/27/81	2	pCi/L		
299-W10-9	Gross alpha	8/19/81	4	pCi/L		
299-W10-9	Gross alpha	10/15/81	4	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Gross alpha	1/28/82	1	pCi/L		
299-W10-9	Gross alpha	4/22/82	3	pCi/L		
299-W10-9	Gross alpha	7/26/82	3	pCi/L		
299-W10-9	Gross alpha	10/12/82	4	pCi/L		
299-W10-9	Gross alpha	1/05/83	3	pCi/L		
299-W10-9	Gross alpha	1/27/83	2	pCi/L		
299-W10-9	Gross alpha	4/26/83	2	pCi/L		
299-W10-9	Gross alpha	7/13/83	3	pCi/L		
299-W10-9	Gross alpha	7/28/83	5	pCi/L		
299-W10-9	Gross alpha	10/18/83	8	pCi/L		
299-W10-9	Gross alpha	4/25/84	3	pCi/L		
299-W10-9	Gross alpha	7/17/84	1	pCi/L		
299-W10-9	Gross alpha	1/23/85	2	pCi/L		
299-W10-9	Gross alpha	4/12/85	2	pCi/L		
299-W10-9	Gross alpha	8/27/85	1	pCi/L		
299-W10-9	Gross alpha	11/18/85	2	pCi/L		
299-W10-9	Gross alpha	3/03/86	1	pCi/L		
299-W10-9	Gross alpha	5/16/86	3	pCi/L		
299-W10-9	Gross alpha	7/31/86	2	pCi/L		
299-W10-9	Gross alpha	1/21/87	2	pCi/L		
299-W10-9	Gross alpha	5/18/87	3	pCi/L		
299-W10-9	Gross alpha	5/18/87	3	pCi/L		
299-W10-9	Gross alpha	8/19/87	2	pCi/L		
299-W10-9	Gross alpha	12/06/87	3	pCi/L		
299-W10-9	Gross alpha	12/06/87	5	pCi/L		
299-W10-9	Gross alpha	2/28/88	4	pCi/L		
299-W10-9	Gross alpha	8/31/88	2	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Gross alpha	2/28/90	5	pCi/L		
299-W10-9	Gross alpha	7/22/91	1	pCi/L		
299-W10-9	Gross beta	1/14/80	80	pCi/L		
299-W10-9	Gross beta	4/01/80	110	pCi/L		
299-W10-9	Gross beta	7/22/80	100	pCi/L		
299-W10-9	Gross beta	10/15/80	100	pCi/L		
299-W10-9	Gross beta	2/05/81	83	pCi/L		
299-W10-9	Gross beta	4/27/81	78	pCi/L		
299-W10-9	Gross beta	8/19/81	29	pCi/L		
299-W10-9	Gross beta	10/15/81	61	pCi/L		
299-W10-9	Gross beta	1/28/82	57	pCi/L		
299-W10-9	Gross beta	4/22/82	66	pCi/L		
299-W10-9	Gross beta	7/26/82	82	pCi/L		
299-W10-9	Gross beta	10/12/82	73	pCi/L		
299-W10-9	Gross beta	1/05/83	89	pCi/L		
299-W10-9	Gross beta	1/27/83	116	pCi/L		
299-W10-9	Gross beta	4/26/83	66	pCi/L		
299-W10-9	Gross beta	7/13/83	63	pCi/L		
299-W10-9	Gross beta	7/28/83	64	pCi/L		
299-W10-9	Gross beta	10/18/83	158	pCi/L		
299-W10-9	Gross beta	1/30/84	65	pCi/L		
299-W10-9	Gross beta	4/25/84	116	pCi/L		
299-W10-9	Gross beta	7/17/84	136	pCi/L		
299-W10-9	Gross beta	10/22/84	91	pCi/L		
299-W10-9	Gross beta	1/23/85	47	pCi/L		
299-W10-9	Gross beta	4/12/85	42	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Gross beta	8/27/85	54	pCi/L		
299-W10-9	Gross beta	11/18/85	50	pCi/L		
299-W10-9	Gross beta	3/03/86	36	pCi/L		
299-W10-9	Gross beta	5/16/86	49	pCi/L		
299-W10-9	Gross beta	7/31/86	43	pCi/L		
299-W10-9	Gross beta	1/21/87	34	pCi/L		
299-W10-9	Gross beta	5/18/87	42	pCi/L		
299-W10-9	Gross beta	5/18/87	89	pCi/L		
299-W10-9	Gross beta	8/19/87	51	pCi/L		
299-W10-9	Gross beta	8/19/87	53	pCi/L		
299-W10-9	Gross beta	12/06/87	50	pCi/L		
299-W10-9	Gross beta	12/06/87	51	pCi/L		
299-W10-9	Gross beta	2/28/88	49	pCi/L		
299-W10-9	Gross beta	8/31/88	45	pCi/L		
299-W10-9	Gross beta	2/28/90	50	pCi/L		
299-W10-9	Gross beta	7/22/91	40	pCi/L		
299-W10-9	Gross beta	10/03/91	54	pCi/L		
299-W10-9	Iron	3/21/88	164	ppb		
299-W10-9	Iron	2/28/90	4200	ppb		
299-W10-9	Iron	7/22/91	2400	ppb		
299-W10-9	Iron	10/03/91	2200	ppb		
299-W10-9	Iron, filtered	12/06/87	31	ppb	Y	
299-W10-9	Iron, filtered	3/21/88	37	ppb	Y	
299-W10-9	Iron, filtered	8/23/88	49	ppb	Y	
299-W10-9	Iron, filtered	2/28/90	31	ppb	Y	
299-W10-9	Iron, filtered	10/03/91	21	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Lead	2/28/90	17	ppb		
299-W10-9	Lead	7/22/91	6	ppb		
299-W10-9	Magnesium	3/21/88	14700	ppb		
299-W10-9	Magnesium	2/28/90	13300	ppb		
299-W10-9	Magnesium	7/22/91	19000	ppb		
299-W10-9	Magnesium	7/22/91	20000	ppb		
299-W10-9	Magnesium	10/03/91	18000	ppb		
299-W10-9	Magnesium, filtered	5/18/87	15400	ppb	Y	
299-W10-9	Magnesium, filtered	8/19/87	13900	ppb	Y	
299-W10-9	Magnesium, filtered	12/06/87	15900	ppb	Y	
299-W10-9	Magnesium, filtered	3/21/88	15300	ppb	Y	
299-W10-9	Magnesium, filtered	8/23/88	13800	ppb	Y	
299-W10-9	Magnesium, filtered	2/28/90	13600	ppb	Y	
299-W10-9	Magnesium, filtered	10/03/91	19000	ppb	Y	
299-W10-9	Magnesium, filtered	5/05/93	14000	ppb	Y	
299-W10-9	Manganese	2/28/90	49	ppb		
299-W10-9	Manganese	7/22/91	37	ppb		
299-W10-9	Manganese	10/03/91	34	ppb		
299-W10-9	Methylene chloride	5/05/93	22	ppb		BL
299-W10-9	Nitrate	1/23/85	513	ppm		
299-W10-9	Nitrate	4/12/85	339	ppm		
299-W10-9	Nitrate	8/27/85	296	ppm		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Nitrate	11/18/85	414	ppm		
299-W10-9	Nitrate	3/03/86	361	ppm		
299-W10-9	Nitrate	5/16/86	433	ppm		
299-W10-9	Nitrate	7/31/86	269	ppm		
299-W10-9	Nitrate	1/21/87	397000	ppb		
299-W10-9	Nitrate	5/18/87	311000	ppb		
299-W10-9	Nitrate	5/18/87	324000	ppb		
299-W10-9	Nitrate	8/19/87	378000	ppb		
299-W10-9	Nitrate	8/19/87	381000	ppb		
299-W10-9	Nitrate	12/06/87	361000	ppb		
299-W10-9	Nitrate	12/06/87	377000	ppb		
299-W10-9	Nitrate	2/28/88	396000	ppb		
299-W10-9	Nitrate	3/21/88	356000	ppb		
299-W10-9	Nitrate	8/23/88	426000	ppb		
299-W10-9	Nitrate	8/31/88	371000	ppb		
299-W10-9	Nitrate	2/28/90	361000	ppb		
299-W10-9	Nitrate	7/22/91	495000	ppb		
299-W10-9	Nitrate	10/03/91	480000	ppb		
299-W10-9	Nitrate	5/05/93	350000	ppb		
299-W10-9	Potassium	3/21/88	4720	ppb		
299-W10-9	Potassium	2/28/90	4530	ppb		
299-W10-9	Potassium	7/22/91	6000	ppb		
299-W10-9	Potassium	7/22/91	6100	ppb		
299-W10-9	Potassium	10/03/91	5300	ppb		
299-W10-9	Potassium, filtered	5/18/87	4960	ppb	Y	
299-W10-9	Potassium, filtered	8/19/87	4580	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Potassium, filtered	12/06/87	5080	ppb	Y	
299-W10-9	Potassium, filtered	3/21/88	4890	ppb	Y	
299-W10-9	Potassium, filtered	8/23/88	4940	ppb	Y	
299-W10-9	Potassium, filtered	2/28/90	4550	ppb	Y	
299-W10-9	Potassium, filtered	10/03/91	5600	ppb	Y	
299-W10-9	Potassium, filtered	5/05/93	5000	ppb	Y	
299-W10-9	Potassium-40	10/03/91	359	pCi/L		
299-W10-9	Radium	10/03/91	0	pCi/L		
299-W10-9	Ruthenium-106	10/15/80	2	pCi/L		
299-W10-9	Ruthenium-106	2/05/81	150	pCi/L		
299-W10-9	Ruthenium-106	4/27/81	17	pCi/L		
299-W10-9	Ruthenium-106	8/19/81	6	pCi/L		
299-W10-9	Ruthenium-106	10/15/81	38	pCi/L		
299-W10-9	Ruthenium-106	1/28/82	15	pCi/L		
299-W10-9	Ruthenium-106	4/22/82	28	pCi/L		
299-W10-9	Ruthenium-106	10/12/82	15	pCi/L		
299-W10-9	Ruthenium-106	1/27/83	65	pCi/L		
299-W10-9	Ruthenium-106	4/26/83	6	pCi/L		
299-W10-9	Ruthenium-106	7/13/83	27	pCi/L		
299-W10-9	Ruthenium-106	7/28/83	12	pCi/L		
299-W10-9	Ruthenium-106	1/30/84	25	pCi/L		
299-W10-9	Ruthenium-106	4/25/84	67	pCi/L		
299-W10-9	Ruthenium-106	10/22/84	54	pCi/L		
299-W10-9	Ruthenium-106	1/23/85	19	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Ruthenium-106	8/19/87	55	pCi/L		
299-W10-9	Silicon	2/28/90	21100	ppb		
299-W10-9	Silicon, filtered	2/28/90	20900	ppb	Y	
299-W10-9	Sodium	3/21/88	191000	ppb		
299-W10-9	Sodium	2/28/90	170000	ppb		
299-W10-9	Sodium	7/22/91	200000	ppb		
299-W10-9	Sodium	10/03/91	190000	ppb		
299-W10-9	Sodium, filtered	5/18/87	178000	ppb	Y	
299-W10-9	Sodium, filtered	8/19/87	157000	ppb	Y	
299-W10-9	Sodium, filtered	12/06/87	185000	ppb	Y	
299-W10-9	Sodium, filtered	3/21/88	181000	ppb	Y	
299-W10-9	Sodium, filtered	8/23/88	178000	ppb	Y	
299-W10-9	Sodium, filtered	2/28/90	171000	ppb	Y	
299-W10-9	Sodium, filtered	10/03/91	200000	ppb	Y	
299-W10-9	Sodium, filtered	5/05/93	160000	ppb	Y	
299-W10-9	Specific conductance	5/18/87	1206	umhos		
299-W10-9	Specific conductance	8/19/87	1056	umhos		
299-W10-9	Specific conductance	12/06/87	1073	umhos		
299-W10-9	Specific conductance	3/21/88	1055	umhos		
299-W10-9	Specific conductance	8/23/88	923	umhos		
299-W10-9	Specific conductance	2/28/90	1088	umhos		
299-W10-9	Specific conductance	2/28/90	1093	umhos		
299-W10-9	Specific conductance	2/28/90	1094	umhos		
299-W10-9	Specific conductance	2/28/90	1110	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Specific conductance	7/22/91	1300	umhos		
299-W10-9	Specific conductance	7/22/91	1335	umhos		
299-W10-9	Specific conductance	7/22/91	1342	umhos		
299-W10-9	Specific conductance	7/22/91	1346	umhos		
299-W10-9	Specific conductance	7/22/91	1400	umhos		
299-W10-9	Specific conductance	10/03/91	1325	umhos		
299-W10-9	Specific conductance	10/03/91	1329	umhos		
299-W10-9	Specific conductance	10/03/91	1330	umhos		
299-W10-9	Specific conductance	5/05/93	1194	umhos		
299-W10-9	Strontium	3/21/88	245	ppb		
299-W10-9	Strontium	2/28/90	234	ppb		
299-W10-9	Strontium, filtered	12/06/87	252	ppb	Y	
299-W10-9	Strontium, filtered	3/21/88	249	ppb	Y	
299-W10-9	Strontium, filtered	8/23/88	233	ppb	Y	
299-W10-9	Strontium, filtered	2/28/90	239	ppb	Y	
299-W10-9	Strontium-90	10/03/91	1	pCi/L		
299-W10-9	Sulfate	5/18/87	58000	ppb		
299-W10-9	Sulfate	8/19/87	59300	ppb		
299-W10-9	Sulfate	12/06/87	57500	ppb		
299-W10-9	Sulfate	3/21/88	63500	ppb		
299-W10-9	Sulfate	8/23/88	65600	ppb		
299-W10-9	Sulfate	2/28/90	59800	ppb		
299-W10-9	Sulfate	7/22/91	59000	ppb		
299-W10-9	Sulfate	10/03/91	59000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Sulfate	5/05/93	62000	ppb		
299-W10-9	Technetium-99	7/22/91	310	pCi/L		
299-W10-9	Technetium-99	10/03/91	309	pCi/L		
299-W10-9	Technetium-99	5/05/93	385	pCi/L		
299-W10-9	Tetrachloroethene	5/05/93	0	ppb		L
299-W10-9	Total Carbon	8/19/87	38700	ppb		
299-W10-9	Total Carbon	12/06/87	38300	ppb		
299-W10-9	Total Carbon	3/21/88	39900	ppb		
299-W10-9	Total Carbon	8/23/88	38100	ppb		
299-W10-9	Total Carbon	2/28/90	38000	ppb		
299-W10-9	Total Carbon	7/22/91	43000	ppb		
299-W10-9	Total Carbon	10/03/91	42000	ppb		
299-W10-9	Total Organic Haloge	5/18/87	3720	ppb		
299-W10-9	Total Organic Haloge	8/19/87	1200	ppb		
299-W10-9	Total Organic Haloge	12/06/87	926	ppb		
299-W10-9	Total Organic Haloge	3/21/88	1110	ppb		
299-W10-9	Total Organic Haloge	2/28/90	1070	ppb		
299-W10-9	Total Organic Haloge	2/28/90	1100	ppb		
299-W10-9	Total Organic Haloge	2/28/90	1180	ppb		
299-W10-9	Total Organic Haloge	2/28/90	1510	ppb		
299-W10-9	Total Organic Haloge	7/22/91	700	ppb		
299-W10-9	Total Organic Haloge	7/22/91	810	ppb		
299-W10-9	Total Organic Haloge	7/22/91	870	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Total Organic Haloge	7/22/91	900	ppb		
299-W10-9	Total Organic Haloge	10/03/91	750	ppb		
299-W10-9	Total Organic Haloge	10/03/91	840	ppb		
299-W10-9	Total Organic Haloge	10/03/91	880	ppb		
299-W10-9	Total Organic Haloge	10/03/91	1200	ppb		
299-W10-9	Trichloroethene	5/18/87	21	ppb		
299-W10-9	Trichloroethene	8/19/87	16	ppb		
299-W10-9	Trichloroethene	12/06/87	19	ppb		
299-W10-9	Trichloroethene	3/21/88	15	ppb		
299-W10-9	Trichloroethene	8/23/88	19	ppb		
299-W10-9	Trichloroethene	5/05/93	10	ppb		L
299-W10-9	Trichloroethene	5/05/93	11	ppb		
299-W10-9	Tritium	1/21/87	70900	pCi/L		
299-W10-9	Tritium	8/19/87	70800	pCi/L		
299-W10-9	Tritium	2/28/88	65000	pCi/L		
299-W10-9	Tritium	8/31/88	59000	pCi/L		
299-W10-9	Tritium	2/28/90	57900	pCi/L		
299-W10-9	Tritium	7/22/91	45000	pCi/L		
299-W10-9	Tritium	10/03/91	42000	pCi/L		
299-W10-9	Tritium	5/05/93	38800	pCi/L		
299-W10-9	Turbidity	2/28/90	14	NTU		
299-W10-9	Turbidity	7/22/91	6	NTU		
299-W10-9	Turbidity	10/03/91	9	NTU		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Uranium	1/21/87	2	pCi/L		
299-W10-9	Uranium	8/19/87	2	pCi/L		
299-W10-9	Uranium	2/28/88	2	pCi/L		
299-W10-9	Uranium	8/31/88	2	pCi/L		
299-W10-9	Uranium	7/22/91	3	ppb		
299-W10-9	Uranium	10/03/91	3	ppb		
299-W10-9	Vanadium	3/21/88	67	ppb		
299-W10-9	Vanadium	2/28/90	74	ppb		
299-W10-9	Vanadium	7/22/91	58	ppb		
299-W10-9	Vanadium	7/22/91	68	ppb		
299-W10-9	Vanadium	10/03/91	63	ppb		
299-W10-9	Vanadium, filtered	5/18/87	60	ppb	Y	
299-W10-9	Vanadium, filtered	8/19/87	56	ppb	Y	
299-W10-9	Vanadium, filtered	12/06/87	65	ppb	Y	
299-W10-9	Vanadium, filtered	3/21/88	67	ppb	Y	
299-W10-9	Vanadium, filtered	8/23/88	71	ppb	Y	
299-W10-9	Vanadium, filtered	2/28/90	63	ppb	Y	
299-W10-9	Vanadium, filtered	10/03/91	61	ppb	Y	
299-W10-9	Vanadium, filtered	5/05/93	50	ppb	Y	
299-W10-9	Zinc	3/21/88	11	ppb		
299-W10-9	Zinc	2/28/90	739	ppb		
299-W10-9	Zinc	7/22/91	23	ppb		
299-W10-9	Zinc	10/03/91	12	ppb		
299-W10-9	Zinc, filtered	5/18/87	5	ppb	Y	
299-W10-9	Zinc, filtered	12/06/87	6	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	Zinc, filtered	2/28/90	17	ppb	Y	
299-W10-9	pH	5/18/87	8			
299-W10-9	pH	5/18/87	8			
299-W10-9	pH	8/19/87	8			
299-W10-9	pH	8/19/87	8			
299-W10-9	pH	12/06/87	6			
299-W10-9	pH	12/06/87	8			
299-W10-9	pH	3/21/88	8			
299-W10-9	pH	3/21/88	8			
299-W10-9	pH	8/23/88	8			
299-W10-9	pH	8/23/88	8			
299-W10-9	pH	2/28/90	8			
299-W10-9	pH	2/28/90	8			
299-W10-9	pH	2/28/90	8			
299-W10-9	pH	2/28/90	8			
299-W10-9	pH	7/22/91	7			
299-W10-9	pH	7/22/91	7	pH		
299-W10-9	pH	7/22/91	7			
299-W10-9	pH	7/22/91	7			
299-W10-9	pH	7/22/91	7			
299-W10-9	pH	7/22/91	7			
299-W10-9	pH	7/22/91	8			
299-W10-9	pH	7/22/91	8	pH		
299-W10-9	pH	7/22/91	8			
299-W10-9	pH	7/22/91	8	pH		
299-W10-9	pH	10/03/91	7			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-9	pH	10/03/91	7			
299-W10-9	pH	10/03/91	7			
299-W10-9	pH	5/05/93	7			

Table A2-5. Upgradient Well 299-W10-16. (31 sheets)

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Alkalinity	12/16/93	150	ppm		
299-W10-16	Alkalinity	3/17/94	150	ppm		
299-W10-16	Alkalinity	7/01/94	150	ppm		B
299-W10-16	Alkalinity	9/21/94	150	ppm		
299-W10-16	Alkalinity	11/29/94	150	ppm		
299-W10-16	Aluminum	2/27/90	175	ppb		
299-W10-16	Aluminum	6/21/93	34	ppb		L
299-W10-16	Aluminum	9/28/93	2300	ppb		
299-W10-16	Aluminum	12/16/93	71	ppb		L
299-W10-16	Aluminum	3/17/94	85	ppb		L
299-W10-16	Aluminum	7/01/94	87	ppb		LB
299-W10-16	Aluminum	9/21/94	51	ppb		L
299-W10-16	Aluminum	11/29/94	57	ppb		L
299-W10-16	Aluminum, filtered	6/21/93	120	ppb	Y	L
299-W10-16	Aluminum, filtered	7/01/94	33	ppb	Y	LB
299-W10-16	Ammonium ion	11/10/92	100	ppb		
299-W10-16	Ammonium ion	9/28/93	60	ppb		L
299-W10-16	Arsenic	1/27/92	6	ppb		
299-W10-16	Arsenic	4/20/92	5	ppb		
299-W10-16	Arsenic	3/05/93	6	ppb		
299-W10-16	Arsenic	6/21/93	6	ppb		
299-W10-16	Arsenic	9/28/93	8	ppb		
299-W10-16	Arsenic	12/16/93	6	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Arsenic	3/17/94	3	ppb		L
299-W10-16	Arsenic	7/01/94	4	ppb		L
299-W10-16	Arsenic	9/21/94	7	ppb		
299-W10-16	Arsenic	11/29/94	5	ppb		
299-W10-16	Arsenic, filtered	6/21/93	6	ppb	Y	
299-W10-16	Arsenic, filtered	9/28/93	7	ppb	Y	
299-W10-16	Arsenic, filtered	12/16/93	5	ppb	Y	
299-W10-16	Arsenic, filtered	3/17/94	3	ppb	Y	L
299-W10-16	Arsenic, filtered	7/01/94	5	ppb	Y	L
299-W10-16	Arsenic, filtered	9/21/94	7	ppb	Y	
299-W10-16	Arsenic, filtered	11/29/94	5	ppb	Y	
299-W10-16	Barium	2/27/90	47	ppb		
299-W10-16	Barium	7/22/91	0	ppb		
299-W10-16	Barium	7/22/91	46	ppb		
299-W10-16	Barium	9/24/91	43	ppb		
299-W10-16	Barium	1/27/92	40	ppb		
299-W10-16	Barium	4/20/92	45	ppb		
299-W10-16	Barium	7/13/92	38	ppb		
299-W10-16	Barium	11/10/92	40	ppb		
299-W10-16	Barium	3/05/93	40	ppb		
299-W10-16	Barium	6/21/93	37	ppb		
299-W10-16	Barium	9/28/93	55	ppb		
299-W10-16	Barium	12/16/93	36	ppb		
299-W10-16	Barium	3/17/94	34	ppb		
299-W10-16	Barium	7/01/94	35	ppb		
299-W10-16	Barium	9/21/94	31	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Barium	11/29/94	34	ppb		
299-W10-16	Barium, filtered	2/27/90	43	ppb	Y	
299-W10-16	Barium, filtered	7/22/91	46	ppb	Y	
299-W10-16	Barium, filtered	9/24/91	42	ppb	Y	
299-W10-16	Barium, filtered	1/27/92	42	ppb	Y	
299-W10-16	Barium, filtered	4/20/92	41	ppb	Y	
299-W10-16	Barium, filtered	7/13/92	38	ppb	Y	
299-W10-16	Barium, filtered	11/10/92	40	ppb	Y	
299-W10-16	Barium, filtered	3/05/93	30	ppb	Y	
299-W10-16	Barium, filtered	6/21/93	37	ppb	Y	
299-W10-16	Barium, filtered	9/28/93	36	ppb	Y	
299-W10-16	Barium, filtered	12/16/93	35	ppb	Y	
299-W10-16	Barium, filtered	3/17/94	34	ppb	Y	
299-W10-16	Barium, filtered	7/01/94	35	ppb	Y	
299-W10-16	Barium, filtered	9/21/94	31	ppb	Y	
299-W10-16	Barium, filtered	11/29/94	34	ppb	Y	
299-W10-16	Benzene	9/21/94	0	ppb		L
299-W10-16	Boron	2/27/90	52	ppb		
299-W10-16	Boron	7/22/91	0	ppb		
299-W10-16	Boron, filtered	2/27/90	34	ppb	Y	
299-W10-16	Bromide	1/27/92	400	ppb		
299-W10-16	Bromide	9/21/94	100	ppb		DU
299-W10-16	Bromide	11/29/94	200	ppb		L

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Calcium	2/27/90	29800	ppb		
299-W10-16	Calcium	7/22/91	36	ppb		
299-W10-16	Calcium	7/22/91	38000	ppb		
299-W10-16	Calcium	9/24/91	37000	ppb		
299-W10-16	Calcium	1/27/92	37000	ppb		
299-W10-16	Calcium	4/20/92	37000	ppb		
299-W10-16	Calcium	7/13/92	34000	ppb		
299-W10-16	Calcium	11/10/92	34000	ppb		
299-W10-16	Calcium	3/05/93	34000	ppb		
299-W10-16	Calcium	6/21/93	33000	ppb		
299-W10-16	Calcium	9/28/93	34000	ppb		
299-W10-16	Calcium	12/16/93	33000	ppb		
299-W10-16	Calcium	3/17/94	31000	ppb		
299-W10-16	Calcium	7/01/94	31000	ppb		
299-W10-16	Calcium	9/21/94	29000	ppb		
299-W10-16	Calcium	11/29/94	30000	ppb		
299-W10-16	Calcium, filtered	2/27/90	29400	ppb	Y	
299-W10-16	Calcium, filtered	7/22/91	39000	ppb	Y	
299-W10-16	Calcium, filtered	9/24/91	37000	ppb	Y	
299-W10-16	Calcium, filtered	1/27/92	38000	ppb	Y	
299-W10-16	Calcium, filtered	4/20/92	36000	ppb	Y	
299-W10-16	Calcium, filtered	7/13/92	35000	ppb	Y	
299-W10-16	Calcium, filtered	11/10/92	34000	ppb	Y	
299-W10-16	Calcium, filtered	3/05/93	34000	ppb	Y	
299-W10-16	Calcium, filtered	6/21/93	34000	ppb	Y	
299-W10-16	Calcium, filtered	9/28/93	33000	ppb	Y	
299-W10-16	Calcium, filtered	12/16/93	32000	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Calcium, filtered	3/17/94	32000	ppb	Y	
299-W10-16	Calcium, filtered	7/01/94	31000	ppb	Y	
299-W10-16	Calcium, filtered	9/21/94	29000	ppb	Y	
299-W10-16	Calcium, filtered	11/29/94	32000	ppb	Y	
299-W10-16	Carbon tetrachloride	1/27/92	690	ppb		
299-W10-16	Carbon tetrachloride	4/20/92	834	ppb		
299-W10-16	Carbon tetrachloride	12/16/93	910	ppb		D
299-W10-16	Carbon tetrachloride	3/17/94	690	ppb		D
299-W10-16	Carbon tetrachloride	7/01/94	790	ppb		D
299-W10-16	Carbon tetrachloride	9/21/94	810	ppb		D
299-W10-16	Carbon tetrachloride	11/29/94	1200	ppb		BDX
299-W10-16	Cesium-134	7/01/94	1	pCi/L		
299-W10-16	Chloride	2/27/90	23700	ppb		
299-W10-16	Chloride	7/22/91	32000	ppb		
299-W10-16	Chloride	9/24/91	34000	ppb		
299-W10-16	Chloride	1/27/92	34000	ppb		
299-W10-16	Chloride	4/20/92	33000	ppb		
299-W10-16	Chloride	7/13/92	34000	ppb		
299-W10-16	Chloride	11/10/92	30000	ppb		
299-W10-16	Chloride	3/05/93	30000	ppb		
299-W10-16	Chloride	6/21/93	30000	ppb		
299-W10-16	Chloride	9/28/93	30000	ppb		D
299-W10-16	Chloride	12/16/93	31000	ppb		D
299-W10-16	Chloride	3/17/94	30000	ppb		D

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Chloride	7/01/94	31000	ppb		D
299-W10-16	Chloride	9/21/94	31000	ppb		D
299-W10-16	Chloride	11/29/94	30000	ppb		D
299-W10-16	Chloroform	1/27/92	8	ppb		J
299-W10-16	Chloroform	4/20/92	11	ppb		
299-W10-16	Chloroform	12/16/93	6	ppb		
299-W10-16	Chloroform	3/17/94	8	ppb		
299-W10-16	Chloroform	7/01/94	7	ppb		
299-W10-16	Chloroform	9/21/94	7	ppb		
299-W10-16	Chloroform	11/29/94	10	ppb		
299-W10-16	Chromium	2/27/90	138	ppb		
299-W10-16	Chromium	7/22/91	0	ppb		
299-W10-16	Chromium	7/22/91	100	ppb		
299-W10-16	Chromium	9/24/91	350	ppb		
299-W10-16	Chromium	1/27/92	230	ppb		
299-W10-16	Chromium	4/20/92	360	ppb		
299-W10-16	Chromium	7/13/92	390	ppb		
299-W10-16	Chromium	11/10/92	50	ppb		
299-W10-16	Chromium	3/05/93	160	ppb		
299-W10-16	Chromium	6/21/93	97	ppb		
299-W10-16	Chromium	9/28/93	230	ppb		
299-W10-16	Chromium	12/16/93	300	ppb		
299-W10-16	Chromium	3/17/94	270	ppb		
299-W10-16	Chromium	7/01/94	370	ppb		
299-W10-16	Chromium	9/21/94	170	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Chromium	11/29/94	350	ppb		
299-W10-16	Chromium, filtered	2/27/90	41	ppb	Y	
299-W10-16	Chromium, filtered	7/22/91	35	ppb	Y	
299-W10-16	Chromium, filtered	9/24/91	27	ppb	Y	
299-W10-16	Chromium, filtered	1/27/92	38	ppb	Y	
299-W10-16	Chromium, filtered	4/20/92	30	ppb	Y	
299-W10-16	Chromium, filtered	7/13/92	36	ppb	Y	
299-W10-16	Chromium, filtered	11/10/92	30	ppb	Y	
299-W10-16	Chromium, filtered	3/05/93	50	ppb	Y	
299-W10-16	Chromium, filtered	6/21/93	44	ppb	Y	
299-W10-16	Chromium, filtered	12/16/93	41	ppb	Y	
299-W10-16	Chromium, filtered	3/17/94	43	ppb	Y	
299-W10-16	Chromium, filtered	7/01/94	45	ppb	Y	
299-W10-16	Chromium, filtered	9/21/94	41	ppb	Y	
299-W10-16	Chromium, filtered	11/29/94	51	ppb	Y	
299-W10-16	Cobalt	11/29/94	9	ppb		L
299-W10-16	Cobalt-60	3/05/93	10	pCi/L		
299-W10-16	Cobalt-60	12/16/93	2	pCi/L		
299-W10-16	Copper	2/27/90	10	ppb		
299-W10-16	Copper	7/22/91	27	ppb		
299-W10-16	Copper	9/24/91	23	ppb		
299-W10-16	Copper	4/20/92	36	ppb		
299-W10-16	Copper	7/13/92	27	ppb		
299-W10-16	Copper	12/16/93	9	ppb		L

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Copper	3/17/94	18	ppb		L
299-W10-16	Copper	7/01/94	18	ppb		L
299-W10-16	Copper	9/21/94	5	ppb		L
299-W10-16	Copper	11/29/94	14	ppb		L
299-W10-16	Copper, filtered	4/20/92	23	ppb	Y	
299-W10-16	Cyanide	9/28/93	1	ppb		UX
299-W10-16	Ethylbenzene	9/21/94	0	ppb		L
299-W10-16	Fluoride	7/22/91	2100	ppb		
299-W10-16	Fluoride	9/24/91	2100	ppb		
299-W10-16	Fluoride	1/27/92	1900	ppb		
299-W10-16	Fluoride	4/20/92	2300	ppb		
299-W10-16	Fluoride	7/13/92	2000	ppb		
299-W10-16	Fluoride	11/10/92	2800	ppb		
299-W10-16	Fluoride	3/05/93	2400	ppb		
299-W10-16	Fluoride	6/21/93	2400	ppb		
299-W10-16	Fluoride	9/28/93	2500	ppb		
299-W10-16	Fluoride	12/16/93	2600	ppb		
299-W10-16	Fluoride	3/17/94	2500	ppb		
299-W10-16	Fluoride	7/01/94	2700	ppb		
299-W10-16	Fluoride	9/21/94	2900	ppb		
299-W10-16	Fluoride	11/29/94	2600	ppb		
299-W10-16	Fluorine	2/27/90	1800	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Gross alpha	2/27/90	10	pCi/L		
299-W10-16	Gross alpha	9/24/91	2	pCi/L		
299-W10-16	Gross alpha	9/28/93	2	pCi/L		
299-W10-16	Gross alpha	3/17/94	3	pCi/L		
299-W10-16	Gross alpha	11/29/94	9	pCi/L		
299-W10-16	Gross beta	2/27/90	18	pCi/L		
299-W10-16	Gross beta	7/22/91	19	pCi/L		
299-W10-16	Gross beta	9/24/91	18	pCi/L		
299-W10-16	Gross beta	1/27/92	21	pCi/L		
299-W10-16	Gross beta	4/20/92	22	pCi/L		
299-W10-16	Gross beta	7/13/92	20	pCi/L		
299-W10-16	Gross beta	11/10/92	24	pCi/L		
299-W10-16	Gross beta	3/05/93	29	pCi/L		
299-W10-16	Gross beta	6/21/93	32	pCi/L		
299-W10-16	Gross beta	9/28/93	34	pCi/L		
299-W10-16	Gross beta	12/16/93	31	pCi/L		
299-W10-16	Gross beta	3/17/94	28	pCi/L		
299-W10-16	Gross beta	7/01/94	28	pCi/L		
299-W10-16	Gross beta	9/21/94	34	pCi/L		
299-W10-16	Gross beta	11/29/94	30	pCi/L		
299-W10-16	Iodine-129, Low leve	12/16/93	1	pCi/L		
299-W10-16	Iodine-129, Low leve	3/17/94	0	pCi/L		
299-W10-16	Iodine-129, Low leve	7/01/94	0	pCi/L		
299-W10-16	Iron	2/27/90	835	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Iron	7/22/91	0	ppb		
299-W10-16	Iron	7/22/91	610	ppb		
299-W10-16	Iron	9/24/91	1800	ppb		
299-W10-16	Iron	1/27/92	1200	ppb		
299-W10-16	Iron	4/20/92	1700	ppb		
299-W10-16	Iron	7/13/92	1700	ppb		
299-W10-16	Iron	11/10/92	160	ppb		
299-W10-16	Iron	3/05/93	570	ppb		
299-W10-16	Iron	6/21/93	440	ppb		
299-W10-16	Iron	9/28/93	11000	ppb		
299-W10-16	Iron	12/16/93	1400	ppb		
299-W10-16	Iron	3/17/94	1100	ppb		B
299-W10-16	Iron	7/01/94	1500	ppb		
299-W10-16	Iron	9/21/94	1100	ppb		
299-W10-16	Iron	11/29/94	1600	ppb		B
299-W10-16	Iron, filtered	7/22/91	39	ppb	Y	
299-W10-16	Iron, filtered	9/24/91	76	ppb	Y	
299-W10-16	Iron, filtered	1/27/92	86	ppb	Y	
299-W10-16	Iron, filtered	4/20/92	70	ppb	Y	
299-W10-16	Iron, filtered	7/13/92	55	ppb	Y	
299-W10-16	Iron, filtered	11/10/92	30	ppb	Y	
299-W10-16	Iron, filtered	3/05/93	40	ppb	Y	
299-W10-16	Iron, filtered	6/21/93	96	ppb	Y	
299-W10-16	Iron, filtered	9/28/93	39	ppb	Y	
299-W10-16	Iron, filtered	12/16/93	25	ppb	Y	
299-W10-16	Iron, filtered	3/17/94	63	ppb	Y	B
299-W10-16	Iron, filtered	7/01/94	53	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Iron, filtered	9/21/94	38	ppb	Y	
299-W10-16	Iron, filtered	11/29/94	38	ppb	Y	B
299-W10-16	Lead	1/27/92	5	ppb		
299-W10-16	Lead	6/21/93	2	ppb		L
299-W10-16	Lead	9/28/93	5	ppb		
299-W10-16	Lead	12/16/93	2	ppb		L
299-W10-16	Lead	3/17/94	1	ppb		L
299-W10-16	Lead	7/01/94	5	ppb		BL
299-W10-16	Lead	9/21/94	3	ppb		BL
299-W10-16	Lead	11/29/94	11	ppb		
299-W10-16	Lead, filtered	11/10/92	6	ppb	Y	
299-W10-16	Lead, filtered	12/16/93	1	ppb	Y	L
299-W10-16	Lead, filtered	3/17/94	1	ppb	Y	L
299-W10-16	Lead, filtered	7/01/94	1	ppb	Y	BL
299-W10-16	Magnesium	2/27/90	9300	ppb		
299-W10-16	Magnesium	7/22/91	11	ppb		
299-W10-16	Magnesium	7/22/91	11000	ppb		
299-W10-16	Magnesium	9/24/91	11000	ppb		
299-W10-16	Magnesium	1/27/92	12000	ppb		
299-W10-16	Magnesium	4/20/92	11000	ppb		
299-W10-16	Magnesium	7/13/92	9900	ppb		
299-W10-16	Magnesium	11/10/92	10000	ppb		
299-W10-16	Magnesium	3/05/93	10000	ppb		
299-W10-16	Magnesium	6/21/93	10000	ppb		
299-W10-16	Magnesium	9/28/93	11000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Magnesium	12/16/93	10000	ppb		
299-W10-16	Magnesium	3/17/94	9500	ppb		
299-W10-16	Magnesium	7/01/94	9400	ppb		
299-W10-16	Magnesium	9/21/94	8900	ppb		
299-W10-16	Magnesium	11/29/94	9300	ppb		
299-W10-16	Magnesium, filtered	2/27/90	8880	ppb	Y	
299-W10-16	Magnesium, filtered	7/22/91	11000	ppb	Y	
299-W10-16	Magnesium, filtered	9/24/91	11000	ppb	Y	
299-W10-16	Magnesium, filtered	1/27/92	12000	ppb	Y	
299-W10-16	Magnesium, filtered	4/20/92	11000	ppb	Y	
299-W10-16	Magnesium, filtered	7/13/92	10000	ppb	Y	
299-W10-16	Magnesium, filtered	11/10/92	10000	ppb	Y	
299-W10-16	Magnesium, filtered	3/05/93	10000	ppb	Y	
299-W10-16	Magnesium, filtered	6/21/93	10000	ppb	Y	
299-W10-16	Magnesium, filtered	9/28/93	10000	ppb	Y	
299-W10-16	Magnesium, filtered	12/16/93	10000	ppb	Y	
299-W10-16	Magnesium, filtered	3/17/94	9700	ppb	Y	
299-W10-16	Magnesium, filtered	7/01/94	9500	ppb	Y	
299-W10-16	Magnesium, filtered	9/21/94	9000	ppb	Y	
299-W10-16	Magnesium, filtered	11/29/94	9600	ppb	Y	
299-W10-16	Manganese	2/27/90	20	ppb		
299-W10-16	Manganese	9/24/91	30	ppb		
299-W10-16	Manganese	1/27/92	18	ppb		
299-W10-16	Manganese	4/20/92	34	ppb		
299-W10-16	Manganese	7/13/92	32	ppb		
299-W10-16	Manganese	3/05/93	10	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Manganese	9/28/93	100	ppb		
299-W10-16	Manganese	12/16/93	27	ppb		
299-W10-16	Manganese	3/17/94	22	ppb		
299-W10-16	Manganese	7/01/94	31	ppb		
299-W10-16	Manganese	9/21/94	20	ppb		
299-W10-16	Manganese	11/29/94	32	ppb		
299-W10-16	Manganese, filtered	9/28/93	18	ppb	Y	
299-W10-16	Manganese, filtered	12/16/93	3	ppb	Y	L
299-W10-16	Manganese, filtered	3/17/94	2	ppb	Y	L
299-W10-16	Manganese, filtered	7/01/94	3	ppb	Y	L
299-W10-16	Manganese, filtered	9/21/94	3	ppb	Y	L
299-W10-16	Manganese, filtered	11/29/94	3	ppb	Y	L
299-W10-16	Mercury	9/21/94	0	ppb		L
299-W10-16	Nickel	2/27/90	49	ppb		
299-W10-16	Nickel	9/24/91	150	ppb		
299-W10-16	Nickel	1/27/92	72	ppb		
299-W10-16	Nickel	4/20/92	180	ppb		
299-W10-16	Nickel	7/13/92	150	ppb		
299-W10-16	Nickel	3/05/93	70	ppb		
299-W10-16	Nickel	9/28/93	130	ppb		
299-W10-16	Nickel	12/16/93	120	ppb		
299-W10-16	Nickel	3/17/94	120	ppb		
299-W10-16	Nickel	7/01/94	280	ppb		
299-W10-16	Nickel	9/21/94	75	ppb		
299-W10-16	Nickel	11/29/94	160	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Nickel, filtered	3/17/94	24	ppb	Y	L
299-W10-16	Nickel, filtered	9/21/94	24	ppb	Y	L
299-W10-16	Nitrate	2/27/90	163000	ppb		
299-W10-16	Nitrate	7/22/91	195000	ppb		
299-W10-16	Nitrate	9/24/91	196000	ppb		
299-W10-16	Nitrate	1/27/92	170000	ppb		
299-W10-16	Nitrate	4/20/92	170000	ppb		
299-W10-16	Nitrate	7/13/92	160000	ppb		
299-W10-16	Nitrate	11/10/92	160000	ppb		
299-W10-16	Nitrate	3/05/93	140000	ppb		
299-W10-16	Nitrate	6/21/93	150000	ppb		
299-W10-16	Nitrate	9/28/93	150000	ppb		D
299-W10-16	Nitrate	12/16/93	150000	ppb		D
299-W10-16	Nitrate	3/17/94	160000	ppb		D
299-W10-16	Nitrate	7/01/94	160000	ppb		D
299-W10-16	Nitrate	9/21/94	140000	ppb		D
299-W10-16	Nitrate	11/29/94	130000	ppb		D
299-W10-16	Perchlorate	9/28/93	300	ppb		L
299-W10-16	Potassium	2/27/90	4120	ppb		
299-W10-16	Potassium	7/22/91	5	ppb		
299-W10-16	Potassium	7/22/91	4100	ppb		
299-W10-16	Potassium	9/24/91	4200	ppb		
299-W10-16	Potassium	1/27/92	3800	ppb		
299-W10-16	Potassium	4/20/92	4000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Potassium	7/13/92	3000	ppb		
299-W10-16	Potassium	11/10/92	4000	ppb		
299-W10-16	Potassium	3/05/93	4000	ppb		
299-W10-16	Potassium	6/21/93	3400	ppb		
299-W10-16	Potassium	9/28/93	4400	ppb		
299-W10-16	Potassium	12/16/93	3700	ppb		
299-W10-16	Potassium	3/17/94	4000	ppb		
299-W10-16	Potassium	7/01/94	3900	ppb		
299-W10-16	Potassium	9/21/94	3700	ppb		
299-W10-16	Potassium	11/29/94	3700	ppb		
299-W10-16	Potassium, filtered	2/27/90	3990	ppb	Y	
299-W10-16	Potassium, filtered	7/22/91	4600	ppb	Y	
299-W10-16	Potassium, filtered	9/24/91	4100	ppb	Y	
299-W10-16	Potassium, filtered	1/27/92	4700	ppb	Y	
299-W10-16	Potassium, filtered	4/20/92	3400	ppb	Y	
299-W10-16	Potassium, filtered	7/13/92	3700	ppb	Y	
299-W10-16	Potassium, filtered	11/10/92	3400	ppb	Y	
299-W10-16	Potassium, filtered	3/05/93	4200	ppb	Y	
299-W10-16	Potassium, filtered	6/21/93	3800	ppb	Y	
299-W10-16	Potassium, filtered	9/28/93	4100	ppb	Y	
299-W10-16	Potassium, filtered	12/16/93	3700	ppb	Y	
299-W10-16	Potassium, filtered	3/17/94	3900	ppb	Y	
299-W10-16	Potassium, filtered	7/01/94	3900	ppb	Y	
299-W10-16	Potassium, filtered	9/21/94	3500	ppb	Y	
299-W10-16	Potassium, filtered	11/29/94	4000	ppb	Y	
299-W10-16	Potassium-40	12/16/93	33	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Potassium-40	7/01/94	80	pCi/L		
299-W10-16	Potassium-40	9/21/94	59	pCi/L		
299-W10-16	Potassium-40	11/29/94	51	pCi/L		
299-W10-16	Radium	2/27/90	2	pCi/L		
299-W10-16	Radium	9/28/93	1	pCi/L		
299-W10-16	Ruthenium-106	11/10/92	4	pCi/L		
299-W10-16	Selenium	2/27/90	6	ppb		
299-W10-16	Selenium	6/21/93	4	ppb		L
299-W10-16	Selenium	9/28/93	4	ppb		L
299-W10-16	Selenium	12/16/93	5	ppb		L
299-W10-16	Selenium	3/17/94	4	ppb		L
299-W10-16	Selenium	7/01/94	4	ppb		L
299-W10-16	Selenium	9/21/94	3	ppb		L
299-W10-16	Selenium	11/29/94	6	ppb		L
299-W10-16	Selenium, filtered	6/21/93	3	ppb	Y	L
299-W10-16	Selenium, filtered	9/28/93	5	ppb	Y	L
299-W10-16	Selenium, filtered	12/16/93	5	ppb	Y	L
299-W10-16	Selenium, filtered	3/17/94	5	ppb	Y	L
299-W10-16	Selenium, filtered	7/01/94	4	ppb	Y	L
299-W10-16	Selenium, filtered	9/21/94	3	ppb	Y	L
299-W10-16	Selenium, filtered	11/29/94	5	ppb	Y	L
299-W10-16	Silicon	2/27/90	20100	ppb		
299-W10-16	Silicon, filtered	2/27/90	19500	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Silver	7/01/94	5	ppb		LB
299-W10-16	Silver, filtered	7/01/94	4	ppb	Y	LB
299-W10-16	Sodium	2/27/90	119000	ppb		
299-W10-16	Sodium	7/22/91	119	ppb		
299-W10-16	Sodium	7/22/91	120000	ppb		
299-W10-16	Sodium	9/24/91	120000	ppb		
299-W10-16	Sodium	1/27/92	110000	ppb		
299-W10-16	Sodium	4/20/92	120000	ppb		
299-W10-16	Sodium	7/13/92	110000	ppb		
299-W10-16	Sodium	11/10/92	110000	ppb		
299-W10-16	Sodium	3/05/93	110000	ppb		
299-W10-16	Sodium	6/21/93	110000	ppb		
299-W10-16	Sodium	9/28/93	110000	ppb		
299-W10-16	Sodium	12/16/93	120000	ppb		B
299-W10-16	Sodium	3/17/94	110000	ppb		B
299-W10-16	Sodium	7/01/94	110000	ppb		
299-W10-16	Sodium	9/21/94	110000	ppb		B
299-W10-16	Sodium	11/29/94	120000	ppb		B
299-W10-16	Sodium, filtered	2/27/90	113000	ppb	Y	
299-W10-16	Sodium, filtered	7/22/91	120000	ppb	Y	
299-W10-16	Sodium, filtered	9/24/91	120000	ppb	Y	
299-W10-16	Sodium, filtered	1/27/92	120000	ppb	Y	
299-W10-16	Sodium, filtered	4/20/92	110000	ppb	Y	
299-W10-16	Sodium, filtered	7/13/92	110000	ppb	Y	
299-W10-16	Sodium, filtered	11/10/92	110000	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Sodium, filtered	3/05/93	110000	ppb	Y	
299-W10-16	Sodium, filtered	6/21/93	110000	ppb	Y	
299-W10-16	Sodium, filtered	9/28/93	110000	ppb	Y	
299-W10-16	Sodium, filtered	12/16/93	110000	ppb	Y	B
299-W10-16	Sodium, filtered	3/17/94	110000	ppb	Y	B
299-W10-16	Sodium, filtered	7/01/94	110000	ppb	Y	
299-W10-16	Sodium, filtered	9/21/94	110000	ppb	Y	B
299-W10-16	Sodium, filtered	11/29/94	120000	ppb	Y	B
299-W10-16	Specific conductance	2/27/90	764	umhos		
299-W10-16	Specific conductance	7/22/91	840	umhos		
299-W10-16	Specific conductance	7/22/91	850	umhos		
299-W10-16	Specific conductance	7/22/91	860	umhos		
299-W10-16	Specific conductance	7/22/91	880	umhos		
299-W10-16	Specific conductance	7/22/91	885	umhos		
299-W10-16	Specific conductance	7/22/91	888	umhos		
299-W10-16	Specific conductance	9/24/91	873	umhos		
299-W10-16	Specific conductance	9/24/91	876	umhos		
299-W10-16	Specific conductance	9/24/91	877	umhos		
299-W10-16	Specific conductance	9/24/91	880	umhos		
299-W10-16	Specific conductance	11/25/91	834	umhos		
299-W10-16	Specific conductance	1/27/92	823	umhos		
299-W10-16	Specific conductance	1/27/92	826	umhos		
299-W10-16	Specific conductance	1/27/92	830	umhos		
299-W10-16	Specific conductance	4/20/92	795	umhos		
299-W10-16	Specific conductance	4/20/92	801	umhos		
299-W10-16	Specific conductance	4/20/92	802	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Specific conductance	4/20/92	811	umhos		
299-W10-16	Specific conductance	7/13/92	795	umhos		
299-W10-16	Specific conductance	7/13/92	796	umhos		
299-W10-16	Specific conductance	11/10/92	769	umhos		
299-W10-16	Specific conductance	11/10/92	773	umhos		
299-W10-16	Specific conductance	11/10/92	777	umhos		
299-W10-16	Specific conductance	3/05/93	760	umhos		
299-W10-16	Specific conductance	3/05/93	788	umhos		
299-W10-16	Specific conductance	3/05/93	789	umhos		
299-W10-16	Specific conductance	3/05/93	794	umhos		
299-W10-16	Specific conductance	4/29/93	742	umhos		
299-W10-16	Specific conductance	4/29/93	756	umhos		
299-W10-16	Specific conductance	4/29/93	758	umhos		
299-W10-16	Specific conductance	4/29/93	759	umhos		
299-W10-16	Specific conductance	4/29/93	762	umhos		
299-W10-16	Specific conductance	4/29/93	764	umhos		
299-W10-16	Specific conductance	6/21/93	750	umhos		
299-W10-16	Specific conductance	6/21/93	778	umhos		
299-W10-16	Specific conductance	6/21/93	779	umhos		
299-W10-16	Specific conductance	6/21/93	780	umhos		
299-W10-16	Specific conductance	9/28/93	766	umhos		
299-W10-16	Specific conductance	9/28/93	770	umhos		
299-W10-16	Specific conductance	9/28/93	771	umhos		
299-W10-16	Specific conductance	9/28/93	773	umhos		
299-W10-16	Specific conductance	9/28/93	780	umhos		
299-W10-16	Specific conductance	12/16/93	767	umhos		
299-W10-16	Specific conductance	12/16/93	770	umhos		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Specific conductance	12/16/93	775	umhos		
299-W10-16	Specific conductance	12/16/93	777	umhos		
299-W10-16	Specific conductance	12/16/93	780	umhos		
299-W10-16	Specific conductance	3/17/94	769	umhos		
299-W10-16	Specific conductance	3/17/94	771	umhos		
299-W10-16	Specific conductance	3/17/94	772	umhos		
299-W10-16	Specific conductance	3/17/94	790	umhos		
299-W10-16	Specific conductance	7/01/94	770	umhos		
299-W10-16	Specific conductance	7/01/94	795	umhos		
299-W10-16	Specific conductance	7/01/94	798	umhos		
299-W10-16	Specific conductance	7/01/94	799	umhos		
299-W10-16	Specific conductance	9/21/94	684	umhos		
299-W10-16	Specific conductance	9/21/94	770	umhos		
299-W10-16	Specific conductance	11/29/94	766	umhos		
299-W10-16	Specific conductance	11/29/94	770	umhos		
299-W10-16	Strontium	2/27/90	175	ppb		
299-W10-16	Strontium, filtered	2/27/90	169	ppb	Y	
299-W10-16	Strontium-90	3/17/94	0	pCi/L		
299-W10-16	Sulfate	2/27/90	56500	ppb		
299-W10-16	Sulfate	7/22/91	60000	ppb		
299-W10-16	Sulfate	9/24/91	62000	ppb		
299-W10-16	Sulfate	1/27/92	67000	ppb		
299-W10-16	Sulfate	4/20/92	67000	ppb		
299-W10-16	Sulfate	7/13/92	64000	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Sulfate	11/10/92	65000	ppb		
299-W10-16	Sulfate	3/05/93	62000	ppb		
299-W10-16	Sulfate	6/21/93	61000	ppb		
299-W10-16	Sulfate	9/28/93	64000	ppb		D
299-W10-16	Sulfate	12/16/93	64000	ppb		D
299-W10-16	Sulfate	3/17/94	66000	ppb		D
299-W10-16	Sulfate	7/01/94	64000	ppb		D
299-W10-16	Sulfate	9/21/94	62000	ppb		D
299-W10-16	Sulfate	11/29/94	59000	ppb		D
299-W10-16	Sulfide	6/21/93	400	ppb		LB
299-W10-16	Technetium-99	7/22/91	99	pCi/L		
299-W10-16	Technetium-99	9/24/91	96	pCi/L		
299-W10-16	Technetium-99	1/27/92	131	pCi/L		
299-W10-16	Technetium-99	4/20/92	118	pCi/L		
299-W10-16	Technetium-99	7/13/92	123	pCi/L		
299-W10-16	Technetium-99	11/10/92	127	pCi/L		
299-W10-16	Technetium-99	3/05/93	70	pCi/L		
299-W10-16	Technetium-99	6/21/93	107	pCi/L		
299-W10-16	Technetium-99	9/28/93	115	pCi/L		
299-W10-16	Technetium-99	12/16/93	125	pCi/L		
299-W10-16	Technetium-99	3/17/94	118	pCi/L		
299-W10-16	Technetium-99	7/01/94	107	pCi/L		
299-W10-16	Technetium-99	9/21/94	116	pCi/L		
299-W10-16	Technetium-99	11/29/94	113	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Tetrachloroethene	4/20/92	1	ppb		
299-W10-16	Tetrachloroethene	12/16/93	0	ppb		L
299-W10-16	Tetrachloroethene	3/17/94	1	ppb		
299-W10-16	Tetrachloroethene	7/01/94	0	ppb		LX
299-W10-16	Tetrachloroethene	9/21/94	1	ppb		
299-W10-16	Tetrachloroethene	11/29/94	0	ppb		L
299-W10-16	Thallium, filtered	11/29/94	1	ppb	Y	L
299-W10-16	Toluene	9/21/94	0	ppb		BL
299-W10-16	Total Carbon	2/27/90	35200	ppb		
299-W10-16	Total Carbon	7/22/91	36000	ppb		
299-W10-16	Total Carbon	9/24/91	34000	ppb		
299-W10-16	Total Carbon	1/27/92	36000	ppb		
299-W10-16	Total Carbon	4/20/92	35000	ppb		
299-W10-16	Total Carbon	7/13/92	35000	ppb		
299-W10-16	Total Carbon	11/10/92	31000	ppb		
299-W10-16	Total Carbon	3/05/93	33000	ppb		
299-W10-16	Total Carbon	6/21/93	36000	ppb		B
299-W10-16	Total Carbon	9/28/93	35000	ppb		B
299-W10-16	Total Dissolved Soli	6/21/93	520	ppm		
299-W10-16	Total Dissolved Soli	9/28/93	520	ppm		
299-W10-16	Total Dissolved Soli	12/16/93	520	ppm		
299-W10-16	Total Dissolved Soli	3/17/94	530	ppm		
299-W10-16	Total Dissolved Soli	7/01/94	500	ppm		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Total Dissolved Soli	9/21/94	500	ppm		
299-W10-16	Total Dissolved Soli	11/29/94	500	ppm		
299-W10-16	Total Organic Carbon	6/21/93	300	ppb		L
299-W10-16	Total Organic Carbon	6/21/93	400	ppb		L
299-W10-16	Total Organic Carbon	9/28/93	500	ppb		LB
299-W10-16	Total Organic Carbon	9/28/93	600	ppb		LB
299-W10-16	Total Organic Carbon	12/16/93	300	ppb		L
299-W10-16	Total Organic Carbon	12/16/93	400	ppb		L
299-W10-16	Total Organic Carbon	3/17/94	330	ppb		L
299-W10-16	Total Organic Carbon	3/17/94	340	ppb		L
299-W10-16	Total Organic Carbon	7/01/94	340	ppb		L
299-W10-16	Total Organic Carbon	7/01/94	400	ppb		L
299-W10-16	Total Organic Carbon	7/01/94	500	ppb		L
299-W10-16	Total Organic Carbon	11/29/94	200	ppb		L
299-W10-16	Total Organic Haloge	2/27/90	768	ppb		
299-W10-16	Total Organic Haloge	2/27/90	771	ppb		
299-W10-16	Total Organic Haloge	2/27/90	801	ppb		
299-W10-16	Total Organic Haloge	2/27/90	802	ppb		
299-W10-16	Total Organic Haloge	7/22/91	270	ppb		
299-W10-16	Total Organic Haloge	7/22/91	500	ppb		
299-W10-16	Total Organic Haloge	7/22/91	520	ppb		
299-W10-16	Total Organic Haloge	7/22/91	600	ppb		
299-W10-16	Total Organic Haloge	9/24/91	540	ppb		
299-W10-16	Total Organic Haloge	9/24/91	630	ppb		
299-W10-16	Total Organic Haloge	9/24/91	650	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Total Organic Haloge	9/24/91	660	ppb		
299-W10-16	Total Organic Haloge	1/27/92	560	ppb		
299-W10-16	Total Organic Haloge	1/27/92	660	ppb		
299-W10-16	Total Organic Haloge	1/27/92	710	ppb		
299-W10-16	Total Organic Haloge	1/27/92	1100	ppb		
299-W10-16	Total Organic Haloge	4/20/92	770	ppb		
299-W10-16	Total Organic Haloge	4/20/92	920	ppb		
299-W10-16	Total Organic Haloge	4/20/92	950	ppb		
299-W10-16	Total Organic Haloge	4/20/92	1100	ppb		
299-W10-16	Total Organic Haloge	7/13/92	210	ppb		
299-W10-16	Total Organic Haloge	7/13/92	220	ppb		
299-W10-16	Total Organic Haloge	7/13/92	510	ppb		
299-W10-16	Total Organic Haloge	7/13/92	520	ppb		
299-W10-16	Total Organic Haloge	7/13/92	530	ppb		
299-W10-16	Total Organic Haloge	7/13/92	560	ppb		
299-W10-16	Total Organic Haloge	7/13/92	620	ppb		
299-W10-16	Total Organic Haloge	7/13/92	650	ppb		
299-W10-16	Total Organic Haloge	11/10/92	390	ppb		
299-W10-16	Total Organic Haloge	11/10/92	540	ppb		
299-W10-16	Total Organic Haloge	11/10/92	580	ppb		
299-W10-16	Total Organic Haloge	11/10/92	620	ppb		
299-W10-16	Total Organic Haloge	11/10/92	670	ppb		
299-W10-16	Total Organic Haloge	11/10/92	750	ppb		
299-W10-16	Total Organic Haloge	11/10/92	810	ppb		
299-W10-16	Total Organic Haloge	11/10/92	850	ppb		
299-W10-16	Total Organic Haloge	3/05/93	440	ppb		
299-W10-16	Total Organic Haloge	3/05/93	480	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Total Organic Haloge	3/05/93	500	ppb		
299-W10-16	Total Organic Haloge	3/05/93	510	ppb		
299-W10-16	Total Organic Haloge	3/05/93	550	ppb		
299-W10-16	Total Organic Haloge	3/05/93	590	ppb		
299-W10-16	Total Organic Haloge	6/21/93	430	ppb		
299-W10-16	Total Organic Haloge	6/21/93	440	ppb		
299-W10-16	Total Organic Haloge	6/21/93	480	ppb		
299-W10-16	Total Organic Haloge	6/21/93	510	ppb		
299-W10-16	Total Organic Haloge	6/21/93	600	ppb		
299-W10-16	Total Organic Haloge	6/21/93	630	ppb		
299-W10-16	Total Organic Haloge	9/28/93	390	ppb		
299-W10-16	Total Organic Haloge	9/28/93	400	ppb		
299-W10-16	Total Organic Haloge	9/28/93	460	ppb		
299-W10-16	Total Organic Haloge	9/28/93	510	ppb		
299-W10-16	Total Organic Haloge	12/16/93	762	ppb		
299-W10-16	Total Organic Haloge	12/16/93	770	ppb		
299-W10-16	Total Organic Haloge	12/16/93	779	ppb		
299-W10-16	Total Organic Haloge	12/16/93	805	ppb		
299-W10-16	Total Organic Haloge	3/17/94	363	ppb		
299-W10-16	Total Organic Haloge	3/17/94	686	ppb		
299-W10-16	Total Organic Haloge	3/17/94	706	ppb		
299-W10-16	Total Organic Haloge	3/17/94	858	ppb		
299-W10-16	Total Organic Haloge	7/01/94	626	ppb		
299-W10-16	Total Organic Haloge	7/01/94	632	ppb		
299-W10-16	Total Organic Haloge	7/01/94	642	ppb		
299-W10-16	Total Organic Haloge	7/01/94	644	ppb		
299-W10-16	Total Organic Haloge	9/21/94	721	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Total Organic Haloge	11/29/94	646	ppb		
299-W10-16	Trichloroethene	1/27/92	8	ppb		
299-W10-16	Trichloroethene	4/20/92	13	ppb		
299-W10-16	Trichloroethene	12/16/93	10	ppb		
299-W10-16	Trichloroethene	3/17/94	11	ppb		
299-W10-16	Trichloroethene	7/01/94	10	ppb		
299-W10-16	Trichloroethene	9/21/94	10	ppb		
299-W10-16	Trichloroethene	11/29/94	12	ppb		
299-W10-16	Tritium	2/27/90	53200	pCi/L		
299-W10-16	Tritium	7/22/91	46800	pCi/L		
299-W10-16	Tritium	9/24/91	44000	pCi/L		
299-W10-16	Tritium	1/27/92	45900	pCi/L		
299-W10-16	Tritium	4/20/92	44500	pCi/L		
299-W10-16	Tritium	7/13/92	50500	pCi/L		
299-W10-16	Tritium	11/10/92	49100	pCi/L		
299-W10-16	Tritium	3/05/93	51700	pCi/L		
299-W10-16	Tritium	6/21/93	50000	pCi/L		
299-W10-16	Tritium	9/28/93	46100	pCi/L		
299-W10-16	Tritium	12/16/93	48000	pCi/L		
299-W10-16	Tritium	3/17/94	45400	pCi/L		
299-W10-16	Tritium	7/01/94	46300	pCi/L		
299-W10-16	Tritium	9/21/94	46600	pCi/L		
299-W10-16	Tritium	11/29/94	45000	pCi/L		
299-W10-16	Turbidity	2/27/90	4	NTU		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Turbidity	7/22/91	2	NTU		
299-W10-16	Turbidity	9/24/91	5	NTU		
299-W10-16	Turbidity	1/27/92	2	NTU		
299-W10-16	Turbidity	4/20/92	2	NTU		
299-W10-16	Turbidity	7/13/92	2	NTU		
299-W10-16	Turbidity	11/10/92	1	NTU		
299-W10-16	Turbidity	3/05/93	1	NTU		
299-W10-16	Turbidity	6/21/93	4	NTU		
299-W10-16	Turbidity	9/28/93	19	NTU		
299-W10-16	Turbidity	12/16/93	5	NTU		
299-W10-16	Turbidity	3/17/94	3	NTU		
299-W10-16	Turbidity	7/01/94	5	NTU		
299-W10-16	Turbidity	9/21/94	7	NTU		
299-W10-16	Turbidity	11/29/94	6	NTU		
299-W10-16	Uranium	7/22/91	2	ppb		
299-W10-16	Uranium	9/24/91	2	ppb		
299-W10-16	Uranium	1/27/92	2	ppb		
299-W10-16	Uranium	4/20/92	2	ppb		
299-W10-16	Uranium	7/13/92	2	ppb		
299-W10-16	Uranium	11/10/92	1	ppb		
299-W10-16	Uranium	6/21/93	1	ppb		
299-W10-16	Uranium	9/28/93	1	ppb		
299-W10-16	Uranium	12/16/93	2	ppb		
299-W10-16	Uranium	3/17/94	2	ppb		
299-W10-16	Uranium	9/21/94	2	ppb		
299-W10-16	Uranium	11/29/94	1	ppb		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Vanadium	2/27/90	27	ppb		
299-W10-16	Vanadium	7/22/91	39	ppb		
299-W10-16	Vanadium	9/24/91	35	ppb		
299-W10-16	Vanadium	1/27/92	37	ppb		
299-W10-16	Vanadium	4/20/92	44	ppb		
299-W10-16	Vanadium	7/13/92	40	ppb		
299-W10-16	Vanadium	11/10/92	40	ppb		
299-W10-16	Vanadium	3/05/93	40	ppb		
299-W10-16	Vanadium	6/21/93	37	ppb		
299-W10-16	Vanadium	9/28/93	48	ppb		
299-W10-16	Vanadium	12/16/93	44	ppb		
299-W10-16	Vanadium	3/17/94	41	ppb		
299-W10-16	Vanadium	7/01/94	37	ppb		
299-W10-16	Vanadium	9/21/94	38	ppb		
299-W10-16	Vanadium	11/29/94	37	ppb		
299-W10-16	Vanadium, filtered	2/27/90	24	ppb	Y	
299-W10-16	Vanadium, filtered	7/22/91	30	ppb	Y	
299-W10-16	Vanadium, filtered	9/24/91	32	ppb	Y	
299-W10-16	Vanadium, filtered	1/27/92	39	ppb	Y	
299-W10-16	Vanadium, filtered	7/13/92	36	ppb	Y	
299-W10-16	Vanadium, filtered	11/10/92	40	ppb	Y	
299-W10-16	Vanadium, filtered	3/05/93	50	ppb	Y	
299-W10-16	Vanadium, filtered	6/21/93	42	ppb	Y	
299-W10-16	Vanadium, filtered	12/16/93	43	ppb	Y	
299-W10-16	Vanadium, filtered	3/17/94	38	ppb	Y	
299-W10-16	Vanadium, filtered	7/01/94	36	ppb	Y	

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	Vanadium, filtered	9/21/94	34	ppb	Y	
299-W10-16	Vanadium, filtered	11/29/94	33	ppb	Y	
299-W10-16	Zinc	2/27/90	43	ppb		
299-W10-16	Zinc	9/24/91	11	ppb		
299-W10-16	Zinc	9/28/93	170	ppb		
299-W10-16	Zinc	12/16/93	2	ppb		L
299-W10-16	Zinc	3/17/94	9	ppb		L
299-W10-16	Zinc	9/21/94	9	ppb		L
299-W10-16	Zinc, filtered	2/27/90	19	ppb	Y	
299-W10-16	Zinc, filtered	4/20/92	12	ppb	Y	
299-W10-16	Zinc, filtered	12/16/93	1	ppb	Y	L
299-W10-16	Zinc-65	9/21/94	2	pCi/L		
299-W10-16	cis-1,2-Dichloroethy	3/17/94	0	ppb		L
299-W10-16	pH	2/27/90	8			
299-W10-16	pH	7/22/91	8			
299-W10-16	pH	7/22/91	8	pH		
299-W10-16	pH	7/22/91	8			
299-W10-16	pH	7/22/91	8	pH		
299-W10-16	pH	7/22/91	8			
299-W10-16	pH	7/22/91	8	pH		
299-W10-16	pH	7/22/91	8			
299-W10-16	pH	7/22/91	8			
299-W10-16	pH	7/22/91	8			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	pH	9/24/91	7			
299-W10-16	pH	9/24/91	7			
299-W10-16	pH	9/24/91	7			
299-W10-16	pH	11/25/91	8			
299-W10-16	pH	1/27/92	8			
299-W10-16	pH	1/27/92	8			
299-W10-16	pH	1/27/92	8			
299-W10-16	pH	4/20/92	8			
299-W10-16	pH	4/20/92	8			
299-W10-16	pH	4/20/92	8			
299-W10-16	pH	7/13/92	8			
299-W10-16	pH	7/13/92	8			
299-W10-16	pH	11/10/92	8			
299-W10-16	pH	11/10/92	8			
299-W10-16	pH	11/10/92	8			
299-W10-16	pH	11/10/92	8			
299-W10-16	pH	3/05/93	8			
299-W10-16	pH	3/05/93	8			
299-W10-16	pH	3/05/93	8	pH		
299-W10-16	pH	6/21/93	8			
299-W10-16	pH	6/21/93	8			
299-W10-16	pH	6/21/93	8			
299-W10-16	pH	6/21/93	8			
299-W10-16	pH	6/21/93	8	pH		
299-W10-16	pH	9/28/93	8			
299-W10-16	pH	9/28/93	8			
299-W10-16	pH	9/28/93	8			

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W10-16	pH	9/28/93	8			
299-W10-16	pH	9/28/93	8			
299-W10-16	pH	9/28/93	8	pH		
299-W10-16	pH	12/16/93	7			
299-W10-16	pH	12/16/93	7			
299-W10-16	pH	12/16/93	7			
299-W10-16	pH	12/16/93	7			
299-W10-16	pH	12/16/93	8			
299-W10-16	pH	12/16/93	8	pH		
299-W10-16	pH	3/17/94	8			
299-W10-16	pH	3/17/94	8			
299-W10-16	pH	3/17/94	8			
299-W10-16	pH	3/17/94	8	pH		
299-W10-16	pH	7/01/94	8			
299-W10-16	pH	7/01/94	8			
299-W10-16	pH	7/01/94	8			
299-W10-16	pH	7/01/94	8	pH		
299-W10-16	pH	9/21/94	7			
299-W10-16	pH	9/21/94	8			
299-W10-16	pH	9/21/94	8	pH		
299-W10-16	pH	11/29/94	8			
299-W10-16	pH	11/29/94	8	pH		

Table A2-6. Upgradient Well 299-W11-24. (6 sheets)

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W11-24	Cesium-137	1/14/80	35	pCi/L		
299-W11-24	Cesium-137	10/15/80	7	pCi/L		
299-W11-24	Cesium-137	2/05/81	40	pCi/L		
299-W11-24	Cesium-137	4/27/81	1	pCi/L		
299-W11-24	Cesium-137	8/19/81	3	pCi/L		
299-W11-24	Cesium-137	10/15/81	1	pCi/L		
299-W11-24	Cesium-137	1/28/82	1	pCi/L		
299-W11-24	Cesium-137	4/22/82	1	pCi/L		
299-W11-24	Cesium-137	10/12/82	1	pCi/L		
299-W11-24	Cesium-137	1/05/83	4	pCi/L		
299-W11-24	Cesium-137	1/27/83	0	pCi/L		
299-W11-24	Cesium-137	4/26/83	3	pCi/L		
299-W11-24	Cesium-137	2/02/84	2	pCi/L		
299-W11-24	Cesium-137	4/25/84	1	pCi/L		
299-W11-24	Cesium-137	4/15/85	2	pCi/L		
299-W11-24	Cesium-137	8/30/85	8	pCi/L		
299-W11-24	Cesium-137	3/03/86	7	pCi/L		
299-W11-24	Cesium-137	5/17/87	7	pCi/L		
299-W11-24	Cobalt-60	1/14/80	82	pCi/L		
299-W11-24	Cobalt-60	4/01/80	43	pCi/L		
299-W11-24	Cobalt-60	7/22/80	46	pCi/L		
299-W11-24	Cobalt-60	10/15/80	32	pCi/L		
299-W11-24	Cobalt-60	2/05/81	27	pCi/L		
299-W11-24	Cobalt-60	4/27/81	27	pCi/L		
299-W11-24	Cobalt-60	8/19/81	27	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W11-24	Cobalt-60	10/15/81	25	pCi/L		
299-W11-24	Cobalt-60	1/28/82	26	pCi/L		
299-W11-24	Cobalt-60	4/22/82	25	pCi/L		
299-W11-24	Cobalt-60	7/26/82	13	pCi/L		
299-W11-24	Cobalt-60	10/12/82	22	pCi/L		
299-W11-24	Cobalt-60	1/05/83	16	pCi/L		
299-W11-24	Cobalt-60	1/27/83	23	pCi/L		
299-W11-24	Cobalt-60	4/26/83	15	pCi/L		
299-W11-24	Cobalt-60	7/13/83	11	pCi/L		
299-W11-24	Cobalt-60	10/18/83	11	pCi/L		
299-W11-24	Cobalt-60	2/02/84	18	pCi/L		
299-W11-24	Cobalt-60	4/25/84	4	pCi/L		
299-W11-24	Cobalt-60	7/17/84	17	pCi/L		
299-W11-24	Cobalt-60	10/22/84	16	pCi/L		
299-W11-24	Cobalt-60	4/15/85	9	pCi/L		
299-W11-24	Cobalt-60	8/30/85	14	pCi/L		
299-W11-24	Cobalt-60	11/18/85	11	pCi/L		
299-W11-24	Cobalt-60	7/31/86	7	pCi/L		
299-W11-24	Cobalt-60	1/21/87	5	pCi/L		
299-W11-24	Gross alpha	1/14/80	17	pCi/L		
299-W11-24	Gross alpha	4/01/80	17	pCi/L		
299-W11-24	Gross alpha	7/22/80	17	pCi/L		
299-W11-24	Gross alpha	10/15/80	2	pCi/L		
299-W11-24	Gross alpha	2/05/81	3	pCi/L		
299-W11-24	Gross alpha	4/27/81	2	pCi/L		
299-W11-24	Gross alpha	8/19/81	2	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W11-24	Gross alpha	10/15/81	1	pCi/L		
299-W11-24	Gross alpha	1/28/82	1	pCi/L		
299-W11-24	Gross alpha	4/22/82	1	pCi/L		
299-W11-24	Gross alpha	7/26/82	3	pCi/L		
299-W11-24	Gross alpha	10/12/82	2	pCi/L		
299-W11-24	Gross alpha	1/05/83	1	pCi/L		
299-W11-24	Gross alpha	1/27/83	1	pCi/L		
299-W11-24	Gross alpha	4/26/83	2	pCi/L		
299-W11-24	Gross alpha	7/13/83	3	pCi/L		
299-W11-24	Gross alpha	10/18/83	1	pCi/L		
299-W11-24	Gross alpha	4/25/84	8	pCi/L		
299-W11-24	Gross alpha	7/17/84	3	pCi/L		
299-W11-24	Gross alpha	10/22/84	2	pCi/L		
299-W11-24	Gross alpha	4/15/85	2	pCi/L		
299-W11-24	Gross alpha	8/30/85	2	pCi/L		
299-W11-24	Gross alpha	11/18/85	1	pCi/L		
299-W11-24	Gross alpha	3/03/86	1	pCi/L		
299-W11-24	Gross alpha	5/16/86	2	pCi/L		
299-W11-24	Gross alpha	7/31/86	1	pCi/L		
299-W11-24	Gross alpha	1/21/87	1	pCi/L		
299-W11-24	Gross alpha	5/17/87	1	pCi/L		
299-W11-24	Gross alpha	9/18/87	0	pCi/L		
299-W11-24	Gross alpha	2/28/88	1	pCi/L		
299-W11-24	Gross beta	1/14/80	120	pCi/L		
299-W11-24	Gross beta	4/01/80	120	pCi/L		
299-W11-24	Gross beta	7/22/80	130	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W11-24	Gross beta	10/15/80	150	pCi/L		
299-W11-24	Gross beta	2/05/81	85	pCi/L		
299-W11-24	Gross beta	4/27/81	110	pCi/L		
299-W11-24	Gross beta	8/19/81	100	pCi/L		
299-W11-24	Gross beta	10/15/81	46	pCi/L		
299-W11-24	Gross beta	1/28/82	120	pCi/L		
299-W11-24	Gross beta	4/22/82	100	pCi/L		
299-W11-24	Gross beta	7/26/82	94	pCi/L		
299-W11-24	Gross beta	10/12/82	110	pCi/L		
299-W11-24	Gross beta	1/05/83	117	pCi/L		
299-W11-24	Gross beta	1/27/83	94	pCi/L		
299-W11-24	Gross beta	4/26/83	84	pCi/L		
299-W11-24	Gross beta	7/13/83	85	pCi/L		
299-W11-24	Gross beta	10/18/83	115	pCi/L		
299-W11-24	Gross beta	2/02/84	137	pCi/L		
299-W11-24	Gross beta	4/25/84	130	pCi/L		
299-W11-24	Gross beta	7/17/84	163	pCi/L		
299-W11-24	Gross beta	10/22/84	110	pCi/L		
299-W11-24	Gross beta	4/15/85	60	pCi/L		
299-W11-24	Gross beta	8/30/85	58	pCi/L		
299-W11-24	Gross beta	11/18/85	62	pCi/L		
299-W11-24	Gross beta	3/03/86	43	pCi/L		
299-W11-24	Gross beta	5/16/86	55	pCi/L		
299-W11-24	Gross beta	7/31/86	43	pCi/L		
299-W11-24	Gross beta	1/21/87	56	pCi/L		
299-W11-24	Gross beta	5/17/87	9	pCi/L		
299-W11-24	Gross beta	9/18/87	9	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W11-24	Gross beta	10/29/87	8	pCi/L		
299-W11-24	Gross beta	2/28/88	6	pCi/L		
299-W11-24	Gross beta	9/21/88	9	pCi/L		
299-W11-24	Nitrate	4/15/85	258	ppm		
299-W11-24	Nitrate	8/30/85	347	ppm		
299-W11-24	Nitrate	11/18/85	308	ppm		
299-W11-24	Nitrate	3/03/86	288	ppm		
299-W11-24	Nitrate	5/16/86	322	ppm		
299-W11-24	Nitrate	7/31/86	240	ppm		
299-W11-24	Nitrate	1/21/87	320000	ppb		
299-W11-24	Nitrate	5/17/87	221000	ppb		
299-W11-24	Nitrate	9/18/87	333000	ppb		
299-W11-24	Nitrate	10/29/87	264000	ppb		
299-W11-24	Nitrate	2/28/88	163000	ppb		
299-W11-24	Nitrate	9/21/88	148000	ppb		
299-W11-24	Ruthenium-106	10/15/80	39	pCi/L		
299-W11-24	Ruthenium-106	2/05/81	280	pCi/L		
299-W11-24	Ruthenium-106	4/27/81	9	pCi/L		
299-W11-24	Ruthenium-106	8/19/81	150	pCi/L		
299-W11-24	Ruthenium-106	10/15/81	8	pCi/L		
299-W11-24	Ruthenium-106	1/28/82	17	pCi/L		
299-W11-24	Ruthenium-106	4/22/82	9	pCi/L		
299-W11-24	Ruthenium-106	7/26/82	24	pCi/L		
299-W11-24	Ruthenium-106	1/05/83	4	pCi/L		
299-W11-24	Ruthenium-106	1/27/83	27	pCi/L		

Well	Constituent Name	Collect Date	Result	Units	Filtered	Qualifier
299-W11-24	Ruthenium-106	4/26/83	23	pCi/L		
299-W11-24	Ruthenium-106	2/02/84	23	pCi/L		
299-W11-24	Ruthenium-106	7/17/84	35	pCi/L		
299-W11-24	Ruthenium-106	8/30/85	32	pCi/L		
299-W11-24	Ruthenium-106	3/03/86	40	pCi/L		
299-W11-24	Technetium-99	9/18/87	25	pCi/L		

Table A2-7. Summary of Provisional Hanford Site Groundwater Background Values[a] (Johnson, 1993). (3 sheets)

Constituent (concentration)	PNL Results[b]	USGS Results[b] (sample size)	WHC Unconfined[b] (sample size)	WHC Provisional Threshold Values
Aluminum (ppb)	<2	110 ± 139 (12)	<200 (50)	<200
Ammonium (ppb)	<50	NA	<50 (18)	<120
Arsenic (ppb)	3.9±2.4	6.7 ± 3.7 (7)	<5 (14)	10
Barium (ppb)	42±20	53 ± 14 (11)	41±20 (53)	68.5
Beryllium (ppb)	<0.3	NA	<5 (16)	<5
Bismuth (ppb)	<0.02	NA	<5 (4)	<5
Boron (ppb)	<50	<50 (14)	<100 (35)	<100
Cadmium (ppb)	<0.2	<10 (1)	<10 (16)	<10
Calcium (ppb)	40,400 ± 10,300	40,857 ± 8,282 (14)	38,542 ± 11,023 (53)	63,600
Chloride-low (ppb)	NA	5,825 ± 1,355 (8)	5,032 ± 1,774 (53)	8,690
Chloride-high (ppb)	NA	20,667 ± 2,503 (6)	23,296 ± 2,463 (14)	28,500
Chloride-all (ppb)	10,300 ± 6,500	12,186 ± 7,842 (14)	8,848 ± 7,723 (67)	NC
Chromium (ppb)	4±2	<50 (11)	<30 (8)	<30
Copper (ppb)	<1	<10 (10)	<30 (50)	<30
Fluoride (ppb)	370 ± 100	550 ± 330 (14)	437 ± 131[c] (47)	1,340 775[c]
Iron-low (ppb)	NA	22 ± 16[c]	<50 (34)	86
Iron-mid (ppb)	NA	NA	115 ± 52 (7)	291
Iron-high (ppb)	NA	NA	494 ± 118 (12)	818
Iron-all (ppb)	NA	NA	149 ± 199 (53)	NC
Lead (ppb)	<0.5	<30[c] (6)	<5 (15)	<5
Magnesium (ppb)	11,800 ± 3,400	10,814 ± 1,813 (14)	11,190 ± 2,578 (14)	16,840
Manganese-low (ppb)	NA	26 ± 27 (8)	<20 (33)	24.5
Manganese-high (ppb)	NA	150 ± 87 (3)	118 ± 17 (20)	163.5

Table A2-7. Summary of Provisional Hanford Site Groundwater Background Values[a] (Johnson, 1993). (3 sheets)

Constituent (concentration)	PNL Results[b]	USGS Results[b] (sample size)	WHC Unconfined[b] (sample size)	WHC Provisional Threshold Values
Manganese-all (ppb)	---	60 ± 73 (11)	50 ± 55 (53)	NC
Mercury (ppb)	---	NA	<0.1 (14)	<0.1
Nickel (ppb)	<4	<50 (14)	<30 (23)	<30
Nitrate (ppb)	NA	3,224 ± 3,380 (13)	5,170 ± 3,576 (78)	12,400
Phosphate (ppb)	<1000	140 ± 62 (3)	<1,000	<1,000
Potassium (ppb)	4,950 ± 1,240	5,900 ± 1,253 (14)	4,993 ± 1,453 (53)	7.975
Selenium (ppb)	<2	NA	<5 (14)	<5
Silver (ppb)	<10	NA	<10	<10
Silicon (ppb)	NA	16,786 ± 3,683 (14)	18,152 ± 4,974 (35)	26,500
Sodium (ppb)	18,260 ± 10.150	20,286 ± 7,907 (14)	15,774 ± 6,784 (53)	33,500
Strontium (ppb)	236 ± 102	159 ± 78 (14)	164 ± 47 (43)	264.1
Sulfate (ppb)	34,300 ± 16,900	41,286 ± 27,880 (14)	30,605 ± 22,611 (67)	90,500
Uranium (pCi/L)	1.7 ± 0.8	NA	1.7 ± 1.2 (10)	3.43
Vanadium (ppb)	17 ± 9	NA	9 ± 4 (18)	15
Zinc-low (ppb)	NA	14 ± 20 (11)	<50 (36)	<50
Zinc-high (ppb)	NA	373 ± 284 (3)	247 ± 165 (17)	673
Zinc-all (ppb)	6 ± 2	91 ± 190 (14)	95 ± 140 (53)	NC
Field alkalinity (ppb)	NA	134,100 ± 20,469 (10)	137,758 ± 33,656 (31)	215,000
Lab alkalinity (ppb)	123,000 ± 21,000	130,000 ± 8,165 (4)	133,717 ± 29,399 (52)	210,000
Field pH	NA	NA	7.57 ± 0.29 (57)	[6.90, 8.24]
Lab pH	7.64 ± 0.16	NA	7.75 ± 0.21 (52)	[7.25, 8.25]
Total organic carbon (ppb)	586 ± 347	NA	519 ± 367[c] (62)	2,610 1,610[c]

Table A2-7. Summary of Provisional Hanford Site Groundwater Background Values[a] (Johnson, 1993). (3 sheets)

Constituent (concentration)	PNL Results[b]	USGS Results[b] (sample size)	WHC Unconfined[b] (sample size)	WHC Provisional Threshold Values
Field conductivity (µmhos/cm)	NA	NA	344 ± 83 (22)	539
Lab conductivity (µmhos/cm)	380 ± 82	NA	332 ± 93 (36)	530
Total organic halogen, lower detection limit (ppb)	NA	NA	<20[c] (14)	60.8 37.6[c]
Total carbon (ppb)	NA	NA	31,772 ± 7,022 (48)	50,100
Gross alpha (pCi/L)	2.5 ± 1.4	NA	2.5 ± 1.5[c] (36)	63 5.79[c]
Gross beta (pCi/L)	19 ± 12	NA	7.1 ± 2.6[c] (44)	35.5 12.62[c]
Radium (pCi/L)	<0.2	NA	ND (10)	0.23

Note: Johnson, V. G., 1993, Westinghouse Hanford Company Operational Groundwater Status Report, WHC-EP-0595, Westinghouse Hanford Company, Richland, Washington.

[a] Source: From Tables 5-9 and 5-11 (DOE-RL, 1992, Hanford Site Groundwater Background, DOE/RL-92-23, U.S. Department of Energy, Richland Operations Office, Richland, Washington).
[b] Results shown are mean ± one standard deviation.
[c] Potential outlier observation(s) were removed.
NA = not available.
NC = not calculated.
ND = not detected.
PNL = Pacific Northwest Laboratory.
ppb = parts per billion.
USGS = United States Geological Survey.
WHC = Westinghouse Hanford Company.

Table A2-8. Background Level 95% Upper Confidence Limit and Bowen's Background Numbers.

Constituent	CAS Number	90P[1] (mg/Kg)	90PUCL[1] (mg/Kg)	Bowen's Background Numbers[2]		
				Igneous (ppm)	Shale (ppm)	Sandstone (ppm)
Aluminum	7429-90-5	12200	13400	82000	---	25000
Antimony	7440-36-0			0.2	1.5	0.05
Arsenic	7440-38-2	6.41	7.27	1.8	13	1.0
Barium	7440-39-3	136	148	425	580	50
Beryllium	7440-41-7	1.48	1.58	2.8	3	<1
Cadmium	7440-43-9			0.2	0.3	0.05
Calcium	7440-70-2	17230	19500	41500	22100	39110
Chromium	7440-47-3	19.4	22.2	100	90	35
Cobalt	7440-48-4	16.3	17.5	25	19	0.3
Copper	7440-50-8	22.5	24.5	55	45	5
Iron	7439-89-6	32920	35150	56300	47200	9800
Lead	7439-92-1	10.41	11.88	12.5	20	7
Magnesium	7439-95-4	7210	7760	23300	15000	10700
Manganese	7439-96-5	514	549	950	850	50
Mercury	7439-97-6	0.287	0.502	0.08	0.4	0.03
Nickel	7440-02-0	19.7	21.6	75	68	2
Potassium	7440-09-7	2250	22550	20900	26600	10700
Selenium	7782-49-2			0.05	0.6	0.05
Silver	7440-22-4	0.64	1.1	0.07	0.1-soil	0.07
Sodium	7440-23-5	630 705	721 887	23600	9600	3300
Thallium	7440-28-0			0.45	1.4	0.82
Vanadium	7440-62-2	86.5	94.9	135	130	20
Zinc	7440-66-6	67.8	71.8	70	95	16
Lithium	7439-93-2	33.4	35	20	66	15
Molybdenum	7439-98-7			1.5	2.6	0.2
Titanium	7440-32-6	2580	2940	5700	4600	1500
Zirconium	7440-67-7	38.97	45.8	165	160	220

[1] 90th Percentile, 90th Percentile Upper Confidence Limit; Reference: DOE/RL-92-24, Rev. 1.220
[2] Reference: Bowen, H.J.M., "Trace Elements in Biochemistry", Academic Press, Inc., New York, 241 pp.

Table A2-9. Maximum Contamination Levels and Derived Concentration Guidelines (WHC 1990b). (4 sheets)

Reference	Constituent	Guideline Limit	Units	Source of Guideline
40 CFR 141	1,1,1-trichloroethane	200	ppb	MCLG
Primary	1,1-dichloroethylene	7	ppb	MCLG
Drinking	1,2-dichloroethane	5	ppb	MCL
Water	2,4-D	100	ppb	MCL
Standards	2,4,5 Silvex	10	ppb	MCL
	Alpha, high detec. level	15	pCi/L	MCL
	Arsenic	50	ppb	MCL
	Arsenic, filtered	50	ppb	MCL
	Barium	1,000	ppb	MCL
	Barium, filtered	1,000	ppb	MCL
	Benzene	5	ppb	MCL
	Bromodichloromethane	100	ppb	MCL
	Bromoform	100	ppb	MCL
	Cadmium	10	ppb	MCL
	Cadmium, filtered	10	ppb	MCL
	Carbon tetrachloride	5	ppb	MCL
	Chloroform	100	ppb	MCL
	Chromium	50	ppb	MCL
	Chromium, filtered	50	ppb	MCL
	Chromium-6	.05	ppb	MCL
	Coliform (membrane filter)	1	ppb	MCL
	Coliform bacteria	1	MPN	MCL
	Dibromochloromethane	100	ppb	MCL
	Endrin	.2	ppb	MCL
	Fluoride	4,000	ppb	MCL
	Fluoride, low detec. level	4,000	ppb	MCL
	Gross alpha[b]	15	pCi/L	MCL
	Gross beta[b]	50	pCi/L	MCL[a]
	Lead (graphite furnace)	50	ppb	MCL
	Lead, filtered	50	ppb	MCL
	Lindane, alpha-BHC	4	ppb	MCL
	Lindane, beta-BHC	4	ppb	MCL
	Lindane, delta-BHC	4	ppb	MCL
	Lindane, gamma-BHC	4	ppb	MCL
	Mercury	2	ppb	MCL
	Mercury, filtered	2	ppb	MCL
	Methoxychlor	100	ppb	MCL
	Nitrate	45,000	ppb	MCL
	Nitrate, high detec. level	45,000	ppb	MCL
	Nitrate, phenodisulfonic acid	45	mg/L	MCL
	Nitrate-ion	45	mg/L	MCL
	Selenium	10	ppb	MCL
	Selenium, filtered	10	ppb	MCL
	Silver	50	ppb	MCL
	Silver, filtered	50	ppb	MCL
	Toxaphene	5	ppb	MCL
	Trichloroethylene	5	ppb	MCL

Table A2-9. Maximum Contamination Levels and Derived Concentration Guidelines (WHC 1990b). (4 sheets)

Reference	Constituent	Guideline Limit	Units	Source of Guideline
40 CFR 141 (Contd)	Turbidity[b]	5	NTU	MCL
	p-Dichlorobenzene	750	ppb	MCL
	Vinyl chloride	2	ppb	MCL
40 CFR 143 Secondary Drinking Water Standards	Chloride	250,000	ppb	SMCL
	Copper	1,000	ppb	SMCL
	Copper, filtered	1,000	ppb	SMCL
	Iron	300	ppb	SMCL
	Iron, filtered	300	ppb	SMCL
	Manganese	50	ppb	SMCL
	Manganese, filtered	50	ppb	SMCL
	Sulfate	250,000	ppb	SMCL
	Total dissolved solids[b]	500,000	ppb	SMCL
	Zinc	5,000	ppb	SMCL
	Zinc, filtered	5,000	ppb	SMCL
	pH, field measurement, max.[b]	8.5		SMCL
	pH, lab. measurement, max.[b]	8.5		SMCL
54 FR 22062 Proposed Primary and Secondary Drinking Water Standards	1,2-dibromo-3-chloropropane	.2	ppb	MCL prop
	1,2-dichloropropane	5	ppb	MCL prop
	Alachlor	2	ppb	MCL prop
	Aluminum	50	ppb	SMCL prop
	Aluminum, filtered	50	ppb	MCL prop
	Arochlor 1016	.5	ppb	MCL prop
	Arochlor 1221	.5	ppb	MCL prop
	Arochlor 1232	.5	ppb	MCL prop
	Arochlor 1242	.5	ppb	MCL prop
	Arochlor 1248	.5	ppb	MCL prop
	Arochlor 1254	.5	ppb	MCL prop
	Arochlor 1260	.5	ppb	MCL prop
	Chlordane	2	ppb	MCL prop
	Chlorobenzene	100	ppb	MCL prop
	Chlorobenzene (by ABN)	60	ppb	MCL prop
	Ethyl benzene	700	ppb	MCL prop
	Heptachlor	.4	ppb	MCL prop
	Nitrite	3,300	ppb	MCL prop
	Pentachlorophenol	200	ppb	MCL prop
	Styrene	5	ppb	MCL prop
	Tetrachloroethylene	5	ppb	MCL prop
	Toluene	2,000	ppb	MCL prop
	Xylene-m	10,000	ppb	MCL prop
	Xylene-o,p	10,000	ppb	MCL prop
	trans-1,2 Dichloroethylene	100	ppb	MCL prop

Table A2-9. Maximum Contamination Levels and Derived Concentration Guidelines (WHC 1990b). (4 sheets)

Reference	Constituent	Guideline Limit	Units	Source of Guideline
40 CFR 141 (Contd)	Turbidity[b]	5	NTU	MCL
	p-Dichlorobenzene	750	ppb	MCL
	Vinyl chloride	2	ppb	MCL
40 CFR 143 Secondary Drinking Water Standards	Chloride	250,000	ppb	SMCL
	Copper	1,000	ppb	SMCL
	Copper, filtered	1,000	ppb	SMCL
	Iron	300	ppb	SMCL
	Iron, filtered	300	ppb	SMCL
	Manganese	50	ppb	SMCL
	Manganese, filtered	50	ppb	SMCL
	Sulfate	250,000	ppb	SMCL
	Total dissolved solids[b]	500,000	ppb	SMCL
	Zinc	5,000	ppb	SMCL
	Zinc, filtered	5,000	ppb	SMCL
	pH, field measurement, max.[b]	8.5		SMCL
	pH, lab. measurement, max.[b]	8.5		SMCL
54 FR 22062 Proposed Primary and Secondary Drinking Water Standards	1,2-dibromo-3-chloropropane	.2	ppb	MCL prop
	1,2-dichloropropane	5	ppb	MCL prop
	Alachlor	2	ppb	MCL prop
	Aluminum	50	ppb	SMCL prop
	Aluminum, filtered	50	ppb	MCL prop
	Arochlor 1016	.5	ppb	MCL prop
	Arochlor 1221	.5	ppb	MCL prop
	Arochlor 1232	.5	ppb	MCL prop
	Arochlor 1242	.5	ppb	MCL prop
	Arochlor 1248	.5	ppb	MCL prop
	Arochlor 1254	.5	ppb	MCL prop
	Arochlor 1260	.5	ppb	MCL prop
	Chlordane	2	ppb	MCL prop
	Chlorobenzene	100	ppb	MCL prop
	Chlorobenzene (by ABN)	60	ppb	MCL prop
	Ethyl benzene	700	ppb	MCL prop
	Heptachlor	.4	ppb	MCL prop
	Nitrite	3,300	ppb	MCL prop
	Pentachlorophenol	200	ppb	MCL prop
	Styrene	5	ppb	MCL prop
	Tetrachloroethylene	5	ppb	MCL prop
	Toluene	2,000	ppb	MCL prop
	Xylene-m	10,000	ppb	MCL prop
	Xylene-o,p	10,000	ppb	MCL prop
	trans-1,2 Dichloroethylene	100	ppb	MCL prop

Table A2-9. Maximum Contamination Levels and Derived Concentration Guidelines (WHC 1990b). (4 sheets)

Reference	Constituent	Guideline Limit	Units	Source of Guideline
DOE 5400.5 (Contd)	Uranium-235	24	pCi/L	1/25 DCG
	Uranium-236	20	pCi/L	1/25 DCG
	Uranium-238	24	pCi/L	1/25 DCG
	Zinc-65	360	pCi/L	1/25 DCG
	Zirconium-95	1,600	pCi/L	1/25 DCG

[a]This value represents a screening value for assumed compliance with the 4 mrem/yr MCL (WAC 248-54-185).

[b]These parameters not used to select key constituents since they are indicator parameters and not actual discrete chemical or radiological constituents.

ppb = Parts per billion (or micrograms per liter).
MCLG = Maximum contamination level goal.
MCL = Maximum contamination level.
p/Ci/L = Picocuries per liter.
MPN = Most probable number.
NTU = Nephelometric turbidity unit.
SMCL = Secondary maximum contamination level.
MCL prop = Maximum contamination level-proposed.
SMCL prop = Secondary maximum contamination level-proposed.
1/25 DCG = 1/25 Derived concentration guide.

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APPENDIX B

CHEMISTRY PLOTS

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Chemistry data correlation plots of the available effluent and groundwater monitoring data were created and are provided in this appendix. The plots show groundwater data for wells near upgradient past-practice disposal sites and contaminant sources in the vicinity of the T-4-2 Ditch, T-4-2 Ditch effluent data, and for comparison, Hanford Site background 95% upper confidence limit concentration data.

The plots were created to illustrate differences between the different sites sampled. The Hanford Site background 95% upper confidence limit concentration for the unconfined aquifer (Johnson 1993) was plotted to show how the concentration of a given constituent in effluent and/or groundwater compared to the background unconfined aquifer concentration. Where a background value was not available, or did not provide a good basis for comparison, other values were used in place of background values. The two other values that were used are maximum contamination levels (MCLs), which can be used for most chemicals (40 CFR 141), and 1/25 of the derived concentration guideline (1/25 DCG), used for radionuclides (WHC 1988). Concentrations that are lower than the "average value" (either a background, MCL, or 1/25 DCG), are most likely the result of disposal of Hanford Site "system water" or "raw water" (e.g. treated or untreated Columbia River water), with little or no contamination. Concentrations that are higher than the average value are most likely the result of disposal of wastewater from Hanford Site processes and operations (i.e. process facility effluent), which is often elevated in concentration and/or contaminated. The elevated parameters can be used to determine the source of the contamination if enough is known about the composition of the wastewater that was originally discharged to a given facility. Even without this information a general source of contaminants can be determined by tracing a path back upgradient from the well and seeing what facilities it intersects.

The plots show a difference in effluent chemistry versus groundwater chemistry, with the effluent exhibiting lower concentrations than the 95% upper confidence limit value in most cases, and the groundwater exhibiting higher concentrations than the 95% upper confidence limit value. Considering the presence of several groundwater contaminant plumes within the 200 West Area, this is not unexpected. Several of the parameters that were plotted are related to these plumes.

Figure B-1 shows two groundwater quality parameters, pH and specific conductance (conductivity). Almost all the pH measurements are at or below the Hanford Site background value. In the last year (1993-1994), it appears that the pH is rising in both the T-4-2 Ditch effluent and the nearby monitoring wells. Conductivity is above the Hanford Site background in all of the wells examined for this exercise.

Figure B-2 shows two radionuclides, uranium and technetium-99. The uranium concentrations are all below the 1/25 DCG for uranium and all of technetium-99 concentrations are below the 1/25 DCG for technetium-99.

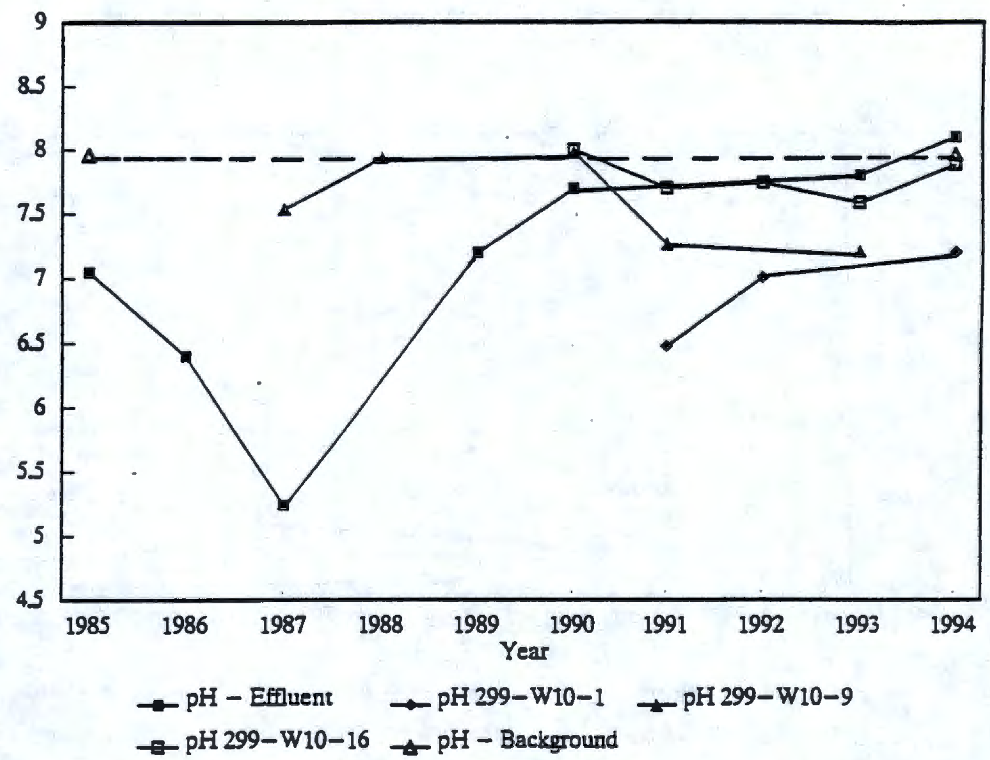
Figure B-3 shows the metals chromium and cobalt. In the case of chromium, the MCL was used for comparison, because contamination guidelines are more useful for determining if observed concentrations represent a problem or not. There is no background value or MCL for cobalt, so the cobalt concentrations were plotted to compare them with other constituents. The two wells that exhibit elevated chromium concentrations are monitoring wells for the T Tank Farm. They are located south/southwest of the T-4-2 Ditch (upgradient). Chromium is not elevated in the groundwater at the T-4-2 Ditch (downgradient), or in well 299-W10-16, which is upgradient of the tank farm. It is possible that the elevated chromium is related to the T Tank Farm, and therefore is localized. Cobalt concentrations were elevated during 1990 to 1992 in well 299-W10-16, but returned to acceptable levels in 1993 to 1994.

Figure B-4 shows calcium and manganese concentration plots; both parameters are present in concentrations that are below the Hanford Site background values.

Figure B-5 shows anion parameters nitrate, sulfate, and chloride. Nitrate, sulfate, and chloride concentrations are low in the T-4-2 Ditch effluent. However, the nearby wells examined here all exhibit elevated concentrations of all three constituents. The T-4-2 Ditch seems to be a pocket of relatively "clean" groundwater (e.g. little or no detectable contamination in groundwater), when compared to some of the nearby sites and wells. There are groundwater plumes all around the site for nitrate and several other parameters and, while the plumes seem to be affecting upgradient wells, they are not affecting the T-4-2 Ditch.

Figure B-1. Concentration Plots of 216-T-4-2 Ditch Effluent, Groundwater, and the Hanford Site Background Average for the Unconfined Aquifer (Johnson 1993) for (a) pH and (b) Conductivity.

(a)



(b)

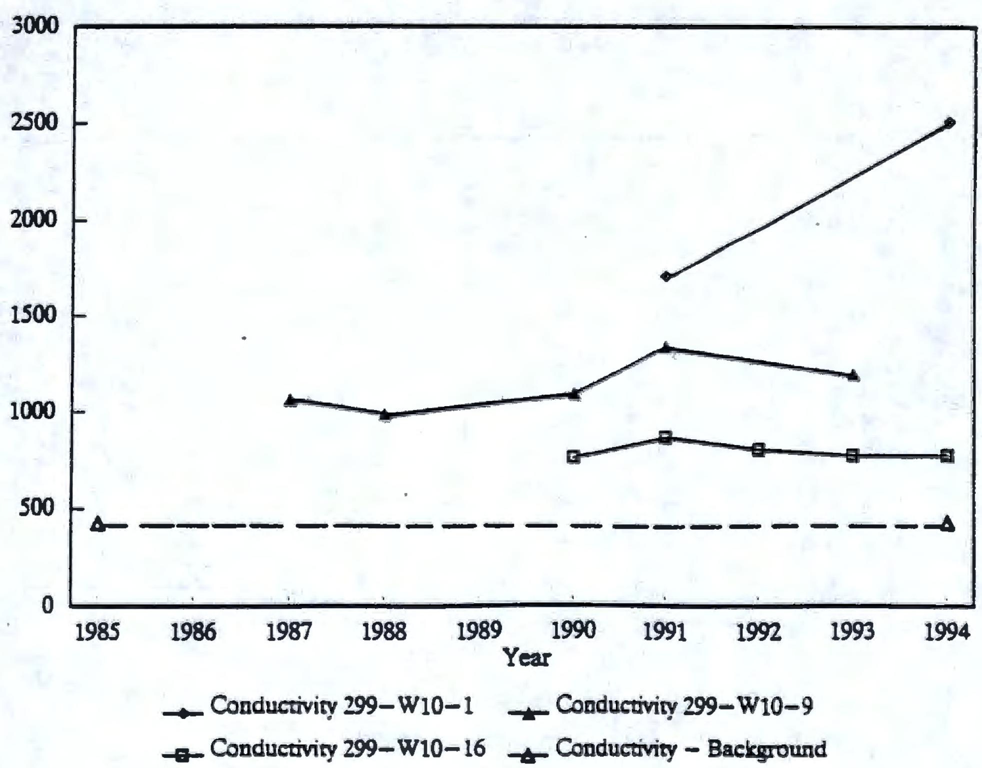
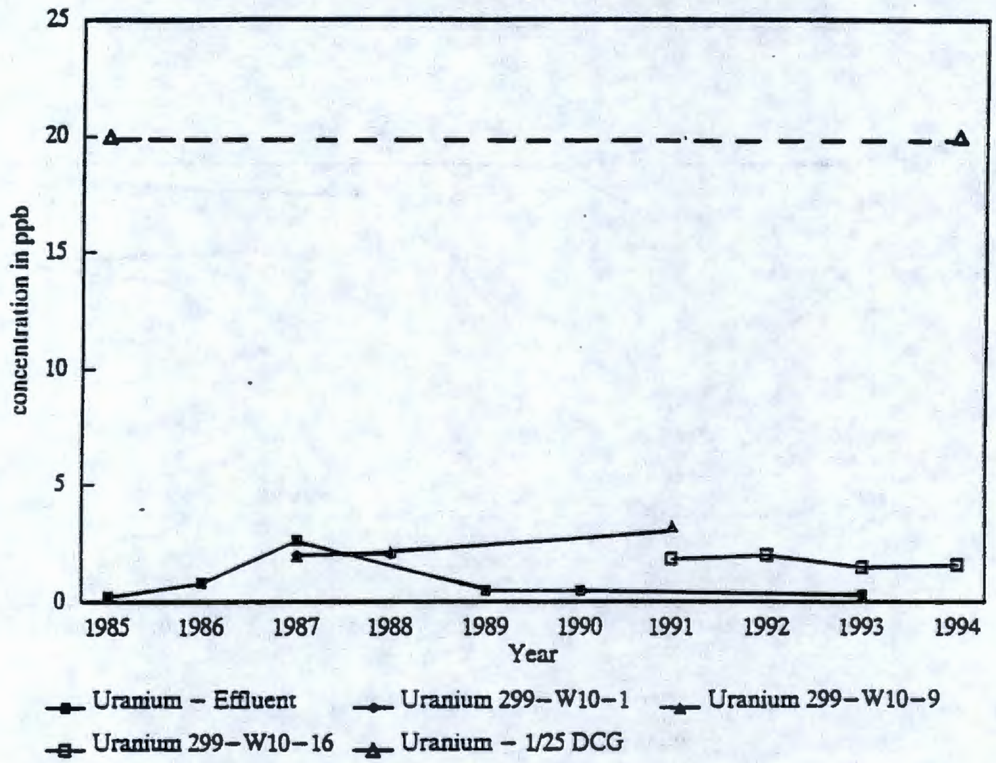


Figure B-2. Concentration Plots of 216-T-4-2 Ditch Effluent, Groundwater, and 1/25 Derived Concentration Guideline (WHC 1988) for (a) Uranium and (b) Technetium-99.

(a)



(b)

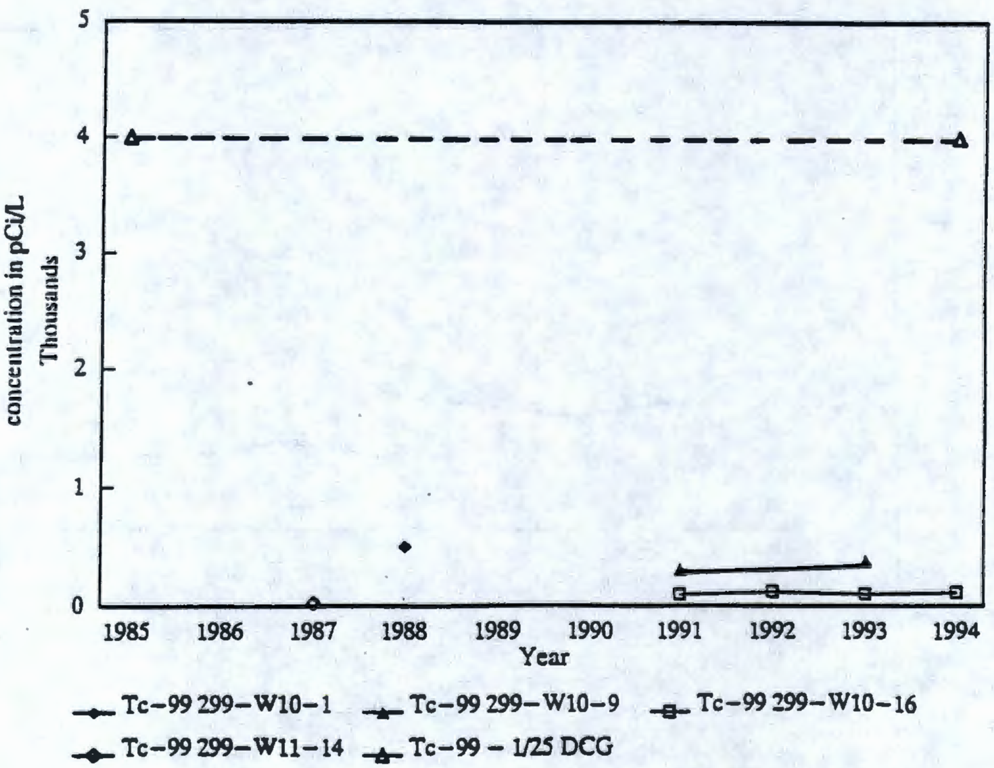
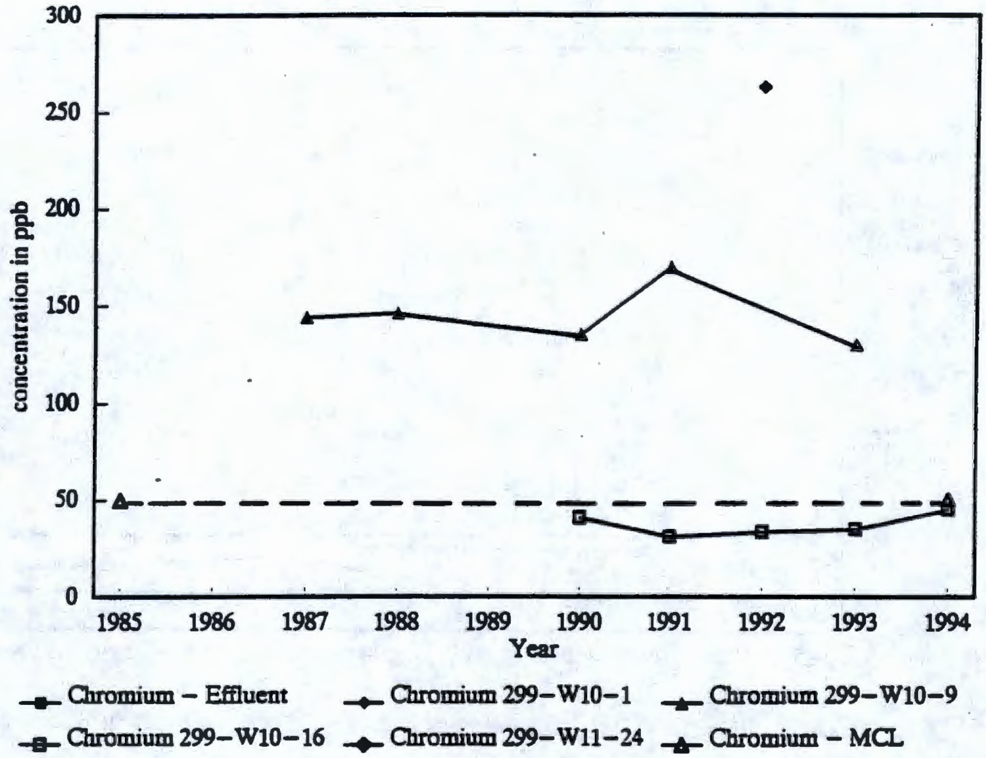


Figure B-3. Concentration Plots of 216-T-42 Ditch Effluent, Groundwater, and Maximum Concentration Guidelines (40 CFR 141) for (a) Chromium and (b) Cobalt.

(a)



(b)

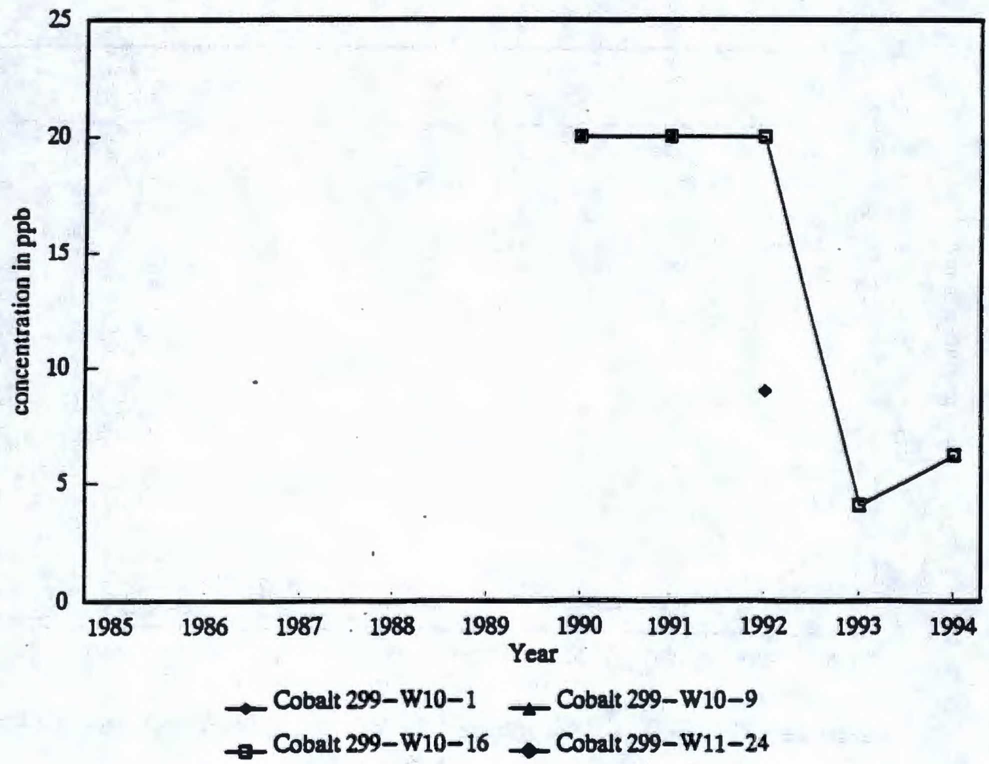
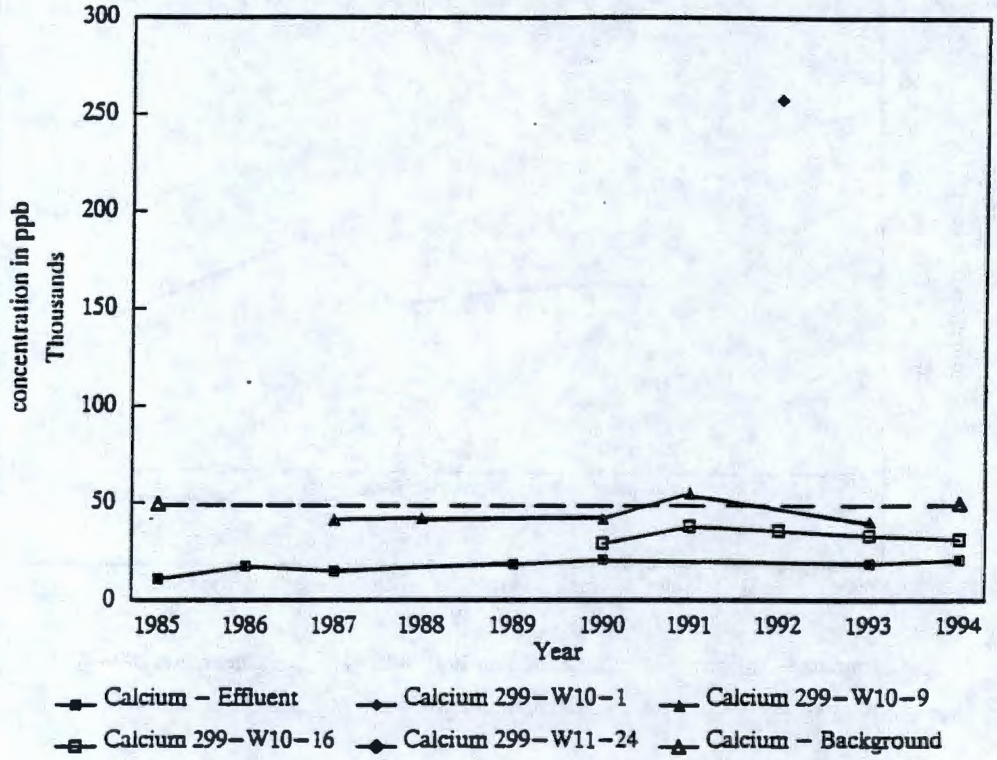


Figure B-4. Concentration Plots of 216-T-1 Ditch Effluent, Groundwater, and the Hanford Site Background Average for the Unconfined Aquifer (Johnson 1993) for (a) Calcium and (b) Manganese.

(a)



(b)

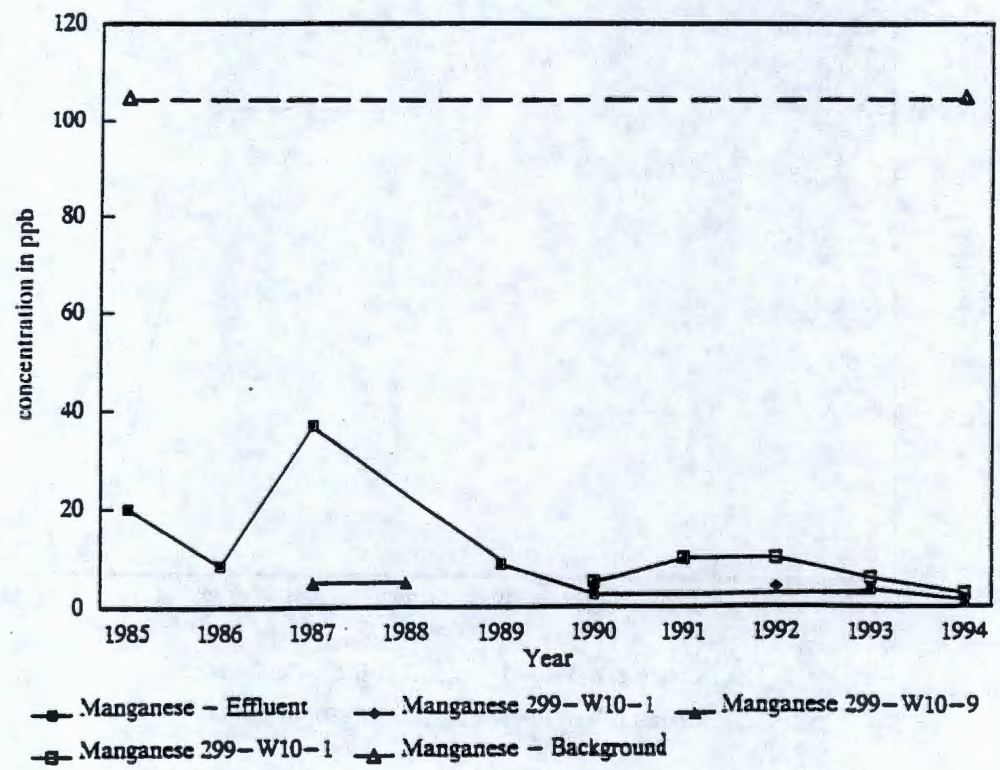
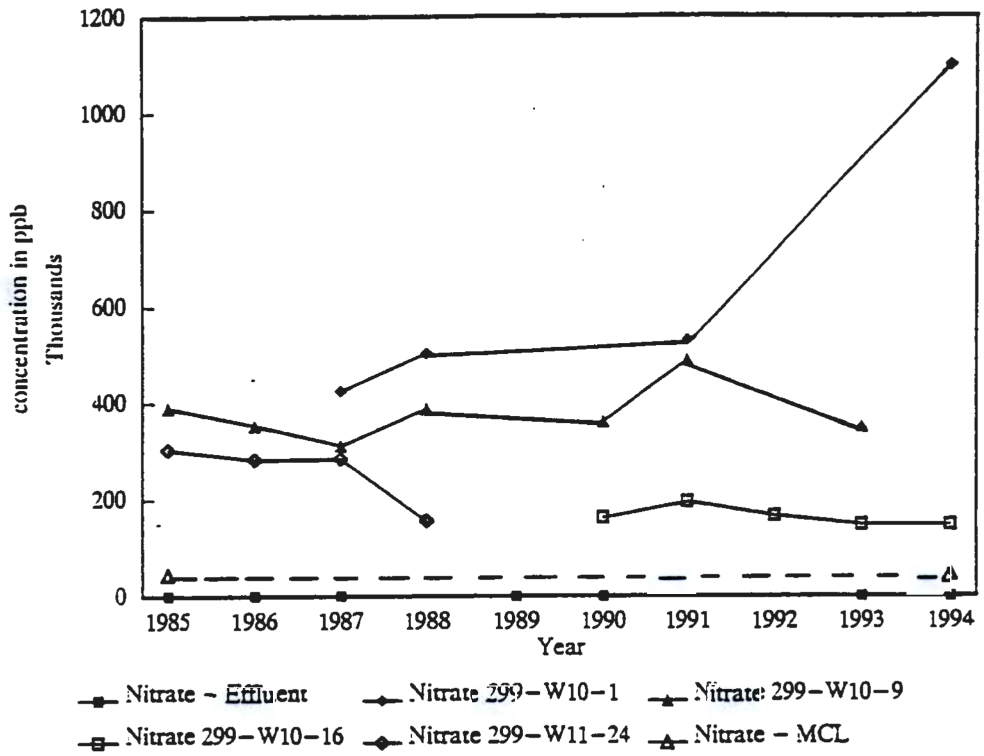


Figure B-5. Concentration Plots of 216-T-1 Ditch Effluent, Groundwater, and Maximum Concentration Guidelines (40 CFR 141)/Hanford Site Background Average for the Unconfined Aquifer (Johnson 1993) for (a) Nitrate, (b) Sulfate, and (c) Chloride. (2 sheets)

(a)



(b)

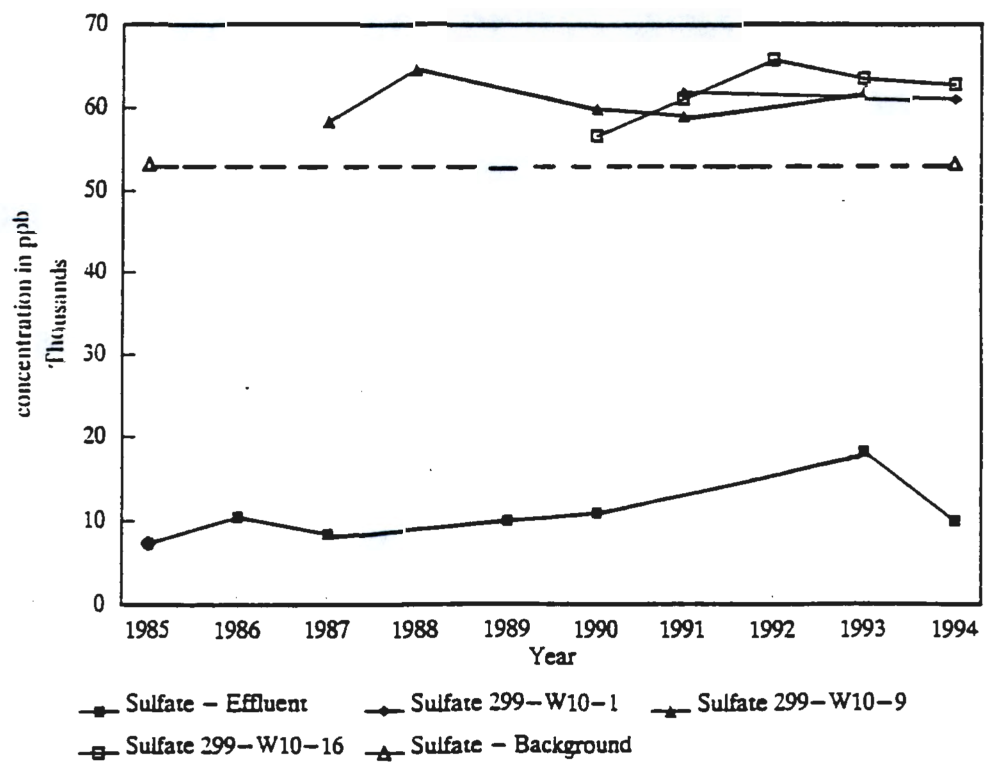
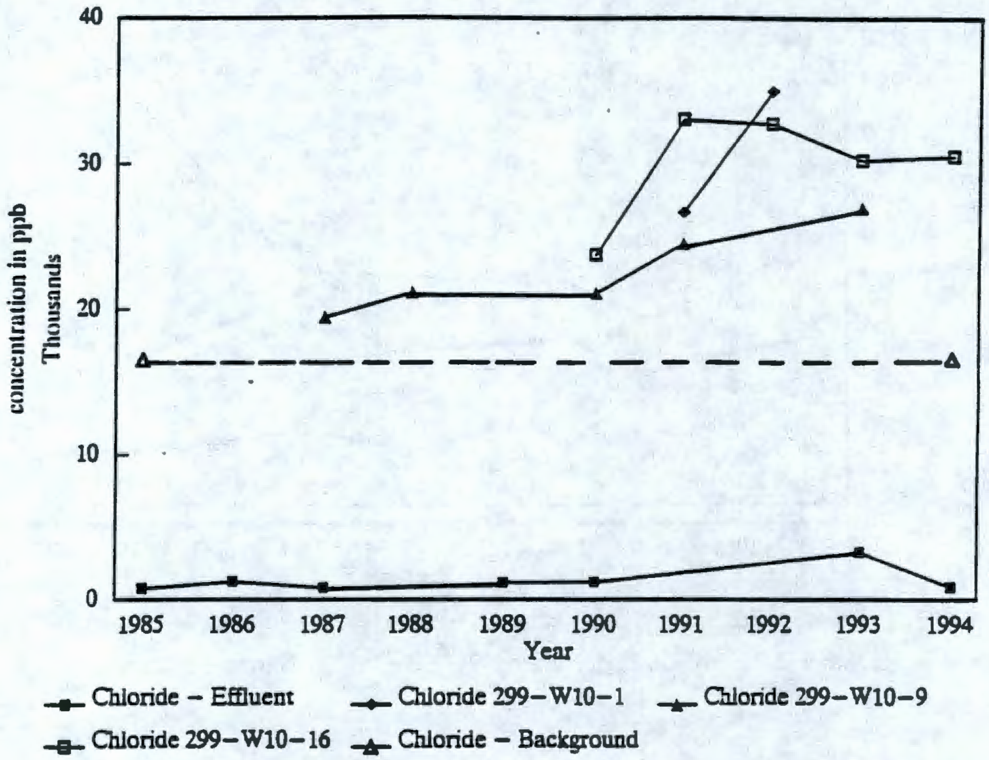


Figure B-5. Concentration Plots of 216-T-1 Ditch Effluent, Groundwater, and Maximum Concentration Guidelines (40 CFR 141)/Hanford Site Background Average for the Unconfined Aquifer (Johnson 1993) for (a) Nitrate, (b) Sulfate, and (c) Chloride. (2 sheets)

(c)



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