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RCRA GROUND-WATER MONITORING PROJECTS FOR HANFORD FACILITIES: ANNUAL PROGRESS REPORT FOR 1989

Edited by
R. M. Smith
W. R. Gorst

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Pacific Northwest Laboratory
Richland, Washington 99352

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PREFACE

The work described in this document is conducted by the Pacific Northwest Laboratory under the management of Westinghouse Hanford Company for the U.S. Department of Energy.

Concentrations of ground-water constituents are compared to federal drinking water standards throughout this document for reference purposes. All drinking water supplied from the sampled aquifer meets regulatory standards for drinking water quality.

SUMMARY

This report describes the progress during 1989 of 16 Hanford Site ground-water monitoring projects covering 25 hazardous waste facilities and 1 nonhazardous waste facility (the Solid Waste Landfill). Each of the projects is being conducted according to federal regulations based on the Resource Conservation and Recovery Act (RCRA) of 1976 (40 CFR 265 for hazardous wastes and 40 CFR 257 for nonhazardous wastes) and the State of Washington Administrative Code (WAC 173-303 for hazardous wastes and WAC 173-304 for nonhazardous wastes).

The 26 individual facilities covered are the

- 300 Area Process Trenches
- 183-H Solar Evaporation Basins
- five 200 Areas Low-Level Burial Grounds--Waste Management Area (WMA)-1, WMA-2, WMA-3, WMA-4, and WMA-5
- Nonradioactive Dangerous Waste Landfill
- Solid Waste Landfill
- 1301-N Liquid Waste Disposal Facility (LWDF)
- 1324-N/NA Surface Impoundment and Percolation Ponds
- 1325-N LWDF
- 216-A-10 Crib
- 216-A-29 Ditch
- 216-A-36B Crib
- 216-B-3 Pond
- 2101-M Pond
- Grout Treatment Facility
- seven Single-Shell Tanks Waste Management Areas--WMA-T, WMA-TY-TX, WMA-U, WMA-S-SX, WMA-B-BX-BY, WMA-A-AX, and WMA-A-C
- 216-B-63 Trench.

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Under 40 CFR 265.94(b)(2), an annual report containing the results of the assessment monitoring projects is required. Under 40 CFR 265.94(a)(2)(ii), an annual report is required that includes an evaluation of the indicator parameter results for each previous year. Under 40 CFR 265.94(a)(2)(iii), an annual report for water-level evaluation is required. An annual report for solid waste landfills is required under WAC 173-304. This report meets those requirements.

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1.0 INTRODUCTION

This report describes the calendar year 1989 progress of 16 Hanford Site ground-water monitoring projects covering 25 hazardous waste facilities and 1 nonhazardous waste facility (the Solid Waste Landfill). Each of the projects is being conducted according to federal regulations based on the Resource Conservation and Recovery Act (RCRA) of 1976 (40 CFR 265 for hazardous wastes and 40 CFR 257 for nonhazardous wastes) and the State of Washington Administrative Code (WAC 173-303 for hazardous wastes and WAC 173-304 for nonhazardous wastes). Under 40 CFR 265.94(b)(2), an annual report containing the results of the assessment monitoring projects is required. Under 40 CFR 265.94(a)(2)(ii), an annual report is required that includes an evaluation of the indicator parameter results for each previous year. Under 40 CFR 265.94(a)(2)(iii), an annual report for water-level evaluation is required. An annual report for solid waste landfills is required under WAC 173-304. This report meets those requirements.

The work described in this annual report is being conducted by the Pacific Northwest Laboratory[a] for Westinghouse Hanford Company, both contractors for the U.S. Department of Energy at the Hanford Site.

The 26 individual facilities covered are the

- 300 Area Process Trenches
- 183-H Solar Evaporation Basins (183-H Basins)
- five 200 Areas Low-Level Burial Grounds (LLBGs)--Waste Management Area (WMA)-1, WMA-2, WMA-3, WMA-4, and WMA-5
- Nonradioactive Dangerous Waste Landfill (NRDW)
- Solid Waste Landfill (SWL)
- 1301-N Liquid Waste Disposal Facility (LWDF)
- 1324-N/NA Surface Impoundment and Percolation Ponds (1324-N/NA Facilities)

(a) Pacific Northwest Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.

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- 1325-N LWDF
- 216-A-10 Crib
- 216-A-29 Ditch
- 216-A-36B Crib
- 216-B-3 Pond (B Pond)
- 2101-M Pond
- Grout Treatment Facility
- seven Single-Shell Tanks Waste Management Areas--WMA-T, WMA-TY-TX, WMA-U, WMA-S-SX, WMA-B-BX-BY, WMA-A-AX, and WMA-A-C
- 216-B-63 Trench.

The locations of these facilities on the Hanford Site are shown in Figure 1.1. All of the ground-water monitoring projects are under interim status regulations with the exception of the Solid Waste Landfill, which is regulated under 40 CFR 257 and WAC 173-304. Table 1.1 provides the status of these programs as of November 30, 1989 (data collection may have occurred for some of the projects in December, but those results are not yet available). Ground-water quality assessment projects are in progress for the 1301-N LWDF, 1324-N and 1324-NA facilities, 300 Area Process Trenches, and the 183-H Solar Evaporation Basins. Of the other projects listed in Table 1.1, the SST and 216-B-63 Trench projects and WMA-5 of the LLBG project are drilling and installing their monitoring networks; the Nonradioactive Dangerous Waste Landfill, 2101-M Pond, the 1325-N LWDF, 216-A-36B Crib, the remaining WMAs in LLBGs, and the Grout Treatment Facility are in the indicator evaluation phase of monitoring; and the remaining projects have completed the final quarter of background monitoring.

This report provides, for each of the projects, an introduction stating the status of the project and summarizing the work conducted during calendar year 1989. This is followed by evaluation of the water-level elevations available for 1989, and evaluation of the indicator parameters and the parameters for drinking water standards for the projects that have reached this phase. For comparison purposes, the Hanford Site water table map is

presented in Figure 1.2. For ground-water quality assessment projects, water-table evaluations are presented, followed by a summary of 1989 analytical results for constituents above drinking water standards and an assessment of the rate and movement of the contamination. In most cases, constituents are compared to primary drinking water standards (PDWS) in 40 CFR 141, which also includes the interim primary drinking water standards in Appendix III of 40 CFR 265. In addition, each site is monitored annually for those constituents listed in WAC 173-303-9905 for which accepted analytical techniques are available. [Within this report, reference to the long list (WAC 173-303-9905) corresponds to these constituents.] In general, data are not included in this report if they have appeared in previously published annual or quarterly reports (i.e., Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Instead, the appropriate references are given.

Where appropriate, commentaries are included to clarify past or future conduct of the projects. However, such explanations do not necessarily represent final technical consensus and are subject to modification.

QUALITY CONTROL

The objective of this task is to oversee and control the quality of the analytical data. This is done through a program of various samples including blanks, blind samples, intralaboratory, and interlaboratory analyses. The results of these tests indicate potential concerns and give comprehensive insight into the overall quality of the analytical results.

Of the quality control (QC) analyses performed during the period reported, approximately 15% were duplicate analysis results, 2% trip blanks, 2% transfer blanks, and 4% blind standard analysis results. This means that approximately 23% of analysis results were quality control data. This does not include other QC samples, such as interlaboratory analyses, that were performed.

In general, results were found to be within acceptable limits. The only recurring problems were with the organics, methyl ethyl ketone (MEK), and acetone, appearing sporadically in volatile organic analysis data at low levels, and attributed to laboratory contamination. The U.S. Environmental

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Protection Agency (EPA) Test Methods for Evaluating Solid Waste, SW-846, November 1986, Third Ed., Procedure 8240, states the Practical Quantitation Limits for acetone and MEK are both 100 ppb. This would indicate that, because of the common use of these compounds in the laboratory as solvents, values below this level may be attributed to laboratory contamination.

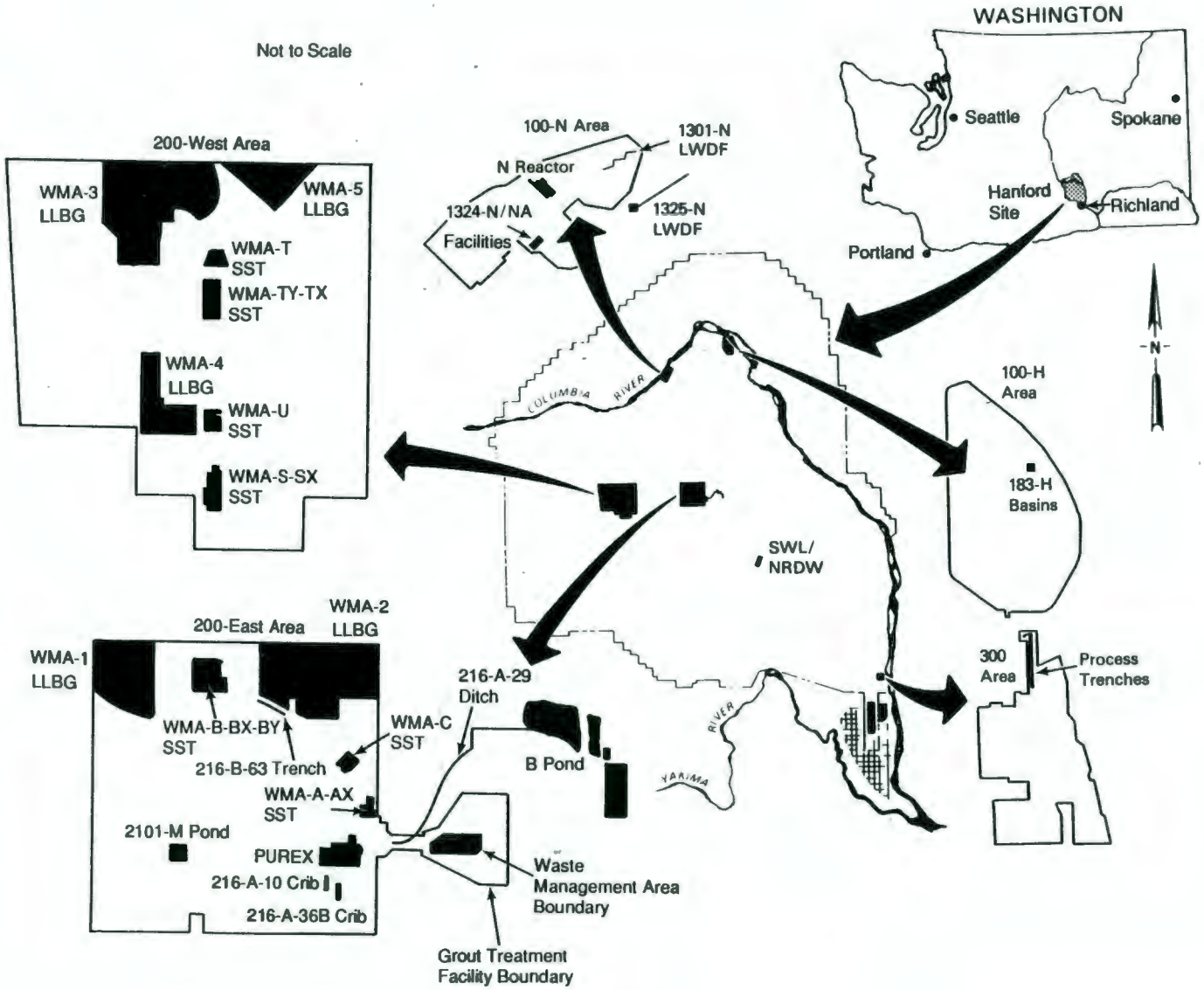

FIGURE 1.1. Map of the Hanford Site

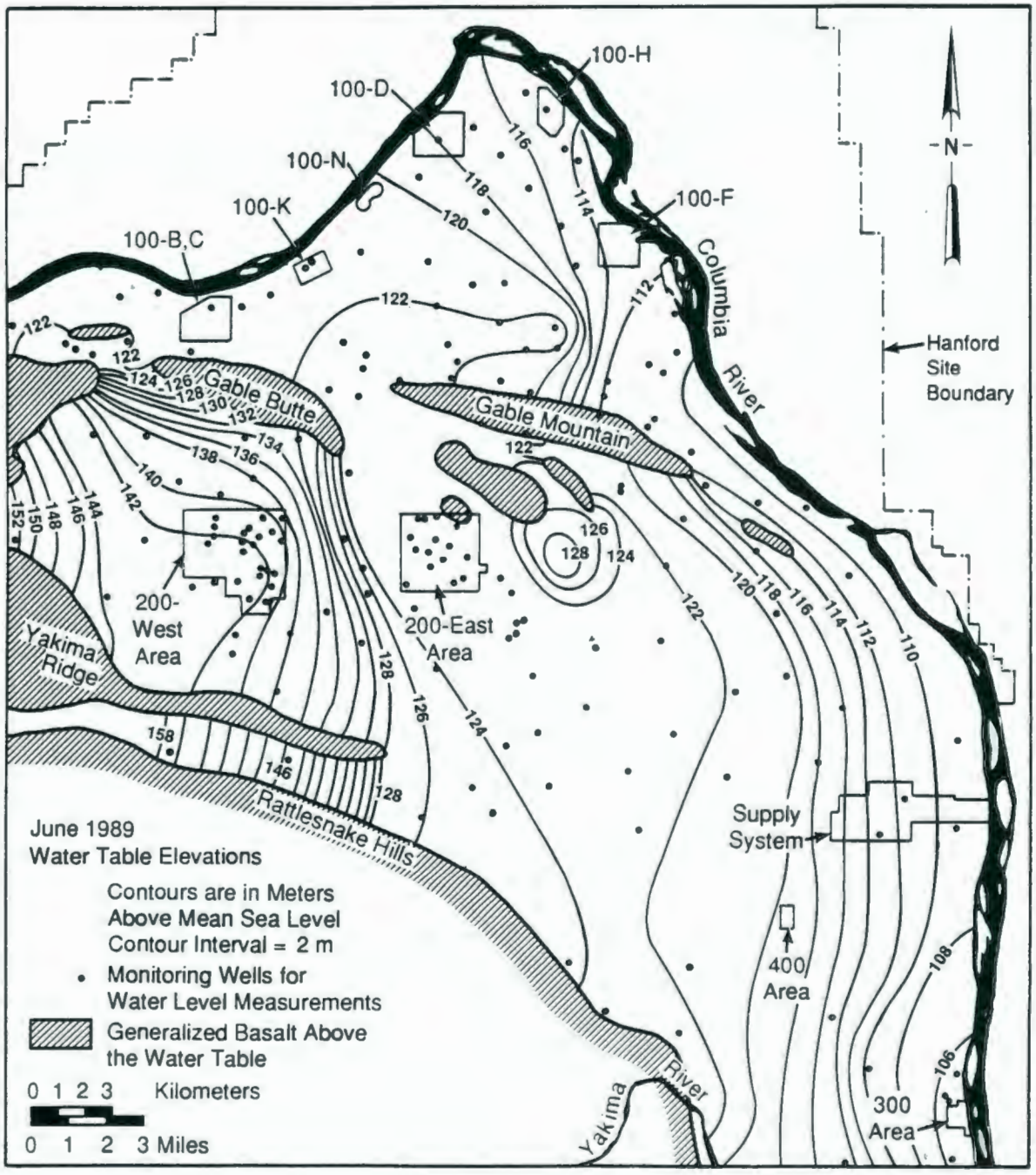

FIGURE 1.2. Hanford Site Water-Table Map, June 1989

TABLE 1.1. Status of Hanford Site Resource Conservation and Recovery Act Interim-Status Ground-Water Monitoring Projects as of November 30, 1989

Project	Background Monitoring (quarters)	Indicator Parameter Evaluation	Ground-Water Quality Assessment Monitoring
Hazardous Waste Facilities			
300 Area Process Trenches			X
183-H Solar Evaporation Basins			X
LLBG WMA-1		X	
LLBG WMA-2		X	
LLBG WMA-3		X	
LLBG WMA-4		X	
LLBG WMA-5	0[a]		
NRDW		X	
1301-N LWDF			X
1324-N/NA Facilities			X
1325-N LWDF		X	
216-A-10 Crib	4		
216-A-29 Ditch	4		
216-A-36B Crib		X	
216-B-3 Pond	4		
2101-M Pond		X	
Grout Treatment Facility		X	
Single-Shell Tanks	0[b]		
216-B-63 Trench	0[a]		
Solid Waste Facilities			
Solid Waste Landfill	12 sampling rounds completed		

(a) Wells are currently being drilled at these facilities. When all wells are completed, background monitoring will begin.
(b) Quarterly sampling will begin on 12 new wells and some existing wells in February 1990.

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2.0 300 AREA PROCESS TRENCHES

R. Schalla

The ground water near the 300 Area Process Trenches has been monitored by a RCRA interim-status ground-water quality assessment well network since June 1985. This project is currently in the ground-water quality assessment stage of monitoring. A revised ground-water monitoring plan has been prepared for this facility (Schalla 1986).

The 300 Area Process Trenches are located in the northern portion of the 300 Area. The two trenches are each 1500 ft long, 10 ft wide at the bottom, and about 34 ft wide at the top. They are unlined trenches, excavated about 12 ft into the subsurface and separated by an earthen berm. The trench bottoms are about 20 ft above the water table. Since 1975, the trenches have been used for disposal of most liquid wastes generated in the 300 Area, and are used alternately for periods of up to 8 months each. Discharge volumes gradually increased to about 3 million gal/d of waste water in 1987. This waste water consisted primarily of cooling water with small quantities of nonhazardous maintenance and process wastes. Following shutdown of fuel fabrication in February 1987, and some other operations in the 300 Area in 1988, the volume of process water has declined to approximately 1.5 million gal/d of waste water. This waste water is derived from a wide variety of 300 Area operations and typically contains small quantities of nonhazardous maintenance and process waste. The liquid wastes also contained hazardous constituents usually in very low concentrations; however, higher concentrations of hazardous constituents such as perchloroethene (PCE) have been reported (Cline et al. 1985). Administrative controls to prevent disposal of dangerous wastes to the process trenches were instituted by Westinghouse Hanford Company on February 1, 1985. Perchloroethene and its degradation isomers (i.e., trichloroethene and dichloroethene) continue to be present in a few monitoring wells downgradient of the process trenches, but no large spills affecting the process trenches have occurred since administrative controls were implemented.

In recent years, contaminants have been observed in monitoring wells that are downgradient and adjacent to the process trenches that cannot be

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attributed to another source of contamination (e.g., activities during laboratory analysis, bottle preparation, sample collection, or other 300 Area CERCLA sources). These potential releases are usually of undetermined origin, that is, it is unknown if the presence of these constituents is caused by re-mobilization of constituents adsorbed onto the soil from historical releases or by new releases.

There are currently 20 wells in the monitoring network for the process trenches. The purposes of these wells are shown in Table 2.1. Suffixes on well designations have the following meanings:

- A - completed at the top of the unconfined aquifer
- B - completed at the bottom of the unconfined aquifer
- C - completed in the upper confined aquifer
- D - completed at the bottom of the unconfined aquifer; reconfigured from a "C" completion.

The locations of these wells are shown in Figure 2.1. The locations of the 49 wells used for water-level measurements and February and November water-level contour maps and a hydrograph are shown in Figures 2.2, 2.3, and 2.4, respectively. Activities conducted during 1989 included the following:

- measurements of water-levels
- sampling and analysis of ground-water
- monitoring the changes in ground-water chemistry and water level in adjacent monitoring wells to determine the impact of abandoning well 399-1-16D.

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EVALUATION OF WATER-LEVEL ELEVATIONS

Water levels in wells near the river are highly correlated with river stage. An understanding of the rate and magnitude of water-level changes is used to predict contaminant migration pathways and rates. Therefore, in addition to the monthly water-level measurements that are made in a network of 49 wells (Figure 2.2), continuous hourly water-level monitoring is conducted at eight locations: SWS-1 and SWS-2, the two surface-water monitoring stations on the Columbia River (shown in Figure 2.2), and in six monitoring

wells (shown as solid dots in Figure 2.3). The data collected over the past year and previous years show there are three very important time scales of variability in the Columbia River: 1) daily variations associated with power production at Priest Rapids Dam; 2) weekly changes associated with power production that reflect the business cycle needs; and 3) seasonal variations associated with highly regulated discharges of the upper Columbia River system to meet irrigation, flood control, and fishery conservation goals. There is a fourth, and less important, time scale that involves the natural hydrologic cycle. The natural hydrologic variability of the river system now occurs over a period of years, and represents only a very small percentage of the variability in river stages. Although daily cycles can have some impact on pathways and travel times near the river, the effect is attenuated substantially 0.5 mi inland as exhibited in well 399-1-18 (Figure 2.4).

The southerly flow of ground water and the gentle hydraulic gradient (only 0.75 ft/mi in Figure 2.2) represent a flow pattern that is not typical for the unconfined aquifer. Based on hydrographs from the continuous water level wells and river stations, this gentle, southerly flow was caused by a rise in river stage and probably persisted for only a few days in early February. The gradient in the river at this time was slightly greater (approximately 1 ft/mi) than the average gradient in the unconfined aquifer. Such short-term conditions are caused by the high and rapid rise in river stage that resulted in surface water flow into the river bank (unconfined aquifer) and created the appearance of a no-flow boundary at the river's edge. Although patterns similar to this one occur continuously for several weeks in the spring every year, water level contour patterns are most like the one shown in Figure 2.3 most of the year. The flow pattern shown for August is typical for most of the summer and fall, and parts of the winter seasons.

Leakage around broken casing in well 399-1-16D is believed to have caused communication between the unconfined and confined aquifer. A review of the events during construction of well 399-1-16D and adjacent well 399-1-16C and the water level hydrographs (Figure 2.5) indicate that well 399-1-16D is the likely cause of hydraulic intercommunication between the aquifers. Water levels in well 399-1-16C indicate that hydraulic

9 2 1 2 6 4 2 1 9 7 1

interconnection between the confined and unconfined aquifers shown in Figure 2.6 occurred some time after January 14, 1987. By July 1988, the water level in well 399-1-9 (located adjacent to well 399-1-7 and completed in the upper confined aquifer), which is 292 ft from well 399-1-16D began to decline steadily (Figure 2.5). Apparently, the cone of depression, which is a depression of the piezometric surface with the lowest elevation at well 399-1-16D, had extended its radius to encompass well 399-1-9 by July 1988 (Figure 2.7). In the last few months of 1989 the water level in this distant well had ceased declining. This may mean that the cone of depression has expanded to a point where it is in equilibrium or that a more transmissive portion of the confined aquifer has caused equilibration and as a consequence the water level has stabilized. To date, water levels have not declined in well 399-1-17C (Figure 2.5).

9 2 1 2 6 4 2 1 9 7 2

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

This is a ground-water quality assessment project that, since June 1985, has monitored the contaminants from process water and other sources discharged to the trenches. The impact of trench operation on ground-water quality has also been assessed since 1985, and the monitoring system has been continually upgraded for more effective monitoring. Highlights for the year of 1989 are summarized below.

- The number of wells and the frequency of sampling in the quarterly monitoring network was reduced in the fourth quarter of 1989.
- Gross alpha exceeded the EPA National Primary Drinking Water Regulations of 15 pCi/L in several wells near the process trenches including well 399-1-17A. This high value in well 399-1-17A is caused primarily by uranium.
- Uranium concentrations are exhibiting a pattern of seasonal variation that has existed since cessation of fuel fabrication operations in February 1987.
- Coliform exceeded the EPA National Drinking Water Regulations of 1 per 100 mL in one sample this year.
- Ruthenium-106 exceeded the National Interim Primary Drinking Water Regulations of 30 pCi/L in two samples in December 1989.

- Small quantities of methylene chloride, methyl ethyl ketone (MEK), and acetone were detected this year, but laboratory data indicate that their presence in the samples was the result of contamination in the laboratory.

This year the 27-well quarterly network was reduced to 20 wells (see Figure 2.1), which will be sampled semiannually in FY 1990 including the sampling completed in December 1989. The 7 wells eliminated from the previous 27-well monitoring network are 399-1-19, 399-1-16C, 399-1-17C, 399-1-18B, 399-8-2, 399-8-3, and 399-2-2 (see Figure 2.1). Wells in the 27-well and 20-well networks and their purposes and reasons for elimination from the network are shown in Tables 2.1 and 2.2.

Only one (well 399-1-17A) of the four wells that were sampled biweekly January through September was sampled in the last three months of 1989; however, this well will be sampled weekly in 1990. Sampling of this single well represents the minimum requirement for detecting significant releases of contaminants of concern from the process trenches. Effluent monitoring of the process waste stream does not monitor all of the constituents that were previously released to the process trenches. Therefore, ground-water monitoring of the water released to the process trenches is conducted on a weekly basis, primarily to detect volatile organic constituents.

An annual cycle for uranium has developed since cessation of the fuel fabrication activities in February 1987. In well 399-1-17A the highest concentration of uranium occurs in early May and the lowest in October. A similar pattern occurs in well 399-1-11 except the annual low occurs during July through October and the peak concentration occurs in February (Figure 2.8). Well 399-1-19 also has a similar pattern to well 399-1-17A for its low in October, but it has several peaks occurring from January through March. The reason for the annual cyclic variation in uranium is unknown, but may be related to changes in water level elevations near the process trenches. The differences in occurrences of peak and low concentrations between wells appear to be related to the location of each well in relation to the process trenches and the seasonal cycles in river stage and ground-water flow direction. For example, the highest concentrations of uranium appear in wells 399-1-11 and 399-1-19 before well 399-1-17A probably because

9 2 1 2 6 4 2 1 9 7 3

of their proximity to the process trenches. The highest concentrations occur later in well 399-1-17A during the spring high river stage in April and May when ground-water flow is southward from the process trenches toward well 399-1-17A. Also, the lowest concentrations occur gradually from July through October with all of the wells usually reaching their lowest concentration in October when ground-water flow is to the east and southeast.

Chloroform in well 399-1-17A near the trenches exhibited typical seasonal (autumn) decline in its concentrations. Other monitored constituents showed no significant changes from previous results or seasonal patterns. Chloroform is consistently found in most wells near the process trenches. Trichloroethene (TCE) is consistently found in well 399-1-16B in the lower portion of the unconfined aquifer, and 1,2-dichloroethene (DCE) is consistently found in wells 399-1-16B and 399-1-17B.

Concentrations Above Primary Drinking Water Standards

As in previous years, coliform exceeded the EPA National Drinking Water Standard of 1 per 100 mL in one sample this year (well 399-1-3).

Trichloroethene (TCE), with a maximum contaminant level (MCL) of 5 ppb, was found in well 399-1-16B in the lower portion of the unconfined aquifer to be consistently above 13 ppb and as high as 24 ppb. During abandonment of well 399-1-16D, TCE was detected at concentrations ranging from 15 to 33 ppb in well 399-1-16C, which is screened in the confined aquifer (Figure 2.9). Because of the addition of drilling fluids introduced into the well during abandonment, the hydraulic head in the unconfined aquifer was greater than the confined, and TCE contaminated water was driven into the confined aquifer. Historically, this gradient reversal has also occurred during periods of high river stage and during well purging.

Dichloroethene (DCE) is consistently found in wells 399-1-16B and 399-1-17B; however, concentrations in well 399-1-17B are only around 10 ppb, whereas well 399-1-16B has been consistently above the MCL of 70 ppb (Figure 2.10). During abandonment of well 399-1-16D, DCE was also found in well 399-1-16C at concentrations consistently above the contractual detection limits of 10 and 5, but never above the MCL (Figure 2.10). A summary of abandonment activities for well 399-1-16D is presented in Table 2.3.

9 2 1 2 6 4 2 1 9 7 4

Rate of Migration of Contaminants

The rate and extent of migration of uranium have been previously reported in Hall (1988), and the two distinct sources of uranium in Fruland and Lundgren (1989). Trichloroethene and DCE are below the MCLs in the upper portion of the unconfined aquifer, while both are now consistently above the MCLs in the bottom portion of the unconfined aquifer in the vicinity of well 399-1-16B. The flow rate in the top of the unconfined aquifer is believed to be about 35 ft/d, but the rate of migration in the bottom of the unconfined aquifer is unknown. For all constituents originating from the process trenches, the data collected during the past year have not changed our understanding of their temporal or spatial variation, the data have only confirmed our understanding of declines, or annual concentration cycles. The current monitoring program will no longer be needed to produce confirmatory data after February 1990 because of completion of the second year of the annual cycle for uranium. Cycles for other constituents were completed in June 1989 for periods of 2 to 4 years with either no significant change in concentration patterns from year to year, or concentrations that have declined below or near the detection limit. Detection monitoring using well 399-1-17A should be discontinued if an adequate effluent monitoring system can be completed that will include volatile organic constituents. The monitoring network should be reduced to regulatory minimums of one well upgradient and three downgradient for semiannual sampling. This minimal network could be used to confirm that historical patterns for each constituent are continuing. A final characterization report could now be prepared summarizing and interpreting all of the historical data patterns for both the hydrology and chemistry of the 300 Area.

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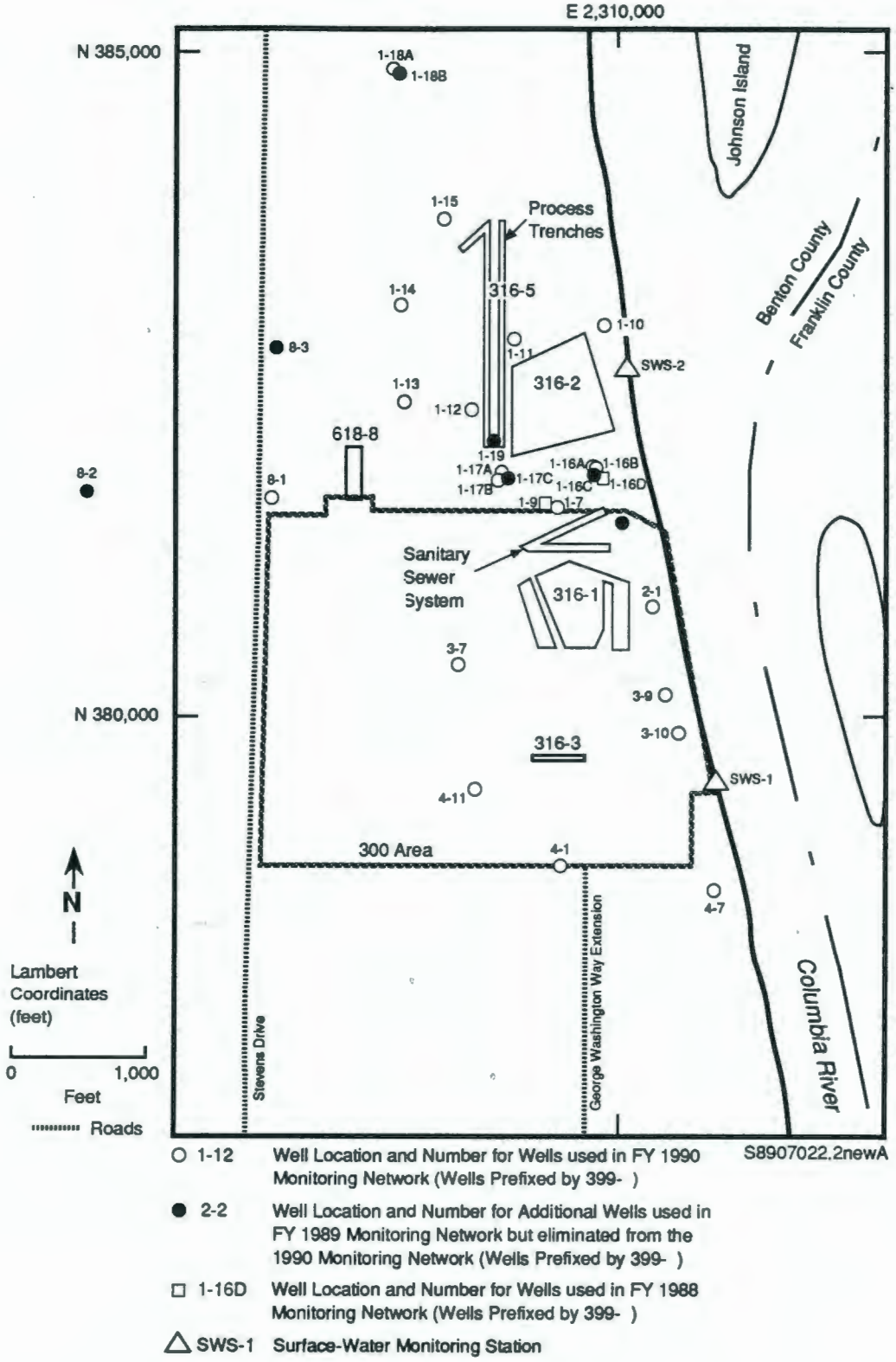

FIGURE 2.1. Locations of Monitoring Wells Used in CY 1988 and 1989 for the 300 Area Process Trenches

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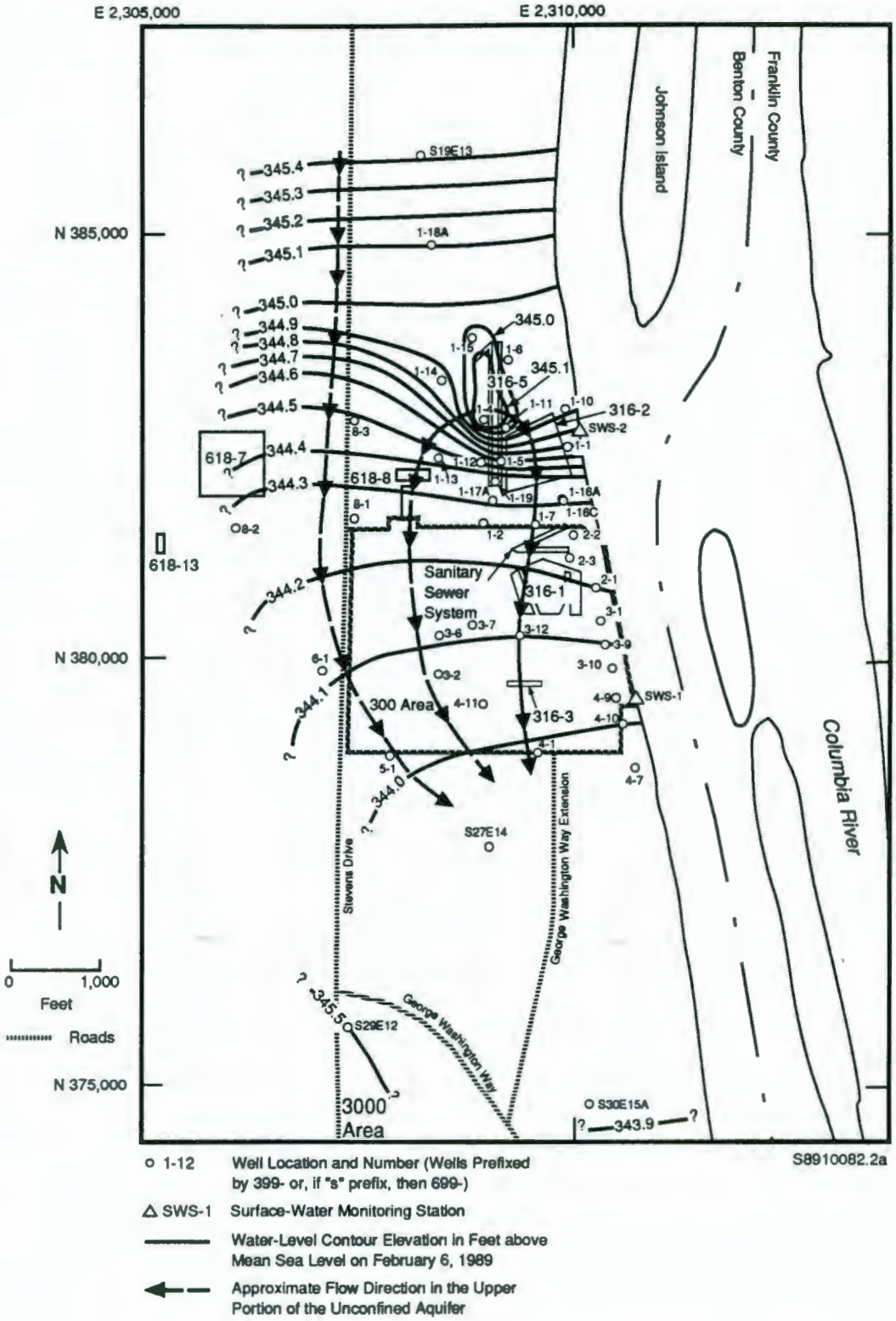

FIGURE 2.2. Water-Level Well Locations and Ground-Water Flow Pattern Near the 300 Area Process Trenches (February 1989)

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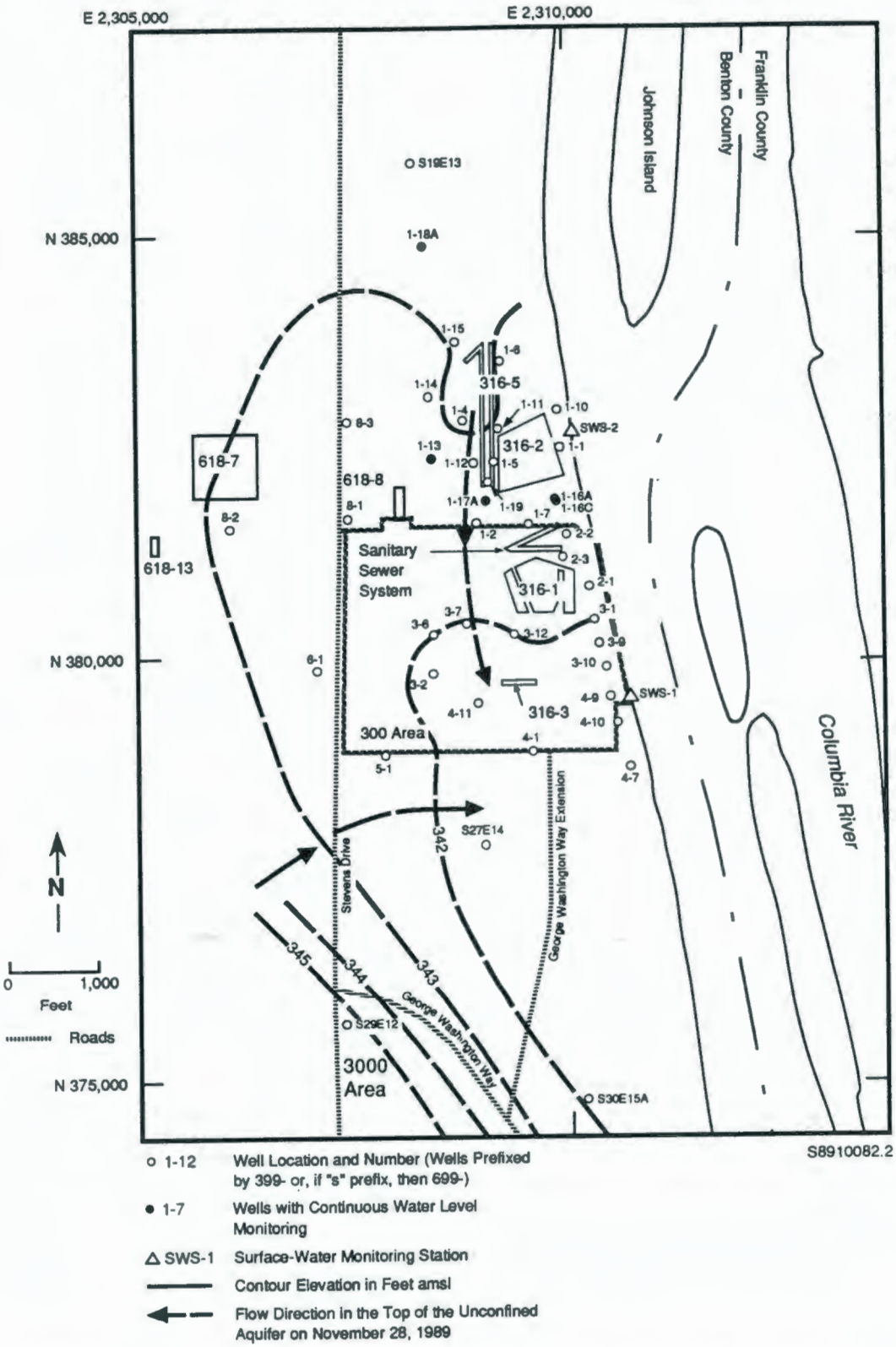

FIGURE 2.3. Water Levels and Ground-Water Flow Pattern in the Top of the Unconfined Aquifer, November 1989

9 2 1 2 6 4 2 1 9 7 8

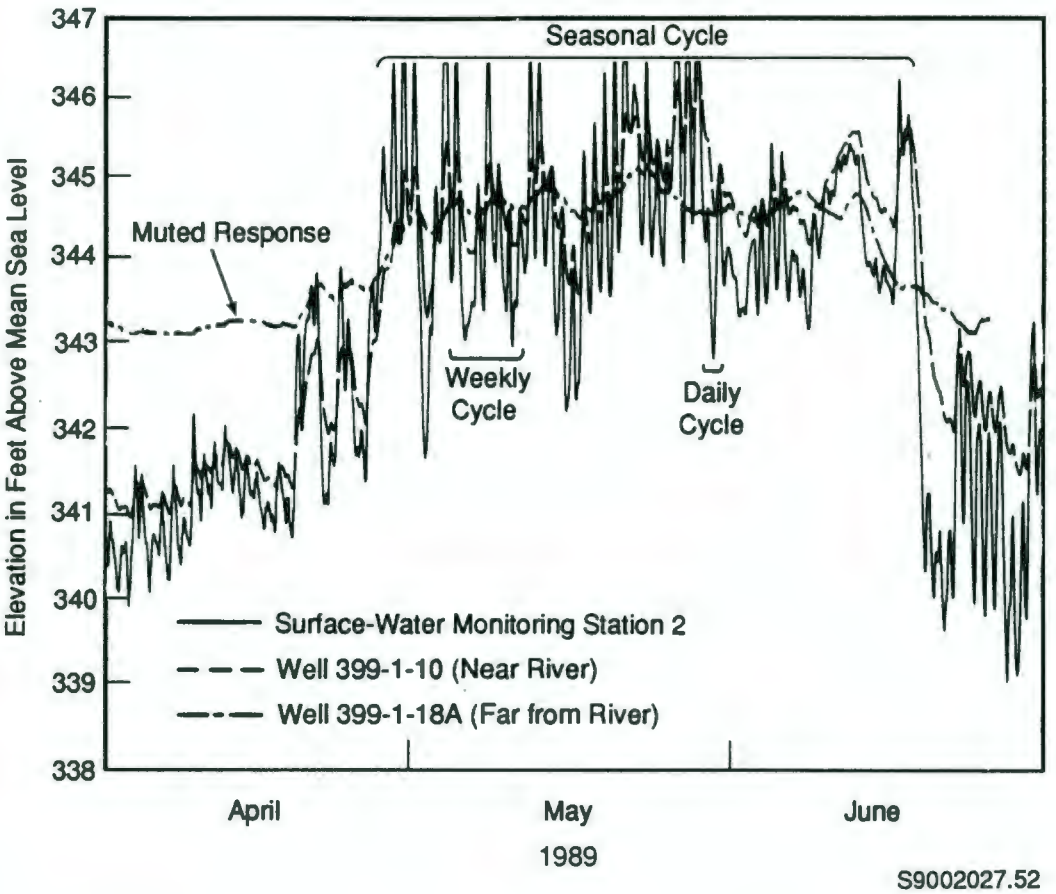

FIGURE 2.4. Hydrograph of Water-Level Elevations for the 300 Area Process Trenches, April Through June 1989

9 2 1 2 5 4 2 1 9 7 9

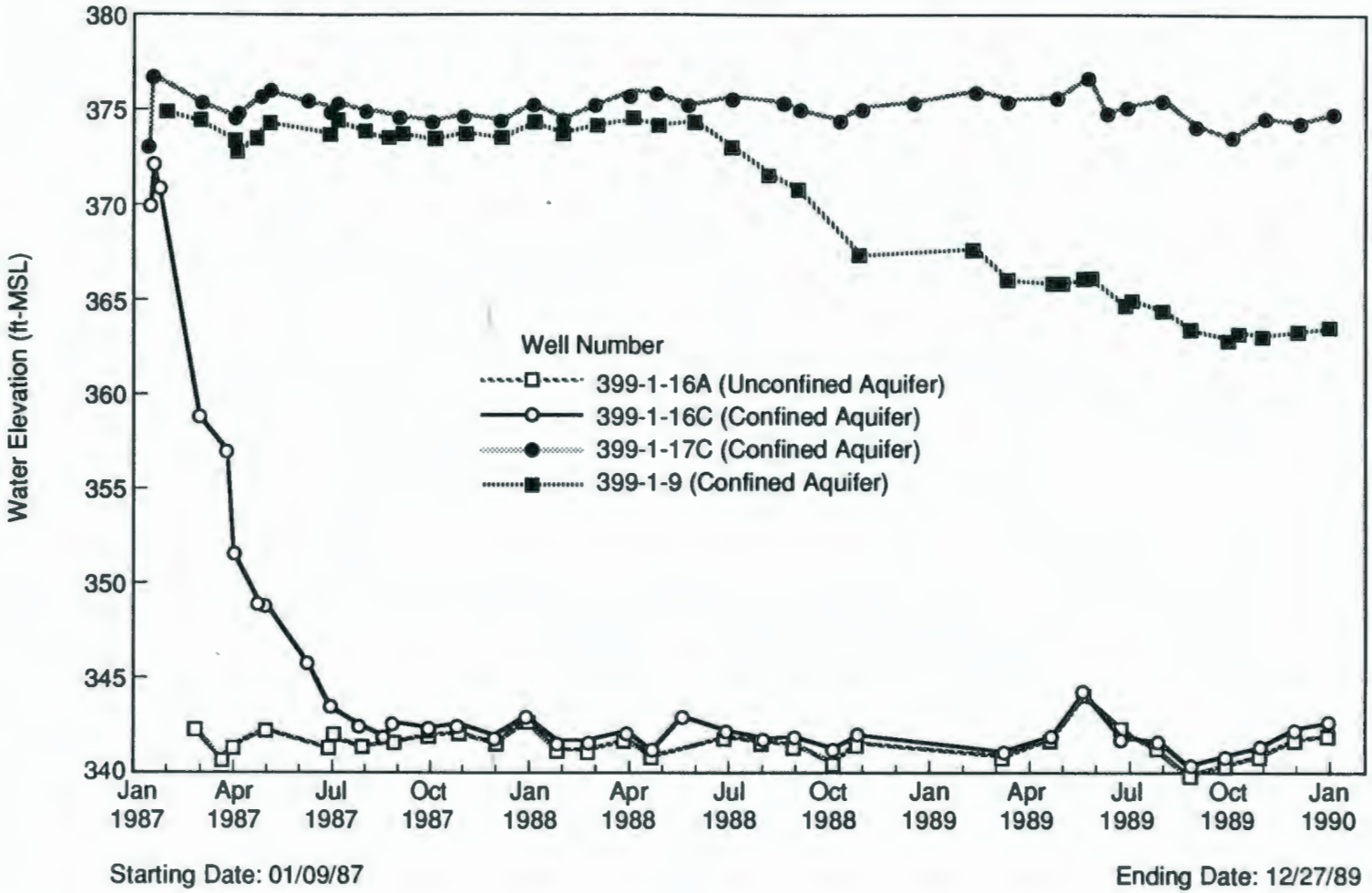

FIGURE 2.5. Water Levels in Wells 399-1-9, 399-1-16A, 399-1-16C, and 399-1-17C, January 1987 Through December 1989

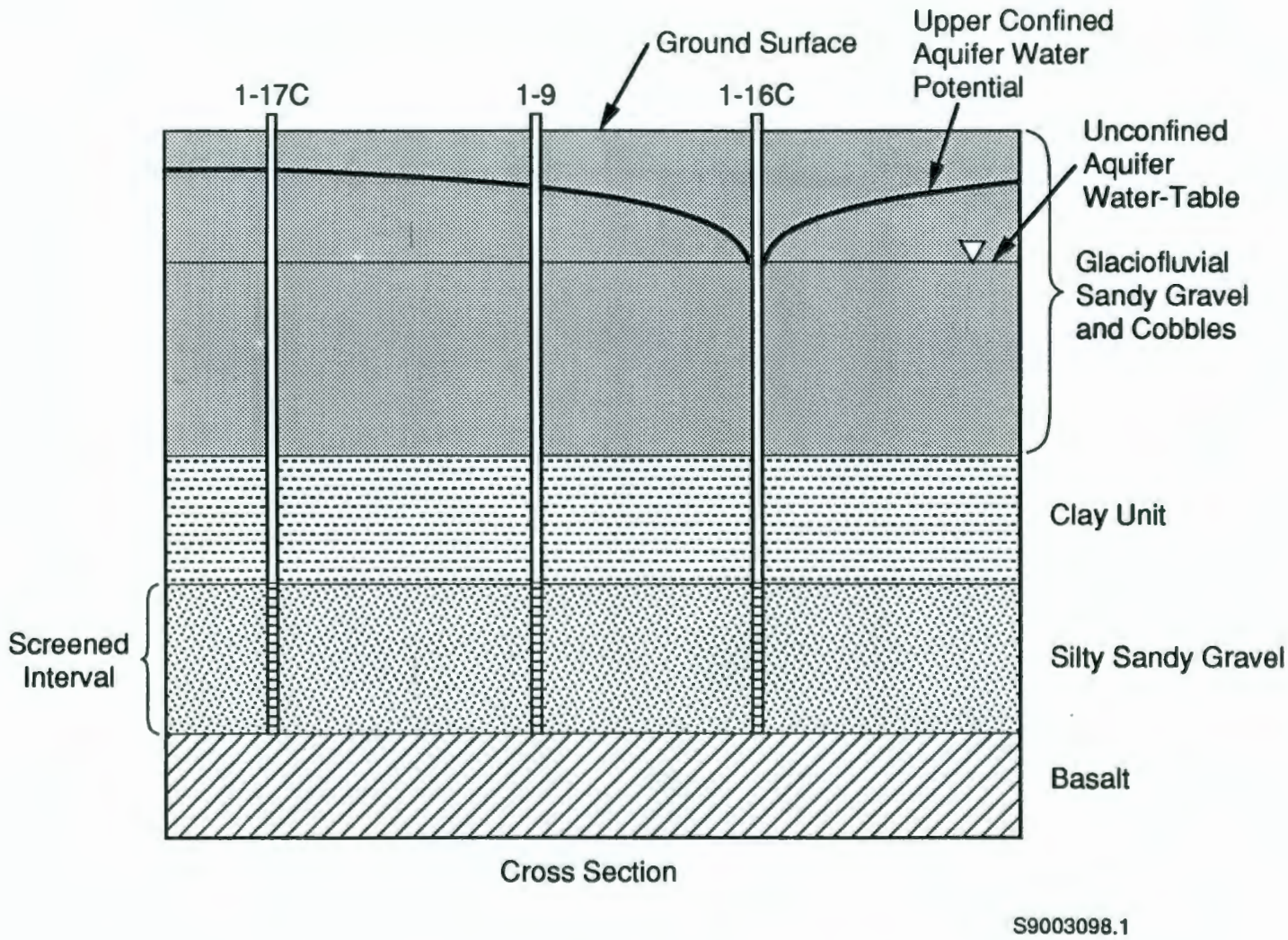

FIGURE 2.6. Schematic Cross Section of the Cone of Depression in the Confined Aquifer Showing Hydraulic Interconnection of the Confined and Unconfined Aquifers

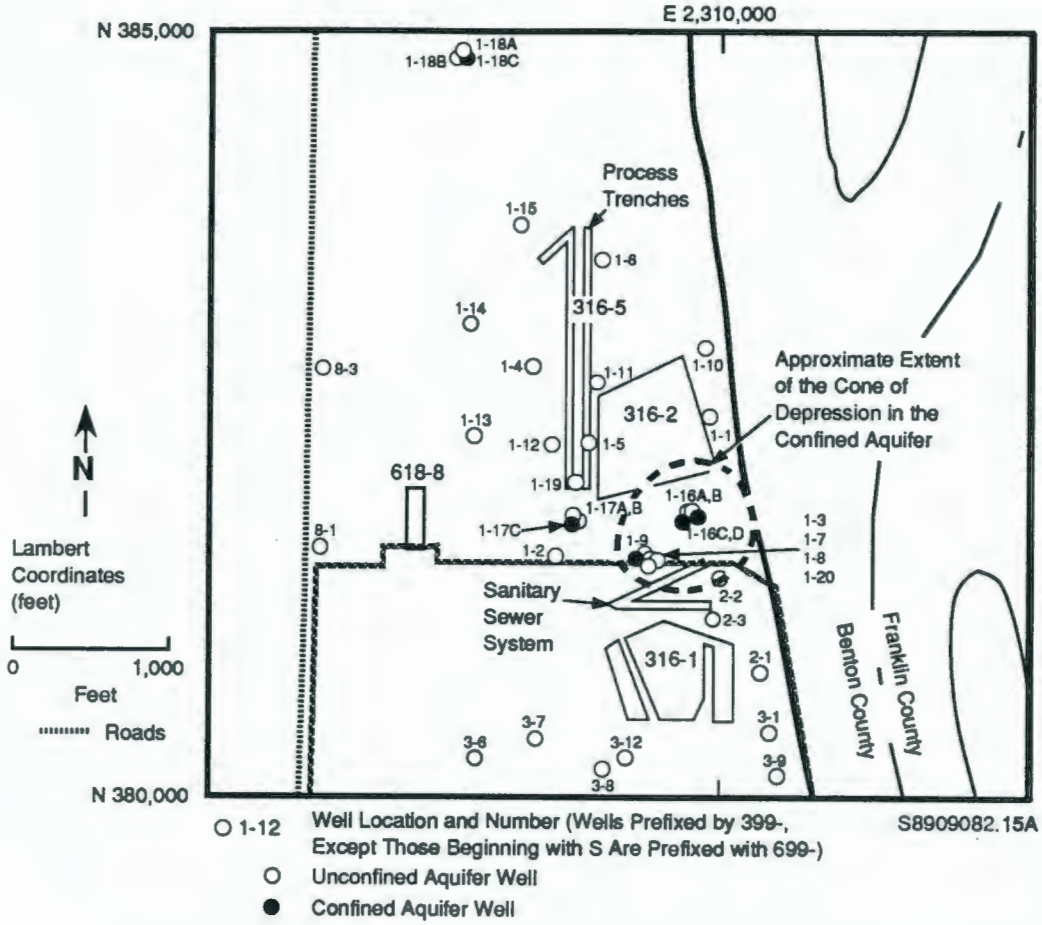

FIGURE 2.7. Extent of the Cone of Depression in the Confined Aquifer by December 1989

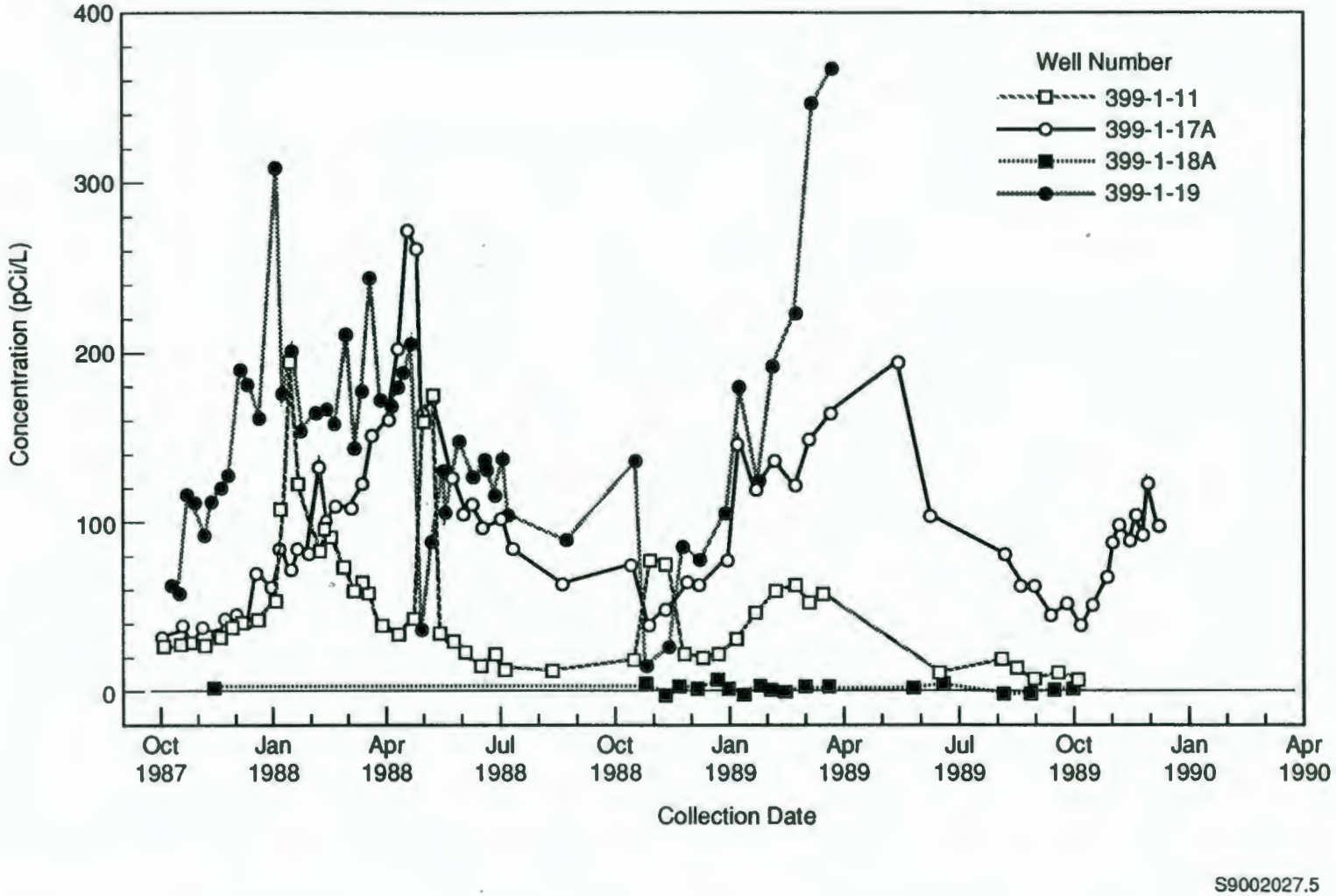

FIGURE 2.8. Uranium Concentrations in pCi/L in Wells 399-1-11, 399-1-17A, 399-1-18A, and 399-1-19. (Plotting symbols are abbreviations of wells names. Horizontal solid line is contractual detection level.)

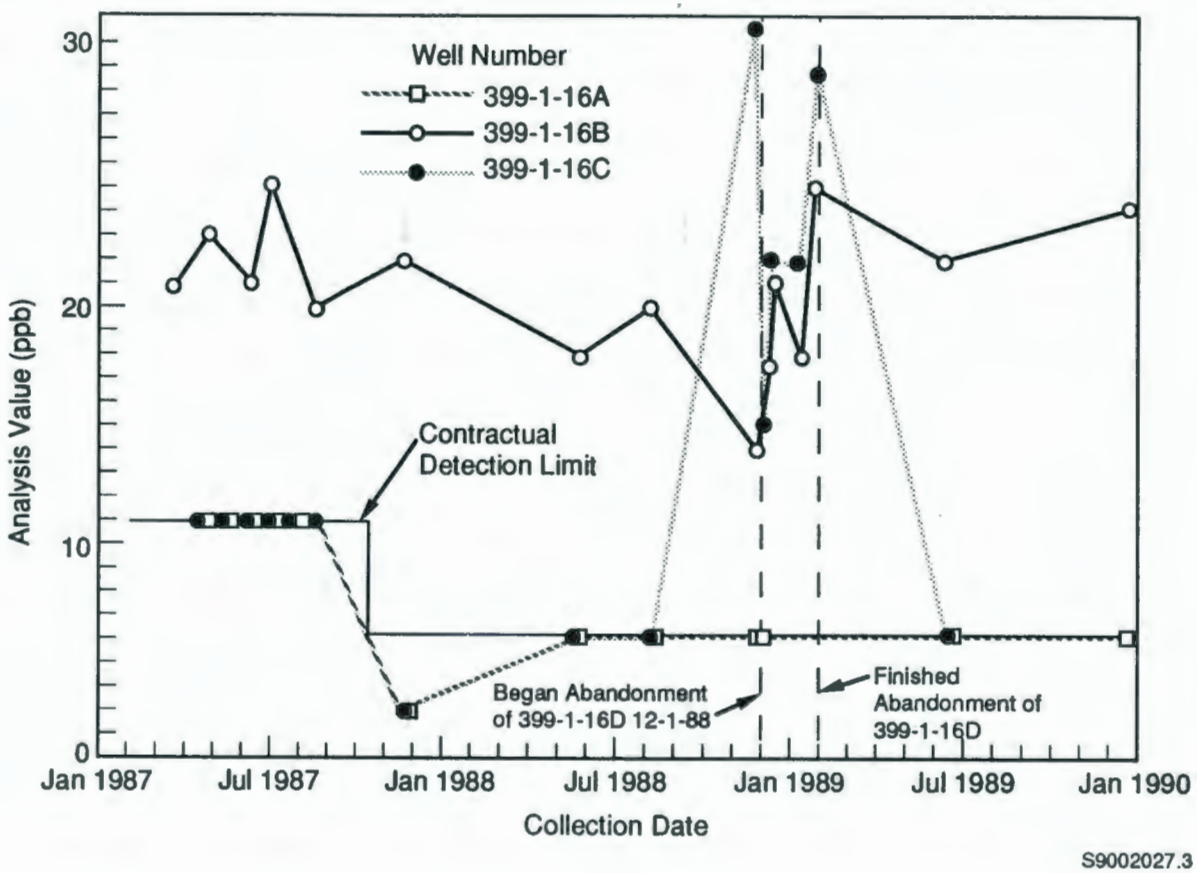

FIGURE 2.9. Trichloroethene Concentrations in Wells 399-1-16A, 399-1-16B, and 399-1-16C

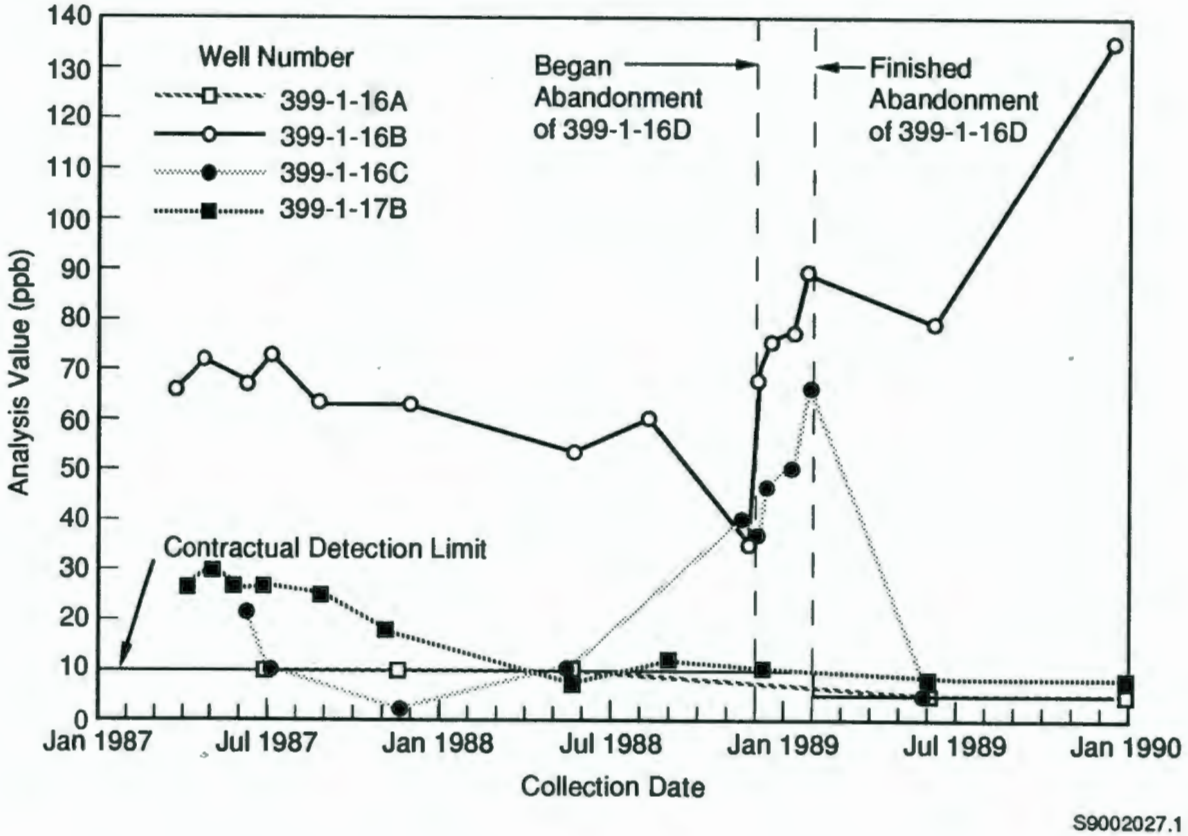

FIGURE 2.10. Dichloroethene Concentrations in Wells 399-1-16A, 399-1-16B, 399-1-16C, and 399-1-17B

TABLE 2.1. Ground-Water Monitoring Wells for the 300 Area Process Trenches (December 1989)

Wells for Point of Compliance

399-1-11
399-1-17A

Background Wells

399-1-18A

Wells to Define the Horizontal Extent of Contamination

399-1-7
399-1-10
399-1-12
399-1-13
399-1-14
399-1-15
399-1-16A
399-2-1
399-3-7
399-3-9
399-3-10
399-4-1
399-4-7
399-4-11
399-8-1

Wells to Define the Vertical Extent of Contamination

399-1-16B
399-1-17B

TABLE 2.2. Changes to 300 Area Process Trenches RCRA Interim-Status Ground-Water Quality Assessment Monitoring Network During 1989

Hanford Well Name	Phase III Quarterly, Oct 88-Sep 89	Phase IV Semiannually, Start Oct 89	Reason for Change
399-1-7	X[a]	X	
399-1-10	X	X	
399-1-11	B[b]	X	
399-1-12	X	X	
399-1-13	X	X	
399-1-14	X	X	
399-1-15	X	X	
399-1-16A	X	X	
399-1-16B	X	X	
399-1-16C	X		Dropped[d]
399-1-17A	B	W[c]	
399-1-17B	X	X	
399-1-17C	X		Dropped[d]
399-1-18A	B	X	
399-1-18B	X		Dropped[e]
399-1-19	B		Dropped[f]
399-2-1	X	X	
399-2-2	X		Dropped[g]
399-3-7	X	X	
399-3-9	X	X	
399-3-10	X	X	
399-4-1	X	X	
399-4-7	X	X	
399-4-11	X	X	
399-8-1	X	X	
399-8-2	X		Dropped[h]
399-8-3	X		Dropped[h]
	--	--	
	27	20	

(a) X - Sampled for regular (quarterly or semiannual) monitoring.
(b) B - Sampled for regular and bi-weekly (October 1988 to July 1989) monitoring.
(c) W - Sampled for regular and weekly (initiated October 1989) monitoring.
(d) Data indicate confined aquifer wells not needed for semiannual monitoring.
(e) Well not needed as a background well for well 399-1-16B and 399-1-17B because of extensive historical data.
(f) Well not easily accessible for disposal of purge water.
(g) Well not needed because adequate definition of constituents for RCRA monitoring can be achieved using other nearby wells.
(h) Wells 399-8-2 and 399-8-3 reduced to a single western 300 Area upgradient monitoring well, 399-8-1.

TABLE 2.3. Summary of Abandonment Activities for Well 399-1-16D

Date	Activity
November 22, 1988	Began field setup for abandonment.
December 1, 1988	Began overwashing 6-in. stainless steel casing.
December 2, 1988	Began loosing several thousand gallons of water and mud.
December 2, 1988	Overwashing stopped by boulders at 44 ft.
December 3, 1988	Began overdrilling 6-in. stainless steel casing with 8.5-in. casing with a cutting shoe with cutrite surfaces.
December 3, 1988	Encountered boulder blockage at 22 ft.
December 5, 1988	Began grinding up 6-in. casing with milling tool.
December 6, 1988	Detected particulate chromium and nickel in water samples.
December 16, 1988	Set H casing inside 6-in. stainless steel casing to 112 ft.
December 19, 1988	Drilled through bottom of 6-in. stainless steel casing.
December 20, 1988	Washed out 10-in. broken carbon steel casing from 112 to 182 ft.
January 10, 1989	Filled 10-in. casing with sand.
January 13, 1989	Filled upper 8 ft of 10-in. casing with cement grout to 88 ft below land surface.
January 16, 1989	Began drilling through cement plug.
January 18, 1989	Completed drilling plug and removed silica sand.
January 25, 1989	Set bentonite pellets from 182 to 159 ft.
January 25, 1989	Filled 10-in. casing with bentonite/cement grout from 159 to 87.5 ft.
January 30, 1989	Grouted well with bentonite from 87.5 to 29 ft.
January 30, 1989	Grouted well from 29 ft to land surface with cement/ bentonite grout.

3.0 183-H SOLAR EVAPORATION BASINS

S. H. Hall

The RCRA ground-water monitoring project for the 183-H Solar Evaporation Basins is an interim-status ground-water quality assessment monitoring and hydrogeologic characterization effort focused on the basins and their vicinity in the 100-H Area of the Hanford Site (see Figures 1.1 and 3.1). The 183-H Solar Evaporation Basins consist of four concrete basins that were used for solar evaporation and storage of aqueous chemical wastes from nuclear fuel processing facilities elsewhere on the Hanford Site (Liikala et al. 1988). The wastes discharged to the basins consisted primarily of nitric, sulfuric, and hydrofluoric acids, contaminated by heavy metals and radionuclides, and neutralized by sodium hydroxide. Originally, the basins were used for water treatment for the 100-H Plutonium Production Reactor, which was retired in 1965. Each basin has a capacity of approximately 450,000 gal. Until August 1978, only basin #1 was in use for waste storage. In 1973, it received 8000 gal, and from 1975 to August 1978, it received wastes at the rate of about 145,000 gal/yr. Elevated nitrate concentrations were detected in well 199-H4-3 in mid-1977, indicating that the basin was leaking. Basins #2 and #3 were coated with urethane, and were ready to receive wastes by August 1978. At that time, the waste stream was redirected to basins #2 and #3, and the liquid fraction of the waste remaining in basin #1 was pumped to the newly prepared basins, leaving a slurry. The slurry remained in basin #1 until July 1985. There is no evidence of leakage from basin #2 or #3 [or from basin #4, later put into service with a butyl and Hypalon[a] coating]. A Final Status Post-Closure Permit Application for this facility was submitted to the Washington State Department of Ecology in June 1988 (WHC 1988a).

Activities for this RCRA project during 1989 included the following:

- monthly, quarterly, and annual ground-water sampling and analysis
- twice-monthly water level measurement

(a) Hypalon is a registered tradename of E. I. duPont de Nemours and Company, Wilmington, Delaware.

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- publication of a report evaluating the areal extent of the contaminant plume from basin #1 and its rate of migration.

EVALUATION OF WATER-LEVEL ELEVATIONS

Ground-water elevation data were collected during the year at the time of sample collection at each well. In addition, twice-monthly synoptic water level data were collected from the entire monitoring network in the 100-H Area. The data continue to show the pattern described in the hydrogeologic characterization report for this project (Liikala et al. 1988). That is, net annual flow is toward the Columbia River, but seasonal gradient reversals occur, corresponding to high river stage. Water level data collected during the year, including river elevations, are presented in the quarterly reports (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990).

For the purposes of this project, the existing well network is considered adequate for monitoring ground water at the 183-H basins.

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

This ground-water quality assessment project has, since 1985, monitored the contaminant plume caused by the leakage of process wastes from the basins and the resulting effect on ground-water quality. Data related to the following discussions have been previously reported (Hall 1989; Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990).

Concentrations Above the Primary Drinking Water Standards

The plume from the basins (Liikala et al. 1988; Hall 1989) is principally characterized by elevated concentrations, relative to background concentrations, of nitrate, sodium, sulfate, technetium-99, and uranium. The waste liquid that escaped from the basins to the ground water also contained hexavalent chromium. However, the plume is superimposed on a larger, preexisting chromium plume that extends from the vicinity of the retired 100-H reactor. At times, the chromium concentration in wells immediately upgradient from the basins exceeds that of wells immediately downgradient. However, Hall (1989) showed that the chromium contamination <u>within</u> the plume extending from the basins comprises roughly equal contributions from basin

leakage and from the pre-existing reactor plume for the period July 1987 to September 1988. Further, Hall showed that only wells 199-H4-3 and 199-H4-4 are fully involved by the basin plume, and that wells 199-H4-9, 199-H4-12A, and 199-H4-12B lie along the approximate northern boundary of the plume. No other well appears to intersect the contaminant plume from the basins.

Table 3.1 lists, by well, those contaminants found to be in excess of drinking water standards in samples collected during 1989. Inspection of the table shows that contamination has been detected in most of the wells in the 100-H Area. In view of the plume boundaries proposed by Hall, it is clear that much of the contamination in the ground water in the 100-H Area is unrelated to basin leakage. Results of analysis of ground-water samples are presented in Smith, Bates, and Lundgren (1989a, 1989b, 1989c, 1990).

Rate of Migration of Contaminants

The plume extending from the basins is truncated by the Columbia River. Further, none of the downgradient monitoring wells (other than 199-H4-3) were installed before the plume reached the river. Therefore, determination of the rate of plume migration has never been possible by "direct" observation. Nevertheless, regulatory guidelines require that the plume migration rate be reported annually. Computer modeling results presented by Liikala et al. (1988) show a net flow rate of 0.7 ft/d from the basins to the river, along a flow path normal to the static water contours (i.e., normal to the river channel). In contrast, Hall (1989) postulated a plume migration rate of 1.6 to 2.1 ft/d based on concentration patterns in nitrate data, and a flow path that is approximately easterly from the basins to the river.

OTHER ACTIVITIES

River and spring sampling during both high and low river stage showed that nitrate and chromium contamination from the basin plume is not detectable in near-shore surface water.

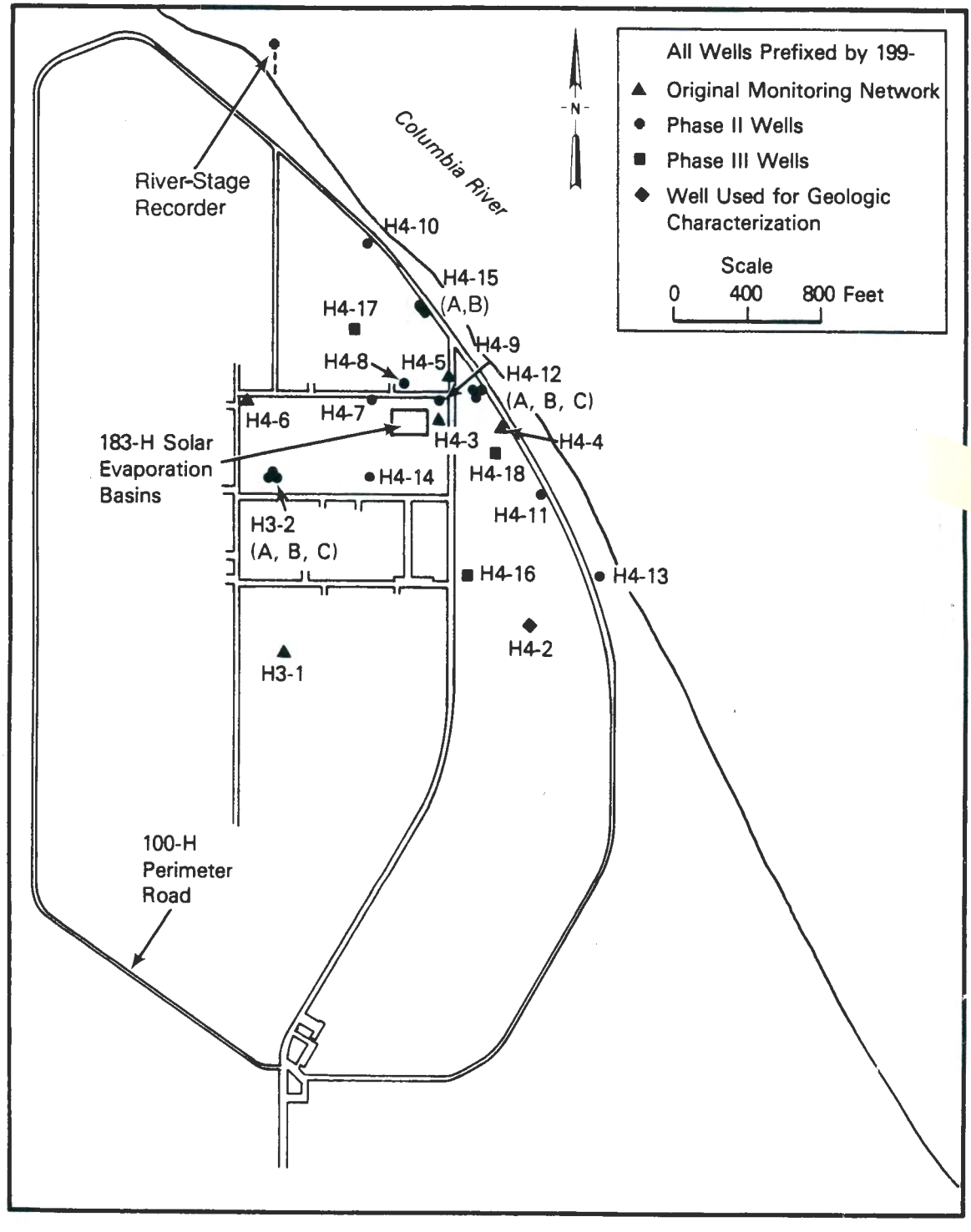

FIGURE 3.1. Ground-Water Monitoring Wells Near the 183-H Solar Evaporation Basins

TABLE 3.1. Key Contamination Parameters in Excess of Drinking Water Standards During 1989 for the 183-H Solar Evaporation Basins

Well Number	Gross Alpha	Gross Beta	Chromium	Nitrate	Technetium-99[a]	Cadmium
199-H3-1						
199-H3-2A			X			
199-H3-2B			X			
199-H3-2C						
199-H4-3	X	X	X	X	X	X
199-H4-4	X	X	X	X	X	
199-H4-5			X			
199-H4-6			X			
199-H4-7			X	X		
199-H4-8			X			
199-H4-9			X	X	X	
199-H4-10						
199-H4-11		X	X			
199-H4-12A	X	X	X	X		
199-H4-12B		X	X	X		
199-H4-12C			X			
199-H4-13		X	X			
199-H4-14			X			
199-H4-15A			X			
199-H4-15B			X			
199-H4-16						
199-H4-17			X	X		
199-H4-18			X			
Primary Drinking Water Standard	15 pCi/L	50 pCi/L	0.05 mg/L	45 mg/L	900 pCi/L	0.01 mg/L

(a) The 900-pCi/L primary drinking water standard for technetium-99 is taken from EPA (1976).

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4.0 200 AREAS LOW-LEVEL BURIAL GROUNDS

G. V. Last

The RCRA ground-water monitoring project for the 200 Areas Low-Level Burial Grounds (LLBGs) is under interim status and is in the first year of indicator-evaluation monitoring. The revised ground-water monitoring plan (Last and Bjornstad 1989) for the LLBGs discusses expansion of the LLBG ground-water monitoring project from four waste management areas (WMAs) to five WMAs, covering all or portions of eight burial grounds. Each of these LLBGs is located in either the 200-East Area or the 200-West Area of the Hanford Site (see Figure 1.1). The fifth waste management area (WMA-5) is not yet active and thus is currently not being monitored.

The LLBGs contain a diverse range of mixed radioactive/hazardous waste types from Hanford operations (e.g., miscellaneous dry waste, failed equipment, vehicles, contaminated soil, 183-H cleanup wastes) and other offsite wastes (e.g., submarine reactor compartments, Three-Mile Island Reactor cleanup wastes). These wastes are buried in unlined trenches and pits from 15 to 60 ft deep. Disposal to these LLBGs has been ongoing since 1960.

Progress during 1989 included the following:

- installing 11 new monitoring wells
- collecting 2 quarterly sets of background ground-water samples
- collecting one set of indicator-evaluation samples from the existing wells.

The eleven new wells combined with the 35 existing wells around the LLBGs, brings the total number of wells in the ground-water monitoring system for the LLBGs to 46; 20 in the 200-East Area and 26 in the 200-West Area. Table 4.1 lists the upgradient and downgradient wells for each WMA.

EVALUATION OF WATER-LEVEL ELEVATIONS

Water levels have been measured monthly and at the time ground-water samples were collected. The casing elevations, water-level measurements, and water-level elevations for the monthly measurements have been reported quarterly (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, and 1990). Hydrographs of these measurements for each WMA are provided in Figures 4.1, 4.2, 4.3, and 4.4. The December 18, 1989, water-level elevations and inferred water-table maps for each WMA are shown in Figures 4.5, 4.6, 4.7, 4.8, and 4.9. The general flow directions inferred from these water-table maps suggests that at least one monitoring well is located upgradient from each WMA and at least three monitoring wells are located downgradient of each WMA (see Table 4.1).

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

Three sets of quarterly ground-water samples were collected this year: March and May 1989; July and August 1989; and September 1989. Results of the ground-water sample analyses have been reported in quarterly reports (Smith, Bates, and Lundgren 1989b, 1989c, and 1990). The July and August set of samples completed the fourth set of background monitoring samples. Background data for the upgradient wells at each WMA consists of quadruplicate pH, conductivity, total organic carbon (TOC), and total organic halogens (TOX).

Comparison of the September 1989 replicate averages of the indicator parameters to the critical means from the first four sets of quarterly samples indicated significantly higher conductivity and TOX concentrations in wells downgradient of WMA-1 and WMA-3, respectively. It has not yet been determined if the high values are due to contamination from these WMAs, as other potential sources exist. Ground-water quality assessment plans were initiated to address these alternate sources.

Concentrations Above Primary Drinking Water Standards (PDWS)

The three sets of quarterly ground-water samples collected this year (March and May 1989; July and August 1989; and September 1989) show that the PDWS were exceeded in at least one sample for each of the following contaminants, listed by WMA.

- WMA-1: alpha, chromium, coliform, iron, nitrate, tritium, turbidity.
- WMA-2: chromium, iron, manganese, and turbidity.
- WMA-3: alpha, chromium, coliform, iron, lead, manganese, nitrate, pH, radium, tetrchloromethane (carbon tetrachloride), and turbidity.
- WMA-4: alpha, cadmium, chromium, iron, nitrate, manganese, pH, tetrachloromethane (carbon tetrachloride), 1,1,2-Trichloroethene, tritium, and turbidity.

Rate of Migration of Contaminants

This section is not yet applicable to this ground-water monitoring project.

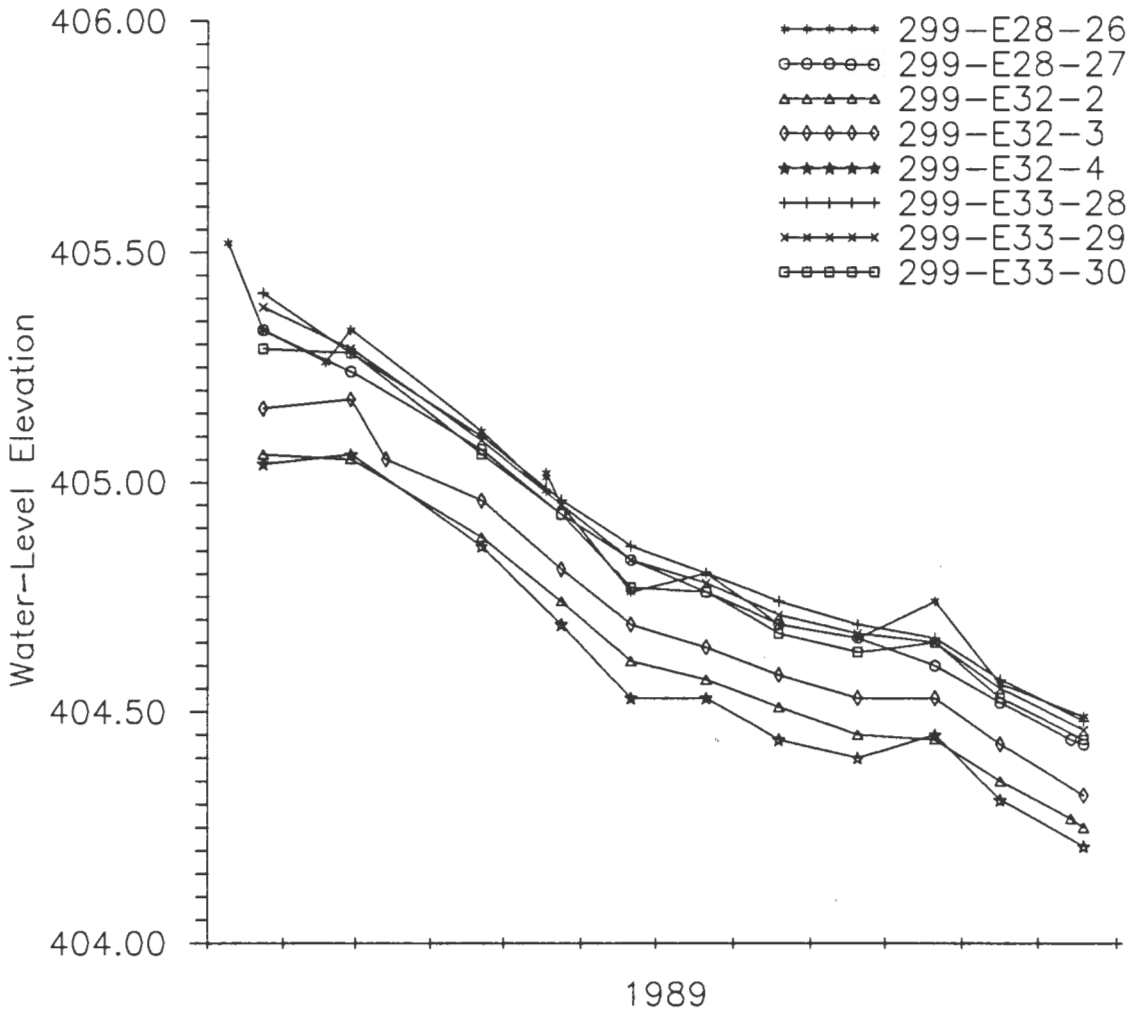

FIGURE 4.1. Hydrographs of Water-Level Elevations for WMA-1

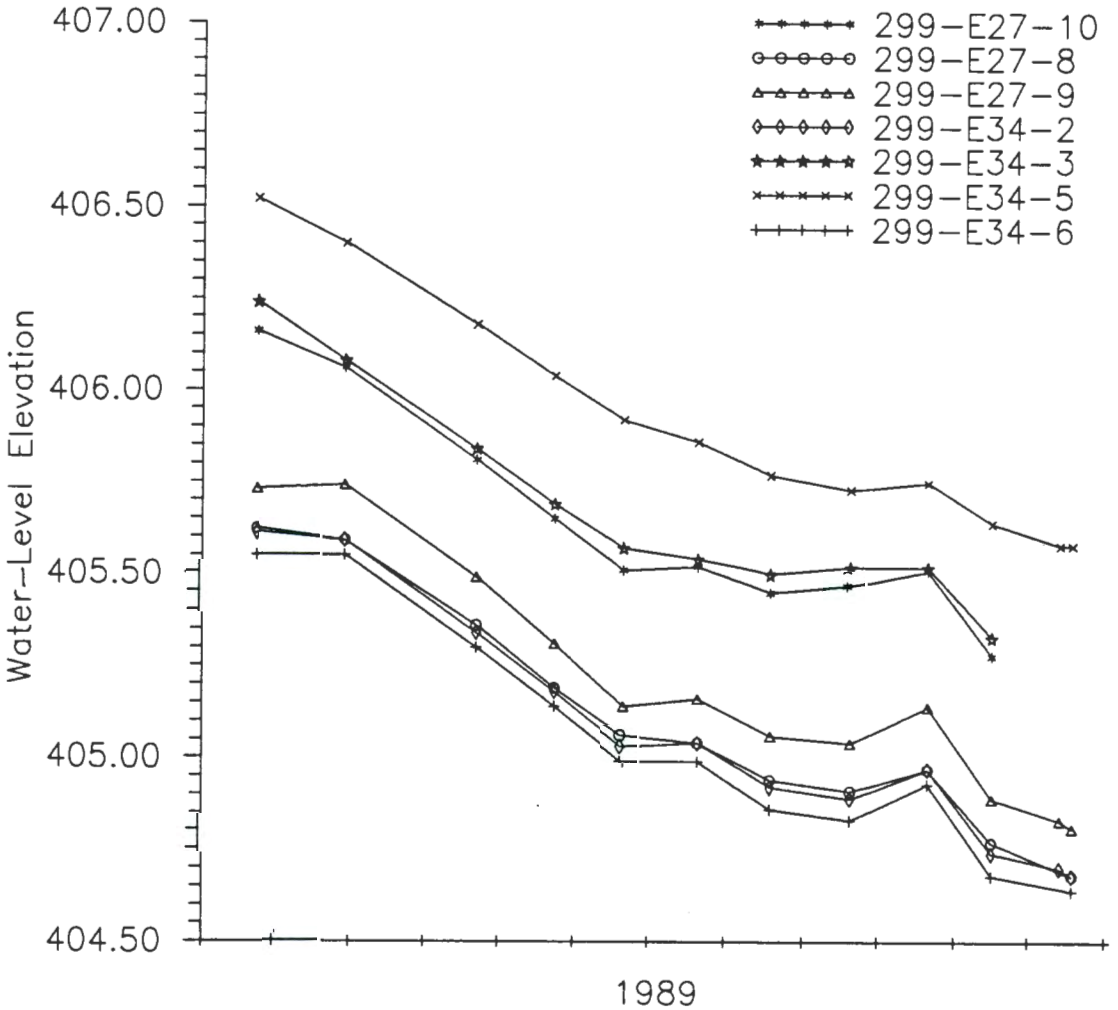

FIGURE 4.2. Hydrographs of Water-Level Elevations for WMA-2

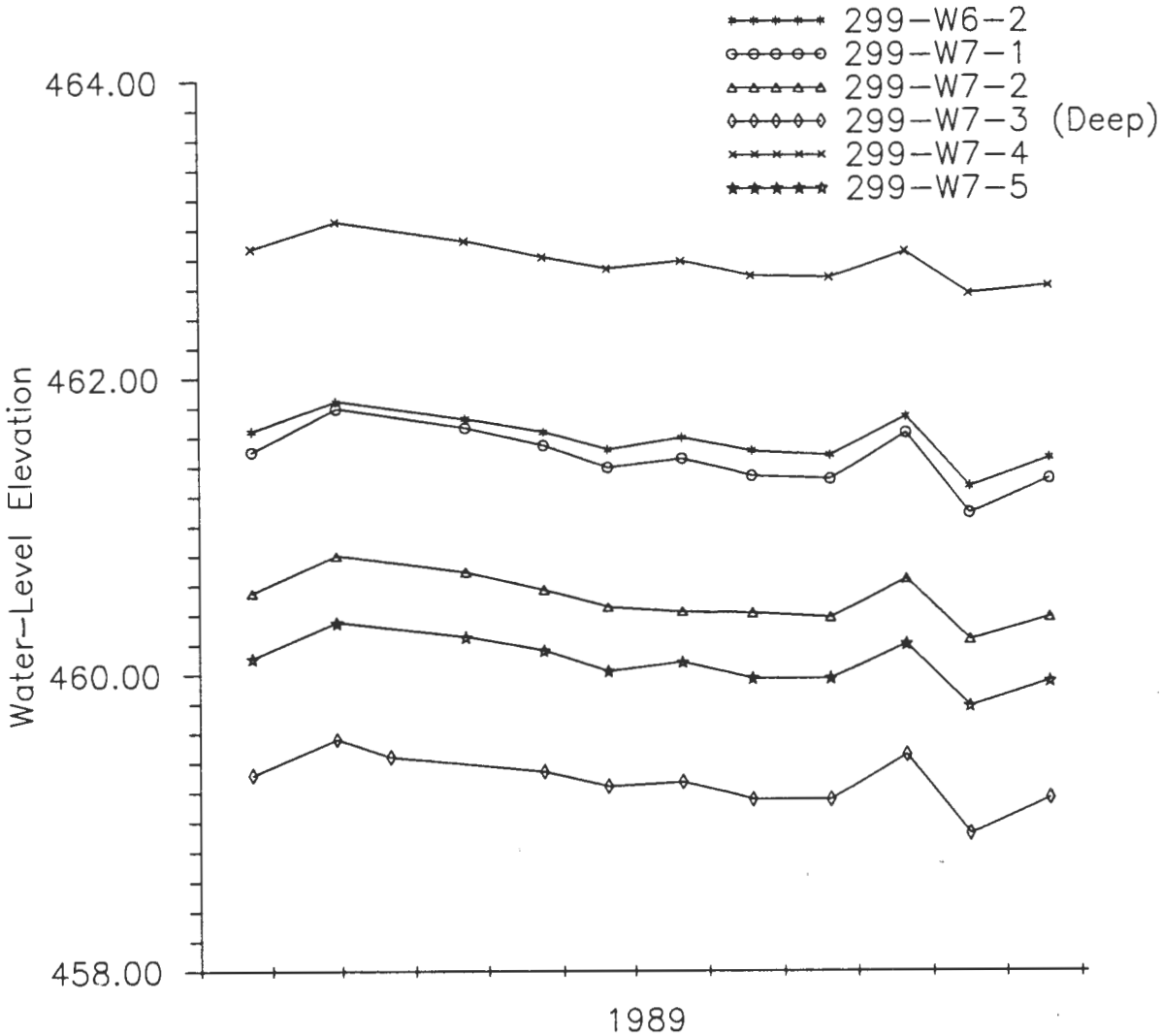

FIGURE 4.3. Hydrographs of Water-Level Elevations for WMA-3

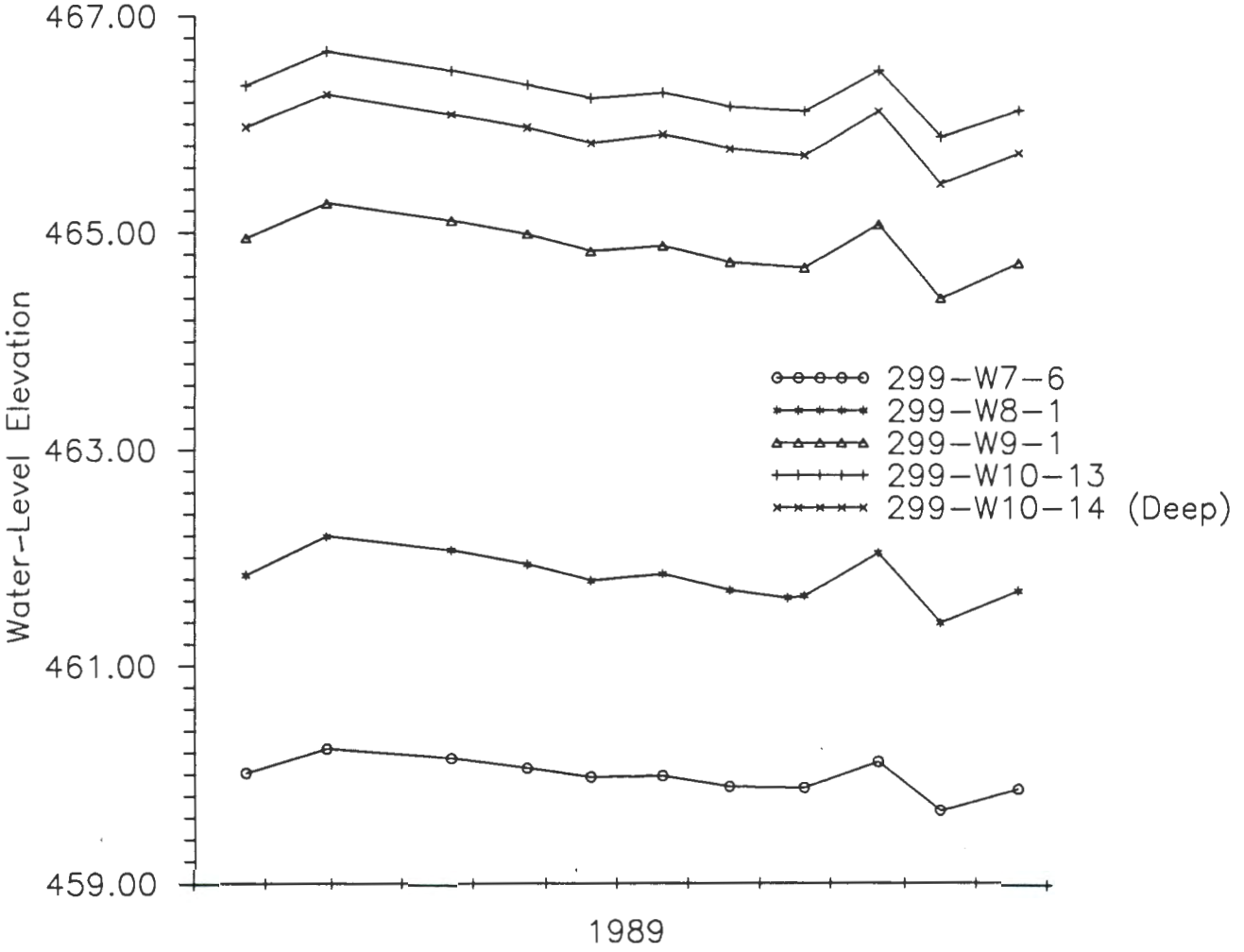

FIGURE 4.3. (contd)

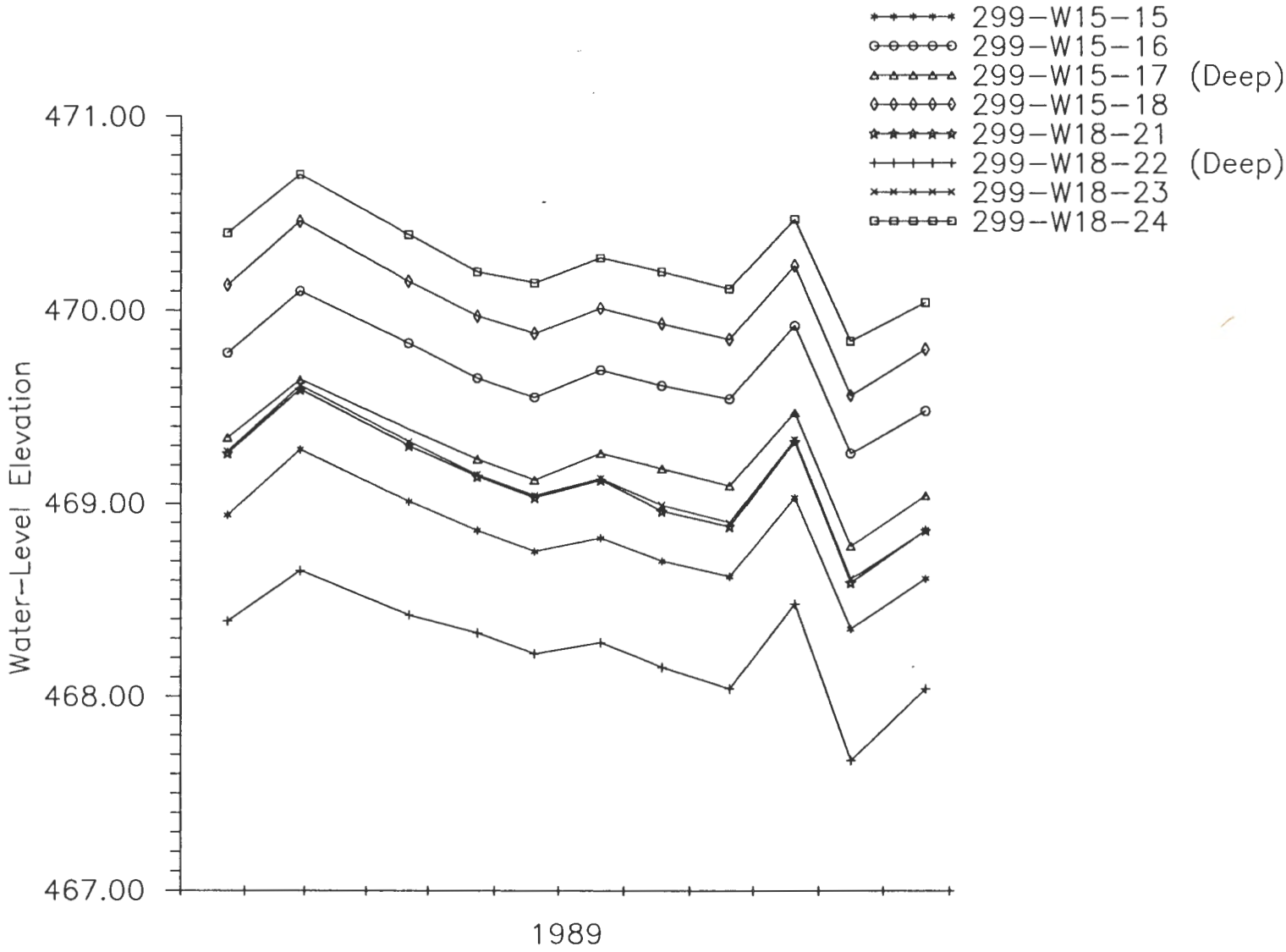

FIGURE 4.4. Hydrographs of Water-Level Elevations for WMA-4

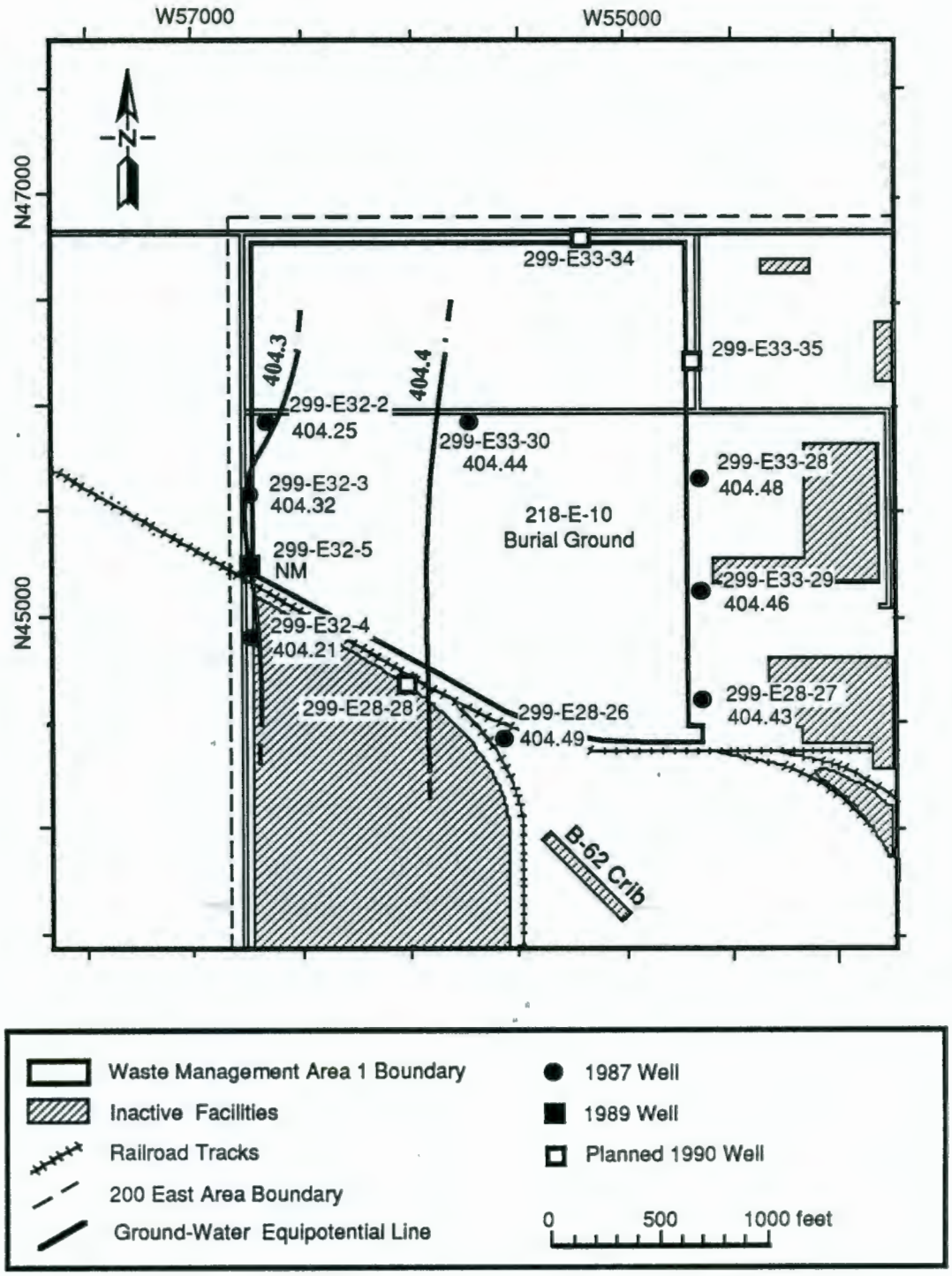

FIGURE 4.5. Waste Management Area 1 Ground-Water Level Contours for December 18, 1989. Note: NM indicates that no measurement was obtained.

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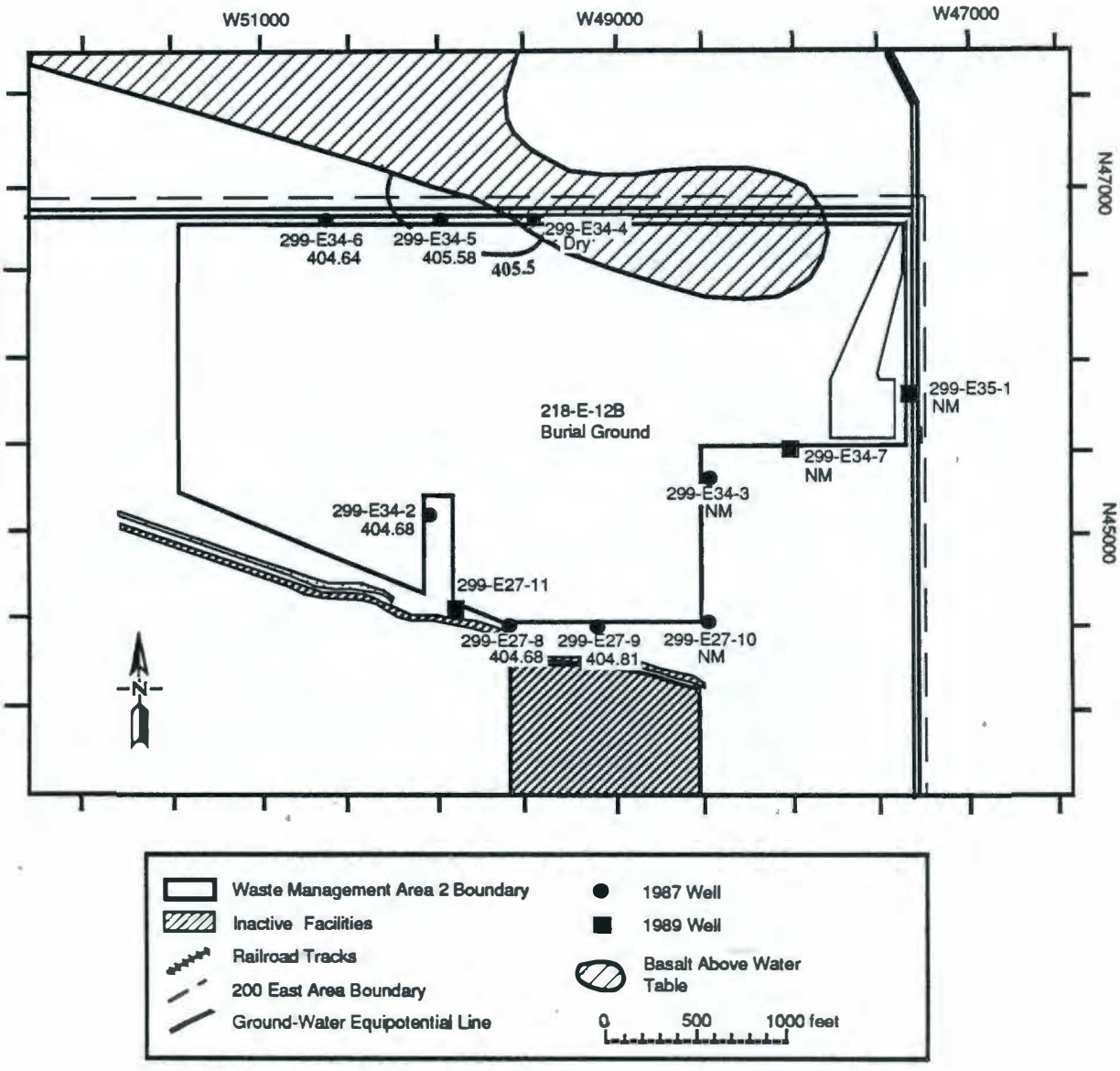

FIGURE 4.6. Waste Management Area 2 Ground-Water Level Contours for December 18, 1989. Note: NM indicates that no measurement was obtained.

9 2 1 2 6 4 2 2 0 0 3

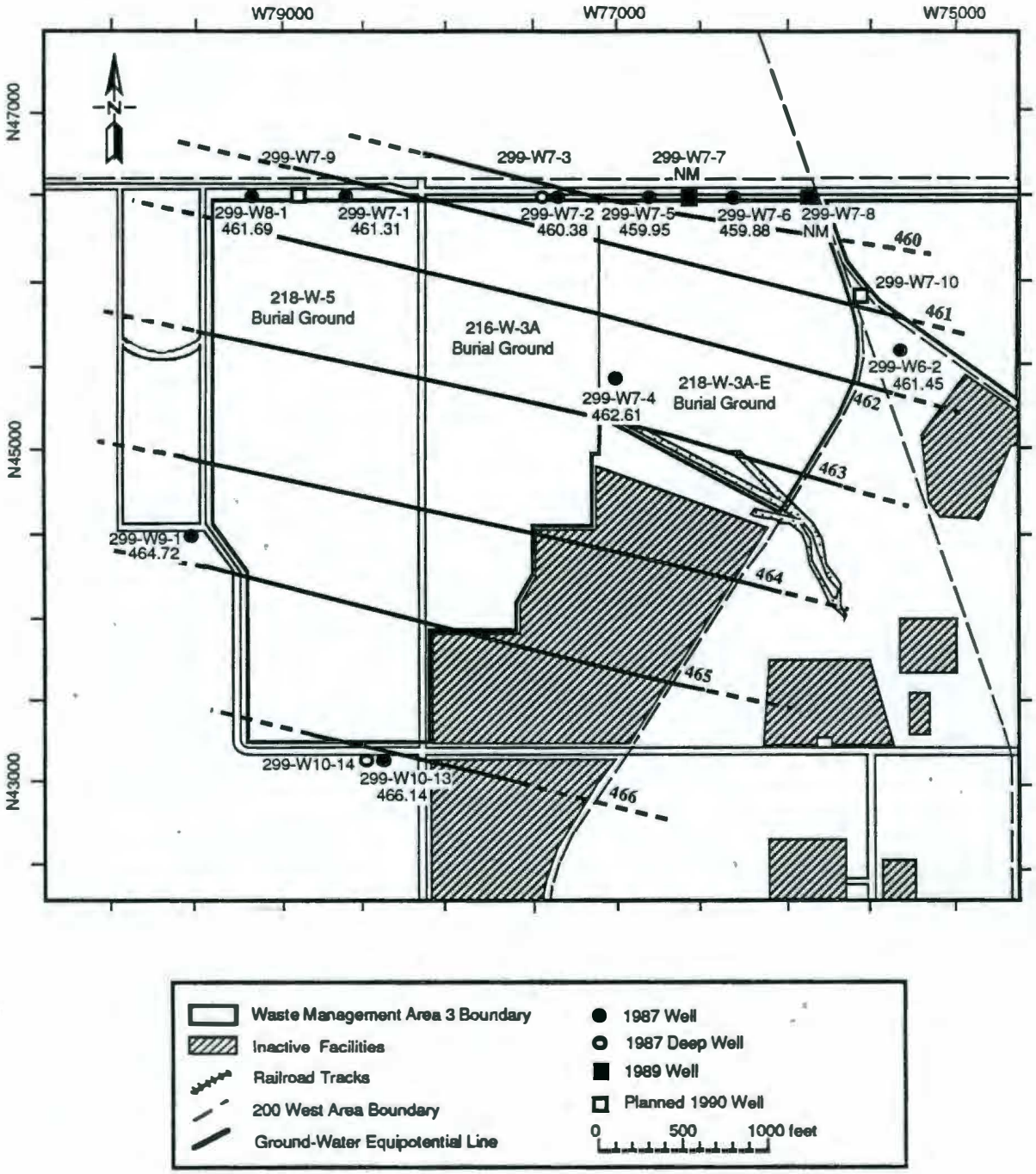

FIGURE 4.7. Waste Management Area 3 Ground-Water Level Contours for December 18, 1989. Note: NM indicates that no measurement was obtained.

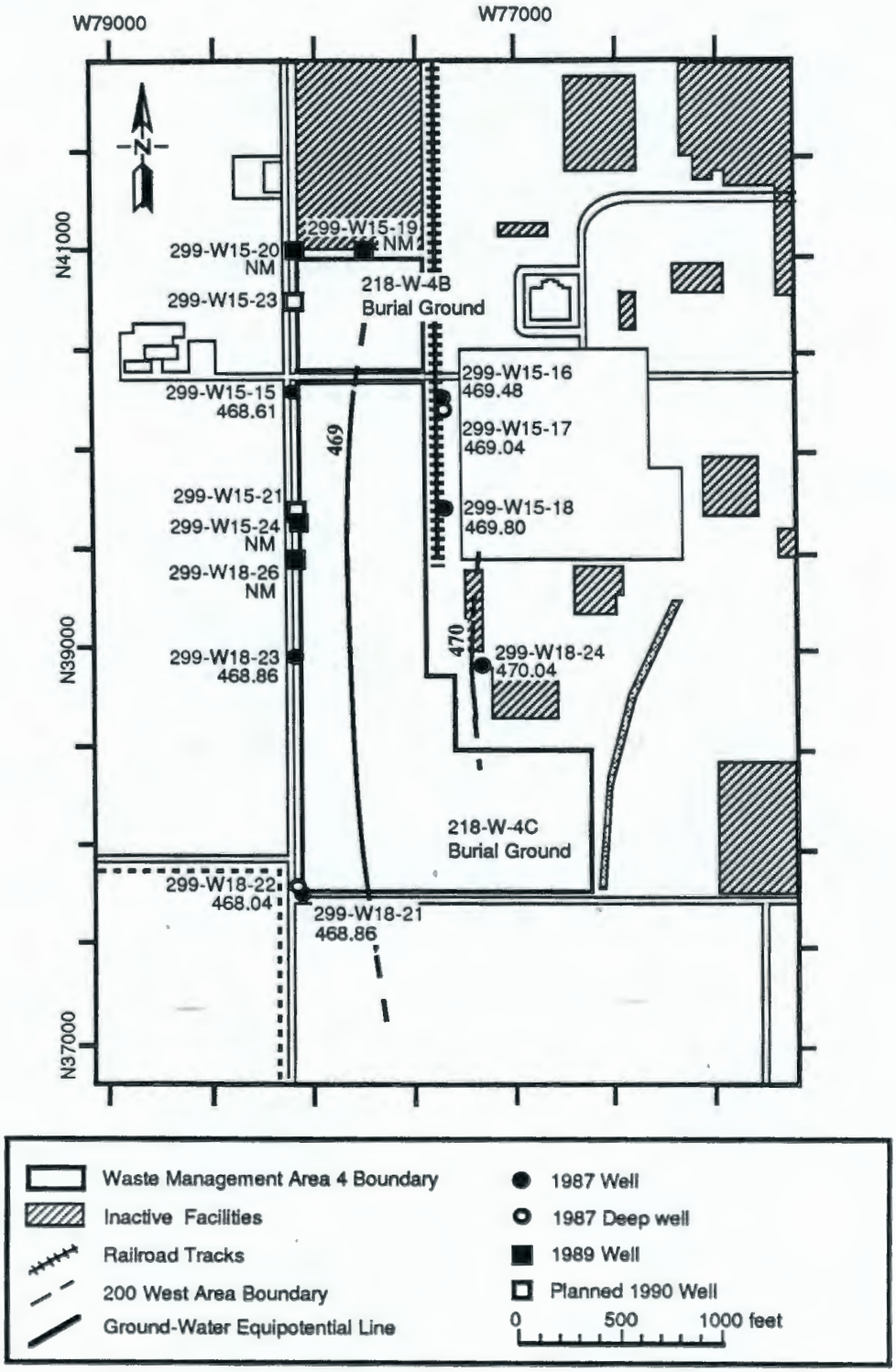

FIGURE 4.8. Waste Management Area 4 Ground-Water Level Contours for December 18, 1989. Note: NM indicates that no measurement was obtained.

9 2 1 2 6 4 2 2 0 0 5

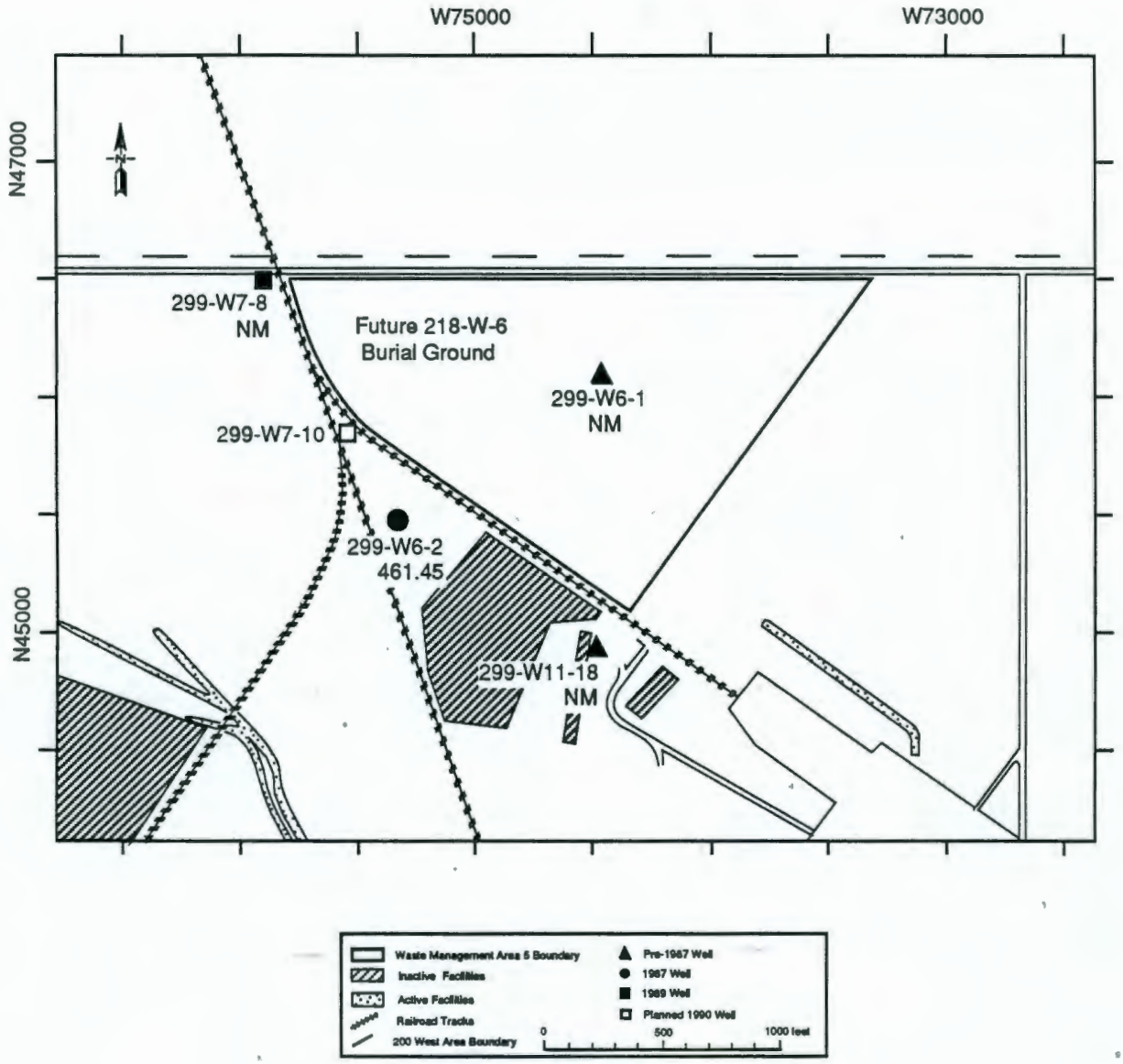

FIGURE 4.9. Waste Management Area 5 Ground-Water Level Measurements for December 18, 1989. NM: Note: NM indicates that no measurement was obtained.

TABLE 4.1. Upgradient and Downgradient Wells for Each Waste Management Area (WMA)

	WMA-1	WMA-2	WMA-3	WMA-4	WMA-5
			Upgradient Wells		
Existing Shallow Wells	299-E28-27 299-E33-28 299-E33-29	299-E27-10 299-E34-3	299-W9-1 299-W10-13	299-W15-16 299-W15-18 299-W18-24	299-W6-2[a]
Existing Deep Wells	None	None	299-W10-14	299-W15-17	None
New Shallow Wells	None	299-E35-1	None	None	None
New Deep Wells	None	None	None	None	None
			Downgradient Wells		
Existing Shallow Wells	299-E28-26 299-E32-2 299-E32-3 299-E32-4 299-E33-30	299-E27-8 299-E27-9 299-E34-2 299-E34-4 299-E34-5 299-E34-6	299-W6-2[a] 299-W7-1 299-W7-2 299-W7-4 299-W7-5 299-W7-6 299-W8-1	299-W15-15 299-W18-21 299-W18-23	None
Existing Deep Wells	None	None	299-W7-3	299-W18-22	None
New Shallow Wells	299-E32-5	299-E27-11 299-E34-7	299-W7-7 299-W7-8 299-W7-9	299-W15-19 299-W15-20 299-W15-24 299-W18-26	None
New Deep Wells	None	None	None	None	None

(a) Well shared by other WMA.

5.0 NONRADIOACTIVE DANGEROUS WASTE LANDFILL

R. M. Fruland/F. N. Hodges

The RCRA ground-water monitoring project at the Nonradioactive Dangerous Waste Landfill (NRDW) is an interim-status project in the indicator parameter phase of monitoring. The NRDW and Solid Waste Landfill (SWL) are adjacent facilities centrally located on the Hanford Site and approximately 6 miles west of the Columbia River (Figure 1.1). The NRDW occupies approximately 11.5 acres next to the SWL, which covers about 65 acres (Figure 5.1). A perimeter fence surrounds the landfills, and a mobile field office supports landfill operations. The NRDW and SWL each have their own ground-water monitoring project. However, the proximity of the two facilities warrants data relating to both facilities be included in discussions for each facility.

The NRDW received containerized liquid and asbestos wastes from 1975 to 1985. Wastes were discharged to unlined trenches constructed 46 ft wide at the top, 14 ft wide at the base, and 15 ft deep.

The NRDW ground-water monitoring compliance plan, based on 40 CFR 265 and WAC 173-303 covering hazardous waste facilities, was sent to the Washington State Department of Ecology (Ecology) in 1986, and well installation was completed in January 1987. After the first year's background data collection was completed, contamination indicator parameter background evaluation was initiated in October 1987. Quarterly monitoring for an extended constituent list continued throughout calendar year 1988. Semiannual indicator parameter monitoring and one sampling round for a comprehensive constituent suite based on WAC 173-303-9905 were planned for 1989. The indicator parameter monitoring was accomplished in 1989; however, the extended list was not. Instead, special sampling for specified constituents as part of the Tri-Party Agreement is planned for 1990.

Major activities during calendar year 1989 included the following:

- monthly water-level measurements at NRDW, SWL, and nearby Hanford Site wells throughout the calendar year

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- monitoring for water chemistry parameters three times in the 1989 calendar year (two times in FY89, one time in FY90)
- background water quality evaluation three times in calendar year 1989.

EVALUATION OF WATER-LEVEL ELEVATIONS

A very flat gradient of approximately 0.0001 underlies the NRDW (Weekes, Luttrell, and Fuchs 1987; Fruland, Bates, and Lundgren 1989a, 1989b) and SWL (Fruland et al. 1989). In 1989, monthly water level measurements and the water level measurements made prior to sampling, indicate the same gradient and general, northwest-to-southeast ground-water flow direction (Figure 5.2). Although the gradient has not changed, the actual water level has gradually decreased approximately 1 ft over the last year (Figure 5.3). Historical data for Hanford Site Well 699-24-33, which is about 500 ft downgradient from the SWL, indicates that the water level in the vicinity of the NRDW and SWL has been heavily influenced by discharges in the Separations Areas; thus, a lower discharge rate in the 200 Areas is the likely explanation for the decrease in 1989 (Figure 5.4).

EVALUATION OF INDICATOR PARAMETERS

The NRDW ground-water monitoring for calendar year 1989 included three rounds of sampling and analysis for indicator parameters. The results of the initial background water quality determination for the NRDW were reported in the annual report for calendar year 1987 (Hall 1988). Analytical results for 1989 monitoring have been reported in quarterly reports (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Over the last year there have been no detected impacts to the ground water under the NRDW from past or present landfill activities.

One atypical value for tritium (2,600,000 pCi/L), a constituent monitored at NRDW wells because of its wide-spread occurrence in the ground-water at the Hanford Site, was reported for the October sampling of NRDW well 699-25-34B. This value is an order of magnitude higher than in nearby wells.

Well 699-25-34B will be resampled in duplicate to determine whether the elevated tritium value represents true ground-water composition. The results will be reported in the first quarterly report for 1990.

Rate of Migration of Contaminants

The NRDW is in an indicator evaluation stage of monitoring and there is no indication of ground-water contamination from this facility. Therefore, a discussion of contaminant migration is not applicable to the NRDW. For a discussion of ground-water flow in the area, see Section 6.0.

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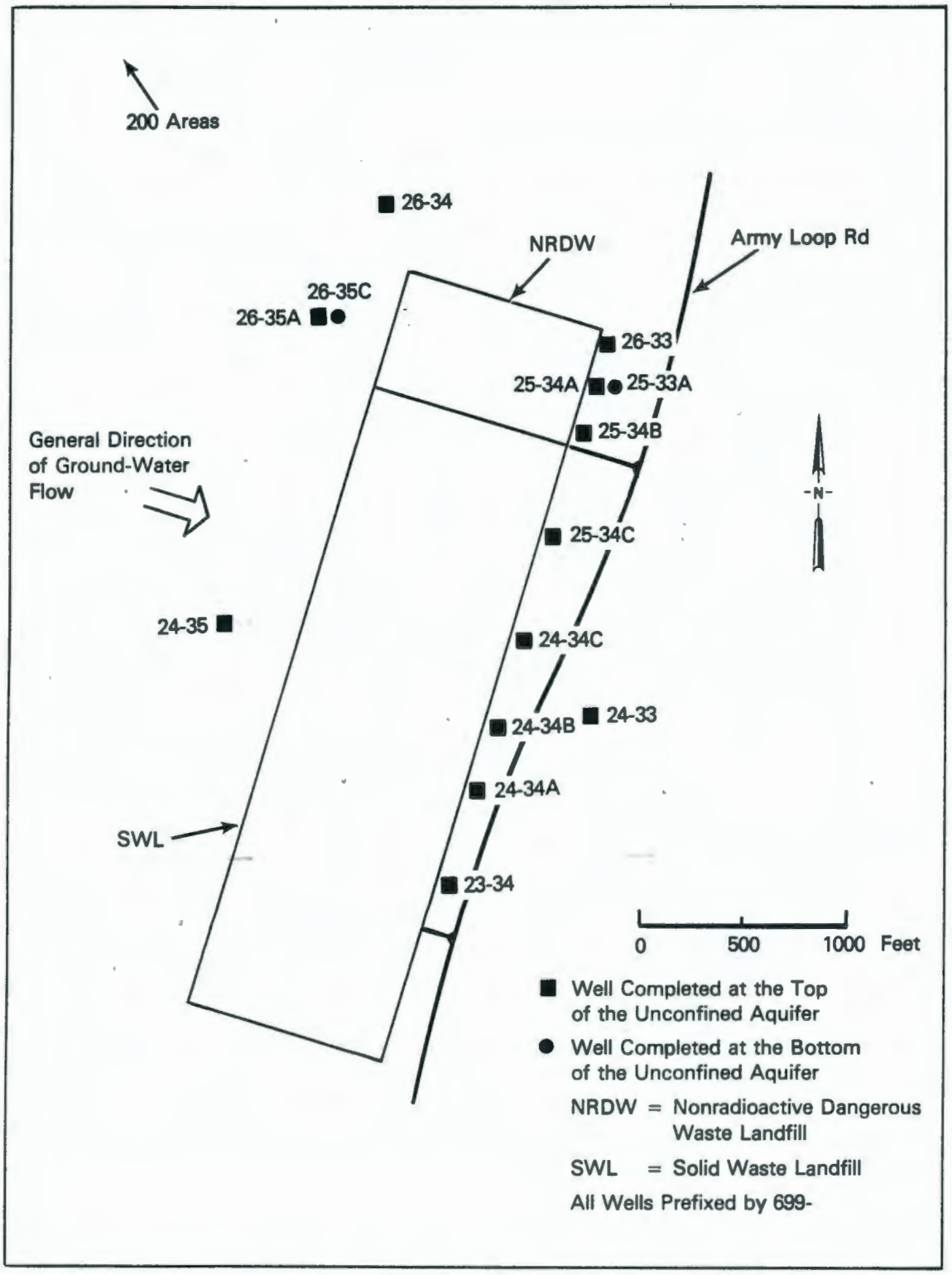

FIGURE 5.1. Ground-Water Monitoring Wells Near the Nonradioactive Dangerous Waste Landfill and the Solid Waste Landfill

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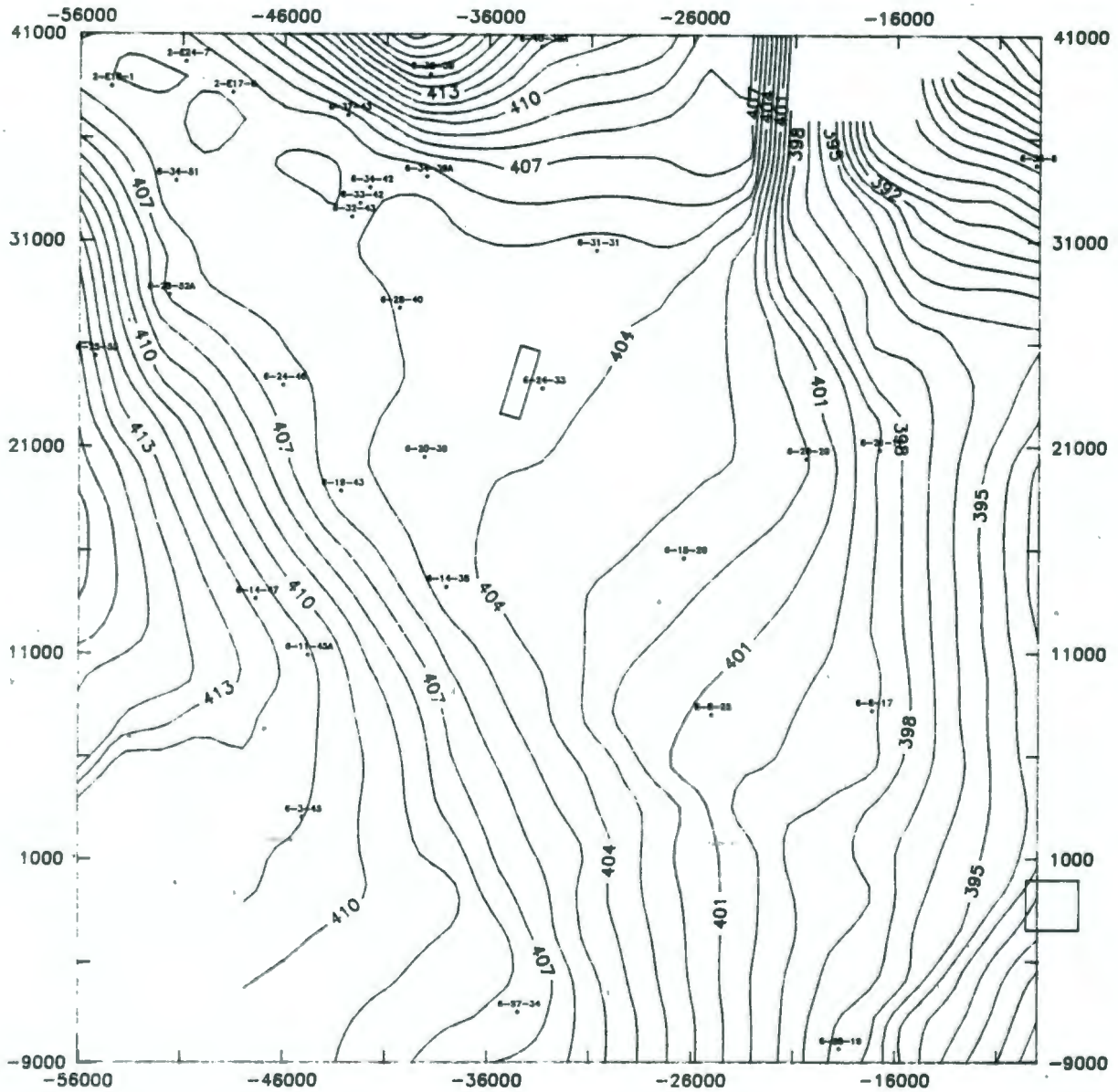

FIGURE 5.2. Ground-Water Elevation Contour Map for the Nonradioactive Dangerous Waste Landfill and the Solid Waste Landfill and Vicinity, June 1989

9 2 1 2 6 4 2 2 0 1 2

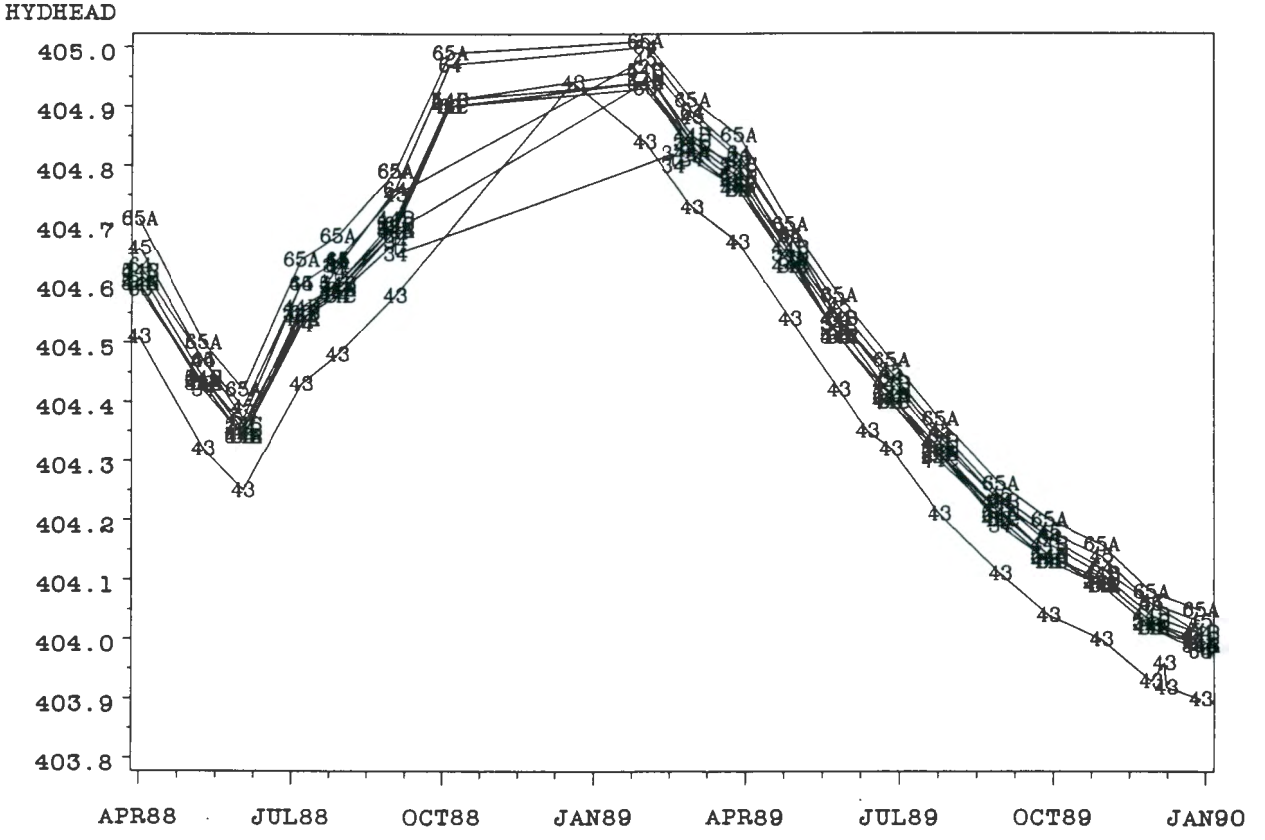

FIGURE 5.3. Ground-Water Elevation Measurements from April 1988 Through December 1989 for Selected Nonradioactive Dangerous Waste and Solid Waste Landfill Wells

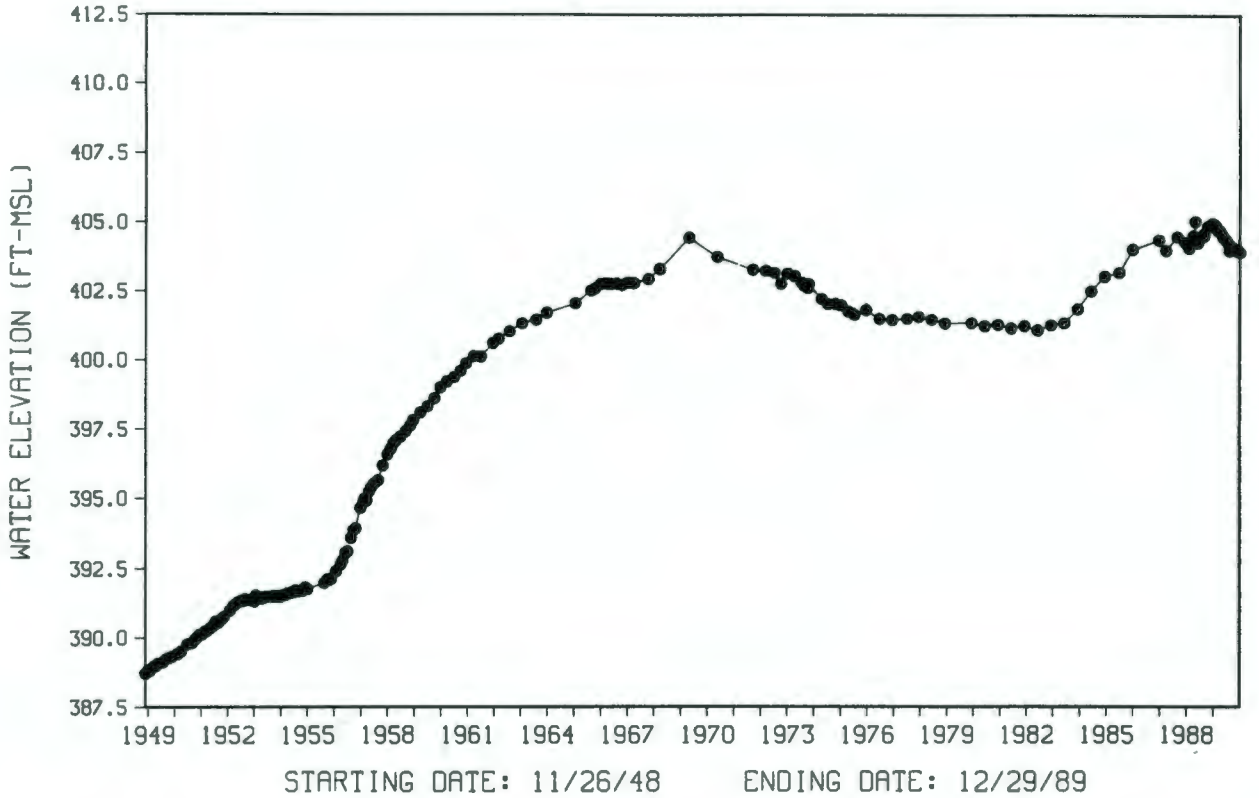

FIGURE 5.4. Ground-Water Elevations Measured for Well 699-24-33 Through Time

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6.0 SOLID WASTE LANDFILL

R. M. Fruland/F. N. Hodges

The RCRA ground-water monitoring project at the Solid Waste Landfill (SWL) has completed 12 rounds of sampling and analysis through 1989. The SWL and NRDW are adjacent facilities centrally located on the Hanford Site and approximately 6 miles west of the Columbia River (Figure 1.1). The SWL occupies approximately 65 acres next to the NRDW, which covers about 11.5 acres (Figure 5.1). A perimeter fence surrounds the landfills, and a mobile field office supports SWL operations. Wastes are discharged to one of two unlined trenches: one is 46 ft wide at the top, 14 ft wide at the base, and 15 ft deep; and the other is 106 ft wide at the top, 65 ft wide at the base, and 20 ft deep. Beginning in 1990, leachate-collection systems will be installed under new SWL trenches.

The SWL has operated continuously from 1973 to the present. Currently the SWL receives office and lunchroom trash and construction debris. Sewage was discharged to the SWL from 1975 through April 1987, and washwater from the 1100 Area bus maintenance facility between January 1985 and January 1987.

The compliance plan for detection-level ground-water monitoring at the SWL, based on Washington State regulations WAC 173-304, was sent to Ecology in the Fall of 1986 (PNL 1986). Construction of the monitoring network was completed in April 1987 and monitoring commenced on May 20, 1987. Although the SWL and NRDW have separate ground-water monitoring programs, their physical proximity warrants data relating to both facilities be included in discussion for each facility.

Chlorinated hydrocarbons were reported in the first round of SWL sampling and analysis, and their detection was subsequently confirmed by additional monitoring (Hall 1988; Fruland et al. 1989). The same chlorinated hydrocarbons continue to be detected. Their concentration distributions among the SWL wells have shown a distinctive and consistent pattern through time; absolute concentrations have shown a general decrease for three of the four constituents, but their relative concentrations have remained the same (Fruland et al. 1989). The three southernmost downgradient SWL wells

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(699-23-34, 699-24-34A, and 699-24-34B) have consistently shown the highest concentrations of trichloroethene (TCE), trichloroethane (TCA), perchloroethene (PCE) and dichloroethane (DCA). TCE is currently present in levels near the Primary Drinking Water Standards (PDWS) in these wells and PCE levels are above the EPA proposed PDWS.

Major activities during calendar year 1989 included the following:

- quarterly samplings at the six original SWL ground-water monitoring wells, and at one downgradient Hanford Site well (699-24-33)
- monthly water-level measurements at SWL, NRDW and nearby Hanford Site wells for calendar year 1989
- a partial soil-gas survey at the SWL and reporting of the results
- a laboratory unsaturated hydraulic conductivity study with landfill sediments and reporting of the results.

EVALUATION OF WATER-LEVEL ELEVATIONS

A very flat gradient of approximately 0.0001 underlies the SWL (Fruland et al. 1989) and NRDW (Weekes, Luttrell, and Fuchs 1987; Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). In 1989, monthly water level measurements, and the water level measurements made prior to sampling, indicate the same gradient and general, northwest-to-southeast ground-water flow direction (Figure 5.2). Although the gradient has not changed, the actual water level has slowly dropped approximately 1 ft in the last year (Figure 5.3). Historical data for Hanford Site Well 699-24-33, which is about 500 ft downgradient from the SWL, indicates that the water level in the vicinity of the NRDW and SWL has been heavily influenced by discharges in the 200 Areas; that is the likely explanation for this decrease as well (Figure 5.4).

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

The monitoring effort continued in 1989 at the SWL. This effort was augmented by field and laboratory studies to determine the source and possibly assess the extent of contamination at the facility. The results of these activities are discussed below.

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Sampling and Analysis

The results of the ground-water monitoring project at the SWL continue to indicate contamination in downgradient wells (Figures 6.1 through 6.4). These results also indicate a general trend of decreasing concentration levels, with a slight increase during 1989 for all the constituents except PCE. No decreasing trend is observed in the reported values of PCE over the last 2 1/2 years.

Soil-Gas Survey

The results of the soil-gas survey are reported in Evans et al. (1989), and indicate that elevated concentrations of chlorinated hydrocarbons only occur within the boundary of the SWL. The plan of the SWL and NRDW is provided in Figure 6.5, along with the two ground-water monitoring networks and the soil-gas survey sampling locations. The three liquid disposal trenches on the west side that received both sewage and washwater are numbered in order of their use (I, II, and III). Figures 6.6 through 6.8 summarize the soil-gas survey results for TCA, TCE, and PCE.

Laboratory Conductivity Study Results

A laboratory study of soil hydraulic conductivity was completed on samples collected at the SWL during 1989. This study showed that Hanford formation soils are heterogeneous regarding hydraulic conductivity in the soils beneath the SWL. The hydraulic conductivity ranged from 10^{-7} cm/sec to 10^{-4} cm/sec depending on soil type and water content. Diffusion coefficients varied less due to soil type than water content, and ranged from 2×10^{-8} cm^2/sec at volumetric water contents between about 3% and 5% to 1×10^{-6} cm^2/sec at volumetric water contents between about 15% and 25%. These hydraulic conductivities and diffusion coefficients were determined for aqueous solutions, not with sewage/washwater or analog fluids.

The same study included, as one case, flow through a two-media system, and those results indicate that thin silt lenses common in the Hanford formation at the SWL would have negligible effect on the hydraulic conductivity, and a very slight effect on the diffusion coefficient. These data are consistent with the detection of chlorinated hydrocarbons in an

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unconfined aquifer well 1500 ft downgradient of the disposal sites within approximately 1 year of their initial introduction in January 1985 to the SWL. Chlorinated hydrocarbons were observed in well 699-24-33 in January 1986. Because this was the first time well 699-24-33 was sampled for those constituents (as part of the Hanford Site-Wide hazardous materials monitoring effort), the travel time for contaminants from the trenches to this well must have been 1 year or less.

Some lateral movement of the chlorinated hydrocarbons was determined from soil gas analysis. The horizontal distributions of chlorinated hydrocarbons observed by the soil-gas survey support the conclusion that the source is the sewage/washwater trenches on the west side of the SWL. However, the exact relationship between the concentration of chlorinated hydrocarbons observed in the vicinity of the sewage/washwater trenches and elsewhere is uncertain at this time.

Future Monitoring

The soil-gas survey results show elevated levels of hydrocarbons near the east side of the SWL, downgradient from the source trenches. It is not known whether this represents an accumulation in the vadoze zone, which would not be as likely to affect ground-water concentrations, or elevated levels in the ground water, which will be detected by the downgradient SWL monitoring network wells. Continued ground-water monitoring in 1990 should provide some evidence to support one of these possibilities over the other.

Rate of Migration of Contaminants

The ground-water flow rate (rate of migration of contaminants) was originally calculated to range from 2 to 6 ft/d (Weekes, Luttrell, and Fuchs 1987; Fruland et al. 1989). The calculation was based on

$$v = \frac{K}{n} i$$

where v = velocity
K = hydraulic conductivity (3500 to 6000 ft/d)

n = effective porosity (0.1)
i = ground-water gradient (10^{-4}).

The resulting ground-water velocity calculated values ranged from 3.5 to 6 ft/d for the SW1.

Although the water-table elevations have decreased about 1 ft over the last year, the gradient has remained the same (10^{-4}). Calculated ground-water flow rate remains in the 3 to 6 ft/d range for CY 1989.

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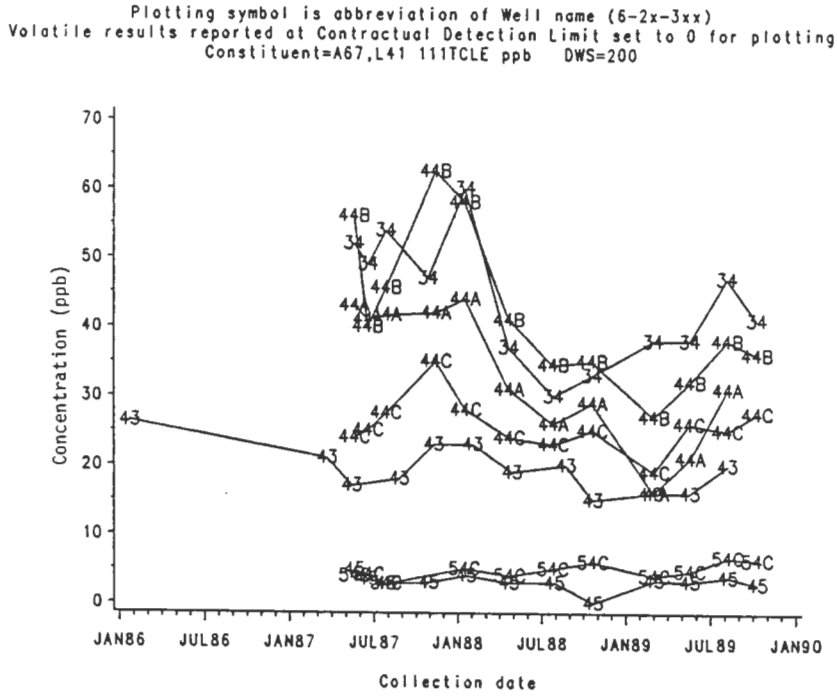

FIGURE 6.1. Graph of the Concentration Levels for Ground-Water Constituent Trichloroethane (TCA) for Solid Waste Landfill (SWL) Wells, from Initiation of SWL Monitoring Through Calendar 1989

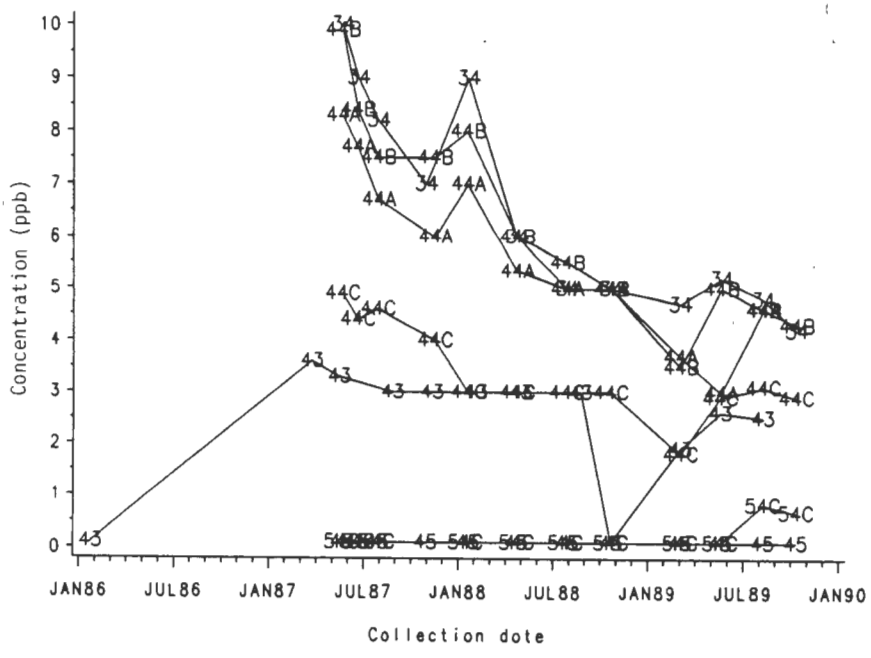

FIGURE 6.2. Graph of the Concentration Levels for Ground-Water Constituent Trichloroethene (TCE) for Solid Waste Landfill (SWL) Wells, from Initiation of SWL Monitoring Through Calendar Year 1989

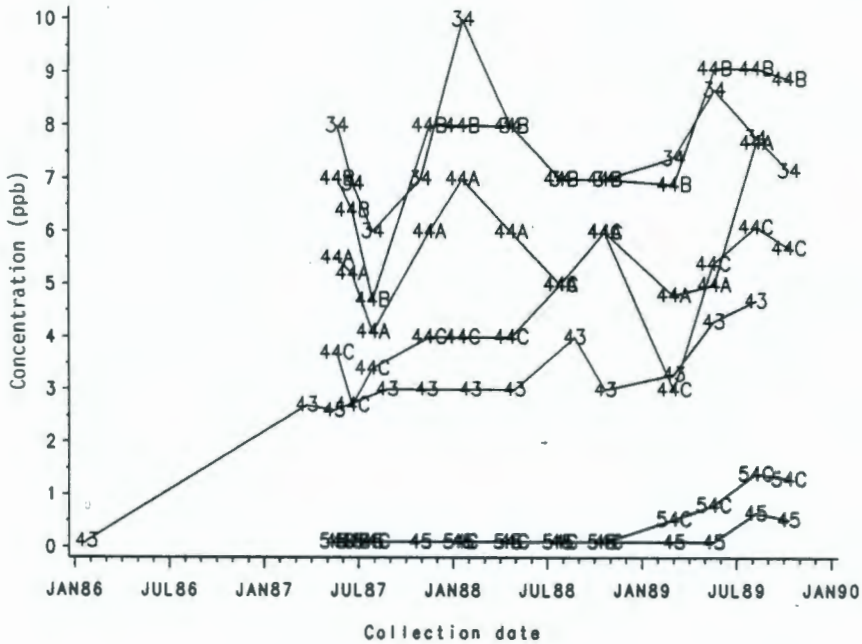

FIGURE 6.3. Graph of the Concentration Levels for Ground-Water Constituent Perchloroethene (PCE) for Solid Waste Landfill (SWL) Wells, from Initiation of SWL Monitoring

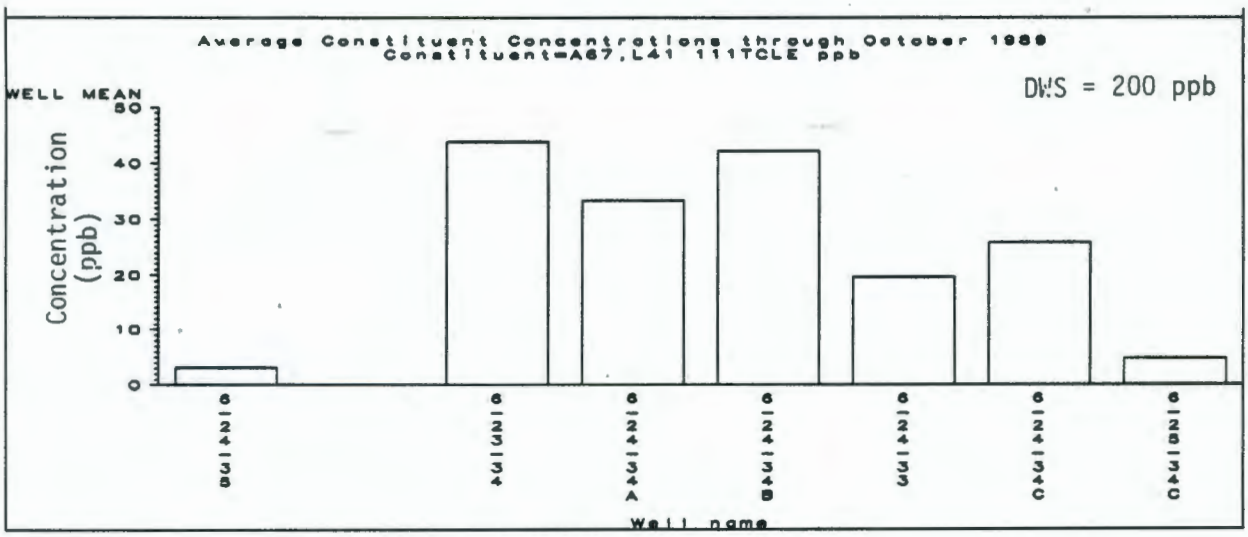

FIGURE 6.4. Bar Graph Representation of the Average Constituent Concentration Through 1989 for Trichloroethane (TCA) at Each Solid Waste Landfill (SWL) Well

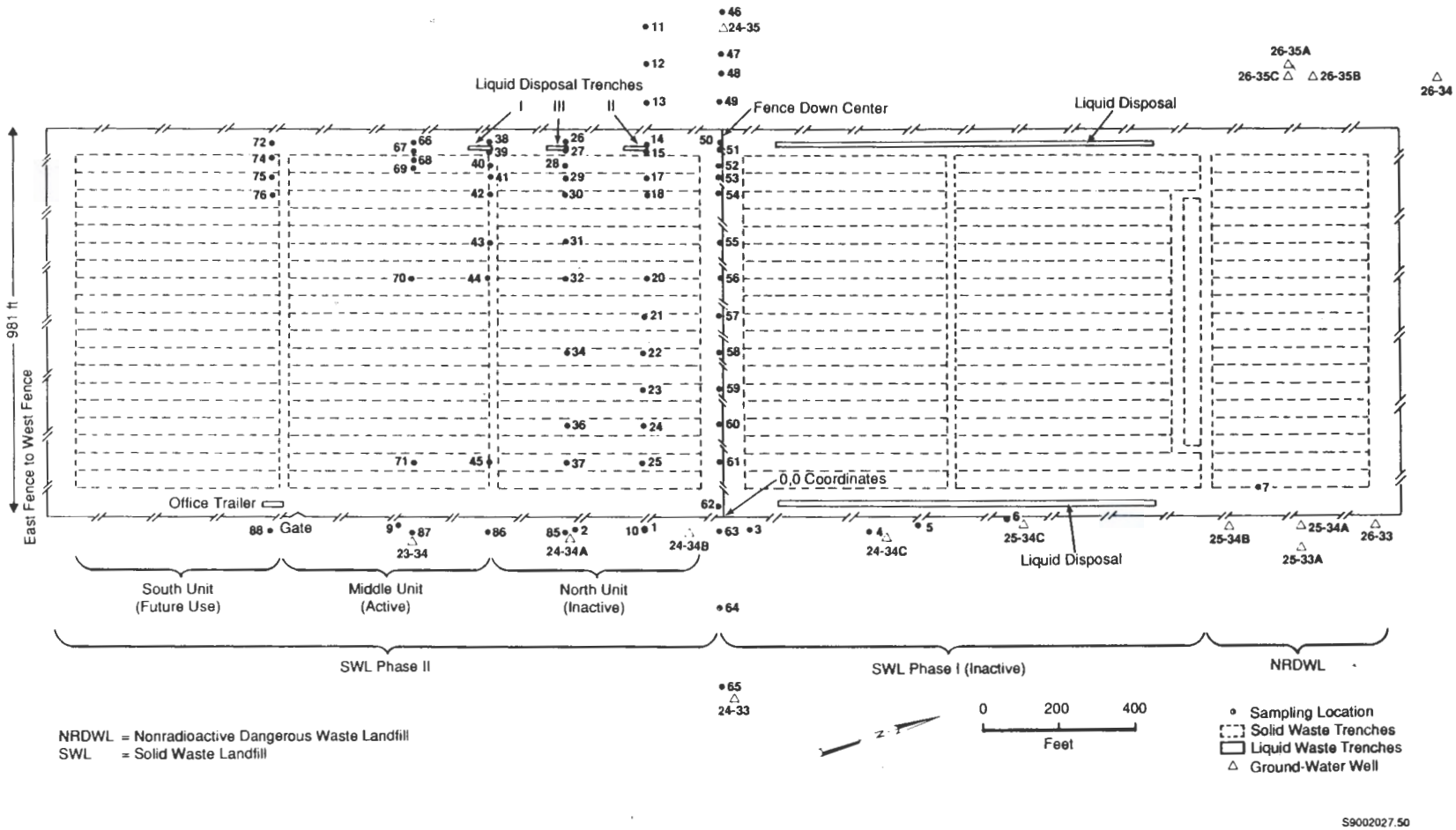

FIGURE 6.5. Plan of the Solid Waste Landfill (SWL) and the Nonradioactive Dangerous Waste Landfill (NRDW) Showing Approximate Dry and Liquid Trench Disposal Locations, the Two Ground-Water Monitoring Networks, and the Soil-Gas Survey Sampling Locations

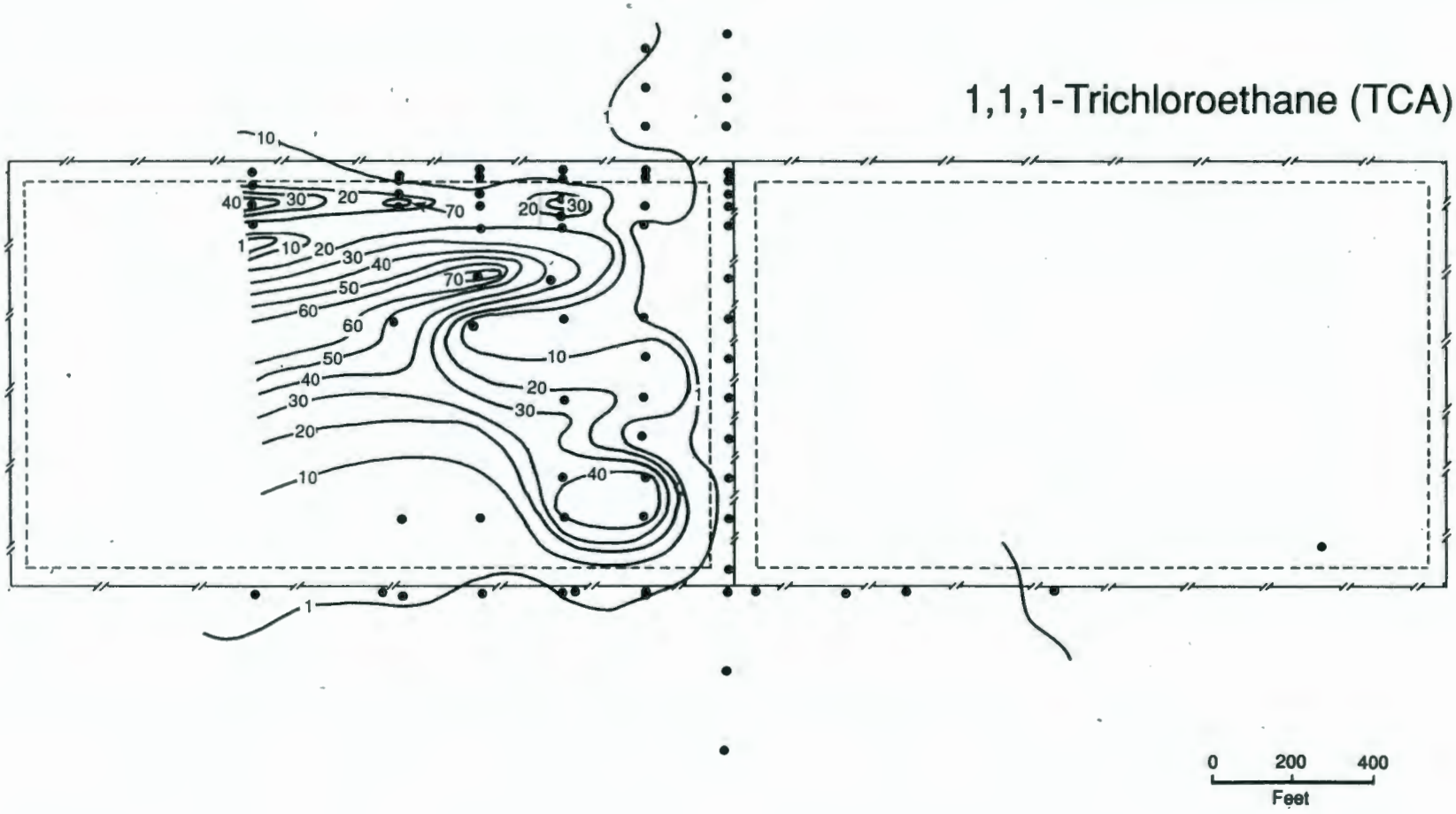

FIGURE 6.6. Concentration Level Contours for Trichloroethane (TCA), Based on the Results of the Soil-Gas Survey (concentration contours are in μg/L)

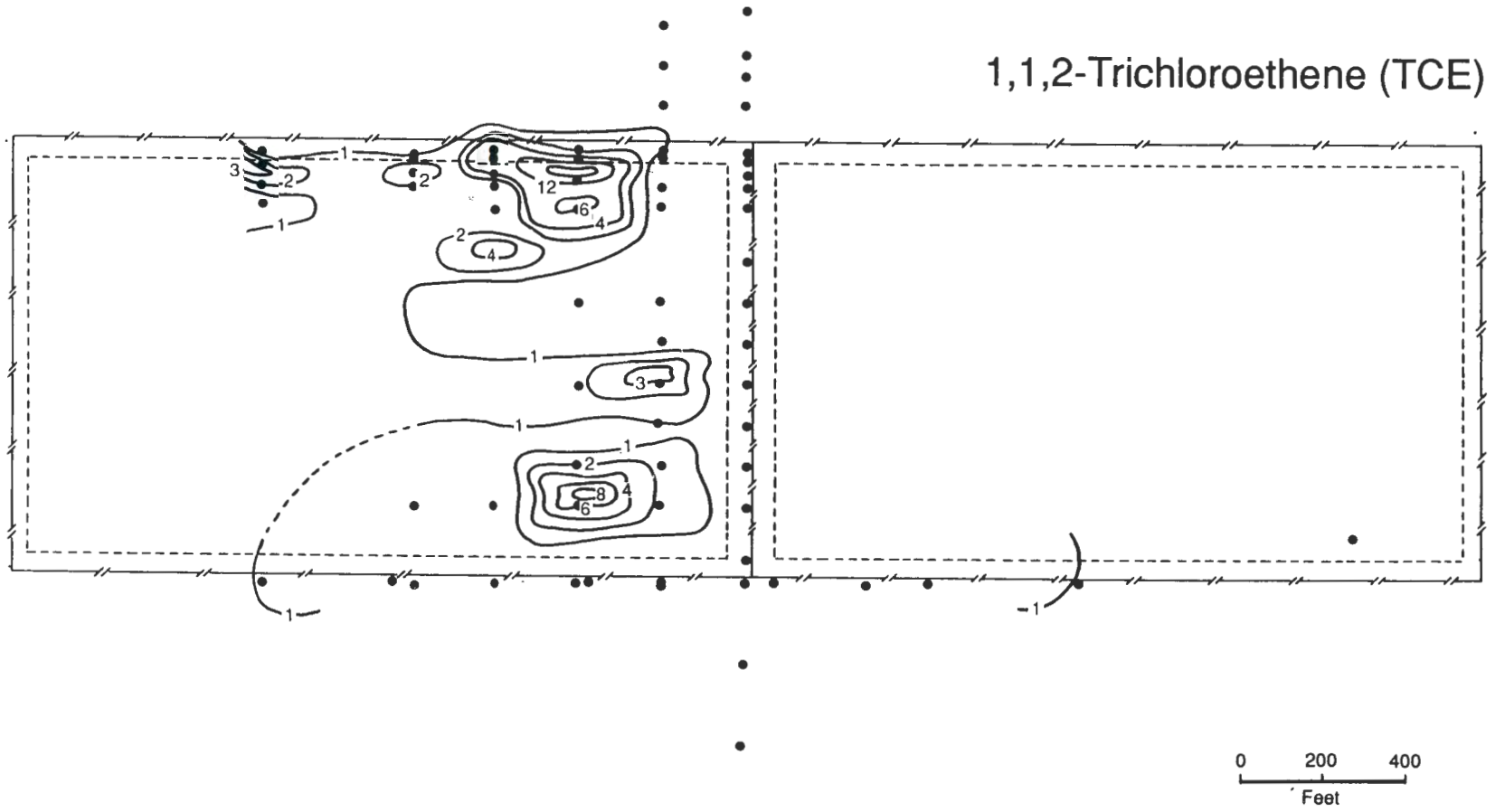

FIGURE 6.7. Concentration Level Contours for Trichloroethene (TCE), Based on the Results of the Soil-Gas Survey (concentration contours are in $\mu g/L$)

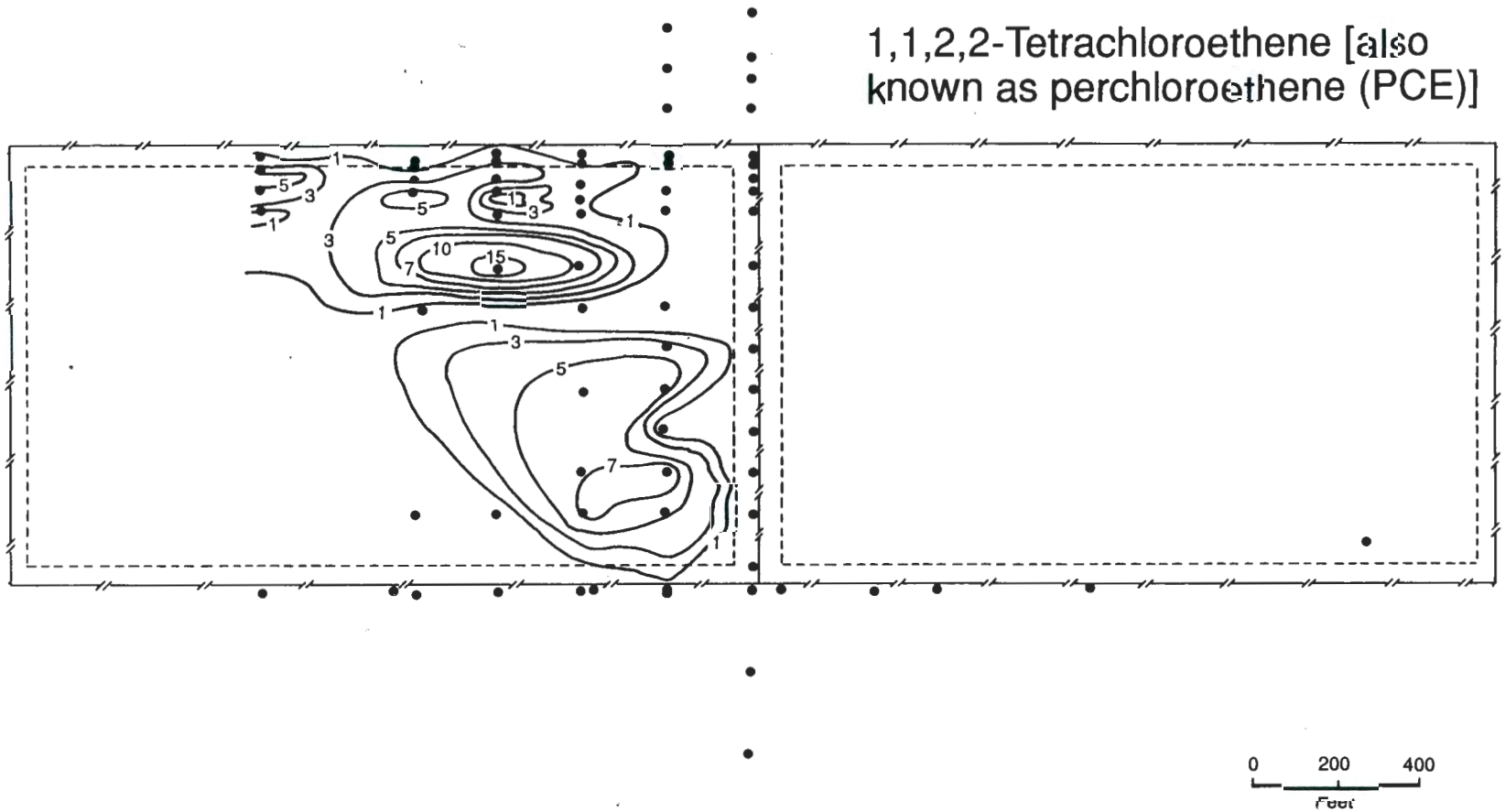

FIGURE 6.8. Concentration Level Contours for Perchloroethene (PCE), Based on the Results of the Soil-Gas Survey (concentration contours are in $\mu g/L$)

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7.0 1301-N LIQUID WASTE DISPOSAL FACILITY

M. J. Hartman
Westinghouse Hanford Company

The 1301-N LWDF is located in the 100-N Area approximately 800 ft east of the Columbia River (Figure 1.1). This facility consists of a 52- by 12-ft concrete trough connected to a 125- by 250-ft rectangular basin. The basin bottom is covered with a 3-ft-thick layer of large stones. Adjacent to the basin is an excavated ditch 1600 ft long, 50 ft wide, and 12 ft deep, which extends to the north in a zigzag pattern and is intended to handle the overflow from the basin (Figure 7.1). The facility was used to dispose of waste streams that were generated in the N Reactor and related facilities from the startup of the N Reactor in 1963 until September 1985. It is currently not in use. Wastes discharged to the 1301-N LWDF were primarily radioactive fission and activation products including cobalt-60, strontium-90, and cesium-137. Small quantities of nonradioactive hazardous wastes were also discharged to the facility.

EVALUATION OF WATER-LEVEL ELEVATIONS

Ground-water flow in the 100-N Area is affected by artificial recharge from liquid waste discharged to the 1325-N and 1324-NA facilities, as well as by changes in river level and natural recharge.

Water levels are measured in the network monitoring wells at the time of sampling. Monthly measurements are also made in most of the usable wells in the 100-N Area, in conjunction with the 1324-N/NA and 1325-N projects. Columbia River elevations in the 100-N Area are measured continuously at the 100-N gaging station.

The amount of liquid discharged to the 1325-N facility fluctuated widely during 1989 as a result of changing operations of N Reactor. These changes in artificial recharge caused large variations in ground-water levels beneath the 100-N Area. Early in 1989, ground-water mounds beneath the 1324-NA and 1325-N facilities were approximately equal in elevation (Figure 7.2). The mound beneath the 1325-N LWDF grew through the spring, reaching a maximum of

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over 413 ft above MSL in June (Figure 7.3). This mound dominated the flow system in the 100-N Area for several months, with ground-water flowing primarily northwest, perpendicular to the river beneath the 1301-LWDF. Artificial recharge decreased after July, and the 1325-N ground-water mound began to dissipate. The water table in December illustrates that the primary flow direction is toward the north or north-northwest (Figure 7.4).

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

The RCRA interim-status ground-water monitoring project at the 1301-N LWDF has been in progress since December 1987. Data collected from the first four quarters at the upgradient wells were used to determine background conditions. Analyses of samples collected from downgradient wells in December 1988 were compared to background concentrations. Specific conductance was greater in well 199-N-3 than background as indicated by well 199-N-4 (Figure 7.5). The well was resampled, and elevated specific conductance was confirmed. The Washington State Department of Ecology was notified, and a ground-water quality assessment program (Gilmore and Jensen 1989) was developed and implemented as required by 40 CFR 265. This program outlined an expansion of the monitoring network and increased the sampling frequency for selected constituents that could affect the specific conductance of the ground water.

There are seven monitoring wells in the original 1301-N LWDF ground-water monitoring network (Figure 7.1). Wells 199-N-4 and 199-N-66 are designated the upgradient wells, and wells 199-N-2, 199-N-3, 199-N-14, 199-N-67, and 199-N-69 are designated downgradient wells. To assess the source and extent of the elevated specific conductance of the ground water, existing wells 199-N-16, 199-N-17, 199-N-18, 199-N-21, 199-N-54, 199-N-55, 199-N-56, and 199-N-57 were added to the 1301-N network in April 1989. In May 1989, the nearby 1324-N/NA facilities also began assessment monitoring for elevated specific conductance (see Section 8.0). Wells 199-N-23, 199-N-24, 199-N-25, 199-N-26, and 199-N-47 were added to the monitoring network for the 1324-N/NA facilities, and data from those wells are also used in the 1301-N assessment program. All of the wells monitor the uppermost aquifer, which comprises primarily sand, gravel, and cobbles.

Preliminary results of assessment monitoring at 1301-N indicate that specific conductance and the constituents that are causing it (e.g., sulfate and chloride) are highest in the wells nearest the 1324-NA facility. In December 1988 and March 1989, when well 199-N-3 was found to have elevated specific conductance, the ground-water gradient included a component from the direction of 1324-N/NA. This ground-water may have been the source of sulfate and chloride at well 199-N-3. Specific conductance and sulfate concentrations decreased in well 199-N-3 as the ground-water gradient shifted in the summer and the effects of 1324-NA were overshadowed by artificial recharge from 1325-N (see Figure 7.3). Assessment monitoring is continuing at 1301-N and at 1324-N/NA to investigate the source of the elevated specific conductance.

Concentrations Above the Primary Drinking Water Standards

Results of chemical analyses of ground-water samples for the 1301-N LWDF during 1989 are compiled in Smith, Bates, and Lundgren (1989a, 1989b, 1989c, 1990). The following constituents were detected at concentrations greater than primary drinking water standards during 1989:

- Gross beta activity--The drinking water standard for beta radiation is 50 pCi/L. Beta concentrations greater than this level were common in the wells downgradient of the 1301-N LWDF during 1989. The highest beta concentration observed was 40,800 pCi/L in a sample collected from well 199-N-67 in December 1988 (the analytical results were received in 1989). An adjacent well, 199-N-69, had beta concentrations of 43.4 pCi/L in December 1988. These wells consistently showed differences of three orders of magnitude in gross beta concentrations. Well 199-N-67 is screened from the water table to a depth of 76 ft; well 199-N-69 is screened from 90 to 100 ft, at the top of a clay layer. Beta concentrations at the upgradient wells were generally at or below the drinking water standard.

- Strontium-90--The primary constituent causing the elevated beta concentrations is strontium-90. Strontium-90 concentrations in down-gradient wells ranged from less than detection to 23,400 pCi/L (well 199-N-67 in March 1989). Strontium-90 was below detection

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limits in all samples from well 199-N-69. Strontium-90 concentrations at the upgradient wells were generally near or below the drinking water standard of 8 pCi/L.

- Tritium--Tritium exceeded the primary drinking water standard (20,000 pCi/L) in nearly all of the samples collected from the core monitoring network in 1989. The highest observed concentration was in well 199-N-69 in August, with 92,700 pCi/L.

- Nitrate--The drinking water standard for nitrate is 45,000 ppb. This level was exceeded in wells 199-N-67 in March (87,000 ppb), 199-N-56 in June (63,000 ppb) and 199-N-55 in November (93,000 ppb).

Rate of Migration of Contaminants

The rate of contaminant migration from 1301-N has not been calculated, but contaminants have been detected in N-Springs, a series of ground seepages along the Columbia River (Perkins 1989).

A range of estimates for ground-water flow velocity can be calculated with the Darcy Equation, assuming the following range of input parameters:

Hydraulic conductivity of the uppermost aquifer (Hanford formation):
2000 to 10,000 ft/d (Graham et al. 1981).
Effective porosity: 0.10 to 0.30
Groundwater gradient beneath 1301-N: 0.01 (June); 0.004 (December).

The calculated range of ground-water velocity in June 1989, when the gradient was steepest for the year, is 70 to 1000 ft/d. In December, the calculated range is 30 to 400 ft/d.

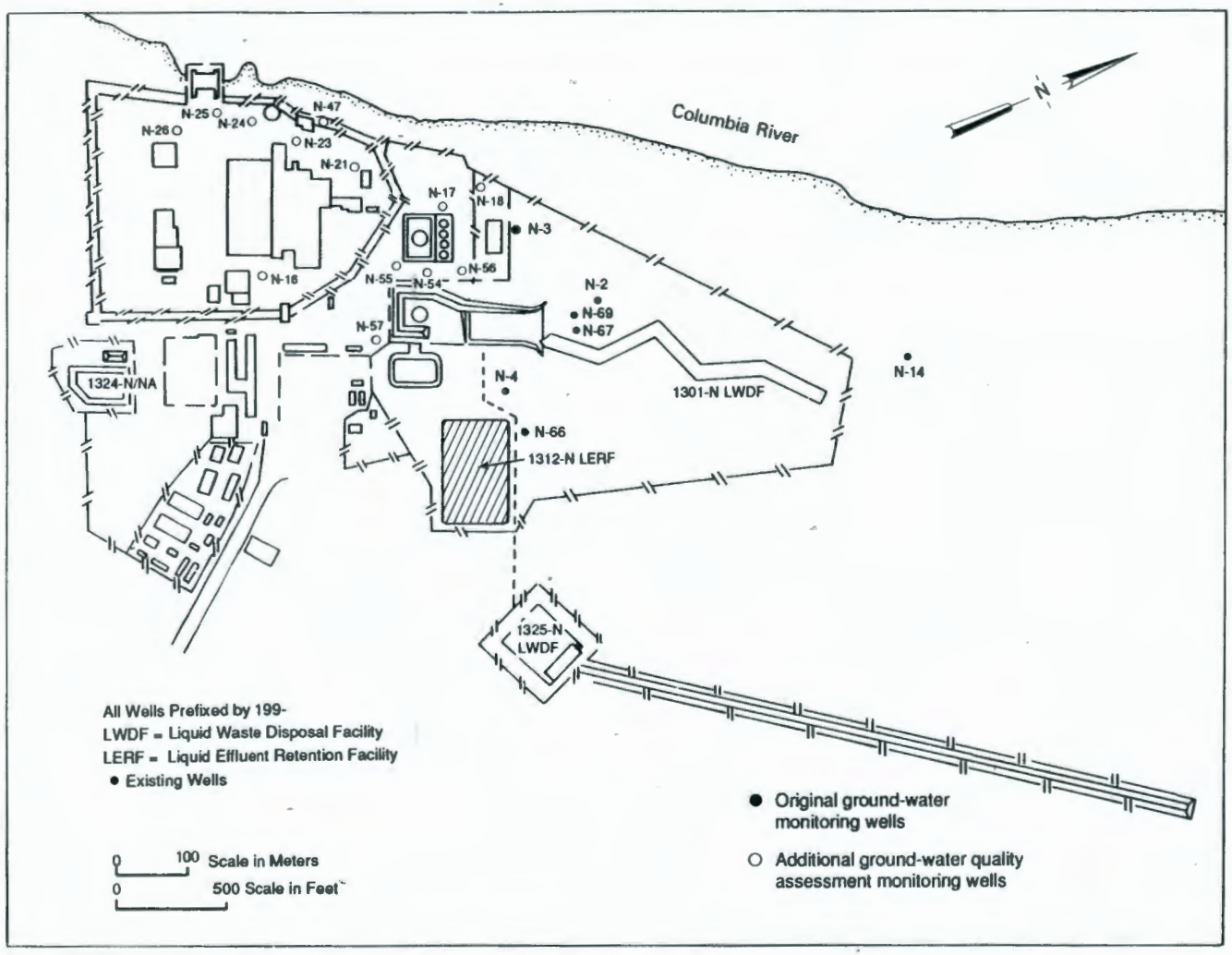

FIGURE 7.1. Ground-Water Monitoring Wells Near the 1301-N Liquid Waste Disposal Facility

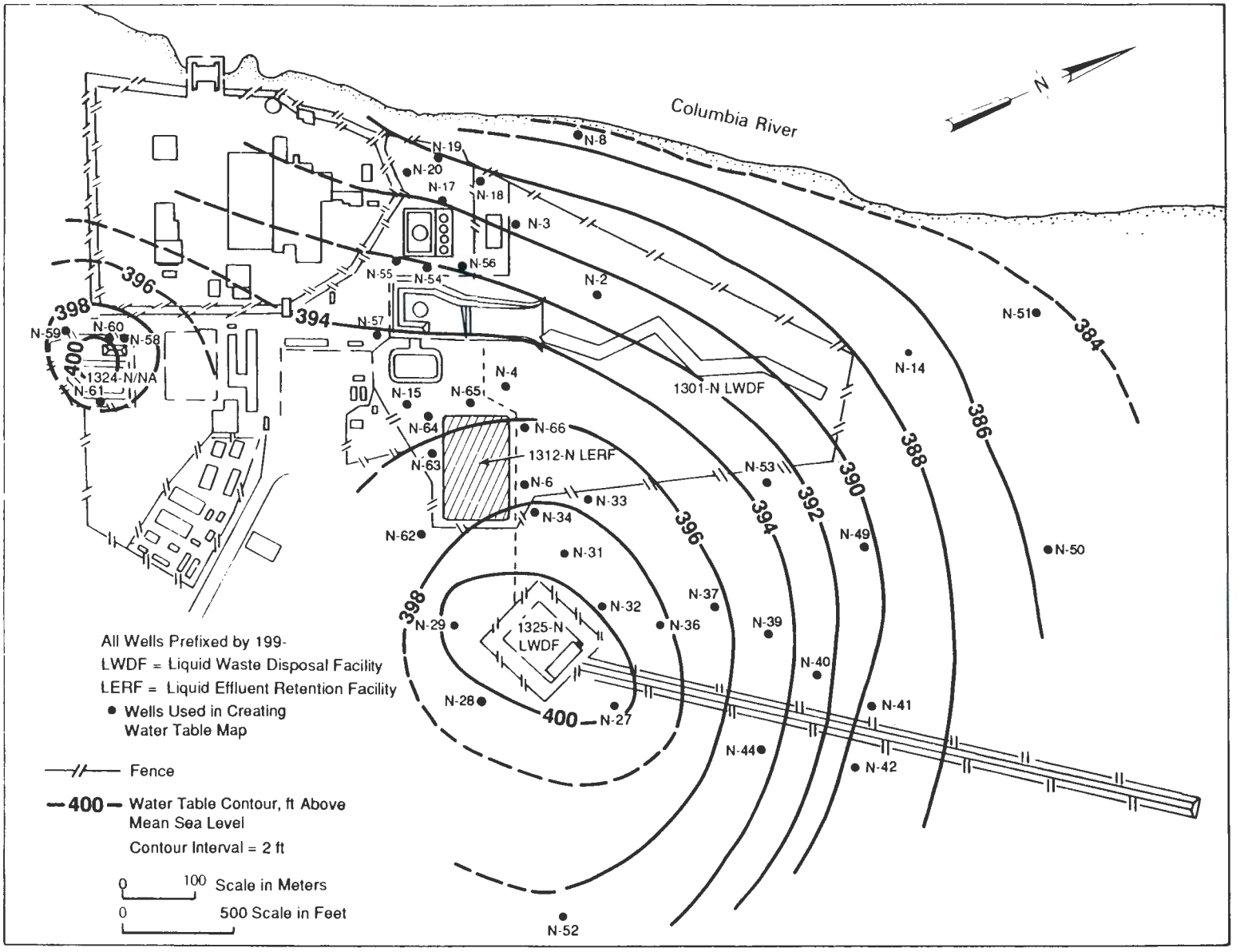

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FIGURE 7.2. Water Table in the 100-N Area, January 30, 1989

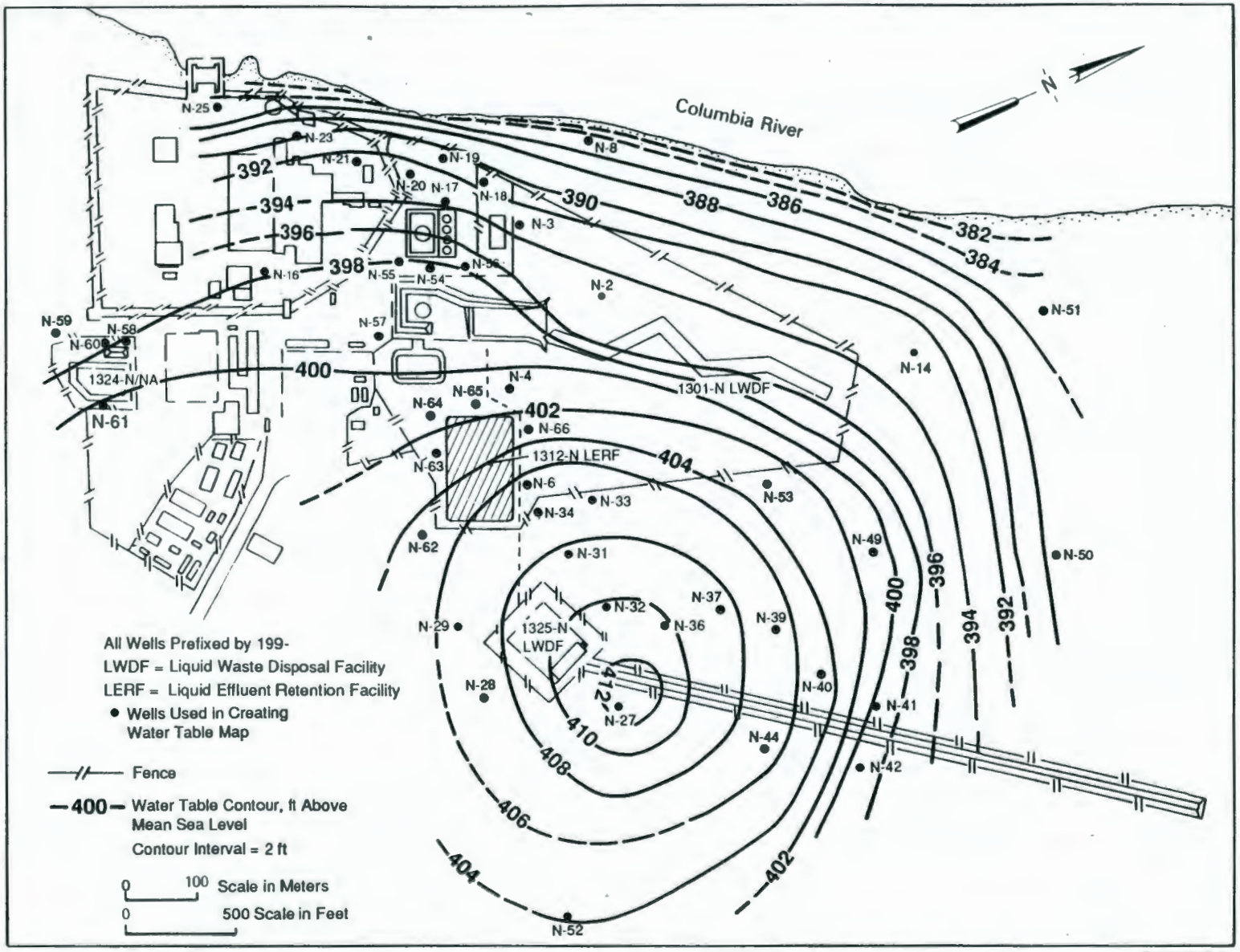

FIGURE 7.3. Water Table in the 100-N Area, June 30, 1989

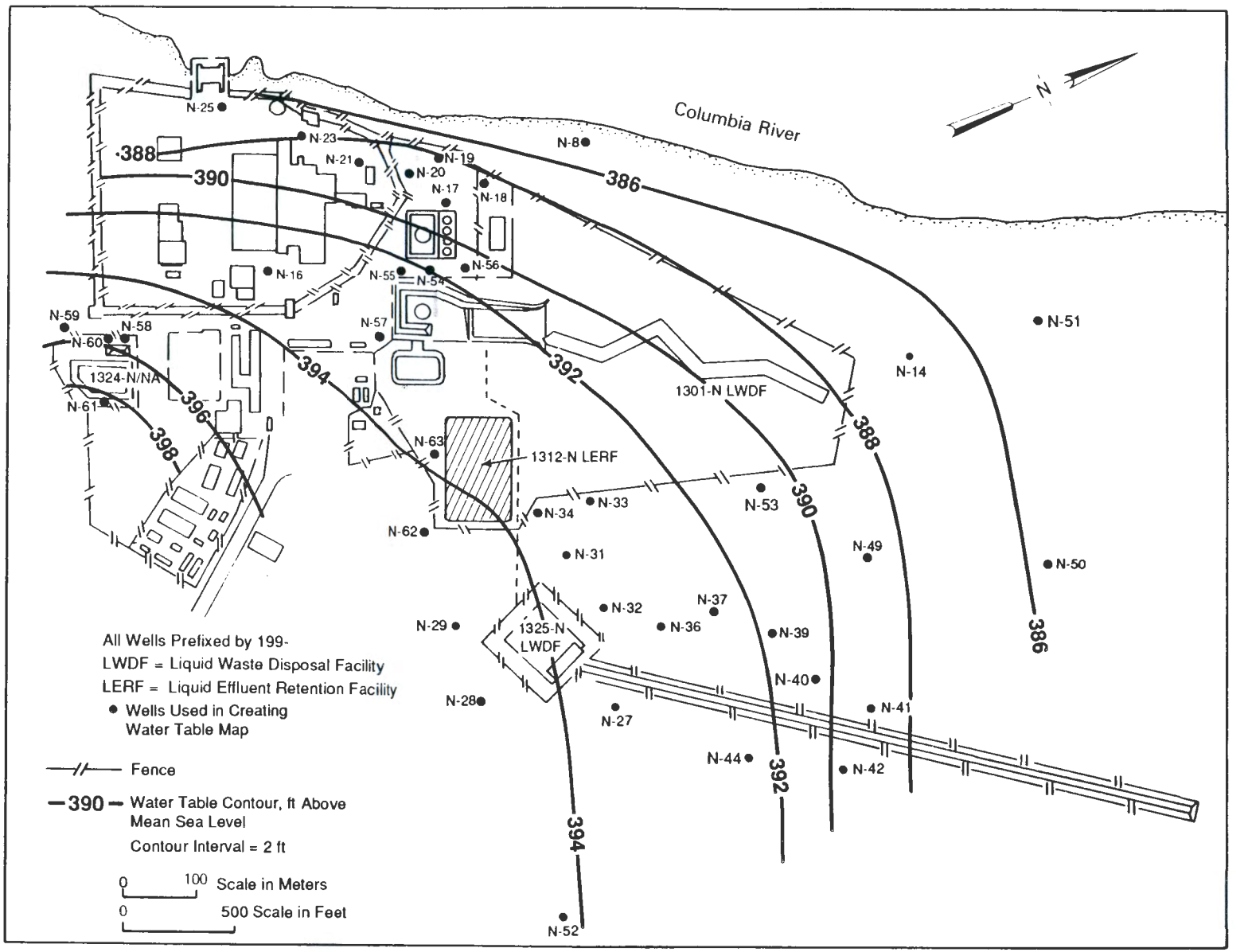

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FIGURE 7.4. Water Table in the 100-N Area, December 28, 1989

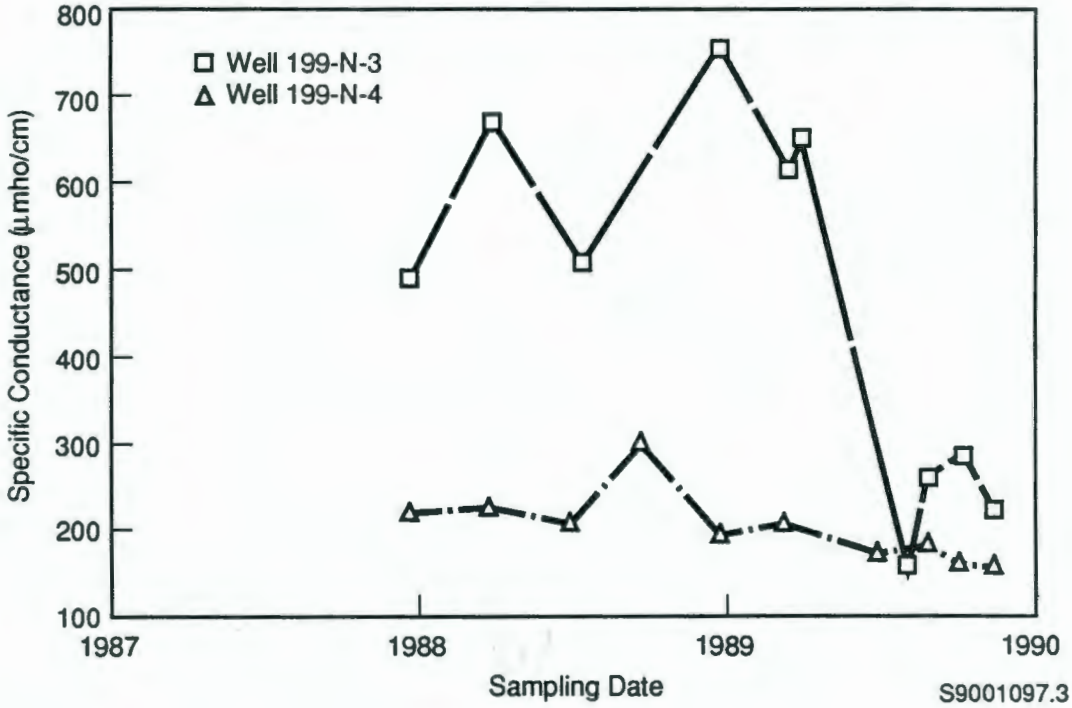

FIGURE 7.5. Field Specific Conductance of Ground-Water Samples from Wells 199-N-3 and 199-N-4, 1987 Through 1989

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8.0 1324-N SURFACE IMPOUNDMENT AND 1324-NA PERCOLATION POND

M. J. Hartman
Westinghouse Hanford Company

The 1324-N/NA facilities are located in the 100-N Area approximately 1300 ft east of the Columbia River (Figure 8.1). The 1324-N Surface Impoundment was a treatment facility that was in service from May 1986 to November 1988, when it was replaced with an elementary neutralization vessel. This facility is a doubly lined pond with a leachate collection system that was used to neutralize the wastes. It is currently not in use. The 1324-NA Percolation Pond is an unlined pond that was used to treat corrosive hazardous wastes from August 1977 to May 1986. These wastes contained sulfuric acid and sodium hydroxide. The 1324-NA pond is currently a disposal facility, receiving treated wastes from the elementary neutralization vessel that replaced the 1324-N facility.

EVALUATION OF WATER-LEVEL ELEVATIONS

Water levels are measured in the network monitoring wells at the time of sampling. Monthly measurements are also made in most of the usable wells in the 100-N Area, in conjunction with the 1301-N and 1325-N projects. Water-level elevations and ground-water flow in the 100-N Area during 1989 are discussed in Section 7.0.

Early in the year when the ground-water mound beneath 1324-N/NA was distinct, ground-water flowed radially outward from the mound in the immediate vicinity of the LWDF (see Figure 7.2). In the summer, the 1324-N/NA mound was overwhelmed by the influence of 1325-N, and ground-water flowed toward the west beneath 1324-N/NA (see Figure 7.3). As of December 1989, ground-water flow had changed again toward the north-northwest, and the ground-water mound beneath 1324-N/NA may be reappearing (see Figure 7.4).

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

The RCRA interim-status ground-water monitoring project at the 1324-N/NA Liquid Waste Disposal Facility (LWDF) has been in progress since December

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1987. Data collected from the first four quarters at the upgradient well were used to determine background conditions. Analyses of samples collected from downgradient wells in March 1989 were compared to background concentrations. Specific conductance was greater than background in all of the downgradient monitoring wells (Smith, Bates, and Lundgren 1989b). The wells had shown high specific conductance throughout the first year of sampling, so the wells were not resampled to confirm the results. The Washington State Department of Ecology was notified, and a ground-water quality assessment program (Gilmore 1989) was developed and implemented as required by 40 CFR 265. This program outlined an expansion of the monitoring network and increased the sampling frequency for selected constituents that could affect the specific conductance in the ground water. Assessment monitoring at 1324-N/NA is conducted in conjunction with the 1301-N project (see Section 7.0).

Specific conductance in wells 199-N-58, 199-N-59, 199-N-60, and 199-N-61, which are adjacent to the facility, are commonly between 1000 and 2000 μmho/cm. The highest specific conductance measured in 1989 was at well 199-N-61 in August, with 3900 μmho/cm. Sulfate and sodium are the major constituents causing the elevated specific conductance (Figures 8.2 and 8.3).

Assessment monitoring is designed to define the extent and nature of the contaminant plume from the 1324-N/NA facility. Analytical data to date indicate that contaminants have moved downgradient from the facility toward the north and northeast. Concentrations of sulfate and other ions, as well as specific conductance, are highest near the facility. Additional monitoring is necessary to define the contaminant plume in greater detail.

Concentrations Above the Primary Drinking Water Standards

Results of chemical analyses of ground-water samples for the 1324-N/NA facilities during 1989 are compiled in Smith, Bates, and Lundgren, (1989a, 1989b, 1989c, 1990). The following constituents were detected at concentrations greater than primary drinking water standards during 1989:

- Sulfate--Extremely high concentrations of sulfate were measured in the four wells adjacent to the facility, ranging from one million

to greater than two million ppb. Sulfate concentrations in some of the assessment wells also were greater than the drinking water standard of 250,000 ppb.

- Coliform bacteria--The drinking water standard for coliform is 1 MPN (most probable number). In August 1989, 2 MPN coliform was reported in a sample from well 199-N-60. In December 1989 well 199-N-24 showed 63.0 MPN. The cause of this elevated concentration is not known.

Rate of Migration of Contaminants

The rate of contaminant migration from the 1324-N/NA facility has not been determined, but wells in the assessment network that are adjacent to the river contain elevated levels of sulfate (Smith, Bates, and Lundgren 1990), so it appears that contaminants have reached the Columbia River.

A range of estimates for ground-water flow velocity can be calculated with the Darcy Equation, assuming the following ranges of input parameters:

Hydraulic conductivity of the uppermost aquifer (Hanford formation): 2000 to 10,000 ft/d (Graham et al. 1981).

Effective porosity: 0.10 to 0.30

Ground-water gradient beneath 1324-N/NA: 0.01 (June); 0.005 (December).

The calculated range of groundwater velocity in June 1989, when the gradient was steepest for the year, is 70 to 1000 ft/d. In December, the calculated range is 30 to 500 ft/d.

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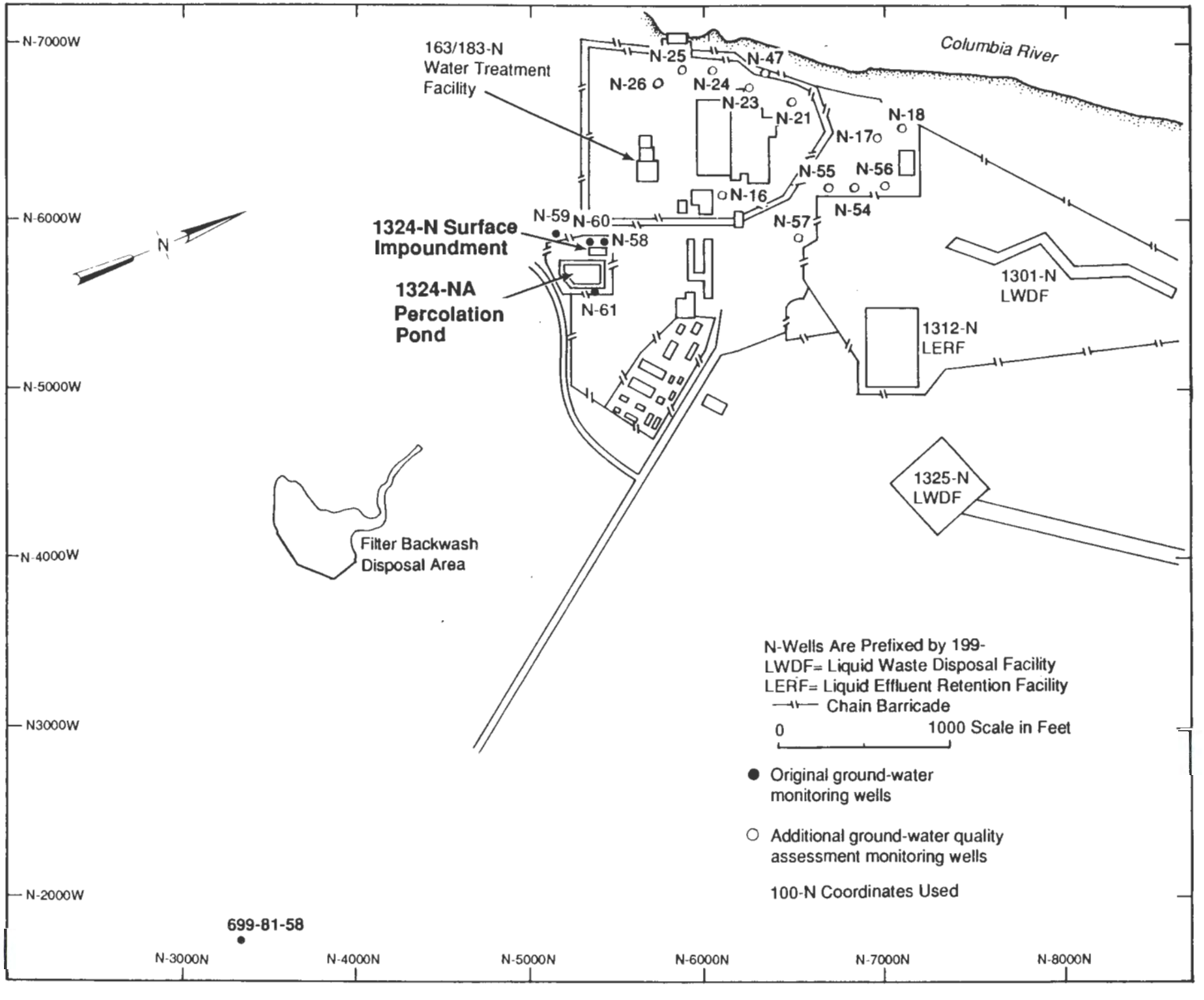

FIGURE 8.1. Ground-Water Monitoring Wells Near the 1324-N and 1324-NA Facilities

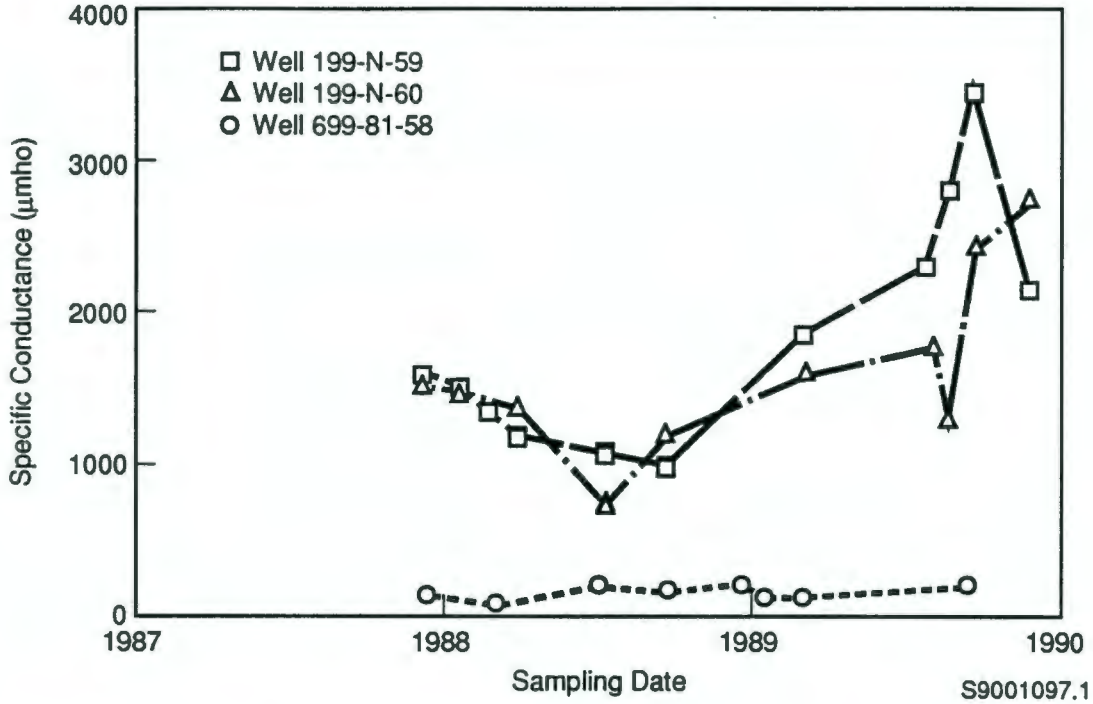

FIGURE 8.2. Field Specific Conductance of Ground-Water Samples from Wells 199-N-59, 199-N-60, and 699-81-58, 1987 Through 1989

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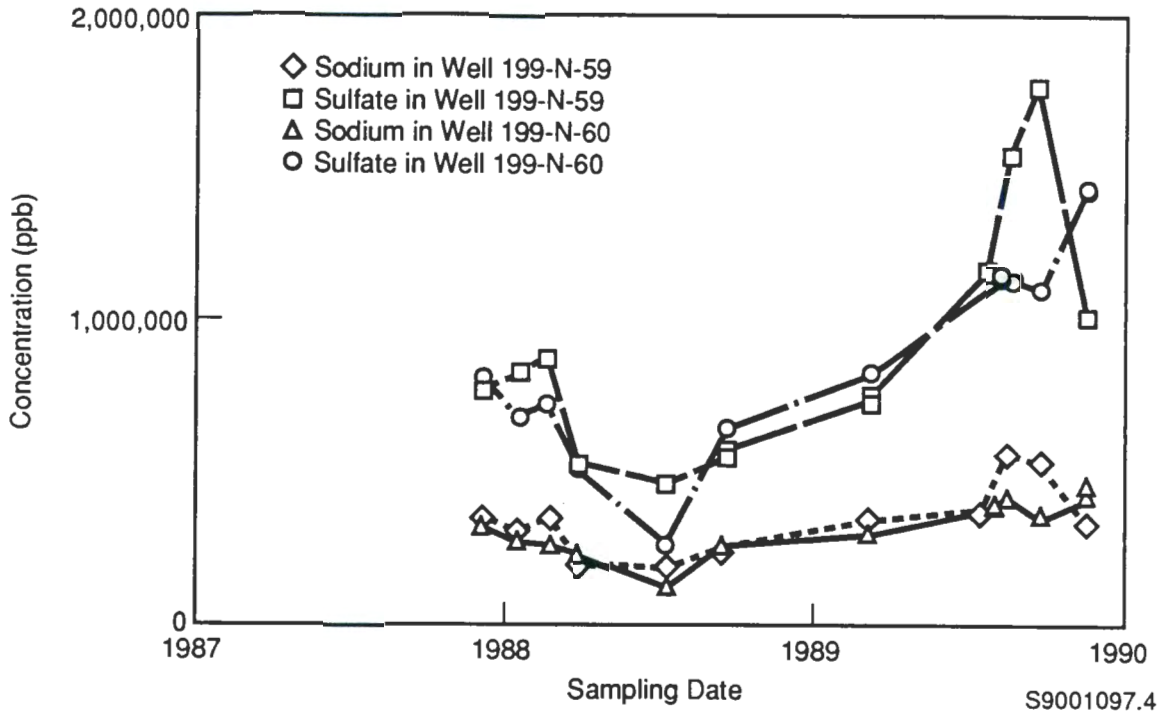

FIGURE 8.3. Sulfate and Sodium Concentrations in Ground-Water Samples from Wells 199-N-59 and 199-N-60, 1987 Through 1989

9.0 1325-N LIQUID WASTE DISPOSAL FACILITY

M. J. Hartman
Westinghouse Hanford Company

The 1325-N Liquid Waste Disposal Facility (LWDF) was the primary liquid waste disposal system for the N Reactor. The facility began operation in 1983 and is currently in use. Wastes discharged to the 1325-N LWDF have included primarily radioactive fission and activation products, which were formerly discharged to the 1301-N LWDF (see Section 7.0). The facility is located in the 100-N Area, approximately 2200 ft east of the Columbia River. It consists of a 240- by 250-ft concrete basin with an extension trench that is approximately 3000 ft long, 55 ft wide, and 7 ft deep (Figure 9.1).

EVALUATION OF WATER-LEVEL ELEVATIONS

Water levels are measured in the network monitoring wells at the time of sampling. Monthly measurements are also made in most of the usable wells in the 100-N Area, in conjunction with the 1301-N and 1324-N/NA projects. Water-level elevations and ground-water flow in the 100-N Area during 1989 are discussed in Section 7.0.

A ground-water mound beneath the 1325-N LWDF was the dominant ground-water feature in the 100-N Area during the summer of 1989 (see Figure 7.3). During this time, ground water flowed radially outward from the center of the mound. As the mound dissipated, ground-water flow directions changed; as of December 1989 the primary flow direction beneath the 1325-N LWDF was toward the north (see Figure 7.4).

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

The RCRA interim-status ground-water monitoring project at the 1325-N LWDF has been in progress since December 1987. The project is in the indicator parameter evaluation stage of monitoring.

There are 11 wells in the 1325-N LWDF ground-water monitoring network (Figure 9.1). Well 699-81-58 is the designated upgradient well, and wells 199-N-27, 199-N-29, 199-N-31, 199-N-32, 199-N-33, 199-N-36, 199-N-41,

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199-N-42, 199-N-52, and 199-N-70 are the designated downgradient wells. Analytical results indicate that well 199-N-52, which had been previously designated upgradient, is affected by waste discharges to the 1325-N LWDF because of the ground-water mound (Smith, Bates, and Lundgren 1989b). Well 199-N-52 is now considered downgradient. All of the wells monitor the uppermost aquifer, which comprises primarily sand, gravel, and cobbles.

Data collected during the first four quarters at the upgradient well were used to determine background conditions. Analyses of samples collected from downgradient wells are compared to background concentrations each quarter. Samples collected in March 1989 showed concentrations greater than the critical mean for TOX and specific conductance in some wells. The wells were resampled and the elevated constituents were not verified (Smith, Bates, and Lundgren 1989b). Therefore, the project continued in an indicator evaluator monitoring program. Samples collected from June through December did not exceed critical means for the indicator parameters (pH, specific conductance, TOC, and TOX).

Concentrations Above the Primary Drinking Water Standards

Results of chemical analyses of ground-water samples for the 1325-N LWDF during 1989 are compiled in Smith, Bates, and Lundgren (1989a, 1989b, 1989c, 1990). The following constituents were detected at concentrations greater than primary drinking water standards during 1989:

- Beta activity--Gross beta concentrations at wells downgradient of the 1325-N LWDF were commonly between 100 and 500 pCi/L. Concentrations at well 199-N-29 were often higher than this, reaching 2970 pCi/L in June. The drinking water standard for gross beta is 50 pCi/L.

- Strontium-90--The highest concentrations of strontium-90 were in the wells nearest the active portion of the 1325-N LWDF (i.e., the square basin). Concentrations in these wells were generally in the tens to hundreds of pCi/L. The highest observed concentration of strontium-90 was in well 199-N-29 in June, with 1750 pCi/L. Wells at the remote end of the 1325-N Trench, which has never received waste, were less than detection for strontium-90. The drinking water standard for strontium-90 is 8 pCi/L.

- Tritium--Tritium concentrations were commonly above the drinking water standard of 20,000 pCi/L in most of the wells downgradient of the 1325-N LWDF during 1989. The highest concentration observed

was in well 199-N-32 in December 1988 (results were received in 1989), with 234,000 pCi/L. In December 1989, well 199-N-31 had 218,000 pCi/L tritium.

- Polychlorinated Biphenyls (PCBs)--Arochlor 1016, a PCB, was detected in a sample collected from well 199-N-33 in March 1989. The well was resampled and PCB was detected again (Smith, Bates, and Lundgren 1989b). The well was equipped with an oil-lubricated, submersible pump, which was pulled from the well and found to be leaking fluid. A sample of that fluid was analyzed and was found to contain Arochlor 1016. A new pump was installed in well 199-N-33 and the well was sampled again in December 1989. No PCBs were detected (Smith, Bates, and Lundgren 1990). It appears that fluid leaking from the old pump was the source of the PCBs in the ground-water samples from this well, and that the ground water itself is not contaminated with PCBs.

Rate of Migration of Contaminants

The rate of contaminant migration from the 1325-N/NA facility has not been determined. When the first liquid was discharged to the 1325-N LWDF, water levels were monitored in nearby wells to detect their response to the artificial recharge (Jensen 1987). This study indicated that the discharge had reached the water table within 2 hr. Water levels in well 199-N-34 began to increase in approximately 1 day. If the response in well 199-N-34 is assumed to be due to ground-water movement from beneath the 1325-N LWDF, then ground-water velocity was approximately 400 ft/d. The ground-water gradient near 1325-N was approximately 0.005 to 0.01 when the study was conducted.

A range of estimates for ground-water flow velocity also can be calculated with the Darcy Equation, assuming the following ranges of input parameters:

Hydraulic conductivity of the uppermost aquifer (Hanford formation):
2000 to 10,000 ft/d (Graham et al. 1981).
Effective porosity: 0.10 to 0.30
Ground-water gradient beneath 1325-N: 0.01 (June); 0.003 (December).

The calculated range of ground-water velocity in June 1989, when the gradient was steepest for the year, is 70 to 1000 ft/d. In December, the calculated range is 20 to 300 ft/d.

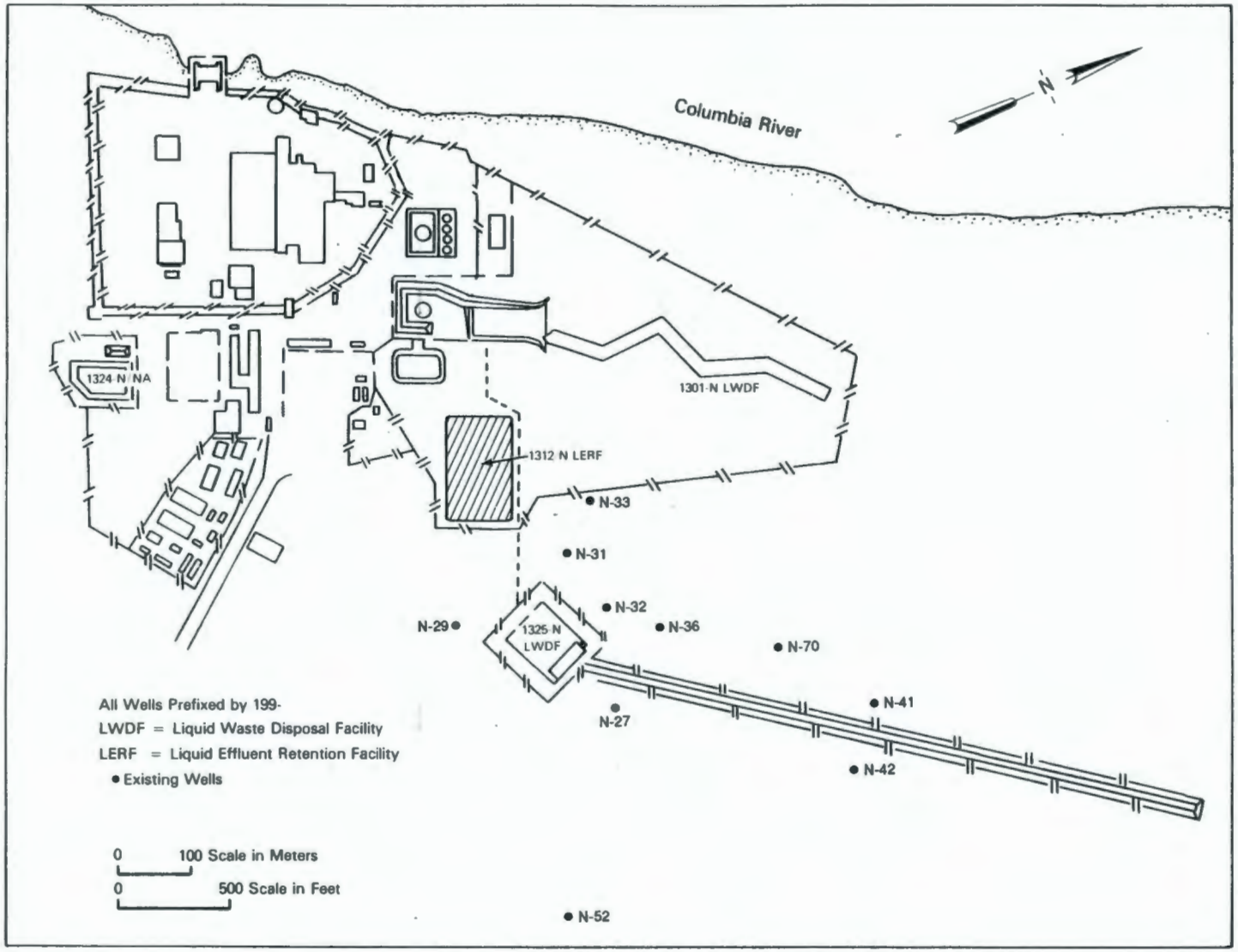

FIGURE 9.1. Ground-Water Monitoring Wells Near the 1325-N Liquid Waste Disposal Facility

10.0 216-A-10 CRIB

S. P. Luttrell

The RCRA ground-water monitoring project for the 216-A-10 Crib is an interim-status, indicator parameter evaluation monitoring effort in the 200-East Area (Figures 1.1 and 10.1). The 216-A-10 Crib is a cross-sectionally v-shaped crib approximately 45 ft deep and 275 ft long and located in the 200-East Area (Figure 1.1). The crib received startup wastes from the Plutonium Uranium Extraction (PUREX) Plant 400 ft to the north during a 4-month period in 1956, but did not begin continuous service until 1961 when it replaced the retired 216-A-5 Crib. The crib operated continuously from 1961 to 1973, sporadically in 1977, 1978, and 1981, then continuously until 1987.

Progress during 1989 included sampling and analysis of the ground-water monitoring wells. Wells 299-E24-18 and 299-E25-36 are upgradient monitoring wells; wells 299-E17-1, 299-E17-19, 299-E17-20, 299-E24-2, 299-E24-16, and 299-E24-17 are downgradient monitoring wells (see Figure 10.1). Also, well 299-E17-8, located west of the 216-A-10 Crib, is used for water-level measurements. Four sets of quarterly ground-water samples have been collected and analyzed from the eight monitoring wells.

EVALUATION OF WATER-LEVEL ELEVATIONS

Depth-to-water measurements are made before purging each time samples are collected. In addition, supplemental measurements have been made quarterly. These measurements, including casing elevation, depth-to-water, and water-level elevation data are presented in the four RCRA quarterly reports for 1989 (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Hydrographs of water-level elevations determined from supplemental measurements are shown in Figures 10.2 and 10.3. Water-level data from December 21, 1989 are shown in Figure 10.4 in conjunction with data from 21-A-36B Crib monitoring wells. These data have been inconclusive for determining the ground-water flow direction because of the very small gradient and uncertainties in the data.

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Water-chemistry data may be more useful for determining a general ground-water flow direction beneath the 216-A-10 Crib, as discussed in the next section.

Two of the monitoring wells were installed on each side of the crib because of the uncertainty of the ground-water flow direction. These four wells and the two existing wells ring the facility in order to ensure that wells are located hydraulically downgradient. Thus, downgradient ground-water monitoring wells for the 216-A-10 Crib are appropriately located.

Well 299-E24-18 may not be appropriately located to serve as an adequate upgradient monitoring well, as discussed in the next section.

EVALUATION OF WATER CHEMISTRY AND INDICATOR PARAMETERS

Four quarters of data have been collected to establish background levels at the 216-A-10 Crib. Indicator parameters for each ground-water monitoring well for 1989 are provided in RCRA quarterly reports (Smith, Bates, and Lundgren 1989a, 1989c). Statistical evaluation of background and indicator parameters will not be performed until the first semiannual sample has been collected and analyzed in 1990.

Ground-water chemistry data may provide a method for determining the general ground-water flow direction beneath the 216-A-10 Crib. Both nitrate and tritium are elevated in well 299-E24-18 in relation to well 299-E24-7, located northwest of well 299-E24-18. Waste disposal facilities south of PUREX, including the 216-A-10 crib, are the most likely sources of these constituents. It is reasonable to assume, therefore, that ground water currently and/or in the past moved toward the west from the 216-A-10 Crib.

Water-chemistry data from well 299-E24-18 indicate that nitrate and tritium have consistently been above their respective drinking-water limits. Nitrate has been at least ten times greater in samples from well 299-E24-18 than in samples from well 299-E25-36 for the entire period these wells have been sampled. Tritium has been more than 200 times greater in samples from well 299-E24-18 than in samples from well 299-E25-36. Furthermore, specific conductance has always been higher (as much as 127% higher) in well

299-E24-18 than in well 299-E25-36. These results suggest that well 299-E24-18 is influenced by the waste disposal facilities south of PUREX, including the 216-A-10 Crib.

The following constituents have, in at least one well, exceeded their respective maximum contaminant levels in 40 CFR 141, National Primary Drinking Water Regulations (for ground water):

- gross beta
- chromium (unfiltered)
- nitrate
- tritium.

Rate of Migration of Contaminants

The 216-A-10 Crib is in an indicator evaluation program and, therefore, a discussion of the rate of contaminant migration is not applicable. Ground-water flow velocity is estimated to range from 1 to 10 ft/d ($K = 10^3$ to 10^4 ft/d, gradient = 10^4).

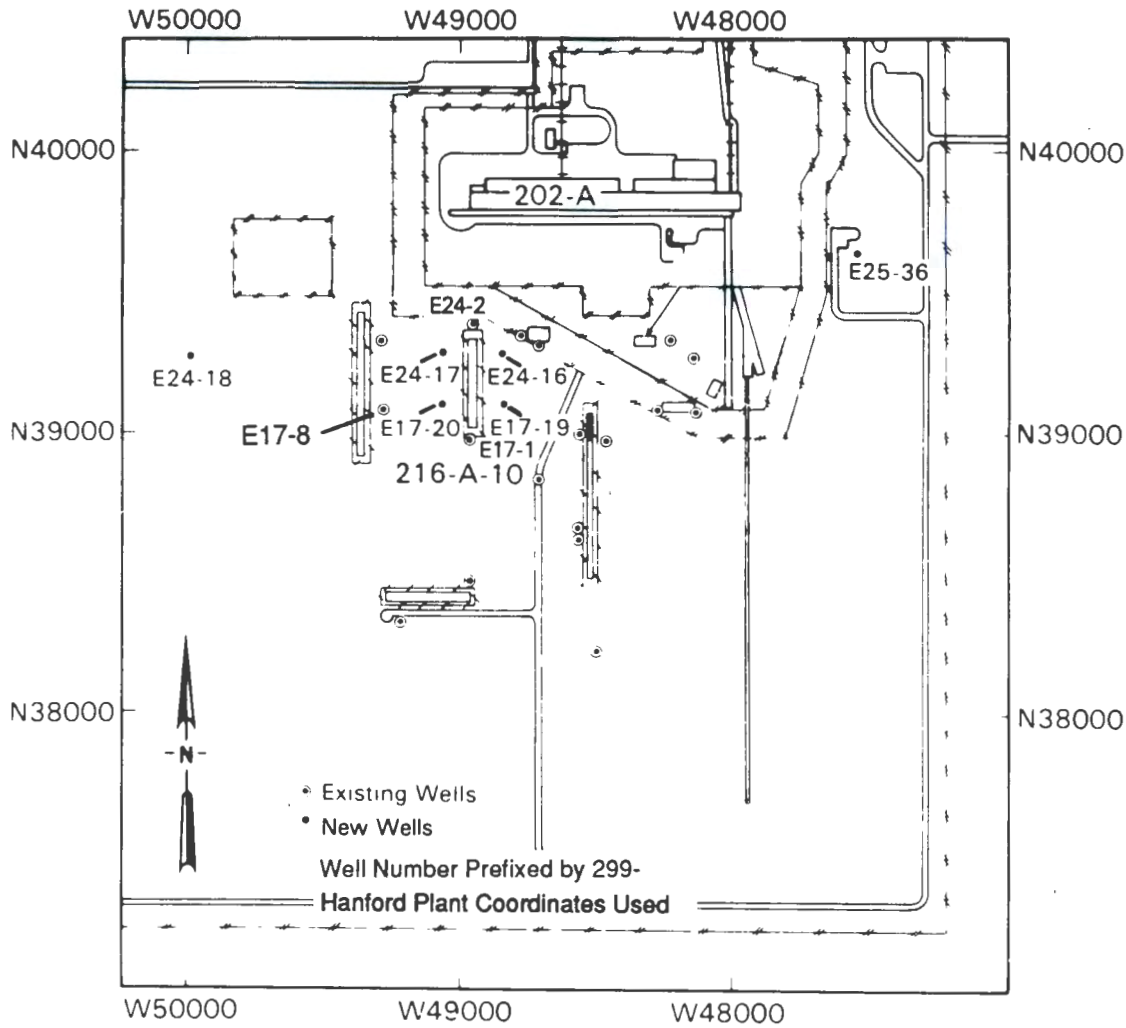

FIGURE 10.1. Location of the 216-A-10 Crib and Locations of Ground-Water Monitoring Wells for the Crib

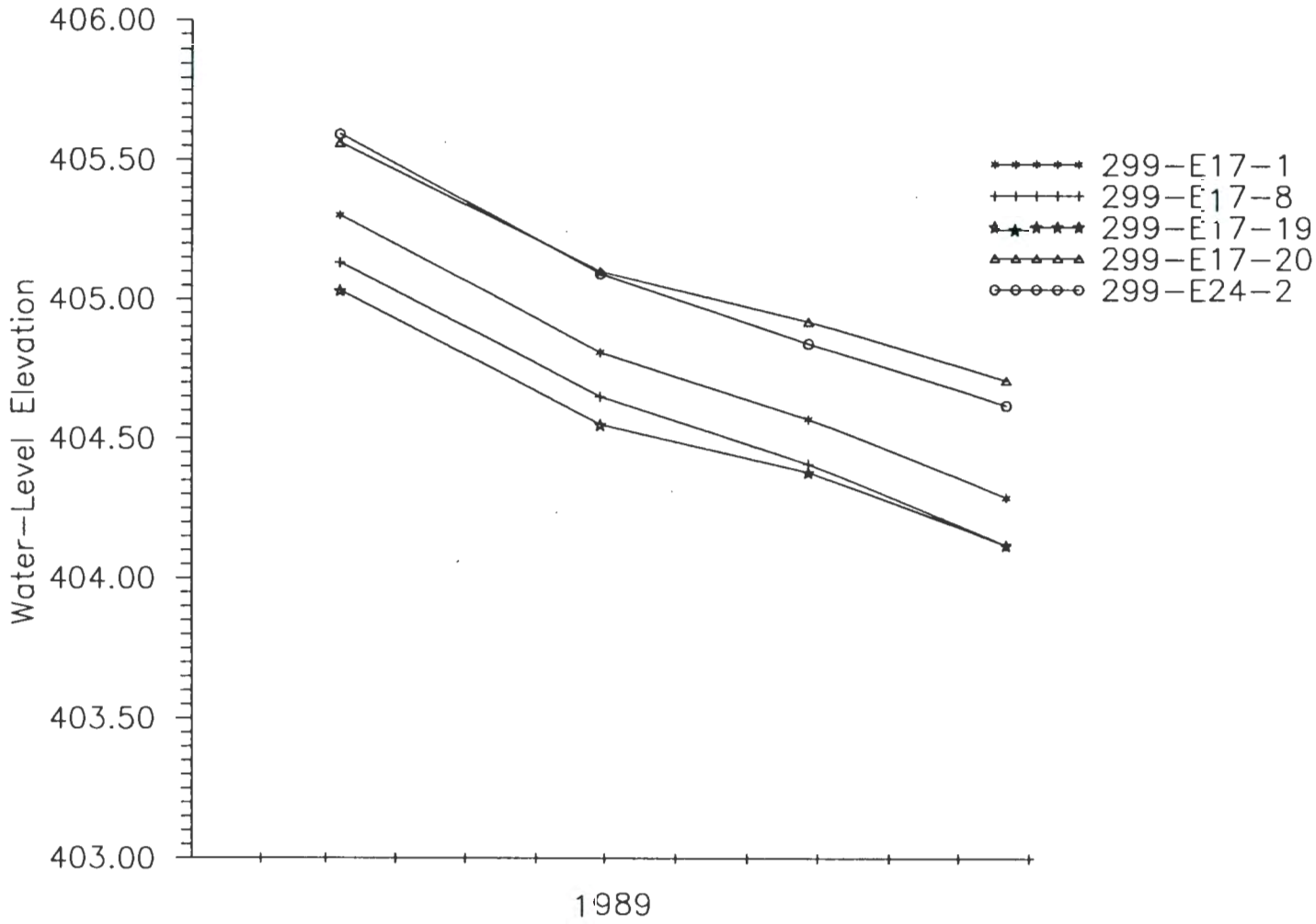

FIGURE 10.2. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 299-E17-1, 299-E17-8, 299-E17-19, 299-E17-20, and 299-E24-2 at the 216-A-10 Crib

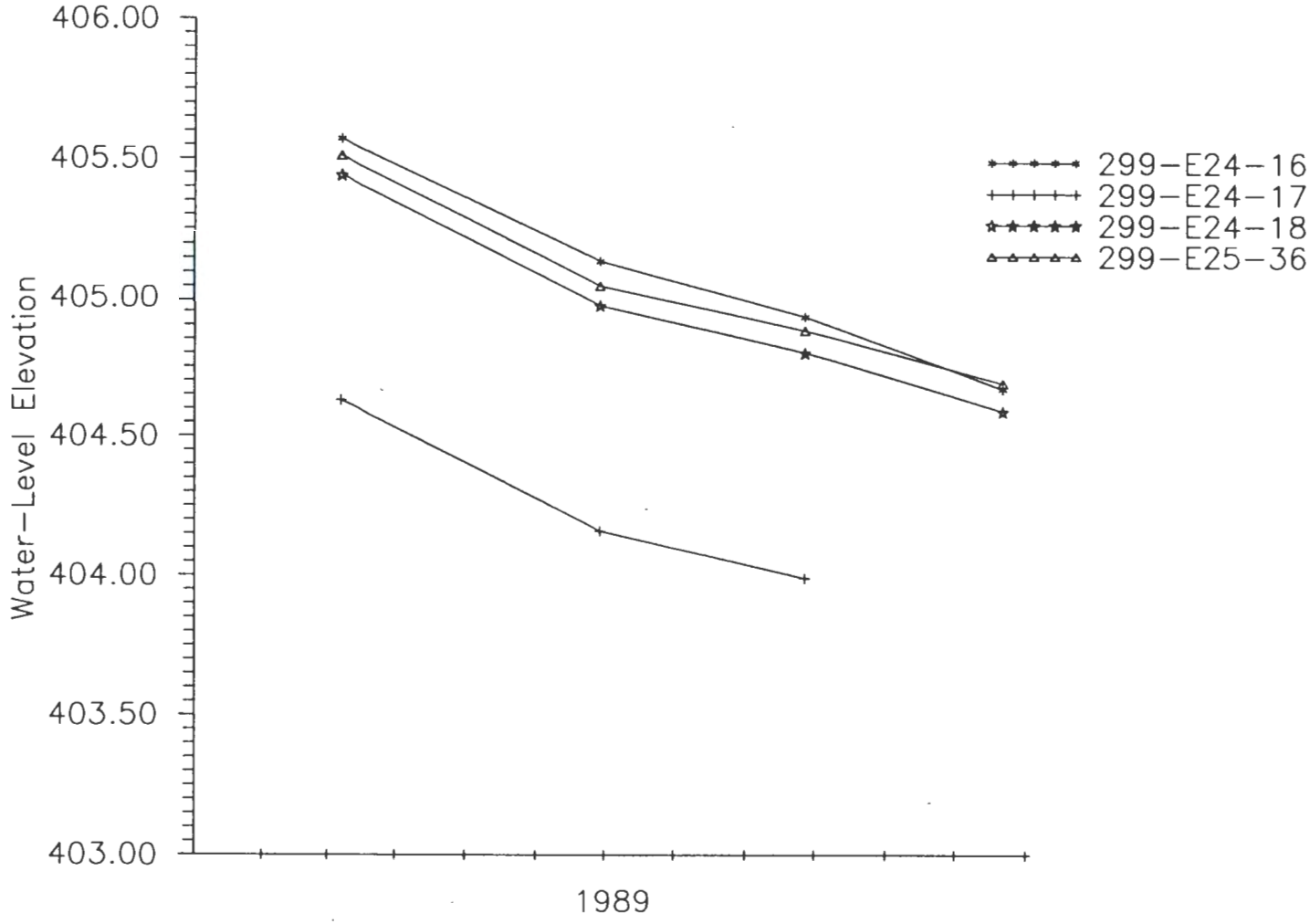

FIGURE 10.3. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 299-E24-16, 299-E24-17, 299-E24-18, and 299-E25-36 at the 216-A-10 Crib

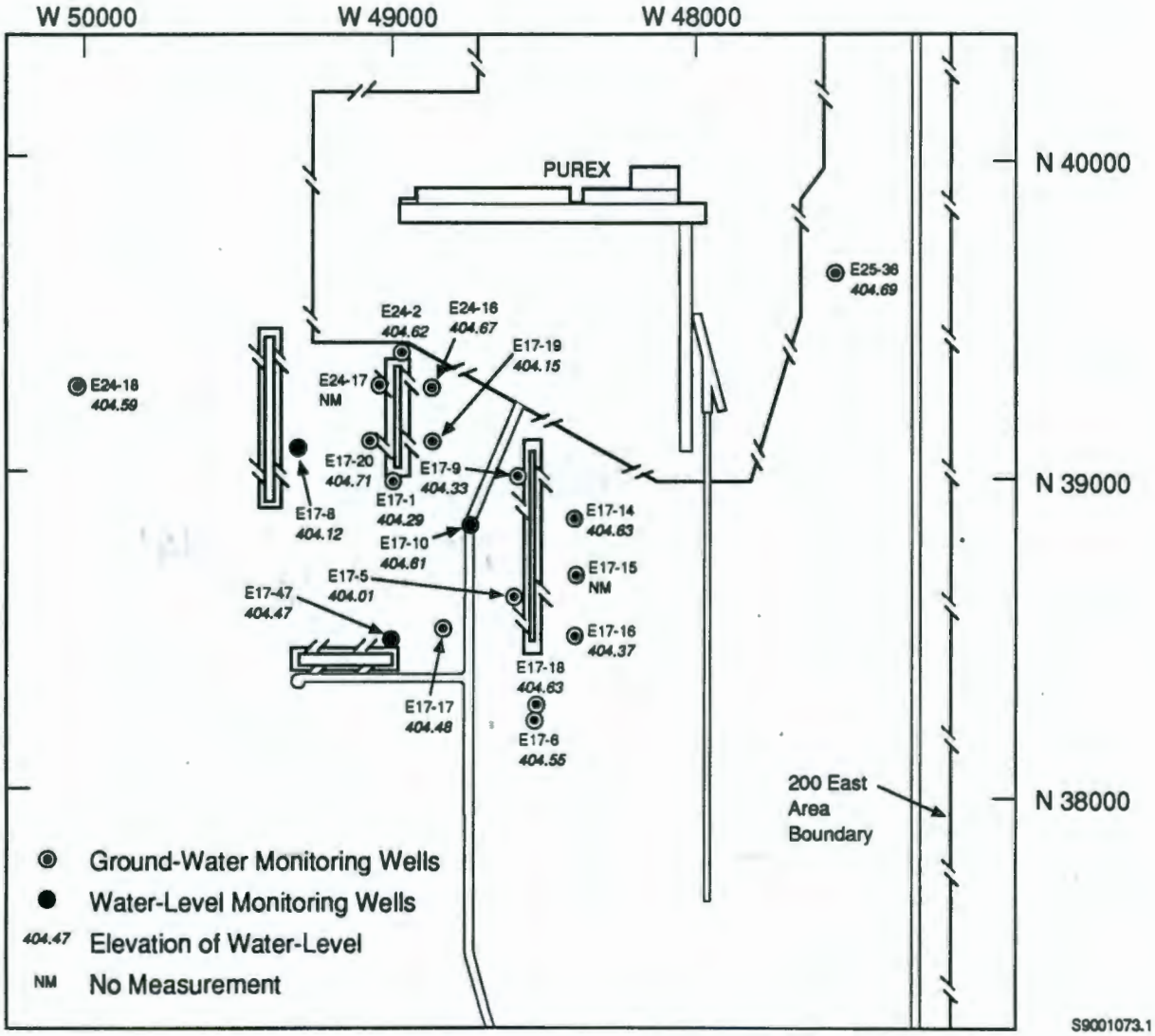

FIGURE 10.4. Water-Level Elevations in Wells at the 216-A-10 Crib and the 216-A-36B Crib, December 21, 1989

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11.0 216-A-29 DITCH

S. P. Luttrell

The RCRA ground-water monitoring project for the 216-A-29 Ditch is an interim-status, indicator parameter evaluation monitoring effort near the 200-East Area (Figure 1.1). The 216-A-29 Ditch (Figure 11.1) is a manmade, earthen ditch approximately 6 ft wide and 6500 ft long that has been in use since 1955. It receives discharge from the PUREX Plant chemical sewer line.

Progress during 1989 included sampling and analysis of the ground-water monitoring wells. Well 299-E25-32P is the background (upgradient) well, and wells 299-E25-26, 299-E25-28, 299-E25-34, and 299-E25-35 are the downgradient monitoring wells (see Figure 11.1). Wells 299-E25-26 and 299-E25-28 are also Grout Treatment Facility site characterization wells, and well 299-E25-32P is part of the Grout Treatment Facility RCRA ground-water monitoring network. Four sets of ground-water samples have been collected and analyzed for RCRA ground-water monitoring.

EVALUATION OF WATER-LEVEL ELEVATIONS

Depth-to-water measurements are made before purging each time samples are collected. In addition, supplemental measurements have been made quarterly. These measurements, including casing elevation, depth-to-water, and water-level elevation data are presented in the four RCRA quarterly reports for 1989 (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Hydrographs of water-level elevations determined from the supplemental measurements are shown in Figure 11.2. Water-level data for November 16, 1989, are shown in Figure 11.3 (with data from the 216-B-3 Pond monitoring wells) for the 216-A-29 Ditch and 216-B-3 Pond vicinity. General ground-water flow directions are shown in the figure. The ground-water flow direction has not changed significantly in the past year, and thus, wells are appropriately located.

EVALUATION OF WATER CHEMISTRY AND INDICATOR PARAMETERS

Four quarters of data have been collected to establish background levels at the 216-A-29 Ditch. Indicator parameters for each ground-water monitoring well for 1989 are provided in RCRA quarterly reports (Smith, Bates, and Lundgren 1989a, 1989c). Statistical evaluation of background and indicator parameters will not be performed until the first semiannual sample has been collected and analyzed in 1990.

The following constituents have, in at least one well, exceeded their respective maximum contaminant levels in 40 CFR 141, National Primary Drinking Water Regulations (for ground water):

- chromium (unfiltered)
- tritium.

Rate of Migration of Contaminants

The 216-A-29 Ditch is in an indicator evaluation program and, therefore, a discussion of the rate of contaminant migration is not applicable. The ground-water flow velocity in the area is estimated to be 4 to 12 ft/d ($K = 10^3$ to 3×10^3 ft/d, gradient = 4×10^{-4}).

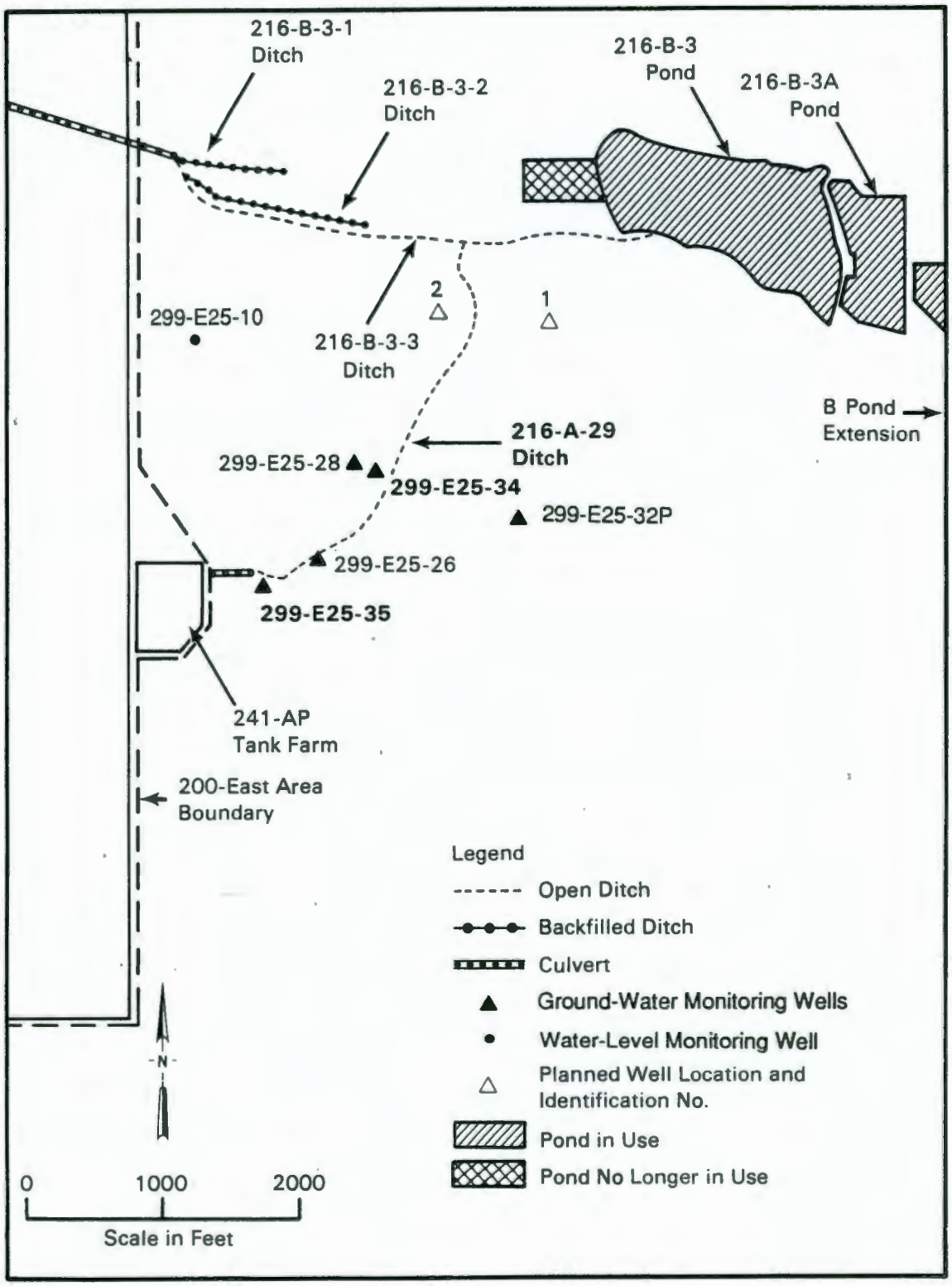

FIGURE 11.1. Location of the 216-A-29 Ditch and Location of Ground-Water Monitoring Wells for the Ditch

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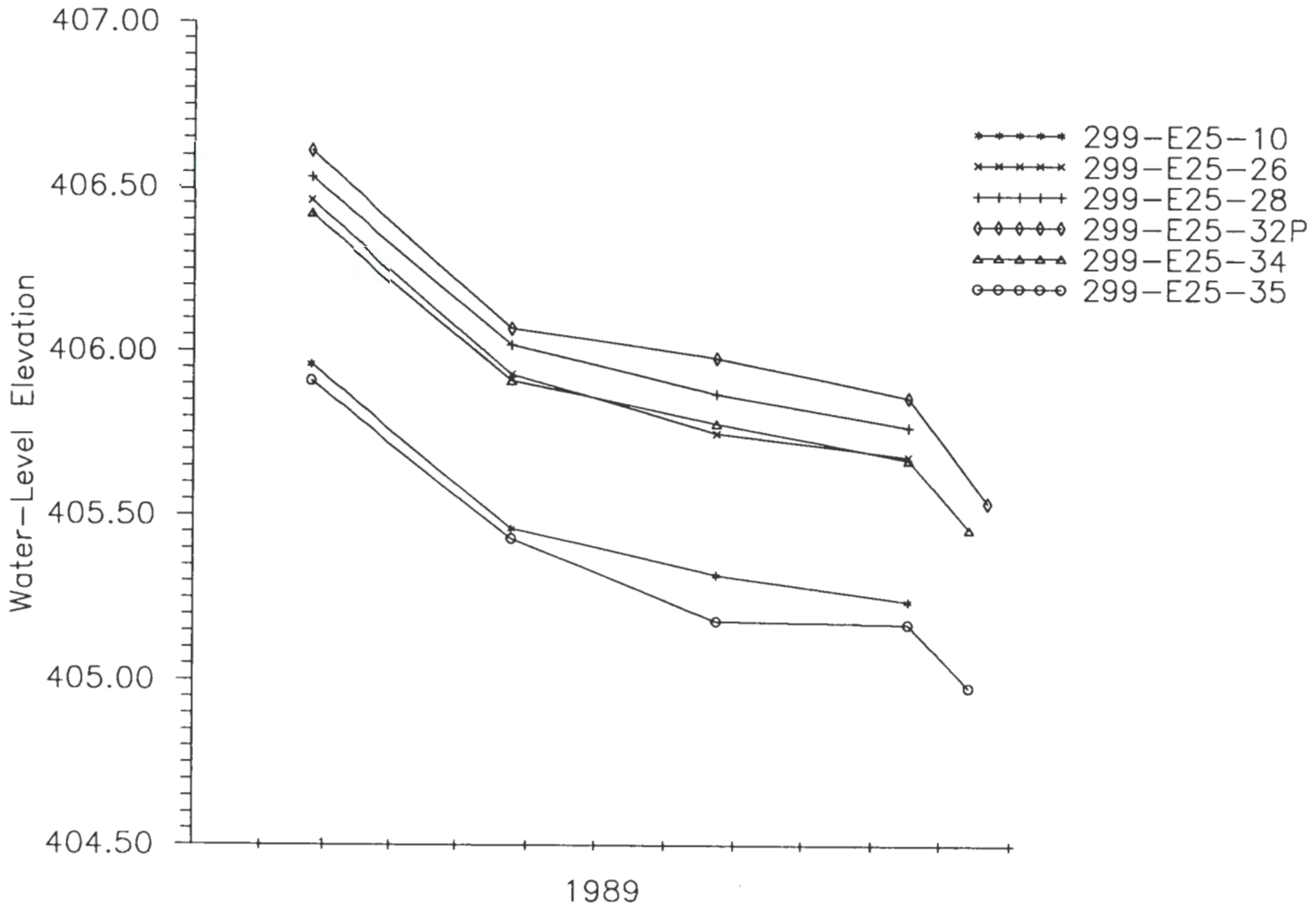

FIGURE 11.2. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 299-E25-10, 299-E25-26, 299-E25-28, 299-E25-32P, 299-E25-34, and 299-E25-35 at the 216-A-29 Ditch

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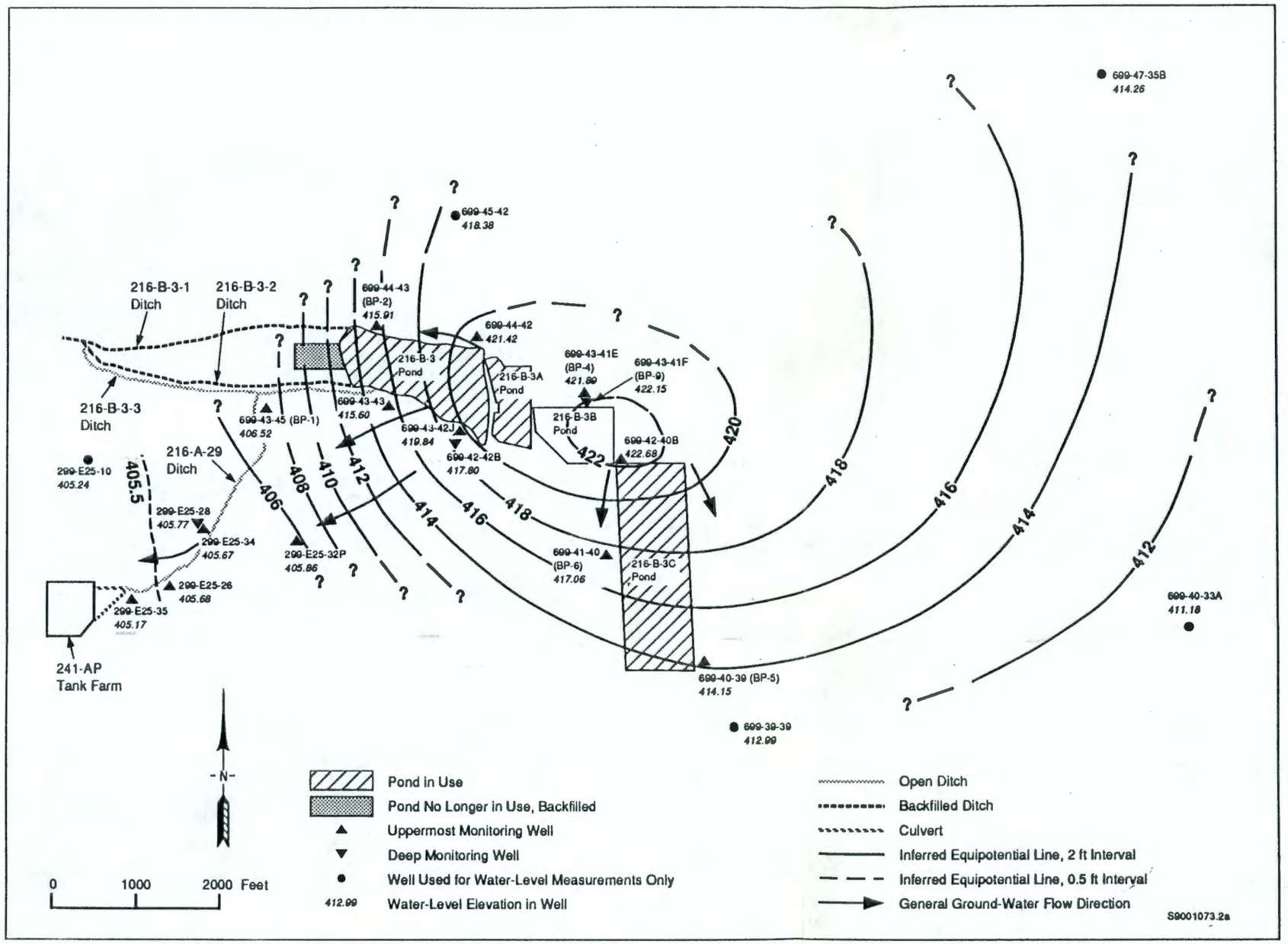

FIGURE 11.3. Water-Level Elevations in Wells at the 216-A-29 Ditch and 216-B-3 Pond, and a Water-Table Map Indicating the General Direction of Ground-Water Flow, November 16, 1989

12.0 216-A-36B CRIB

S. P. Luttrell

The RCRA ground-water monitoring project for the 216-A-36B Crib is an interim-status, indicator parameter evaluation monitoring effort near the 200-East Area (Figure 1.1). The 216-A-36B Crib is the southern 500-ft section of a 600-ft-long crib (Figure 12.1). The crib is 12 ft wide and 12 ft deep, and was separated from the 216-A-36A Crib in 1966 by a grout curtain. The 216-A-36B Crib received ammonia scrubber distillate from the PUREX Plant from September 1965 to 1972, then was reactivated from November 1982 until October 1987. The crib has been unused since that time.

Progress during 1989 included sampling and analysis of the ground-water monitoring wells, determination of background statistics, and statistical evaluations of two sets of data.

Well 299-E17-17 has been identified as the background well, and wells 299-E17-5, 299-E17-9, 299-E17-14, 299-E17-15, 299-E17-16, and 299-E17-18 are the downgradient monitoring wells. Well 299-E17-6 is sampled for qualitative water chemistry information; no statistical evaluations will be made with data from this well. Also, water levels are measured in nearby wells 299-E17-10 and 299-E17-13. Six quarterly sets of ground-water samples have been collected and analyzed from wells at the 216-A-36B Crib.

EVALUATION OF WATER-LEVEL ELEVATIONS

Depth-to-water measurements are made before purging each time samples are collected. In addition, supplemental measurements have been made quarterly. These measurements, including casing elevation, depth-to-water, and water-level elevation data are presented in the four RCRA quarterly reports for 1989 (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Hydrographs of water-level elevations determined from the supplemental measurements are shown in Figures 12.2 and 12.3. Water-level data from December 21, 1989, are shown in Figure 10.4 in conjunction with data from the 216-A-10 Crib monitoring wells. These data have been inconclusive for determining the ground-water flow direction because of the very small gradient and

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uncertainties in the data. It is not currently possible to determine whether ground-water monitoring wells for the 216-A-36B Crib are optimally located in relation to the hydraulic gradient; however, it is noted that downgradient wells are located on each side of the facility (299-E17-5 and 299-E17-9 on the west; 299-E17-14, 299-E17-15, 299-E17-16 on the east) and south (299-E17-18) of the facility, thereby providing an adequate ground-water monitoring system for detecting contamination from the facility. No changes to the monitoring network are planned at this time.

EVALUATION OF WATER CHEMISTRY AND INDICATOR PARAMETERS

Six quarterly sets of data have been collected; therefore, sufficient data are available to establish background levels at the 216-A-36B Crib. Indicator parameters for each ground-water monitoring well for 1989 are provided in RCRA quarterly reports (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Background statistics were calculated using the first through the fourth quarterly sets of data (Smith, Bates, and Lundgren 1989c) and the second through the fifth quarterly sets of data (Smith, Bates, and Lundgren 1990). The background was recalculated using the second through fifth quarterly sets of data because the first quarter data are questionable with respect to their representativeness of ground-water conditions.

Data from two quarters have been evaluated against the background values. The fifth-quarter set of data was compared to the background composed of the first through the fourth quarterly data sets (Smith, Bates, and Lundgren 1989c), and none of the indicator parameters for any of the wells had a statistical increase (or pH decrease) over background. The sixth-quarter set of data was compared to the background composed of the second through the fifth quarterly data sets (Smith, Bates, and Lundgren 1990), and none of the indicator parameters for any of the wells had a statistical increase (or pH decrease) over background.

The following constituents have, in at least one well, exceeded their respective maximum contaminant levels in 40 CFR 141, National Primary Drinking Water Regulations (for ground water):

- coliform bacteria
- gross beta
- gross alpha
- chromium (unfiltered)
- nitrate
- tritium
- strontium-90.

Rate of Migration of Contaminants

The 216-A-36B Crib is in an indicator evaluation program and, therefore, a discussion of the rate of contaminant migration is not applicable. Ground-water flow velocity is estimated to range from 1 to 10 ft/d ($K = 10^3$ to 10^4 ft/d, gradient = 10^{-4}).

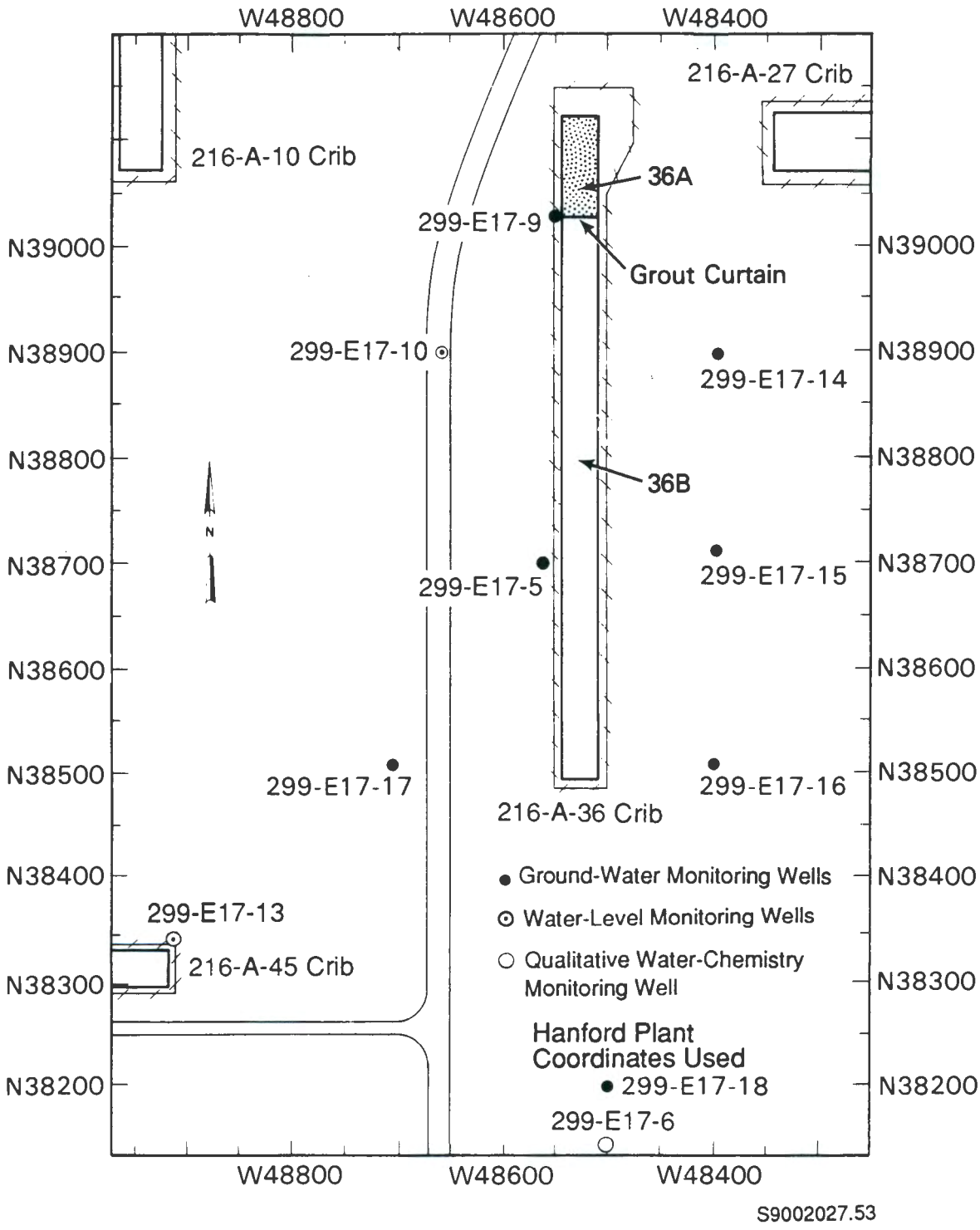

FIGURE 12.1. Location of the 216-A-36B Crib and Locations of Ground-Water Monitoring Wells for the Crib

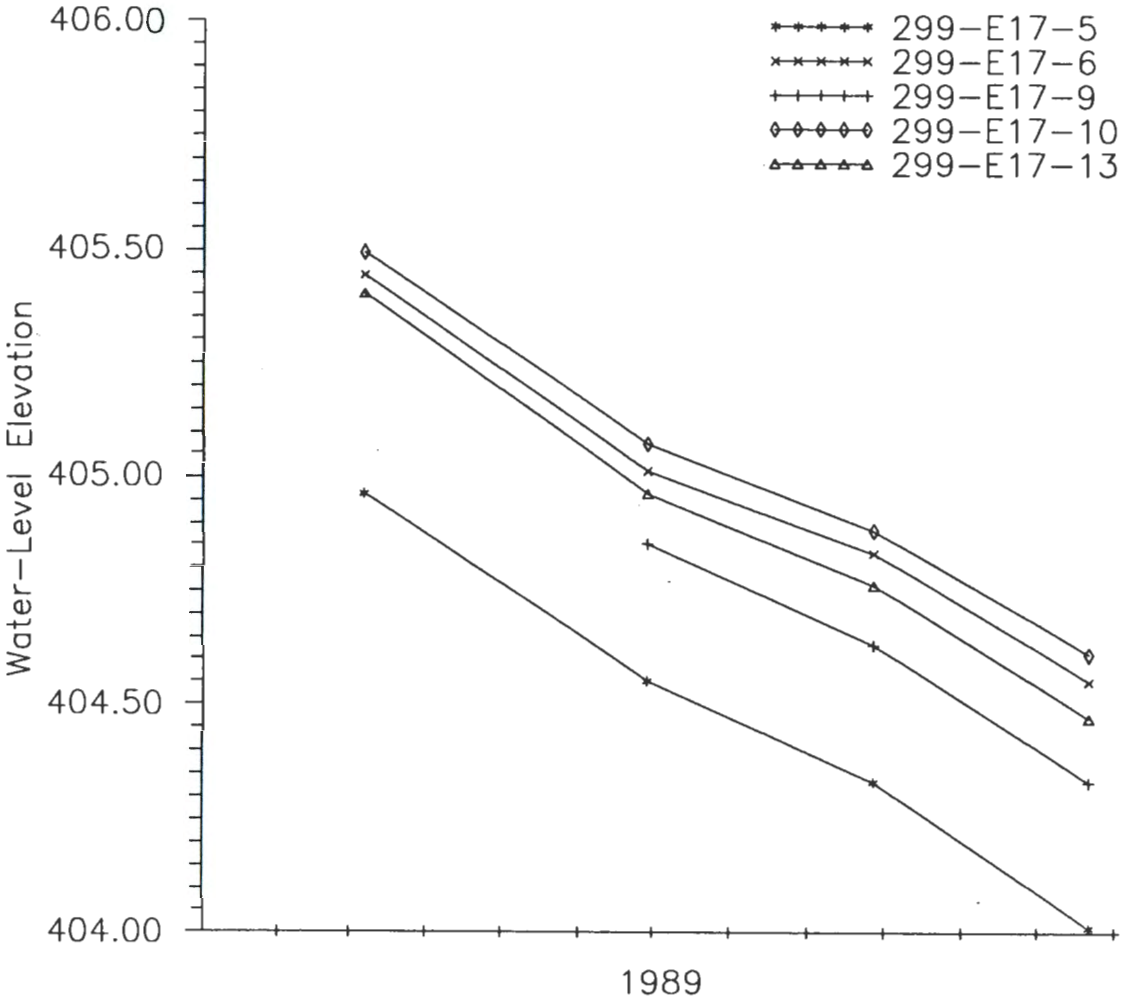

FIGURE 12.2. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 299-E17-5, 299-E17-6, 299-E17-9, 299-E17-10, and 299-E17-13 Near the 216-A-36B Crib

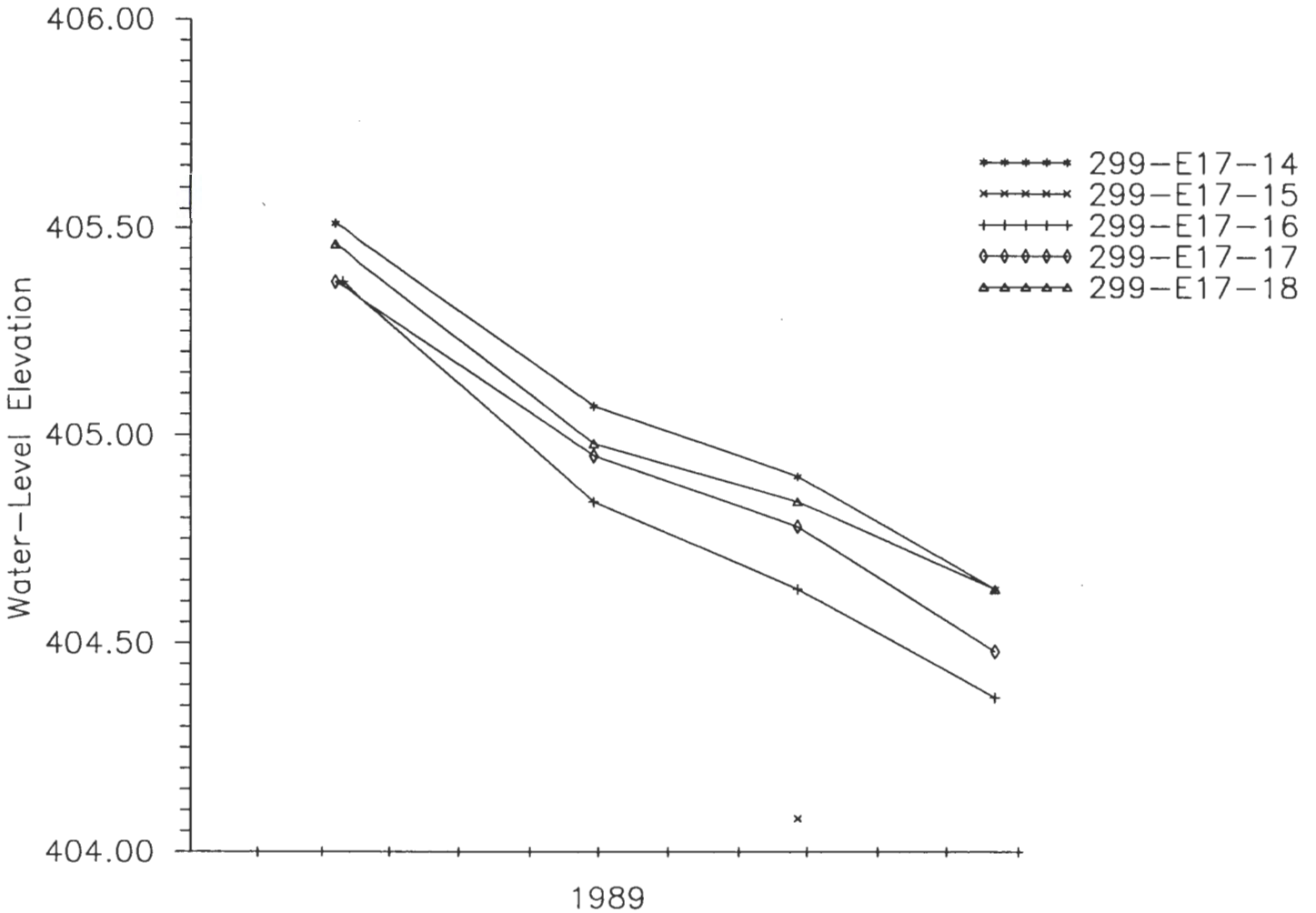

FIGURE 12.3. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 299-E17-14, 299-E17-15, 299-E17-16, 299-E17-17, and 299-E17-18 Near the 216-A-36B Crib

13.0 216-B-3 POND

S. P. Luttrell

The RCRA ground-water monitoring project for the 216-B-3 Pond is an interim-status, indicator parameter evaluation monitoring effort near the 200-East Area (Figure 1.1). The 216-B-3 Pond (B Pond) is actually a series of interconnected ponds covering 102 acres to the east of the 200-East Area (Figure 13.1). The pond receives large volumes of waste water (e.g., approximately 6 x 10^9 gal in 1987) from facilities in the 200-East Area.

Progress during 1989 included installation of six new wells and ground-water sampling and analysis. Wells 299-E18-1 and 299-E32-4 are the background (upgradient) wells, and wells 699-40-39, 699-41-40, 699-42-40A, 699-42-42B, 699-43-41E, 699-43-41F, 699-43-42J, 699-43-43, 699-43-45, 699-44-42, and 699-44-43B are the downgradient wells. In addition, wells 299-E25-32P, 699-39-39, 699-40-33A, 699-45-42, and 699-47-35B are used for water-level measurements. Well 299-E18-1 is also part of the ground-water monitoring system for the 2101-M Pond, and well 299-E32-4 is part of the ground-water monitoring system for the 200 Areas Low-Level Burial Grounds. Four sets of ground-water samples have been collected and analyzed for RCRA ground-water monitoring.

EVALUATION OF WATER-LEVEL ELEVATIONS

Depth-to-water measurements are made before purging each time samples are collected. In addition, supplemental measurements have been made almost every month. These measurements, including casing elevation, depth-to-water, and water-level elevation data are presented in the four RCRA quarterly reports for 1989 (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Hydrographs of water-level elevations determined from the supplemental measurements in all wells are shown in Figures 13.2, 13.3, 13.4, and 13.5. Water-level data for November 16, 1989, are shown in Figure 11.3 (with data from the 216-A-29 Ditch monitoring wells) for the B Pond and 216-A-29 Ditch vicinity. General ground-water flow directions are shown in the figure. A ground-water mound is apparent beneath B Pond; therefore, all the wells are located downgradient from the B Pond.

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The background wells, shown in Figure 13.1, are located over 2 miles west of the pond. These wells are located regionally "upgradient" of the pond. Evaluation of the water levels from these wells is not used to determine ground-water flow directly beneath the pond.

EVALUATION OF WATER CHEMISTRY AND INDICATOR PARAMETERS

Four quarters of data have been collected to establish background levels at the B Pond. Indicator parameters for each ground-water monitoring well for 1989 are provided in RCRA quarterly reports (Smith, Bates, and Lundgren 1989a, 1989c). Statistical evaluation of background and indicator parameters will not be performed until the first semiannual sample has been collected and analyzed in 1990.

The following constituents have, in at least one well, exceeded their respective maximum contaminant levels in 40 CFR 141, National Primary Drinking Water Regulations (for ground water):

- chromium (unfiltered)
- tritium.

Rate of Migration of Contaminants

The 216-B-3 Pond is in an indicator evaluation program and, therefore, a discussion of the rate of contaminant migration is not applicable. The ground-water flow rate is estimated to be approximately 50 to 150 ft/d ($K = 2100$ ft/d, gradient $= 7 \times 10^{-3}$, effective porosity = 0.1 to 0.3) in the Hanford formation sediments and 0.03 to 0.1 ft/day ($K = 5$ ft/d, gradient $= 2 \times 10^{-3}$, effective porosity = 0.1 to 0.3) in the Ringold Formation sediments).

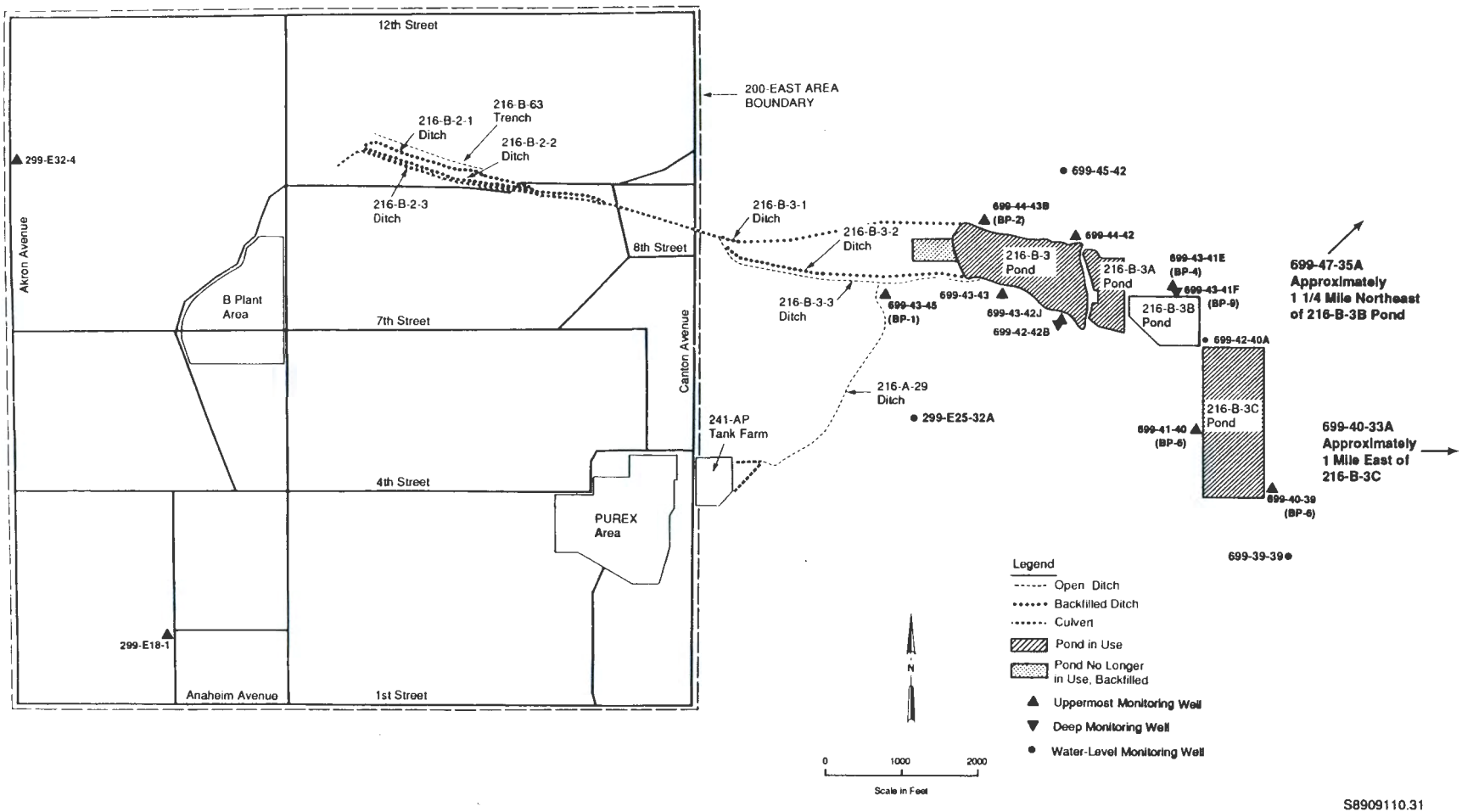

FIGURE 13.1. Location of the 216-B-3 Pond and Location of Ground-Water Monitoring Wells for the Pond

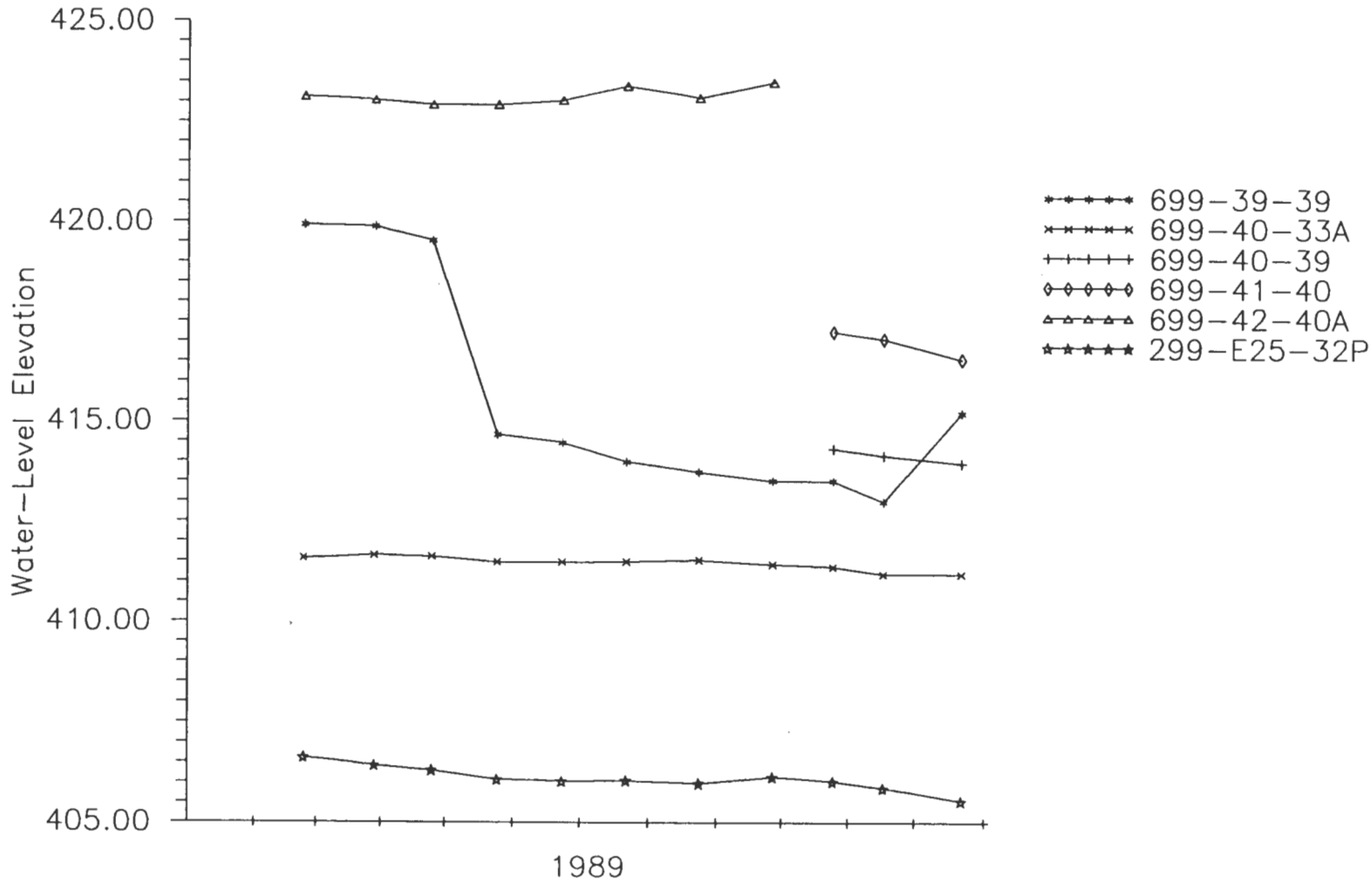

FIGURE 13.2. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 299-E25-32P, 699-39-39, 699-40-33A, 699-40-39, 699-41-40, and 699-42-40A Near the 216-B-3 Pond

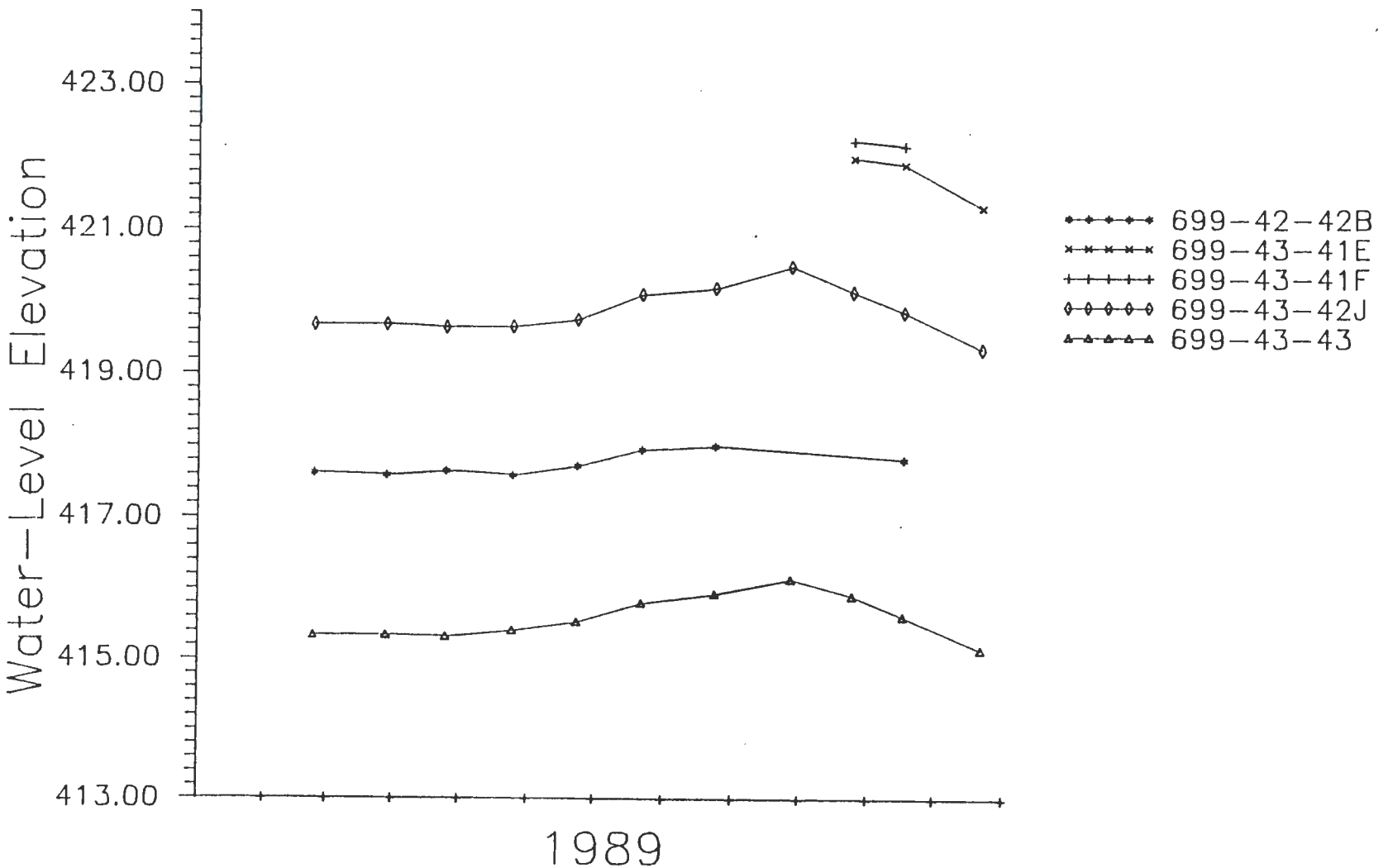

FIGURE 13.3. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 699-42-42B, 699-43-41E, 699-43-41F, 699-43-42J, and 699-43-43 Near the 216-B-3 Pond

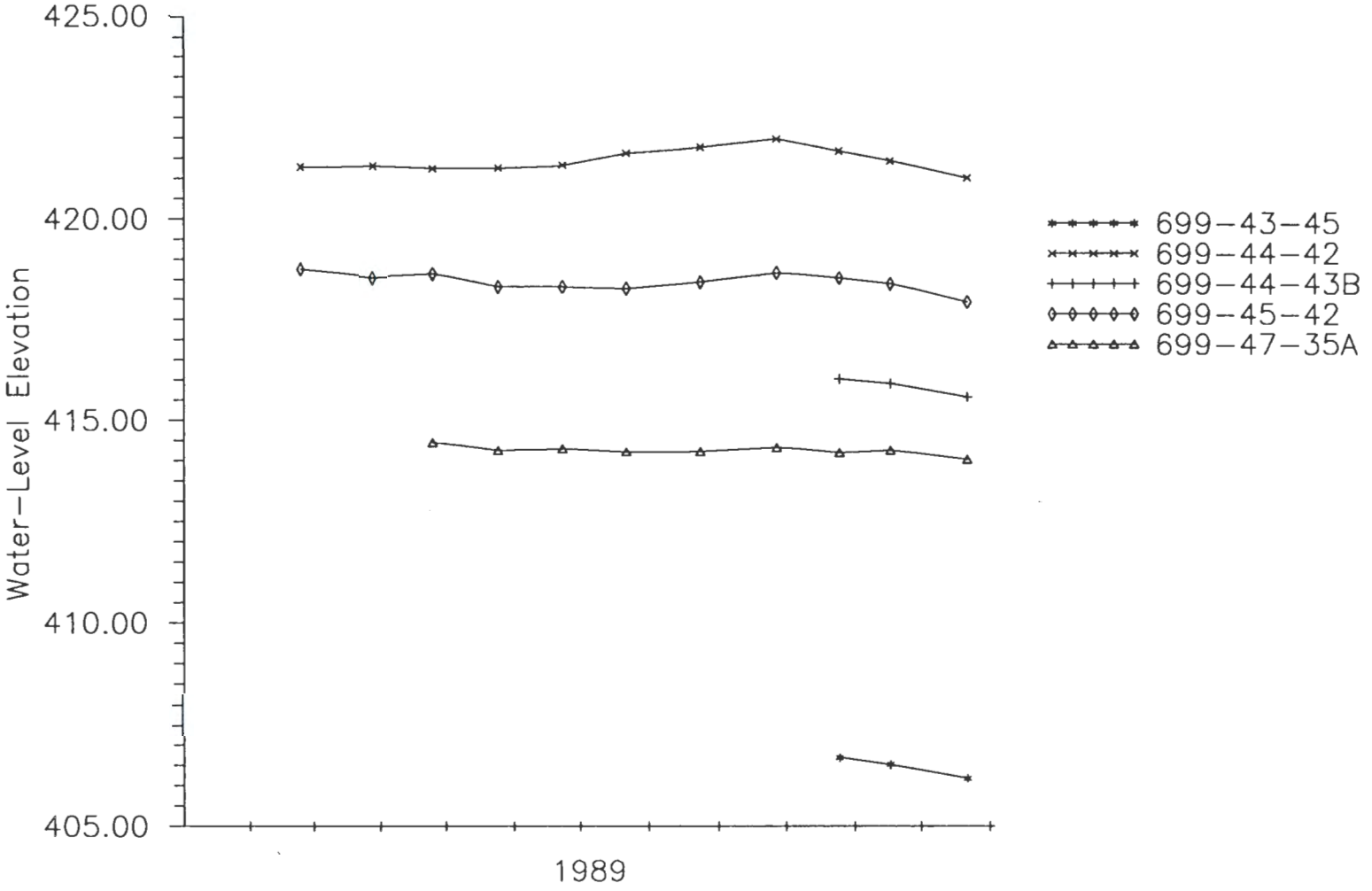

FIGURE 13.4. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Wells 699-43-45, 699-44-42, 699-44-43B, 699-45-42, and 699-47-35A Near the 216-B-3 Pond

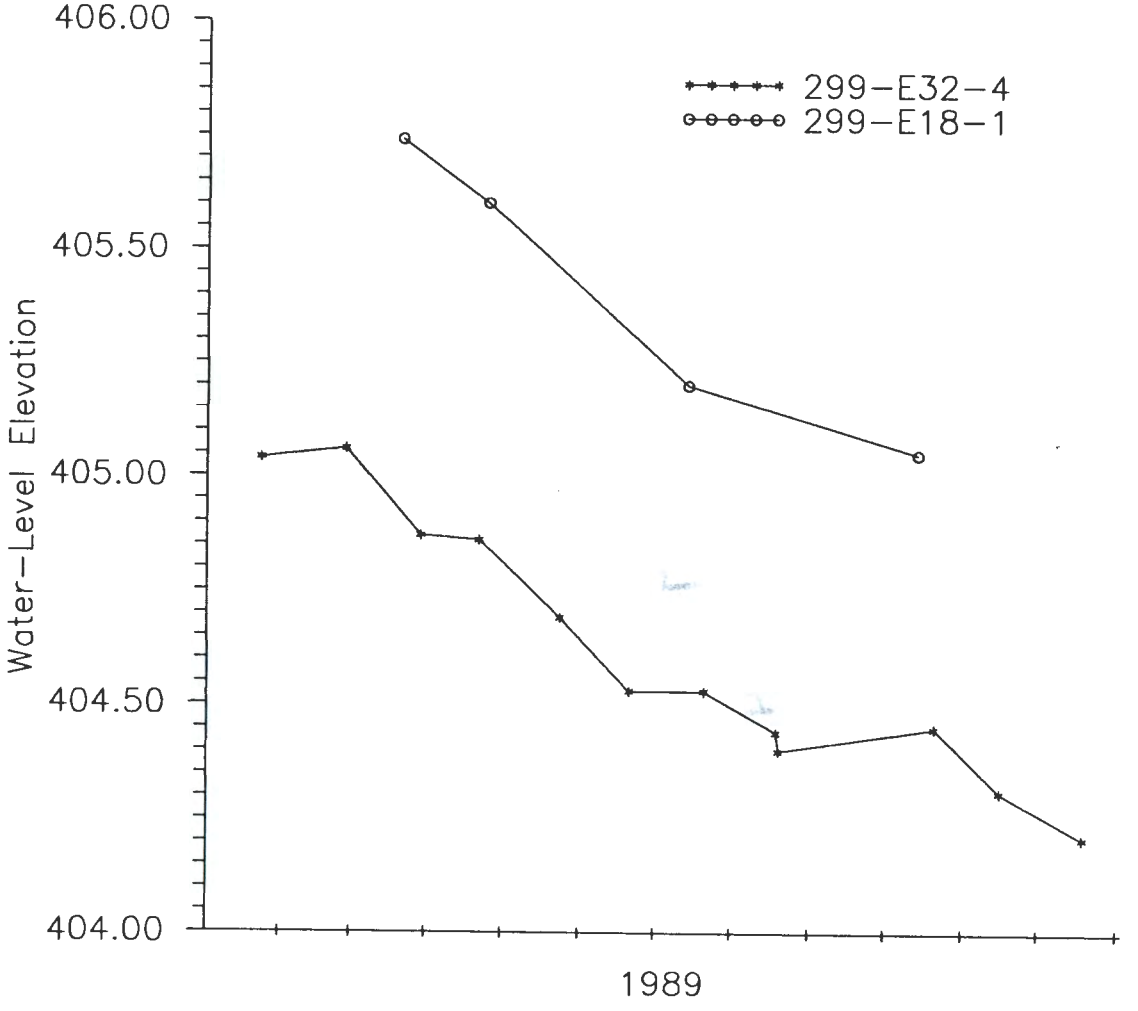

FIGURE 13.5. Hydrographs of Water-Level Elevations Determined from Supplemental Measurements in Upgradient Wells 299-E18-1 and 299-E32-4 for the 216-B-3 Pond

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14.0 2101-M POND

M. A. Chamness

The RCRA ground-water monitoring project for the 2101-M Pond is an interim-status, background monitoring and characterization effort located in the 200-East Area (Figure 1.1). The 2101-M Pond is located west-southwest of the 2101-M Building in the southwest portion of the 200-East Area (Figure 14.1). The pond has received waste water from the 2101-M Building heating and air conditioning system from 1953 to the present. In 1981, laboratories were plumbed into the discharge line from the 2101-M Building to the pond. From 1981 until mid-1985, these laboratories may have discharged dangerous wastes into the pond.

Four ground-water monitoring wells were installed in the uppermost portion of the unconfined aquifer in August 1988, and have been sampled quarterly since then. Activities in 1989 included the completion of the first year of quarterly background monitoring and the initiation of semi-annual indicator parameter evaluation monitoring.

EVALUATION OF WATER-LEVEL ELEVATIONS

Water-level measurements were taken before each set of ground-water samples were collected and periodically since October 1988. The latter set of data is used exclusively here since those measurements are made from all wells in the water-level network for the 2101-M Pond on the same day within a few hours of each other. This set of data for the four monitoring wells at 2101-M Pond is provided in past quarterly reports (e.g., Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990).

Regional water-table maps (Figure 14.2) indicate general ground-water flow in the southwest portion of the 200-East Area is to the northeast. The water-level network for the 2101-M Site consists of the four monitoring wells and five other nearby wells (those underlined in Figure 14.2). Water-level data for these wells are presented in the hydrographs in Figure 14.3. Because the gradient is so flat in the vicinity of the 2101-M Pond (approximately 8×10^{-4} ft/ft), the water-level network could not conclusively

determine the site-specific ground-water flow direction. The following discussion is intended to support the northeast flow direction indicated by the regional water-table maps.

Located approximately 1700 ft to the southwest of the 2101-M Pond (Figure 14.2) is an older well, 299-E19-1, which extends uncased to the top of basalt and is partially filled with drilling mud. This drilling mud and the stagnant water lying immediately above the mud were sampled and found to contain elevated levels of molecular sulfur. The concentration of sulfate in well 299-E18-1, the nearest 2101-M Pond monitoring well, is the highest of any wells in or near the southwest corner of 200-East Area. It is therefore concluded that the ground-water flow direction is to the northeast, from well 299-E19-1 and its potential source of sulfur toward well 299-E18-1 and the highest sulfate concentration in the 200-East Area region. Based on this, the locations of the monitoring network provide the site with one upgradient and three downgradient wells as required by 40 CFR 265.91(a).

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

During calendar year 1989, three quarters of ground-water samples were collected and analyzed for contamination indicator, drinking water quality, and water quality parameters, and one quarter of samples were analyzed as well for the 40 CFR 264 Appendix IX and WAC 173-303-9905 constituents. The results of these analyses have been reported in the quarterly reports (e.g., Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990).

Contamination indicator parameters data consist of quadruplicate measurements for field conductivity and pH, total organic carbon (TOC), and total organic halogen (TOX). Statistical analyses required by 40 CFR 265.93(b) were performed on the background samples obtained during the first four quarters, and the results are presented in Smith, Bates, and Lundgren (1989c). These analyses include the average background, standard deviation, and critical mean for the four contamination indicator parameters from the upgradient well. The critical mean is the value to which future averages of quadruplicate measurements are compared. If a parameter average is greater than (and less than, in the case of pH) its critical mean, that parameter is

considered statistically different from background. The results from the August sample analyses were the first to be statistically compared to the established background values as required by 40 CFR 265.93(b) (Smith, Bates, and Lundgren 1989c). The replicate averages for the November contamination indicator parameters are compared to the critical mean values given in Smith, Bates, and Lundgren (1990). The statistical analyses performed to date (Smith, Bates, and Lundgren 1989c, 1990) indicate no ground-water indicator parameters are statistically different from background.

Rate of Migration of Contaminants

The 2101-M Pond is in a background monitoring stage and, therefore, a discussion of contaminant migration is not applicable. The ground-water flow velocity in the area is estimated to be 0.1 to 0.6 ft/d (K = 25 to 150 ft/d, gradient = 4×10^{-4}).

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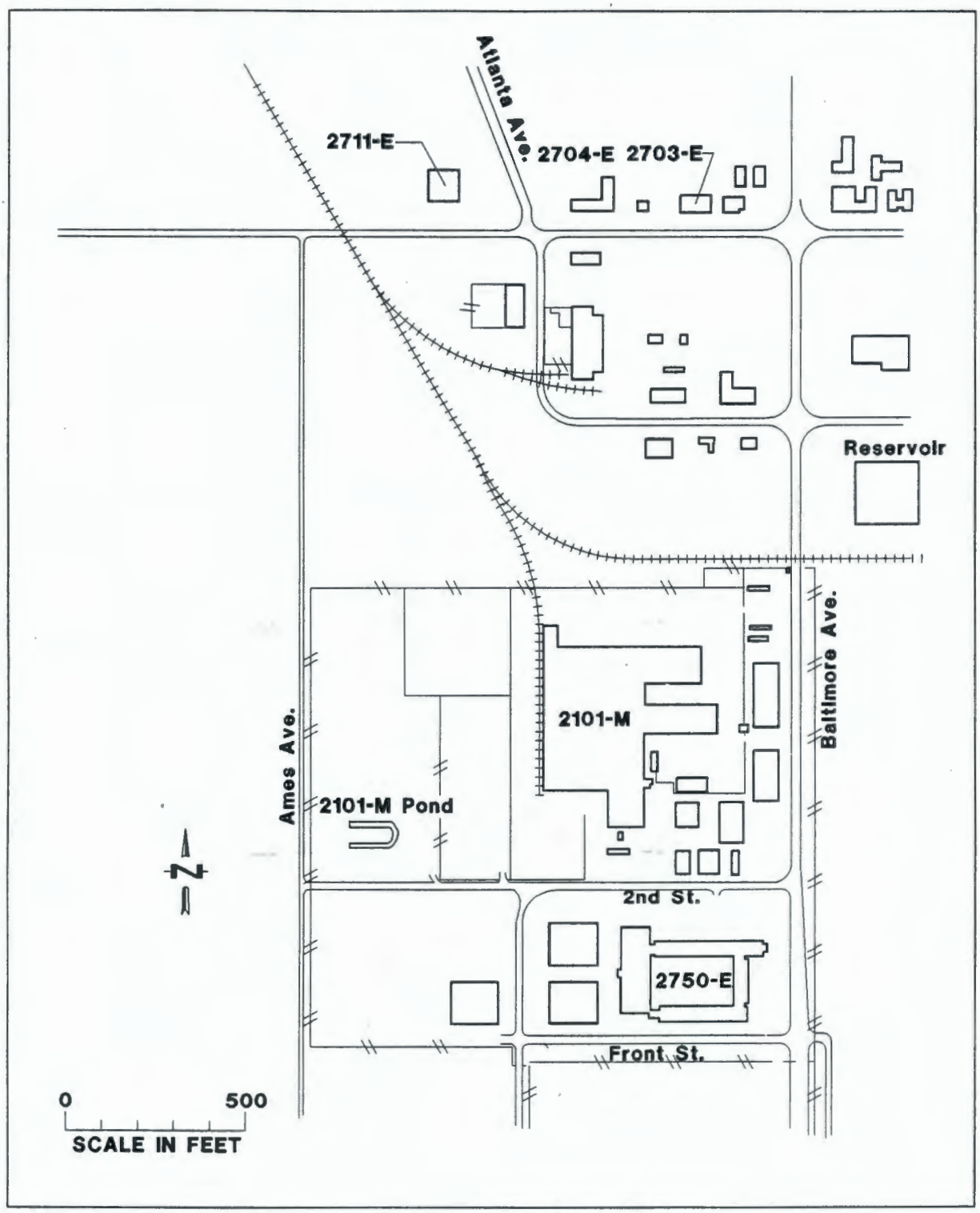

FIGURE 14.1. Location of the 2101-M Pond

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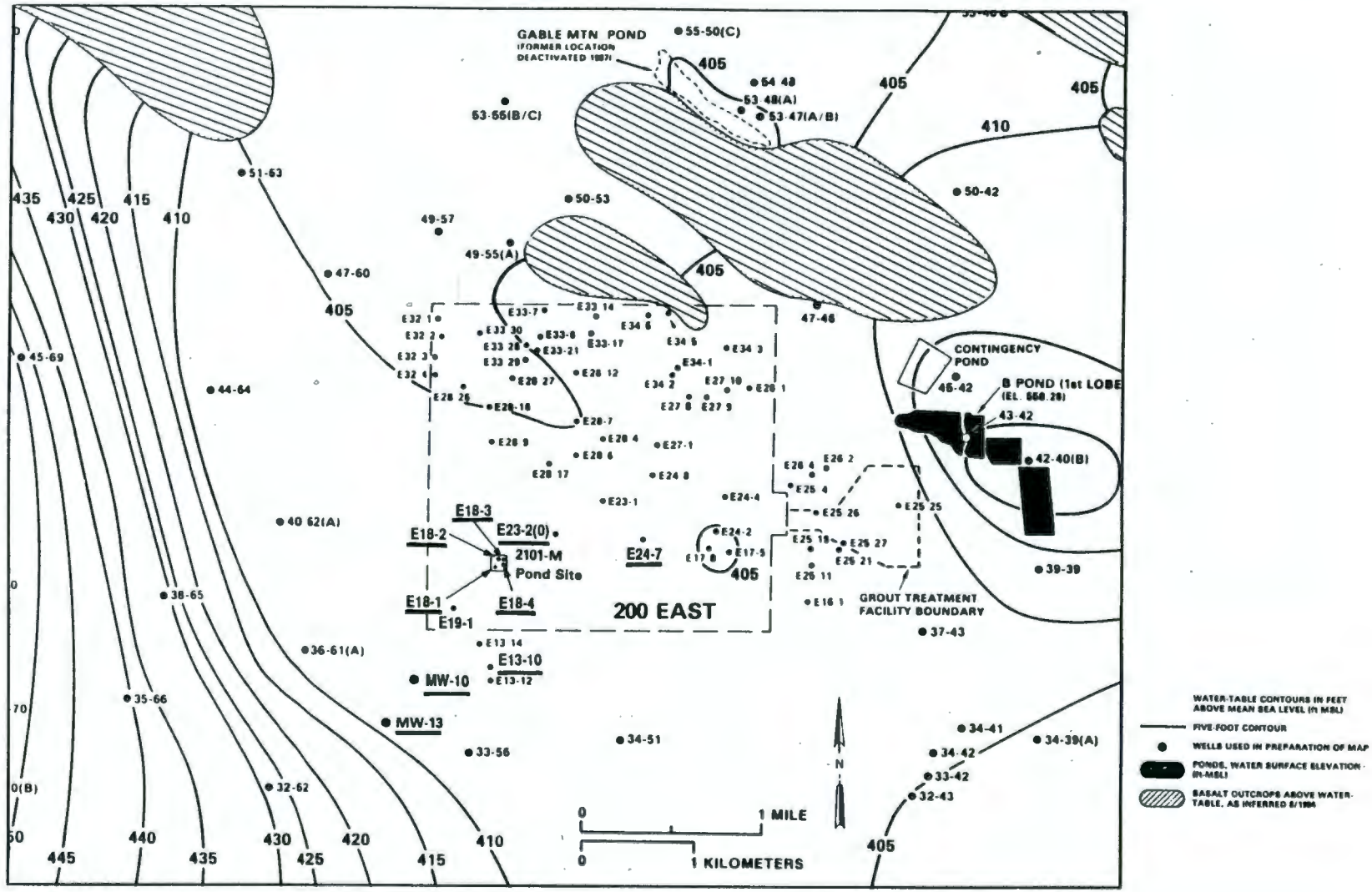
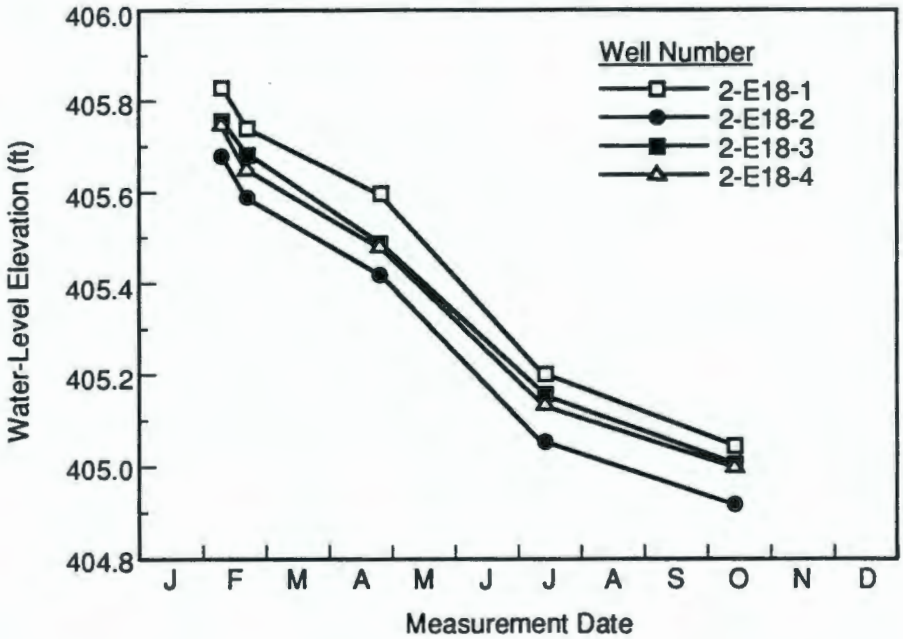


FIGURE 14.2. Location of the Water-Level Network and Well 299-E19-1 in Relation to 2101-M Pond



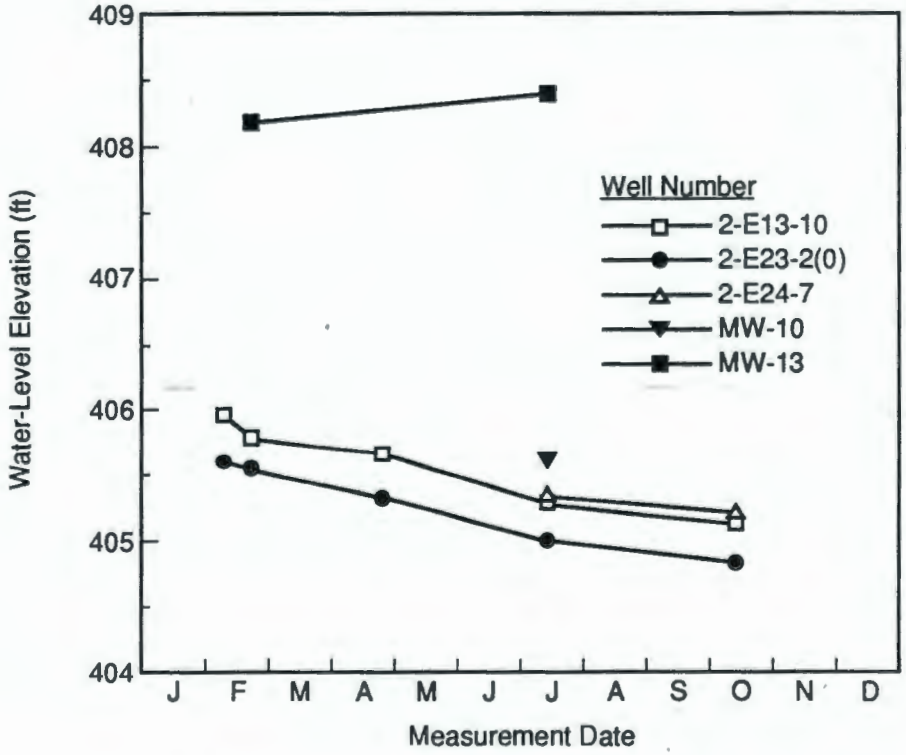


FIGURE 14.3. 1989 Hydrographs for the 2101-M Pond Water-Level Network

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15.0 GROUT TREATMENT FACILITY

S. S. Teel

The RCRA ground-water monitoring project for the Grout Treatment Facility (GTF) is an interim-status, monitoring and characterization effort located adjacent to the eastern boundary of the 200-East Area (Figure 1.1). The project was initiated in 1988. Indicator parameter evaluation began with the samples collected during June/July 1989. The project is based on characterization work presented in Swanson et al. (1988) and the Part B Permit Application (WHC 1988b) submitted to the Washington State Department of Ecology in November 1988.

The Grout Treatment Facility will be used for the treatment and disposal of liquid mixed waste (WHC 1988b). The wastes will be mixed with a cementitious grout material and then poured into concrete-lined vaults where they will solidify. Field data collection in support of this project began in 1984. Treatment and disposal of a nondangerous mixture of phosphate/sulfate waste began in August 1988 (WHC 1988b). The site is scheduled to begin processing mixed wastes in FY 1991.

The RCRA monitoring project consists of two upgradient wells (299-E25-25 and 299-E25-32P) and five downgradient wells (299-E25-29P, 299-E25-31, 299-E25-33, 299-E25-37, and 299-E25-38). The latter two wells were installed during the past year and were sampled for the first time in December 1989. Ground-water samples were also collected and analyzed from eight site characterization wells (299-E25-18, 299-E25-20, 299-E25-22, 299-E25-24, 299-E25-26, 299-E25-27, 299-E25-28, and 299-E25-30P) to monitor the effects of nearby waste-disposal facilities. The locations of all of the wells in the monitoring network are shown in Figure 15.1.

Quarterly samples were collected in January (FY 1988), February/March, June/July, August, and December 1989.

EVALUATION OF WATER-LEVEL ELEVATIONS

Water-level measurements are collected on a quarterly basis, prior to sample collection. In addition to the quarterly measurements, monthly

water-level measurements were made from January until August. This schedule was changed to semiannual following the August measurement, with the next measurement occurring in December 1989. Water-level data for the GTF have been reported in previous quarterly reports (Smith, Bates, and Lundgren 1989a, 1989b, 1989c, 1990). Hydrographs for the monthly/semiannual measurements for the GTF wells are shown in Figure 15.2.

All of the wells in the sampling network, except for well 299-E25-28, monitor the top of the unconfined aquifer. Well 299-E25-28 monitors the bottom portion of the unconfined aquifer. A December 13-14, 1989, water-table map of the top of the unconfined aquifer is shown in Figure 15.3. This map shows that the direction of ground-water flow beneath the GTF is to the southwest. This is consistent with data reported by WHC (1988b) and Fruland and Lundgren (1989). Therefore, the locations of the upgradient and downgradient wells are appropriate based on the ground-water flow direction shown in this map.

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EVALUATION OF WATER CHEMISTRY AND PARAMETERS

Some samples for the RCRA monitoring wells exceeded the PDWSs for chromium (unfiltered) and tritium. The source of the elevated chromium values may be natural borehole sediments and/or well construction materials. The elevated tritium values probably result from the disposal of liquids used in chemical processing activities in the 200-East Area.

Some samples from the site characterization wells exceeded the PDWSs for chromium (unfiltered) and nitrate. The source of the elevated chromium is probably the same as discussed above. The elevated nitrate values probably result from the disposal of liquids used in chemical processing activities in the 200-East Area; they were found in wells adjacent to an active liquid waste disposal facility (216-A-37 Crib).

Indicator parameter evaluation began with the samples collected during June/July 1989. Comparisons of the statistical critical means for the contamination indicator parameters and the third and fourth quarter analytical results for the downgradient wells were discussed in Smith, Bates, and Lundgren (1989c). Wells 299-E25-29 and 299-E25-31 were above the critical

mean for TOX and well 299-E25-33 was above the critical mean for specific conductance. However, the GTF is not yet disposing of dangerous wastes so these concentrations are probably not a result of facility operations. Thus, there are no immediate plans to begin assessment monitoring at the site, although quarterly analytical data will continue to be closely monitored under indicator parameter evaluation. This decision was discussed in an October letter from DOE to Ecology.

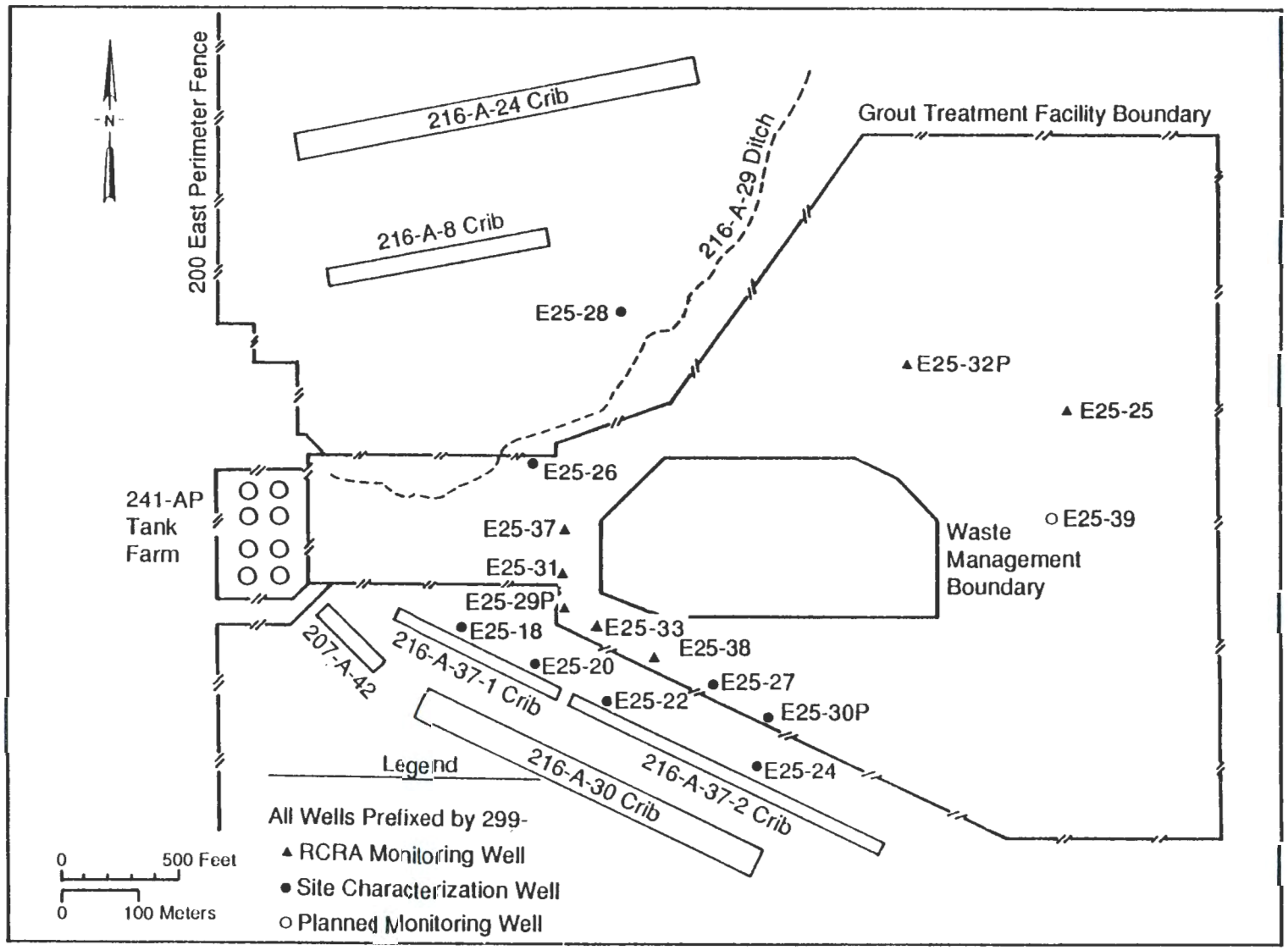

FIGURE 15.1. Ground-Water Monitoring Wells Near the Grout Treatment Facility

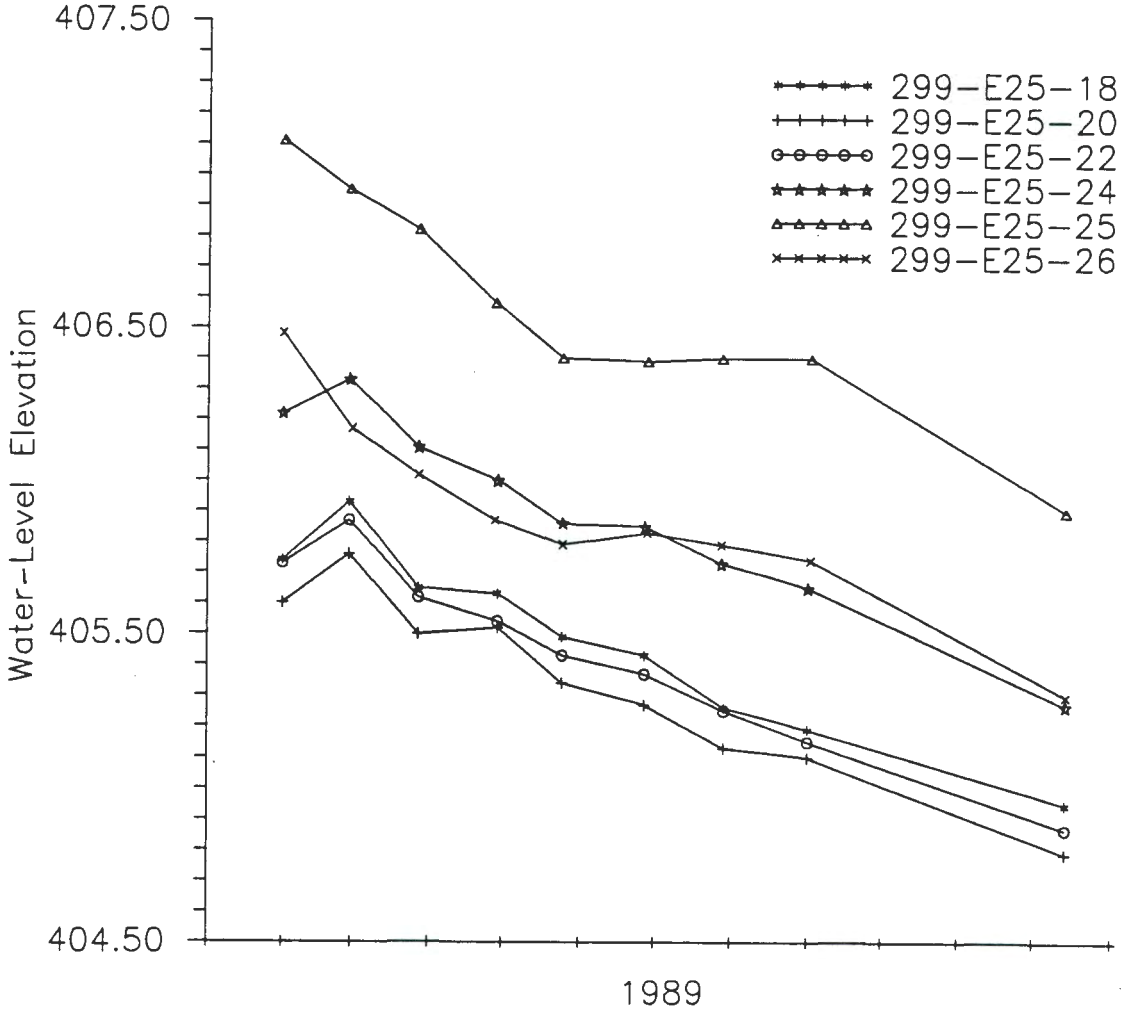

FIGURE 15.2. Hydrographs for the Monthly/Semiannual Measurements for the Grout Treatment Facility Wells

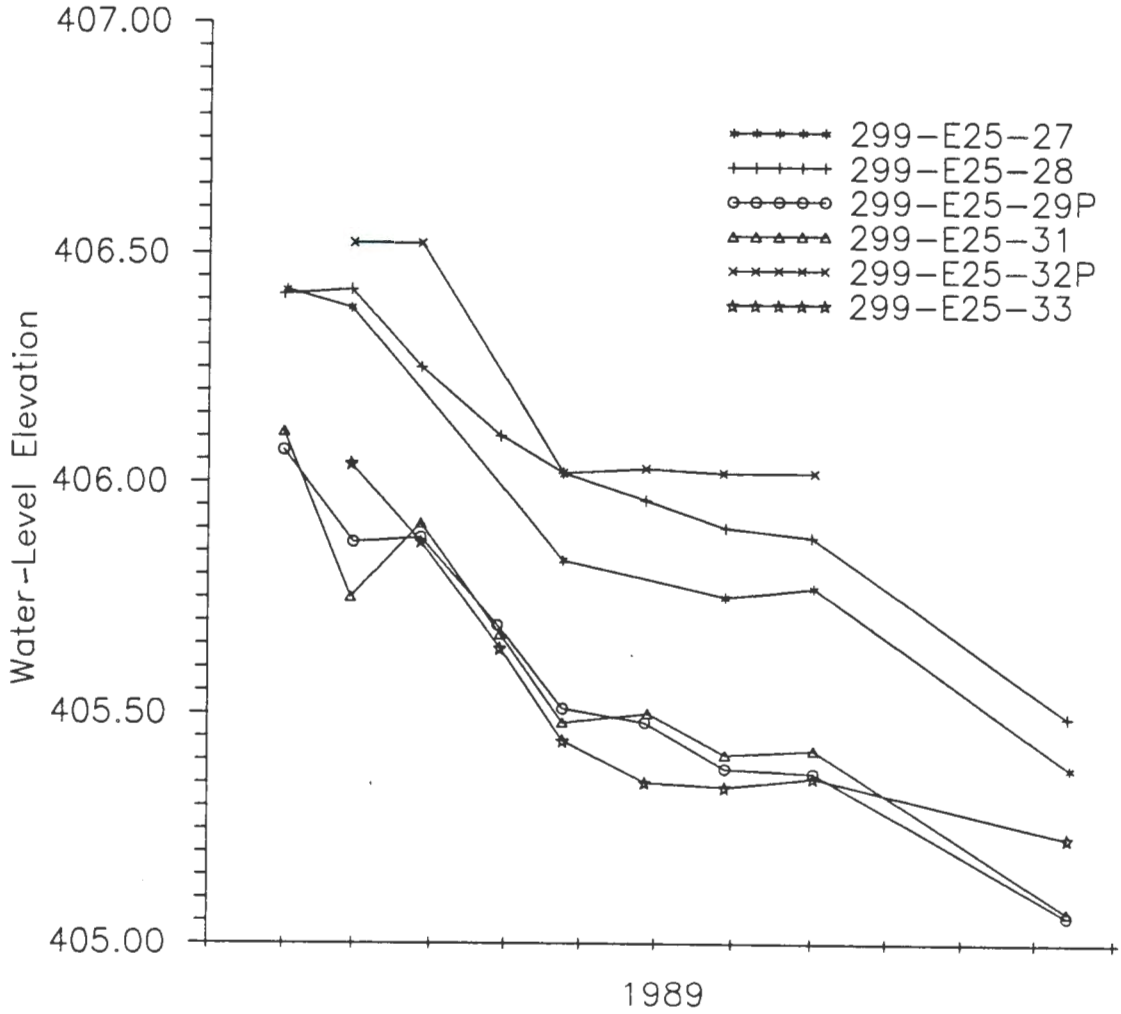

FIGURE 15.2. (contd)

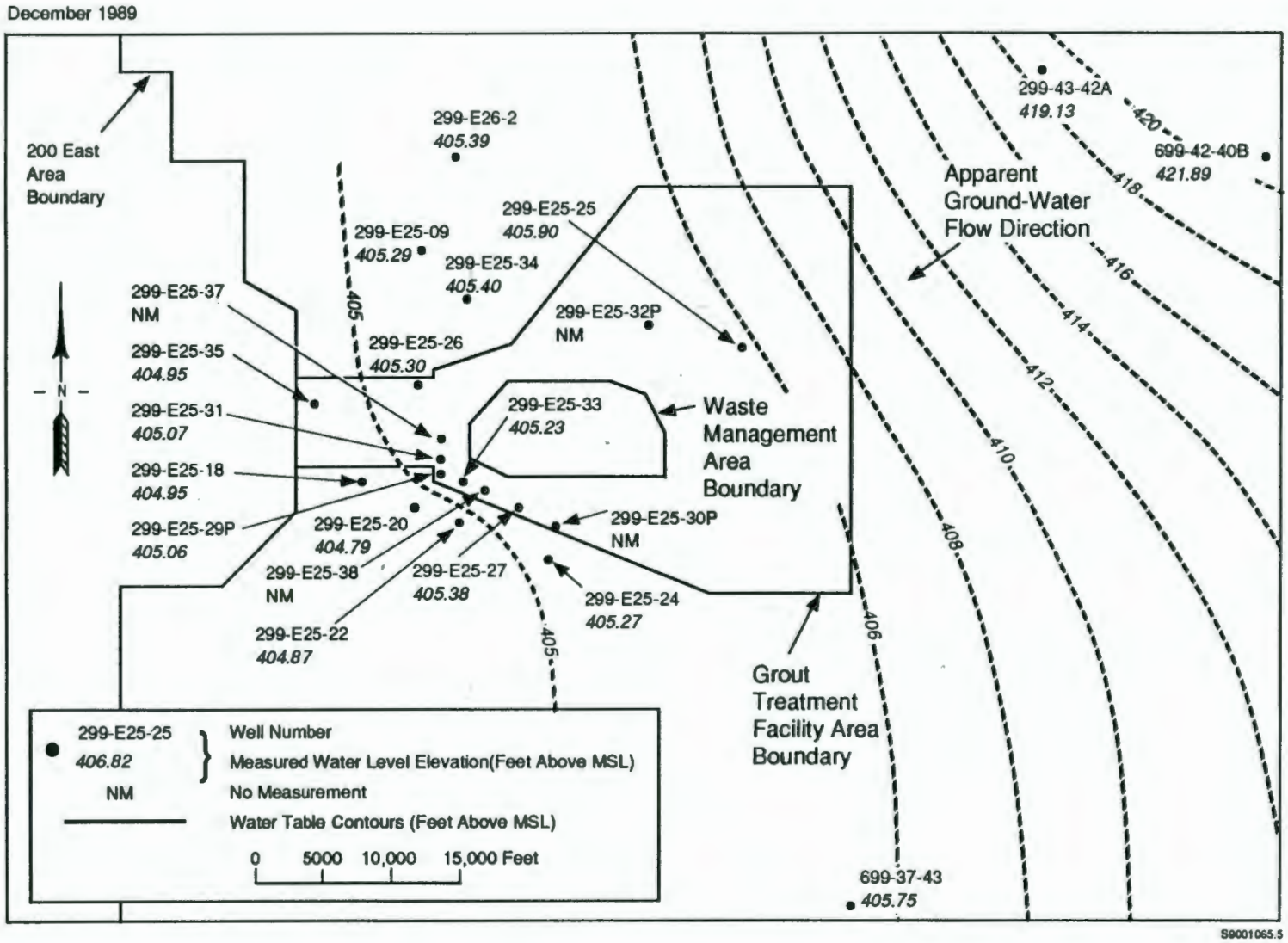

FIGURE 15.3. Water-Table Map of the Top of the Unconfined Aquifer, December 13-14, 1989

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16.0 SINGLE-SHELL TANKS

E. J. Jensen

The interim-status ground-water monitoring project at the Single-Shell Tanks (SSTs) was initiated in June 1989 in conformance with RCRA. There are 149 underground SSTs, located in 7 Waste Management Areas in the 200-East and 200-West Areas on the Hanford Site (see Figure 1.1). These tanks were constructed between 1943 and 1964 to store radioactive and hazardous mixed wastes that were a result of Hanford defense operations. They are constructed of a single-walled carbon steel liner in a concrete tank. These tanks are no longer in active service, and there is an ongoing program to pump the supernate and interstitial liquids from the SSTs to double-shell tanks. This program is scheduled for completion in 1995.

Twelve ground water monitoring wells were installed in CY 1989 and will be added to the CY 1990 sampling network. Eleven additional wells will be added to the sampling network in CY 1991. There are 51 existing ground-water monitoring wells within 1000 ft of the SSTs. These existing wells will be evaluated according to the ground-water monitoring plan for possible use in the ground-water monitoring network around the SSTs.

EVALUATION OF WATER-LEVEL ELEVATIONS

No water-level elevation data have been collected yet.

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

No ground-water monitoring data have been collected yet.

OTHER ACTIVITIES

During CY 1989, a ground-water monitoring plan was prepared to direct all RCRA ground-water monitoring activities around the single-shell tanks (Jensen et al. 1989). Twelve ground-water monitoring wells were installed and are ready for ground-water sample collection.

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17.0 216-B-63 TRENCH

B. N. Bjornstad

The interim-status ground-water monitoring project at the 216-B-63 Trench (B-63 Trench) was initiated in December 1989. A revised ground-water monitoring plan (Bjornstad and Dudziak 1989) for the B-63 Trench was issued in March 1989.

The B-63 Trench is an open, unlined ditch, which has received liquid effluent (100,000 to 400,000 gal/d) from the B-Plant chemical sewer since March 1970. An earthen dam, located 860 ft from the west end of the trench, prevents effluent from entering the eastern third of the trench (Figure 17.1). Steam condensate is the primary constituent discharged to the trench. Other effluents in the waste stream have included sulfuric acid, sodium hydroxide, and nitrate, as well as unspecified organics.

Drilling of the first three (299-E27-16, 299-E33-36, and 299-E33-37) of four ground-water monitoring wells was completed by year's end. There are seven wells in the planned monitoring network for B-63 Trench (see Figure 17.1). Three existing wells, 299-E27-8, 299-E27-11, and 299-E34-2, currently are hydraulically upgradient of the trench. Four new wells (299-E27-16, 299-E33-36, 299-E33-37, and 299-E34-8) are being installed as detection wells. At least three of these new wells will act as downgradient wells depending on ground-water flow, which currently flows westward, roughly parallel to the trench. Because the project is still in the drilling stage no ground-water samples have been collected.

Ground-water chemistry and water-level data from an eighth well (299-E33-33), which is being monitored as a background well for Waste Management Area B-BX-BY (i.e., Single-Shell Tanks) may be incorporated into the B-63 Trench monitoring network at a later time. Well 299-E33-33 was installed in October 1989 only 120 ft northwest of proposed well 299-E34-8 (well #1 in the ground-water monitoring plan). In order to maximize well efficiency 299-E34-8 has been relocated approximately 300 ft southeast of its present location and approximately 100 ft from the trench, in an opposite

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direction from well 299-E27-16 (Figure 17.1). Wells 299-E27-8, 299-E27-11, and 299-E34-2 are also monitored for Waste Management Area 2 (Low-Level Burial Grounds).

EVALUATION OF WATER-LEVEL ELEVATIONS

No water-level elevation data have been collected yet.

EVALUATION OF WATER CHEMISTRY AND PARAMETERS

No ground-water monitoring data have been collected yet.

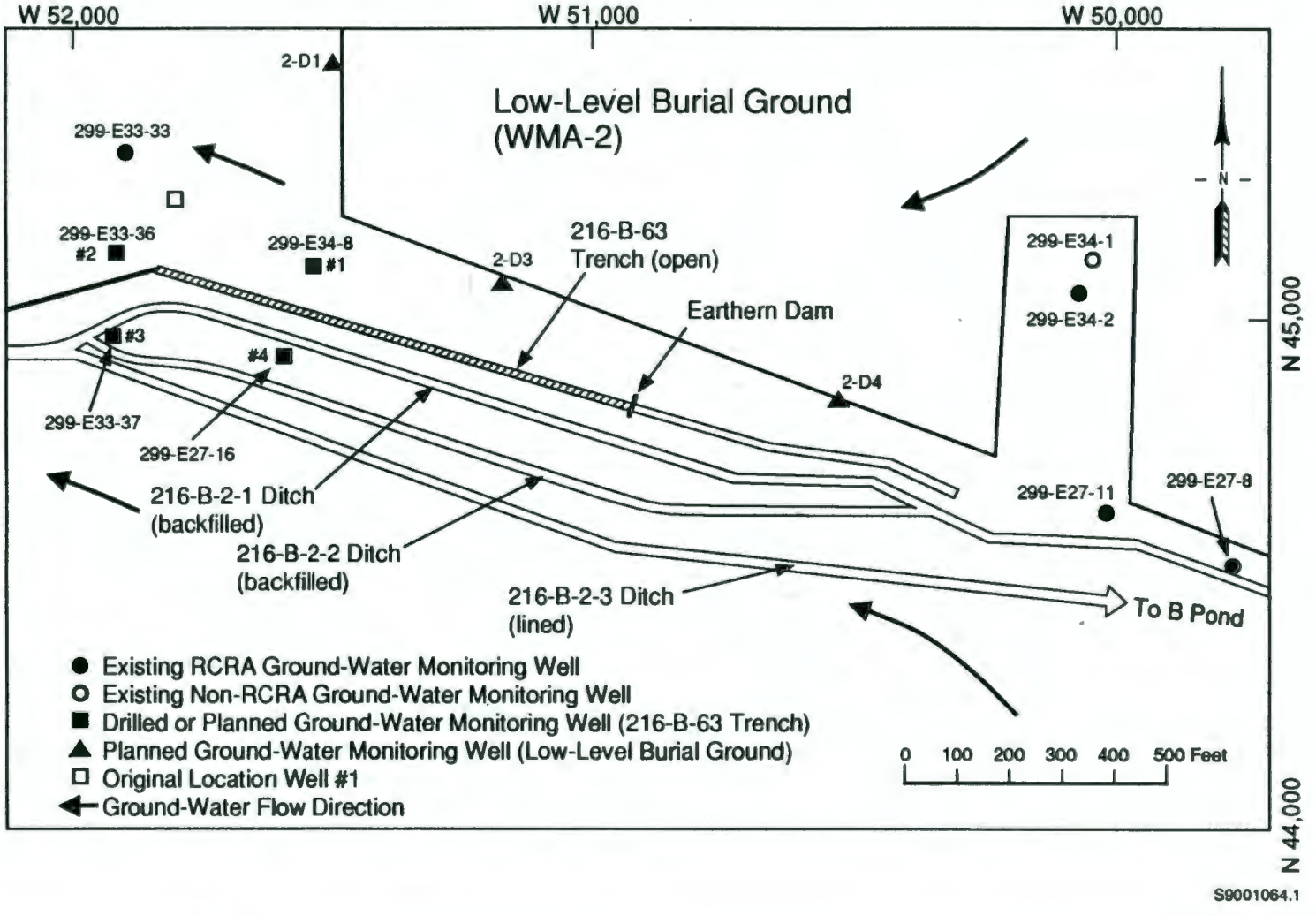

FIGURE 17.1. Ground-Water Monitoring Wells Near the 216-B-63 Trench

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