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SEP 23 1997

DOE-1466-97

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U.S. Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF SOUTH PLUME REMOVAL ACTION SYSTEM EVALUATION REPORT FOR JANUARY 1, 1997, THROUGH JUNE 30, 1997

Enclosed for your review is the South Plume Removal Action System Evaluation Report covering the period January 1, 1997, through June 30, 1997. This document meets the reporting requirements defined in the Design, Monitoring, and Evaluation Program Plan (DMEPP) by summarizing the monitoring and operational activities and assessing the effectiveness of the South Plume recovery wellfield.

Please note that the analytical data (i.e., Appendix A) used to prepare this System Evaluation Report is on a computer disk enclosed with the report. The computer disk is being supplied only to the U.S. Environmental Protection Agency (U.S. EPA), Ohio Environmental Protection Agency (OEPA), and their technical support subcontractors.

Due to implementation of the IEMP, this will be the last DMEPP semi-annual report. Future reporting of the Fernald Environmental Management Project (FEMP) groundwater remedy performance monitoring will follow the schedule and format established in the IEMP. As noted in the IEMP, the first quarterly report will be submitted in November 1997. We look forward to the successful implementation of the new IEMP reporting format for the FEMP groundwater remedy performance reporting.

Recycled and Recyclable

If you have any questions, please contact John Kappa at (513) 648-3149, or Robert Janke at (513) 648-3124.

Sincerely,

FEMP:Kappa

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosure: As Stated

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SOUTH PLUME REMOVAL ACTION DESIGN MONITORING EVALUATION PROGRAM PLAN

SYSTEM EVALUATION REPORT FOR JANUARY 1 - JUNE 30, 1997

OPERABLE UNIT 5

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

SEPTEMBER 1997

U.S. DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

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SOUTH PLUME REMOVAL ACTION DESIGN MONITORING EVALUATION PROGRAM PLAN

SYSTEM EVALUATION REPORT FOR JANUARY 1 - JUNE 30, 1997

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DRAFT

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EXECUTIVE SUMMARY

This System Evaluation Report summarizes the performance of the South Plume recovery well field during the period January 1, 1997 through June 30, 1997. This document fulfills the reporting requirements defined in the South Plume Groundwater Recovery System Design, Monitoring, and Evaluation Program Plan (DMEPP) of April 1993. The reporting schedule was amended by correspondence between the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA) and the Ohio EPA (OEPA); reports are due in April and October of each year. With the approval by EPA and OEPA of the Integrated Environmental Monitoring Plan (IEMP), this is the last South Plume System Evaluation Report to be issued under the DMEPP. Future South Plume Recovery System performance and analysis results will be reported in quarterly and annual IEMP reports.

As in previous DMEPP reports, a disk containing the analytical data for this reporting period is included in the front binder pocket.

The recovery system operated in optimum four-well configuration (Wells 3924 and 3925 pumping at 300 gpm each and Wells 3926 and 3927 pumping at 400 gpm) for 45 out of 181 days or 25 percent of the time. Due to the well rehabilitation activities discussed below, the system operated in a three-well configuration for 106 out of 181 days or 59 percent of the time. The recovery system operated at less than the three-well configuration for 30 out of 181 days or 17 percent of the time.

During this reporting period a total of 282 million gallons of water was pumped and 37.4 pounds of uranium were removed from the aquifer. A major well rehabilitation program which was initiated with Recovery Well 3926 (RW-3) during the last reporting period was completed during this period. Recovery Well 3927 (RW-4) which was taken out of service during the previous reporting period for rehabilitation was returned to service on January 8, 1997. Recovery Well 3925 (RW-2) was removed from service on January 20, 1997 for well rehabilitation and returned to service on April 11. Post rehabilitation performance tests on both wells indicate significant performance improvements after rehabilitation. A performance test was run on Recovery Well 3924 (RW-1) prior to rehabilitation, however, because the test indicated that the well efficiency was good, rehabilitation of this well was postponed until a later date.

During the last part of January through the first part of April, while Recovery Well 3925 (RW-2) was being rehabilitated, the system operated at a set point of 1100 gpm with Recovery Well 3924 (RW-1) pumping at 300 gpm and Recovery Wells 3926 (RW-3) and 3927 (RW-4) operating at 400 gpm each. During the month of May, the system set point was 700 gpm with Recovery Well 3924 (RW-1) operating at 300 gpm and Recovery Well 3927 (RW-4) operating at 400 gpm while Recovery Wells 3925 (RW-2) and 3926 (RW-3) were off line. The system operated at the optimum 1400 gpm pumping rate for the entire month of June.

The most significant cause of unexpected recovery well down time during this reporting period was from iron fouling of the flow controller valve system. Revised maintenance procedures have been issued which call for periodic cleaning and/or tear down and rebuilding of the flow controller valve assembly.

Recovery well maintenance procedures and recovery well performance monitoring requirements are documented in the South Plume Performance Monitoring and Maintenance Plan which was included as Appendix A in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Projects (DOE, June 1997). This document was submitted in draft form to U.S. EPA and Ohio EPA on June 30, 1997.

A Geoprobe™ sampling program to further delineate the total uranium plume was completed during this reporting period and detailed results were presented in the Baseline Remedial Strategy Report (BRSR) (DOE, June, 1997). Those results have been incorporated into this report and updated with the most recent DMEPP sampling data from the second quarter. While the off-property uranium plume just north of the recovery system was found to be significantly wider with the incorporation of the Geoprobe™ data, the total plume remains within the capture zone created by the current recovery system when it operates at the optimum 1400 gpm pumping rate. Furthermore, the South Plume Optimization Wells RW-6 and RW-7 which are described in the BRSR are to be located in the optimum position to significantly improve off-property plume recovery when they come on line in 1998.

The southwestern lobe of the plume around Monitoring Well 2552 (See Figure 1-1) continues to fluctuate seasonally with recharge from Paddys Run as evidenced by the data from first and second quarter sampling events. The extent of the southern lobe of the plume is defined by total uranium

concentrations in Monitoring Well 2552; those concentrations once again decreased during this reporting period to below 20 μg/L. Results of the Mann-Kendall test for trend on the data set for Well 2552 indicate that the Down Significant trend reported previously (October, 1996) has resumed. Borescope data taken at Monitoring Wells 2552 and 3552 during this reporting period indicate flow to the southeast in Well 2552 away from the recovery system and flow to the north in Well 3552 toward the recovery system.

Groundwater elevation data confirm that the highest concentrations within the total uranium plume continue to be captured by Recovery Wells 3924 (RW-1) and 3925 (RW-2). While groundwater modeling indicates the possibility of some breakthrough between Recovery Wells 3925 (RW-2) and 3926 (RW-3) when they were off line in May, consideration of the retarded flow velocities for uranium indicate that the plume would have moved approximately 65 feet or less while the wells were out of service. Furthermore, sampling data from these two recovery wells indicate total uranium concentrations in this area average 21.2 μg/L which is very close to the proposed 20 μg/L MCL for uranium.

At the northeastern lobe of the plume total uranium concentrations increased slightly during this reporting period in Monitoring Well 2398 (See Figure 1-1). As indicated in the BRSR, this portion of the plume is still well within the modeled capture zone which will be induced when the South Field and Injection Demonstration modules are brought on line in 1998.

The hydraulic, chemical, and radiological data collected during the reporting period are, with the exception of those data discussed above, consistent with past reports. Evaluation of the data indicates that the South Plume recovery wells are not affecting the Paddys Run Road Site (PRRS) plume.

Section 1.0

1.0 OPERATIONAL SUMMARY

This section summarizes the operation of the recovery wellfield from January 1, 1997 through June 30, 1997. The wellfield includes four recovery wells - 3924, 3925, 3926, and 3927. Well 3928 has been shut down since December of 1994 because it is not needed to meet current system objectives. Figure 1-1 shows the location of the well field and the associated monitoring wells in the area which are used to provide data for this report.

As noted in the previous System Evaluation Report (April, 1997), a major well rehabilitation program was initiated for the South Plume Recovery System wells in 1996. This program continued into 1997. The well rehabilitation process begins with a pre-treatment performance test which consists of a short duration step test to assess the specific capacity of the well. The actual well treatment includes cleaning of the recovery well utilizing dual swab and airlift pumping methods. After cleaning, the recovery well is acid treated to break down iron encrustation on the recovery well screen and within the local formation. This is followed by chlorination and pumping to inhibit future growth of iron fouling bacteria. A post-treatment performance test is run and compared against the pre-test to provide a measure of the effectiveness of the rehabilitation program. The post-treatment performance tests will be used as a baseline for monitoring future performance of the recovery wells.

Recovery Well 3927 (RW-4) was removed from service on November 27,1996 for rehabilitation and returned to service on January 8, 1997 at its target pumping rate of 400 gpm. A pre-treatment performance test run on Well 3927 (RW-4) resulted in 17 feet of drawdown in the well when it was pumped at 175 gpm for short periods of time (less than 15 minutes). After rehabilitation, the post-treatment performance test resulted in only 1.25 feet of drawdown in the well when it was pumped at 175 gpm.

While Well 3927 (RW-4) was out of service the average system pumping rate was 1000 gpm; Recovery Wells 3924 (RW-1) and 3925 (RW-2) were pumped at 300 gpm each and Well 3926 (RW-3) was pumped at 400 gpm. The pumping rate on Well 3926 (RW-3) was not increased while Well 3927 (RW-4) was being rehabilitated because of its proximity to Paddys Run Road Site (PRRS) and concerns

that increased pumping rates in the well above the nominal 400 gpm rate might have adverse impacts on PRRS contaminants.

Recovery Well 3925 (RW-2) was taken out of service on January 20, 1997 for rehabilitation and returned to service on April 11, 1997 at its target pumping rate of 300 gpm. While Well 3925 (RW-2) was out of service the average system pumping rate was 1100 gpm; Well 3924 (RW-1) was pumped at 300 gpm and Wells 3926 (RW-3) and 3927 (RW-4) were pumped at 400 gpm each. Well 3925 (RW-2) was also out of service from May 1 to May 28 to install a new self-cooling pump/motor assembly.

A performance test conducted in May 1997 on Recovery Well 3924 (RW-1) to assess the condition of the screen and pump/motor assembly indicated that this recovery well did not have extensive screen fouling. Minimal drawdown was observed at normal flows and at maximum flows. Because of the positive results from the performance test, rehabilitation of this recovery well has been postponed until a later time.

The following pages provide operational summary sheets for Recovery Wells 3924, 3925, 3926, and 3927. Monitoring data for these wells were collected at the individual well locations. Data representative of the entire recovery wellfield were collected at the Storm Water Retention Basin (SWRB) valve house; a wellfield operational summary sheet follows those for the individual recovery wells. Due to the different flow measurement points, minor differences in the cumulative wellhead totals and the valve house measurements for total flow are common. Data from the valve house were used to plot daily total uranium concentrations in the South Plume discharge water for the reporting period (Figure 1-2), monthly average total uranium concentrations since the start-up of the recovery wellfield in 1993 (Figure 1-3), and the cumulative pounds of uranium removed versus the cumulative gallons pumped by the recovery wells (Figure 1-4).

The recovery system operated in optimum four-well configuration (Wells 3924 and 3925 pumping at 300 gpm each and Wells 3926 and 3927 pumping at 400 gpm) for 45 out of 181 days or 25 percent of the time. Due to the well rehabilitation activities discussed above, the system operated in a three-well configuration for 106 out of 181 days or 59 percent of the time. The recovery system operated at less than the three-well configuration for 30 out of 181 days or 17 percent of the time.

Over the entire reporting period, the individual recovery wells operated from 40.0 percent of the time for Well 3925 (RW-2) (which was undergoing rehabilitation from January 20 until April 11) to 92.4 percent of the time for Well 3924 (RW-1). Individual wells were out of service at several times during the reporting period, the most notable of which is the outage of Well 3925 for rehabilitation and pump replacement as discussed above. Well 3926 (RW-3) was out of service from May 6 to May 29 in order to remove the pump intake screen which was clogged with iron encrustation. The clogged screen produced erratic performance and excessive amperage draw.

Iron fouling has been identified as the principal cause of flow controller related outages. Preventative maintenance procedures have been implemented to minimize outages due to iron fouling of flow control valves. The existing control valves rely upon water pressure in the line to position the valve body. This line pressure is transmitted to a diaphragm via a small-diameter tubing that is prone to plugging. The revised procedures require that the pilot tubing be cleaned every two months and rebuilt every six months. The present flow control valves are scheduled to be replaced with motor controlled valves as part of the South Plume Optimization project.

Recovery well maintenance procedures and recovery well performance monitoring requirements are documented in the South Plume Performance Monitoring and Maintenance Plan which was included as Appendix A in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment Projects (DOE, June 1997). This document was submitted in draft form to U.S. EPA and Ohio EPA on June 30, 1997.

A total of 282 million gallons of water was pumped during this reporting period and accounted for 37.4 pounds of uranium being removed from the aquifer; the average daily total uranium concentration in the South Plume discharge water was 15.9 micrograms per liter (μg/L). There was one extended time period from November 27, 1996 through January 8, 1997 when daily total uranium concentrations were above 20 μg/L in the South Plume discharge water. An examination of the operational data for the recovery wellfield revealed that the concentrations were above 20 μg/L during this period because Well 3927 (RW-4) was off line for rehabilitation and Well 3926 (RW-3)(which has higher uranium concentrations than 3927) was returned to service. The daily total uranium concentrations were 20 μg/L or greater from April 10 through April 17 due to the fact that Well 3925 (RW-2)(which has higher uranium concentrations than 3926) was returned to service following

rehabilitation, and Well 3926 was removed from service because of a malfunctioning flow controller. The uranium concentration in Recovery Well 3924 (RW-1) averages around 42 μg/L compared to 28 μg/L for Recovery Well 3925 (RW-2), 10.8 μg/L for Recovery Well 3926 (RW-3), and 1.2 μg/L for Recovery Well 3927 (RW-4).

WELL 3924 (RW-1)
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 531.9 (top of casing)
Northing Coordinate ('27) - 474,190.37
Easting Coordinate ('27) - 1,379,783.13

Hours in reporting period - 4,344
Hours not pumped - 331
Hours pumped - 4,013
Operational percent - 92.4
Target pumping rate - 300 gpm

Monthly Measurements at Wellfield

Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97	262[a]	11.7	41	0.34
2/97	224[b]	9.0	47	0.39
3/97	309	13.8	41	0.34
4/97	284	12.3	42	0.35
5/97	280	12.5	N/A	N/A
6/97	298	12.9	41	0.34
		Total 72.2	Average 42	Average 0.35

[a]Well out of service 1/10 to 1/14 due to malfunctioning flow control valve attributed to iron fouling.
[b]Well out of service 2/9, 2/10, 2/18 due to malfunctioning flow control valve attributed to iron fouling.

N/A No sample collected for monthly uranium analysis because well was inoperative at the time of the scheduled sampling.

WELL 3925 (RW-2)
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 540.3 (top of casing)
Northing Coordinate ('27) - 474,290.32
Easting Coordinate ('27) - 1,380,034.28

Hours in reporting period - 4,344 Hours pumped - 1,738 Target pumping rate - 300 gpm
Hours not pumped - 2,606 Operational percent - 40.0

Monthly Measurements at Wellfield

Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97	164[a]	7.3	N/A	N/A
2/97	0[a]	0	N/A	N/A
3/97	0[a]	0	N/A	N/A
4/97	186[b]	8.0	28	0.23
5/97	32[c]	1.4	N/A	N/A
6/97	303	13.1	29	0.24
		Total 29.8	Average 28	Average 0.23

[a]Recovery well taken out of service 1/21 for rehabilitation.
[b]Well returned to service 4/11.
[c]Well out of service 5/1 - 5/28 for installation of new self-cooling pump/motor assembly.

N/A No sample collected for monthly uranium analysis because well was inoperative at the time of scheduled sampling.

WELL 3926 (RW-3)
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 585.0 (top of casing)
Northing Coordinate ('27) - 474,399.22
Easting Coordinate ('27) - 1,380,306.40

Hours in reporting period - 4,344 Hours pumped - 3,344 Target pumping rate - 400 gpm
Hours not pumped - 1,000 Operational percent - 76.9

Monthly Measurements at Wellfield

Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97	362[a]	16.2	9.9	0.08
2/97	404	16.3	9.4	0.08
3/97	499	22.3	8.6	0.07
4/97	256[a]	11.1	12	0.10
5/97	101[b]	4.5	14	0.12
6/97	398	17.2	11	0.09
		Total 87.6	Average 10.8	Average 0.09

[a]Well out of service 1/10 - 1/14 and 4/11 - 4/24 due to malfunctioning flow control valve attributed to iron fouling.
[b]Well out of service 5/6 - 5/29 due to clogged pump intake screen.

WELL 3927 (RW-4)
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 589.0 (top of casing)
Northing Coordinate ('27) - 474,512.49
Easting Coordinate ('27) - 1,380,596.15

Hours in reporting period - 4,344 Hours pumped - 3,880 Target pumping rate - 400 gpm
Hours not pumped - 464 Operational percent - 89.5

Monthly Measurements at Wellfield

Month	Monthly Average Pumping Rate (gpm)	Million Gallons Pumped	Uranium Concentration (μg/L)	Well Efficiency (lbs/M gal)
1/97	225[a]	10.1	1.2	0.01
2/97	346[a]	13.9	1.3	0.01
3/97	393	17.6	1.2	0.01
4/97	375[a]	16.2	1.3	0.01
5/97	398	17.7	N/A	N/A
6/97	402	17.3	1.2	0.01
		Total 92.8	Average 1.2	Average 0.01

[a]Well out of service 1/10 - 1/14, 2/16, 2/17, and 4/5 - 4/7 due to malfunctioning flow control valve attributed to iron fouling.

N/A No sample collected for monthly uranium analysis because the well inoperative at the time of scheduled sampling.

WELL 3928 (RW-5)
OPERATIONAL SUMMARY SHEET

Reference Elevation (AMSL) - 588.3 (top of casing)
Northing Coordinate ('27) - 474,608.92
Easting Coordinate ('27) - 1,380,841.74

Hours in reporting period - 4,344 Hours pumped - 0 Target pumping rate - 0
Hours not pumped - 4,344 Operational percent - 0

Monthly Measurements at Wellfield

Month	Monthly Average Pumping Rate[a] (gpm)	Million Gallons Pumped[a]	Uranium Concentration[a] (μg/L)	Well Efficiency[a] (lbs/M gal)
1/97	0	0	---	---
2/97	0	0	---	---
3/97	0	0	---	---
4/97	0	0	---	---
5/97	0	0	---	---
6/97	0	0	---	---
	Total	0	Average ---	Average ---

[a]This recovery well is shut down because it is not needed currently to meet system objectives due to observed low concentrations of uranium in this well's discharge water when the system was in operation.

WELLFIELD OPERATIONAL SUMMARY SHEET

Total gallons pumped this reporting period (M gal) - 282
Total uranium recovered this reporting period (lbs) - 37.4
Average system efficiency this reporting period (lbs/M gal) - 0.13
Gallons pumped from August 1993 to June 1997 (billion gal) - 2.4
Uranium recovered from August 1993 to June 1997 (lbs) - 337.7
System efficiency from August 1993 to June 1997 (lbs/M gal) - 0.14

Monthly Measurements at Storm Water Retention Basin Valve House

	Monthly Average Well Pumping Rates (gpm)					Total System Pumping Rate (gpm)	Total System Average Uranium Concentration (μg/L)
Month	3924	3925	3926	3927	3928		
1/97	262	164[a]	362	225	0	1014	18.9
2/97	224	0[a]	404	346	0	974	11.5
3/97	309	0[a]	499	393	0	1201	13.1
4/97	284	186[a]	256	375	0	1102	18.7
5/97	280	32[b]	101[c]	398	0	811	16.4
6/97	298	303	398	402	0	1400	16.7
						Average	15.9

[a]Well out of service due to rehabilitation, 1/21 - 4/11.
[b]Well out of service 5/1 - 5/28 for installation of new pump/motor assembly.
[c]Well out of service 5/6 - 5/29 for removal of clogged pump intake screen.

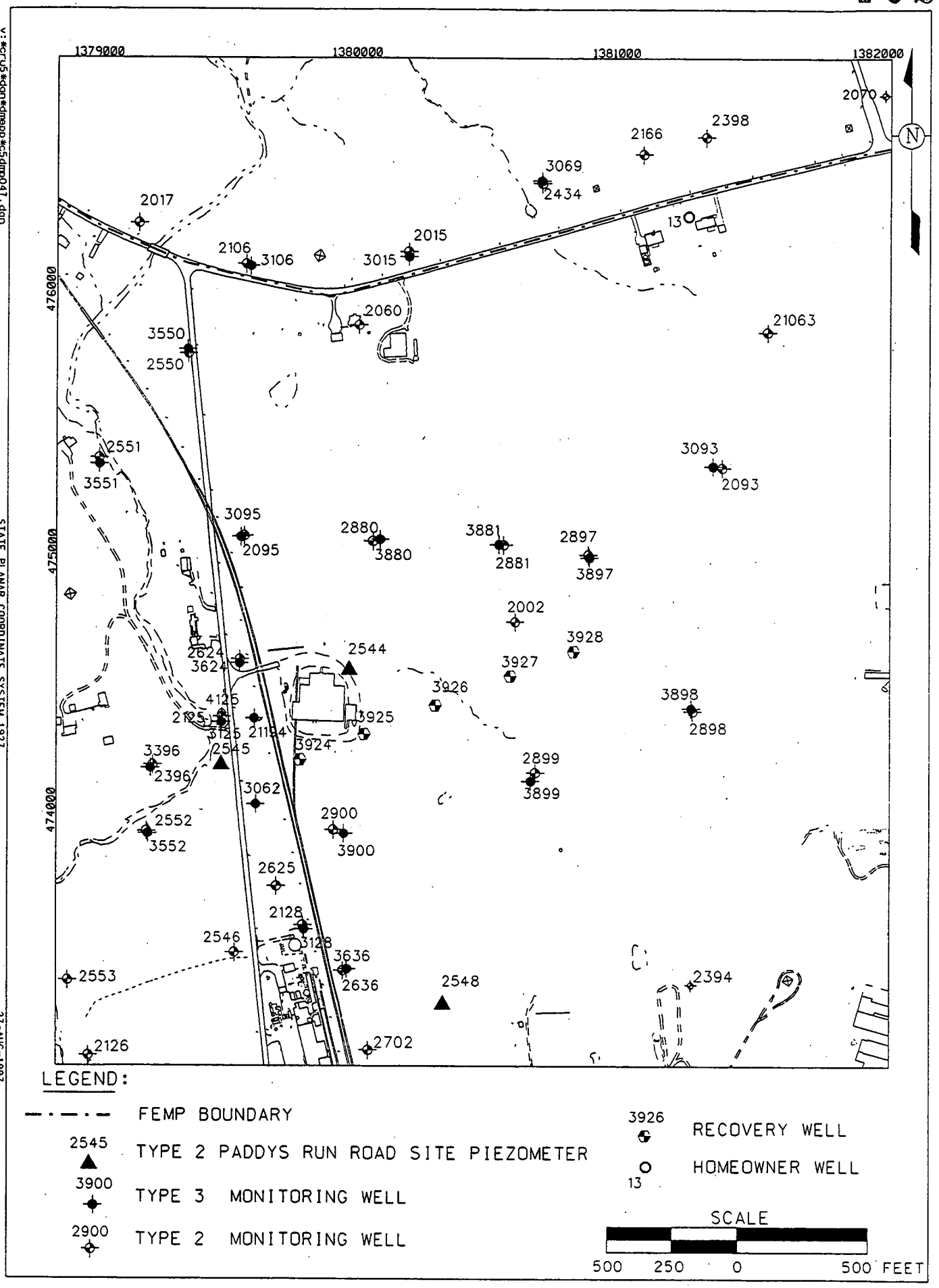
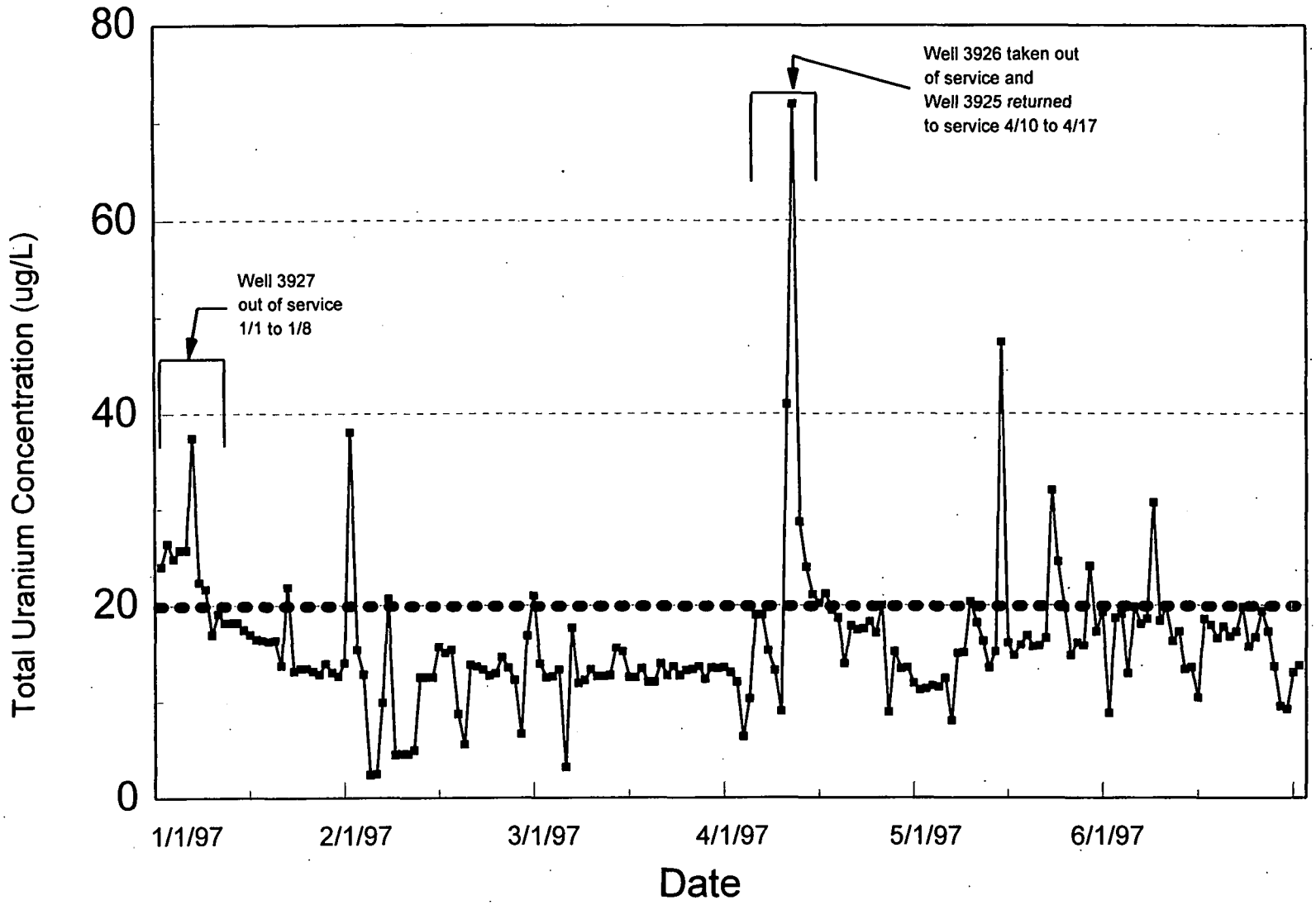


FIGURE 1-1. MONITORING WELLS THAT PROVIDE DATA FOR THE DMEPP



Proposed maximum contaminant level

Daily uranium concentration

Note: Measured daily at the SWRB valve house

Figure 1-2. Daily Total Uranium Concentration South Plume Discharge Water, 1/97 - 6/97

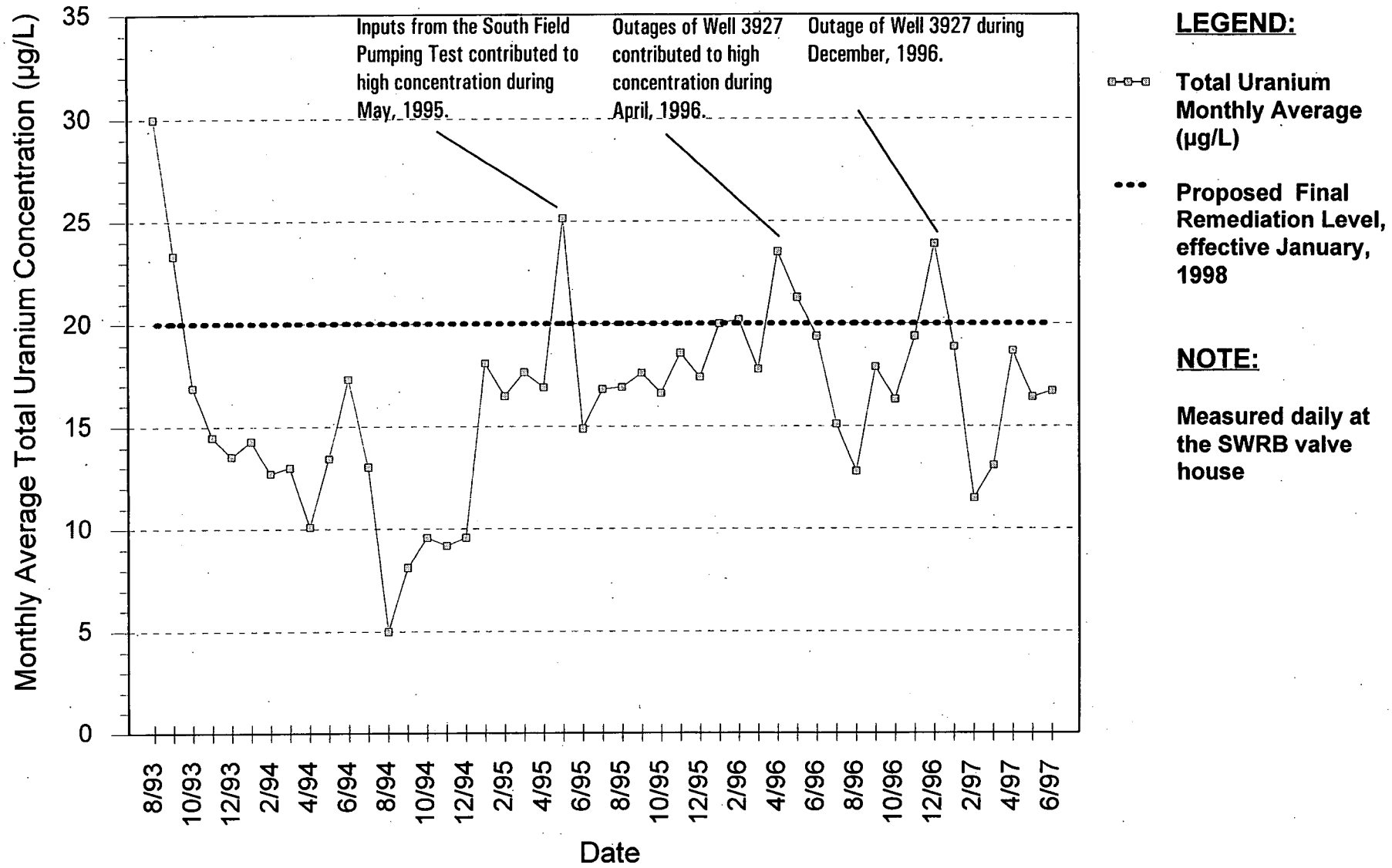


Figure 1-3. Monthly Average Total Uranium Concentration in South Plume Discharge Water, 8/93 - 12/96

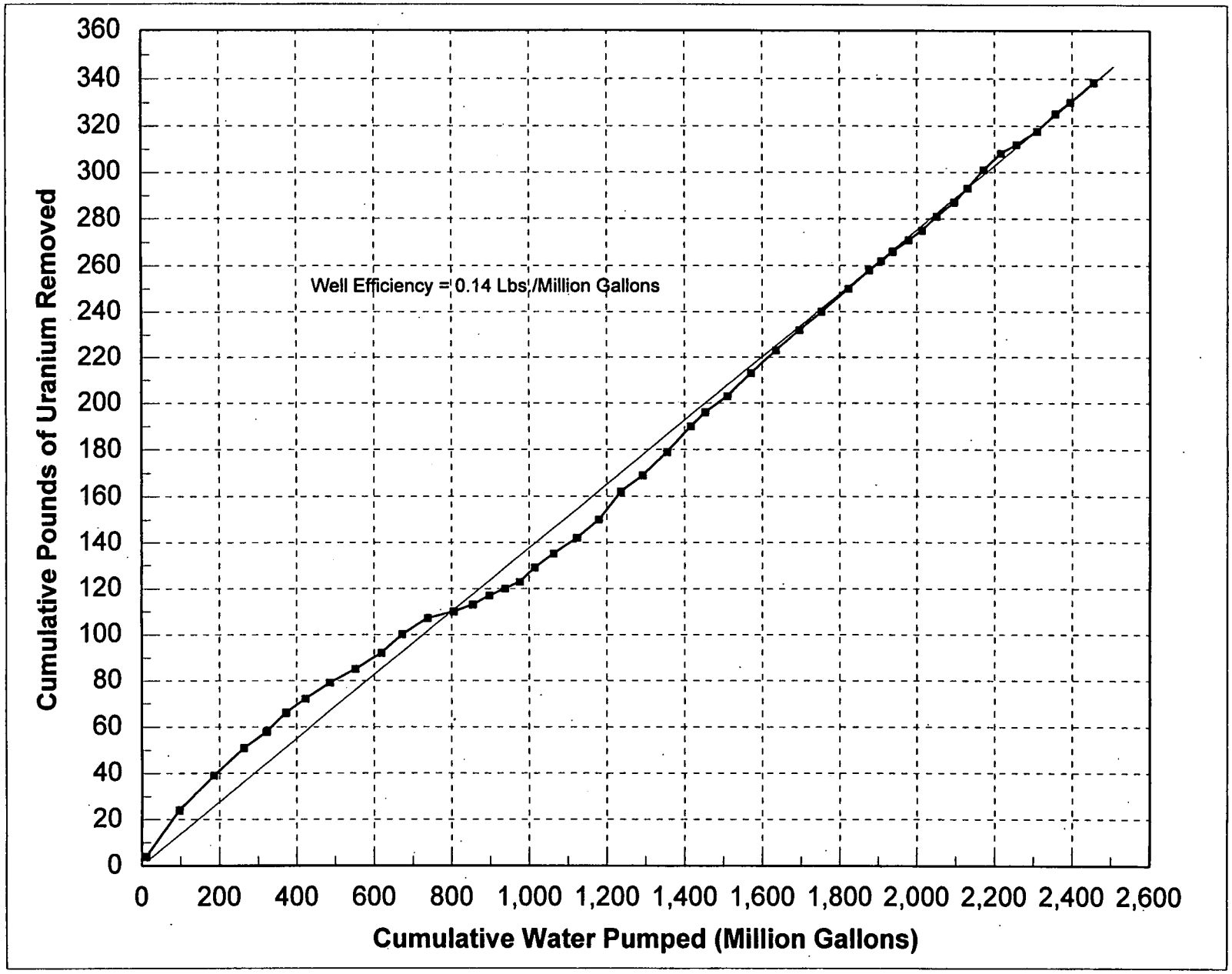


Figure 1-4. Total Uranium Removed -vs- Water Pumped, 8/93 - 6/97

Section 2.0

2.0 MONITORING WELL SUMMARY

Currently, water elevation data are collected from the 33 DMEPP monitoring wells shown in Table 2-1. For the period covered by this report groundwater elevation measurements were collected monthly rather than quarterly because of the different pumping scenarios used while the recovery wells were being rehabilitated. In the future, this frequency will be reduced back to quarterly when the rehabilitation activities have been completed and the recovery well system appears to have stabilized. These elevation data are used to assess the effective capture of uranium-contaminated groundwater by the recovery wellfield, as reported in Section 4.0.

Groundwater quality data are collected from 57 monitoring wells (Table 2-2). Figure 1-1 shows the location of all wells that provide analytical results for the DMEPP and Table 2-2 identifies the constituents analyzed for. This information is used to prepare statistical summary tables (Section 3.0) and to provide contour maps of the uranium plume at the Type 2- and Type 3-well-depth intervals (Section 4.0). During this reporting period, monitoring was not performed at four of the well locations. Well 3062, formerly a process water supply well for Albright and Wilson, is no longer available for sampling due to electrical problems associated with the pump. Wells 2548, 2624, and 3624 remain inaccessible for sampling due to the lack of a current access agreement with the property owner, CSX Railroad. Negotiations for an access agreement are ongoing.

TABLE 2-1

MONITORING WELLS FOR THE DMEPP GROUNDWATER ELEVATION PROGRAM

33 Total Wells	
2002	2545
2015	2546
2070	2548
2093	2551
2095	2552
2106	2553
21063	2624
21194	2625
2125	2636
2126	2702
2128	2880
2166	2881
2394	2897
2396	2898
2398	2899
2434	2900
2544	

TABLE 2-2

DMEPP MONITORING WELLS AND ANALYTICAL PARAMETERS FOR THE GROUNDWATER SAMPLING PROGRAM

33 Original Wells	Analytical Parameters[a]	24 Supplemental Wells/Date Added[b]	Analytical Parameters[a]
2002	A,B	2015 / 2/94 (5/95)[c]	A,B
2093	A,B	2017 / 2/94 (5/95)[c]	A,B
2095	A,B	2060 / 2/95 (2/95)[c]	A,B
2125	A,B	2106 / 2/94[c]	A,B
2128	A,B,C,D,E	21063 / 5/94 (5/95)	A,B
2544	A,B	2166 / 5/95 (5/95)[c]	A,B
2545	A,B	2396 / 5/95 (5/95)	A,B
2548	A,B,C,D,E	2398 / 1/94[c]	A,B
2624	A,B	2434 / 1/94[c]	A,B
2625	A,B,C,D,E	2546 / (7/96)	A,B
2636	A,B,C,D,E	2550 / 2/94 (5/95)	A,B
2880	A,B	2551 / 2/94 (5/95)	A,B
2881	A,B	2552 / 2/94 (5/95)	A,B
2897	A,B	2553 / 2/94 (5/95)	A,B
2898	A,B,C,D	3015 / 2/94 (5/95)[c]	A,B
2899	A,B,C,D	3062 / (6/95)[d]	A,B
2900	A,B,C,D,E	3069 / 1/96[c]	A,B
3093	A,B	3106 / 2/94[c]	A,B
3095	A,B	3396 / (6/95)	A,B
3125	A,B	3550 / 2/94 (5/95)	A,B
3128	A,B,C,D	3551 / 2/94 (5/95)	A,B
3624	A,B	3552 / 2/94 (5/95)	A,B
3636	A,B,C,D	21194 / 2/95 (2/95)	A,B
3880	A,B	4125 / (6/95)	A,B
3881	A,B		
3897	A,B		
3898	A,B,C,D		
3899	A,B,C,D		
3900	A,B,C,D		
3924	A,B,E		
3925	A,B,E		
3926	A,B		
3927	A,B		

[a]A Dissolved oxygen, pH, specific conductance, temperature (analyzed in the field)
B Total uranium (analyzed at the on-site laboratory)
C Arsenic, phosphorus (total), potassium, sodium (Paddys Run Road Site [PRRS] inorganics)
D Benzene, cumene (isopropyl benzene), ethyl benzene, toluene, xylene (PRRS organics)
E Arsenic (collected on a weekly basis; see results in Appendix A for exact sample collection dates)
[b]Date added identifies when analytical results were first used in support of findings for the DMEPP. The date in parentheses is when the monitoring well was formally added to the DMEPP sampling program.
[c]Monitoring well is sampled under a separate program but provides the necessary analytical results on a sampling schedule compatible with the DMEPP.
[d]Well not available for sampling due to electrical problems with the pump.

Section 3.0

3.0 ANALYTICAL DATA SUMMARY

Statistical summaries of results (minimum, maximum, average, standard deviation, and trend) for unfiltered samples from individual wells are presented in Tables 3-1 through 3-5 for total uranium, arsenic, phosphorus, potassium and sodium, respectively. Normal and duplicate samples taken on the same day were first averaged then counted as one sampling event for that day before the minimum, maximum, average, and standard deviation statistics were calculated. Any sample with a non-detect (i.e., a laboratory validation qualifier of "U") was assigned a value equal to one-half the minimum detection limit (MDL) for the analytical method used. If the non-detect sample was one of a duplicate-normal sample pair, the one-half MDL for the non-detect was assigned then averaged with the other member of the sample pair.

Appendix A consists of validation qualifiers and a disk containing the analytical data used to prepare this report. The two files on the disk, one for filtered and one for unfiltered data, are in ASCII format with quotes and semicolons used as delimiters. Appendix B contains total uranium concentration plots for each monitoring well over time for unfiltered samples.

As in previous System Evaluation Reports, the Mann-Kendall trend test was performed on total uranium, arsenic, phosphorus, potassium, and sodium sampling results from August 27, 1993 through June 30, 1997. Tables 3-1 through 3-5 include summaries of the Mann-Kendall test results by analyte and location, the number of distinct sampling events used in the calculation, and the probability that the trend calculated is due to chance. In preparing these tables only data with validation qualifiers "-," "J," "NV," "U," and "UJ" were used (see Appendix A). All "U" and "UJ" qualified data were used at one-half the reported value. Details of the Mann-Kendall trend calculation are given in Appendix C.

The Mann-Kendall probability value gives the probability that the apparent trend is due to chance and not a real trend. Therefore, a smaller probability value from the Mann-Kendall test indicates that the calculated trend is more likely to be real. For example, a probability value of 0.05 indicates that the calculated trend is real with a certainty of 95 percent; or, in other words, there is only a five percent chance that such a trend could have been calculated from random points. In Tables 3-1 through 3-5 a probability value less than or equal to five percent (.05) was interpreted as a significant trend and a

probability value less than or equal to 10 percent (.10) but greater than five (.05) percent was interpreted as a marginally significant trend.

Mann-Kendall test results with significant upward or downward trends identified from the August 27, 1993 through June 30, 1997 data have been compiled in Table 3-6 for total uranium, arsenic, phosphorus, potassium and sodium, along with specific explanations for each result.

3.1 TOTAL URANIUM TRENDS

An examination of the trend results for total uranium (Table 3-6) shows that 13 wells have significant downward trends, and 14 wells have significant upward trends for this reporting period. This compares with 14 wells that had significant downward trends and 12 wells that had significant upward trends during the last reporting period (July 1, 1996 through December 31, 1996). Monitoring Wells 2551 and 3106 changed from No Trend to Up Significant while Monitoring Wells 21063 and 2552 changed from No Trend to Down Significant. Monitoring Well 2015 changed from Down Significant to No Trend.

The trend data for Monitoring Well 2551 which is just west of Paddys Run and northwest of the recovery system changed from No Trend during the last reporting period to Up Significant for this reporting period. As shown in the concentration plots in Appendix B for this well, a maximum total uranium concentration of 39.0 μg/L was observed during the first quarter sampling round. Total uranium concentrations in this well decreased to 28.0 μg/L by the second quarter sampling round. The cause for this increase in concentration is unknown at this time. However, since the well is northwest of the recovery system, within the capture zone, and since regional groundwater flow is to the southeast, no additional action is required. Monitoring of this well will continue as part of the IEMP program and subsequent results will be provided in the IEMP quarterly reports.

Data for Monitoring Well 3106 also indicated an Up Significant trend for this reporting period as opposed to a No Trend result during the last reporting period. An examination of the total uranium concentration plot in Appendix B for this well shows that maximum concentration for this reporting period was 2.4 μg/L, which is within the range of background concentration.

Two monitoring wells (2093 and 3125) changed from No Trend to Up Marginal. Average total uranium concentrations observed during this reporting period were 0.7 μg/L for Monitoring Well 2093 (within background) and 67.0 μg/L for Monitoring Well 3125. The maximum total uranium concentration observed in this reporting period for Monitoring Well 3125 was 74.0 μg/L for the second quarter sampling event which is below the maximum total uranium concentration of 82.0 μg/L which was observed in the second quarter of 1995. Since this well is immediately northwest of the recovery system, it is well within the capture zone so no additional action is required.

Monitoring Well 3095 continued to show an Up Significant trend with an average total uranium concentration of 19.0 μg/L for this reporting period compared with an average of 14.0 μg/L for the previous reporting period. Since this well is near the center of the plume and upgradient of the recovery system, this trend is believed to be due to the continued operation of the recovery wells as the uranium contamination moves toward the recovery system.

Of the remaining monitoring wells which exhibited a change in trend for total uranium from the previous reporting period, two monitoring wells (2015 and 2017) changed from Down Significant and Down Marginal to No Trend, and three monitoring wells (21063, 21194, and 2552) changed from No Trend to Down Significant or Down Marginal. Of note is the change in trend for Monitoring Well 2552 which is representative of the extreme southwestern lobe of the plume. This well resumed its downward trend during this reporting period as shown in the total uranium concentration plot in Appendix B. As predicted in previous DMEPP reports, the extreme southwestern lobe of the plume located between Paddys Run and Paddys Run Road appears to continue dissipating with average concentrations at 16.0 μg/L for this reporting period.

Of the 14 wells with significant upward trends in total uranium concentrations, only one, Monitoring Wells 2128 is outside the 1400 gpm capture zone of the recovery system as defined by the groundwater elevation data, the colloidal borescope data, and SWIFT groundwater modeling results. This Wells is shown on Figure 1-1.

Monitoring Well 2128 exhibited a significant upward trend in total uranium with an average concentration of 12.8 μg/L for this reporting period. A concentration of 12.0 μg/L was previously observed in this well in the third quarter of 1995 and reported in the April 1996 DMEPP as a

significant upward trend. As discussed in previous DMEPP reports, Monitoring Well 2625 is immediately up gradient of Well 2128 and continues to show no trend with a maximum concentration of 1.5 μg/L observed in this reporting period. Monitoring Well 2128 will continue to be sampled as part of the IEMP sampling program and results will be presented in future IEMP reports.

Monitoring Well 2398 which is on property just north of Willey Road at the extreme eastern edge of the plume continues to exhibit an Up Significant trend with an average concentration of 22.9 μg/L observed during the reporting period. As shown in Figure 4-9 of Section 4.0 of this report, the well is just inside the eastern edge of the capture zone when the recovery well system is pumping at 1400 gpm. Samples were taken at 10 foot intervals beginning at the water table at a location approximately 150 feet east of Well 2398 in May 1997 (Geoprobe™ location 12265). These samples exhibited a maximum total uranium concentration of less than 3 μg/L (BRSR, Appendix G, DOE June 1997). The increasing concentrations observed at Monitoring Well 2398 are believed to be due to the lateral expansion of the plume due to regional groundwater flow which is to the southeast in area of Monitoring Well 2398. Groundwater modeling performed in support of the BRSR, predicts that this part of the plume will ultimately be captured by the combined action of the fenceline injection system and Recovery Well 22 in the South Field which are scheduled to begin operation in calendar year 1998 (See Figure 5-15 on page 5-32 of the BRSR, DOE, June 1997). Well 2398 will continue to be monitored as part of the Integrated Environmental Monitoring Plan and results presented in subsequent IEMP quarterly reports.

Monitoring Well 3069, in the northeastern lobe of the plume just north of the proposed fenceline re-injection wells, continues to show an Up Significant trend in total uranium concentration with first and second quarter sampling events showing an average total uranium concentration of 291.0 μg/L. As described in Appendix G of the Baseline Remedial Strategy Report (DOE, June 1997), Geoprobe™ sampling was performed in early 1997 to further delineate the plume in this area. It is planned that Recovery Well 22, which is scheduled to go on line in 1998, will remediate this portion of the plume.

Monitoring Wells 2880 and 3880 which are up gradient of the recovery system continued to show significant upward trends for uranium even though the average total uranium concentrations (1.6 μg/L for Well 2880; 2.6 μg/L for Well 3880) remain within background levels. Monitoring Well 2002 also continued to exhibit a significant upward trend with concentrations slightly above background at an average value of 4.6 μg/L for this reporting period. The upward trends in these wells is attributed to

the arrival of the leading edge of the total uranium plume as it moves toward the recovery system. Monitoring Wells 2624 and 3624, also up gradient of the recovery system were not sampled during this reporting period due to continuing negotiations with the land owner (CSX Railroad) for access rights.

Wells 2899 and 2900 continue to exhibit significant upward trends in total uranium with average concentrations of 2.3 μg/L and 6.0 μg/L respectively during this reporting period. These wells are south of the recovery system and near the boundary of the interpreted capture zone, as shown in Figures 4-6 and 4-7. The colloidal borescope data gathered during the first and second quarters of 1997 from Well 2900 continues to show that groundwater flow direction is almost due north as shown in Figures 4-8 and D-7 of Appendix D. This demonstrates that it is within the recovery well capture zone. Borescope flow data for Well 2899 shows flow directions to the southeast indicating that this well is outside the capture zone of the recovery system. However, with total uranium concentrations within the background range in Well 2899, this upward trend is not a significant concern at this time. Wells 2899 and 2900 will continue to be monitored and reported on in future IEMP reports.

Recovery Wells 3925 and 3926 continue to exhibit significant upward trends in total uranium due to the continued pumping with average concentration of 28.5 μg/L and 10.8 μg/L respectively for this reporting period. This increase is due to the pumping action which continues to pull contamination from the heart of the plume to the recovery system where it is removed from the aquifer.

Finally, Monitoring Well 2546 which is south of the recovery system and west of Paddys Run Road was added to the DMEPP sampling program during the last reporting period. This well has exhibited fluctuating uranium concentrations with no apparent trend at this time. As shown in the concentration plot in Appendix B for this well, out of four sampling events during the last year, two have been below 20 μg/L and two have been above 20 μg/L with an average concentration of 17.9 μg/L during the last reporting period and 23.5 μg/L during this period. Monitoring of this well will continue under the IEMP and future data will be reported as part of the quarterly IEMP status reports.

3.2 ARSENIC TRENDS

An examination of the arsenic trends in Table 3-2 shows that only one well (Monitoring Well 2548) exhibited an upward trend. Because of the position and distance of Monitoring Well 2548 from the recovery well system (over 1000 feet south of Recovery Well 3925), this marginal upward trend is

believed to be attributable to natural migration of Paddys Run Road Site contaminants and not due to operation of the South Plume Recovery System. Wells 2625 and 2900, which are used as early warning indicators for potential capture of PRRS constituents, both continue to show significant downward trends in arsenic concentrations during this reporting period.

3.3 PHOSPHORUS, POTASSIUM, AND SODIUM TRENDS

Mann-Kendall trend results for the remaining PRRS constituents (phosphorus, potassium, and sodium) are also presented in Tables 3-3 through 3-5. Monitoring Wells 2898 and 2899 both exhibited significant upward trends for phosphorus with average concentrations of 0.08 mg/L in each well. Since this value is well below the background 95th percentile value of 0.954 mg/L reported in the site background report (Characterization of Background Water Quality for Streams and Groundwater, DOE, May 1994), and since the wells are over 1000 feet northeast of Paddys Run Road Site, this trend is not believed to be problematic.

Monitoring Well 2899 also continues to show increasing trends for both potassium and sodium with maximum concentrations observed in this reporting period of 3.84 mg/L and 19.00 mg/L respectively. While the 3.84 mg/L maximum observed concentration for potassium is above the 95th percentile value of 1.96 mg/L for background (reference the site background report), the 19.00 mg/L observed concentration for sodium continues to be well below the background 95th percentile value of 47.2 mg/L as reported in the site background report. The maximum observed sodium concentration in this well is 22.90 mg/L. Well 2899 will continue to be monitored as part of the IEMP sampling program for potassium, sodium, and phosphorus and any changes reported in future IEMP quarterly reports.

Well 2900 continues to show increasing concentrations and upward trend for sodium. A maximum of 38.80 mg/L was observed in the second quarter sampling round during this reporting period. This value is still below the 95th percentile background value of 47.2 mg/L and less than the previous maximum of 43.3 mg/L which was observed in the third quarter of 1996. Because sodium is a mobile PRRS constituent, and groundwater flow direction at Well 2900 is to the north toward the recovery well system, Well 2900 will continue to be monitored for sodium as part of the IEMP sampling program and the results presented in future IEMP quarterly reports.

3.4 VOLATILE ORGANIC COMPOUND TRENDS

Toluene was detected during the first quarter of the reporting period with a concentration of 3.0 μg/L in Monitoring Well 3900. A similar result was reported in the previous DMEPP report for Monitoring Well 3636. Since Monitoring Well 3900 is approximately 500 feet north of Monitoring Well 3636, the two positive results for toluene are probably not related. Furthermore, since Monitoring Well 2900 did not test positive for toluene, the result for Well 3900 is believed to be a false positive. No statistical summaries or Mann-Kendall trend calculations were performed on toluene or the other volatile organic constituents (benzene, cumene, ethyl benzene, and xylene) sampled for under the DMEPP because, other than the toluene mentioned above, no other detections were noted during the reporting period.

TABLE 3-1

STATISTICS FOR TOTAL URANIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2002	22	1.8	8.9	2.8	1.4	2	4.0	5.2	4.6	0.8	24	0.003	Up, Sig.
2015	13	130.0	170.0	147.7	12.3	2	163.0	169.0	166.0	4.2	15	0.345	No Trend
2017	9	1.9	5.0	3.7	1.2	2	3.5	3.6	3.5	0.1	11	0.106	No Trend
2060	12	28.0	75.0	46.1	14.1	2	25.0	52.0	34.7	15.0	14	0.002	Down, Sig.
2093	14	0.3	0.9	0.5	0.1	2	0.6	0.7	0.7	0.1	16	0.071	Up, Mar.
2095	13	110.0	200.0	155.6	21.9	2	159.0	166.0	162.3	3.5	15	0.421	No Trend
2106	14	1.1	70.0	48.8	18.0	2[f]	45.3	67.0	36.2	15.3	16	0.371	No Trend
21063	11	1.7	15.0	4.3	4.8	2	1.3	1.5	1.4	0.1	13	0.043	Down, Sig.
21194	6	0.6	5.8	2.8	1.9	2	0.3	0.9	0.6	0.4	8	0.054	Down, Mar.
2125	14	8.8	39.0	15.8	9.1	2	14.0	15.0	15.0	0.7	16	0.031	Down, Sig.
2128	15	0.8	12.0	7.6	3.9	2	12.0	14.0	12.8	1.0	17	0.002	Up, Sig.
2166	7	48.0	75.0	65.0	8.7	2	60.0	67.0	63.5	4.9	9	0.090	Down, Mar.
2396	12	0.8	1.3	1.0	0.2	2	0.9	0.9	0.9	0.0	14	0.131	No Trend
2398	14	0.7	27.7	12.0	6.2	2[f]	17.8	28.0	22.9	7.2	16	0.002	Up, Sig.
2434	14	0.9	2.2	1.3	0.3	2[f]	1.3	9.7	5.5	5.9	16	0.008	No Trend
2544	22	0.6	21.0	9.7	5.5	2	0.4	13.0	6.7	8.9	24	0.284	No Trend
2545	15	19.0	81.0	39.6	18.9	2	16.0	22.0	19.0	4.2	17	0.005	Down, Sig.
2546	2	0.8	35.0	17.9	24.2	2	13.0	34.0	23.5	14.8	4	0.375	No Trend
2548	12	0.3	5.5	2.9	1.5	0[d]	N/A	N/A	N/A	N/A	12	0.050	Down, Sig.
2550	12	72.0	86.0	78.4	4.4	2	74.0	79.0	76.5	3.5	14	0.291	No Trend
2551	12	7.5	30.0	20.9	7.0	2	28.0	39.0	33.5	7.8	14	0.044	Up, Sig.
2552	12	16.0	25.0	21.2	2.7	2	15.0	17.0	16.0	1.2	14	0.043	Down, Sig.

TABLE 3-1
(Continued)

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2553	11	0.9	1.9	1.3	0.4	2	1.1	1.1	1.1	0.0	13	0.306	No Trend
2624	19	7.5	160.0	76.7	30.9	0[d]	N/A	N/A	N/A	N/A	19	0.003	Down, Sig.
2625	14	0.8	8.2	2.9	1.8	2	0.7	1.5	1.1	0.6	16	0.172	No Trend
2636	13	0.5	3.9	1.4	0.9	2	0.4	1.1	0.8	0.5	15	0.107	No Trend
2880	21	0.4	1.4	0.8	0.3	2	1.5	1.7	1.6	0.1	23	<0.001	Up, Sig.
2881	21	0.1	4.0	3.1	0.8	2	2.5	2.6	2.6	0.1	23	0.102	No Trend
2897	14	0.5	1.3	0.8	0.2	2	0.7	0.8	0.8	0.1	16	<0.001	Down, Sig.
2898	15	1.7	3.6	2.7	0.6	2	2.7	2.8	2.8	0.1	17	0.451	No Trend
2899	15	0.9	2.3	1.8	0.3	2	2.1	2.4	2.3	0.2	17	<0.001	Up, Sig.
2900	15	0.5	12.0	3.7	3.1	2	6.0	6.0	6.0	0.0	17	<0.001	Up, Sig.
3015	13	0.9	1.3	1.2	0.1	2	1.2	1.4	1.3	0.1	15	0.256	No Trend
3062	4	16.0	69.0	47.8	22.5	0[e]	N/A	N/A	N/A	N/A	4	0.167	No Trend
3069	14	0.3	223.6	99.2	57.1	2[f]	252.0	330.0	291.0	55.2	16	<0.001	Up, Sig.
3093	13	0.2	0.8	0.4	0.2	2	0.4	0.4	0.4	0.0	15	0.418	No Trend
3095	13	6.0	19.0	10.4	3.9	2	18.0	20.0	19.0	1.4	15	<0.001	Up, Sig.
3106	14	0.7	13.4	2.3	3.0	2[f]	1.6	2.4	2.0	0.60	16	0.040	Up, Sig.
3125	14	43.0	82.0	57.2	11.5	2	57.0	74.0	67.0	8.9	16	0.081	Up , Mar.
3128	15	0.0	1.0	0.5	0.2	2	0.4	0.5	0.5	0.1	17	0.232	No Trend
3396	6	0.5	0.6	0.6	0.1	2	0.6	0.7	0.7	0.1	8	0.199	No Trend
3550	12	2.6	6.1	4.4	1.3	2	3.0	3.4	3.2	0.3	14	<0.001	Down, Sig.
3551	12	0.6	5.0	1.0	1.1	2	0.6	0.7	0.7	0.1	14	0.500	No Trend
3552	6	0.5	0.7	0.6	0.1	2	0.6	0.8	0.7	0.1	8	0.360	No Trend

TABLE 3-1
(Continued)

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
3624	13	0.3	0.8	0.5	0.1	0[d]	N/A	N/A	N/A	N/A	13	0.033	Up, Sig.
3636	15	0.2	3.0	0.6	0.6	2	0.8	1.0	0.9	0.1	17	0.172	No Trend
3880	14	0.1	2.3	0.9	0.8	2	2.5	2.7	2.6	0.1	16	0.002	Up, Sig.
3881	14	0.0	0.6	0.2	0.1	2	0.1	0.2	0.2	0.1	16	0.423	No Trend
3897	21	0.3	0.8	0.5	0.1	2	0.4	0.4	0.4	0.0	23	0.003	Down, Sig.
3898	15	0.2	180.0	21.0	58.0	2	0.4	0.4	0.4	0.0	17	0.319	No Trend
3899	15	0.6	1.2	0.9	0.2	2	0.7	0.7	0.7	0.0	17	<0.001	Down, Sig.
3900	15	0.0	0.5	0.1	0.1	2	0.2	0.2	0.2	0.0	17	0.333	No Trend
3924	36	41.0	180.0	64.2	32.4	5	41.0	47.0	43.2	3.0	41	<0.001	Down, Sig.
3925	44	0.5	33.0	21.0	10.3	2	28.0	29.0	28.5	0.7	46	<0.001	Up, Sig.
3926	38	1.5	9.3	4.8	2.3	6	8.6	14.0	10.8	1.8	44	<0.001	Up, Sig.
3927	37	1.1	5.4	1.9	1.2	5	1.2	1.3	1.2	0.1	42	<0.001	Down, Sig.
4125	7	0.6	9.8	2.1	3.4	2	0.6	4.8	2.7	3.0	9	0.238	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]These wells not sampled because negotiations with CSX Railroad for an access agreement are ongoing.
[e]Previous Albright Wilson Water Supply Well before alternate water supply available. No samples collected due to electrical malfunction at pump.
[f]Data collected as part of the RCRA monitoring program.

TABLE 3-2

STATISTICS FOR ARSENIC

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	163	0.001	0.188	0.014	0.024	25	0.002	0.020	0.006	0.004	188	<0.001	Down, Sig.
2548	107	0.001	0.706	0.034	0.078	0[d]	N/A	N/A	N/A	N/A	107	0.064	Up, Mar.
2625	155	0.003	0.071	0.013	0.010	25	0.004	0.014	0.007	0.003	180	0.001	Down, Sig.
2636	142	0.010	0.094	0.047	0.018	12	0.010	0.036	0.022	0.007	154	0.040	Down, Sig.
2898	15	0.000	0.006	0.002	0.002	2	0.001	0.003	0.001	0.003	17	0.151	No Trend
2899	16	0.000	0.003	0.002	0.001	2	0.001	0.002	0.001	0.001	18	0.500	No Trend
2900	163	0.001	0.050	0.005	0.004	25	0.001	0.005	0.005	0.001	188	0.050	Down, Sig.
3128	16	0.001	0.234	0.016	0.055	2	0.002	0.006	0.004	0.002	18	0.410	No Trend
3636	16	0.001	0.003	0.002	0.001	3	0.002	0.014	0.005	0.006	19	0.430	No Trend
3898	16	0.001	0.006	0.002	0.001	2	0.002	0.003	0.003	0.001	18	0.395	No Trend
3899	16	0.000	0.003	0.002	0.001	2	0.002	0.003	0.002	0.001	18	0.324	No Trend
3900	16	0.001	0.005	0.002	0.001	2	0.002	0.004	0.003	0.001	18	0.297	No Trend
3924	124	0.005	0.012	0.005	0.001	24	0.005	0.005	0.005	0.000	148	0.271	No Trend
3925	137	0.005	0.005	0.005	0.000	10	0.005	0.005	0.005	0.000	147	0.500	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]This well was not sampled during this reporting period due to continuing negotiations with the CSX Railroad for access rights. In the April 1997 DMEPP report this well exhibited an Up Significant trend however, a re-run of the Mann Kendall test resulted in an Up Marginal trend rather than Up Significant trend. The original calculation was found to be in error because some of the early non-detect sample results for the well were not divided by two before the calculation was done. This error did not affect any other previously reported results.

TABLE 3-3

STATISTICS FOR PHOSPHORUS

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	15	0.09	6.40	1.99	1.92	2	0.67	1.05	0.85	0.20	17	0.026	Down, Sig.
2548	13	0.05	6.20	1.89	1.88	0[d]	N/A	N/A	N/A	N/A	13	0.080	Down, Mar.
2625	14	0.31	12.30	3.10	3.76	2	1.70	2.08	1.89	0.27	16	0.058	Down, Mar.
2636	14	8.97	170.00	98.46	53.92	2	41.65	80.50	61.08	27.47	16	0.130	No Trend
2898	16	0.01	0.08	0.04	0.02	2	0.08	0.09	0.08	0.01	18	0.030	Up, Sig.
2899	16	0.01	0.07	0.04	0.02	2	0.08	0.09	0.08	0.00	18	0.004	Up, Sig.
2900	16	0.05	0.96	0.45	0.26	2	0.13	0.34	0.24	0.15	18	0.048	Down, Sig.
3128	15	0.01	13.00	0.81	3.14	2	0.06	0.07	0.07	0.01	17	0.103	No Trend
3636	16	0.02	0.23	0.07	0.05	2	0.08	0.10	0.09	0.01	18	0.247	No Trend
3898	16	0.02	0.34	0.09	0.08	2	0.09	0.21	0.15	0.09	18	0.455	No Trend
3899	16	0.03	0.83	0.16	0.19	2	0.07	0.08	0.07	0.01	18	0.224	No Trend
3900	16	0.01	1.26	0.11	0.27	2	0.07	0.09	0.08	0.01	18	0.180	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]Well not sampled because negotiations with CSX Railroad for an access agreement are ongoing

TABLE 3-4

STATISTICS FOR POTASSIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	16	1.69	18.00	5.24	5.58	2	2.03	2.51	2.20	0.20	18	0.009	Down, Sig.
2548	13	1.36	40.00	12.07	10.59	0[d]	N/A	N/A	N/A	N/A	13	0.038	Down, Sig.
2625	14	0.64	6.26	3.02	1.84	2	2.16	5.73	3.50	1.94	16	0.069	Up, Mar.
2636	14	8.51	218.00	110.10	53.95	2	17.80	32.00	22.70	8.06	16	0.032	Down, Sig.
2898	16	2.50	5.05	3.76	0.65	2	3.65	4.06	3.81	0.22	18	0.272	No Trend
2899	17	1.36	4.42	3.36	0.74	2	3.31	3.84	3.49	0.30	19	0.043	Up, Sig.
2900	17	0.71	6.00	2.02	1.24	2	0.83	1.07	0.92	0.13	19	0.002	Down, Sig.
3128	16	1.79	3.70	2.63	0.54	2	2.08	2.17	2.14	0.05	18	0.008	Down, Sig.
3636	16	1.38	3.50	2.62	0.48	2	2.35	2.73	2.54	0.19	18	0.181	No Trend
3898	16	1.34	3.93	2.33	0.64	2	1.97	2.15	2.05	0.09	18	0.064	Down Mar.
3899	16	1.34	3.30	2.44	0.56	2	2.29	2.48	2.39	0.13	18	0.041	Down, Sig.
3900	16	0.98	3.19	1.77	0.57	2	1.71	1.78	1.74	0.04	18	0.080	Down, Mar.

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]Well not sampled because negotiations with CSX Railroad for an access agreement are ongoing

TABLE 3-5

STATISTICS FOR SODIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	16	27.00	75.20	42.37	14.91	2	29.20	46.10	34.57	6.99	18	0.285	No Trend
2548	13	18.20	35.00	25.23	5.83	0[d]	N/A	N/A	N/A	N/A	13	0.050	Down, Sig.
2625	14	16.50	50.70	36.35	8.80	2	25.10	30.50	28.63	3.06	16	0.058	Down, Mar.
2636	14	43.20	79.90	58.99	8.88	2	30.80	33.10	32.27	1.27	16	0.235	No Trend
2898	16	17.00	29.20	21.34	3.80	2	17.20	17.50	17.33	0.15	18	0.024	Down, Sig.
2899	16	11.20	22.90	16.60	3.85	2	18.30	19.00	18.63	0.35	18	0.027	Up, Sig.
2900	16	23.40	43.30	31.14	7.02	2	38.10	38.80	38.50	0.36	18	0.012	Up, Sig.
3128	16	4.42	13.50	8.58	3.39	2	4.56	4.82	4.71	0.14	18	<0.001	Down, Sig.
3636	16	6.39	15.10	10.45	2.50	2	6.29	6.43	6.38	0.08	18	<0.001	Down, Sig.
3898	16	7.00	14.60	9.45	2.19	2	8.00	8.41	8.18	0.21	18	0.236	No Trend
3899	16	6.24	14.60	9.61	2.26	2	7.78	8.47	8.13	0.49	18	0.012	Down, Sig.
3900	16	4.23	10.80	6.77	2.27	2	4.80	4.99	4.88	0.10	18	0.002	Down, Sig.

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]Well not sampled because negotiations with CSX Railroad for an access agreement are ongoing

TABLE 3-6

SUMMARY OF SIGNIFICANT MANN-KENDALL TREND TEST RESULTS FOR SELECT ANALYTES (AUGUST 27, 1993 - JUNE 30, 1997)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Total Uranium					
2002	24	0.003	Up, Sig.	4.6	Effectiveness of recovery wellfield as uranium is pulled toward recovery well 3927
2060	14	0.002	Down, Sig.	34.7	Source removal and effectiveness of recovery wellfield[c]
21063	13	0.043	Down, Sig.	1.4	Concentration within background range
2125	16	0.031	Down, Sig.	15.0	Source removal and effectiveness of recovery wellfield[c]
2128	17	0.002	Up, Sig.	12.8	Possibly due to existing contamination prior to south plume removal action pumping, will continue to evaluate.
2398	16	0.002	Up, Sig.	22.9	Continued migration of the northeastern lobe of the plume; will be addressed by optimization of the South Plume recovery system and/or the Injection Demonstration Project in conjunction with South Field Extraction System.
2545	17	0.005	Down, Sig.	19.0	Source removal and effectiveness of recovery wellfield[c]
2548	12	0.050	Down, Sig.	2.9[d]	Concentration within background range
2551	14	0.044	Up, Sig.	33.5	Unknown; will continue to evaluate
2552	14	0.043	Down, Sig.	16.0	Continued dissipation of southwestern lobe of the plume
2624	19	0.003	Down, Sig.	76.7[d]	Source removal and effectiveness of recovery wellfield[c]
2880	23	<0.001	Up, Sig.	1.6	Concentration within the background range
2897	16	<0.001	Down, Sig.	0.8	Source removal and effectiveness of recovery wellfield[c]
2899	17	<0.001	Up, Sig.	2.3	Concentration within background range
2900	17	<0.001	Up, Sig.	6.0	Unknown; will continue to evaluate
3069	16	<0.001	Up, Sig.	291.0	Recharge area forcing contamination deeper into the aquifer
3095	15	<0.001	Up, Sig.	19.0	Induced capture
3106	16	0.040	Up, Sig.	2.0	Concentration within background range

TABLE 3-6
(Continued)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Total Uranium (continued)					
3550	14	<0.001	Down, Sig.	3.2	Source removal and effectiveness of recovery wellfield[c]
3624	13	0.033	Up, Sig.	0.5[d]	Concentration within background range
3880	16	0.002	Up, Sig.	2.6	Concentration within background range
3897	23	0.003	Down, Sig.	0.4	Concentration within background range
3899	17	<0.001	Down, Sig.	0.7	Concentration within background range
3924	41	<0.001	Down, Sig.	43.2	Source removal and effectiveness of recovery wellfield[c]
3925	46	<0.001	Up, Sig.	28.5	Recovery of area of plume with higher concentrations than originally at recovery well
3926	44	<0.001	Up, Sig.	10.8	Recovery of area of plume with higher concentrations than originally at recovery well
3927	42	<0.001	Down, Sig.	1.2	Recovery of area of plume with lower concentrations than originally at recovery well
Arsenic				(mg/L)	
2128	188	<0.001	Down, Sig.	0.006	Natural migration of PRRS plume
2625	180	0.001	Down, Sig.	0.007	Natural migration of PRRS plume
2636	154	0.040	Down, Sig.	0.022	Natural migration of PRRS plume
2900	188	0.050	Down, Sig.	0.005	Natural migration of PRRS plume
Phosphorous					
2128	17	0.026	Down, Sig.	0.85	Natural migration of PRRS plume
2898	18	0.030	Up, Sig.	0.08	Concentration within background range
2899	18	0.004	Up, Sig.	0.08	Concentrations within background range
2900	18	0.048	Down, Sig.	0.24	Natural migration of PRRS plume
Potassium					
2128	18	0.009	Down, Sig.	2.20	Natural migration of PRRS plume
2548	13	0.038	Down, Sig.	12.07[d]	Natural migration of PRRS Plume
2636	16	0.032	Down, Sig.	22.70	Natural migration of PRRS Plume
2899	19	0.043	Up, Sig.	3.49	Unknown; will continue to evaluate
2900	19	0.002	Down, Sig.	0.92	Effective operation of recovery wellfield
3128	18	0.008	Down, Sig.	2.14	Effective operation of recovery wellfield
3899	18	0.041	Down, Sig.	2.39	Effective operation of recovery wellfield

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TABLE 3-6
(Continued)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Sodium					
2548	13	0.050	Down, Sig.	25.23[d]	Natural migration of PRRS plume
2898	18	0.024	Down, Sig.	17.33	Natural migration of PRRS plume
2899	18	0.027	Up, Sig.	18.63	Unknown; will continue to evaluate
2900	18	0.012	Up, Sig.	38.50	Unknown; will continue to evaluate
3128	18	<0.001	Down, Sig.	4.71	Natural migration of PRRS plume
3636	18	<0.001	Down, Sig.	6.38	Natural migration of PRRS plume
3899	18	0.012	Down, Sig.	8.13	Natural migration of PRRS plume
3900	18	0.002	Down, Sig.	4.88	Natural migration of PRRS plume

[a]Up, Sig. = Up, Significant
Down, Sig. = Down, Significant
[b]Average concentration for January 1 to June 30, 1997
[c]Source removal refers to the 1986 installation of the SWRB which effectively reduced uranium loading to the aquifer by Paddys Run. The term "effectiveness of recovery wellfield" is a reference to the mass removal of uranium from the plume by the recovery system.
[d]Data was not available from the reporting period; average shown is from historical data (8/93 to 12/96).

3.0 ANALYTICAL DATA SUMMARY

Statistical summaries of results (minimum, maximum, average, standard deviation, and trend) for unfiltered samples from individual wells are presented in Tables 3-1 through 3-5 for total uranium, arsenic, phosphorus, potassium and sodium, respectively. Normal and duplicate samples taken on the same day were first averaged then counted as one sampling event for that day before the minimum, maximum, average, and standard deviation statistics were calculated. Any sample with a non-detect (i.e., a laboratory validation qualifier of "U") was assigned a value equal to one-half the minimum detection limit (MDL) for the analytical method used. If the non-detect sample was one of a duplicate-normal sample pair, the one-half MDL for the non-detect was assigned then averaged with the other member of the sample pair.

Appendix A consists of validation qualifiers and a disk containing the analytical data used to prepare this report. The two files on the disk, one for filtered and one for unfiltered data, are in ASCII format with quotes and semicolons used as delimiters. Appendix B contains total uranium concentration plots for each monitoring well over time for unfiltered samples.

As in previous System Evaluation Reports, the Mann-Kendall trend test was performed on total uranium, arsenic, phosphorus, potassium, and sodium sampling results from August 27, 1993 through June 30, 1997. Tables 3-1 through 3-5 include summaries of the Mann-Kendall test results by analyte and location, the number of distinct sampling events used in the calculation, and the probability that the trend calculated is due to chance. In preparing these tables only data with validation qualifiers "-," "J," "NV," "U," and "UJ" were used (see Appendix A). All "U" and "UJ" qualified data were used at one-half the reported value. Details of the Mann-Kendall trend calculation are given in Appendix C.

The Mann-Kendall probability value gives the probability that the apparent trend is due to chance and not a real trend. Therefore, a smaller probability value from the Mann-Kendall test indicates that the calculated trend is more likely to be real. For example, a probability value of 0.05 indicates that the calculated trend is real with a certainty of 95 percent; or, in other words, there is only a five percent chance that such a trend could have been calculated from random points. In Tables 3-1 through 3-5 a probability value less than or equal to five percent (.05) was interpreted as a significant trend and a

probability value less than or equal to 10 percent (.10) but greater than five (.05) percent was interpreted as a marginally significant trend.

Mann-Kendall test results with significant upward or downward trends identified from the August 27, 1993 through June 30, 1997 data have been compiled in Table 3-6 for total uranium, arsenic, phosphorus, potassium and sodium, along with specific explanations for each result.

3.1 TOTAL URANIUM TRENDS

An examination of the trend results for total uranium (Table 3-6) shows that 13 wells have significant downward trends, and 14 wells have significant upward trends for this reporting period. This compares with 14 wells that had significant downward trends and 12 wells that had significant upward trends during the last reporting period (July 1, 1996 through December 31, 1996). Monitoring Wells 2551 and 3106 changed from No Trend to Up Significant while Monitoring Wells 21063 and 2552 changed from No Trend to Down Significant. Monitoring Well 2015 changed from Down Significant to No Trend.

The trend data for Monitoring Well 2551 which is just west of Paddys Run and northwest of the recovery system changed from No Trend during the last reporting period to Up Significant for this reporting period. As shown in the concentration plots in Appendix B for this well, a maximum total uranium concentration of 39.0 μg/L was observed during the first quarter sampling round. Total uranium concentrations in this well decreased to 28.0 μg/L by the second quarter sampling round. The cause for this increase in concentration is unknown at this time. However, since the well is northwest of the recovery system, within the capture zone, and since regional groundwater flow is to the southeast, no additional action is required. Monitoring of this well will continue as part of the IEMP program and subsequent results will be provided in the IEMP quarterly reports.

Data for Monitoring Well 3106 also indicated an Up Significant trend for this reporting period as opposed to a No Trend result during the last reporting period. An examination of the total uranium concentration plot in Appendix B for this well shows that maximum concentration for this reporting period was 2.4 μg/L, which is within the range of background concentration.

Two monitoring wells (2093 and 3125) changed from No Trend to Up Marginal. Average total uranium concentrations observed during this reporting period were 0.7 μg/L for Monitoring Well 2093 (within background) and 67.0 μg/L for Monitoring Well 3125. The maximum total uranium concentration observed in this reporting period for Monitoring Well 3125 was 74.0 μg/L for the second quarter sampling event which is below the maximum total uranium concentration of 82.0 μg/L which was observed in the second quarter of 1995. Since this well is immediately northwest of the recovery system, it is well within the capture zone so no additional action is required.

Monitoring Well 3095 continued to show an Up Significant trend with an average total uranium concentration of 19.0 μg/L for this reporting period compared with an average of 14.0 μg/L for the previous reporting period. Since this well is near the center of the plume and upgradient of the recovery system, this trend is believed to be due to the continued operation of the recovery wells as the uranium contamination moves toward the recovery system.

Of the remaining monitoring wells which exhibited a change in trend for total uranium from the previous reporting period, two monitoring wells (2015 and 2017) changed from Down Significant and Down Marginal to No Trend, and three monitoring wells (21063, 21194, and 2552) changed from No Trend to Down Significant or Down Marginal. Of note is the change in trend for Monitoring Well 2552 which is representative of the extreme southwestern lobe of the plume. This well resumed its downward trend during this reporting period as shown in the total uranium concentration plot in Appendix B. As predicted in previous DMEPP reports, the extreme southwestern lobe of the plume located between Paddys Run and Paddys Run Road appears to continue dissipating with average concentrations at 16.0 μg/L for this reporting period.

Of the 14 wells with significant upward trends in total uranium concentrations, only one, Monitoring Wells 2128 is outside the 1400 gpm capture zone of the recovery system as defined by the groundwater elevation data, the colloidal borescope data, and SWIFT groundwater modeling results. This Wells is shown on Figure 1-1.

Monitoring Well 2128 exhibited a significant upward trend in total uranium with an average concentration of 12.8 μg/L for this reporting period. A concentration of 12.0 μg/L was previously observed in this well in the third quarter of 1995 and reported in the April 1996 DMEPP as a

significant upward trend. As discussed in previous DMEPP reports, Monitoring Well 2625 is immediately up gradient of Well 2128 and continues to show no trend with a maximum concentration of 1.5 μg/L observed in this reporting period. Monitoring Well 2128 will continue to be sampled as part of the IEMP sampling program and results will be presented in future IEMP reports.

Monitoring Well 2398 which is on property just north of Willey Road at the extreme eastern edge of the plume continues to exhibit an Up Significant trend with an average concentration of 22.9 μg/L observed during the reporting period. As shown in Figure 4-9 of Section 4.0 of this report, the well is just inside the eastern edge of the capture zone when the recovery well system is pumping at 1400 gpm. Samples were taken at 10 foot intervals beginning at the water table at a location approximately 150 feet east of Well 2398 in May 1997 (Geoprobe™ location 12265). These samples exhibited a maximum total uranium concentration of less than 3 μg/L (BRSR, Appendix G, DOE June 1997). The increasing concentrations observed at Monitoring Well 2398 are believed to be due to the lateral expansion of the plume due to regional groundwater flow which is to the southeast in area of Monitoring Well 2398. Groundwater modeling performed in support of the BRSR, predicts that this part of the plume will ultimately be captured by the combined action of the fenceline injection system and Recovery Well 22 in the South Field which are scheduled to begin operation in calendar year 1998 (See Figure 5-15 on page 5-32 of the BRSR, DOE, June 1997). Well 2398 will continue to be monitored as part of the Integrated Environmental Monitoring Plan and results presented in subsequent IEMP quarterly reports.

Monitoring Well 3069, in the northeastern lobe of the plume just north of the proposed fenceline re-injection wells, continues to show an Up Significant trend in total uranium concentration with first and second quarter sampling events showing an average total uranium concentration of 291.0 μg/L. As described in Appendix G of the Baseline Remedial Strategy Report (DOE, June 1997), Geoprobe™ sampling was performed in early 1997 to further delineate the plume in this area. It is planned that Recovery Well 22, which is scheduled to go on line in 1998, will remediate this portion of the plume.

Monitoring Wells 2880 and 3880 which are up gradient of the recovery system continued to show significant upward trends for uranium even though the average total uranium concentrations (1.6 μg/L for Well 2880; 2.6 μg/L for Well 3880) remain within background levels. Monitoring Well 2002 also continued to exhibit a significant upward trend with concentrations slightly above background at an average value of 4.6 μg/L for this reporting period. The upward trends in these wells is attributed to

the arrival of the leading edge of the total uranium plume as it moves toward the recovery system. Monitoring Wells 2624 and 3624, also up gradient of the recovery system were not sampled during this reporting period due to continuing negotiations with the land owner (CSX Railroad) for access rights.

Wells 2899 and 2900 continue to exhibit significant upward trends in total uranium with average concentrations of 2.3 μg/L and 6.0 μg/L respectively during this reporting period. These wells are south of the recovery system and near the boundary of the interpreted capture zone, as shown in Figures 4-6 and 4-7. The colloidal borescope data gathered during the first and second quarters of 1997 from Well 2900 continues to show that groundwater flow direction is almost due north as shown in Figures 4-8 and D-7 of Appendix D. This demonstrates that it is within the recovery well capture zone. Borescope flow data for Well 2899 shows flow directions to the southeast indicating that this well is outside the capture zone of the recovery system. However, with total uranium concentrations within the background range in Well 2899, this upward trend is not a significant concern at this time. Wells 2899 and 2900 will continue to be monitored and reported on in future IEMP reports.

Recovery Wells 3925 and 3926 continue to exhibit significant upward trends in total uranium due to the continued pumping with average concentration of 28.5 μg/L and 10.8 μg/L respectively for this reporting period. This increase is due to the pumping action which continues to pull contamination from the heart of the plume to the recovery system where it is removed from the aquifer.

Finally, Monitoring Well 2546 which is south of the recovery system and west of Paddys Run Road was added to the DMEPP sampling program during the last reporting period. This well has exhibited fluctuating uranium concentrations with no apparent trend at this time. As shown in the concentration plot in Appendix B for this well, out of four sampling events during the last year, two have been below 20 μg/L and two have been above 20 μg/L with an average concentration of 17.9 μg/L during the last reporting period and 23.5 μg/L during this period. Monitoring of this well will continue under the IEMP and future data will be reported as part of the quarterly IEMP status reports.

3.2 ARSENIC TRENDS

An examination of the arsenic trends in Table 3-2 shows that only one well (Monitoring Well 2548) exhibited an upward trend. Because of the position and distance of Monitoring Well 2548 from the recovery well system (over 1000 feet south of Recovery Well 3925), this marginal upward trend is

believed to be attributable to natural migration of Paddys Run Road Site contaminants and not due to operation of the South Plume Recovery System. Wells 2625 and 2900, which are used as early warning indicators for potential capture of PRRS constituents, both continue to show significant downward trends in arsenic concentrations during this reporting period.

3.3 PHOSPHORUS, POTASSIUM, AND SODIUM TRENDS

Mann-Kendall trend results for the remaining PRRS constituents (phosphorus, potassium, and sodium) are also presented in Tables 3-3 through 3-5. Monitoring Wells 2898 and 2899 both exhibited significant upward trends for phosphorus with average concentrations of 0.08 mg/L in each well. Since this value is well below the background 95th percentile value of 0.954 mg/L reported in the site background report (Characterization of Background Water Quality for Streams and Groundwater, DOE, May 1994), and since the wells are over 1000 feet northeast of Paddys Run Road Site, this trend is not believed to be problematic.

Monitoring Well 2899 also continues to show increasing trends for both potassium and sodium with maximum concentrations observed in this reporting period of 3.84 mg/L and 19.00 mg/L respectively. While the 3.84 mg/L maximum observed concentration for potassium is above the 95th percentile value of 1.96 mg/L for background (reference the site background report), the 19.00 mg/L observed concentration for sodium continues to be well below the background 95th percentile value of 47.2 mg/L as reported in the site background report. The maximum observed sodium concentration in this well is 22.90 mg/L. Well 2899 will continue to be monitored as part of the IEMP sampling program for potassium, sodium, and phosphorus and any changes reported in future IEMP quarterly reports.

Well 2900 continues to show increasing concentrations and upward trend for sodium. A maximum of 38.80 mg/L was observed in the second quarter sampling round during this reporting period. This value is still below the 95th percentile background value of 47.2 mg/L and less than the previous maximum of 43.3 mg/L which was observed in the third quarter of 1996. Because sodium is a mobile PRRS constituent, and groundwater flow direction at Well 2900 is to the north toward the recovery well system, Well 2900 will continue to be monitored for sodium as part of the IEMP sampling program and the results presented in future IEMP quarterly reports.

3.4 VOLATILE ORGANIC COMPOUND TRENDS

Toluene was detected during the first quarter of the reporting period with a concentration of 3.0 μg/L in Monitoring Well 3900. A similar result was reported in the previous DMEPP report for Monitoring Well 3636. Since Monitoring Well 3900 is approximately 500 feet north of Monitoring Well 3636, the two positive results for toluene are probably not related. Furthermore, since Monitoring Well 2900 did not test positive for toluene, the result for Well 3900 is believed to be a false positive. No statistical summaries or Mann-Kendall trend calculations were performed on toluene or the other volatile organic constituents (benzene, cumene, ethyl benzene, and xylene) sampled for under the DMEPP because, other than the toluene mentioned above, no other detections were noted during the reporting period.

TABLE 3-1

STATISTICS FOR TOTAL URANIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (µg/L)	Max. (µg/L)	Avg. (µg/L)	SD	No. of Samples[a]	Min. (µg/L)	Max. (µg/L)	Avg. (µg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2002	22	1.8	8.9	2.8	1.4	2	4.0	5.2	4.6	0.8	24	0.003	Up, Sig.
2015	13	130.0	170.0	147.7	12.3	2	163.0	169.0	166.0	4.2	15	0.345	No Trend
2017	9	1.9	5.0	3.7	1.2	2	3.5	3.6	3.5	0.1	11	0.106	No Trend
2060	12	28.0	75.0	46.1	14.1	2	25.0	52.0	34.7	15.0	14	0.002	Down, Sig.
2093	14	0.3	0.9	0.5	0.1	2	0.6	0.7	0.7	0.1	16	0.071	Up, Mar.
2095	13	110.0	200.0	155.6	21.9	2	159.0	166.0	162.3	3.5	15	0.421	No Trend
2106	14	1.1	70.0	48.8	18.0	2[f]	45.3	67.0	36.2	15.3	16	0.371	No Trend
21063	11	1.7	15.0	4.3	4.8	2	1.3	1.5	1.4	0.1	13	0.043	Down, Sig.
21194	6	0.6	5.8	2.8	1.9	2	0.3	0.9	0.6	0.4	8	0.054	Down, Mar.
2125	14	8.8	39.0	15.8	9.1	2	14.0	15.0	15.0	0.7	16	0.031	Down, Sig.
2128	15	0.8	12.0	7.6	3.9	2	12.0	14.0	12.8	1.0	17	0.002	Up, Sig.
2166	7	48.0	75.0	65.0	8.7	2	60.0	67.0	63.5	4.9	9	0.090	Down, Mar.
2396	12	0.8	1.3	1.0	0.2	2	0.9	0.9	0.9	0.0	14	0.131	No Trend
2398	14	0.7	27.7	12.0	6.2	2[f]	17.8	28.0	22.9	7.2	16	0.002	Up, Sig.
2434	14	0.9	2.2	1.3	0.3	2[f]	1.3	9.7	5.5	5.9	16	0.008	No Trend
2544	22	0.6	21.0	9.7	5.5	2	0.4	13.0	6.7	8.9	24	0.284	No Trend
2545	15	19.0	81.0	39.6	18.9	2	16.0	22.0	19.0	4.2	17	0.005	Down, Sig.
2546	2	0.8	35.0	17.9	24.2	2	13.0	34.0	23.5	14.8	4	0.375	No Trend
2548	12	0.3	5.5	2.9	1.5	0[d]	N/A	N/A	N/A	N/A	12	0.050	Down, Sig.
2550	12	72.0	86.0	78.4	4.4	2	74.0	79.0	76.5	3.5	14	0.291	No Trend
2551	12	7.5	30.0	20.9	7.0	2	28.0	39.0	33.5	7.8	14	0.044	Up, Sig.
2552	12	16.0	25.0	21.2	2.7	2	15.0	17.0	16.0	1.2	14	0.043	Down, Sig.

TABLE 3-1
(Continued)

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2553	11	0.9	1.9	1.3	0.4	2	1.1	1.1	1.1	0.0	13	0.306	No Trend
2624	19	7.5	160.0	76.7	30.9	0[d]	N/A	N/A	N/A	N/A	19	0.003	Down, Sig.
2625	14	0.8	8.2	2.9	1.8	2	0.7	1.5	1.1	0.6	16	0.172	No Trend
2636	13	0.5	3.9	1.4	0.9	2	0.4	1.1	0.8	0.5	15	0.107	No Trend
2880	21	0.4	1.4	0.8	0.3	2	1.5	1.7	1.6	0.1	23	<0.001	Up, Sig.
2881	21	0.1	4.0	3.1	0.8	2	2.5	2.6	2.6	0.1	23	0.102	No Trend
2897	14	0.5	1.3	0.8	0.2	2	0.7	0.8	0.8	0.1	16	<0.001	Down, Sig.
2898	15	1.7	3.6	2.7	0.6	2	2.7	2.8	2.8	0.1	17	0.451	No Trend
2899	15	0.9	2.3	1.8	0.3	2	2.1	2.4	2.3	0.2	17	<0.001	Up, Sig.
2900	15	0.5	12.0	3.7	3.1	2	6.0	6.0	6.0	0.0	17	<0.001	Up, Sig.
3015	13	0.9	1.3	1.2	0.1	2	1.2	1.4	1.3	0.1	15	0.256	No Trend
3062	4	16.0	69.0	47.8	22.5	0[e]	N/A	N/A	N/A	N/A	4	0.167	No Trend
3069	14	0.3	223.6	99.2	57.1	2[f]	252.0	330.0	291.0	55.2	16	<0.001	Up, Sig.
3093	13	0.2	0.8	0.4	0.2	2	0.4	0.4	0.4	0.0	15	0.418	No Trend
3095	13	6.0	19.0	10.4	3.9	2	18.0	20.0	19.0	1.4	15	<0.001	Up, Sig.
3106	14	0.7	13.4	2.3	3.0	2[f]	1.6	2.4	2.0	0.60	16	0.040	Up, Sig.
3125	14	43.0	82.0	57.2	11.5	2	57.0	74.0	67.0	8.9	16	0.081	Up , Mar.
3128	15	0.0	1.0	0.5	0.2	2	0.4	0.5	0.5	0.1	17	0.232	No Trend
3396	6	0.5	0.6	0.6	0.1	2	0.6	0.7	0.7	0.1	8	0.199	No Trend
3550	12	2.6	6.1	4.4	1.3	2	3.0	3.4	3.2	0.3	14	<0.001	Down, Sig.
3551	12	0.6	5.0	1.0	1.1	2	0.6	0.7	0.7	0.1	14	0.500	No Trend
3552	6	0.5	0.7	0.6	0.1	2	0.6	0.8	0.7	0.1	8	0.360	No Trend

TABLE 3-1
(Continued)

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a]	Min. (μg/L)	Max. (μg/L)	Avg. (μg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
3624	13	0.3	0.8	0.5	0.1	0[d]	N/A	N/A	N/A	N/A	13	0.033	Up, Sig.
3636	15	0.2	3.0	0.6	0.6	2	0.8	1.0	0.9	0.1	17	0.172	No Trend
3880	14	0.1	2.3	0.9	0.8	2	2.5	2.7	2.6	0.1	16	0.002	Up, Sig.
3881	14	0.0	0.6	0.2	0.1	2	0.1	0.2	0.2	0.1	16	0.423	No Trend
3897	21	0.3	0.8	0.5	0.1	2	0.4	0.4	0.4	0.0	23	0.003	Down, Sig.
3898	15	0.2	180.0	21.0	58.0	2	0.4	0.4	0.4	0.0	17	0.319	No Trend
3899	15	0.6	1.2	0.9	0.2	2	0.7	0.7	0.7	0.0	17	<0.001	Down, Sig.
3900	15	0.0	0.5	0.1	0.1	2	0.2	0.2	0.2	0.0	17	0.333	No Trend
3924	36	41.0	180.0	64.2	32.4	5	41.0	47.0	43.2	3.0	41	<0.001	Down, Sig.
3925	44	0.5	33.0	21.0	10.3	2	28.0	29.0	28.5	0.7	46	<0.001	Up, Sig.
3926	38	1.5	9.3	4.8	2.3	6	8.6	14.0	10.8	1.8	44	<0.001	Up, Sig.
3927	37	1.1	5.4	1.9	1.2	5	1.2	1.3	1.2	0.1	42	<0.001	Down, Sig.
4125	7	0.6	9.8	2.1	3.4	2	0.6	4.8	2.7	3.0	9	0.238	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]These wells not sampled because negotiations with CSX Railroad for an access agreement are ongoing.
[e]Previous Albright Wilson Water Supply Well before alternate water supply available. No samples collected due to electrical malfunction at pump.
[f]Data collected as part of the RCRA monitoring program.

TABLE 3-2

STATISTICS FOR ARSENIC

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	163	0.001	0.188	0.014	0.024	25	0.002	0.020	0.006	0.004	188	<0.001	Down, Sig.
2548	107	0.001	0.706	0.034	0.078	0[d]	N/A	N/A	N/A	N/A	107	0.064	Up, Mar.
2625	155	0.003	0.071	0.013	0.010	25	0.004	0.014	0.007	0.003	180	0.001	Down, Sig.
2636	142	0.010	0.094	0.047	0.018	12	0.010	0.036	0.022	0.007	154	0.040	Down, Sig.
2898	15	0.000	0.006	0.002	0.002	2	0.001	0.003	0.001	0.003	17	0.151	No Trend
2899	16	0.000	0.003	0.002	0.001	2	0.001	0.002	0.001	0.001	18	0.500	No Trend
2900	163	0.001	0.050	0.005	0.004	25	0.001	0.005	0.005	0.001	188	0.050	Down, Sig.
3128	16	0.001	0.234	0.016	0.055	2	0.002	0.006	0.004	0.002	18	0.410	No Trend
3636	16	0.001	0.003	0.002	0.001	3	0.002	0.014	0.005	0.006	19	0.430	No Trend
3898	16	0.001	0.006	0.002	0.001	2	0.002	0.003	0.003	0.001	18	0.395	No Trend
3899	16	0.000	0.003	0.002	0.001	2	0.002	0.003	0.002	0.001	18	0.324	No Trend
3900	16	0.001	0.005	0.002	0.001	2	0.002	0.004	0.003	0.001	18	0.297	No Trend
3924	124	0.005	0.012	0.005	0.001	24	0.005	0.005	0.005	0.000	148	0.271	No Trend
3925	137	0.005	0.005	0.005	0.000	10	0.005	0.005	0.005	0.000	147	0.500	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]This well was not sampled during this reporting period due to continuing negotiations with the CSX Railroad for access rights. In the April 1997 DMEPP report this well exhibited an Up Significant trend however, a re-run of the Mann Kendall test resulted in an Up Marginal trend rather than Up Significant trend. The original calculation was found to be in error because some of the early non-detect sample results for the well were not divided by two before the calculation was done. This error did not affect any other previously reported results.

TABLE 3-3

STATISTICS FOR PHOSPHORUS

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	15	0.09	6.40	1.99	1.92	2	0.67	1.05	0.85	0.20	17	0.026	Down, Sig.
2548	13	0.05	6.20	1.89	1.88	0[d]	N/A	N/A	N/A	N/A	13	0.080	Down, Mar.
2625	14	0.31	12.30	3.10	3.76	2	1.70	2.08	1.89	0.27	16	0.058	Down, Mar.
2636	14	8.97	170.00	98.46	53.92	2	41.65	80.50	61.08	27.47	16	0.130	No Trend
2898	16	0.01	0.08	0.04	0.02	2	0.08	0.09	0.08	0.01	18	0.030	Up, Sig.
2899	16	0.01	0.07	0.04	0.02	2	0.08	0.09	0.08	0.00	18	0.004	Up, Sig.
2900	16	0.05	0.96	0.45	0.26	2	0.13	0.34	0.24	0.15	18	0.048	Down, Sig.
3128	15	0.01	13.00	0.81	3.14	2	0.06	0.07	0.07	0.01	17	0.103	No Trend
3636	16	0.02	0.23	0.07	0.05	2	0.08	0.10	0.09	0.01	18	0.247	No Trend
3898	16	0.02	0.34	0.09	0.08	2	0.09	0.21	0.15	0.09	18	0.455	No Trend
3899	16	0.03	0.83	0.16	0.19	2	0.07	0.08	0.07	0.01	18	0.224	No Trend
3900	16	0.01	1.26	0.11	0.27	2	0.07	0.09	0.08	0.01	18	0.180	No Trend

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]Well not sampled because negotiations with CSX Railroad for an access agreement are ongoing

TABLE 3-4

STATISTICS FOR POTASSIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	16	1.69	18.00	5.24	5.58	2	2.03	2.51	2.20	0.20	18	0.009	Down, Sig.
2548	13	1.36	40.00	12.07	10.59	0[d]	N/A	N/A	N/A	N/A	13	0.038	Down, Sig.
2625	14	0.64	6.26	3.02	1.84	2	2.16	5.73	3.50	1.94	16	0.069	Up, Mar.
2636	14	8.51	218.00	110.10	53.95	2	17.80	32.00	22.70	8.06	16	0.032	Down, Sig.
2898	16	2.50	5.05	3.76	0.65	2	3.65	4.06	3.81	0.22	18	0.272	No Trend
2899	17	1.36	4.42	3.36	0.74	2	3.31	3.84	3.49	0.30	19	0.043	Up, Sig.
2900	17	0.71	6.00	2.02	1.24	2	0.83	1.07	0.92	0.13	19	0.002	Down, Sig.
3128	16	1.79	3.70	2.63	0.54	2	2.08	2.17	2.14	0.05	18	0.008	Down, Sig.
3636	16	1.38	3.50	2.62	0.48	2	2.35	2.73	2.54	0.19	18	0.181	No Trend
3898	16	1.34	3.93	2.33	0.64	2	1.97	2.15	2.05	0.09	18	0.064	Down Mar.
3899	16	1.34	3.30	2.44	0.56	2	2.29	2.48	2.39	0.13	18	0.041	Down, Sig.
3900	16	0.98	3.19	1.77	0.57	2	1.71	1.78	1.74	0.04	18	0.080	Down, Mar.

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]Well not sampled because negotiations with CSX Railroad for an access agreement are ongoing

TABLE 3-5

STATISTICS FOR SODIUM

	Sampling Period										Mann-Kendall Trend Analysis		
	August 27, 1993 - December 31, 1996					January 1, 1997 - June 30, 1997					August 27, 1993 - June 30, 1997		
Well No.	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a]	Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	SD	No. of Samples[a,b]	Probability	Trend[c]
2128	16	27.00	75.20	42.37	14.91	2	29.20	46.10	34.57	6.99	18	0.285	No Trend
2548	13	18.20	35.00	25.23	5.83	0[d]	N/A	N/A	N/A	N/A	13	0.050	Down, Sig.
2625	14	16.50	50.70	36.35	8.80	2	25.10	30.50	28.63	3.06	16	0.058	Down, Mar.
2636	14	43.20	79.90	58.99	8.88	2	30.80	33.10	32.27	1.27	16	0.235	No Trend
2898	16	17.00	29.20	21.34	3.80	2	17.20	17.50	17.33	0.15	18	0.024	Down, Sig.
2899	16	11.20	22.90	16.60	3.85	2	18.30	19.00	18.63	0.35	18	0.027	Up, Sig.
2900	16	23.40	43.30	31.14	7.02	2	38.10	38.80	38.50	0.36	18	0.012	Up, Sig.
3128	16	4.42	13.50	8.58	3.39	2	4.56	4.82	4.71	0.14	18	<0.001	Down, Sig.
3636	16	6.39	15.10	10.45	2.50	2	6.29	6.43	6.38	0.08	18	<0.001	Down, Sig.
3898	16	7.00	14.60	9.45	2.19	2	8.00	8.41	8.18	0.21	18	0.236	No Trend
3899	16	6.24	14.60	9.61	2.26	2	7.78	8.47	8.13	0.49	18	0.012	Down, Sig.
3900	16	4.23	10.80	6.77	2.27	2	4.80	4.99	4.88	0.10	18	0.002	Down, Sig.

[a]Variation in number of samples is due to resampling events, different sampling frequencies, and/or number of sampling events in reporting period.
[b]Number of samples used for trend analysis is a count of the number of unique sampling dates.
[c]Up, Sig. = Up, Significant
Up, Mar. = Up, Marginal
No Trend = No Significant Trend
Down, Sig. = Down, Significant
Down, Mar. = Down, Marginal
[d]Well not sampled because negotiations with CSX Railroad for an access agreement are ongoing

TABLE 3-6

SUMMARY OF SIGNIFICANT MANN-KENDALL TREND TEST RESULTS FOR SELECT ANALYTES (AUGUST 27, 1993 - JUNE 30, 1997)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Total Uranium					
2002	24	0.003	Up, Sig.	4.6	Effectiveness of recovery wellfield as uranium is pulled toward recovery well 3927
2060	14	0.002	Down, Sig.	34.7	Source removal and effectiveness of recovery wellfield[c]
21063	13	0.043	Down, Sig.	1.4	Concentration within background range
2125	16	0.031	Down, Sig.	15.0	Source removal and effectiveness of recovery wellfield[c]
2128	17	0.002	Up, Sig.	12.8	Possibly due to existing contamination prior to south plume removal action pumping, will continue to evaluate.
2398	16	0.002	Up, Sig.	22.9	Continued migration of the northeastern lobe of the plume; will be addressed by optimization of the South Plume recovery system and/or the Injection Demonstration Project in conjunction with South Field Extraction System.
2545	17	0.005	Down, Sig.	19.0	Source removal and effectiveness of recovery wellfield[c]
2548	12	0.050	Down, Sig.	2.9[d]	Concentration within background range
2551	14	0.044	Up, Sig.	33.5	Unknown; will continue to evaluate
2552	14	0.043	Down, Sig.	16.0	Continued dissipation of southwestern lobe of the plume
2624	19	0.003	Down, Sig.	76.7[d]	Source removal and effectiveness of recovery wellfield[c]
2880	23	<0.001	Up, Sig.	1.6	Concentration within the background range
2897	16	<0.001	Down, Sig.	0.8	Source removal and effectiveness of recovery wellfield[c]
2899	17	<0.001	Up, Sig.	2.3	Concentration within background range
2900	17	<0.001	Up, Sig.	6.0	Unknown; will continue to evaluate
3069	16	<0.001	Up, Sig.	291.0	Recharge area forcing contamination deeper into the aquifer
3095	15	<0.001	Up, Sig.	19.0	Induced capture
3106	16	0.040	Up, Sig.	2.0	Concentration within background range

TABLE 3-6
(Continued)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Total Uranium (continued)					
3550	14	<0.001	Down, Sig.	3.2	Source removal and effectiveness of recovery wellfield[c]
3624	13	0.033	Up, Sig.	0.5[d]	Concentration within background range
3880	16	0.002	Up, Sig.	2.6	Concentration within background range
3897	23	0.003	Down, Sig.	0.4	Concentration within background range
3899	17	<0.001	Down, Sig.	0.7	Concentration within background range
3924	41	<0.001	Down, Sig.	43.2	Source removal and effectiveness of recovery wellfield[c]
3925	46	<0.001	Up, Sig.	28.5	Recovery of area of plume with higher concentrations than originally at recovery well
3926	44	<0.001	Up, Sig.	10.8	Recovery of area of plume with higher concentrations than originally at recovery well
3927	42	<0.001	Down, Sig.	1.2	Recovery of area of plume with lower concentrations than originally at recovery well
Arsenic				(mg/L)	
2128	188	<0.001	Down, Sig.	0.006	Natural migration of PRRS plume
2625	180	0.001	Down, Sig.	0.007	Natural migration of PRRS plume
2636	154	0.040	Down, Sig.	0.022	Natural migration of PRRS plume
2900	188	0.050	Down, Sig.	0.005	Natural migration of PRRS plume
Phosphorous					
2128	17	0.026	Down, Sig.	0.85	Natural migration of PRRS plume
2898	18	0.030	Up, Sig.	0.08	Concentration within background range
2899	18	0.004	Up, Sig.	0.08	Concentrations within background range
2900	18	0.048	Down, Sig.	0.24	Natural migration of PRRS plume
Potassium					
2128	18	0.009	Down, Sig.	2.20	Natural migration of PRRS plume
2548	13	0.038	Down, Sig.	12.07[d]	Natural migration of PRRS Plume
2636	16	0.032	Down, Sig.	22.70	Natural migration of PRRS Plume
2899	19	0.043	Up, Sig.	3.49	Unknown; will continue to evaluate
2900	19	0.002	Down, Sig.	0.92	Effective operation of recovery wellfield
3128	18	0.008	Down, Sig.	2.14	Effective operation of recovery wellfield
3899	18	0.041	Down, Sig.	2.39	Effective operation of recovery wellfield

TABLE 3-6
(Continued)

Well No.	No. of Samples	Probability	Trend[a]	Average Concentration[b] (μg/L)	Explanation
Sodium					
2548	13	0.050	Down, Sig.	25.23[d]	Natural migration of PRRS plume
2898	18	0.024	Down, Sig.	17.33	Natural migration of PRRS plume
2899	18	0.027	Up, Sig.	18.63	Unknown; will continue to evaluate
2900	18	0.012	Up, Sig.	38.50	Unknown; will continue to evaluate
3128	18	<0.001	Down, Sig.	4.71	Natural migration of PRRS plume
3636	18	<0.001	Down, Sig.	6.38	Natural migration of PRRS plume
3899	18	0.012	Down, Sig.	8.13	Natural migration of PRRS plume
3900	18	0.002	Down, Sig.	4.88	Natural migration of PRRS plume

[a]Up, Sig. = Up, Significant
Down, Sig. = Down, Significant
[b]Average concentration for January 1 to June 30, 1997
[c]Source removal refers to the 1986 installation of the SWRB which effectively reduced uranium loading to the aquifer by Paddys Run. The term "effectiveness of recovery wellfield" is a reference to the mass removal of uranium from the plume by the recovery system.
[d]Data was not available from the reporting period; average shown is from historical data (8/93 to 12/96).

4.0 CAPTURE ASSESSMENT

One of the requirements of the DMEPP is to determine if the recovery well field is serving as a complete hydraulic barrier to migration of the total uranium plume, preventing uranium north of the recovery well field from migrating past it. This is accomplished by performing capture zone analyses using actual and modeled data, and by comparing the results. This comparison allows the use of modeled results to predict future capture based on hypothetical changes to the recovery well pumping rates and to assist in assessing various pumping configurations as needed.

In order to evaluate the effectiveness of capture, the most current total uranium concentration data is posted to maps and the plume maps are then compared with the capture zone maps constructed from groundwater elevation and colloidal borescope measurements. The interpretations from this comparison are then verified with modeled groundwater particle tracks and capture zones to confirm the results.

4.1 TOTAL URANIUM PLUME DATA

In late 1996 and continuing into the first part of 1997, a Geoprobe™ study of the South Plume area was conducted to delineate the plume conditions around Monitoring Well 3069 which has shown a significant upward trend in total uranium concentrations. Type 2 monitoring wells in this same area show little or no contamination. As discussed in previous DMEPP System Evaluation Reports, the depth of the uranium plume in this area is believed to be due to surface recharge from a small ponding feature in the southeast drainage ditch. The initial Geoprobe™ study around Monitoring Well 3069 was expanded to include the eastern and central portions of the off-property plume in order to acquire data to support the design of the South Plume Optimization System.

As presented in Figure G-23, Appendix G of the Baseline Remedial Strategy Report (BRSR - DOE, June 1997) the results of the Geoprobe™ investigation in the South Plume significantly altered the interpretation of the shape of the plume from what had been interpreted from just the Type 2 and Type 3 monitoring well data in the area. The final plume map presented in the BRSR was made by combining the Geoprobe™ results with the maximum observed concentration values from the monitoring well network and the maximum total uranium result from each Geoprobe™ location in the area.

Figure 4-1 shows the maximum Geoprobe™ results for the South Plume updated with the second quarter 1997 sample results for total uranium from the Type 2 and Type 3 monitoring wells in the area. As shown in the figure, the plume is similar in shape to that presented in the BRSR. Note that the contouring of this plume honors the highest total uranium concentration at each location thereby providing a plan view of the maximum extent of the uranium plume independent of depth.

There are only two significant differences in the new plume map. First, the extreme southwestern tip of the plume has decreased in size because uranium concentrations in Monitoring Well 2552 have fallen back below 20 μg/L, and second, the northeastern edge of the plume has increased slightly in width due to the concentrations increasing in Monitoring Well 2398. As explained in Section 3.0 of this report, the increase in width is believed to be due to lateral expansion of the plume due to regional groundwater flow.

Also shown in Figure 4-1 are the proposed South Plume Optimization wells RW-6 and RW-7 which were selected based on the Geoprobe™ data and modeling information contained in the BRSR. When examined in light of the most recent monitoring well data, these proposed recovery wells for optimization are positioned in the best location to enhance plume recovery when they come on line in 1998.

Figures 4-2 and 4-3 show the first quarter 1997 total uranium plume at the Type 2 and Type 3 well depths, respectively along with the Geoprobe™ data at the corresponding depth. The monitoring well data used to create these figures were gathered in late January and early February, 1997. Similarly, Figures 4-4 and 4-5 show the second quarter 1997 total uranium plume at Type 2 and Type 3 well depths, respectively along with the Geoprobe™ data at the corresponding depth. The monitoring well data used to create these figures were gathered in April and May, 1997. Both the first and second quarter total uranium plumes are similar in size and shape to plumes presented in the April 1997 DMEPP System Evaluation Report and previous reports before that. Statistical data and a well by well summary of significant changes for total uranium concentrations are presented and discussed in Section 3.0 of this report.

When compared to plume maps made from Type 2 and Type 3 monitoring well data presented in Figures 4-2 through 4-5 and in earlier DMEPP reports, the integrated plume interpretation shown in Figure 4-1 is considerably wider in the east-west direction just north of the recovery system. However, as shown in Figures 4-6 and 4-7, the off-property portion of the eastern edge of the integrated plume still remains

within the capture zone imposed by the system. As explained in Section 3.0, capture of the extreme northeastern on-property portion of the plume will be ensured when the South Field and Injection Demonstration Modules come on line in 1998.

4.2 WATER ELEVATION AND HYDRAULIC CAPTURE ZONE DATA

Because multiple pumping configurations were used during this reporting period, water elevation data were collected monthly instead of quarterly. The frequency of water elevation measurements may be returned to quarterly when the aquifer/pumping system returns to a more stable configuration.

Representative groundwater elevation maps made from the Type 2 monitoring well data for the first and second quarters of 1997 were selected from the monthly elevation data sets. These maps are shown in Figures 4-6 and 4-7, with the 20 μg/L total uranium plume (from Figure 4-1). While the groundwater elevations were, on average, about a foot higher in April than in January, the overall groundwater elevation surfaces appear to be similar in shape. Furthermore, the hydraulic capture zones inferred from the water elevation contours are similar to capture zones presented in previous DMEPP reports.

The colloidal borescope flow directions presented in Figure 4-8 confirm the inferred capture zones from the groundwater elevation maps which are also shown in the figure. The capture zone imposed by the system has not changed significantly during this reporting period. Directional flow data from borescope measurements show that the capture zone has decreased slightly in size at Monitoring Well 2552. Flow in Well 2552 is to the southeast while flow in Well 3552 is to the north-northeast toward the recovery system. This change is believed to be due to additional recharge from Paddys Run which has the effect of reducing capture at the depth of Well 2552 but not at the depth of Well 3552. This small change in capture zone extent is believed to be temporary because, as the intermittent recharge from Paddys Run decreases, the influence from the pumping system at this well will increase. As discussed in Section 3.0 of this report, total uranium concentrations at Monitoring Well 2552 have once again dropped below the 20 μg/L MCL.

These results are consistent with previous interpretations that Monitoring Well 2552 is sometimes within the capture zone of the recovery system and sometimes outside the capture zone as water levels in the aquifer fluctuate from seasonal recharge and drawdown.

Because of the differences in flow directions observed with the borescope at well clusters 2899-3899 and 2900-3900, the capture zone is inferred to be in close proximity to these well clusters as in previous reporting periods. The borescope data is presented for reference in Appendix D.

4.3 MODELED CAPTURE ZONES

As described in Section 1.0, three pumping configurations were used during this reporting period because of well rehabilitation activities and because of flow controller/flow control valve iron fouling. The target pumping rate for the recovery system was 1100 gpm during most of January through April with Recovery Well 3924 (RW-1) set at a target rate of 300 gpm and Recovery Wells 3926 and 3927 (RW-3 and RW-4) set at 400 gpm. In May with Recovery Wells 3925 (RW-2) and 3926 (RW-3) down, the system target pumping rate was 700 gpm with Recovery Well 3924 (RW-1) set at 300 gpm and Recovery Well 3927 (RW-4) set at 400 gpm. In June with the completion of rehabilitation activities and after maintenance to clean the flow control valves, the total system pumping rate was returned to the optimum 1400 gpm (RW-1 and RW-2 at 300 gpm and RW-3 and RW-4 at 400 gpm).

These three pumping scenarios were modeled with the site groundwater model to confirm the hydraulic capture zones interpreted from groundwater elevation data and borescope observations. The results are presented in Figures 4-9 through 4-11 with the capture zone being defined by the particle tracks.

The 1400 gpm capture zone is shown in Figure 4-9 with the 20 μg/L total uranium contour for April 1997 which consists of monitoring well data and Geoprobe™ data. As evidenced from the particle tracks in the figure, the plume continues to be entirely within the capture zone when the system is operating at the optimum 1400 gpm pumping rate. The model slightly over estimates the extent of the capture zone around Monitoring Well 2899 and under estimates the extent of the capture zone to the east around Monitoring Well 2898 when compared with groundwater elevation data. However, overall, the modeled capture zone still agrees very well with the capture zones from water elevation data and borescope observations shown in Figure 4-6.

The modeled 1100 gpm capture zone is shown in Figure 4-10 with Recovery Well 3925 (RW-2) not pumping. A small amount of breakthrough is predicted between Recovery Wells 3924 (RW-1) and 3925 (RW-2) as one particle moves south of the system after being deflected toward Recovery Well 3924 (RW-1). The amount of breakthrough predicted by the model (one particle out of 30 captured) is so small that

the effect is within the uncertainty of the model when compared to field conditions. The modeled capture zone at the 1100 gpm pumping rate is also reduced on the eastern end of the array so the extreme northeastern edge of the plume might not have been within the induced capture zone for this pumping configuration.

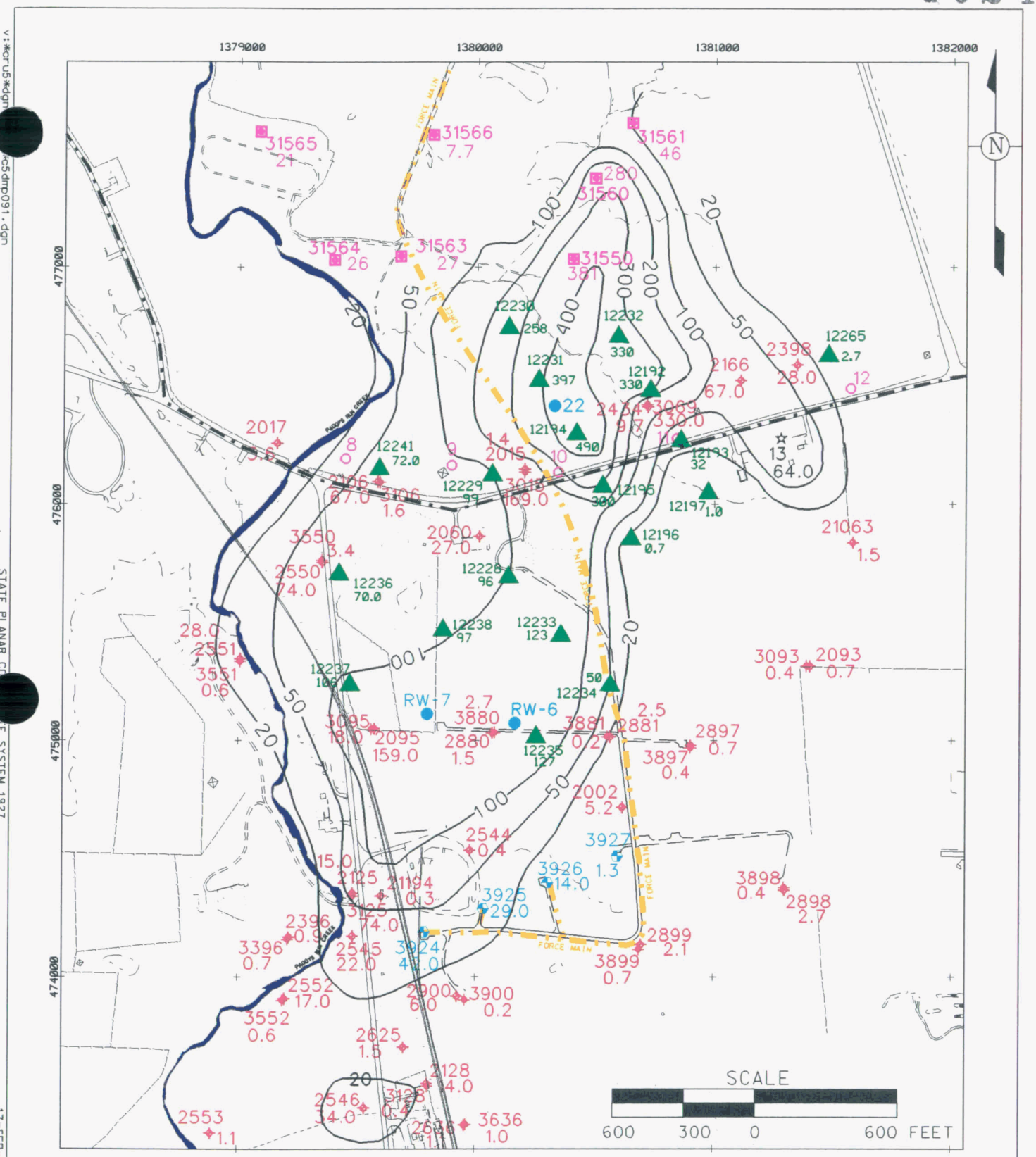
The modeled 700 gpm capture zone is shown in Figure 4-11 with Recovery Wells 3925 (RW-2) and 3926 (RW-3) not pumping. As expected, additional breakthrough is evident from the particle tracks in the figure with three particles moving between Recovery Wells 3924 (RW-1) and 3927 (RW-4). As in the 1100 gpm scenario, the 700 gpm modeled capture zone is also reduced on the eastern end of the array so again the extreme northeastern edge of the plume might not have been within the induced capture zone for this pumping scenario.

The particle tracks displayed in Figures 4-9 through 4-11 are non-retarded so the actual distance moved by the uranium plume during the month the system was pumping at 700 gpm is predicted to be 65 feet at most in the area of the recovery wells where the hydraulic gradient is the steepest.[1] Since the total uranium concentration in Recovery Well 3925 (RW-2) during May was 28.5 μg/L (average of April and June values) and since the uranium concentration in Recovery Well 3926 (RW-3) was 14 μg/L during May, the average total uranium concentration in this part of the aquifer was approximately 21.2 μg/L or very close to the uranium FRL of 20 μg/L. At the northeastern edge of the plume the distance moved during the month the system was pumping at 700 gpm would have been about 6.5 feet since the gradient is only about one tenth of that near the recovery system or about 1 foot per 800 feet.

Groundwater elevation and water quality data will continue to be collected for the DMEPP program wells under the IEMP and future IEMP reports will include similar capture zone analyses as that provided above.

[1]This calculation was performed assuming a horizontal hydraulic conductivity of 638 ft/day (for model layer 1 north of the recovery system), a maximum hydraulic gradient of 2.5 feet per 200 feet (taken from Figures 4-6 and 4-7 when the entire system was pumping at 1100 gpm), a porosity of 30% and a retardation factor for uranium of 12. Since the modeled hydraulic conductivity changes at the recovery system from 638 ft/day to 280 ft/day, the actual amount of contaminant travel would probably have been less than 65 feet.

48



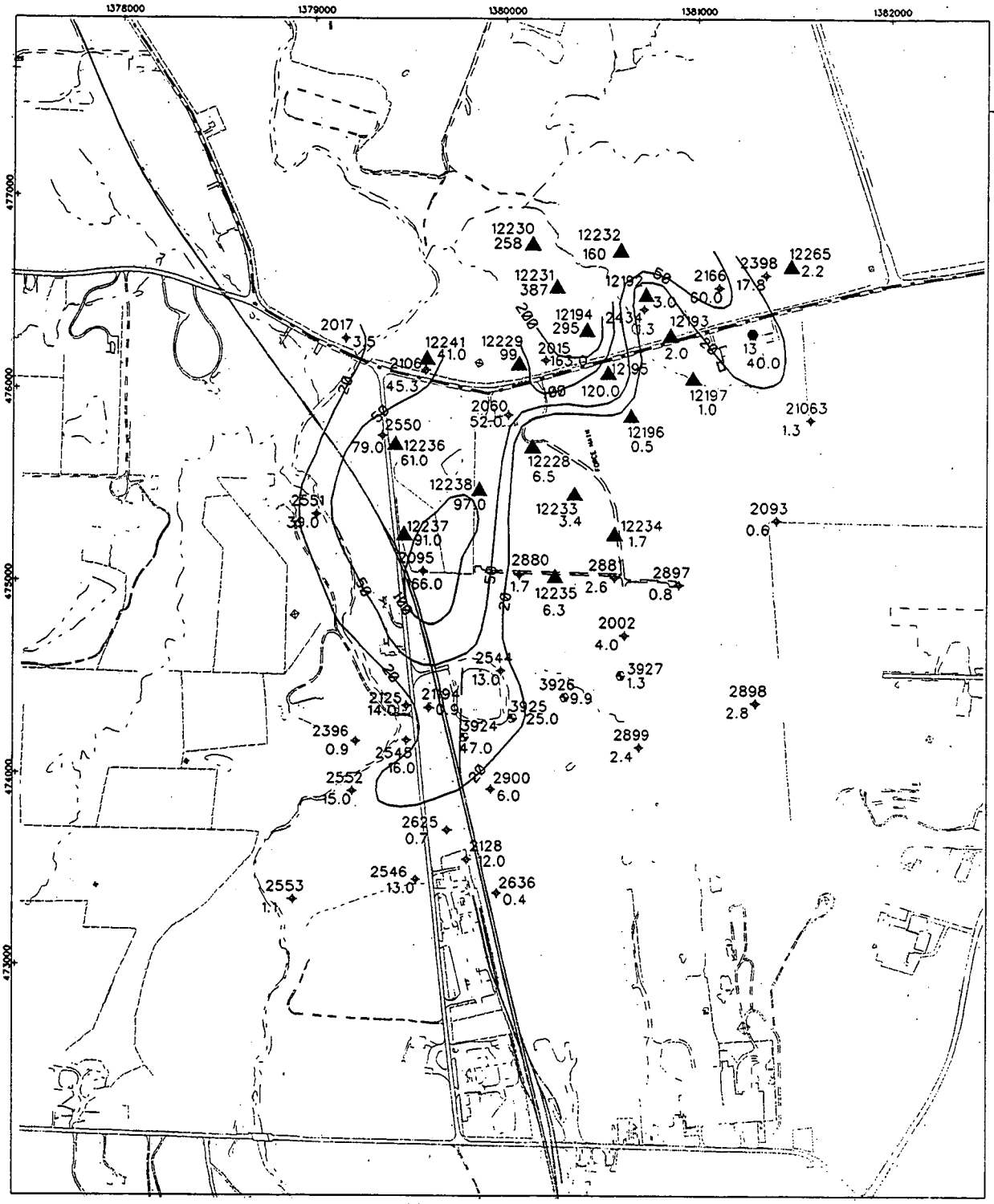
LEGEND:

- FEMP BOUNDARY
- FORCE MAIN
- TYPE 2 MONITORING WELL
- TYPE 3 MONITORING WELL
- HOMEOWNER WELL
- PROPOSED EXTRACTION WELLS
- GEOPROBE LOCATION
- SOUTH PLUME EXTRACTION WELL
- PROPOSED INJECTION WELL
- SOUTH FIELD EXTRACTION WELL
- URANIUM CONCENTRATION CONTOURS (μg/L)

FIGURE 4-1. MAXIMUM TOTAL URANIUM MAP OF SOUTH PLUME, SPRING 1997

v:\cru5\dgn\c5dmp091.dgn
STATE PLANAR COORDINATE SYSTEM 1927
17-SEP-1997

DGIS/CRUS/DGN/DMEPP/CSDMP086.DGN FER OU5 8/13/97 STATE PLANAR COORDINATE SYSTEM 1927



NOTE: BASED ON FIRST QUARTER 1997 DATA

LEGEND:

FEMP BOUNDARY

20 — TOTAL URANIUM CONCENTRATION CONTOUR

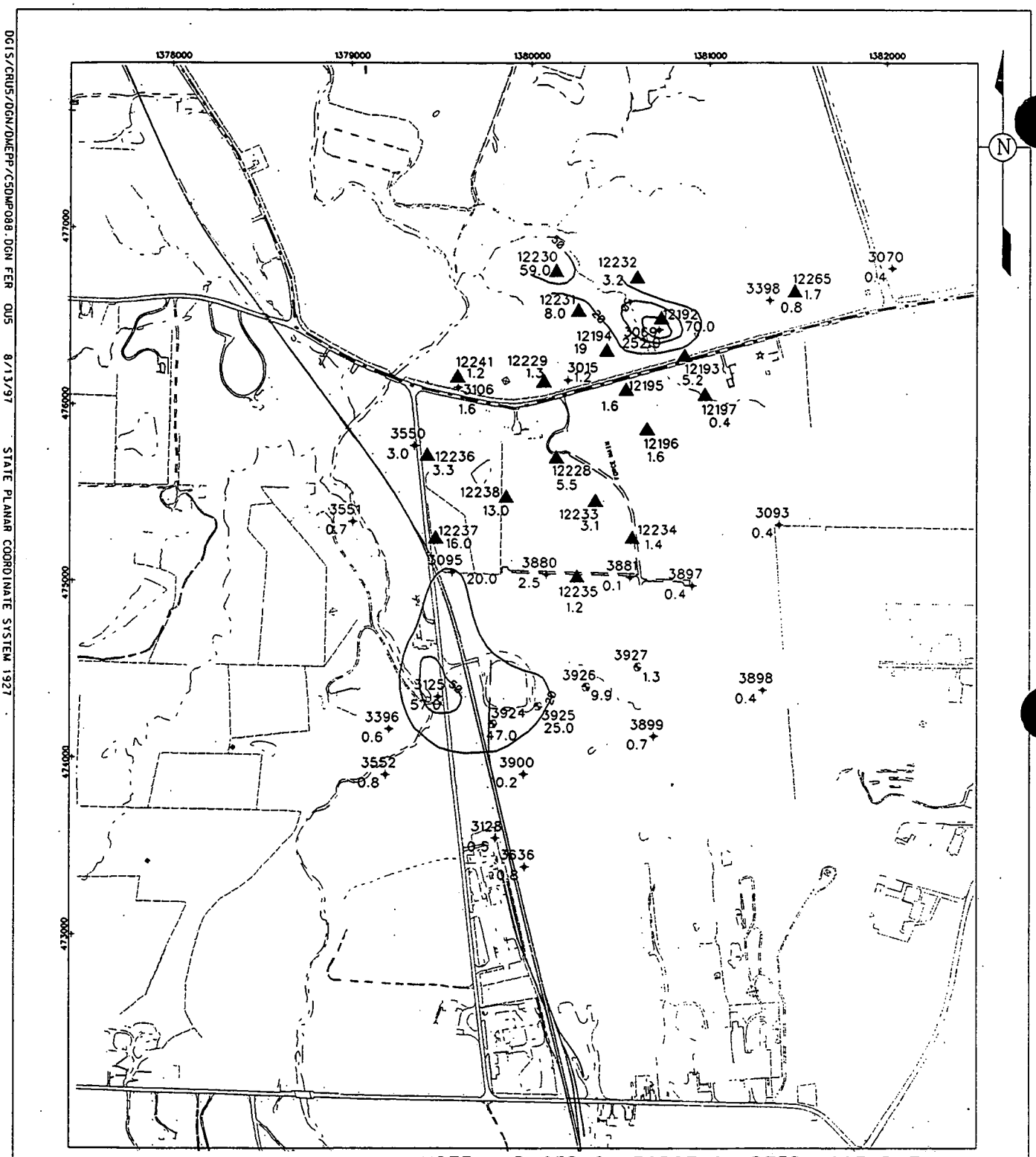
2553 / 1.1 — WELL NUMBER / TOTAL URANIUM CONCENTRATION (μg/L)

▲ GEOPROBE LOCATION

SCALE

800 400 0 800 FEET

FIGURE 4-2. TOTAL URANIUM PLUME, TYPE 2 MONITORING WELLS AND GEOPROBE DATA AT TYPE 2 LEVEL



NOTE: BASED ON FIRST QUARTER 1997 DATA

LEGEND:

FEMP BOUNDARY

20 TOTAL URANIUM CONCENTRATION CONTOUR

3553 / 1.1 WELL NUMBER / TOTAL URANIUM CONCENTRATION (μg/L)

GEOPROBE LOCATION

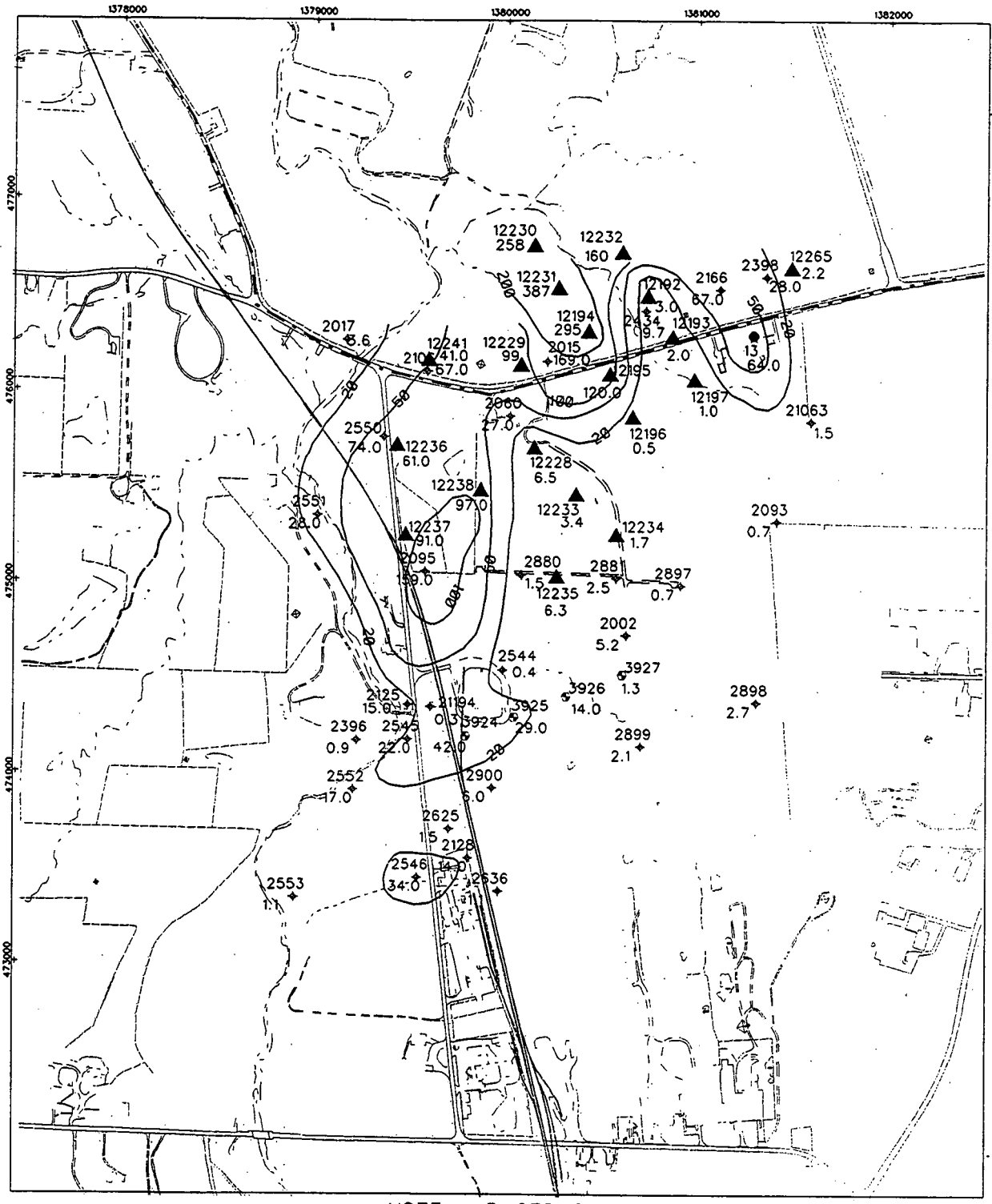
SCALE

800 400 0 800 FEET

FIGURE 4-3. TOTAL URANIUM PLUME, TYPE 3 MONITORING WELLS AND GEOPROBE DATA, TYPE 3 LEVEL

DGIS/CRUS/DGN/DMEPP/C5DMP088.DGN FER OU5 8/13/97 STATE PLANAR COORDINATE SYSTEM 1927

DGIS/CRU5/DGN/DMEPP/C5DMP087.DGN FER QU5 8/13/97 STATE PLANAR COORDINATE SYSTEM 1927



NOTE: BASED ON SECOND QUARTER 1997 DATA

LEGEND:

FEMP BOUNDARY

20 TOTAL URANIUM CONCENTRATION CONTOUR

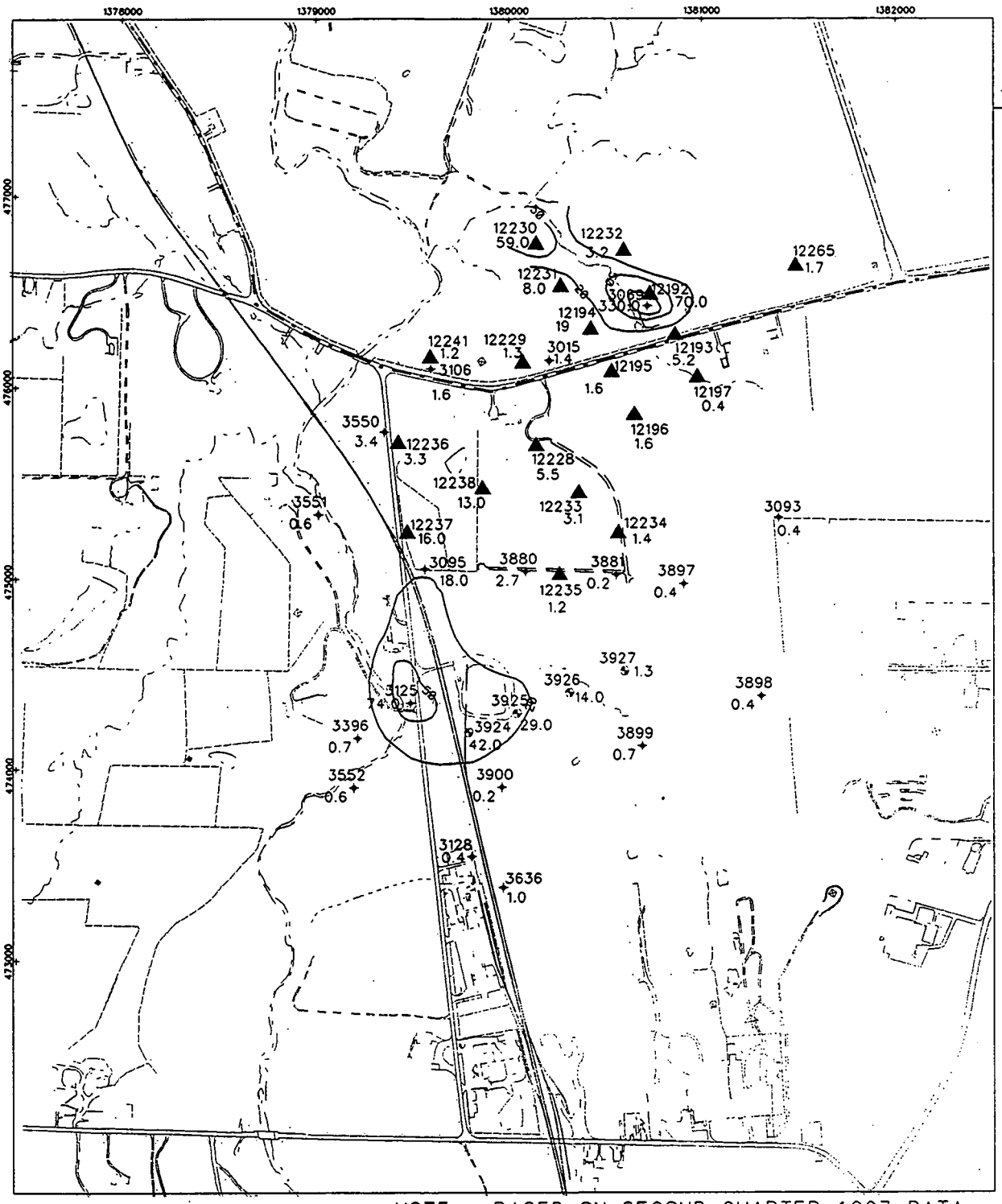
2553 1.1 WELL NUMBER
TOTAL URANIUM CONCENTRATION (μg/L)

GEOPROBE LOCATION

SCALE
800 400 0 800 FEET

FIGURE 4-4. TOTAL URANIUM PLUME, TYPE 2 MONITORING WELLS AND GEOPROBE DATA AT TYPE 2 LEVEL

DGIS/CRUS/DGN/OMEPP/C5DMP089.DGN FER OU5 8/13/97 STATE PLANAR COORDINATE SYSTEM 1927



NOTE: BASED ON SECOND QUARTER 1997 DATA

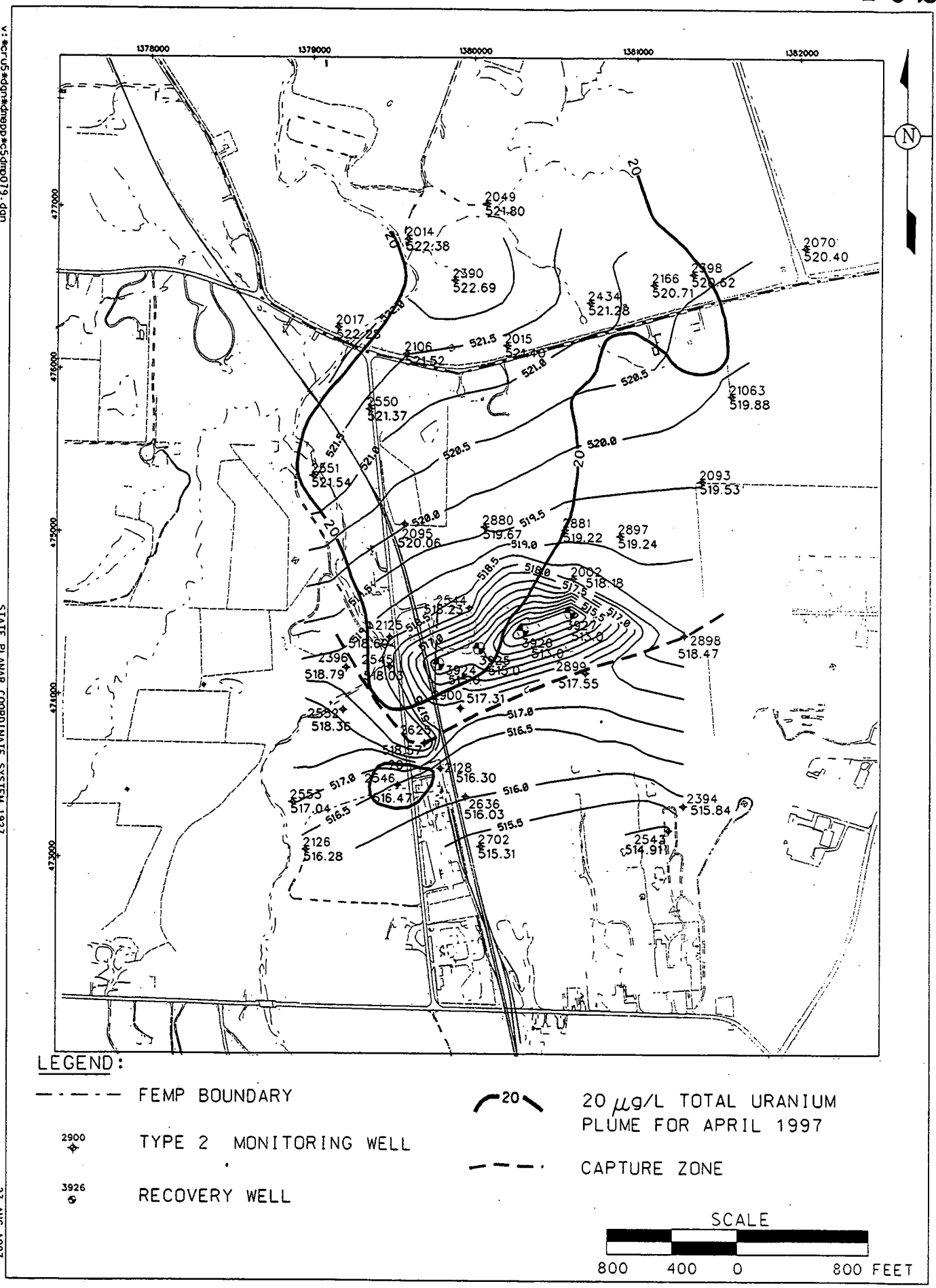
LEGEND:

- FEMP BOUNDARY
- 20 — TOTAL URANIUM CONCENTRATION CONTOUR
- 2553 / 1.1 — WELL NUMBER / TOTAL URANIUM CONCENTRATION (μg/L)
- ▲ GEOPROBE LOCATION

SCALE

800 400 0 800 FEET

FIGURE 4-5. TOTAL URANIUM PLUME, TYPE 3 MONITORING WELLS AND GEOPROBE DATA AT TYPE 3 LEVEL



LEGEND:

FEMP BOUNDARY

TYPE 2 MONITORING WELL

RECOVERY WELL

20 µg/L TOTAL URANIUM PLUME FOR APRIL 1997

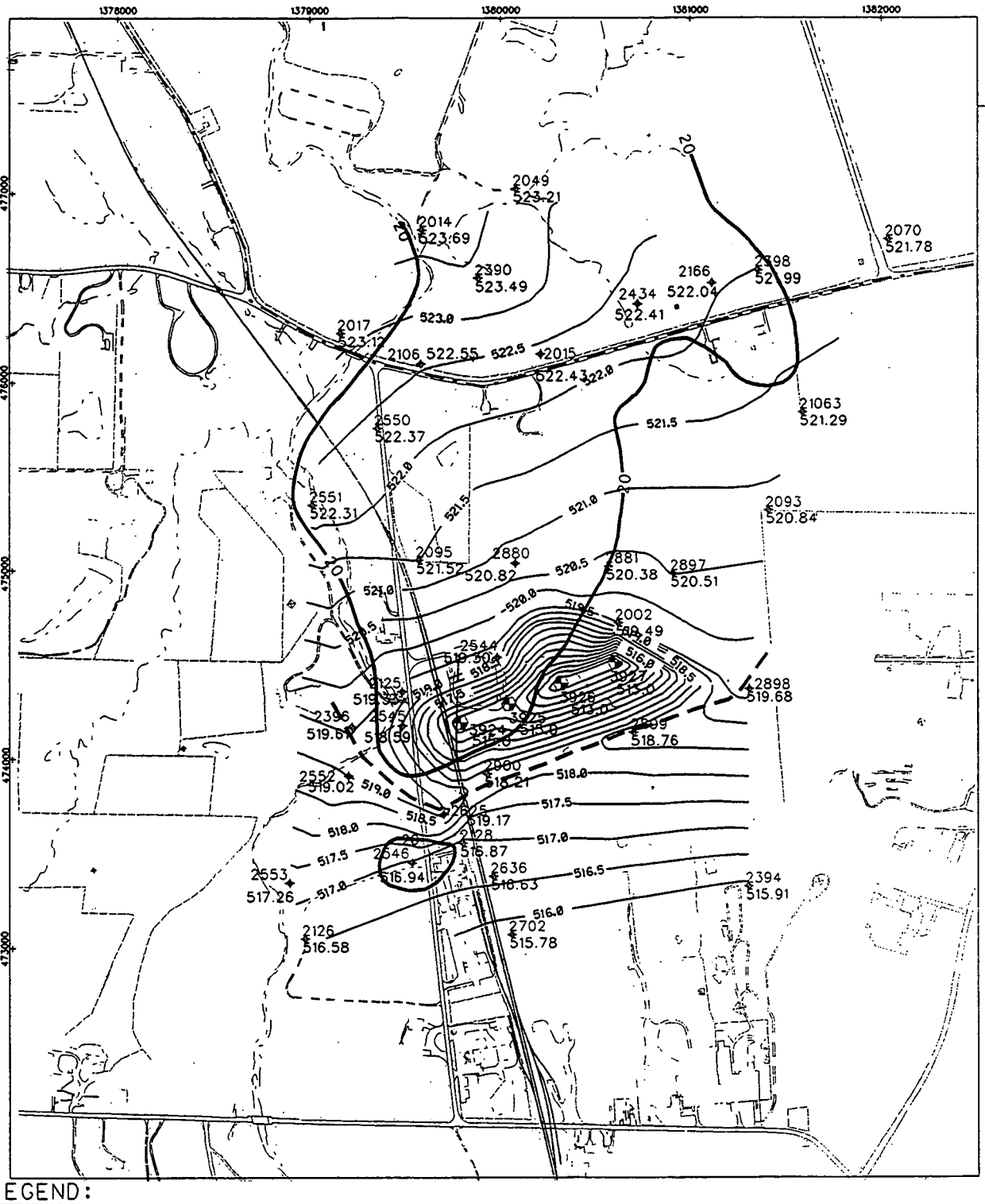
CAPTURE ZONE

SCALE

800 400 0 800 FEET

FIGURE 4-6. JANUARY 1997 GROUNDWATER ELEVATION, TYPE 2 WELLS

v:\cru5\dgn\dnepp\c5dmp019.dgn
STATE PLANAR COORDINATE SYSTEM 1927
27-AUG-1997



LEGEND:

FEMP BOUNDARY

2900 TYPE 2 MONITORING WELL

3926 RECOVERY WELL

20 20 μg/L TOTAL URANIUM PLUME FOR APRIL 1997

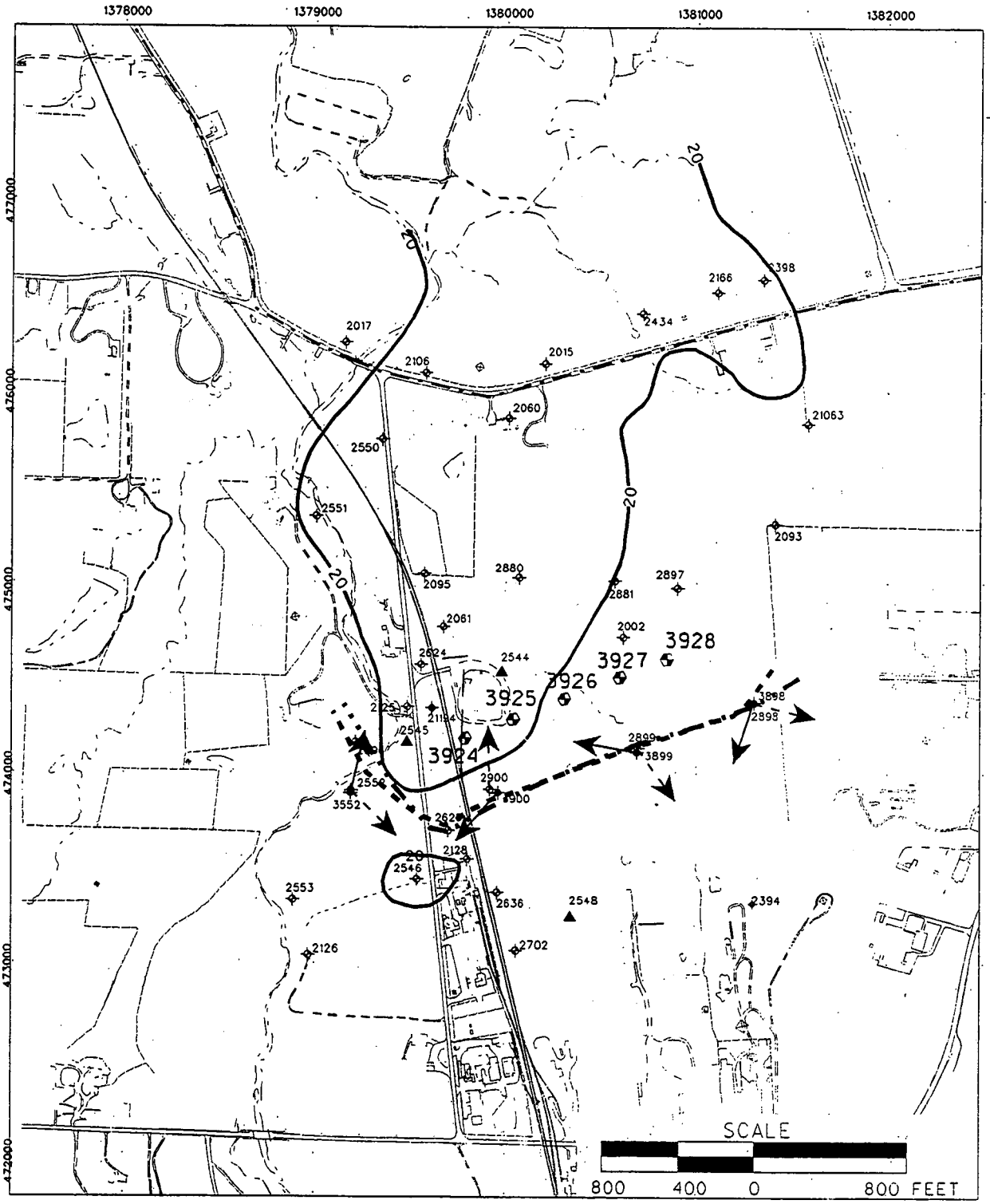
CAPTURE ZONE

SCALE

800 400 0 800 FEET

FIGURE 4-7. APRIL 1997 GROUNDWATER ELEVATION, TYPE 2 WELLS

v:\crus\dgn\dmapp\c5dmp082.dgn
STATE PLANAR COORDINATE SYSTEM 1927
27-AUG-1997



LEGEND:

- FEMP BOUNDARY
- CAPTURE ZONE BASED ON FIRST QUARTER GROUNDWATER ELEVATIONS
- CAPTURE ZONE BASED ON SECOND QUARTER GROUNDWATER ELEVATIONS
- GROUNDWATER FLOW FOR TYPE 3 WELL
- GROUNDWATER FLOW FOR TYPE 2 WELL
- SECOND QUARTER 1997 TOTAL URANIUM PLUME

FIGURE 4-8. HYDRAULIC CAPTURE ZONES AND GROUNDWATER FLOW VECTORS

DGTS/CRUS/DGN/DMEPP/C5DMP090.DGN FER OU5 2/12/97 STATE PLANAR COORDINATE SYSTEM 1927

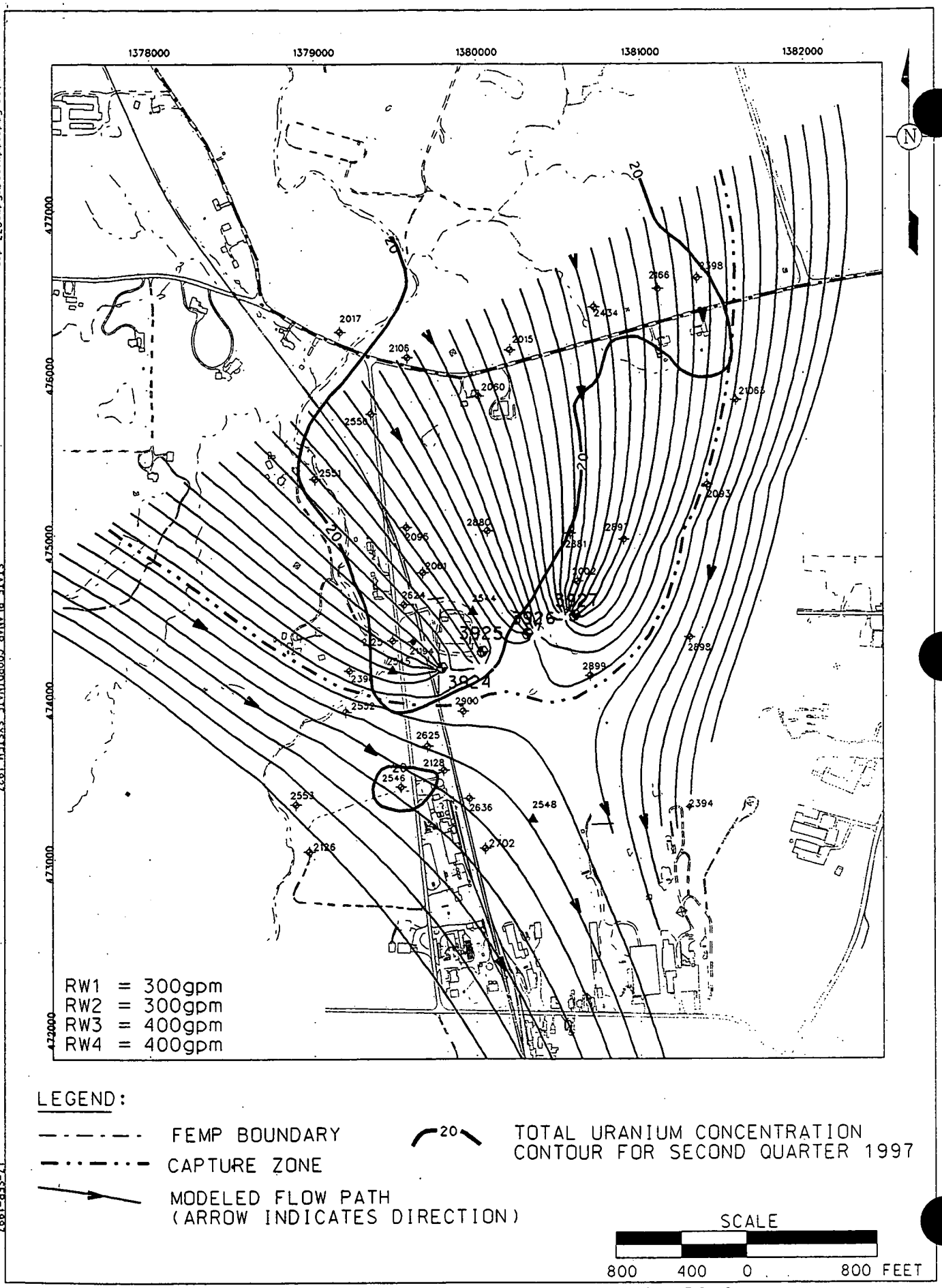


FIGURE 4-9. MODELED 1400 GPM PUMPING CONFIGURATION, PARTICLE TRACKS AND CAPTURE ZONE

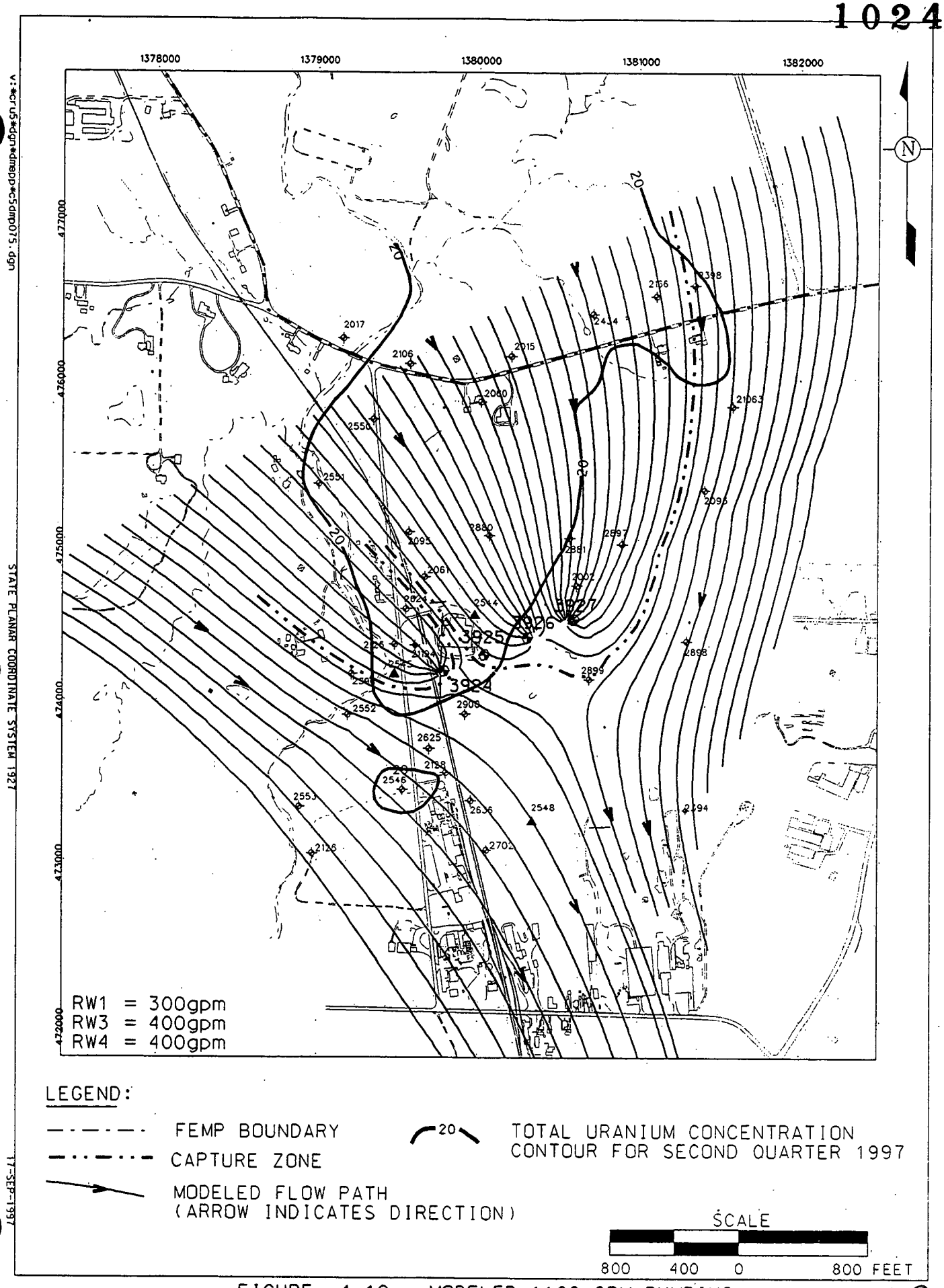
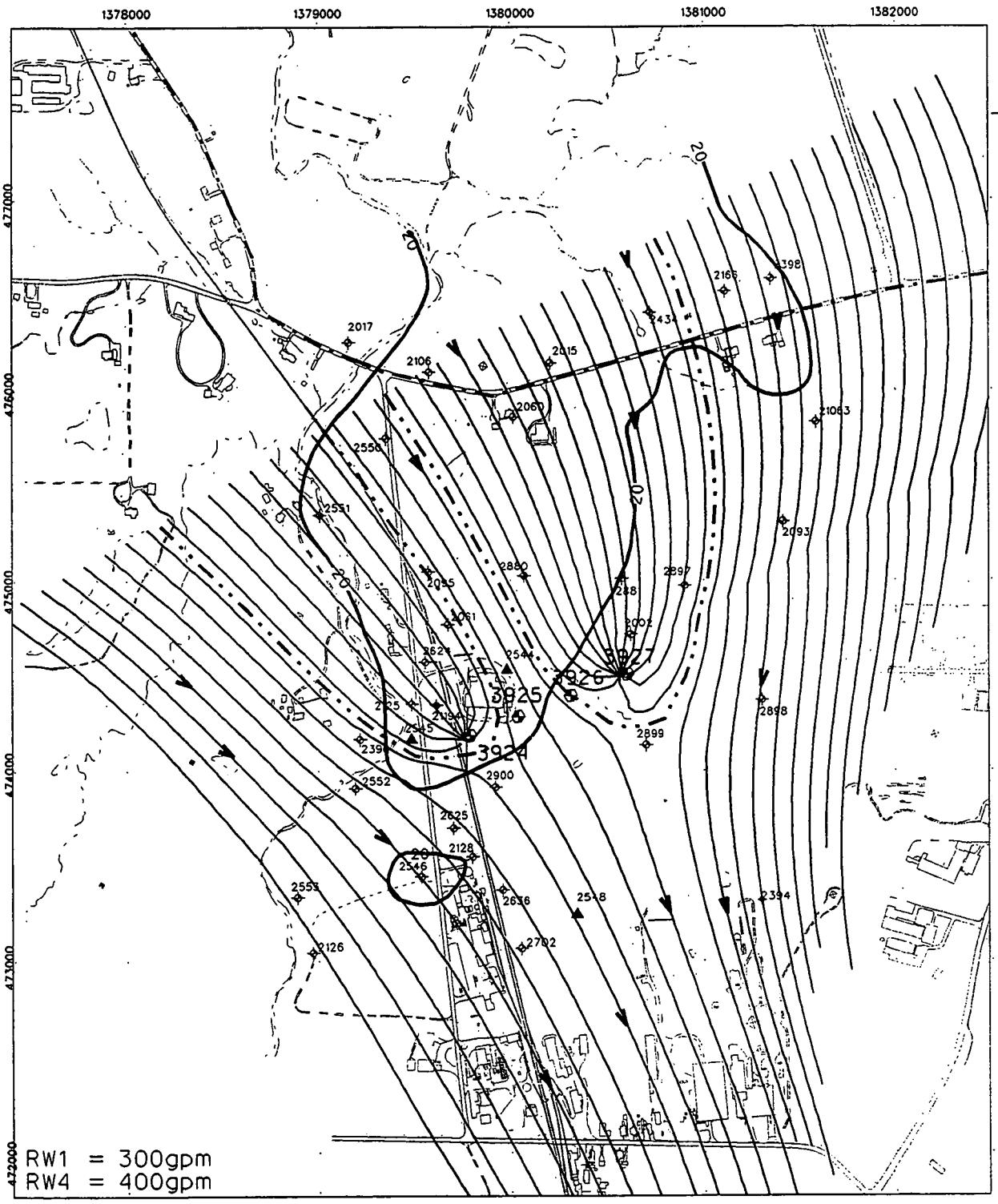


FIGURE 4-10. MODELED 1100 GPM PUMPING CONFIGURATION, PARTICLE TRACKS AND CAPTURE ZONE



LEGEND:

FEMP BOUNDARY

CAPTURE ZONE

MODELED FLOW PATH
(ARROW INDICATES DIRECTION)

20 TOTAL URANIUM CONCENTRATION CONTOUR FOR SECOND QUARTER 1997

SCALE

800 400 0 800 FEET

FIGURE 4-11. MODELED 700 GPM PUMPING CONFIGURATION, PARTICLE TRACKS AND CAPTURE ZONE

v:\cru5\dgn\dmepp\c5dmp078.dgn
STATE PLANAR COORDINATE SYSTEM 1927
17-SEP-1997

Section 5.0

5.0 SUMMARY AND CONCLUSIONS

A total of 282 million gallons of groundwater was pumped and 37.4 pounds of uranium were removed from the aquifer during the reporting period (January 1 through June 30, 1997); the average system efficiency for the reporting period was 0.13 pounds of uranium removed per million gallons of water pumped. Since operations began in August 1993, a total of 2.4 billion gallons of water have been pumped and 337.7 pounds of uranium have been removed from the aquifer. The net system efficiency (August 1993 through June 30, 1997) remains at 0.14 pounds of uranium recovered per million gallons pumped.

A major well rehabilitation program was completed during this reporting period with all recovery wells pumping at optimum rates by June of 1997. Rehabilitation of Recovery Well 3927 (RW-4) was successfully completed and the well was returned to service at a target pumping rate of 400 gpm on January 8, 1997. After Well 3927 was back on line, Well 3925 (RW-2) was removed from service on January 20 for rehab. Well 3925 was successfully re-conditioned and returned to service on April 11, 1997. Post-treatment performance tests on both Recovery Wells 3925 and 3927 indicate significant improvement in well performance. Pre-rehabilitation performance tests on Recovery Well 3924 (RW-1) indicated that the efficiency of this well was good. Therefore rehabilitation for this well has been postponed until a later time.

A significant portion of the down time for the pumping wells during this reporting period is attributed to the well rehabilitation program. Most of the other down time was due to flow controller/ flow controller valve problems associated with iron fouling. Revised maintenance procedures have been implemented which call for routine tear down and cleaning of the critical parts of the flow controller system every six months. These and other recovery well maintenance procedures as well as recovery well performance monitoring requirements are documented in the South Plume Performance Monitoring and Maintenance Plan. This plan was included as Appendix A of the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment which was transmitted in draft form to the U.S. EPA and Ohio EPA on June 30, 1997.

The wellfield was pumped at three configurations during the reporting period to accommodate individual well outages:

- For most of January through April, Recovery Well 3924 (RW-1) was pumped at 300 gpm and Wells 3926 (RW-3) and 3927 (RW-4) were pumped at 400 gpm each. The total system target pumping rate during this time was 1100 gpm.

- For most of May, Recovery Wells 3925 (RW-2) and 3926 (RW-3) were out of service and Recovery Well 3924 (RW-1) was pumping at 300 gpm while Recovery Well 3927 (RW-4) was pumping at 400 gpm for a total system rate of 700 gpm.

- For most of June, 1997 the system was pumping in the optimum 1400 gpm configuration with Recovery Wells 3924 (RW-1) and 3925 (RW-2) pumping at 300 gpm each and Recovery Wells 3926 (RW-3) and 3927 (RW-4) pumping at 400 gpm each.

Because of variation in the pumping configurations which occurred in this reporting period groundwater elevation data was collected monthly instead of quarterly. The frequency of groundwater elevation measurements will be returned to quarterly when the aquifer/pumping system returns to a more stable configuration.

A Geoprobe™ sampling program in support of the aquifer restoration remedial design was completed in April 1997 and presented in detail in the BRSR (DOE, June 1997). The results of that study have been incorporated into this report. While sampling results from this study have significantly altered the interpretation of the lateral extent of the off-property portion of the plume north of the recovery system, the South Plume Optimization Wells sited as a result of the BRSR study are in an optimum location to enhance off-property plume recovery when they come on line in 1998. In the meantime, the existing four well system pumping at 1400 gpm continues to capture the plume and is preventing further movement of the contamination to the south of the operating recovery wells.

Groundwater elevation data confirm that the highest concentrations in the total uranium plume continue to be captured by Recovery Wells 3924 (RW-1) and 3925 (RW-2). While groundwater modeling indicates the possibility of some breakthrough at Recovery Well 3925 (RW-2) and 3926 (RW-3) when they were off line in May, consideration of the retarded flow velocities for uranium indicate that the plume would have moved approximately 65 feet or less while the wells were out of service. Furthermore, sampling data from these two recovery wells indicate total uranium concentrations in this area are at an average of 21.2 μg/L or very close to the 20 μg/L MCL for uranium.

Borescope data obtained during the reporting period continues to confirm the capture zone analysis derived from groundwater elevation data. On the west side of the recovery array, Monitoring Well 2552 continues to move in and out of the capture zone depending on the groundwater elevations and the amount of recharge to the aquifer from Paddys Run, which is in close proximity to the well. Total uranium concentrations at Monitoring Well 2552 have once again dropped below the 20 μg/L FRL. The Down Significant statistical trend reported prior to the last DMEPP report (DOE, April 1997) for this well has resumed as this portion of the plume continues to dissipate.

At the northeastern lobe of the plume total uranium concentrations increased slightly in Monitoring Well 2398 during this reporting period. This is attributed to expansion of the plume with regional groundwater flow which is to the southeast at this location. However, as indicated in the BRSR, this portion of the plume is still well within the modeled capture zone which will be induced when the South Field and Injection Demonstration modules are brought on line in late 1998.

With the approval of the Integrated Environmental Monitoring Plan, this is the last DMEPP System Evaluation Report. Future system reports will be integrated into the IEMP quarterly and annual progress reports.

In conclusion, significant results for this reporting period and recommendations for future IEMP reports are summarized below.

Operational changes of note during this reporting period:

- A major well rehabilitation program undertaken in late 1996 was completed with all recovery wells back on line by June 1997. Post-treatment pumping tests and down hole camera surveys indicate significant improvements in well/screen conditions.

- Revised recovery well monitoring and maintenance procedures were implemented during this reporting period. These procedures are summarized in the South Plume Performance Monitoring and Maintenance Plan.

- Three target pumping configurations of 1100 gpm and 700 gpm and 1400 gpm were used during the reporting period while Recovery Wells 3925 (RW-2) and 3926 (RW3) were off line.

Significant data analysis results include:

- Trend analysis indicates 14 wells with increasing uranium concentrations for this reporting period. Monitoring Wells 2551 and 3106 exhibited an increasing trend for the first time. Both wells are up gradient of the recovery system and within the capture zone. Well 2551 is immediately west of Paddys Run at the extreme western edge of the plume and exhibited uranium concentrations of 39 μg/L and 28 μg/L during the first and second quarters of 1997 respectively. Well 3106 is located on property along the southern fence line and exhibited uranium concentrations of 1.6 μg/L and 2.4 μg/L during the first and second quarters respectively. Refer to Section 3.0.

- Trend analysis indicates 13 wells with decreasing uranium concentrations for this reporting period. Two wells changed from a Decreasing Trend to No Trend (Wells 2015 and 2434) and two wells changed from No Trend to Decreasing Trend (Wells 21063 and 2552). Refer to Section 3.0.

- Of the 27 wells with significant trends in total uranium concentrations, only two, Monitoring Wells 2128 with an upward trend and Monitoring Well 2548 with a downward trend are outside the capture zone of the recovery system as defined by the groundwater elevation data and supported by the colloidal borescope data and SWIFT site groundwater modeling results. These Wells are discussed in Section 3.0.

- Total uranium concentrations in Monitoring Well 2552 which defines the southwestern lobe of the plume decreased during this period to 15.0 μg/L and 17.0 μg/L during the first and second quarters respectively. The Mann-Kendall trend analysis for this well indicates that concentrations have resumed the Down Significant trend reported prior to the April 1997 DMEPP report.

- Geoprobe™ sampling conducted in support of the aquifer restoration remedial design which was completed during this reporting period indicates a wider plume off-property and up gradient of the recovery system than was previously mapped with the Type 2 and Type 3 monitoring well network. However, the off-property portion of the plume is still within the capture zone of the existing recovery system and the planned South Plume Optimization Wells RW-6 and RW-7 are optimally placed to enhance plume recovery when they come on line in late 1998. Refer to Section 4.0 and Figure 4-1.

- Monitoring Wells 2128 and 2900 (located south of the recovery wells) continue to show increasing trends in uranium concentrations with average concentrations of 12.8 μg/L and 6.0 μg/L respectively for this reporting period. Borescope data from Well 2900 indicate flow directions to the north toward the recovery system. Refer to Section 3.0.

- Monitoring Well 2899 continues to show increasing trends for potassium and sodium and Monitoring Well 2900 shows increasing trends for sodium. While the potassium concentration in Well 2899 is above background, the sodium concentrations in both wells are significantly below background. Refer to Section 3.0.

- Based on the analysis of sampling data from this reporting period, the recovery system continues to have a negligible influence on Paddys Run Road Site contaminants to the south.

Recommendations and areas of focus for the next reporting period include:

- Continue to collect borescope flow direction data to assist in capture zone interpretations.
- Continue to monitor the recovery wellfield to ensure continuing negligible influence to the Paddys Run Road Site plume
- Continue to evaluate capture of the contiguous 20 μg/L uranium plume with the use of groundwater elevation data in Type 2 monitoring wells, borescope data collected in both Type 2 and selected Type 3 wells, and groundwater modeling.
- Continue to investigate alternative monitoring options to replace Wells 2061 and 3062 which are no longer available for sampling.
- Continue to seek ways to improve the mechanical reliability of the system and to enhance the operating time of the system as the South Plume Optimization System is installed and comes on line in late 1998.
- Continue to monitor the boundary of the southwestern lobe of the uranium plume which at times resides outside the capture zone of the recovery wellfield (Monitoring Well 2552).
- Continue to monitor and evaluate uranium concentrations in Well 2900 and 2128 which are south of the recovery system.
- Continue to monitor and evaluate sodium and potassium concentrations in Wells 2899 and 2900.
- Continue to refine the streamlined reporting approach as necessary, based on stakeholder input.

Appendix A

APPENDIX A

SUMMARY OF ANALYTICAL DETECTIONS

(See disk in front pocket of binder)

VALIDATION QUALIFIERS

J — These data are considered quantitatively estimated, and may be biased due to effects reflected in the associated quality control results. Analyte identification is reliable, however, and EPA guidance allows the use of "J" qualified data to be used in baseline evaluation of risk assessment as well as nature and extent of contamination. This qualifier is also applied to organic data when the actual result is less than the contract required detection limit; these data are also considered quantitatively estimated. "J" may carry additional meaning when used in radiochemical validation; the Data Validation Summary Report further defines the use of this qualifier.

NV — These data are not validated. Reasons for nonvalidation can be found in the Data Validation Summary Report associated with the data set. These data cannot be used in risk assessment evaluation.

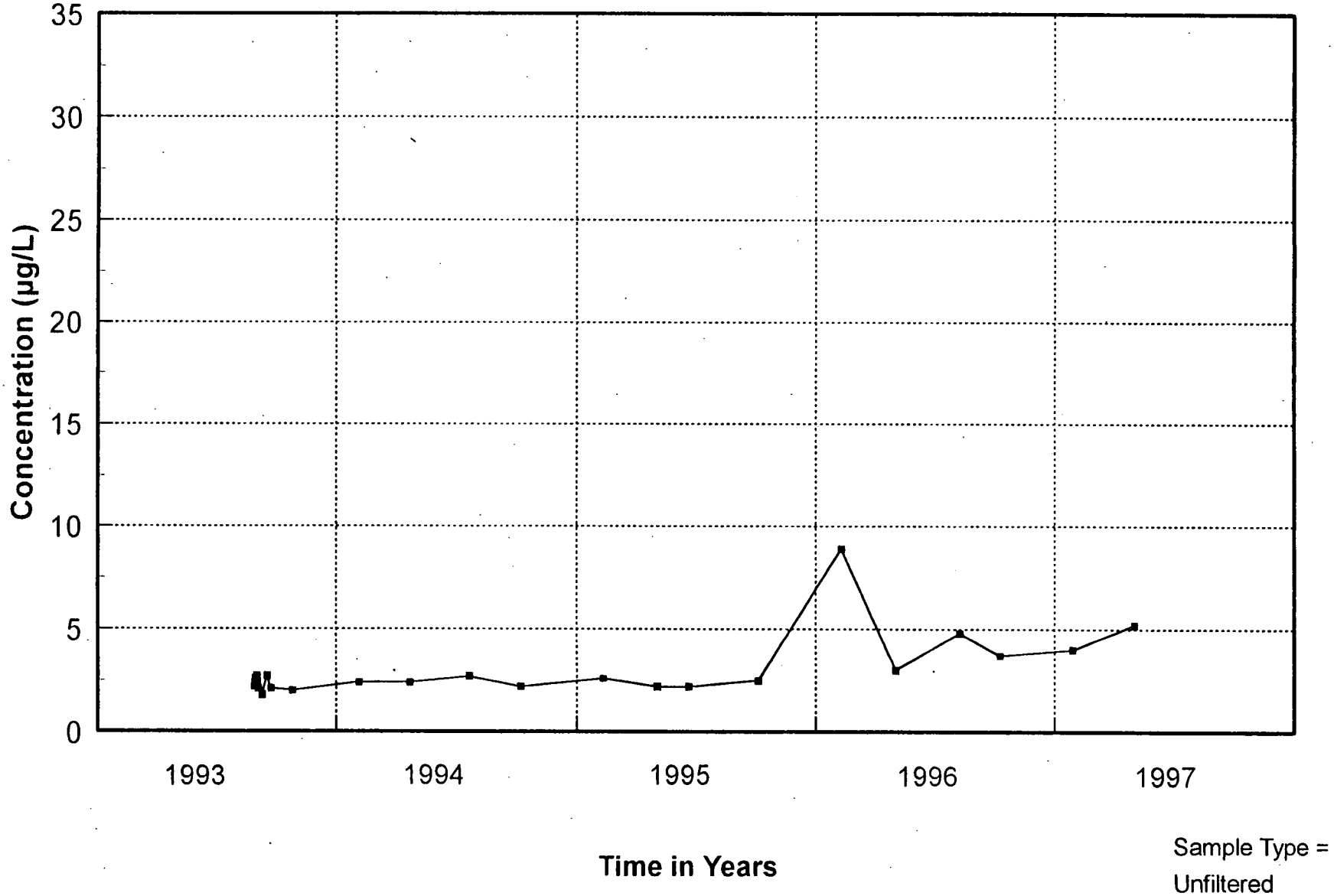
-(dash) — A dash (-) indicates that the result is CONFIDENT AS REPORTED; the validator did NOT assign any of the above qualifiers to the positive result. (NOTE: When an undetected result is not further qualified, the validator will still enter the "U" qualifier in the qualifier column.)

U — Data that were observed at levels less than the corresponding limit of detection were qualified as U, meaning not detected above the associated value. This qualifier is assigned by the laboratory, and it was also used as a validation qualifier when common field or laboratory blank contaminants were detected in a sample less than action level as defined by the validation criteria. For nature and extent, the U qualifier establishes the lowest concentration of an analyte that can confidently be defined as nondetect. If an analyte was not detected in a certain media of a specific waste area, the calculation for concentration source terms did not include one-half the sample quantitation limits. Like the laboratory qualifier U, one-half of the sample quantitation limit has been used as a surrogate in calculating the concentration term in risk calculations.

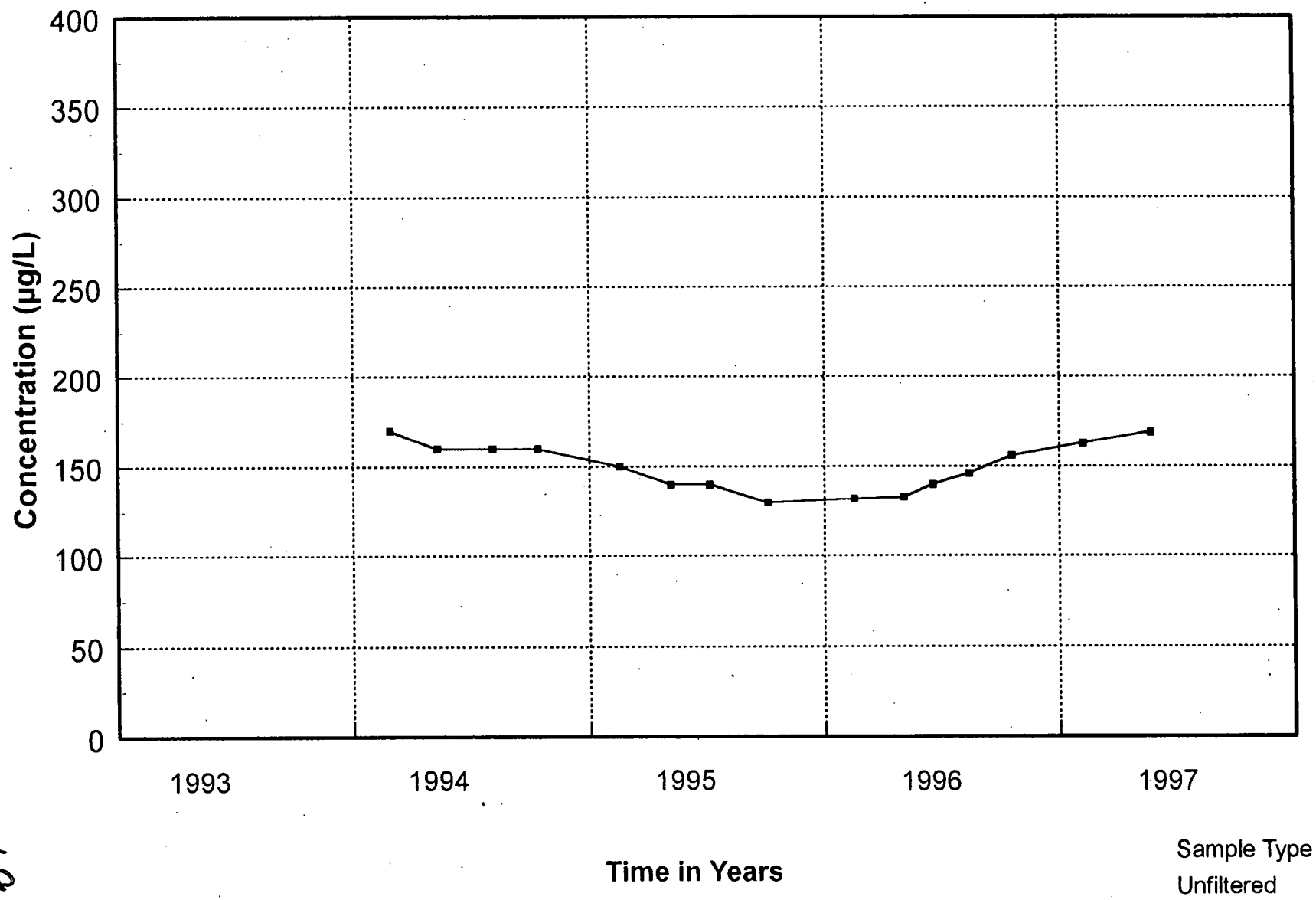
UJ — Data that were quantitatively estimated at levels less than the corresponding limit of detection.

APPENDIX B

CONCENTRATION PLOTS
FOR DMEPP MONITORING AND RECOVERY WELLS
(Data are for total uranium from unfiltered samples)

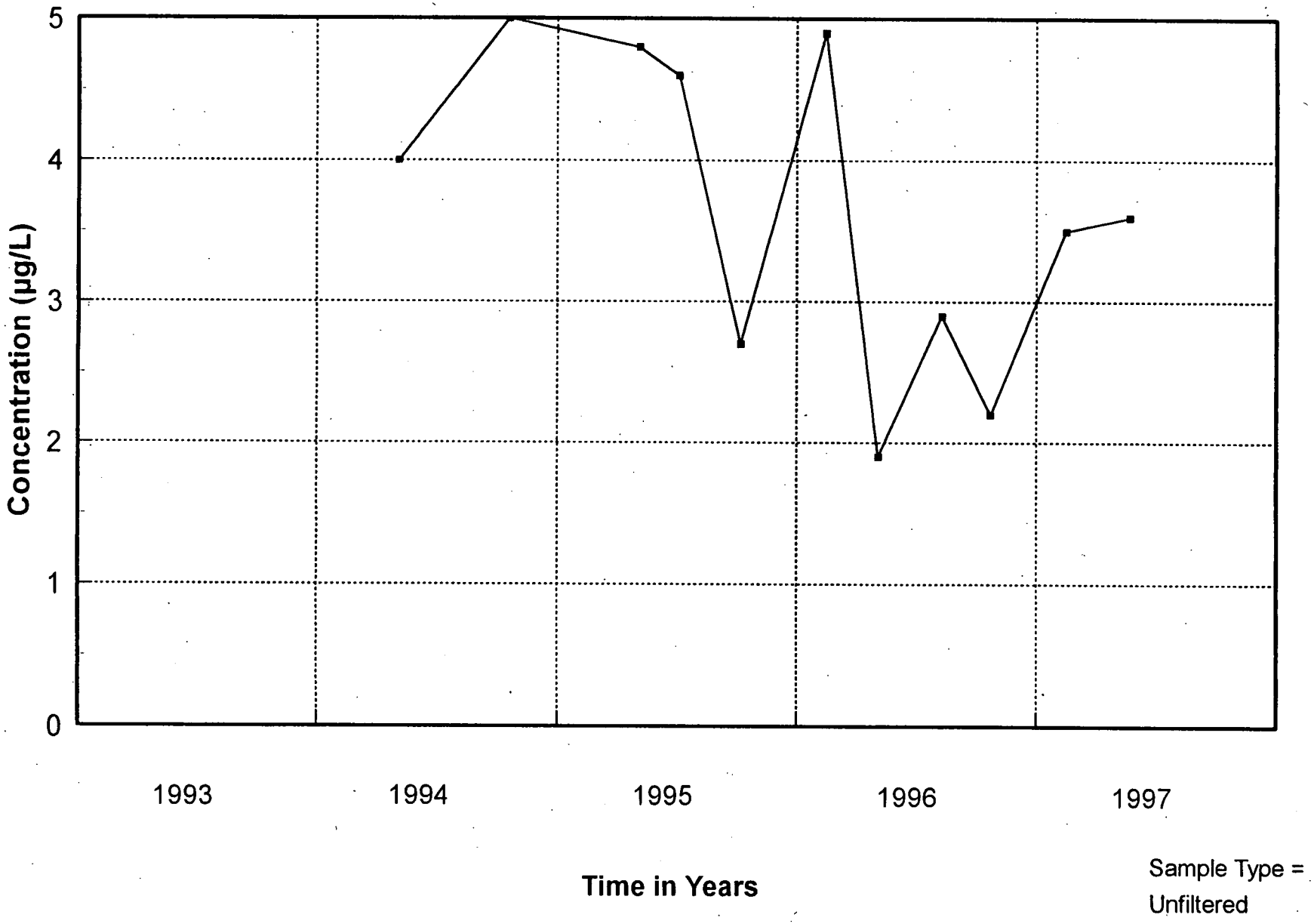


Monitoring Well 2002 Total Uranium Concentrations

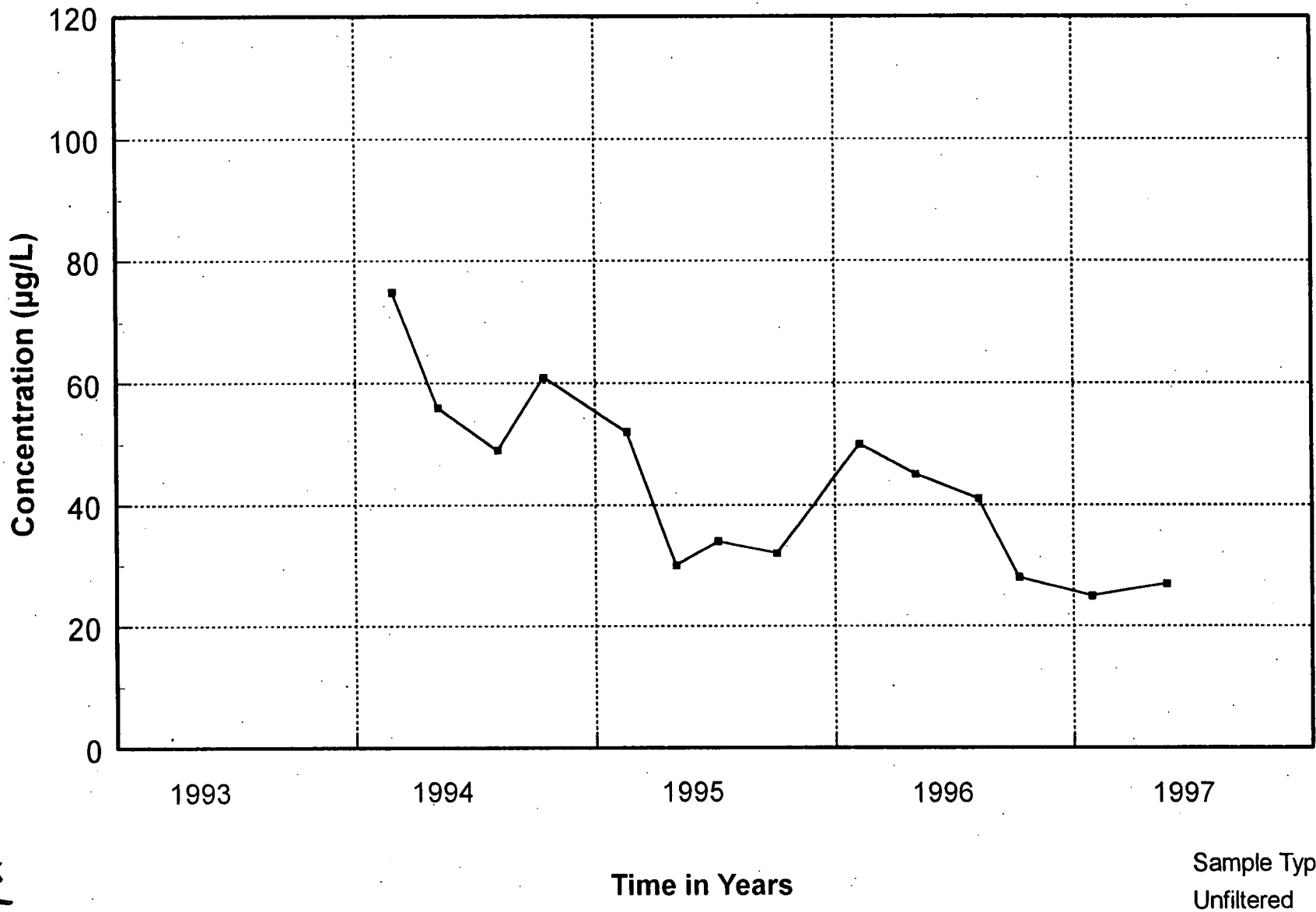


Monitoring Well 2015 Total Uranium Concentrations

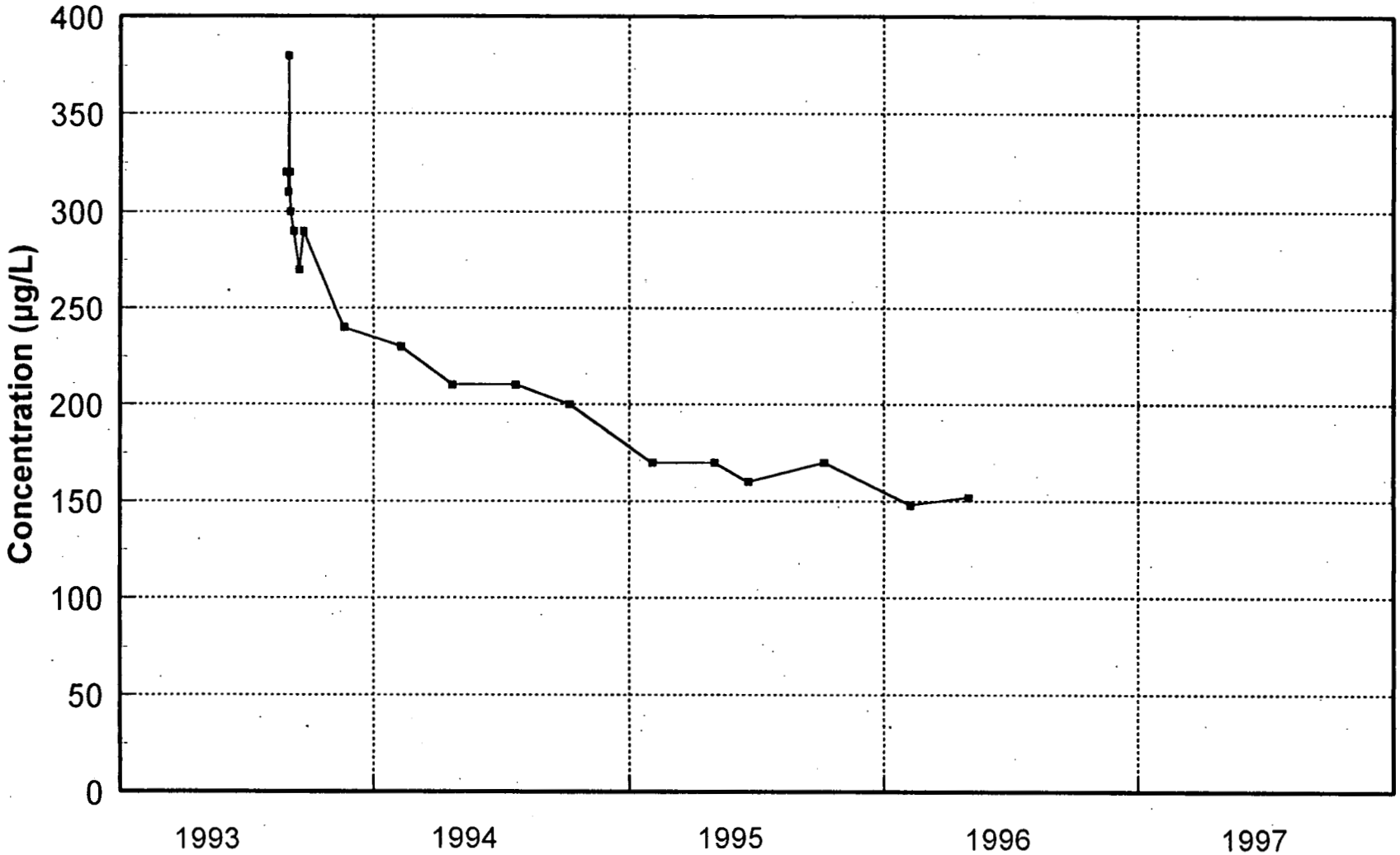
69



Monitoring Well 2017 Total Uranium Concentrations



Monitoring Well 2060 Total Uranium Concentrations

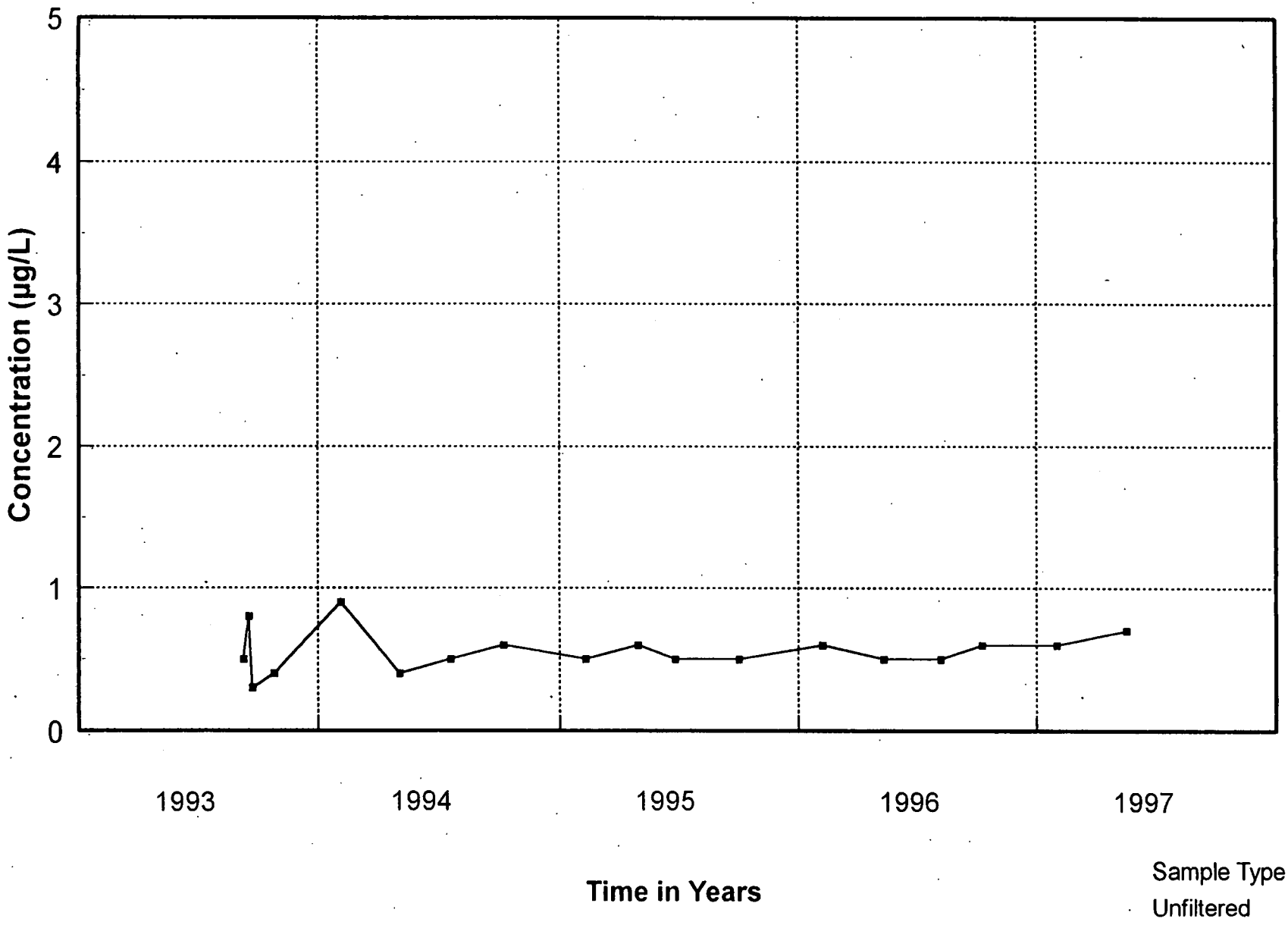


Well 2061 was the supply well for Delta Steel. It was plugged per Ohio Department of Health requirements, and therefore, can no longer be sampled.

Time in Years

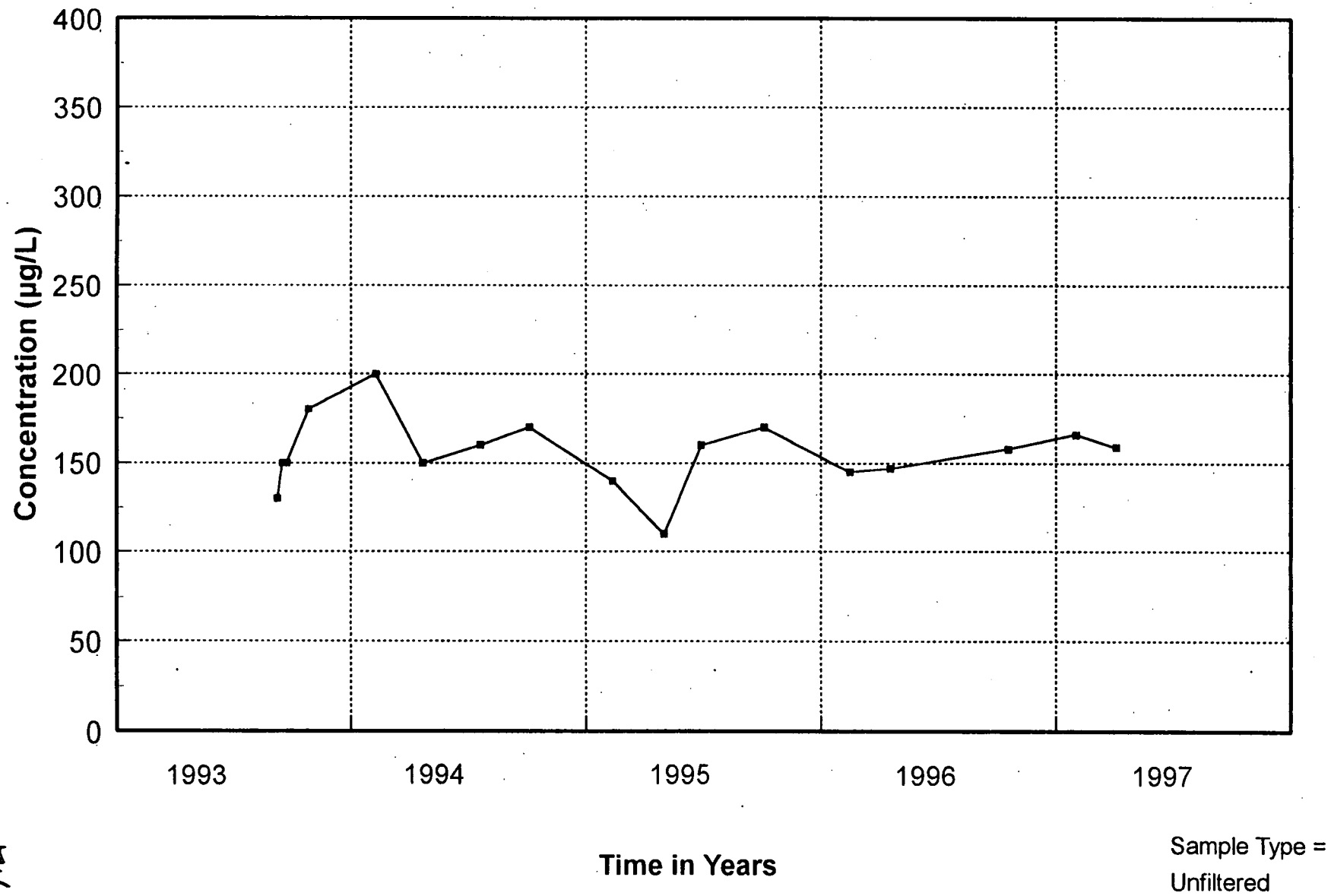
Sample Type = Unfiltered

Monitoring Well 2061 Total Uranium Concentrations



43

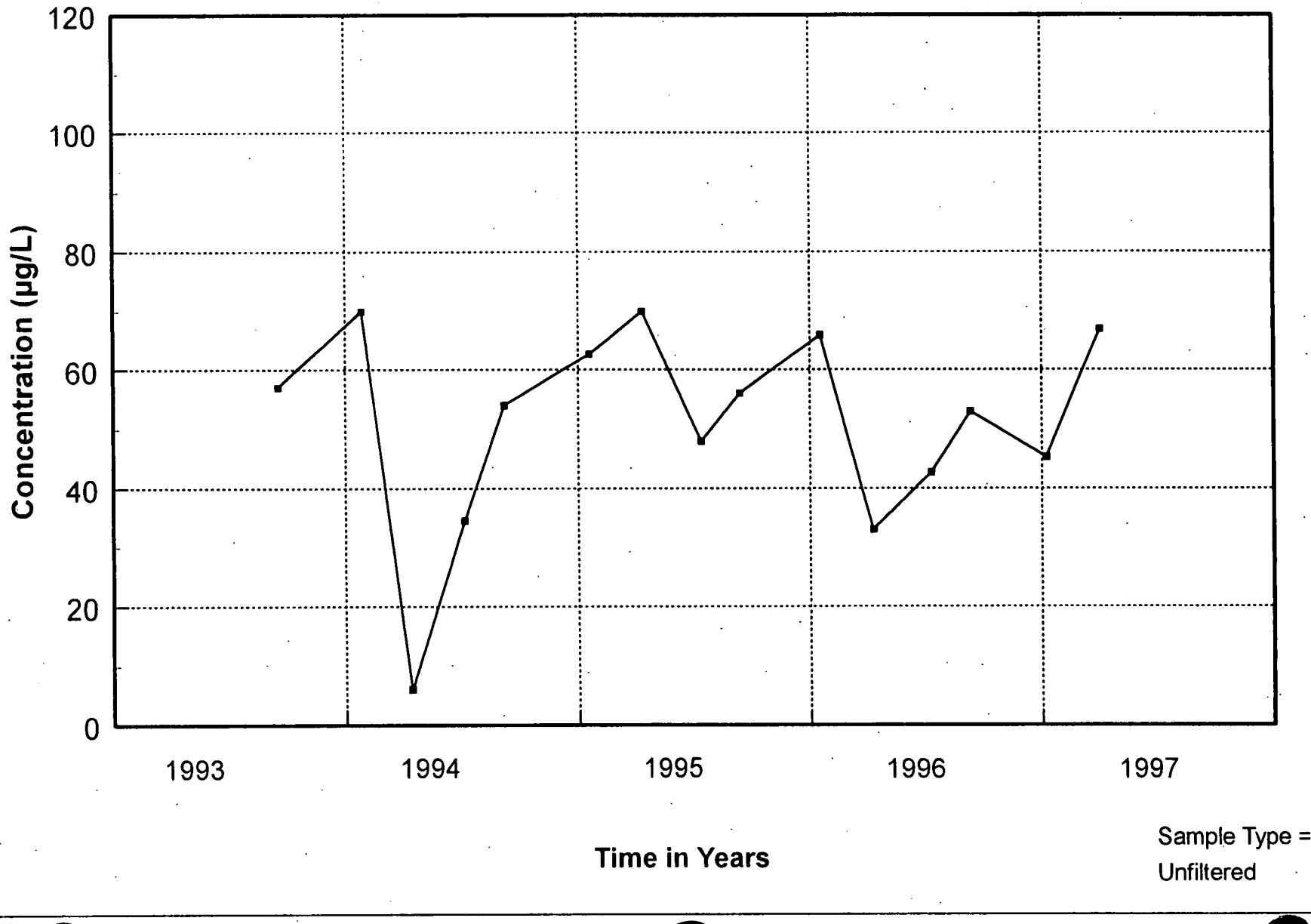
Monitoring Well 2093 Total Uranium Concentrations



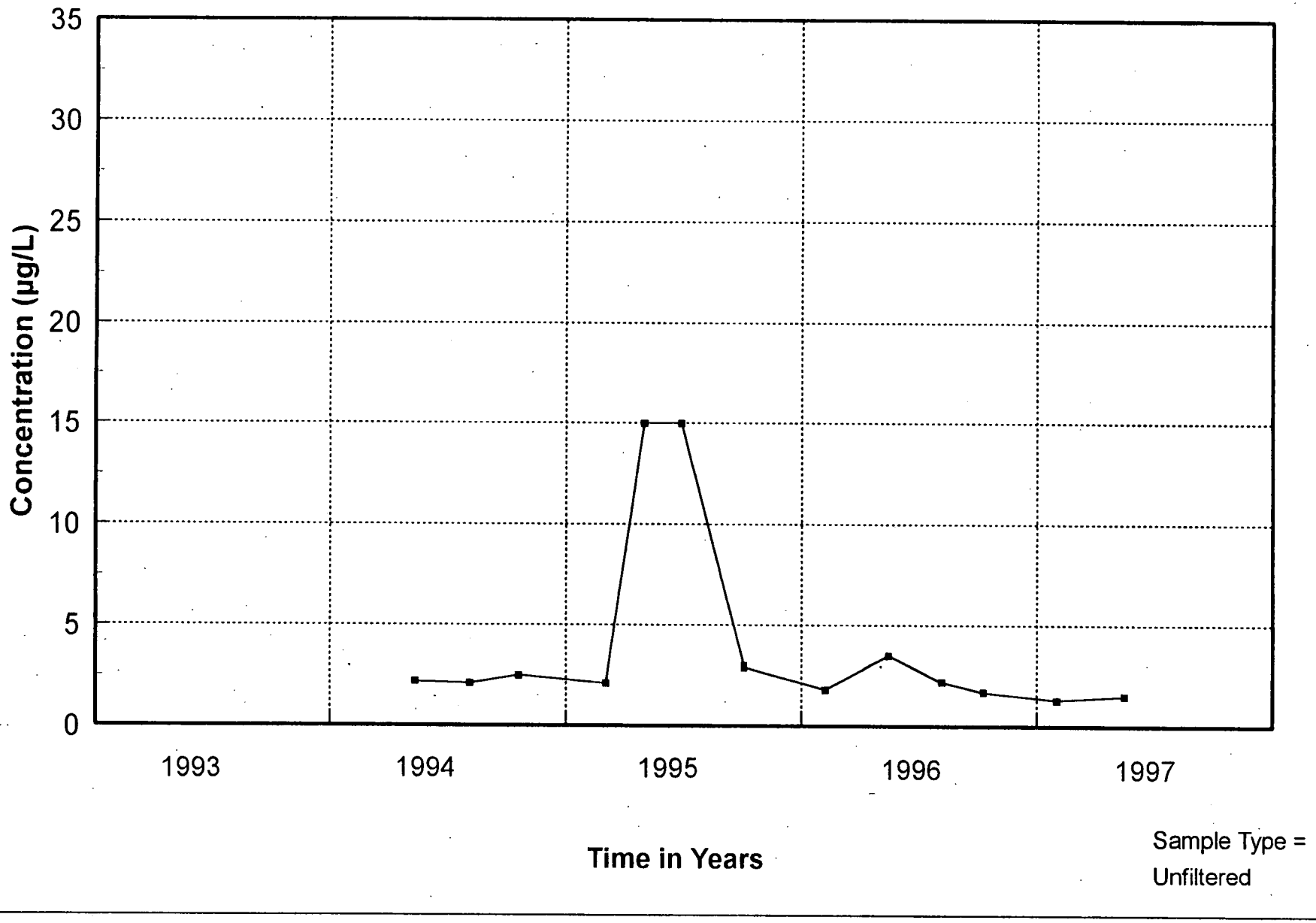
Monitoring Well 2095 Total Uranium Concentrations

74

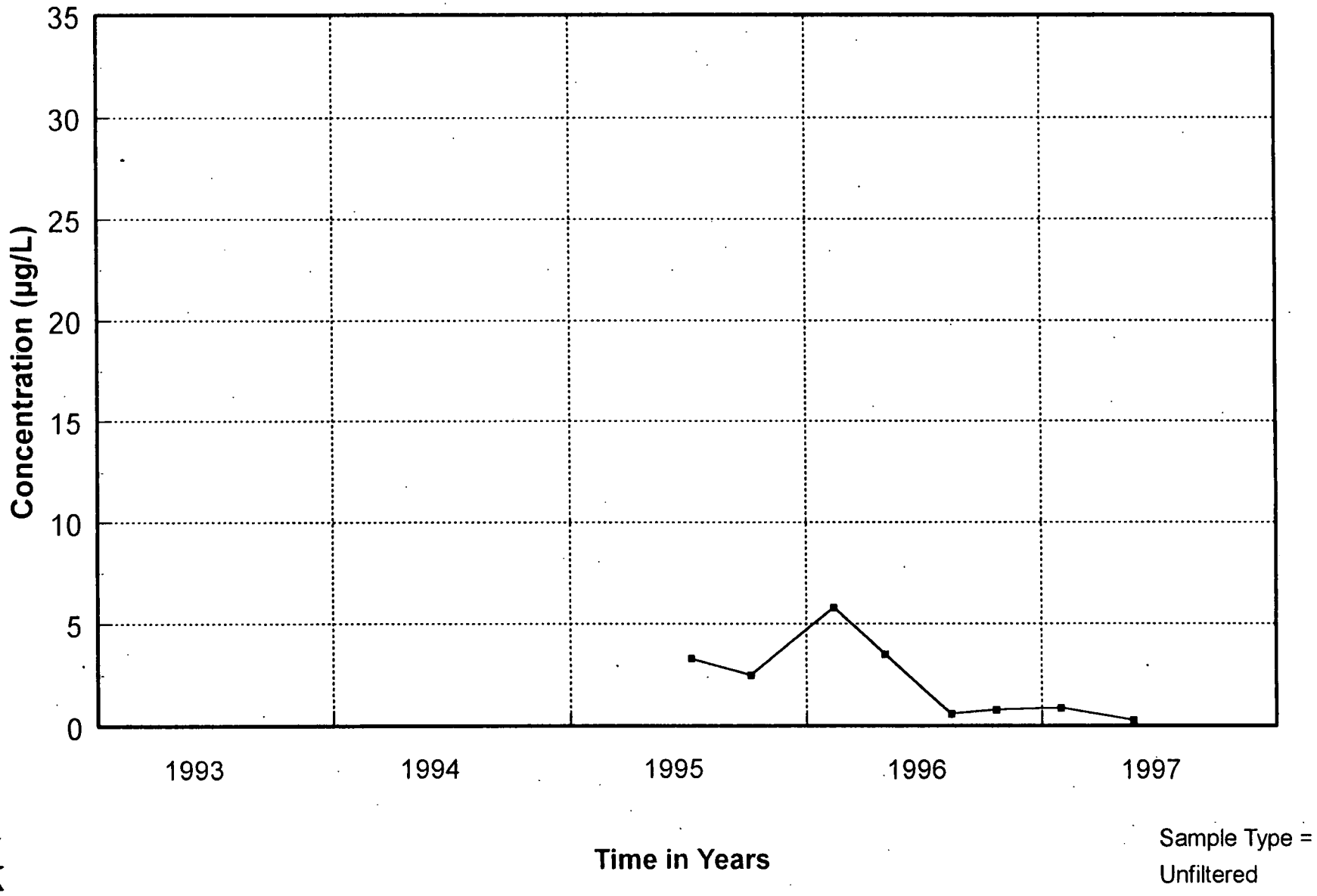
1024



Monitoring Well 2106 Total Uranium Concentrations

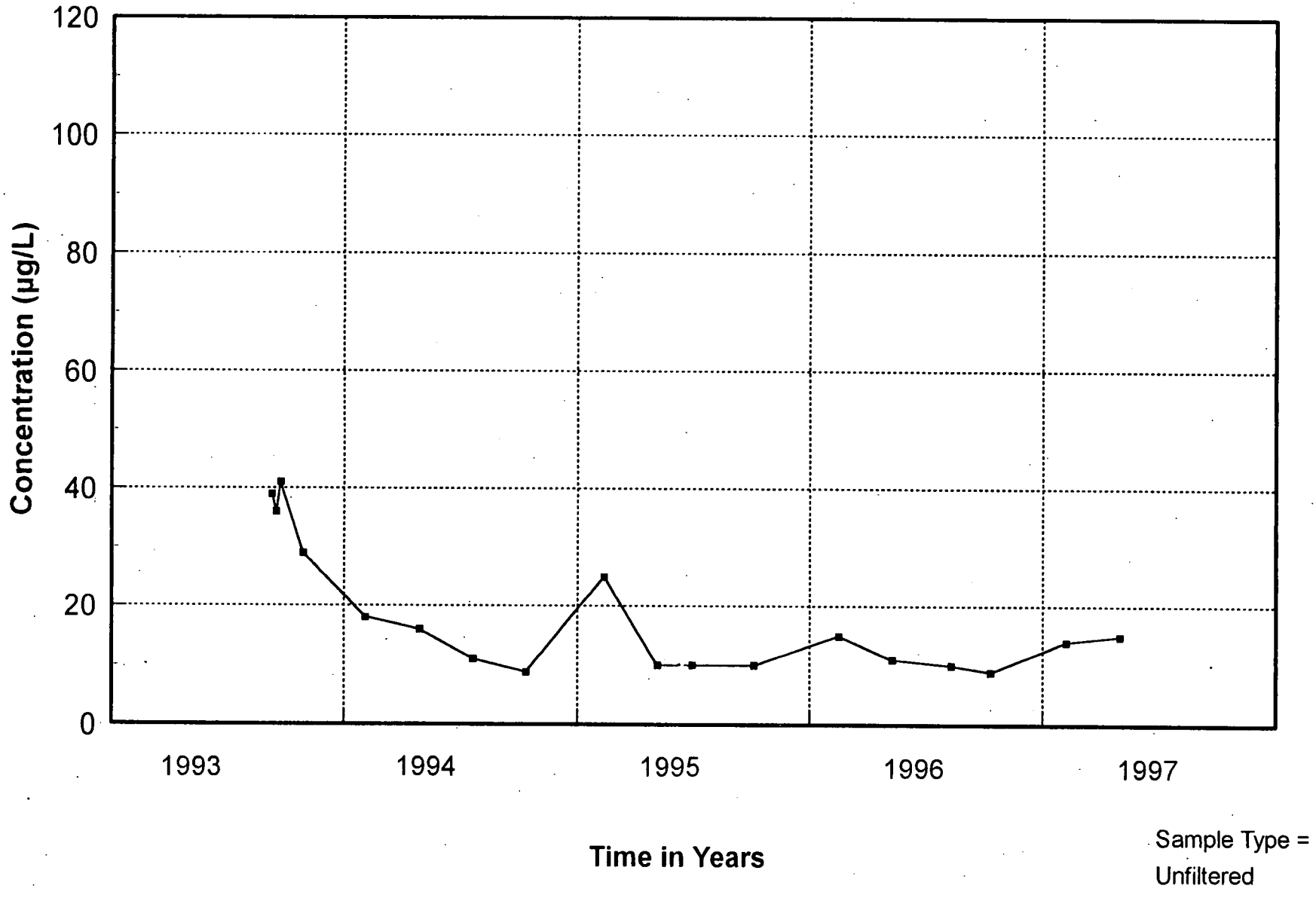


Monitoring Well 21063 Total Uranium Concentrations

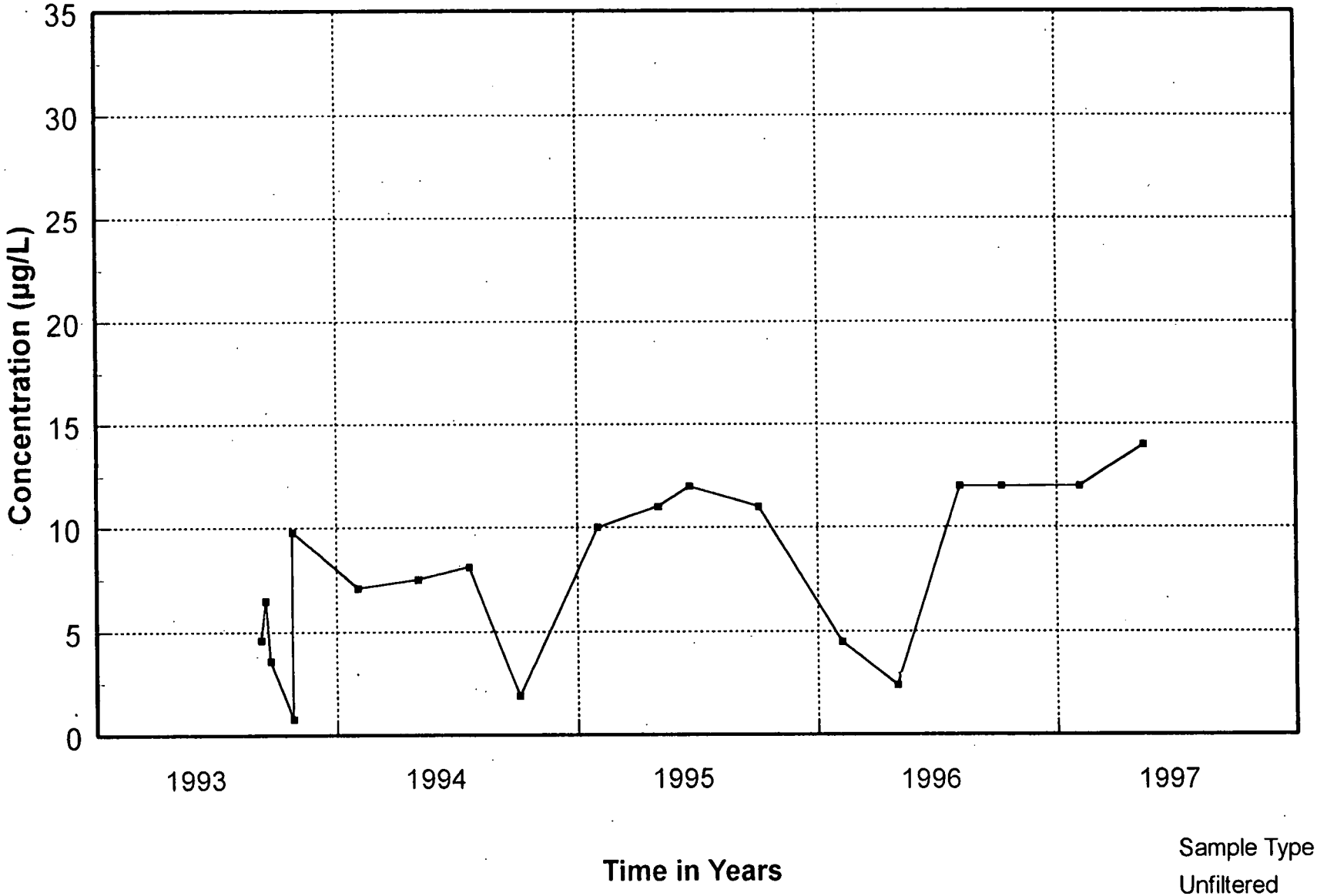


Monitoring Well 21194Total Uranium Concentrations

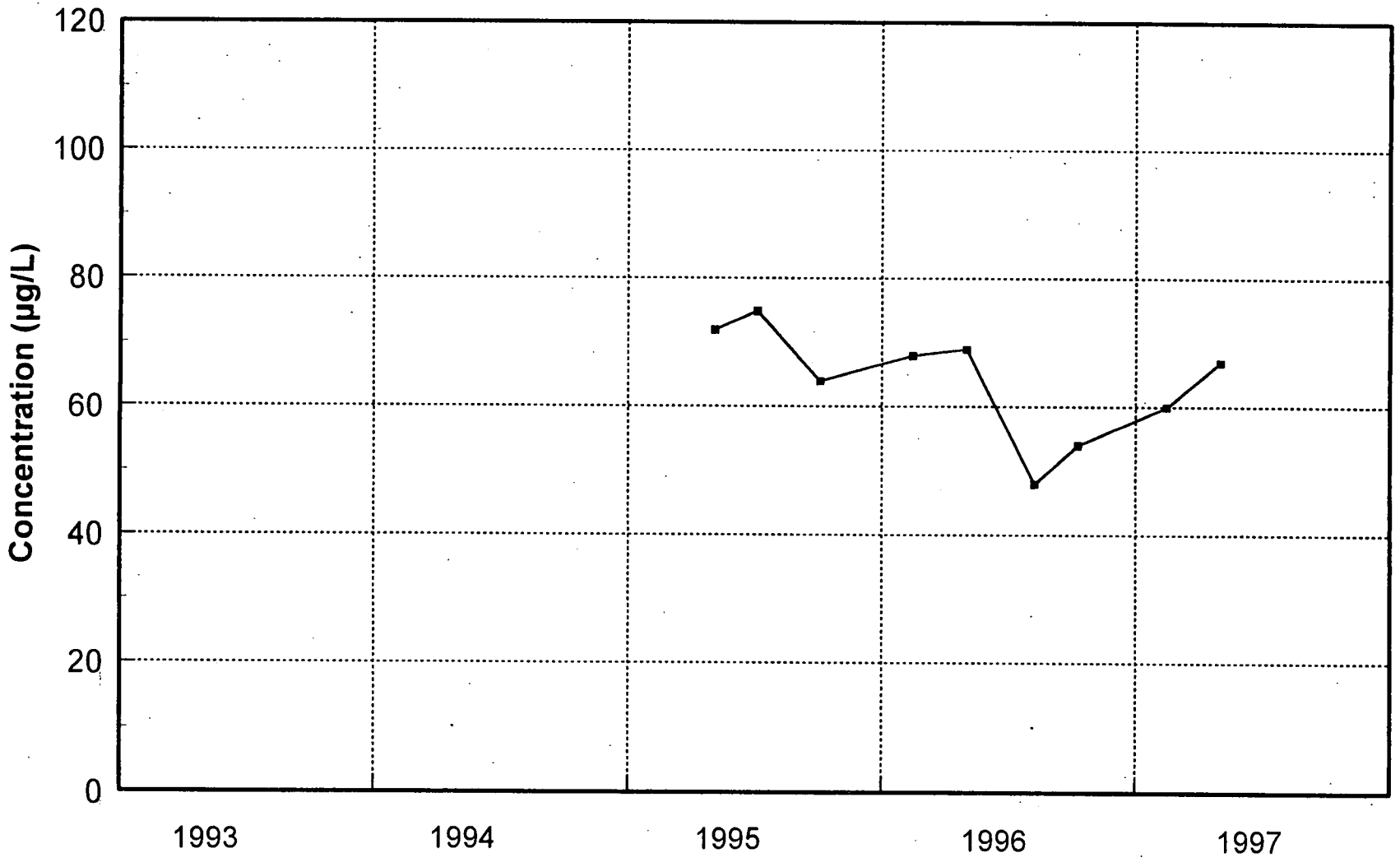
44



Monitoring Well 2125 Total Uranium Concentrations

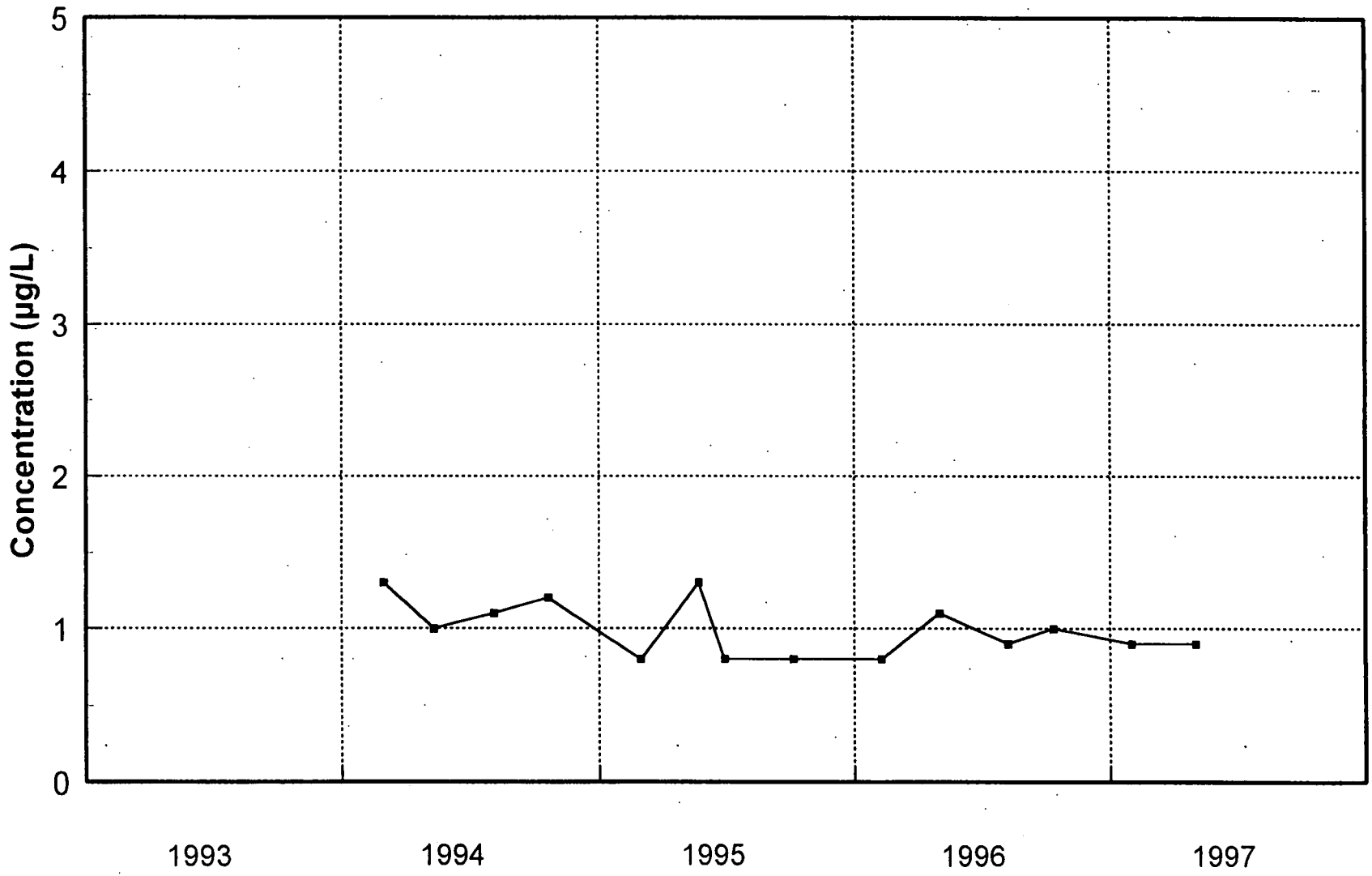


Monitoring Well 2128 Total Uranium Concentrations



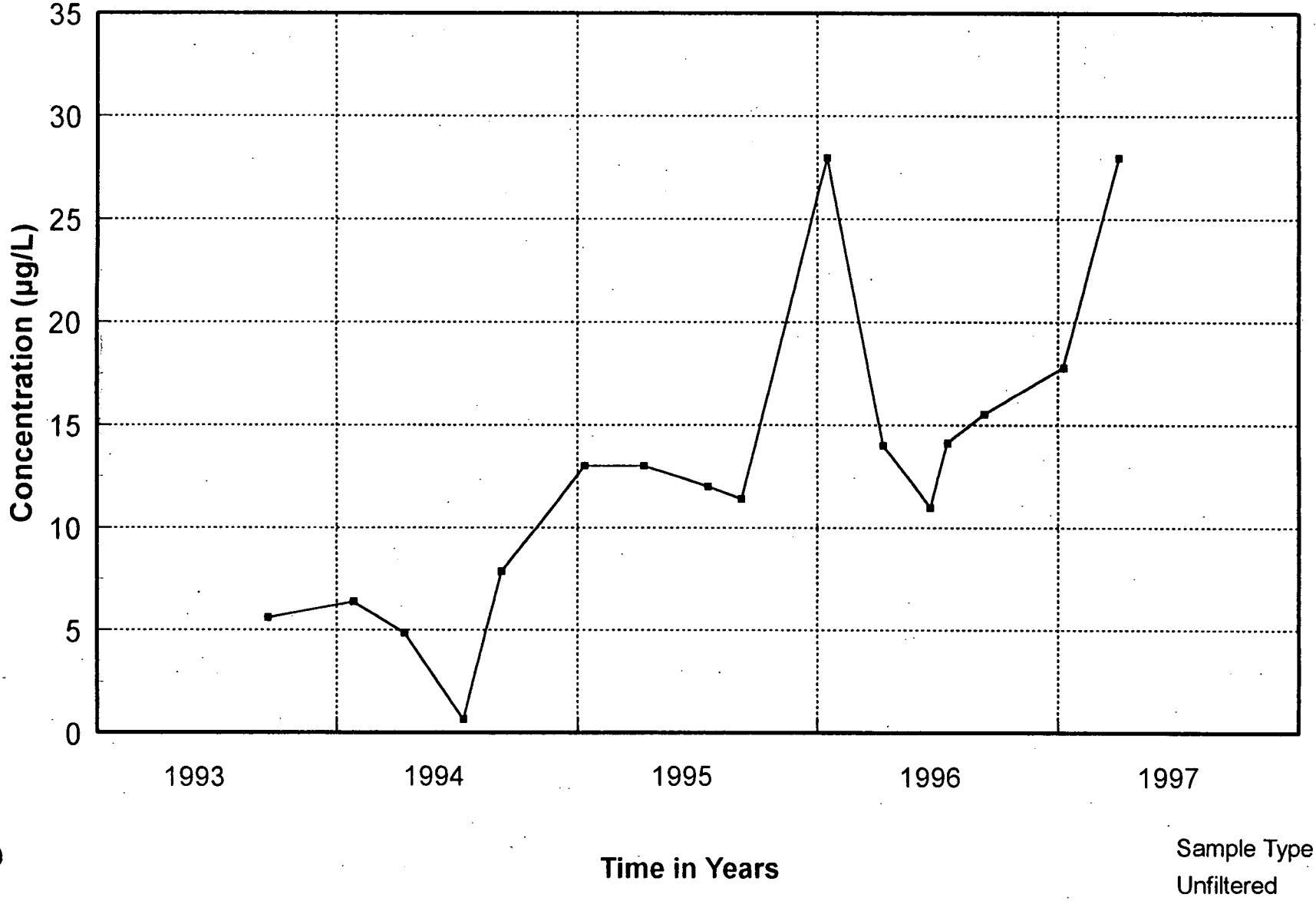
Sample Type =
Unfiltered

Monitoring Well 2166 Total Uranium Concentrations

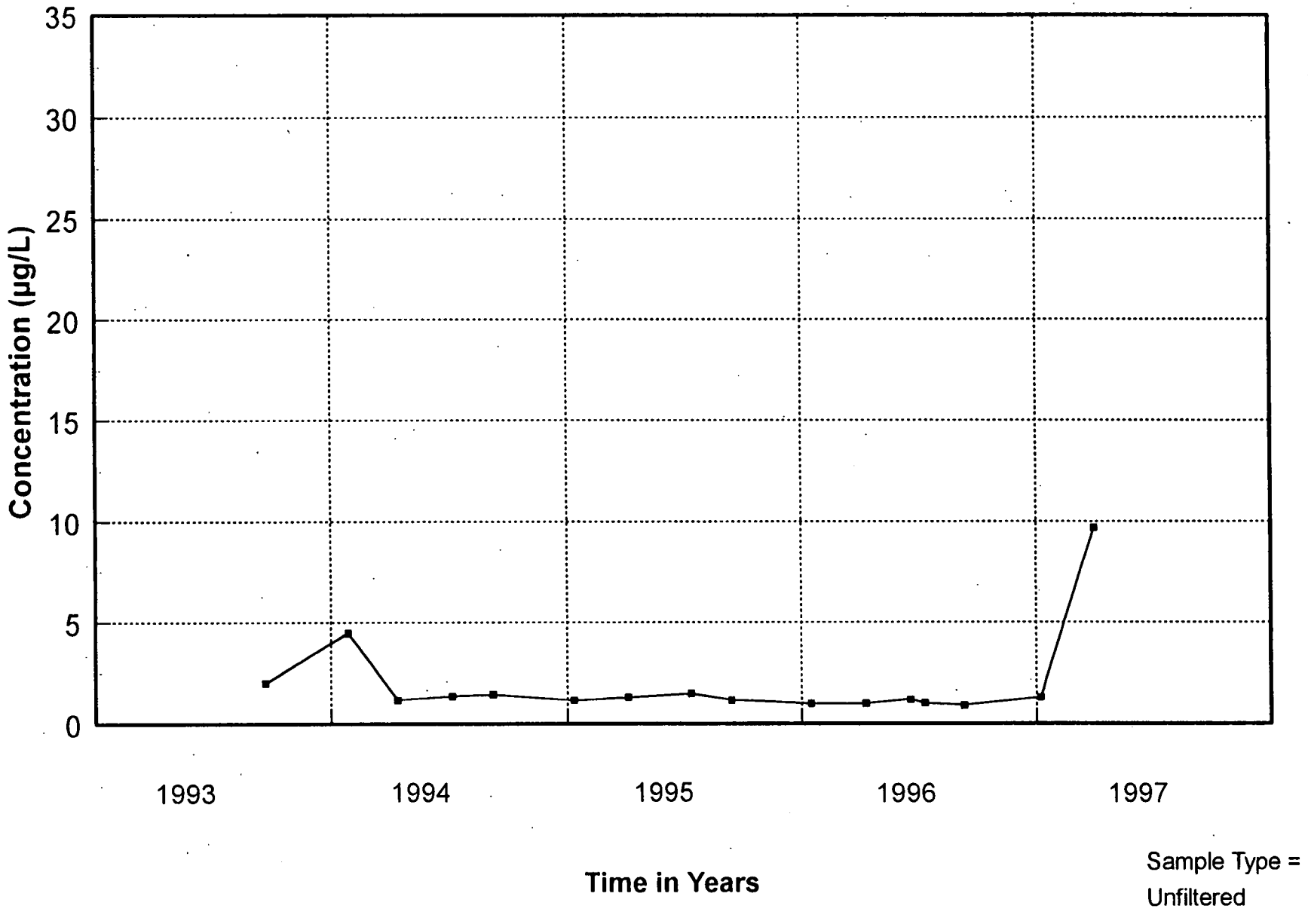


Sample Type =
Unfiltered

Monitoring Well 2396 Total Uranium Concentrations

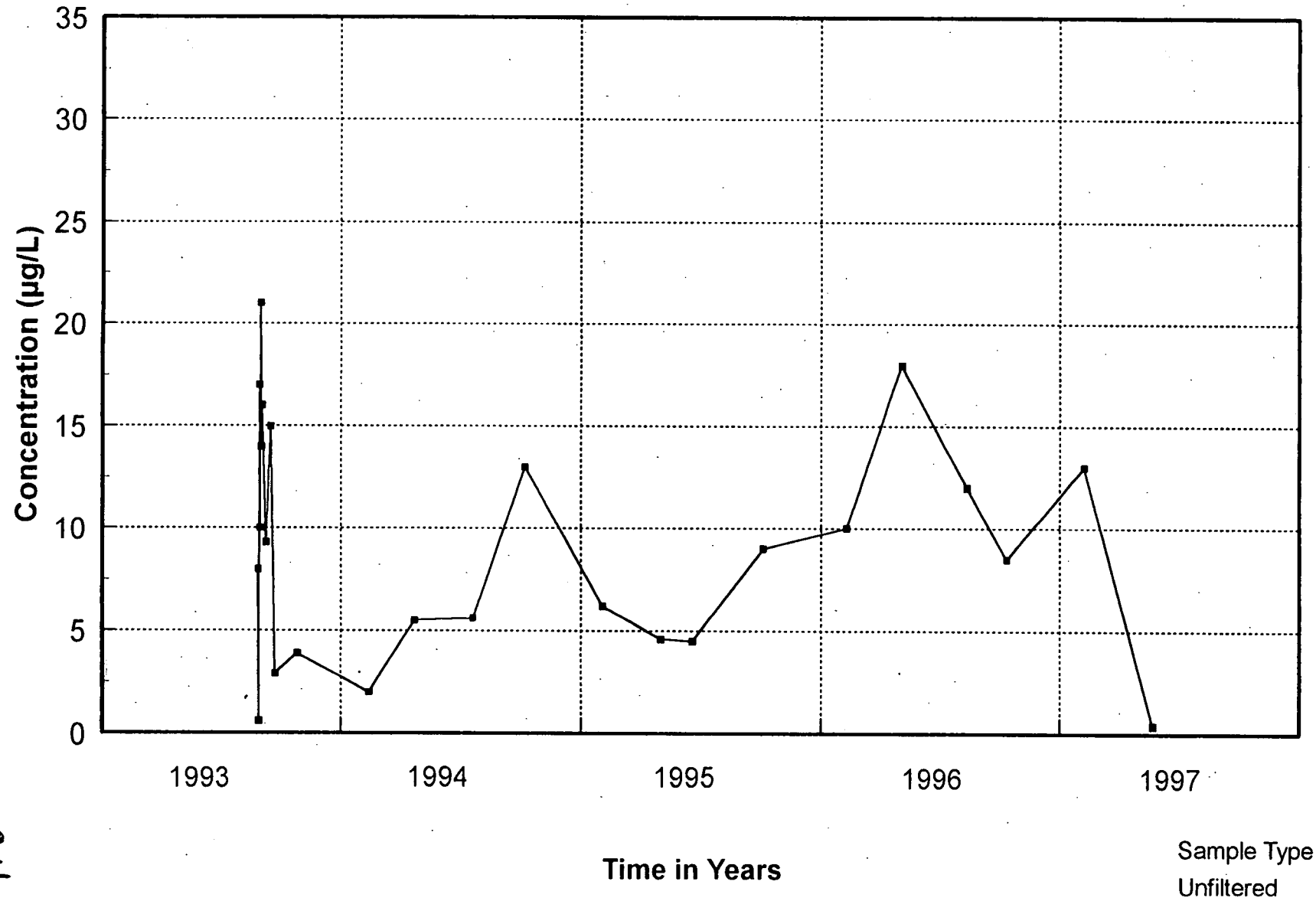


Monitoring Well 2398 Total Uranium Concentrations



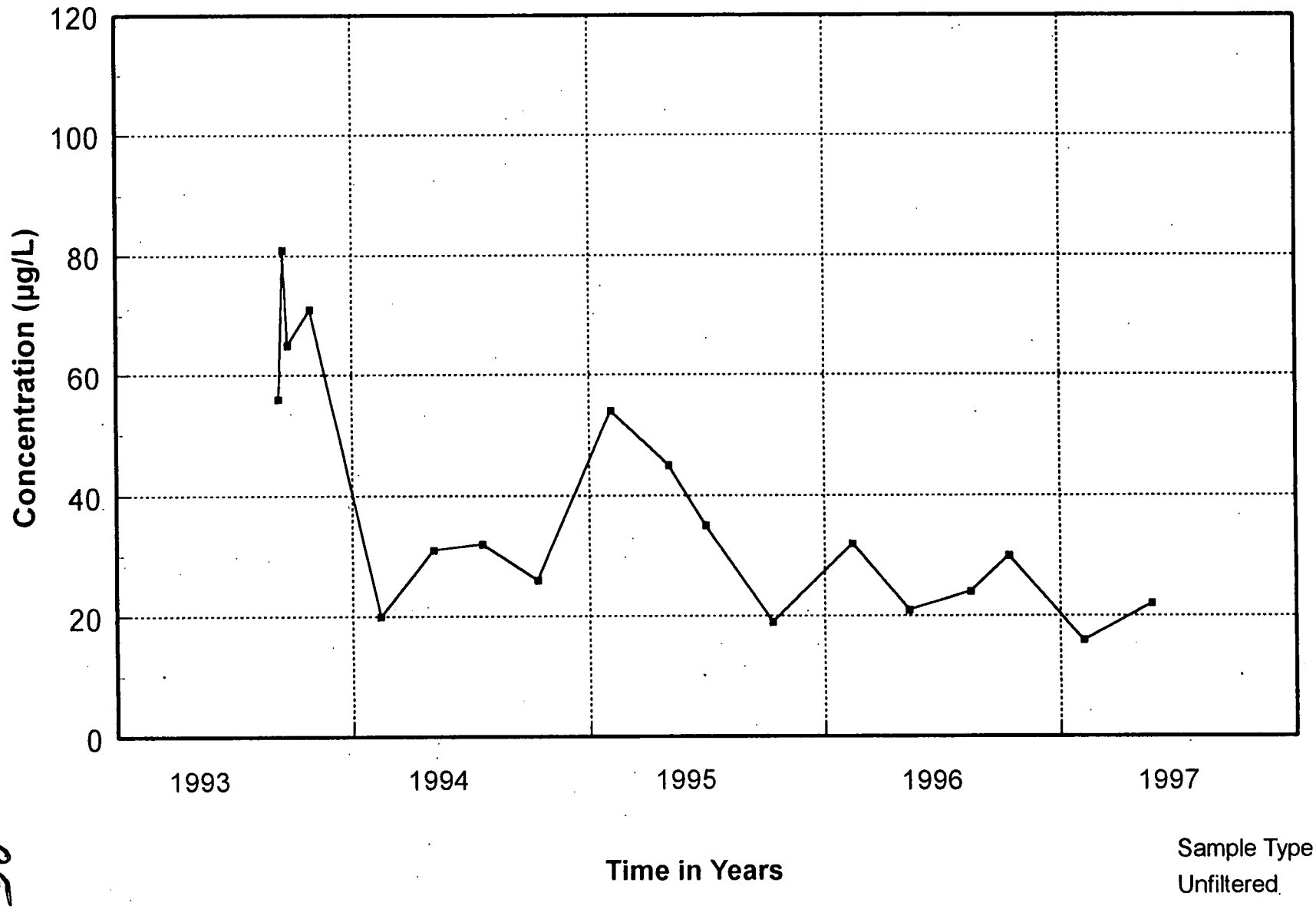
83

Monitoring Well 2434 Total Uranium Concentrations



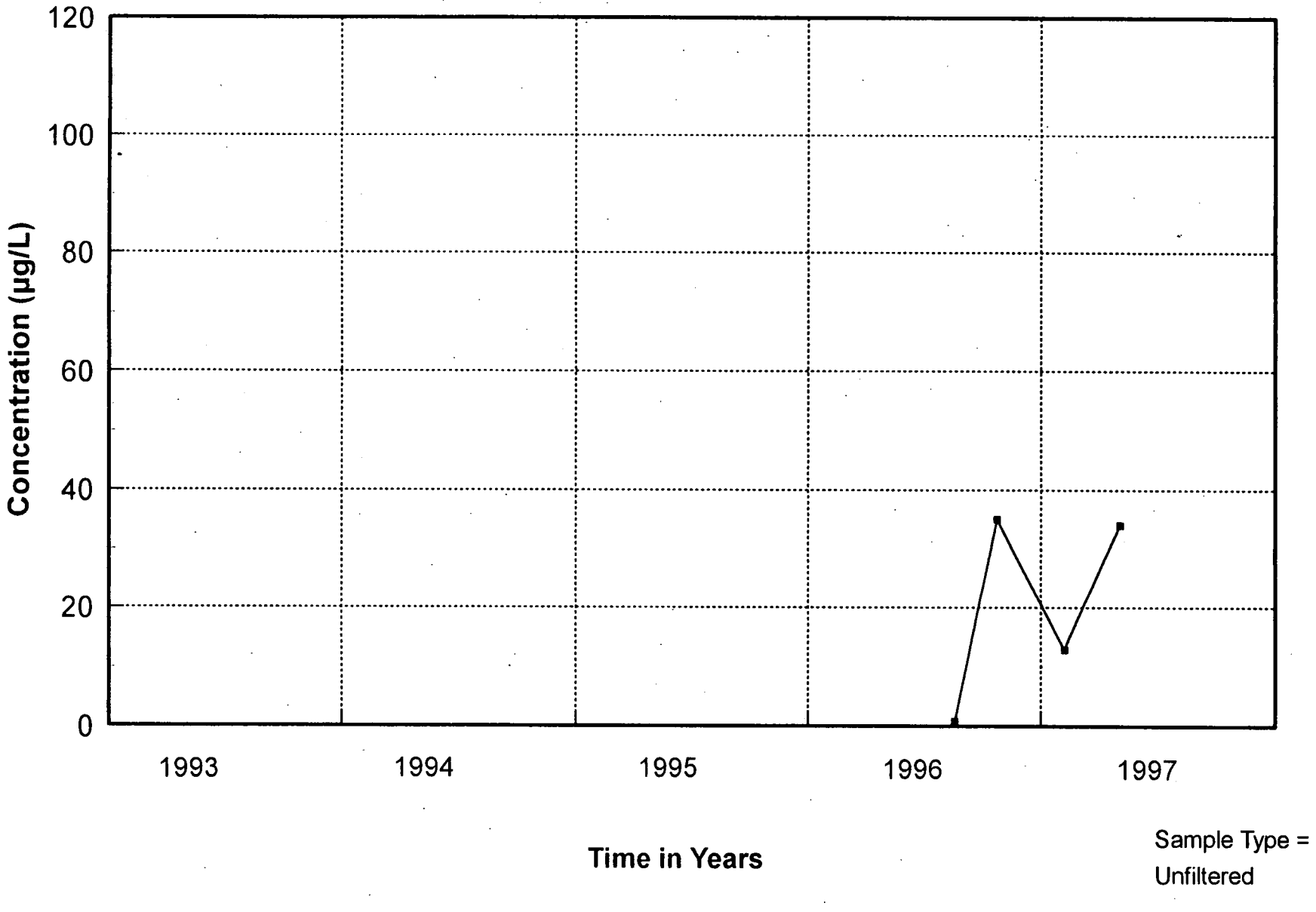
84

Monitoring Well 2544 Total Uranium Concentrations

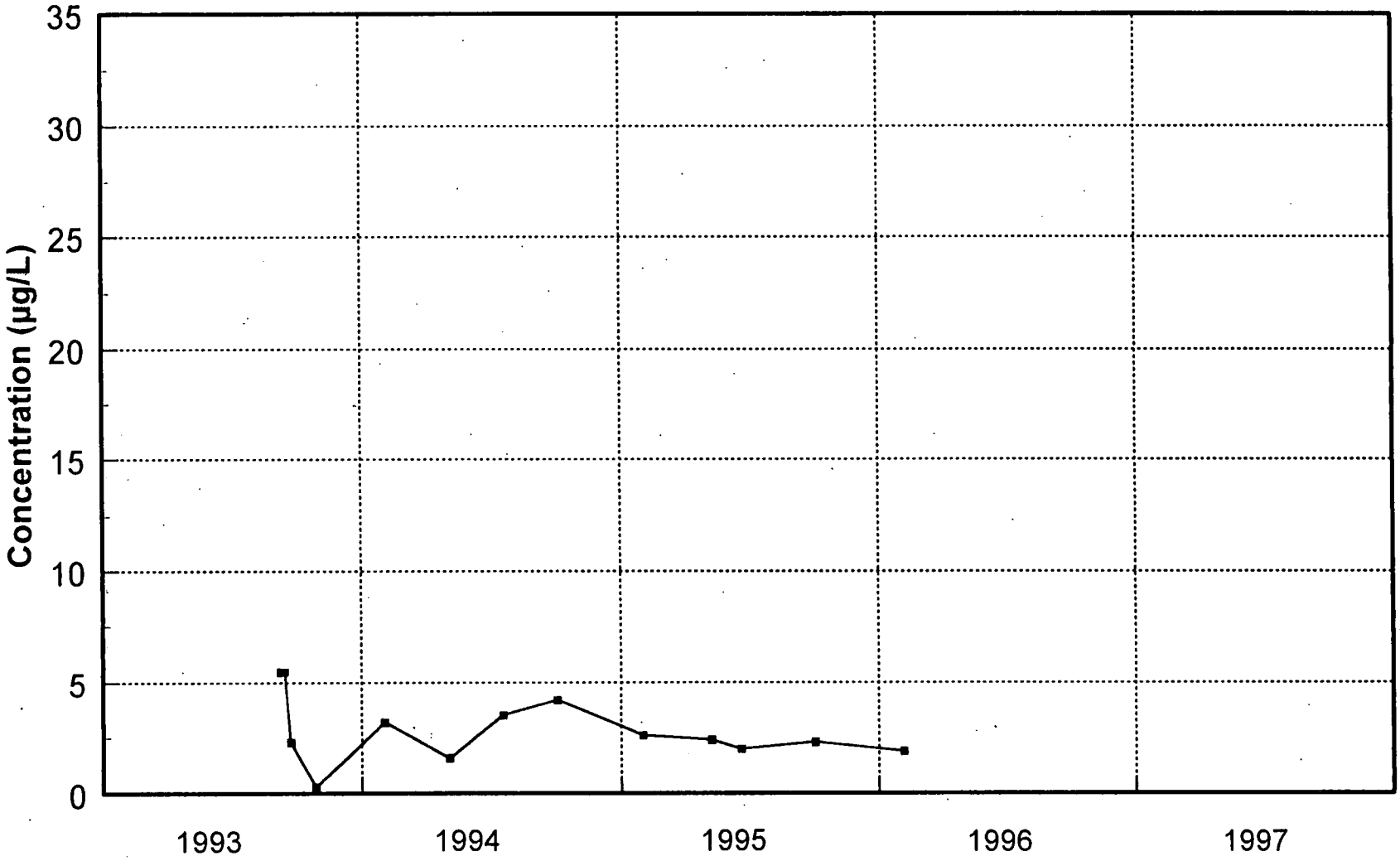


85

Monitoring Well 2545 Total Uranium Concentrations



Monitoring Well 2546 Total Uranium Concentrations

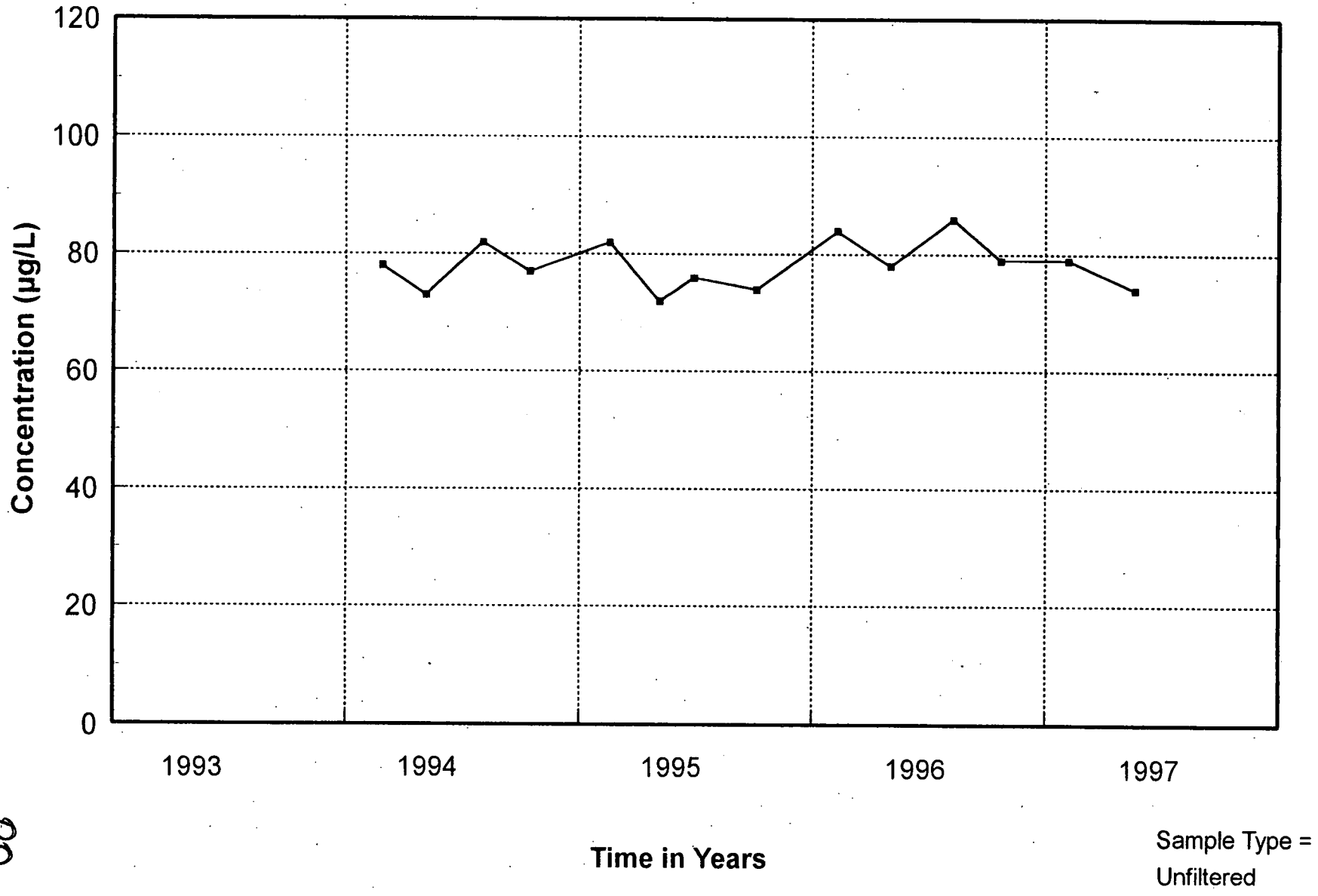


Due to access restrictions no samples have been collected since the first quarter of 1996.

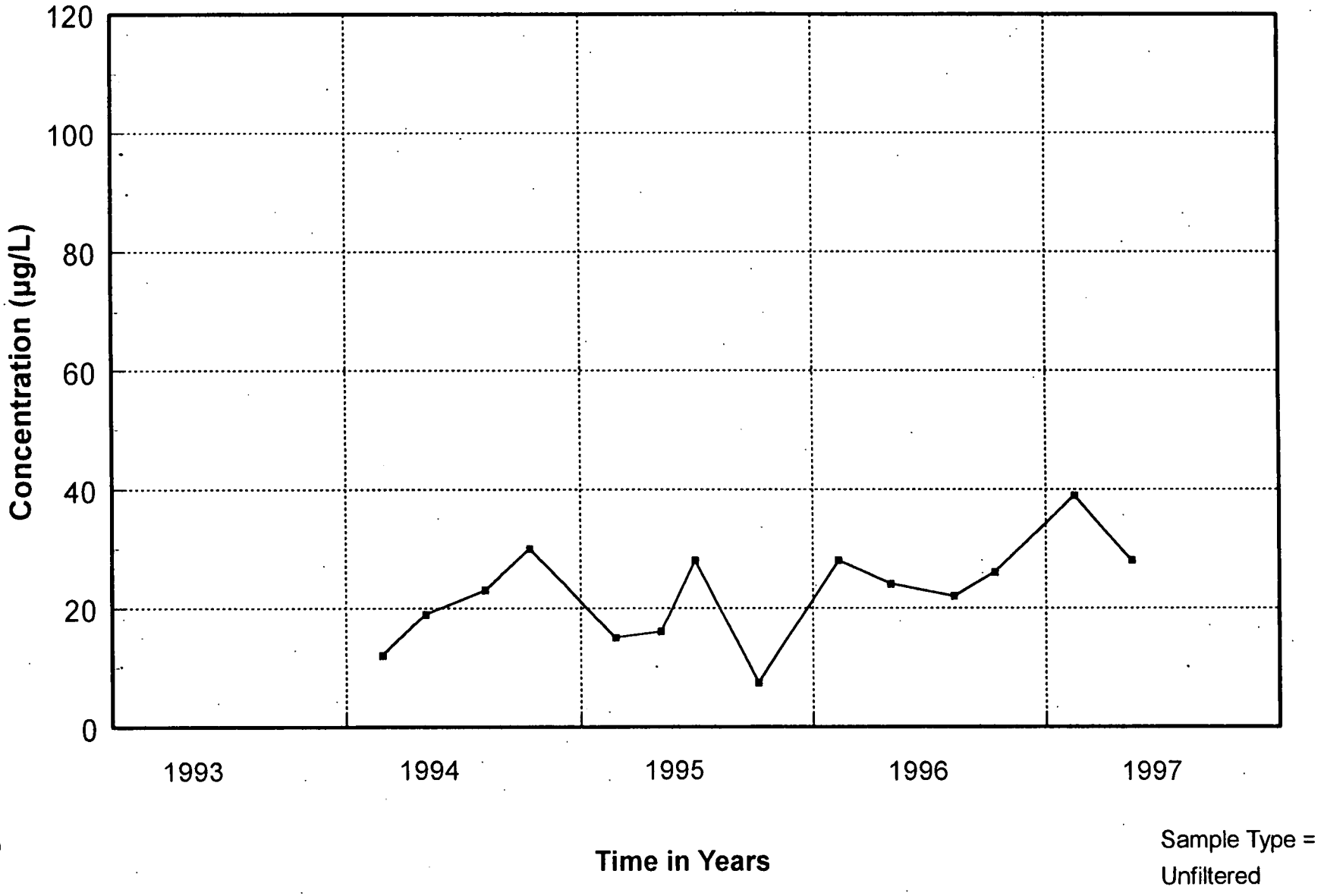
Sample Type = Unfiltered

Monitoring Well 2548 Total Uranium Concentrations

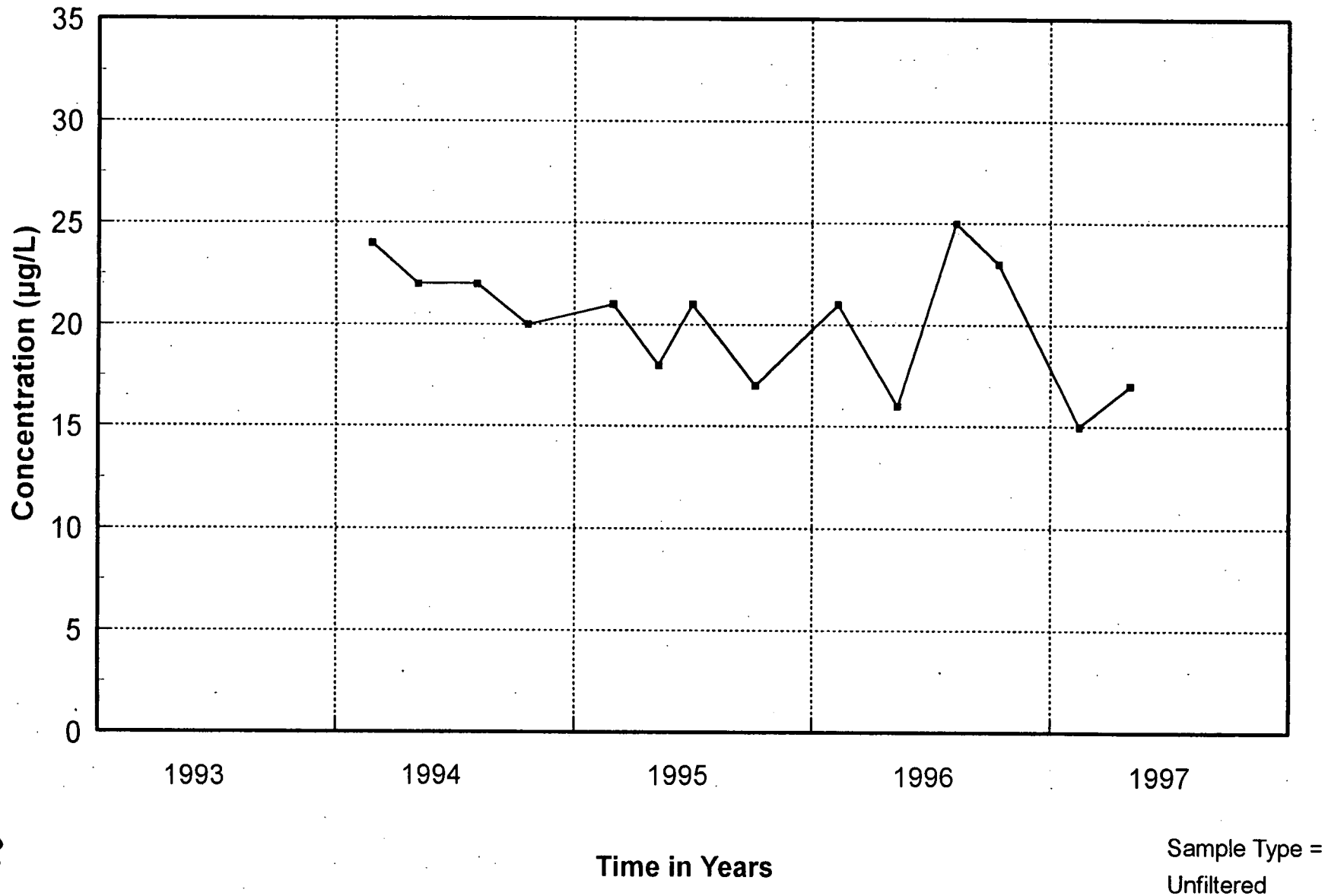
87



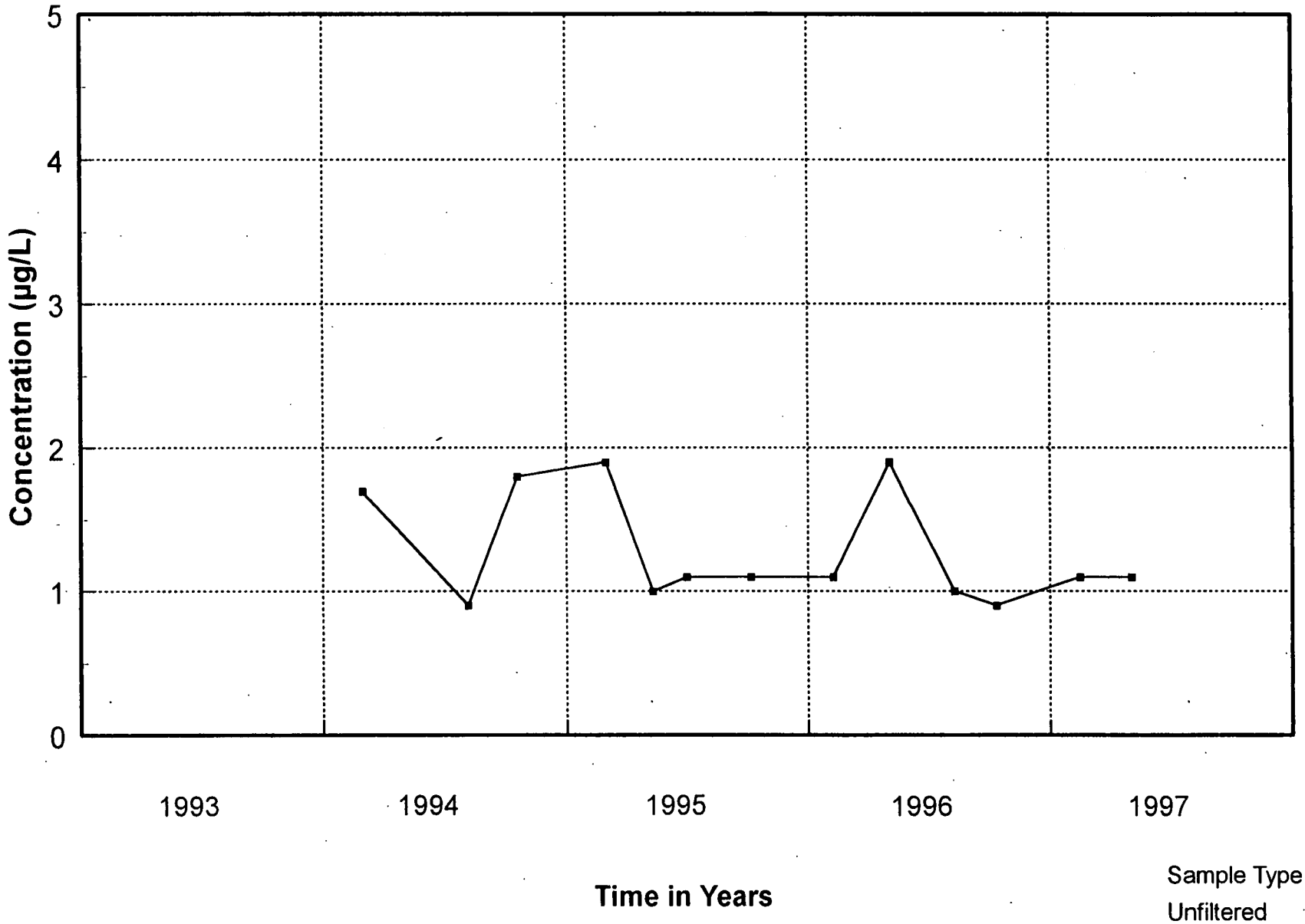
Monitoring Well 2550 Total Uranium Concentrations



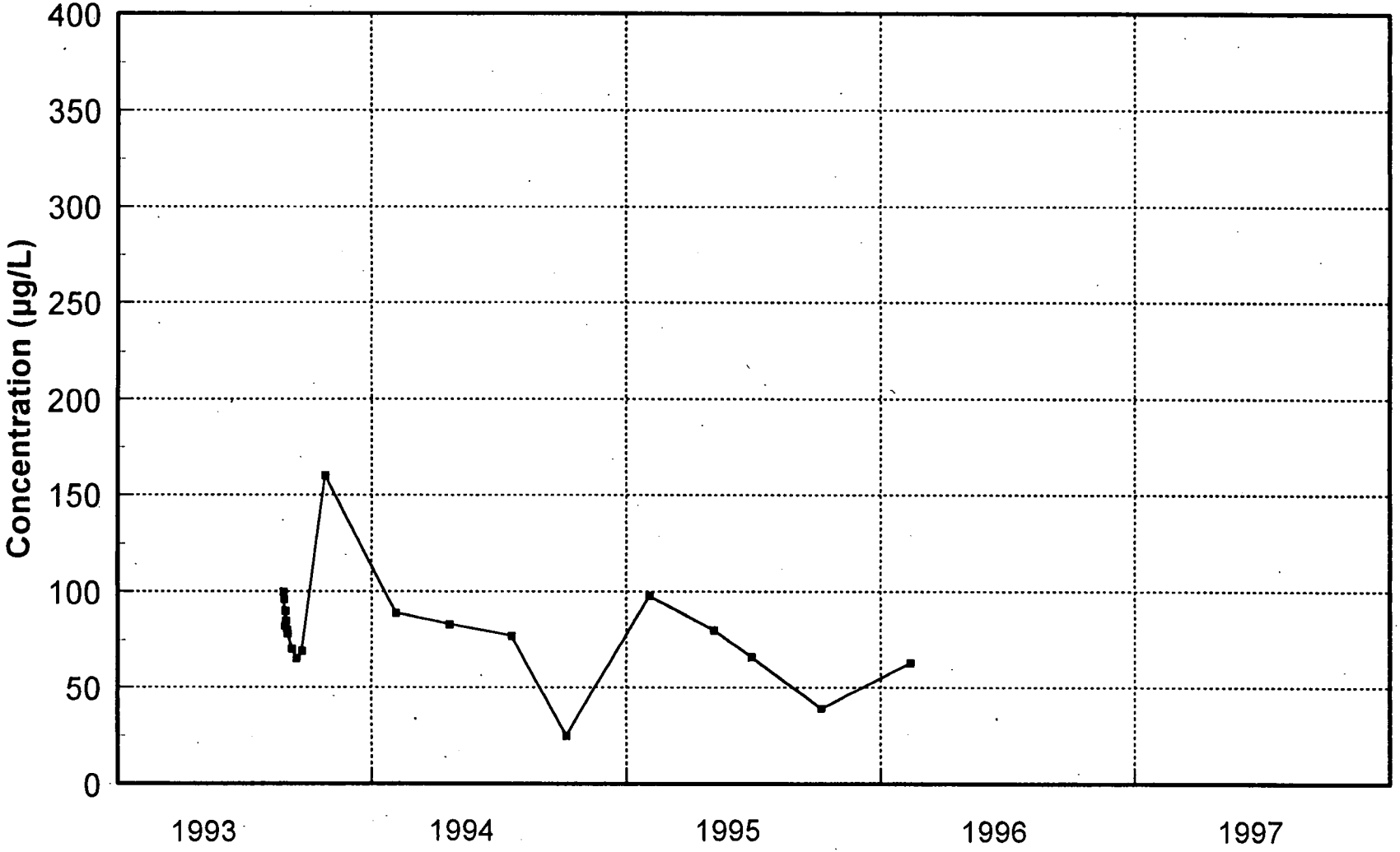
Monitoring Well 2551 Total Uranium Concentrations



Monitoring Well 2552 Total Uranium Concentrations



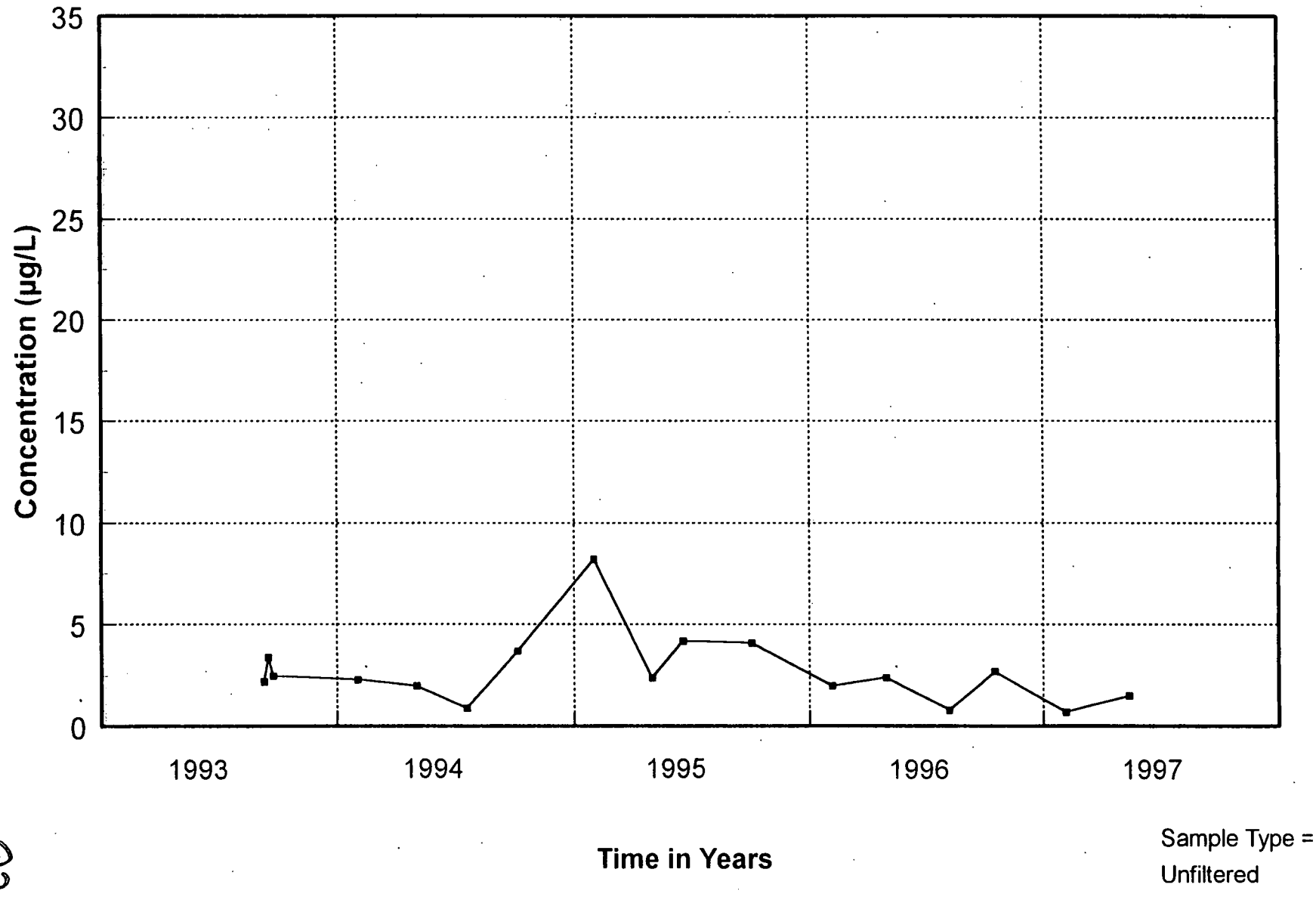
Monitoring Well 2553 Total Uranium Concentrations



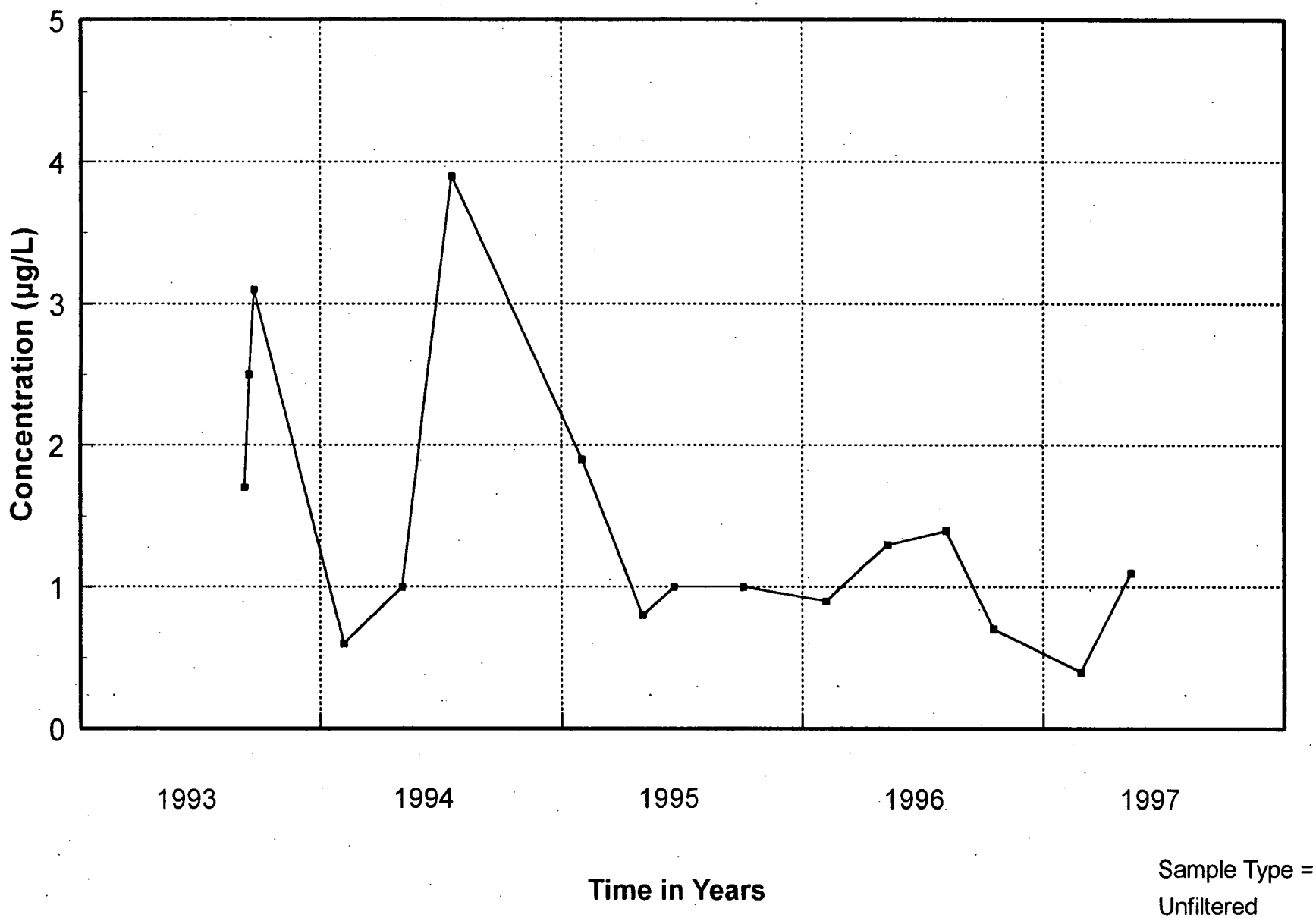
Due to access restrictions no samples have been collected since the first quarter of 1996.

Sample Type = Unfiltered

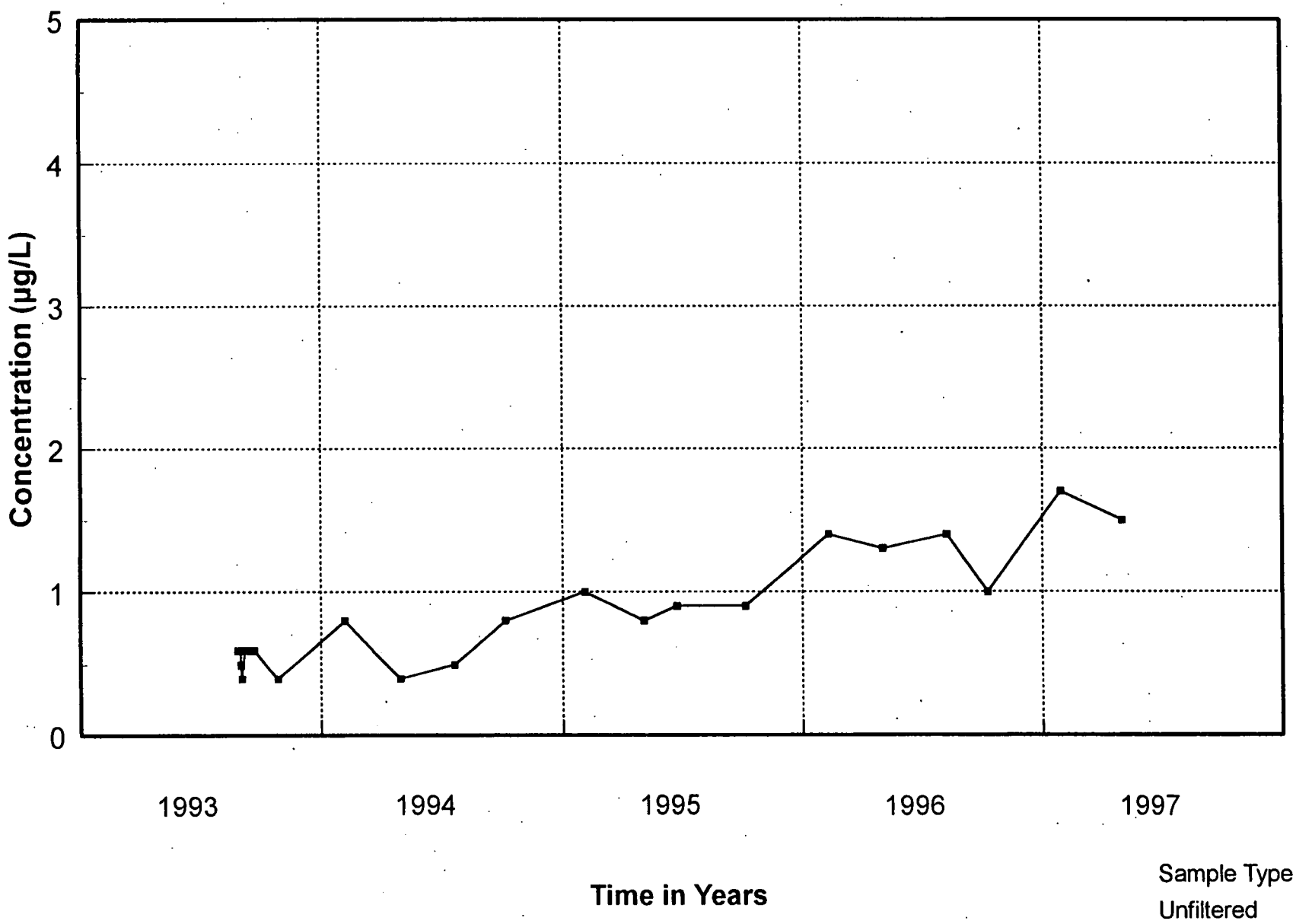
Monitoring Well 2624 Total Uranium Concentrations



Monitoring Well 2625 Total Uranium Concentrations

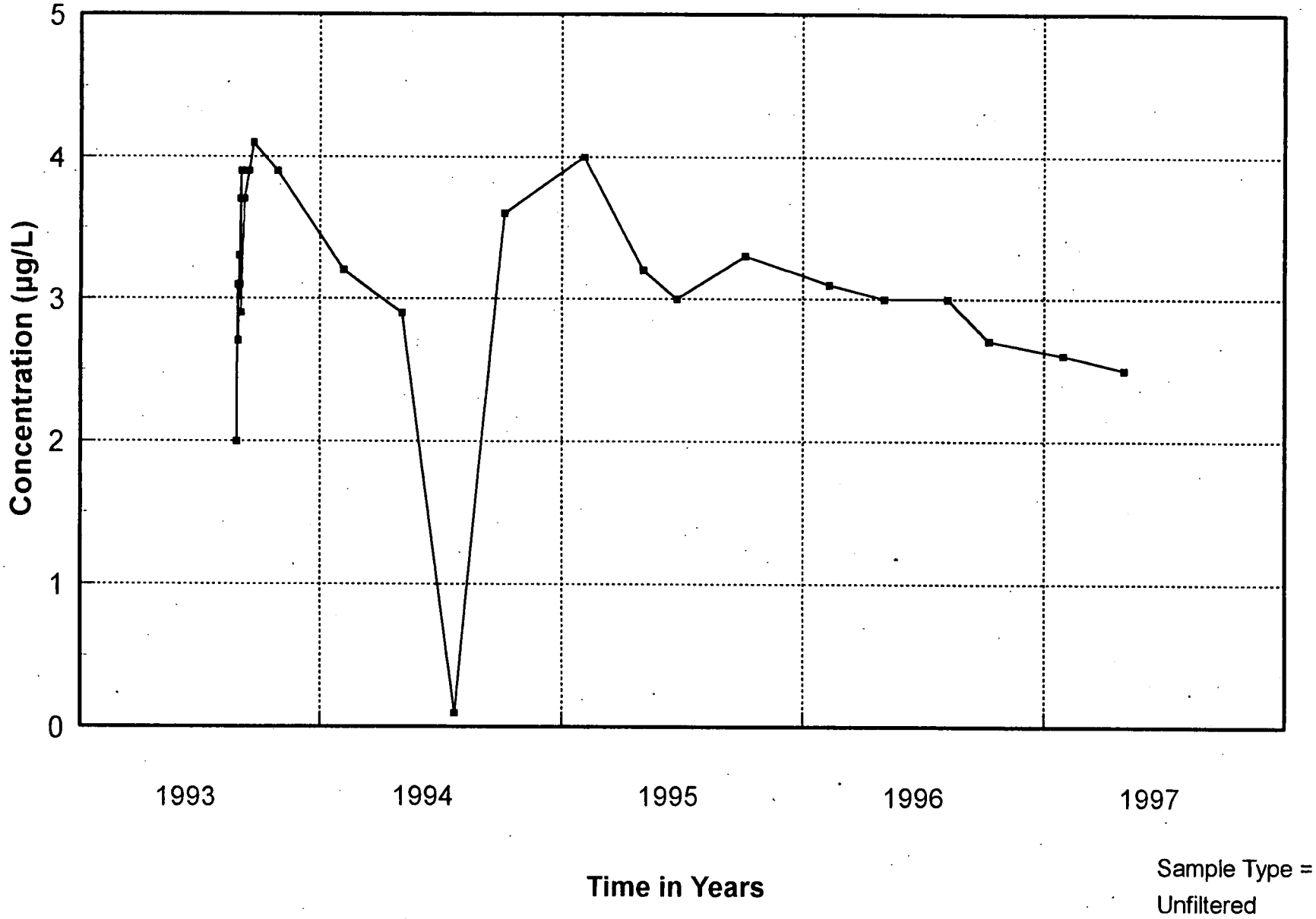


Monitoring Well 2636 Total Uranium Concentrations

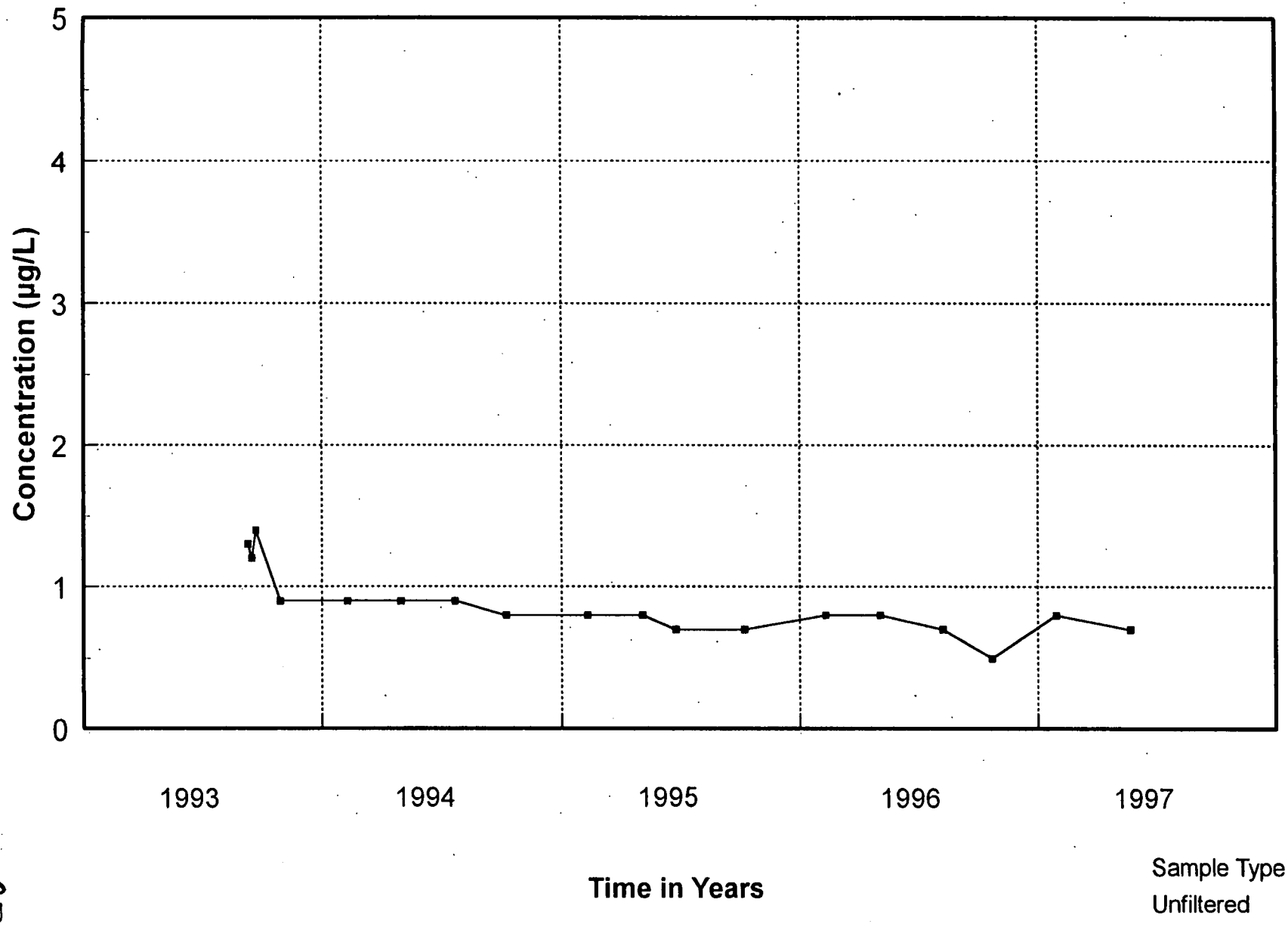


95

Monitoring Well 2880 Total Uranium Concentrations

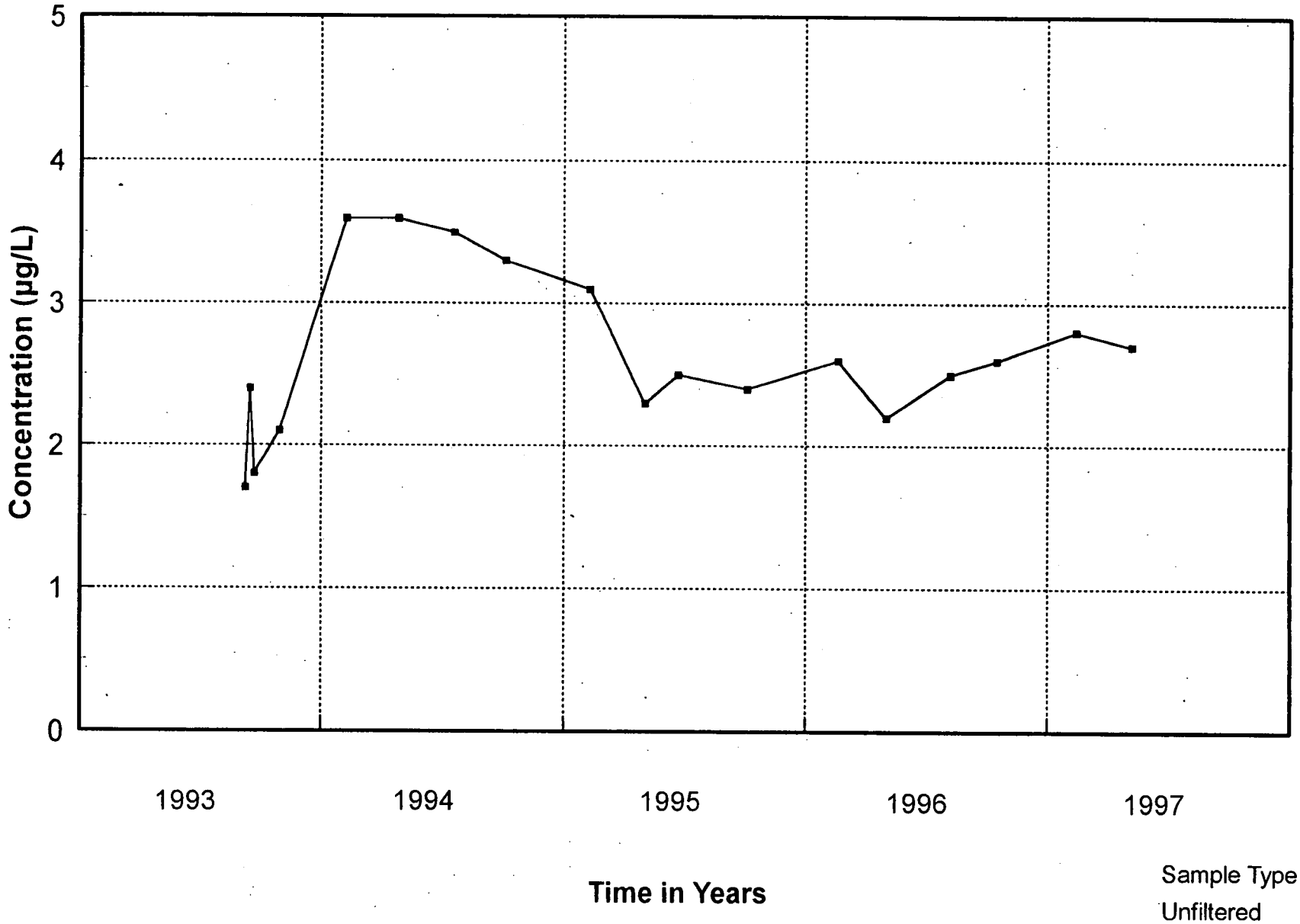


Monitoring Well 2881 Total Uranium Concentrations



Monitoring Well 2897 Total Uranium Concentrations

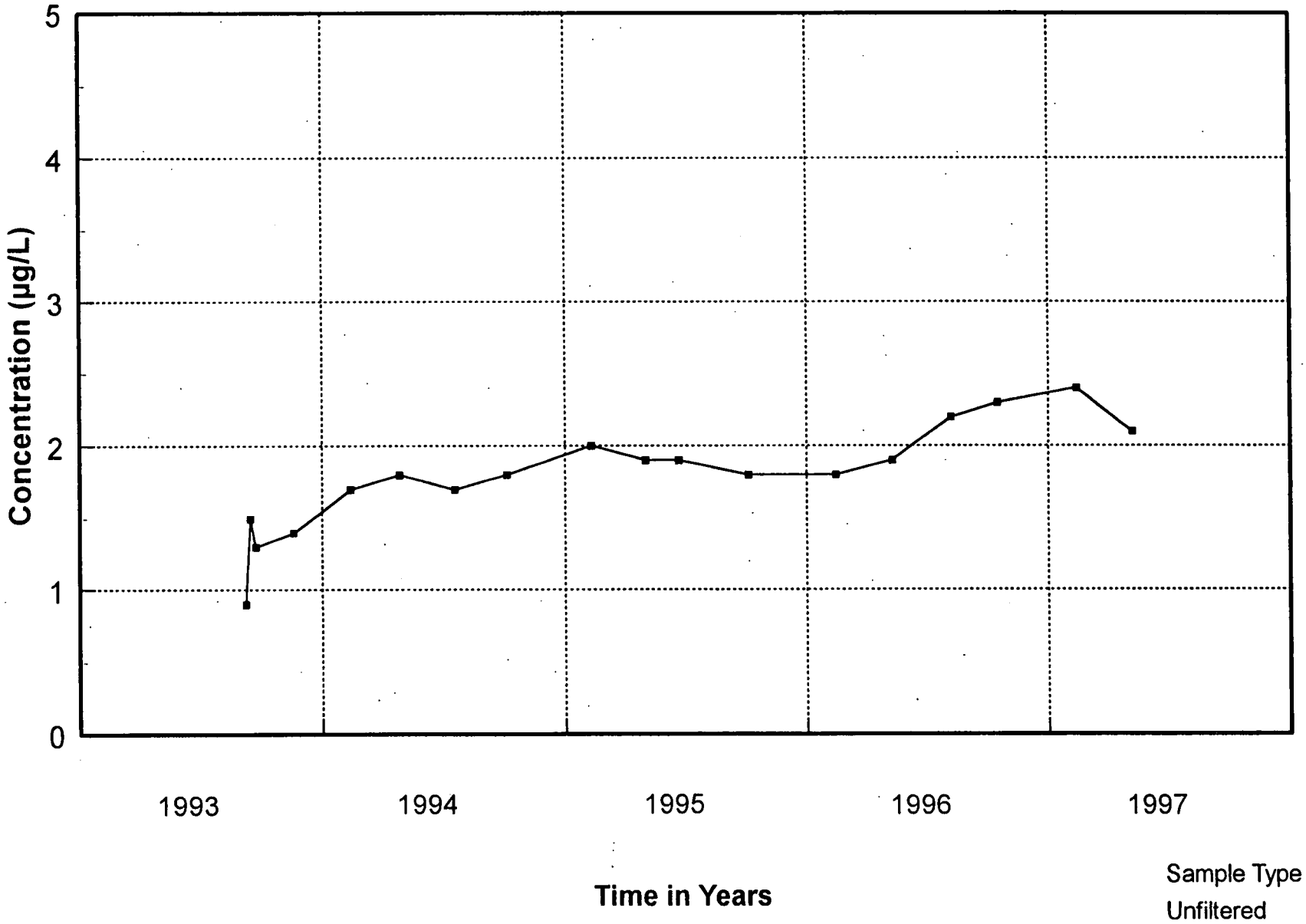
97



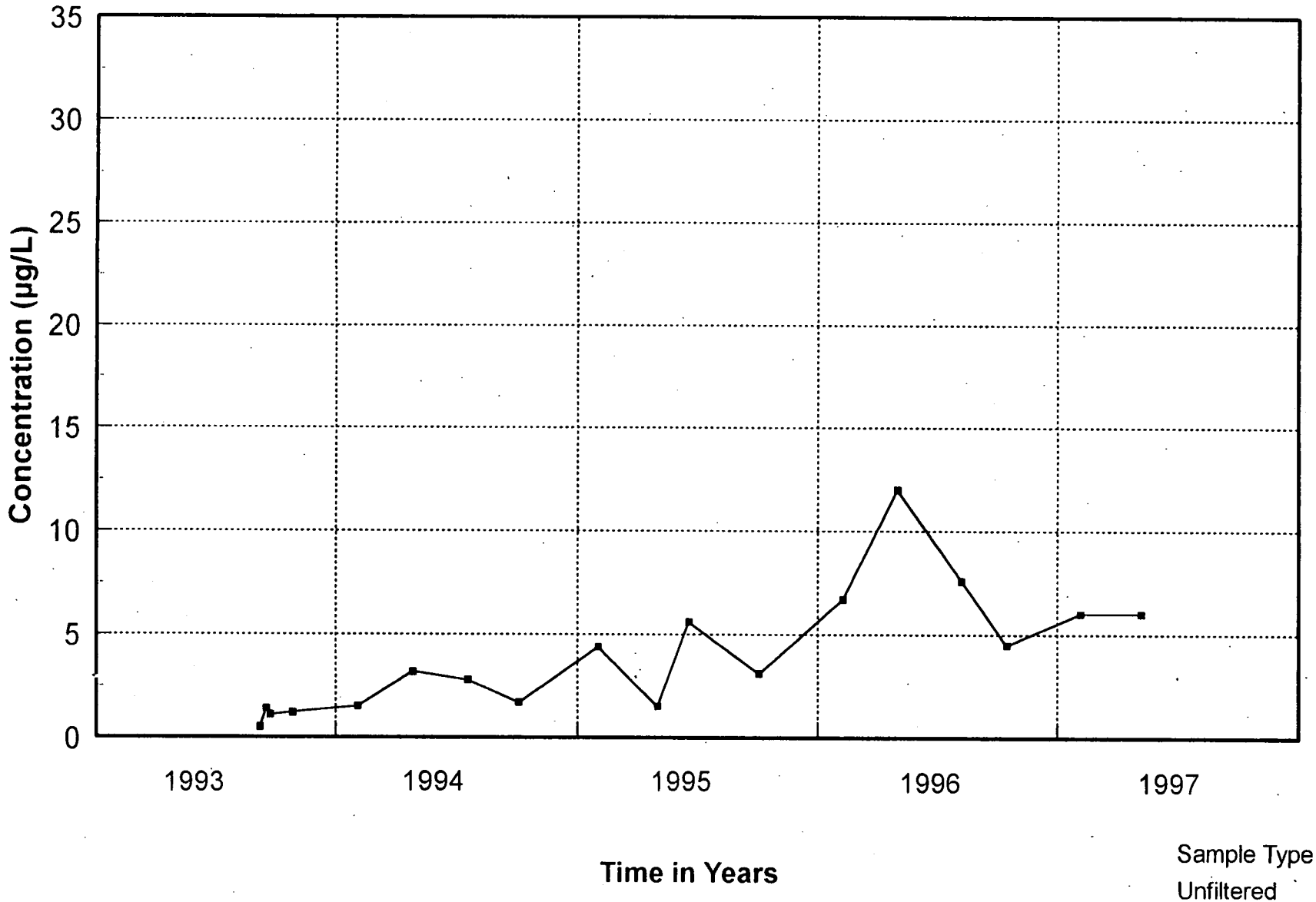
Monitoring Well 2898 Total Uranium Concentrations

98

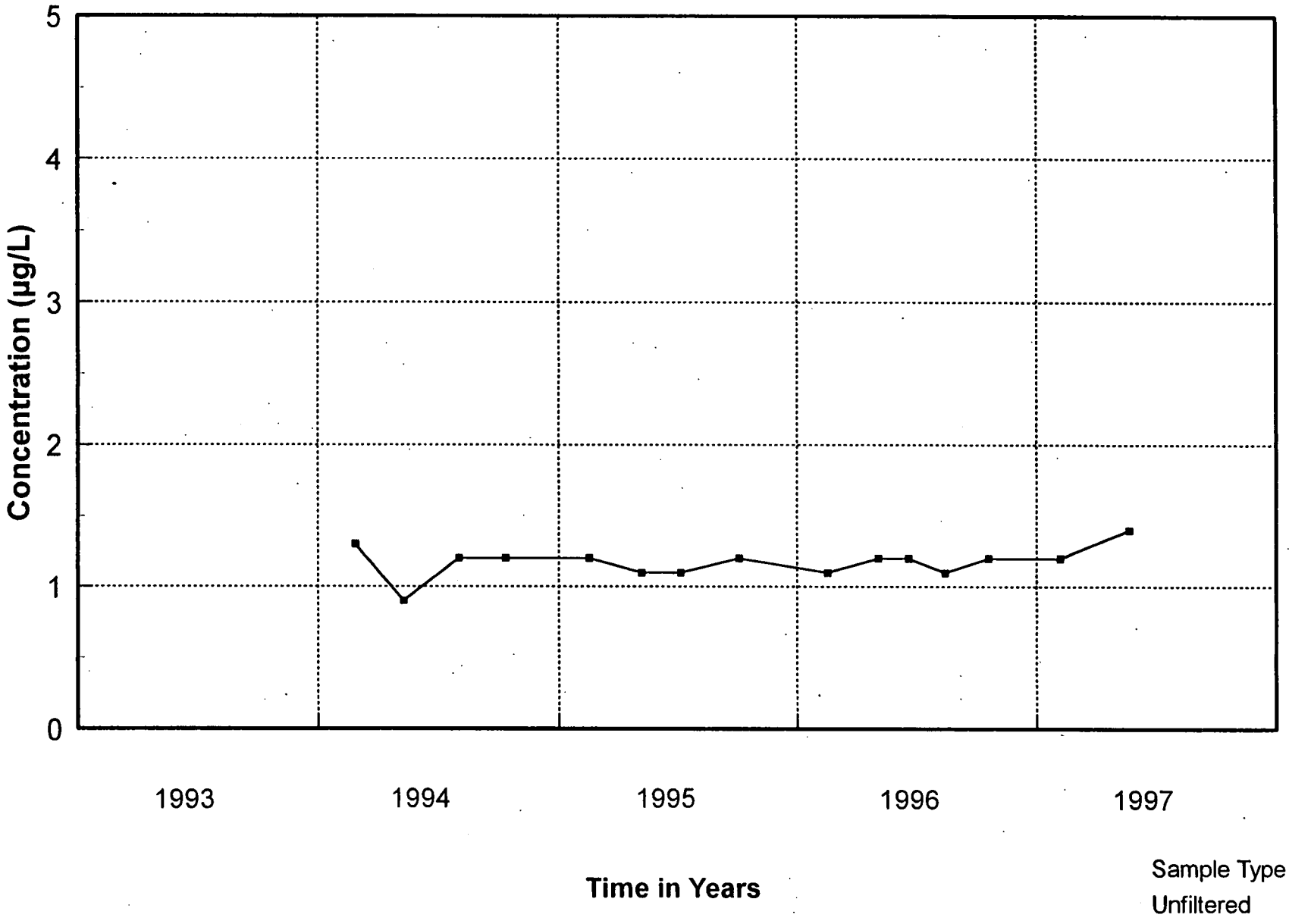
1024



Monitoring Well 2899 Total Uranium Concentrations

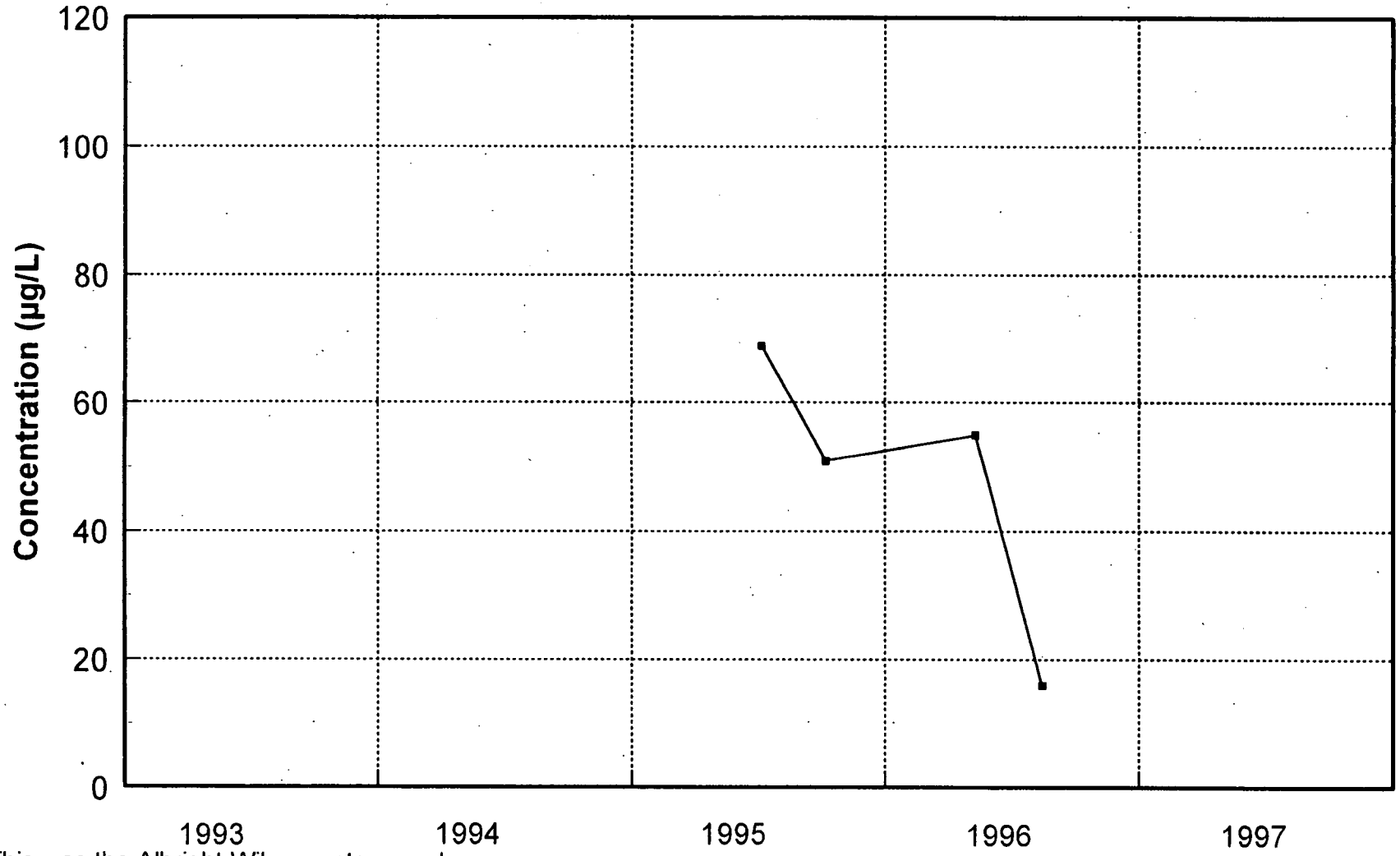


Monitoring Well 2900 Total Uranium Concentrations



Monitoring Well 3015 Total Uranium Concentrations

181



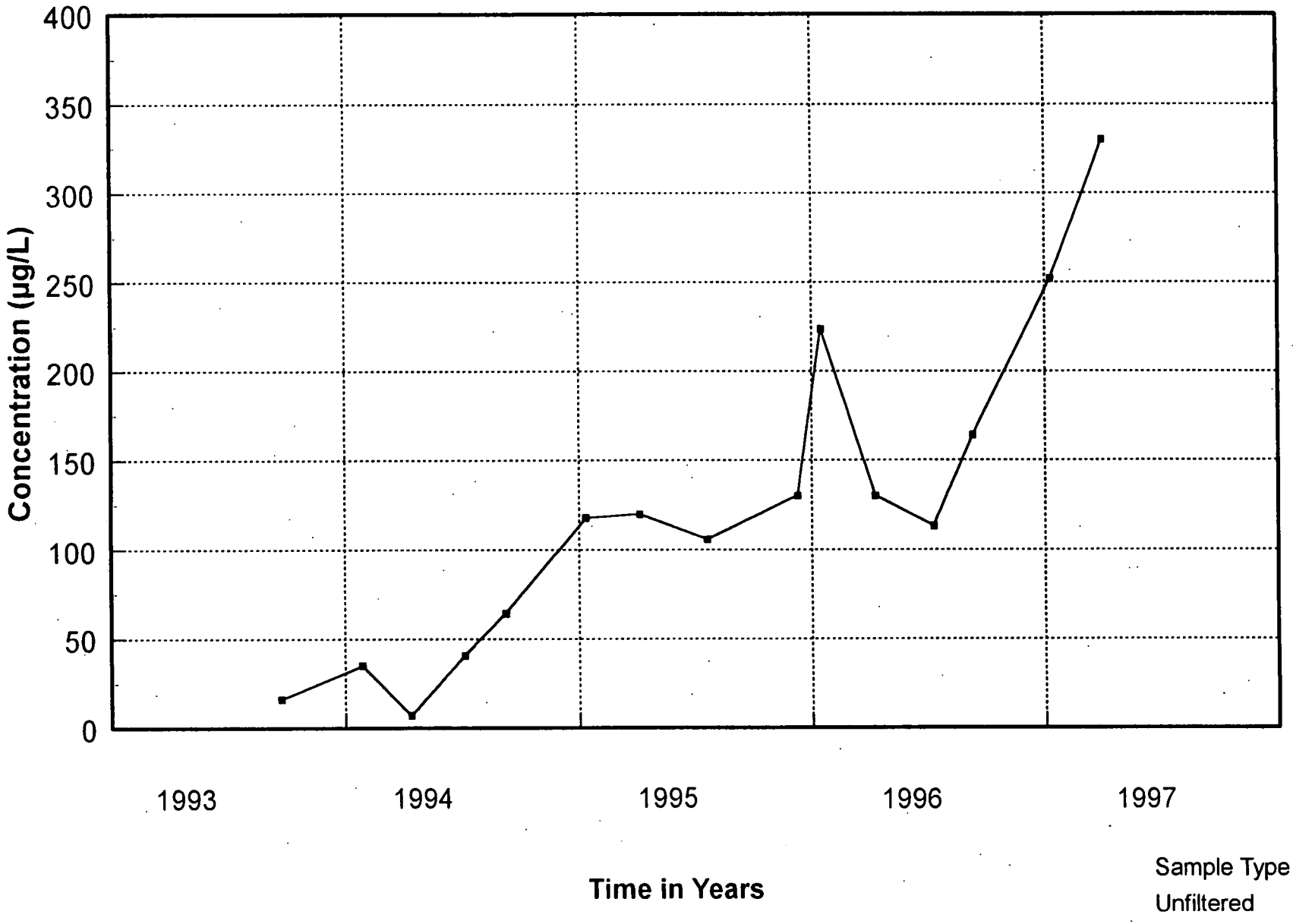
This was the Albright Wilson water supply well before the alternate water supply was available. No samples have been collected since third quarter 1996 because electrical service to the well has been unavailable.

Sample Type = Unfiltered

Monitoring Well 3062 Total Uranium Concentrations

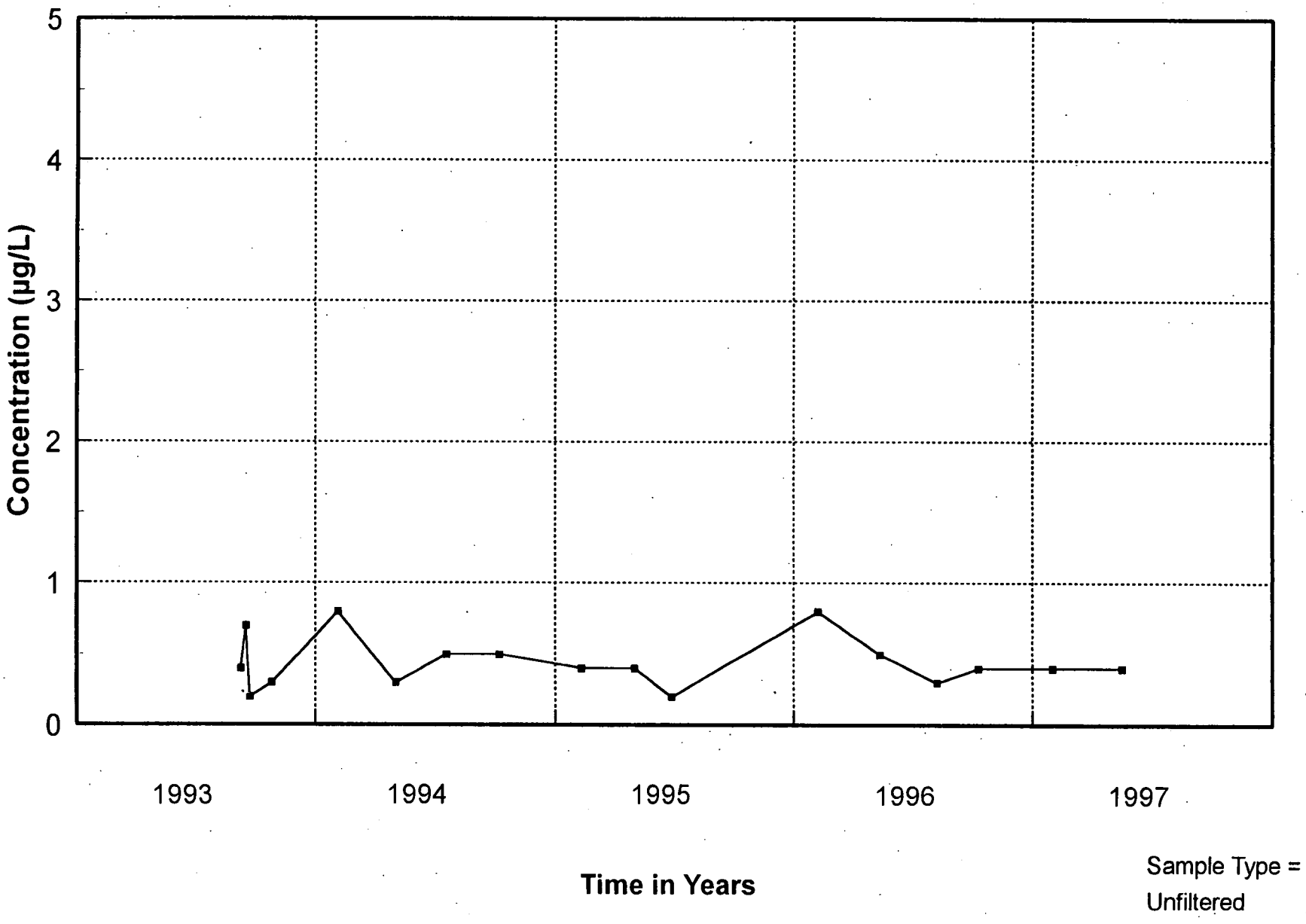
102

1024

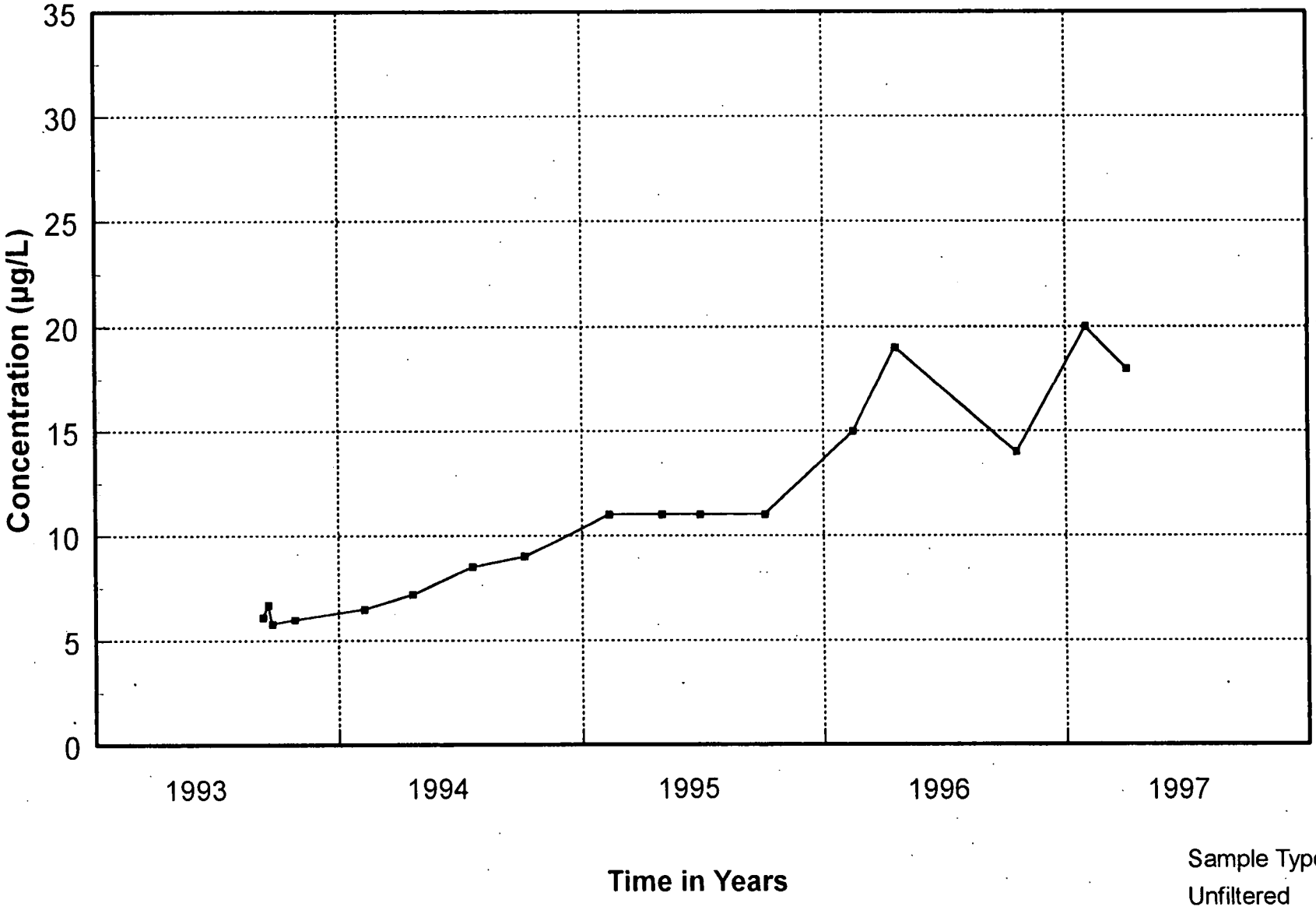


103

Monitoring Well 3069 Total Uranium Concentrations

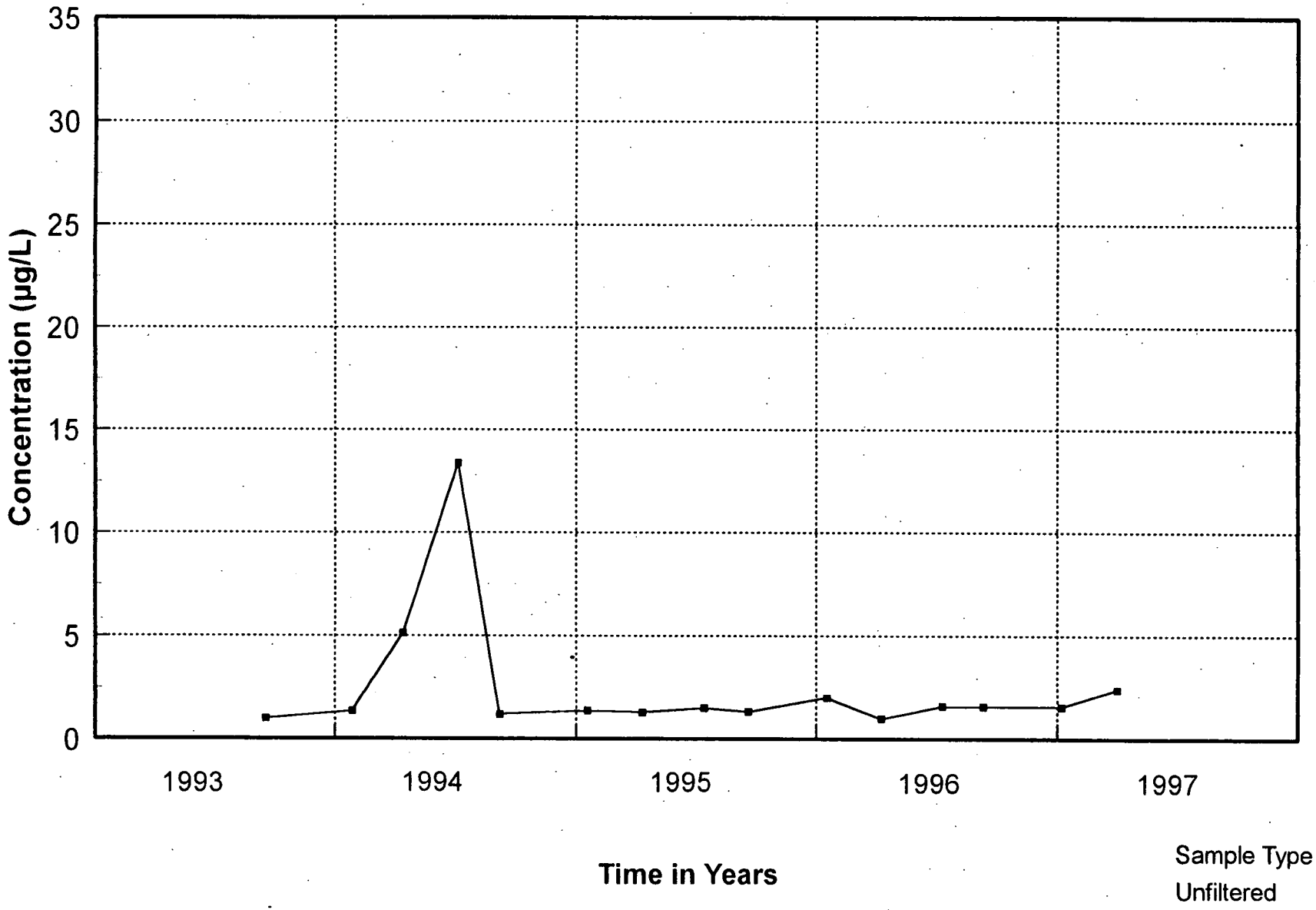


Monitoring Well 3093 Total Uranium Concentrations

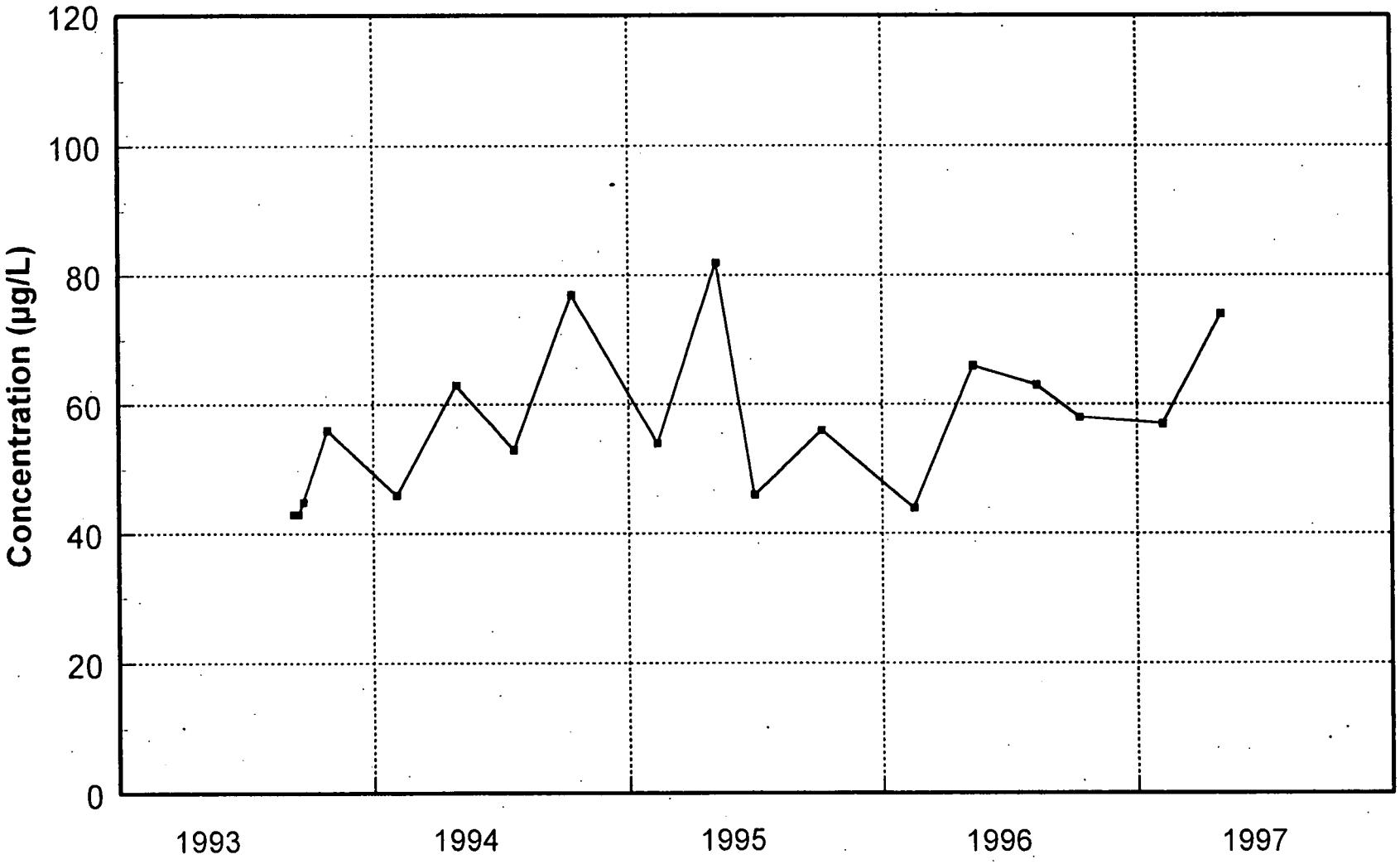


Monitoring Well 3095 Total Uranium Concentrations

105

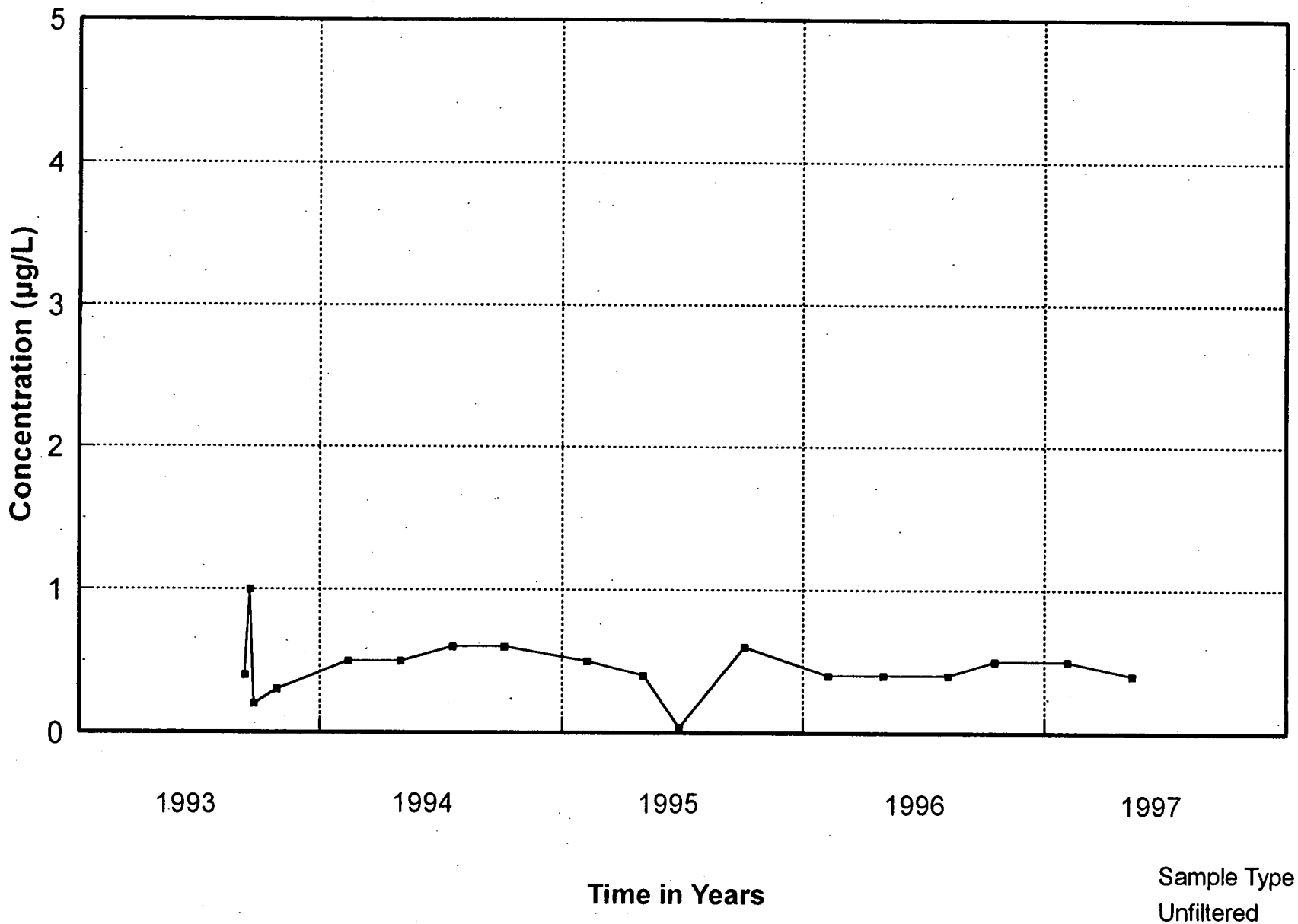


Monitoring Well 3106 Total Uranium Concentrations

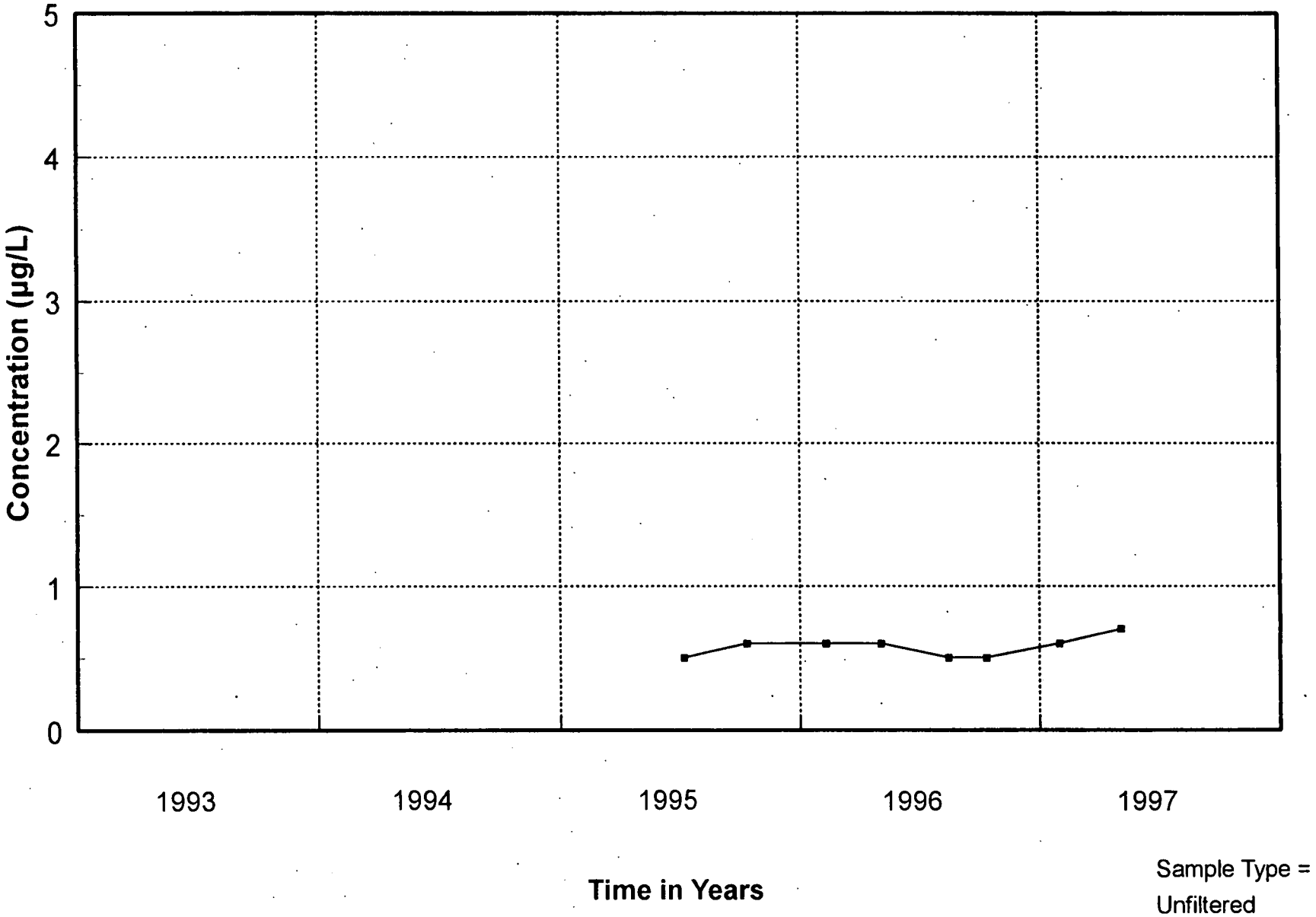


Sample Type =
Unfiltered

Monitoring Well 3125 Total Uranium Concentrations

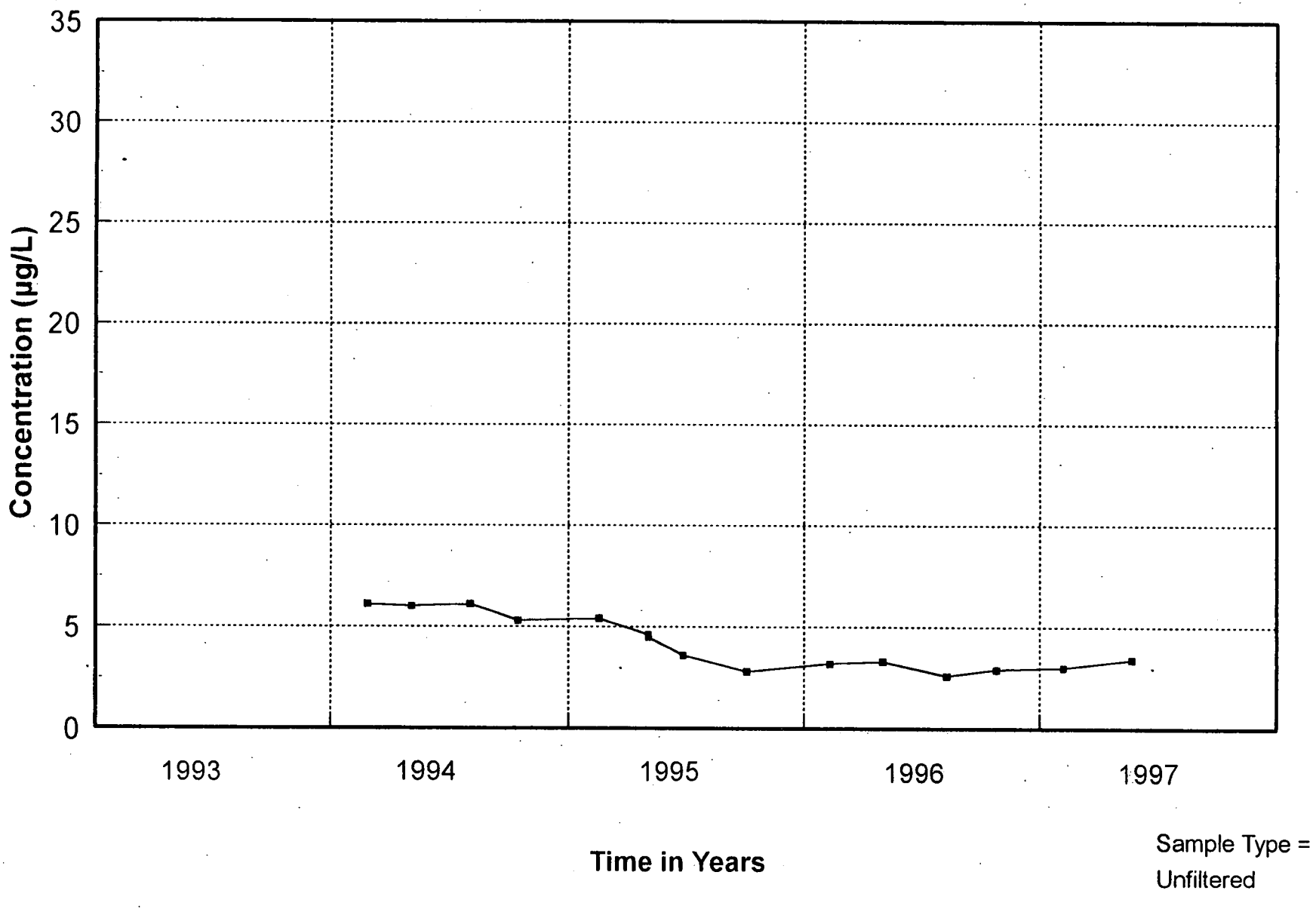


Monitoring Well 3128 Total Uranium Concentrations

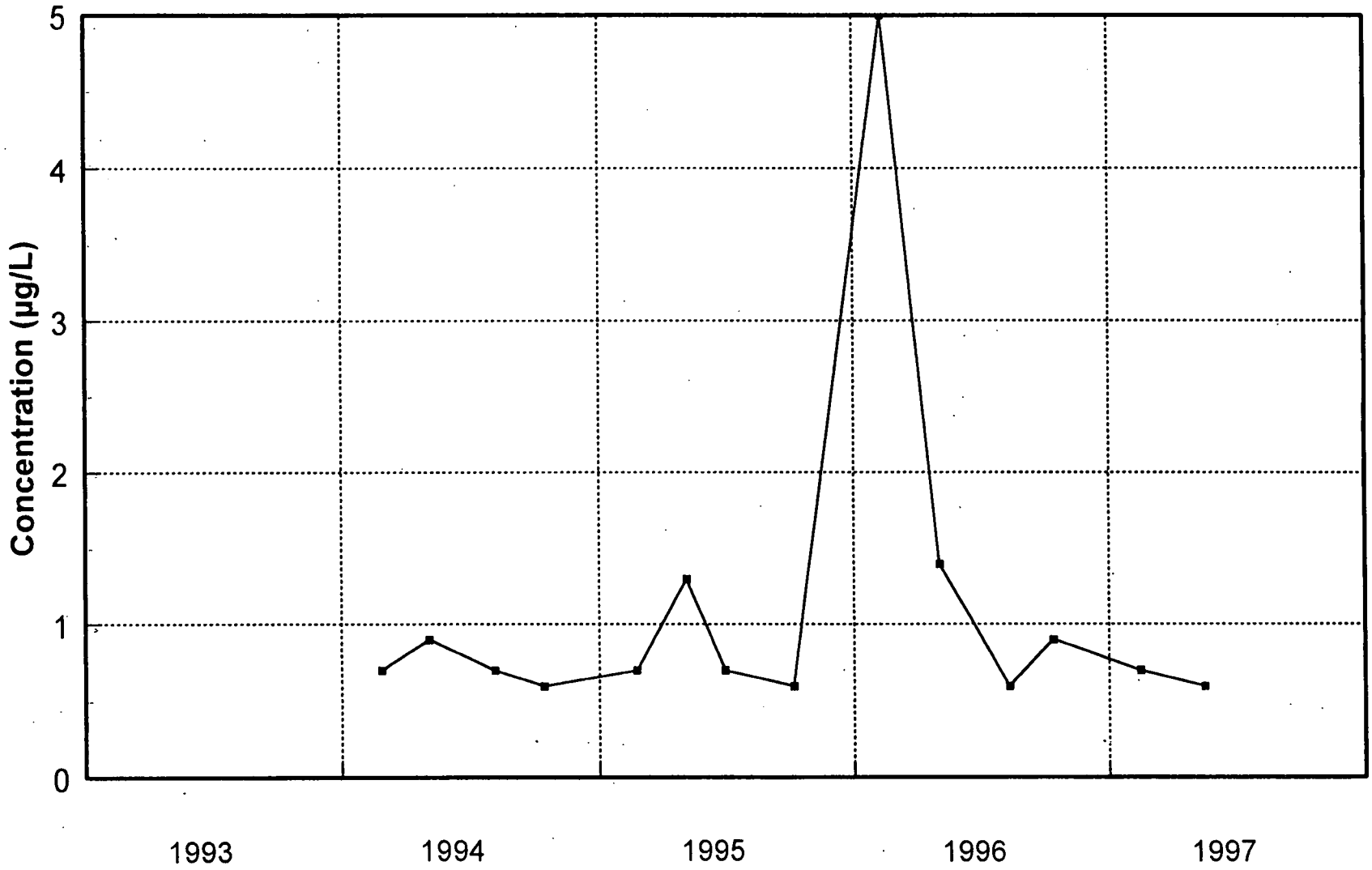


Monitoring Well 3396 Total Uranium Concentrations

109

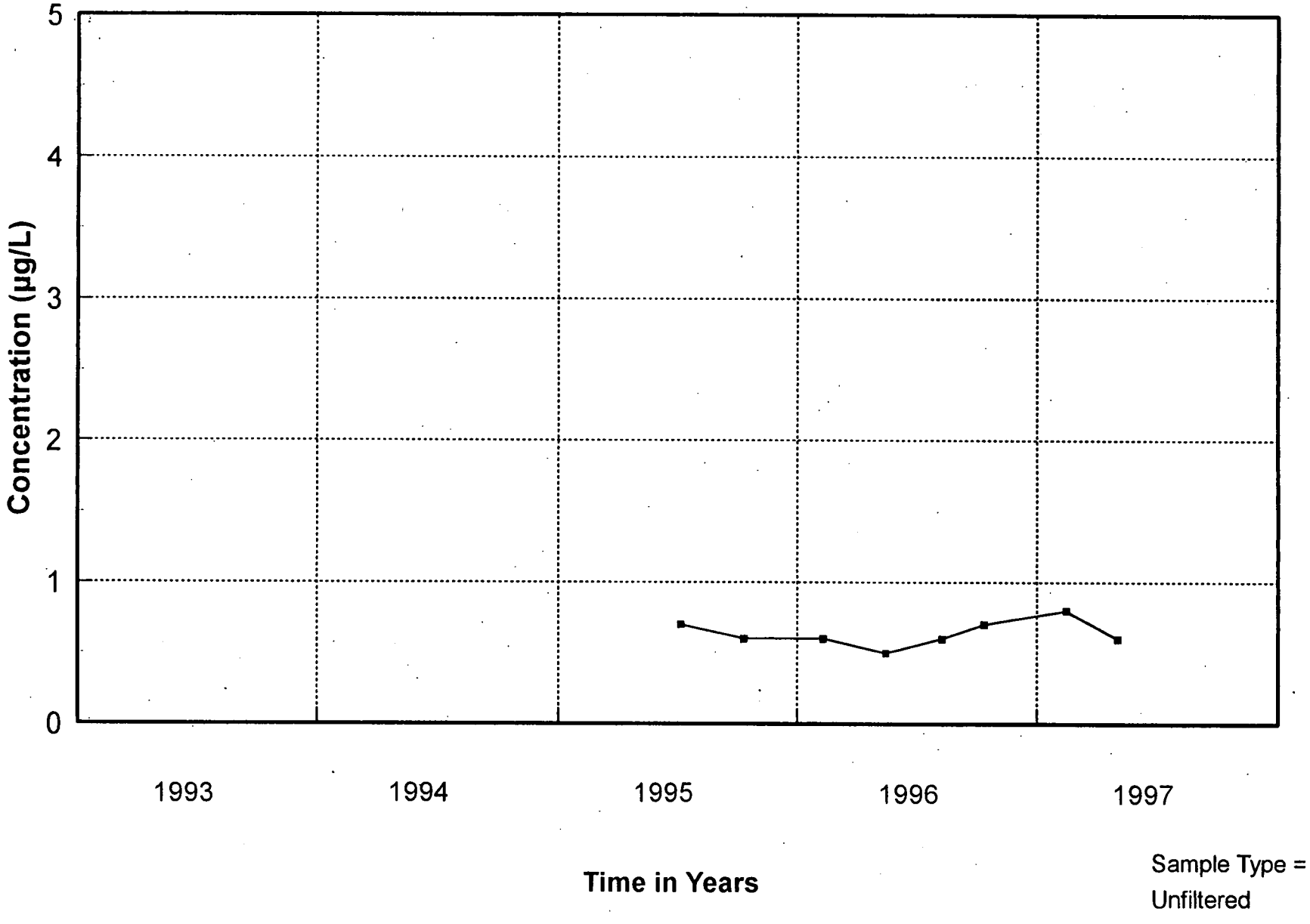


Monitoring Well 3550 Total Uranium Concentrations



Sample Type =
Unfiltered

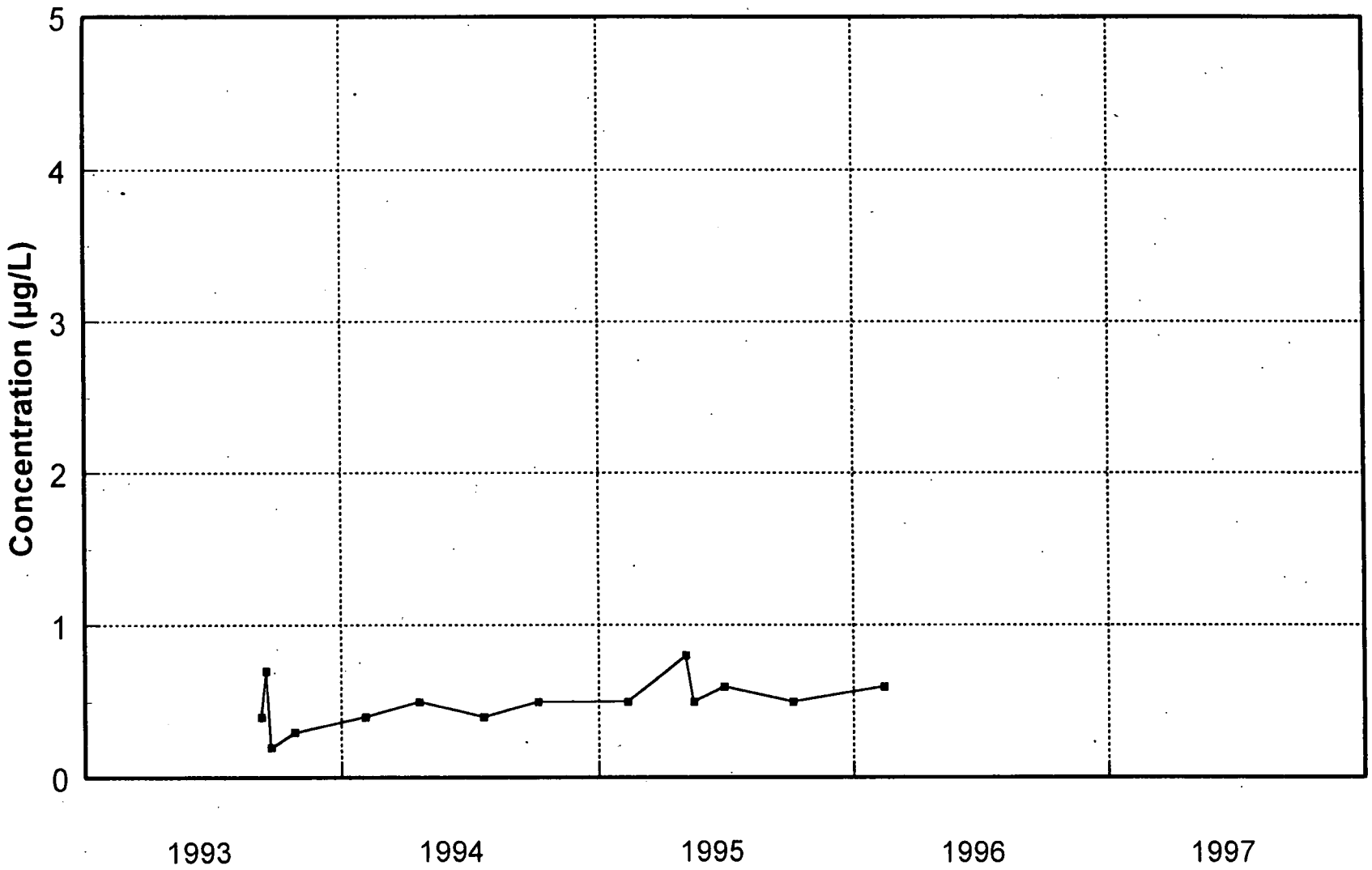
Monitoring Well 3551 Total Uranium Concentrations



Monitoring Well 3552 Total Uranium Concentrations

1/12

1094

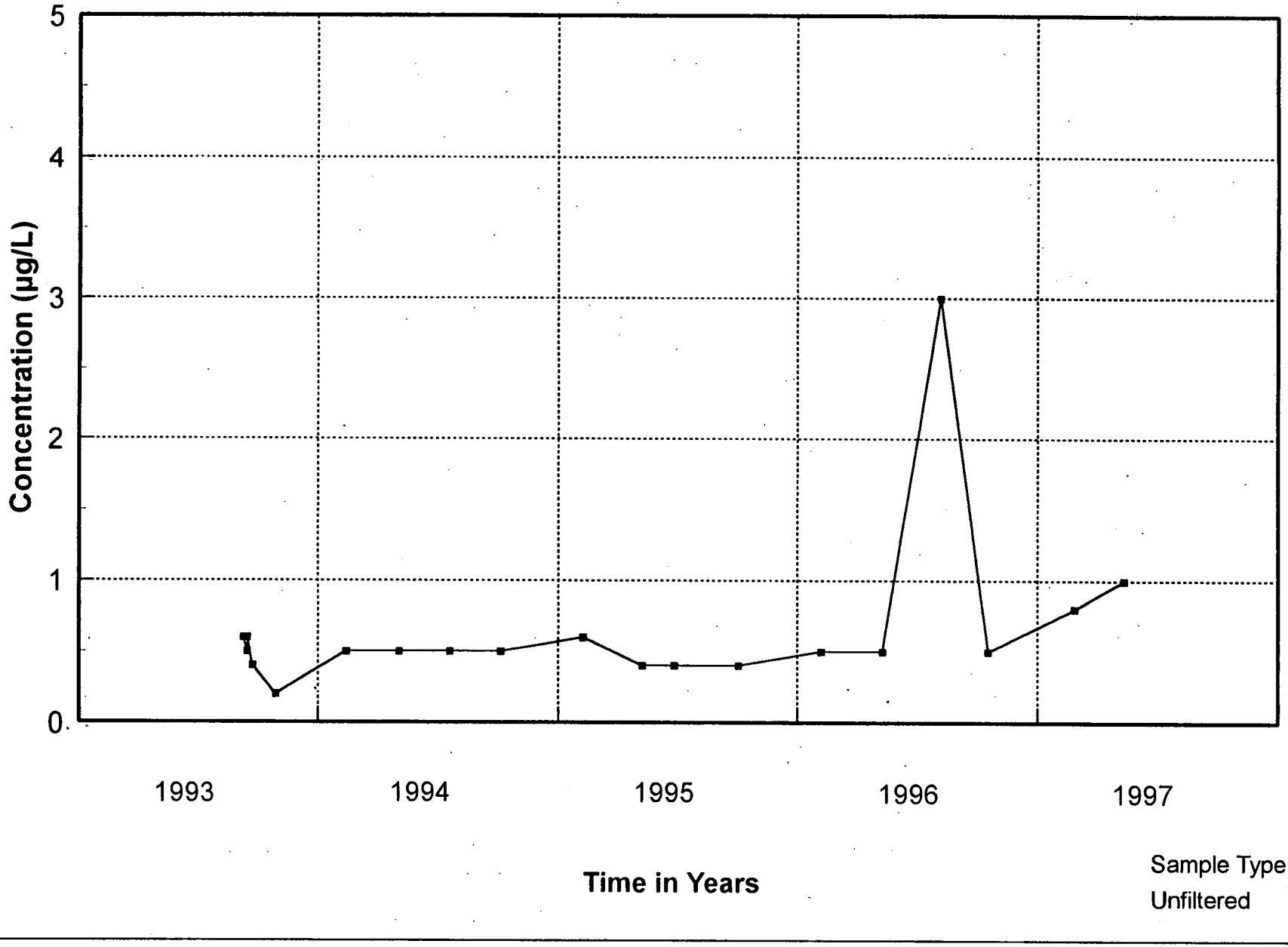


113

Due to access restrictions no samples have been collected since the first quarter of 1996.

Sample Type = Unfiltered

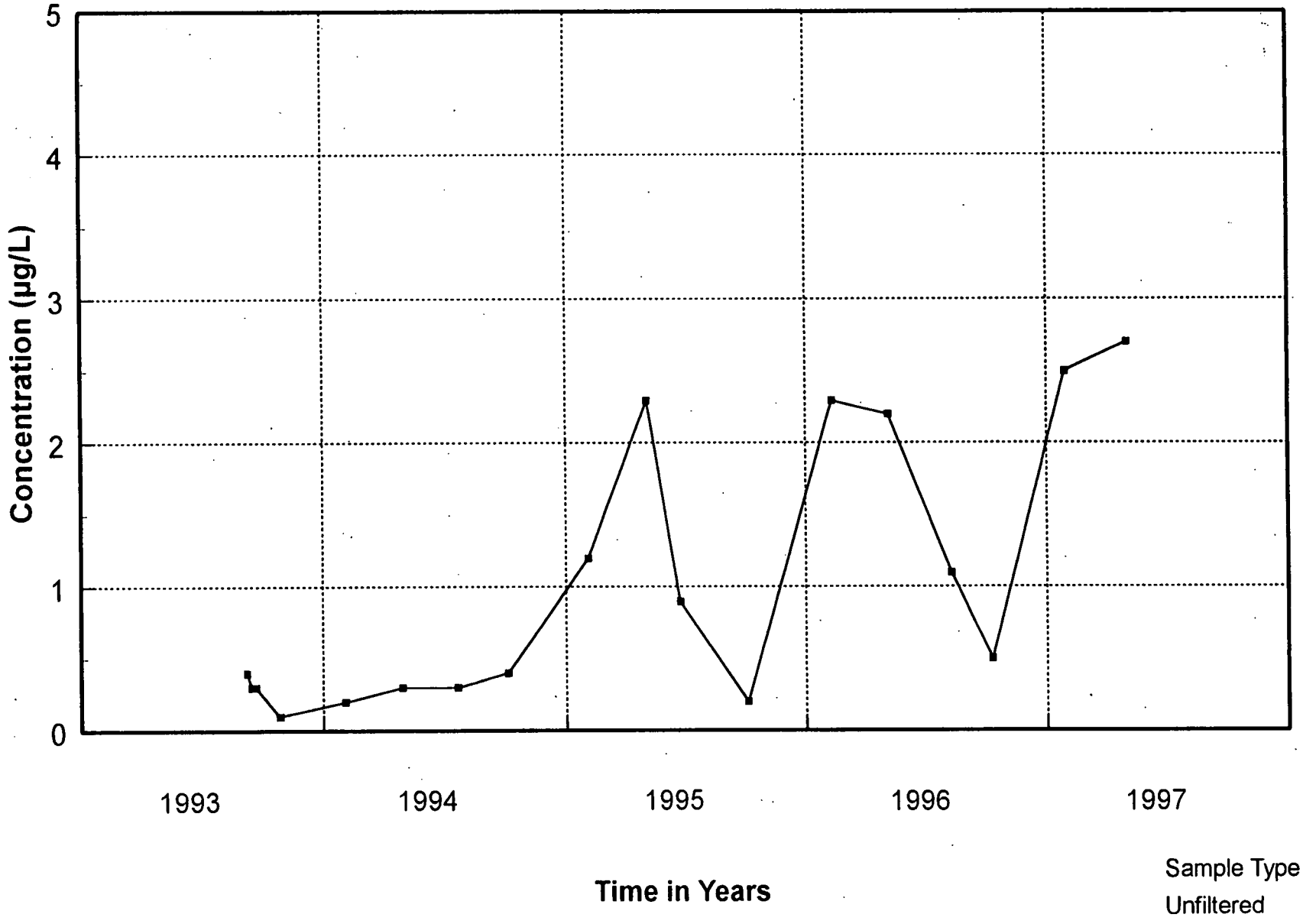
Monitoring Well 3624 Total Uranium Concentrations



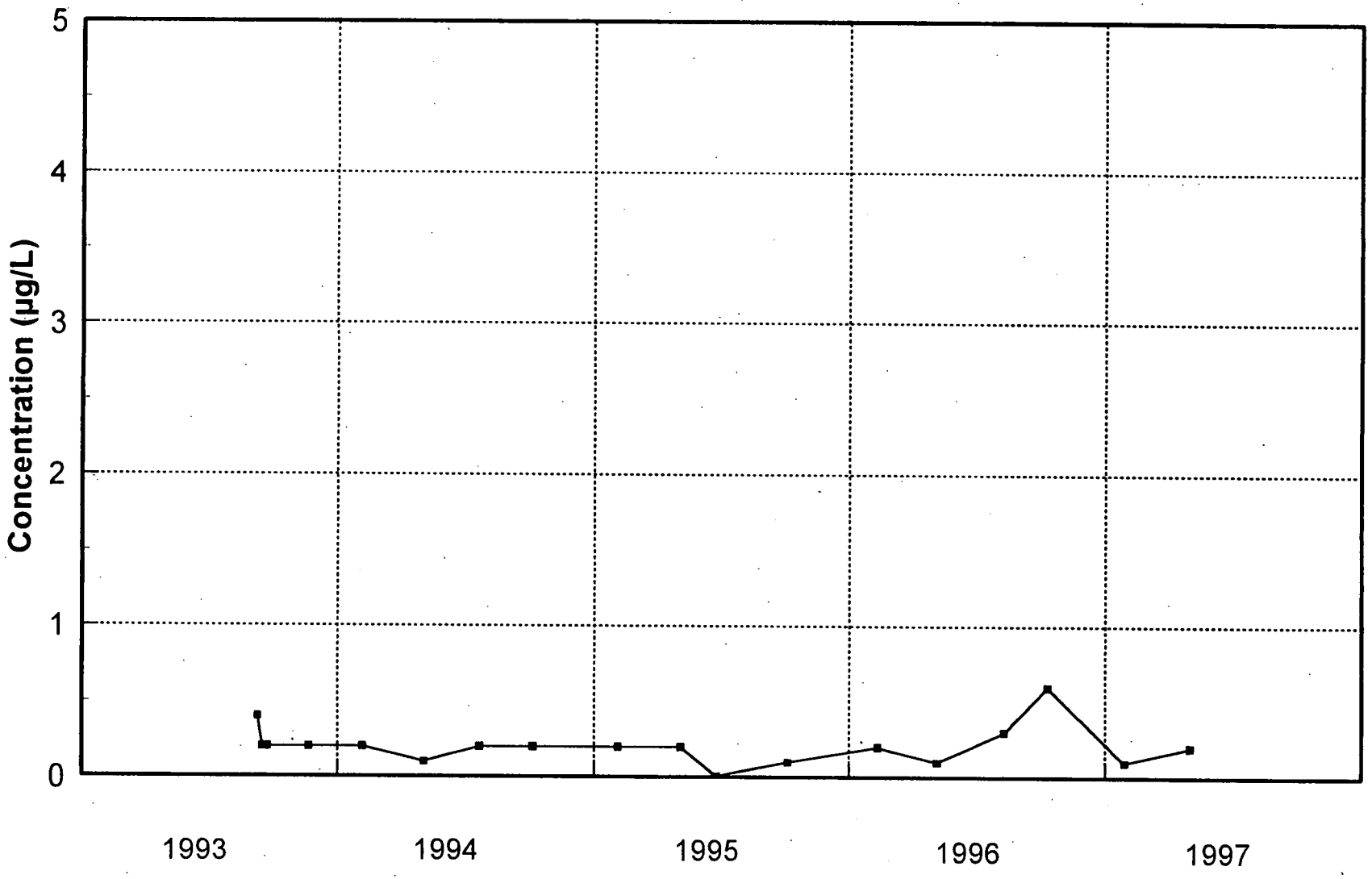
Monitoring Well 3636 Total Uranium Concentrations

114

1024

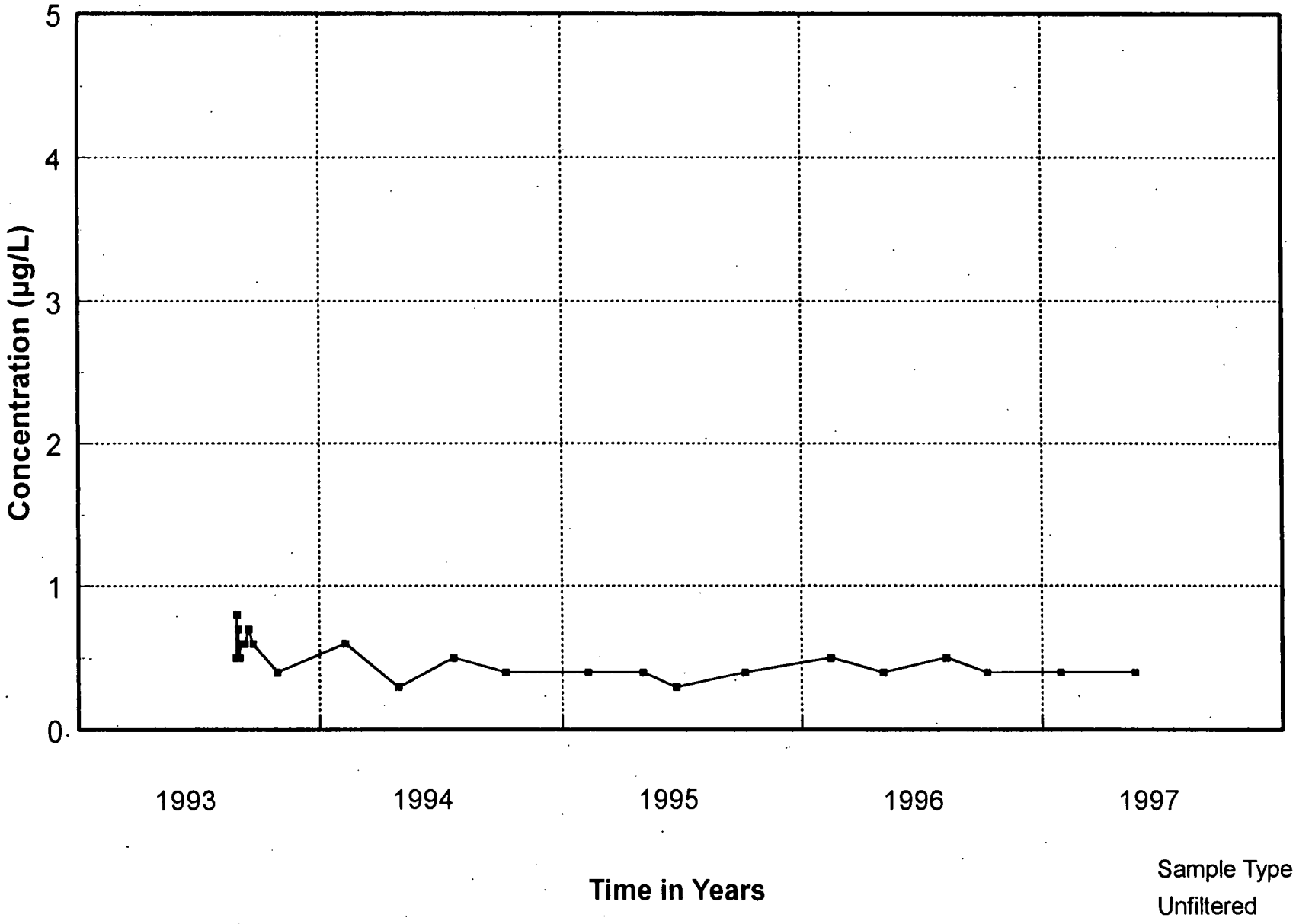


Monitoring Well 3880 Total Uranium Concentrations



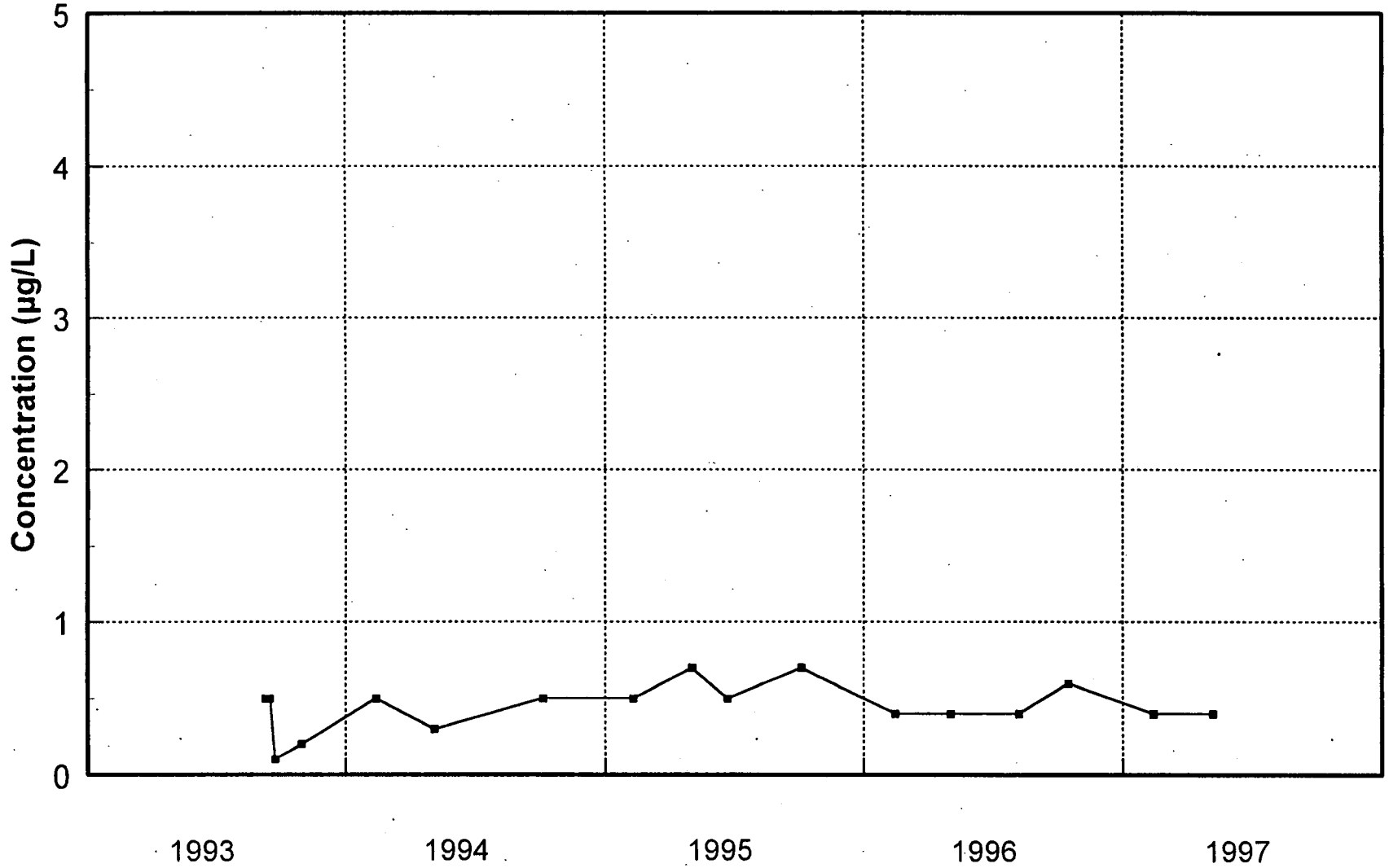
Sample Type =
Unfiltered

Monitoring Well 3881 Total Uranium Concentrations



Monitoring Well 3897 Total Uranium Concentrations

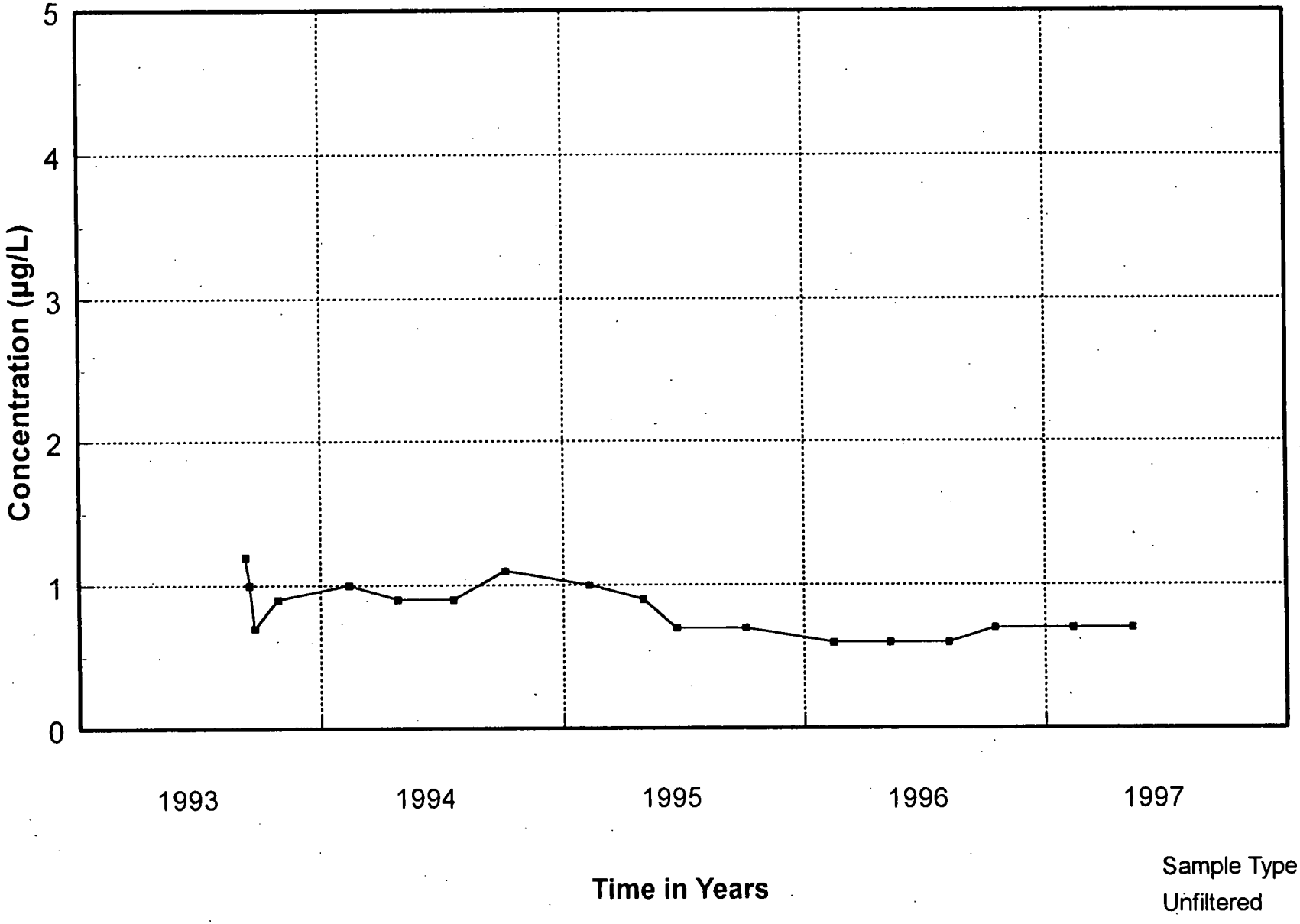
117



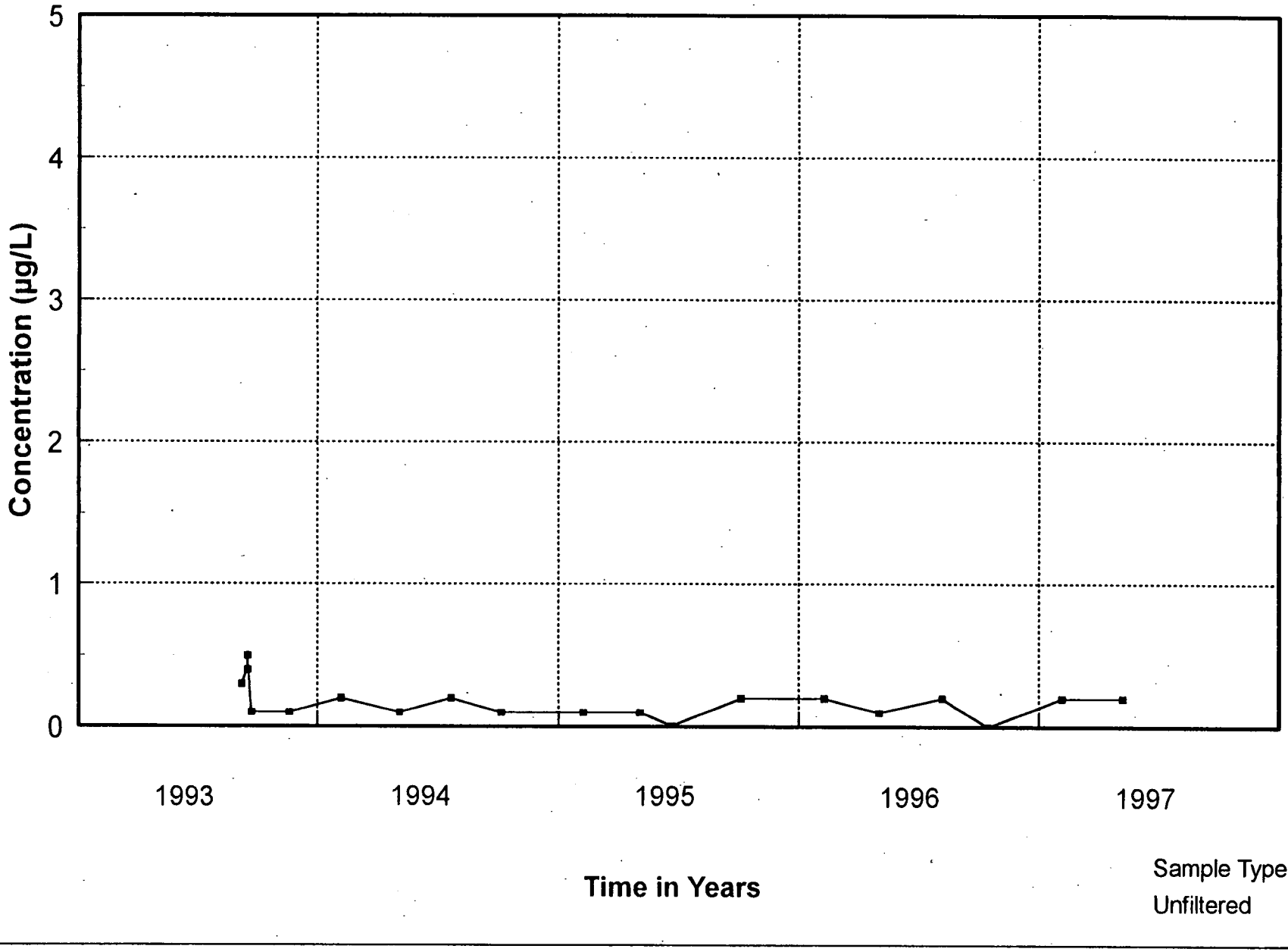
Note:
Outliers of 170 ppb and 180 ppb from July 19, 1994 have been omitted from the graph (see October 1995 DMEPP, p. 19)

Sample Type = Unfiltered

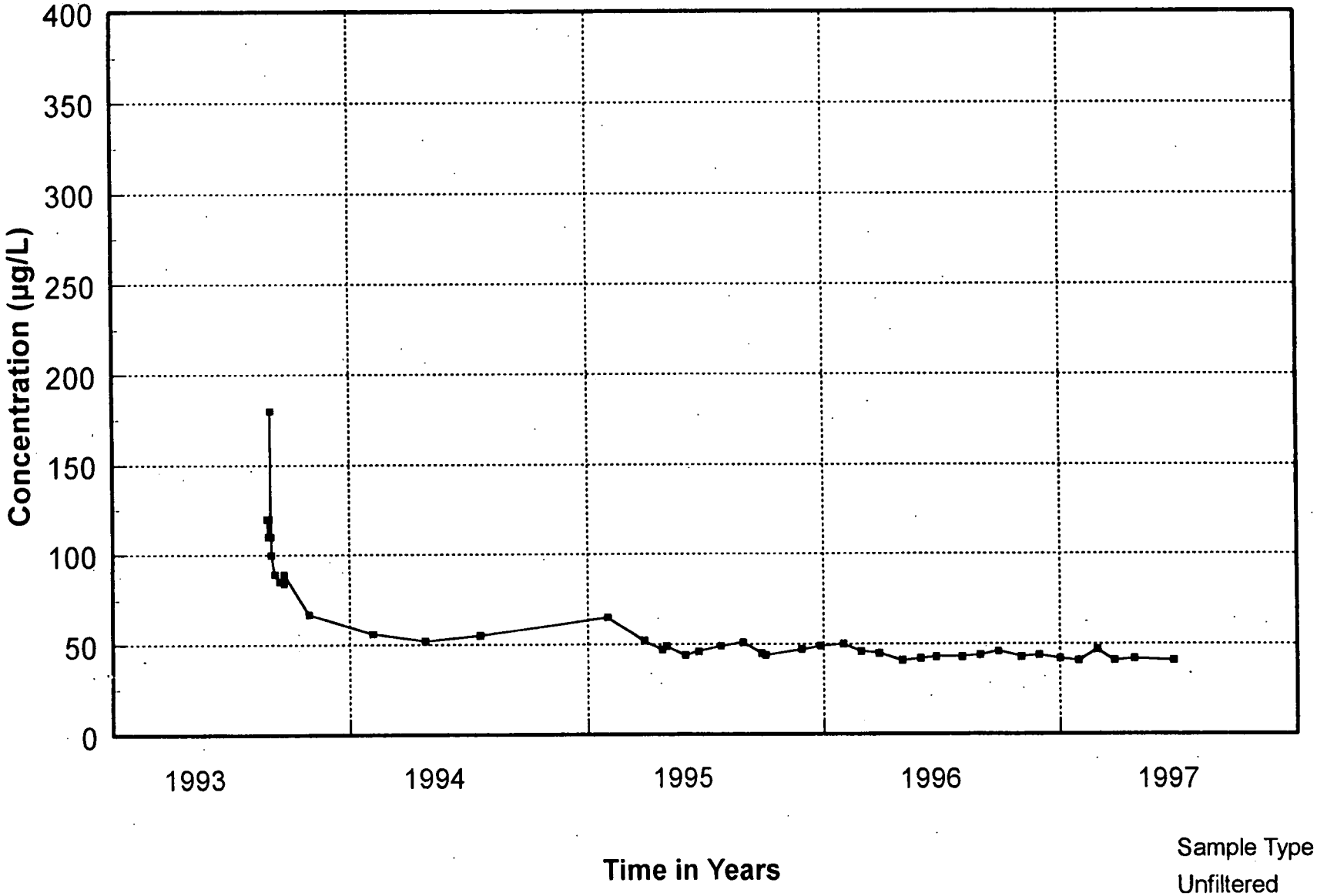
Monitoring Well 3898 Total Uranium Concentrations



Monitoring Well 3899 Total Uranium Concentrations

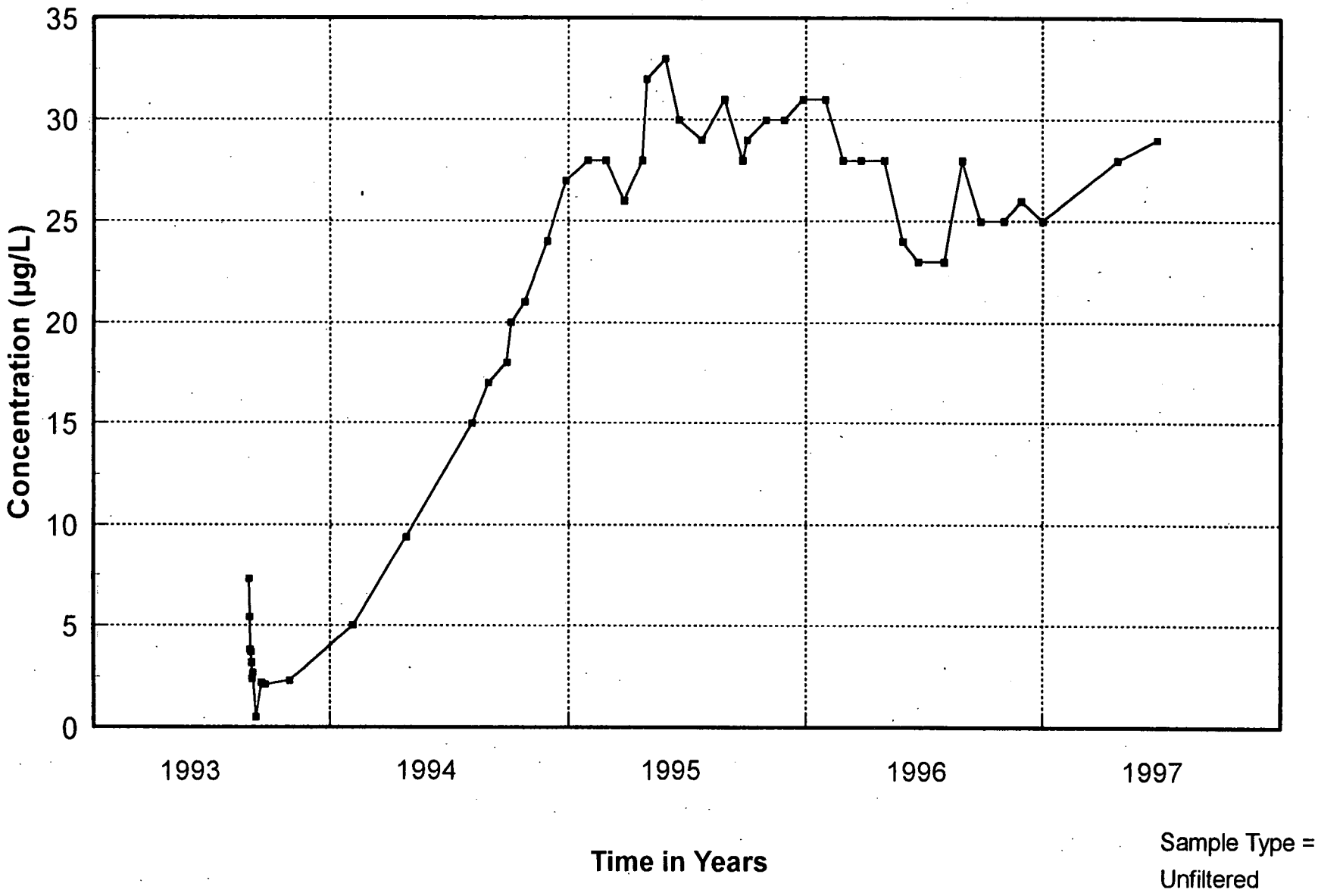


Monitoring Well 3900 Total Uranium Concentrations

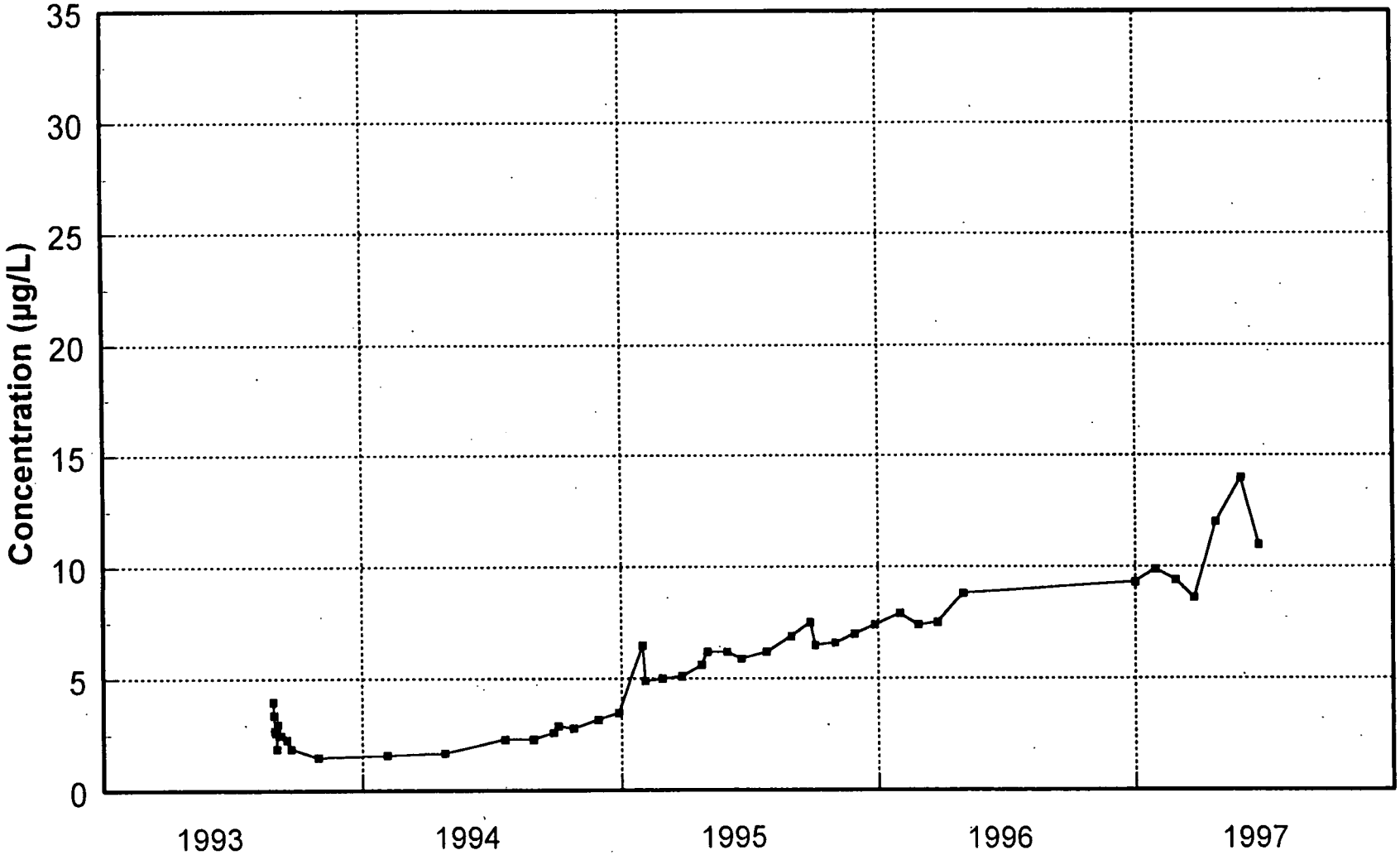


Recovery Well 3924 (RW- otal Uranium Concentrations

21



Recovery Well 3925 (RW-2) Total Uranium Concentrations

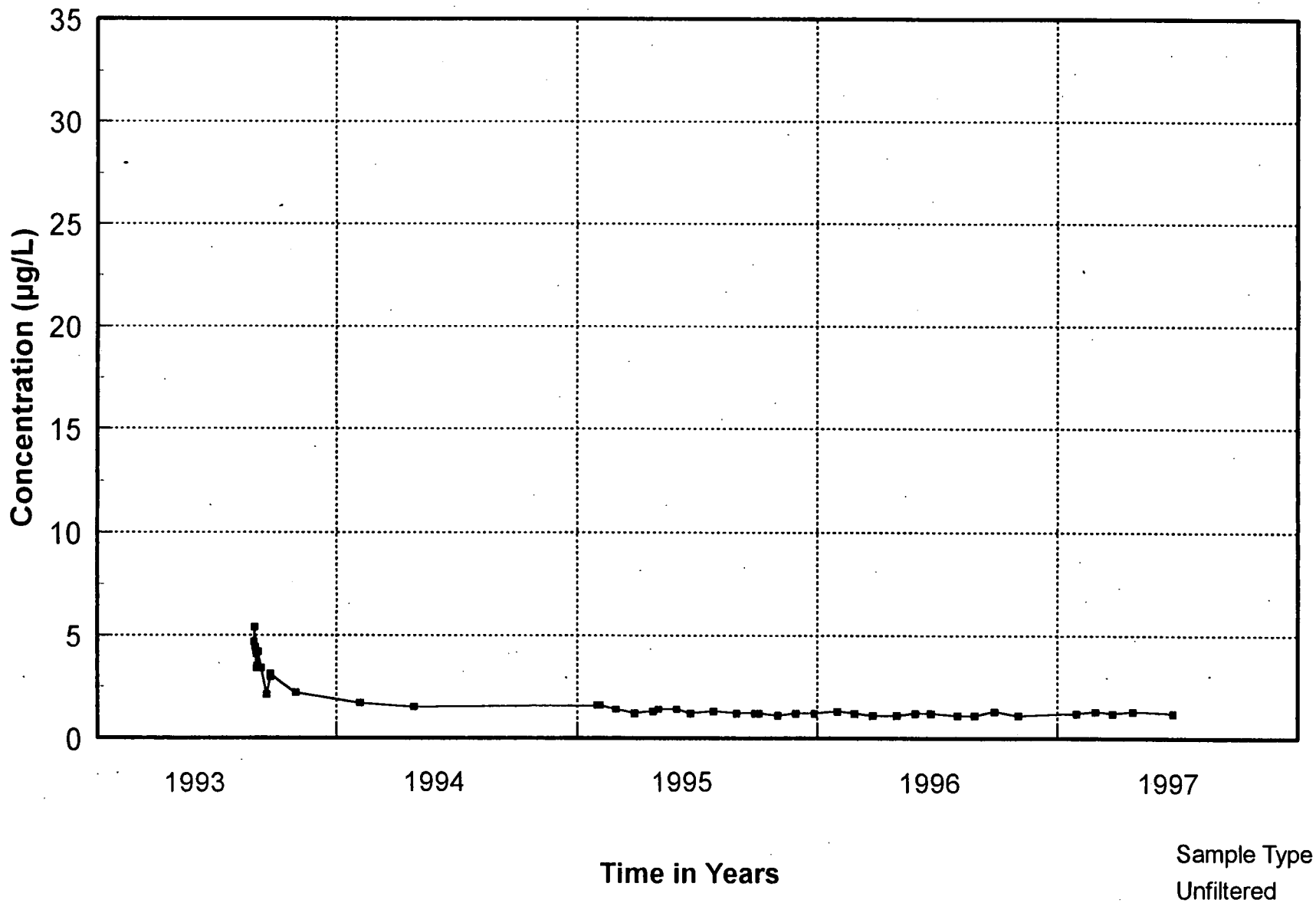


123 Due to well rehabilitation no samples were collected from May througgh November 1996.

Time in Years

Sample Type = Unfiltered

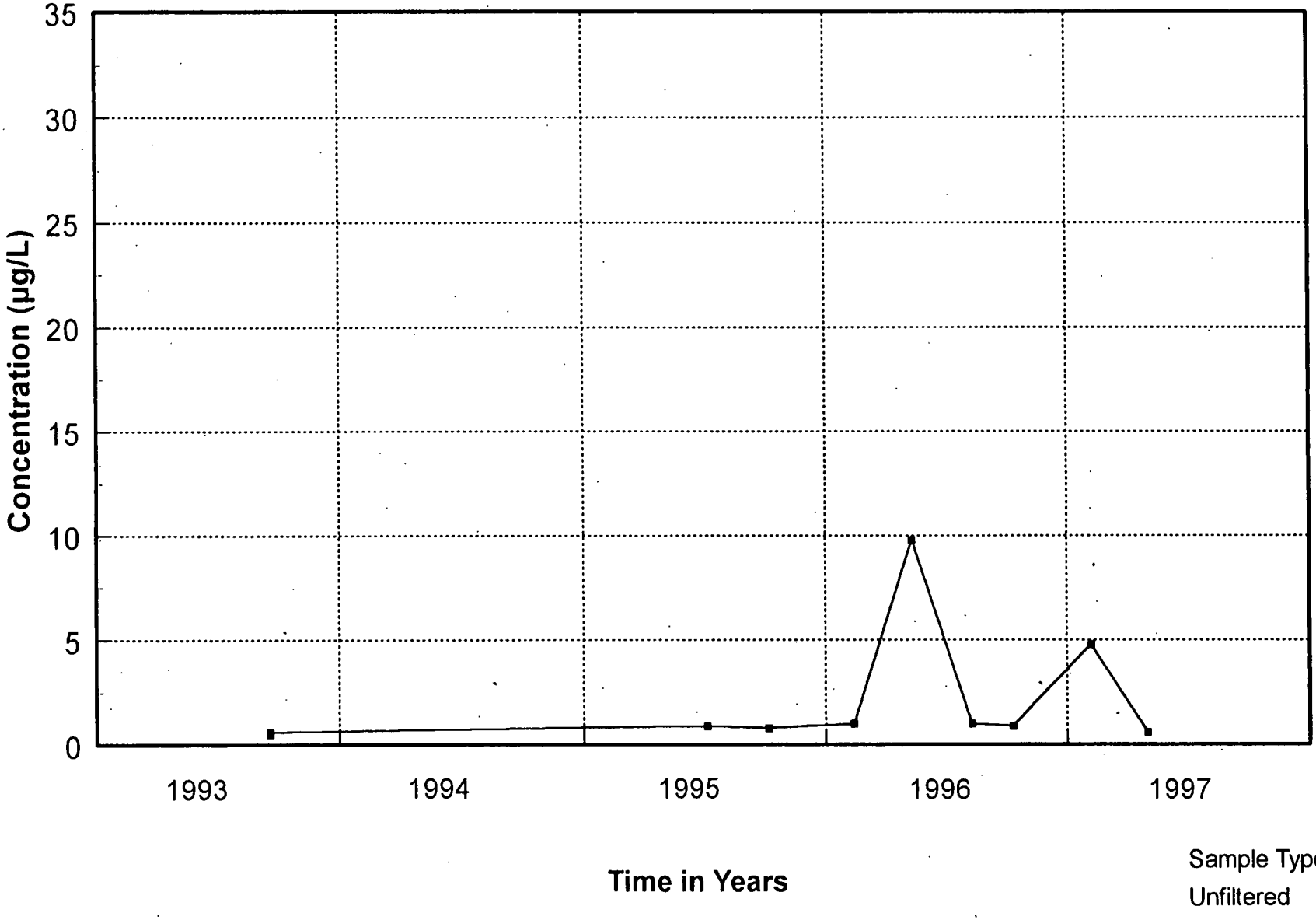
Recovery Well 3926 (RW- tal Uranium Concentrations



Recovery Well 3927 (RW-4) Total Uranium Concentrations

124

1024



125

Monitoring Well 4125 Total Uranium Concentrations

APPENDIX C

MANN-KENDALL TREND CALCULATION

CALCULATION

The time-ordered data are represented as x_i, x_2, ... x_n, where x_k is the datum at time interval k. All possible differences are represented as $x_i - x_j$, where $i < j$. The Mann-Kendall test for trend assigns an integer (-1, 0, or 1) such that:

$$\text{sgn}\,(x_j - x_i) = \begin{cases} -1, \text{ if } x_i > x_j \\ 0, \text{ if } x_i = x_j \\ 1, \text{ if } x_i < x_j \end{cases}$$

The Mann-Kendall statistic is then calculated as:

$$S = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} sgn\,(x_j - x_i)$$

A value for S greater than one implies a possible upward trend, a value for S less than one implies a possible downward trend, and a value of S = 0 implies no trend.

APPENDIX D

COLLOIDAL BORESCOPE DATA

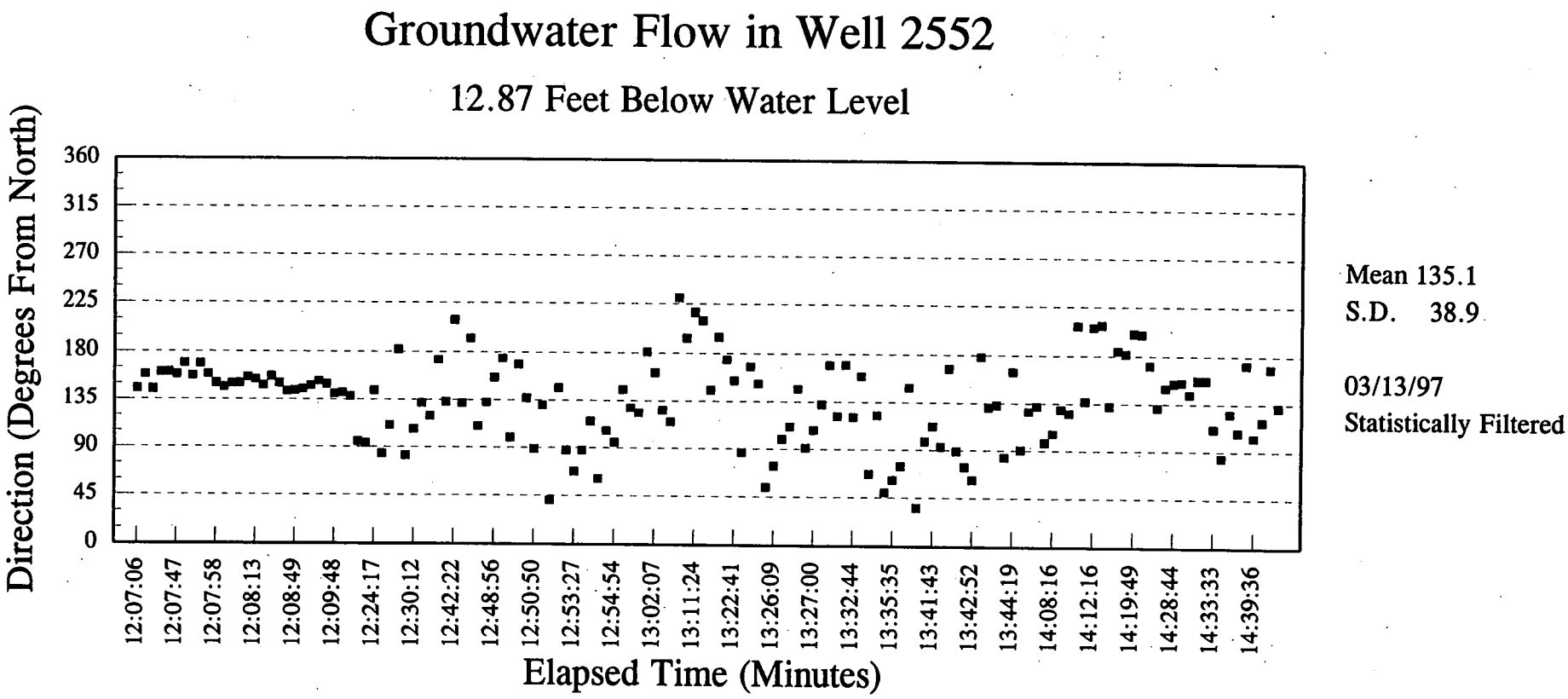


Figure D-1. Groundwater Flow Direction in Monitoring Well 2552

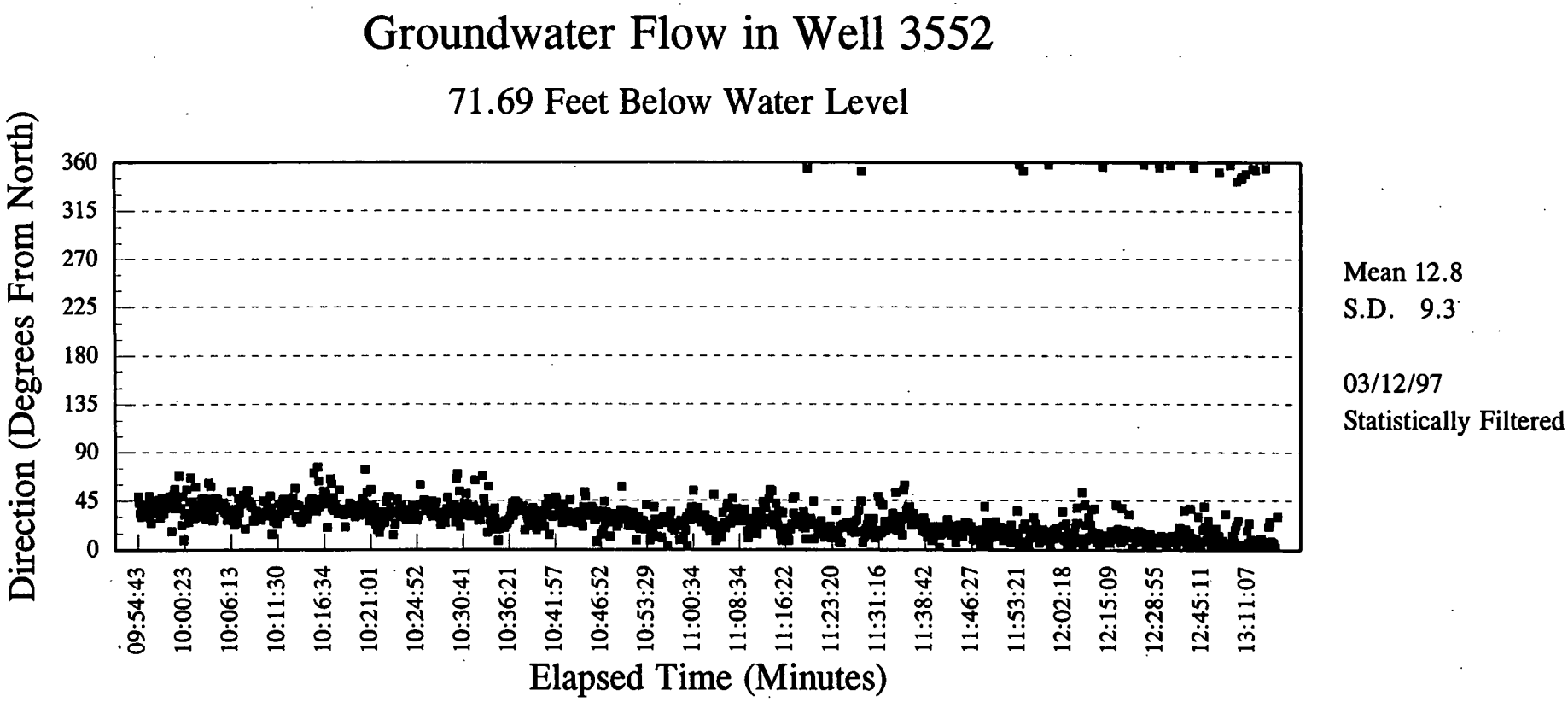


Figure D-2. Groundwater Flow Direction in Monitoring Well 3552

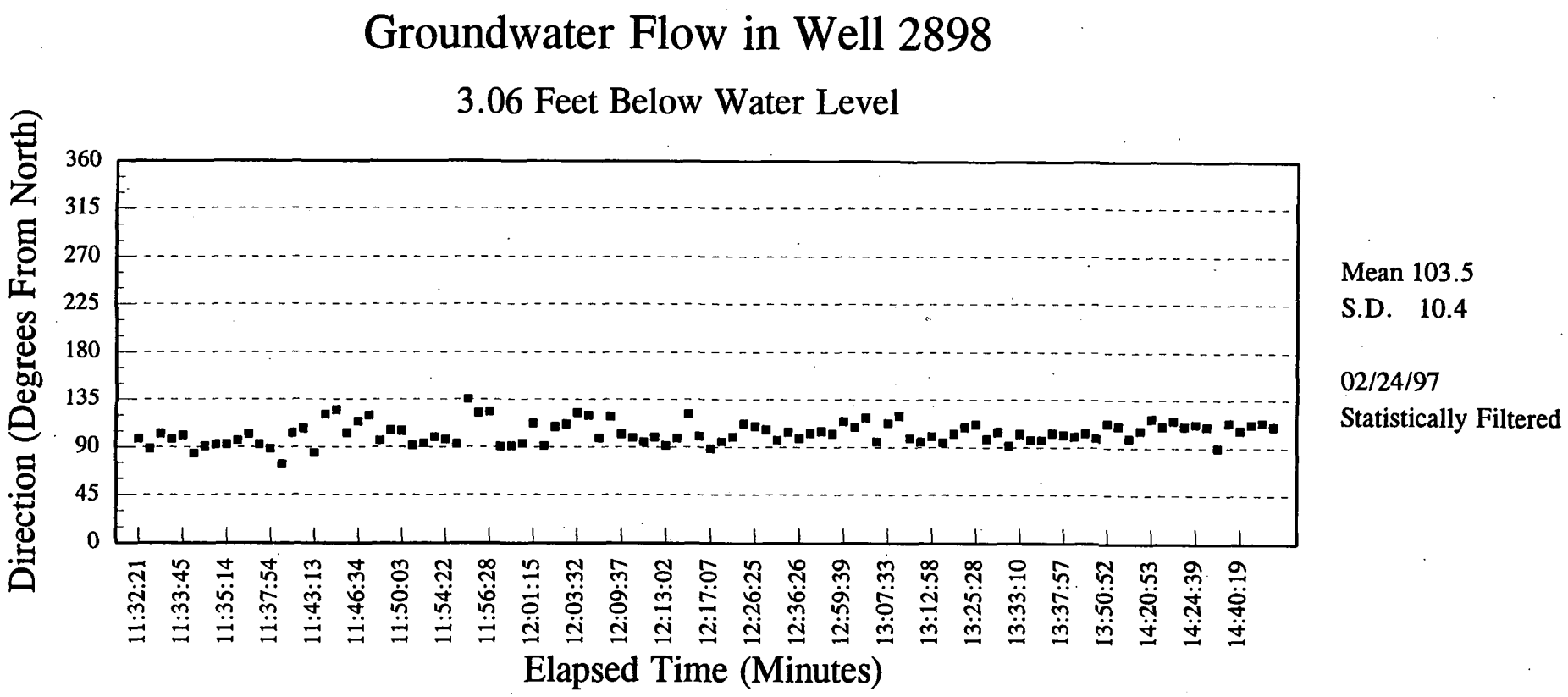


Figure D-3. Groundwater Flow Direction in Monitoring Well 2898

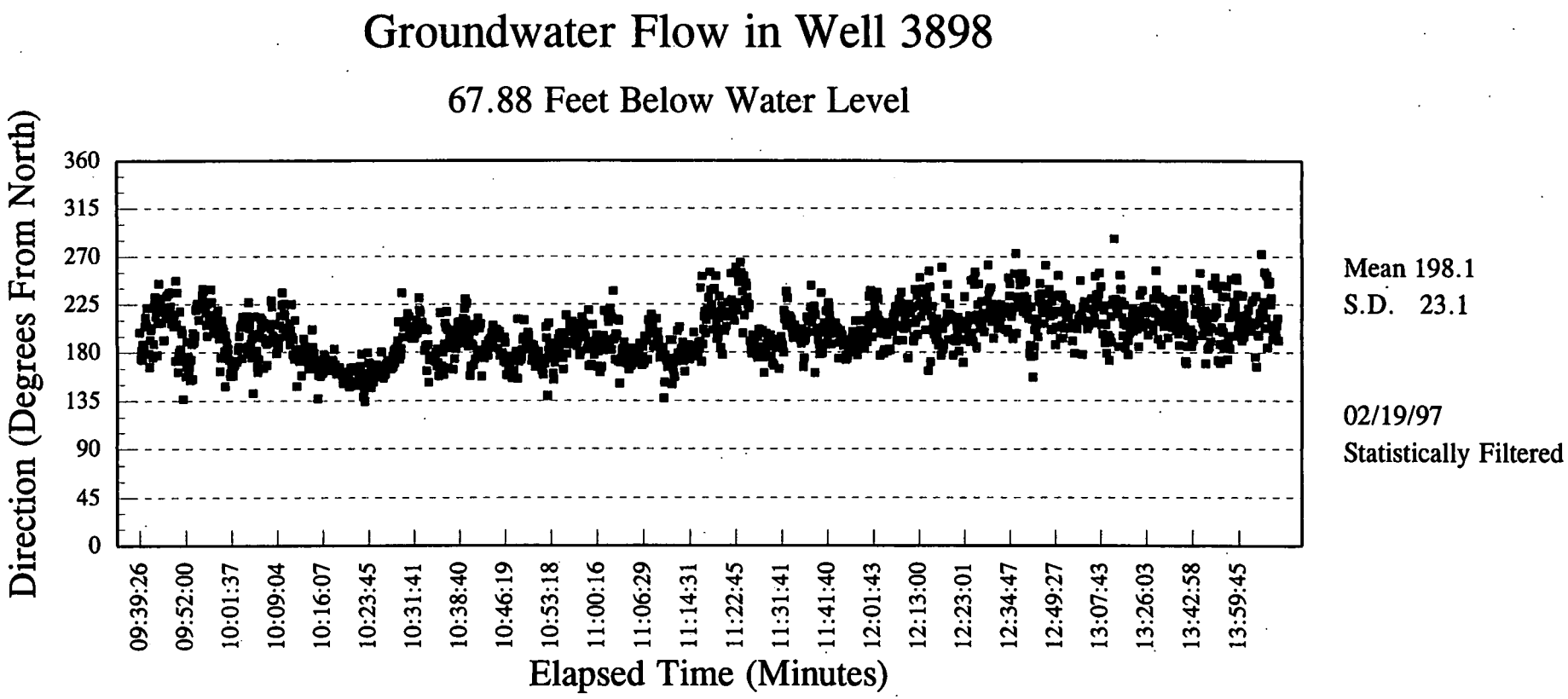


Figure D-4. Groundwater Flow Direction in Monitoring Well 3898

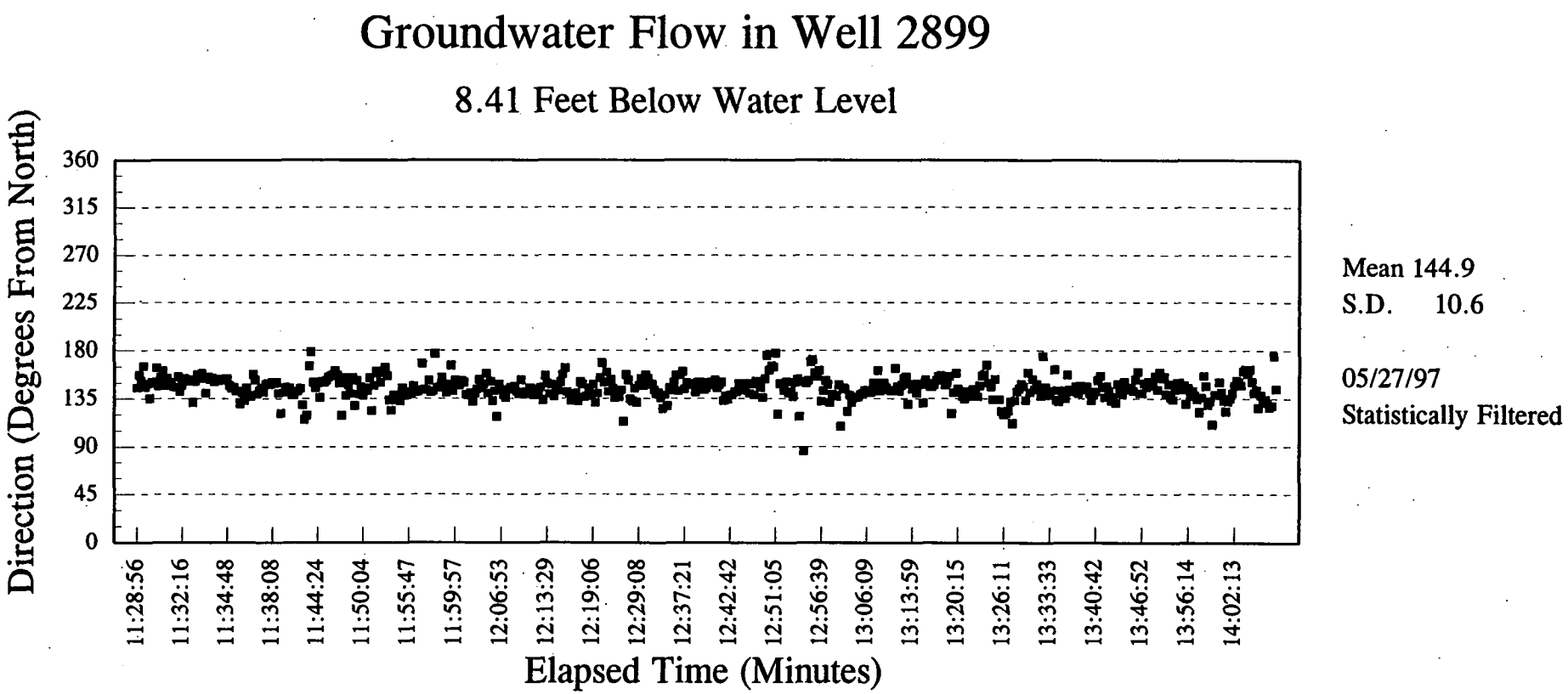


Figure D-5. Groundwater Flow Direction in Monitoring Well 2899

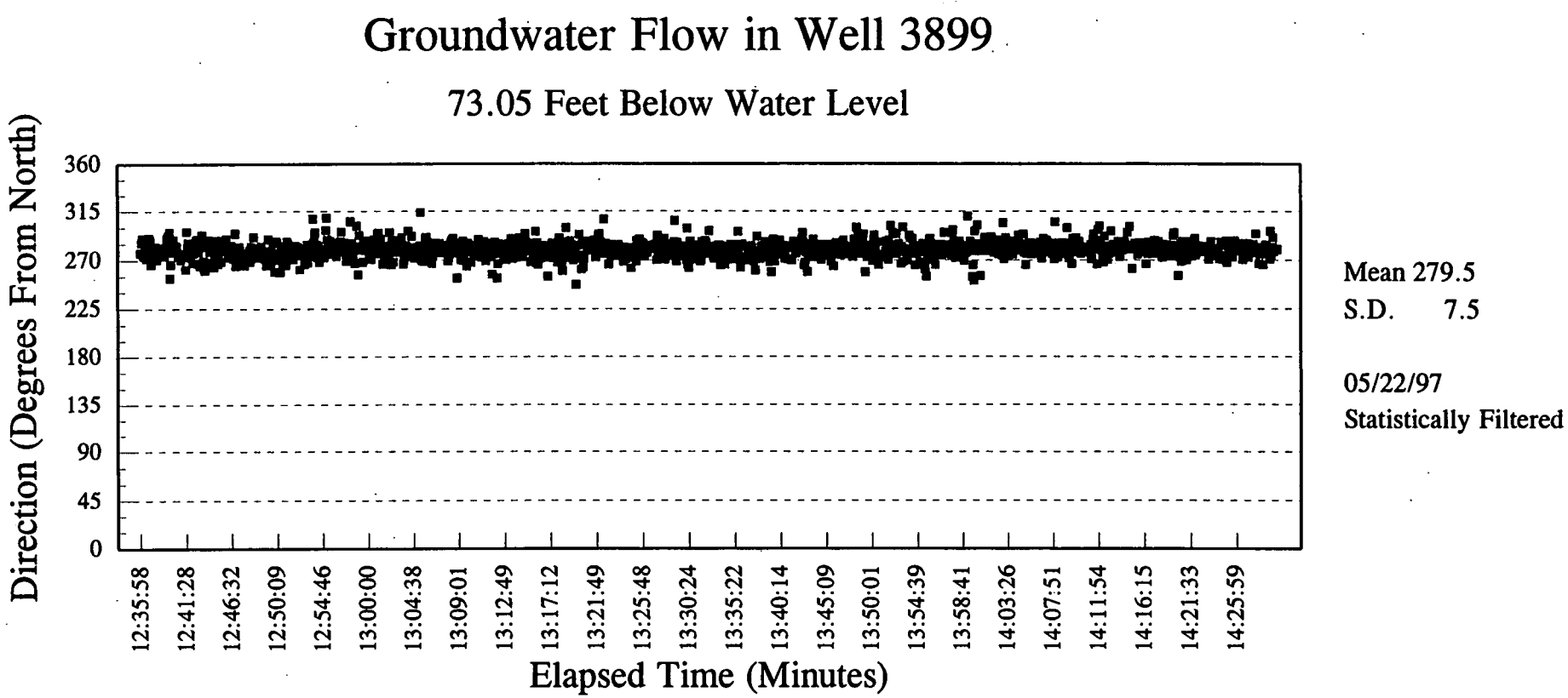


Figure D-6. Groundwater Flow Direction in Monitoring Well 3899

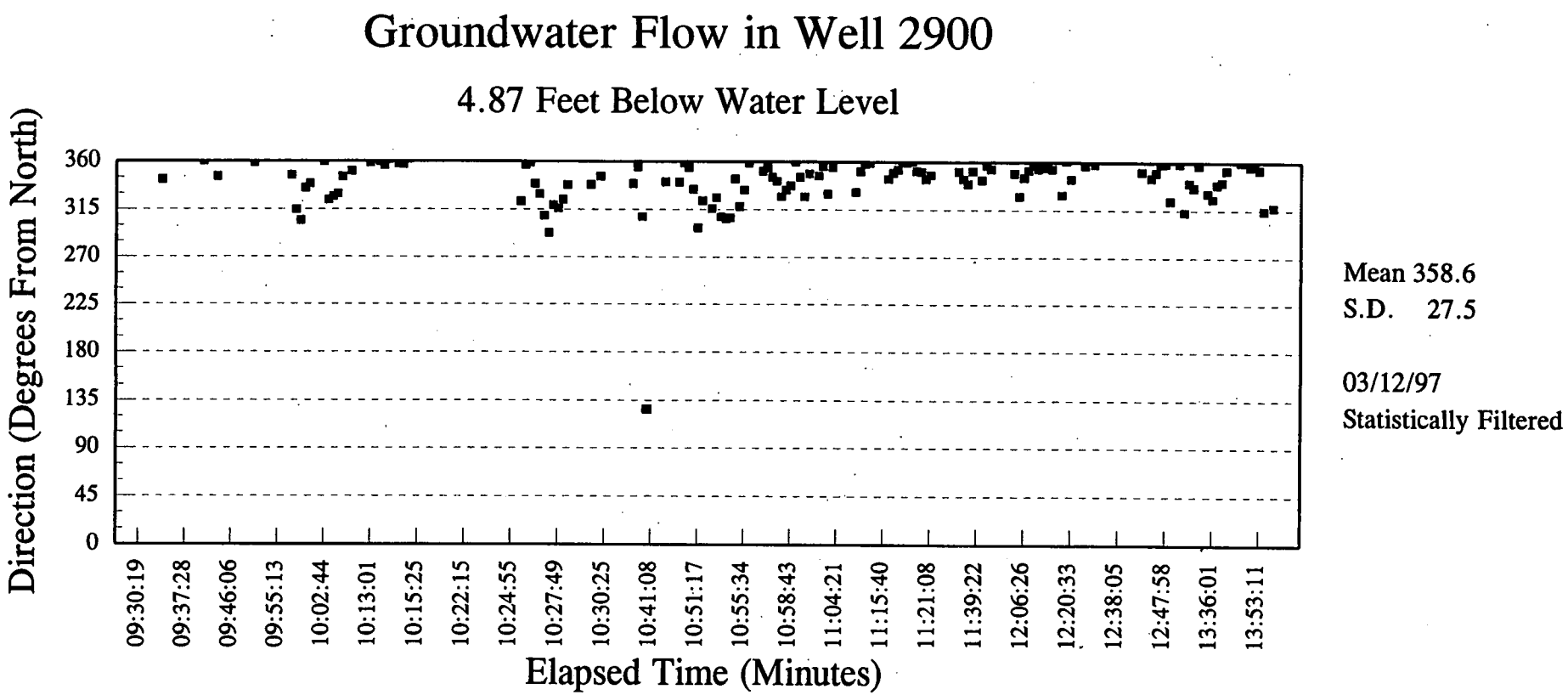


Figure D-7. Groundwater Flow Direction in Monitoring Well 2900

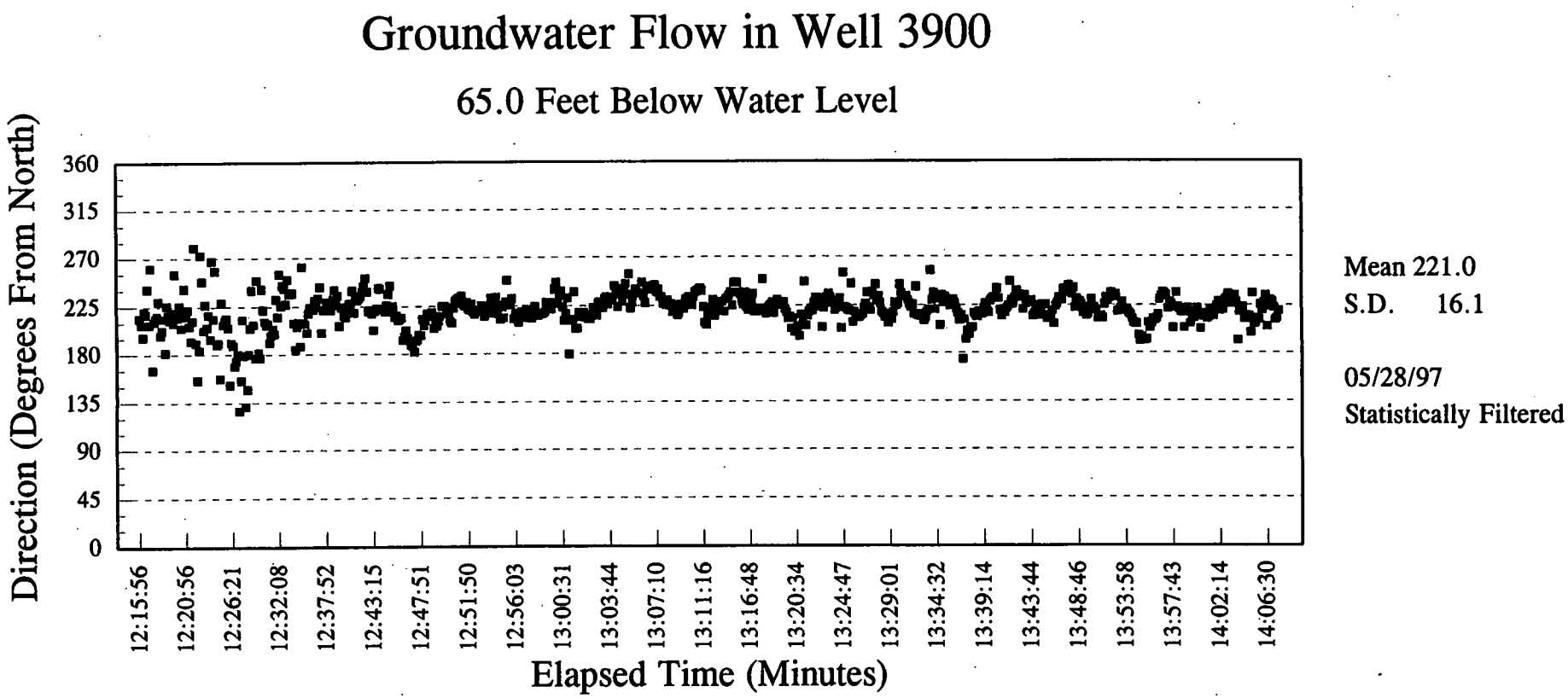


Figure D-8. Groundwater Flow Direction in Monitoring Well 3900

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