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7. Abstract

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The upgradient monitoring well in the original network will be replaced due to the decrease in the water level at that location. Existing wells located upgradient of the facility are evaluated according to this ground water monitoring plan as substitutes for the upgradient well.

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GROUND WATER MONITORING PLAN FOR THE 216-A-29 DITCH

G. L. Kasza, Westinghouse Hanford Company
and
S. M. Goodwin, Pacific Northwest Laboratory

February 1991

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ABSTRACT

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1.0 INTRODUCTION

This document presents a revision to the ground water monitoring plan for the 216-A-29 Ditch Facility (A-29 Ditch) located in the 200 East Area of the Hanford Site in southeastern Washington State (Figures 1-1 and 1-2). The ground water monitoring plan is based on requirements for interim-status facilities, as defined by the Resource Conservation and Recovery Act of 1976 (RCRA) and amended by the Hazardous and Solid Waste Amendments of 1984. These regulations are promulgated by the U.S. Environmental Protection Agency (EPA) in 40 CFR 265, Subpart F, and by the Washington Department of Ecology (Ecology) in Washington Administrative Code (WAC) 173-303-400.

Under RCRA interim status, the A-29 Ditch requires a detection-level ground water monitoring program because it has received wastewater from the Plutonium Uranium Extraction (PUREX) Plant. In the past, this wastewater contained hazardous waste and materials. Since 1984, physical controls and operating procedures have been modified to avoid inadvertent discharge of chemicals to the wastewater stream. No additional hazardous substances are expected to be received by the A-29 Ditch in the future. The A-29 Ditch is currently in assessment monitoring due to elevated specific conductance values in well 2-E25-35. The A-29 Ditch is scheduled to be closed in late 1991.

The purpose of this document is to present a revised ground water monitoring program to continue to monitor the impact of the A-29 Ditch on the quality of the ground water in the uppermost aquifer beneath the facility [40 CFR 265.90(a)]. The original ground water monitoring plan, dated November, 1988, was never released as a supporting document. Specific objectives of this revision include:

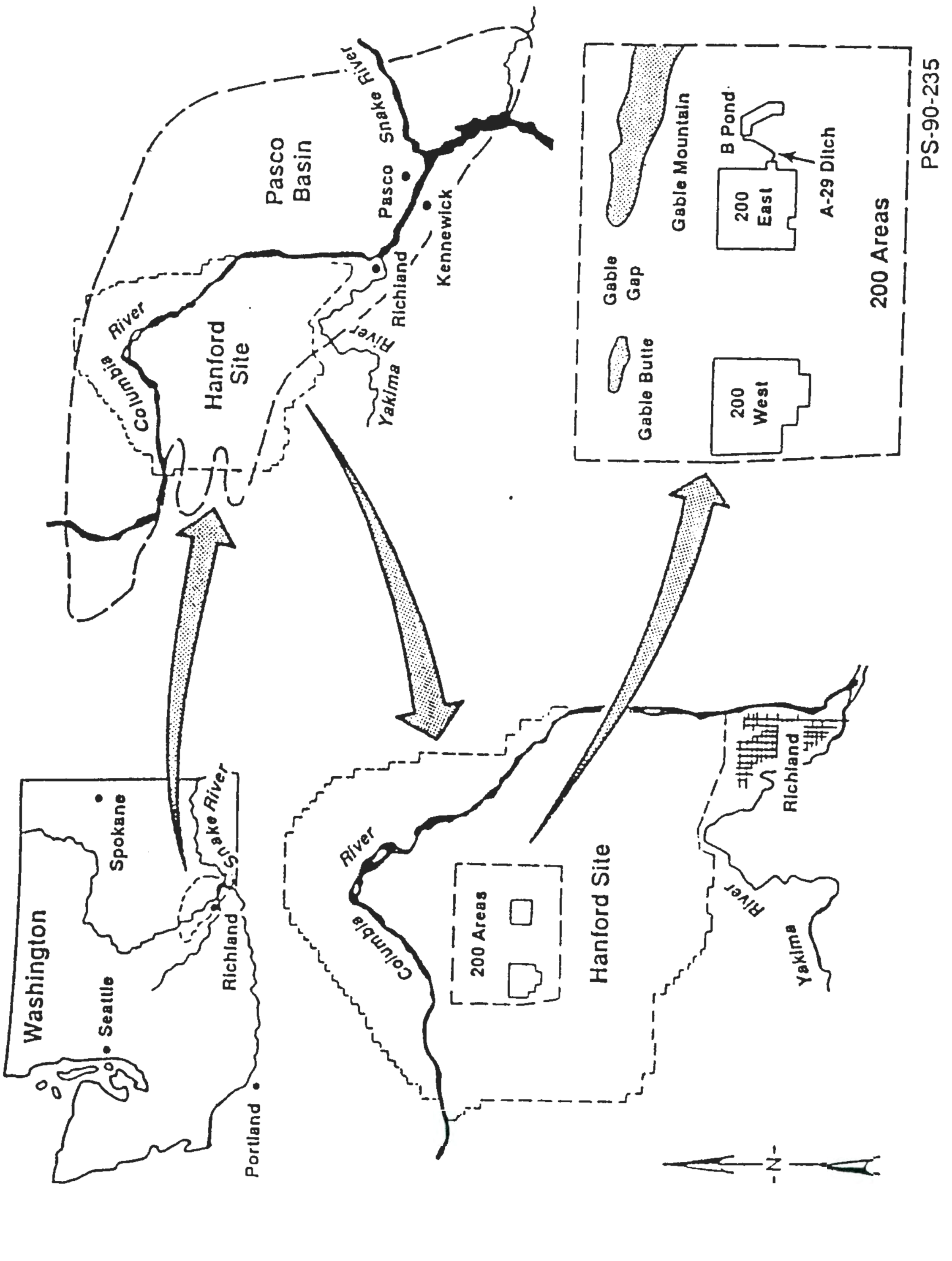
- Present substitute upgradient monitoring wells to replace the well currently used for upgradient monitoring and sampling. Upgradient monitoring is needed to bring the ground water monitoring network into compliance with 40 CFR 265.91(a). The original upgradient well no longer meets this criteria due to the decline in water table elevation.

- Present and justify the locations of the four ground water monitoring wells to be drilled in 1991 to satisfy the requirements of the Tri-Party Agreement Milestone M-24-18.

Chapter 2.0 presents an overview and history of the A-29 Ditch, the waste characteristics of the discharges to the facility, and the geology and hydrogeology of the area. Chapter 3.0 describes the ground water monitoring indicator-evaluation program and the proposed revisions to the monitoring network. A discussion of the ground water quality assessment program is presented in Chapter 4.0.

The hydrogeologic characterization activities and ground water monitoring system presented in this plan constitute a revision to the initial program. Recent hydrogeologic data, ground water chemistry data, stratigraphic, and other pertinent information was evaluated during the preparation of this ground water monitoring plan.

Figure 1-1. Location Map of the Hanford Site and the 200 Areas.



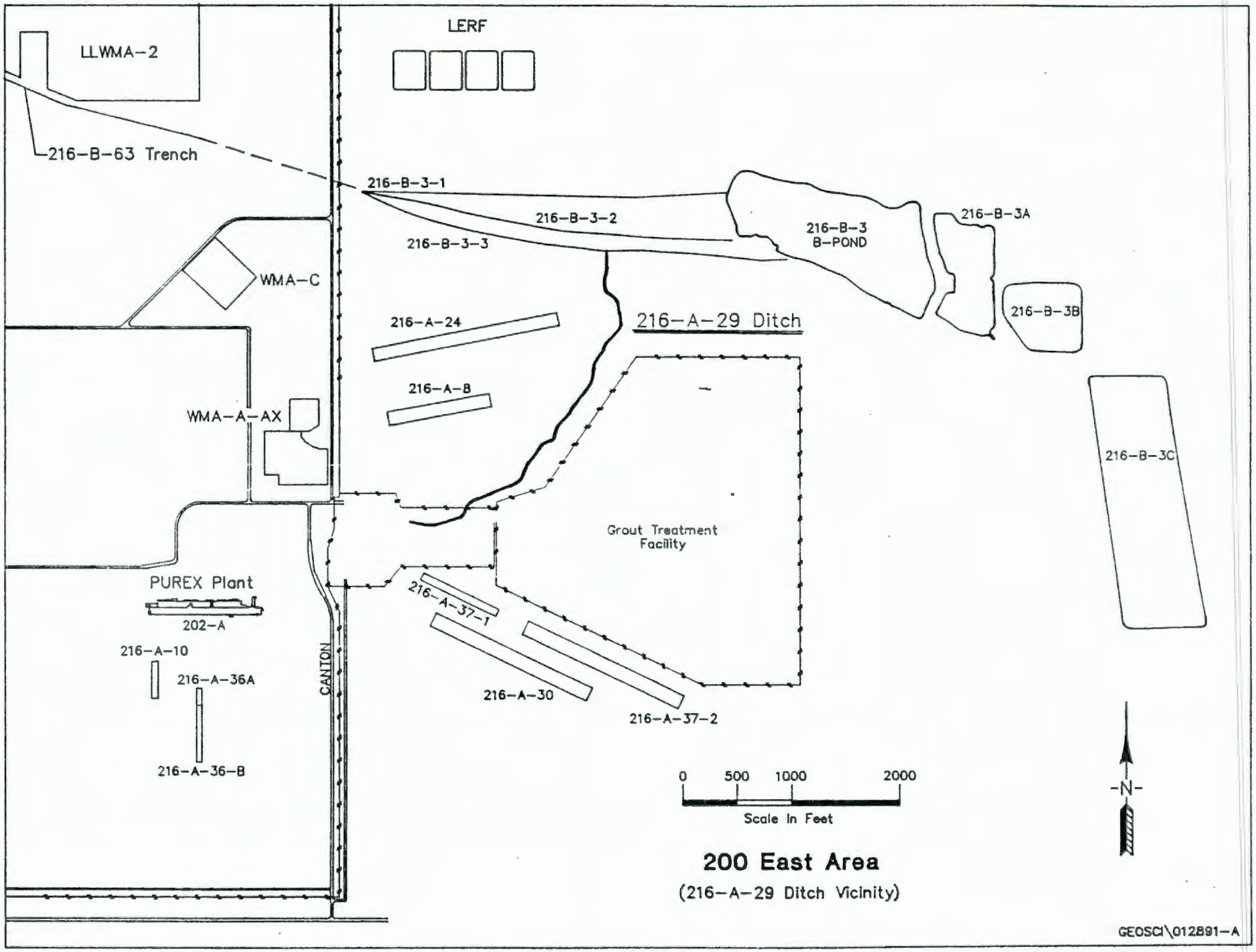


Figure 1-2. Location Map of the 216-A-29 Ditch Vicinity.

2.0 BACKGROUND INFORMATION

The U.S. Department of Energy's (DOE's) Hanford Site has been used for more than four decades for nuclear reactor operations, nuclear fuel processing, radioactive waste management, and related activities. Nuclear reactor operations and nuclear fuel processing activities have ceased on the Hanford Site. The ongoing environmental restoration and radioactive waste management facilities in the 200 East and 200 West Areas are currently operated by Westinghouse Hanford Company (Westinghouse Hanford).

In earlier publications, the combined 200 East and 200 West Areas were commonly referred to as the Separations Areas.

2.1 FACILITY DESCRIPTION

This section describes the A-29 Ditch, its operational history, and waste characteristics. Additional information is located in the Waste Information Data System (WIDS) General Summary Reports. The WIDS data base is controlled and maintained by Westinghouse Hanford. The general summary report for the A-29 Ditch is contained in Appendix A.

2.1.1 Location and Physical Description

The A-29 Ditch is a manmade earthen ditch approximately 6 ft wide and 4,000 ft long that has been in use since 1955. The depth of the ditch varies from 2 to 3 ft at the upper end to approximately 15 ft at the lower end. The point of discharge to the ditch is approximately 900 ft west of the east perimeter fenceline of the 200 East Area. The ditch passes beneath the fence and runs northeast to the 216-B-3-3 Ditch, which discharges to the 216-B-3 Pond.

All discharges to the ditch originate within the 200 East perimeter fence and come from the PUREX chemical sewer line (CSL). Historical discharge sources are listed in Appendix A. Current waste stream sources discharging to the CSL are listed in Table 2-1. Flow from the CSL is continuous, with the volume discharged ranging from 100 to 1,400 gal/min. The average flow is about 970 gal/min. An unknown amount of effluent flowing in the ditch infiltrates into the soil along the course of the ditch.

2.1.2 History of Operation

The A-29 Ditch was put into service in November 1955. The A-29 Ditch initially discharged to the 216-B-3-1 Ditch (Figure 1-2). When the 216-B-3-1 Ditch was retired in 1964, the A-29 Ditch was shortened and discharged to the 216-B-3-2 Ditch. The 216-B-3-2 Ditch was retired in 1970. As a result, the A-29 Ditch was rerouted and now discharges to the 216-B-3-3 Ditch.

Table 2-1. PUREX Chemical Sewer Line Sources.[a]

Waste stream	Source
Floor, funnel, shower, sink, and drinking fountain drain[b]	Aqueous makeup area, battery room, 216-A-211 Building (A-211), process blower room, various service rooms (compressor room, etc.)
Steam condensate	TK-618-1 flash tank, acid fractionator, R-cell evaporative cooling tower, various Service rooms
Tank overflow and drain effluent	Pipe and operating gallery, aqueous makeup area, A-211 tank farm,[c] TK-120, -21, -30, -50, and -618-2 tanks
Demineralizer recharge[d]	A-211 Building
Electric water cooler effluent	Process blower room, two other service rooms
Welding quench tank drain effluent	Instrument and maintenance shops
Sanitary water	R-cell evaporative cooling tower spray wash
Pipe shaft sump/pipe trench effluent	Aqueous makeup area, A-211 Building
Cooling water	Acid fractionator

[a] From DOE 1987.
[b] Flow drains in the pipe and operating gallery are routed to the chemical sewer for short periods during safety shower checks and floor washes.
[c] Secondary containment diking has been installed around tanks in the A-211 tank farm to minimize overflow discharge into the PUREX CSL.
[d] Effluents from the anion and cation units are co-neutralized before discharge.

2.1.3 Waste Characteristics

The A-29 Ditch past received intermittent batches of potentially hazardous spilled chemical materials and/or off-specification process chemicals. Additionally, periodic corrosive effluents were discharged from the plant demineralizer regeneration system. Table 2-2 and Appendix A provide summaries of hazardous discharges to the ditch. The discharges of sodium hydroxide and sulfuric acid solutions from demineralizer operations occurred daily from 1955 until February 1986.

The results of PUREX CSL effluent analyses for hazardous and radioactive components are given in Table 2-3. Additional analysis data is published in the *Liquid Effluent Study Final Project Report* (WHC 1990). These preliminary data indicate that this stream does not currently contain dangerous waste as defined in WAC 173-303.

2.2 GEOLOGY

The geology of the Columbia Plateau, particularly the Pasco Basin, has been studied in detail for DOE as part of the siting studies for a deep geologic repository for nuclear waste. The *Consultation Draft, Site Characterization Plan* (DOE 1988) summarizes much of the information known about the Hanford Site, especially near the 200 West Area where the candidate repository site was located. A more recent compilation of geologic studies relevant to the Hanford Site is provided by Reidel and Hooper (1989). Geologic studies have also been done as part of nuclear power plant licensing efforts, including those for the Washington Public Power Supply System (Supply System 1981) and the Skagit/Hanford Project (PSPL 1982). More detailed information is available in the following reports:

- structural geology, tectonics and volcanism - Caggiano and Duncan (1983) and Reidel and Hooper (1989)
- basalt stratigraphy and chemistry - Swanson et al. (1979); Reidel et al. (1982); Reidel and Hooper (1989)
- sedimentary units interfingered with and overlying the basalts - Bjornstad (1984, 1985); Fecht et al.(1985); Myers/Price et al. (1979); Myers and Price (1981); Graham et al. (1984); and Reidel and Hooper (1989). Tallman et al. (1979) is the only in-depth study of the geology of the 200 Areas.

2.2.1 Regional Geologic Setting

The Hanford Site lies within the Columbia Plateau, which is generally characterized by a thick sequence of tholeiitic basalt flows called the Columbia River Basalt Group (Swanson et al. 1979). These flows have been folded and faulted, creating broad structural and topographic basins separated by asymmetric anticlinal structures (i.e., ridges). The Hanford Site lies within the Pasco Basin, one of these structural basins (Figure 2-1).

Table 2-2. Known Hazardous Discharges to 216-A-29 Ditch.

Waste Constituents	Date	Description
Demineralizer regenerant	1955 to February 1986	Characteristic (corrosive)
Aqueous makeup tank heels and off-specification batches	1955 to October 1984	Characteristic (corrosive and EP[a] toxic)
N-Cell prestart testing (oxalic acid, nitric acid, hydrogen peroxide, calcium nitrate)	April 11, 1983 to August 7, 1983	Characteristic (corrosive)
Potassium permanganate, sodium carbonate solution	October 19, 1983	CERCLA-reportable release[b]
Hydrazine HN solution	June 6, 1984 September 13, 1984 to October 2, 1984	CERCLA-reportable release
Potassium hydroxide	December 2, 1984	CERCLA-reportable release
Nitric acid	August 22, 1984 January 18, 1985 May 27, 1985 June 25, 1985 October 28, 1985	CERCLA-reportable release
Sodium hydroxide	February 26, 1984 November 19, 1984 August 6, 1985	CERCLA-reportable release
Cadmium nitrate	May 16, 1984 December 18, 1985	CERCLA-reportable release
Hydrazine	July 9, 1986	CERCLA-reportable release

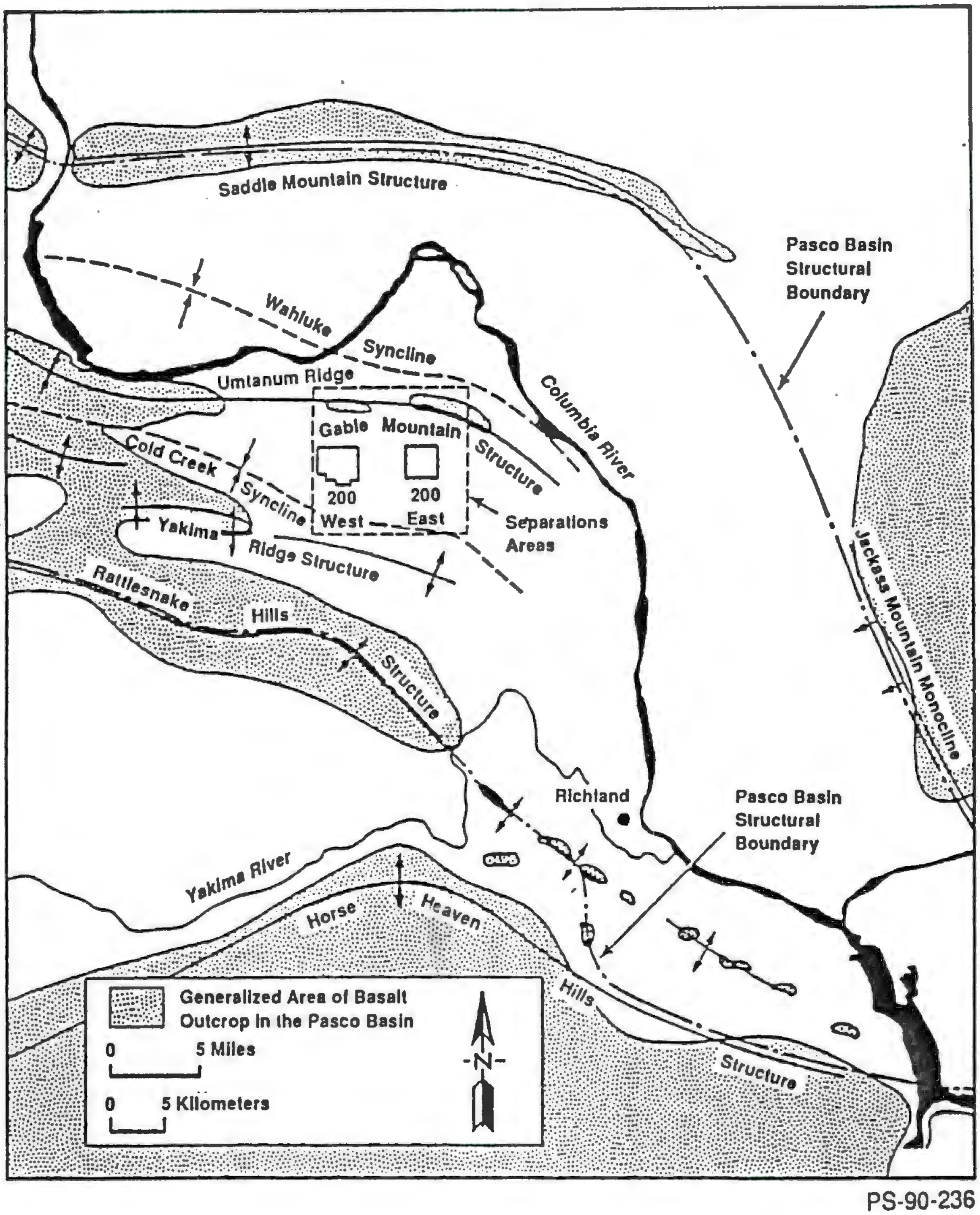
[a] Extraction procedure.
[b] Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

Table 2-3. PUREX Chemical Sewer Line - Data Reports[a]

Parameter	Sample Dates and Result[b]			
	06/06/86	12/19/86	03/18/87	04/06/87
Aluminum	2.0E+02	<1.5E+02	<1.5E+02	<1.5E+02
Ammonium	<5.0E+01	1.2E+02	<5.0E+01	NIC[c]
Antimony	<1.0E+02	<1.0E+02	<1.0E+02	<1.0E+02
Barium	2.4E+01	3.1E+01	2.6E+01	2.4E+01
Beryllium	<5.0E+00	<5.0E+00	<5.0E+00	<5.0E-00
Cadmium	<2.0E+00	<2.0E+00	<2.0E+00	<2.0E+00
Calcium	1.4E+04	2.0E+04	2.1E+04	2.0E+04
Chromium	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Copper	<1.0E+01	2.8E+01	<1.0E+01	<1.0E+01
Iron	2.2E+02	5.0E+01	6.8E+01	6.0E+01
Lead	NR[d]	<5.0E+00	<5.0E+00	<5.0E+00
Magnesium	3.2E+03	4.7E+03	4.7E+03	4.2E+03
Manganese	1.3E+01	<5.0E+00	5.0E+00	<5.0E+00
Mercury	<1.0E-01	<1.0E-01	1.5E-01	<1.0E-01
Nickel	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Potassium	1.3E+03	8.2E+02	8.4E+02	7.4E+02
Silver	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Sodium	2.6E+03	1.2E+04	3.2E+03	2.0E+03
Strontium	<3.0E+02	<3.0E+02	<3.0E+02	<3.0E+02
Uranium	4.1E-01	4.2E-01	4.2E-01	3.0E-01
Vanadium	<5.0E+00	<5.0E+00	<5.0E+00	<5.0E+00
Zinc	5.0E+00	1.0E+01	1.3E+01	7.0E+00
Chloride	<5.0E+02	1.0E+03	1.2E+03	1.2E+03
Cyanide	<1.0E+01	<1.0E+01	<1.0E+01	<1.0E+01
Fluoride	<5.0E+02	<5.0E+02	<5.0E+02	<5.0E+02
Nitrate	<5.0E+02	5.4E+02	5.8E+02	<5.0E+02
Phosphate	<1.0E+03	<1.0E+03	<1.0E+03	<1.0E+03
Sulfide	HTE[e]	HTE	HTE	NIC
Sulfate	8.0E+03	1.2E+04	1.3E+04	1.1E+04
Acetone	<1.0E+01	<1.0E+01	<1.0E-01	2.0E+02
Amount (L/month)	1.5E+08	9.2E+07	4.8E+07	7.5E+07
pH (dimensionless)	7.72	8.56	7.12	8.52
Temperature (Celsius)	31.0	15.9	13.4	24.6
Alpha activity (pCi/L)[f]	4.0E+00	6.0E-01	<1.8E-01	<4.2E-01
Beta activity (pCi/L)	2.3E+01	3.8E+00	4.9E+00	5.1E+00
Conductivity (µS/cm)	1.3E+01	1.7E+02	1.1E+02	1.5E+02
Total organic carbon (p/b)	2.5E+03	1.3E+03	1.2E+03	1.3E+03
Total organic halide (p/b)	1.7E+01	3.1E+01	2.8E+01	2.0E+01

(a) From Jungfleisch (1988).
(b) Analyte concentrations are in p/b.
(c) NIC = measurements made by methods that were not in control at the time of the measurement.
(d) NR = data were not recorded.
(e) HTE = measurements were made after holding times were exceeded.
(f) pico Curies per liter.

Figure 2-1. Structural Geology of the Pasco Basin Near the 200 Areas.



Principal geologic units within the Pasco Basin include, in ascending order, the Columbia River Basalt Group (Miocene), the Ringold Formation (Miocene-Pliocene), and the Hanford formation (Pleistocene). A regionally discontinuous veneer of recent alluvium, colluvium, and/or eolian sediments overlies the principal geologic units.

2.2.2 Geology of the 200 Areas

The surface topography of the 200 Areas is primarily the result of two geomorphic processes: (1) Pleistocene cataclysmic flooding and (2) Holocene eolian activity. Cataclysmic flooding, which ended about 13,000 years ago (Mullineaux et al. 1978), created Cold Creek bar (Bretz et al. 1956), a prominent flood feature within the 200 Areas (Figure 2-2). The last cataclysmic flood(s) covered the 200 Areas with a blanket of coarse-grained deposits that become finer-grained to the south. The northern boundary of the Cold Creek bar is defined by an erosional channel running east-southeast, which formed during waning stages of flooding as floodwaters drained from the basin (Bjornstad et al. 1987).

Since the end of the Pleistocene, winds have locally reworked the surface of the glaciofluvial sediments, depositing a thin discontinuous veneer of eolian sand. Holocene sand dunes are present along the southern boundary of the 200 East Area (Figure 2-2). Holocene alluvium, associated with the Cold Creek-Dry Creek alluvial plain, was deposited less than 1 mi southwest of the 200 West Area (Figure 2-2).

The 200 Areas lie within the Cold Creek syncline, which is bounded on the north by the Umtanum Ridge-Gable Mountain anticlinal structure and on the south by the Yakima Ridge anticlinal structure (Figure 2-1). In the 200 Areas, the top of the basalt generally dips gently (<5 degrees) to the south-southwest, except in the southwest corner of the 200 West Area, where beds are nearly horizontal along the axis of the Cold Creek syncline.

The generalized stratigraphy of the 200 Areas is shown in Figure 2-3. Bedrock is composed of basalt flows and sedimentary interbeds, which belong to the Columbia River Basalt Group and Ellensburg Formation, respectively. The uppermost basalt flow in the 200 Areas is generally the Elephant Mountain Member, which acts as a confining layer to the underlying Rattlesnake Ridge interbed. Overlying Columbia River basalt is the fluvial-lacustrine Ringold Formation, consisting of variably mixed and interbedded layers of gravel, sand, silt and clay. The thickness of the Ringold Formation ranges from 0 ft in the northern part of the 200 East Area to about 500 ft in the southwest portion of the 200 West Area near the axis of the Cold Creek syncline (DOE 1988; Tallman et al. 1979).

The Ringold Formation has been subdivided into four stratigraphic units: basal, lower, middle, and upper. The basal Ringold unit consists of clast supported pebble to cobble gravel overlain by a fining upward sequence of silt and sand. Overlying the basal Ringold is the lower Ringold unit, a coarse to medium-grained silty sand to sandy silt. Sediments of the lower Ringold and upper basal Ringold units are often indurated and have been recognized locally as a potential confining layer (Graham et al. 1981).

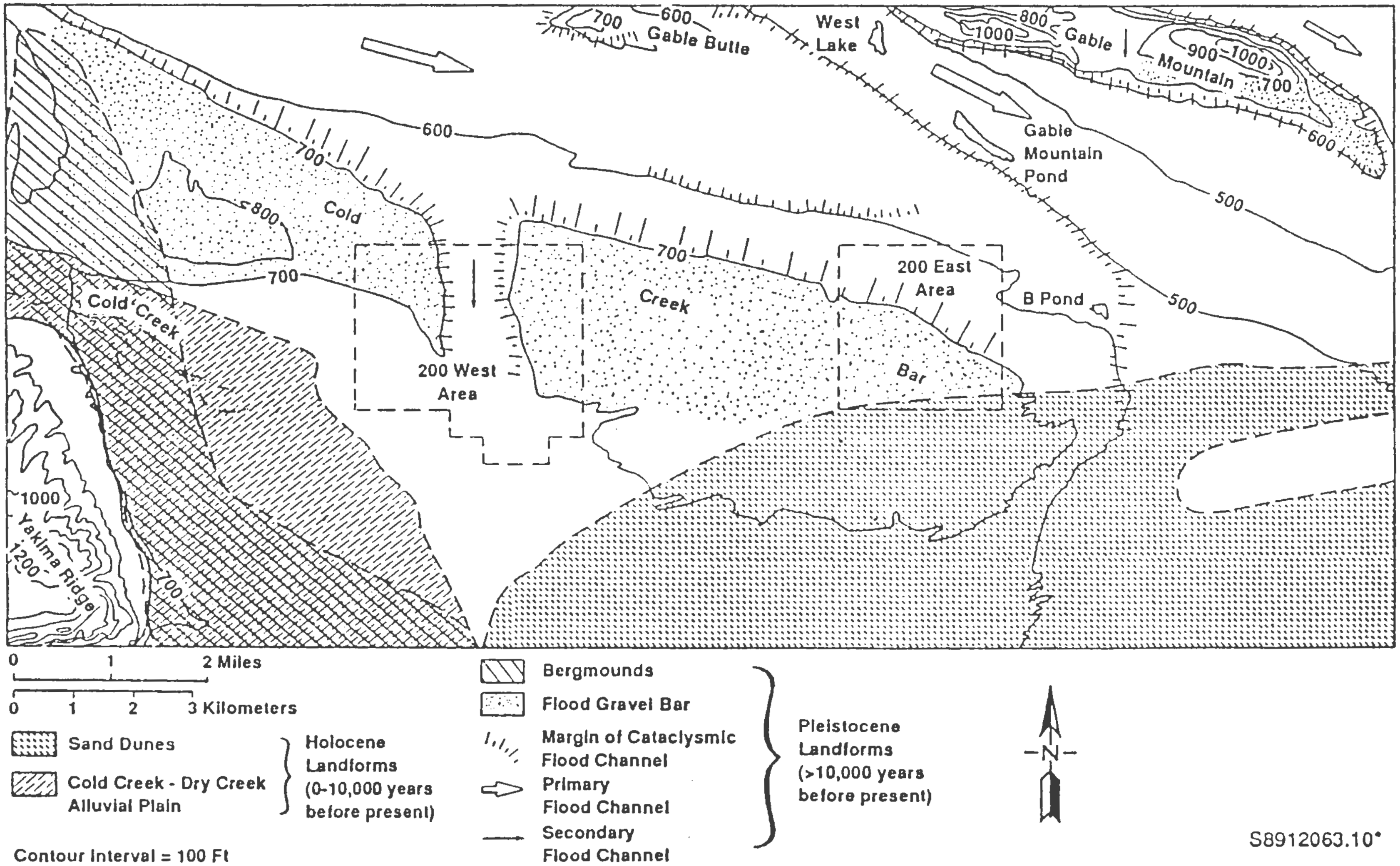
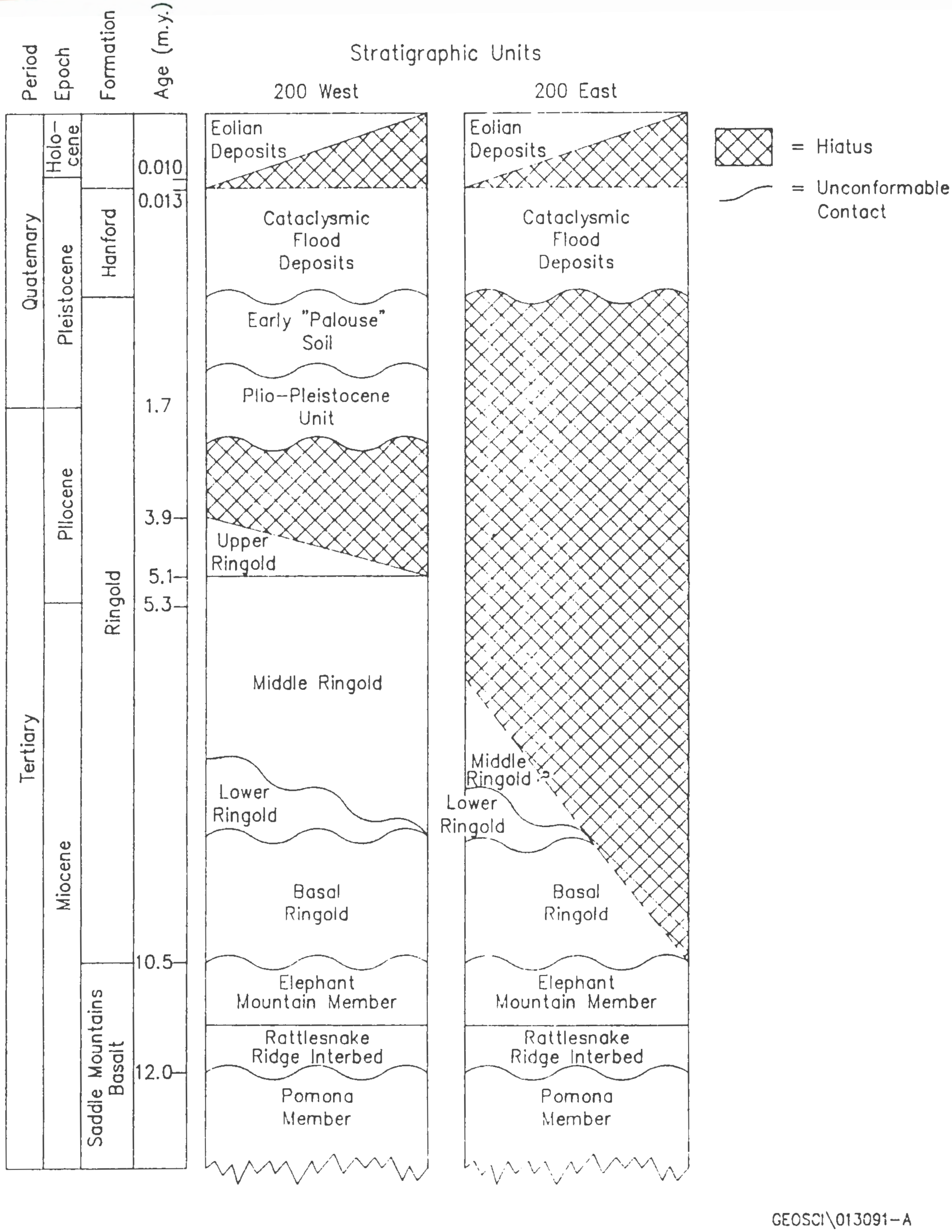


Figure 2-2. Geomorphic Features Surrounding the 200 Areas.

Figure 2-3. Generalized Geologic Columns for the 200 Areas.



The middle Ringold unit is the thickest of the Ringold units in the vicinity of the 200 Areas. It consists of a clast-supported, pebble to cobble gravel with a fine- to coarse-grained sand matrix. Cobbles and boulders are locally common (Tallman et al. 1979), as are discontinuous sand and silt interbeds. Because of similarity of textures and gravel lithologies, the coarse-grained basal and middle Ringold units are difficult to distinguish unless separated by the fine-grained sediments of the upper basal Ringold unit or the lower Ringold unit. The upper Ringold is a sequence of thinly bedded, well-sorted sands/silts and silty clay.

Not all of the units of the Ringold Formation are present throughout the 200 Areas. Erosion by the ancestral Columbia River and later cataclysmic flooding during the Pleistocene Epoch has partially or completely eroded the Ringold Formation in some areas (DOE 1988; Tallman et al. 1979). All four units are currently identified only in the western and southern portion of the 200 West Area, while little or no Ringold Formation is present in the north-eastern part of the 200 East Area (Last et al. 1989; Tallman et al. 1979).

A well-developed calcrete belonging to the Plio-Pleistocene unit is found on the uppermost surface of the eroded Ringold sediments in the 200 West Area (Bjornstad 1984; Last et al. 1989). In places, the Plio-Pleistocene unit is overlain by as much as 30 ft of early "Palouse" soil, an eolian deposit of silt and fine-grained sand. Both of these units are present over most of the 200 West Area, but they have apparently been eroded in the 200 East Area.

The cataclysmic flooding that eroded the Ringold Formation also deposited a sequence of relatively unconsolidated silt, sand, and gravel informally called the Hanford formation. At least four major flood events occurred in the Pasco Basin during the Pleistocene (Fecht et al. 1985). Near flood channels (e.g., in the northern 200 East Area), the Hanford formation consists predominantly of coarse gravel grading to sand (Pasco Gravel facies), while to the south and west, slack-water type deposits of silt and sand (Touchet Bed facies) lie between or beneath coarse-grained flood deposits (Last et al. 1989). Within much of the southern portion of the 200 Areas, the Hanford formation consists predominantly of sand. Thickness of the formation ranges from approximately 70 ft in the 200 West Area to a maximum of about 350 ft east of the 200 East Area (Tallman et al. 1979).

The contact between the Hanford and Ringold formations is commonly a transition upward from more indurated deposits containing a variety of lithologies (Ringold Formation) to very weakly cemented or unconsolidated sediments with a higher proportion of basaltic clasts (Hanford formation). The textures of the Pasco Gravel and the middle Ringold are similar, although the difference in gravel lithologies can sometimes be used to distinguish between them. However, basalt-rich gravel lenses have been found in the middle Ringold unit, and if the middle Ringold unit and Pasco Gravel are not separated by the upper Ringold, the Plio-Pleistocene unit, and/or the early "Palouse" soil, they can be difficult to distinguish. This is particularly true where considerable reworking and incorporation of the Ringold sediments into the Hanford formation has occurred.

Graham et al. (1984) suggest the possibility that the Elephant Mountain Member has been completely eroded near the northeast corner of the 200 East Area, with partial erosion over a larger area. As a result, the Hanford formation may directly overlie the Rattlesnake Ridge interbed in the northeast portion of the 200 East Area.

2.2.3 Geology Beneath the A-29 Ditch

This subsection describes the site-specific stratigraphic characteristics beneath the A-29 Ditch. General information on the geology beneath the ditch is presented here, based on well log data collected by DOE contractors during previous drilling and well installations in the area. Well log data from wells surrounding the ditch are presented in Figure 2-4 and Appendix B. These logs are kept in the project files of the Westinghouse Hanford Geosciences Group. Additional geologic data were collected south and east of the A-29 Ditch as part of the Grout Treatment Facility (GTF) site investigation (Swanson et al. 1988). The cross section presented in Figure 2-5 illustrates the stratigraphy beneath the southern portion of the ditch.

The Elephant Mountain Member of the Saddle Mountains Basalt forms the bedrock surface beneath the A-29 Ditch and is estimated to be 80 ft thick (Graham et al. 1984). This surface generally dips 250 ft/mi to the south as determined through various borehole investigations (Graham et al. 1984; Swanson et al. 1988). In the vicinity of the A-29 Ditch, basalt has been encountered in well 299-E25-28, 299-E25-32, and 299-E25-33 at 319, 319, and 289 ft above mean sea level (MSL), respectively (Figure 2-5). Basalt was not encountered during drilling in any other wells near the A-29 Ditch; however, none of the wells penetrated depths greater than 360 ft above MSL. Insufficient information is available to locate the contact between the Hanford and Ringold formations.

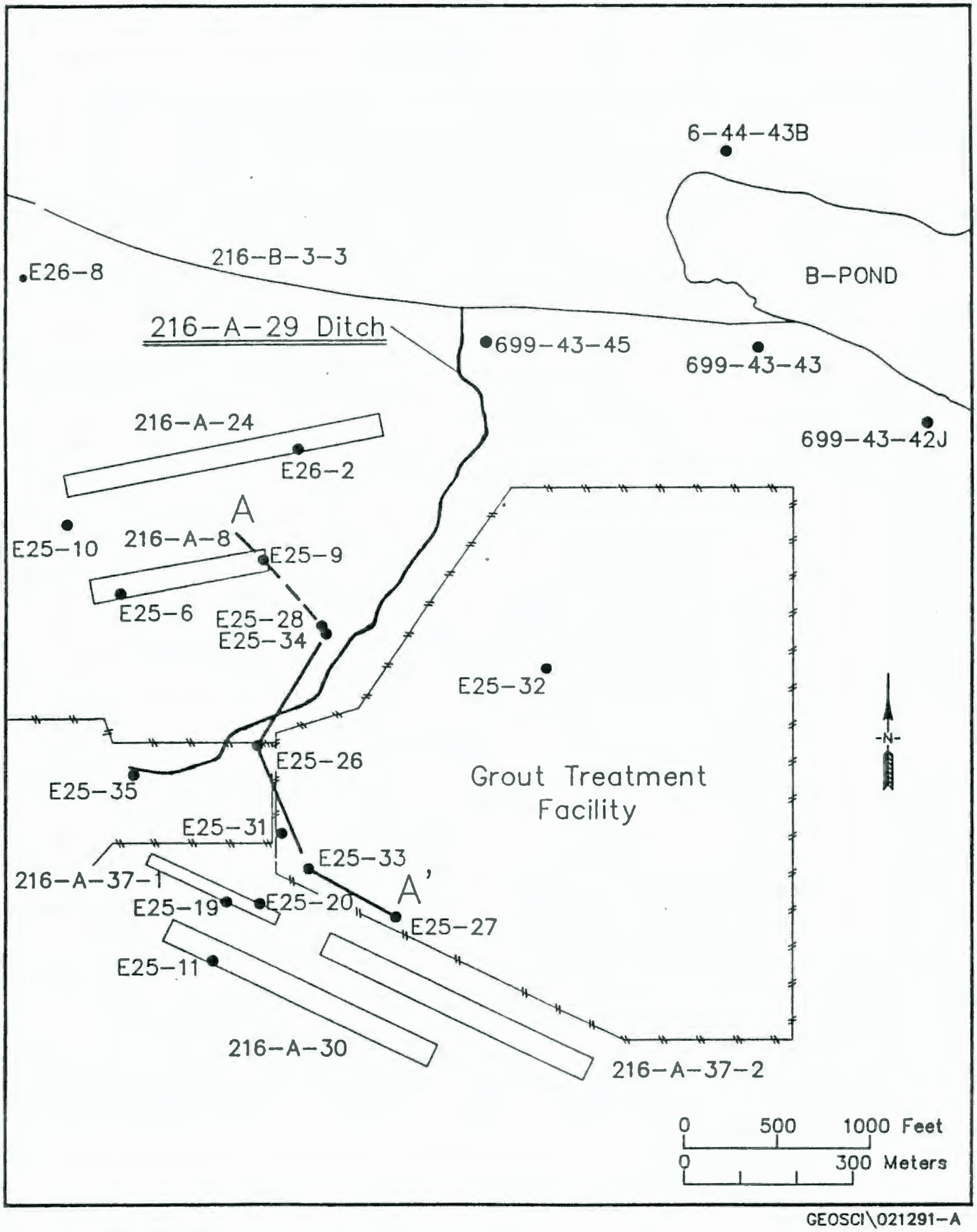
2.3 HYDROGEOLOGY

This section provides background information on the hydrogeology of the Hanford Site, the 200 Areas, and the A-29 Ditch in support of the indicator-evaluation ground water monitoring program presented in Section 3.0. Detailed descriptions of the Hanford Site and the 200 Areas hydrogeology are available in reports by DOE (1988); Gephart et al. (1979); Graham et al. (1981); Graham et al. (1984); Last et al. 1989; and Law et al. (1987), and in water level data collected and reported semiannually by Kasza et al. (1990).

2.3.1 Regional Setting

The Hanford Site lies within a semiarid climatic zone that commonly has warm, dry summers and cool winters. Climatic records indicate that annual precipitation at the Hanford Site has varied from a low of 3 in. to a high of 11.5 in. with a mean of 6.3 in. (DOE 1988). The majority of annual precipitation, approximately 42%, occurs between November and February. The largest body of surface water at Hanford is the Columbia River (see Figure 1-1), which serves as the local and regional discharge for ground water and surface water runoff.

Figure 2-4. Location Map of Wells Near the 216-A-29 Ditch.



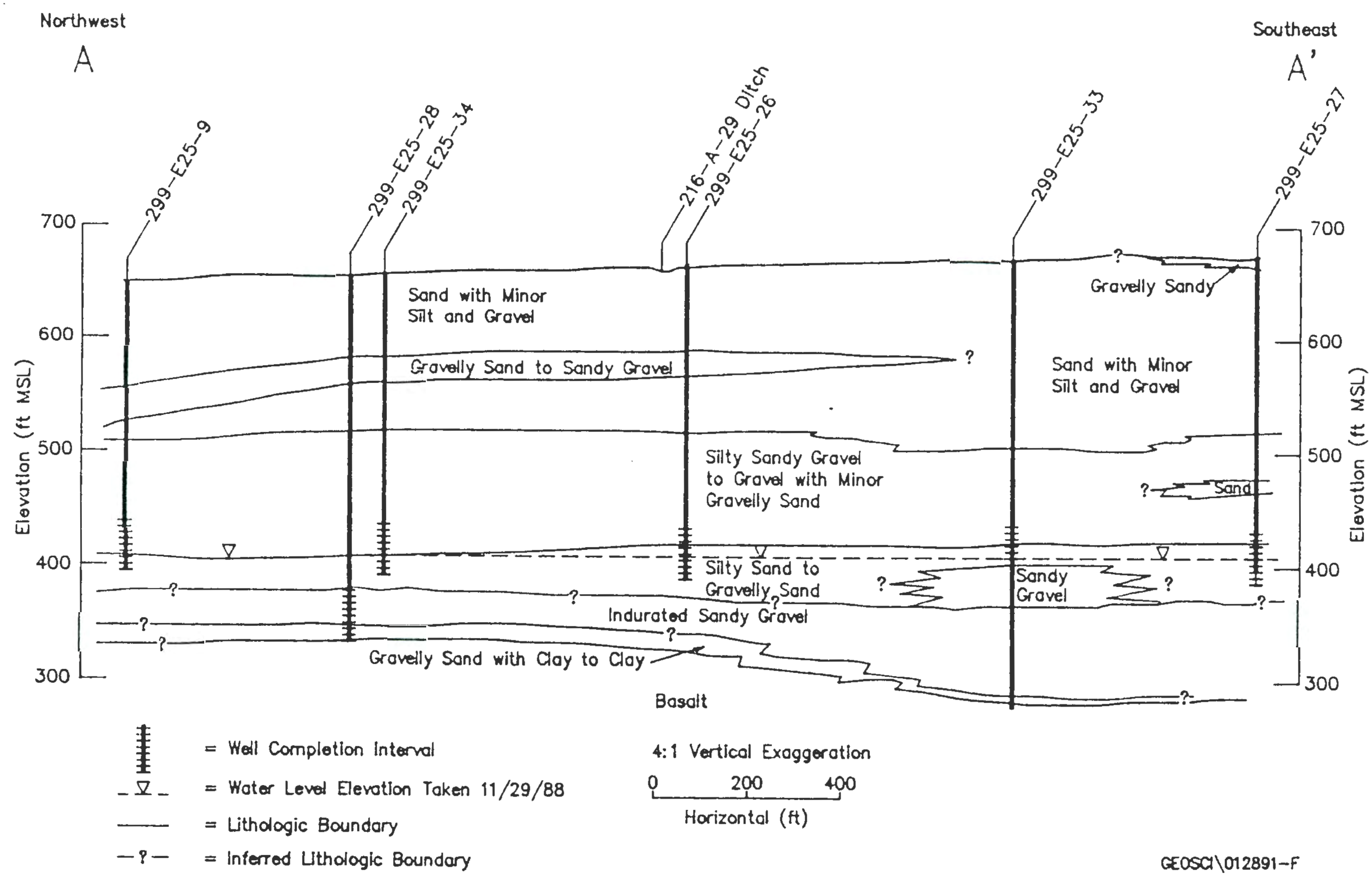


Figure 2-5. Stratigraphic Cross Section A-A'.

Some evapotranspiration studies have been conducted on the Hanford Site, but a detailed study the 200 Areas has not been produced. Wallace (1977) used the Hanford Meteorology Station data to compute average potential evapotranspiration for the Hanford Site using three different methods: the Penman, Thornthwaite-Maither, and Morton methods. These estimates of potential evapotranspiration show values ranging from five to nine times the mean annual precipitation. However, a comparison of monthly estimates reported in Stone et al. (1983) indicates that precipitation may exceed potential evapotranspiration for the months of November through February and may be available for ground water recharge.

Within the Hanford Site, annual natural recharge rates have been estimated to range from near zero to more than 4 in. annually, depending on surface conditions (Gee 1987; Routson et al. 1988). Small recharge rates occur where fine-textured sediments and deep-rooted plants occur (e.g., in undisturbed portions of the 200 Areas). The larger values are associated with areas having a coarse gravelly surface and no vegetative cover.

Ground water beneath the Hanford Site occurs under unconfined, semiconfined, and confined conditions. The unconfined aquifer is contained primarily within the lower portion of the Hanford formation and the middle unit of the Ringold Formation (Graham et al. 1981). The base of the unconfined aquifer is the basalt surface, or, where present, the clays and silts of the lower and basal Ringold units (Figure 2-3). Where these fine-grained sediments occur they represent a semiconfining layer for the coarse-grained facies of the basal Ringold unit (DOE 1988). Confined aquifers beneath the Hanford Site include sedimentary interbeds and interflow zones that occur between dense basalt flows of the Columbia River Basalt Group.

The major sources of natural recharge to the unconfined aquifer are rainfall and runoff from areas of high relief bordering the Hanford Site, ephemeral streams in the Cold Creek and Dry Creek valleys, and localized areas where river water is induced into the ground water as temporary bank storage during high stages of the Yakima or Columbia rivers (Graham et al. 1981). Discharge from the unconfined aquifer is primarily to the Columbia River.

2.3.2 Ground Water Hydrology of the 200 Areas

As more characterization efforts are undertaken on the Hanford Site, the understanding of the geologic framework and its relation to the hydrogeologic system will continue to be developed and refined. This document does not attempt to integrate all that is known of the hydrogeologic system within the 200 Areas. Instead, this discussion is limited to the hydrologic properties of the uppermost portion of the unconfined aquifer contained in the Hanford and Ringold formations.

The unconfined aquifer receives artificial recharge from liquid waste disposal areas. This artificial recharge is estimated to be 10 times greater than natural recharge (Graham et al. 1981). Graham et al. estimated natural recharge from the Cold Creek valley to the 200 Areas to be approximately 1.3×10^6 gal/d. The total volume of liquid effluents discharged to radioactive disposal facilities in the 200 Areas in 1988 was approximately 2.4×10^{10} gal (Coony and Thomas 1989), or a rate of approximately 6.6×10^7 gal/d.

The major sources of artificial recharge in the central Hanford Site have been three waste ponds designated U Pond, Gable Mountain Pond, and B Pond. All are located near or in the 200 Areas. These areas of artificial recharge have had, and continue to have, a major effect on ground water flow within the unconfined aquifer. U Pond, located in the 200 West Area, and Gable Mountain Pond, located north of the 200 East Area, were decommissioned in 1984 and 1987, respectively. B Pond is scheduled for decommissioning in the mid-1990s.

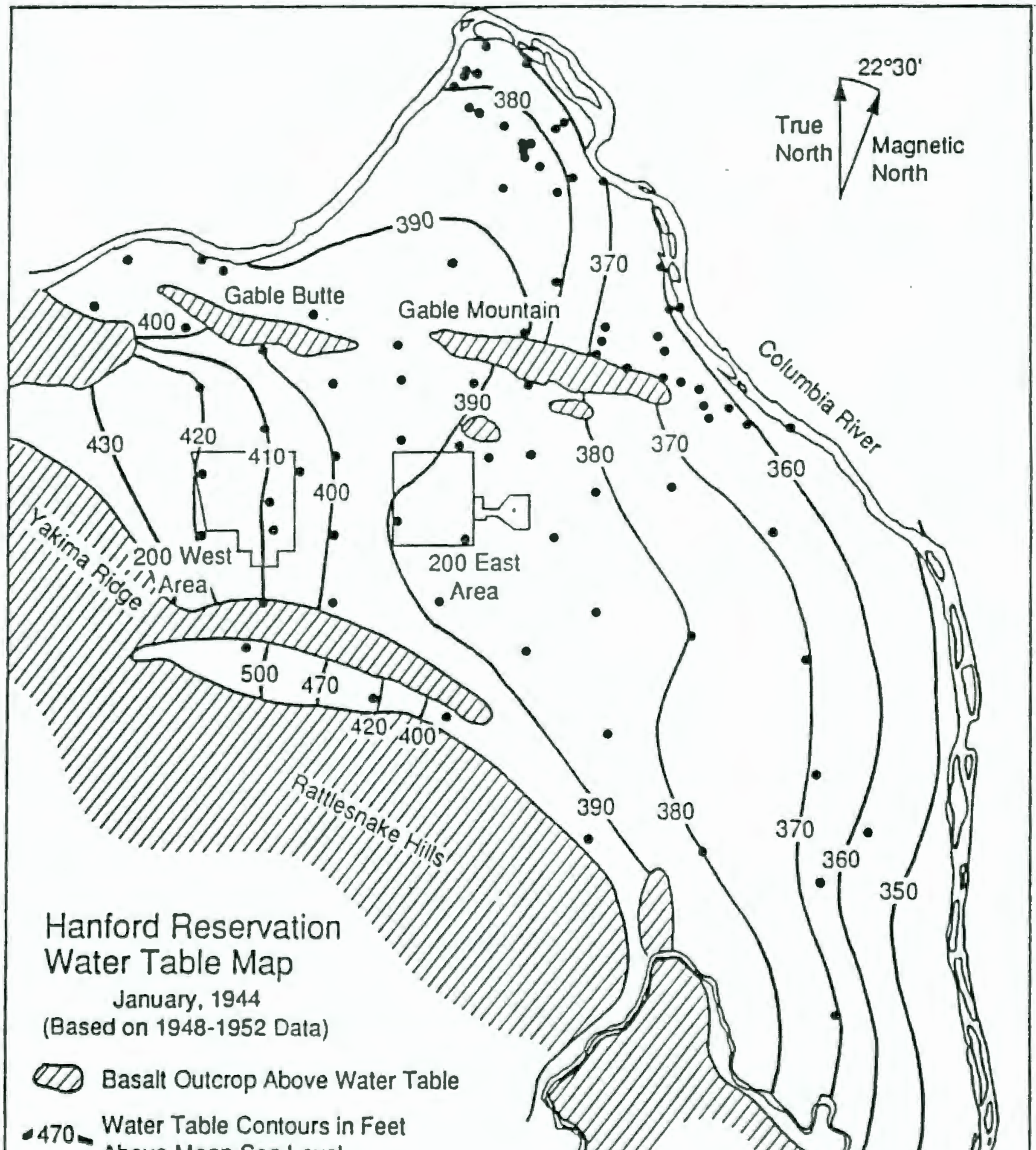
The depth to water within the unconfined aquifer in the 200 Areas ranges from approximately 190 ft beneath the former U Pond to approximately 340 ft west of the 200 East Area. The saturated thickness of the unconfined aquifer ranges from 0 ft at the north edge of the 200 East Area to more than 250 ft in the northwest part of the 200 West Area. A reconstruction of the Hanford Site water table elevations for January 1944 is depicted in Figure 2-6. Figure 2-7 shows a recent water table map for the 200 Areas (Kasza et al. 1990). The December 1990 water table levels adjacent to the A-29 Ditch are shown in Figure 2-8. The regional flow direction across the 200 Areas is generally from west to east, but is affected by two ground water mounds that have resulted from discharges to U Pond and B Pond. Ground water flow beneath the 200 West Area is generally toward the north and the east, away from the mound created by past discharges to U Pond. As this mound dissipates, the horizontal hydraulic gradient is expected to decrease and shift to the east.

The horizontal hydraulic gradient in the 200 West Area is relatively high, ranging from 4 ft/1,000 ft to 1.5 ft/1,000 ft. Downward vertical hydraulic gradients are expected to be present within the unconfined aquifer in portions of the 200 West Area as a result of the U Pond ground water mound (Graham et al. 1981).

A comparison of the hindcast water table map of the Hanford Site for 1944 (Figure 2-6) and the 200 Areas water table map for June 1990 (Figure 2-7) indicates that the natural water table elevation in the 200 West Area was 65 ft lower in 1944. The hindcast map indicates that the direction of regional flow was toward the east, and the natural hydraulic gradient was on the order of 1 ft/1,000 ft in the 200 West Area.

Ground water flow beneath the 200 East Area is more complex because of the convergence from the west (local ground water flow system) and east (B Pond artificial recharge effects). This flow convergence and hydrogeologic barrier conditions caused ground water within the unconfined aquifer to diverge with a component flowing northward between Gable Butte and Gable Mountain and another component following southeast toward the Columbia River. This convergence and divergence of ground water flow is evident on the water table map in Figure 2-7. In addition, the high transmissivity (up to 135,000 ft^2/d) beneath most of the 200 East Area results in very small hydraulic gradients ranging from 0.10 to 0.30 (Graham 1981). Flow directions may change temporarily because of changing rates of wastewater discharged to B-Pond and other disposal sites. Therefore, it is often difficult to define flow directions from water table maps of the 200 East Area. However, contaminant plume maps of the 200 Areas can indicate long term trends in ground water flow directions (Serkowski et al. 1988). These plume maps indicate a north-northwest direction of flow in the extreme north central portion of the 200 East Area and a south to southeast direction of flow in the southeast portion of the 200 East Area.

Figure 2-6. Hindcast Water Table Map of the Hanford Site, January 1944. (ERDA 1975)



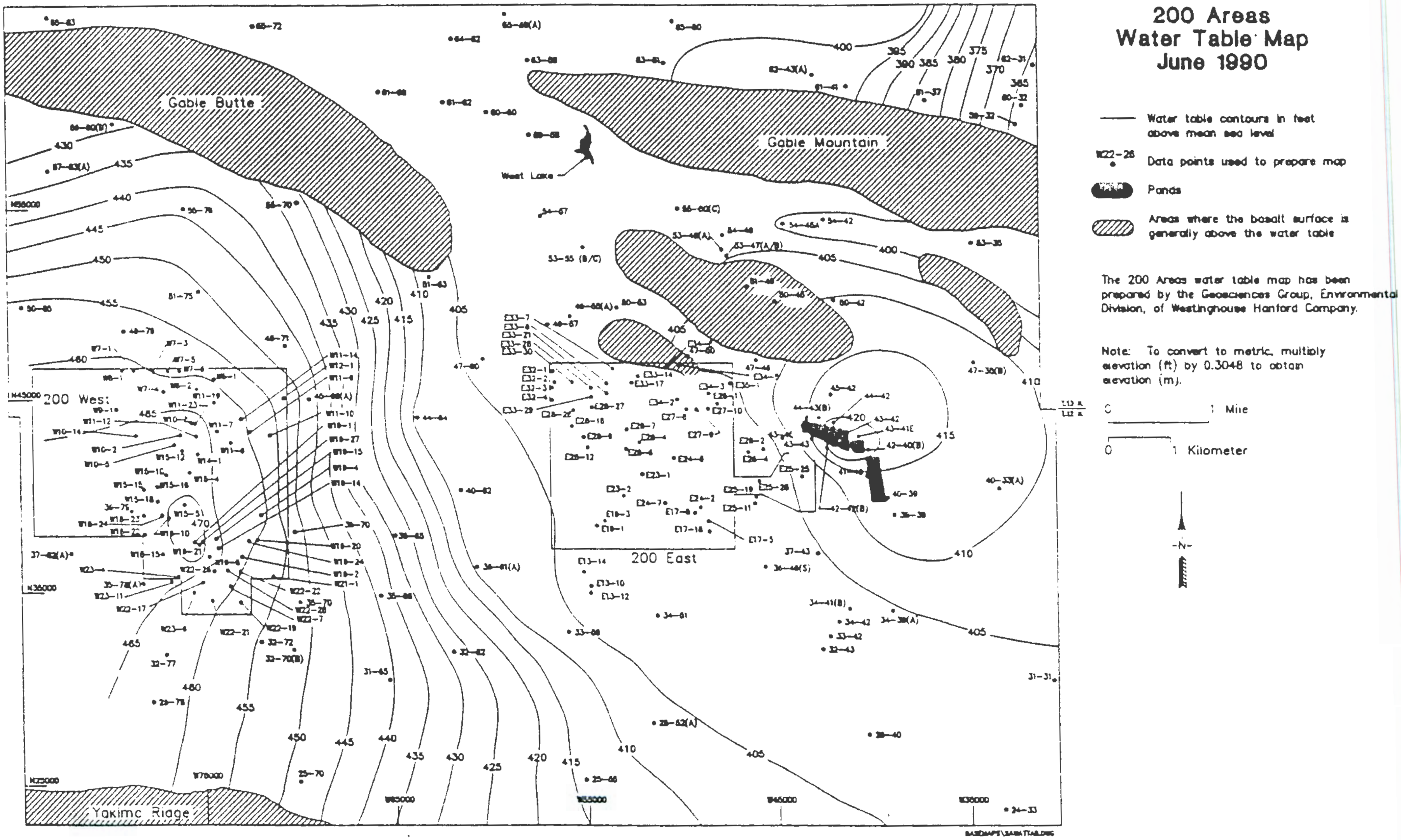
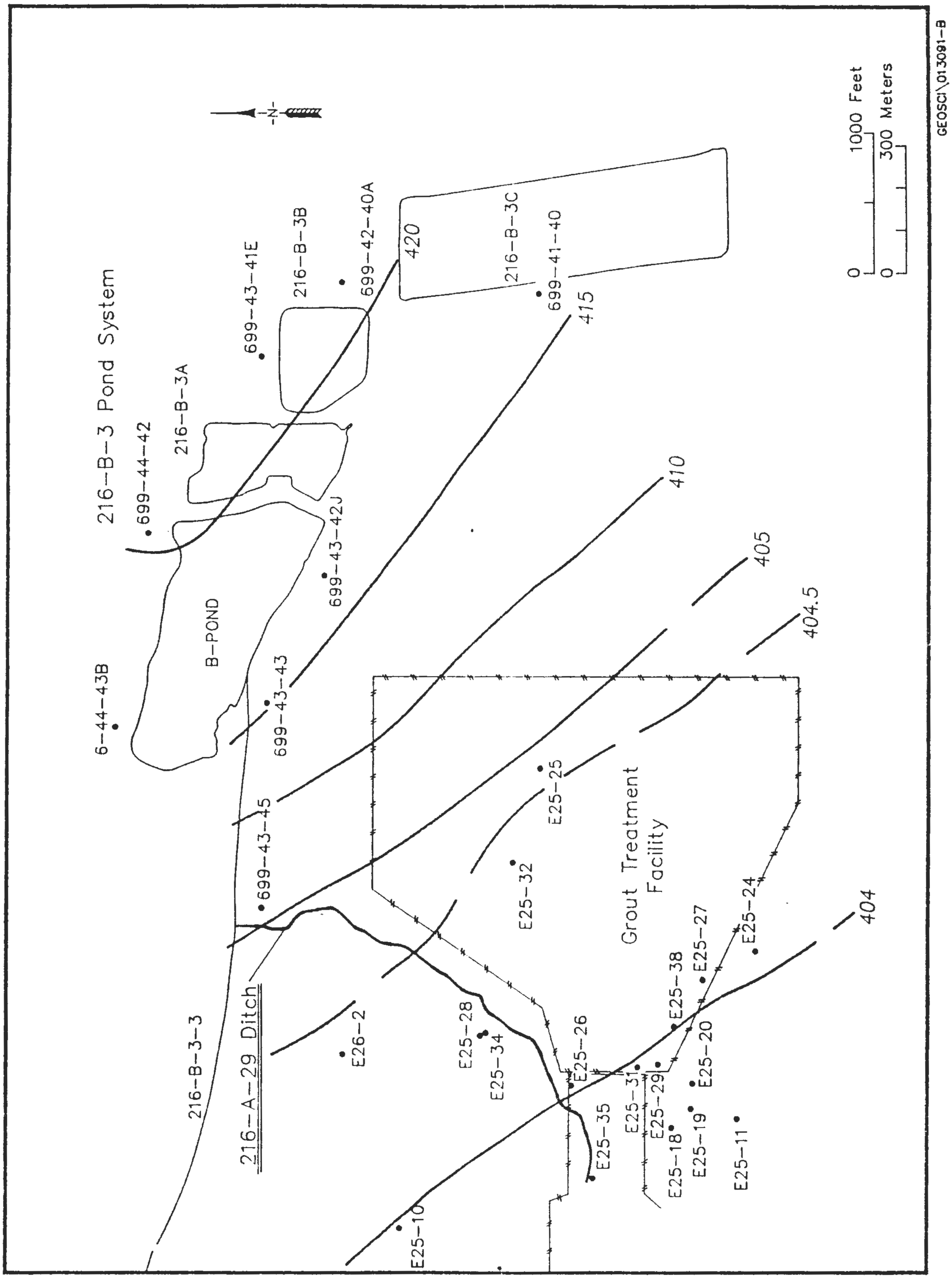


Figure 2-7. Water Table Map of the 200 Areas, June 1990.

Figure 2-8. Water Table Levels in the 216-A-29 Ditch Area, December 1990.



The principal geologic units (see Figure 2-3) controlling the ground water flow in the 200 Areas are, in ascending order, the Elephant Mountain Member, which acts as a lower confining layer in most areas; the Ringold Formation, which contains both semiconfined and unconfined aquifer components; and the Hanford formation. Basalt of the Elephant Mountain Member is assumed to be the base of the unconfined or uppermost aquifer near the 200 East Area. However, two studies by Graham et al. (1984) and Jensen (1987) indicate possible aquifer intercommunication between the unconfined aquifer and the confined Rattlesnake Ridge aquifer near the 200 East Area.

The Elephant Mountain Member has possibly been removed by erosion in the vicinity of the northeast corner of the 200 East Area, providing a means for aquifer intercommunication. A zone of downward hydraulic gradient occurs between the unconfined aquifer and the uppermost confined Rattlesnake Ridge aquifer beneath B Pond (Graham et al. 1984; Jensen 1987; Kasza et al. 1990).

The Ringold Formation exhibits a variety of hydrologic characteristics, including hydraulic conditions ranging from locally confined to unconfined. In the southern portion of the 200 East Area and much of the 200 West Area, the coarse-grained facies of the basal Ringold unit are locally confined by the overlying lower and fine-grained basal Ringold units (Last et al. 1989). In other areas, the fine-grained basal and lower Ringold units are missing, and the coarse-grained basal and/or middle Ringold units contain the unconfined aquifer. In the northeastern portion of the 200 East Area, the Ringold Formation is completely removed by erosion. Here, the unconfined aquifer lies within the Hanford formation, which directly overlies the basalt (Tallman et al. 1979).

The lithologies in the unconfined aquifer exhibit widely varying hydrogeologic properties (Table 2-4). The values given in this table are generalizations; in some locations hydraulic properties may lie outside the estimated ranges given.

Table 2-4. Hydraulic Properties in the 200 Areas[a].

Interval tested	Hydraulic conductivity (ft/d)	Storativity	Effective porosity (%)
Hanford formation	2,000-10,000	0.07	30
Middle Ringold Unit	9-230	NA[b]	NA
Lower Ringold Unit	1-12	0.002	10

[a] Graham et al. 1981.
[b] NA = not available.

In the 200 West Area, the unconfined aquifer occurs primarily within the middle Ringold unit, which is compacted and often partially cemented. Transmissivities range from 300 to 5,400 ft^2/d (Graham et al. 1981). In the 200 East Area, the aquifer is in either the unconsolidated Hanford formation, the middle Ringold unit, or both, leading to a wide range of transmissivities (i.e., from 5 to 135,000 ft^2/d). Transmissivities generally increase from west to east across the 200 Areas as a result of thinning of the Ringold Formation.

The measured storativity values for the unconfined aquifer range from 0.002 to 0.07 (Table 2-4); the lower values are associated with the lower Ringold unit and the higher values with the Hanford formation (Graham et al. 1981).

The effective porosity of the sediments in the unconfined aquifer ranges from 10 to 30% (Graham et al. 1981). The lower value corresponds to sediments contained within the lower Ringold unit, and the upper range approaches the total porosity of the sediments contained within the Hanford formation.

An estimate of horizontal ground water velocity has been made for the 200 Areas, based on the movement of the tritium plume (Wilbur et al. 1983). The configuration of the plume in 1964 indicates that the ground water flowed at an average of 0.9 mi/yr since the PUREX Plant began operations. Data from 1972 indicate tritium migration of 11.4 mi in 16 yr, or an average of 0.7 mi/ yr. These estimates correspond to a range from 10 to 13 ft/d. These estimates probably represent ground water flow in the Hanford formation and in the coarser-grained portions of the Ringold Formation.

The chemical composition of the water in the unconfined aquifer ranges between calcium-bicarbonate, sodium-bicarbonate, and calcium-sulfate types (Graham et al. 1981). Calcium-bicarbonate is the most prevalent constituent in the ground water. However, there is considerable variability in chemical composition of the ground water beneath the 200 Areas.

Discontinuous perched water tables occur in localized areas in the 200 West Area, often lying on top of a calcrete horizon in the Plio-Pleistocene unit or above markedly finer-grained sediments in the upper Ringold unit, early "Palouse" soil, and Hanford formation. The lateral extent of these perched water tables has not been defined in detail, but they are believed to be discontinuous and found only near areas where large quantities of water were disposed to waste facilities.

2.3.3 Hydrogeology Beneath the 216-A-29 Ditch

The uppermost aquifer beneath the A-29 Ditch is unconfined and occurs within the undifferentiated Hanford/Ringold formations. According to as-built diagrams in Appendix B and Figure 2-5, existing shallow wells in the A-29 Ditch monitoring network are completed within a silty sand to gravelly sand unit. On the basis of information from existing wells in the area, depth to the water table is expected to be about 200 to 275 ft (the large range is caused primarily by land surface elevation differences). Perched water conditions were observed near the northern end of the A-29 Ditch at well 6-43-45. Water was encountered from approximately 44 to 47 ft below land surface. The confining layer appeared to be a thin silty sand lens at 48 ft below ground surface.

On a local scale, ground water moves radially outward from a ground water high beneath B Pond, which lies directly northeast of A-29 Ditch. This ground water mound is evident in the water table map, Figure 2-7. Within the A-29 Ditch area, the direction of ground water flow is generally from northeast to southwest across the ditch at approximately S 60° W. Figure 2-8 illustrates the water level elevation in December 1990 from wells in the vicinity of the A-29 Ditch. Water level elevation data for the wells are provided in Table 2-5. The saturated thickness of the unconfined aquifer beneath the A-29 Ditch is approximately 50 to 70 ft.

Table 2-5. December 1990 Water Level Elevation Data for Wells Near the 216-A-29 Ditch Completed in the Unconfined Aquifer

Well no.	Top of casing elevation (ft)[a]	Depth to water (ft)	Water elevation (ft)
* 299-E25-32P#	670.04[b]	265.83	404.21
* 299-E25-26#	668.52	264.78	403.74
* 299-E25-28#	662.44	258.08	404.36
* 299-E25-34#	662.87	258.63	404.24
* 299-E25-35#	674.39	270.43	403.96
299-E25-10	655.84	251.86	403.98
299-E25-11	681.28	277.32	403.96
299-E25-18	679.05	275.08	403.97
299-E25-19	677.2	273.36	403.84
299-E25-20	676.3	272.51	403.8
299-E25-21	669.42	264.88	404.54
299-E25-24	679.55	275.30	404.25
299-E25-25#	669.42	264.88	404.54
299-E25-27#	676.08	271.86	404.22
299-E25-31#	672.53	268.50	404.03
299-E25-38#	673.52	269.40	404.12
299-E26-02	635.3	231.01	404.3
699-41-40#	545.94	129.99	415.95
699-42-40A#	545.43	124.41	421.02
699-43-42J#	564.48	145.85	418.63
699-43-43#	579.37	164.09	415.28
699-43-45#	597.68	192.58	405.10

(a) Elevation at time of measurement.
(b) All data in feet above mean sea level.
(*) Detection Level Network Well.
(#) RCRA standard or equivalent well.

The calculations of ground water velocity assume horizontal flow and homogeneous aquifer. An estimation of the average linear ground water velocity near the A-29 Ditch can be calculated from the following equation based on Darcy's law:

$$v=(KI)/n \qquad (1)$$

where:

v = velocity, ft/d
K = hydraulic conductivity, ft/d
I = hydraulic gradient (dimensionless)
n = effective porosity (dimensionless).

Hydraulic gradient values for the 200 Areas are discussed in Section 2.3.2. Hydraulic conductivities and effective porosities are discussed in Section 2.3.2 and Table 2-4. The following inputs were used to determine the velocity near well 699-43-43: (1) K = 2,100 ft/d (WHC 1990, p. 76); (2) I = 0.007 (WHC 1990, p. 79); and (3) n = 0.10 to 0.30 (Graham et al. 1981, p. 3-12).

The given value of K is most likely representative of the Hanford formation (WHC 1990, p. 74). The calculated velocity ranges from approximately 50 to 150 ft/d.

3.0 GROUND WATER MONITORING PROGRAM

This plan has been developed in accordance with RCRA, as described in 40 CFR 265, Subpart F, to conduct an interim-status ground water monitoring program for the A-29 Ditch. All work outlined in this plan will be conducted using *Environmental Investigations and Site Characterization Manual* (WHC 1988), the *Quality Assurance Project Plan for RCRA Groundwater Monitoring Activities* (WHC 1990), and *RCRA Ground Water Monitoring Project Quality Assurance Project Plan* (PNL 1989). In addition, all onsite personnel must meet Occupational Safety and Health Administration (OSHA) medical, monitoring, and training requirements in accordance with 29 CFR 1910.120.

3.1 SUMMARY OF MONITORING PROGRAM HISTORY

The A-29 Ditch received hazardous waste discharges from the PUREX CSL. In 1984, administrative and physical controls were installed to avoid inadvertent discharges of chemicals to the waste stream. Because the A-29 Ditch was not expected to receive additional discharges of hazardous substances, the DOE Richland Operations Office proposed that the facility be closed under RCRA interim status (DOE 1987).

Ground water monitoring wells were installed and the ground water beneath the A-29 Ditch has been monitored by a RCRA-compliant monitoring network since November 1988. The original detection level monitoring network consisted of one upgradient well (299-E25-32P) and four downgradient wells (299-E25-26, 299-E25-28, 299-E25-34, and 299-E25-35) as shown in Figure 3-1. These wells were sampled quarterly for 1 yr to establish background levels and the analytical results and water level measurement data were presented to Ecology.

In late 1989, the four quarters of ground water network monitoring were completed and the background values were established. The first scheduled contamination indicator parameter semiannual sampling event occurred in late January 1990. Statistical evaluation of the results, as required by 40 CFR 265.93(b), indicated that the specific conductivity (field) value in downgradient well 299-E25-34 was statistically greater than the background levels. Confirmatory resampling later verified this measurement and the required ground water quality assessment plan was prepared and initiated for the A-29 Ditch (Chou et al. 1990).

The ground water quality assessment plan proposed an investigation to confirm that the contamination detected in well 299-E25-35 originated from the A-29 Ditch. The detection level network and several surrounding wells were scheduled for quarterly water sampling and analysis to better monitor the quality of the groundwater. Due to the suspension of the U.S. Testing contract, no analytical data were collected between June 1, 1990 and early 1991. The ground water quality assessment plan increased the water level measurement in the detection level network wells to a monthly frequency and in selected surrounding wells to a quarterly frequency. The increased scrutiny was intended to more closely define the ground water flow direction and gradient, attempt to identify any other potential contamination sources, and eliminate the possibility of a the high specific conductivity coming from a source other than the A-29 Ditch.

Figure 3-1. Location Map of Ground Water Monitoring Wells for the 216-A-29 Ditch.

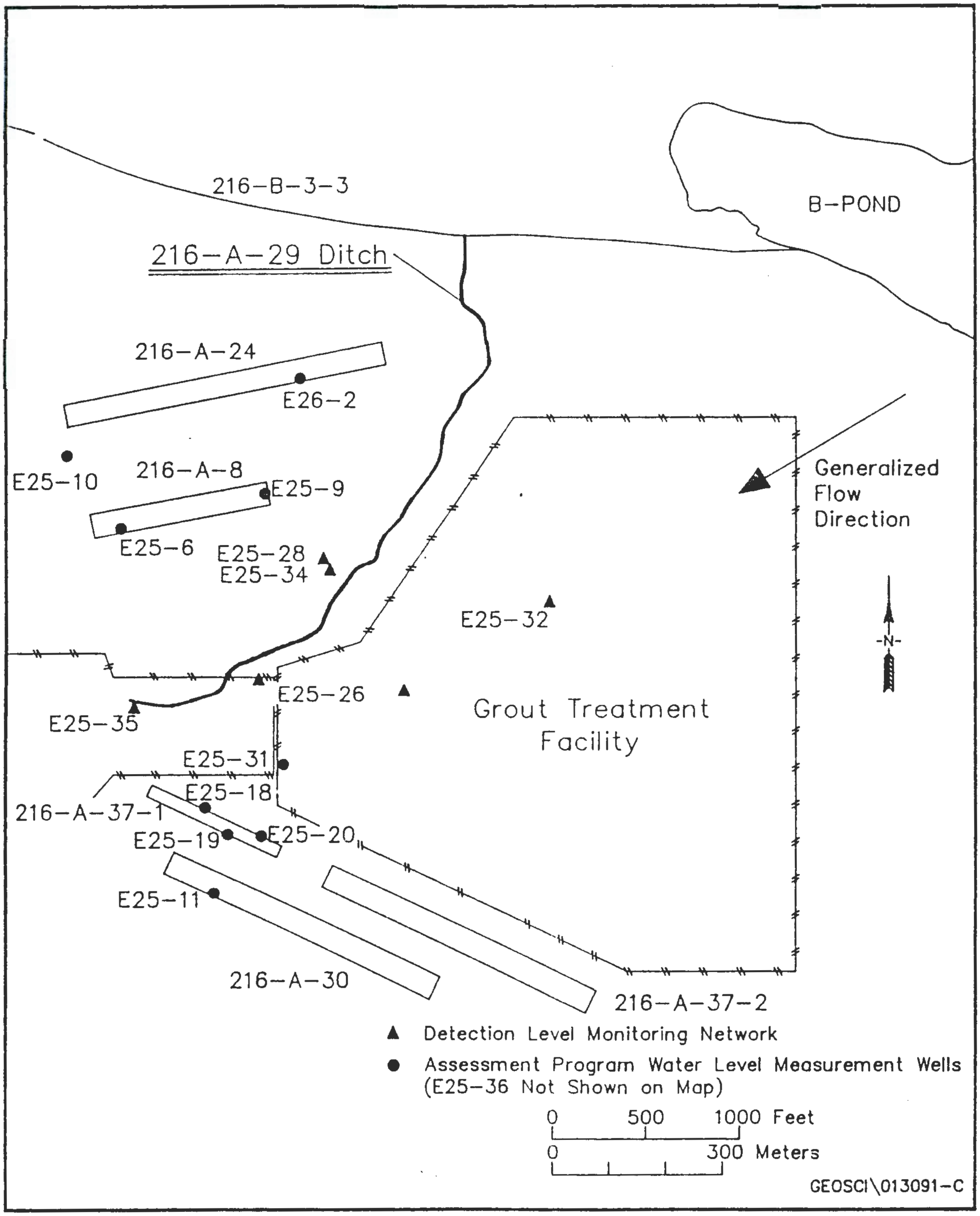


Table 3-1 lists the wells used in the A-29 Ditch ground water quality assessment investigation. Figure 3-1 shows the locations of water level measurement wells.

Table 3-1. Ground Water Monitoring Wells used in the A-29 Ground Water Quality Assessment Monitoring Program.

Well	Water level measurement	Groundwater sampling	RCRA Standard Wells
299-E25-32P (D) (U)	X	X	X
299-E25-26 (D)	X	X	X
299-E25-28 (D)	X	X	X
299-E25-34 (D)	X	X	X
299-E25-35 (D)	X	X	X
299-E17-15		X	
299-E17-20		X	
299-E25-06	X		
299-E25-09	X		
299-E25-10	X		
299-E25-11	X	X	
299-E25-18	X	X	
299-E25-19	X	X	
299-E25-20	X	X	
299-E25-21		X	
299-E25-31	X		X
299-E25-36	X	X	X
299-E26-02	X		

(D) Detection network well.
(U) Upgradient well.

By December 1990, it was apparent that the water level in the network upgradient well (299-E25-32P) had decreased to where it was no longer representative of upgradient conditions (Table 2-5, Figure 2-8, and Figure 3-2). The monitoring network was then out of compliance with 40 CFR 265.91(a). After an evaluation of the December 1990 data, it was determined that a new upgradient ground water monitoring well was necessary for the A-29 Ditch monitoring network and that the ground water monitoring plan needed revision.

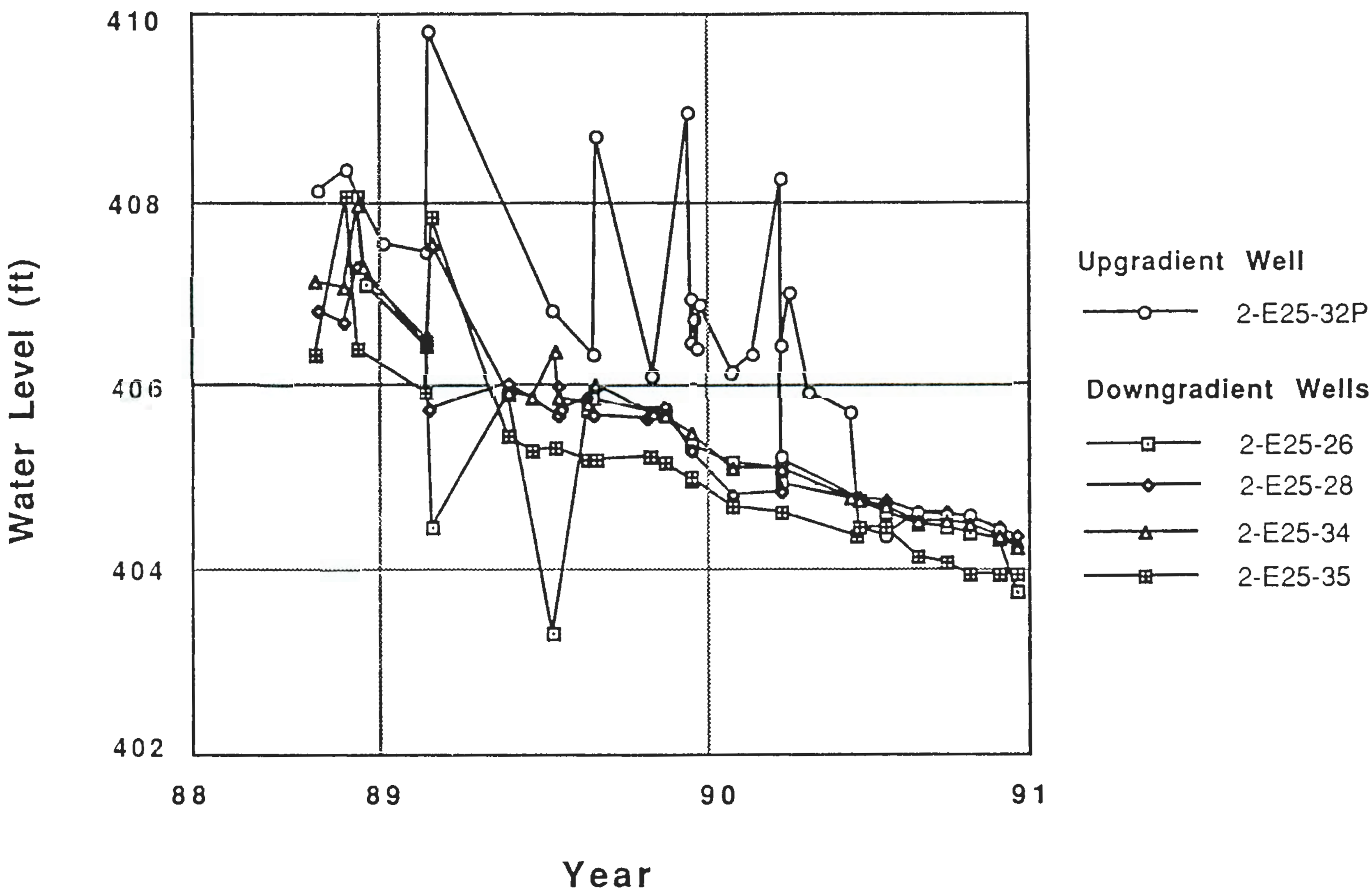


Figure 3-2. Hydrograph of Wells in the 216-A-29 Ground Water Monitoring Network.

3.2 OBJECTIVES

The objectives of the ground water monitoring plan for the A-29 Ditch are to:

- Characterize the stratigraphy and determine the horizontal (and if possible, the vertical) ground water flow directions beneath the site. The focus will be on the uppermost unconfined aquifer.
- Continue a ground water monitoring program to determine if any statistically significant amounts of hazardous waste constituents originating from the A-29 Ditch are present in the ground water.
- Establish an upgradient monitoring well that comply with the requirements of 40 CFR 265.91(a).
- Present and justify the location of the monitoring wells to be drilled at the A-29 Ditch during 1991 to partially satisfy the requirements of the Tri-Party Agreement Milestone M-24-00.

3.3 APPROACH

The A-29 Ditch ground water monitoring network will be revised and expanded. The approach to revising the A-29 Ditch ground water monitoring system will be based on a knowledge of the regulatory requirements, the existing site geologic and hydrologic data, the regulations governing the safe operation of the facility, and DOE Order 5400.1, *General Environmental Protection Program* (DOE 1986). In response to these factors, the *Hanford Site Groundwater Protection Management Program* (DOE-RL 1985) was published, setting forth goals and objectives for the Hanford Site.

Existing wells upgradient of the facility will be evaluated to determine their suitability to replace the original upgradient well that is no longer representative of the facility. Four new downgradient monitoring wells will be installed in 1991 to satisfy the requirements of the Tri-Party Agreement. After evaluation of the data received from the 1991 drilling and analytical activities, additional wells will be installed if there is a demonstrated need for the information that they would provide.

Locations for the 1991 ground water monitoring wells will be chosen to increase the efficiency of the A-29 Ditch groundwater monitoring network, provide additional information to characterize the geology and shallow hydrogeology at the facility, and determine the quality of groundwater near the top of the unconfined aquifer. Other considerations in locating the new wells are obstacles or drilling hazards, such as steamlines, cribs, underground piping, power lines, or surface contamination. Areas with known surface contamination will be avoided to prevent the introduction of drilling-induced contamination into the ground water.

Subsurface sediment samples will be obtained during drilling of each new well. These samples will be described and classified in the field, and selected samples will be submitted for laboratory analysis to determine selected physical and chemical parameters. Ground water samples will be collected upon reaching the water table according to the sampling and analysis plan, Appendix D. These samples will be analyzed for contamination before disposal of purgewater from well development or aquifer testing. If contamination above established guidelines is detected, purgewater disposal and aquifer testing will be done according to the Westinghouse Hanford purgewater policy.

Water samples will be collected and analyzed quarterly from all new monitoring wells. In addition, quarterly samples will be collected and analyzed from the selected existing monitoring wells in the ground water quality assessment network. Statistical evaluation of data for the required parameters and constituents will be initiated after 1 yr of sampling for each of the newly constructed wells. Sampling and analysis activities will be conducted following approved procedures.

3.4 GROUND WATER MONITORING SYSTEM

This section defines the aquifer that will be monitored, the substitute upgradient wells for the detection network, and the location, justification and installation specifications for the new downgradient monitoring wells. Additional information is provided on the types of hydrogeologic data that will be collected, the sampling frequency, and ground water constituents that will be analyzed.

3.4.1 Uppermost Aquifer

According to 40 CFR 265.90, the ground water monitoring program must be capable of determining the facility's impact on the quality of the ground water in the uppermost aquifer underlying the facility. The uppermost aquifer beneath the A-29 Ditch is the unconfined aquifer, contained primarily within the sediments of the Hanford and Ringold formations. This aquifer extends from the water table to the top of the uppermost basalt flow (Elephant Mountain Member). This basalt unit is assumed to be the confining unit between the uppermost aquifer and deeper confined aquifers. The unconfined aquifer is approximately 50 to 70 ft thick beneath the ditch.

The current water table decline in the uppermost aquifer is in response to a decrease in discharges from the operating facilities. The water level trends from the detection level monitoring network are shown in Figure 3-2. The locations of these wells are shown in Figure 3-1.

3.4.2 Current Monitoring Network

The five ground water monitoring wells that currently comprise the A-29 Ditch monitoring network are located around the site as shown in Figure 3-1 and listed in Table 3-1. Well construction records and recent monitoring data have been reviewed to verify that these wells meet the acceptance criteria specified in WAC 173-160 and 40 CFR 265.91: (1) the wells must be adequately located, (2) the wells must provide samples that are representative of the ground water, (3) the wells must be cased to maintain the integrity of the well bores, and (4) the annular spaces must be sealed.

The downgradient monitoring wells (2-E25-26, 2-E25-28, 2-E25-34, and 2-E25-35) having been constructed to meet RCRA standards, meet the conditions discussed below.

Wells 2-E25-26 and 2-E25-35, located south of the ditch, are downgradient of the inlet end of the ditch. Well 2-E25-28 provides an opportunity to monitor the bottom of the aquifer downgradient of the A-29 Ditch near well 2-E25-34, which monitors at the water table. The 20-ft screened intervals in all wells are consistent with screen lengths in other RCRA wells.

The second, third, and fourth conditions regarding justification of the use of these wells as part of the monitoring system are also satisfied. Wells 2-E25-26 and 2-E25-28 are constructed of carbon steel casing above the water table with stainless steel screens and casings below the water table. The wells were naturally developed with no filter pack. They are completed in highly permeable material that does not necessitate an artificial filter pack. The annular space in well 2-E25-26 was grouted from land surface to 150 ft, and the remaining depth of the well is sealed by the 6-in. drive casing, which was left in place after drilling to the total depth and backpulling to expose the screen and stainless steel casing. In well 2-E25-28, the annular space was grouted from land surface to 218 ft; the remainder of the well is sealed by the 6-in. drive casing, which was left in place after drilling to the total depth and backpulling to expose the screen and stainless steel casing. The integrity of these wells is maintained by the casings. Wells 2-E25-34 and 2-E25-35 were constructed in 1988 to RCRA standards. Since these wells have met the RCRA construction standards, they may be used to support the most stringent data quality objectives (DQOs).

The construction details and lithologic information for these wells are given in as-built diagrams in Appendix B. The coordinates, total depth, and screened intervals are summarized in Table 3-2. Water chemistry data are presented in Appendix C.

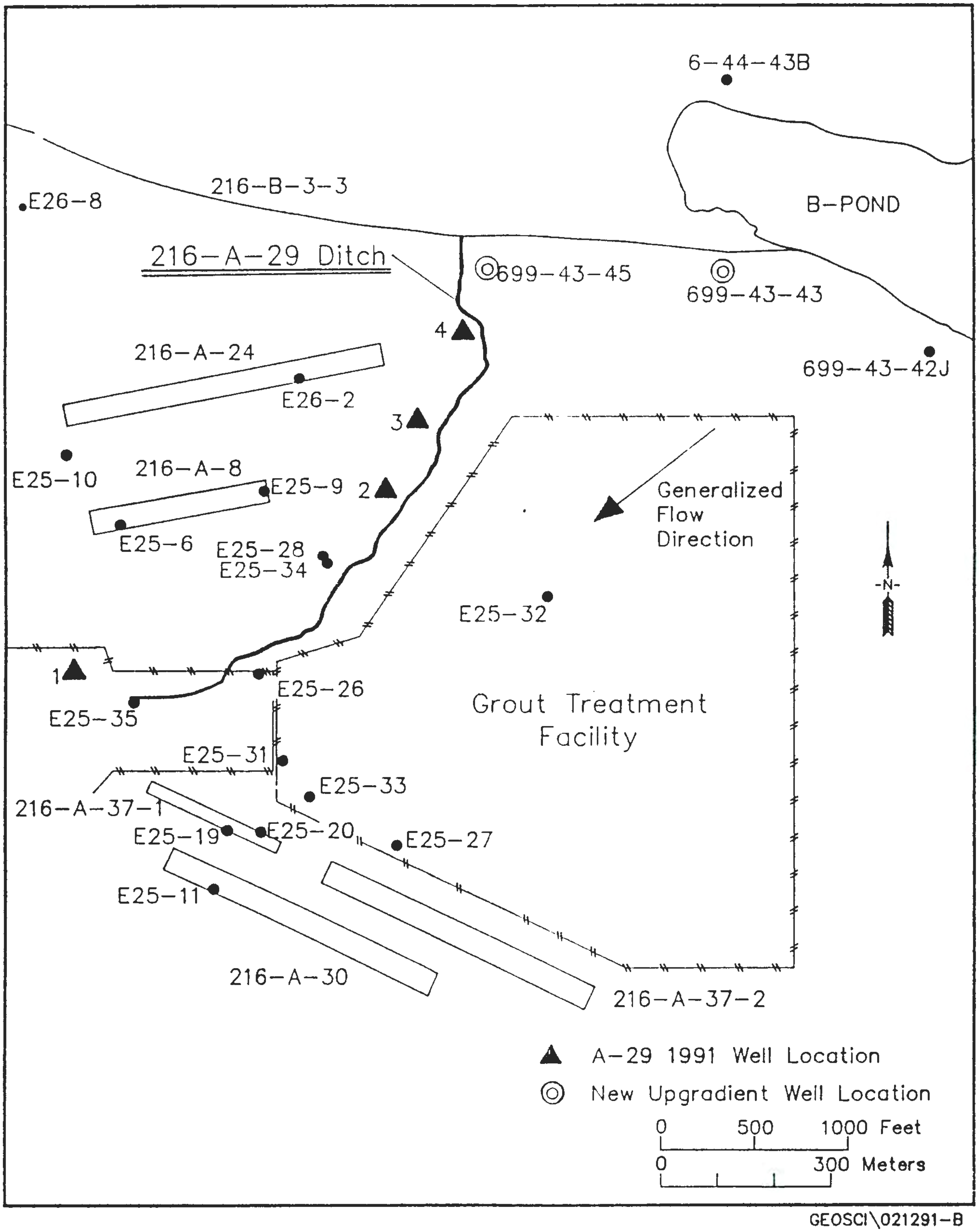
3.4.3 Upgradient Wells

The intent of upgradient monitoring wells is to provide representative background ground water chemistry data that are not affected by the facility. The decreasing water level at well 2-E25-32P created a need to provide a satisfactory substitute. As an alternative to drilling a new well, existing ground water monitoring wells were investigated as a possible substitute. Due to the proximity of B-Pond and the orientation of the A-29 Ditch with respect to the ground water gradient, two of the B-Pond RCRA standard downgradient monitoring wells, 6-43-43 and 6-43-45, are adequately located to serve also as the upgradient monitoring wells for the A-29 Ditch (Figure 3-3). Well 6-43-45 is upgradient of the northern portion of the ditch and well 6-43-43 provides upgradient coverage for the central and southern portions of the facility (Figure 3-4). Construction of an upgradient monitoring well at the location of 6-43-45 was proposed in the original unpublished ground water monitoring plan. Hydrographs for wells 6-43-43 and 6-43-45 are shown in Figure 3-5.

Table 3-2. Locations, Depths, and Screened Intervals for Existing and Planned Ground Water Monitoring Wells Around the 216-A-29 Ditch.

Well no.	Type of well	Hanford coordinates	Depth to water (ft)	Depth to Bottom of screen (ft)	Screen length (ft)
		EXISTING WELLS			
299-E25-26	Shallow	N40773/W45885	264.78	289	20
299-E25-28	Deep	N41424/W45541	258.08	320	20
299-E25-32	Shallow	N41200/W44325	265.83	279.4	20
299-E25-34	Shallow	N41386/W45517	258.63	271.6	20
299-E25-35	Shallow	N40617/W46538	270.43	281.0	20
699-43-43	Shallow	N42942/W43184	164.09	177.5	20
699-43-45	Shallow	N42977/W44643	192.58	203.3	20
		PLANNED 1991 WELLS (Estimated Coordinates and Depths)			
1	Shallow	N40658/W46773	272	287	20
2	Shallow	N41839/W45116	242	257	20
3	Shallow	N42252/W44930	223	238	20
4	Shallow	N42735/W44903	199	224	20

Figure 3-3. Location of Planned Ground Water Monitoring Wells for the 216-A-29 Ditch.



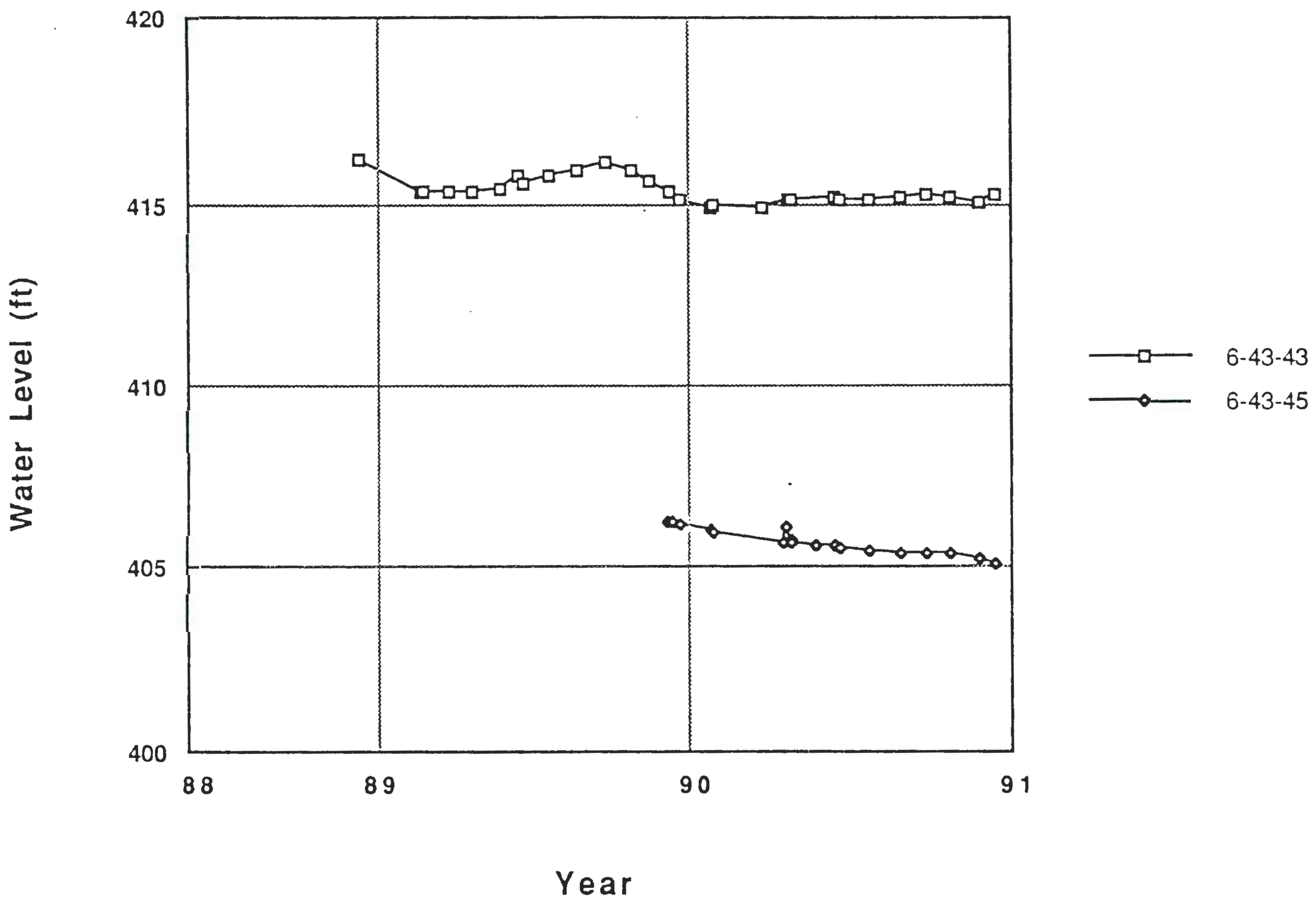
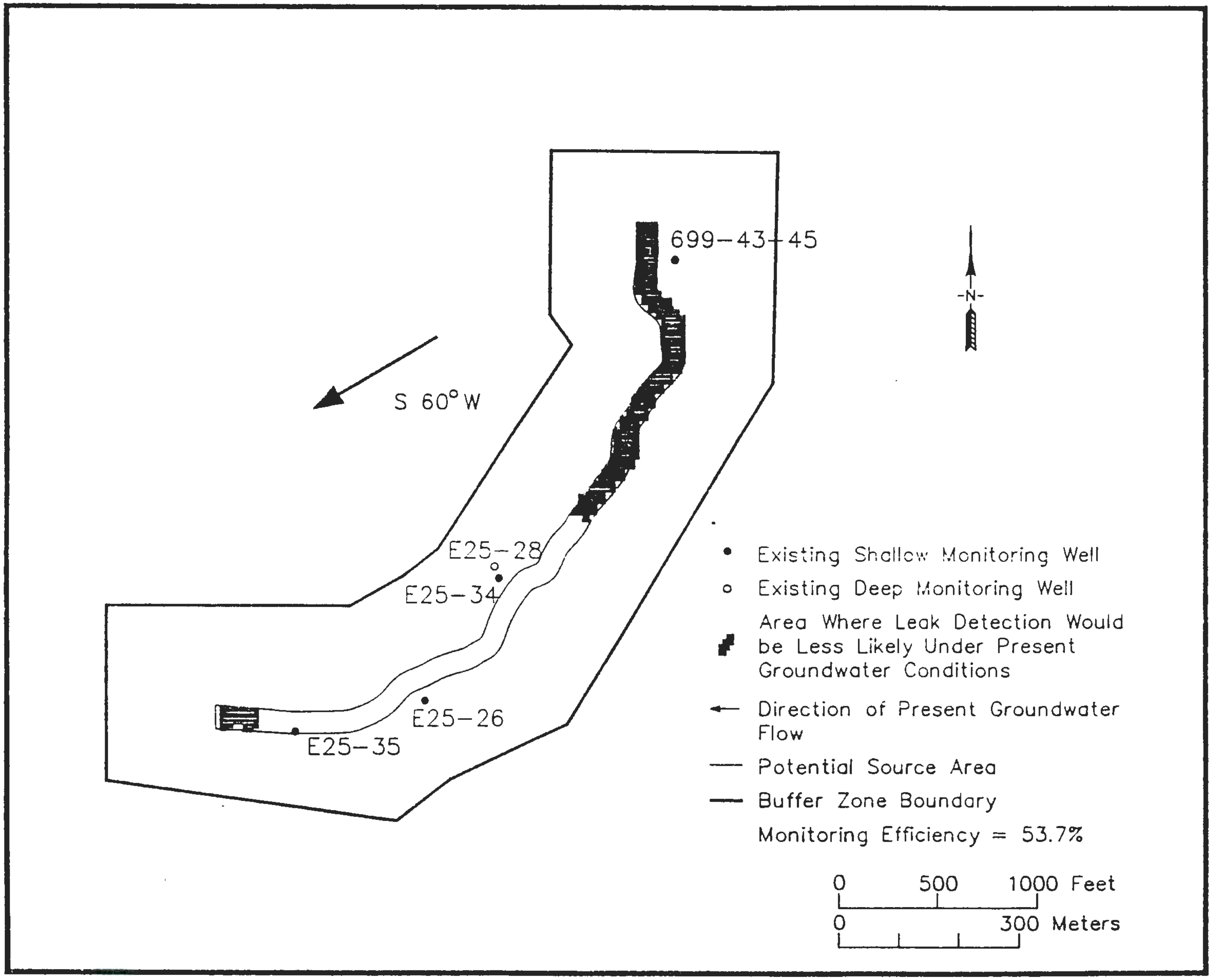


Figure 3-4. Hydrograph for Proposed Upgradient Monitoring Wells 699-43-43 and 699-43-45.



GEOSCI\020891-B

Figure 3-5. MEMO Model Results for Current Monitoring Network.

The ground water at well 699-43-43 has been sampled and analyzed for five calendar quarters and well 699-43-45 has been sampled for three quarters. The water chemistry data for these wells are presented in Appendix C.

The advantages of substituting existing wells instead of drilling a new well include:

- Water level and water chemistry data from these RCRA standard wells are available with no breaks in the data acquisition and analysis -- upgradient data acquisition will not have to wait until the new well is constructed. Correlations may be possible between contemporary data from the original upgradient well and from the chosen replacements.

- Since funding is available for the construction of only four monitoring wells at the A-29 Ditch in 1991, use of existing wells will allow construction of an additional downgradient well. This will provide greater monitoring efficiency in the area downgradient of the facility.

Well construction records and recent monitoring data have been reviewed to verify that the proposed wells meet the acceptance criteria specified in 40 CFR 265.91 (Section 3.4.2). These wells were satisfactorily constructed in 1988 and 1989 to comply to RCRA standards. The construction details for these wells are given in the as-built diagrams in Appendix B. The coordinates, total depth, and screen intervals are summarized in Table 3-2.

Wells 6-43-43 and 6-43-45 will begin to serve as the upgradient monitoring wells for the A-29 Ditch upon approval of this ground water monitoring plan.

3.4.4 Downgradient Well

Four new RCRA standard downgradient wells will be added to the existing monitoring network at the A-29 Ditch. The proposed well coordinates and construction details are presented in Table 3-2 and located on Figure 3-4. The wells will be completed in the top 15 ft of the unconfined aquifer and located 50 to 100 ft from the centerline of the ditch. This distance was chosen to allow adequate working space around the drill site and to be consistent with the compliance point defined by the existing wells.

The need for additional downgradient monitoring wells is indicated by both the chemistry of ground water in the downgradient wells and the configuration of the downgradient boundary of the A-29 Ditch. The general ground water flow direction at the A-29 Ditch (S 60° W.) indicates that monitoring well coverage is insufficient along the western boundary of the ditch. Without new wells to the west of the ditch, it is not possible to fully evaluate the impact of the A-29 Ditch on the unconfined aquifer. The new wells will increase the monitoring coverage west and south of the facility.

The four new wells were sited using professional judgement and validated with the Monitoring Efficiency (MEMO) model (Golder 1990). The wells were located to complete the detection level monitoring network coverage. The MEMO model was used to estimate the monitoring efficiency of the current compliance point monitoring network and the effect of adding the new downgradient wells. The MEMO model simulates contaminant plumes originating at a number of grid points along the ditch using the Domenico-Robbins method (Domenico and Robbins 1985) and determines whether the plume will be detected by a monitoring well before it travels some predetermined distance past the A-29 Ditch site boundary (buffer zone). The area of the site where a plume will be detected before it travels the predetermined distance past the site boundary is reported as the monitoring efficiency (Appendix E).

The MEMO model results for the existing downgradient monitoring network are presented in Figure 3-6. The site-specific parameters assumed for the calculation are a groundwater flow direction of S 60° W, a transverse dispersivity of 4 ft, a limit of detection for the contaminant of 0.001 of the initial concentration when it entered the ground water, and a buffer-zone width of 500 ft. Justification for the input parameters is located in Golder (1990). The dark areas on the map represent plume origination areas from which a plume would not be detected before reaching the existing A-29 Ditch site boundary. The estimated monitoring efficiency for the existing network is 53.7 %, indicating that plumes originating from nearly one-half of the ditch would be more than 500 ft past the A-29 Ditch site boundary before being detected. Detailed discussions of applying the MEMO model, its input parameters, and the conservative assumptions used in analysis of the 200 Areas on the Hanford Site are presented in Golder (1990).

The MEMO model results for the existing monitoring network plus the four new downgradient wells are shown in Figure 3-7. The parameters for this computation were the same as used in the existing well network calculations. With the addition of four wells, the estimated monitoring efficiency for the network is 91.0 %.

3.4.5 Well Installation

The 1991 ground water monitoring wells to be constructed at the A-29 Ditch will be RCRA standard wells constructed to the generic specification for ground water monitoring wells (WHC 1990a). WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells* was used to set the basic design requirements.

Procedures for controlling the well site activities are given in the Environmental Investigations and Site Characterization Manual, WHC-CM-7-7 (WHC 1989) and listed in Table 3-3.

3.4.5.1 Well Drilling. The cable tool method is the preferred means of drilling the A-29 Ditch monitoring wells. If another method of drilling is chosen, it will have the same advantages as the cable tool method. These advantages include (1) drill cuttings being easily contained (important in contaminated material), (2) representative geologic samples can be collected, (3) moisture samples can be collected from above the water table, (4) disturbance to the borehole wall is minimized, and (5) a straight, plumb borehole is produced.

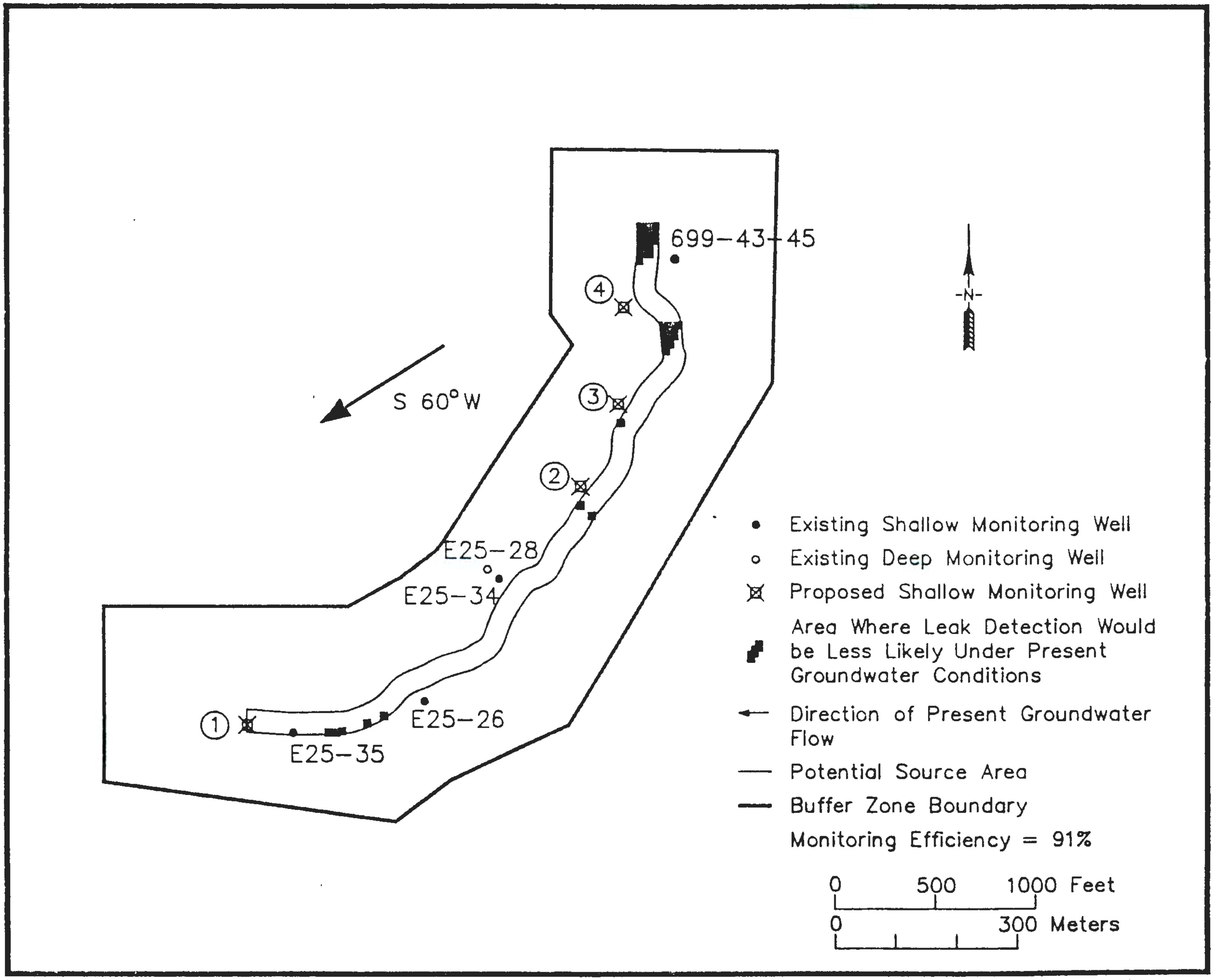


Figure 3-6. MEMO Model Results for Monitoring Network and New Wells.

Figure 3-7. Schematic Diagram of a Completed Ground Water Monitoring Well.

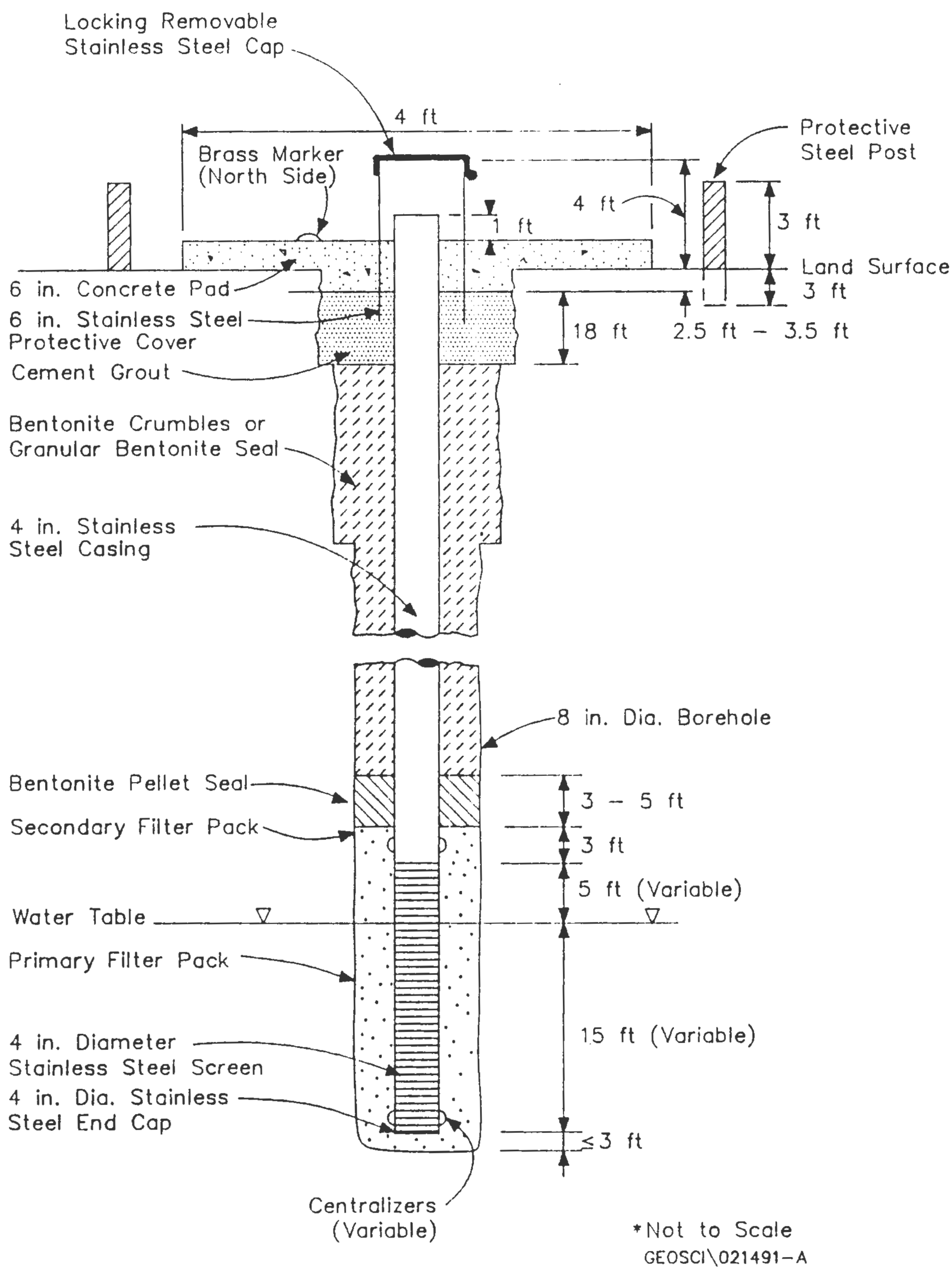


Table 3-3. Applicable Environmental Investigations Instructions.

Number	Title
EII 1.1	Hazardous Waste Site Entry Requirements
EII 1.2	Preparation and Revision of Environmental Investigations Instructions
EII 1.4	Deviation from Environmental Investigations Instructions
EII 1.5	Field Logbooks
EII 1.6	Records Management
EII 1.7	Indoctrination, Training and Qualification
EII 1.9	Work Plan Review
EII 1.10	Identifying, Evaluating, and Documenting Suspect Waste Sites
EII 1.11	Technical Data Management
EII 2.1	Preparation of Hazardous Waste Operations Permits
EII 2.2	Occupational Health Monitoring
EII 2.3	Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site
EII 3.2	Health and Safety Monitoring Instruments
EII 4.2	Interim Control of Unknown, Suspected Hazardous and Mixed Waste
EII 5.1	Chain of Custody
EII 5.2	Soil and Sediment Sampling
EII 5.4	Field Decontamination of Drilling, Well Development and Sampling Equipment
EII 5.5	Decontamination of Equipment for RCRA/CERCLA Sampling
EII 5.7A	Hanford Geotechnical Sample Library Control
EII 5.8	Groundwater Sampling
EII 5.10	Sample Identification and Data Entry into HEIS Database
EII 5.11	Sample Packaging and Shipping
EII 5.12	Air Quality Sampling of Ambient and Downwind air at Waste Sites
EII 5.13	Drum Sampling
EII 5.14	Drum Handling
EII 6.1	Activity Reports of Field Operations
EII 6.6	Ground Water Well Characterization and Evaluation
EII 6.7	Groundwater Well and Borehole Drilling
EII 6.8	Well Completion
EII 6.9	Groundwater Well and Borehole Identification and Tracking
EII 9.1	Geologic Logging
EII 10.1	Aquifer Testing
EII 10.2	Measurement of Ground-Water Levels
EII 10.3	Purge Water Management
EII 10.4	Well Development Activities
EII 11.1	Geophysical Logging
EII 12.1	Surveying

Drill cuttings will be routinely monitored for radiation and hazardous material. If contamination is encountered, cuttings will be handled, transported, and disposed according to Westinghouse Hanford procedures. If the level of contamination is significant enough to require changes in well design or well location, Ecology will be notified by Westinghouse Hanford prior to making the changes.

To help prevent introduction of contaminants into the borehole, the drill rigs and peripheral equipment (e.g., drill tools, cables, and temporary casing) will be steam cleaned before arriving on a site and between wells. While drilling in the zone to be sampled, the addition of water to the borehole will be kept to a minimum or avoided to minimize well development pumping after the well is completed and to minimize the chances of driving any vadose zone contaminants into the ground water.

Temporary carbon steel casing with a minimum diameter of 8 in. will be driven to total depth as each borehole is advanced. The temporary casing will be telescoped so that no more than 150 ft of any one size of casing will be in contact with the formation. This will facilitate pulling the temporary casing out of the borehole and enable any zones of contamination or perched water to be sealed off during construction of the borehole.

After the borehole has been drilled to its total depth, the final well casing and screen will be installed and the temporary carbon steel casing will be removed as the filter pack and annular seal materials are placed in the annular space.

3.4.5.2 Well Construction. The new wells will be completed with 4-in. inside diameter stainless steel casing and continuous-slot stainless steel well screen. Final screens will be 20 ft in length. The screens will extend approximately 15 ft below the water table and 5 ft above. This placement will allow sampling of the upper portion of the aquifer and allow detection of immiscible constituents floating on the water table or constituents in solution at the water table surface. It will also allow for fluctuations of the unconfined aquifer, but may not be sufficient for the decrease in the water table that would result from termination of waste water disposal in the 200 Areas.

The onsite geologist will determine the screen slot size and the filter pack size and will document results per EII 6.8 (WHC 1988). Sand filter packs will be placed in the annulus between either the 8-in. telescoping screen or the temporary (8-in.) casing, and the permanent (4-in.) casing and screen as the temporary casing is withdrawn. If a telescoping screen is used during shallow well aquifer tests, it will be left in the hole. The sand filter pack will be placed from total well depth to 3 to 5 ft above the top of the screen.

A 3- to 5-ft-thick bentonite pellet seal will be placed on top of the sand pack for shallow wells. The annulus between the bentonite pellet seal and 20 $\pm$ 2 ft below ground surface will be filled with bentonite. Cement grout will then be installed to within 3 ft of the ground surface. The well casing will extend 1 to 2 ft above ground surface and will be protected by an outer steel casing and a locking cap. The casing will be set into the ground and cemented in place within a 4- by 4-ft concrete well pad with bumper guards. All protective casings will be permanently marked with well identification numbers and a brass survey marker. A schematic diagram of a completed well is presented in Figure 3-7. Construction information and locations of the new monitoring wells are provided in Table 3-2.

Data sheets, as shown in Figure 3-8, will be completed and provided in the borehole data report.

3.4.5.3 Well Development. All wells will be developed following completion. Wells will be developed by the surge-and-bail technique, overpumping, or any other techniques deemed necessary until turbidity is <5 nephelometric turbidity units (NTU) and sediment content is <8 mg/L. If the water cannot be developed to a turbidity of <5 NTU, an explanation will be documented by a qualified hydrogeologist. All ground water discharged from the well during development will be disposed of in accordance with EII 10.3 (WHC 1988).

3.4.6 Surveying

After monitoring well installation is completed, all wells will be surveyed for location and elevation by qualified surveyors. The elevation of the top of the stainless steel protective casing and of a brass marker set in the concrete pad will be determined within 0.01 ft relative to a referenced datum common to the other wells in the monitoring network. A mark will be placed on the casing to indicate the location that was surveyed. The survey will meet the requirements of a third-order survey, as defined by the EPA (1987, pp. 14-2 to 14-3) and will be referenced to North American Datum 1983. The survey results will be supervised and reviewed by a licensed surveyor.

3.5 MONITORING PARAMETERS

The ground water in newly drilled wells will be sampled and analyzed for the parameters listed in Table 3-4. In addition, constituents listed in the sampling and analysis plan (Appendix D) will be analyzed once during the first year of sampling.

After 1 yr of detection monitoring, these wells will be sampled per the ground water quality assessment sampling plan and schedule. If the quality assessment plan proves that A-29 Ditch is not the source of contamination, the A-29 Ditch monitoring network will revert to a detection level program.

3.6 HYDROGEOLOGIC CHARACTERIZATION

Subsurface characterization will be conducted to describe geologic and hydrogeologic conditions and properties. Data collection and interpretation will focus on geology, geochemistry, hydrogeology, hydrochemistry, and groundwater contaminant monitoring. Work performed will follow a quality assurance project plan meeting EPA requirements of QAMS 005/80 (EPA 1983). The characterization efforts will be performed during and after construction of the planned monitoring wells.

Table 3-4. Ground Water Sampling Parameters[a]

Interim Primary Drinking Water Standards	Maximum Level[b]
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Fluoride	1.4 to 2.4
Lead	0.05
Mercury	0.002
Nitrate (as NO_3^-)	45
Selenium	0.01
Silver	0.05
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-D	0.1
2,4,5-TP Silvex	0.01
Radium	5 pCi/L
Gross alpha	15 pCi/L
Gross beta	4 mrem/yr
Coliform bacteria	1/100 mL

Ground Water Quality Parameters	
Chloride	Iron
Manganese	Phenols
Sodium	Sulfate

Ground Water Contamination Indicator Parameters	
pH	Specific conductance
Total organic carbon	Total organic halogen

Site-Specific Parameters[c]	
Hydrazine	Tritium
Ammonium	

[a] Regulatory requirements for sampling parameters are subject to change because of federal regulations.
[b] Unless otherwise noted, levels are in mg/L.
[c] Site-specific parameters are subject to change as the effluent is better defined.

An outline of the work to be performed is included in the following sections. Information obtained from the existing wells and the new wells at the A-29 Ditch will be integrated into the characterization and interpretation effort. The characterization effort is an iterative discovery process, and data collection in these areas may expand or decrease, depending on the information obtained.

3.6.1 Geologic Characterization

Geologic characterization will include geologic sampling, lithologic description, physical and chemical laboratory analyses, and geophysical borehole logging.

3.6.1.1 Geologic Sampling. Representative samples for geologic analysis will be collected at 5-ft intervals and at changes in lithology during drilling (EPA 1986). Samples will be collected with a drive barrel or split spoon in the unsaturated sediments whenever possible. No drilling fluids or other material will be added to the borehole during drive-barrel drilling unless necessary and the addition must be approved by the well site geologist so that perched water zones can be detected, representative moisture samples can be taken, and water chemistry will not be affected. Samples for moisture content measurements will be collected at 5-ft intervals and at moist or wet zones. If hard-tool drilling is necessary, a bailer will be used to collect the sediment samples. No moisture samples will be from the borehole when hard-tool drilling.

A description of the borehole cuttings between sampling intervals will be recorded to obtain a continuous lithologic record. Lithologic descriptions of samples will include color, texture, sorting, mineralogy, roundness, relative calcium carbonate concentration, consolidation, and cementation. The samples collected will be described as hand specimens in the field and documented on geologic log forms in accordance to WHC-CM-7-7, EII 9.1 (WHC 1988). Samples will be archived for possible future analyses. Drilling, well construction, and sample information will be documented on the borehole logs. A guide to subsurface data collection and documentation during cable tool drilling is presented in WHC-CM-7-7, EII 5.2 (WHC 1988), and the procedures for ground water sampling are presented WHC-CM-7-7, EII 5.8 (WHC 1988).

3.6.1.2 Laboratory Analyses. Calcium carbonate content and moisture content analyses will be performed on geologic samples collected at 5-ft intervals or on samples selected by the well site geologist. Other laboratory tests including particle size analyses, permeability testing, petrography, and clay mineralogy will be performed on samples selected by the project scientist.

3.6.1.3 Sediment Collection and Analysis. In addition to samples collected for geologic characterization, samples will also be collected for chemical or radiologic analysis. These samples will be collected following the frequency outlined below:

- at major lithologic changes
- at perched water zones or increased soil moisture content
- at zones where contamination is suspected based on unusual soil discoloration, odor, or detection instrumentation response above background levels.

All samples will be collected and kept in refrigerated storage under the established chain-of-custody procedures. Immediately after a borehole has been drilled to depth, the geologist and the project manager will select certain samples to be analyzed. The first samples chosen for analysis will be samples from zones of suspected contamination, next from changes in lithology, then a sample from below the water table, and finally, samples will be chosen to fill in the gaps between the samples selected from the first three criteria. Each sample may be analyzed from the constituents listed in Table 3-3.

3.6.1.4 Borehole Geophysical Logging. The primary purpose of geophysical logging will be to correlate and interpret subsurface stratigraphy between boreholes. An additional purpose is to identify zones in the subsurface that may have been contaminated by gamma-ray emitting radionuclides. The monitoring wells will be geophysically logged during well construction with the spectral gamma-ray logging sonde and may also be logged with the gross gamma-ray system, as appropriate.

If the temporary casing is to be telescoped in the borehole (with the exception of the surface starter casing), the borehole shall be logged before the insertion of the next smaller diameter casing. This shall be done in order to collect data through only one thickness of steel casing. Each well shall also be logged upon reaching the total depth.

After completion, wells with a final casing of 4-in. internal diameter or greater will be relogged with the spectral gamma system, as appropriate, to provide a baseline for future radionuclide monitoring. Appropriate neutron or density sondes calibrated for the Hanford environment should also be used, as well as caliper, spontaneous potential, resistivity, and magnetic probes in specific instances as approved by Westinghouse Hanford.

3.6.1.5 Data Interpretation and Presentation. All geologic and geophysical data will be interpreted to determine the stratigraphy beneath the site. These data will be presented in cross sections, fence diagrams, contour maps, and tables, as recommended by EPA (1986). Interpretations of the stratigraphy will be used to evaluate potential contaminant flow paths, determine hydrostratigraphic units, and aid in locating additional monitoring wells as necessary. The data will be presented in a borehole completion data report and interpretations will be included in an interim site characterization report, permitting documents, or other applicable documents. The documents will include (1) descriptions of stratigraphic units, (2) results of analyses, (3) as-built diagrams of wells, and, if necessary, (4) recommendations for further characterization or additional monitoring wells.

3.6.2 Hydrogeologic Characterization

Data that will be used to characterize the hydrogeology will be collected during and after drilling of the monitoring wells. The general types and methods of data collection are discussed below. Ground water samples will be taken following the procedures discussed in the sampling and analysis plan (Appendix D), or their revised, approved, and documented equivalents.

3.6.2.1 Aquifer Testing. The purpose of aquifer testing is to determine the hydraulic properties of in situ geologic materials in the uppermost aquifer underlying the 216-A-29 Ditch. The decision on whether or not to carry out pump tests will be based on the requirements of the appropriate DOE-RL guidance on purgewater. A ground water sample may be analyzed before aquifer testing to determine the appropriate handling and disposal of purgewater. Slug testing may be the only aquifer testing performed if purgewater from aquifer testing cannot be disposed to the ground. Purgewater disposal will be according to WHC-CM-7-7, EII 10.3 (WHC 1988).

A bailer will be used to remove drilling fluids and coarse materials from the borehole. Pretest well development will be conducted after bailing to determine the optimum pump discharge rate and, thus, the best pump size for the constant-discharge test. If the pump has a check valve, then pretest development will consist of pumping at a low flow rate followed by successively higher flow-rate steps until full pump capacity or maximum drawdown has been achieved. If the pump is not equipped with a check valve, a surging technique will be used (wherein the pump is alternately turned on and off) followed by step pumping as described above. The constant-discharge test will not be performed until water levels have fully recovered from the development test.

A number of aquifer test methods may be used in the field testing program depending on the hydrologic parameters sought and existing hydraulic test conditions. Some test methods commonly used include bailer, slug, development, constant-discharge, and recovery techniques. Constant-discharge tests could be conducted for up to 24 h in instances where at least one observation well is available and drawdown is large enough (>0.2 ft) to allow a quantitative analysis of the data. Additional information on conducting slug, constant-discharge, and recovery techniques is described in WHC EII 10.1 (WHC 1988). When available, data from the observation wells can be analyzed to yield estimates of transmissivity, storativity, and sometimes, hydraulic conductivity anisotropy. Results from constant discharge tests can also be used to verify lateral continuity. Single well constant-discharge tests can normally be conducted for up to 8 h. Tests of 8-h duration can be used to estimate transmissivity.

A constant-discharge pumping test should be conducted in at least one of the new downgradient wells. If a constant-discharge pumping test is conducted, a temporary section of nominal 8-in. telescoping screen will be set in each well before pumping. The screen will be open to the uppermost portion of the aquifer.

A submersible pump will be placed in the bottom portion of the screened interval. If the sediments in the test interval appear to have relatively high permeabilities, such as those characteristic of the Hanford formation, a large discharge rate will be required. The largest pump size that will fit in a nominal 8-in. telescoping screen (normally 40 hp) will be used in this case because it is expected that even a maximum discharge from this size pump (200 to 250 gal/min) will produce only a small drawdown (no more than 2 ft).

If sediments in the test interval have low permeabilities, such as those characteristic of the Ringold Formation, a much lower discharge rate will be required and a smaller pump can be installed. In some locations, the sediments in a test interval may be of such low permeability that a pumping test would not be possible. In these situations, a slug test may be conducted.

A slug test may be conducted in the following manner. The drive casing will be pulled back a few feet to expose the formation to the open hole. If heaving or caving formations are expected, a temporary section of telescoping screen will be set in the well before testing. The screen may be set as described above for the constant-discharge pumping test. The borehole will be bailed to remove drilling fluids and debris before conducting the test. During the slug test, the hydraulic head will be changed instantaneously by suddenly introducing or removing a cylinder of known volume. The water-level recovery response will then be observed over time.

A slug test will not yield representative results if the interval is of heterogeneous materials with hydraulic conductivities ranging over several orders of magnitude. In this case, split-spoon samples may be collected, and laboratory tests may be used to determine hydraulic conductivity.

One or two days of continuous water-level monitoring will be conducted (as needed) before and/or after terminating the pumping tests. These data will be used to determine whether outside influences will have a significant impact on the tests. If so, the data will be corrected for these effects.

The conventional analysis methods by Cooper and Jacob (1946) and Theis (1935) can be used to estimate transmissivity in the unconfined aquifer (Graham et al. 1981). Modifications of these methods may be used to correct for partial penetration effects, delayed yield response, leakage effects, and borehole storage effects. Available slug test methods include Hvorslev (1951), Cooper et al. (1967), Bouwer and Rice (1976), and Bouwer (1989). The laboratory methods to determine hydraulic conductivity include the falling-head or constant-head permeameter tests (Klute and Dirksen 1986).

3.6.2.2 Direction and Rate of Groundwater Flow. The determination of ground water flow directions will be based on nonroutine water level measurements in all wells of the A-29 Ditch ground water monitoring network, in the wells of the A-29 Ditch ground water quality assessment monitoring network, and in the adjacent Grout Treatment Facility and B-Pond monitoring networks. These measurements will be used to make direct estimates of ground water flow direction and to estimate the potentiometric surface near the A-29 Ditch. The nonroutine measurements are currently taken on a monthly schedule to satisfy the requirements of the A-29 Ditch ground water quality assessment plan and will continue on that schedule until a reasonable level of confidence in the results is developed. As understanding of ground water flow directions increases, the frequency of nonroutine measurements will decrease accordingly, but will not drop below a quarterly schedule. In addition, the distribution of contaminants in plumes originating in the 200 Areas will be used to aid in evaluation of ground water flow directions when data are available.

3.6.2.3 Data Interpretation and Presentation. Hydrogeologic data, interpretations, and recommendations will be presented in a borehole completion report after well installation and initial monitoring are completed. Specifically, this report will include (1) descriptions of hydrostratigraphic units, (2) water level data and water table maps, (3) test data and results of analyses, (4) as-built diagrams of wells (5) hydrochemistry data, and, if necessary, (6) recommendations for further characterization or construction of additional monitoring wells. The data will also be used to evaluate whether the characterization was adequate and if the ground water monitoring system is appropriately designed.

The hydrogeologic data will be integrated to form an initial concept of the ground water flow system in the vicinity of the A-29 Ditch. Components of the concept will include the flow paths and their possible changes over time, estimates of ground water velocity, unsaturated zone conditions as they relate to the ground water monitoring system, and hydrochemical characterization.

3.7 SAMPLING AND ANALYSIS

3.7.1 Sampling

HydroStar* sampling pumps will be installed in the new wells as soon as practical after construction and well development are complete.

At the start of the sampling activity, the depth to water will be measured before the wells are purged. The wells will be purged and samples will be collected only after at least three borehole volumes have been removed and when the specific conductance, temperature, and pH have stabilized. Purgewater will be collected and handled per EII 10.3 (WHC 1988). In the case of wells completed in very low permeability materials, the sample will be collected after the well has recharged.

3.7.2 Analysis

Samples will be collected from all ground water monitoring wells in conformance with 40 CFR 265.92 for analyses of the constituents listed in Table 3-3. Additional constituents may be added to this list after evaluation of the results.

Sampling, preservation, and chain-of-custody procedures are discussed in Appendix D. The quality assurance and control protocols, which are in addition to 40 CFR 265.92 requirements, are also given in Appendix D. The purpose of quality control activities is to determine and document the quality of analytical results and to institute corrective actions as necessary.

Under this ground water monitoring program, the water table elevation data will be evaluated at least annually to determine if the monitoring wells are appropriately located. If the evaluation indicates that existing wells are no longer adequately located, the ground water monitoring system will be modified to bring it into compliance with 40 CFR 265.91(a).

*Hydrostar is a trademark of Instrumentation Northwest, Incorporated.

Table 3-5. Reports Required for Compliance with 40 CFR 265, Subpart F, for Ground Water Monitoring.

Submittal	Period
First year of sampling for new wells: Concentrations of interim primary drinking water standards, identifying those that exceed the limits listed in Table 3-3.	Quarterly according to current schedule
All monitoring network wells after the first year of sampling.	According to ground water quality assessments plan (Chou, et al. 1990)
Results of ground water surface elevation and description of response if appropriate.	Annually by March 30 of following year
Results of the ground water quality assessment program.	Annually by March 30 of following year, until closure of the facility

4.0 GROUND WATER QUALITY ASSESSMENT PROGRAM

The A-29 Ditch is currently monitored under a ground water quality assessment program due to the high specific conductivity measured in monitoring well 299-E25-35 (Chou et al. 1990). The Quality Assessment Plan established an investigative approach to determine if A-29 Ditch was the source of the detected contamination. the monitoring detection level network and several surrounding wells are currently sampled and analyzed quarterly to better monitor the quality of the ground water. Water level measurements in the detection level network wells are obtained monthly, and selected surrounding wells are measured quarterly. If the quality Assessment Plan proves that A-29 Ditch is not the source of contamination, the A-29 Ditch will revert to a detection level program. Analysis under the Quality Assessment Program will satisfy the requirements of such a program.

5.0 REFERENCES

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APPENDIX A

WASTE INFORMATION DATA SYSTEM GENERAL SUMMARY REPORT

SURVEILLANCE INFORMATION

Waste Information Data System
General Summary Report
February 21, 1991

SITE NAME: 216-A-29 [58]
ALIASES:
Snow's Canyon [NR]; PUREX Chemical Sewer (CSL) [315]

SITE TYPE: Ditch [315]
WASTE CATEGORY: Mixed Waste [315]
WASTE TYPE: Liquid [315]

STATUS: Active [355]
START DATE: November 1955 [355]

OPERABLE UNIT: 200-PO-5 [329]
TSD NUMBER: D-2-3 [323]
REG. AUTHORITY: TSD [323]
DOE/RL PROGRAM: Surveillance and Maintenance [358]

This site is included in the Tri-Party Agreement Action Plan [329]

The following have been submitted for this site: Part A Permit [308]
Interim Closure Plan [308]

DESIGNATED AREA: 200 East, A Plant [315]
COORDINATES: N40685 W46350, N43050 W44750 (center line) [370]
LOCATION:
Outside the 200 East Area perimeter fence [58], 525 ft southeast of the southeast corner of the 241-A Tank Farm [NR]. The unit empties into 216-B-3-3 Ditch which terminates at 217-B-3 Pond [58]

CONTAMINATED SOIL VOLUME: 9,600.00 cubic meters [253]

GROUND ELEVATION: 672.00 feet above MSL [NR]
WATER TABLE DEPTH: 220.00 feet below grade [NR]

SITE DIMENSIONS (Bottom) [58]: Length: 4,000.00 feet [661]
Width: 6.00 feet [58]

SITE DESCRIPTION:
The unit is man-made, earthen, and uncovered. The banks vary from 2 to 3 ft high at the head end to 15 ft high at the lower end. The first 10 ft from the point of influent is a concrete spillway for erosion [355].

ASSOCIATED STRUCTURES:
Two earth dams with wooden gate structures to regulate water flow. The locations of the dams are N41150, W45500 and N41550, W45200 [NR].

SITE NAME: 216-A-29 Page 2

WASTE TYPES AND AMOUNTS:
The unit receives wastes from 202-A chemical sewer, acid fractionator condensate and condenser cooling water that flow to 216-B-3 Pond [58]. Until 12/57, the site received process cooling water and chemical sewer waste from 202-A. From 12/57 to 2/58, the site received the above minus the process cooling water, which was rerouted to 216-A-25 Pond. From 2/58 to 12/62, the site received the above plus acid fractionator condensate from 202-A. From 12/62 to 12/63, the site received the above plus seal cooling water from air sampler vacuum pumps in 202-A. From 12/63 to 1/66, the site received the above minus vacuum pump cooling water, which was rerouted to 216-A-35 French Drain [2].

KNOWN RELEASES:
10/2/84: Hydrazine - 280 lb, Hydroxylamine nitrate - 407 lb; 12/2/84: Potassium hydroxide - 62,683 lb; 1/18/85: Nitric acid - 6,236 lb; 2/8/85: Sodium nitrite - 160 lb; 5/27/85: Nitric acid - 223 lb; 6/25/85: Nitric acid - 24,189 lb, Ammonium flouride - 5,368 lb, Ammonium nitrate - 1,016 lb; 8/6/85: Sodium hydroxide - 42,440 lb; 10/28/85: Nitric acid - 1,181 lb; 12/18/85: Cadmium nitrate - 35 lb; 7/7/86: Hydrazine - 6 lb [315].

COMMENTS:
Traces of radioactivity have been detected in broad-leaf plants growing at the water line of the unit. The radionuclide inventory is included with 216-B-3 [58]. The site is partially stabilized [NR].

ENVIRONMENTAL MONITORING:
Water samples are taken weekly. Sediment and vegetation samples are taken annually. Radiological surveys of the surface are performed annually [349].

SURVEILLANCE INFORMATION [487]

SURVEILLANCE DATE: 3/89
SURVEY SCHEDULE: Annual
SITE POSTING: Surface Contamination
CAVE-IN POTENTIAL: None

RESULTS/STATUS: No contamination detected and no change in activity since the last survey, 3/88. The area is posted "Surface Contamination" but has no chains; therefore, it is out of compliance with WHC-CM-4-10.

ACTION REQUIRED: Chains connecting the Surface Contamination signs should be installed or the posting changed to a less restrictive category.

These results show the unit to be in compliance with the Environmental Compliance Manual.

APPENDIX B

GEOLOGIC AND WELL CONSTRUCTION DIAGRAMS FOR EXISTING WELLS

APPENDIX B

GEOLOGIC AND WELL CONSTRUCTION DIAGRAMS FOR EXISTING WELLS

Geologic and well construction logs from the five current wells in the A-29 Ditch ground water monitoring and other selected wells in the vicinity of the A-29 Ditch are included in this appendix. These logs were compiled from data obtained from wells drilled by DOE contractors. The lithologic and well construction information was obtained from drillers' logs and, where available, geologist's logs, borehole geophysics logs, and ROCSAN (sieve and calcium carbonate) data. The well log information was used, where possible, to substantiate site-specific geologic information and evaluate the construction of existing wells.

Table 3-2 provides a summary of the log information including the Hanford Plant Coordinates, the total depth, and the screen length.

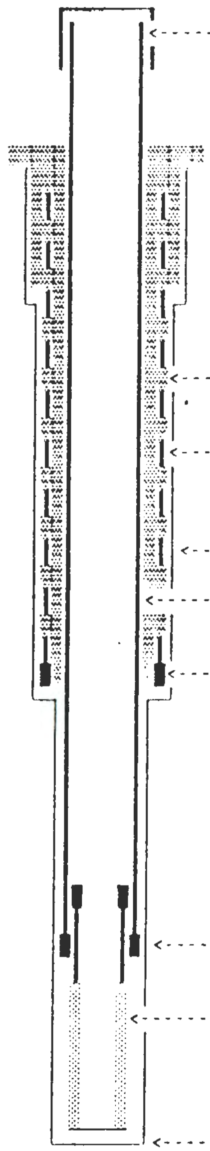
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Hard tool (nom)	WELL NUMBER: 299-E25-26 — TEMPORARY WELL NO:
Drilling Fluid Used: Water	Additives Used: Not documented	Hanford Coordinates: N/S N 40,773 — E/W W 45,885
Driller's Name: J. Bultena	WA State Lic Nr: 0066	State Coordinates: N 445,957 — E 2,249,336
Drilling Company: Onwego Drilling	Company Location: Kennewick, WA	Start Card #: Not documented — T___ R___ S___
Date Started: 01Mar85	Date Complete: 11Apr85	Elevation Ground surface (ft): Not documented

Depth to water: 264 ft Apr85
(Top of casing)-> 264 ft Jul90

GENERALIZED STRATIGRAPHY — Geologist's Log

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



Elevation of reference point: (top of casing) [668.52 ft]
Height of reference point above ground surface [ND]
Depth of surface seal [0-20 ft]
Type of surface seal: Grout around 12-in casing, pulled back cement pad not documented
I.D. of surface casing (If present) [8-in]
8-in casing perforated 0-150 ft 2 cuts/rd/ft
I.D. of riser pipe: [6 & 8-in]
Type of riser pipe: Carbon steel
Diameter of borehole: [9-in nom]
Type of filler: Cement grout 0-150 ft
8-in casing to 150 ft
6-in casing to 264 ft
Telescoping screen 6-in; 269-289 ft, 20 slot stainless steel 10-ft blank welded on top, packer @ 248-ft
Depth bottom of borehole: [290 ft]

Drawing By: RKL/2#E25#26.ASB Date: 17Aug90

Reference: Golder 8831752\7785

WELL CONSTRUCTION AND COMPLETION SUMMARY

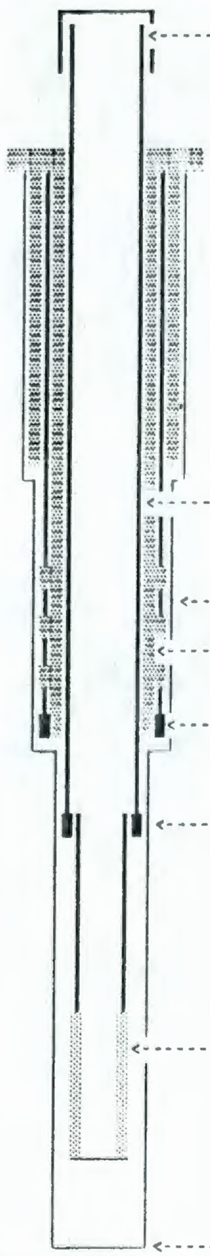
Drilling Method: Cable tool	Sample Method: Hard tool (nom)
Drilling Fluid Used: Water	Additives Used: Not documented
Driller's Name: L. Bultena	WA State Lic Nr: 0066
Drilling Company: Onwego Drilling	Company Location: Kennewick, WA
Date Started: 01Mar85	Date Complete: 11Apr85

WELL NUMBER: 299-E25-28 TEMPORARY WELL NO: ______
Hanford Coordinates: N/S N 41,424 E/W W 45,541
State Coordinates: N 445,609 E 2,249,678
Start Card #: Not documented T___ R___ S______
Elevation Ground surface (ft): Not documented

Depth to water: 265 ft Apr85
(Top of casing)-> 258 ft Jul90

GENERALIZED STRATIGRAPHY   Geologist's Log

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



Elevation of reference point: (top of casing) [662.44 ft]
Height of reference point above ground surface [ND]
Depth of surface seal [0-80 ft]
Type of surface seal: Grout inside 10-in casing, pulled back 2-ft cement pad
I.D. of surface casing (If present) [Pulled]
I.D. of riser pipe: [6 & 8-in]
Type of riser pipe: Carbon steel
Diameter of borehole: [9-in nom]
Type of filler: Cement/5% bentonite grout 0-220 ft, 1,050 gals
8-in casing to 220 ft
Perforated 148-198 ft, 2 cuts/rd/ft
Perforated 198-202 ft, 2 cuts/rd 2 rds/ft
6-in casing to 244 ft
Telescoping screen 6-in; 320-340 ft, 10 slot stainless steel 80-ft blank on top, 240-320 ft
Depth bottom of borehole: [348 ft]

Drawing By: RKL/2#E25#28.ASB Date: 17Aug90
Reference: Golder 8831752\7787

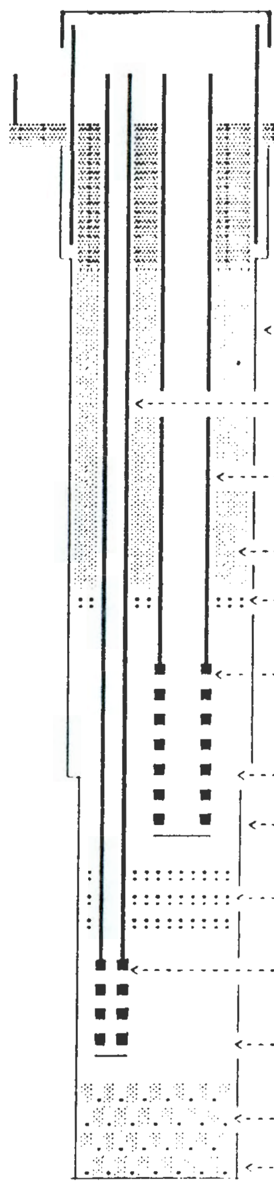
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 299-E25-32 TEMPORARY WELL NO:
Drilling Fluid Used: Water (200E Area)	Additives Used: Not documented	Hanford Coordinates: N/S N 41,200 E/W W 44,325
Driller's Name: O. Amos	WA State Lic Nr: 1224	State Coordinates: N 446,388 E 2,250,894
Drilling Company: Kaiser Engineers	Company Location: Hanford	Start Card #: Not documented T ___ R ___ S ___
Date Started: 12Nov87	Date Complete: 27Jun88	Elevation Ground surface (ft): Not documented

Depth to water: 264 ft Jun88
(Top of casing)-> 264 ft Jul90

GENERALIZED STRATIGRAPHY   Geologist's Log

0-5: Not documented
10-30: Silty gravelly SAND
10-35: SAND
35-45: Silty SAND
45-50: SAND
50-60: Gravelly SAND
60-65: Silty SAND
65-80: SAND
80-90: Silty SAND
90-95: SAND
95-110: Silty SAND
110-140: Silty gravelly SAND
140-145: Silty SAND
145-155: SAND
155-160: Gravelly silty SAND
160-180: Silty sandy GRAVEL
180-185: Sandy GRAVEL
185-235: Silty sandy GRAVEL
235-245: Gravelly silty SAND
245-285: Silty sandy GRAVEL
285-295: Gravelly silty SAND
295-300: GRAVEL
300-305: Sandy GRAVEL
305-350: Silty sandy GRAVEL
350-354: BASALT flowtop



<----: Elevation of reference point: (top of 12-in casing) [670.04 ft]
.--: Height of reference point above ground surface [ND]
| Depth of surface seal [0-12 ft]

Type of surface seal: Cement grout 4-ft x 4-ft x 4-in surface pad. 4 equidistant protective posts. Cement grouted to 12 ft.

<-----| Diameter of borehole; 12-270 ft [11-in nom]
<-----| I.D. of riser pipe, (Q): Stainless steel, Type 304 [2-in]
<-----| I.D. of riser pipe, (P): Stainless steel [4-in]
<-----| Powdered bentonite seal 12-251 ft
<-----| Granular bentonite seal 251-253 ft
<-----| 4-in screen 259.4-279.4 ft Stainless steel 20 slot
<-----| Sandpack 253-284.8 ft
<-----| Diameter of borehole; 270-354 ft [9-in nom]
<-----| Granular bentonite seal 284.8-310.5 ft tremmied "EnviroGel"
<-----| 2-in screen 320-330.6 ft 304 stainless steel 20 slot
<-----| Sandpack 310.5-338 ft
<-----| Bentonite/sand slurry 338-354 ft
<-----| Depth bottom of borehole: [354 ft]

Drawing By: RKL/2#E25#32.ASB   Date: 17Aug90

Reference: Golder 8831752\14260

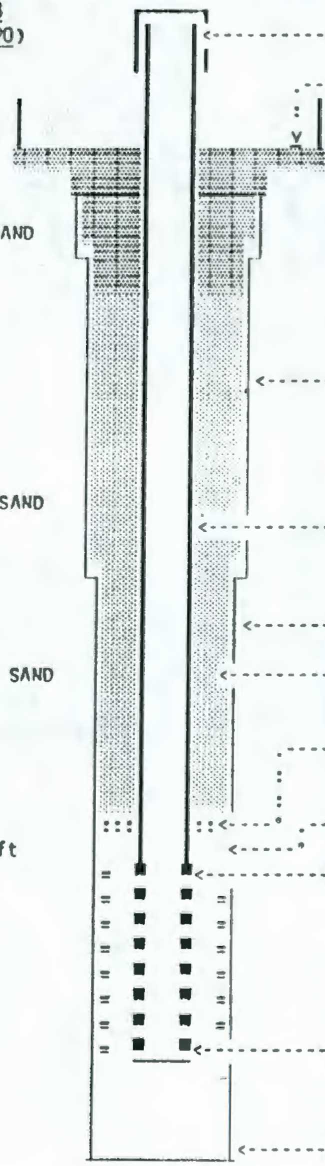
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel	WELL NUMBER: 299-E25-34 TEMPORARY WELL NO:
Drilling 200E Area Fluid Used: Water	Additives Used: Not documented	Hanford Coordinates: N/S N 41,386 E/W W 45,517
Driller's Name: Cordon/Garcia/Murphy	WA State Lic Nr: 1143 (Garcia)	State Coordinates: N 446,571 E 2,249,702
Drilling Company: Kaiser Engineers	Company Location: Hanford	Start Card #: 007916 T 26E R 12N S 1
Date Started: 03Jun88	Date Complete: 19Sep88	Elevation Ground surface (ft): 660.62 (Brass cap)

Depth to water: 254.5 ft Sep88
(Top of casing)->(258.2 ft Jul90)

GENERALIZED Geologist's
STRATIGRAPHY Log

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



Elevation of reference point: (top of casing) [662.87 ft]
Height of reference point above ground surface [2.25 ft]
Depth of surface seal [2.2-20.1 ft]
Type of surface seal: Cement grout 4-ft x 4-ft x 4-in surface pad. 4 equidistant protective posts. Pad extends 2.2 ft into annulus. Cement grouted to 20.1-ft
Diameter of borehole: 10-162.5 ft [11-in nom]
I.D. of riser pipe: [4-in]
Type of riser pipe: Stainless steel, Type 304
Diameter of borehole: 162.5-281.25 ft [9-in nom]
Type of filler: Granular/powdered bentonite
Depth top of seal: [250.3 ft]
Type of seal: Bentonite pellets, ¼-in Enviroplug
Depth top of sand pack: Silica sand, 16-30 mesh [251 ft]
Depth top of screens: 4-in, 20-slot 304 SS 8-in telescoping, 20-slot 304 SS [251.6 ft]
Depth bottom of screens: [271.6 ft]
Depth to bottom: [281.25 ft]

Drawing By: RKL/2#E25#34.ASB   Date: 17Aug90

Reference: Golder 8831752\14087

WELL CONSTRUCTION AND COMPLETION SUMMARY

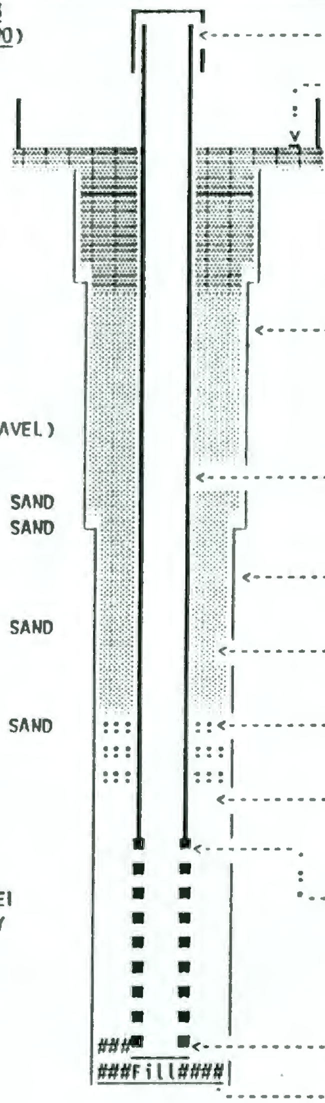
Drilling Method: Cable tool	Sample Method: Not documented
Drilling Fluid Used: Water (200E Area)	Additives Used: Not documented
Driller's Name: Amos/Wamsley	WA State Lic Nr: 1224 (Amos)
Drilling Company: Kaiser Engineers	Company Location: Hanford
Date Started: 03May88	Date Complete: 27Aug88

WELL NUMBER: 299-E25-35 TEMPORARY WELL NO: ______
Hanford Coordinates: N/S N 40,617 E/W W 46,538
State Coordinates: N 445,799 E 2,248,682
Start Card #: Not documented T___ R___ S___
Elevation Ground surface (ft): 670.98 (Brass cap)

Depth to water: 264.3 ft Aug88
(Top of casing)->(270.0 ft Jul90)

GENERALIZED STRATIGRAPHY Geologist's Log

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



Elevation of reference point: (top of casing) [674.39 ft]
Height of reference point above ground surface [3.4 ft]
Depth of surface seal [3-19.5 ft]
Type of surface seal: Cement grout 4-ft x 4-ft x 4-in surface pad. 4 equidistant protective posts. Pad extends 3.0 ft into annulus. Cement grouted to 19.5 ft.
Diameter of borehole:
3-20.2 ft [13-in nom]
20.2-145.3 ft [11-in nom]
I.D. of riser pipe: [4-in]
Type of riser pipe: Stainless steel, Type 304
Diameter of borehole: 145.3-285 ft [9-in nom]
Type of filler: Bentonite crumbles
Depth top of seal: [250.9 ft]
Type of seal: Bentonite pellets
Depth top of sand pack: [256.2 ft]
Silica sand 10-20 mesh
Depth top of screen: [260.5 ft]
4-in, stainless steel Johnson 20-slot
Depth bottom of screen: [281.0 ft]
Depth to bottom: [285.0 ft]

Drawing By: RKL/2#E25#35.ASB Date: 17Aug90
Reference: Golder 8831752\14123

WELL CONSTRUCTION AND COMPLETION SUMMARY

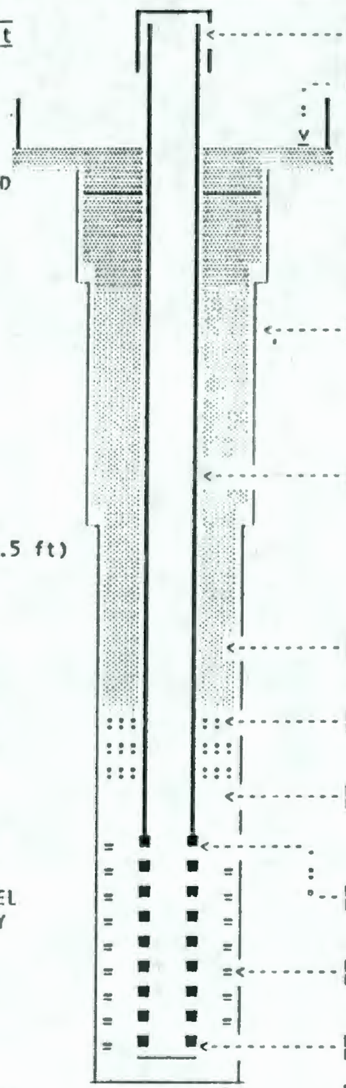
Drilling Method: Cable tool	Sample Method: Drive barrel & Hard tool	WELL NUMBER: 699-43-43
Drilling Fluid Used: 200E Area Water	Additives Used: Not documented	TEMPORARY WELL NO: BP-8
Driller's Name: Ludtke	WA State Lic Nr: Not documented	Hanford Coordinates: N/S N 42,942.4 E/W W 43,184.4
Drilling Company: Onwego Drilling Co	Company Location: Kennewick, WA	State Coordinates: N 448,133.4 E 2,252,030.5
Date Started: 02Aug88	Date Complete: 23Sep88	Start Card #: Not documented T____ R____ S____
		Elevation Ground surface (ft): 576.00 (Brass cap)

Depth to water: 159 ft Sep88
(Top of casing)-> Sep88 161.0 ft

GENERALIZED STRATIGRAPHY Geologist's Log

0-5: Slightly silty gravelly SAND
5-10: Silty sandy GRAVEL
10-35: SAND (medium)
35-40: SAND (medium to fine)
40-45: SAND (fine)
45-60: SAND (medium)
60-80: Gravelly SAND
80-85: SAND (fine)
85-90: Slightly gravelly, slighty silty SAND
90-95: Slightly gravelly SAND
95-105: SAND (medium)
105-120: Sandy GRAVEL
120-125: Gravelly SAND
125-130: (Sandy GRAVEL - Basalt BOULDER 124-138.5 ft)
130-135: SAND (medium)
135-140: Slightly gravelly SAND
140-145: Gravelly SAND
145-165: Sandy GRAVEL
165-170: Gravelly SAND
170-175: Silty sandy GRAVEL (Top of Ringold 173 ft)
175-180: Sandy GRAVEL
180- : Slightly gravelly SAND
235-240: Slightly silty SAND
240-245: Silty sandy GRAVEL
245-250: Gravelly SAND
250-255: Silty sandy GRAVEL
255-260: Silty/clayey sandy GRAVEL
260-265: Gravelly sandy SILT/CLAY
265-270: CLAY/SILT
270-275: Slighty gravelly slightly silty SAND
275-280: Slightly gravelly SAND
280-285: SAND

DRILLER'S NOTE:
Added basalt gravel and rocks to hole when drilling basalt boulder at 124 ft.



Elevation of reference point: (top of casing) [579.37 ft]
Height of reference point above ground surface [3.4 ft]
Depth of surface seal [2-18.0 ft]
Type of surface seal: Cement grout 4-ft x 4-ft x 4-in surface pad. 4 equidistant protective posts. Pad extends 2.0 ft into annulus. Cement grouted to 18.0 ft.
Diameter of borehole:
- 2-15.5 ft [13-in nom]
- 15.5-126 ft [11-in nom]
- 126-184 ft [9-in nom]

I.D. of riser pipe: [4-in]
Type of riser pipe: Stainless steel, Type 304

Type of filler: Granular bentonite

Depth top of seal: [147.5 ft]
Type of seal: Bentonite pellets

Depth top of sand pack: [152.0 ft]
Silica sand, 20-40 mesh

Depth top of screen: [156.8 ft]
4-in, 304 stainless steel, 10 slot

Telescoping screen, 159.5-179.5 ft
8-in, 304 stainless steel, 20 slot

Depth bottom of screen: [177.45 ft]

Depth to bottom: [180.0 ft]

Drawing By: RKL/6#43#43.ASB Date: 29Jan91

Reference: ____

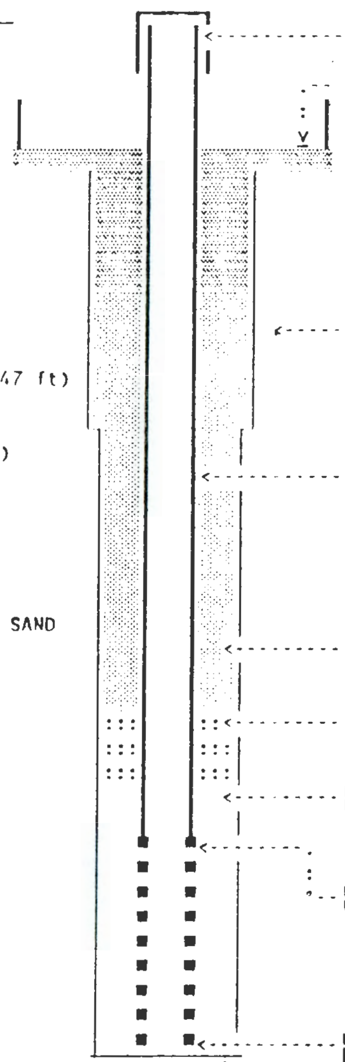
WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool	Sample Method: Drive barrel & Hard tool	WELL NUMBER: 699-43-45 / TEMPORARY WELL NO: BP-1
Drilling Fluid Used: 200E Area Water	Additives Used: Not documented	Hanford Coordinates: N/S N 42,977.4 E/W W 44,643.6
Driller's Name: L. Watkins	WA State Lic Nr: Not documented	State Coordinates: N 448,164.7 E 2,250,571.2
Drilling Company: KEH	Company Location: Hanford	Start Card #: Not documented T____ R____ S____
Date Started: 02May89	Date Complete: 02Jun89	Elevation Ground surface (ft): 594.70 (Brass cap)

Depth to water: 187.7 ft Jun89
(Ground surface)

GENERALIZED STRATIGRAPHY | Geologist's Log

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



Elevation of reference point: (top of casing) [597.68 ft]
Height of reference point above ground surface [3.0 ft]
Depth of surface seal [3.4-18.5 ft]
Type of surface seal: Cement grout 4-ft x 4-ft x 4-in surface pad. 4 equidistant protective posts. Pad extends 3.4 ft into annulus. Cement grouted to 18.5 ft.
Diameter of borehole:
3.4-47 ft [11-in nom]
47-203.4 ft [9-in nom]
I.D. of riser pipe: [4-in]
Type of riser pipe: Stainless steel, Type 304
Type of filler: Granular bentonite
Depth top of seal: [173.4 ft]
Type of seal: Bentonite pellets
Depth top of sand pack: [179.2 ft]
Silica sand, 8-20 mesh
Depth top of screen: [182.95 ft]
4-in, 304 stainless steel, 20 slot
Depth bottom of screen: [203.3 ft]
Depth to bottom: [203.6 ft]

Drawing By: RKL/6#43#45.ASB Date: 29Jan91

Reference: __________

APPENDIX C

WATER CHEMISTRY DATA LISTINGS AND SUMMARIES

APPENDIX C

WATER CHEMISTRY DATA LISTINGS AND SUMMARIES

This appendix presents all available water chemistry data that are greater than the detection limit from the existing wells of the A-29 Ditch ground water monitoring network. The results of the analyses of the ground water from these wells are listed in Table C-1 (Water Chemistry Data - Analytic Data for the 216-A-29 Ditch). The long name for the constituents and the limit of detection for each constituent is listed in Table C-2.

Regulatory agency guidelines are based on the following:

EPA - Maximum Contaminant Levels given in 40 CFR 141 (July 1987) National Primary Drinking Water Regulations as amended by 52 FR 25690.

EPAP - Proposed Maximum Contaminant Goals in 50 FR 46936.

DOE - draft DOE Derived Concentration Guides, DOE Order 5480.1A (DOE, 1981).

Table C.1. Water-Chemistry Data Analytic Data for the A-29 Ditch.

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	9/20/85	AMMONIU	118.00	PPB
2-E25-26	9/20/85	ARSENIC	9.66	PPB
2-E25-26	9/20/85	BARIUM	11.00	PPB
2-E25-26	9/20/85	BETA	6.76	PCI/L
2-E25-26	9/20/85	CALCIUM	17200.00	PPB
2-E25-26	9/20/85	CHLORID	3100.00	PPB
2-E25-26	9/20/85	CONDLAB	255.00	UMHO
2-E25-26	9/20/85	IRON	118.00	PPB
2-E25-26	9/20/85	NICKEL	12.00	PPB
2-E25-26	9/20/85	NITRATE	3280.00	PPB
2-E25-26	9/20/85	PH-LAB	7.91	
2-E25-26	9/20/85	PHFIELD	8.30	
2-E25-26	9/20/85	POTASUM	3840.00	PPB
2-E25-26	9/20/85	SODIUM	13900.00	PPB
2-E25-26	9/20/85	SOLIDS	250.00	MG/L
2-E25-26	9/20/85	SULFATE	19300.00	PPB
2-E25-26	9/20/85	TOC	1310.00	PPB
2-E25-26	9/20/85	TRITIUM	4200.00	PCI/L
2-E25-26	9/20/85	VANADUM	36.00	PPB
2-E25-26	9/20/85	ZINC	8.00	PPB
2-E25-26	2/07/86	ALPHA	1.33	PCI/L
2-E25-26	2/07/86	AMMONIU	57.80	PPB
2-E25-26	2/07/86	ARSENIC	7.80	PPB
2-E25-26	2/07/86	BARIUM	11.00	PPB
2-E25-26	2/07/86	BETA	7.33	PCI/L
2-E25-26	2/07/86	CALCIUM	16800.00	PPB
2-E25-26	2/07/86	CHLORID	4420.00	PPB
2-E25-26	2/07/86	CONDFLD	211.00	UMHO
2-E25-26	2/07/86	CONDLAB	179.00	UMHO
2-E25-26	2/07/86	FLUORID	530.00	PPB
2-E25-26	2/07/86	IRON	197.00	PPB
2-E25-26	2/07/86	NITRATE	3560.00	PPB
2-E25-26	2/07/86	PH-LAB	8.24	
2-E25-26	2/07/86	PHFIELD	8.10	
2-E25-26	2/07/86	POTASUM	3800.00	PPB
2-E25-26	2/07/86	RU-106	69.40	PCI/L
2-E25-26	2/07/86	SODIUM	13300.00	PPB
2-E25-26	2/07/86	SOLIDS	250.00	MG/L
2-E25-26	2/07/86	SULFATE	14600.00	PPB
2-E25-26	2/07/86	TRITIUM	2750.00	PCI/L
2-E25-26	2/07/86	VANADUM	42.00	PPB
2-E25-26	2/07/86	ZINC	8.00	PPB
2-E25-26	3/10/86	ALPHA	2.15	PCI/L
2-E25-26	3/10/86	BARIUM	10.00	PPB
2-E25-26	3/10/86	CALCIUM	16800.00	PPB
2-E25-26	3/10/86	CHLORID	4460.00	PPB
2-E25-26	3/10/86	CONDFLD	206.00	UMHO
2-E25-26	3/10/86	IRON	170.00	PPB
2-E25-26	3/10/86	NITRATE	2770.00	PPB
2-E25-26	3/10/86	PHFIELD	7.20	

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	3/10/86	POTASUM	3840.00	PPB
2-E25-26	3/10/86	SODIUM	14800.00	PPB
2-E25-26	3/10/86	SOLIDS	800.00	MG/L
2-E25-26	3/10/86	SULFATE	13900.00	PPB
2-E25-26	3/10/86	TOC	1060.00	PPB
2-E25-26	3/10/86	TRITIUM	2290.00	PCI/L
2-E25-26	3/10/86	VANADUM	41.00	PPB
2-E25-26	3/10/86	ZINC	6.00	PPB
2-E25-26	6/04/86	ALPHA	1.66	PCI/L
2-E25-26	6/04/86	BARIUM	11.00	PPB
2-E25-26	6/04/86	BETA	9.51	PCI/L
2-E25-26	6/04/86	CALCIUM	18300.00	PPB
2-E25-26	6/04/86	CHLORID	4690.00	PPB
2-E25-26	6/04/86	CONDFLD	193.00	UMHO
2-E25-26	6/04/86	IRON	211.00	PPB
2-E25-26	6/04/86	NITRATE	1500.00	PPB
2-E25-26	6/04/86	PHFIELD	5.60	
2-E25-26	6/04/86	POTASUM	3700.00	PPB
2-E25-26	6/04/86	SODIUM	13200.00	PPB
2-E25-26	6/04/86	SULFATE	16800.00	PPB
2-E25-26	6/04/86	TRITIUM	2780.00	PCI/L
2-E25-26	6/04/86	VANADUM	38.00	PPB
2-E25-26	9/03/86	ARSENIC	5.20	PPB
2-E25-26	9/03/86	BARIUM	11.00	PPB
2-E25-26	9/03/86	BETA	8.17	PCI/L
2-E25-26	9/03/86	CALCIUM	18300.00	PPB
2-E25-26	9/03/86	CHLORID	4270.00	PPB
2-E25-26	9/03/86	CONDFLD	162.00	UMHO
2-E25-26	9/03/86	CS-137	7.41	PCI/L
2-E25-26	9/03/86	IRON	364.00	PPB
2-E25-26	9/03/86	MAGNES	5250.00	PPB
2-E25-26	9/03/86	NITRATE	1400.00	PPB
2-E25-26	9/03/86	PHFIELD	7.60	
2-E25-26	9/03/86	POTASUM	3940.00	PPB
2-E25-26	9/03/86	SODIUM	13500.00	PPB
2-E25-26	9/03/86	SULFATE	14300.00	PPB
2-E25-26	9/03/86	TC	18900.00	PPB
2-E25-26	9/03/86	TDS	151000.00	
2-E25-26	9/03/86	TRITIUM	2650.00	PCI/L
2-E25-26	9/03/86	VANADUM	37.00	PPB
2-E25-26	9/03/86	ZINC	10.00	PPB
2-E25-26	12/15/86	BARIUM	11.00	PPB
2-E25-26	12/15/86	BETA	7.47	PCI/L
2-E25-26	12/15/86	CALCIUM	16600.00	PPB
2-E25-26	12/15/86	CHLORID	3990.00	PPB
2-E25-26	12/15/86	CO-60	5.33	PCI/L
2-E25-26	12/15/86	CONDFLD	246.00	UMHO
2-E25-26	12/15/86	IRON	91.00	PPB
2-E25-26	12/15/86	MAGNES	4750.00	PPB
2-E25-26	12/15/86	NITRATE	1160.00	PPB
2-E25-26	12/15/86	PHFIELD	8.40	

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	12/15/86	POTASUM	3540.00	PPB
2-E25-26	12/15/86	SODIUM	11300.00	PPB
2-E25-26	12/15/86	SULFATE	13700.00	PPB
2-E25-26	12/15/86	TC	18900.00	PPB
2-E25-26	12/15/86	TDS	128000.00	
2-E25-26	12/15/86	TRITIUM	2390.00	PCI/L
2-E25-26	12/15/86	VANADUM	34.00	PPB
2-E25-26	3/12/87	ARSENIC	5.00	PPB
2-E25-26	3/12/87	BARIUM	11.00	PPB
2-E25-26	3/12/87	BETA	9.02	PCI/L
2-E25-26	3/12/87	CALCIUM	18100.00	PPB
2-E25-26	3/12/87	CHLORID	5420.00	PPB
2-E25-26	3/12/87	CONDFLD	174.00	UMHO
2-E25-26	3/12/87	IRON	167.00	PPB
2-E25-26	3/12/87	MAGNES	5080.00	PPB
2-E25-26	3/12/87	NITRATE	1370.00	PPB
2-E25-26	3/12/87	PHFIELD	7.80	
2-E25-26	3/12/87	POTASUM	3790.00	PPB
2-E25-26	3/12/87	SODIUM	11900.00	PPB
2-E25-26	3/12/87	SULFATE	15300.00	PPB
2-E25-26	3/12/87	TC	18800.00	PPB
2-E25-26	3/12/87	TDS	90000.00	
2-E25-26	3/12/87	TRITIUM	1640.00	PCI/L
2-E25-26	3/12/87	VANADUM	37.00	PPB
2-E25-26	3/12/87	ZINC	8.00	PPB
2-E25-26	7/01/87	ARSENIC	9.00	PPB
2-E25-26	7/01/87	BARIUM	17.00	PPB
2-E25-26	7/01/87	CALCIUM	17600.00	PPB
2-E25-26	7/01/87	CHLORID	4030.00	PPB
2-E25-26	7/01/87	CO-60	7.28	PCI/L
2-E25-26	7/01/87	CONDFLD	156.00	UMHO
2-E25-26	7/01/87	CS-137	7.18	PCI/L
2-E25-26	7/01/87	IRON	73.00	PPB
2-E25-26	7/01/87	MAGNES	5190.00	PPB
2-E25-26	7/01/87	NITRATE	1450.00	PPB
2-E25-26	7/01/87	PHFIELD	7.20	
2-E25-26	7/01/87	POTASUM	3970.00	PPB
2-E25-26	7/01/87	SODIUM	12300.00	PPB
2-E25-26	7/01/87	SULFATE	16600.00	PPB
2-E25-26	7/01/87	TC	19100.00	PPB
2-E25-26	7/01/87	TDS	146000.00	
2-E25-26	7/01/87	TRITIUM	1820.00	PCI/L
2-E25-26	7/01/87	VANADUM	39.00	PPB
2-E25-26	10/01/87	ARSENIC	9.00	PPB
2-E25-26	10/01/87	BARIUM	17.00	PPB
2-E25-26	10/01/87	BETA	5.84	PCI/L
2-E25-26	10/01/87	CALCIUM	18200.00	PPB
2-E25-26	10/01/87	CHLORID	3610.00	PPB
2-E25-26	10/01/87	CONDFLD	158.00	UMHO
2-E25-26	10/01/87	IRON	150.00	PPB
2-E25-26	10/01/87	LEADGF	5.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	10/01/87	MAGNES	5150.00	PPB
2-E25-26	10/01/87	NITRATE	1220.00	PPB
2-E25-26	10/01/87	PHFIELD	7.60	
2-E25-26	10/01/87	POTASUM	3910.00	PPB
2-E25-26	10/01/87	RADIUM	0.20	PCI/L
2-E25-26	10/01/87	SODIUM	11100.00	PPB
2-E25-26	10/01/87	SULFATE	13700.00	PPB
2-E25-26	10/01/87	TC	17800.00	PPB
2-E25-26	10/01/87	TDS	104000.00	
2-E25-26	10/01/87	TOC	1000.00	PPB
2-E25-26	10/01/87	TRITIUM	1940.00	PCI/L
2-E25-26	10/01/87	U-234	0.53	PCI/L
2-E25-26	10/01/87	U-235	0.03	PCI/L
2-E25-26	10/01/87	U-238	0.36	PCI/L
2-E25-26	10/01/87	VANADUM	38.00	PPB
2-E25-26	10/01/87	ZINC	6.00	PPB
2-E25-26	3/28/88	ARSENIC	7.00	PPB
2-E25-26	3/28/88	BARIUM	13.00	PPB
2-E25-26	3/28/88	CALCIUM	20100.00	PPB
2-E25-26	3/28/88	CHLORID	2990.00	PPB
2-E25-26	3/28/88	CONDFLD	185.00	UMHO
2-E25-26	3/28/88	FARSENI	5.00	PPB
2-E25-26	3/28/88	FBARIUM	18.00	PPB
2-E25-26	3/28/88	FCALCIU	18600.00	PPB
2-E25-26	3/28/88	FCOPPER	17.00	PPB
2-E25-26	3/28/88	FMAGNES	5270.00	PPB
2-E25-26	3/28/88	FPOTASS	4060.00	PPB
2-E25-26	3/28/88	FSODIUM	11000.00	PPB
2-E25-26	3/28/88	FSTRONT	105.00	PPB
2-E25-26	3/28/88	FVANADI	34.00	PPB
2-E25-26	3/28/88	FZINC	13.00	PPB
2-E25-26	3/28/88	IRON	363.00	PPB
2-E25-26	3/28/88	MAGNES	5510.00	PPB
2-E25-26	3/28/88	NITRATE	1210.00	PPB
2-E25-26	3/28/88	PHFIELD	8.20	
2-E25-26	3/28/88	POTASUM	4160.00	PPB
2-E25-26	3/28/88	SODIUM	11200.00	PPB
2-E25-26	3/28/88	STRONUM	101.00	PPB
2-E25-26	3/28/88	SULFATE	16500.00	PPB
2-E25-26	3/28/88	TC	17600.00	PPB
2-E25-26	3/28/88	TC-99	0.57	PCI/L
2-E25-26	3/28/88	TRITIUM	3120.00	PCI/L
2-E25-26	3/28/88	VANADUM	43.00	PPB
2-E25-26	3/28/88	ZINC	13.00	PPB
2-E25-26	10/19/88	ARSENIC	7.00	PPB
2-E25-26	10/19/88	BARIUM	12.40	PPB
2-E25-26	10/19/88	CALCIUM	20100.00	PPB
2-E25-26	10/19/88	CHLORID	3200.00	PPB
2-E25-26	10/19/88	CONDFLD	185.00	UMHO
2-E25-26	10/19/88	FARSENI	7.00	PPB
2-E25-26	10/19/88	FBARIUM	11.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	10/19/88	FCALCIU	21400.00	PPB
2-E25-26	10/19/88	FMAGNES	5230.00	PPB
2-E25-26	10/19/88	FPOTASS	3760.00	PPB
2-E25-26	10/19/88	FSODIUM	8900.00	PPB
2-E25-26	10/19/88	FSTRONT	98.00	PPB
2-E25-26	10/19/88	FVANADI	31.00	PPB
2-E25-26	10/19/88	FZINC	9.00	PPB
2-E25-26	10/19/88	IRON	77.10	PPB
2-E25-26	10/19/88	MAGNES	5590.00	PPB
2-E25-26	10/19/88	NITRATE	1500.00	PPB
2-E25-26	10/19/88	PHFIELD	8.10	
2-E25-26	10/19/88	PHFIELD	8.20	
2-E25-26	10/19/88	POTASUM	4200.00	PPB
2-E25-26	10/19/88	SODIUM	10200.00	PPB
2-E25-26	10/19/88	STRONUM	107.00	PPB
2-E25-26	10/19/88	SULFATE	14400.00	PPB
2-E25-26	10/19/88	TC	17000.00	PPB
2-E25-26	10/19/88	TC-99	3.14	PCI/L
2-E25-26	10/19/88	TOC	1100.00	PPB
2-E25-26	10/19/88	TRITIUM	2380.00	PCI/L
2-E25-26	10/19/88	VANADUM	25.10	PPB
2-E25-26	10/19/88	ZINC	12.40	PPB
2-E25-26	12/15/88	ARSENIC	6.00	PPB
2-E25-26	12/15/88	BARIUM	11.00	PPB
2-E25-26	12/15/88	CALCIUM	17900.00	PPB
2-E25-26	12/15/88	CHLORID	2800.00	PPB
2-E25-26	12/15/88	CONDFLD	173.00	UMHO
2-E25-26	12/15/88	CONDFLD	175.00	UMHO
2-E25-26	12/15/88	COPPER	69.00	PPB
2-E25-26	12/15/88	FARSENI	8.00	PPB
2-E25-26	12/15/88	FBARIUM	16.00	PPB
2-E25-26	12/15/88	FCALCIU	19800.00	PPB
2-E25-26	12/15/88	FIRON	49.00	PPB
2-E25-26	12/15/88	FMAGNES	5450.00	PPB
2-E25-26	12/15/88	FPOTASS	3940.00	PPB
2-E25-26	12/15/88	FSODIUM	8990.00	PPB
2-E25-26	12/15/88	FSTRONT	99.00	PPB
2-E25-26	12/15/88	FVANADI	29.00	PPB
2-E25-26	12/15/88	FZINC	53.00	PPB
2-E25-26	12/15/88	IRON	72.00	PPB
2-E25-26	12/15/88	MAGNES	5250.00	PPB
2-E25-26	12/15/88	NITRATE	1400.00	PPB
2-E25-26	12/15/88	PHFIELD	8.10	
2-E25-26	12/15/88	POTASUM	3950.00	PPB
2-E25-26	12/15/88	SODIUM	9110.00	PPB
2-E25-26	12/15/88	STRONUM	95.00	PPB
2-E25-26	12/15/88	SULFATE	14400.00	PPB
2-E25-26	12/15/88	TURBID	0.30	NTU
2-E25-26	12/15/88	VANADUM	27.00	PPB
2-E25-26	12/15/88	ZINC	49.00	PPB
2-E25-26	2/28/89	ALPHAHI	1.16	PCI/L

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	2/28/89	ARSENIC	7.00	PPB
2-E25-26	2/28/89	BARIUM	9.00	PPB
2-E25-26	2/28/89	BORON	15.00	PPB
2-E25-26	2/28/89	CALCIUM	18400.00	PPB
2-E25-26	2/28/89	CHLORID	2800.00	PPB
2-E25-26	2/28/89	CONDFLD	192.00	UMHO
2-E25-26	2/28/89	CONDFLD	193.00	UMHO
2-E25-26	2/28/89	CONDFLD	194.00	UMHO
2-E25-26	2/28/89	CONDLAB	178.00	UMHO
2-E25-26	2/28/89	FARSENI	7.00	PPB
2-E25-26	2/28/89	FBARIUM	12.00	PPB
2-E25-26	2/28/89	FBORON	12.00	PPB
2-E25-26	2/28/89	FCALCIU	20400.00	PPB
2-E25-26	2/28/89	FCOPPER	13.00	PPB
2-E25-26	2/28/89	FMAGNES	5740.00	PPB
2-E25-26	2/28/89	FPOTASS	4410.00	PPB
2-E25-26	2/28/89	FSILICO	15800.00	PPB
2-E25-26	2/28/89	FSODIUM	10600.00	PPB
2-E25-26	2/28/89	FSTRONT	113.00	PPB
2-E25-26	2/28/89	FVANADI	29.00	PPB
2-E25-26	2/28/89	FZINC	19.00	PPB
2-E25-26	2/28/89	IRON	50.00	PPB
2-E25-26	2/28/89	MAGNES	5240.00	PPB
2-E25-26	2/28/89	NITRATE	1400.00	PPB
2-E25-26	2/28/89	PH-LAB	8.23	
2-E25-26	2/28/89	PHFIELD	8.20	
2-E25-26	2/28/89	PHFIELD	8.30	
2-E25-26	2/28/89	PHFIELD	8.40	
2-E25-26	2/28/89	POTASUM	4060.00	PPB
2-E25-26	2/28/89	SILICON	14400.00	PPB
2-E25-26	2/28/89	SODIUM	9660.00	PPB
2-E25-26	2/28/89	STRONUM	102.00	PPB
2-E25-26	2/28/89	SULFATE	14800.00	PPB
2-E25-26	2/28/89	TC	16700.00	PPB
2-E25-26	2/28/89	TURBID	0.15	NTU
2-E25-26	2/28/89	VANADUM	32.00	PPB
2-E25-26	2/28/89	ZINC	26.00	PPB
2-E25-26	7/12/89	ARSENIC	6.00	PPB
2-E25-26	7/12/89	BARIUM	12.00	PPB
2-E25-26	7/12/89	BETA	3.73	PCI/L
2-E25-26	7/12/89	BIS2EPH	14.00	PPB
2-E25-26	7/12/89	BORON	12.00	PPB
2-E25-26	7/12/89	CALCIUM	23000.00	PPB
2-E25-26	7/12/89	CHLORID	3110.00	PPB
2-E25-26	7/12/89	CONDFLD	154.00	UMHO
2-E25-26	7/12/89	COPPER	20.00	PPB
2-E25-26	7/12/89	FARSENI	5.00	PPB
2-E25-26	7/12/89	FBARIUM	12.00	PPB
2-E25-26	7/12/89	FBORON	13.00	PPB
2-E25-26	7/12/89	FCALCIU	21400.00	PPB
2-E25-26	7/12/89	FMAGNES	5480.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	7/12/89	FPOTASS	4190.00	PPB
2-E25-26	7/12/89	FSILICO	13600.00	PPB
2-E25-26	7/12/89	FSODIUM	9280.00	PPB
2-E25-26	7/12/89	FSTRONT	111.00	PPB
2-E25-26	7/12/89	FVANADI	26.00	PPB
2-E25-26	7/12/89	FZINC	8.00	PPB
2-E25-26	7/12/89	IRON	130.00	PPB
2-E25-26	7/12/89	MAGNES	5910.00	PPB
2-E25-26	7/12/89	NITRATE	1600.00	PPB
2-E25-26	7/12/89	PHFIELD	7.22	
2-E25-26	7/12/89	POTASUM	4560.00	PPB
2-E25-26	7/12/89	SILICON	14800.00	PPB
2-E25-26	7/12/89	SODIUM	10100.00	PPB
2-E25-26	7/12/89	STRONUM	119.00	PPB
2-E25-26	7/12/89	SULFATE	17500.00	PPB
2-E25-26	7/12/89	TC	17500.00	PPB
2-E25-26	7/12/89	TURBID	0.40	NTU
2-E25-26	7/12/89	VANADUM	32.00	PPB
2-E25-26	7/12/89	ZINC	23.00	PPB
2-E25-26	8/11/89	ALPHAHI	1.12	PCI/L
2-E25-26	8/11/89	ARSENIC	5.00	PPB
2-E25-26	8/11/89	BARIUM	9.00	PPB
2-E25-26	8/11/89	BETA	8.34	PCI/L
2-E25-26	8/11/89	BORON	17.00	PPB
2-E25-26	8/11/89	CALCIUM	19400.00	PPB
2-E25-26	8/11/89	CHLORID	3000.00	PPB
2-E25-26	8/11/89	CONDFLD	208.00	UMHO
2-E25-26	8/11/89	CONDFLD	209.00	UMHO
2-E25-26	8/11/89	CONDLAB	187.00	UMHO
2-E25-26	8/11/89	FBARIUM	16.00	PPB
2-E25-26	8/11/89	FCALCIU	22500.00	PPB
2-E25-26	8/11/89	FCOPPER	12.00	PPB
2-E25-26	8/11/89	FMAGNES	6040.00	PPB
2-E25-26	8/11/89	FPOTASS	4730.00	PPB
2-E25-26	8/11/89	FSILICO	15400.00	PPB
2-E25-26	8/11/89	FSODIUM	10600.00	PPB
2-E25-26	8/11/89	FSTRONT	123.00	PPB
2-E25-26	8/11/89	FVANADI	28.00	PPB
2-E25-26	8/11/89	FZINC	7.00	PPB
2-E25-26	8/11/89	IRON	53.00	PPB
2-E25-26	8/11/89	MAGNES	5130.00	PPB
2-E25-26	8/11/89	NITRATE	1500.00	PPB
2-E25-26	8/11/89	PH-LAB	8.20	
2-E25-26	8/11/89	PHFIELD	8.24	
2-E25-26	8/11/89	PHFIELD	8.26	
2-E25-26	8/11/89	POTASUM	3860.00	PPB
2-E25-26	8/11/89	SILICON	13200.00	PPB
2-E25-26	8/11/89	SODIUM	8740.00	PPB
2-E25-26	8/11/89	STRONUM	99.00	PPB
2-E25-26	8/11/89	SULFATE	15700.00	PPB
2-E25-26	8/11/89	TC	18500.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	8/11/89	TOXLDL	10.00	PPB
2-E25-26	8/11/89	TOXLDL	12.00	PPB
2-E25-26	8/11/89	TRITIUM	3590.00	PCI/L
2-E25-26	8/11/89	TURBID	0.50	NTU
2-E25-26	8/11/89	U	0.98	PCI/L
2-E25-26	8/11/89	VANADUM	15.00	PPB
2-E25-26	8/11/89	ZINC	13.00	PPB
2-E25-26	8/29/89	BARIUM	13.00	PPB
2-E25-26	8/29/89	BETA	5.16	PCI/L
2-E25-26	8/29/89	BORON	13.00	PPB
2-E25-26	8/29/89	CALCIUM	20700.00	PPB
2-E25-26	8/29/89	CHLORID	2900.00	PPB
2-E25-26	8/29/89	CONDFLD	179.00	UMHO
2-E25-26	8/29/89	CONDFLD	180.00	UMHO
2-E25-26	8/29/89	CONDFLD	182.00	UMHO
2-E25-26	8/29/89	CONDLAB	183.00	UMHO
2-E25-26	8/29/89	FARSENI	5.00	PPB
2-E25-26	8/29/89	FBARIUM	13.00	PPB
2-E25-26	8/29/89	FCALCIU	21500.00	PPB
2-E25-26	8/29/89	FMAGNES	5630.00	PPB
2-E25-26	8/29/89	FPOTASS	4620.00	PPB
2-E25-26	8/29/89	FSILICO	14600.00	PPB
2-E25-26	8/29/89	FSODIUM	10000.00	PPB
2-E25-26	8/29/89	FSTRONT	113.00	PPB
2-E25-26	8/29/89	FVANADI	24.00	PPB
2-E25-26	8/29/89	FZINC	7.00	PPB
2-E25-26	8/29/89	IRON	35.00	PPB
2-E25-26	8/29/89	MAGNES	5570.00	PPB
2-E25-26	8/29/89	NITRATE	1400.00	PPB
2-E25-26	8/29/89	PH-LAB	8.10	
2-E25-26	8/29/89	PHFIELD	8.15	
2-E25-26	8/29/89	PHFIELD	8.16	
2-E25-26	8/29/89	PHFIELD	8.17	
2-E25-26	8/29/89	POTASUM	4090.00	PPB
2-E25-26	8/29/89	RADIUM	0.19	PCI/L
2-E25-26	8/29/89	SILICON	14000.00	PPB
2-E25-26	8/29/89	SODIUM	9070.00	PPB
2-E25-26	8/29/89	STRONUM	108.00	PPB
2-E25-26	8/29/89	SULFATE	15300.00	PPB
2-E25-26	8/29/89	TC	18000.00	PPB
2-E25-26	8/29/89	TURBID	0.30	NTU
2-E25-26	8/29/89	VANADUM	21.00	PPB
2-E25-26	8/29/89	ZINC	10.00	PPB
2-E25-26	11/01/89	ALPHAHI	1.14	PCI/L
2-E25-26	11/01/89	ARSENIC	6.00	PPB
2-E25-26	11/01/89	BARIUM	12.00	PPB
2-E25-26	11/01/89	BETA	3.02	PCI/L
2-E25-26	11/01/89	CALCIUM	20100.00	PPB
2-E25-26	11/01/89	CHLORID	2900.00	PPB
2-E25-26	11/01/89	CONDFLD	188.00	UMHO
2-E25-26	11/01/89	FARSENI	7.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-26	11/01/89	FBARIUM	12.00	PPB
2-E25-26	11/01/89	FBORON	22.00	PPB
2-E25-26	11/01/89	FCALCIU	19600.00	PPB
2-E25-26	11/01/89	FMAGNES	5400.00	PPB
2-E25-26	11/01/89	FPOTASS	4200.00	PPB
2-E25-26	11/01/89	FSILICO	13000.00	PPB
2-E25-26	11/01/89	FSODIUM	8790.00	PPB
2-E25-26	11/01/89	FSTRONT	110.00	PPB
2-E25-26	11/01/89	FVANADI	19.00	PPB
2-E25-26	11/01/89	FZINC	5.00	PPB
2-E25-26	11/01/89	IRON	78.00	PPB
2-E25-26	11/01/89	MAGNES	5560.00	PPB
2-E25-26	11/01/89	NITRATE	1100.00	PPB
2-E25-26	11/01/89	PHFIELD	8.26	
2-E25-26	11/01/89	POTASUM	4350.00	PPB
2-E25-26	11/01/89	SILICON	13500.00	PPB
2-E25-26	11/01/89	SODIUM	9060.00	PPB
2-E25-26	11/01/89	STRONUM	113.00	PPB
2-E25-26	11/01/89	SULFATE	12900.00	PPB
2-E25-26	11/01/89	TC	18900.00	PPB
2-E25-26	11/01/89	TDS	95000.00	
2-E25-26	11/01/89	TOXLDL	16.00	PPB
2-E25-26	11/01/89	TRITIUM	2730.00	PCI/L
2-E25-26	11/01/89	TURBID	0.20	NTU
2-E25-26	11/01/89	U	1.04	PCI/L
2-E25-26	11/01/89	VANADUM	24.00	PPB
2-E25-26	11/01/89	ZINC	15.00	PPB
2-E25-26	1/29/90	CONDFLD	203.00	UMHO
2-E25-26	1/29/90	CONDFLD	205.00	UMHO
2-E25-26	1/29/90	CONDLAB	191.00	UMHO
2-E25-26	1/29/90	CONDLAB	192.00	UMHO
2-E25-26	1/29/90	CONDLAB	193.00	UMHO
2-E25-26	1/29/90	PH-LAB	8.10	
2-E25-26	1/29/90	PH-LAB	8.20	
2-E25-26	1/29/90	PHFIELD	8.29	
2-E25-26	1/29/90	TOXLDL	10.00	PPB
2-E25-26	3/25/90	CONDFLD	185.00	UMHO
2-E25-26	3/25/90	I-129DW	1.57	PCI/L
2-E25-26	3/25/90	PHFIELD	8.27	
2-E25-26	3/25/90	U	1.20	PCI/L
2-E25-28	6/04/86	ARSENIC	21.00	PPB
2-E25-28	6/04/86	BARIUM	18.00	PPB
2-E25-28	6/04/86	BETA	11.20	PCI/L
2-E25-28	6/04/86	CALCIUM	19900.00	PPB
2-E25-28	6/04/86	CHLORID	4190.00	PPB
2-E25-28	6/04/86	COLIFRM	28.00	MPN
2-E25-28	6/04/86	CONDFLD	205.00	UMHO
2-E25-28	6/04/86	IRON	191.00	PPB
2-E25-28	6/04/86	MANGESE	8.00	PPB
2-E25-28	6/04/86	NITRATE	2150.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	6/04/86	PHFIELD	6.20	
2-E25-28	6/04/86	POTASUM	3770.00	PPB
2-E25-28	6/04/86	SODIUM	12200.00	PPB
2-E25-28	6/04/86	SULFATE	15900.00	PPB
2-E25-28	6/04/86	TRITIUM	3100.00	PCI/L
2-E25-28	6/04/86	VANADUM	39.00	PPB
2-E25-28	6/04/86	ZINC	8.00	PPB
2-E25-28	9/03/86	ALPHA	1.00	PCI/L
2-E25-28	9/03/86	ARSENIC	8.00	PPB
2-E25-28	9/03/86	BARIUM	16.00	PPB
2-E25-28	9/03/86	BETA	3.25	PCI/L
2-E25-28	9/03/86	CALCIUM	19600.00	PPB
2-E25-28	9/03/86	CHLORID	4480.00	PPB
2-E25-28	9/03/86	COLIFRM	5.10	MPN
2-E25-28	9/03/86	CONDFLD	166.00	UMHO
2-E25-28	9/03/86	LEADGF	16.10	PPB
2-E25-28	9/03/86	MAGNES	6260.00	PPB
2-E25-28	9/03/86	NITRATE	1840.00	PPB
2-E25-28	9/03/86	PHFIELD	7.80	
2-E25-28	9/03/86	POTASUM	4130.00	PPB
2-E25-28	9/03/86	SODIUM	13600.00	PPB
2-E25-28	9/03/86	SULFATE	14900.00	PPB
2-E25-28	9/03/86	TC	20200.00	PPB
2-E25-28	9/03/86	TDS	165000.00	
2-E25-28	9/03/86	TRITIUM	3130.00	PCI/L
2-E25-28	9/03/86	VANADUM	40.00	PPB
2-E25-28	9/03/86	ZINC	13.00	PPB
2-E25-28	12/05/86	CONDFLD	266.00	UMHO
2-E25-28	12/05/86	PHFIELD	8.60	
2-E25-28	12/15/86	ALPHA	1.89	PCI/L
2-E25-28	12/15/86	ARSENIC	8.00	PPB
2-E25-28	12/15/86	BARIUM	15.00	PPB
2-E25-28	12/15/86	BETA	8.18	PCI/L
2-E25-28	12/15/86	CALCIUM	18500.00	PPB
2-E25-28	12/15/86	CHLORID	4440.00	PPB
2-E25-28	12/15/86	CS-137	4.82	PCI/L
2-E25-28	12/15/86	MAGNES	5810.00	PPB
2-E25-28	12/15/86	NITRATE	1660.00	PPB
2-E25-28	12/15/86	POTASUM	3810.00	PPB
2-E25-28	12/15/86	SODIUM	11800.00	PPB
2-E25-28	12/15/86	SULFATE	13800.00	PPB
2-E25-28	12/15/86	TC	20000.00	PPB
2-E25-28	12/15/86	TDS	129000.00	
2-E25-28	12/15/86	TRITIUM	2490.00	PCI/L
2-E25-28	12/15/86	VANADUM	38.00	PPB
2-E25-28	12/15/86	ZINC	10.00	PPB
2-E25-28	3/12/87	ALPHA	1.14	PCI/L
2-E25-28	3/12/87	ARSENIC	6.00	PPB
2-E25-28	3/12/87	BARIUM	11.00	PPB
2-E25-28	3/12/87	BETA	5.45	PCI/L
2-E25-28	3/12/87	CALCIUM	19600.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	3/12/87	CHLORID	4950.00	PPB
2-E25-28	3/12/87	CO-60	5.05	PCI/L
2-E25-28	3/12/87	CONDFLD	186.00	UMHO
2-E25-28	3/12/87	CS-137	3.83	PCI/L
2-E25-28	3/12/87	IRON	56.00	PPB
2-E25-28	3/12/87	MAGNES	6190.00	PPB
2-E25-28	3/12/87	NITRATE	1410.00	PPB
2-E25-28	3/12/87	PHFIELD	8.00	
2-E25-28	3/12/87	POTASUM	3860.00	PPB
2-E25-28	3/12/87	RADIUM	0.19	PCI/L
2-E25-28	3/12/87	RU-106	37.00	PCI/L
2-E25-28	3/12/87	SODIUM	12400.00	PPB
2-E25-28	3/12/87	SULFATE	13100.00	PPB
2-E25-28	3/12/87	TC	21200.00	PPB
2-E25-28	3/12/87	TDS	83000.00	
2-E25-28	3/12/87	TRITIUM	2610.00	PCI/L
2-E25-28	3/12/87	VANADUM	37.00	PPB
2-E25-28	3/12/87	ZINC	16.00	PPB
2-E25-28	6/30/87	ALPHA	2.06	PCI/L
2-E25-28	6/30/87	ARSENIC	9.00	PPB
2-E25-28	6/30/87	BARIUM	22.00	PPB
2-E25-28	6/30/87	BETA	8.28	PCI/L
2-E25-28	6/30/87	CALCIUM	23600.00	PPB
2-E25-28	6/30/87	CHLORID	4340.00	PPB
2-E25-28	6/30/87	CONDFLD	181.00	UMHO
2-E25-28	6/30/87	CS-137	4.13	PCI/L
2-E25-28	6/30/87	FARSENI	11.00	PPB
2-E25-28	6/30/87	FBARIUM	20.00	PPB
2-E25-28	6/30/87	FCALCIU	18800.00	PPB
2-E25-28	6/30/87	FMAGNES	5920.00	PPB
2-E25-28	6/30/87	FPOTASS	4090.00	PPB
2-E25-28	6/30/87	FSODIUM	13400.00	PPB
2-E25-28	6/30/87	FVANADI	45.00	PPB
2-E25-28	6/30/87	FZINC	67.00	PPB
2-E25-28	6/30/87	IRON	68.00	PPB
2-E25-28	6/30/87	MAGNES	7430.00	PPB
2-E25-28	6/30/87	NITRATE	1390.00	PPB
2-E25-28	6/30/87	PHFIELD	7.50	
2-E25-28	6/30/87	POTASUM	4960.00	PPB
2-E25-28	6/30/87	RADIUM	0.21	PCI/L
2-E25-28	6/30/87	SODIUM	16200.00	PPB
2-E25-28	6/30/87	SULFATE	14800.00	PPB
2-E25-28	6/30/87	TC	20100.00	PPB
2-E25-28	6/30/87	TDS	140000.00	
2-E25-28	6/30/87	TOXLDL	51.30	PPB
2-E25-28	6/30/87	TRITIUM	2350.00	PCI/L
2-E25-28	6/30/87	VANADUM	56.00	PPB
2-E25-28	6/30/87	ZINC	244.00	PPB
2-E25-28	10/01/87	ALPHA	1.00	PCI/L
2-E25-28	10/01/87	AM-241	0.02	PCI/L
2-E25-28	10/01/87	ARSENIC	12.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	10/01/87	BARIUM	20.00	PPB
2-E25-28	10/01/87	BETA	7.71	PCI/L
2-E25-28	10/01/87	CALCIUM	18400.00	PPB
2-E25-28	10/01/87	CHLORID	4440.00	PPB
2-E25-28	10/01/87	CONDFLD	169.00	UMHO
2-E25-28	10/01/87	MAGNES	5610.00	PPB
2-E25-28	10/01/87	NITRATE	1120.00	PPB
2-E25-28	10/01/87	PHFIELD	7.60	
2-E25-28	10/01/87	POTASUM	3940.00	PPB
2-E25-28	10/01/87	RADIUM	0.16	PCI/L
2-E25-28	10/01/87	SODIUM	12300.00	PPB
2-E25-28	10/01/87	SULFATE	13700.00	PPB
2-E25-28	10/01/87	TC	19000.00	PPB
2-E25-28	10/01/87	TDS	114000.00	
2-E25-28	10/01/87	TRITIUM	1770.00	PCI/L
2-E25-28	10/01/87	U-234	0.53	PCI/L
2-E25-28	10/01/87	U-235	0.03	PCI/L
2-E25-28	10/01/87	U-238	0.43	PCI/L
2-E25-28	10/01/87	VANADUM	46.00	PPB
2-E25-28	10/01/87	ZINC	35.00	PPB
2-E25-28	3/31/88	ARSENIC	11.00	PPB
2-E25-28	3/31/88	BARIUM	20.00	PPB
2-E25-28	3/31/88	CALCIUM	19600.00	PPB
2-E25-28	3/31/88	CHLORID	3210.00	PPB
2-E25-28	3/31/88	CONDFLD	174.00	UMHO
2-E25-28	3/31/88	FARSENI	9.00	PPB
2-E25-28	3/31/88	FBARIUM	19.00	PPB
2-E25-28	3/31/88	FCALCIU	19700.00	PPB
2-E25-28	3/31/88	FMAGNES	5800.00	PPB
2-E25-28	3/31/88	FPOTASS	3840.00	PPB
2-E25-28	3/31/88	FSODIUM	11600.00	PPB
2-E25-28	3/31/88	FSTRONT	104.00	PPB
2-E25-28	3/31/88	FVANADI	43.00	PPB
2-E25-28	3/31/88	FZINC	23.00	PPB
2-E25-28	3/31/88	IRON	118.00	PPB
2-E25-28	3/31/88	MAGNES	6070.00	PPB
2-E25-28	3/31/88	NITRATE	812.00	PPB
2-E25-28	3/31/88	PHFIELD	8.60	
2-E25-28	3/31/88	POTASUM	4050.00	PPB
2-E25-28	3/31/88	SODIUM	12400.00	PPB
2-E25-28	3/31/88	STRONUM	108.00	PPB
2-E25-28	3/31/88	SULFATE	12600.00	PPB
2-E25-28	3/31/88	TC	19000.00	PPB
2-E25-28	3/31/88	TC-99	0.62	PCI/L
2-E25-28	3/31/88	TRITIUM	1690.00	PCI/L
2-E25-28	3/31/88	VANADUM	42.00	PPB
2-E25-28	3/31/88	ZINC	52.00	PPB
2-E25-28	10/19/88	ARSENIC	11.00	PPB
2-E25-28	10/19/88	BARIUM	13.40	PPB
2-E25-28	10/19/88	CALCIUM	17500.00	PPB
2-E25-28	10/19/88	CHLORID	3000.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	10/19/88	CONDFLD	194.00	UMHO
2-E25-28	10/19/88	FARSENI	12.00	PPB
2-E25-28	10/19/88	FBARIUM	12.00	PPB
2-E25-28	10/19/88	FCALCIU	20100.00	PPB
2-E25-28	10/19/88	FMAGNES	5310.00	PPB
2-E25-28	10/19/88	FPOTASS	3510.00	PPB
2-E25-28	10/19/88	FSODIUM	9850.00	PPB
2-E25-28	10/19/88	FSTRONT	95.00	PPB
2-E25-28	10/19/88	FVANADI	43.00	PPB
2-E25-28	10/19/88	FZINC	17.00	PPB
2-E25-28	10/19/88	IRON	49.00	PPB
2-E25-28	10/19/88	MAGNES	5190.00	PPB
2-E25-28	10/19/88	NITRATE	1300.00	PPB
2-E25-28	10/19/88	PHFIELD	8.20	
2-E25-28	10/19/88	PHFIELD	8.30	
2-E25-28	10/19/88	POTASUM	3520.00	PPB
2-E25-28	10/19/88	SODIUM	10300.00	PPB
2-E25-28	10/19/88	STRONUM	95.30	PPB
2-E25-28	10/19/88	SULFATE	12900.00	PPB
2-E25-28	10/19/88	TC	18200.00	PPB
2-E25-28	10/19/88	TC-99	2.81	PCI/L
2-E25-28	10/19/88	TRITIUM	1490.00	PCI/L
2-E25-28	10/19/88	VANADUM	33.00	PPB
2-E25-28	10/19/88	ZINC	33.70	PPB
2-E25-28	11/18/88	ARSENIC	9.00	PPB
2-E25-28	11/18/88	BARIUM	13.00	PPB
2-E25-28	11/18/88	CALCIUM	20800.00	PPB
2-E25-28	11/18/88	CHLORID	3000.00	PPB
2-E25-28	11/18/88	CONDFLD	197.00	UMHO
2-E25-28	11/18/88	CONDFLD	198.00	UMHO
2-E25-28	11/18/88	FARSENI	9.00	PPB
2-E25-28	11/18/88	FBARIUM	14.00	PPB
2-E25-28	11/18/88	FCALCIU	20300.00	PPB
2-E25-28	11/18/88	FCOPPER	10.00	PPB
2-E25-28	11/18/88	FMAGNES	5930.00	PPB
2-E25-28	11/18/88	FPOTASS	4010.00	PPB
2-E25-28	11/18/88	FSODIUM	11600.00	PPB
2-E25-28	11/18/88	FSTRONT	106.00	PPB
2-E25-28	11/18/88	FVANADI	38.00	PPB
2-E25-28	11/18/88	FZINC	12.00	PPB
2-E25-28	11/18/88	MAGNES	6220.00	PPB
2-E25-28	11/18/88	NITRATE	1000.00	PPB
2-E25-28	11/18/88	PHFIELD	8.40	
2-E25-28	11/18/88	PHFIELD	8.50	
2-E25-28	11/18/88	POTASUM	4110.00	PPB
2-E25-28	11/18/88	SODIUM	11600.00	PPB
2-E25-28	11/18/88	STRONUM	108.00	PPB
2-E25-28	11/18/88	SULFATE	12500.00	PPB
2-E25-28	11/18/88	VANADUM	44.00	PPB
2-E25-28	11/18/88	ZINC	20.00	PPB
2-E25-28	2/24/89	ARSENIC	10.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	2/24/89	BARIUM	14.00	PPB
2-E25-28	2/24/89	BORON	13.00	PPB
2-E25-28	2/24/89	CALCIUM	18500.00	PPB
2-E25-28	2/24/89	CHLORID	2800.00	PPB
2-E25-28	2/24/89	CONDFLD	100.00	UMHO
2-E25-28	2/24/89	CONDLAB	176.00	UMHO
2-E25-28	2/24/89	COPPER	52.00	PPB
2-E25-28	2/24/89	FARSENI	10.00	PPB
2-E25-28	2/24/89	FBARIUM	14.00	PPB
2-E25-28	2/24/89	FBORON	29.00	PPB
2-E25-28	2/24/89	FCALCIU	18800.00	PPB
2-E25-28	2/24/89	FMAGNES	5580.00	PPB
2-E25-28	2/24/89	FPOTASS	3800.00	PPB
2-E25-28	2/24/89	FSILICO	16300.00	PPB
2-E25-28	2/24/89	FSODIUM	10900.00	PPB
2-E25-28	2/24/89	FSTRONT	102.00	PPB
2-E25-28	2/24/89	FVANADI	41.00	PPB
2-E25-28	2/24/89	FZINC	11.00	PPB
2-E25-28	2/24/89	MAGNES	5570.00	PPB
2-E25-28	2/24/89	NITRATE	900.00	PPB
2-E25-28	2/24/89	PH-LAB	8.20	
2-E25-28	2/24/89	PHFIELD	8.80	
2-E25-28	2/24/89	POTASUM	3830.00	PPB
2-E25-28	2/24/89	SILICON	15800.00	PPB
2-E25-28	2/24/89	SODIUM	10900.00	PPB
2-E25-28	2/24/89	STRONUM	102.00	PPB
2-E25-28	2/24/89	SULFATE	12400.00	PPB
2-E25-28	2/24/89	TC	17900.00	PPB
2-E25-28	2/24/89	TURBID	0.10	NTU
2-E25-28	2/24/89	VANADUM	41.00	PPB
2-E25-28	2/24/89	ZINC	16.00	PPB
2-E25-28	7/20/89	ALPHAHI	1.36	PCI/L
2-E25-28	7/20/89	ARSENIC	8.80	PPB
2-E25-28	7/20/89	BARIUM	12.00	PPB
2-E25-28	7/20/89	BETA	10.50	PCI/L
2-E25-28	7/20/89	BORON	12.00	PPB
2-E25-28	7/20/89	CALCIUM	18800.00	PPB
2-E25-28	7/20/89	CHLORID	2990.00	PPB
2-E25-28	7/20/89	CONDFLD	146.00	UMHO
2-E25-28	7/20/89	CONDFLD	147.00	UMHO
2-E25-28	7/20/89	CONDFLD	148.00	UMHO
2-E25-28	7/20/89	CONDFLD	150.00	UMHO
2-E25-28	7/20/89	FARSENI	9.30	PPB
2-E25-28	7/20/89	FBARIUM	12.00	PPB
2-E25-28	7/20/89	FBORON	14.00	PPB
2-E25-28	7/20/89	FCALCIU	19900.00	PPB
2-E25-28	7/20/89	FMAGNES	5430.00	PPB
2-E25-28	7/20/89	FPOTASS	3730.00	PPB
2-E25-28	7/20/89	FSILICO	16000.00	PPB
2-E25-28	7/20/89	FSODIUM	10300.00	PPB
2-E25-28	7/20/89	FSTRONT	102.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	7/20/89	FVANADI	42.00	PPB
2-E25-28	7/20/89	MAGNES	5210.00	PPB
2-E25-28	7/20/89	NITRATE	996.00	PPB
2-E25-28	7/20/89	PHFIELD	8.19	
2-E25-28	7/20/89	PHFIELD	8.20	
2-E25-28	7/20/89	PHFIELD	8.21	
2-E25-28	7/20/89	POTASUM	3620.00	PPB
2-E25-28	7/20/89	RADIUM	0.19	PCI/L
2-E25-28	7/20/89	SILICON	15200.00	PPB
2-E25-28	7/20/89	SODIUM	10100.00	PPB
2-E25-28	7/20/89	STRONUM	95.00	PPB
2-E25-28	7/20/89	SULFATE	13800.00	PPB
2-E25-28	7/20/89	VANADUM	36.00	PPB
2-E25-28	7/20/89	ZINC	9.00	PPB
2-E25-28	7/24/89	CONDFLD	140.00	UMHO
2-E25-28	7/24/89	PHFIELD	8.14	
2-E25-28	7/24/89	PHFIELD	8.16	
2-E25-28	7/24/89	PHFIELD	8.17	
2-E25-28	7/24/89	TC	18700.00	PPB
2-E25-28	7/24/89	TURBID	0.10	NTU
2-E25-28	8/29/89	ARSENIC	8.00	PPB
2-E25-28	8/29/89	ARSENIC	9.00	PPB
2-E25-28	8/29/89	BARIUM	14.00	PPB
2-E25-28	8/29/89	BARIUM	15.00	PPB
2-E25-28	8/29/89	BETA	3.51	PCI/L
2-E25-28	8/29/89	BORON	12.00	PPB
2-E25-28	8/29/89	BORON	14.00	PPB
2-E25-28	8/29/89	CALCIUM	20100.00	PPB
2-E25-28	8/29/89	CALCIUM	21000.00	PPB
2-E25-28	8/29/89	CHLORID	3300.00	PPB
2-E25-28	8/29/89	CONDFLD	186.00	UMHO
2-E25-28	8/29/89	CONDFLD	187.00	UMHO
2-E25-28	8/29/89	CONDFLD	190.00	UMHO
2-E25-28	8/29/89	CONDLAB	183.00	UMHO
2-E25-28	8/29/89	FARSENI	9.00	PPB
2-E25-28	8/29/89	FARSENI	10.00	PPB
2-E25-28	8/29/89	FBARIUM	12.00	PPB
2-E25-28	8/29/89	FBARIUM	13.00	PPB
2-E25-28	8/29/89	FBORON	54.00	PPB
2-E25-28	8/29/89	FCALCIU	18400.00	PPB
2-E25-28	8/29/89	FCALCIU	19400.00	PPB
2-E25-28	8/29/89	FMAGNES	5120.00	PPB
2-E25-28	8/29/89	FMAGNES	5410.00	PPB
2-E25-28	8/29/89	FPOTASS	3800.00	PPB
2-E25-28	8/29/89	FPOTASS	4000.00	PPB
2-E25-28	8/29/89	FSILICO	15700.00	PPB
2-E25-28	8/29/89	FSILICO	16500.00	PPB
2-E25-28	8/29/89	FSODIUM	10100.00	PPB
2-E25-28	8/29/89	FSODIUM	10800.00	PPB
2-E25-28	8/29/89	FSTRONT	92.00	PPB
2-E25-28	8/29/89	FSTRONT	97.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	8/29/89	FVANADI	36.00	PPB
2-E25-28	8/29/89	FVANADI	37.00	PPB
2-E25-28	8/29/89	FZINC	10.00	PPB
2-E25-28	8/29/89	MAGNES	5850.00	PPB
2-E25-28	8/29/89	MAGNES	6100.00	PPB
2-E25-28	8/29/89	NITRATE	900.00	PPB
2-E25-28	8/29/89	NITRATE	1000.00	PPB
2-E25-28	8/29/89	PH-LAB	8.00	
2-E25-28	8/29/89	PHFIELD	8.20	
2-E25-28	8/29/89	PHFIELD	8.21	
2-E25-28	8/29/89	POTASUM	3960.00	PPB
2-E25-28	8/29/89	POTASUM	4120.00	PPB
2-E25-28	8/29/89	SILICON	17200.00	PPB
2-E25-28	8/29/89	SILICON	17900.00	PPB
2-E25-28	8/29/89	SODIUM	11000.00	PPB
2-E25-28	8/29/89	SODIUM	11500.00	PPB
2-E25-28	8/29/89	STRONUM	105.00	PPB
2-E25-28	8/29/89	STRONUM	110.00	PPB
2-E25-28	8/29/89	SULFATE	14100.00	PPB
2-E25-28	8/29/89	SULFATE	14200.00	PPB
2-E25-28	8/29/89	TC	18200.00	PPB
2-E25-28	8/29/89	TC	18300.00	PPB
2-E25-28	8/29/89	TOXLDL	14.00	PPB
2-E25-28	8/29/89	TURBID	0.10	NTU
2-E25-28	8/29/89	VANADUM	39.00	PPB
2-E25-28	8/29/89	VANADUM	40.00	PPB
2-E25-28	8/29/89	ZINC	9.00	PPB
2-E25-28	8/29/89	ZINC	11.00	PPB
2-E25-28	10/27/89	ALPHAHI	1.06	PCI/L
2-E25-28	10/27/89	ARSENIC	9.00	PPB
2-E25-28	10/27/89	BARIUM	13.00	PPB
2-E25-28	10/27/89	BETA	14.10	PCI/L
2-E25-28	10/27/89	CALCIUM	17700.00	PPB
2-E25-28	10/27/89	CHLORID	3100.00	PPB
2-E25-28	10/27/89	CONDFLD	191.00	UMHO
2-E25-28	10/27/89	FARSENI	8.00	PPB
2-E25-28	10/27/89	FBARIUM	13.00	PPB
2-E25-28	10/27/89	FCALCIU	17600.00	PPB
2-E25-28	10/27/89	FMAGNES	5440.00	PPB
2-E25-28	10/27/89	FPOTASS	3610.00	PPB
2-E25-28	10/27/89	FSILICO	15900.00	PPB
2-E25-28	10/27/89	FSODIUM	9700.00	PPB
2-E25-28	10/27/89	FSTRONT	99.00	PPB
2-E25-28	10/27/89	FVANADI	38.00	PPB
2-E25-28	10/27/89	FZINC	12.00	PPB
2-E25-28	10/27/89	IRON	38.00	PPB
2-E25-28	10/27/89	MAGNES	5490.00	PPB
2-E25-28	10/27/89	NITRATE	1600.00	PPB
2-E25-28	10/27/89	PHFIELD	7.97	
2-E25-28	10/27/89	POTASUM	3670.00	PPB
2-E25-28	10/27/89	SILICON	16000.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-28	10/27/89	SODIUM	9780.00	PPB
2-E25-28	10/27/89	STRONUM	99.00	PPB
2-E25-28	10/27/89	SULFATE	12500.00	PPB
2-E25-28	10/27/89	TC	19000.00	PPB
2-E25-28	10/27/89	TDS	129000.00	
2-E25-28	10/27/89	TRITIUM	1350.00	PCI/L
2-E25-28	10/27/89	TURBID	0.20	NTU
2-E25-28	10/27/89	U	0.93	PCI/L
2-E25-28	10/27/89	VANADUM	37.00	PPB
2-E25-28	10/27/89	ZINC	16.00	PPB
2-E25-28	1/29/90	CONDFLD	144.00	UMHO
2-E25-28	1/29/90	CONDFLD	145.00	UMHO
2-E25-28	1/29/90	CONDFLD	147.00	UMHO
2-E25-28	1/29/90	CONDLAB	195.00	UMHO
2-E25-28	1/29/90	CONDLAB	196.00	UMHO
2-E25-28	1/29/90	CONDLAB	197.00	UMHO
2-E25-28	1/29/90	PH-LAB	8.10	
2-E25-28	1/29/90	PHFIELD	8.13	
2-E25-28	1/29/90	PHFIELD	8.14	
2-E25-28	1/29/90	PHFIELD	8.15	
2-E25-28	3/25/90	CONDFLD	192.00	UMHO
2-E25-28	3/25/90	I-129DW	2.79	PCI/L
2-E25-28	3/25/90	PHFIELD	8.08	
2-E25-28	3/25/90	U	0.88	PCI/L
2-E25-32P	8/11/88	BARIUM	15.00	PPB
2-E25-32P	8/11/88	BARIUM	16.00	PPB
2-E25-32P	8/11/88	BETA	6.31	PCI/L
2-E25-32P	8/11/88	CALCIUM	18600.00	PPB
2-E25-32P	8/11/88	CALCIUM	18800.00	PPB
2-E25-32P	8/11/88	CHLORID	3140.00	PPB
2-E25-32P	8/11/88	CHROMUM	18.00	PPB
2-E25-32P	8/11/88	CHROMUM	26.00	PPB
2-E25-32P	8/11/88	CO-60	0.00	PCI/L
2-E25-32P	8/11/88	CONDFLD	137.00	UMHO
2-E25-32P	8/11/88	CONDFLD	138.00	UMHO
2-E25-32P	8/11/88	FCALCIU	19600.00	PPB
2-E25-32P	8/11/88	FCALCIU	20600.00	PPB
2-E25-32P	8/11/88	FMAGNES	4800.00	PPB
2-E25-32P	8/11/88	FMAGNES	5070.00	PPB
2-E25-32P	8/11/88	FPOTASS	3530.00	PPB
2-E25-32P	8/11/88	FPOTASS	3710.00	PPB
2-E25-32P	8/11/88	FSODIUM	6070.00	PPB
2-E25-32P	8/11/88	FSODIUM	6400.00	PPB
2-E25-32P	8/11/88	FSTRONT	87.00	PPB
2-E25-32P	8/11/88	FSTRONT	91.00	PPB
2-E25-32P	8/11/88	IRON	65.00	PPB
2-E25-32P	8/11/88	IRON	99.00	PPB
2-E25-32P	8/11/88	MAGNES	5080.00	PPB
2-E25-32P	8/11/88	MAGNES	5160.00	PPB
2-E25-32P	8/11/88	NICKEL	12.00	PPB
2-E25-32P	8/11/88	NITRATE	665.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	8/11/88	PHFIELD	7.90	
2-E25-32P	8/11/88	PHFIELD	8.00	
2-E25-32P	8/11/88	POTASUM	3850.00	PPB
2-E25-32P	8/11/88	POTASUM	3920.00	PPB
2-E25-32P	8/11/88	SODIUM	6790.00	PPB
2-E25-32P	8/11/88	SODIUM	6990.00	PPB
2-E25-32P	8/11/88	STRONUM	104.00	PPB
2-E25-32P	8/11/88	STRONUM	105.00	PPB
2-E25-32P	8/11/88	SULFATE	11400.00	PPB
2-E25-32P	8/11/88	TC	16200.00	PPB
2-E25-32P	8/11/88	TC-99	0.64	PCI/L
2-E25-32P	8/11/88	TC-99	0.76	PCI/L
2-E25-32P	8/11/88	TRITIUM	865.00	PCI/L
2-E25-32P	8/11/88	VANADUM	16.00	PPB
2-E25-32P	8/11/88	VANADUM	17.00	PPB
2-E25-32P	8/11/88	ZINC	9.00	PPB
2-E25-32P	10/19/88	ARSENIC	6.00	PPB
2-E25-32P	10/19/88	BARIUM	12.60	PPB
2-E25-32P	10/19/88	BETA	8.05	PCI/L
2-E25-32P	10/19/88	CALCIUM	17500.00	PPB
2-E25-32P	10/19/88	CHLORID	2900.00	PPB
2-E25-32P	10/19/88	CHROMUM	32.20	PPB
2-E25-32P	10/19/88	CONDFLD	170.00	UMHO
2-E25-32P	10/19/88	FARSENI	5.00	PPB
2-E25-32P	10/19/88	FBARIUM	15.00	PPB
2-E25-32P	10/19/88	FCALCIU	19400.00	PPB
2-E25-32P	10/19/88	FMAGNES	5240.00	PPB
2-E25-32P	10/19/88	FPOTASS	4440.00	PPB
2-E25-32P	10/19/88	FSODIUM	7360.00	PPB
2-E25-32P	10/19/88	FSTRONT	107.00	PPB
2-E25-32P	10/19/88	FVANADI	23.00	PPB
2-E25-32P	10/19/88	IRON	196.00	PPB
2-E25-32P	10/19/88	MAGNES	4800.00	PPB
2-E25-32P	10/19/88	MANGESE	6.64	PPB
2-E25-32P	10/19/88	NICKEL	20.10	PPB
2-E25-32P	10/19/88	NITRATE	700.00	PPB
2-E25-32P	10/19/88	PHFIELD	8.20	
2-E25-32P	10/19/88	PHFIELD	8.30	
2-E25-32P	10/19/88	POTASUM	4100.00	PPB
2-E25-32P	10/19/88	SODIUM	6920.00	PPB
2-E25-32P	10/19/88	STRONUM	99.80	PPB
2-E25-32P	10/19/88	SULFATE	12800.00	PPB
2-E25-32P	10/19/88	TC	15500.00	PPB
2-E25-32P	10/19/88	TC-99	2.75	PCI/L
2-E25-32P	10/19/88	TRITIUM	1150.00	PCI/L
2-E25-32P	10/19/88	VANADUM	13.60	PPB
2-E25-32P	10/19/88	ZINC	7.00	PPB
2-E25-32P	11/21/88	BARIUM	13.00	PPB
2-E25-32P	11/21/88	BETA	4.47	PCI/L
2-E25-32P	11/21/88	CALCIUM	19000.00	PPB
2-E25-32P	11/21/88	CHLORID	2700.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	11/21/88	CHROMUM	20.00	PPB
2-E25-32P	11/21/88	CONDFLD	182.00	UMHO
2-E25-32P	11/21/88	CONDFLD	183.00	UMHO
2-E25-32P	11/21/88	FBARIUM	15.00	PPB
2-E25-32P	11/21/88	FCALCIU	21600.00	PPB
2-E25-32P	11/21/88	FCHROMI	11.00	PPB
2-E25-32P	11/21/88	FMAGNES	5910.00	PPB
2-E25-32P	11/21/88	FPOTASS	5260.00	PPB
2-E25-32P	11/21/88	FSODIUM	8540.00	PPB
2-E25-32P	11/21/88	FSTRONT	121.00	PPB
2-E25-32P	11/21/88	FVANADI	25.00	PPB
2-E25-32P	11/21/88	IRON	93.00	PPB
2-E25-32P	11/21/88	MAGNES	5310.00	PPB
2-E25-32P	11/21/88	NICKEL	11.00	PPB
2-E25-32P	11/21/88	NITRATE	800.00	PPB
2-E25-32P	11/21/88	PHFIELD	8.40	
2-E25-32P	11/21/88	POTASUM	4660.00	PPB
2-E25-32P	11/21/88	SODIUM	7460.00	PPB
2-E25-32P	11/21/88	STRONUM	107.00	PPB
2-E25-32P	11/21/88	SULFATE	12700.00	PPB
2-E25-32P	11/21/88	TURBID	0.70	NTU
2-E25-32P	11/21/88	VANADUM	18.00	PPB
2-E25-32P	1/04/89	ALPHA	1.41	PCI/L
2-E25-32P	1/04/89	BARIUM	12.00	PPB
2-E25-32P	1/04/89	BETA	6.77	PCI/L
2-E25-32P	1/04/89	BORON	15.00	PPB
2-E25-32P	1/04/89	CALCIUM	19000.00	PPB
2-E25-32P	1/04/89	CHLORID	2800.00	PPB
2-E25-32P	1/04/89	CHROMUM	40.00	PPB
2-E25-32P	1/04/89	COLIFRM	0.00	MPN
2-E25-32P	1/04/89	CONDFLD	150.00	UMHO
2-E25-32P	1/04/89	CONDFLD	151.00	UMHO
2-E25-32P	1/04/89	FBARIUM	13.00	PPB
2-E25-32P	1/04/89	FCALCIU	18500.00	PPB
2-E25-32P	1/04/89	FMAGNES	4890.00	PPB
2-E25-32P	1/04/89	FPOTASS	4270.00	PPB
2-E25-32P	1/04/89	FSILICO	12000.00	PPB
2-E25-32P	1/04/89	FSODIUM	6970.00	PPB
2-E25-32P	1/04/89	FSTRONT	105.00	PPB
2-E25-32P	1/04/89	FVANADI	18.00	PPB
2-E25-32P	1/04/89	IRON	185.00	PPB
2-E25-32P	1/04/89	MAGNES	5060.00	PPB
2-E25-32P	1/04/89	NICKEL	20.00	PPB
2-E25-32P	1/04/89	NITRATE	800.00	PPB
2-E25-32P	1/04/89	PHFIELD	8.30	
2-E25-32P	1/04/89	POTASUM	4420.00	PPB
2-E25-32P	1/04/89	SILICON	12400.00	PPB
2-E25-32P	1/04/89	SODIUM	7220.00	PPB
2-E25-32P	1/04/89	STRONUM	109.00	PPB
2-E25-32P	1/04/89	SULFATE	12000.00	PPB
2-E25-32P	1/04/89	TC-99	1.99	PCI/L

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	1/04/89	TRITIUM	670.00	PCI/L
2-E25-32P	1/04/89	VANADUM	20.00	PPB
2-E25-32P	2/24/89	ALPHAHI	1.47	PCI/L
2-E25-32P	2/24/89	BARIUM	14.00	PPB
2-E25-32P	2/24/89	BETA	3.00	PCI/L
2-E25-32P	2/24/89	BORON	13.00	PPB
2-E25-32P	2/24/89	CALCIUM	18800.00	PPB
2-E25-32P	2/24/89	CHLORID	2900.00	PPB
2-E25-32P	2/24/89	CHROMUM	24.00	PPB
2-E25-32P	2/24/89	CONDFLD	100.00	UMHO
2-E25-32P	2/24/89	CONDLAB	168.00	UMHO
2-E25-32P	2/24/89	FBARIUM	14.00	PPB
2-E25-32P	2/24/89	FBORON	11.00	PPB
2-E25-32P	2/24/89	FCALCIU	20100.00	PPB
2-E25-32P	2/24/89	FMAGNES	5730.00	PPB
2-E25-32P	2/24/89	FPOTASS	4740.00	PPB
2-E25-32P	2/24/89	FSILICO	12000.00	PPB
2-E25-32P	2/24/89	FSODIUM	7310.00	PPB
2-E25-32P	2/24/89	FSTRONT	121.00	PPB
2-E25-32P	2/24/89	FVANADI	20.00	PPB
2-E25-32P	2/24/89	IRON	82.00	PPB
2-E25-32P	2/24/89	MAGNES	5380.00	PPB
2-E25-32P	2/24/89	NICKEL	13.00	PPB
2-E25-32P	2/24/89	NITRATE	700.00	PPB
2-E25-32P	2/24/89	PH-LAB	8.20	
2-E25-32P	2/24/89	PHFIELD	8.70	
2-E25-32P	2/24/89	PHFIELD	8.80	
2-E25-32P	2/24/89	POTASUM	4450.00	PPB
2-E25-32P	2/24/89	SILICON	11200.00	PPB
2-E25-32P	2/24/89	SODIUM	6850.00	PPB
2-E25-32P	2/24/89	STRONUM	113.00	PPB
2-E25-32P	2/24/89	SULFATE	13000.00	PPB
2-E25-32P	2/24/89	TC	16700.00	PPB
2-E25-32P	2/24/89	TC-99	0.54	PCI/L
2-E25-32P	2/24/89	TURBID	0.55	NTU
2-E25-32P	2/24/89	VANADUM	16.00	PPB
2-E25-32P	7/13/89	ALPHAHI	1.09	PCI/L
2-E25-32P	7/13/89	BARIUM	10.00	PPB
2-E25-32P	7/13/89	BARIUM	13.00	PPB
2-E25-32P	7/13/89	BETA	10.20	PCI/L
2-E25-32P	7/13/89	BETA	23.00	PCI/L
2-E25-32P	7/13/89	CALCIUM	16800.00	PPB
2-E25-32P	7/13/89	CALCIUM	19800.00	PPB
2-E25-32P	7/13/89	CALCIUM	20600.00	PPB
2-E25-32P	7/13/89	CALCIUM	20900.00	PPB
2-E25-32P	7/13/89	CHLORID	2930.00	PPB
2-E25-32P	7/13/89	CHLORID	2950.00	PPB
2-E25-32P	7/13/89	CHROMUM	25.00	PPB
2-E25-32P	7/13/89	CHROMUM	41.00	PPB
2-E25-32P	7/13/89	CHROMUM	49.00	PPB
2-E25-32P	7/13/89	CHROMUM	70.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	7/13/89	CONDFLD	172.00	UMHO
2-E25-32P	7/13/89	CONDFLD	173.00	UMHO
2-E25-32P	7/13/89	CONDFLD	174.00	UMHO
2-E25-32P	7/13/89	FBARIUM	11.00	PPB
2-E25-32P	7/13/89	FBARIUM	12.00	PPB
2-E25-32P	7/13/89	FBARIUM	13.00	PPB
2-E25-32P	7/13/89	FCALCIU	18500.00	PPB
2-E25-32P	7/13/89	FCALCIU	19100.00	PPB
2-E25-32P	7/13/89	FCALCIU	19200.00	PPB
2-E25-32P	7/13/89	FCALCIU	19600.00	PPB
2-E25-32P	7/13/89	FIRON	33.00	PPB
2-E25-32P	7/13/89	FMAGNES	5420.00	PPB
2-E25-32P	7/13/89	FMAGNES	5580.00	PPB
2-E25-32P	7/13/89	FMAGNES	5610.00	PPB
2-E25-32P	7/13/89	FMAGNES	5750.00	PPB
2-E25-32P	7/13/89	FMANGAN	5.00	PPB
2-E25-32P	7/13/89	FMANGAN	6.00	PPB
2-E25-32P	7/13/89	FPOTASS	3980.00	PPB
2-E25-32P	7/13/89	FPOTASS	4040.00	PPB
2-E25-32P	7/13/89	FPOTASS	4090.00	PPB
2-E25-32P	7/13/89	FPOTASS	4160.00	PPB
2-E25-32P	7/13/89	FSILICO	9300.00	PPB
2-E25-32P	7/13/89	FSILICO	9390.00	PPB
2-E25-32P	7/13/89	FSILICO	9500.00	PPB
2-E25-32P	7/13/89	FSILICO	9660.00	PPB
2-E25-32P	7/13/89	FSODIUM	6030.00	PPB
2-E25-32P	7/13/89	FSODIUM	6070.00	PPB
2-E25-32P	7/13/89	FSODIUM	6270.00	PPB
2-E25-32P	7/13/89	FSODIUM	6330.00	PPB
2-E25-32P	7/13/89	FSTRONT	119.00	PPB
2-E25-32P	7/13/89	FSTRONT	120.00	PPB
2-E25-32P	7/13/89	FSTRONT	125.00	PPB
2-E25-32P	7/13/89	FVANADI	9.00	PPB
2-E25-32P	7/13/89	FVANADI	11.00	PPB
2-E25-32P	7/13/89	FVANADI	14.00	PPB
2-E25-32P	7/13/89	FVANADI	15.00	PPB
2-E25-32P	7/13/89	FZINC	5.00	PPB
2-E25-32P	7/13/89	IRON	167.00	PPB
2-E25-32P	7/13/89	IRON	268.00	PPB
2-E25-32P	7/13/89	IRON	297.00	PPB
2-E25-32P	7/13/89	IRON	373.00	PPB
2-E25-32P	7/13/89	MAGNES	4850.00	PPB
2-E25-32P	7/13/89	MAGNES	5680.00	PPB
2-E25-32P	7/13/89	MAGNES	5940.00	PPB
2-E25-32P	7/13/89	MAGNES	6000.00	PPB
2-E25-32P	7/13/89	MANGESE	7.00	PPB
2-E25-32P	7/13/89	MANGESE	9.00	PPB
2-E25-32P	7/13/89	NICKEL	16.00	PPB
2-E25-32P	7/13/89	NICKEL	25.00	PPB
2-E25-32P	7/13/89	NICKEL	28.00	PPB
2-E25-32P	7/13/89	NICKEL	43.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	7/13/89	NITRATE	1020.00	PPB
2-E25-32P	7/13/89	NITRATE	1270.00	PPB
2-E25-32P	7/13/89	PHFIELD	6.92	
2-E25-32P	7/13/89	PHFIELD	6.96	
2-E25-32P	7/13/89	PHFIELD	7.00	
2-E25-32P	7/13/89	PHFIELD	7.01	
2-E25-32P	7/13/89	POTASUM	3530.00	PPB
2-E25-32P	7/13/89	POTASUM	4020.00	PPB
2-E25-32P	7/13/89	POTASUM	4290.00	PPB
2-E25-32P	7/13/89	POTASUM	4320.00	PPB
2-E25-32P	7/13/89	RADIUM	0.18	PCI/L
2-E25-32P	7/13/89	SILICON	8140.00	PPB
2-E25-32P	7/13/89	SILICON	9550.00	PPB
2-E25-32P	7/13/89	SILICON	9900.00	PPB
2-E25-32P	7/13/89	SILICON	10100.00	PPB
2-E25-32P	7/13/89	SODIUM	5260.00	PPB
2-E25-32P	7/13/89	SODIUM	6020.00	PPB
2-E25-32P	7/13/89	SODIUM	6430.00	PPB
2-E25-32P	7/13/89	SODIUM	6480.00	PPB
2-E25-32P	7/13/89	STRONUM	106.00	PPB
2-E25-32P	7/13/89	STRONUM	124.00	PPB
2-E25-32P	7/13/89	STRONUM	130.00	PPB
2-E25-32P	7/13/89	STRONUM	131.00	PPB
2-E25-32P	7/13/89	SULFATE	13300.00	PPB
2-E25-32P	7/13/89	TC	17600.00	PPB
2-E25-32P	7/13/89	TURBID	0.50	NTU
2-E25-32P	7/13/89	VANADUM	11.00	PPB
2-E25-32P	7/13/89	VANADUM	12.00	PPB
2-E25-32P	7/13/89	ZINC	6.00	PPB
2-E25-32P	7/13/89	ZINC	8.00	PPB
2-E25-32P	7/13/89	ZINC	9.00	PPB
2-E25-32P	8/29/89	BARIUM	13.00	PPB
2-E25-32P	8/29/89	BETA	6.63	PCI/L
2-E25-32P	8/29/89	BORON	15.00	PPB
2-E25-32P	8/29/89	CALCIUM	20000.00	PPB
2-E25-32P	8/29/89	CHLORID	2900.00	PPB
2-E25-32P	8/29/89	CHROMUM	33.00	PPB
2-E25-32P	8/29/89	CONDFLD	134.00	UMHO
2-E25-32P	8/29/89	CONDFLD	136.00	UMHO
2-E25-32P	8/29/89	CONDFLD	139.00	UMHO
2-E25-32P	8/29/89	CONDFLD	142.00	UMHO
2-E25-32P	8/29/89	CONDLAB	160.00	UMHO
2-E25-32P	8/29/89	FBARIUM	11.00	PPB
2-E25-32P	8/29/89	FCALCIU	19000.00	PPB
2-E25-32P	8/29/89	FIRON	34.00	PPB
2-E25-32P	8/29/89	FMAGNES	5130.00	PPB
2-E25-32P	8/29/89	FPOTASS	4000.00	PPB
2-E25-32P	8/29/89	FSILICO	9460.00	PPB
2-E25-32P	8/29/89	FSODIUM	5790.00	PPB
2-E25-32P	8/29/89	FSTRONT	105.00	PPB
2-E25-32P	8/29/89	FVANADI	8.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	8/29/89	FZINC	8.00	PPB
2-E25-32P	8/29/89	IRON	164.00	PPB
2-E25-32P	8/29/89	MAGNES	5540.00	PPB
2-E25-32P	8/29/89	NICKEL	21.00	PPB
2-E25-32P	8/29/89	NITRATE	800.00	PPB
2-E25-32P	8/29/89	PH-LAB	8.10	
2-E25-32P	8/29/89	PHFIELD	8.21	
2-E25-32P	8/29/89	PHFIELD	8.22	
2-E25-32P	8/29/89	POTASUM	3860.00	PPB
2-E25-32P	8/29/89	SILICON	10000.00	PPB
2-E25-32P	8/29/89	SODIUM	5760.00	PPB
2-E25-32P	8/29/89	STRONUM	112.00	PPB
2-E25-32P	8/29/89	SULFATE	11800.00	PPB
2-E25-32P	8/29/89	TC	16300.00	PPB
2-E25-32P	8/29/89	TURBID	0.90	NTU
2-E25-32P	8/29/89	TURBID	1.60	NTU
2-E25-32P	8/29/89	VANADUM	10.00	PPB
2-E25-32P	8/29/89	ZINC	7.00	PPB
2-E25-32P	8/30/89	BARIUM	11.00	PPB
2-E25-32P	8/30/89	BARIUM	12.00	PPB
2-E25-32P	8/30/89	BORON	12.00	PPB
2-E25-32P	8/30/89	BORON	19.00	PPB
2-E25-32P	8/30/89	CALCIUM	19000.00	PPB
2-E25-32P	8/30/89	CALCIUM	19400.00	PPB
2-E25-32P	8/30/89	CALCIUM	19700.00	PPB
2-E25-32P	8/30/89	CHROMUM	18.00	PPB
2-E25-32P	8/30/89	CHROMUM	31.00	PPB
2-E25-32P	8/30/89	CHROMUM	43.00	PPB
2-E25-32P	8/30/89	FBARIUM	11.00	PPB
2-E25-32P	8/30/89	FBARIUM	12.00	PPB
2-E25-32P	8/30/89	FBORON	11.00	PPB
2-E25-32P	8/30/89	FBORON	12.00	PPB
2-E25-32P	8/30/89	FCALCIU	18300.00	PPB
2-E25-32P	8/30/89	FCALCIU	18800.00	PPB
2-E25-32P	8/30/89	FCALCIU	19200.00	PPB
2-E25-32P	8/30/89	FIRON	38.00	PPB
2-E25-32P	8/30/89	FMAGNES	5050.00	PPB
2-E25-32P	8/30/89	FMAGNES	5260.00	PPB
2-E25-32P	8/30/89	FMAGNES	5340.00	PPB
2-E25-32P	8/30/89	FPOTASS	3770.00	PPB
2-E25-32P	8/30/89	FPOTASS	3900.00	PPB
2-E25-32P	8/30/89	FPOTASS	3960.00	PPB
2-E25-32P	8/30/89	FSILICO	9290.00	PPB
2-E25-32P	8/30/89	FSILICO	9620.00	PPB
2-E25-32P	8/30/89	FSILICO	9850.00	PPB
2-E25-32P	8/30/89	FSODIUM	5400.00	PPB
2-E25-32P	8/30/89	FSODIUM	5620.00	PPB
2-E25-32P	8/30/89	FSODIUM	5660.00	PPB
2-E25-32P	8/30/89	FSTRONT	100.00	PPB
2-E25-32P	8/30/89	FSTRONT	104.00	PPB
2-E25-32P	8/30/89	FSTRONT	105.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	8/30/89	FVANADI	9.00	PPB
2-E25-32P	8/30/89	FVANADI	12.00	PPB
2-E25-32P	8/30/89	FZINC	5.00	PPB
2-E25-32P	8/30/89	IRON	112.00	PPB
2-E25-32P	8/30/89	IRON	166.00	PPB
2-E25-32P	8/30/89	IRON	205.00	PPB
2-E25-32P	8/30/89	MAGNES	5060.00	PPB
2-E25-32P	8/30/89	MAGNES	5160.00	PPB
2-E25-32P	8/30/89	MAGNES	5270.00	PPB
2-E25-32P	8/30/89	NICKEL	13.00	PPB
2-E25-32P	8/30/89	NICKEL	18.00	PPB
2-E25-32P	8/30/89	NICKEL	24.00	PPB
2-E25-32P	8/30/89	POTASUM	3890.00	PPB
2-E25-32P	8/30/89	POTASUM	3930.00	PPB
2-E25-32P	8/30/89	POTASUM	4060.00	PPB
2-E25-32P	8/30/89	SILICON	9490.00	PPB
2-E25-32P	8/30/89	SILICON	9650.00	PPB
2-E25-32P	8/30/89	SILICON	9810.00	PPB
2-E25-32P	8/30/89	SODIUM	5740.00	PPB
2-E25-32P	8/30/89	SODIUM	5820.00	PPB
2-E25-32P	8/30/89	SODIUM	5970.00	PPB
2-E25-32P	8/30/89	STRONUM	105.00	PPB
2-E25-32P	8/30/89	STRONUM	106.00	PPB
2-E25-32P	8/30/89	STRONUM	109.00	PPB
2-E25-32P	8/30/89	VANADUM	8.00	PPB
2-E25-32P	8/30/89	VANADUM	11.00	PPB
2-E25-32P	8/30/89	ZINC	8.00	PPB
2-E25-32P	8/30/89	ZINC	13.00	PPB
2-E25-32P	10/31/89	BARIUM	13.00	PPB
2-E25-32P	10/31/89	BETA	2.62	PCI/L
2-E25-32P	10/31/89	CALCIUM	17200.00	PPB
2-E25-32P	10/31/89	CHLORID	2900.00	PPB
2-E25-32P	10/31/89	CHROMUM	33.00	PPB
2-E25-32P	10/31/89	CONDFLD	166.00	UMHO
2-E25-32P	10/31/89	FBARIUM	13.00	PPB
2-E25-32P	10/31/89	FCALCIU	19300.00	PPB
2-E25-32P	10/31/89	FMAGNES	5570.00	PPB
2-E25-32P	10/31/89	FPOTASS	4060.00	PPB
2-E25-32P	10/31/89	FSILICO	10900.00	PPB
2-E25-32P	10/31/89	FSODIUM	5870.00	PPB
2-E25-32P	10/31/89	FSTRONT	115.00	PPB
2-E25-32P	10/31/89	FVANADI	14.00	PPB
2-E25-32P	10/31/89	IRON	196.00	PPB
2-E25-32P	10/31/89	MAGNES	5060.00	PPB
2-E25-32P	10/31/89	NICKEL	22.00	PPB
2-E25-32P	10/31/89	NITRATE	1100.00	PPB
2-E25-32P	10/31/89	PHFIELD	7.01	
2-E25-32P	10/31/89	POTASUM	3710.00	PPB
2-E25-32P	10/31/89	SILICON	9710.00	PPB
2-E25-32P	10/31/89	SODIUM	5390.00	PPB
2-E25-32P	10/31/89	STRONUM	104.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	10/31/89	SULFATE	11700.00	PPB
2-E25-32P	10/31/89	TC	17100.00	PPB
2-E25-32P	10/31/89	TDS	25000.00	
2-E25-32P	10/31/89	TRITIUM	1040.00	PCI/L
2-E25-32P	10/31/89	TURBID	0.70	NTU
2-E25-32P	10/31/89	U	0.68	PCI/L
2-E25-32P	10/31/89	VANADUM	13.00	PPB
2-E25-32P	12/12/89	ALPHAHI	1.20	PCI/L
2-E25-32P	12/12/89	BARIUM	13.00	PPB
2-E25-32P	12/12/89	BETA	5.67	PCI/L
2-E25-32P	12/12/89	BORON	13.00	PPB
2-E25-32P	12/12/89	CALCIUM	18400.00	PPB
2-E25-32P	12/12/89	CALCIUM	18900.00	PPB
2-E25-32P	12/12/89	CALCIUM	19000.00	PPB
2-E25-32P	12/12/89	CALCIUM	19100.00	PPB
2-E25-32P	12/12/89	CHLORID	3000.00	PPB
2-E25-32P	12/12/89	CHROMUM	59.00	PPB
2-E25-32P	12/12/89	CHROMUM	61.00	PPB
2-E25-32P	12/12/89	CHROMUM	63.00	PPB
2-E25-32P	12/12/89	CHROMUM	89.00	PPB
2-E25-32P	12/12/89	CONDFLD	173.00	UMHO
2-E25-32P	12/12/89	CONDFLD	174.00	UMHO
2-E25-32P	12/12/89	CONDLAB	172.00	UMHO
2-E25-32P	12/12/89	FBARIUM	11.00	PPB
2-E25-32P	12/12/89	FBARIUM	12.00	PPB
2-E25-32P	12/12/89	FBARIUM	13.00	PPB
2-E25-32P	12/12/89	FBORON	10.00	PPB
2-E25-32P	12/12/89	FCALCIU	18400.00	PPB
2-E25-32P	12/12/89	FCALCIU	18600.00	PPB
2-E25-32P	12/12/89	FCALCIU	19200.00	PPB
2-E25-32P	12/12/89	FIRON	30.00	PPB
2-E25-32P	12/12/89	FIRON	33.00	PPB
2-E25-32P	12/12/89	FMAGNES	5140.00	PPB
2-E25-32P	12/12/89	FMAGNES	5200.00	PPB
2-E25-32P	12/12/89	FMAGNES	5270.00	PPB
2-E25-32P	12/12/89	FMAGNES	5350.00	PPB
2-E25-32P	12/12/89	FPOTASS	4040.00	PPB
2-E25-32P	12/12/89	FPOTASS	4150.00	PPB
2-E25-32P	12/12/89	FPOTASS	4210.00	PPB
2-E25-32P	12/12/89	FPOTASS	4350.00	PPB
2-E25-32P	12/12/89	FSILICO	9620.00	PPB
2-E25-32P	12/12/89	FSILICO	9710.00	PPB
2-E25-32P	12/12/89	FSILICO	10000.00	PPB
2-E25-32P	12/12/89	FSILICO	10100.00	PPB
2-E25-32P	12/12/89	FSODIUM	5670.00	PPB
2-E25-32P	12/12/89	FSODIUM	5860.00	PPB
2-E25-32P	12/12/89	FSODIUM	5870.00	PPB
2-E25-32P	12/12/89	FSODIUM	6130.00	PPB
2-E25-32P	12/12/89	FSTRONT	103.00	PPB
2-E25-32P	12/12/89	FSTRONT	104.00	PPB
2-E25-32P	12/12/89	FSTRONT	108.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	12/12/89	FSTRONT	110.00	PPB
2-E25-32P	12/12/89	FVANADI	12.00	PPB
2-E25-32P	12/12/89	FVANADI	13.00	PPB
2-E25-32P	12/12/89	FVANADI	14.00	PPB
2-E25-32P	12/12/89	IRON	361.00	PPB
2-E25-32P	12/12/89	IRON	395.00	PPB
2-E25-32P	12/12/89	IRON	443.00	PPB
2-E25-32P	12/12/89	IRON	589.00	PPB
2-E25-32P	12/12/89	LEADGF	6.00	PPB
2-E25-32P	12/12/89	MAGNES	5170.00	PPB
2-E25-32P	12/12/89	MAGNES	5260.00	PPB
2-E25-32P	12/12/89	MAGNES	5290.00	PPB
2-E25-32P	12/12/89	MAGNES	5320.00	PPB
2-E25-32P	12/12/89	MANGESE	9.00	PPB
2-E25-32P	12/12/89	MANGESE	10.00	PPB
2-E25-32P	12/12/89	MANGESE	12.00	PPB
2-E25-32P	12/12/89	NICKEL	26.00	PPB
2-E25-32P	12/12/89	NICKEL	28.00	PPB
2-E25-32P	12/12/89	NICKEL	30.00	PPB
2-E25-32P	12/12/89	NICKEL	40.00	PPB
2-E25-32P	12/12/89	NITRATE	700.00	PPB
2-E25-32P	12/12/89	PH-LAB	8.10	
2-E25-32P	12/12/89	PHFIELD	8.30	
2-E25-32P	12/12/89	PHFIELD	8.31	
2-E25-32P	12/12/89	PHFIELD	8.32	
2-E25-32P	12/12/89	POTASUM	4200.00	PPB
2-E25-32P	12/12/89	POTASUM	4210.00	PPB
2-E25-32P	12/12/89	POTASUM	4230.00	PPB
2-E25-32P	12/12/89	POTASUM	4270.00	PPB
2-E25-32P	12/12/89	SILICON	9620.00	PPB
2-E25-32P	12/12/89	SILICON	9820.00	PPB
2-E25-32P	12/12/89	SILICON	9940.00	PPB
2-E25-32P	12/12/89	SILICON	9970.00	PPB
2-E25-32P	12/12/89	SODIUM	5910.00	PPB
2-E25-32P	12/12/89	SODIUM	5970.00	PPB
2-E25-32P	12/12/89	SODIUM	6010.00	PPB
2-E25-32P	12/12/89	STRONUM	107.00	PPB
2-E25-32P	12/12/89	STRONUM	108.00	PPB
2-E25-32P	12/12/89	STRONUM	110.00	PPB
2-E25-32P	12/12/89	SULFATE	12500.00	PPB
2-E25-32P	12/12/89	TC	16500.00	PPB
2-E25-32P	12/12/89	TURBID	2.00	NTU
2-E25-32P	12/12/89	VANADUM	13.00	PPB
2-E25-32P	12/12/89	VANADUM	14.00	PPB
2-E25-32P	12/12/89	VANADUM	15.00	PPB
2-E25-32P	12/12/89	ZINC	5.00	PPB
2-E25-32P	12/12/89	ZINC	6.00	PPB
2-E25-32P	12/12/89	ZINC	7.00	PPB
2-E25-32P	1/29/90	CONDFLD	191.00	UMHO
2-E25-32P	1/29/90	CONDFLD	192.00	UMHO
2-E25-32P	1/29/90	CONDFLD	193.00	UMHO

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	1/29/90	CONDLAB	182.00	UMHO
2-E25-32P	1/29/90	CONDLAB	184.00	UMHO
2-E25-32P	1/29/90	PH-LAB	8.10	
2-E25-32P	1/29/90	PHFIELD	8.18	
2-E25-32P	1/29/90	TOXLDL	153.00	PPB
2-E25-32P	1/29/90	TOXLDL	166.00	PPB
2-E25-32P	1/29/90	TOXLDL	182.00	PPB
2-E25-32P	1/29/90	TOXLDL	199.00	PPB
2-E25-32P	2/20/90	CONDFLD	175.00	UMHO
2-E25-32P	2/20/90	PHFIELD	8.31	
2-E25-32P	2/20/90	TOXLDL	182.00	PPB
2-E25-32P	2/20/90	TOXLDL	278.00	PPB
2-E25-32P	2/20/90	TOXLDL	297.00	PPB
2-E25-32P	2/20/90	TOXLDL	329.00	PPB
2-E25-32P	3/25/90	CONDFLD	175.00	UMHO
2-E25-32P	3/25/90	CONDFLD	176.00	UMHO
2-E25-32P	3/25/90	CONDFLD	177.00	UMHO
2-E25-32P	3/25/90	CONDFLD	178.00	UMHO
2-E25-32P	3/25/90	PHFIELD	8.17	
2-E25-32P	3/25/90	PHFIELD	8.18	
2-E25-32P	3/26/90	CONDFLD	181.00	UMHO
2-E25-32P	3/26/90	I-129DW	0.68	PCI/L
2-E25-32P	3/26/90	PHFIELD	7.94	
2-E25-32P	3/26/90	U	1.70	PCI/L
2-E25-32P	4/04/90	ALPHAHI	1.73	PCI/L
2-E25-32P	4/04/90	BARIUM	16.00	PPB
2-E25-32P	4/04/90	BETA	2.73	PCI/L
2-E25-32P	4/04/90	BORON	12.00	PPB
2-E25-32P	4/04/90	BORON	14.00	PPB
2-E25-32P	4/04/90	BORON	22.00	PPB
2-E25-32P	4/04/90	CALCIUM	21300.00	PPB
2-E25-32P	4/04/90	CALCIUM	21400.00	PPB
2-E25-32P	4/04/90	CHLORID	5100.00	PPB
2-E25-32P	4/04/90	CHROMUM	77.00	PPB
2-E25-32P	4/04/90	CHROMUM	91.00	PPB
2-E25-32P	4/04/90	CHROMUM	104.00	PPB
2-E25-32P	4/04/90	CHROMUM	140.00	PPB
2-E25-32P	4/04/90	CONDFLD	205.00	UMHO
2-E25-32P	4/04/90	CONDLAB	199.00	UMHO
2-E25-32P	4/04/90	FBARIUM	15.00	PPB
2-E25-32P	4/04/90	FBARIUM	16.00	PPB
2-E25-32P	4/04/90	FBORON	11.00	PPB
2-E25-32P	4/04/90	FBORON	19.00	PPB
2-E25-32P	4/04/90	FCALCIU	20000.00	PPB
2-E25-32P	4/04/90	FCALCIU	20500.00	PPB
2-E25-32P	4/04/90	FCALCIU	20700.00	PPB
2-E25-32P	4/04/90	FMAGNES	5730.00	PPB
2-E25-32P	4/04/90	FMAGNES	5810.00	PPB
2-E25-32P	4/04/90	FMAGNES	5860.00	PPB
2-E25-32P	4/04/90	FMAGNES	5890.00	PPB
2-E25-32P	4/04/90	FPOTASS	4090.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	4/04/90	FPOTASS	4140.00	PPB
2-E25-32P	4/04/90	FPOTASS	4200.00	PPB
2-E25-32P	4/04/90	FPOTASS	4220.00	PPB
2-E25-32P	4/04/90	FSILICO	9290.00	PPB
2-E25-32P	4/04/90	FSILICO	9500.00	PPB
2-E25-32P	4/04/90	FSILICO	9510.00	PPB
2-E25-32P	4/04/90	FSILICO	9610.00	PPB
2-E25-32P	4/04/90	FSODIUM	5940.00	PPB
2-E25-32P	4/04/90	FSODIUM	6000.00	PPB
2-E25-32P	4/04/90	FSODIUM	6110.00	PPB
2-E25-32P	4/04/90	FSODIUM	6150.00	PPB
2-E25-32P	4/04/90	FSTRONT	118.00	PPB
2-E25-32P	4/04/90	FSTRONT	119.00	PPB
2-E25-32P	4/04/90	FSTRONT	120.00	PPB
2-E25-32P	4/04/90	FSTRONT	121.00	PPB
2-E25-32P	4/04/90	FVANADI	9.00	PPB
2-E25-32P	4/04/90	FVANADI	12.00	PPB
2-E25-32P	4/04/90	FVANADI	13.00	PPB
2-E25-32P	4/04/90	IRON	347.00	PPB
2-E25-32P	4/04/90	IRON	414.00	PPB
2-E25-32P	4/04/90	IRON	458.00	PPB
2-E25-32P	4/04/90	IRON	584.00	PPB
2-E25-32P	4/04/90	MAGNES	5950.00	PPB
2-E25-32P	4/04/90	MAGNES	5990.00	PPB
2-E25-32P	4/04/90	MAGNES	6020.00	PPB
2-E25-32P	4/04/90	MANGESE	7.00	PPB
2-E25-32P	4/04/90	MANGESE	8.00	PPB
2-E25-32P	4/04/90	MANGESE	9.00	PPB
2-E25-32P	4/04/90	MANGESE	11.00	PPB
2-E25-32P	4/04/90	NICKEL	43.00	PPB
2-E25-32P	4/04/90	NICKEL	49.00	PPB
2-E25-32P	4/04/90	NICKEL	55.00	PPB
2-E25-32P	4/04/90	NICKEL	72.00	PPB
2-E25-32P	4/04/90	NITRATE	1000.00	PPB
2-E25-32P	4/04/90	PH-LAB	7.90	
2-E25-32P	4/04/90	PHFIELD	7.79	
2-E25-32P	4/04/90	PHFIELD	7.82	
2-E25-32P	4/04/90	POTASUM	4210.00	PPB
2-E25-32P	4/04/90	POTASUM	4220.00	PPB
2-E25-32P	4/04/90	POTASUM	4280.00	PPB
2-E25-32P	4/04/90	RADIUM	0.21	PCI/L
2-E25-32P	4/04/90	SILICON	9840.00	PPB
2-E25-32P	4/04/90	SILICON	9870.00	PPB
2-E25-32P	4/04/90	SILICON	9890.00	PPB
2-E25-32P	4/04/90	SILICON	9940.00	PPB
2-E25-32P	4/04/90	SODIUM	6210.00	PPB
2-E25-32P	4/04/90	SODIUM	6250.00	PPB
2-E25-32P	4/04/90	SODIUM	6260.00	PPB
2-E25-32P	4/04/90	SODIUM	6360.00	PPB
2-E25-32P	4/04/90	STRONUM	126.00	PPB
2-E25-32P	4/04/90	STRONUM	127.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-32P	4/04/90	SULFATE	13000.00	PPB
2-E25-32P	4/04/90	TC	18000.00	PPB
2-E25-32P	4/04/90	TOXLDL	16.00	PPB
2-E25-32P	4/04/90	TOXLDL	17.00	PPB
2-E25-32P	4/04/90	TOXLDL	21.00	PPB
2-E25-32P	4/04/90	TOXLDL	22.00	PPB
2-E25-32P	4/04/90	TURBID	0.60	NTU
2-E25-32P	4/04/90	UHALC	14.00	PPB
2-E25-32P	4/04/90	VANADUM	12.00	PPB
2-E25-32P	4/04/90	VANADUM	13.00	PPB
2-E25-32P	4/04/90	ZINC	7.00	PPB
2-E25-34	11/18/88	ARSENIC	8.00	PPB
2-E25-34	11/18/88	BARIUM	20.00	PPB
2-E25-34	11/18/88	CALCIUM	20900.00	PPB
2-E25-34	11/18/88	CHLORID	3000.00	PPB
2-E25-34	11/18/88	CHROMUM	17.00	PPB
2-E25-34	11/18/88	CONDFLD	194.00	UMHO
2-E25-34	11/18/88	FARSENI	7.00	PPB
2-E25-34	11/18/88	FBARIUM	20.00	PPB
2-E25-34	11/18/88	FCALCIU	21900.00	PPB
2-E25-34	11/18/88	FCHROMI	10.00	PPB
2-E25-34	11/18/88	FIRON	37.00	PPB
2-E25-34	11/18/88	FMAGNES	6030.00	PPB
2-E25-34	11/18/88	FMANGAN	10.00	PPB
2-E25-34	11/18/88	FPOTASS	4310.00	PPB
2-E25-34	11/18/88	FSODIUM	10900.00	PPB
2-E25-34	11/18/88	FSTRONT	113.00	PPB
2-E25-34	11/18/88	FVANADI	35.00	PPB
2-E25-34	11/18/88	IRON	497.00	PPB
2-E25-34	11/18/88	MAGNES	5930.00	PPB
2-E25-34	11/18/88	MANGESE	11.00	PPB
2-E25-34	11/18/88	METHYCH	160.00	PPB
2-E25-34	11/18/88	NICKEL	10.00	PPB
2-E25-34	11/18/88	NITRATE	1100.00	PPB
2-E25-34	11/18/88	PHFIELD	8.20	
2-E25-34	11/18/88	PHFIELD	8.30	
2-E25-34	11/18/88	POTASUM	4170.00	PPB
2-E25-34	11/18/88	SODIUM	10500.00	PPB
2-E25-34	11/18/88	STRONUM	108.00	PPB
2-E25-34	11/18/88	SULFATE	13600.00	PPB
2-E25-34	11/18/88	TOXLDL	98.00	PPB
2-E25-34	11/18/88	TOXLDL	122.00	PPB
2-E25-34	11/18/88	TOXLDL	127.00	PPB
2-E25-34	11/18/88	TOXLDL	136.00	PPB
2-E25-34	11/18/88	TURBID	7.20	NTU
2-E25-34	11/18/88	VANADUM	37.00	PPB
2-E25-34	11/18/88	ZINC	33.00	PPB
2-E25-34	12/13/88	CONDFLD	165.00	UMHO
2-E25-34	12/13/88	PHFIELD	7.90	
2-E25-34	2/27/89	ARSENIC	7.00	PPB
2-E25-34	2/27/89	ARSENIC	9.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-34	2/27/89	BARIUM	17.00	PPB
2-E25-34	2/27/89	BARIUM	19.00	PPB
2-E25-34	2/27/89	BETA	2.70	PCI/L
2-E25-34	2/27/89	BORON	11.00	PPB
2-E25-34	2/27/89	BORON	13.00	PPB
2-E25-34	2/27/89	CALCIUM	18000.00	PPB
2-E25-34	2/27/89	CALCIUM	19000.00	PPB
2-E25-34	2/27/89	CHLORID	2800.00	PPB
2-E25-34	2/27/89	CHROMUM	13.00	PPB
2-E25-34	2/27/89	CHROMUM	27.00	PPB
2-E25-34	2/27/89	CONDFLD	180.00	UMHO
2-E25-34	2/27/89	CONDLAB	655.00	UMHO
2-E25-34	2/27/89	FARSENI	9.00	PPB
2-E25-34	2/27/89	FBARIUM	19.00	PPB
2-E25-34	2/27/89	FBARIUM	20.00	PPB
2-E25-34	2/27/89	FBORON	18.00	PPB
2-E25-34	2/27/89	FBORON	20.00	PPB
2-E25-34	2/27/89	FCALCIU	19000.00	PPB
2-E25-34	2/27/89	FCALCIU	20300.00	PPB
2-E25-34	2/27/89	FIRON	38.00	PPB
2-E25-34	2/27/89	FMAGNES	5620.00	PPB
2-E25-34	2/27/89	FMAGNES	6040.00	PPB
2-E25-34	2/27/89	FPOTASS	4170.00	PPB
2-E25-34	2/27/89	FPOTASS	4510.00	PPB
2-E25-34	2/27/89	FSILICO	14700.00	PPB
2-E25-34	2/27/89	FSILICO	16100.00	PPB
2-E25-34	2/27/89	FSODIUM	10500.00	PPB
2-E25-34	2/27/89	FSODIUM	11400.00	PPB
2-E25-34	2/27/89	FSTRONT	106.00	PPB
2-E25-34	2/27/89	FSTRONT	113.00	PPB
2-E25-34	2/27/89	FVANADI	38.00	PPB
2-E25-34	2/27/89	IRON	104.00	PPB
2-E25-34	2/27/89	IRON	169.00	PPB
2-E25-34	2/27/89	MAGNES	5320.00	PPB
2-E25-34	2/27/89	MAGNES	5640.00	PPB
2-E25-34	2/27/89	NICKEL	15.00	PPB
2-E25-34	2/27/89	NITRATE	1100.00	PPB
2-E25-34	2/27/89	PH-LAB	8.10	
2-E25-34	2/27/89	PHFIELD	8.10	
2-E25-34	2/27/89	POTASUM	3830.00	PPB
2-E25-34	2/27/89	POTASUM	4100.00	PPB
2-E25-34	2/27/89	RADIUM	0.21	PCI/L
2-E25-34	2/27/89	RADIUM	0.50	PCI/L
2-E25-34	2/27/89	SILICON	14200.00	PPB
2-E25-34	2/27/89	SILICON	15000.00	PPB
2-E25-34	2/27/89	SODIUM	9680.00	PPB
2-E25-34	2/27/89	SODIUM	10300.00	PPB
2-E25-34	2/27/89	STRONUM	101.00	PPB
2-E25-34	2/27/89	STRONUM	106.00	PPB
2-E25-34	2/27/89	SULFATE	13400.00	PPB
2-E25-34	2/27/89	TC	17300.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-34	2/27/89	TC	17500.00	PPB
2-E25-34	2/27/89	TRITIUM	922.00	PCI/L
2-E25-34	2/27/89	TRITIUM	989.00	PCI/L
2-E25-34	2/27/89	TURBID	0.70	NTU
2-E25-34	2/27/89	VANADUM	35.00	PPB
2-E25-34	2/27/89	VANADUM	38.00	PPB
2-E25-34	2/27/89	ZINC	8.00	PPB
2-E25-34	7/17/89	ARSENIC	7.30	PPB
2-E25-34	7/17/89	BARIUM	19.00	PPB
2-E25-34	7/17/89	BETA	3.97	PCI/L
2-E25-34	7/17/89	BORON	19.00	PPB
2-E25-34	7/17/89	CALCIUM	20200.00	PPB
2-E25-34	7/17/89	CHLORID	3190.00	PPB
2-E25-34	7/17/89	CHROMUM	91.00	PPB
2-E25-34	7/17/89	CONDFLD	128.00	UMHO
2-E25-34	7/17/89	CONDFLD	129.00	UMHO
2-E25-34	7/17/89	CONDFLD	130.00	UMHO
2-E25-34	7/17/89	CONDLAB	183.00	UMHO
2-E25-34	7/17/89	FARSENI	8.50	PPB
2-E25-34	7/17/89	FBARIUM	19.00	PPB
2-E25-34	7/17/89	FBORON	17.00	PPB
2-E25-34	7/17/89	FCALCIU	20900.00	PPB
2-E25-34	7/17/89	FMAGNES	5620.00	PPB
2-E25-34	7/17/89	FPOTASS	3980.00	PPB
2-E25-34	7/17/89	FSILICO	15000.00	PPB
2-E25-34	7/17/89	FSODIUM	9600.00	PPB
2-E25-34	7/17/89	FSTRONT	112.00	PPB
2-E25-34	7/17/89	FVANADI	34.00	PPB
2-E25-34	7/17/89	IRON	791.00	PPB
2-E25-34	7/17/89	MAGNES	5460.00	PPB
2-E25-34	7/17/89	MANGESE	14.00	PPB
2-E25-34	7/17/89	NICKEL	46.00	PPB
2-E25-34	7/17/89	NITRATE	1090.00	PPB
2-E25-34	7/17/89	PH-LAB	8.20	
2-E25-34	7/17/89	PHFIELD	7.88	
2-E25-34	7/17/89	PHFIELD	7.89	
2-E25-34	7/17/89	POTASUM	3950.00	PPB
2-E25-34	7/17/89	SILICON	14700.00	PPB
2-E25-34	7/17/89	SODIUM	9400.00	PPB
2-E25-34	7/17/89	STRONUM	110.00	PPB
2-E25-34	7/17/89	SULFATE	15000.00	PPB
2-E25-34	7/17/89	TC	18300.00	PPB
2-E25-34	7/17/89	TRITIUM	1410.00	PCI/L
2-E25-34	7/17/89	TURBID	2.00	NTU
2-E25-34	7/17/89	VANADUM	35.00	PPB
2-E25-34	7/17/89	ZINC	12.00	PPB
2-E25-34	8/30/89	ARSENIC	5.00	PPB
2-E25-34	8/30/89	BARIUM	22.00	PPB
2-E25-34	8/30/89	BERYLUM	6.00	PPB
2-E25-34	8/30/89	BETA	5.48	PCI/L
2-E25-34	8/30/89	BORON	12.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-34	8/30/89	CALCIUM	20800.00	PPB
2-E25-34	8/30/89	CHLORID	3300.00	PPB
2-E25-34	8/30/89	CHROMUM	31.00	PPB
2-E25-34	8/30/89	CONDFLD	190.00	UMHO
2-E25-34	8/30/89	CONDFLD	191.00	UMHO
2-E25-34	8/30/89	CONDFLD	192.00	UMHO
2-E25-34	8/30/89	CONDLAB	674.00	UMHO
2-E25-34	8/30/89	FARSENI	6.00	PPB
2-E25-34	8/30/89	FBARIUM	19.00	PPB
2-E25-34	8/30/89	FBERYLL	6.00	PPB
2-E25-34	8/30/89	FCALCIU	19200.00	PPB
2-E25-34	8/30/89	FMAGNES	5130.00	PPB
2-E25-34	8/30/89	FMANGAN	6.00	PPB
2-E25-34	8/30/89	FPOTASS	4040.00	PPB
2-E25-34	8/30/89	FSILICO	13700.00	PPB
2-E25-34	8/30/89	FSODIUM	9420.00	PPB
2-E25-34	8/30/89	FSTRONT	99.00	PPB
2-E25-34	8/30/89	FVANADI	29.00	PPB
2-E25-34	8/30/89	IRON	177.00	PPB
2-E25-34	8/30/89	MAGNES	5680.00	PPB
2-E25-34	8/30/89	NICKEL	13.00	PPB
2-E25-34	8/30/89	NITRATE	1200.00	PPB
2-E25-34	8/30/89	PH-LAB	8.00	
2-E25-34	8/30/89	PHFIELD	8.00	
2-E25-34	8/30/89	PHFIELD	8.04	
2-E25-34	8/30/89	PHFIELD	8.07	
2-E25-34	8/30/89	PHFIELD	8.08	
2-E25-34	8/30/89	POTASUM	3920.00	PPB
2-E25-34	8/30/89	SILICON	15400.00	PPB
2-E25-34	8/30/89	SODIUM	9300.00	PPB
2-E25-34	8/30/89	STRONUM	107.00	PPB
2-E25-34	8/30/89	SULFATE	14700.00	PPB
2-E25-34	8/30/89	TC	18300.00	PPB
2-E25-34	8/30/89	TOXLDL	21.00	PPB
2-E25-34	8/30/89	TRITIUM	1520.00	PCI/L
2-E25-34	8/30/89	TURBID	1.10	NTU
2-E25-34	8/30/89	VANADUM	31.00	PPB
2-E25-34	8/30/89	ZINC	15.00	PPB
2-E25-34	10/31/89	ALPHAHI	1.98	PCI/L
2-E25-34	10/31/89	AM-241	0.02	PCI/L
2-E25-34	10/31/89	ARSENIC	8.00	PPB
2-E25-34	10/31/89	BARIUM	20.00	PPB
2-E25-34	10/31/89	BETA	4.66	PCI/L
2-E25-34	10/31/89	CALCIUM	20900.00	PPB
2-E25-34	10/31/89	CHLORID	3100.00	PPB
2-E25-34	10/31/89	CHROMUM	76.00	PPB
2-E25-34	10/31/89	CONDFLD	198.00	UMHO
2-E25-34	10/31/89	FARSENI	8.00	PPB
2-E25-34	10/31/89	FBARIUM	20.00	PPB
2-E25-34	10/31/89	FCALCIU	21600.00	PPB
2-E25-34	10/31/89	FMAGNES	6260.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-34	10/31/89	FPOTASS	4190.00	PPB
2-E25-34	10/31/89	FSILICO	16300.00	PPB
2-E25-34	10/31/89	FSODIUM	9590.00	PPB
2-E25-34	10/31/89	FSTRONT	121.00	PPB
2-E25-34	10/31/89	FVANADI	34.00	PPB
2-E25-34	10/31/89	IRON	385.00	PPB
2-E25-34	10/31/89	MAGNES	6130.00	PPB
2-E25-34	10/31/89	MANGESE	9.00	PPB
2-E25-34	10/31/89	NICKEL	39.00	PPB
2-E25-34	10/31/89	NITRATE	1200.00	PPB
2-E25-34	10/31/89	PHFIELD	7.68	
2-E25-34	10/31/89	POTASUM	4200.00	PPB
2-E25-34	10/31/89	SILICON	15700.00	PPB
2-E25-34	10/31/89	SODIUM	9500.00	PPB
2-E25-34	10/31/89	STRONUM	119.00	PPB
2-E25-34	10/31/89	SULFATE	12600.00	PPB
2-E25-34	10/31/89	TC	20000.00	PPB
2-E25-34	10/31/89	TDS	117000.00	
2-E25-34	10/31/89	TRITIUM	1570.00	PCI/L
2-E25-34	10/31/89	TURBID	0.80	NTU
2-E25-34	10/31/89	U	0.83	PCI/L
2-E25-34	10/31/89	VANADUM	35.00	PPB
2-E25-34	1/29/90	CONDFLD	185.00	UMHO
2-E25-34	1/29/90	CONDFLD	186.00	UMHO
2-E25-34	1/29/90	CONDFLD	187.00	UMHO
2-E25-34	1/29/90	CONDLAB	194.00	UMHO
2-E25-34	1/29/90	CONDLAB	195.00	UMHO
2-E25-34	1/29/90	CONDLAB	196.00	UMHO
2-E25-34	1/29/90	CONDLAB	198.00	UMHO
2-E25-34	1/29/90	PH-LAB	7.80	
2-E25-34	1/29/90	PH-LAB	7.90	
2-E25-34	1/29/90	PH-LAB	8.00	
2-E25-34	1/29/90	PHFIELD	8.31	
2-E25-34	1/29/90	PHFIELD	8.32	
2-E25-35	11/21/88	ALPHA	3.19	PCI/L
2-E25-35	11/21/88	ARSENIC	9.00	PPB
2-E25-35	11/21/88	BARIUM	34.00	PPB
2-E25-35	11/21/88	BETA	12.80	PCI/L
2-E25-35	11/21/88	CALCIUM	76300.00	PPB
2-E25-35	11/21/88	CHLORID	7500.00	PPB
2-E25-35	11/21/88	CHROMUM	30.00	PPB
2-E25-35	11/21/88	CONDFLD	767.00	UMHO
2-E25-35	11/21/88	CONDFLD	771.00	UMHO
2-E25-35	11/21/88	FARSENI	9.00	PPB
2-E25-35	11/21/88	FBARIUM	32.00	PPB
2-E25-35	11/21/88	FCALCIU	79800.00	PPB
2-E25-35	11/21/88	FIRON	33.00	PPB
2-E25-35	11/21/88	FLUORID	600.00	PPB
2-E25-35	11/21/88	FMAGNES	29000.00	PPB
2-E25-35	11/21/88	FMANGAN	8.00	PPB
2-E25-35	11/21/88	FPOTASS	6570.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-35	11/21/88	FSODIUM	48500.00	PPB
2-E25-35	11/21/88	FSTRONT	403.00	PPB
2-E25-35	11/21/88	FVANADI	17.00	PPB
2-E25-35	11/21/88	FZINC	29.00	PPB
2-E25-35	11/21/88	IRON	238.00	PPB
2-E25-35	11/21/88	MAGNES	28300.00	PPB
2-E25-35	11/21/88.	MANGESE	24.00	PPB
2-E25-35	11/21/88	NICKEL	16.00	PPB
2-E25-35	11/21/88	NITRATE	9000.00	PPB
2-E25-35	11/21/88	PHFIELD	7.80	
2-E25-35	11/21/88	POTASUM	6240.00	PPB
2-E25-35	11/21/88	RADIUM	0.19	PCI/L
2-E25-35	11/21/88	SODIUM	45400.00	PPB
2-E25-35	11/21/88	STRONUM	385.00	PPB
2-E25-35	11/21/88	SULFATE	236000.00	PPB
2-E25-35	11/21/88	TURBID	3.50	NTU
2-E25-35	11/21/88	VANADUM	15.00	PPB
2-E25-35	11/21/88	ZINC	38.00	PPB
2-E25-35	2/27/89	ALPHAHI	3.67	PCI/L
2-E25-35	2/27/89	ARSENIC	11.00	PPB
2-E25-35	2/27/89	BARIUM	33.00	PPB
2-E25-35	2/27/89	BETA	5.37	PCI/L
2-E25-35	2/27/89	BORON	37.00	PPB
2-E25-35	2/27/89	CALCIUM	62700.00	PPB
2-E25-35	2/27/89	CHLORID	7200.00	PPB
2-E25-35	2/27/89	CHROMUM	27.00	PPB
2-E25-35	2/27/89	CONDFLD	605.00	UMHO
2-E25-35	2/27/89	CONDLAB	628.00	UMHO
2-E25-35	2/27/89	FARSENI	11.00	PPB
2-E25-35	2/27/89	FBARIUM	32.00	PPB
2-E25-35	2/27/89	FBORON	33.00	PPB
2-E25-35	2/27/89	FCALCIU	63200.00	PPB
2-E25-35	2/27/89	FIRON	39.00	PPB
2-E25-35	2/27/89	FLUORID	600.00	PPB
2-E25-35	2/27/89	FMAGNES	24900.00	PPB
2-E25-35	2/27/89	FPOTASS	5960.00	PPB
2-E25-35	2/27/89	FSILICO	17800.00	PPB
2-E25-35	2/27/89	FSODIUM	45100.00	PPB
2-E25-35	2/27/89	FSTRONT	345.00	PPB
2-E25-35	2/27/89	FVANADI	20.00	PPB
2-E25-35	2/27/89	FZINC	9.00	PPB
2-E25-35	2/27/89	IRON	144.00	PPB
2-E25-35	2/27/89	MAGNES	24800.00	PPB
2-E25-35	2/27/89	MANGESE	6.00	PPB
2-E25-35	2/27/89	NICKEL	11.00	PPB
2-E25-35	2/27/89	NITRATE	7800.00	PPB
2-E25-35	2/27/89	PH-LAB	7.86	
2-E25-35	2/27/89	PHFIELD	7.50	
2-E25-35	2/27/89	POTASUM	5710.00	PPB
2-E25-35	2/27/89	RADIUM	0.14	PCI/L
2-E25-35	2/27/89	SILICON	17000.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-35	2/27/89	SODIUM	43700.00	PPB
2-E25-35	2/27/89	STRONUM	347.00	PPB
2-E25-35	2/27/89	SULFATE	201000.00	PPB
2-E25-35	2/27/89	TC	29800.00	PPB
2-E25-35	2/27/89	TRITIUM	69900.00	PCI/L
2-E25-35	2/27/89	TURBID	1.20	NTU
2-E25-35	2/27/89	VANADUM	21.00	PPB
2-E25-35	2/27/89	ZINC	10.00	PPB
2-E25-35	7/17/89	ALPHAHI	2.05	PCI/L
2-E25-35	7/17/89	ALPHAHI	3.66	PCI/L
2-E25-35	7/17/89	ARSENIC	9.90	PPB
2-E25-35	7/17/89	ARSENIC	10.00	PPB
2-E25-35	7/17/89	BARIUM	27.00	PPB
2-E25-35	7/17/89	BETA	3.37	PCI/L
2-E25-35	7/17/89	BETA	7.51	PCI/L
2-E25-35	7/17/89	BORON	21.00	PPB
2-E25-35	7/17/89	BORON	22.00	PPB
2-E25-35	7/17/89	CALCIUM	51800.00	PPB
2-E25-35	7/17/89	CALCIUM	53200.00	PPB
2-E25-35	7/17/89	CHLORID	6190.00	PPB
2-E25-35	7/17/89	CHLORID	6820.00	PPB
2-E25-35	7/17/89	CHROMUM	49.00	PPB
2-E25-35	7/17/89	CHROMUM	123.00	PPB
2-E25-35	7/17/89	CONDFLD	330.00	UMHO
2-E25-35	7/17/89	CONDLAB	506.00	UMHO
2-E25-35	7/17/89	FARSENI	10.40	PPB
2-E25-35	7/17/89	FBARIUM	24.00	PPB
2-E25-35	7/17/89	FBARIUM	25.00	PPB
2-E25-35	7/17/89	FBORON	20.00	PPB
2-E25-35	7/17/89	FBORON	21.00	PPB
2-E25-35	7/17/89	FCALCIU	46600.00	PPB
2-E25-35	7/17/89	FCALCIU	47200.00	PPB
2-E25-35	7/17/89	FCHROMI	10.00	PPB
2-E25-35	7/17/89	FIRON	45.00	PPB
2-E25-35	7/17/89	FIRON	61.00	PPB
2-E25-35	7/17/89	FLUORID	588.00	PPB
2-E25-35	7/17/89	FLUORID	616.00	PPB
2-E25-35	7/17/89	FMAGNES	16900.00	PPB
2-E25-35	7/17/89	FMAGNES	17100.00	PPB
2-E25-35	7/17/89	FPOTASS	4880.00	PPB
2-E25-35	7/17/89	FPOTASS	4930.00	PPB
2-E25-35	7/17/89	FSILICO	18400.00	PPB
2-E25-35	7/17/89	FSILICO	18800.00	PPB
2-E25-35	7/17/89	FSODIUM	33900.00	PPB
2-E25-35	7/17/89	FSODIUM	34400.00	PPB
2-E25-35	7/17/89	FSTRONT	255.00	PPB
2-E25-35	7/17/89	FSTRONT	259.00	PPB
2-E25-35	7/17/89	FVANADI	23.00	PPB
2-E25-35	7/17/89	FZINC	6.00	PPB
2-E25-35	7/17/89	IRON	473.00	PPB
2-E25-35	7/17/89	IRON	804.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-35	7/17/89	MAGNES	18900.00	PPB
2-E25-35	7/17/89	MAGNES	19400.00	PPB
2-E25-35	7/17/89	MANGESE	16.00	PPB
2-E25-35	7/17/89	MANGESE	23.00	PPB
2-E25-35	7/17/89	NICKEL	26.00	PPB
2-E25-35	7/17/89	NICKEL	60.00	PPB
2-E25-35	7/17/89	NITRATE	5960.00	PPB
2-E25-35	7/17/89	NITRATE	6830.00	PPB
2-E25-35	7/17/89	PH-LAB	8.00	
2-E25-35	7/17/89	PHFIELD	7.54	
2-E25-35	7/17/89	PHFIELD	7.57	
2-E25-35	7/17/89	PHFIELD	7.58	
2-E25-35	7/17/89	PHFIELD	7.59	
2-E25-35	7/17/89	POTASUM	5130.00	PPB
2-E25-35	7/17/89	POTASUM	5240.00	PPB
2-E25-35	7/17/89	RADIUM	0.27	PCI/L
2-E25-35	7/17/89	RADIUM	0.27	PCI/L
2-E25-35	7/17/89	SILICON	17400.00	PPB
2-E25-35	7/17/89	SILICON	18400.00	PPB
2-E25-35	7/17/89	SODIUM	36200.00	PPB
2-E25-35	7/17/89	SODIUM	37100.00	PPB
2-E25-35	7/17/89	STRONUM	288.00	PPB
2-E25-35	7/17/89	STRONUM	293.00	PPB
2-E25-35	7/17/89	SULFATE	142000.00	PPB
2-E25-35	7/17/89	SULFATE	165000.00	PPB
2-E25-35	7/17/89	TC	28900.00	PPB
2-E25-35	7/17/89	TC	30000.00	PPB
2-E25-35	7/17/89	TOXLDL	10.00	PPB
2-E25-35	7/17/89	TRITIUM	51500.00	PCI/L
2-E25-35	7/17/89	TRITIUM	60800.00	PCI/L
2-E25-35	7/17/89	TURBID	1.30	NTU
2-E25-35	7/17/89	TURBID	1.90	NTU
2-E25-35	7/17/89	VANADUM	24.00	PPB
2-E25-35	7/17/89	VANADUM	26.00	PPB
2-E25-35	7/17/89	ZINC	13.00	PPB
2-E25-35	7/17/89	ZINC	15.00	PPB
2-E25-35	8/30/89	ALPHAHI	2.78	PCI/L
2-E25-35	8/30/89	ARSENIC	9.00	PPB
2-E25-35	8/30/89	BARIUM	36.00	PPB
2-E25-35	8/30/89	BERYLUM	5.00	PPB
2-E25-35	8/30/89	BETA	6.89	PCI/L
2-E25-35	8/30/89	BORON	25.00	PPB
2-E25-35	8/30/89	CALCIUM	75100.00	PPB
2-E25-35	8/30/89	CHLORID	8000.00	PPB
2-E25-35	8/30/89	CHROMUM	31.00	PPB
2-E25-35	8/30/89	CONDFLD	729.00	UMHO
2-E25-35	8/30/89	CONDFLD	731.00	UMHO
2-E25-35	8/30/89	CONDFLD	734.00	UMHO
2-E25-35	8/30/89	CONDFLD	736.00	UMHO
2-E25-35	8/30/89	CONDLAB	185.00	UMHO
2-E25-35	8/30/89	FARSENI	8.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-35	8/30/89	FBARIUM	34.00	PPB
2-E25-35	8/30/89	FBORON	24.00	PPB
2-E25-35	8/30/89	FCALCIU	72800.00	PPB
2-E25-35	8/30/89	FLUORID	1000.00	PPB
2-E25-35	8/30/89	FMAGNES	25100.00	PPB
2-E25-35	8/30/89	FPOTASS	6460.00	PPB
2-E25-35	8/30/89	FSILICO	18500.00	PPB
2-E25-35	8/30/89	FSODIUM	44900.00	PPB
2-E25-35	8/30/89	FSTRONT	359.00	PPB
2-E25-35	8/30/89	FVANADI	17.00	PPB
2-E25-35	8/30/89	IRON	329.00	PPB
2-E25-35	8/30/89	MAGNES	27300.00	PPB
2-E25-35	8/30/89	MANGESE	27.00	PPB
2-E25-35	8/30/89	NICKEL	20.00	PPB
2-E25-35	8/30/89	NITRATE	6300.00	PPB
2-E25-35	8/30/89	PH-LAB	7.80	
2-E25-35	8/30/89	PHFIELD	7.79	
2-E25-35	8/30/89	PHFIELD	7.80	
2-E25-35	8/30/89	PHFIELD	7.81	
2-E25-35	8/30/89	POTASUM	6040.00	PPB
2-E25-35	8/30/89	RADIUM	0.55	PCI/L
2-E25-35	8/30/89	SILICON	19300.00	PPB
2-E25-35	8/30/89	SODIUM	43400.00	PPB
2-E25-35	8/30/89	STRONUM	382.00	PPB
2-E25-35	8/30/89	SULFATE	221000.00	PPB
2-E25-35	8/30/89	TC	30500.00	PPB
2-E25-35	8/30/89	TRITIUM	62400.00	PCI/L
2-E25-35	8/30/89	TURBID	5.20	NTU
2-E25-35	8/30/89	VANADUM	16.00	PPB
2-E25-35	8/30/89	ZINC	17.00	PPB
2-E25-35	10/30/89	ALPHAHI	1.91	PCI/L
2-E25-35	10/30/89	ARSENIC	10.00	PPB
2-E25-35	10/30/89	BARIUM	30.00	PPB
2-E25-35	10/30/89	BETA	9.38	PCI/L
2-E25-35	10/30/89	BORON	19.00	PPB
2-E25-35	10/30/89	CALCIUM	51800.00	PPB
2-E25-35	10/30/89	CHLORID	6900.00	PPB
2-E25-35	10/30/89	CHROMUM	38.00	PPB
2-E25-35	10/30/89	CONDFLD	682.00	UMHO
2-E25-35	10/30/89	FARSENI	10.00	PPB
2-E25-35	10/30/89	FBARIUM	29.00	PPB
2-E25-35	10/30/89	FBORON	37.00	PPB
2-E25-35	10/30/89	FCALCIU	55800.00	PPB
2-E25-35	10/30/89	FIRON	40.00	PPB
2-E25-35	10/30/89	FLUORID	700.00	PPB
2-E25-35	10/30/89	FMAGNES	21400.00	PPB
2-E25-35	10/30/89	FPOTASS	5420.00	PPB
2-E25-35	10/30/89	FSILICO	18900.00	PPB
2-E25-35	10/30/89	FSODIUM	45900.00	PPB
2-E25-35	10/30/89	FSTRONT	307.00	PPB
2-E25-35	10/30/89	FVANADI	23.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
2-E25-35	10/30/89	IRON	244.00	PPB
2-E25-35	10/30/89	MAGNES	20000.00	PPB
2-E25-35	10/30/89	MANGESE	9.00	PPB
2-E25-35	10/30/89	NICKEL	17.00	PPB
2-E25-35	10/30/89	NITRATE	6800.00	PPB
2-E25-35	10/30/89	PHFIELD	7.77	
2-E25-35	10/30/89	POTASUM	5280.00	PPB
2-E25-35	10/30/89	PU39-40	0.01	PCI/L
2-E25-35	10/30/89	RADIUM	0.38	PCI/L
2-E25-35	10/30/89	SILICON	17300.00	PPB
2-E25-35	10/30/89	SODIUM	45000.00	PPB
2-E25-35	10/30/89	STRONUM	297.00	PPB
2-E25-35	10/30/89	SULFATE	190000.00	PPB
2-E25-35	10/30/89	TC	33700.00	PPB
2-E25-35	10/30/89	TDS	444000.00	
2-E25-35	10/30/89	TRITIUM	60300.00	PCI/L
2-E25-35	10/30/89	TURBID	2.30	NTU
2-E25-35	10/30/89	U	2.56	PCI/L
2-E25-35	10/30/89	VANADUM	20.00	PPB
2-E25-35	10/30/89	ZINC	6.00	PPB
2-E25-35	1/29/90	CONDFLD	777.00	UMHO
2-E25-35	1/29/90	CONDFLD	782.00	UMHO
2-E25-35	1/29/90	CONDFLD	783.00	UMHO
2-E25-35	1/29/90	CONDFLD	785.00	UMHO
2-E25-35	1/29/90	CONDLAB	780.00	UMHO
2-E25-35	1/29/90	CONDLAB	784.00	UMHO
2-E25-35	1/29/90	CONDLAB	788.00	UMHO
2-E25-35	1/29/90	CONDLAB	794.00	UMHO
2-E25-35	1/29/90	PH-LAB	7.70	
2-E25-35	1/29/90	PHFIELD	8.03	
2-E25-35	1/29/90	PHFIELD	8.05	
2-E25-35	1/29/90	PHFIELD	8.09	
2-E25-35	1/29/90	PHFIELD	8.10	
2-E25-35	3/16/90	CONDFLD	660.00	UMHO
2-E25-35	3/16/90	CONDFLD	664.00	UMHO
2-E25-35	3/16/90	CONDFLD	666.00	UMHO
2-E25-35	3/16/90	CONDFLD	667.00	UMHO
2-E25-35	3/16/90	CONDFLD	670.00	UMHO
2-E25-35	3/16/90	CONDFLD	672.00	UMHO
2-E25-35	3/16/90	CONDFLD	673.00	UMHO
2-E25-35	3/16/90	CONDFLD	677.00	UMHO
6-43-43	11/21/88	ALPHA	0.96	PCI/L
6-43-43	11/21/88	ARSENIC	7.00	PPB
6-43-43	11/21/88	BARIUM	13.00	PPB
6-43-43	11/21/88	BETA	7.05	PCI/L
6-43-43	11/21/88	CALCIUM	25200.00	PPB
6-43-43	11/21/88	CHLORID	2900.00	PPB
6-43-43	11/21/88	CHROMUM	57.00	PPB
6-43-43	11/21/88	CONDFLD	172.00	UMHO
6-43-43	11/21/88	FARSENI	7.00	PPB
6-43-43	11/21/88	FBARIUM	12.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-43	11/21/88	FCALCIU	23500.00	PPB
6-43-43	11/21/88	FMAGNES	5270.00	PPB
6-43-43	11/21/88	FPOTASS	5480.00	PPB
6-43-43	11/21/88	FSODIUM	7020.00	PPB
6-43-43	11/21/88	FSTRONT	105.00	PPB
6-43-43	11/21/88	FVANADI	33.00	PPB
6-43-43	11/21/88	IRON	231.00	PPB
6-43-43	11/21/88	MAGNES	5770.00	PPB
6-43-43	11/21/88	NICKEL	25.00	PPB
6-43-43	11/21/88	NITRATE	800.00	PPB
6-43-43	11/21/88	PHFIELD	8.00	
6-43-43	11/21/88	POTASUM	5900.00	PPB
6-43-43	11/21/88	SODIUM	7450.00	PPB
6-43-43	11/21/88	STRONUM	112.00	PPB
6-43-43	11/21/88	SULFATE	9300.00	PPB
6-43-43	11/21/88	TRITIUM	539.00	PCI/L
6-43-43	11/21/88	TURBID	0.80	NTU
6-43-43	11/21/88	VANADUM	34.00	PPB
6-43-43	2/24/89	ARSENIC	7.00	PPB
6-43-43	2/24/89	BARIUM	12.00	PPB
6-43-43	2/24/89	BARIUM	14.00	PPB
6-43-43	2/24/89	BETA	3.99	PCI/L
6-43-43	2/24/89	BETA	4.23	PCI/L
6-43-43	2/24/89	BORON	12.00	PPB
6-43-43	2/24/89	BORON	14.00	PPB
6-43-43	2/24/89	CALCIUM	24600.00	PPB
6-43-43	2/24/89	CALCIUM	25400.00	PPB
6-43-43	2/24/89	CHLORID	2900.00	PPB
6-43-43	2/24/89	CHROMUM	23.00	PPB
6-43-43	2/24/89	CHROMUM	34.00	PPB
6-43-43	2/24/89	CONDFLD	214.00	UMHO
6-43-43	2/24/89	CONDFLD	217.00	UMHO
6-43-43	2/24/89	CONDLAB	195.00	UMHO
6-43-43	2/24/89	FARSENI	7.00	PPB
6-43-43	2/24/89	FBARIUM	13.00	PPB
6-43-43	2/24/89	FBORON	13.00	PPB
6-43-43	2/24/89	FBORON	20.00	PPB
6-43-43	2/24/89	FCALCIU	22600.00	PPB
6-43-43	2/24/89	FCHROMI	10.00	PPB
6-43-43	2/24/89	FIRON	31.00	PPB
6-43-43	2/24/89	FMAGNES	5370.00	PPB
6-43-43	2/24/89	FMAGNES	5430.00	PPB
6-43-43	2/24/89	FPOTASS	5600.00	PPB
6-43-43	2/24/89	FPOTASS	5750.00	PPB
6-43-43	2/24/89	FSILICO	13300.00	PPB
6-43-43	2/24/89	FSILICO	13400.00	PPB
6-43-43	2/24/89	FSODIUM	7290.00	PPB
6-43-43	2/24/89	FSODIUM	7510.00	PPB
6-43-43	2/24/89	FSTRONT	110.00	PPB
6-43-43	2/24/89	FVANADI	32.00	PPB
6-43-43	2/24/89	IRON	98.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-43	2/24/89	IRON	132.00	PPB
6-43-43	2/24/89	MAGNES	5810.00	PPB
6-43-43	2/24/89	MAGNES	5950.00	PPB
6-43-43	2/24/89	NICKEL	16.00	PPB
6-43-43	2/24/89	NICKEL	20.00	PPB
6-43-43	2/24/89	NITRATE	700.00	PPB
6-43-43	2/24/89	PH-LAB	8.10	
6-43-43	2/24/89	PHFIELD	7.70	
6-43-43	2/24/89	PHFIELD	7.80	
6-43-43	2/24/89	POTASUM	5990.00	PPB
6-43-43	2/24/89	POTASUM	6140.00	PPB
6-43-43	2/24/89	SILICON	14500.00	PPB
6-43-43	2/24/89	SILICON	14900.00	PPB
6-43-43	2/24/89	SODIUM	7860.00	PPB
6-43-43	2/24/89	SODIUM	8050.00	PPB
6-43-43	2/24/89	STRONUM	120.00	PPB
6-43-43	2/24/89	STRONUM	121.00	PPB
6-43-43	2/24/89	SULFATE	11000.00	PPB
6-43-43	2/24/89	TC	20500.00	PPB
6-43-43	2/24/89	TRITIUM	338.00	PCI/L
6-43-43	2/24/89	TRITIUM	432.00	PCI/L
6-43-43	2/24/89	TURBID	0.50	NTU
6-43-43	2/24/89	VANADUM	37.00	PPB
6-43-43	2/24/89	ZINC	7.00	PPB
6-43-43	6/15/89	ARSENIC	8.00	PPB
6-43-43	6/15/89	BARIUM	9.00	PPB
6-43-43	6/15/89	BETA	4.08	PCI/L
6-43-43	6/15/89	CALCIUM	25600.00	PPB
6-43-43	6/15/89	CHLORID	3200.00	PPB
6-43-43	6/15/89	CONDFLD	193.00	UMHO
6-43-43	6/15/89	CONDLAB	213.00	UMHO
6-43-43	6/15/89	FARSENI	8.00	PPB
6-43-43	6/15/89	FBARIUM	13.00	PPB
6-43-43	6/15/89	FCALCIU	24900.00	PPB
6-43-43	6/15/89	FMAGNES	5960.00	PPB
6-43-43	6/15/89	FMANGAN	5.00	PPB
6-43-43	6/15/89	FPOTASS	5630.00	PPB
6-43-43	6/15/89	FSILICO	12900.00	PPB
6-43-43	6/15/89	FSODIUM	7740.00	PPB
6-43-43	6/15/89	FSTRONT	119.00	PPB
6-43-43	6/15/89	FVANADI	35.00	PPB
6-43-43	6/15/89	IRON	58.00	PPB
6-43-43	6/15/89	MAGNES	6030.00	PPB
6-43-43	6/15/89	MANGESE	8.00	PPB
6-43-43	6/15/89	NITRATE	1100.00	PPB
6-43-43	6/15/89	PH-LAB	8.20	
6-43-43	6/15/89	PHFIELD	7.70	
6-43-43	6/15/89	PHFIELD	7.71	
6-43-43	6/15/89	PHFIELD	7.74	
6-43-43	6/15/89	POTASUM	5860.00	PPB
6-43-43	6/15/89	SILICON	13400.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-43	6/15/89	SODIUM	8180.00	PPB
6-43-43	6/15/89	STRONUM	126.00	PPB
6-43-43	6/15/89	SULFATE	12100.00	PPB
6-43-43	6/15/89	TC	23100.00	PPB
6-43-43	6/15/89	TRITIUM	283.00	PCI/L
6-43-43	6/15/89	TURBID	0.30	NTU
6-43-43	6/15/89	VANADUM	28.00	PPB
6-43-43	8/09/89	ARSENIC	7.00	PPB
6-43-43	8/09/89	BARIUM	12.00	PPB
6-43-43	8/09/89	BETA	11.90	PCI/L
6-43-43	8/09/89	CALCIUM	24600.00	PPB
6-43-43	8/09/89	CHLORID	3200.00	PPB
6-43-43	8/09/89	CHROMUM	22.00	PPB
6-43-43	8/09/89	CONDFLD	235.00	UMHO
6-43-43	8/09/89	CONDFLD	236.00	UMHO
6-43-43	8/09/89	CONDLAB	214.00	UMHO
6-43-43	8/09/89	FARSENI	9.00	PPB
6-43-43	8/09/89	FBARIUM	18.00	PPB
6-43-43	8/09/89	FBORON	16.00	PPB
6-43-43	8/09/89	FCALCIU	26400.00	PPB
6-43-43	8/09/89	FMAGNES	6070.00	PPB
6-43-43	8/09/89	FPOTASS	5810.00	PPB
6-43-43	8/09/89	FSILICO	14500.00	PPB
6-43-43	8/09/89	FSODIUM	8330.00	PPB
6-43-43	8/09/89	FSTRONT	126.00	PPB
6-43-43	8/09/89	FVANADI	40.00	PPB
6-43-43	8/09/89	IRON	73.00	PPB
6-43-43	8/09/89	MAGNES	5620.00	PPB
6-43-43	8/09/89	NITRATE	1100.00	PPB
6-43-43	8/09/89	PH-LAB	8.20	
6-43-43	8/09/89	PHFIELD	6.95	
6-43-43	8/09/89	PHFIELD	7.00	
6-43-43	8/09/89	POTASUM	5250.00	PPB
6-43-43	8/09/89	SILICON	11400.00	PPB
6-43-43	8/09/89	SODIUM	7440.00	PPB
6-43-43	8/09/89	STRONUM	109.00	PPB
6-43-43	8/09/89	SULFATE	10600.00	PPB
6-43-43	8/09/89	TC	23600.00	PPB
6-43-43	8/09/89	TOXLDL	10.00	PPB
6-43-43	8/09/89	TOXLDL	13.00	PPB
6-43-43	8/09/89	TRITIUM	287.00	PCI/L
6-43-43	8/09/89	TURBID	0.40	NTU
6-43-43	8/09/89	VANADUM	30.00	PPB
6-43-43	1/26/90	ARSENIC	8.00	PPB
6-43-43	1/26/90	BARIUM	14.00	PPB
6-43-43	1/26/90	BETA	6.29	PCI/L
6-43-43	1/26/90	BORON	13.00	PPB
6-43-43	1/26/90	CALCIUM	25600.00	PPB
6-43-43	1/26/90	CHLORID	3300.00	PPB
6-43-43	1/26/90	CHROMUM	33.00	PPB
6-43-43	1/26/90	CONDFLD	225.00	UMHO

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-43	1/26/90	CONDFLD	226.00	UMHO
6-43-43	1/26/90	CONDLAB	222.00	UMHO
6-43-43	1/26/90	FARSENI	8.00	PPB
6-43-43	1/26/90	FBARIUM	15.00	PPB
6-43-43	1/26/90	FBORON	19.00	PPB
6-43-43	1/26/90	FCALCIU	25900.00	PPB
6-43-43	1/26/90	FMAGNES	5960.00	PPB
6-43-43	1/26/90	FPOTASS	5610.00	PPB
6-43-43	1/26/90	FSILICO	14200.00	PPB
6-43-43	1/26/90	FSODIUM	7550.00	PPB
6-43-43	1/26/90	FSTRONT	122.00	PPB
6-43-43	1/26/90	FVANADI	32.00	PPB
6-43-43	1/26/90	IRON	144.00	PPB
6-43-43	1/26/90	MAGNES	5850.00	PPB
6-43-43	1/26/90	NICKEL	16.00	PPB
6-43-43	1/26/90	NITRATE	1000.00	PPB
6-43-43	1/26/90	PH-LAB	7.90	
6-43-43	1/26/90	PHFIELD	8.35	
6-43-43	1/26/90	PHFIELD	8.38	
6-43-43	1/26/90	PHFIELD	8.40	
6-43-43	1/26/90	PHFIELD	8.41	
6-43-43	1/26/90	POTASUM	5550.00	PPB
6-43-43	1/26/90	SILICON	14000.00	PPB
6-43-43	1/26/90	SODIUM	7400.00	PPB
6-43-43	1/26/90	STRONUM	121.00	PPB
6-43-43	1/26/90	SULFATE	10400.00	PPB
6-43-43	1/26/90	TC	22300.00	PPB
6-43-43	1/26/90	TOXLDL	14.00	PPB
6-43-43	1/26/90	TRITIUM	349.00	PCI/L
6-43-43	1/26/90	TURBID	0.40	NTU
6-43-43	1/26/90	VANADUM	33.00	PPB
6-43-43	4/26/90	CONDFLD	240.00	UMHO
6-43-43	4/26/90	PHFIELD	8.08	
6-43-45	12/06/89	ALPHAHI	2.59	PCI/L
6-43-45	12/06/89	ARSENIC	10.00	PPB
6-43-45	12/06/89	BARIUM	40.00	PPB
6-43-45	12/06/89	BETA	6.86	PCI/L
6-43-45	12/06/89	BORON	11.00	PPB
6-43-45	12/06/89	CALCIUM	26300.00	PPB
6-43-45	12/06/89	CHLORID	2500.00	PPB
6-43-45	12/06/89	CHROMUM	37.00	PPB
6-43-45	12/06/89	CONDFLD	210.00	UMHO
6-43-45	12/06/89	FARSENI	9.00	PPB
6-43-45	12/06/89	FBARIUM	38.00	PPB
6-43-45	12/06/89	FBORON	19.00	PPB
6-43-45	12/06/89	FCALCIU	26200.00	PPB
6-43-45	12/06/89	FMAGNES	6580.00	PPB
6-43-45	12/06/89	FPOTASS	5340.00	PPB
6-43-45	12/06/89	FSILICO	17500.00	PPB
6-43-45	12/06/89	FSODIUM	10500.00	PPB
6-43-45	12/06/89	FSTRONT	138.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-45	12/06/89	FVANADI	36.00	PPB
6-43-45	12/06/89	IRON	265.00	PPB
6-43-45	12/06/89	MAGNES	6610.00	PPB
6-43-45	12/06/89	MANGESE	6.00	PPB
6-43-45	12/06/89	NICKEL	20.00	PPB
6-43-45	12/06/89	NITRATE	1000.00	PPB
6-43-45	12/06/89	PHFIELD	7.92	
6-43-45	12/06/89	PHFIELD	7.93	
6-43-45	12/06/89	POTASUM	5580.00	PPB
6-43-45	12/06/89	RADIUM	0.16	PCI/L
6-43-45	12/06/89	SILICON	17800.00	PPB
6-43-45	12/06/89	SODIUM	11000.00	PPB
6-43-45	12/06/89	STRONUM	142.00	PPB
6-43-45	12/06/89	SULFATE	14500.00	PPB
6-43-45	12/06/89	TC	25400.00	PPB
6-43-45	12/06/89	TDS	144000.00	
6-43-45	12/06/89	TRITIUM	342.00	PCI/L
6-43-45	12/06/89	TURBID	0.80	NTU
6-43-45	12/06/89	U	1.21	PCI/L
6-43-45	12/06/89	VANADUM	38.00	PPB
6-43-45	1/26/90	ALPHAHI	1.47	PCI/L
6-43-45	1/26/90	ARSENIC	12.00	PPB
6-43-45	1/26/90	BARIUM	41.00	PPB
6-43-45	1/26/90	BETA	5.84	PCI/L
6-43-45	1/26/90	BORON	12.00	PPB
6-43-45	1/26/90	CALCIUM	26500.00	PPB
6-43-45	1/26/90	CHLORID	2900.00	PPB
6-43-45	1/26/90	CHROMUM	55.00	PPB
6-43-45	1/26/90	CONDFLD	232.00	UMHO
6-43-45	1/26/90	CONDFLD	233.00	UMHO
6-43-45	1/26/90	CONDFLD	234.00	UMHO
6-43-45	1/26/90	CONDLAB	241.00	UMHO
6-43-45	1/26/90	FARSENI	12.00	PPB
6-43-45	1/26/90	FBARIUM	38.00	PPB
6-43-45	1/26/90	FBORON	30.00	PPB
6-43-45	1/26/90	FCALCIU	25900.00	PPB
6-43-45	1/26/90	FMAGNES	6270.00	PPB
6-43-45	1/26/90	FPOTASS	4890.00	PPB
6-43-45	1/26/90	FSILICO	17000.00	PPB
6-43-45	1/26/90	FSODIUM	10300.00	PPB
6-43-45	1/26/90	FSTRONT	136.00	PPB
6-43-45	1/26/90	FVANADI	34.00	PPB
6-43-45	1/26/90	IRON	479.00	PPB
6-43-45	1/26/90	MAGNES	6380.00	PPB
6-43-45	1/26/90	MANGESE	11.00	PPB
6-43-45	1/26/90	NICKEL	27.00	PPB
6-43-45	1/26/90	NITRATE	1200.00	PPB
6-43-45	1/26/90	PH-LAB	7.80	
6-43-45	1/26/90	PHFIELD	8.14	
6-43-45	1/26/90	PHFIELD	8.15	
6-43-45	1/26/90	POTASUM	4920.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-45	1/26/90	RADIUM	0.20	PCI/L
6-43-45	1/26/90	SILICON	17600.00	PPB
6-43-45	1/26/90	SODIUM	10300.00	PPB
6-43-45	1/26/90	STRONUM	135.00	PPB
6-43-45	1/26/90	SULFATE	14900.00	PPB
6-43-45	1/26/90	TC	23400.00	PPB
6-43-45	1/26/90	TOXLDL	10.00	PPB
6-43-45	1/26/90	TRITIUM	392.00	PCI/L
6-43-45	1/26/90	TURBID	3.80	NTU
6-43-45	1/26/90	VANADUM	36.00	PPB
6-43-45	1/26/90	ZINC	12.00	PPB
6-43-45	4/18/90	ALPHAHI	1.97	PCI/L
6-43-45	4/18/90	ARSENIC	11.00	PPB
6-43-45	4/18/90	BARIUM	39.00	PPB
6-43-45	4/18/90	BETA	6.60	PCI/L
6-43-45	4/18/90	BORON	12.00	PPB
6-43-45	4/18/90	CALCIUM	25400.00	PPB
6-43-45	4/18/90	CHLORID	2700.00	PPB
6-43-45	4/18/90	CHROMUM	54.00	PPB
6-43-45	4/18/90	CONDFLD	240.00	UMHO
6-43-45	4/18/90	CONDFLD	241.00	UMHO
6-43-45	4/18/90	CONDFLD	242.00	UMHO
6-43-45	4/18/90	CONDFLD	244.00	UMHO
6-43-45	4/18/90	CONDLAB	257.00	UMHO
6-43-45	4/18/90	FARSENI	11.00	PPB
6-43-45	4/18/90	FBARIUM	39.00	PPB
6-43-45	4/18/90	FBORON	22.00	PPB
6-43-45	4/18/90	FCALCIU	26300.00	PPB
6-43-45	4/18/90	FMAGNES	6510.00	PPB
6-43-45	4/18/90	FPOTASS	4920.00	PPB
6-43-45	4/18/90	FSILICO	17000.00	PPB
6-43-45	4/18/90	FSODIUM	10300.00	PPB
6-43-45	4/18/90	FSTRONT	133.00	PPB
6-43-45	4/18/90	FVANADI	36.00	PPB
6-43-45	4/18/90	IRON	343.00	PPB
6-43-45	4/18/90	MAGNES	6430.00	PPB
6-43-45	4/18/90	MANGESE	7.00	PPB
6-43-45	4/18/90	NICKEL	29.00	PPB
6-43-45	4/18/90	NITRATE	1500.00	PPB
6-43-45	4/18/90	PH-LAB	8.10	
6-43-45	4/18/90	PHFIELD	8.04	
6-43-45	4/18/90	PHFIELD	8.05	
6-43-45	4/18/90	PHFIELD	8.06	
6-43-45	4/18/90	PHFIELD	8.07	
6-43-45	4/18/90	POTASUM	4840.00	PPB
6-43-45	4/18/90	RADIUM	0.15	PCI/L
6-43-45	4/18/90	SILICON	16600.00	PPB
6-43-45	4/18/90	SODIUM	10300.00	PPB
6-43-45	4/18/90	STRONUM	133.00	PPB
6-43-45	4/18/90	SULFATE	14300.00	PPB
6-43-45	4/18/90	TC	23600.00	PPB

WELL NAME	COLLECTION DATE	CONSTITUENT NAME	ANALYSIS VALUE	ANALYSIS UNITS
6-43-45	4/18/90	TRITIUM	506.00	PCI/L
6-43-45	4/18/90	TURBID	0.60	NTU
6-43-45	4/18/90	VANADUM	37.00	PPB
6-43-45	4/29/90	CONDFLD	286.00	UMHO
6-43-45	4/29/90	PHFIELD	8.09	

Table C.2 Long Name and Limit of Detection for Listed Constituents.

CONSTITUENT NAME	CONSTITUENT LONG NAME	ANALYSIS UNITS	DETECTION LIMIT
1,1,1-T	1,1,1-trichloroethane	PPB	5.00
1,1,2-T	1,1,2-trichloroethane	PPB	5.00
1,1-DIC	1,1-dichloroethane	PPB	5.00
1,1-DIM	1,1-dimethylhydrazine	PPB	10.00
1,2-DIC	1,2-dichloroethane	PPB	5.00
1,2-DIM	1,2-dimethylhydrazine	PPB	10.00
1-napha	1-naphthylamine	PPB	10.00
1112-tc	1,1,1,2-tetrachlorethane	PPB	10.00
1122-tc	1,1,2,2-tetrachlorethane	PPB	5.00
12-dben	1,2-dichlorobenzene	PPB	10.00
123-trp	1,2,3-trichloropropane	PPB	10.00
1234TE	1,2,3,4-tetrachlorobenzene	PPB	10.00
1235TE	1,2,3,5-tetrachlorobenzene	PPB	10.00
123TRI	1,2,3-trichlorobenzene	PPB	10.00
13-dben	1,3-dichlorobenzene	PPB	10.00
135TRI	1,3,5-trichlorobenzene	PPB	10.00
14-dben	p-Dichlorobenzene	PPB	10.00
14DBEN	p-Dichlorobenzene	PPB	5.00
1BUTYN	1-Butynol	PPB	10000.00
1PROPAN	1-Propanol	PPB	10000.00
2,4,5-T	2,4,5-T	PPB	2.00
2,4,5TP	2,4,5-TP silvex	PPB	2.00
2,4-D	2,4-D	PPB	2.00
2-napha	2-naphthylamine	PPB	10.00
2378TCD	2,3,7,8 TCDD	PPB	0.01
24-dchp	2,4-dichlorophenol	PPB	10.00
24-dint	2,4-dinitrotoluene	PPB	10.00
245-trp	2,4,5-Trichlorophenol	PPB	10.00
246-trp	2,4,6-trichlorophenol	PPB	10.00
26-dchp	2,6-dichlorophenol	PPB	10.00
26-dint	2,6-dinitrotoluene	PPB	10.00
2HEXANO	2-Hexanone	PPB	50.00
2MENAPH	2-Methylnaphthalene	PPB	10.00
2NITPH	o-Nitrophenol	PPB	10.00
4NITQUI	4-Nitroquinoline 1-oxide	PPB	10.00
ACEFENE	2-acetylaminofluorene	PPB	10.00
ACENAPH	Acenaphthene	PPB	10.00
ACENATL	Acenaphthalene	PPB	10.00
ACETILE	Acetonitrile	PPB	10.00
ACETONE	Acetone by VOA	PPB	10.00
ACETOPH	Acetophenone	PPB	10.00
ACETREA	1-acetyl-2-thiourea	PPB	200.00
ACROLIN	Acrolein	PPB	10.00
ACRYIDE	Acrylamide	PPB	10000.00
ACRYILE	Acrylonitrile	PPB	10.00
ACTONE	Acetone - by ABN	PPB	10.00
ALDRIN	Aldrin	PPB	0.10
ALLYLAL	Allyl alcohol	PPB	10000.00

ALLYLCL	Allyl Chloride	PPB	100.00
ALPHA	Gross alpha	PCI/L	4.00
ALPHAHI	Alpha, High Detection Level	PCI/L	4.00
ALUMNUM	Aluminum	PPB	150.00
AM-241	Americium-241	PCI/L	0.10
AMIISOX	5-(aminomethyl)-3-isoxazolol	PPB	10.00
AMINOYL	4-aminobyphenyl	PPB	10.00
AMITROL	Amitrole	PPB	10.00
AMMONIU	Ammonium ion	PPB	50.00
ANILINE	Aniline	PPB	10.00
ANTHRA	Anthracene	PPB	10.00
ANTIONY	Antimony	PPB	100.00
AR1016	Arochlor 1016	PPB	1.00
AR1221	Arochlor 1221	PPB	1.00
AR1232	Arochlor 1232	PPB	1.00
AR1242	Arochlor 1242	PPB	1.00
AR1248	Arochlor 1248	PPB	1.00
AR1254	Arochlor 1254	PPB	1.00
AR1260	Arochlor 1260	PPB	1.00
ARAMITE	Aramite	PPB	10.00
ARSENIC	Arsenic	PPB	5.00
AURAMIN	Auramine	PPB	10.00
B2CLMEE	Bis(2-chloro-1-methylethyl)ether	PPB	10.00
BARIUM	Barium	PPB	6.00
BDCM	Bromodichloromethane	PPB	5.00
BENDICM	Benzene, dichloromethyl	PPB	10.00
BENDINE	Benzidine	PPB	10.00
BENTHOL	Benzenethoil	PPB	10.00
BENZAAN	Benz[a]anthracene	PPB	10.00
BENZALC	Benzyl Alcohol	PPB	10.00
BENZBFL	Benzo[b]fluoranthene	PPB	10.00
BENZCAC	Benz[c]acridine	PPB	10.00
BENZCHL	Benzyl chloride	PPB	10.00
BENZENE	Benzene	PPB	5.00
BENZJFL	Benzo[j]fluoranthene	PPB	10.00
BENZOPY	Benzo[a]pyrene	PPB	10.00
BERYLUM	Beryllium	PPB	5.00
BETA	Gross beta	PCI/L	8.00
BGHIPER	Benzo(ghi)perylene	PPB	10.00
BIS2CHE	Bis(2-chloroethyl) ether	PPB	10.00
BIS2CHM	Bis(2-chloroethoxy) methane	PPB	10.00
BIS2EPH	Bis(2-ethylhexyl) phthalate	PPB	10.00
BIS2ETH	Bis(2-chloroisopropyl)ether	PPB	10.00
BISTHER	Bis(chloromethyl) ether	PPB	5.00
BNZKFLU	Benzo(k)fluoranthene	PPB	10.00
BORON	Boron	PPB	10.00
BROMIDE	Bromide	PPB	1000.00
BROMONE	Bromoacetone	PPB	5.00
BROMORM	Bromoform	PPB	5.00
BROPHEN	4-bromophenyl phenyl ether	PPB	10.00
BUTANOL	1-Butanol	PPB	10000.00
BUTBENP	Butyl benzyl phthalate	PPB	10.00
BUTDINP	2-sec-butyl-4,6-dinitrophenol	PPB	10.00
C 14	Carbon-14	PCI/L	20.00
CADMIUM	Cadmium	PPB	2.00

CALCIUM	Calcium	PPB	50.00
CARBIDE	Carbon disulfide	PPB	10.00
CARBPHT	Carbophenothion	PPB	2.00
CHALETH	Chloroalkyl ethers	PPB	10.00
CHLACET	Chloroacetaldehyde	PPB	16000.00
CHLANIL	P-chloroaniline	PPB	10.00
CHLBENZ	Chlorobenzene	PPB	5.00
CHLCRES	P-chloro-m-cresol	PPB	10.00
CHLEPOX	1-chloro-2,3-epoxypropane	PPB	10.00
CHLFORM	Chloroform	PPB	5.00
CHLLATE	Chlorobenzilate	PPB	300.00
CHLNAPH	2-chloronaphthalene	PPB	10.00
CHLNAPZ	Chlornaphazine	PPB	10.00
CHLOANE	Chlordane	PPB	1.00
CHLORAL	Chloral	PPB	3000.00
CHLOREA	1-(o-chlorophenyl) thiourea	PPB	200.00
CHLORID	Chloride	PPB	500.00
CHLPHEN	2-chlorophenol	PPB	10.00
CHLPROP	3-chloropropionitrile	PPB	10000.00
CHLROB	Chlorobenzene (by ABN)	PPB	10.00
CHLTHER	2-chloroethyl vinyl ether	PPB	5.00
CHMTHER	Chloromethyl methyl ether	PPB	10.00
CHROMUM	Chromium	PPB	10.00
CHRYSEN	Chrysene	PPB	10.00
CITRUSR	Citrus red	PPB	1000.00
CLETHAN	Chloroethane	PPB	10.00
CO-60	Cobalt-60	PCI/L	22.50
COBALT	Cobalt	PPB	20.00
COLIFRM	Coliform bacteria	MPN	2.20
COLIMF	Coliform (Membrane Filter)	PPB	1.00
CONDFLD	Specific conductance	UMHO	1.00
CONDLAB	Conductivity, Laboratory	UMHO	0.00
COPPER	Copper	PPB	10.00
CRESOLS	Cresols	PPB	10.00
CROTONA	Crotonaldehyde	PPB	10.00
CS-137	Cesium-137	PCI/L	20.00
CYANBRO	Cyanogen bromide	PPB	3000.00
CYANCHL	Cyanogen chloride	PPB	3000.00
CYANIDE	Cyanide	PPB	10.00
CYANOGN	Cyanogen	PPB	3000.00
CYCHDIN	2-cyclohexyl-4,6-dinitrophenol	PPB	10.00
DBCM	Dibromochloromethane	PPB	5.00
DBP	Dibutyl Phosphate	PPB	10000.00
DDD	DDD	PPB	0.10
DDE	DDE	PPB	0.10
DDT	DDT	PPB	0.10
DIALLAT	Diallate	PPB	10.00
DIBAEPY	Dibenzo[a,e]pyrene	PPB	10.00
DIBAHAC	Dibenz[a,h]acridine	PPB	10.00
DIBAHAN	Dibenz[a,h]anthracene	PPB	10.00
DIBAHPY	Dibenzo[a,h]pyrene	PPB	10.00
DIBAIPY	Dibenzo[a,i]pyrene	PPB	10.00
DIBAJAC	Dibenz[a,j]acridine	PPB	10.00
DIBCGCA	7H-dibenzo[c,g]carbazole	PPB	10.00
DIBENFR	Dibenzofuran	PPB	10.00

DIBPHTH	Di-n-butyl phthalate	PPB	10.00
DIBRCHL	1,2-dibromo-3-chloropropane	PPB	10.00
DIBRETH	1,2-dibromoethane	PPB	10.00
DIBRMET	Dibromomethane	PPB	10.00
DIBUTEN	1,4-dichloro-2-butene	PPB	10.00
DICDIFM	Dichlorodifluoromethane	PPB	10.00
DICETHY	1,1-dichloroethylene	PPB	10.00
DICHBEN	3,3'-dichlorobenzidine	PPB	10.00
DICPANE	1,2-dichloropropane	PPB	5.00
DICPENE	1,3-dichloropropene	PPB	5.00
DICPROP	Dichloropropanol	PPB	3000.00
DIELRIN	Dieldrin	PPB	0.10
DIEPHTH	Diethyl phthalate	PPB	10.00
DIETHY	Diethylarsine	PPB	10.00
DIETROL	Diethylstilbesterol	PPB	200.00
DIHYSAF	Dihydrosafrole	PPB	10.00
DIMBENZ	7,12-dimethylbenz[a]anthracene	PPB	10.00
DIMEAMB	P-dimethylaminoazobenzene	PPB	10.00
DIMETHB	3,3'-dimethoxybenzidine	PPB	10.00
DIMETHO	Dimethoate	PPB	2.00
DIMEYLB	3,3'-dimethylbenzidine	PPB	10.00
DIMPHAM	Alpha,alpha-dimethylphenethylamine	PPB	10.00
DIMPHEN	2,4-dimethylphenol	PPB	10.00
DIMPHTH	Dimethyl phthalate	PPB	10.00
DINBENZ	Dinitrobenzene	PPB	10.00
DINCRES	4,6-dinitro-o-cresol and salts	PPB	10.00
DINOSEB	Dinoseb	PPB	10.00
DINPHEN	2,4-dinitrophenol	PPB	10.00
DIOPHTH	Di-n-octyl phthalate	PPB	10.00
DIOXANE	1,4-Dioxane	PPB	500.00
DIOXIN	Dioxin	PPB	0.10
DIPHAMI	Diphenylamine	PPB	10.00
DIPHHYD	1,2-diphenylhydrazine	PPB	10.00
DIPHOS	0,0-Diethyl-0,2-pyrazinyl phosphorothion	PPB	10.00
DIPRNIT	Di-n-propylnitrosamine	PPB	10.00
DISULFO	Disulfoton	PPB	2.00
ENDO1	Endosulfan I	PPB	0.10
ENDO2	Endosulfan II	PPB	0.10
ENDRIN	Endrin	PPB	0.10
ENDSFAN	Endosulfan Sulfate	PPB	0.50
ETHANOL	Ethanol	PPB	10000.00
ETHBENZ	Ethyl benzene	PPB	5.00
ETHCARB	Ethyl carbamate	PPB	10000.00
ETHCYAN	Ethyl cyanide	PPB	10000.00
ETHGLYC	Ethylene Glycol	PPB	10000.00
ETHMETH	Ethyl methacrylate	PPB	10.00
ETHMETS	Ethyl methanesulfonate	PPB	10.00
ETHMINE	Ethyleneimine	PPB	10.00
ETHOXID	Ethylene oxide	PPB	10.00
ETHYGLY	Ethylene glycol	PPB	10000.00
ETHYREA	Ethylenethiourea	PPB	200.00
FALUMIN	Aluminum, filtered	PPB	150.00
FANTIMO	Antimony, filtered	PPB	100.00
FARSENI	Arsenic, filtered	PPB	5.00
FBARIUM	Barium, filtered	PPB	6.00

FBERYLL	Beryllium, filtered	PPB	5.00
FBORON	Boron, filtered	PPB	10.00
FCADMIU	Cadmium, filtered	PPB	2.00
FCALCIU	Calcium, filtered	PPB	50.00
FCHROMI	Chromium, filtered	PPB	10.00
FCOBALT	Cobalt, filtered	PPB	20.00
FCOPPER	Copper, filtered	PPB	10.00
FIRON	Iron, filtered	PPB	30.00
FLEAD	Lead, filtered	PPB	5.00
FLITHIU	Lithium, filtered	PPB	10.00
FLRENE	Fluorene	PPB	10.00
FLUORAN	Fluoranthene	PPB	10.00
FLUORID	Fluoride	PPB	500.00
FLUOROA	Fluoroacetic acid	PPB	3000.00
FMAGNES	Magnesium, filtered	PPB	50.00
FMANGAN	Manganese, filtered	PPB	5.00
FMERCUR	Mercury, filtered	PPB	0.10
FMOLY	Molybdenum, filtered	PPB	40.00
FNICKEL	Nickel, filtered	PPB	10.00
FORMALN	Formalin	PPB	500.00
FOSMIUM	Osmium, filtered	PPB	300.00
FPOTASS	Potassium, filtered	PPB	100.00
FSELENI	Selenium, filtered	PPB	5.00
FSILICO	Silicon, filtered	PPB	50.00
FSILVER	Silver, filtered	PPB	10.00
FSODIUM	Sodium, filtered	PPB	200.00
FSTRONT	Strontium, filtered	PPB	10.00
FTHALLI	Thallium, filtered	PPB	5.00
FTIN	Tin, filtered	PPB	30.00
FTITAN	Titanium, filtered	PPB	60.00
FVANADI	Vanadium, filtered	PPB	5.00
FZINC	Zinc, filtered	PPB	5.00
FZIRCON	Zirconium, filtered	PPB	50.00
GLYCIDY	Glycidylaldehyde	PPB	3000.00
HEPTIDE	Heptchlor epoxide	PPB	0.10
HEPTLOR	Heptachlor	PPB	0.10
HEXACHL	Hexachlorophene	PPB	10.00
HEXAENE	Hexachloropropene	PPB	10.00
HEXCBEN	Hexachlorobenzene	PPB	10.00
HEXCBUT	Hexachlorobutadiene	PPB	10.00
HEXCCYC	Hexachlorocyclopentadiene	PPB	10.00
HEXCETH	Hexachloroethane	PPB	10.00
HEXONE	Methyl Isobutyl Ketone	PPB	10.00
HYDRAZI	Hydrazine	PPB	3000.00
HYDRSUL	Hydrogen sulfide	PPB	10.00
I-129	Iodine-129	PCI/L	15.00
I-129DW	Iodine-129 (Drinking Water Standard)	PCI/L	1.00
INDENOP	Indeno(1,2,3-cd)pyrene	PPB	10.00
IODOMET	Iodomethane	PPB	10.00
IRON	Iron	PPB	30.00
ISOBUTY	Isobutyl alcohol	PPB	10000.00
ISODRIN	Isodrin	PPB	10.00
ISOPHER	Isopherone	PPB	10.00
ISOSOLE	Isosafrole	PPB	10.00
KEPONE	Kepone	PPB	1.00

KEROSEN	Kerosene	PPB	10000.00
LEAD	Lead	PPB	30.00
LEADGF	Lead (graphite furnace)	PPB	5.00
LHYDRAZ	Hydrazine, Low Detection Level	PPB	30.00
LITHIUM	Lithium	PPB	10.00
LPHENOL	Phenol, low DL	PPB	10.00
M-XYLE	Xylene-m	PPB	5.00
MAGNES	Magnesium	PPB	50.00
MALHYDR	Maleic hydrizide	PPB	500.00
MALOILE	Malononitrile	PPB	10.00
MANGESE	Manganese	PPB	5.00
MBP	Monobutyl Phosphate	PPB	10000.00
MELPHAL	Melphalan	PPB	10.00
MERCURY	Mercury	PPB	0.10
METACRY	Methyl methacrylate	PPB	10.00
METACTO	2-methyllactonitrile	PPB	10.00
METAZIR	2-methylaziridine	PPB	10.00
METBISC	4,4'-methylenebis(2-chloroaniline)	PPB	10.00
METCHAN	3-methylcholanthrene	PPB	10.00
METHACR	Methacrylonitrile	PPB	10.00
METHAPY	Methapyrilene	PPB	10.00
METHBRO	Methyl bromide	PPB	10.00
METHCHL	Methyl chloride	PPB	10.00
METHIOU	Methylthiouracil	PPB	10.00
METHLOR	Methoxychlor	PPB	3.00
METHNYL	Metholonyl	PPB	10.00
METHONE	Methyl ethyl ketone	PPB	10.00
METHPAR	Methyl parathion	PPB	2.00
METHTHI	Methanethiol	PPB	10.00
METHYCH	Methylene Chloride (by VOA GC/MS)	PPB	5.00
METMSUL	Methyl methanesulfonate	PPB	10.00
METPROP	2-methyl-2-(methylthio) propionaldehyde-	PPB	10.00
METZINE	Methyl hydrazine	PPB	3000.00
MNITANI	m-Nitroaniline	PPB	10.00
MOLY	Molybdenum	PPB	40.00
NAPHQUI	1,4-naphthoquinone	PPB	10.00
NAPHREA	1-naphthyl-2-thiourea	PPB	200.00
NAPHTHA	Naphthalene	PPB	10.00
NICKEL	Nickel	PPB	10.00
NICOTIN	Nicotinic acid	PPB	100.00
NITBENZ	Nitrobenzine	PPB	10.00
NITPHEN	p-Nitrophenol	PPB	10.00
NITRANI	P-nitroaniline	PPB	10.00
NITRATE	Nitrate	PPB	500.00
NITRITE	Nitrite	PPB	1000.00
NITRPYR	Nitrosopyrrolidine	PPB	10.00
NITRTOL	5-nitro-o-toluidine	PPB	10.00
NNDIEHY	N,N-diethylhydrazine	PPB	10.00
NNDIPHA	N-Nitrosodiphenylamine	PPB	10.00
NNIBUTY	N-nitrosodi-n-butylamine	PPB	10.00
NNIDIEA	N-nitrosodiethanolamine	PPB	10.00
NNIDIEY	N-nitrosodiethylamine	PPB	10.00
NNIDIME	N-nitrosodimethylamine	PPB	10.00
NNIMETH	N-nitrosomethylethylamine	PPB	10.00
NNIMORP	N-nitrosomorpholine	PPB	10.00

NNINICO	N-nitrosonornicotine	PPB	10.00
NNIPIPE	N-nitrosopiperidine	PPB	10.00
NNIURET	N-nitroso-N-methylurethane	PPB	10.00
NNIVINY	N-nitrosomethylvinylamine	PPB	10.00
ONITANI	o-Nitroaniline	PPB	10.00
OPXYLE	Xylene-o,p	PPB	5.00
OSMIUM	Osmium	PPB	300.00
OTOLHYD	O-toluidine hydrochloride	PPB	10.00
PARALDE	Paraldehyde	PPB	10000.00
PARATHI	Parathion	PPB	2.00
PBENZQU	P benzoquinone	PPB	10.00
PCDD's	Pcdd's	PPB	0.01
PCDF's	Pcdf's	PPB	0.01
PENTACH	Pentachloroethane	PPB	10.00
PENTCHB	Pentachlorobenzene	PPB	10.00
PENTCHN	Pentachloronitrobenzene	PPB	10.00
PENTCHP	Pentachlorophenol	PPB	50.00
PERCENE	Tetrachloroethylene	PPB	5.00
PERCHLO	Perchlorate	PPB	500.00
PH-LAB	pH, Laboratory Measurement		0.01
PHENANT	Phenanthrene	PPB	10.00
PHENINE	Phenylenediamine	PPB	10.00
PHENOL	Phenol	PPB	10.00
PHENREA	N-phenylthiourea	PPB	500.00
PHENTIN	Phenacetin	PPB	10.00
PHFIELD	pH, Field Measurement		0.10
PHORATE	PHORATE	PPB	2.00
PHOSPHA	Phosphate	PPB	1000.00
PHTHEST	Phthalic acid esters	PPB	10.00
PICOLIN	2-picoline	PPB	10.00
POTASUM	Potassium	PPB	100.00
PRONIDE	Pronamide	PPB	10.00
PROPCN	Propionitrile	PPB	5.00
PROPYLA	N-propylamine	PPB	10000.00
PROPYNO	2-propyn-1-ol	PPB	10000.00
PU-238	Plutonium-238	PCI/L	17.00
PU39-40	Plutonium-239/40	PCI/L	17.00
PYRENE	Pyrene	PPB	10.00
PYRIDIN	Pyridine	PPB	500.00
RADIUM	Radium	PCI/L	1.00
RESERPI	Reserpine	PPB	10.00
RESORCI	Resorcinol	PPB	10.00
RU-106	Ruthenium-106	PCI/L	172.50
SAFROL	Safrol	PPB	10.00
SELENUM	Selenium	PPB	5.00
SILICON	Silicon	PPB	50.00
SILVER	Silver	PPB	10.00
SODIUM	Sodium	PPB	200.00
SOLIDS	Total dissolved solids	MG/L	0.00
SR 90	Strontium-90	PCI/L	5.00
STRONUM	Strontium	PPB	10.00
STRYCHN	Strychnine	PPB	50.00
STYRENE	Styrene	PPB	5.00
SULFATE	Sulfate	PPB	500.00
SULFIDE	Sulfide	PPB	1000.00

SYMTRIN	Sym-trinitrobenzene	PPB	10.00
TAF	Tetrahydrofuran	PPB	10.00
TC	Total carbon	PPB	1000.00
TC-99	Technetium-99	PCI/L	15.00
TDS	Total dissolved solids		5000.00
TETEPYR	Tetraethylpyrophosphate	PPB	2.00
TETRANE	Carbon Tetrachloride by GC/MS	PPB	5.00
TETRCHB	1,2,4,5-tetrachlorobenzene	PPB	10.00
TETRCHP	2,3,4,6-tetrachlorophenol	PPB	10.00
THALIUM	Thallium	PPB	5.00
THIONOX	Thiofanox	PPB	10.00
THIOURA	Thiourea	PPB	200.00
THIURAM	Thiuram	PPB	10.00
TIN	Tin	PPB	30.00
TITAN	Titanium	PPB	60.00
TOC	Total organic carbon	PPB	2000.00
TOLUDIA	Toluenediamine	PPB	10.00
TOLUENE	Toluene	PPB	5.00
TOX	Total organic halogen	PPB	100.00
TOXAENE	Toxaphene	PPB	1.00
TOXLDL	Total Organic Halogen, Low Det. Level	PPB	10.00
TRANDCE	Trans-1,2-dichloroethene	PPB	5.00
TRCMEOL	Trichloromethanethiol	PPB	10.00
TRCMFLM	Trichloromonofluoromethane	PPB	10.00
TRCPANE	Trichloropropane	PPB	10.00
TRIBUPH	Tributylphosphoric Acid	PPB	10.00
TRICENE	Trichloroethylene	PPB	5.00
TRICHLB	1,2,4-trichlorobenzene	PPB	10.00
TRIPHOS	O,O,O-triethyl phosphorothioate	PPB	10.00
TRISPHO	Tris(2,3-dibromopropyl) phosphate	PPB	10.00
TRITIUM	Tritium	PCI/L	500.00
TURBID	Turbidity	NTU	0.10
U	Uranium	PCI/L	0.50
U-234	Uranium-234	PCI/L	0.10
U-235	Uranium-235	PCI/L	0.10
U-238	Uranium-238	PCI/L	0.10
UHALC	Unknown Halogenated Hydrocarbon	PPB	0.00
VANADUM	Vanadium	PPB	5.00
VINYIDE	Vinyl chloride	PPB	10.00
VINYLAC	Vinyl Acetate	PPB	5.00
WARFRIN	Warfarin	PPB	10.00
ZINC	Zinc	PPB	5.00
ZIRCON	Zirconium	PPB	50.00
a-BHC	Alpha-BHC	PPB	0.10
b-BHC	Beta-BHC	PPB	0.10
d-BHC	Delta-BHC	PPB	0.10
g-BHC	Gamma-BHC	PPB	0.10

APPENDIX D

SAMPLING AND ANALYSIS PLAN

CONTENTS

TABLES:

CONTENTS (cont)

TABLES (cont):

INTRODUCTION

This appendix introduces the procedures that will be used for sample collection (including well evacuation and sample withdrawal methods); chain-of-custody; analytical methods, including sampling preservation and shipment and chemical analysis; and quality assurance/quality control.

All sampling activities are performed under contract by Pacific Northwest Laboratory (PNL). The U.S. Testing Company, Incorporated, conducted sample analyses for most constituents until June 1990. Future testing will be carried out by other contract laboratories, to be determined, under contract to PNL. This sampling and analysis plan reflects the requirements in the PNL statement of work for the new contract laboratory.

SAMPLE COLLECTION PROCEDURES

The procedures for ground water sample collection, water-level measurement, and field measurements are contained in *Procedures for Groundwater Investigations* (PNL 1989a). Specific applicable procedures include the following:

- GC-1 - Groundwater Sample Collection Procedure
- GC-2 - In-Line Sample Filtration Procedure
- GC-3 - Disposal of Purgewater from Monitoring Wells
- FA-1 - Temperature Measurement Procedure
- FA-2 - Calibration of Conductivity Meter and Measurement of Field Conductivity
- FA-3 - Calibration of pH Meter and Measurement of Field pH
- WL-1 - Water-Level Measurement Procedure
- WL-2 - Procedure for Standardizing Steel Tapes
- AD-1 - Change Control Procedure
- AD-2 - Groundwater Sample Chain-of-Custody

CHAIN-OF-CUSTODY PROCEDURES

Chain-of-custody procedures are contained in *Procedures for Groundwater Investigations* (PNL 1989a). The specific applicable procedure is AD-2, the Groundwater Sample Chain-of-Custody procedure. The history of the custody of each sample will be documented according to this procedure.

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance

Quality assurance (QA) will be conducted in accordance with the PNL QA manual (PNL 1989b). A QA plan describing the manner in which specific QA requirements are to be met has been prepared in accordance with that manual.

Quality Control

The purpose of quality control (QC) is to determine and document the quality of the analytical results being produced by the laboratory and to bring potential problems with analyses to the attention of the contract laboratory for corrective actions if needed. The QC effort has two main components: (1) routine internal checks performed by the contract laboratory and (2) external checks conducted by PNL to independently evaluate contract laboratory performance. The scope of these efforts is described in the following sections.

Contract Laboratory, Internal Quality Control. Internal QC at contract laboratories will include general practices applicable to a wide range of analyses, as well as specific procedures stipulated for particular analyses and will be carried out in conformance to SW-846 (EPA 1986). The QC and QA programs at contract laboratories will be documented in a QC manual and a QA manual. The contract laboratory(s) will produce a quarterly QC report to PNL, which includes blank, matrix, spike, and surrogate data.

Contract Laboratories, External Quality Control. The PNL will use interlaboratory comparisons and replicate, blank, and blind samples to evaluate the accuracy of results from contract laboratories. The purpose and scope of each of these is as follows.

Interlaboratory comparisons using field samples are conducted to determine if the results obtained by the primary contract laboratory are comparable to those obtained from other laboratories. Comparisons are currently being conducted for anions, selected volatile organic constituents, metals, cyanide, gross alpha, gross beta, and tritium. Replicate samples from selected wells are delivered each month to four different PNL laboratories. The results from these PNL laboratories are then compared with the results from the contract laboratory. Samples sent to PNL laboratories are from the same sampling set as those analyzed in duplicate by the contract laboratory(s).

Replicate analyses of field samples are conducted to establish how much variability might be expected in the laboratory measurements performed on nearly identical samples and as a check on gross errors. Blanks for a wide range of analyses are submitted to the contract laboratory monthly to check for container, field, or laboratory contamination.

Trip (transport) and transfer blanks are submitted to the contract laboratory to determine whether environmental conditions encountered during collection and transportation of samples have affected the results obtained by analysis. One set of trip blanks and transfer blanks are submitted each sample period per sample area at the rate of at least one for 1 to 20 wells. These blanks are analyzed for volatile organic constituents.

Blind samples are submitted to the contract laboratory to estimate the bias of analytical laboratory procedures and to determine when this bias exceeds control limits. Blind standard samples, prepared by PNL, containing metals, anions, herbicides, pesticides, and volatile organic compounds have been submitted quarterly since January 1986. Most blind samples are now prepared with materials supplied by the EPA, including the previous list of analytes plus ammonium ion, cyanide, semivolatile compounds, polychlorinated biphenyls, and an expanded number of pesticides and volatile organic compounds. Samples containing constituents not available in EPA performance samples are prepared from high-quality chemicals. These include constituents from the enhanced thiourea and phosphorous pesticides, group analyses, and ethylene glycol, sulfide, perchlorate, and hydrazine dioxin.

ANALYTICAL METHODS

Tables D-1 through D-18 indicate the methods used to analyze samples. The Contractually Required Quantitation Limits (CRQL) for constituents in Tables D-1 through D-18 are at least equivalent to the applicable Practical Quantitation Limit (PQL) for that constituent. The PQL is the lowest detection level achieved during routine laboratory operations (EPA 1986).

REFERENCES

ASTM, 1990, *Annual Book of American Society for Testing and Materials Standards*, Philadelphia, Pennsylvania.

- D4327-88, "Standard Test Method for Anions in Water by Ion Chromatography," Vol. 11.01.
- D1426-89, "Standard Test Methods for Ammonia Nitrogen in Water," Vol. 11.01.
- D2579-85, "Standard Test Methods for Total and Inorganic Carbon in Water," Vol. 11.02.
- D1067-88, "Standard Test Methods for Acidity or Alkalinity in Water," Vol. 11.01.
- D1125-82, "Standard Test Methods for Electrical Conductivity and Resistivity of Water," Vol. 11.01.
- D1293-84, "Standard Test Methods for pH of Water," Vol. 11.01.

EPA, 1984, *Technical Addition to Methods for Chemical Analysis of Water and Wastes*, U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cinncinatti, Ohio.

EPA, 1986, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, 3rd Ed., EPA SW-846, U.S. Environmental Protection Agency, Washington, D.C.

PNL, 1989a, *Procedures for Groundwater Investigations*, PNL-6894, Pacific Northwest Laboratory, Richland, Washington.

PNL, 1989b, *RCRA Ground Water Monitoring Project Quality Assurance Project Plan*, PNL-7225, Rev. 0, Pacific Northwest Laboratory, Richland, Washington.

Table D-1. Metals by Inductively Coupled Plasma Spectrometry Using Method 6010 of SW-846 (EPA 1986).

Constituent	CRQL (p/b)
Antimony	200
Barium	20
Beryllium	3
Cadmium	10
Calcium	100
Chromium	20
Cobalt	20
Copper	20
Iron	20
Magnesium	100
Manganese	10
Nickel	30
Potassium	300
Silver	20
Sodium	300
Tin	100
Vanadium	30
Zinc	10

CRQL = contract required within quantitation limits
p/b = parts per billion.

Table D-2. Metals by Atomic Absorption.

Constituent	CRQL (p/b)	Method
Arsenic	5	7060 (SW-846[a])
Lead	5	7421 (SW-846[a])
Mercury	0.2	7470 (SW-846[a])
Selenium	10	7740 (SW-846[a])
Thallium	5	7841 (SW-846[a])

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-3. Anions by Ion Chromatography Using Either Method 300.0, EPA-600/4-84-017, March 1984[a], or ASTM Method D4327-88[b].

Constituent	CRQL (p/b)
Chloride[c]	2,000
Nitrate[c]	2,000
Nitrite[c]	2,000
Phosphate[c]	4,000
Chloride[d]	000
Nitrate[d]	200
Nitrite[d]	200
Phosphate[d]	400
Bromide[e]	500
Chloride[e]	200
Fluoride[e]	100
Phosphate[e]	400
Sulfate[e]	500

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1984.
[b]ASTM 1990.
[c]Preserved sample, diluted tenfold; chloride may be analyzed from a preserved sample.
[d]Preserved sample, undiluted.
[e]Unpreserved, undiluted sample.

Table D-4. Individual Inorganic Analytical Procedures.

Constituent	CRQL (p/m)	Method
Ammonium ion	100	ASTM D1426-D or D1426-C[a]
Cyanide	20	9010 (SW-846[b])
Sulfide	10,000	9030 (SW-846[b])
Hydrazine	30	ASTM D2579 A or B[a]

CRQL = contract required quantitation limits
p/b = parts per billion
p/m = parts per million
[a]ASTM 1990.
[b]EPA 1986.

Table D-5. Miscellaneous Parameters and Bacteriological Tests.

Constituent	CRQL	Method
Alkalinity	50 mg/L	ASTM D1067 A or B[a]
Conductivity	N/A	ASTM D1125-A[a]
pH	±0.05[b]	ASTM D1293[a]
Turbidity	0.1[c]	Standard Method 214A
Coliform (fermentation)	2.2[d]	9131 (SW-846[e])
Coliform (filter)	1[f]	9132 (SW-846[e])
Total dissolved solids	0.5 mg/L	Standard Method 209B

CRQL = contract required quantitation limits
[a]ASTM 1990.
[b]pH units.
[c]Nephalometric turbidity units.
[d]Maximum probable number.
[e]EPA 1986.
[f]Minimum colony count.

Table D-6. Chlorinated Herbicides by Gas Chromatography Using Method 8150 of SW-846[a].

Constituent	CRQL (p/b)
2,4-D	10
Dinoseb; DNBP	1
Silvex; 2,4,5-TP	2
2,4,5-T	2

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-7. Organophosphorus Pesticides by Gas Chromatography Using Method 8140 of SW-846[a].

Constituent	CRQL (p/b)
Disulfoton	2
Methyl	0.5
Phorate	2

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-8. Pesticides and Polychlorinated Biphenyls by Gas Chromatography Using Method 8080 of SW-846[a].

Constituent	CRQL (p/b)
Aldrin	0.05
Alpha-BHC	0.05
Beta-BHC	0.05
Delta-BHC	0.1
Gamma-BHC (Lindane)	0.05
Chlordane	0.1
4,4'-DDD	0.1
4,4'-DDE	0.05
4,4'-DDT	0.1
Dieldrin	0.05
Endosulfan I	0.1
Endosulfan II	0.05
Endosulfan sulfate	0.5
Endrin	0.1
Endrin aldehyde	0.2
Heptachlor	0.05
Heptachlor epoxide	1
Methoxychlor	2
Toxaphene	2
Polychlorinated biphenyls Aroclor 1016 Aroclor 1221 Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260	1

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-9. Volatile Organics by Gas Chromatography Using Method 8010/8020 of SW-846[a].

Constituent	CRQL (p/b)
Benzene	2
Carbon tetrachloride	1
Chloroform	0.5
p-Dichlorobenzene	2
1,1-Dichloroethane	1
1,2-Dichloroethane	0.5
Cis-1,2-dichloroethylene	1
Trans-1,2-dichloroethylene	1
Ethylbenzene	2
Methylene chloride	5
Tetrachloroethylene	0.5
Toluene	2
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethylene	1
Vinyl chloride	2
Xylene (total)	5

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-10. Volatile Organics by Gas Chromatography/Mass Spectroscopy Using Method 8240 of SW-846[a].

Constituent	CRQL (p/b)
Acetone	100
Benzene	5
Carbon tetrachloride	5
Chloroform	5
p-Dichlorobenzene	5
1,1-Dichloroethane	5
1,2-Dichloroethane	5
Trans-1,2-dichloroethylene (cis + trans)	5
Methylene chloride	5
Methyl ethyl ketone	100
4-Methyl-2-pentanone (methyl isobutyl ketone)	50
Tetrachloroethylene	5
Tetrahydrofuran	10
Toluene	5
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
Trichloroethylene	5
Vinyl chloride	10
Xylene (m)	5
Xylene (o,p)	5
Tentatively identified compounds (TICs) (EPA/NIH Database)	

CRQL = contract required quantitation limits
EPA = U.S. Environmental Protection Agency
NIH = National Institutes of Health
p/b = parts per billion
[a]EPA 1986.

Table D-11. Volatile Organics to be Analyzed for by Method 8240 of SW-846[a] When the *Resource Conservation and Recovery Act* Appendix IX List for Volatile Organics is Requested.

Constituent	CRQL (p/b)
Acetone	100
Benzene	5
Carbon tetrachloride	5
Chloroform	5
Chloroprene (2-chloro-1,3-butadiene)	5
p-Dichlorobenzene	5
1,1-Dichloroethane	5
1,2-Dichloroethane	5
Trans-1,2-dichloroethylene (cis + trans)	5
Methylene bromide	5
Methylene chloride	5
Methyl ethyl ketone	100
Methyl iodide	5
Methyl methacrylate	5
4-Methyl-2-pentanone (methyl isobutyl ketone)	50
Tetrachloroethylene	5
Tetrahydrofuran	10
Toluene	5
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
Trichloroethylene	5
Vinyl chloride	10
Xylene (m)	5
Xylene (o,p)	5
Additional targeted constituents	
Tentatively identified compounds (EPA/NIH Database)	

CRQL = contract required quantitation limits
EPA = U.S. Environmental Protection Agency
NIH = National Institute of Health
p/b = parts per billion
[a]EPA 1986.

Table D-12. Additional Targeted Constituents to be Analyzed by Gas Chromatography Using Method 8240 of SW-846[a].

Constituents	CRQL (p/b)
Acetonitrile	200
Acrolein	5
Acrylonitrile	5
Allyl chloride	100
Bromodichloromethane	5
Bromoform	5
Carbon disulfide	5
Chlorobenzene	5
Chloroethane	10
Dibromochloromethane	5
1,2-Dibromo-3-chloropropane	5
1,2-Dibromoethane	5
Trans-1,4-dichloro-2-butene	5
Dichlorodifluoromethane	5
1,1-Dichloroethylene	5
1,2-Dichloropropane	5
Cis-1,3-dichloropropene	5
Trans-1,3-dichloropropene	5
1,4-Dioxane	200
Ethylbenzene	5
Ethyl methacrylate	5
2-Hexanone	50
Isobutyl alcohol	200
Methacrylonitrile	5
Methyl bromide	10
Methyl chloride	10
Propionitrile	5
Styrene	5
1,1,1,2-Tetrachloroethane	5
1,1,2,2-Tetrachloroethane	5
Trichlorofluoromethane	5
1,2,3-Trichloropropane	5
Vinyl acetate	5

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-13. Phenols by Gas Chromatography Using Method 8040 of SW-846[a].

Constituent	CRQL (p/b)
Phenol	20

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-14. Semi-Volatile Organics by Gas Chromatography Using Method 8270 of SW-846[a].

Constituent	CRQL (p/b)
o-Cresol	10
m-Cresol	10
p-Cresol	10
Decane	10
Dodecane	10
Naphthalene	10
Pentachlorophenol	50
Phenol	10
Tetradecane	10
Tributyl phosphate	10
Tentatively identified compounds (EPA/NIH database)	-

CRQL = contract required quantitation limits
EPA = U.S. Environmental Protection Agency
NIH = National Institutes of Health
p/b = parts per billion
[a]EPA 1986.

Table D-15. Semivolatile Organics to be Analyzed by Method 8270 of SW-846[a] When the *Resource Conservation and Recovery Act Appendix IX* List for Semivolatile Organics is Requested.

Constituent	CRQL (p/b)
o-Cresol	10
m-Cresol	10
p-Cresol	10
Decane	10
Dodecane	10
Naphthalene	10
Pentachlorophenol	50
Phenol	10
Tetradecane	10
Tributyl phosphate	10
Additional targeted constituents (see Table D-16)	
Tentatively identified compounds (EPA/NIH database)	-

CRQL = contract required quantitation limits
EPA = U.S. Environmental Protection Agency
NIH = National Institutes of Health
p/b = parts per billion
[a]EPA 1986.

Table D-16. Additional targeted Constituents for Analysis by Gas Chromatography/Mass Spectroscopy Using Method 8270 of SW-846[a].
(sheet 1 of 4)

Constituent	CRQL (p/b)
Acenaphthene	10
Acenaphthylene	10
Acetophenone	10
2-Acetylaminofluorene	10
4-Aminobiphenyl	10
Aniline	10
Anthracene	10
Aramite	10
Benzo[a]anthracene	10
Benzo[b]fluoranthene	10
Benzo[k]fluoranthene	10
Benzo[ghi]perylene	10
Benzo[a]pyrene	10
Benzyl alcohol	20
Bis(2-chloroethoxy)methane	10
Bis(2-chloroethyl) ether	10
Bis(2-chloro-1-methylethyl) ether	10
Bis(2-ethylhexyl) phthalate	10
4-Bromophenyl phenyl ether	10
Butyl benzyl phthalate	10
p-Chloroaniline	20
Chlorobenzilate	10
p-Chloro-m-cresol	20
2-Chloronaphthalene	10
2-Chlorophenol	10
4-Chlorophenyl phenyl ether	10
Chrysene	10
Diallate	10
Dibenz[a,h]anthracene	10
Dibenzofuran	10

Table D-16. Additional Targeted Constituents for Analysis by Gas Chromatography/Mass Spectroscopy Using Method 8270 of SW-846[a]. (sheet 2 of 4)

Constituent	CRQL (p/b)
Di-n-butyl phthalate	10
o-Dichlorobenzene	10
m-Dichlorobenzene	10
p-Dichlorobenzene	10
3,3'-Dichlorobenzidine	20
2,4-Dichlorophenol	10
2,6-Dichlorophenol	10
Diethyl phthalate	10
O,O-Diethyl O-2-pyrazinyl phosphorothioate	10
Dimethoate	10
p-(Dimethylamino)azobenzene	10
7,12-Dimethylbenz[a]anthracene	10
3,3'-Dimethylbenzidine	10
Alpha, alpha-dimethylphenethylamine	10
2,4-Dimethylphenol	10
Dimethyl phthalate	10
m-Dinitrobenzene	10
4,6-Dinitro-o-cresol	50
2,4-Dinitrophenol	50
2,4-Dinitrotoluene	10
2,6-Dinitrotoluene	10
Di-n-octyl phthalate	10
Diphenylamine	10
Ethyl methanesulfonate	10
Famphur	10
Fluoranthene	10
Fluorene	10
Hexachlorobenzene	10
Hexachlorobutadiene	10
Hexachlorocyclopentadiene	10

Table D-16. Additional Targeted Constituents for Analysis by Gas Chromatography/Mass Spectroscopy Using Method 8270 of SW-846[a].
(sheet 3 of 4)

Constituent	CRQL (p/b)
Hexachloroethane	10
Hexachlorophene	10
Hexachloropropene	10
Indeno[1,2,3-cd]pyrene	10
Isodrin	10
Isophorone	10
Isosafrole	10
Kepone	10
Methapyrilene	10
3-Methylcholanthrene	10
Methyl methanesulfonate	10
2-Methylnaphthalene	10
1,4-Naphthoquinone	10
1-Naphthylamine	10
2-Naphthylamine	10
o-Nitroaniline	50
m-Nitroaniline	50
p-Nitroaniline	50
Nitrobenzene	10
o-Nitrophenol	10
p-Nitrophenol	50
4-Nitroquinoline-x-oxide	10
N-Nitrosodi-n-butylamine	10
N-Nitrosodiethylamine	10
N-Nitrosodimethylamine	10
N-Nitrosodiphenylamine	10
n-Nitrosodipropylamine; di-n-propylnitrosamine	10
n-Nitrosomethylethylamine	10
n-Nitrosomorpholine	10
n-Nitrosopiperidine	10

Table D-16. Additional Targeted Constituents for Analysis by Gas Chromatography/Mass Spectroscopy Using Method 8270 of SW-846[a]. (sheet 4 of 4)

Constituent	CRQL (p/b)
n-Nitrosopyrrolidine	10
5-Nitro-o-toluidine	10
Parathion	10
Pentachlorobenzene	10
Pentachloroethane	10
Pentachloronitrobenzene	10
Phenacetin	10
Phenanthrene	10
p-Phenylenediamine	10
2-Picoline (2-methyl pyridine)	10
Pronamide	10
Pyrene	10
Pyridine	10
Safrole	10
1,2,4,5-Tetrachlorobenzene	10
2,3,4,6-Tetrachlorophenol	10
Tetraethyl dithiopyrophosphate	10
o-Toluidine	10
1,2,4-Trichlorobenzene	10
2,4,5-Trichlorophenol	10
2,4,6-Trichlorophenol	10
O,O,O-Triethyl phosphorothioate	10
sym-Trinitrobenzene	10

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-17. Dioxin and Dibenzofurans by Gas Chromatography Using Method 8280 of SW-846[a].

Constituent	CRQL (p/b)
PCDDs	0.01
PCDFs	0.01
2,3,7,8-TCDD	0.005

2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
CRQL = contract required quantitation limits
PCDD = polychlorinated dibenzo-p-dioxins
PCDF = polychlorinated dibenzofurans
p/b = parts per billion
[a]EPA 1986.

Table D-18. Indicator Parameters.

Constituent	CRQL (p/b)	Method
Total carbon	2,000	ASTM D2579 A or B
Total organic carbon	1,000	Method 9060 (SW-846[a])
Total organic halides	10	Method 9020 (SW-846)

CRQL = contract required quantitation limits
p/b = parts per billion
[a]EPA 1986.

Table D-19. Radiological Parameters

Type of Analysis	MDC
Radium	1 pCi/L
Gross alpha	4 pCi/L
Gross beta	8 pCi/L
Tritium	500 pCi/L
Uranium-Natural	0.5 ug/l
Uranium-Isotopic	0.1 pCi/L
Gamma scan	20 pCi/L
Technetium-99	15 pCi/L
Iodine-129	1 pCi/L
Strontium-89, 90	5 pCi/L
Plutonium-238; Pu 239/240	0.10 pCi/L
Ruthenium-106	20 pCi/L
Americium-241	0.015 pCi/L

APPENDIX E

LOCATION SELECTION FOR 1991 WELLS

APPENDIX E

LOCATION SELECTION FOR 1991 WELLS

MONITORING DESIGN APPROACH FOR SHALLOW WELLS

Initial locations for the shallow monitoring wells were identified along the downgradient side of the A-29 Ditch near the limit of the waste management area using professional judgement. Well locations were selected based on groundwater flow direction, the locations of the interim status monitoring wells, available hydrogeologic data, and information on disposal practices within the A-29 Ditch management area. Based on these considerations, a design was developed, with new monitoring well spacings averaging on the order of 500 ft. This trial network was then refined using a simple analytical transport model (MEMO) (Golder 1990) to evaluate the 'efficiency' of the network to detect plumes.

The Monitoring Efficiency Model (MEMO) was designed specifically for the well location evaluation discussed in the following sections. When combined with professional judgement, planar and vertical flow nets, stratigraphic cross sections, and estimates of aquifer transport properties, it is an effective tool for locating monitoring wells at the Hanford Site.

MONITORING EFFICIENCY MODEL

To comply with Ecology ground water monitoring requirements, monitoring wells at dangerous waste sites are located at intervals along "hydraulically downgradient limit of the waste management area..." [WAC 173-303-645(6)(a) (Ecology 1989)], in which the area is defined as "the limit...on which waste will be placed during the active life of the regulated unit" [WAC 173-303-645(6)(b) (Ecology 1989)]. These regulations, therefore, require that monitoring wells be placed on or close to the edge of the 216-A-29 Ditch.

The hydraulically downgradient limit of a hypothetical waste management area is shown in Figure E-1 with monitoring wells located at intervals immediately downgradient. A plume developing from a continuous release at location A on the figure would be detected by the time it migrated to the vicinity of the waste management area boundary because it would have grown large enough to pass through the location of a monitoring well. However, a plume of the same size, developing from a continuous release between two monitoring wells at location B near the waste management area boundary, would not have been detected. This illustrates that releases occurring at most locations within the waste management area would be detected, but releases occurring at locations between the monitoring wells and near the downgradient boundary would be less likely to be detected within the same constraints. Given that monitoring wells always will be spaced some finite distance apart, and the uncertainties inherent in predicting the behavior of a natural geologic system, a level of uncertainty always will be present in the functioning of any ground water monitoring network design. The model developed here provides a simple way to quantify the effectiveness of a given network design.

MEMO is based on the simple concept of the generation and growth of a plume as that plume migrates downgradient from a continuous source. The model provides a map of the waste management area showing where releases would be likely and would not be detected under the known constraints assumed for the analysis. The constraints consist of the input parameters used to compute the shapes and sizes of the plumes, the hydraulic head information used to determine the direction of groundwater movement, the analytical detection limits for water samples from the monitoring wells, and the extent to which the tip of a plume will be allowed to migrate beyond the waste management area boundary before it is detected. The principal output of MEMO is the 'monitoring efficiency,' defined as the ratio of the area within the waste management area where a release likely would be detected to the total area of the waste management area. This definition assumes that development of a release is equally likely at any location within the waste management area.

An illustration of the application of MEMO is shown in Figure E-2. The model, in its simplest form, is deterministic and is manually applied. Data sets must be developed that conservatively will identify the size and shape of the plumes, the analytical detection limits, and the extent of migration into the 'buffer zone' shown in the figure. Having determined these constraints, a family of plumes of different sizes is developed, each representing the shape of the plume after traveling a known distance. An example of such a family is shown in Figure E-3.

Using successively larger plumes, points are developed on a map of the waste management area that, when connected by a smooth curve, represent the boundary between locations of releases that are likely to be detected and locations of releases that are not likely to be detected within the constraints of the method. Each point represents the location of a release where the resulting plume meets the following three criteria: (1) the edge of the plume touches one or more monitoring wells, (2) the axis of the plume is oriented in the direction of groundwater flow, and (3) the tip of the plume touches the edge of the buffer zone. Satisfying these three criteria uniquely locates the plume in space and identifies the location of the release.

The monitoring efficiency shown in example Figure E-3 is 87%. This value is lower than what normally would be desirable at an actual site and is used for illustration. The monitoring efficiency is a function of the constraints of the method and can be controlled through the spacing of the monitoring wells. Application of the model has been computerized by Golder Associates, Inc., for Westinghouse Hanford. This allows rapid, convenient application of the model to evaluate a variety of network design alternatives and perform sensitivity studies. Detailed discussions of applying MEMO, its input parameters, and the inherently conservative assumptions used in analysis of the 200 Areas on the Hanford Site are presented in Golder (1990).

Figure E-1. Illustrations of Plume Detection by Monitoring Wells.

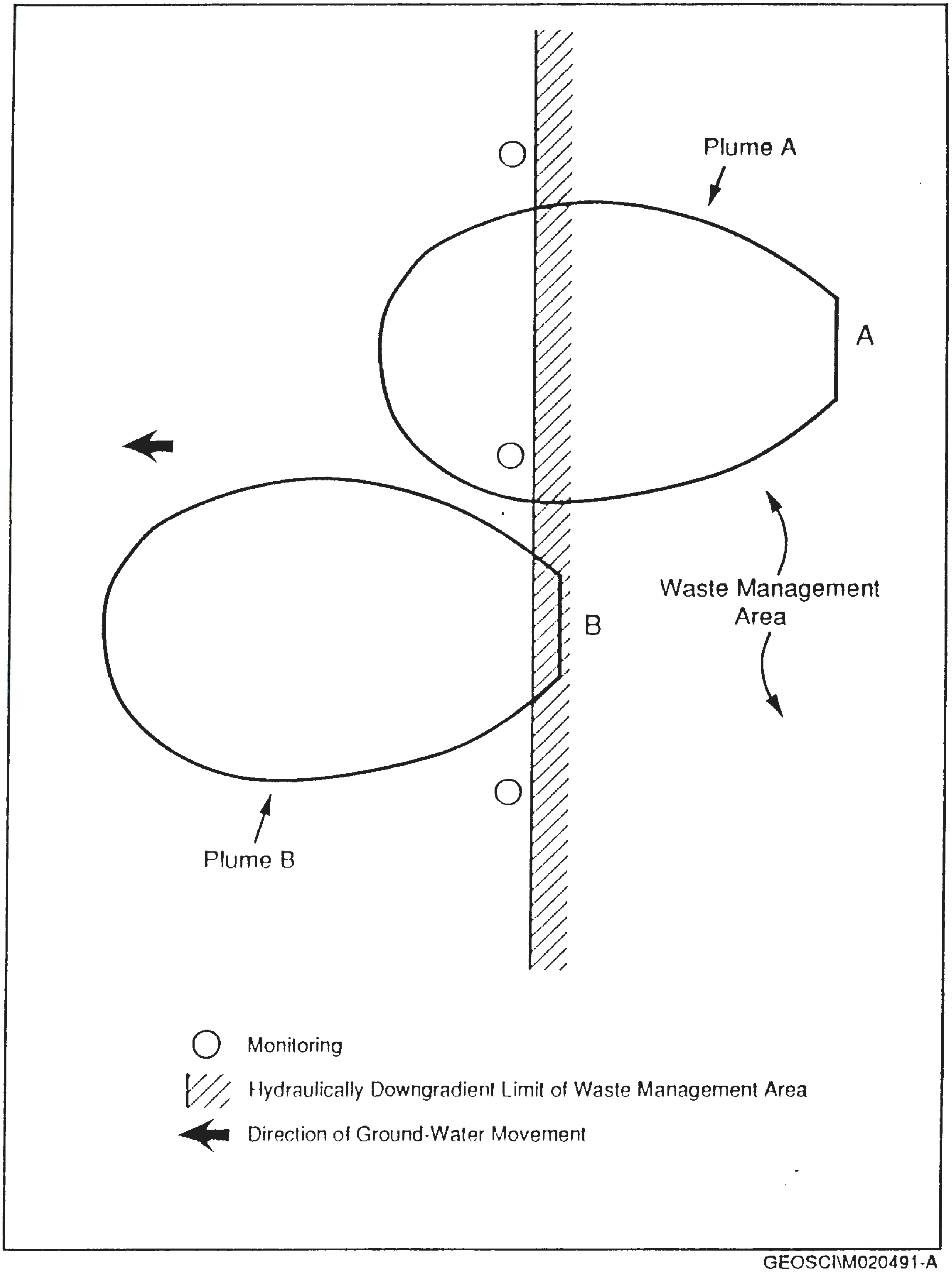


Figure E-2. Illustration of Monitoring Efficiency Model Results.

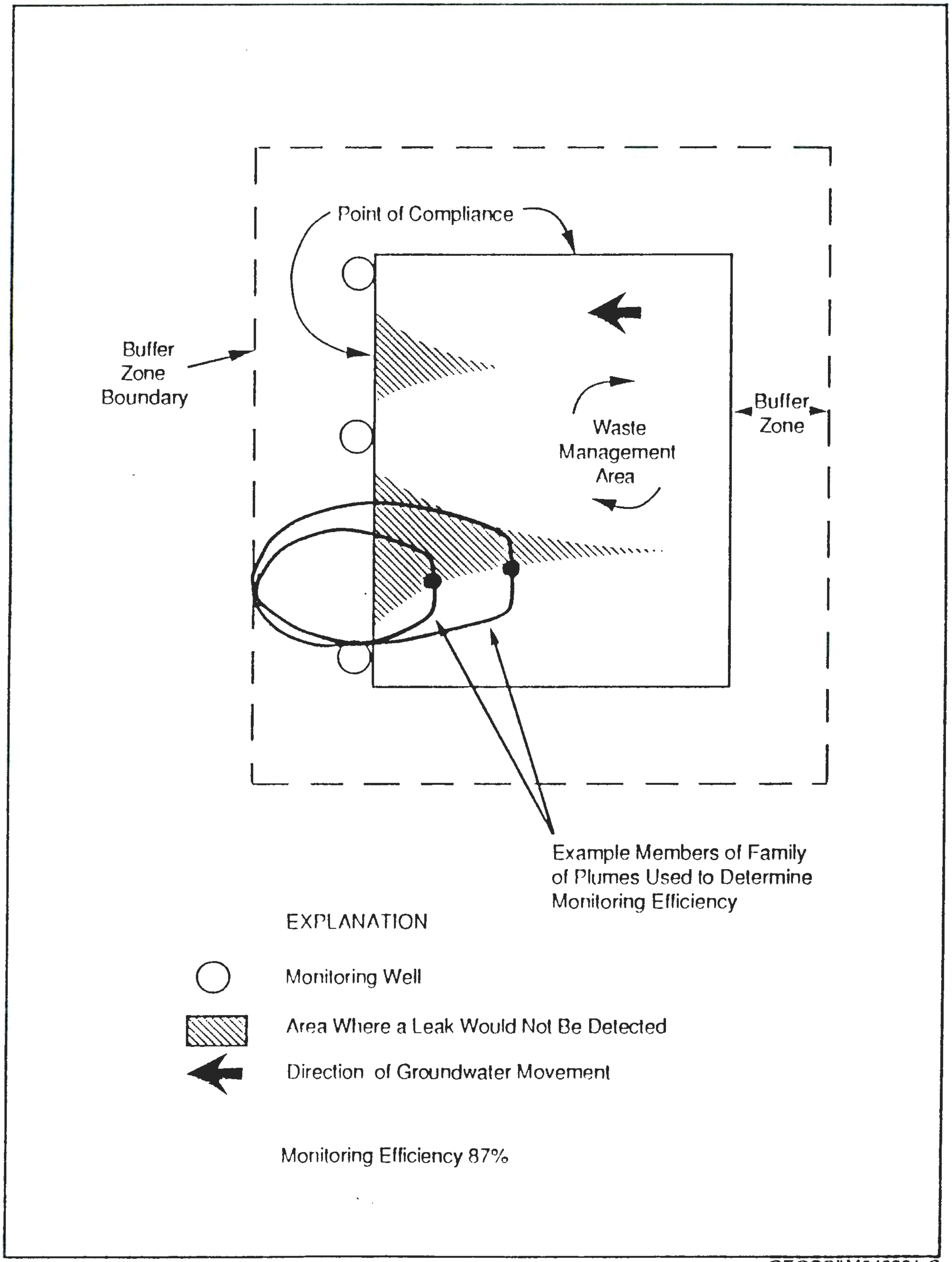


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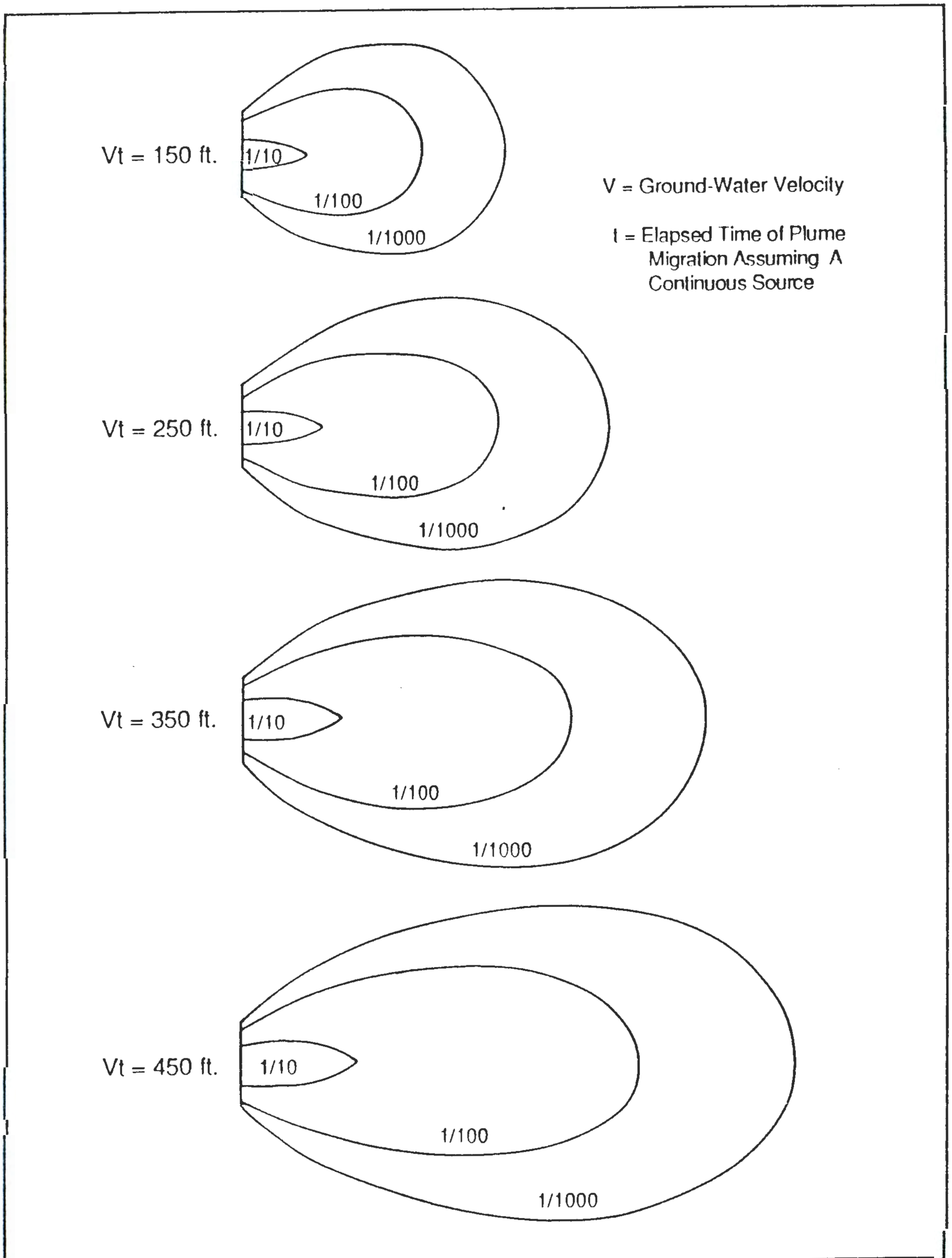
Figure E-3. Dilution Contours for a Family of Plumes.



MONITORING DESIGN FOR A-29 DITCH

Contaminant transport parameters were chosen according to the previous discussions in the appendix; values for these parameters are in Table E-1, the printout of the A-29 Ditch MEMO model file. The ground water flow was determined from the December 1990 ground water map for the 200 East Area (Figure 2-8). The current flow beneath the A-29 Ditch is S 60 W; as the ground water mound under B-Pond dissipates, ground water flow at A-29 is gradually shifting in a westerly direction. Disposal unit coordinates, buffer zone coordinates, and present monitoring well coordinates were entered into the MEMO model, resulting in a monitoring efficiency for the A-29 Ditch of 53.7% (Figure E-4). An additional four wells are planned for the A-29 Ditch monitoring network in FY 91; based on Figure E-4, at least one monitoring well is needed at the head end of the ditch, and several near western side of the lower end. Well coordinates were entered into the MEMO model and positions were adjusted until the monitoring efficiency reached 91% (Figure E-5). Ground water flow directions were then rotated 15 degrees south and 15 degrees west of the current flow direction to determine the impact of shifting flow directions on the monitoring efficiency of the 216-A-29 Ditch network. Movement 15 degrees to the south produces a monitoring efficiency of 84.9%. As contaminate plumes move at an angle nearly parallel the 216-A-29 Ditch, the efficiency of the proposed monitoring network is still quite high (Figure E-6). Movement of ground water flow 15 degrees to the west produces a monitoring efficiency of 79.0%. As flow is rotated to the west, the angle of incidence increases, which results in a drop in monitoring efficiency (Figure E-7).

Table E-1. Summary Printout of A-29 MEMO Ditch File.

```
++++++++++++++++++++++++++++++++++++++++++++
++        MEMO Version   1.1              ++
++                                        ++
++       GOLDER ASSOCIATES INC.           ++
++                                        ++
++    Run on 01/08/91 at 09:24:20         ++
++++++++++++++++++++++++++++++++++++++++++++
--------------------------------------------
< A-29 Ditch                               >
--------------------------------------------

 *   SCALE FACTOR
       1.000000


 *   GRID PARAMETERS
  -46774.000000    40559.000000       30.000000
        72             88


 *   MONITORING WELL COORDINATES
E25-26      -45884.00        40773.00
E25-34      -45517.00        41386.00
E25-35      -46539.00        40617.00
NEW #1      -46773.00        40658.00
NEW #2      -45116.00        41839.00
NEW #3      -44930.00        42252.00
NEW #4      -44903.00        42735.00
6-43-45     -44644.00        42977.00
Note: E25-28 not used as it is a deep monitoring well.


 *   CONTAMINANT TRANSPORT PARAMETERS
   1.000000E-03       70.000000        10.000000    0.000000E+00
      20.000000    0.000000E+00    1.000000E-01


 *   GRADIENT ZONE COORDINATES
   1        -47500.00        44000.00          1           210.00
   2        -44000.00        44000.00          1           210.00
   3        -44000.00        40000.00          1           210.00
   4        -47500.00        40000.00          1           210.00


 *   SOLUTION RESULTS
 Accuracy of solution      =     1.000000E-03
 Total # of source points  =     490
 # of undetected leaks     =     44
 Monitoring efficiency     =     91.0 %.
```

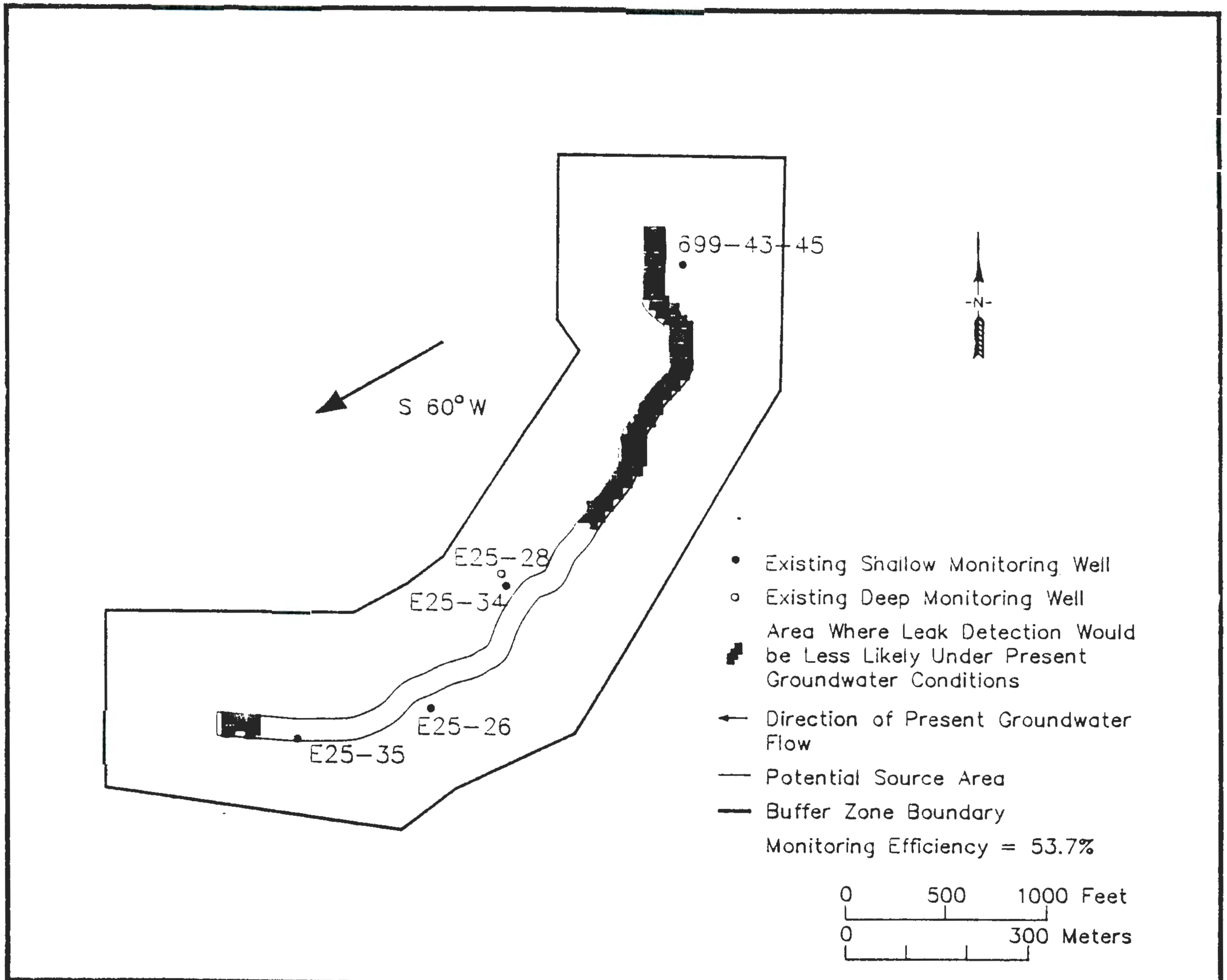


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Figure E-4. MEMO Model Results for Current Monitoring Network.

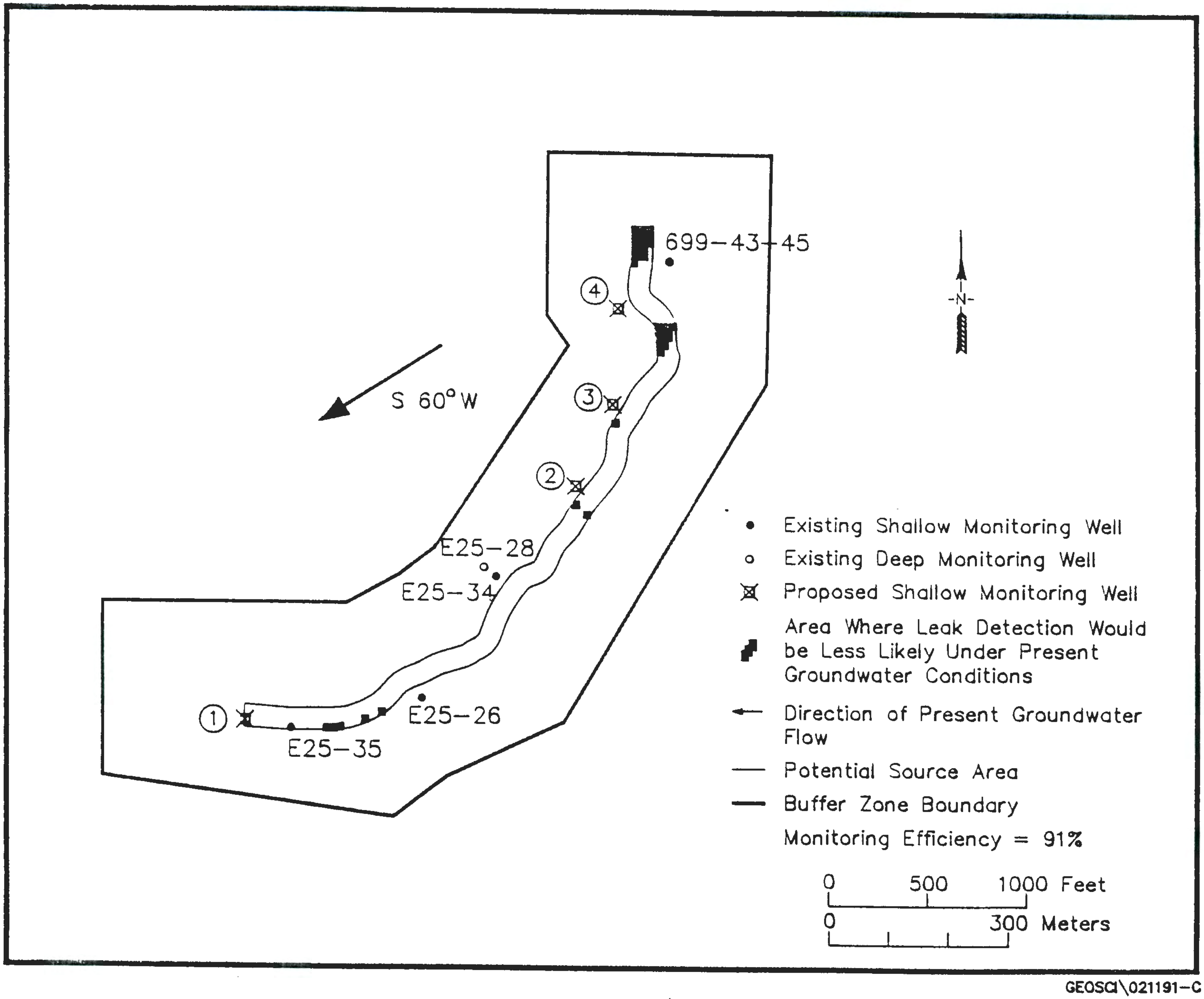

Figure E-5. MEMO Model Results for Monitoring Network and New Wells.

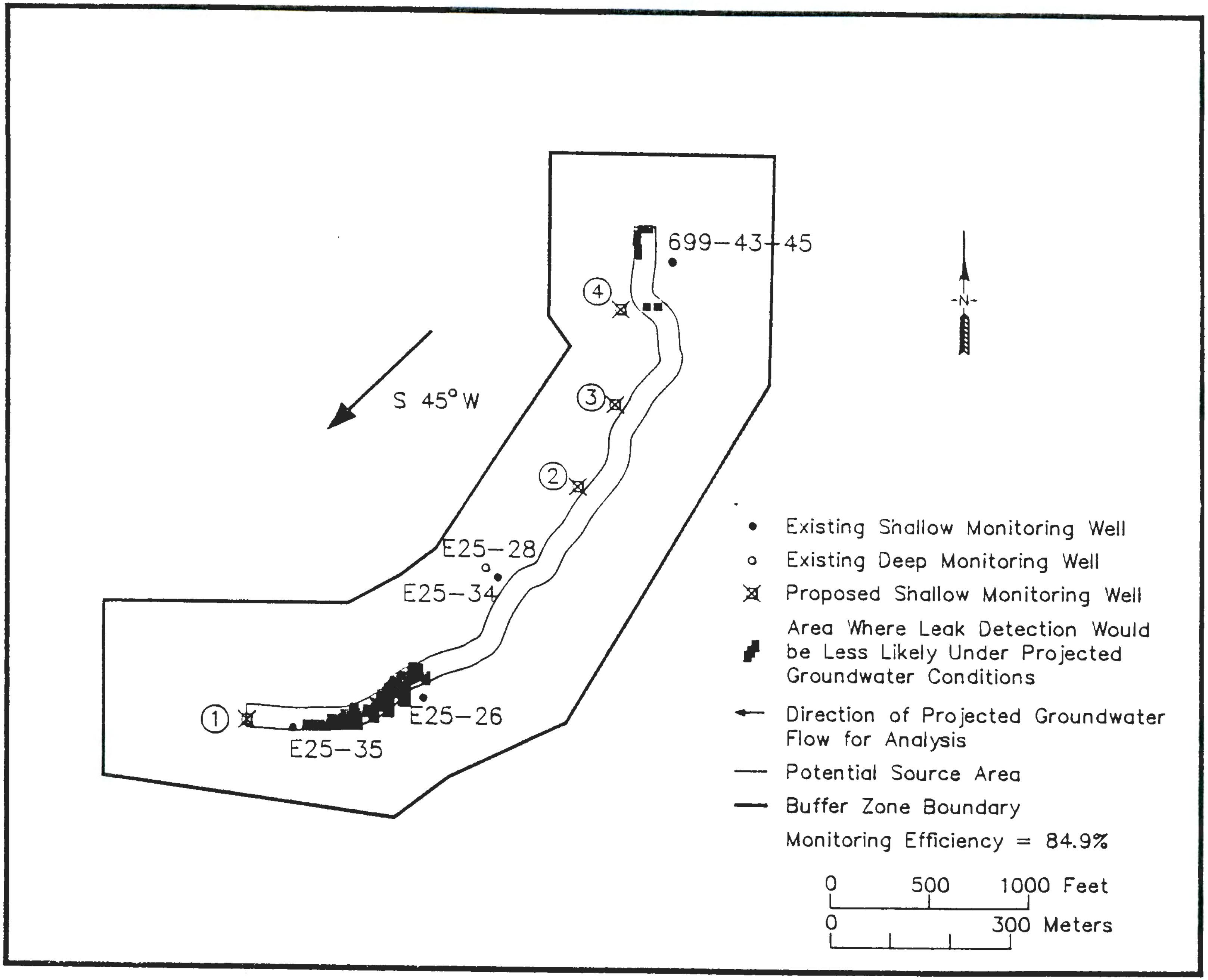

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Figure E-6. MEMO Model Sensitivity Results for 15° Southward Shift of Ground Water Flow Direction.

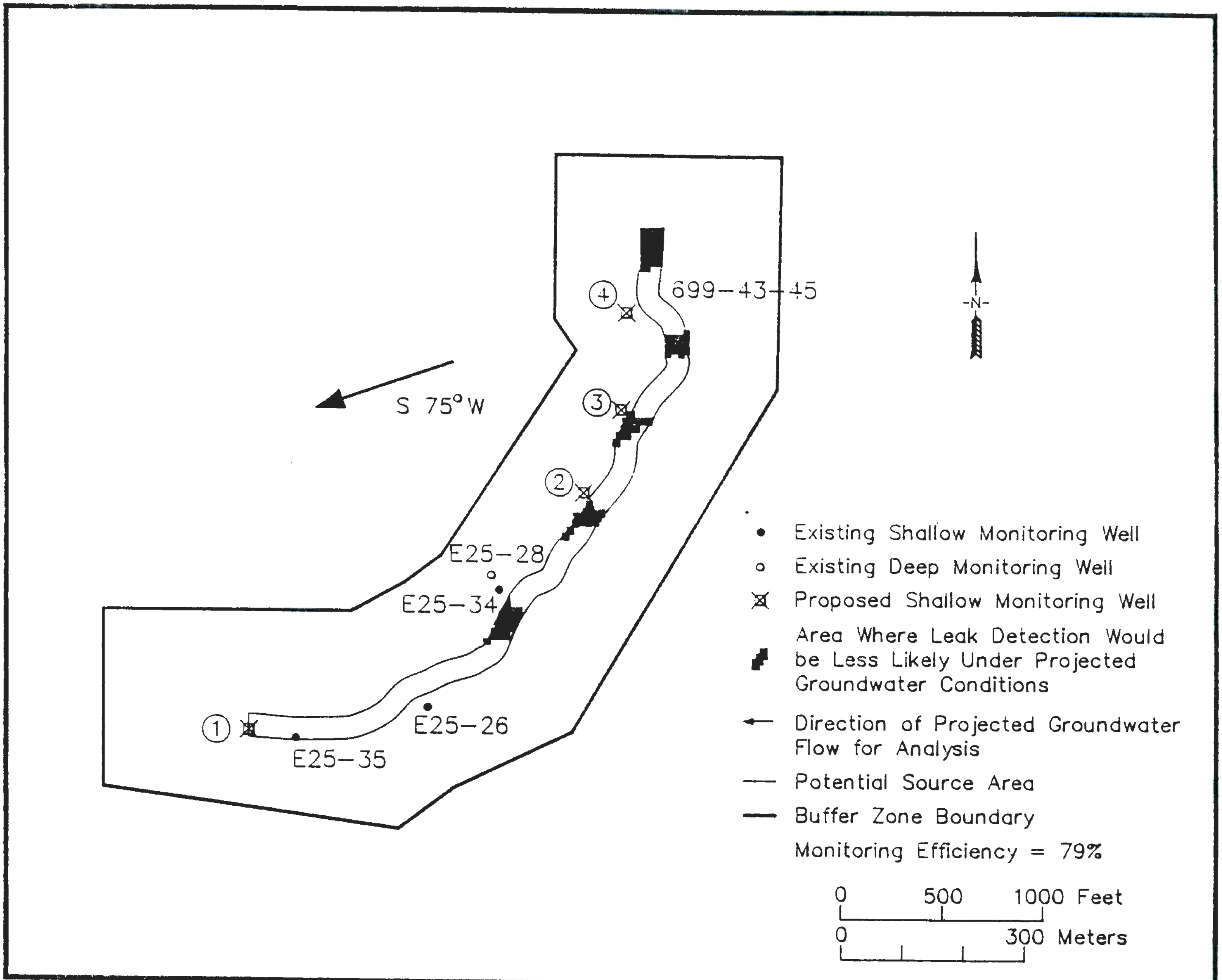

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Figure E-7. MEMO Model Sensitivity Results for 15° Northward Shift of Ground Water Flow Direction.