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RESTORATION AREA VERIFICATION SAMPLING PROGRAM SUMMARY REPORT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

MAY 1998

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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1.0 INTRODUCTION

This summary report presents and interprets groundwater data collected to evaluate Final Remediation Level (FRL) exceedances found outside the uranium-based groundwater remediation footprint. These data were collected during calendar year 1997 in accordance with the Restoration Area Verification Sampling (RAVS) Project Specific Plan (PSP) (DOE 1997c). The report also provides a recommendation as to whether or not modification of the uranium based aquifer remedy is warranted at this time based on the sampling results. Preparation of this report was specified in the Operable Unit 5 Remedial Design Work Plan (DOE 1996b).

As prescribed in the RAVS PSP, seven groundwater monitoring wells were sampled, as outlined below.

Well 3423 for antimony
Wells 2733 and 3070 for lead
Wells 2424 and 2436 for manganese
Wells 2424, 3091, and 31217 for zinc

Figure 1 is a map showing the locations of these seven groundwater monitoring wells. As presented on page 5 of the RAVS PSP the groundwater sampling was "a focused effort targeted solely at confirming/refining the restoration area footprint for design purposes". This summary report is organized into four short sections as outlined below.

Section 1.0 INTRODUCTION: This section explains what the summary report is and what can be found in the report.

Section 2.0 BACKGROUND: This section provides information on why the sampling was conducted.

Section 3.0 ANALYTICAL RESULTS: This section outlines what samples were collected and when the sampling took place. It also presents the analytical results and establishes the information base used for the conclusions and recommendations presented in Section 4.0.

Section 4.0 CONCLUSIONS AND RECOMMENDATIONS: This section presents conclusions reached from the sampling effort in regards to whether or not modification of the uranium based aquifer remedy is warranted at this time.

2.0 BACKGROUND

The RAVS PSP outlined three activities which were to be performed to support the design of the Aquifer Restoration. These activities were:

1) Further defining the vertical and lateral extent of uranium contamination above the groundwater FRL in the vicinity of Monitoring Well 3069.

2) Evaluation of all existing non-uranium groundwater data gathered outside of the uranium-based restoration footprint, and determining which sporadic FRL exceedances could be dismissed as non-FEMP related and/or were not of concern.

3) Determining, from the above evaluation, which of the sporadic FRL exceedances required additional sampling before a final decision could be made regarding whether the exceedances drove a need to expand the restoration footprint beyond that based on uranium.

The vertical and lateral extent of uranium contamination above the groundwater FRL in the vicinity of Monitoring Well 3069 (Activity 1) was completed in time to support the final Baseline Remedial Strategy Report (BRSR), Remedial Design for Aquifer Restoration (DOE 1997a). Uranium profile concentrations were determined in 19 different locations from groundwater samples collected using a direct push sampling tool. The results and data interpretations (cross-sections and maps) are presented in Appendix G of the BRSR.

The evaluation of all existing non-uranium groundwater data gathered outside of the uranium-based restoration footprint (Activity 2), and a determination of the sporadic FRL exceedances which required additional sampling (Activity 3) have also been completed. These two activities were done to support preparation of the RAVS PSP. Data, resulting interpretations, and additional sampling recommendations are presented in Appendix A of the RAVS PSP, and discussed below.

Figure 1 illustrates the extent of the Uranium Based Aquifer Restoration Footprint. The footprint is the modeled, non-retarded hydraulic capture zone which is predicted to result from the aquifer restoration under the 10-year restoration scenario. The 10-year restoration scenario is presented in Section 5.0 of the Baseline Remedial Strategy Report for Aquifer Restoration (Remedial Design, Task 1), DOE 1997a). The size and dimension of the predicted restoration footprint is dependent upon the amount and rate of pumping and/or injection which will be conducted to capture the 20 μg/L total uranium plume. If pumping rates are changed, or the number of pumping/injection wells is altered from that presented in the

10-year scenario, then the size of the footprint will change accordingly. Because the footprint is uranium based, it is designed to capture the entire 20 μg/L total uranium plume. Any non-uranium contaminants located within the footprint will also be within the hydraulic capture zone, but any contaminants located outside of the footprint will not be within the hydraulic capture zone.

FEMP related groundwater contaminants of concern (uranium and non-uranium) have been assigned Final Remediation Levels (FRLs) in the Operable Unit 5 ROD (DOE 1996a) and are referred to in this report as FRL constituents. If an FRL constituent is detected in the Great Miami Aquifer at a concentration above its FRL, then it is referred to as an FRL exceedance.

The evaluation of groundwater FRL exceedances located outside of the Uranium Based Aquifer Restoration Footprint (which is presented in Appendix A of the RAVS PSP) determined if the non-uranium FRL exceedances located outside of the restoration footprint:

- Were attributable to the FEMP
- Were one-time occurrences
- Were persistent and of such magnitude that they required a modification of the uranium based groundwater remedy
- Required additional monitoring to determine what additional action should be taken.

The evaluation focused on 14 FRL constituents which had one or more FRL exceedances at locations outside of the aquifer restoration footprint. The approved RAVS PSP data evaluation protocol is summarized below.

- The constituent concentration data over time were graphed for each of the FRL exceedances by well location to identify the persistence of the exceedance. To be conservative, the values plotted on the graphs represent the greatest concentration for each date of the following: filtered samples, unfiltered samples, normal samples, and duplicate samples. Any large discrepancies between concentrations of the same constituent on the same date were noted on the individual graphs.
- If two or more sampling events following an FRL exceedance indicated that the concentrations were below the FRL, then the location was not considered for remediation or further monitoring above and beyond what was already prescribed by the FEMP Integrated Environmental Monitoring Plan (IEMP).

Ten of the 14 FRL constituents were determined to be either one time occurrences or not attributable to the FEMP and therefore were dismissed from further consideration. The remaining four constituents (antimony, lead, manganese, and zinc) were to be sampled at the locations where the above noted criteria were not met (Monitoring Wells 3423, 2733, 2424, 2436, 3070, 3091, and 31217). The monitoring was to take place for one year to determine what additional action, if any, was required. The main text of the RAVS PSP incorrectly identified that cadmium would also be monitored. However, as noted on Page A-5 of the RAVS PSP, no additional monitoring was needed for cadmium outside of the restoration footprint.

This report presents the one year of additional monitoring data collected to satisfy the data evaluation recommendation made in the RAVS PSP.

3.0 ANALYTICAL RESULTS

The one year of groundwater sampling called for in the RAVS PSP was conducted in 1997. Analytical results are presented in Table 1. Table 1 includes the water quality data collected in 1997, as outlined in the RAVS PSP, and also (for some wells) data collected in 1996 that was not available when the first draft of the RAVS PSP was issued. Figures 2 through 9 are individual graphs for the seven different monitoring wells which were sampled. Monitoring Well 2424 required additional sampling for both manganese and zinc. Each figure is a plot of concentration verses time for a particular FRL constituent. If a concentration was not detected, the detection limit used is plotted on the graphs to illustrate its relation to the FRL. Sampling results are discussed below.

Well 3423 for Antimony

Figure 2 illustrates antimony concentration verses time for groundwater samples collected from Monitoring Well 3423. Sampling in 1997 indicates that the concentration of antimony in Monitoring Well 3423 was consistently below the groundwater FRL for antimony (0.006 mg/L). Therefore, in accordance with the protocol established in the approved RAVS PSP no additional groundwater monitoring for antimony is required at Monitoring Well 3423. Since the 1997 data indicate the antimony concentrations are below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 3423.

Well 2733 for Lead

Figure 3 illustrates the lead concentration verses time for groundwater samples collected from Monitoring Well 2733. Sampling in 1997 indicates that the concentration of lead in Monitoring Well 2733 was consistently below the groundwater FRL for lead (0.015 mg/L). This well was identified for additional sampling in the RAVS PSP because at the time that the first draft of the RAVS PSP was issued, the groundwater FRL for lead was 0.002 mg/L (based on background). Upon finalization of the RAVS PSP, the groundwater FRL for lead was changed from 0.002 mg/L to the Safe Drinking Water Action Level of 0.015 mg/L, (DOE 1997c, Appendix C). Revision of the groundwater FRL for lead eliminated all but one lead FRL exceedance at this location. Therefore in accordance with the protocol established in the approved RAVS PSP no additional groundwater monitoring for lead is required at Monitoring Well 2733. Since the 1997 data indicate the lead concentrations are below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 2733.

Well 3070 for Lead

Figure 4 illustrates the lead concentration verses time for groundwater samples collected from Monitoring Well 3070. Sampling in 1997 indicates that the concentration of lead in Monitoring Well 3070 was below the groundwater FRL for lead (0.015 mg/L). As with Monitoring Well 2733, this well was identified for additional sampling in the RAVS PSP because at the time that the first draft of the RAVS PSP was issued, the FRL for lead was 0.002 mg/L (based on background). Upon finalization of the RAVS PSP, the groundwater FRL for lead was changed from 0.002 mg/L to the Safe Drinking Water Act Action Level of 0.015 mg/L (DOE 1997c, Appendix C). Revision of the groundwater FRL for lead eliminated all but one detected lead FRL exceedance at this location. Therefore, in accordance with the protocol established in the approved RAVSs PSP no additional groundwater monitoring for lead is required in Monitoring Well 3070. Since the 1997 data indicate that lead concentrations are below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 3070.

Well 2424 for Manganese

Figure 5 illustrates the manganese concentration verses time for groundwater samples collected from Monitoring Well 2424. The groundwater sample collected in January of 1997 had a manganese concentration (1.33 mg/L) which was slightly above the groundwater FRL for manganese (0.9 mg/L). The concentration of manganese in all three of the remaining groundwater samples collected in 1997 was below the groundwater FRL for manganese. RAVS PSP data evaluation protocol states that if two or

more sampling events following an FRL exceedance indicate that the concentration is below the FRL, then the location will not be considered for further monitoring or remediation. Therefore, in accordance with the protocol established in the approved RAVS PSP no additional groundwater monitoring for manganese is required at Monitoring Well 2424. Since the 1997 data indicate that the last three sampling events in 1997 produced samples with manganese concentrations below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 2424.

Well 2436 for Manganese

Figure 6 illustrates the manganese concentration verses time for groundwater samples collected from Monitoring Well 2436. Sampling in 1997 indicates that the concentration of manganese in Monitoring Well 2436 was below the groundwater FRL for manganese (0.9 mg/L). Therefore, in accordance with the protocol established in the approved RAVSs PSP no additional groundwater monitoring for manganese is required in Monitoring Well 2436. Since the 1997 data indicate the manganese concentrations are below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 2436.

Well 2424 for Zinc

Figure 7 illustrates the zinc concentration verses time for groundwater samples collected from Monitoring Well 2424. Sampling in 1997 indicates that the last two samples collected from Monitoring Well 2424 in 1997 had zinc concentrations which were below the groundwater FRL for zinc (0.021mg/L). Therefore, in accordance with the protocol established in the approved RAVS PSP no additional groundwater monitoring for zinc is required in Monitoring Well 2424. Since the 1997 data indicate that the last two sampling events in 1997 produced samples with zinc concentrations below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 2424.

Well 3091 for Zinc

Figure 8 illustrates the zinc concentration verses time for groundwater samples collected from Monitoring Well 3091. Sampling in 1997 indicates that the concentration of zinc in Monitoring Well 3091 was below the groundwater FRL (0.021 mg/L). Therefore, in accordance with the protocol established in the approved RAVSs PSP no additional groundwater monitoring for zinc is required at Monitoring Well 3091. Since the 1997 data indicate the zinc concentrations are below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 3091.

Well 31217 for Zinc

Figure 9 illustrates the zinc concentration verses time for groundwater samples collected from Monitoring Well 31217. The concentration of zinc in the last three samples collected in 1997 was below the groundwater FRL for zinc (0.021 mg/L). Data evaluation protocol established in the RAVS PSP states that if two or more sampling events following an FRL exceedance indicate that the concentrations are below the FRL, then the location will not be considered for further monitoring or remediation. Therefore, in accordance with the protocol established in the approved RAVS PSP no additional groundwater monitoring for zinc is required at Monitoring Well 31217. Since the last three sampling events in 1997 had zinc concentrations below the groundwater FRL, there is no need to expand the aquifer restoration footprint to include the area around Monitoring Well 31217.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the groundwater data collected during 1997 to fulfill the RAVS PSP sampling requirements, and comparison of the 1997 data to the approved RAVS PSP data evaluation protocol, it is concluded that no additional groundwater monitoring is needed to satisfy RAVS PSP commitments, and that modification of the uranium based aquifer remedy is not warranted at this time.

At each of the locations monitored in 1997 (Monitoring Wells 2424, 2436, 2733, 3070, 3091, 3423, and 31217) for the RAVS PSP, two or more consecutive samples at each location had measured concentrations which were below the groundwater FRL for the FRL constituent of interest at that location (e.g., either antimony, lead, manganese, or zinc).

With completion of the RAVS PSP monitoring, future groundwater sampling will for the most part focus on the interior of the aquifer restoration footprint. However, the IEMP does outline continued monitoring of the property boundary wells, some of which are located outside of the aquifer restoration footprint. Figure 10 illustrates the location of the property boundary wells which will be monitored according to Section 3.0 of the Integrated Environmental Monitoring Plan (IEMP, DOE 1997c). Monitoring Wells 2424, 2733, 3070, and 31217 which were sampled for the RAVS PSP are also part of the Property Boundary Sampling Network defined in the IEMP. All four of the FRL constituents which were monitored for the RAVS PSP (antimony, lead, manganese, and zinc) are monitored in each of the property boundary wells.

Any FRL exceedances detected at a property boundary well location will be evaluated utilizing the same data evaluation protocol which was approved for the RAVS PSP in order to determine if additional action is required. Results of the ongoing monitoring and data interpretation at the property boundary wells will be communicated to the U.S. EPA and Ohio EPA using IEMP reporting deliverables.

5.0 REFERENCES

U.S. Dept. of Energy, 1996a, "Record of Decision for Remedial Actions at Operable Unit 5", Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1996b, "Remedial Design Work Plan for Remedial Actions at Operable Unit 5", Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997a, "Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997b, "Integrated Environmental Monitoring Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997c, "Restoration Area Verification Sampling Program, Project Specific Plan," Final, Fernald Environmental Management Project, U.S. Dept. of Energy, Fernald Area Office, Cincinnati, OH.

TABLE 1
ANALYTICAL RESULTS

FRL Constituent	Well #	Date Sample Collected	Value (mg/L)	Data Qualifiers[a]	
Antimony	3423	Jan 29, 1997	0.0007	U	
Antimony	3423	Apr 15, 1997	0.00045	U	
Antimony	3423	Apr 15, 1997	0.00045	U	Duplicate
Antimony	3423	Jul 28, 1997	0.00045	U	
Antimony	3423	Sep 23, 1997	0.00095	J	
Antimony	3423	Sep 23, 1997	0.0007	U	Duplicate
Lead	2733	Jan 10, 1996	0.001	U	
Lead	2733	Apr 10, 1996	0.0006	U	
Lead	2733	Jul 10, 1996	0.0024	J	
Lead	2733	Sep 10, 1996	0.0053	UJ	
Lead	2733	Jan 07, 1997	0.0004	U	
Lead	2733	Apr 02, 1997	0.001	U	
Lead	2733	Jul 08, 1997	0.001	UJ	
Lead	2733	Sep 18, 1997	0.001	U	
Lead	3070	Jan 09, 1996	0.001	U	
Lead	3070	Apr 08, 1996	0.0006	U	
Lead	3070	Jul 10, 1996	0.001	UJ	
Lead	3070	Sep 17, 1996	0.001	U	
Lead	3070	Jan 06, 1997	0.00047	U	
Lead	3070	Apr 01, 1997	0.001	U	
Lead	3070	Jul 08, 1997	0.001	UJ	
Lead	3070	Sep 16, 1997	0.001	U	
Manganese	2424	Jan 15, 1996	0.45	-	
Manganese	2424	Apr 08, 1996	2.22	J	
Manganese	2424	Apr 08, 1996	1.48	J	Duplicate
Manganese	2424	Jul 09, 1996	2.83	-	
Manganese	2424	Sep 09, 1996	0.845	-	
Manganese	2424	Sep 09, 1996	0.869	-	Duplicate
Manganese	2424	Jan 15, 1997	1.27	-	
Manganese	2424	Jan 15, 1997	1.33	-	Duplicate
Manganese	2424	Apr 02, 1997	0.611	J	
Manganese	2424	Apr 02, 1997	0.609	J	Duplicate
Manganese	2424	Jul 14, 1997	0.326	J	
Manganese	2424	Sep 15, 1997	0.526	-	

TABLE 1
(Continued)

FRL Constituent	Well #	Date Sample Collected	Value (mg/L)	Data Qualifiers[a]	
Manganese	2436	Jan 29, 1997	0.513	-	
Manganese	2436	Jan 29, 1997	0.521	-	Duplicate
Manganese	2436	Apr 15, 1997	0.64	-	
Manganese	2436	Jul 29, 1997	0.607	-	
Manganese	2436	Sep 23, 1997	0.694	-	
Zinc	2424	Jan 15, 1996	0.013	U	
Zinc	2424	Apr 08, 1996	0.0678	J	
Zinc	2424	Apr 08, 1996	0.0131	UJ	Duplicate
Zinc	2424	Jul 09, 1996	0.0914	-	
Zinc	2424	Sep 09, 1996	0.004	U	
Zinc	2424	Sep 09, 1996	0.004	U	Duplicate
Zinc	2424	Jan 15, 1997	0.0191	U	
Zinc	2424	Jan 15, 1997	0.0187	U	Duplicate
Zinc	2424	Apr 02, 1997	0.0154	UJ	
Zinc	2424	Apr 02, 1997	0.0476	J	Duplicate
Zinc	2424	Jul 14, 1997	0.0086	U	
Zinc	2424	Sep 15, 1997	0.0096	UJ	
Zinc	3091	Jan 29, 1997	0.004	U	
Zinc	3091	Apr 15, 1997	0.0051	U	
Zinc	3091	Jul 29, 1997	0.007	UJ	
Zinc	3091	Sep 23, 1997	0.0048	U	
Zinc	31217	Jan 09, 1996	0.013	U	
Zinc	31217	Apr 09, 1996	0.0065	U	
Zinc	31217	Jul 10, 1996	0.0054	U	
Zinc	31217	Sep 10, 1996	0.004	UJ	
Zinc	31217	Jan 14, 1997	0.0329	UJ	
Zinc	31217	Apr 02, 1997	0.0063	UJ	
Zinc	31217	Jul 15, 1997	0.004	UJ	
Zinc	31217	Jul 15, 1997	0.0044	UJ	Duplicate
Zinc	31217	Sep 15, 1997	0.0098	UJ	

[a]U = Result was less than the instrument detection limit. Analyte is undetected. Associated numerical value is the detection limit.
N = Matrix spike recovery associated with this result was outside of control limits of 75-125%; results should be considered estimates.
J = These data are considered quantitatively estimated, may be biased due to effects reflected in the associated QC results.
- = Indicates that the result is confident.

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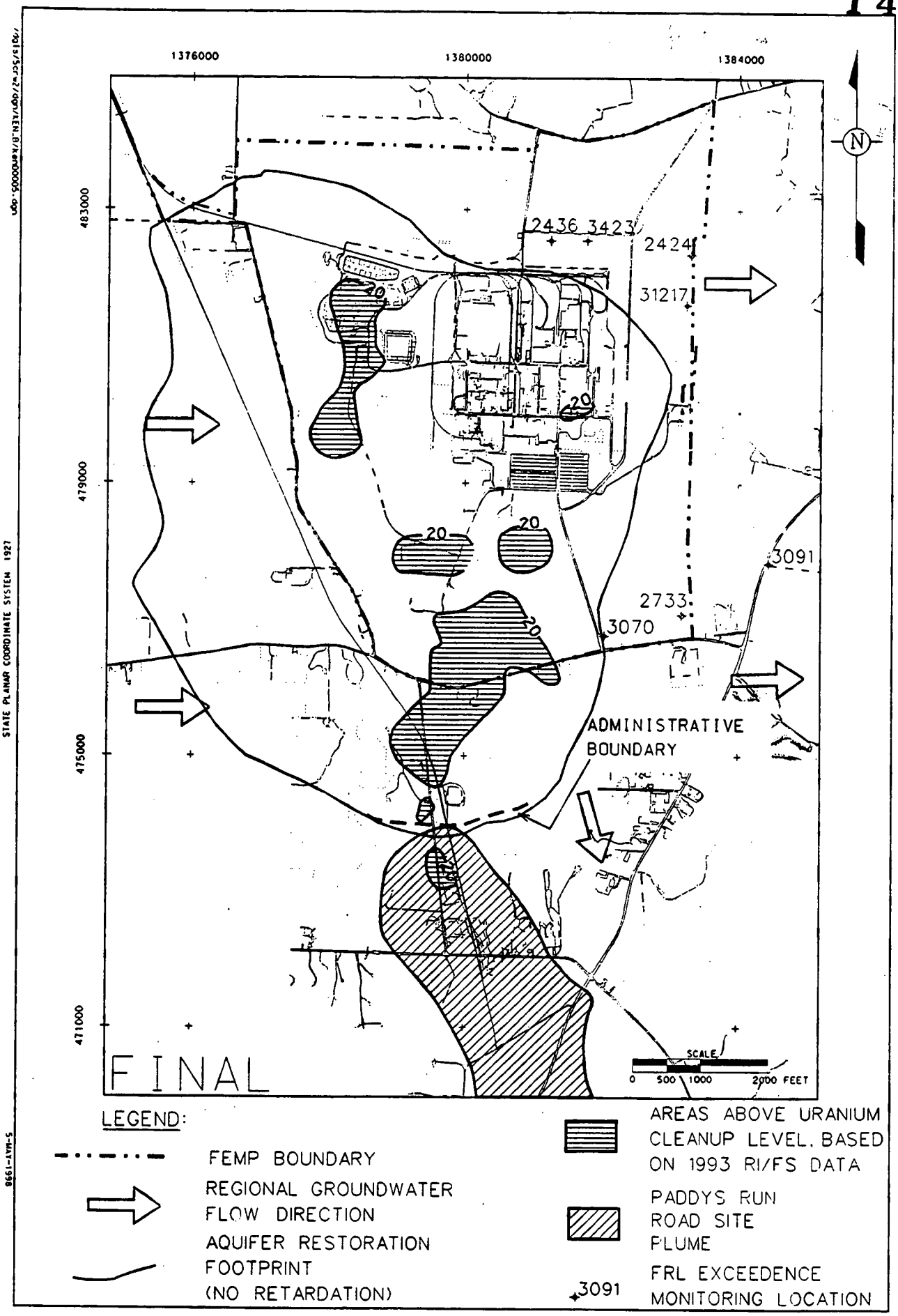

FIGURE 1. FRL EXCEEDANCE LOCATIONS TO BE MONITORED FOR THE RAVS PSP

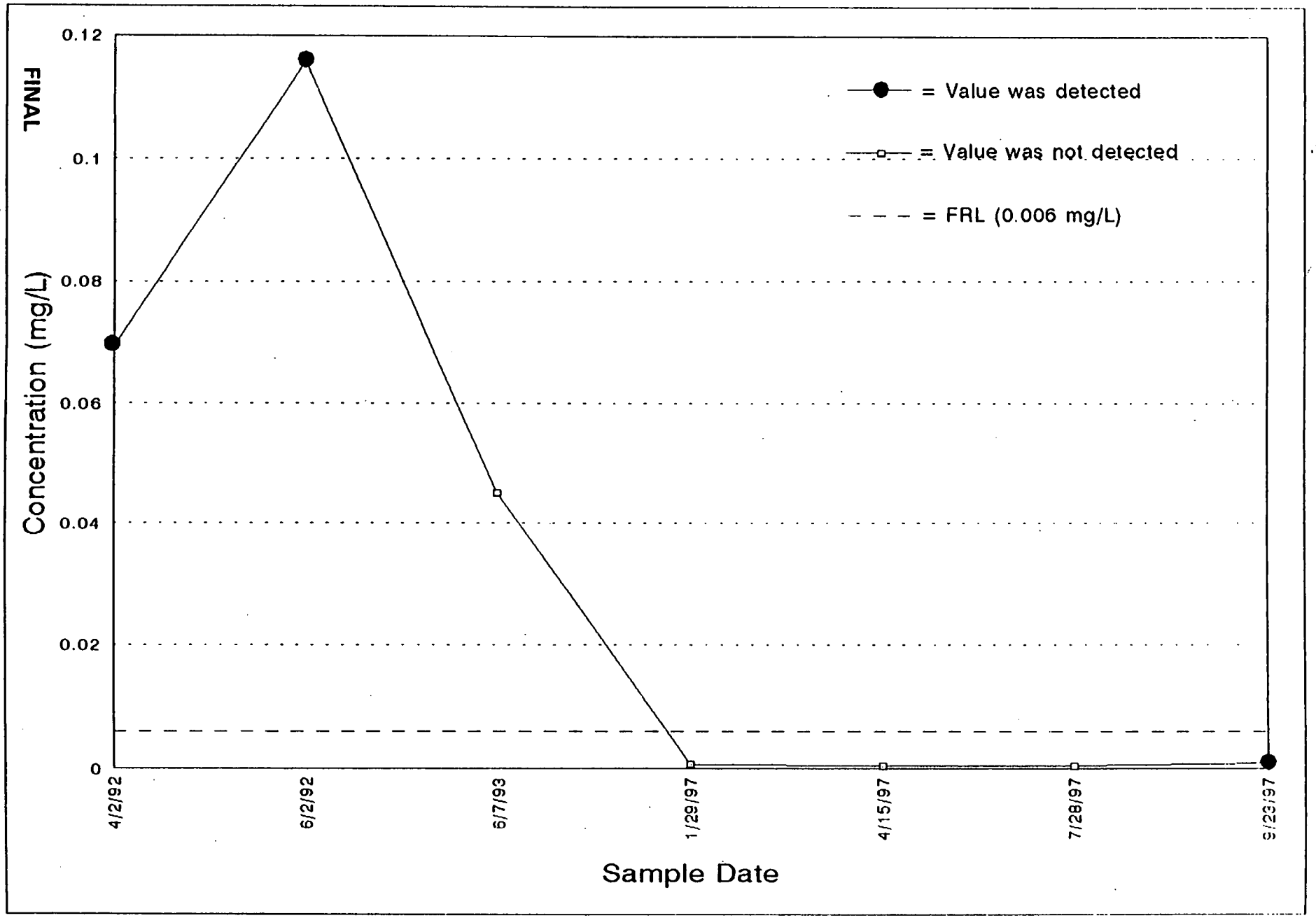

FIGURE 2. ANTIMONY CONCENTRATION VS. TIME, WELL 3423

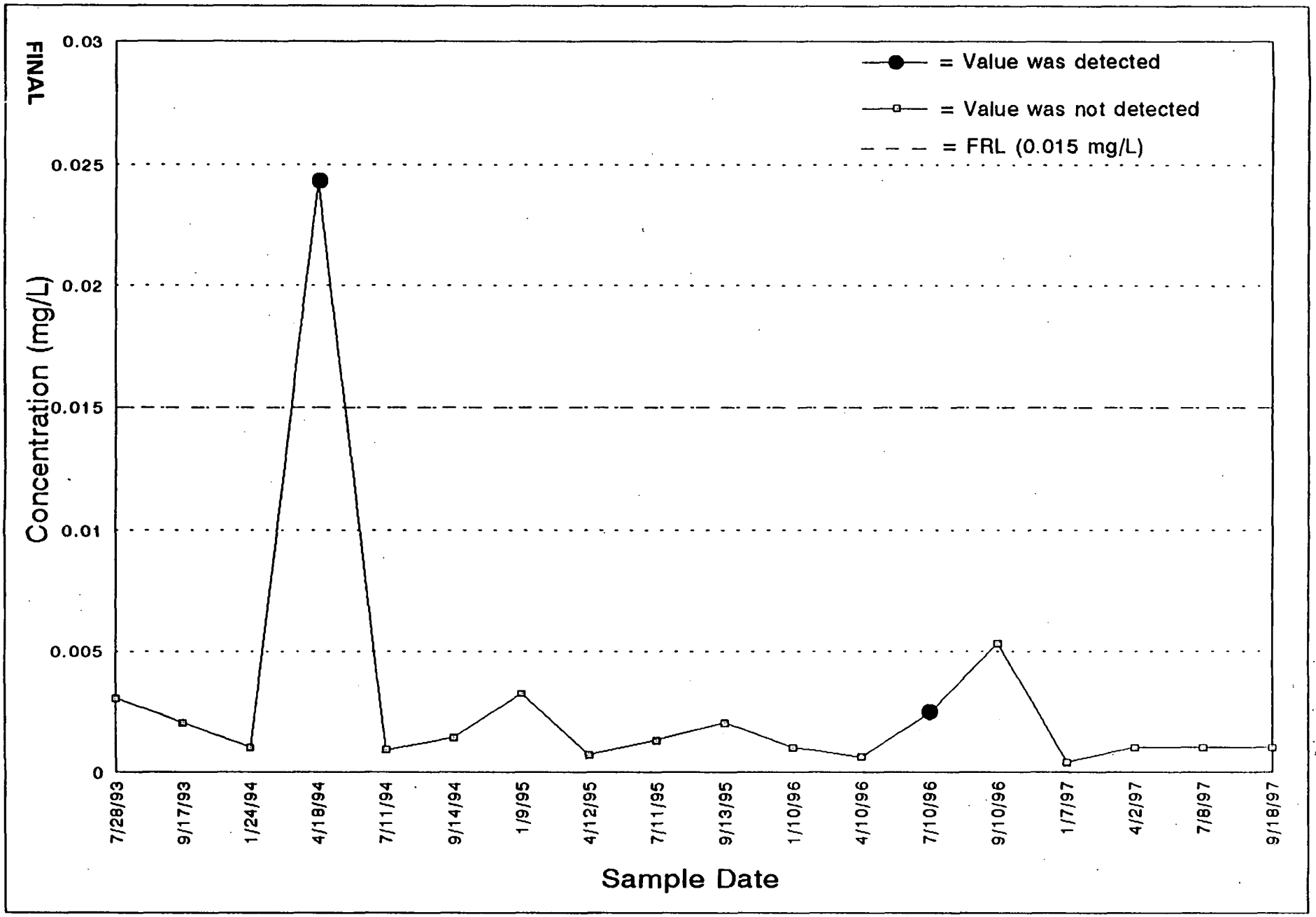

FIGURE 3. LEAD CONCENTRATION VS. TIME, WELL 2733

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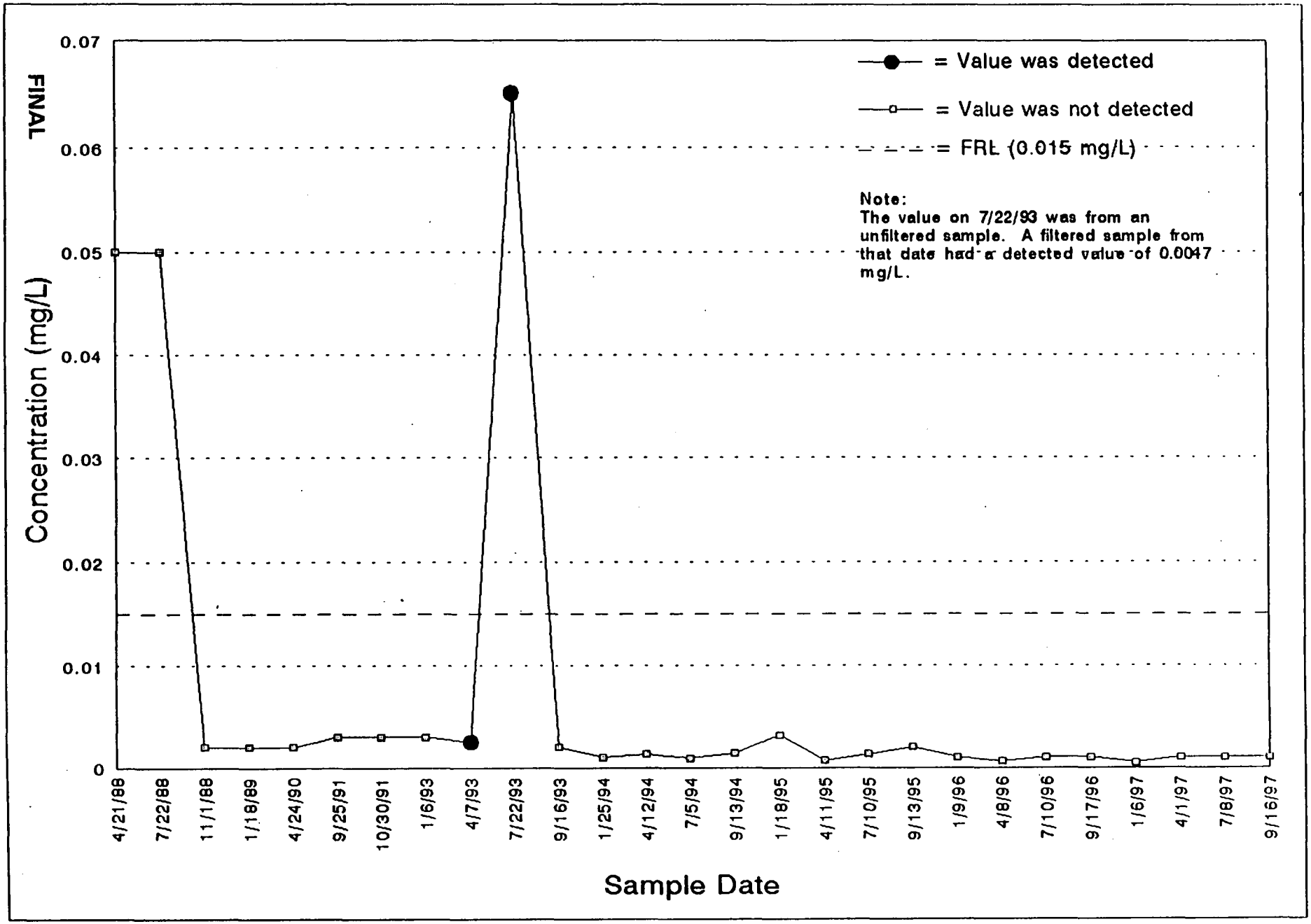

FIGURE 4. LEAD CONCENTRATION VS. TIME, WELL 3070

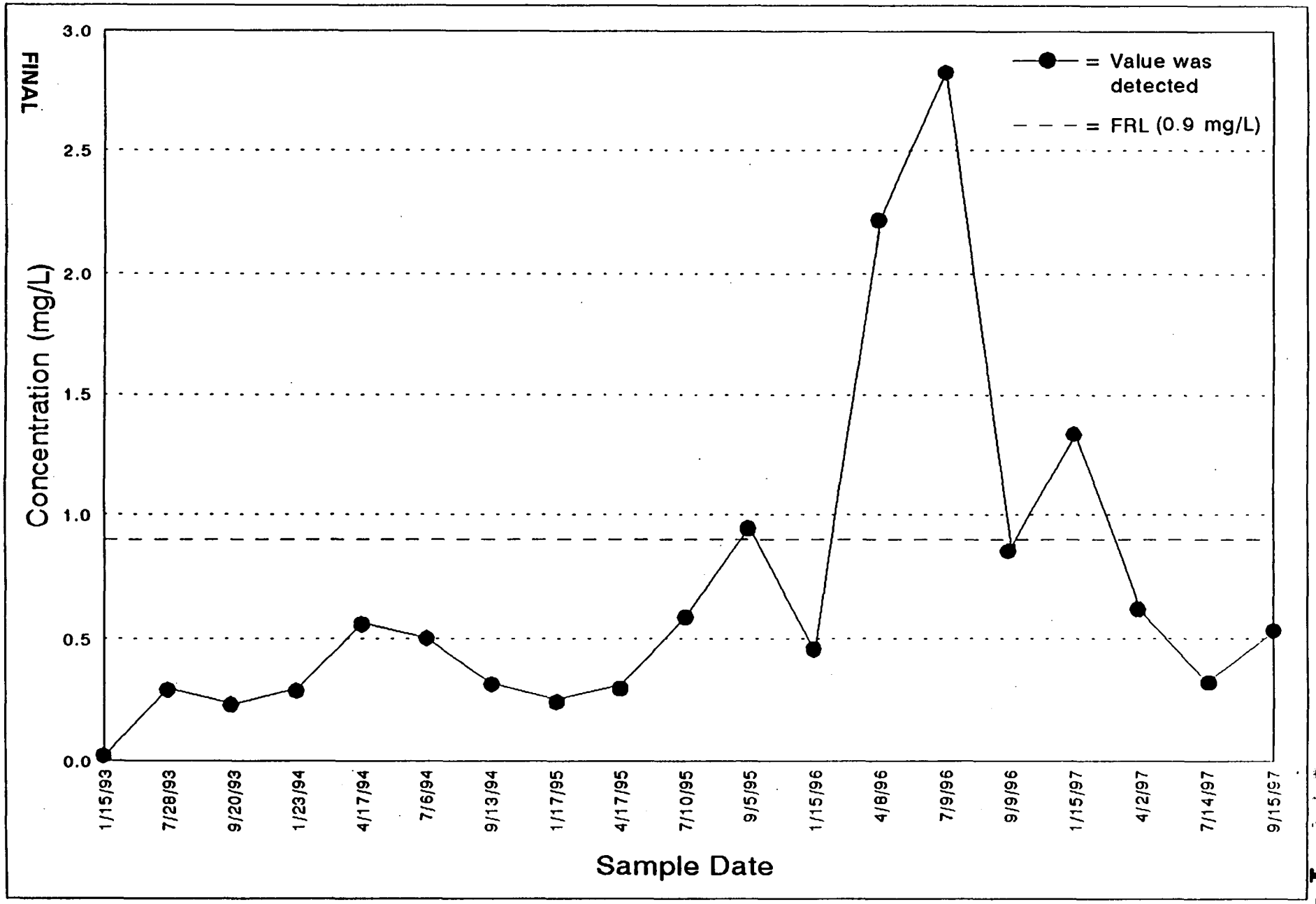

FIGURE 5. MANGANESE CONCENTRATION VS. TIME, WELL 2424

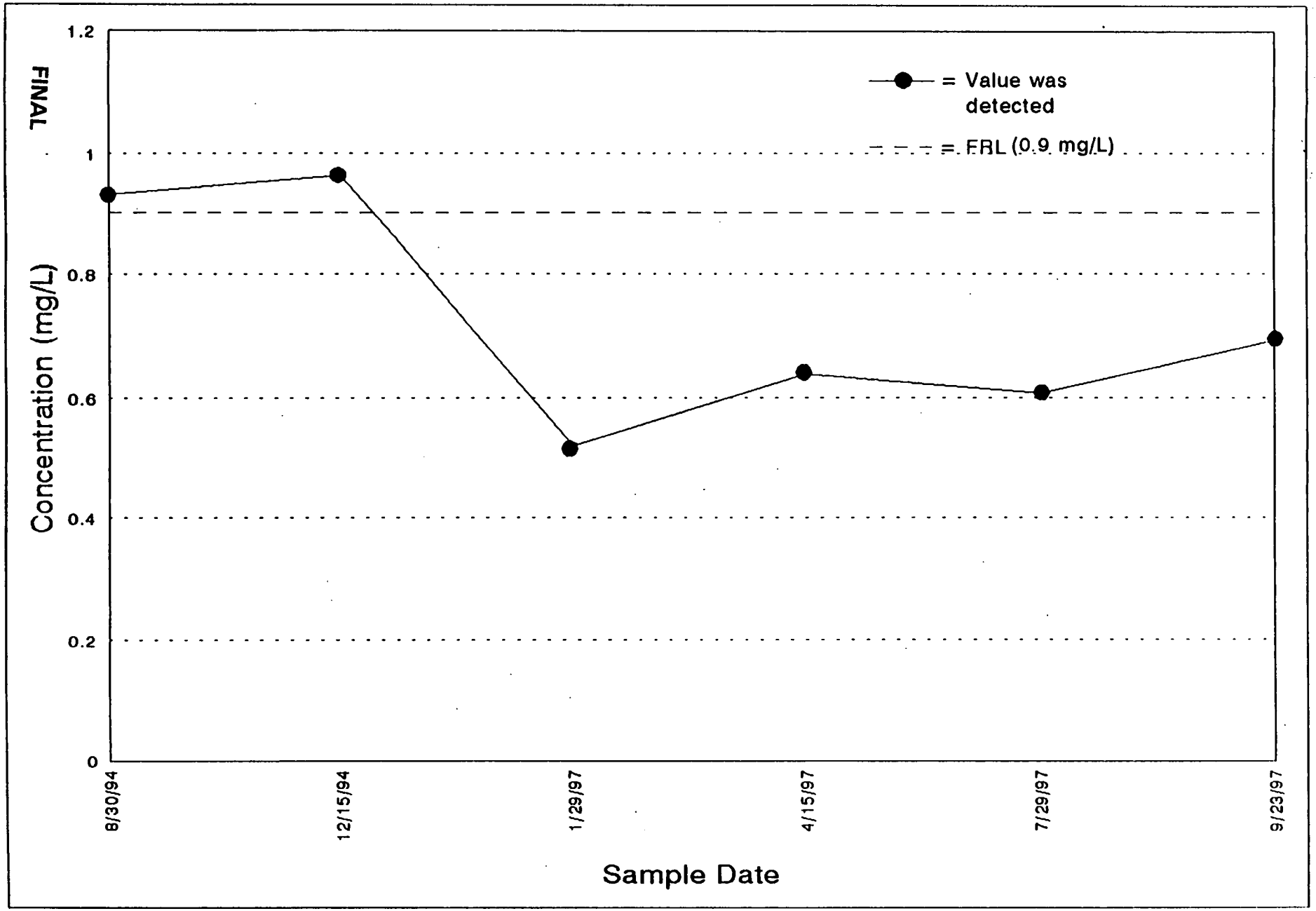

FIGURE 6. MANGANESE CONCENTRATION VS. TIME, WELL 2436

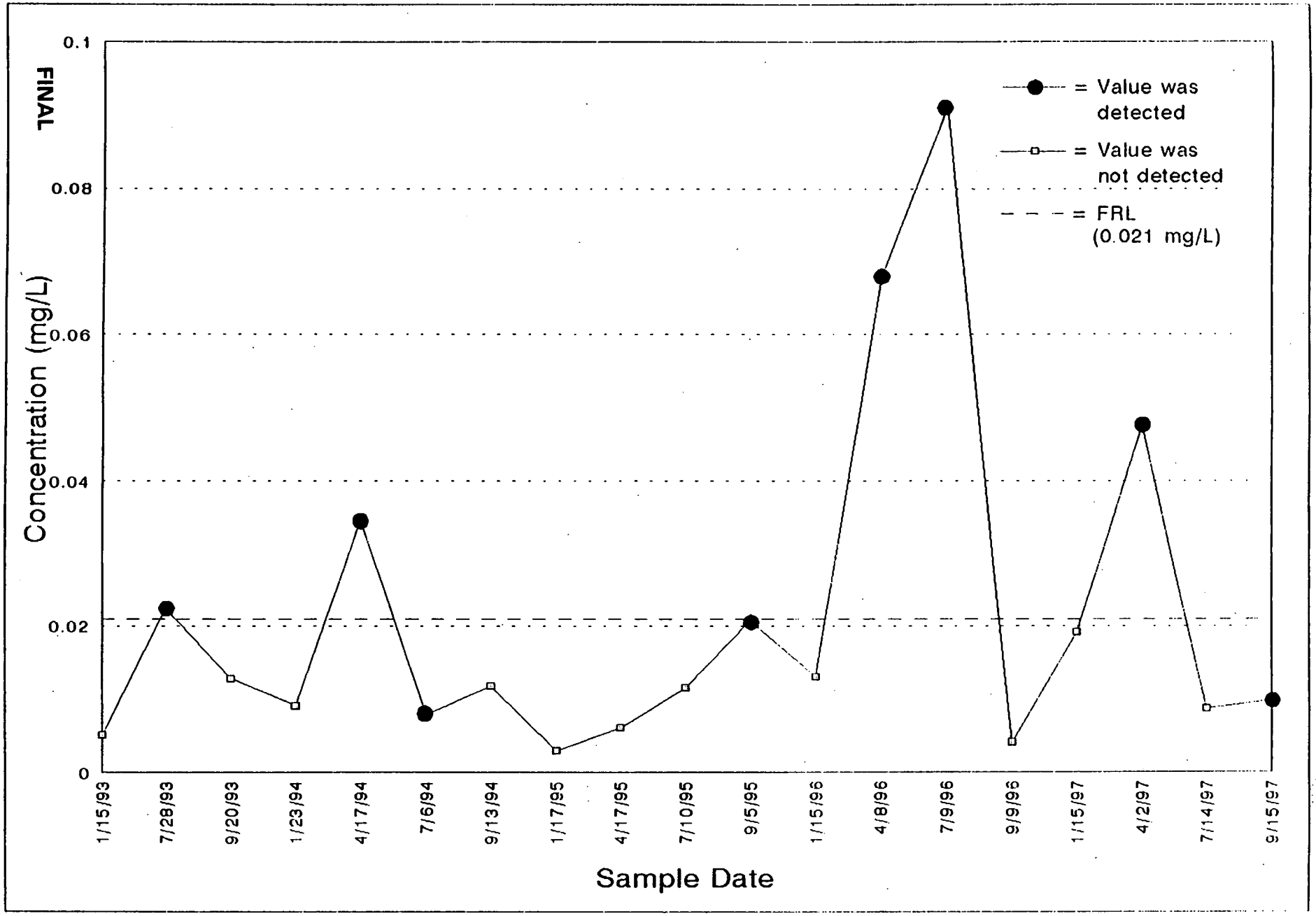

FIGURE 7. ZINC CONCENTRATION VS. TIME, WELL 2424

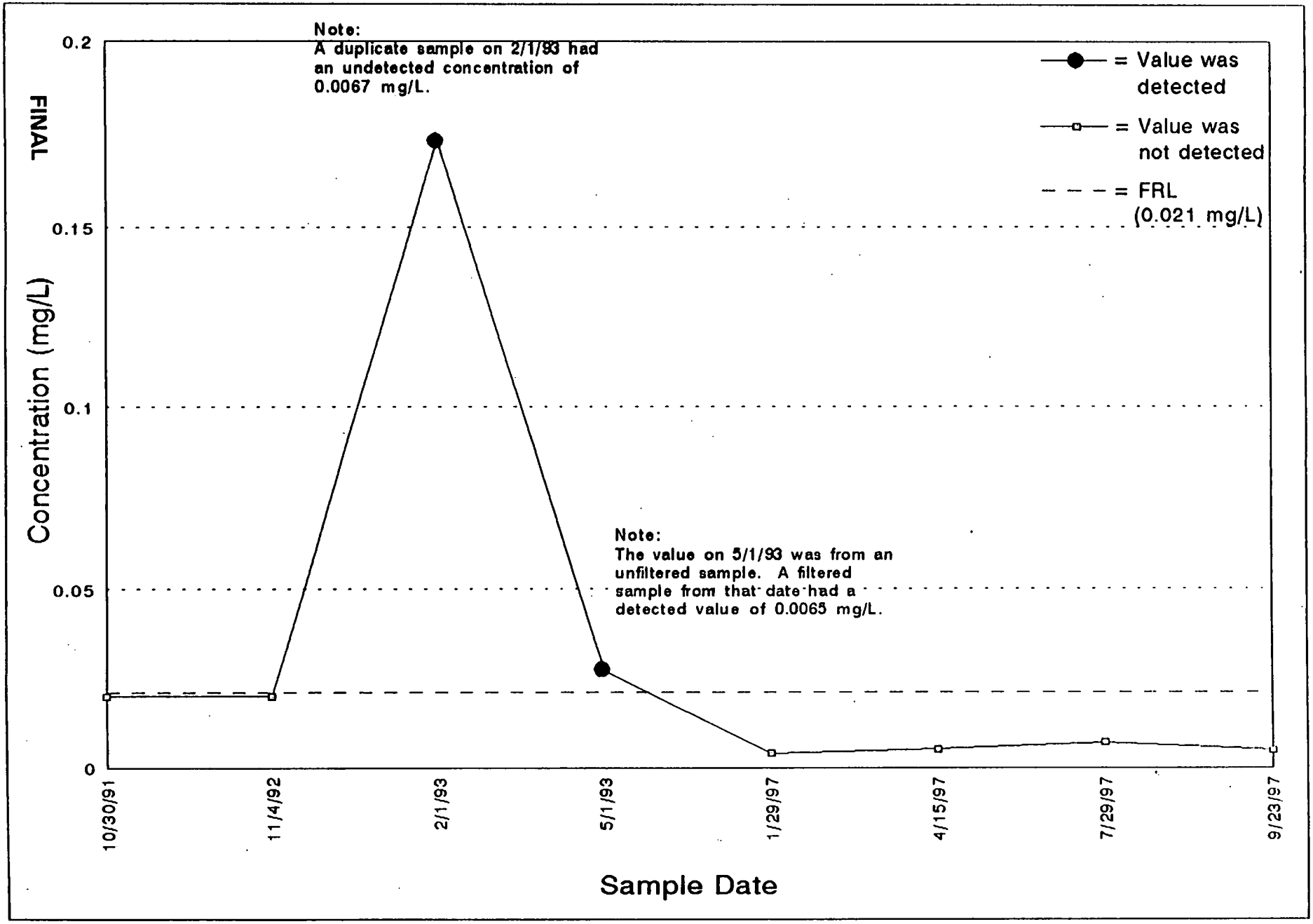

FIGURE 8. ZINC CONCENTRATION VS. TIME, WELL 3091

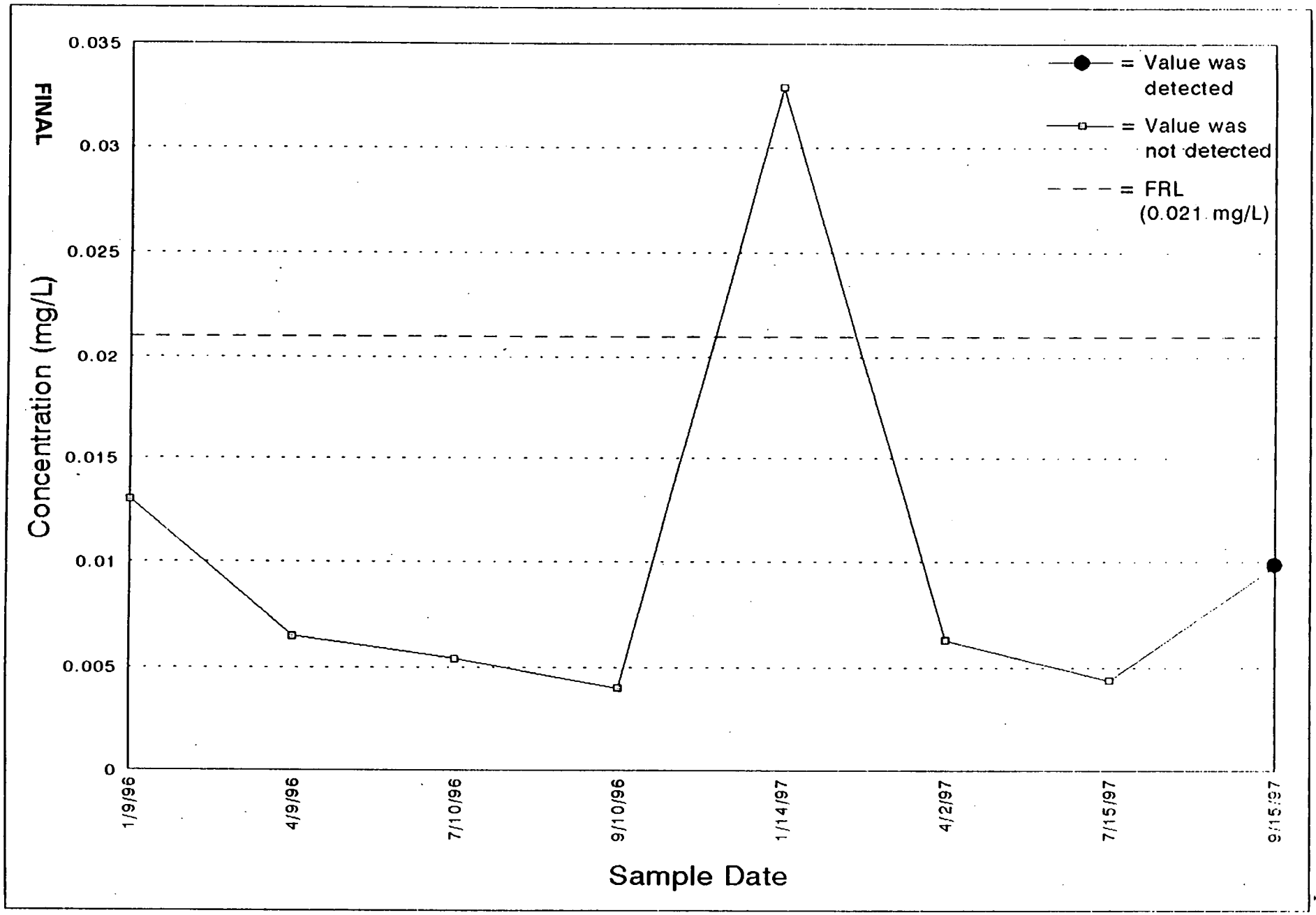

FIGURE 9. ZINC CONCENTRATION VS. TIME, WELL 31217

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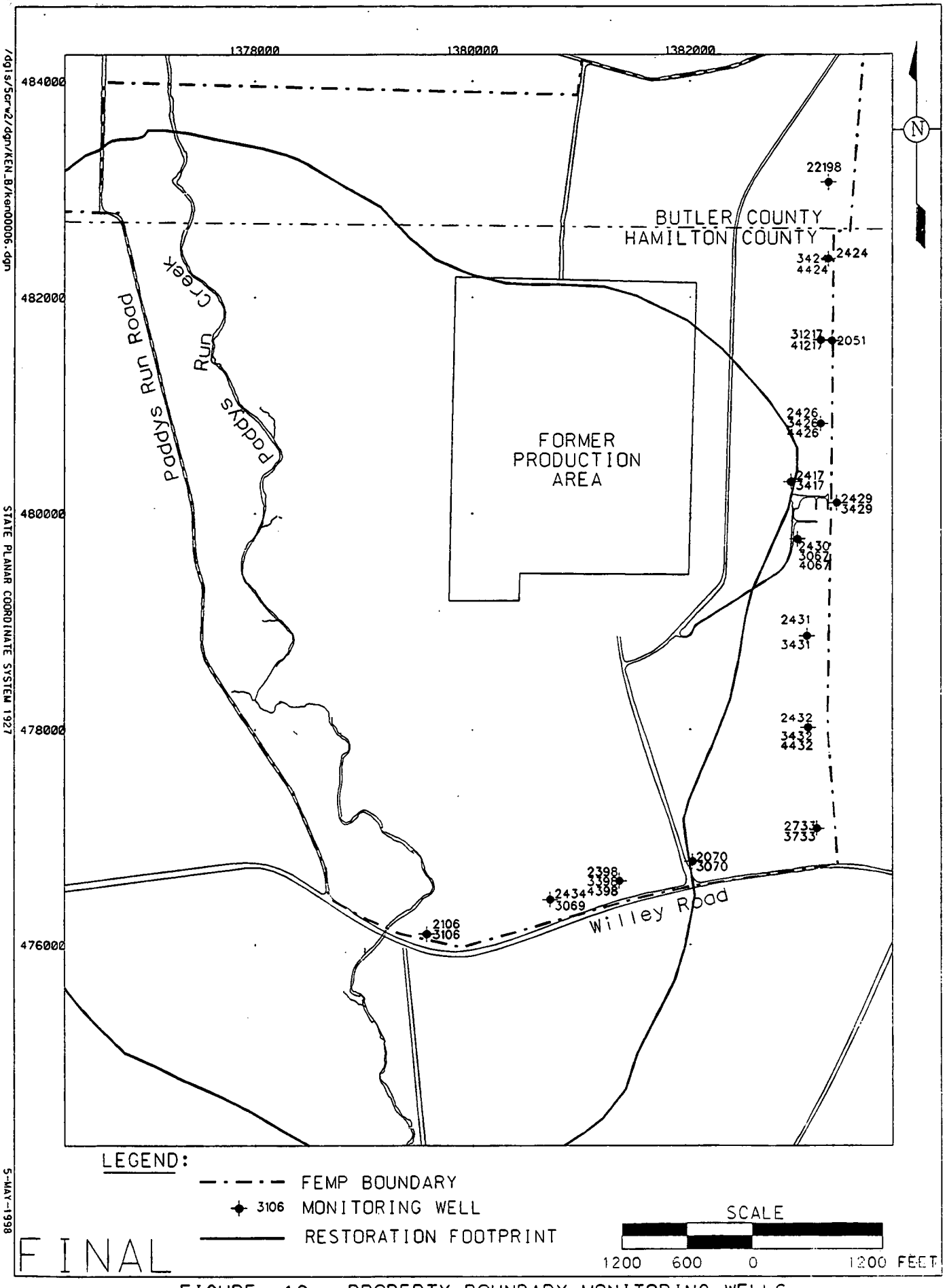

FIGURE 10. PROPERTY BOUNDARY MONITORING WELLS