ROCKY MOUNTAIN ARSENAL
NORTHWEST BOUNDARY CONTAINMENT / TREATMENT SYSTEM
OPERATIONAL ASSESSMENT REPORT

FY87

FINAL REPORT

by

Technical Operations Division
Program Manager, Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland 21010-5401

November 1988

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 11/00/88	3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE ROCKY MOUNTAIN ARSENAL, NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM, OPERATIONAL ASSESSMENT REPORT, FY87, FINAL REPORT	5. FUNDING NUMBERS
6. AUTHOR(S) THOMPSON, D., DILDINE, J., FRANCINGUES, N.	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ROCKY MOUNTAIN ARSENAL (CO.). PMRMA	8. PERFORMING ORGANIZATION REPORT NUMBER 89263R02
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES	
12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED	12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

THIS REPORT WAS PREPARED TO DOCUMENT AND ASSESS THE STATUS AND OVERALL OPERATIONAL PERFORMANCE OF THE NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM. IT COVERS THE PERIOD OCTOBER, 1986, THROUGH SEPTEMBER, 1987.

THE OBJECTIVES OF THE REPORT INCLUDE:

1. ASSESS THE CONTINUING EFFECTIVENESS OF THE NORTHWEST BOUNDARY SYSTEM IN PREVENTING OFF-POST MIGRATION OF CONTAMINATED GROUND WATER
2. DOCUMENT SYSTEM OPERATING PARAMETERS
3. IDENTIFY AND DOCUMENT SYSTEM IMPROVEMENTS, FIELD STUDIES, AND FACILITY ALTERATIONS CONDUCTED DURING FY87
4. IDENTIFY AND DOCUMENT OPERATIONAL IMPROVEMENTS THAT WILL ENHANCE LONG-TERM EFFECTIVENESS.

APPENDICES INCLUDE:

1. GEOLOGIC AND HYDROLOGIC PLATES
2. PLANT FLOW DATA

14. SUBJECT TERMS GROUNDWATER	15. NUMBER OF PAGES
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

Introduction

This report is the second in a set of reports prepared to document and assess the status and overall operational performance of the Northwest Boundary Containment/Treatment System (NWBS). The report covers the operating period from October 1986 to September 1987 (fiscal year 1987).

Monitoring Activities

Ground Water

The ground-water monitoring program conducted during FY87 consisted of the collection of water elevation data and water samples for chemical analysis to define water quality. The FY87 ground-water monitoring program was conducted as part of the Program Manager for Rocky Mountain Arsenal (PMRMA) remedial program activities at the arsenal. The basic monitoring program for FY87 was the regional program, that consisted of the RMA quantity/quality survey and the off post contamination assessment. The chemical analysis and water level data for the NWBS are maintained in special files on the PMRMA computer system. These data bases are the official record and were used as the primary source of information for the ground-water assessments.

Plant Operations

The treatment plant monitoring program included collection of data on flow rates through the system and on the quality of the water entering and leaving the plant. Flow data are collected on a daily basis and a log of plant operations is also maintained daily. The quality of the plant's influent and effluent waters were monitored by taking water samples on a weekly basis and analyzing them. The dewatering wells were sampled and analyzed on a quarterly basis.

Summary of Operational Effectiveness

The NWBS was designed to capture and remove organic contaminants, particularly dibromochloropropane (DBCP) from the ground-water to below maximum operating levels (see Table 4, page 34), so that ground-water down gradient of the system would not contain concentrations of contaminants in excess of acceptable levels (standards and criteria where available). In order to evaluate the system's ability to intercept and control ground-water flow, and to treat contaminants in this flow to an acceptable level, a system operational assessment was performed.

Ground-Water Flow and Evaluations

Ground-water levels did not change appreciably, although the NWBS flow rates declined during FY87. The flow rates for FY86 and FY87 are apparently near that required for system equilibrium since ground-water levels are stable over this period. A flow rate of 450 gpm to 550 gpm should maintain stable ground-water levels in the NWBS area for conditions similar to those of FY86 and FY87.

Contamination Control Operations

The NWBS is effectively reducing the off-post migration of contaminated ground-water in the alluvial aquifer. Historical data indicate a downward trend in contaminant concentrations down gradient of the system. The treatment system is effectively removing organic contaminants (DBCP, DIMP, DCPD, aldrin, endrin, dieldrin, and isodrin) from the influent to the system. The water being recharged contains no levels of the above mentioned organic concentrations above detectable levels. Chloride and fluoride are not removed by the treatment system.

Dewatering Well Contaminant Concentrations

Based on the contaminant concentration data collected for the dewatering wells during FY86 and FY87, it appears that the highest concentration of contaminants are generally found along the northeast end of the system. It should be noted that this is a relatively low flow area in the system resulting in an overall dilution of contaminant concentrations in the influent to the treatment system. In general, the contaminant distributions did not change significantly over the FY86-87 period. Many of the graphs indicate a slight decrease in contaminant concentrations during this period while a few show both increases and decreases associated with the same contaminant.

System Reliability

The operations and performance of the treatment plant was very good in FY87 with little downtime for repairs being reported. The NWBS has, in general, been very reliable. Downtime due to equipment failure has rarely exceeded a few hours. There were no major physical alterations to the NWBS during FY87.

Conclusions

Ground-water levels in the NWBS area are stable for FY87 and closely follow those of FY86. The ground-water contours indicate that, at current operating rates (FY87), the NWBS is effectively intercepting ground-water flow moving towards the system in the alluvium. The consistent and effective reverse gradient along the hydrological control portion of the system continues in FY87. Review of the data bases for the NWBS operational assessment has indicated a lack of sufficient ground-water definition and control to properly define geohydrology upgradient and immediately north of the system. Although some wells have been installed under the Task 25 contract, a need remains for additional monitoring of existing wells and installation of new monitoring wells for a comprehensive assessment of the operational effectiveness of the NWBS.

The NWBS is effectively reducing the off-post migration of contaminated ground-water in the alluvial aquifer. Historical data indicate a downward trend in contaminant concentrations down gradient of the system over the period of operation of the system. The treatment system is effectively removing organic contaminants (DBCP, DIMP, DCPD, aldrin, endrin, dieldrin, and isodrin) from the influent to the system. The water being recharged contains no levels of the above mentioned organic contaminants above detectable levels. Inorganic contaminants such as chloride and fluoride are not removed by the treatment system.

Based upon the data collected for the dewatering wells, the highest concentrations of contaminants are generally found along the northeast end of the control system. During FY86 and FY87, the concentrations of most of the contaminants decreased by varying degrees.

PREFACE

This study was conducted as part of a cooperative effort by personnel from the Technical Operations Division (TOD) of the Program Manager for Rocky Mountain Arsenal (PMRMA) and the U.S. Army Engineer Waterways Experiment Station (WES). Funding for participation by WES was provided by the PMRMA via Intra-Army Order No. 88-R-2. Mr. Brian L. Anderson served as Project Coordinator for the TOD. Project management was provided by Messrs. David W. Strang, TOD, Norman R. Francingues, WES Environmental Laboratory (EL) and James H. May WES Geotechnical Laboratory (GL).

This study is the second operational assessment of the Northwest Boundary Containment/Treatment System at Rocky Mountain Arsenal (RMA). The contributing authors to this report were Messrs. Douglas W. Thompson, Jack H. Dildine, Norman R. Francingues (WES-EL) and Paul Miller and William Murphy (WES-GL). The study and report were authorized by the Program Manager for Rocky Mountain Arsenal, COL Wallace N. Quintrell.

The authors acknowledge the support and assistance of the following people and organizations during this study: Mr. Bennie Washington, WES, Mr. Jack Pantleo, Mr. Jim Clark and Ms. Dianna Reynolds, D. P. Associates, and personnel of the Rocky Mountain Arsenal Information Center (RIC).

CONTENTS

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows.

Multiply	By	To Obtain
acre	4046.873	square metres
cubic feet	0.02831685	cubic metres
feet	0.3048	metres
feet per mile (U. S. statute)	0.1893936	metres per kilometre
gallons (U. S. liquid)	3.785412	cubic decimetres
horsepower (550 foot-pounds (force) per second)	745.6999	watts
inches	2.54	centimetres
miles (U. S. statute)	1.609347	kilometres
pounds (mass) per cubic foot	16.01846	kilograms per cubic metre
square feet	0.09290304	square metres
square miles	2.589998	square kilometres

NORTHWEST BOUNDARY CONTAINMENT/TREATMENT SYSTEM OPERATIONAL ASSESSMENT REPORT FY87

PART I: INTRODUCTION

Background

1. The Northwest Boundary Containment/Treatment System Operational Assessment described herein has been prepared to document and evaluate the geochemical and hydrologic parameters and treatment process performance related to the boundary system operations. This report covers the system operating period of FY87.

2. Ground-water contamination problems have existed in the area of the Northwest boundary since the mid 1950's, when investigations were conducted by the Army Corps of Engineers. In 1975, a ground-water surveillance program for RMA was established. This regional surveillance task included the monitoring of wells in the arsenal boundary areas. Since that time, several problem definition studies and design investigations have been conducted by RMA and the Corps of Engineers. Subsequently, a ground-water surveillance program was initiated in 1978 specifically for the Northwest boundary.

3. As a result of the ground-water investigations in 1980, several contaminants including DIMP, DBCP, chloride, endrin and dieldrin were detected in a narrow plume of ground water leaving the arsenal to the north and northwest. Additional studies by RMA and the Corps of Engineers lead to the design and construction of the Northwest Boundary Containment/Treatment Facility (NWBS) that was completed in October 1984. This was the third boundary ground-water contamination control system constructed and operated at RMA.

4. This report incorporates by reference major system descriptions and previous operations described in the report entitled "Northwest Boundary Containment/Treatment System Baseline Conditions, System Startup and Operational Assessment Report for FY85/86" (PMRMA 1987). The reader is directed to the basic report for detailed information concerning a complete physical description of the system. The basic report is catalogued at the Rocky Mountain Arsenal Information Center (RIC) library and is document number 88054R01.

Report Objectives

5. The objectives of this report are:

a. To assess the continuing effectiveness of the Northwest Boundary System (NWBS) in preventing the offpost migration of contaminated ground-water along the system alignment during the four quarters covering FY87.

b. To document system operating parameters.

c. To identify and document system improvements, field studies, and facility alterations conducted during FY87.

d. To identify and document operational improvements that will enhance long-term system effectiveness.

Approach

6. The Technical Operations Division (TOD) at Rocky Mountain Arsenal (RMA) established and provided the reporting framework and objectives, the data base and general technical guidance. The Waterways Experiment Station (WES), Vicksburg, Mississippi provided specialized environmental engineering and geotechnical assessments.

7. The study was conducted in three phases. Originally, data were retrieved and organized by the TOD and Rocky Mountain Arsenal Information Center (RIC). Next, WES and TOD personnel reviewed the data bases for completeness and then developed geotechnical and water quality assessments along with various system performance evaluations. During the course of study, several in-progress reviews and coordination working sessions were held at the RMA to facilitate exchange of information and to assure continuity and consistency in data interpretations and evaluations. Finally, the report was assembled from individual sections prepared by the various contributing authors.

Organization of Report

8. This report consists of one volume. The main text consists of five parts. Following the introductory part are four parts dealing with data collection, system operations, data evaluations for geologic, hydrologic and tre atment systems, and conclusions and comments. There are four appendices.

Appendix A contains all of the geologic and hydrologic plates referred to in the text. Appendix B, C, and D contain treatment plant flow data, treatment plant water quality data and dewatering well data respectively.

PART II: DATA COLLECTION

Ground-Water Monitoring

Background

9. Numerous ground-water monitoring programs have been conducted in the Northwest Boundary area between 1979 and 1987. Many of the early programs (1979-1983) consisted of hydrogeologic and ground-water contamination investigations that supported the problem definition studies and the design and construction of the NWBS. The need for a comprehensive monitoring program was recognized in late 1983 and a plan was prepared and implemented in 1984. The monitoring program consisted of the collection of water level and water quality data at selected sites on a consistent basis. This monitoring program was conducted by the Rocky Mountain Arsenal, Technical Operations Directorate, Environmental Division and continued through FY85.

10. The FY86 and FY87 monitoring programs were conducted by the Program Manager for Rocky Mountain Arsenal (PMRMA) as part of the remedial studies being conducted at RMA. Environmental Science and Engineering (ESE), Inc., a major remedial study contractor, developed the monitoring technical plans for Task 4, 6, 25, 36, 39, and 44 of the remedial investigations. ESE was also responsible for implementation of the monitoring programs performed under the directions of TOD of the PMRMA.

FY87 Monitoring Program

11. The FY87 ground-water monitoring program was conducted as part of the PMRMA remedial program activities at the arsenal. The data that were developed for the NWBS monitoring program, under the PMRMA, were produced as part of the remedial investigation and feasibility study by three separate tasks: Task 25 "Boundary Systems Monitoring," Task 39 "RMA Offpost Remedial Investigation/Feasibility Study," and Task 44 "Onpost/Offpost Ground/Surface Water Monitoring Program.

12. The basic ground-water monitoring program during FY87 was the regional program, that consisted of the RMA Water Quantity/Quality Survey and the Off Post Contamination Assessment. These programs were initiated at the beginning of FY86 and continued through FY87. Water quality was monitored at 363 alluvial and Denver formation sites under these programs. Forty-three of

the 363 wells were located off-post. Water level measurements were also taken at 863 Alluvial and Denver Formation wells located both on-post and off-post. Out of this regional monitoring effort, 45 sites consisting of 31 Alluvial and 14 Denver Formation wells, were monitored for water quality in the Northwest boundary area. Water level data from 117 alluvial and Denver Formation sites were also developed for both on-post and off-post wells. All monitoring done under Task 25 in the Northwest boundary area was conducted in sections 22 and 27 on-post and section 22 off-post.

13. The above described tasks used the same sampling and measurement protocols that were developed especially for the PMRMA program at RMA. These protocols are presented in the Task 25 technical plan, which is catalogued under document number 87014R24 at the RIC center located at RMA.

14. The monitoring was conducted by ESE and their subcontractors. Water samples were submitted to the ESE laboratories in Gainesville, Florida and Englewood, Colorado for the analysis of the contaminants listed in Table 1.

15. Data Management. The chemical analysis and water level data for the NWBS are maintained in special files on the PMRMA computer system. Laboratory and field data were entered into the data base by the RIC personnel or the task contractors, subjected to the data checking routines, validated and placed into the computer system. Data sets were prepared and then used to construct data tables, maps, and graphs used in this report.

Plant Operations Monitoring

16. The treatment plant monitoring program continued in FY87 and included collection of data on flow rates through the system and on the quality of the water entering and leaving the plant. The flow rates were recorded on a daily basis.

17. Samples are taken weekly from the interior of the adsorbers for process control. These data are used in determining when to change carbon within the adsorber. The quality of the plant's influent and effluent waters was

Table 1

Chemical Analysis

Analysis/Analytes	Maximum Hold Time	Level of Certification	Reference Methods	Method
Organochlorine Pesticides		Quantitative	EPA 608	CAP-GC/ECD
Aldrin	Extract as			
Endrin	quickly as			
Dieldrin	possible. (No			
Isodrin	more than 7 days).			
Hexachlorocyclopentadiene	Analyze within			
p,p'-DDE	40 days of			
p,p'-DDE	extraction.			
Chlordane				
Volatile Organohalogens		Quantitative	EPA 601	PACK-GC/Hall
Chlorobenzene	14 days			
Chloroform	14 days			
Carbon Tetrachloride	14 days			
trans-1,2-Dichloroethylene	14 days			
Trichloroethylene (TCE)	14 days			
Tetrachloroethylene	14 days			
1,1 Dichloroethylene	14 days			
1,1 Dichloroethane	14 days			
1,2 Dichloroethane	14 days			
1,1,1 Trichloroethane	14 days			
1,1,2 Trichloroethane	14 days			
Methylene Chloride	14 days			
Organosulfur Compounds		Quantitative		PACK-GC/FPD-S
P-Chlorophenylmethylsulfone	Extract as			
($PCPMSO_2$)	quickly as			
P-Chlorophenylmethylsulfoxide	possible. (No			
(PCPMSO)	more than 7 days).			
P-Chlorophenylmethylsulfide	Analyze within			
(PCPMS)	40 days of			
1,4-Dithiane	extraction.			
1,4-Oxathiane				
Dimethyldisulfide (DMDS)				

(Continued)

Table 1 (Concluded)

Analysis/Analytes	Maximum Hold Time	Level of Certification	Reference Methods	Method
DCPD/MIBK		Quantitative	EPA 608	CAP-GC/FID
Dicyclopentadiene/ Methylisobutylketone	Extract as quickly as possible. (No more than 7 days). Analyze extract within 40 days of extraction.			
DIMP/DMMP		Qualitative	EPA 622	PACK-GC/FPD-P
Diisopropylmethylphosphonate/ Dimethylmethylphosphonate	Analyze within 47 days of sampling.			
DBCP		Quantitative		CAP-GC/ECD
Dibromochloropropane	14 days			
Inorganics		Quantitative		
Arsenic	6 months		EPA 206	AA-Hydride Furnace
Chloride	28 days		EPA 300	Ion Chromatograph
Fluoride	28 days			
Sulfate	28 days			
Volatile Aromatics		Quantitative	EPA 602	PACK-GC/PID
Toluene	14 days			
Benzene	14 days			
Xylene (o-, m-, p-)	14 days			
Ethylbenzene	14 days			

Source: ESE, 1985.

Table 2

Chemical Analysis of Treatment Plant Samples

Analyte	FY 87 Quarters 1st	2nd	3rd	4th
Organochlorine Pesticides				
Aldrin	x	x	x	x
Endrin	x	x	x	x
Dieldrin	x	x	x	x
Isodrin	x	x	x	x
Hexachlorocyclopentadiene				x
p,p'-DDE				x
p,p'-DDT				x
Chlordane				x
Volatile Organohalogens				
Chlorobenzene				x
Chloroform	x	x	x	x
Carbon Tetrachloride	x	x	x	x
trans-1,2-Dichloroethylene				x
Trichloroethylene (TCE)	x	x	x	x
Tetrachloroethylene		x	x	x
1,1 Dichloroethylene				x
1,1 Dichloroethane				x
1,2 Dichloroethane		x	x	x
1,1,1 Trichloroethane				x
1,1,2 Trichloroethane				x
Methylene Chloride				x
1,2 Dichloroethylene	x	x	x	x
Organosulfur Compounds				
P-Chlorophenylmethylsulfone ($PCPMSO_2$)	x	x	x	x
P-Chlorophenylmethylsulfoxide (PCPMSO)	x	x	x	x
P-Chlorophenylmethylsulfide (PCPMS)	x	x	x	x
1,4-Dithiane	x	x	x	x
1,4-Oxathiane	x	x	x	x
Dimethyldisulfide (DMDS)				x
Benzothiazole				x
DCPD/MIBK				
Dicyclopentadiene/	x	x	x	x
Methylisobutylketone				x

(Continued)

Table 2 (Concluded)

Analyte	FY 87 Quarters 1st	2nd	3rd	4th
DIMP/DMMP				
Diisopropylmethylphosphonate/	x	x	x	x
Dimethylmethylphosphonate				x
DBCP				
Dibromochloropropane	x	x	x	x
Inorganics				
Arsenic				x
Chloride	x	x	x	x
Fluoride	x	x	x	x
Sulfate				x
Volatile Aromatics				
Toluene		x	x	x
Benzene				x
Xylene (o-, m-, p-)				x
Ethylbenzene				x

monitored by taking water samples on a weekly basis and analyzing them. Samples were also collected and analyzed for the dewatering wells on a quarterly basis. These samples were collected from ports located in the well pits.

18. All water samples were collected in previously cleaned, glass containers, sealed, and transported to the appropriate analytical laboratory at RMA or ESE for analysis. The parameters for which the plant samples were analyzed for during FY87 were presented in Table 2. All analyses were performed using standard methods. The sample analysis and flow data were entered into the analytical data base by laboratory personnel, subjected to a quality control routine, validated, and placed into the PMRMA data base by the RIC. Data sets were prepared for use in developing tables and figures. Copies of the plant flow and analytical data for FY87 are contained in Appendix B and Appendix C, respectively, of this report.

PART III: SYSTEM OPERATIONS

Operations Summary

19. A record of plant operations for the NWBS is maintained by RMA plant operating personnel with major events documented on a daily basis. The daily record contains information on the operations, maintenance activities, and repair of the treatment plant equipment and dewatering and recharge wells. The record also details other events such as plant downtime, equipment failure, and filter and carbon removal and replacement.

20. The operations and performance of the treatment plant were very good in FY87 with little downtime for repair being reported. During the 1st quarter of FY87, the treatment plant was out of operation for a total of 21 hours during two days in December for well repair. Approximately 3.5 hours of downtime were reported for the 2nd quarter for well repair and adsorber -- number 1 was down for 30.5 hours due to cycling problems. In the 3rd quarter of FY87, the treatment plant was down for one day during May to replace an effluent sump pump. The plant was down in June for several days when hydraulic pressure surges occurred due to malfunctioning sump pump level controllers. The surges pulsed the carbon beds causing carbon to plug the effluent filters and subsequently forcing RMA operating personnel to shut down the system. During the 4th quarter, the treatment plant was down for approximately 12 hours in late July due to a plugged filter and for a total of 25 hours over several days in September to conduct maintenance work on the dewatering wells. There were no major physical alterations to the NWBS during FY87.

System Flow Quantities

21. The quantity of flow through the treatment system is recorded on a daily basis. The flow data recorded for FY87 are presented in tabular form in Appendix B of this report. Graphs of weekly flow data for each adsorber and the effluent stream have been prepared and are presented in Figures 1 through 4. The treatment plant flow data were gathered on a weekly (7 day) basis beginning with the first day of the FY and continuing through the end of the FY.

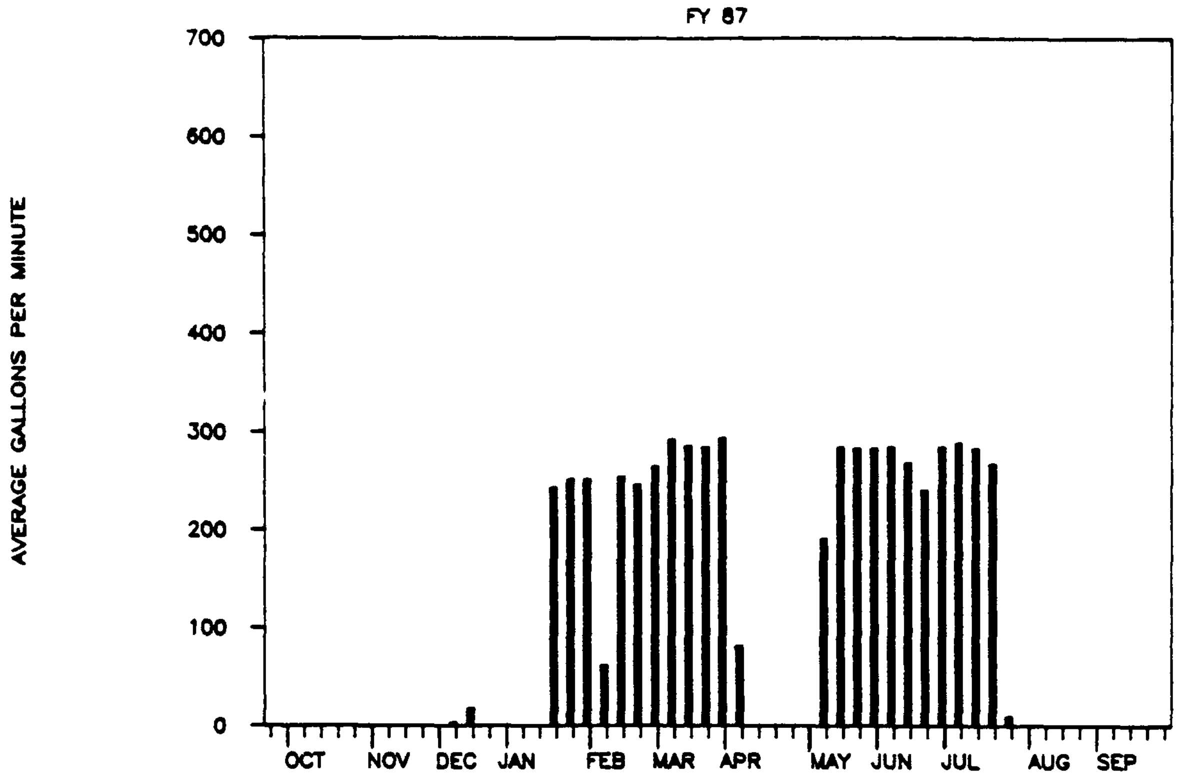


Figure 1. Adsorber 1 flow rate during FY87

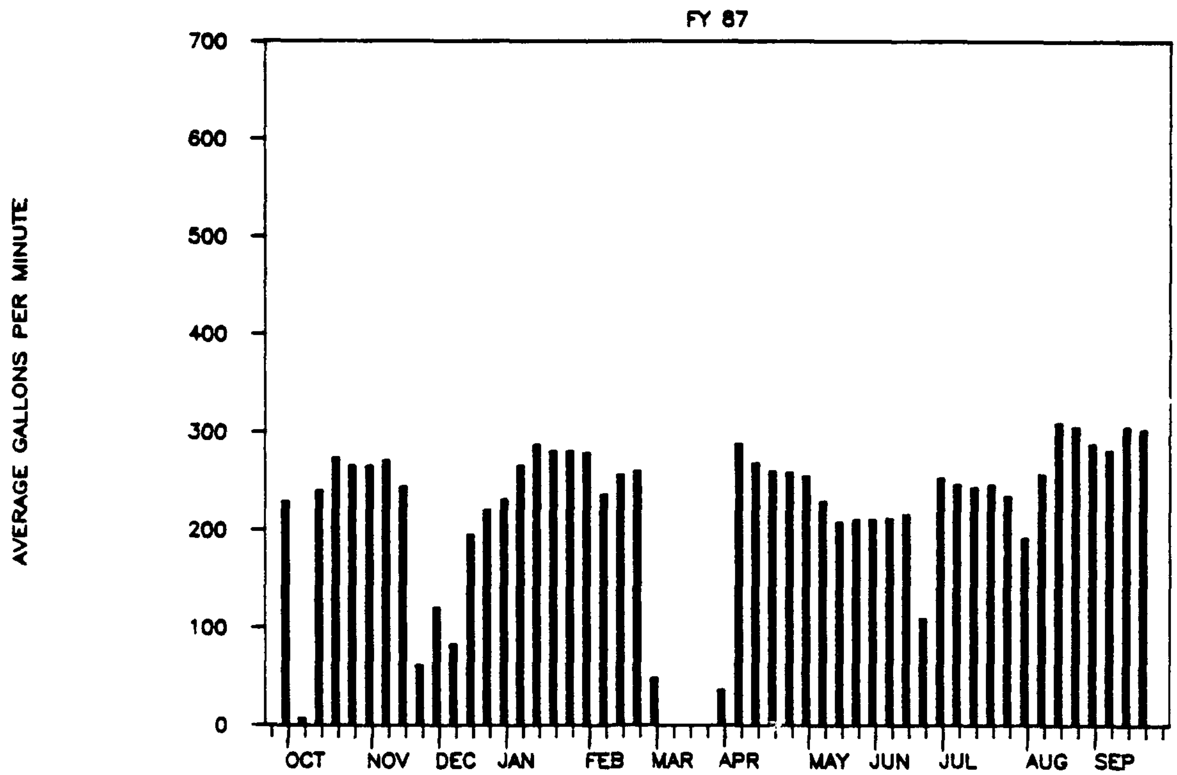


Figure 2. Adsorber 2 flow rate during FY87

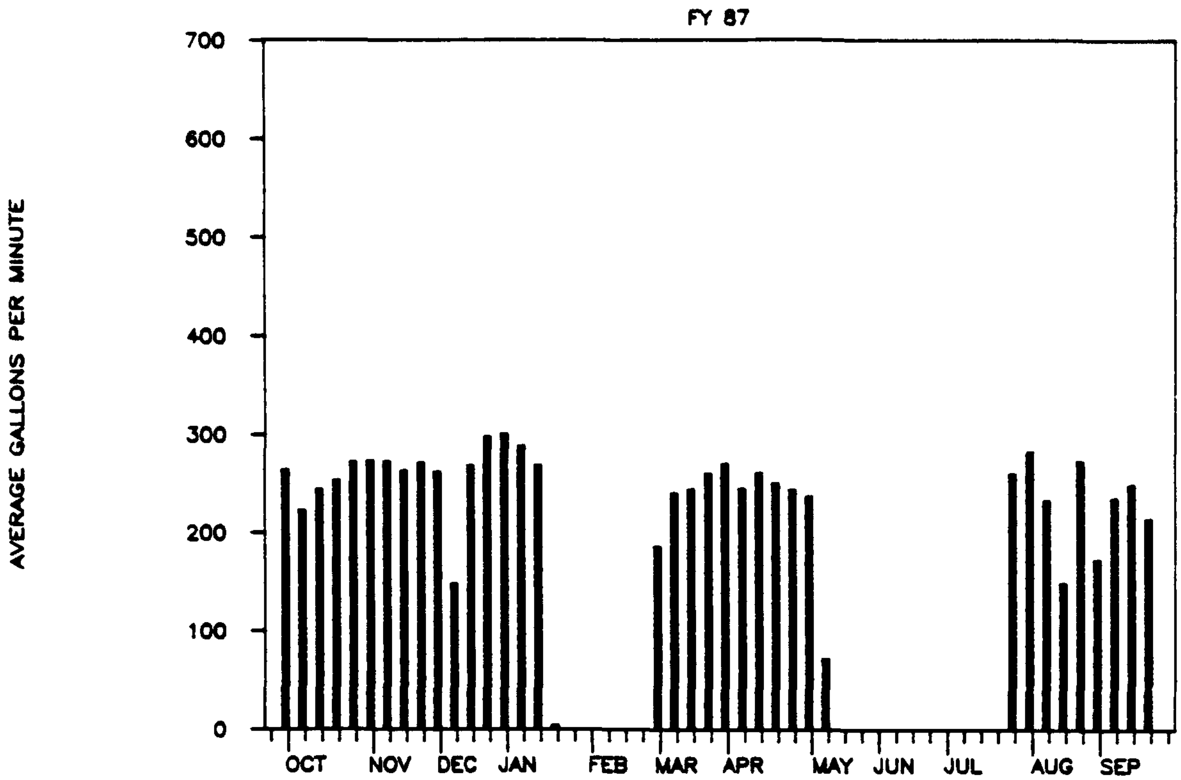


Figure 3. Adsorber 3 flow rate during FY87

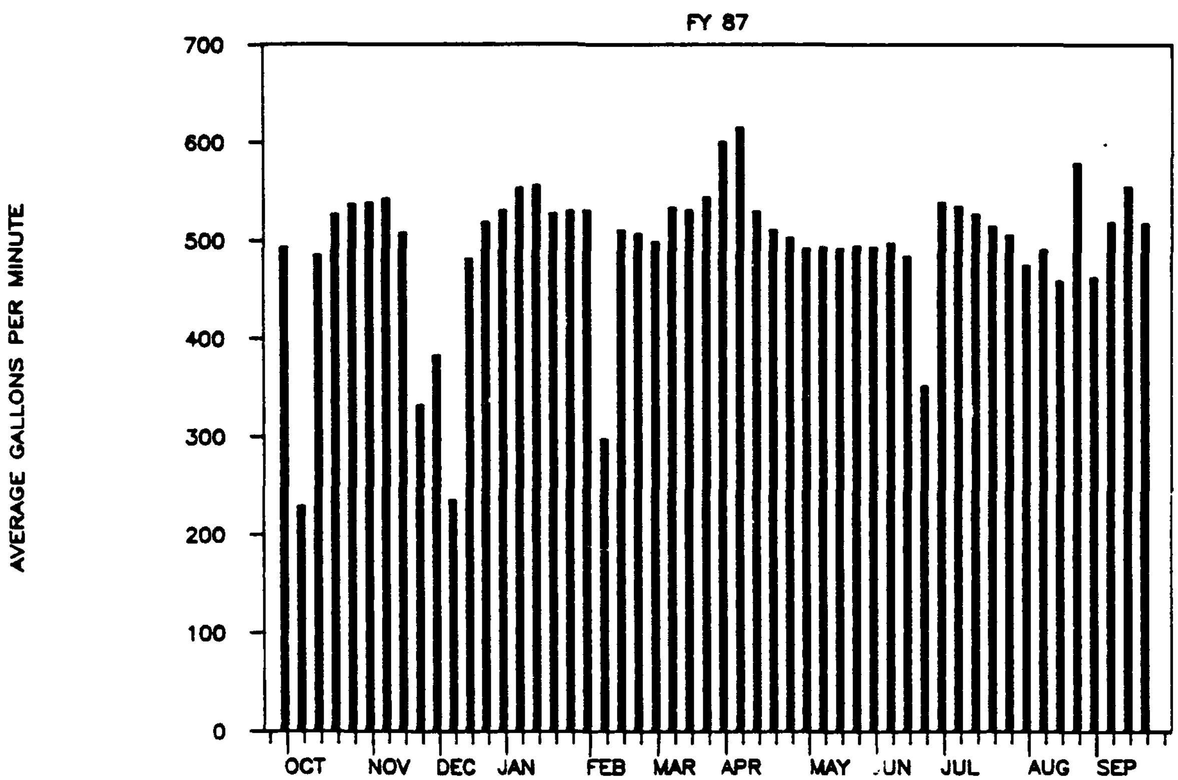


Figure 4. Effluent flow rate during FY87

22. As indicated in the graphs, periods of no flow were experienced for each of the adsorbers during various times of the year. The previously determined optimal dewatering/recharge rate of approximately 500 gpm can be maintained most effectively using two adsorbers in parallel (PMRMA 1987). The third adsorber is maintained in a standby status. During FY87, the total system flow rate (effluent) ranged from a low of 230 gpm to a high of approximately 610 gpm. Average adsorber and total flow rates and total gallons of water treated during FY87 are presented in Table 3. The total volume treated in FY87 was approximately 38.8 million gallons less than that treated in FY86. The average flow rate in FY87 was approximately 73 gpm less than that for FY86.

Table 3

FY87 System Flow Quantities

Adsorber	Average Flow Rate (gpm)	Total Volume Treated (gal)
1	111.75	58,532,000
2	214.69	112,998,000
3	168.83	88,564,000
Total Effluent	495.27	260,094,000

System Influent and Effluent Water Quality

23. The quality of the influent and effluent from the treatment system is monitored periodically by taking grab samples and analyzing them. A single sample was collected from the influent sump to determine the quality of water flowing to the adsorbers. A single sample was collected from the effluent sump after treatment.

24. The influent and effluent samples were analyzed for the contaminants listed in Table 2 of this report. Some of the analyses for certain contaminants were not conducted until late FY87. The chemical analysis data for the period October 1986 through September 1987 are presented in tabular form in Appendix C of this report. Graphs of the concentrations found for endrin, dieldrin, chloroform, trichloroethylene, tetrachloroethylene, 1,2 dichlorethylene, DCPD, DIMP, DMMP, DBCP, arsenic, chloride, fluoride, sulfate,

and toluene over the reporting period (FY87) have been constructed and are presented in Figures 5 through 19. No concentrations of the other contaminants analyzed for in Table 2 in excess of their respective detection levels were found in the samples collected during FY87. Therefore no graphs were constructed for these undetected contaminants.

25. A separate graph has been constructed for each contaminant detected in the plant influent and effluent. Each graph presents a plot of the contaminant concentration reported and three lines indicating the detection level, the maximum operating limit (MOL) permitted, and the average concentration over the FY where sufficient data above detection levels were available to calculate an average. The MOL used in this report is defined as the water quality criterion against which the operating performance of the treatment plant is compared in order to assess treatment effectiveness for the various contaminants of concern. A list of the MOL's used during the FY87 operational assessment is presented in Table 4.

Endrin

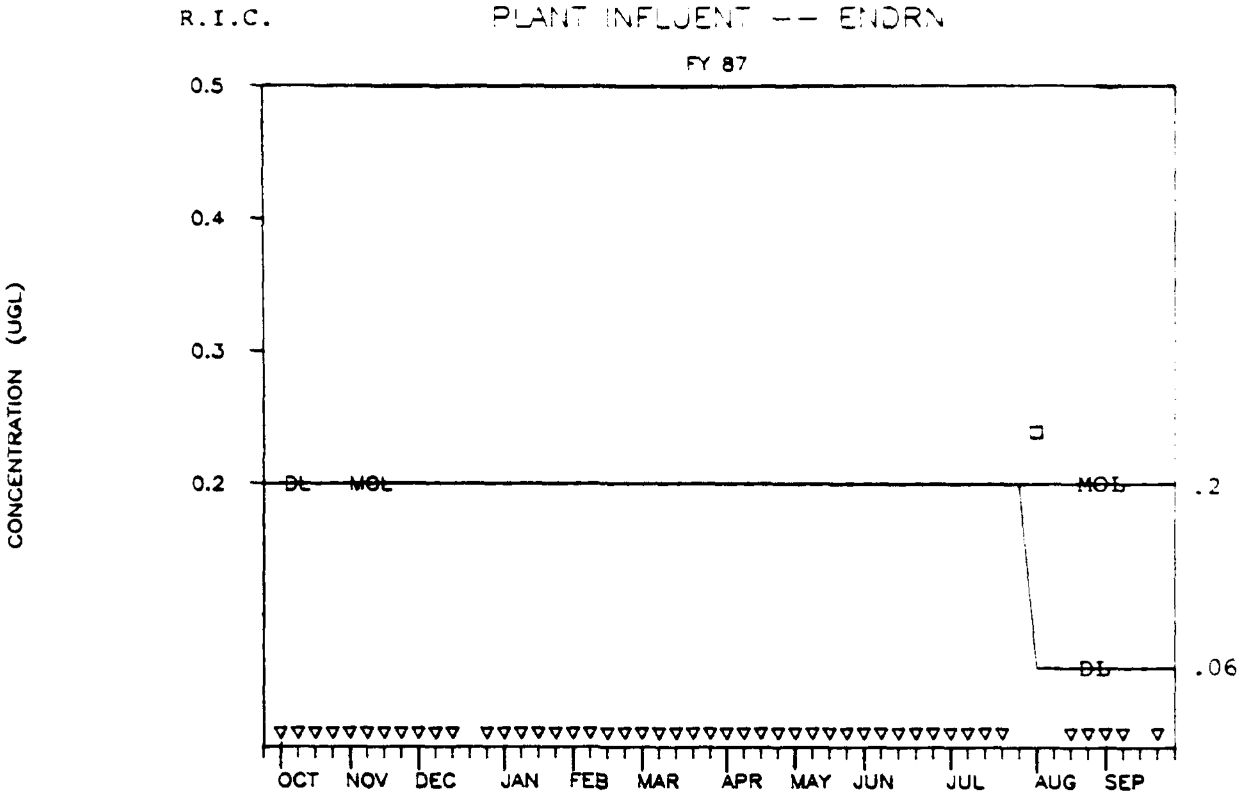
26. The detection level for endrin (Figure 5) in FY87 was 0.2 ppb until the middle of the 4th quarter when it was lowered to 0.06 ppb. The MOL for the NWB treatment plant was 0.2 ppb. A single sample of the plant influent collected in FY87 was found to contain endrin above the detection level at approximately 0.23 ppb. No concentrations above the detection level were found in the plant effluent.

Dieldrin

27. The detection level for dieldrin (Figure 6) in FY87 was 0.2 ppb until the middle of the 4th quarter when it was lowered to 0.054 ppb. The MOL for the NWB treatment plant was 0.2 ppb. The concentrations of dieldrin found in the plant influent ranged from the detection level to approximately 0.58 ppb. The average concentration for FY87 was 0.33 ppb. A single sample of the plant effluent collected in FY87 was found to contain dieldrin above the detection level at approximately 0.22 ppb.

Chloroform

28. The detection level for chloroform (Figure 7) in FY87 was 1.0 ppb. No MOL was established. The concentrations of chloroform found in the plant influent ranged from the detection level to a high of 60 ppb with the highest concentration found during the 1st quarter. The average concentration for FY87 was 15.56 ppb. The concentration found in the plant effluent ranged from



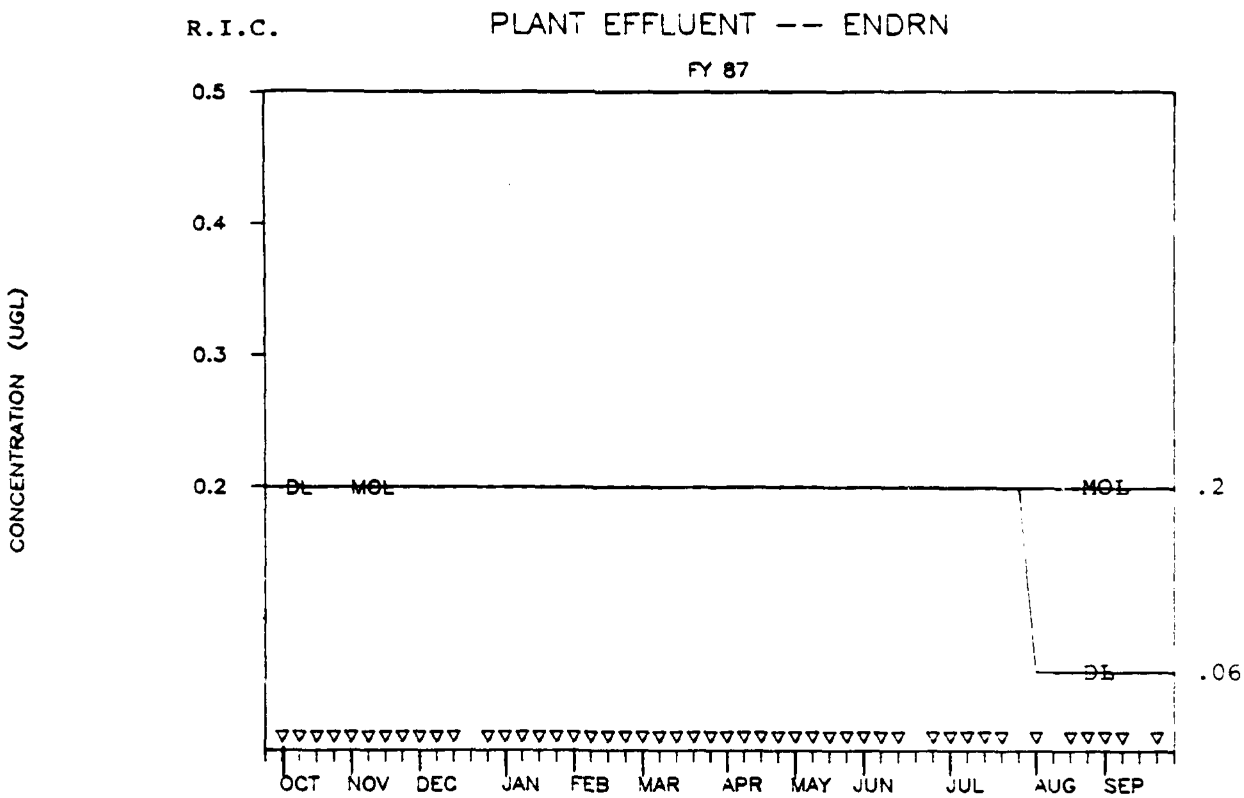
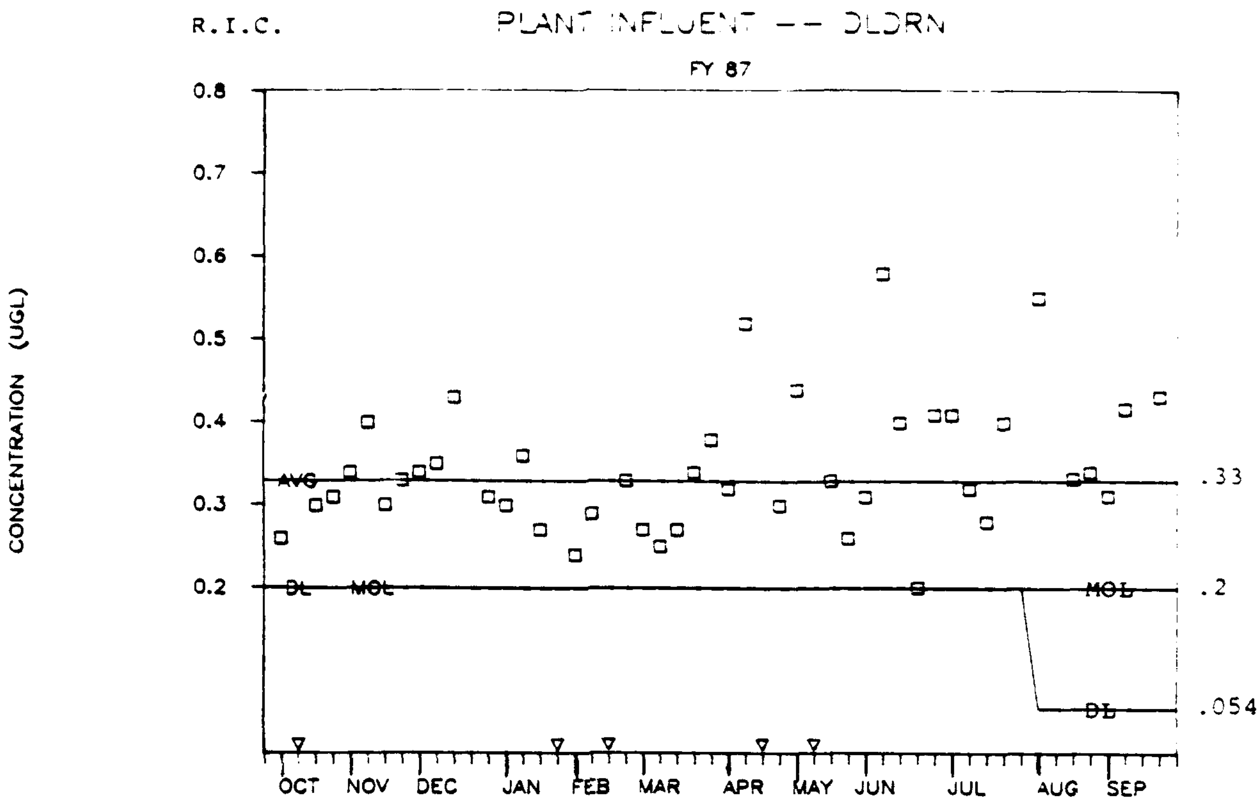


Figure 5. FY87 Endrin



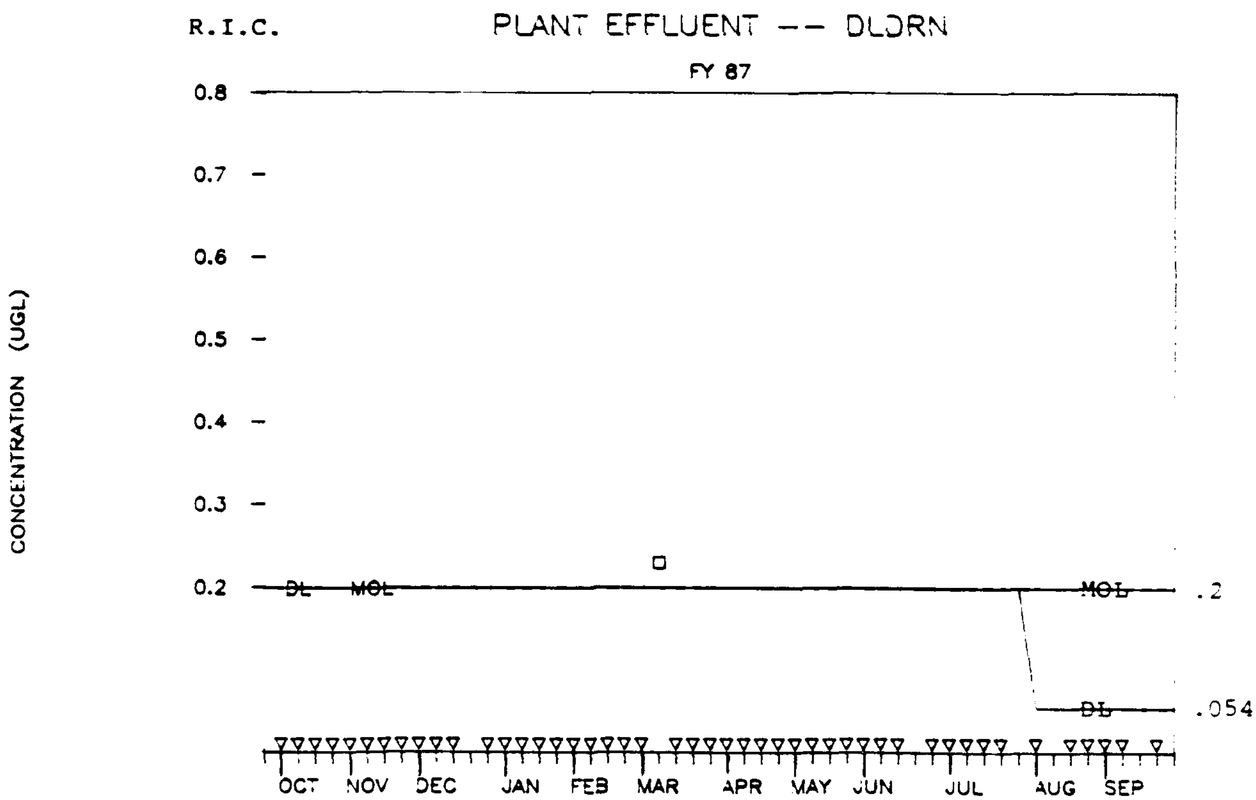
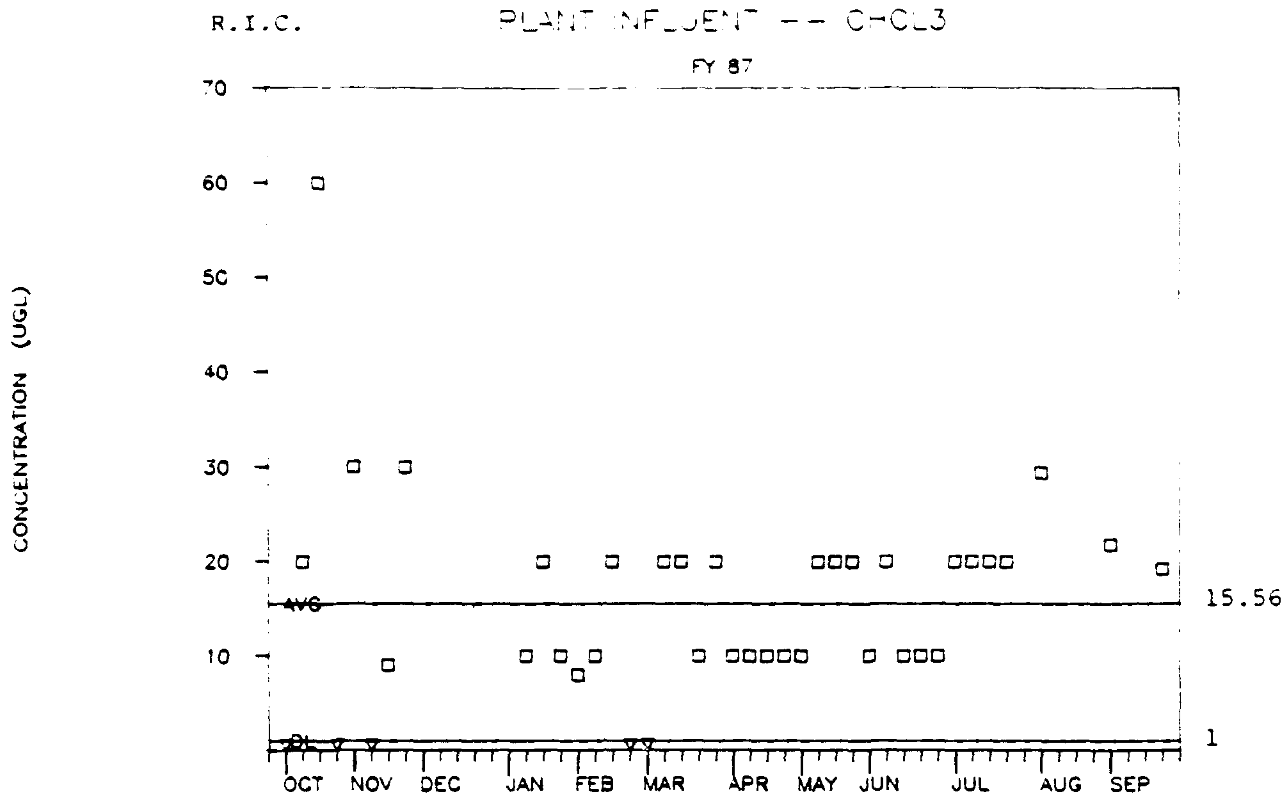


Figure 6. FY87 Dieldrin



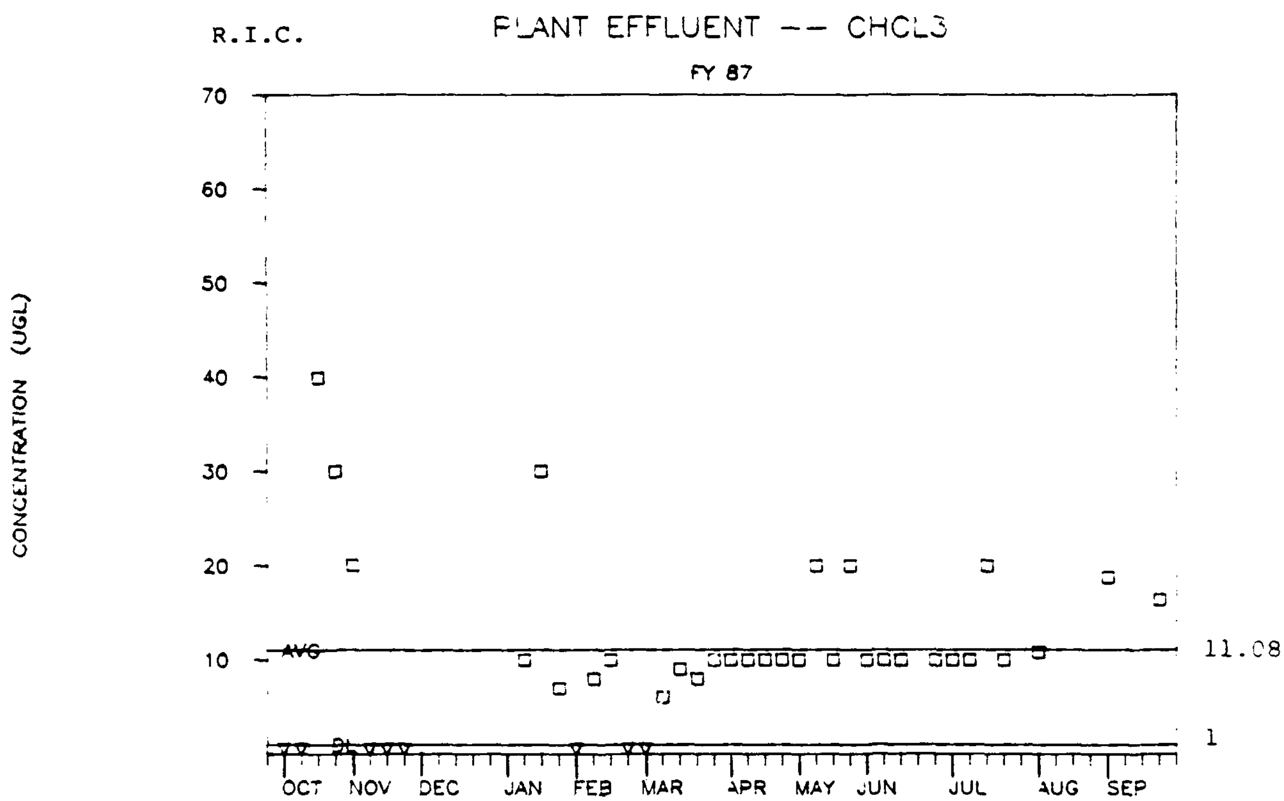
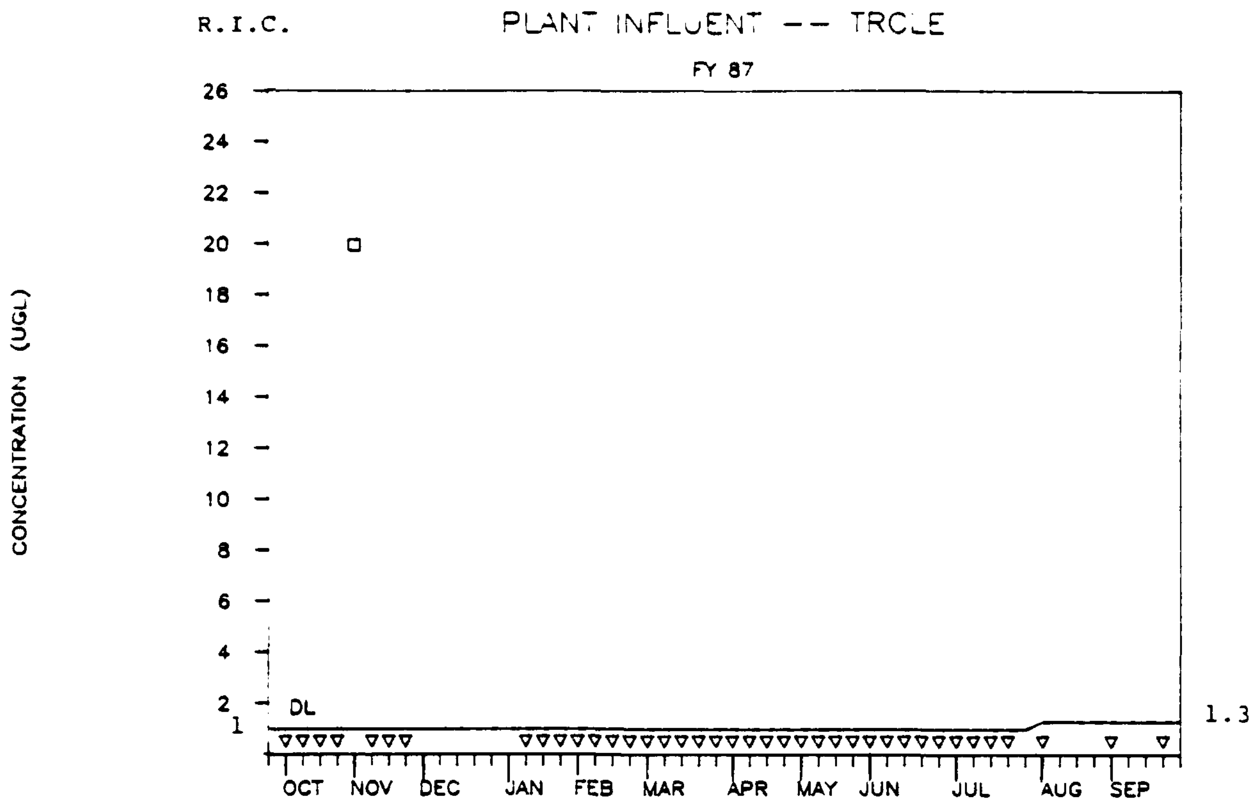


Figure 7 . FY87 Chloroform



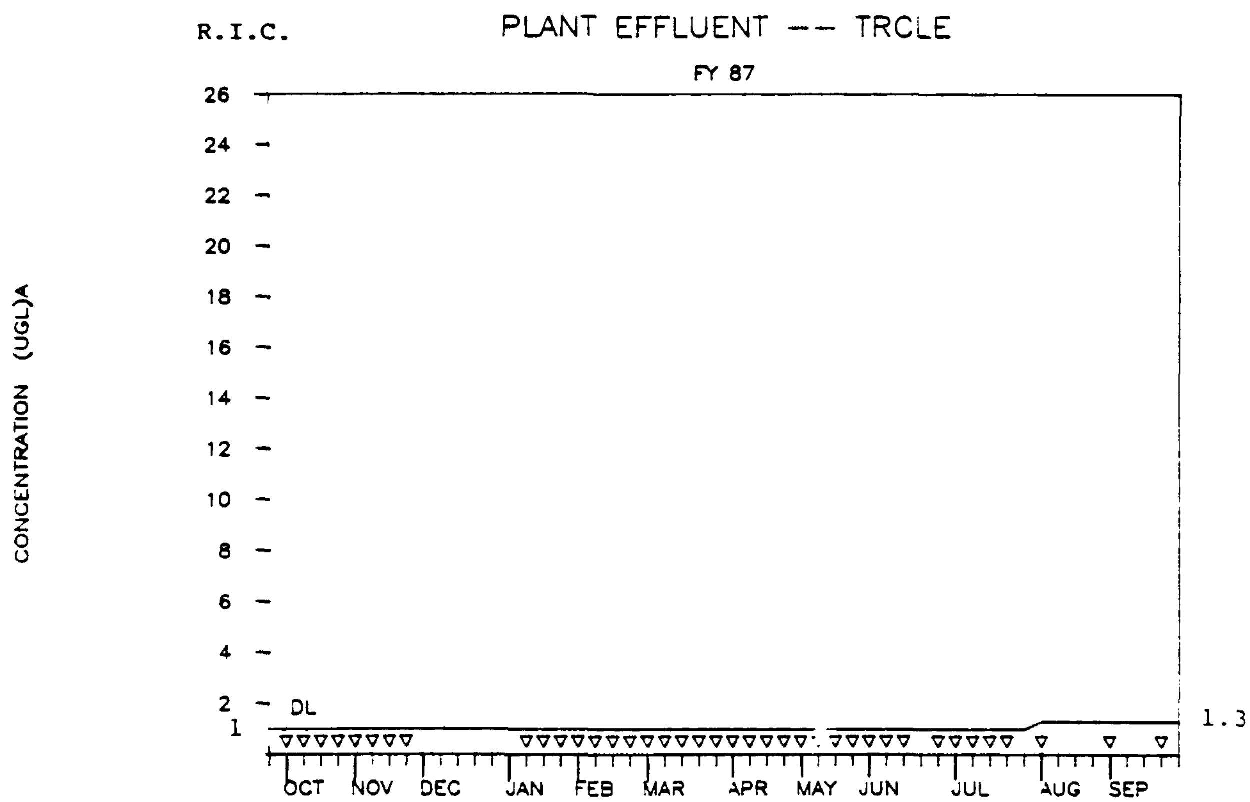
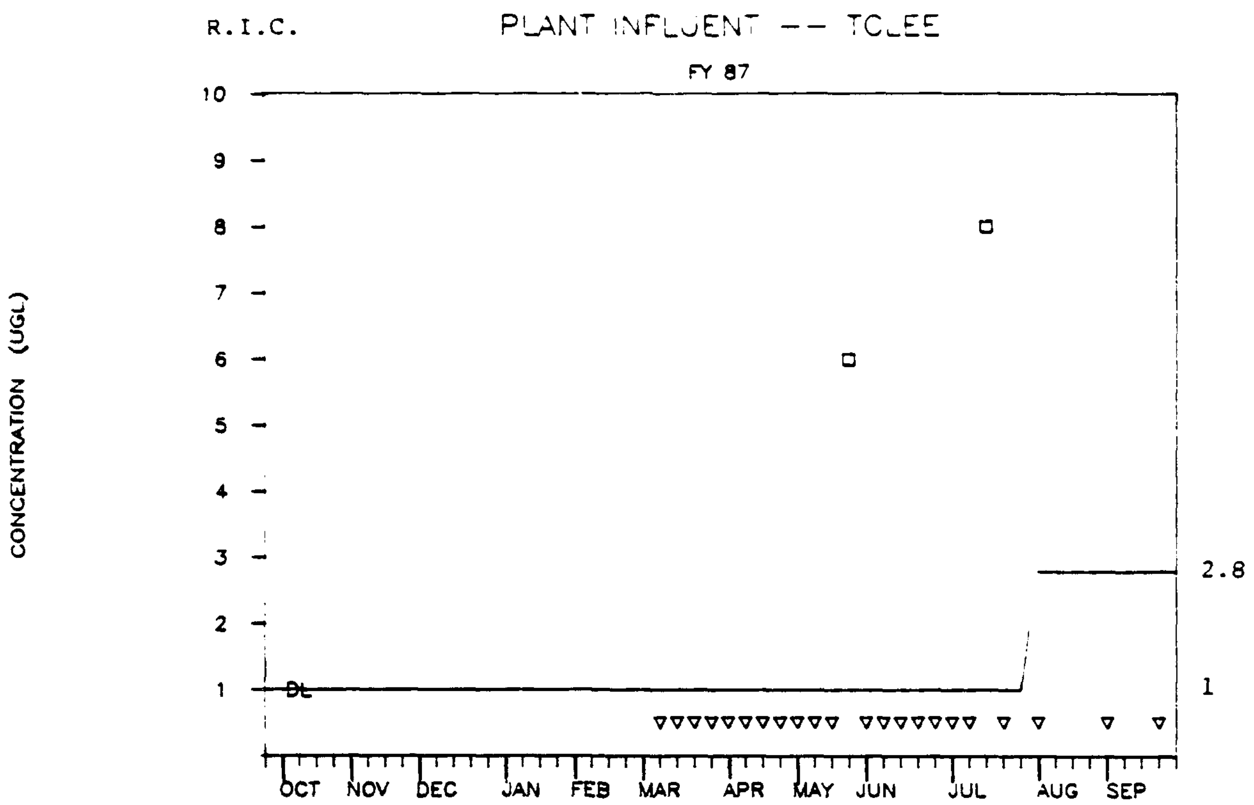


Figure 8 . FY87 Trichloroethylene



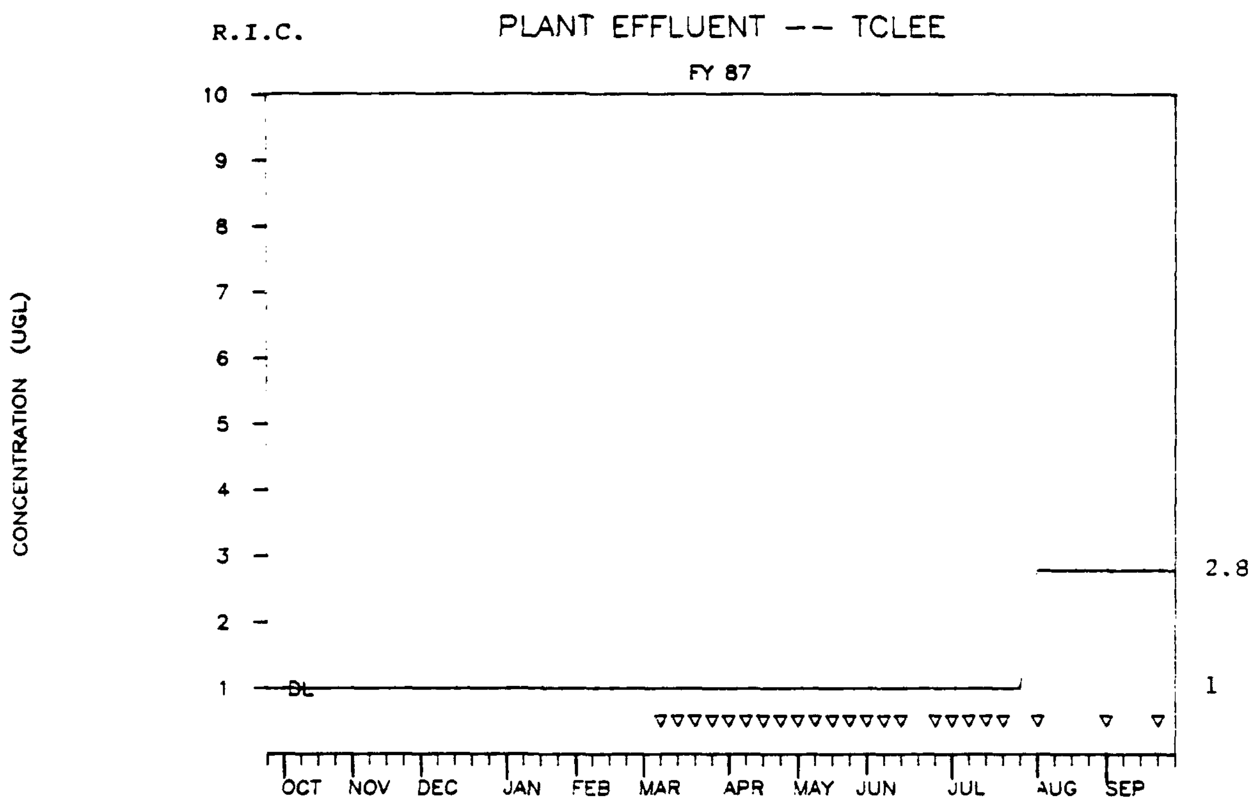
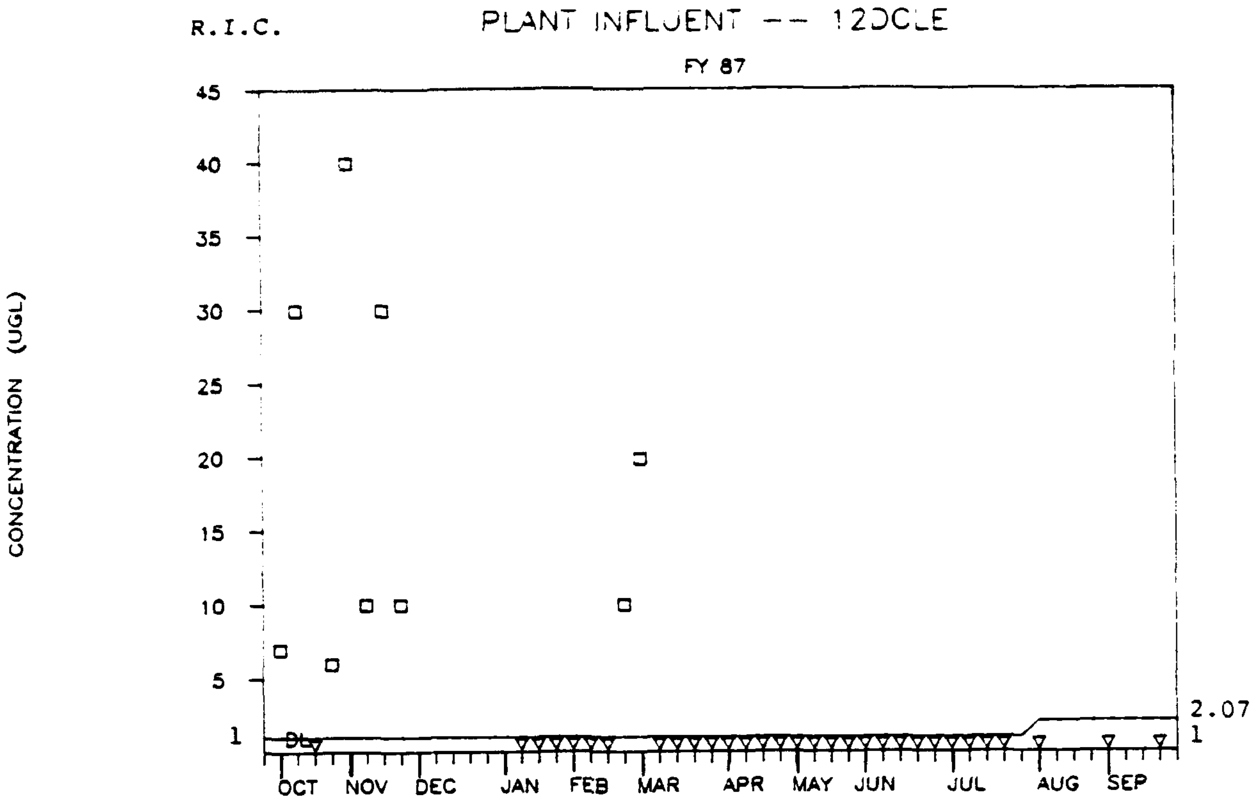


Figure 9. **FY87 Tetrachloroethylene**



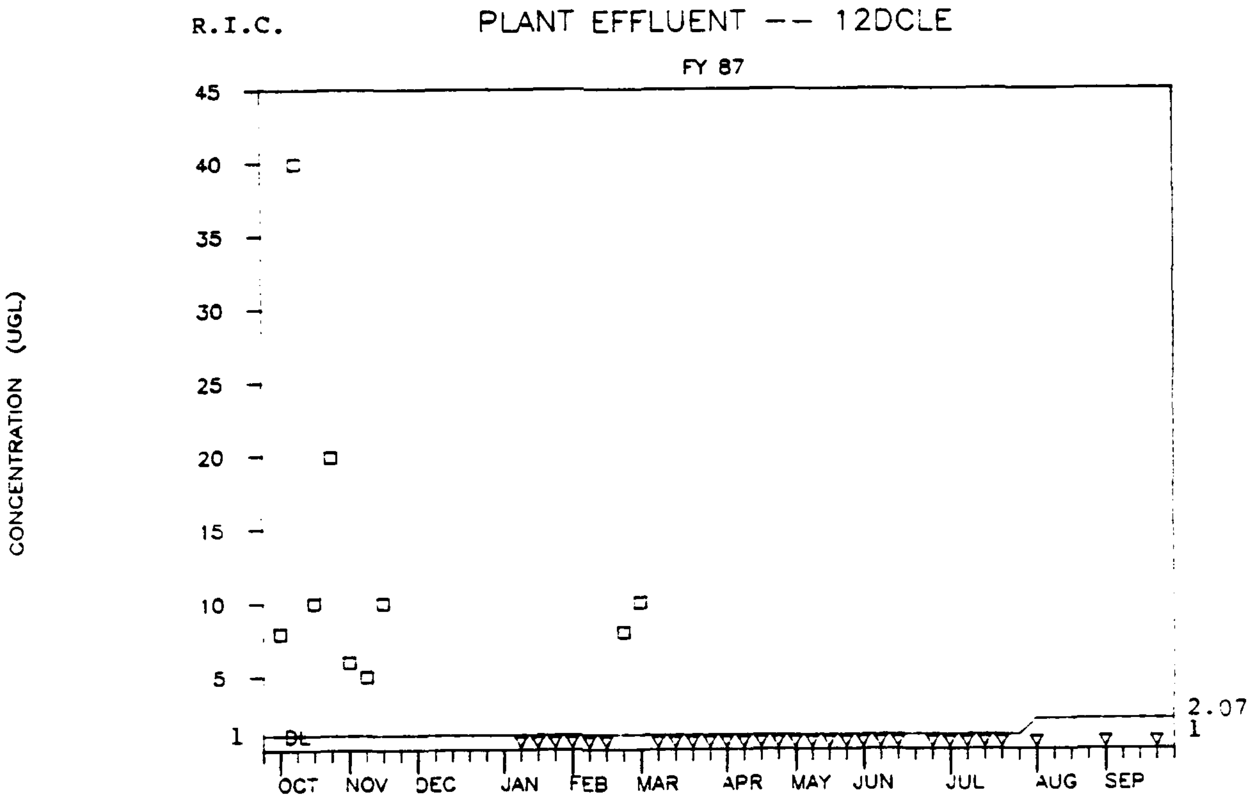
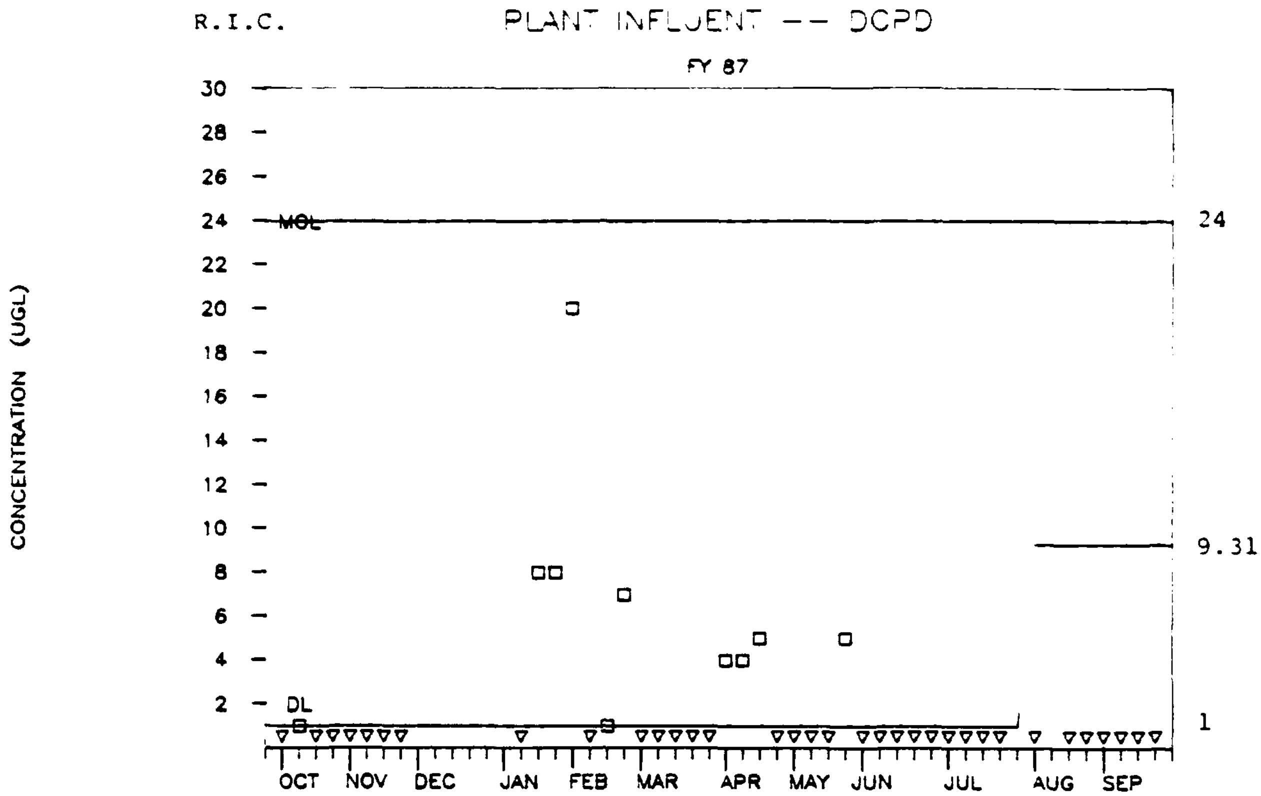


Figure 10. FY87 1,2 Dichloroethylene



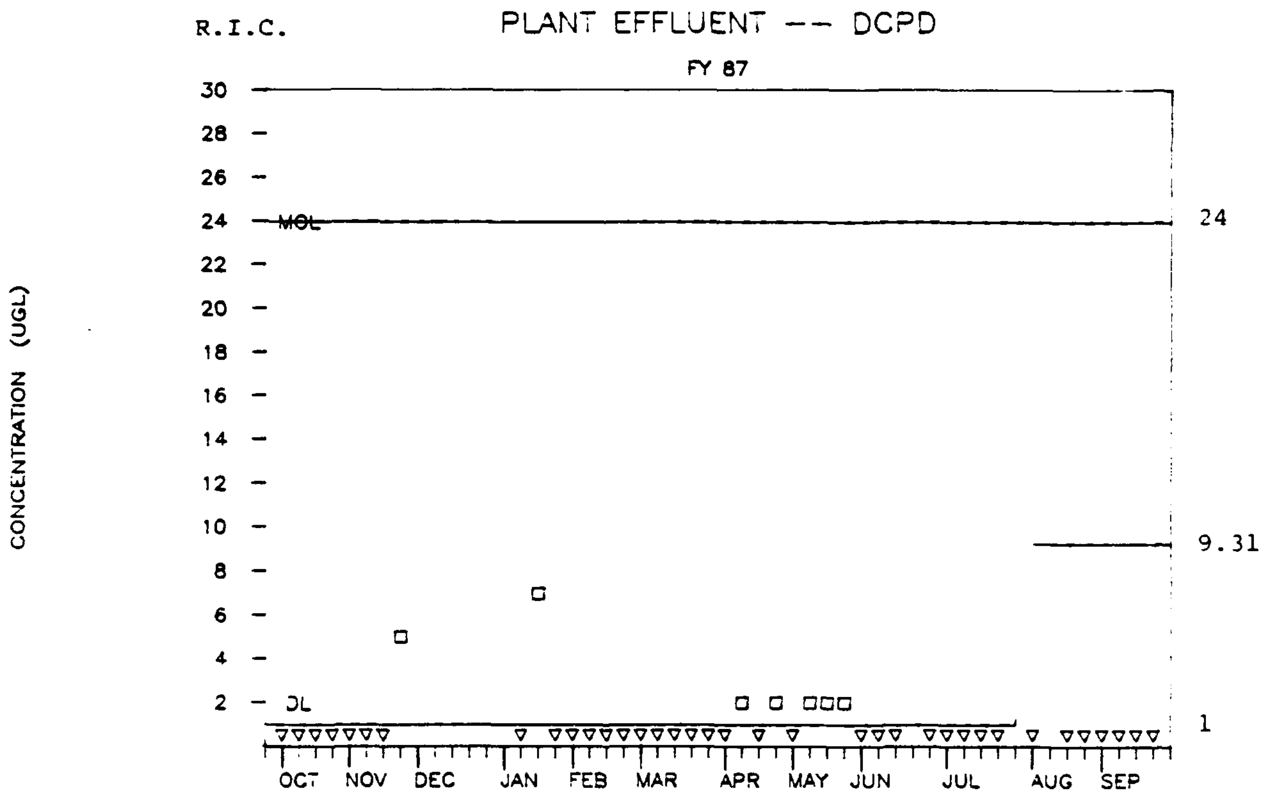
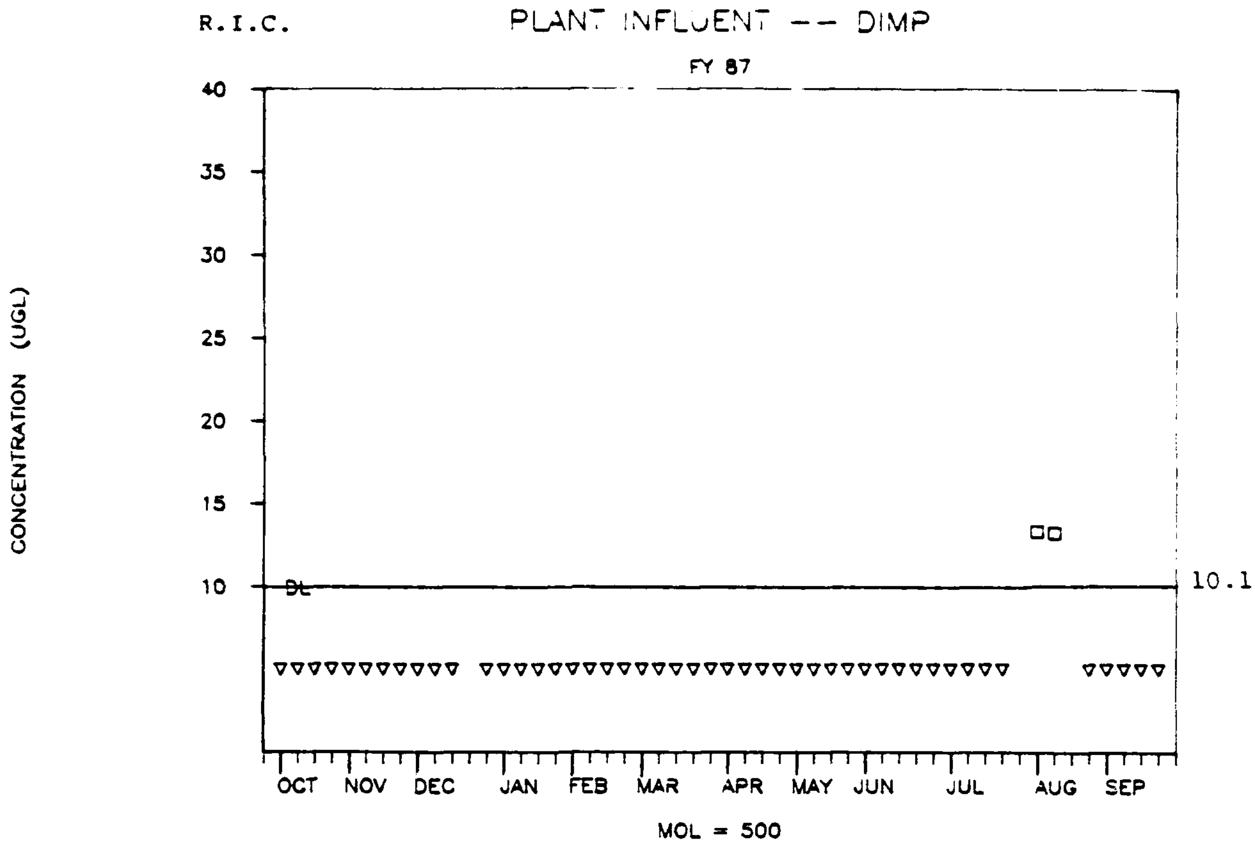


Figure 11. **FY87** Dicyclopentadiene



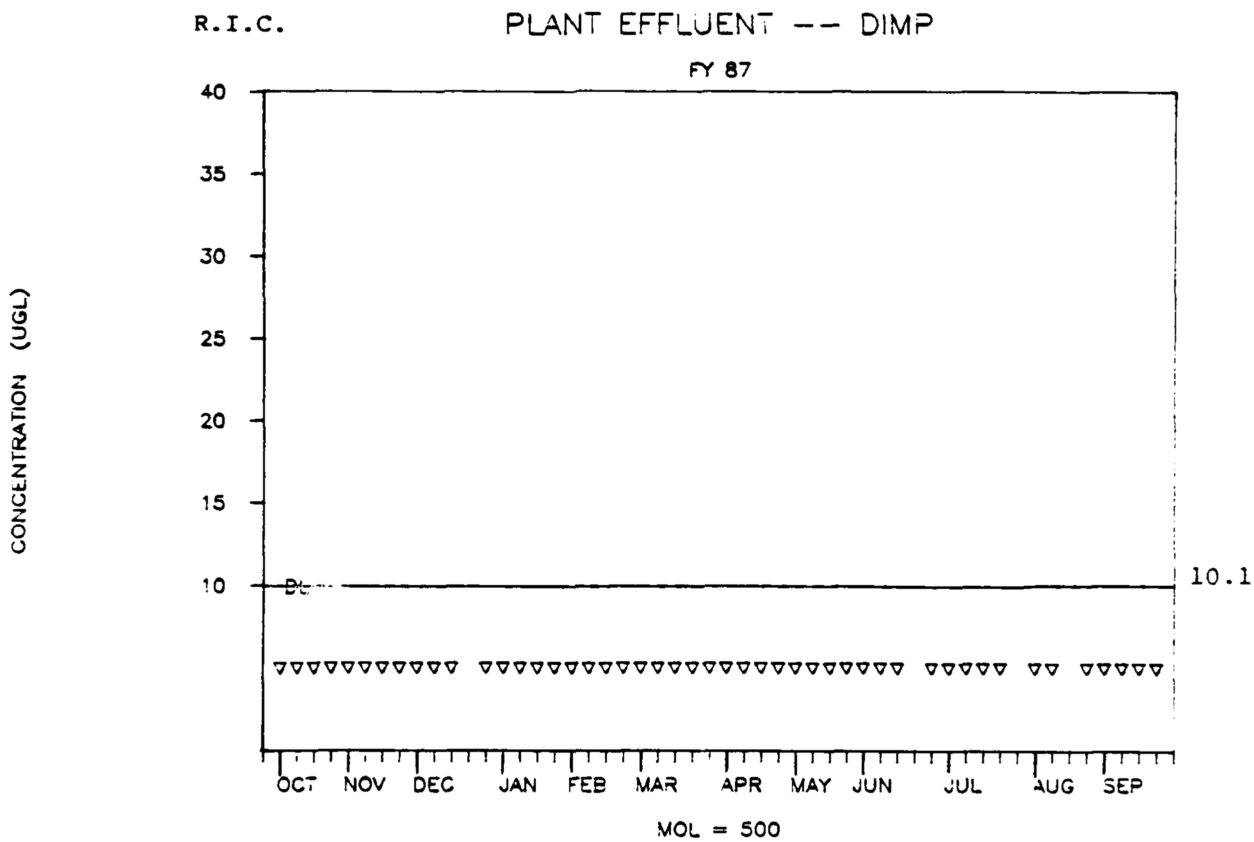
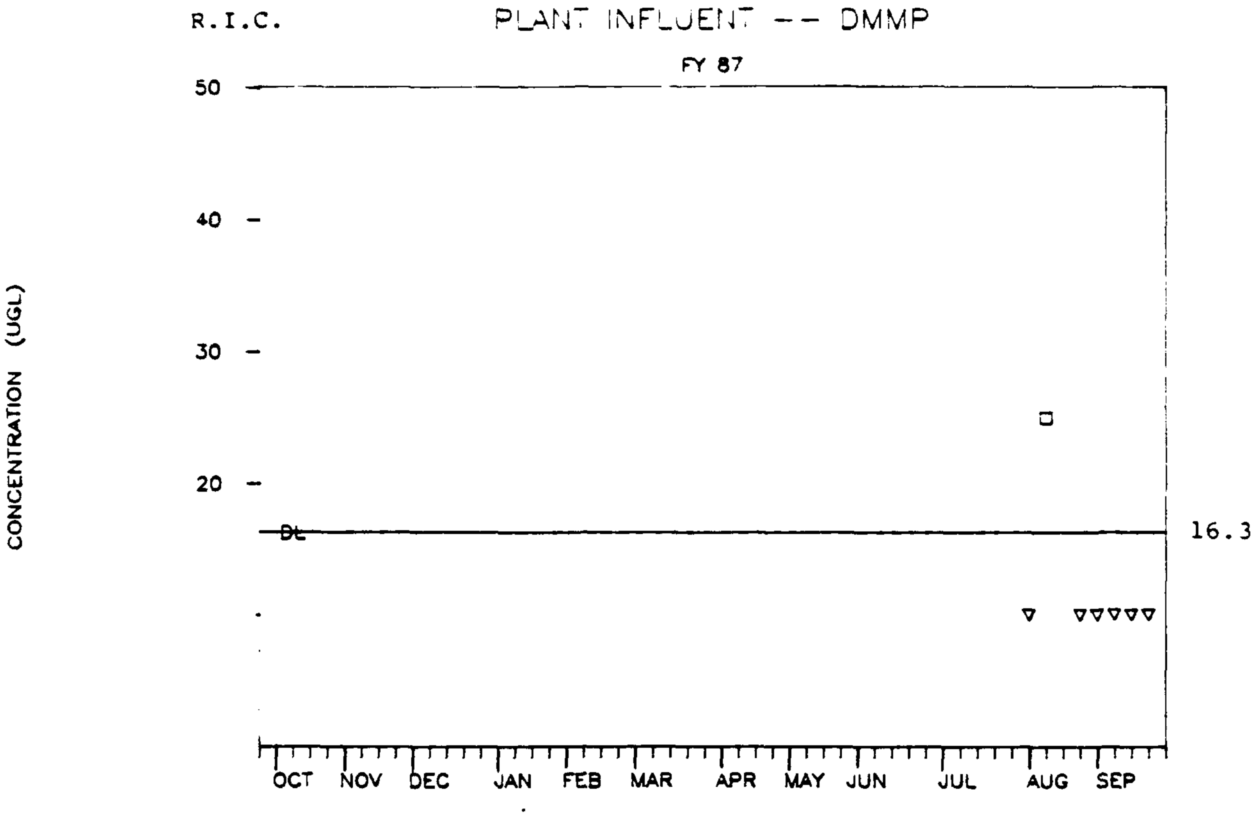


Figure 12. FY87 Diisoproplymethylphosphonate



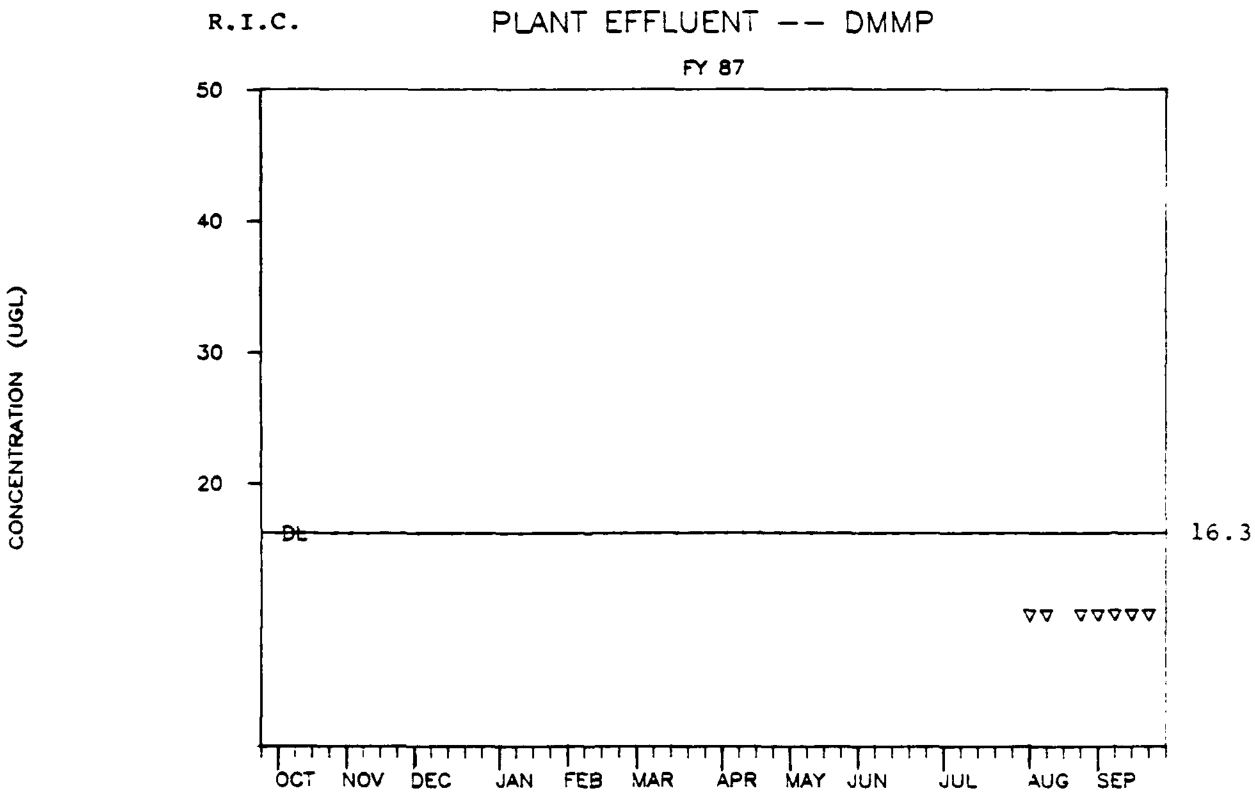
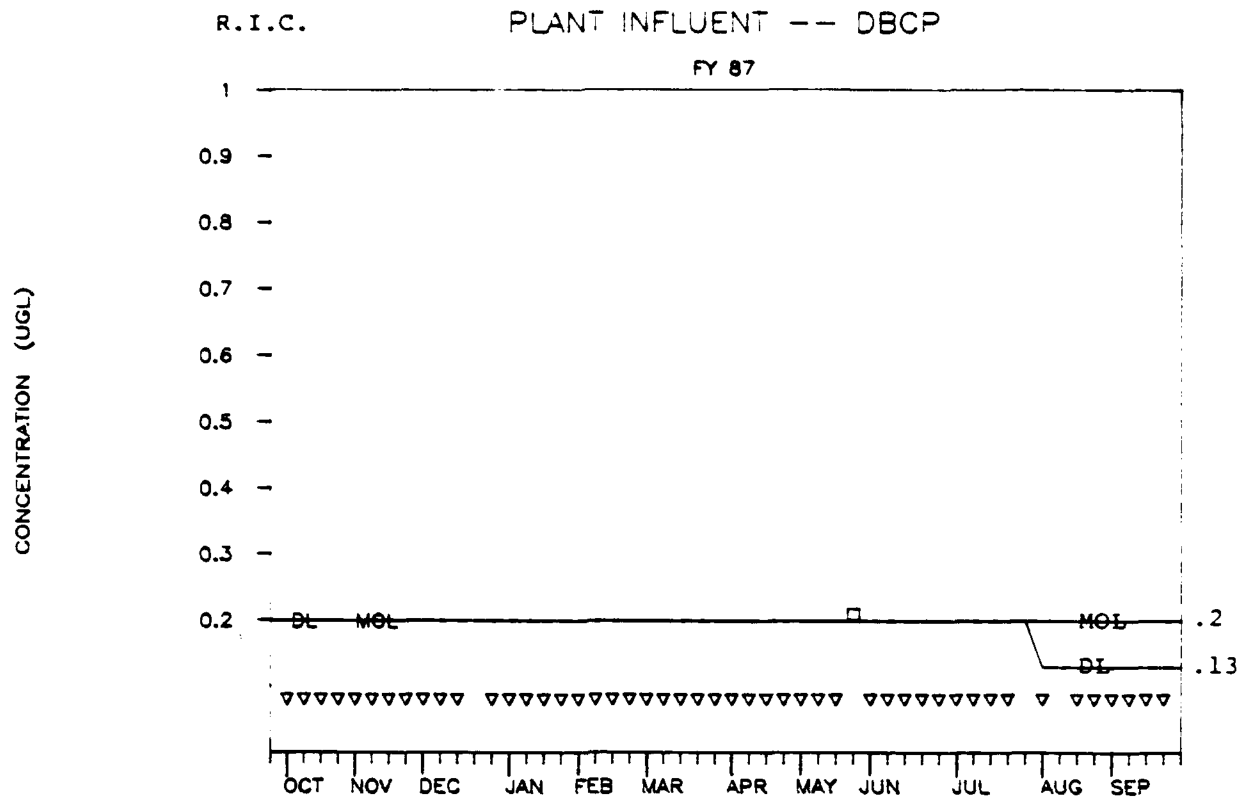


Figure 13. FY87 Dimethylmethylphosphate



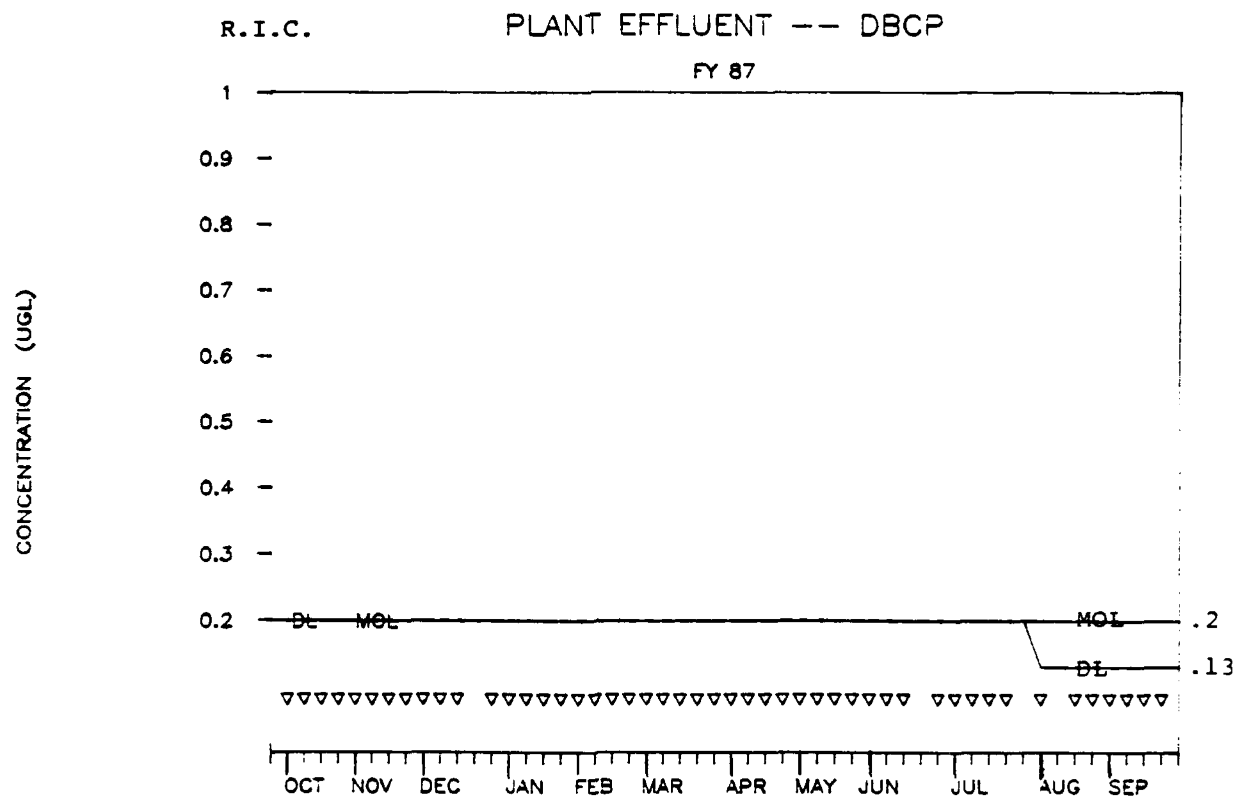
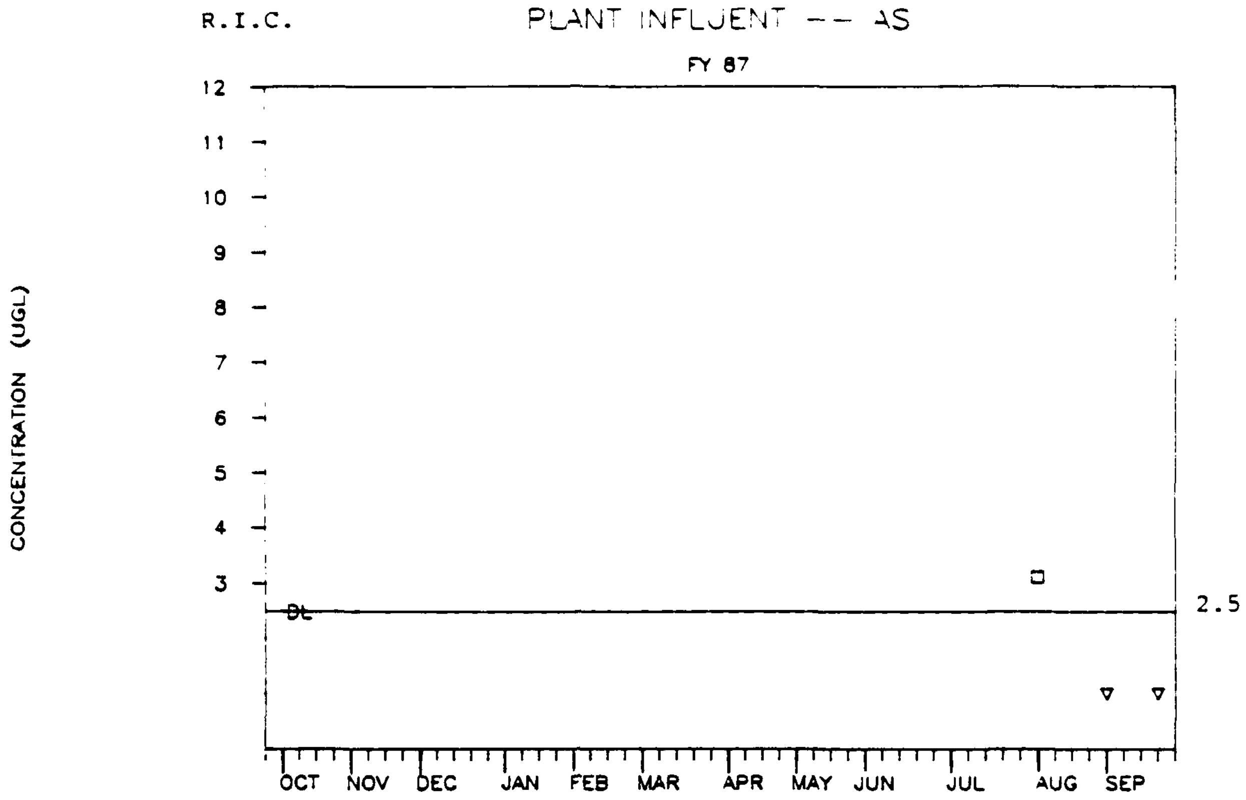


Figure 14. **FY87** Dibromochloropropane



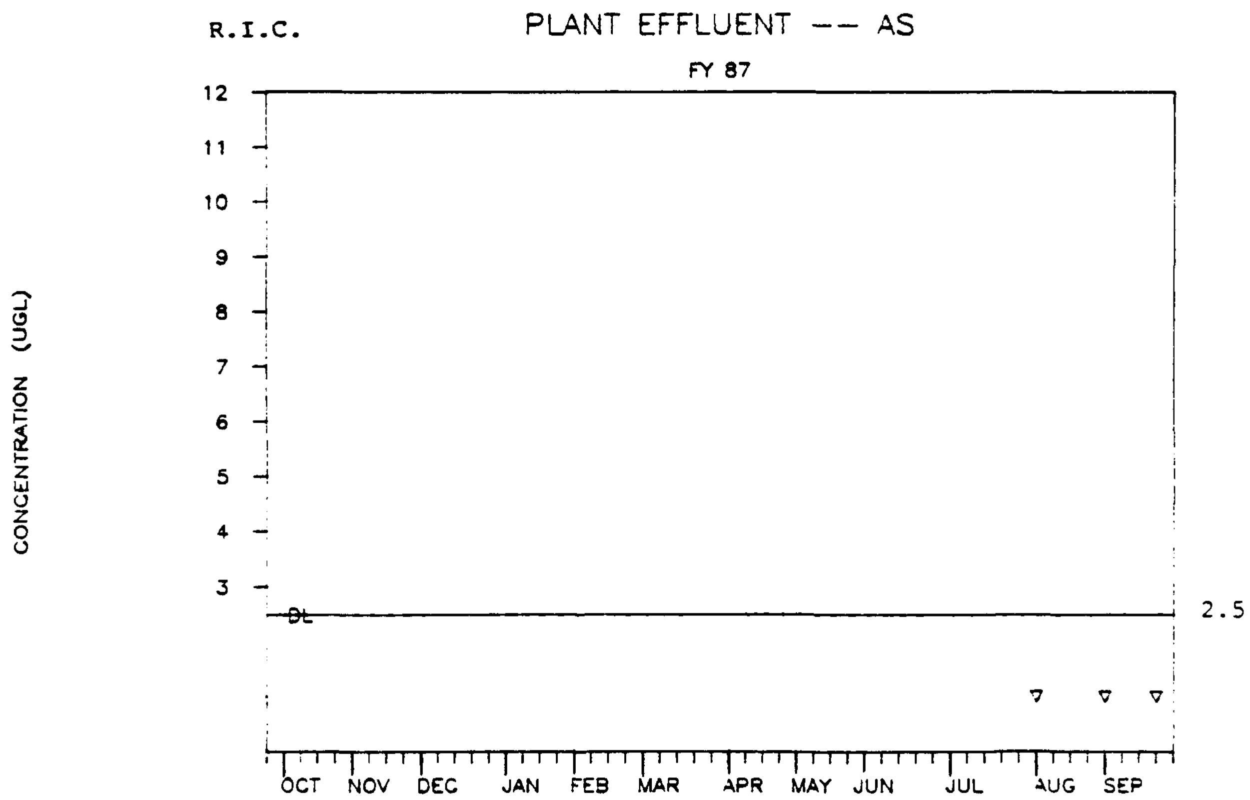
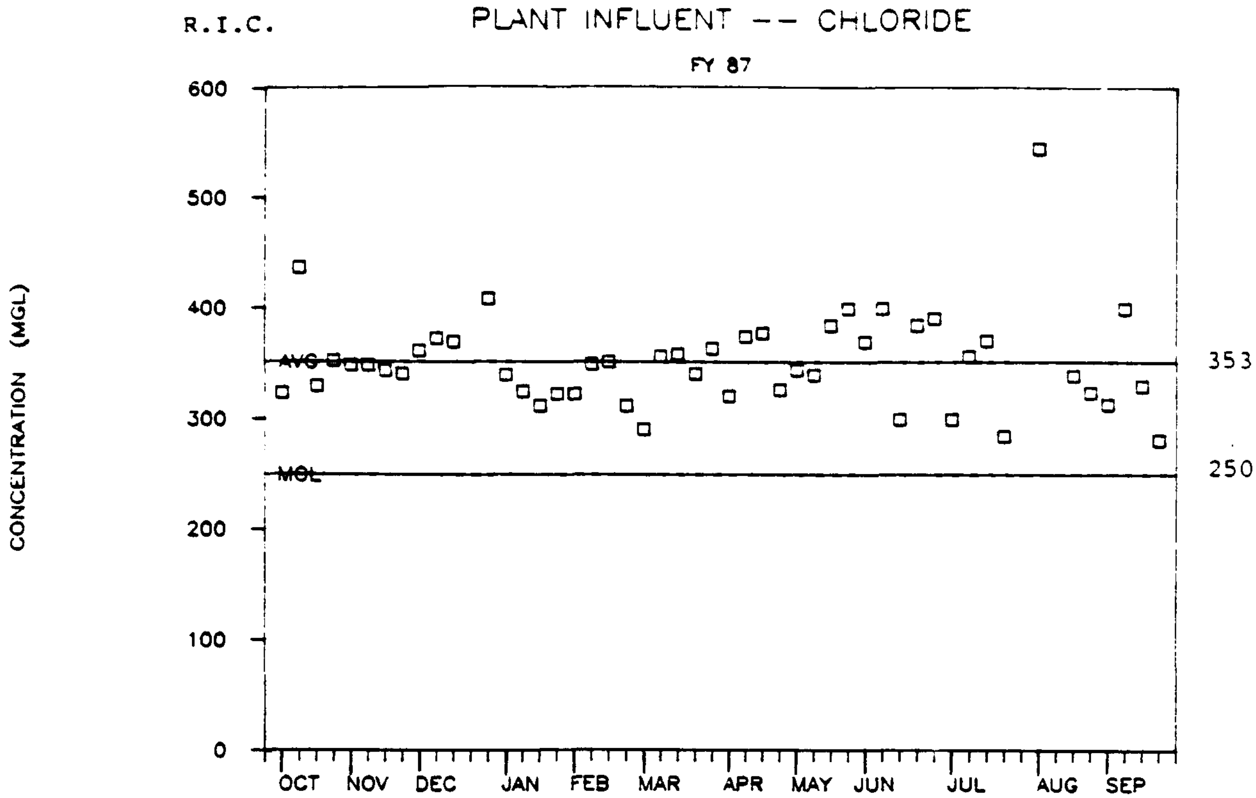


Figure 15. FY87 Arsenic



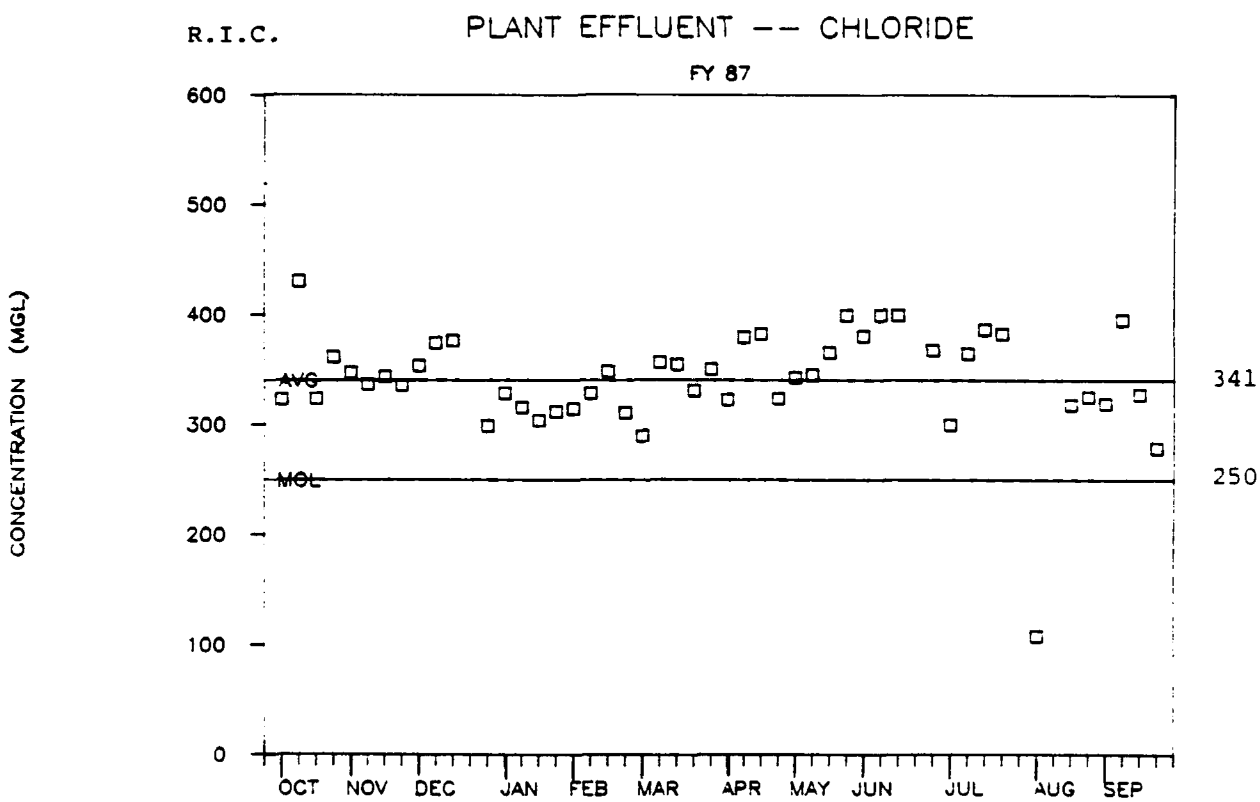
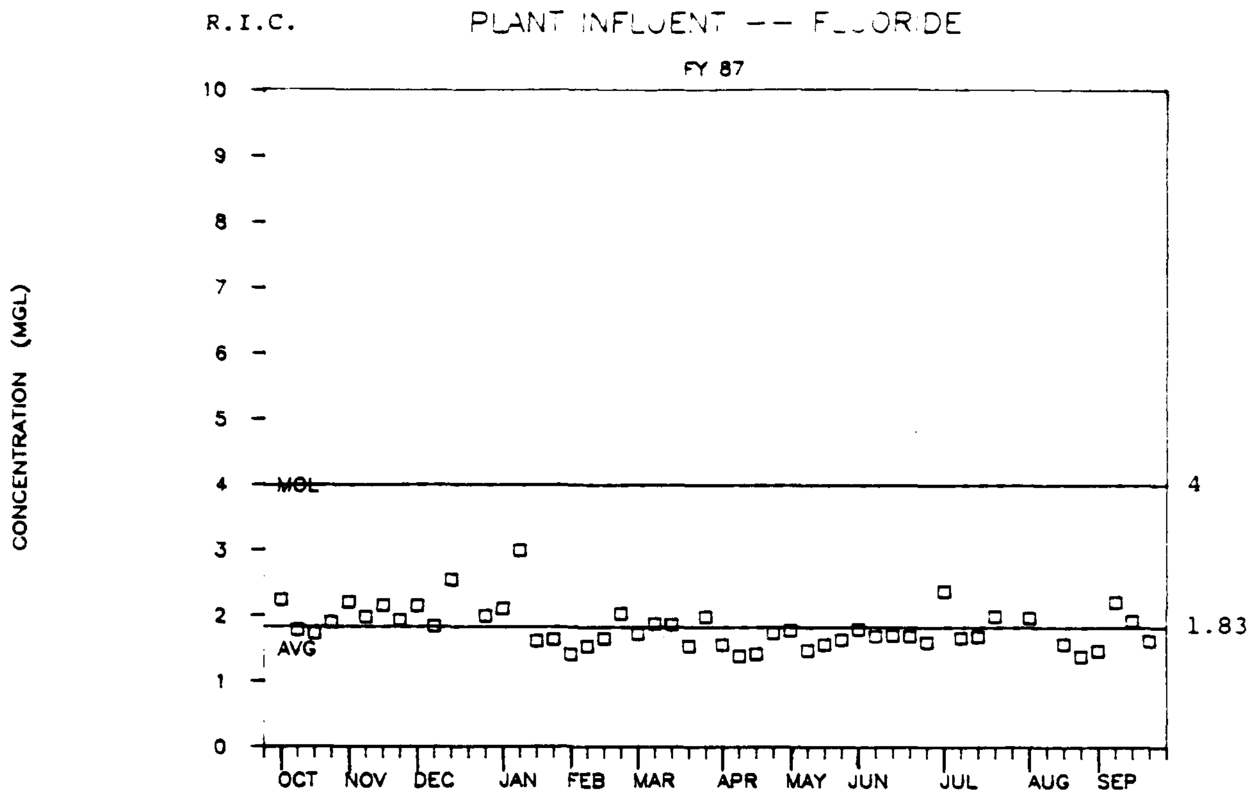


Figure 16. FY87 Chloride



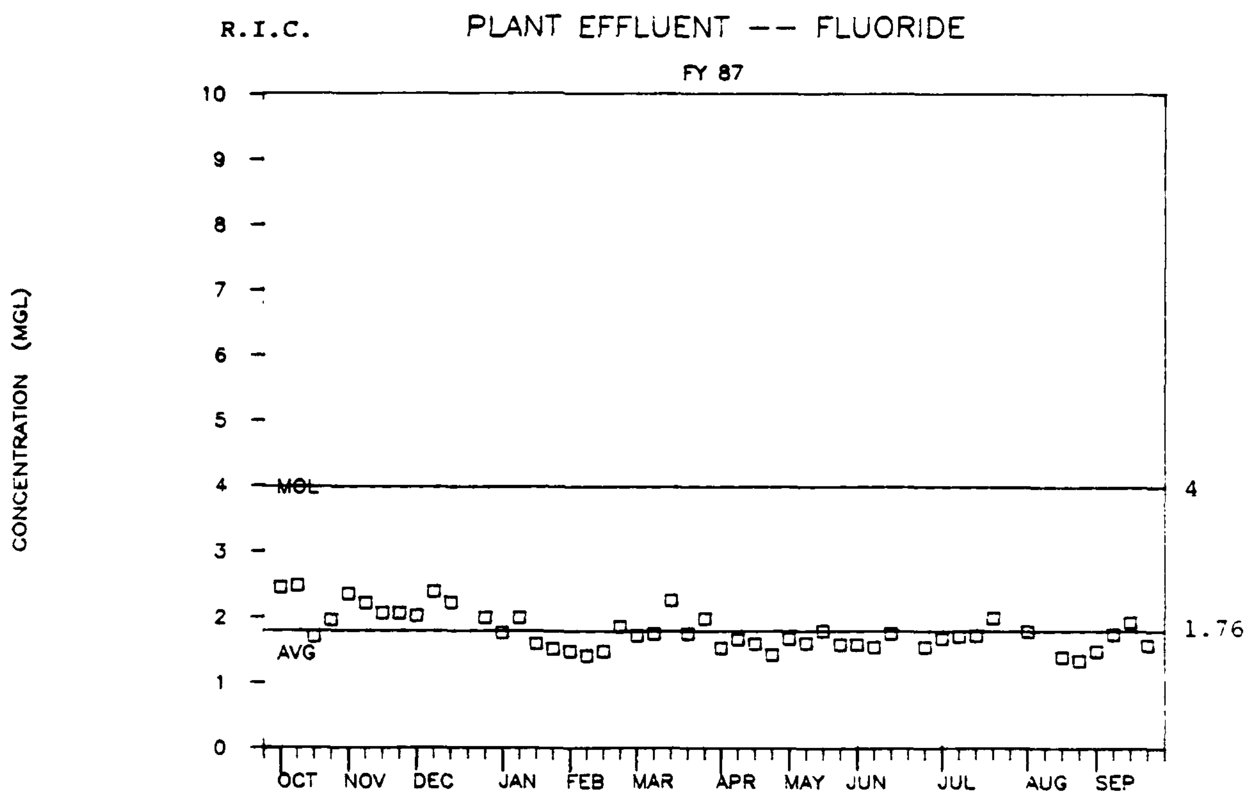
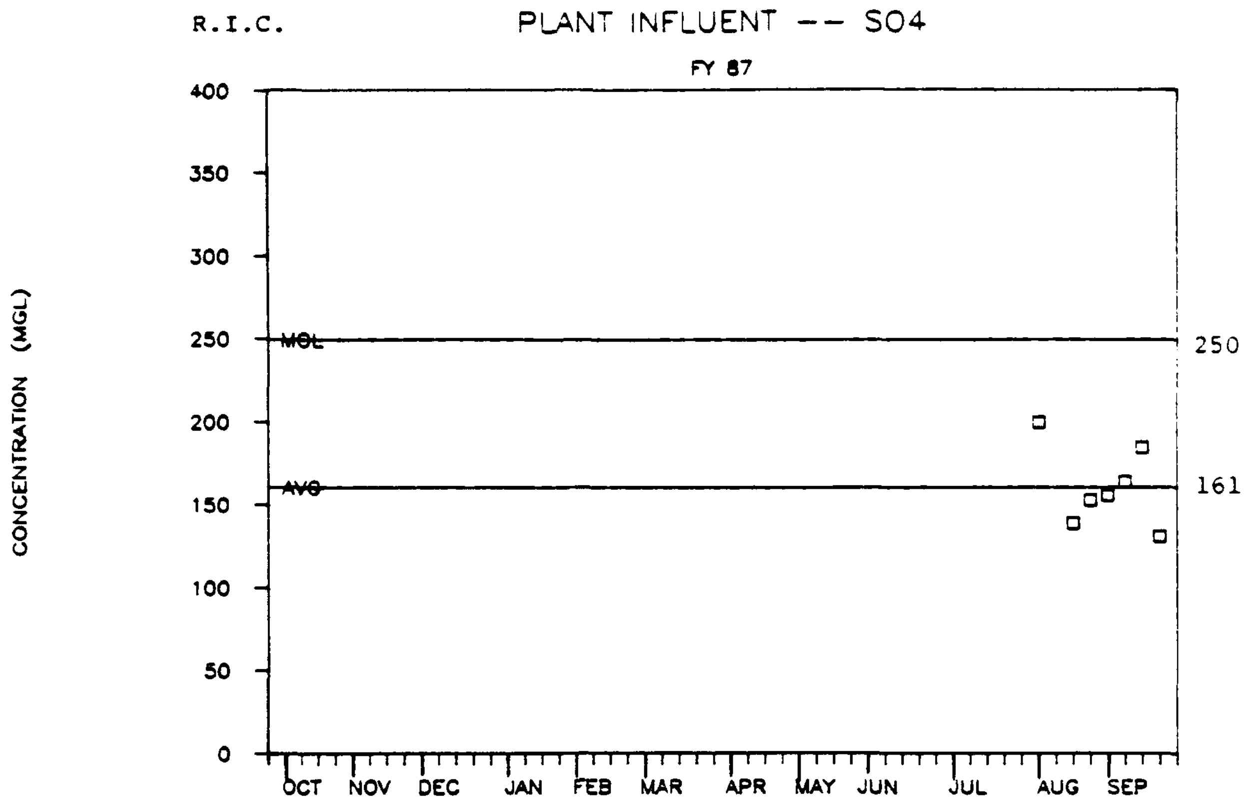


Figure 17. FY87 Fluoride



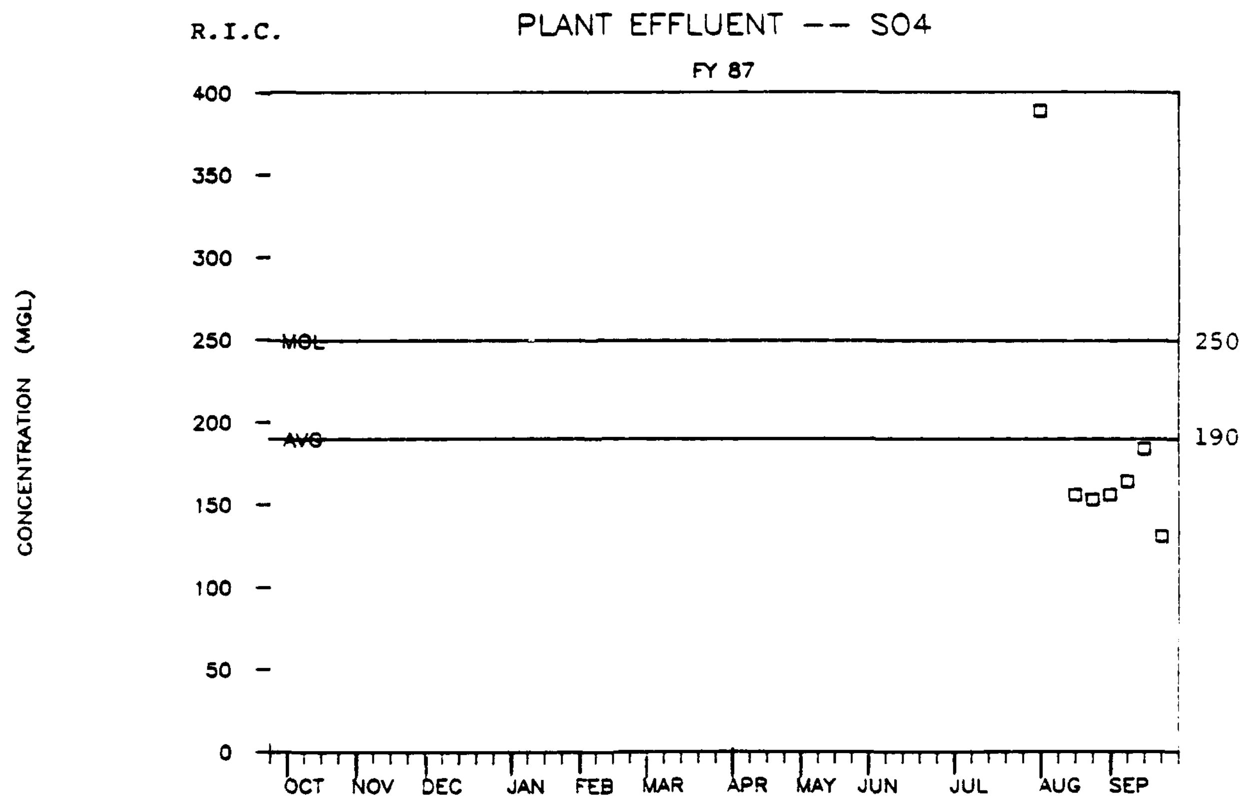
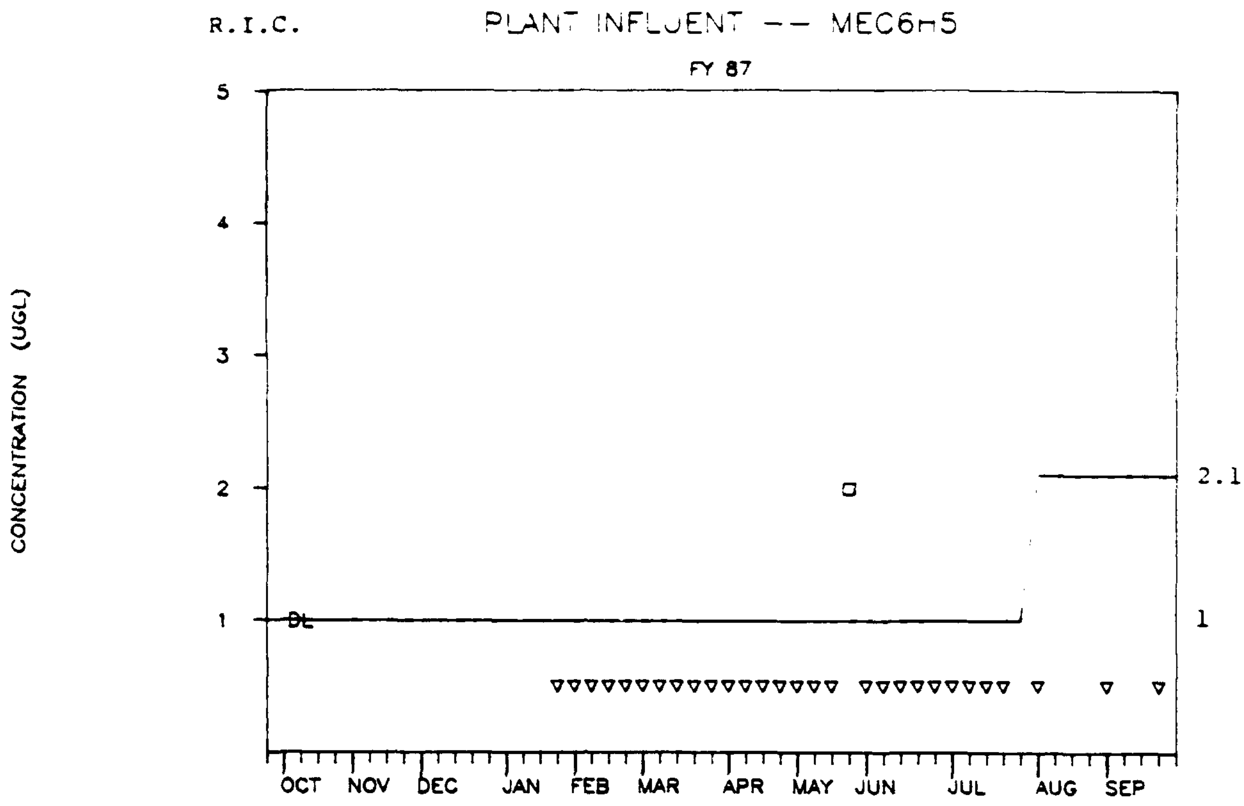


Figure 18. FY87 Sulfate



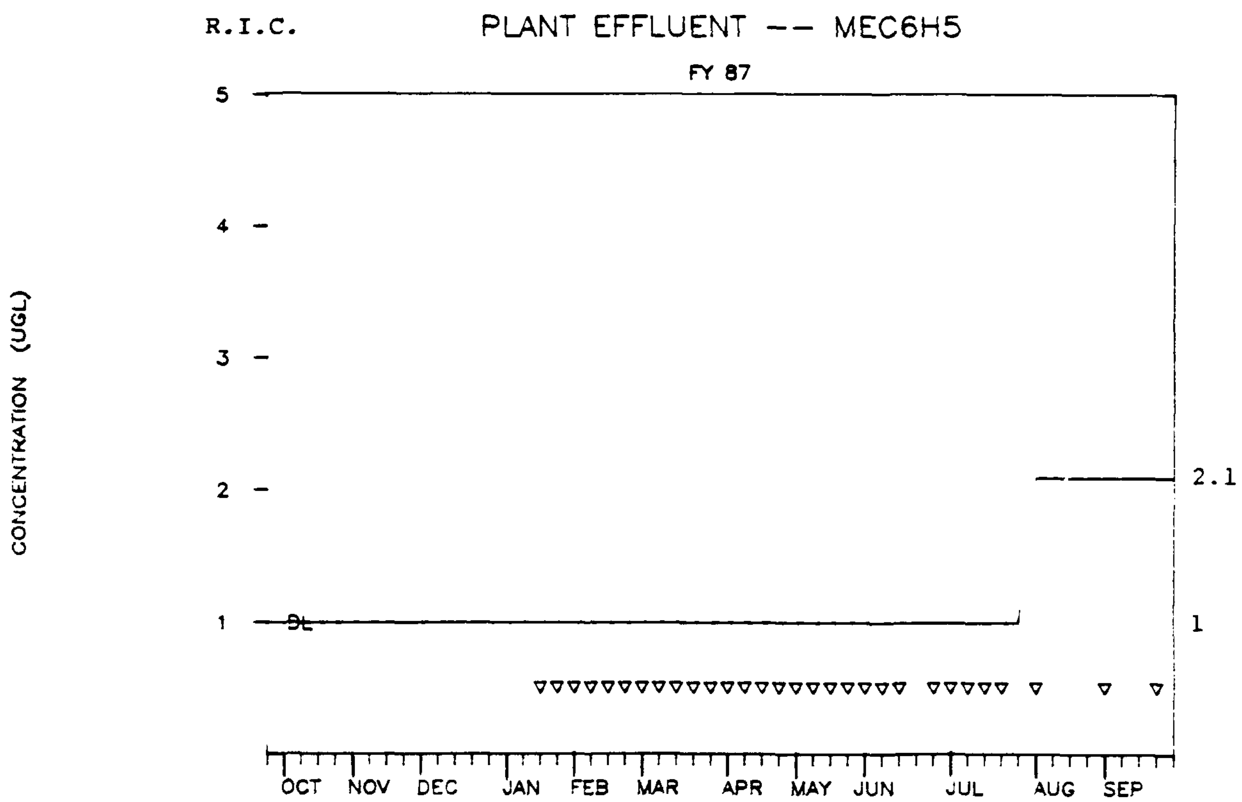


Figure 19. FY 87 Toluene

Table 4

Maximum Operating Limits for Northwest Boundary System

Parameter	Maximum Operating Limit MOL)	Source*
Aldrin	0.2 ug/l	Guidance from OTSG (Army) until standards are developed
Chloride	N.A.	EPA Secondary Drinking Water Regulation standard is 250 mg/l
Dibromochloropropane (DBCP)	0.2 ug/l	State of Colorado Department of Health limit per letter to Commander, RMA, 26 June 79. Army's position for Source Areas
Dicyclopentadiene (DCPD)	24.0 ug/l	The State of Colorado has requested the Army to meet a limit of 24 ug/l of DCPD based on an odor threshold value.
Diisoproplymethyl-phosphonate (DIMP)	500 ug/l	These criteria are recommended by the US Medical Bioengineering Research & Development Lab (26 Aug 76) and are based on toxicology studies (26 Aug 76) conducted by the Army. The National Academy of Sciences Committee on Military Environmental Research has reviewed the procedures and results of toxicology studies and concurred in the drinking water levels (1 Feb 77)
Dieldrin	0.2 ug/l	Guidance from OTSG (Army) until standards are developed
Endrin	0.2 ug/l	EPA National Primary Drinking Water Regulation
Fluoride	N.A.	EPA Final Rule on Fluoride, National Primary and Secondary Drinking Water Standards, 40 CFR Parts 141, 142, and 143, maximum concentration limit is 4.0 mg/l

* Source: After Rocky Mountain Arsenal Contamination Control Program Management Team (1983)

N.A. = Not Applicable

the detection level (1.0 ppb) to a high of 40 ppb with an average for the year of 11.08 ppb. Chloroform is not effectively adsorbed by activated carbon unlike many of the other organic contaminants found in the ground water at RMA. The NWB treatment plant removed only 27 percent of the chloroform in the influent stream.

Trichloroethylene

29. The detection level for trichloroethylene (Figure 8) in FY87 was 1.0 ppb until the middle of the 4th quarter when it was increased to 1.3 ppb. No MOL was established. A single sample of the plant influent collected in FY87 was found to contain trichoroethylene above the detection level at approximately 20 ppb. No concentrations above the detection level were found in the plant effluent.

Tetrachloroethylene

30. The detection level for tetrachloroethylene (Figure 9) in FY87 was 1.0 ppb until the middle of the 4th quarter when it was increased to 2.8 ppb. No MOL was established. Two samples of the plant influent collected in FY87 were found to contain tetrachloroethylene above the detection level at 6.0 ppb and 8.0 ppb. No concentrations above the detection level were found in the plant effluent.

1,2 Dichloroethylene

31. The detection level for 1,2 dichloroethylene (Figure 10) in FY87 was 1.0 ppb until the middle of the 4th quarter when it was increased to 2.07 ppb. No MOL was established. The concentrations of 1,2 dichloroethylene found in the plant influent ranged from the detection level to a high of 40 ppb. The concentrations above the detection level were all found during the 1st and 2nd quarters. The concentrations found in the plant effluent ranged from the detection level to a high of 40 ppb. As for the influent, the concentration above the detection level were all formed during the 1st and 2nd quarters.

DCPD

32. The detection level for DCPD (Figure 11` in FY87 was 1 ppb until the middle of the 4th quarter when it was increased to 9.31 ppb. The MOL for the NWB treatment plant was 24 ppb. The concentrations of DCPD found in the plant influent ranged from the detection level to a high of 20 ppb. The majority of these samples were found to contain 8 ppb or less of DCPD. Seven samples of the plant effluent taken during the year were found to contain concentrations

of DCPD over the detection level with a maximum concentration of 7 ppb being found.

DIMP

33. The detection level for DIMP (Figure 12) in FY87 was 10.1 ppb. The MOL for the NWB treatment plant was 500 ppb. Two samples of the plant influent collected in FY87 were found to contain DIMP above the detection level both at 13.5 ppb. No concentrations above the detection level were found in the plant effluent.

DMMP

34. The detection level for DMMP (Figure 13) in FY87 was 16.3 ppb. No MOL was established. One sample out of a total of seven analyzed for DMMP in FY87 from the plant influent was found to contain a concentration of 25 ppb which was in excess of the detection level. No concentrations above the detection level were found in the plant effluent.

DBCP

35. The detection level for DBCP (Figure 14) in FY87 was 0.2 ppb until the middle of the 4th quarter when it was lowered dropped to 0.13 ppb. The MOL for the NWB treatment plant was 0.2 ppb. A single sample of the plant influent collected in FY87 was found to contain DBCP above the detection level at 0.21 ppb. No concentrations above the detection level were found in the plant effluent.

Arsenic

36. The detection level for arsenic (Figure 15) in FY87 was 2.5 ppb. No MOL was established. One sample out of a total of three analyzed for arsenic in FY87 from the plant influent was found to contain a concentration of 3 ppb which was in excess of the detection level. No concentrations above the detection level were found in the plant effluent. It should be noted that arsenic is not treated by the activated carbon treatment system.

Chloride

37. The detection level for chloride (Figure 16) was not reported. The concentrations of chloride found in the plant influent ranged from 280 ppm to 545 ppm with an average for the year of 353 ppm. The concentrations found in the plant effluent ranged from 280 ppm to 430 ppm with an average for the year of 341 ppm. As evidenced by the data, chloride is not removed from the ground water by the activated carbon treatment system.

Fluoride

38. The detection level for fluoride (Figure 17) was not reported. The concentrations of fluoride found in the plant influent ranged from 1.4 ppm to 3.0 ppm with an average for the year of 1.83 ppm. The concentrations found in the plant effluent ranged from 1.2 ppm to 2.5 ppm with an average for the year of 1.76 ppm. Fluoride is also not removed from the ground water by the activated carbon treatment system.

Sulfate

39. The detection level for sulfate (Figure 18) was not reported. The concentrations of sulfate found in the plant influent ranged from 130 ppm to 200 ppm with an average for the year of 161 ppm. The concentration found in the plant effluent ranged from 130 ppm to 390 ppm with an average for the year of 190 ppm. Only one effluent sample was found to contain a concentration greater than 180 ppm. This high value is somewhat suspicious since it is much greater than any concentration found in the plant influent. Sulfate is not removed from the ground water by the activated carbon treatment system.

Toluene

40. The detection level for toluene (Figure 19) in FY87 was 1 ppb until the middle for the 4th quarter when it was increased to 2.1 ppb. No MOL was established. A single sample of the plant influent collected in FY87 was found to contain toluene above the earlier 1.0 ppb detection level at 2.0 ppb. No concentrations above the detection level were found in the plant effluent.

Carbon Usage

41. Carbon usage in the NWBS treatment plant is very low compared to the North Boundary System treatment plant due to the lower total mass of contamination being removed. During FY87, 1500 pounds (quantity) of fresh carbon was added to adsorber number 2 during the 1st quarter. No other carbon was added to any of the other adsorbers during the year. Thus, it is not possible to calculate a realistic carbon usage rate for the NWBS treatment plant based solely on one year of operating data.

PART IV: DATA EVALUATIONS

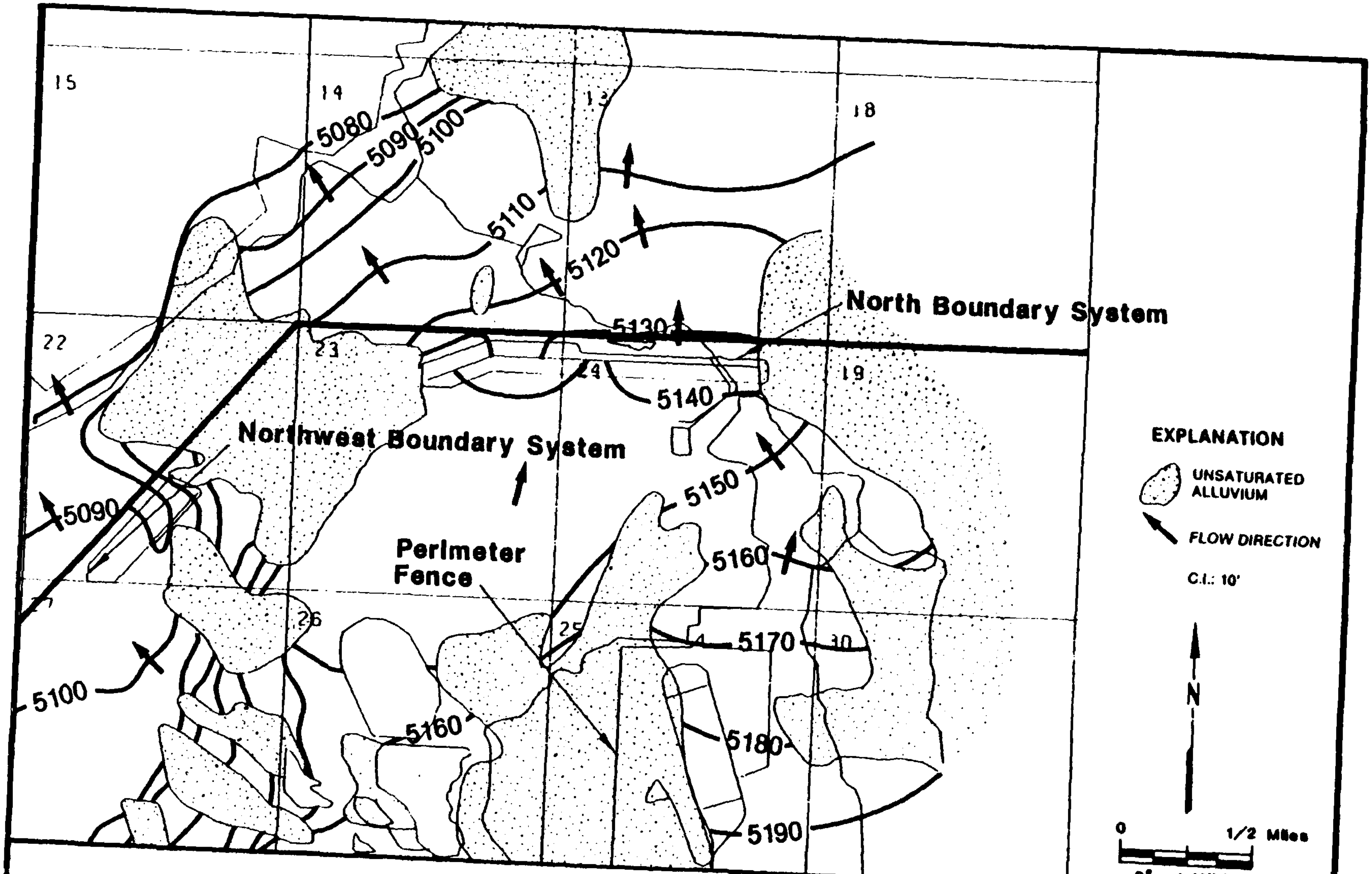
Geology and Hydrogeology

42. General setting. The Northwest Boundary containment system (NWBS) study area is in the northwest corner of RMA in Sections 21, 22, 23, 26, 27, and 28. The geologic units of interest to the NWBS evaluation are the Tertiary aged Denver formation and the overlying Quaternary sediments. The Denver formation consists of interbedded clay shale, claystone, siltstone, sand, sandstone and occasional lignite. The top of the Denver formation in the NWBS study area ranges from 10 to about 70 ft below the ground surface. The Quaternary age surficial deposits (the "alluvium" of this report) overlying the Denver formation consist of windblown and stream-deposited materials of clay to gravel size. The alluvium masks the Tertiary sediments over most of the Arsenal. There are no outcrops of Denver formation in the NWBS study area.

43. Hydrogeology of the alluvial aquifer. The alluvium overlying the Denver formation in the NWBS study area was described previously in PMRMA (1987) and in ESE (1988). A summary of pertinent characteristics of the alluvium is presented below.

44. The surficial deposits (the alluvium) of the Northwest Boundary study area consist of a coarse unit of mostly sand and gravel overlain by a generally fine-grained unit of fine sands, silts and clays. The alluvium is approximately 10 to 70 ft thick in the NWBS study area. The greatest thickness of alluvium penetrated was 69.7 ft in Well 27002, in which approximately 37 ft of silty clay and fine sand overlie 33 ft of gravelly sand. The gravelly sand of Well 27002 is typical of the sediments comprising the alluvial aquifer of the NWBS study area.

45. The alluvium is considered the primary conduit for ground-water movement in the NWBS study area. The general flow direction for ground water in the NWBS study area is to the northwest, Figure 20 and Plates 1-4. A large component of flow approaches the Northwest Boundary in a northerly direction within an alluvium-filled paleochannel on the Denver formation surface. The thickness of saturated alluvium varies considerably within the NWBS study area. Saturated alluvium thickness varies from 5 ft in the eastern half of Sections 22 and 27 to 30 ft in the deep paleochannel. The slurry wall portion of the containment system was placed in 5 to 10 ft of saturated alluvium and



GENERALIZED ALLUVIAL FLOW DIRECTIONS
ALLUVIAL POTENTIOMETRIC SURFACE

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1

FIGURE NO. 20

the hydraulic barrier (extraction wells) portion in 10 to 25 ft of saturated alluvium.

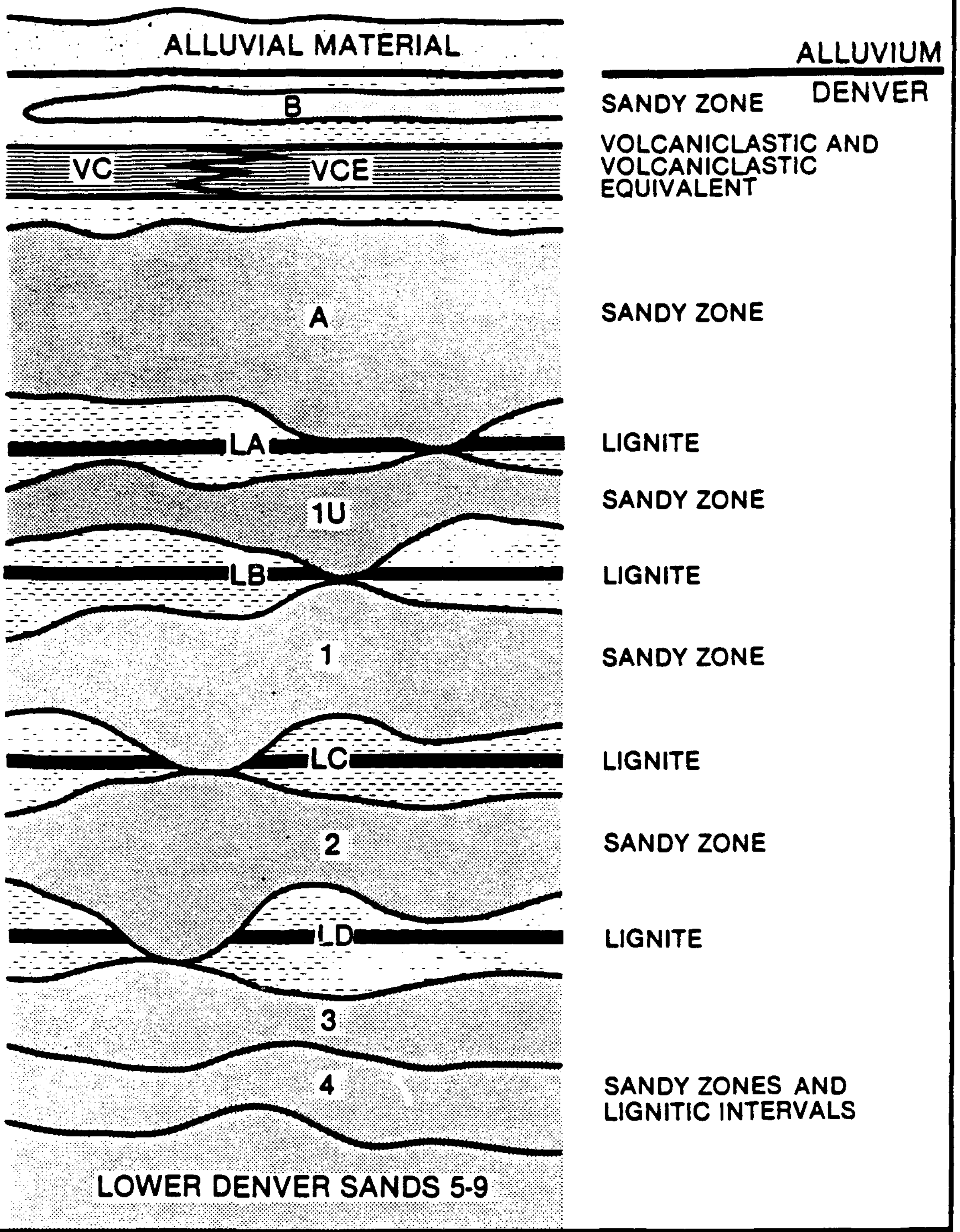
46. Aquifer parameters for the alluvial aquifer in the NWBS study area were determined by pumping tests prior to system installation. Transmissivity (T) ranged from 405,000 gpd/sq ft to 33,213 gpd/sq ft. Corresponding values of permeability (K) were 2,365 ft/day to 587 ft/day, respectively. Corresponding values of storage coefficient were 3.5 x (10(-6) to 0.25, respectively. Aquifer response during the pumping tests ranged from confined to unconfined. Ground-water flow gradients in the alluvial aquifer of the NWBS study area range from about 0.04 in the northeast corner of Section 27 to about 0.0024 in the thick aquifer sands in the western half of Section 27.

47. Hydrogeology of the Denver formation. The hydrogeology of the Denver formation was discussed in ESE (1988) and is summarized below. The Denver formation geology is a complex system of interbedded sandstones and siltstones contained in a matrix of fine-grained claystones and siltstones. In the Northwest Boundary study area, the Denver formation generally consists of interbedded carbonaceous clay shales, claystones and siltstones and lenticular sandstone units. The sandstone units, generally uncemented, may be locally cemented with calcium carbonate or silica, and are considered the principal aquifers in the Denver formation.

48. The contact between the alluvium and the Denver formation is often marked by a weathered zone in the Denver formation. Lignite beds and carbonaceous shales are common, as are volcanic fragments and tuffaceous materials. Sandstone bodies are mainly discontinuous lenticular bodies which may be sinuous. The sandstone lenses are distributed in thick claystone sequences and are poorly defined as the sandstones often grade into the encompassing clay and shale. Figure 21 is a general stratigraphic column for the Denver formation at Rocky Mountain Arsenal. The left side of geologic cross section 26.5 (Plates 5 and 6) shows the general positions and extent of the Denver formation sandstones in the vicinity of the Northwest Boundary.

49. Ground water flows generally to the north-northwest in the Denver formation in the NWBS study area, Figure 22. The potential for vertical flow between the alluvium and the Denver formation in the vicinity of the NWBS is generally downward. Flow trends are discussed in more detail below.

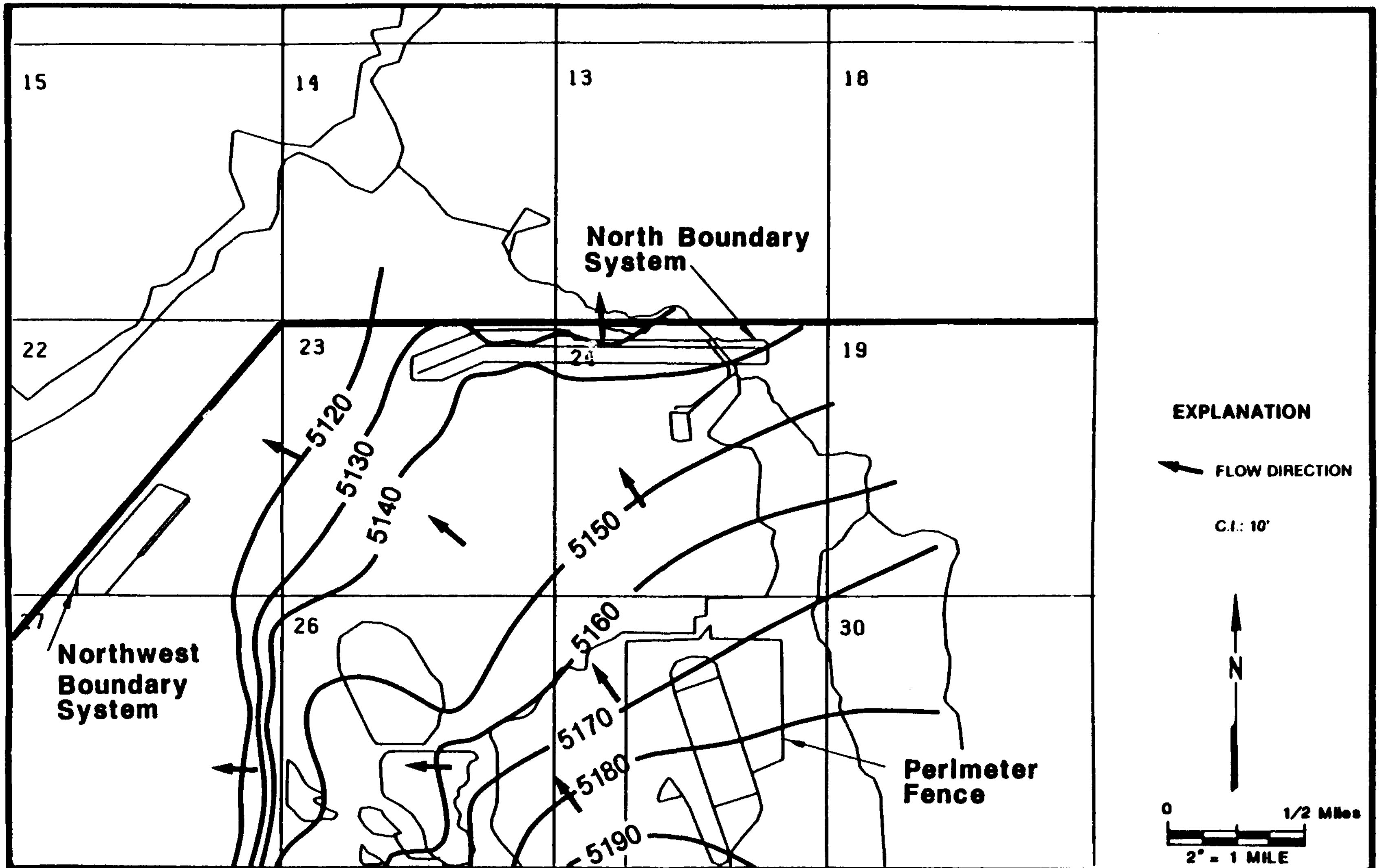
50. Hydraulic gradients of flow indicted by the potentiometric surface map for sand Zone 4 (the deepest zone) range from 0.01 (ft/ft) in the



GENERALIZED DENVER FORMATION
STRATIGRAPHIC COLUMN

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1

FIGURE NO. 21



GENERALIZED DENVER FLOW DIRECTIONS
SAND 2 POTENTIOMETRIC SURFACE

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1

FIGURE NO. 22

northeast part of Section 27 to 0.003 in the southwest part of Section 27. Gradients for sand Zone 3 range from 0.013 to 0.02 in Sections 22 and 27. The gradient for sand Zone 2 is 0.01 in Section 27 and in the western part of Section 26. Generally, the Denver formation sandstones have a permeability three orders of magnitude lower than the coarsest alluvium.

Ground-Water Hydrology

51. Background. PMRMA (1987) and ESE (1988) provide a hydrologic history of the Northwest Boundary area and identify influences on ground-water flow. Annual precipitation fluctuations appear to have little effect on ground-water levels in the alluvial aquifer. Though precipitation in FY 87 (19.05 in.) exceeded that for FY 85, FY 86 or the annual average of 15 in.; ground-water levels in the vicinity of the NWBS remained steady to slightly lower. Longer term precipitation trends may have a greater influence on ground-water levels though this is probably minimal based on FY 81-86 experience, PMRMA (1987). Ground water levels did not change appreciably although NWBS flow rates declined in FY 87. Several other potential recharge sources, historic and current, have been identified, PMRMA (1987) and ESE (1988), but not quantified.

52. Water levels. Ground-water level maps (Plates 1-4, ESE 1988) and ground water profiles (Plates 7 and Figures 23-25) provide data displays for evaluation of ground water conditions in the NWBS for FY 87 and comparisons with previous years. Previous years' data (FY 81-86 contour maps and profiles) are contained in PMRMA (1987).

53. Water level maps. Water table elevation maps, Plates 1-4, indicate the minor fluctuations of previous years have dampened and ground water levels, as in FY 86, are relatively stable. The 5,100 ft contour east of the NWBS is at the same location for all quarters of FY 87 and the 5,093, 5,094, and 5,095 ft contours south of the system exhibit only small movements from quarter to quarter. System flow rates are more stable in FY 87, Figure 4, than in previous years (PMRMA 1987) and have decreased over FY 85-87:

FY	Average System Flow Rate
85	554.2
86	568.6
87	495.3

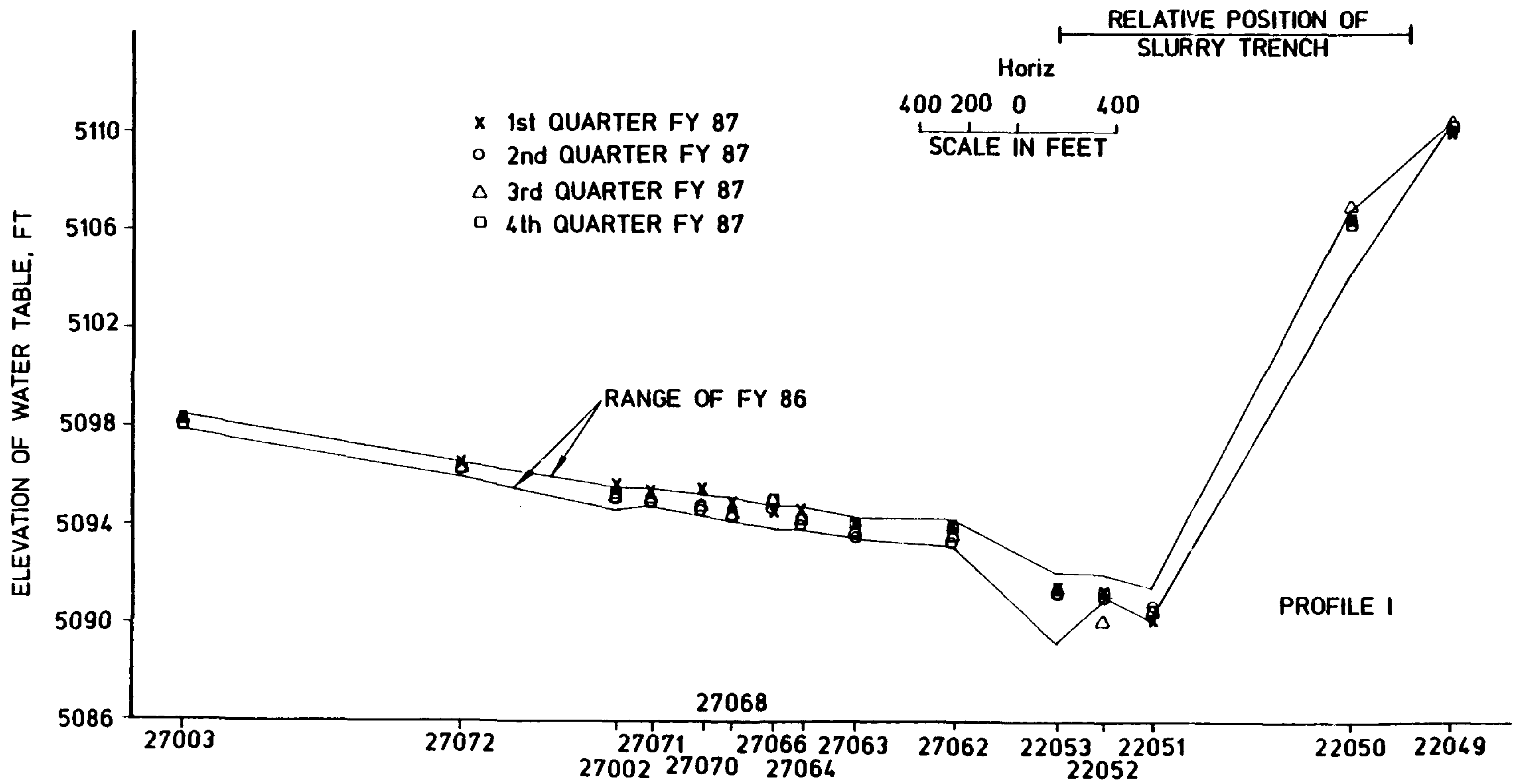


Figure 23. Profile I, NWBS

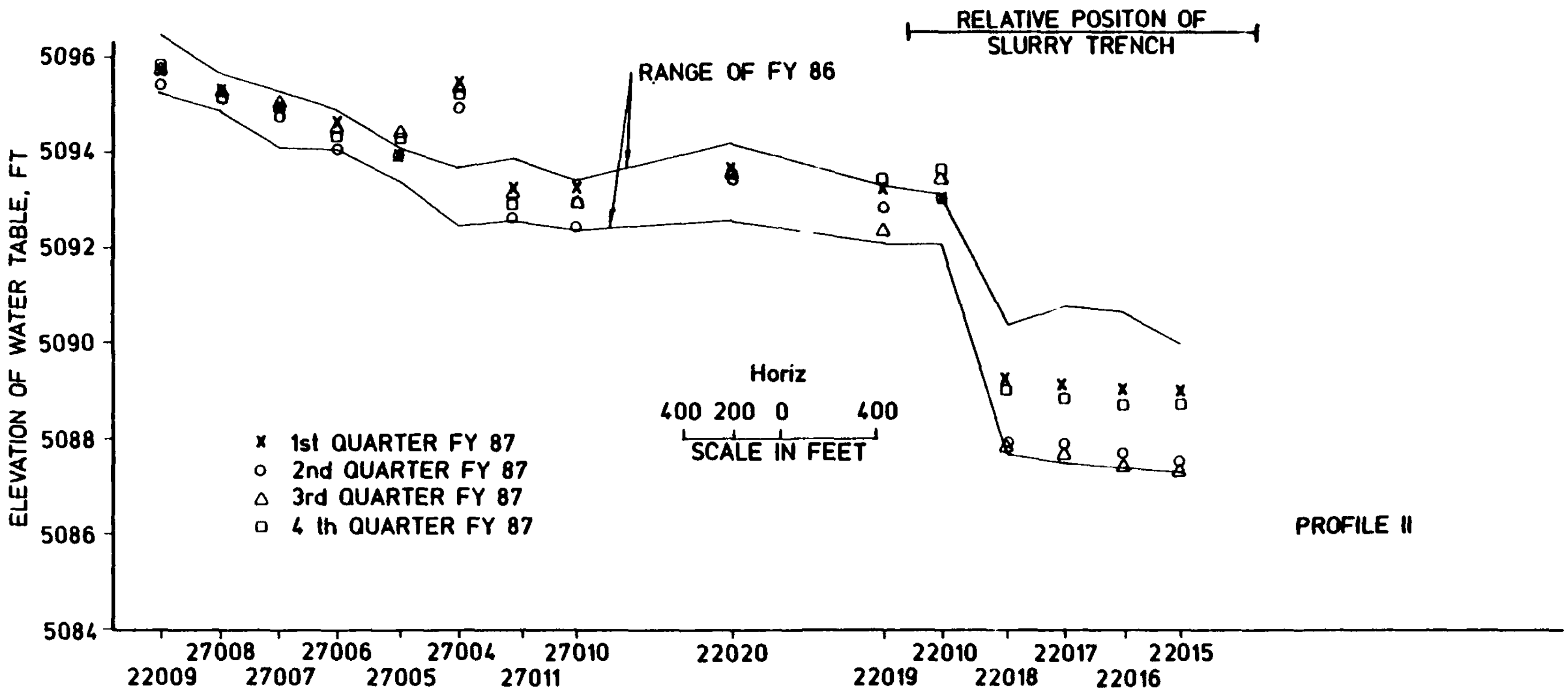


Figure 24. Profile II, NWBS

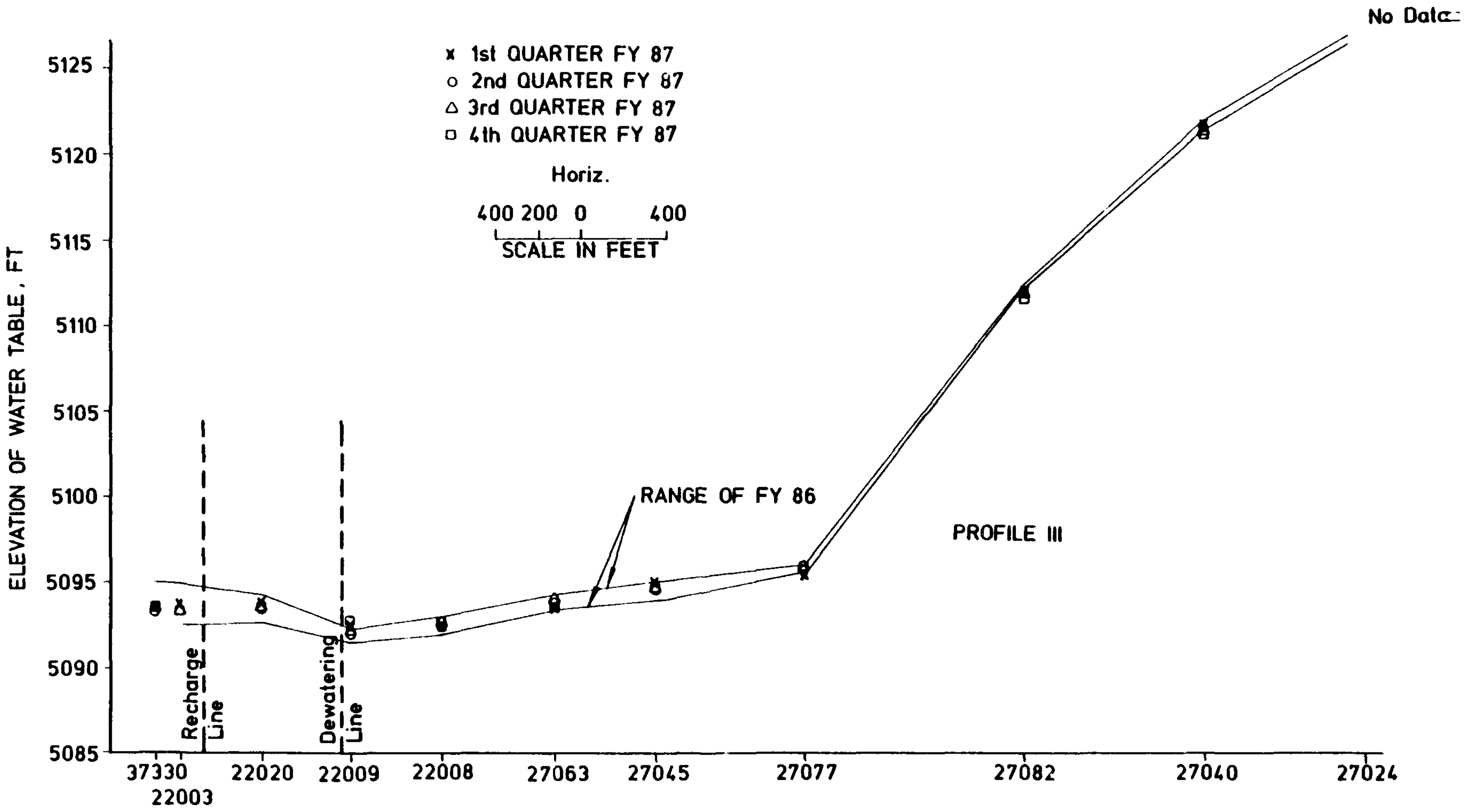


Figure 25. Profile III, NWBS

54. Water level profiles. Profiles I, II, and III; Figures 23, 24, and 25 (location shown on Plate 7); validate the trends of the ground water contour maps described above: cyclic changes dampened and ground water levels were more stable within the NWBS area.

55. Profile I, Figure 23, follows the general configuration of FY 86. It is somewhat less variable in FY 87, particularly near the system components (Wells 27062 to 22049), reflecting the stable flow rates of FY 87.

56. Profile II, Figure 24, because of its proximity to system components, has a greater range of elevations than Profile I. The portion of the profile between the slurry trench and recharge wells (Wells 22018 to 22015) is the most sensitive to variation in system flow and therefore has the greatest change of elevation (three to four feet in FY 86). As with Profile I, this portion of Profile II is less variable in FY 87 than FY 86 reflecting the stable FY 87 flow rate. Well 27004 water levels for FY 87 are approximately two feet higher than the range of previous readings, see Figure 24 and PMRMA (1987). This condition also occurred in the third quarter of FY 83, PMRMA (1987). A local condition or data base error (e.g., a change in casing elevation not entered in the data base) may be responsible.

57. Profile III, Figure 25, closely follows the FY 86 profile and again, as with Profile II, is less variable near the system components.

58. Ground water/NWBS equilibrium. NWBS ground-water levels are stable for FY 86 and 87, particularly outside a 1,000 ft perimeter of the system. NWBS flow fluctuations will have less influence on alluvial ground-water levels than NBS flow fluctuations. As alluvial ground water flows toward the NBS, its movement across the boundary is essentially blocked by the slurry trench between the low permeability Denver highs. Thus the dewatering wells must remove approaching ground water or ground-water levels will increase upgradient of the system. The NWBS is a more open system in that the extent of its influence along the arsenal boundary is directly dependent upon pumping rates and is only partially controlled by the presence of the slurry trench barrier. Thus changes in the NWBS flow rate will have less marked effects on ground water levels than if the NWBS were a more closed system like the NBS. The flow rates for FY 86 and FY 87 are apparently near that required for system equilibrium since ground water levels are stable over this period. A flow rate of 450 gpm to 550 gpm should maintain stable ground-water levels in the NWBS area for conditions similar to those of FY 86 and 87.

59. Flow trends in the Denver formation. The lateral flow of ground water within the Denver formation is generally to the north and west. Flow direction for the Denver sand zones shown in Plate 6 generally follows those shown for sand 2, Figure 22.

60. The potential for vertical flow between the alluvium and the Denver formation is downward in the vicinity of the Northwest Boundary as indicated by four quarters of data from cluster wells for FY 87, ESE 1988. This conclusion was based on data for cluster Wells 22029 and 22030, 22022 and 22023, and 27053 and 27054. Vertical flow between hydrostratigraphic zones within the Denver formation in the Northwest Boundary area is also downward, based on data from six well clusters.

61. General ground-water level trends in the Denver formation of the NWBS are stable to declining for FY 81-87. Hydrographs constructed for Denver formation Wells 22030 and 22031 (collocated with alluvial Well 22029 in the southeast portion of Section 22, Plate 7) indicate declining water levels over the period 1981-1987, ESE (1988). Hydrographs for Denver formation Wells 27057 and 27058 (collocated with alluvial Well 27059 in the north eastern portion of Section 27) indicate stable water levels over the same period with less than a foot of water level fluctuation between quarters. Hydrographs for Denver Wells 22023 and 22024, located between the dewatering and recharge lines with alluvial Well 22022, indicate relatively stable water levels after 1985 (with as much as 14 ft fluctuation in levels for 1982 through 1985, presumably caused by aquifer pumping tests and early system operations).

Distribution of Contaminants

Background

62. Ground-water contamination at the northwest boundary of RMA is a result of the historical disposal of waste from various activities conducted at RMA. Although the contaminants found at the boundary cannot be traced back to a particular source, they are known to be associated with the operation of the disposal basins, chemical plants, and waste handling systems. Historical data on the contaminants are discussed in PMRMA (1987).

63. The reader is referred to the ESE draft report (Task 25) "Boundary Control Systems Assessment Remedial Investigation," June 1988, for a detailed discussion and evaluation of concentrations and distribution of contaminants

(Section 5.0) near the NWBS. Interpretations presented in the ESE draft report have incorporated all of the data collected in the Task 25 study area. The evaluation of alluvial contamination delineates the distribution and concentrations of contaminants historically investigated and also presents an assessment of analytes not previously evaluated.

64. ESE states that the distribution of compounds assessed in previous reports (PMRMA 1987), including DIMP, DCPD, DBCP, combined organo-sulfurs, chloride, and fluoride exhibited a similar pattern for 1987. Even though the monitoring network was different the distribution pattern appears to follow the same general transport pathways. The highest concentrations were generally detected in the samples located along these transport pathways.

Contaminant Concentrations in Dewatering Wells

65. The contaminant distribution maps developed by ESE (1988) for the study area illustrate the general distribution of the contaminants in the area during the study period. As previously noted, these distributions vary from year to year depending on the monitoring program conducted. In order to provide a more detailed picture of the distribution of contaminants in the ground water near NWBS, contaminant concentrations found associated with each alluvial dewatering well were plotted with respect to the well number along the dewatering well line; thus, each graph provides a visual representation of a particular contaminant distribution along the length of the system. Yearly graphs for each contaminant can be compared to assess trends between years.

66. Based on the availability of data, graphs were developed only for aldrin, chloride, DBCP, DCPD, DIMP, dieldrin, endrin, and fluoride for FY 86 and FY 87. These graphs are presented in Figures 26 through 41. Each graph presents the data collected for each well during the year. The vertical lines associated with each well number represent the range of concentrations found (maximum and minimum) with the mean value for each well connected by a dotted line. A mean value was only computed for sets of data where 70 percent or more of the readings were above the detection limit. When this criterion was met, values falling below the detection limit were made equal to the detection limit and included in the computations. A single triangle indicates that all values were below the detection limit. A statistical summary of all the data used to develop the graphs is presented in Appendix D. It should be noted

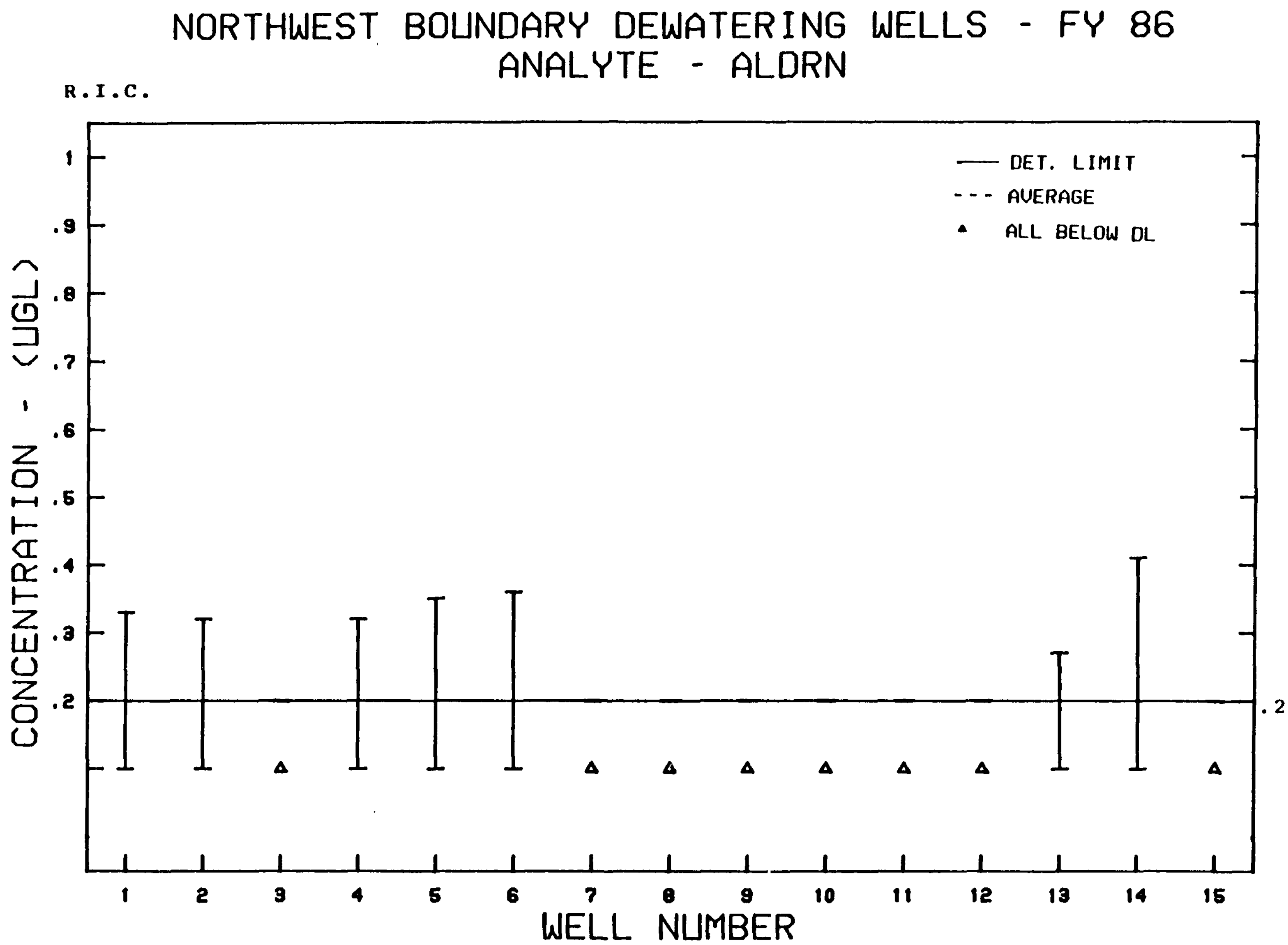


Figure 26. Aldrin concentrations in northwest boundary dewatering wells, FY 86

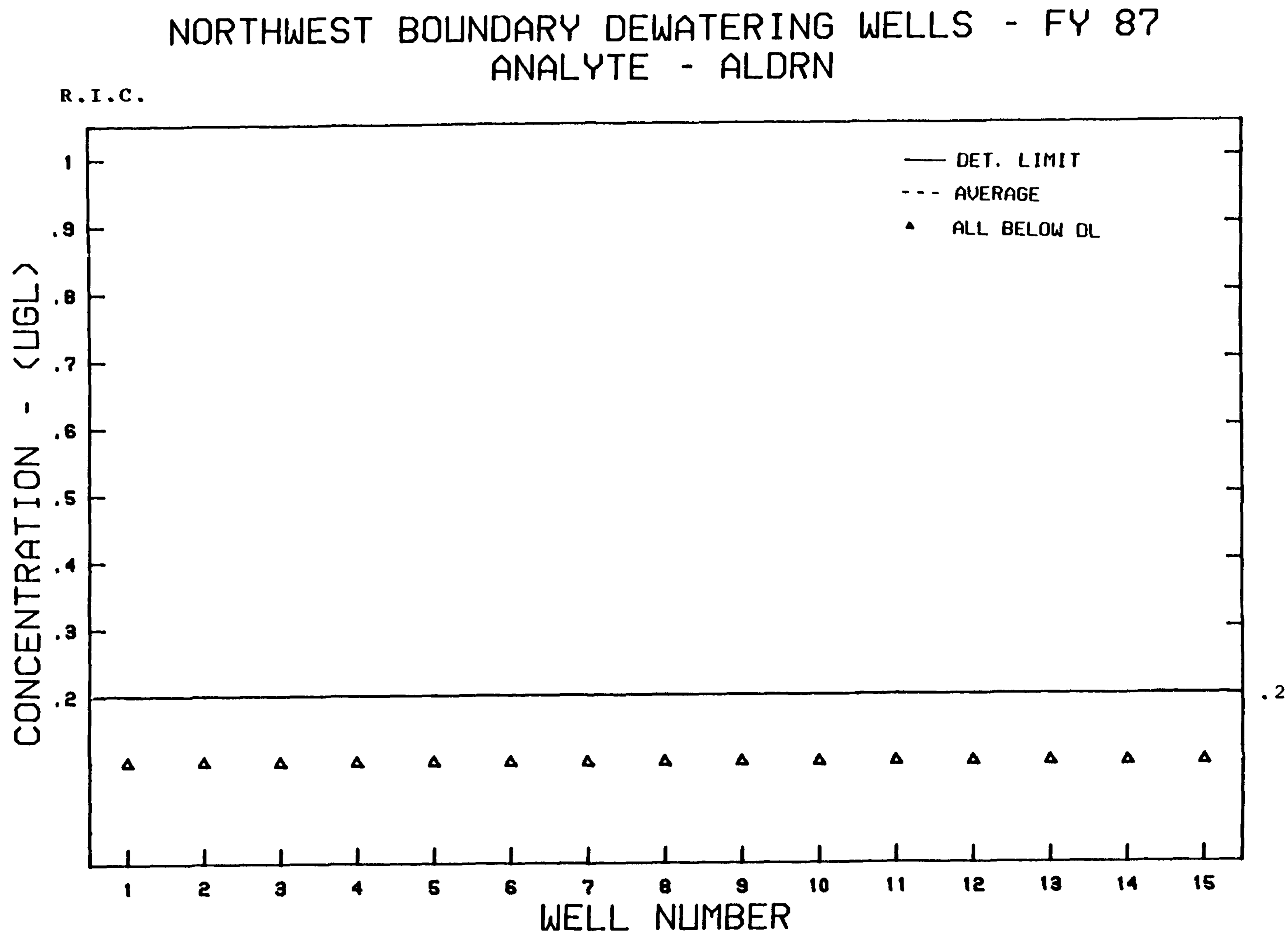


Figure 27. Aldrin concentrations in northwest boundary dewatering wells, FY 87

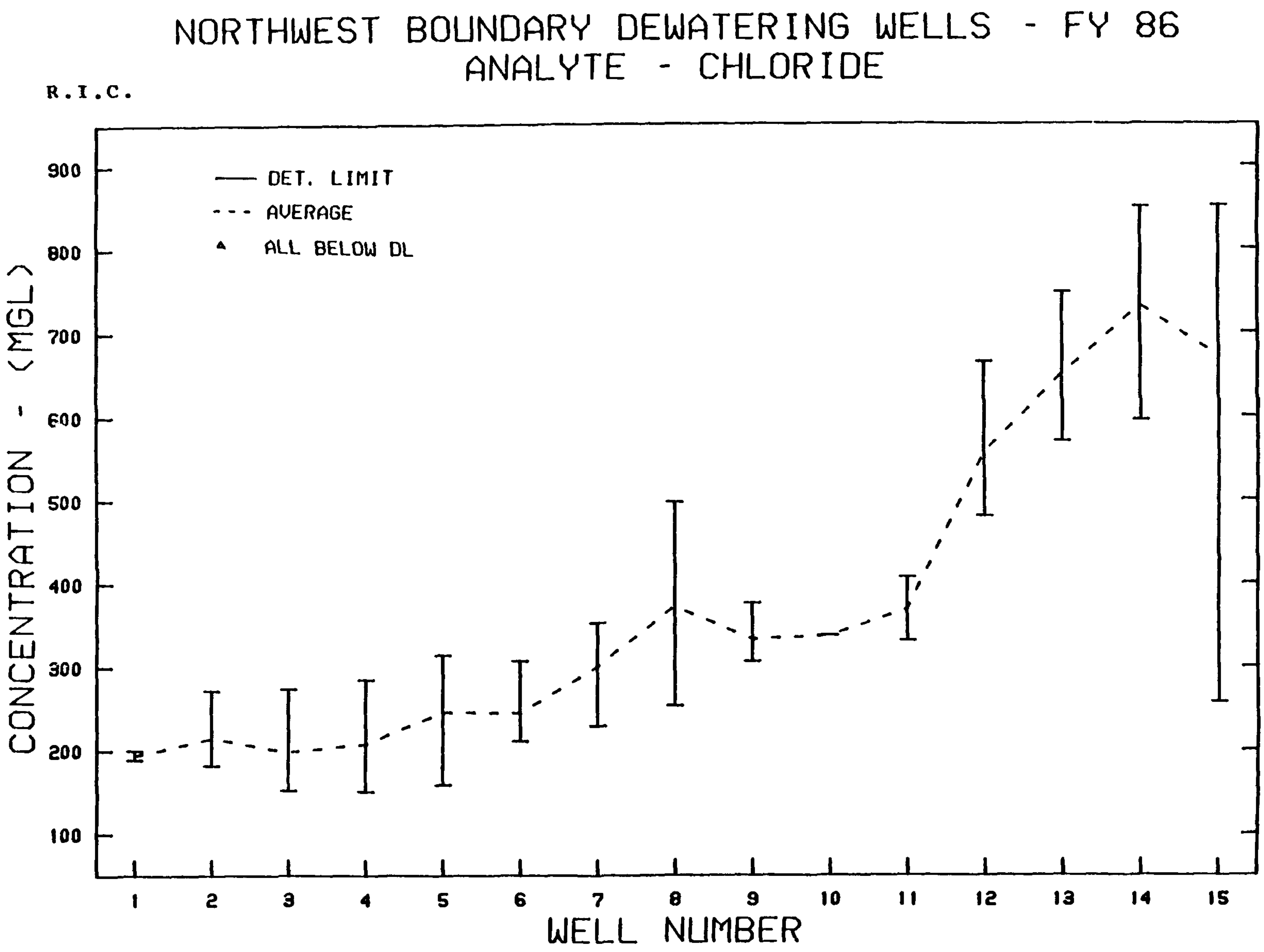


Figure 28. Chloride concentration in northwest boundary dewatering wells, FY 86

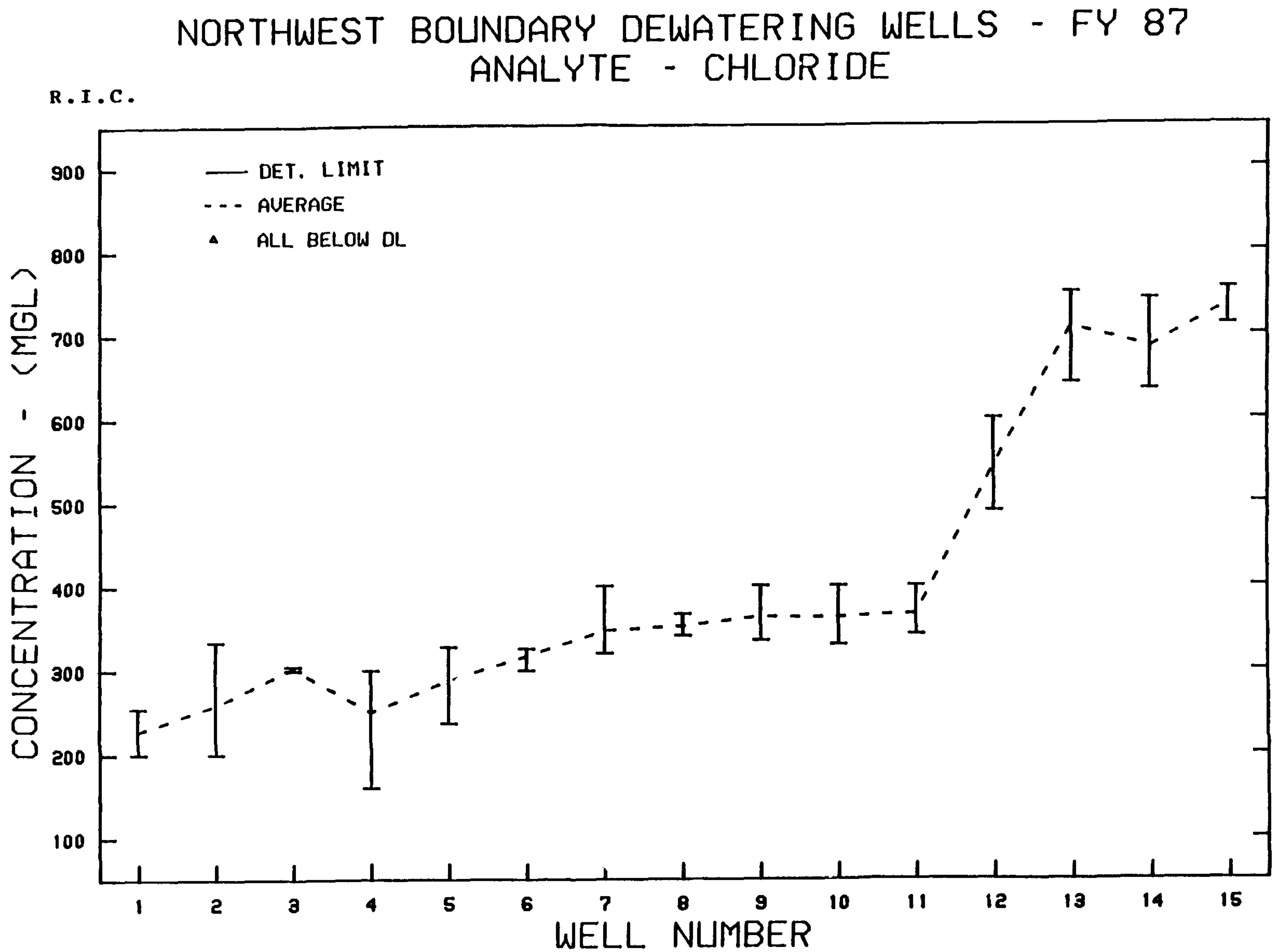


Figure 29. Chloride concentrations in northwest boundary dewatering wells, FY 87

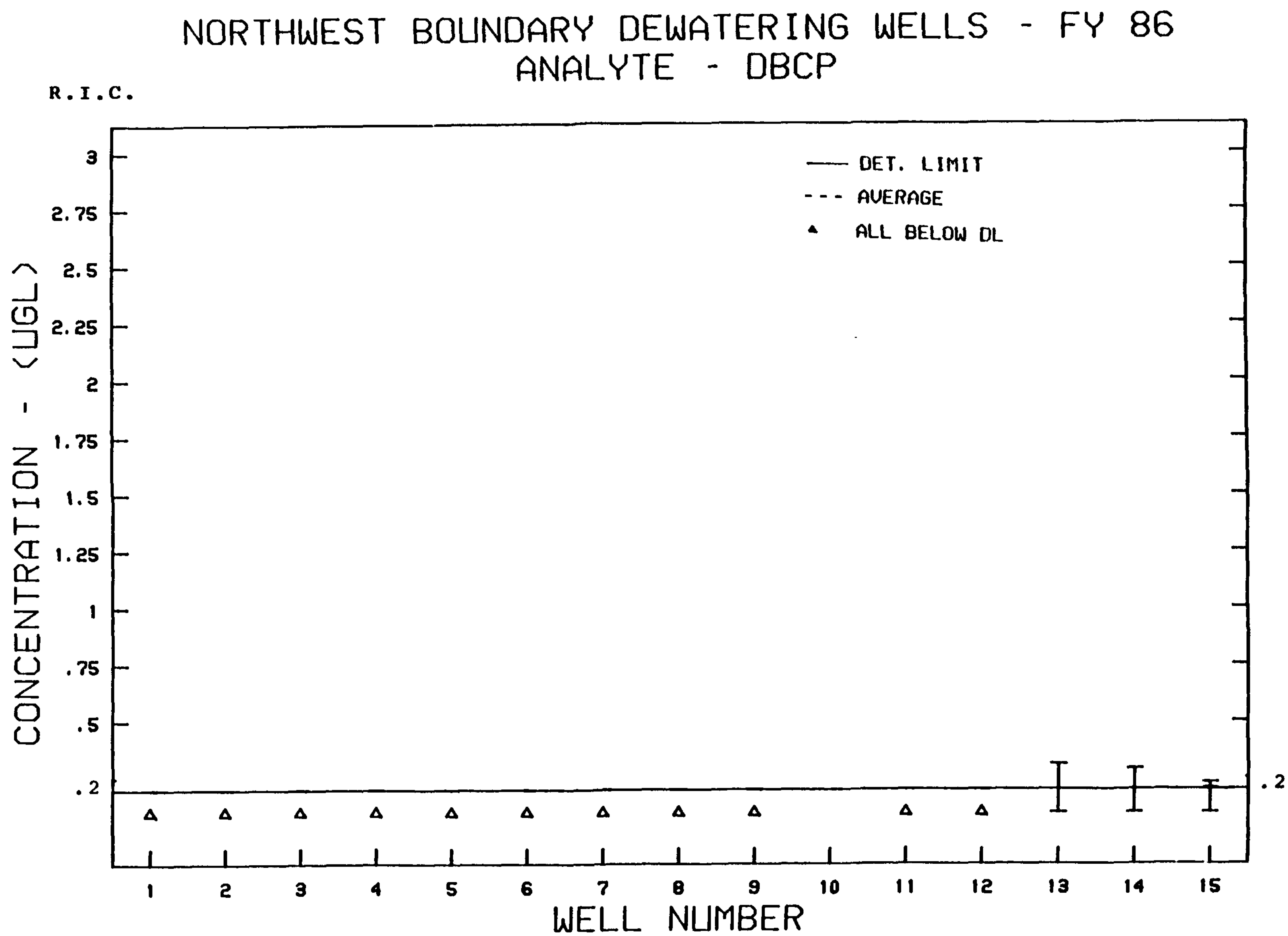


Figure 30. Dibromochloropropane (DBCP) concentrations in northwest boundary dewatering wells, FY 86

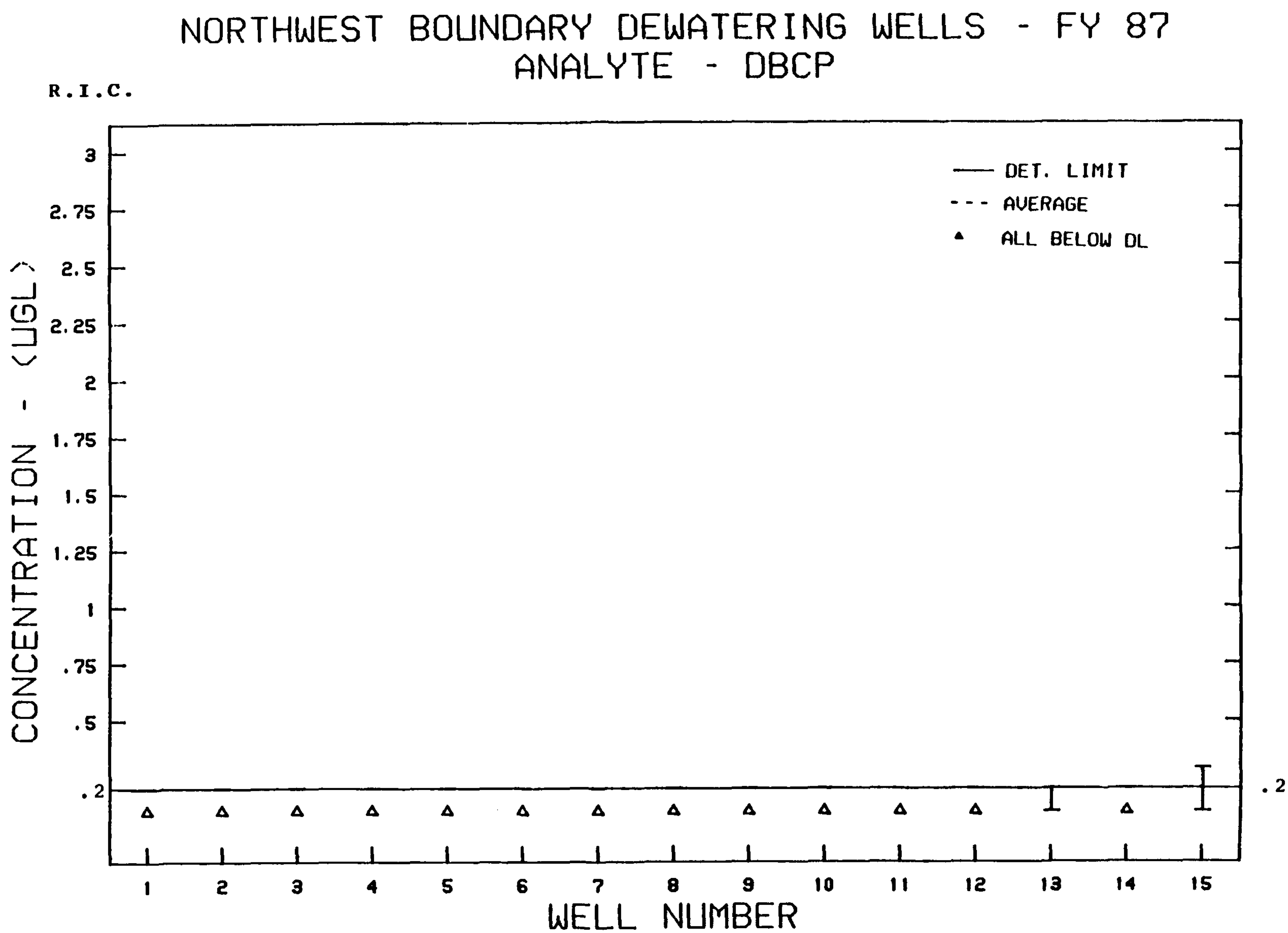


Figure 31. Dibromochloropropane (DBCP) concentrations in northwest boundary dewatering wells, FY 87

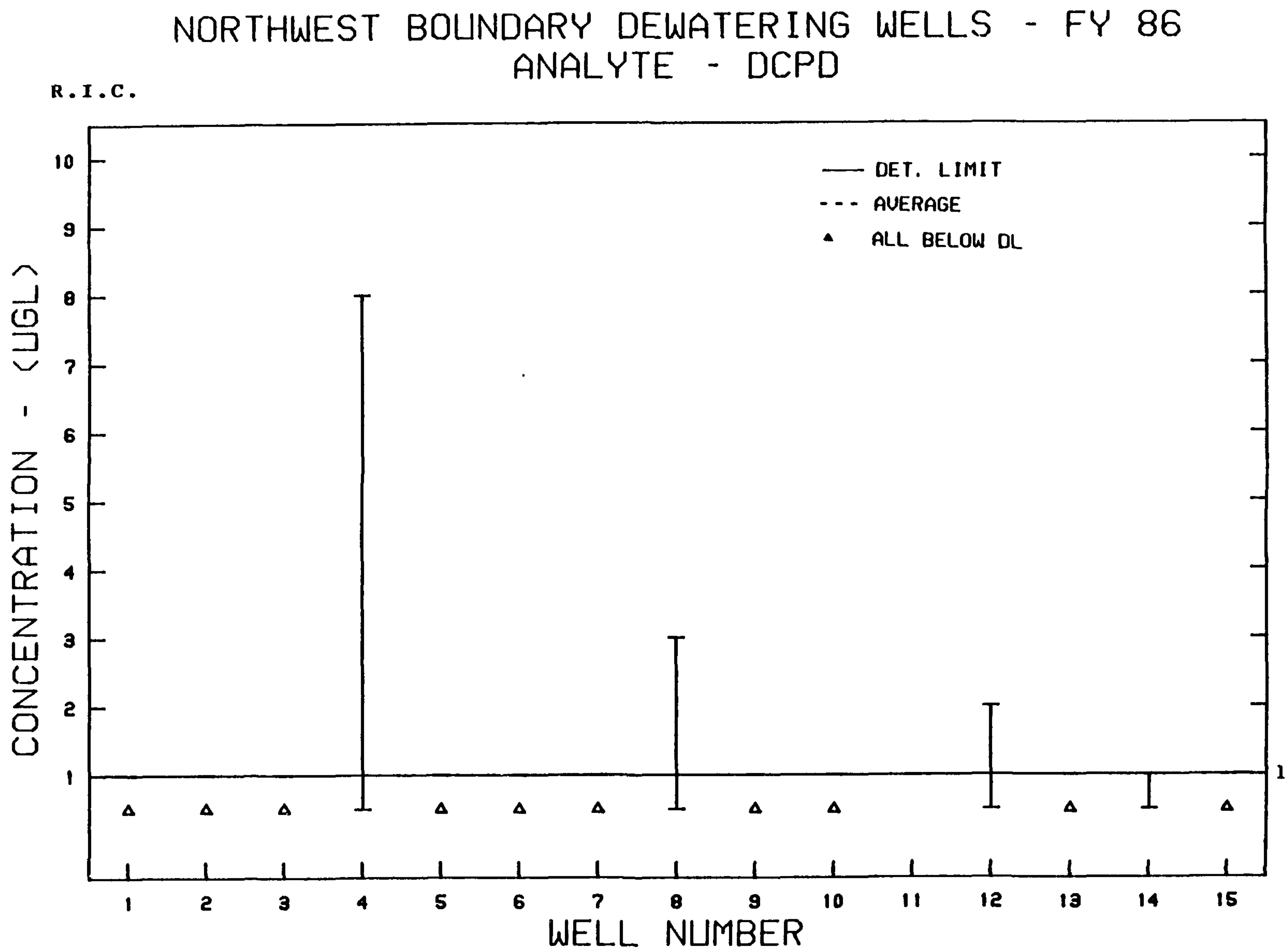


Figure 32. Dicyclopentadiene (DCPD) concentrations in northwest boundary dewatering wells, FY 86

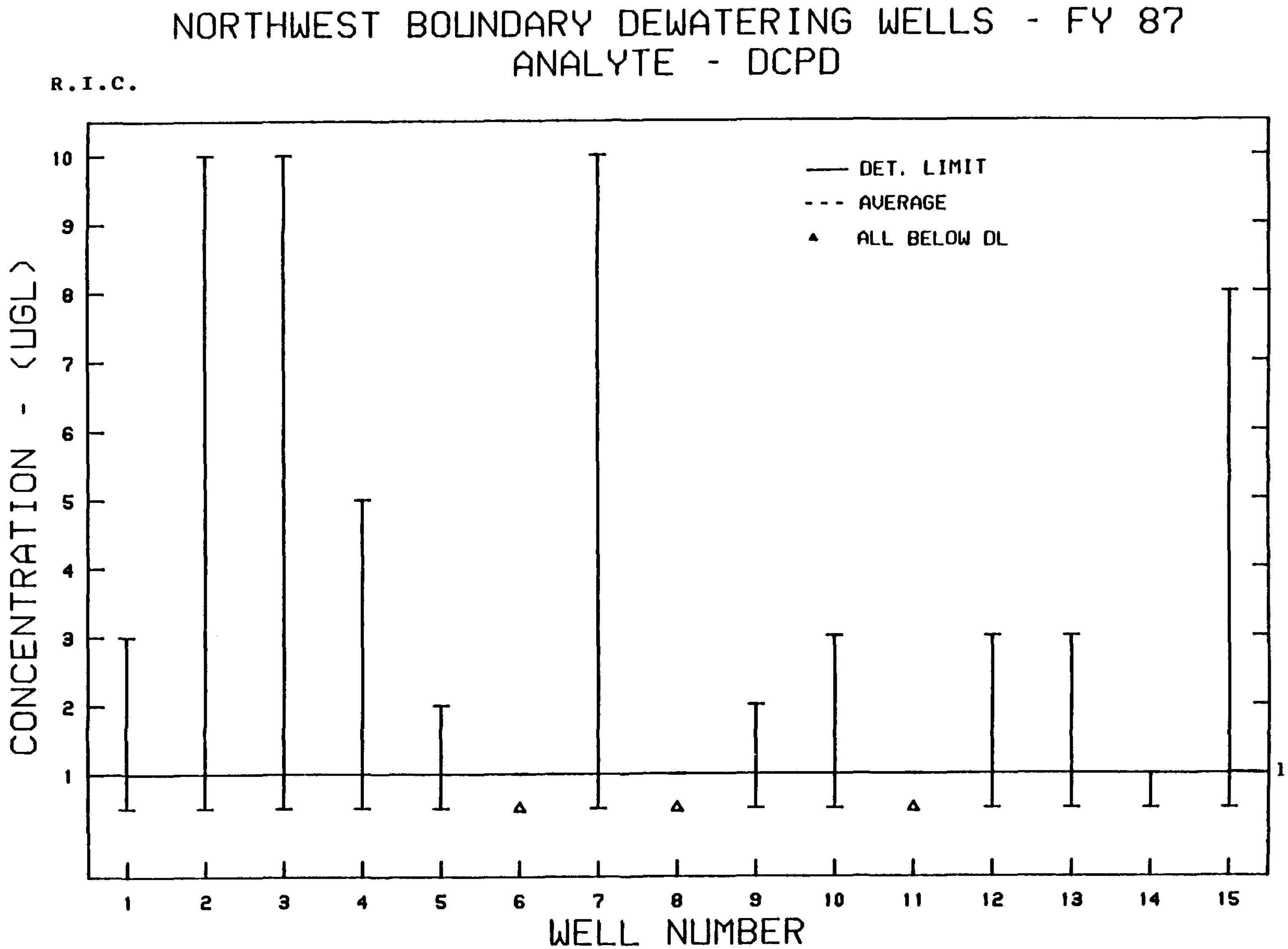


Figure 33. Dicyclopentadiene (DCPD) concentrations in northwest boundary dewatering wells, FY 87

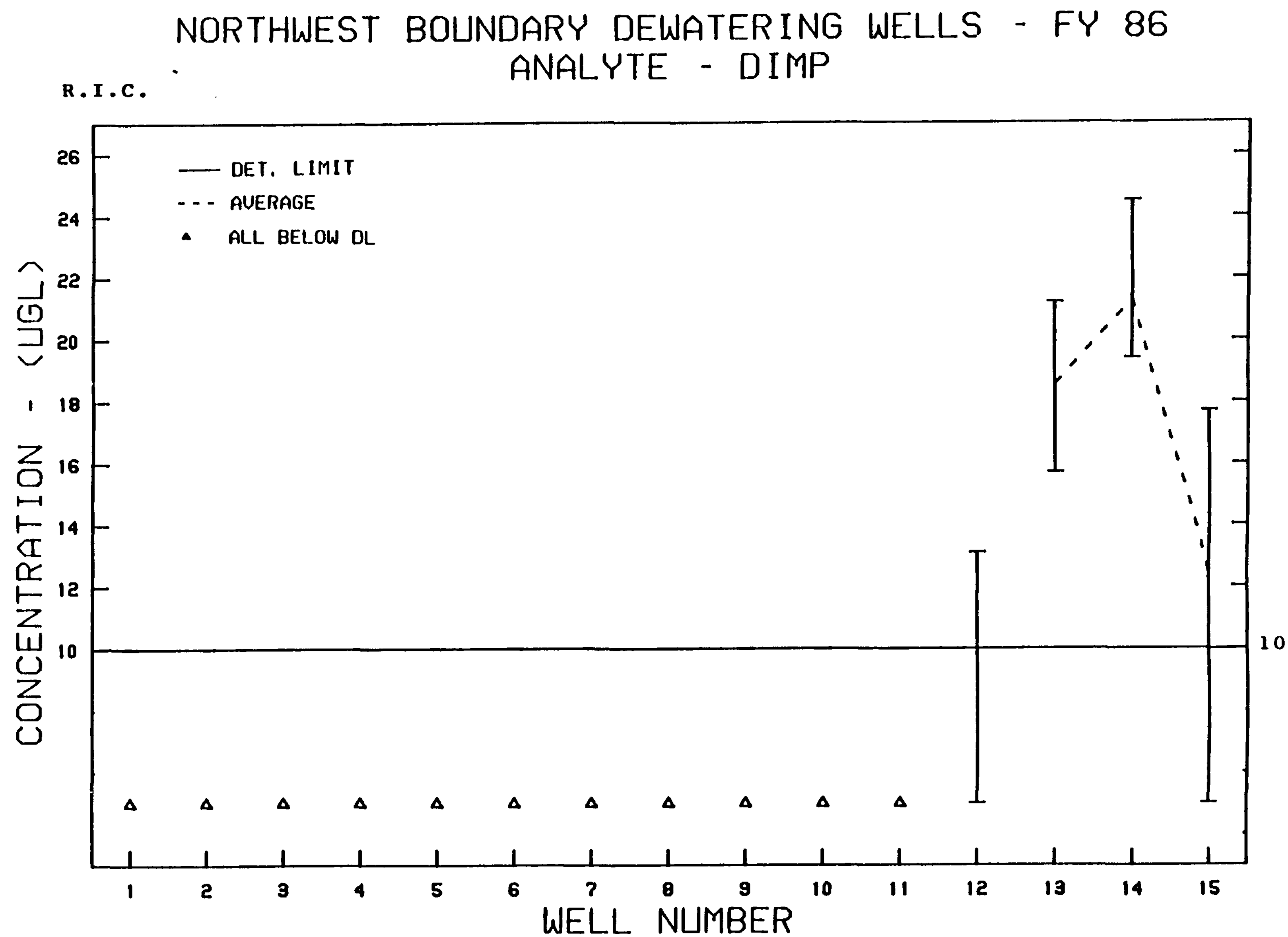


Figure 34. Diisoproplymethylphosphonate (DIMP) concentrations in northwest boundary dewatering wells, FY 86

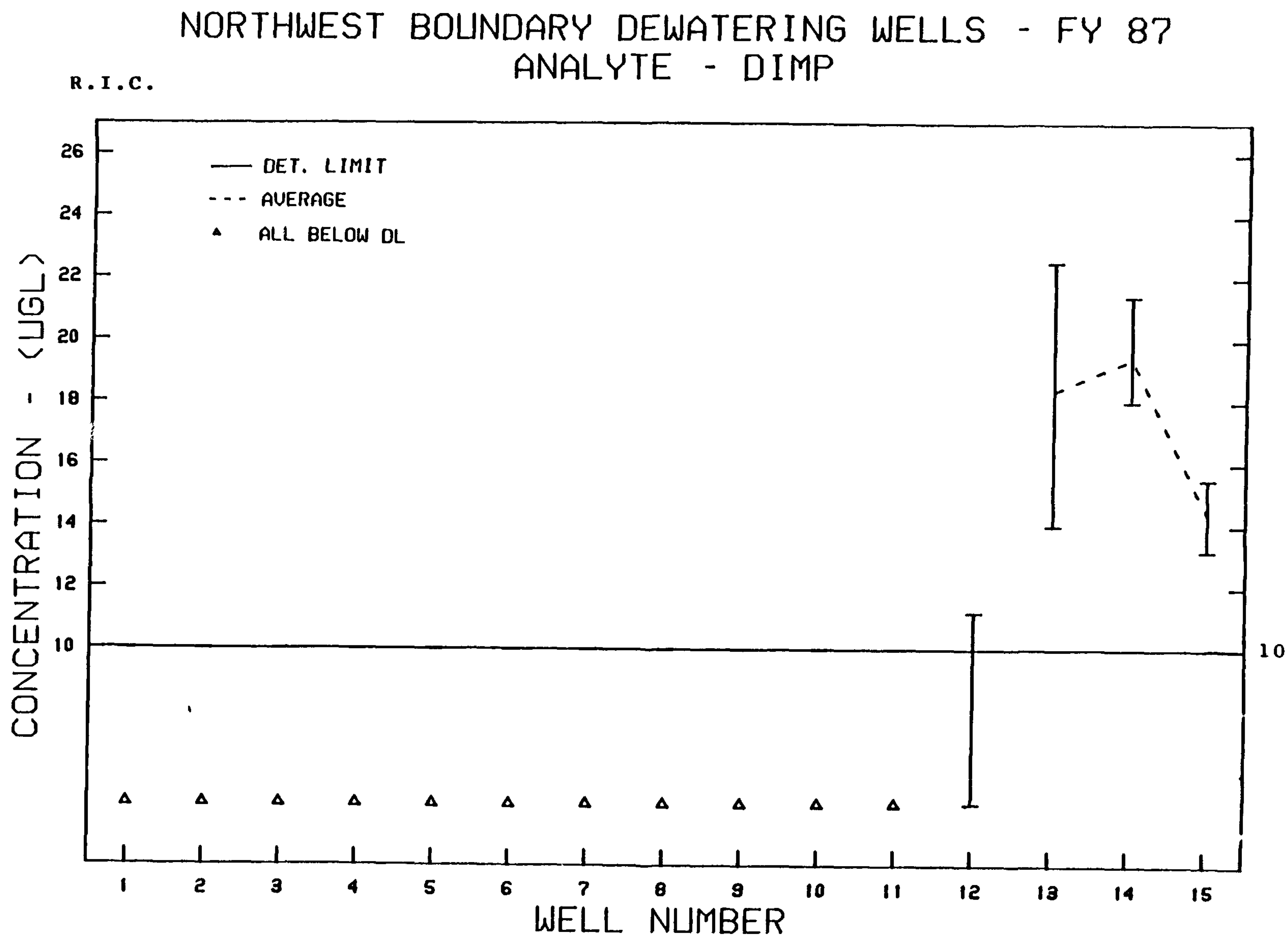


Figure 35. Diisoproplymethylphosphonate (DIMP) concentrations in northwest boundary dewatering wells, FY 87

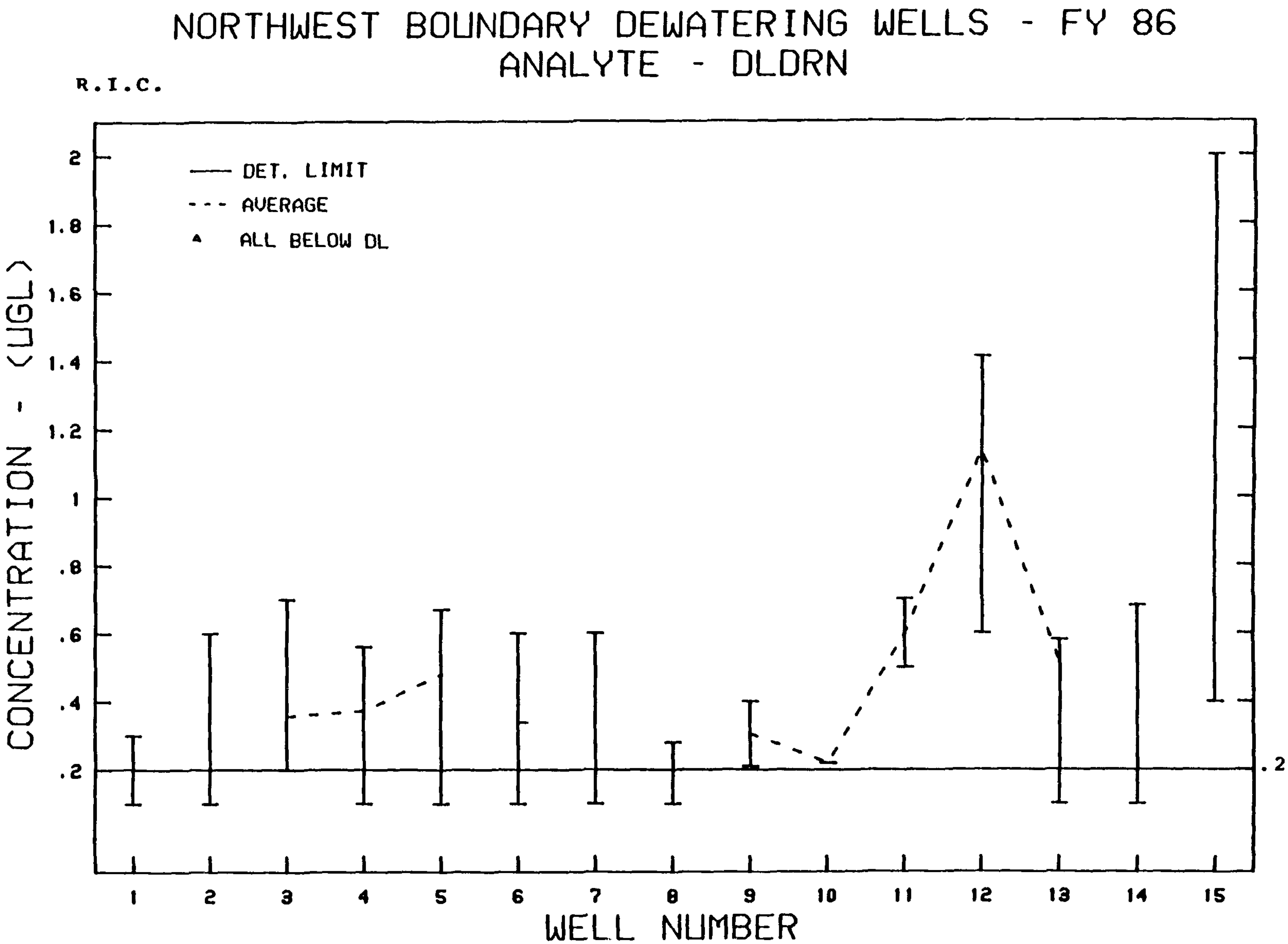


Figure 36. Dieldrin concentrations in northwest boundary dewatering wells, FY 86

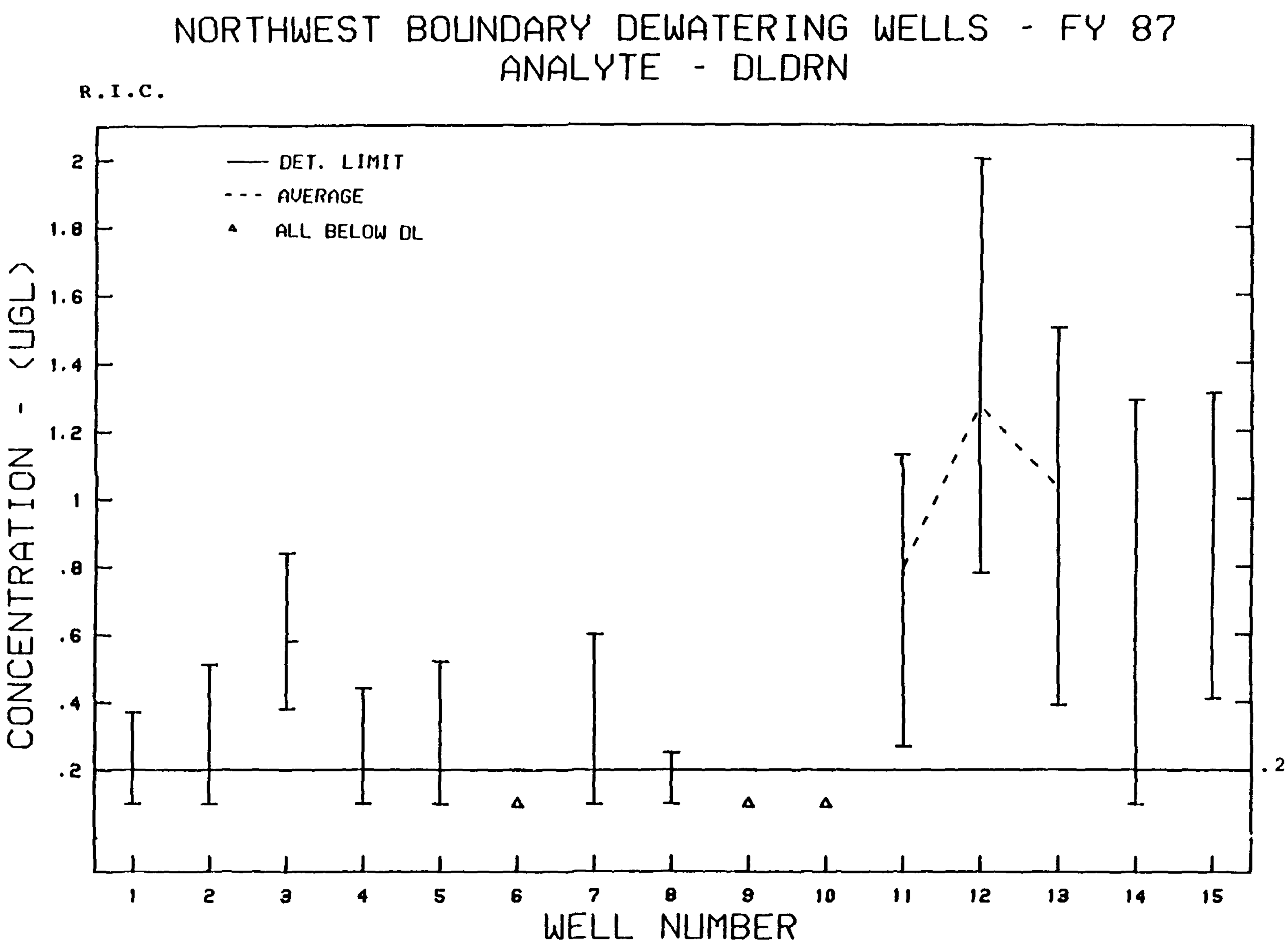


Figure 37. Dieldrin concentrations in northwest boundary dewatering wells, FY 87

NORTHWEST BOUNDARY DEWATERING WELLS - FY 86
ANALYTE - ENDRN

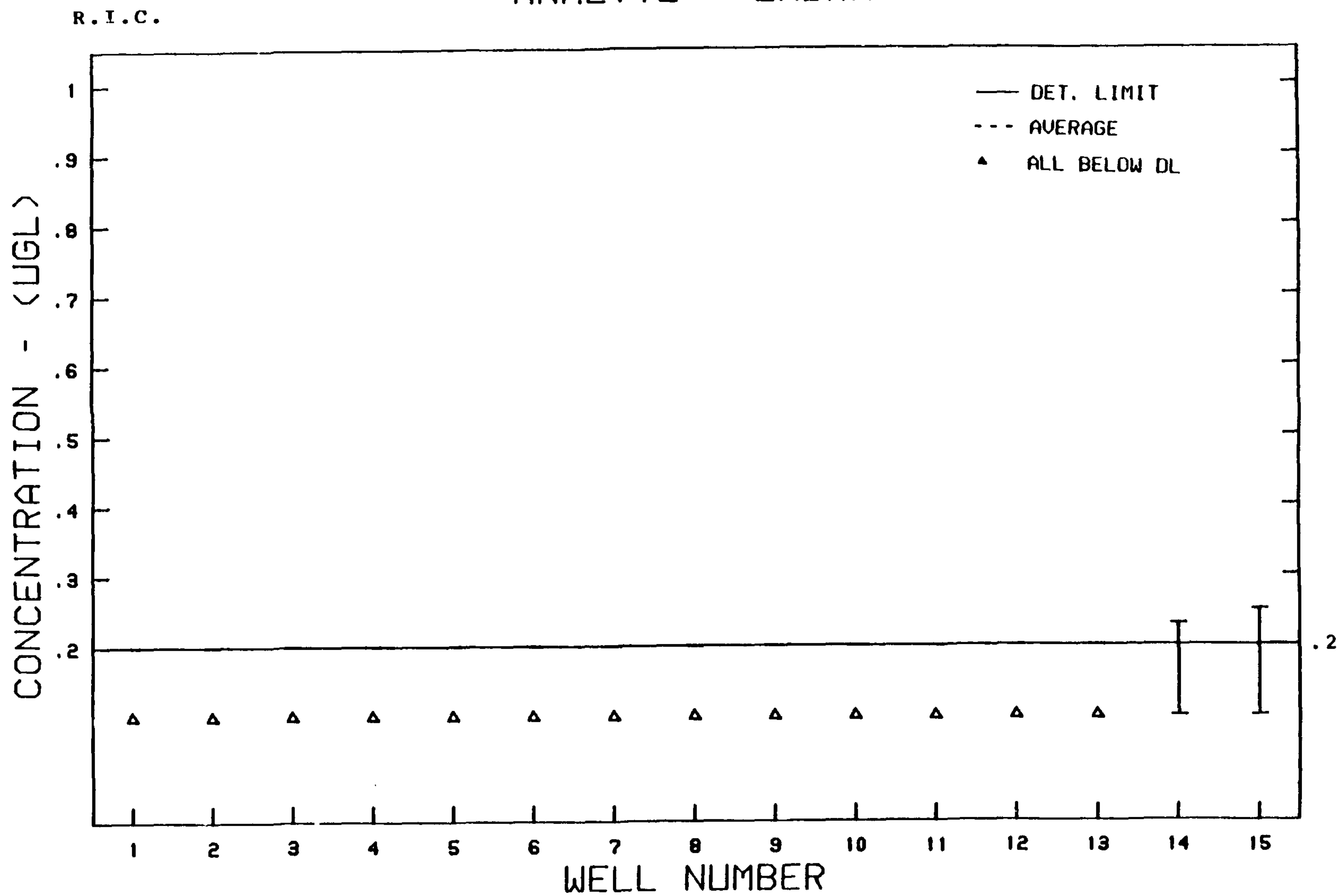


Figure 38. Endrin concentrations in northwest boundary dewatering wells, FY 86

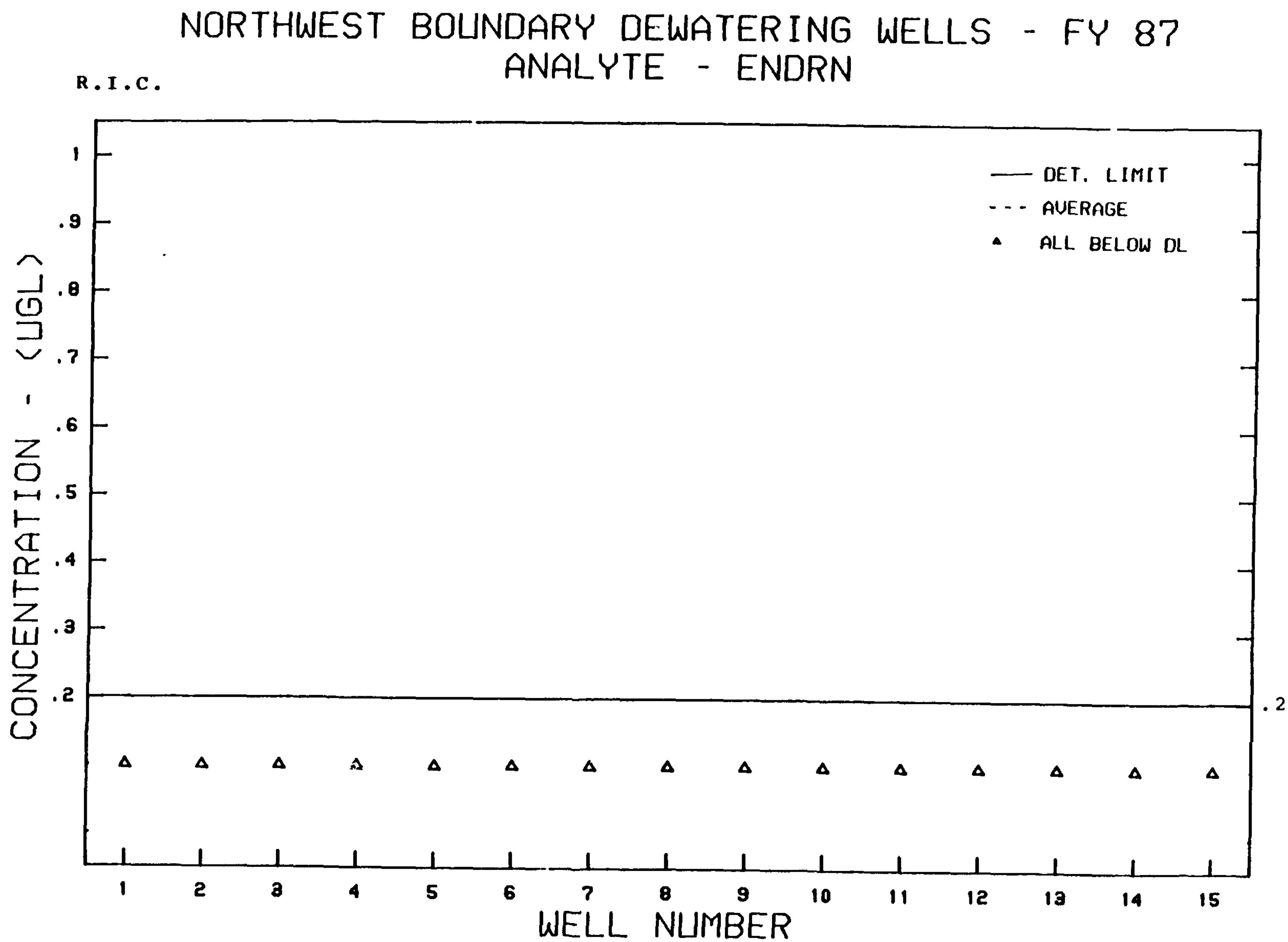


Figure 39. Endrin concentrations in northwest boundary dewatering wells, FY 87

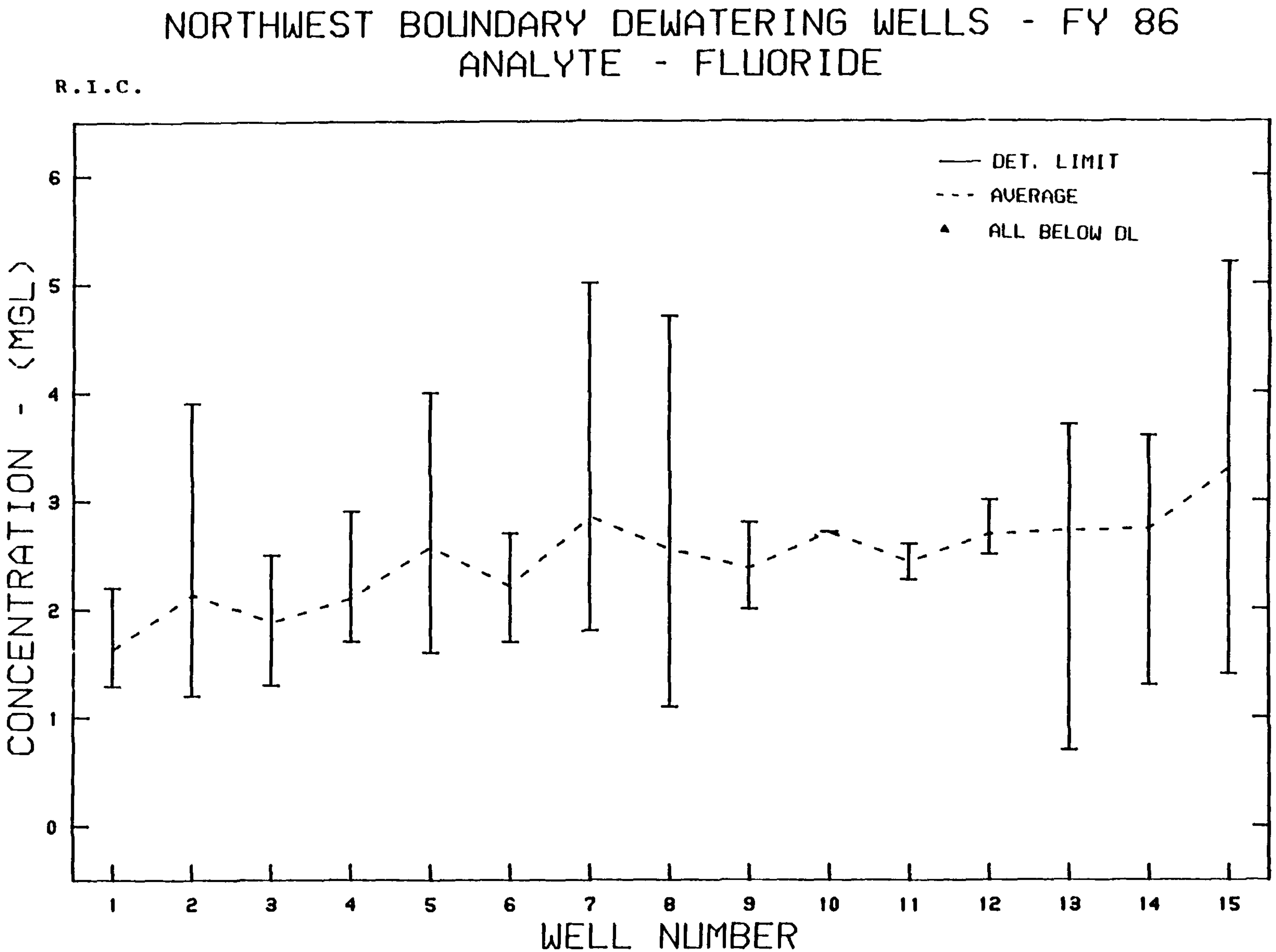


Figure 40. Fluoride concentrations in northwest boundary dewatering wells, FY 86

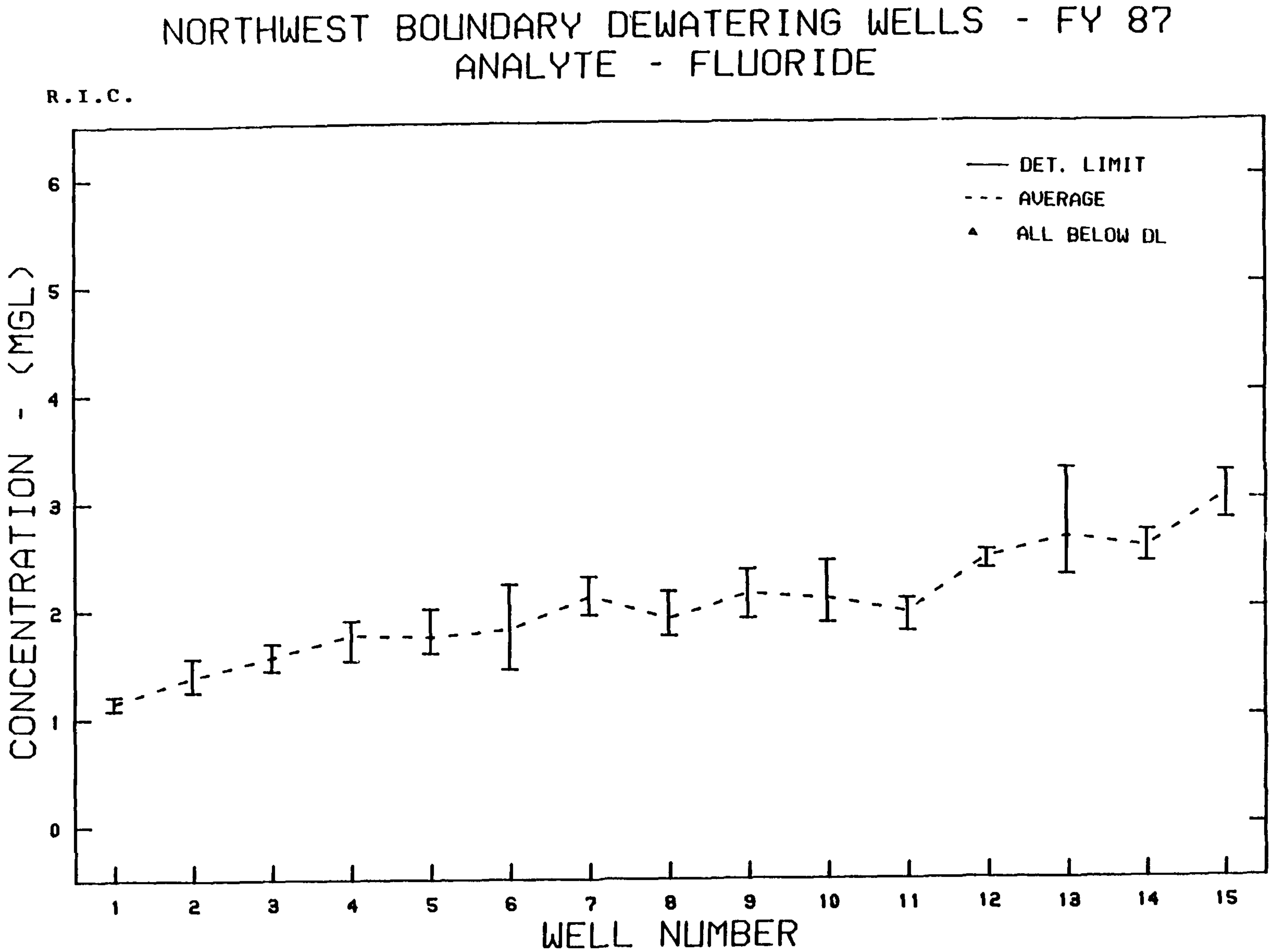


Figure 41. Fluoride concentrations in northwest boundary dewatering wells, FY 87

that the maximum number of samples collected from each well was five with fewer samples collected in many cases.

Aldrin

67. During FY 86, concentrations of aldrin (Figure 26) above the detection limit were found in samples collected from dewatering wells on both ends of the control system. The maximum concentration found was 0.41 ppb in Well No. 14. Concentrations of approximately 0.35 ppb were found on the southwest end of the system. All of the wells produced samples at various times during the year that were found not to contain aldrin above the detection limit. Using the criterion established for calculating means, no concentrations of aldrin above the detection limit were found in any of the wells during FY 87 (Figure 27). This indicates that the concentrations of aldrin along the control system decreased over the two year period.

Chloride

68. The highest concentrations of chloride (Figure 28) during FY 86 were found along the northeast end of the control system. The maximum concentration of approximately 850 ppm was found in samples from Wells No. 14 and 15. The maximum mean concentration was approximately 730 ppm in Well No. 14. The chloride concentration decreased from northeast to southwest along the system with concentrations of 200 ppm found in samples from the southwest end (Figure 28).

69. The chloride distribution for FY 87 (Figure 29) was very similar to FY 86 (Figure 28). The maximum concentration found on the northeast end decreased to approximately 750 ppm while the maximum mean did not change. Mean chloride concentrations on the northwest end of the system generally increased by about 50 ppm.

DBCP

70. During FY 86 (Figure 30), four samples from different dewatering wells were found to contain DBCP above the detection limit. Three of the wells, Wells No. 13, 14, and 15 were on the northeast end of the system. The maximum concentration found in these three samples was approximately 0.3 ppb. Only one sample was collected from Well No. 10 during FY 86 and it was found to have a DBCP concentration of 2.6 ppb. During FY 87 (Figure 31), two samples from different wells on the northeast end of the system were found to contain DBCP at or above the detection limit. The maximum concentration found was approximately 0.3 ppb. No concentrations above the detection limit were

found in any of the samples collected from Well No. 10. Over the two year period, the distribution of DBCP did not change significantly with respect to location or concentration with the exception of the one sample from Well No. 10.

DCPD

71. During FY 86 (Figure 32), samples from four dewatering wells scattered along the system were found to have concentrations of DCPD above the detection limit. However, other samples collected from these same four wells were found not to contain concentrations above the detection limit. The maximum concentration found was 8.0 ppb. In FY 87 (Figure 33), additional wells produced samples which were found to contain DCPD above the detection level. In fact, only three wells did not produce such samples. All of the wells produced at least one sample with a DCPD concentration below the detection level. Thus, no mean concentrations could be calculated due to the limited number of samples analyzed. In summary, the graphs indicate that DCPD is probably distributed all along the system at low concentrations and that the concentrations found increased between FY 86 and FY 87. It should be noted however, that DCPD is difficult to accurately analyze due to its volatility. DCPD can volatilize from samples during sample collection, storage, or transportation. This problem is evidenced by the wide range of concentrations found in the samples from each well. Thus, DCPD may have been more prevalent at the system than indicated by the FY 86 and even FY 87 data.

DIMP

72. Concentrations of DIMP (Figures 34 and 35) above the detection limit were found only in samples from Wells No. 12 through 15 on the northeast end of the system in FY 86. The maximum concentration found was approximately 25 ppb while the maximum mean concentration was 21 ppb and both were associated with Well No. 14.

Dieldrin

73. During FY 86, concentrations of dieldrin (Figure 36) above the detection limit were found in samples from every dewatering well in the system. The highest concentrations were found on the northeast end of the system with the highest concentration of 2.0 ppb found associated with Well No. 15. The highest mean concentration was approximately 1.1 ppb found associated with Well No. 12. Concentrations on the southwest end of the system ranged from the detection limit to a concentration of 0.7 ppb. In FY 87, the distribution

of dieldrin (Figure 37) was very similar to FY 86 with concentrations decreasing slightly along the central and southwestern sections of the system and increasing slightly on the northeastern end. The highest mean concentration, again is Well No. 12 which increased to approximately 1.3 ppb.

Endrin

74. In FY 86, only two samples, one each from Wells No. 14 and 15, were found to contain concentrations of endrin (Figure 38) above the detection limit. The maximum concentration found was 0.25 ppb in Well No. 15. None of the samples collected from the dewatering wells in FY 87 were found to contain concentrations of endrin (Figure 39) above the detection level, indicating that the endrin distribution along the control system dissipated to a point of being undetectable.

Fluoride

75. In FY 86, fluoride (Figure 40) concentrations increased along the control system from southwest to northeast. The maximum concentrations found were approximately 5 ppm while the highest mean concentration was 3.3 ppm found associated with Well No. 15. In FY 87, the fluoride (Figure 41) distribution along the system was very similar to FY 86. Both maximum concentrations and mean concentrations decreased all along the system. The highest mean value in FY 87 was 3.05 ppm in Well No. 5. Mean values decreased by 0.3 to 0.5 ppm on the southwest end of the system.

Summary of dewatering well data

76. Based on the contaminant concentration data collected for the dewatering wells during FY 86 and FY 87, it appears that the highest concentration of contaminants are generally found on the northeast end of the system. It should be noted that this is a relatively low flow area in the system resulting in an overall dilution of contaminant concentrations in the influent to the treatment system. In general, the contaminant distributions did not change significantly over the two year period. Many of the graphs indicate a slight decrease in contaminant concentrations during this period while a few show both increases and decreases associated with the same contaminant.

PART V: CONCLUSIONS AND COMMENTS

77. Based on the evaluation of the FY 87 operations data for the Northwest Boundary System, the following conclusions can be made.

a. Ground-water levels in the NWBS areas are stable for FY 87 and closely follow those of FY 86. The ground-water contours indicate that, at current operating rates (FY 87), the NWBS is effectively intercepting ground-water flow moving toward the system in the alluvium. The consistent and effective reverse gradient along the hydrological control portion of the system continues in FY 87.

b. Review of the data bases for the NWBS operational assessment has indicated a lack of sufficient ground-water definition and control to properly define geohydrology upgradient and immediately north of the system. Though some wells have been installed under Task 25, a need remains for additional monitoring of existing wells and installation of new monitoring wells for a comprehensive assessment of the operational effectiveness of the NWBS.

c. The NWBS is effectively reducing the off-post migration of contaminated ground water in the alluvial aquifer. Historical data indicate a downward trend in contaminant concentrations down gradient of the system over the period of operation of the system.

d. The treatment system is effectively removing organic contaminants (DBCP, DIMP, DCPD, aldrin, endrin, dieldrin, and isodrin) from the influent to the system. The water being recharged contains no levels of the referenced organic contaminants above detectable levels. Inorganic contaminants such as chloride and fluoride are not removed by the treatment system.

e. Based on the data collected for the dewatering wells, the highest concentrations of contaminants are generally found on the northeast end of the control system. During FY 86 and FY 87, the concentrations of most of the contaminants decreased by varying degrees.

COMMENTS

78. The NWBCT Report FY85/86 (PMRMA, Jun 87) indicated the need to improve the ground-water monitoring upgradient and north of the NWBCT system. Additionally, the Program Manager for RMA Contamination Cleanup as part of Tasks 25 and 44 had identified areas in the vicinity of the system that require additional monitoring and ground-water well installation or

replacement. The PMRMA has initiated work as part of the ground-water monitoring programs at RMA. As part of Task 25, ground-water monitoring of the alluvial and Denver aquifers for the NW boundary system was conducted from October 1985 through December 1987. The installation of new or replacement monitoring wells in the NW boundary area is being conducted as part of the composite well program for Tasks 25 and 44. The installation of monitoring wells is based on the technical program requirements of all ground-water monitoring tasks. These new monitoring wells were incorporated into the monitoring program when they became available. The Comprehensive Monitoring Program (CMP), started in 1988, is responsible for all ground-water monitoring in support of the NW Boundary System. Installation of additional monitoring wells as required for detailed assessment of the system is planned as part of the CMP.

REFERENCES

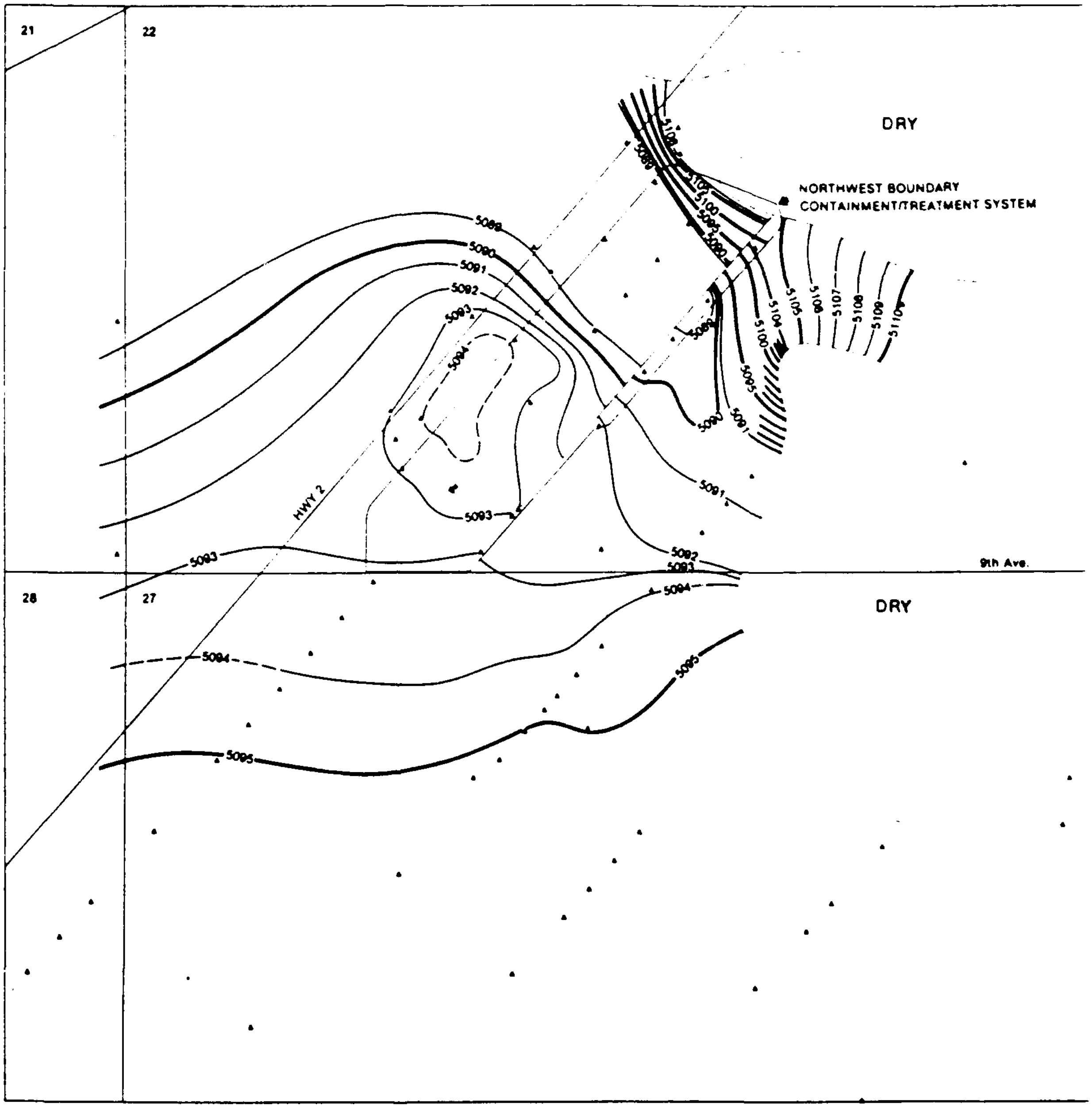
ESE. 1987. "RMA Boundary Systems Monitoring Draft Final Technical Plan, Task 25," Rocky Mountain Arsenal Information Center Reference Library Number 87014R24, Rocky Mountain Arsenal, Commerce City, Colorado.

ESE. 1988. "Boundary Control Systems Assessment Remedial Investigations," Draft Report June 1988 Volume I. Contract Number DAAK 11-84-D-0016. Rocky Mountain Arsenal, Commerce City, Colorado.

PMRMA. 1987. "Northwest Boundary Containment/Treatment System Baseline Conditions, System Startup and Operational Assessment Report for FY 85/86," Rocky Mountain Arsenal Information Center Reference Library Number 88054R01, Rocky Mountain Arsenal, Commerce City, Colorado.

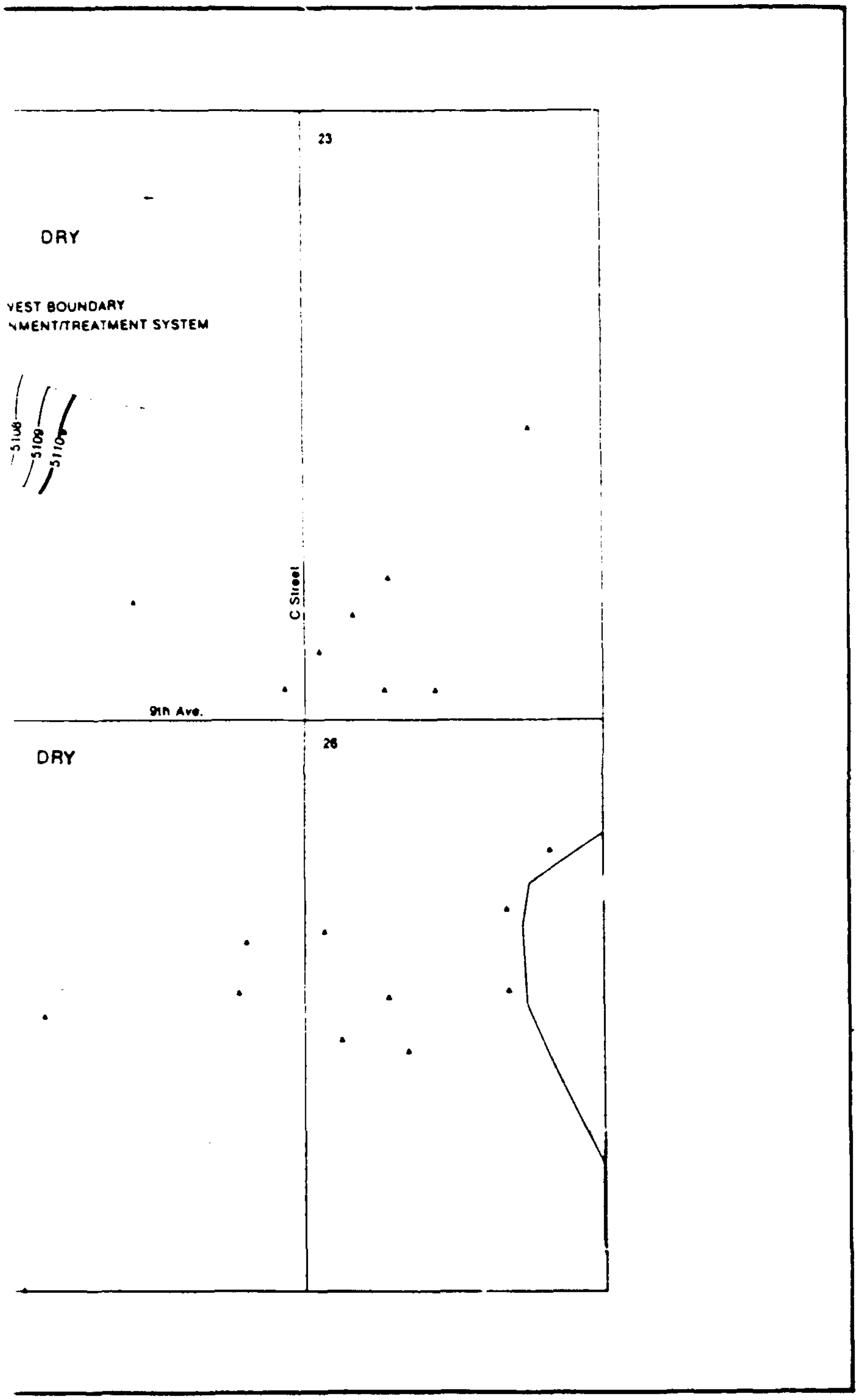
APPENDIX A

GEOLOGIC AND HYDROLOGIC PLATES



NWBCS, WATER TABLE ELEVATION (FEET,MSL)
1ST QUARTER FY87

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1



EXPLANATION

5100 WATER TABLE ELEVATION CONTOUR LINE

5100 INFERRED WATER TABLE ELEVATION LINE

▲ ALLUVIAL WELL MONITORED FOR WATER LEVELS

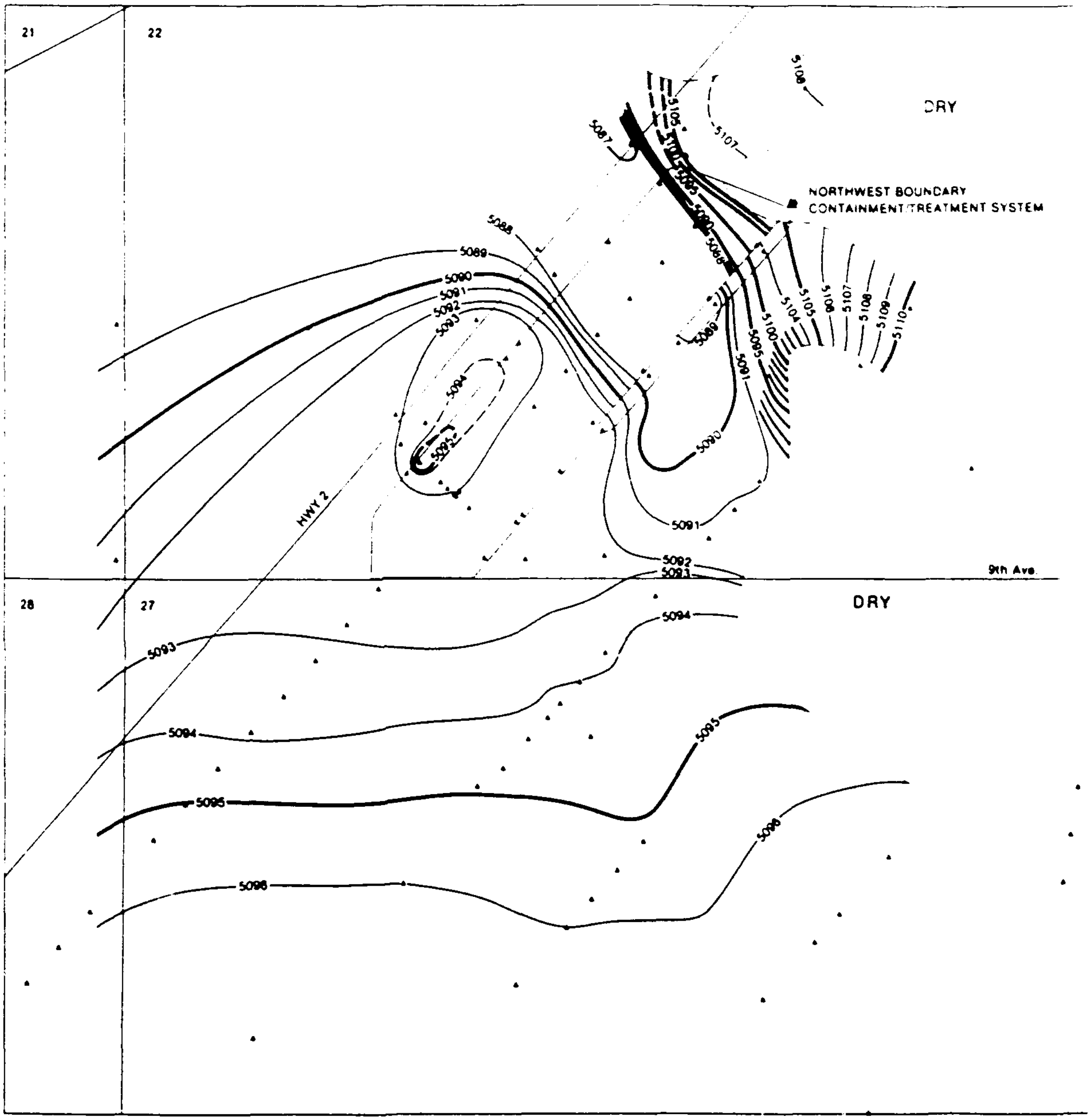
CONTOUR INTERVAL : 1 FT.

N

0 400 800

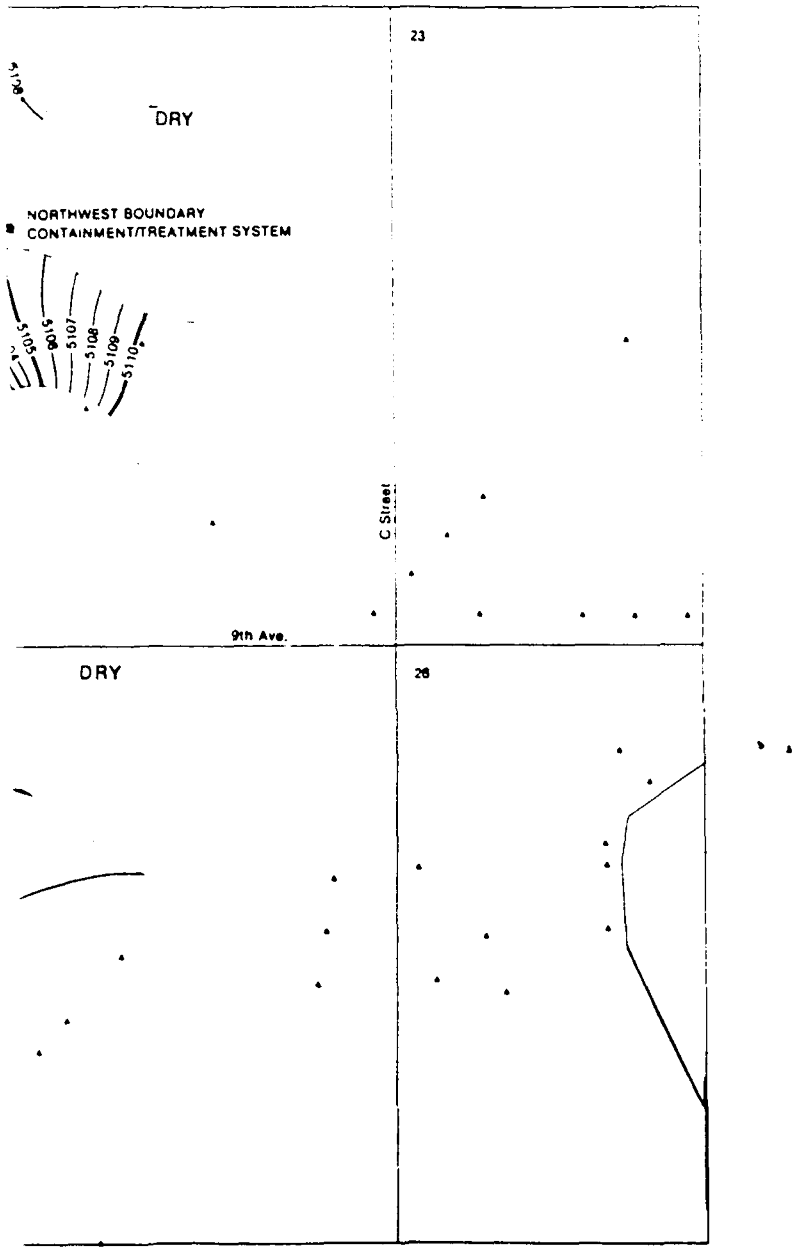
Scale In Feet

PLATE NO. 1

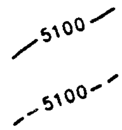


NWBCS, WATER TABLE ELEVATION (FEET,MSL)
2ND QUARTER FY87

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1



EXPLANATION



5100 WATER TABLE ELEVATION CONTOUR LINE

5100 INFERRED WATER TABLE ELEVATION LINE

▲ ALLUVIAL WELL MONITORED FOR WATER LEVELS

CONTOUR INTERVAL : 1 FT.

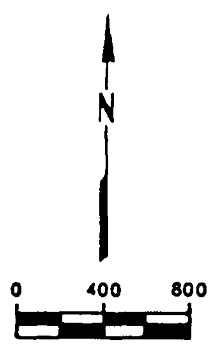
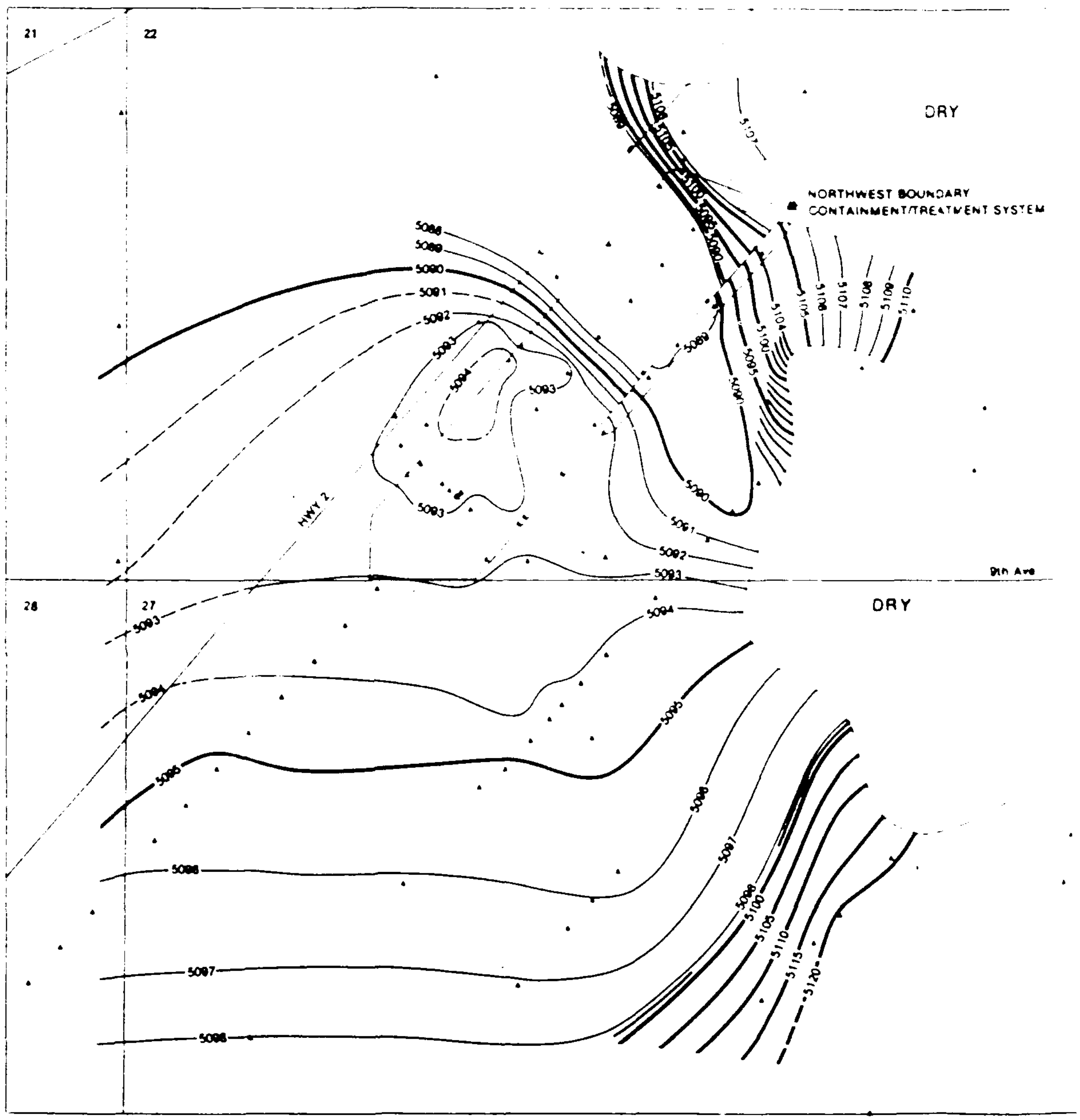
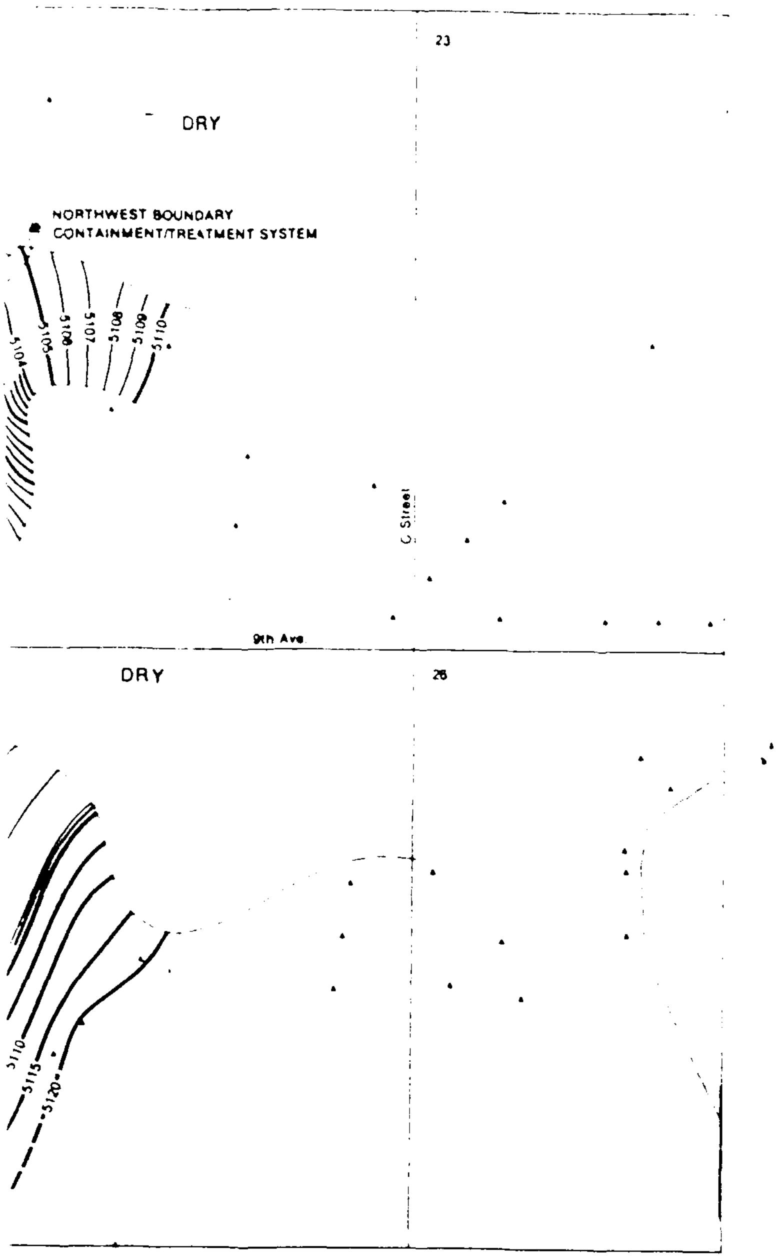


PLATE NO. 2



NWBCS, WATER TABLE ELEVATION (FEET,MSL)
3RD QUARTER FY87

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1



EXPLANATION

5100 WATER TABLE ELEVATION CONTOUR LINE

5100 INFERRED WATER TABLE ELEVATION LINE

▲ ALLUVIAL WELL MONITORED FOR WATER LEVELS

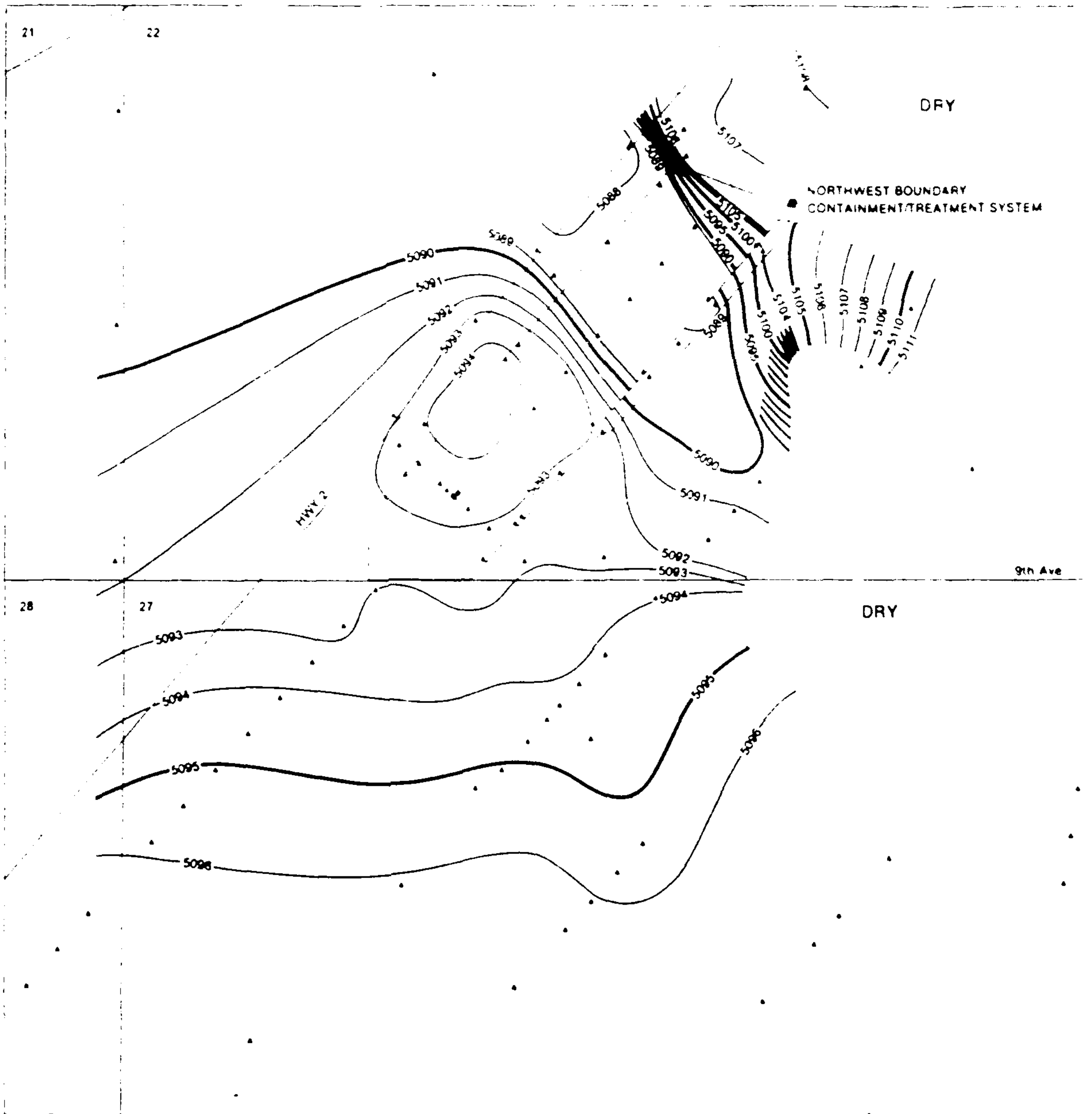
CONTOUR INTERVAL : 1 FT.

N

0 400 800

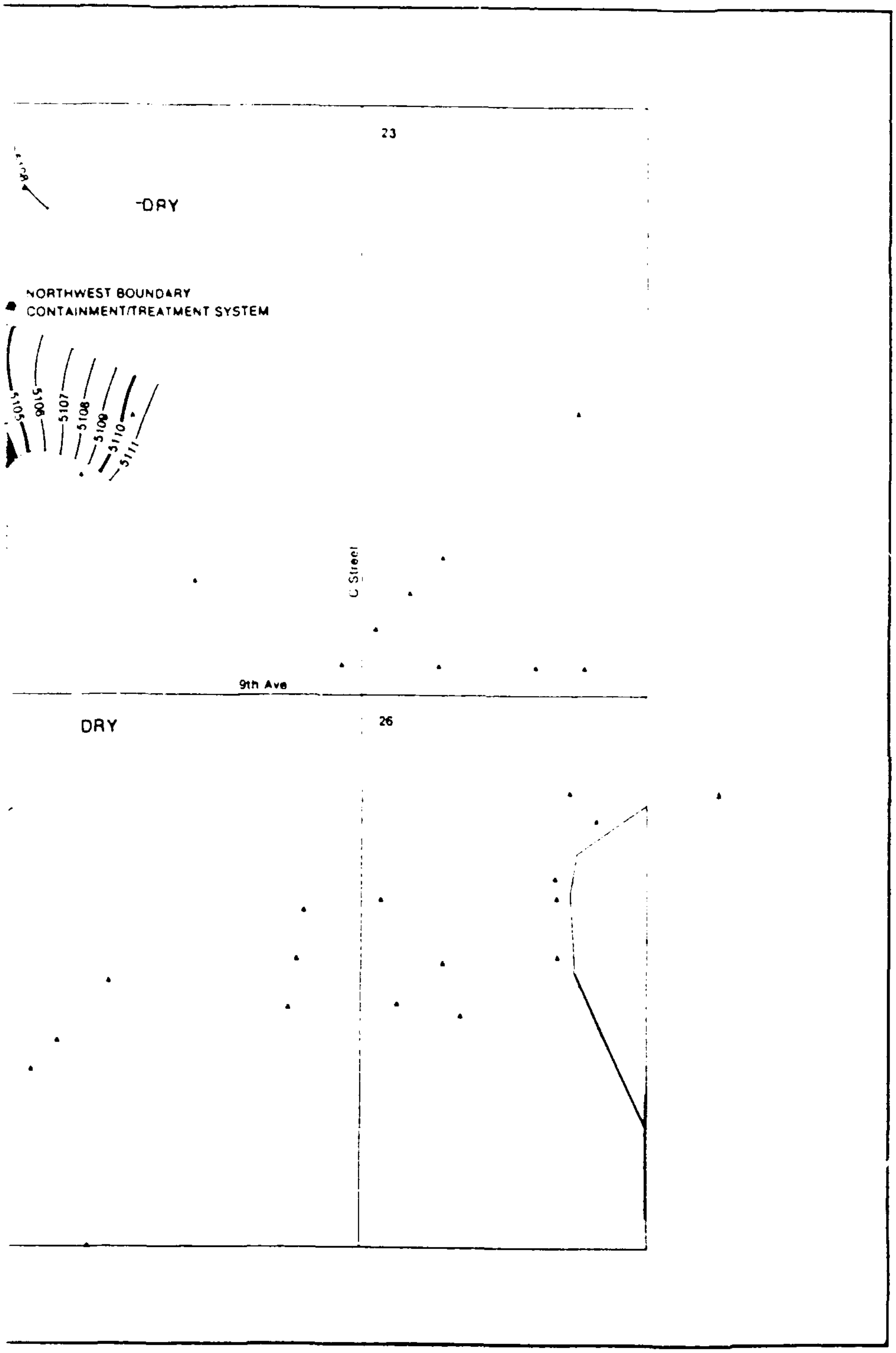
Scale in Feet

PLATE NO. 3



NWBCS, WATER TABLE ELEVATION (FEET,MSL)
4TH QUARTER FY87

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1



EXPLANATION

5100 WATER TABLE ELEVATION CONTOUR LINE

5100 INFERRED WATER TABLE ELEVATION LINE

▲ ALLUVIAL WELL MONITORED FOR WATER LEVELS

CONTOUR INTERVAL : 1 FT.

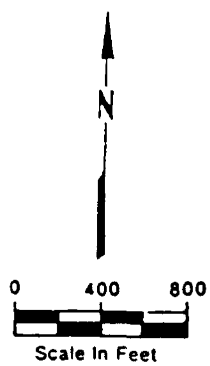
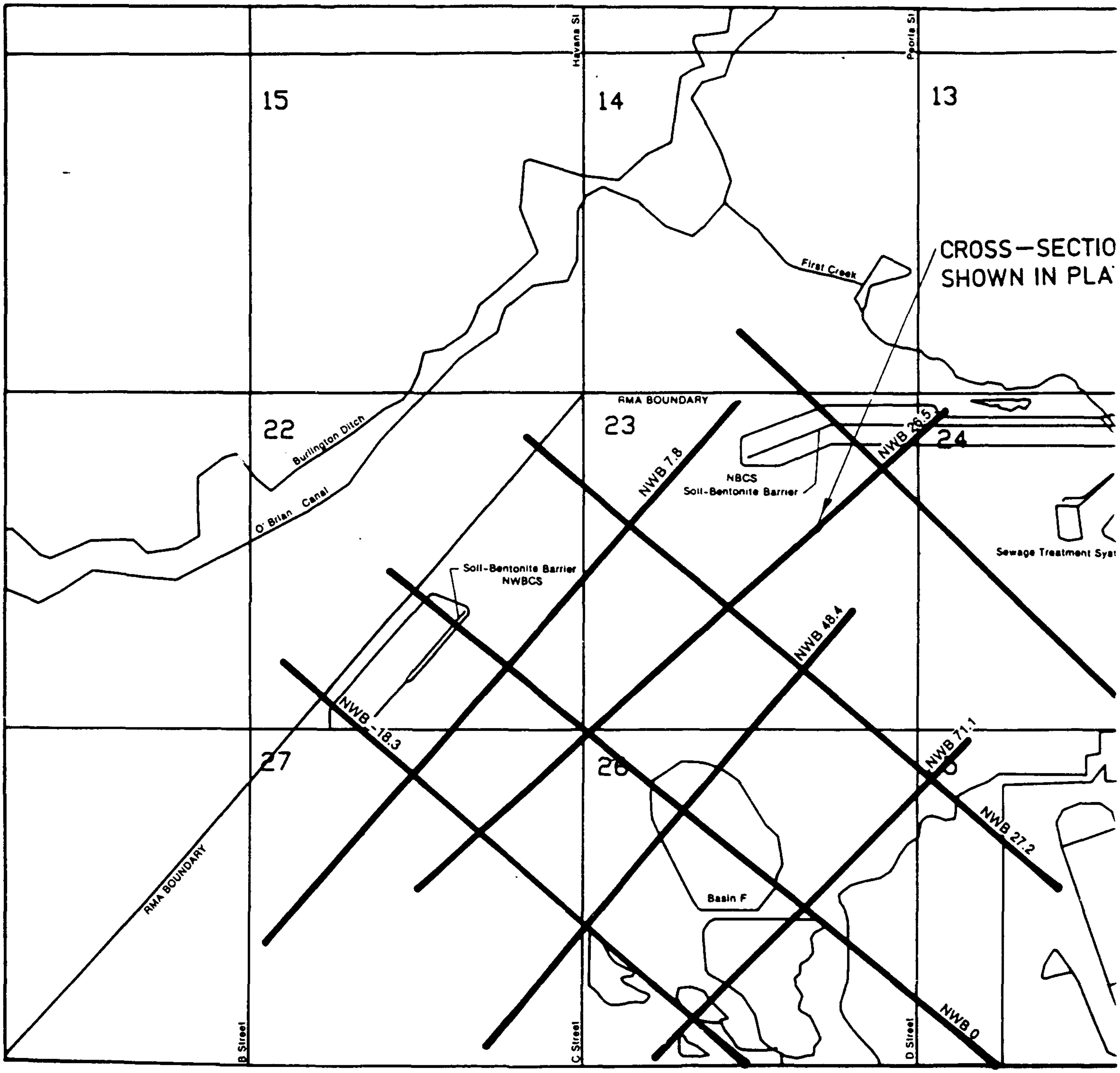
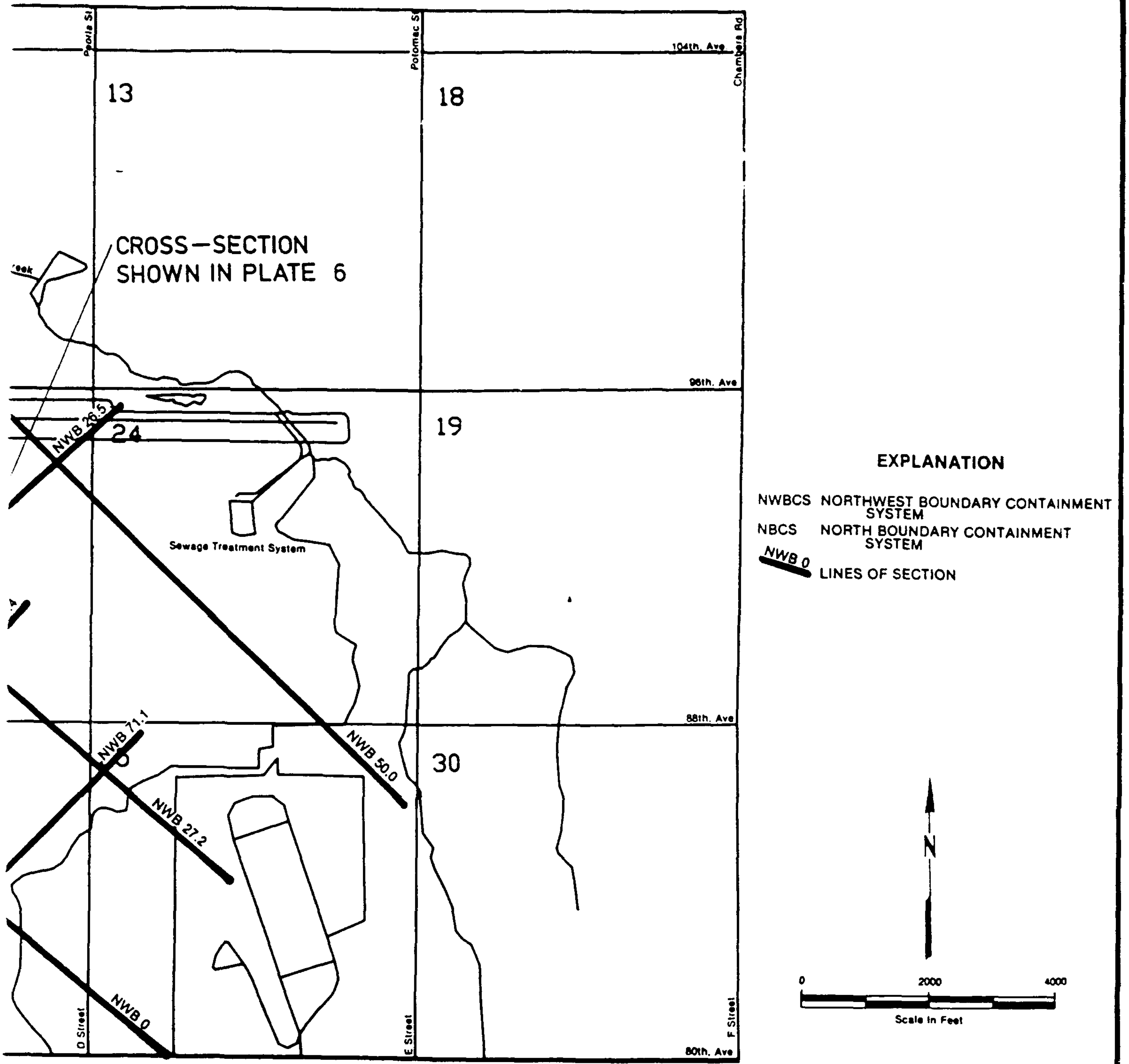


PLATE NO. 4



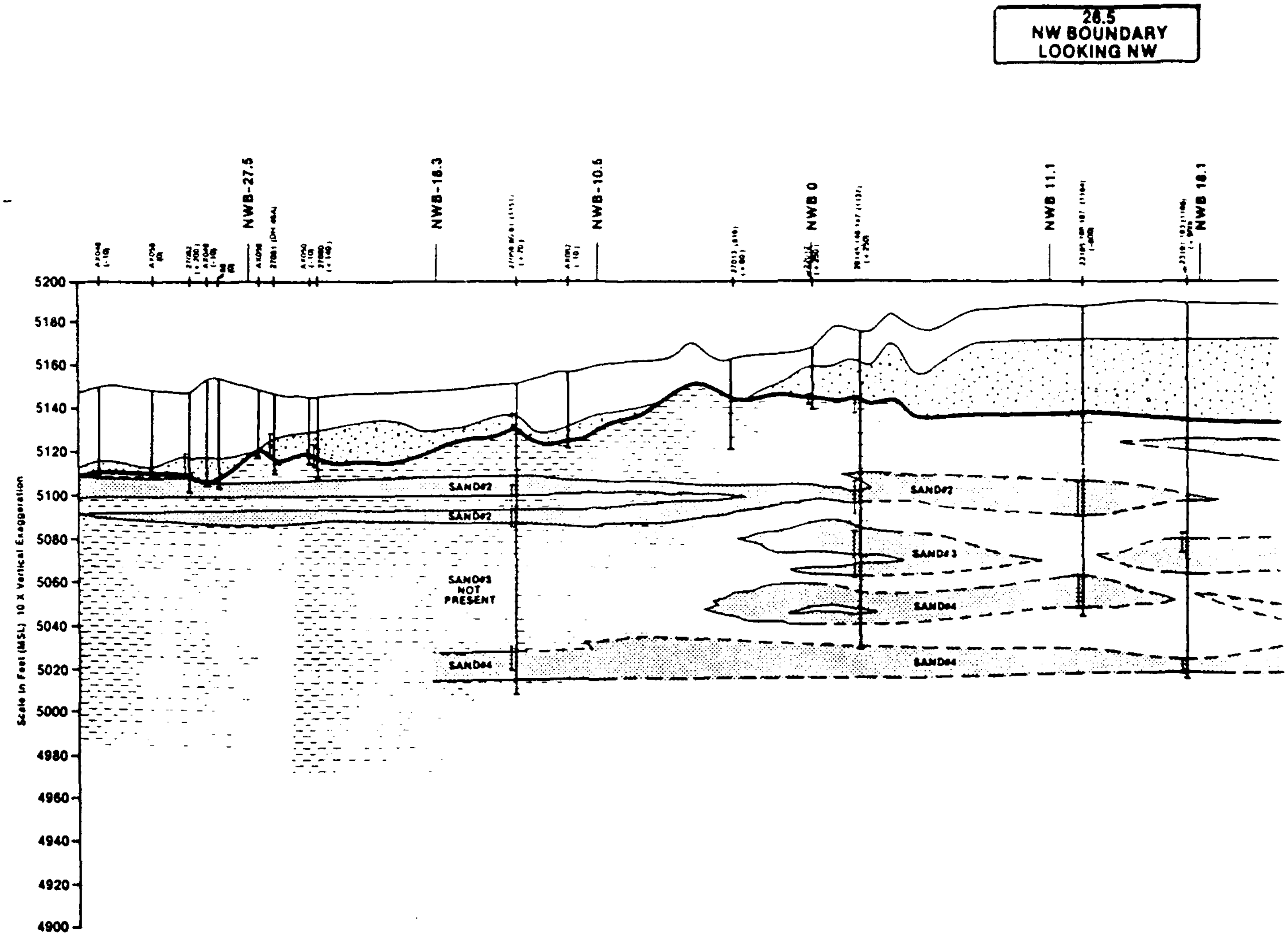
CROSS-SECTION LOCATION MAP

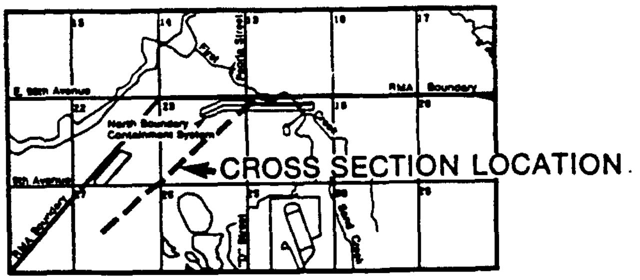
SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1



Peoria St
Potomac St
Chambers Rd
104th. Ave
96th. Ave
88th. Ave
80th. Ave
D Street
E Street
F Street
13
18
19
24
30
CROSS—SECTION
SHOWN IN PLATE 6
Sewage Treatment System
NWB 26.5
NWB 50.0
NWB 71.1
NWB 27.2
NWB 0
EXPLANATION
NWBCS NORTHWEST BOUNDARY CONTAINMENT SYSTEM
NBCS NORTH BOUNDARY CONTAINMENT SYSTEM
NWB 0 LINES OF SECTION
N
0
2000
4000
Scale In Feet

PLATE NO. 5



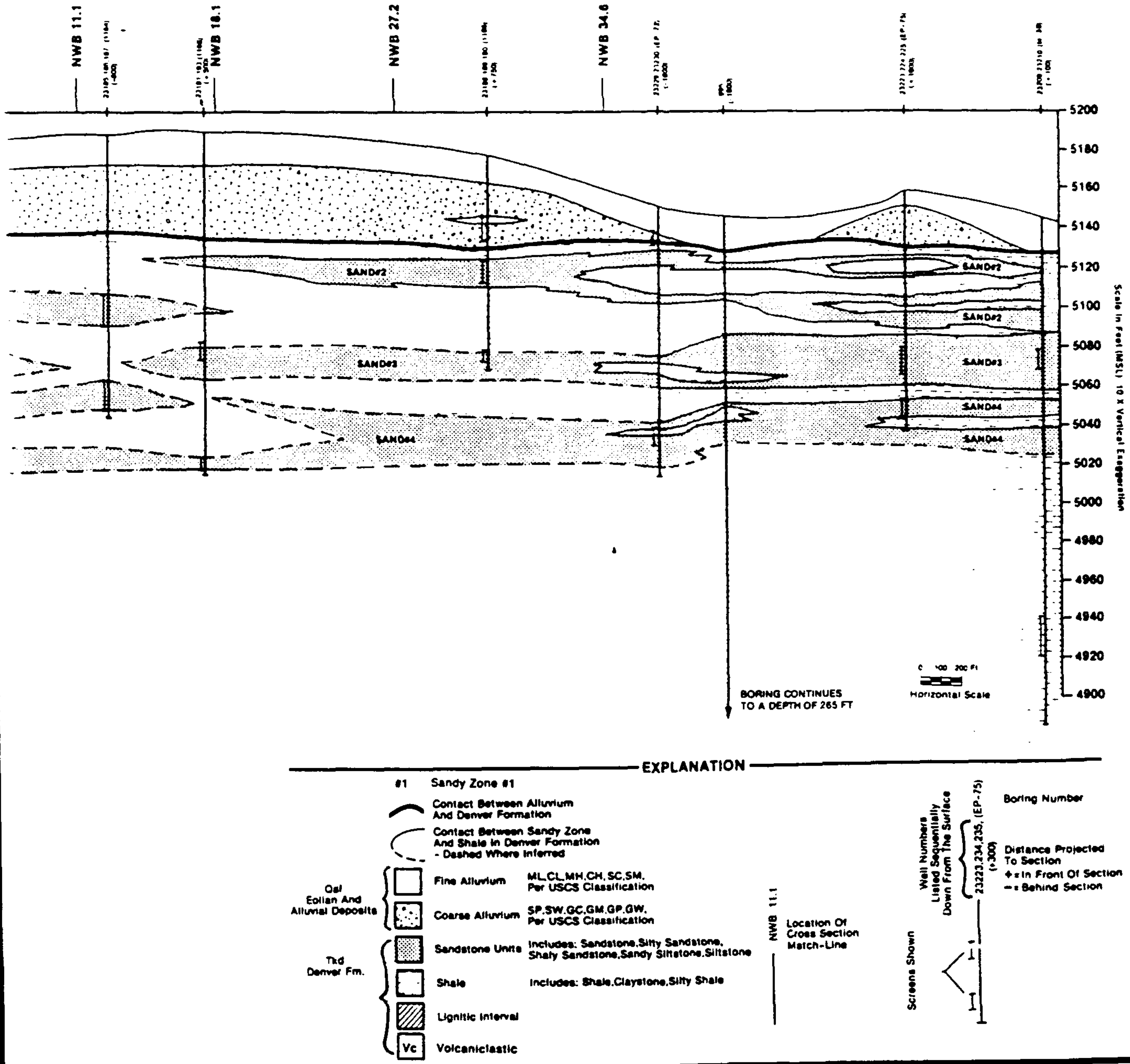


CROSS SECTION LOCATION INDEX MAP

NORTHWEST BOUNDARY CROSS SECTION 26.5

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1

26.5
NW BOUNDARY
LOOKING NW



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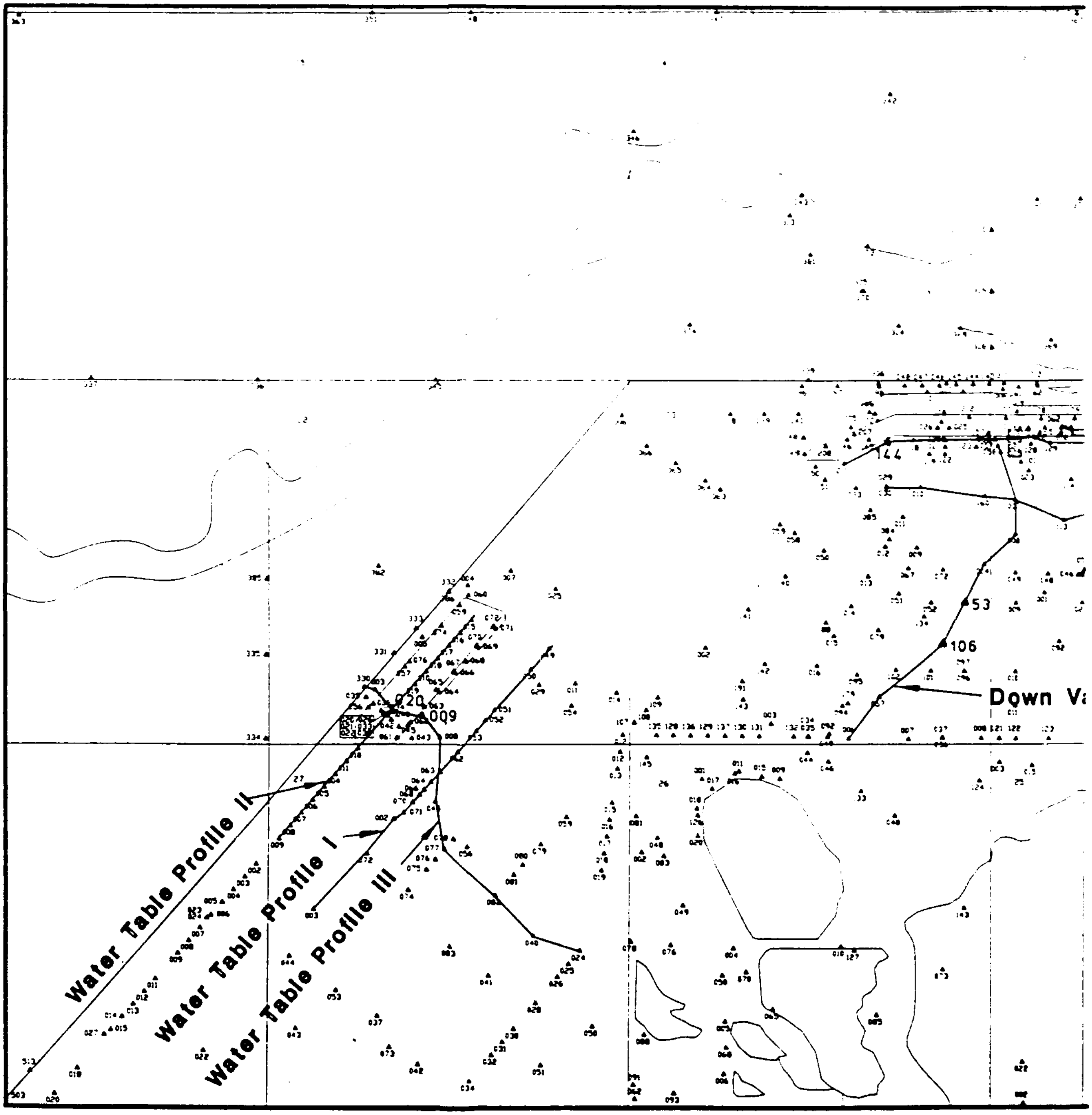
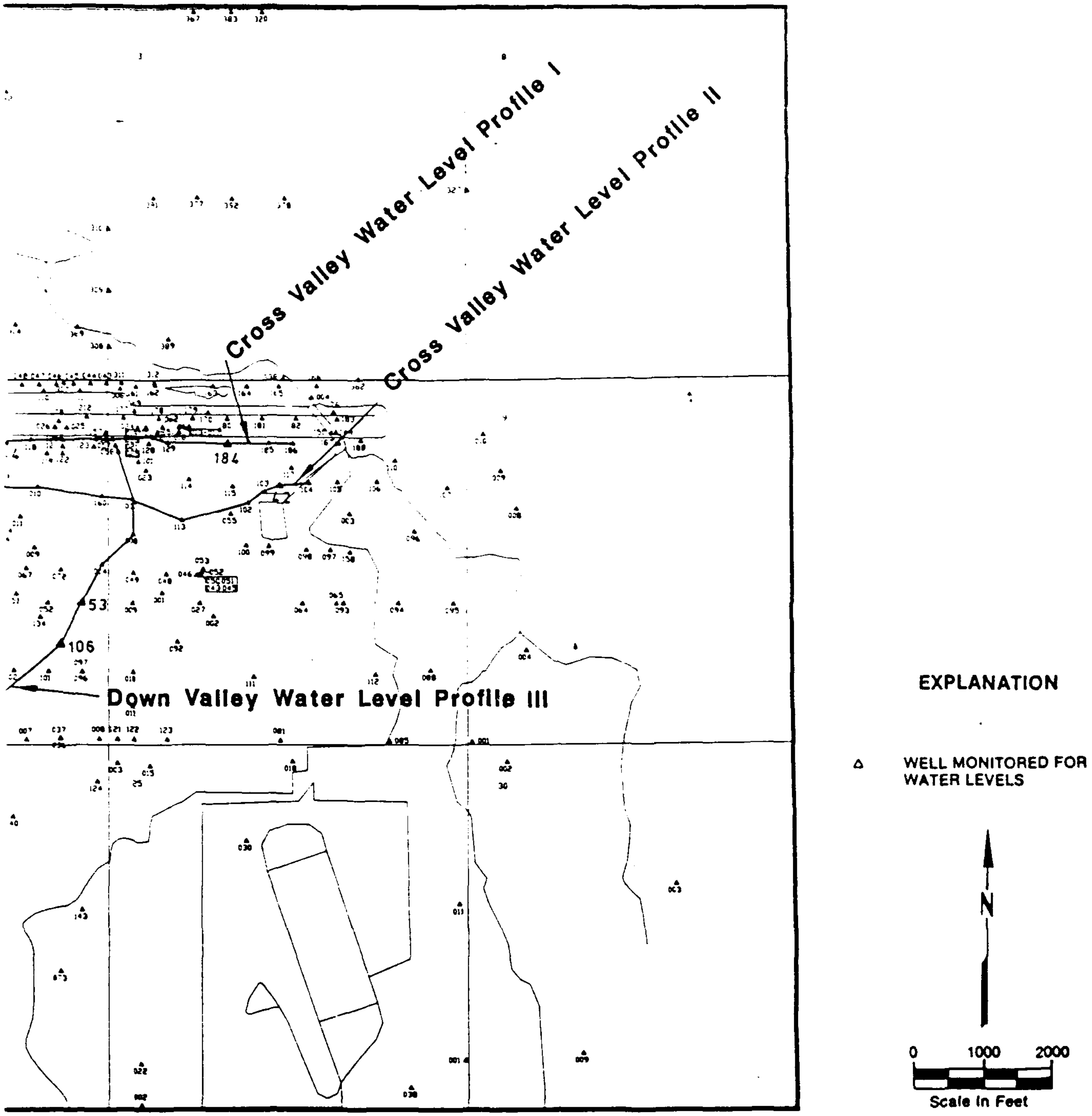


ALLUVIAL MONITORING WELL AND PROFILE LOCATIONS.
WATER LEVEL NETWORK

SOURCE:ESE; 1988, TASK 25 DRAFT REPORT VERSION 1.1



Cross Valley Water Level Profile I
Cross Valley Water Level Profile II
184
53
106
Down Valley Water Level Profile III
EXPLANATION
WELL MONITORED FOR WATER LEVELS
N
0
1000
2000
Scale In Feet

PLATE NO. 7

APPENDIX B

FLOW DATA

R.I.C.

NORTHWEST BOUNDARY TREATMENT PLANT
FY 87 WEEKLY FLOWS FOR ADSORBERS

DATE	1 GAL(000)	1 GPM	2 GAL(000)	2 GPM	3 GAL(000)	3 GPM	TOTAL GAL(000)	TOTAL GPM
10/07/86	4	0.40	2322	230.24	2667	264.45	4993	495.09
10/14/86	0	0.00	69	6.86	2249	223.45	2318	230.31
10/21/86	0	0.00	2456	241.26	2500	245.58	4956	486.84
10/28/86	0	0.00	2752	274.38	2544	253.64	5296	528.02
11/04/86	0	0.00	2706	265.82	2781	273.18	5487	539.00
11/11/86	7	0.69	2692	266.01	2769	273.62	5468	540.32
11/18/86	0	0.00	2697	271.19	2712	272.70	5409	543.89
11/25/86	0	0.00	2470	245.16	2651	263.13	5121	508.29
12/02/86	0	0.00	623	61.62	2749	271.91	3372	333.53
12/09/86	0	0.00	1237	121.22	2677	262.32	3914	383.54
12/16/86	29	2.92	828	83.26	1482	149.02	2339	235.20
12/23/86	183	17.94	1999	195.98	2742	268.82	4924	482.74
12/30/86	0	0.00	2221	221.00	3001	298.61	5222	519.61
01/06/87	0	0.00	2320	232.00	3006	300.60	5326	532.60
01/13/87	0	0.00	2672	265.87	2897	288.26	5569	554.13
01/20/87	0	0.00	2952	287.72	2760	269.01	5712	556.73
01/27/87	2442	243.23	2824	281.27	48	4.78	5314	529.28
02/03/87	2505	251.51	2796	280.72	0	0.00	5301	532.23
02/10/87	2535	251.11	2827	280.04	0	0.00	5362	531.15
02/17/87	624	61.87	2385	236.49	0	0.00	3009	298.36
02/24/87	2585	254.68	2605	256.65	0	0.00	5190	511.33
03/03/87	2458	246.54	2608	261.58	0	0.00	5066	508.12
03/10/87	2678	265.15	487	48.22	1884	186.53	5049	499.90
03/17/87	2955	292.86	0	0.00	2435	241.33	5390	534.19
03/24/87	2884	286.11	0	0.00	2475	245.54	5359	531.65
03/31/87	2868	284.81	0	0.00	2623	260.48	5491	545.29
04/07/87	2950	294.26	365	36.41	2716	270.92	6031	601.59
04/14/87	831	81.87	2932	288.87	2493	245.62	6256	616.36
04/21/87	0	0.00	2718	268.44	2658	262.52	5376	530.96
04/28/87	0	0.00	2606	261.52	2500	250.88	5106	512.40
05/05/87	0	0.00	2616	259.40	2461	244.03	5077	503.43
05/12/87	0	0.00	2576	255.83	2391	237.44	4967	493.27
05/19/87	1923	191.34	2309	229.75	734	73.03	4966	494.12
05/26/87	2876	284.33	2114	209.00	0	0.00	4990	493.33
06/02/87	2882	283.94	2170	211.71	0	0.00	5052	495.65
06/09/87	2834	282.98	2105	211.24	0	0.00	4939	494.22
06/16/87	2873	285.59	2137	212.43	0	0.00	5010	498.02
06/23/87	2714	268.98	2185	216.55	0	0.00	4899	485.53
06/30/87	2438	241.63	1116	110.60	0	0.00	3554	352.23
07/07/87	2898	285.66	2588	254.10	0	0.00	5486	539.76
07/14/87	2938	288.61	2514	246.95	0	0.00	5452	535.56
07/21/87	2811	283.80	2422	244.52	0	0.00	5233	528.32
07/28/87	2701	267.56	2498	247.45	1	0.10	5200	515.11

R.I.C.

NORTHWEST BOUNDARY TREATMENT PLANT
FY 87 WEEKLY FLOWS FOR ADSORBERS

	1		2		3		TOTAL	
DATE	GAL(000)	GPM	GAL(000)	GPM	GAL(000)	GPM	GAL(000)	GPM
08/04/87	106	10.53	2370	235.47	2623	260.61	5099	506.61
08/11/87	0	0.00	1942	192.85	2850	283.02	4792	475.87
08/18/87	0	0.00	2605	258.30	2354	233.42	4959	491.72
08/25/87	0	0.00	3125	309.71	1516	150.25	4641	459.96
09/01/87	0	0.00	3119	305.93	2493	274.02	5612	579.95
09/08/87	0	0.00	2886	289.61	1739	174.51	4625	464.12
09/15/87	0	0.00	2884	282.61	2416	236.75	5300	519.36
09/22/87	0	0.00	3052	306.12	2494	250.15	5546	556.27
09/30/87	0	0.00	3496	303.87	2473	214.95	5969	518.82

R.I.C.

NORTHWEST BOUNDARY TREATMENT PLANT
FY 87 QUARTERLY FLOWS FOR ADSORBERS

DATE	1		2		3		TOTAL	
	GAL(000)	GPM	GAL(000)	GPM	GAL(000)	GPM	GAL(000)	GPM
1st QTR	223	1.69	25072	191.08	33524	255.42	58819	448.18
2nd QTR	24534	187.53	24476	186.97	18128	138.19	67138	512.69
3rd QTR	22321	170.38	27949	213.21	15953	121.88	66223	505.47
4th QTR	11454	87.40	35501	267.50	20959	159.83	67914	514.73
ANNUAL	58532	111.75	112998	214.69	88564	168.83	260094	495.27

APPENDIX C

TREATMENT PLANT WATER QUALITY DATA

NORTHWEST BOUNDARY TREATMENT PLANT - INFLUENT FOR FY87

SAMPLE DATE	ORG.	111TCE ug/l	112TCE ug/l	11DCE ug/l	11DCLE ug/l	12DCE ug/l	12DCLE ug/l	ALDRN ug/l	AS ug/l	BTA ug/l
10/06/86	RM	....	....	....	....	....	7.000	LT 0.200	....	....
10/14/86	RM	....	....	....	....	....	30.000	LT 0.200	....	....
10/20/86	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
10/27/86	RM	....	....	....	....	....	6.000	LT 0.200	....	....
11/03/86	RM	....	....	....	....	....	40.000	LT 0.200	....	....
11/10/86	RM	....	....	....	....	....	10.000	LT 0.200	....	....
11/17/86	RM	....	....	....	....	....	30.000	LT 0.200	....	....
11/24/86	RM	....	....	....	....	....	10.000	LT 0.200	....	....
12/01/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/08/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/17/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/29/86	RM	....	....	....	....	....	....	LT 0.200	....	....
01/05/87	RM	....	....	....	....	....	....	LT 0.200	....	....
01/12/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
01/20/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
01/26/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/02/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/09/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/17/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/23/87	RM	....	....	....	....	....	10.000	LT 0.200	....	....
03/02/87	RM	....	....	....	....	....	20.000	LT 0.200	....	....
03/09/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
03/16/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
03/23/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
03/30/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/06/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/13/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/20/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/27/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/04/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/11/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/18/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/26/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/01/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/08/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/15/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/22/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/29/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/06/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/13/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/20/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/27/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
08/05/87	ES	LT 1.090	LT 1.630	LT 1.850	LT 1.930	....	LT 2.070	LT 0.083	3.130	LT 1.100
08/12/87	ES	....	....	....	....	....	....	....	....	....
08/19/87	ES	....	....	....	....	....	....	LT 0.083	....	....
08/26/87	ES	....	....	....	....	....	....	LT 0.083	....	....
09/02/87	ES	LT 1.090	LT 1.630	LT 1.850	LT 1.930	....	LT 2.070	LT 0.083	LT 2.500	LT 1.100
09/16/87	ES	....	....	....	....	....	....	LT 0.083	....	....
09/23/87	ES	....	....	....	....	....	....	....	....	....
09/30/87	ES	LT 1.090	LT 1.630	LT 1.850	LT 1.930	....	LT 2.070	LT 0.083	LT 2.500	LT 1.100

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - INFLUENT FOR FY87

SAMPLE DATE	ORG.	C6H6 ug/l	CCL4 ug/l	CH2CL2 ug/l	CHCL3 ug/l	CHLORIDE mg/l	CLC6H5 ug/l	CLDAN ug/l	CPMS ug/l	CPMSO ug/l
10/06/86	RM	....	LT 1.000	....	LT 1.000	324.000	....	....	....	....
10/14/86	RM	....	LT 1.000	....	20.000	437.000	....	....	....	....
10/20/86	RM	....	LT 1.000	....	60.000	330.000	....	....	....	....
10/27/86	RM	....	LT 1.000	....	LT 1.000	353.000	....	....	....	....
11/03/86	RM	....	LT 1.000	....	30.000	349.000	....	....	....	....
11/10/86	RM	....	LT 1.000	....	LT 1.000	349.000	....	....	....	....
11/17/86	RM	....	LT 1.000	....	9.000	344.000	....	....	....	....
11/24/86	RM	....	LT 1.000	....	30.000	341.000	....	....	....	....
12/01/86	RM	....	....	....	....	362.000	....	....	....	....
12/08/86	RM	....	....	....	....	373.000	....	....	....	....
12/17/86	RM	....	....	....	....	370.000	....	....	....	....
12/29/86	RM	....	....	....	....	409.000	....	....	....	....
01/05/87	RM	....	....	....	....	340.000	....	....	....	....
01/12/87	RM	....	LT 1.000	....	10.000	325.000	....	....	....	....
01/20/87	RM	....	LT 1.000	....	20.000	312.000	....	....	....	....
01/26/87	RM	....	LT 1.000	....	10.000	323.000	....	....	....	....
02/02/87	RM	....	LT 1.000	....	8.000	323.000	....	....	....	....
02/09/87	RM	....	LT 1.000	....	10.000	350.000	....	....	....	....
02/17/87	RM	....	LT 1.000	....	20.000	352.000	....	....	LT 20.000	LT 20.000
02/23/87	RM	....	LT 1.000	....	LT 1.000	312.000	....	....	LT 20.000	LT 20.000
03/02/87	RM	....	LT 1.000	....	LT 1.000	291.000	....	....	LT 20.000	LT 20.000
03/09/87	RM	....	LT 1.000	....	20.000	357.000	....	....	LT 20.000	LT 20.000
03/16/87	RM	....	LT 1.000	....	20.000	359.000	....	....	LT 20.000	LT 20.000
03/23/87	RM	....	LT 1.000	....	10.000	341.000	....	....	LT 20.000	LT 20.000
03/30/87	RM	....	LT 1.000	....	20.000	364.000	....	....	LT 20.000	LT 20.000
04/06/87	RM	....	LT 1.000	....	10.000	321.000	....	....	LT 20.000	LT 20.000
04/13/87	RM	....	LT 1.000	....	10.000	375.000	....	....	LT 20.000	LT 20.000
04/20/87	RM	....	LT 1.000	....	10.000	378.000	....	....	LT 20.000	LT 20.000
04/27/87	RM	....	LT 1.000	....	10.000	327.000	....	....	LT 20.000	LT 20.000
05/04/87	RM	....	LT 1.000	....	10.000	345.000	....	....	LT 20.000	LT 20.000
05/11/87	RM	....	LT 1.000	....	20.000	340.0[illegible]	....	....	LT 20.000	LT 20.000
05/18/87	RM	....	LT 1.000	....	20.000	385.000	....	....	LT 20.000	LT 20.000
05/26/87	RM	....	LT 1.000	....	20.000	400.000	....	....	LT 20.000	LT 20.000
06/01/87	RM	....	LT 1.000	....	10.000	370.000	....	....	LT 20.000	LT 20.000
06/08/87	RM	....	LT 1.000	....	20.000	400.000	....	....	LT 20.000	LT 20.000
06/15/87	RM	....	LT 1.000	....	10.000	300.000	....	....	LT 20.000	LT 20.000
06/22/87	RM	....	LT 1.000	....	10.000	385.000	....	....	LT 20.000	LT 20.000
06/29/87	RM	....	LT 1.000	....	10.000	391.000	....	....	LT 20.000	LT 20.000
07/06/87	RM	....	LT 1.000	....	20.000	300.000	....	....	LT 20.000	LT 20.000
07/13/87	RM	....	LT 1.000	....	20.000	357.000	....	....	LT 20.000	LT 20.000
07/20/87	RM	....	LT 1.000	....	20.000	371.000	....	....	LT 20.000	LT 20.000
07/27/87	RM	....	LT 1.000	....	20.000	285.000	....	....	LT 20.000	LT 20.000
08/05/87	ES	LT 1.920	LT 1.690	LT 2.480	29.400	545.000	LT 1.360	LT 0.152	LT 1.080	3.830
08/12/87	ES	....	....	....	....	....	....	....	....	....
08/19/87	ES	....	....	....	....	339.000	....	LT 0.152	....	....
08/26/87	ES	....	....	....	....	324.000	....	LT 0.152	....	....
09/02/87	ES	LT 1.920	LT 1.690	LT 2.480	21.800	313.000	LT 1.360	LT 0.152	LT 1.080	LT 1.980
09/16/87	ES	....	....	....	....	400.000	....	LT 0.152	....	....
09/23/87	ES	....	....	....	....	330.000	....	....	....	....
09/30/87	ES	LT 1.920	LT 1.690	LT 2.480	19.200	281.000	LT 1.360	LT 0.152	LT 1.080	LT 1.980

LT = LESS THAN The Following Concentration

.... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER

mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - INFLUENT FOR FY87

SAMPLE DATE	ORG.	ETC6H5 ug/l	FLUORIDE mg/l	HCCPD ug/l	ISODR ug/l	MEC6H5 ug/l	MIBK ug/l	M-XYLENE ug/l	OXAT ug/l	O,P-XYLENE ug/l
10/06/86	RM	....	2.240	....	LT 0.200	....	....	....	....	....
10/14/86	RM	....	1.780	....	LT 0.200	....	....	....	....	....
10/20/86	RM	....	1.730	....	LT 0.200	....	....	....	....	....
10/27/86	RM	....	1.900	....	LT 0.200	....	....	....	....	....
11/03/86	RM	....	2.210	....	LT 0.200	....	....	....	....	....
11/10/86	RM	....	1.980	....	LT 0.200	....	....	....	....	....
11/17/86	RM	....	2.160	....	LT 0.200	....	....	....	....	....
11/24/86	RM	....	1.930	....	LT 0.200	....	....	....	....	....
12/01/86	RM	....	2.150	....	LT 0.200	....	....	....	....	....
12/08/86	RM	....	1.840	....	LT 0.200	....	....	....	....	....
12/17/86	RM	....	2.550	....	LT 0.200	....	....	....	....	....
12/29/86	RM	....	2.000	....	LT 0.200	....	....	....	....	....
01/05/87	RM	....	2.110	....	LT 0.200	....	....	....	....	....
01/12/87	RM	....	3.000	....	LT 0.200	....	....	....	....	....
01/20/87	RM	....	1.620	....	LT 0.200	....	....	....	....	....
01/26/87	RM	....	1.640	....	LT 0.200	LT 1.000	....	....	....	....
02/02/87	RM	....	1.410	....	LT 0.200	LT 1.000	....	....	....	....
02/09/87	RM	....	1.540	....	LT 0.200	LT 1.000	....	....	....	....
02/17/87	RM	....	1.660	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
02/23/87	RM	....	2.040	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/02/87	RM	....	1.730	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/09/87	RM	....	1.880	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/16/87	RM	....	1.870	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/23/87	RM	....	1.540	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/30/87	RM	....	1.990	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/06/87	RM	....	1.560	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/13/87	RM	....	1.390	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/20/87	RM	....	1.420	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/27/87	RM	....	1.740	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/04/87	RM	....	1.780	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/11/87	RM	....	1.480	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/18/87	RM	....	1.570	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/26/87	RM	....	1.640	....	LT 0.200	2.000	....	....	LT 20.000	....
06/01/87	RM	....	1.800	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/08/87	RM	....	1.690	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/15/87	RM	....	1.700	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/22/87	RM	....	1.690	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/29/87	RM	....	1.600	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/06/87	RM	....	2.380	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/13/87	RM	....	1.670	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/20/87	RM	....	1.690	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/27/87	RM	....	2.000	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
08/05/87	ES	LT 0.620	1.980	LT 0.083	LT 0.056	LT 2.100	LT 12.900	LT 1.040	LT 1.350	LT 1.340
08/12/87	ES	....	....	....	....	....	....	....	....	....
08/19/87	ES	....	1.580	LT 0.083	LT 0.056	....	LT 12.900	....	....	....
08/26/87	ES	....	1.390	LT 0.083	LT 0.056	....	LT 12.900	....	....	....
09/02/87	ES	LT 0.620	1.480	LT 0.083	LT 0.056	LT 2.100	LT 12.900	LT 1.040	LT 1.350	LT 1.340
09/16/87	ES	....	2.220	LT 0.083	LT 0.056	....	LT 12.900	....	....	....
09/23/87	ES	....	1.930	....	....	....	LT 12.900	....	....	....
09/30/87	ES	LT 0.620	1.630	LT 0.083	LT 0.056	LT 2.100	LT 12.900	LT 1.040	LT 1.350	LT 1.340

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - INFLUENT FOR FY87

SAMPLE DATE	ORG.	CPMSO2 ug/l	DBCP ug/l	DCPD ug/l	DIMP ug/l	DITH ug/l	DLDRN ug/l	DMDS ug/l	DMMP ug/l	ENDRN ug/l
10/06/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.260	....	....	LT 0.200
10/14/86	RM	....	LT 0.200	1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
10/20/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.300	....	....	LT 0.200
10/27/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.310	....	....	LT 0.200
11/03/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.340	....	....	LT 0.200
11/10/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.400	....	....	LT 0.200
11/17/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.300	....	....	LT 0.200
11/24/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.330	....	....	LT 0.200
12/01/86	RM	....	LT 0.200	....	LT 10.000	....	0.340	....	....	LT 0.200
12/08/86	RM	....	LT 0.200	....	LT 10.000	....	0.350	....	....	LT 0.200
12/17/86	RM	....	LT 0.200	....	LT 10.000	....	0.430	....	....	LT 0.200
12/29/86	RM	....	LT 0.200	....	LT 10.000	....	0.310	....	....	LT 0.200
01/05/87	RM	....	LT 0.200	....	LT 10.000	....	0.300	....	....	LT 0.200
01/12/87	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.360	....	....	LT 0.200
01/20/87	RM	....	LT 0.200	8.000	LT 10.000	....	0.270	....	....	LT 0.200
01/26/87	RM	....	LT 0.200	8.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
02/02/87	RM	....	LT 0.200	20.000	LT 10.000	....	0.240	....	....	LT 0.200
02/09/87	RM	....	LT 0.200	LT 1.000	LT 10.000	....	0.290	....	....	LT 0.200
02/17/87	RM	LT 20.000	LT 0.200	1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
02/23/87	RM	LT 20.000	LT 0.200	7.000	LT 10.000	LT 20.000	0.330	....	....	LT 0.200
03/02/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.270	....	....	LT 0.200
03/09/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.250	....	....	LT 0.200
03/16/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.270	....	....	LT 0.200
03/23/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.340	....	....	LT 0.200
03/30/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.380	....	....	LT 0.200
04/06/87	RM	LT 20.000	LT 0.200	4.000	LT 10.000	LT 20.000	0.320	....	....	LT 0.200
04/13/87	RM	LT 20.000	LT 0.200	4.000	LT 10.000	LT 20.000	0.520	....	....	LT 0.200
04/20/87	RM	LT 20.000	LT 0.200	5.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
04/27/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.300	....	....	LT 0.200
05/04/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.440	....	....	LT 0.200
05/11/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
05/18/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.330	....	....	LT 0.200
05/26/87	RM	LT 20.000	0.210	5.000	LT 10.000	LT 20.000	0.260	....	....	LT 0.200
06/01/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.310	....	....	LT 0.200
06/08/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.580	....	....	LT 0.200
06/15/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.400	....	....	LT 0.200
06/22/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.200	....	....	LT 0.200
06/29/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.410	....	....	LT 0.200
07/06/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.410	....	....	LT 0.200
07/13/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.320	....	....	LT 0.200
07/20/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.280	....	....	LT 0.200
07/27/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	0.400	....	....	LT 0.200
08/05/87	ES	LT 2.240	LT 0.130	LT 9.310	13.400	LT 3.340	0.551	LT 1.160	LT 16.300	0.239
08/12/87	ES	....	....	....	13.300	....	....	....	25.000	....
08/19/87	ES	....	LT 0.130	LT 9.310	....	....	0.332	....	....	LT 0.060
08/26/87	ES	....	LT 0.130	LT 9.310	LT 10.100	....	0.340	....	LT 16.300	LT 0.060
09/02/87	ES	LT 2.240	LT 0.130	LT 9.310	LT 10.100	LT 3.340	0.311	LT 1.160	LT 16.300	LT 0.060
09/16/87	ES	....	LT 0.130	LT 9.310	LT 10.100	....	0.417	....	LT 16.300	LT 0.060
09/23/87	ES	....	LT 0.130	LT 9.310	LT 10.100	....	....	....	LT 16.300	....
09/30/87	ES	LT 2.240	LT 0.130	LT 9.310	LT 10.100	LT 3.340	0.432	LT 1.160	LT 16.300	LT 0.060

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - INFLUENT FOR FY87

SAMPLE DATE	ORG.	PPDDE ug/l	PPDDT ug/l	SO4 mg/l	T12DCE ug/l	TCLEE ug/l	TRCLE ug/l
10/06/86	RM	....	....	....	....	....	LT 1.000
10/14/86	RM	....	....	....	....	....	LT 1.000
10/20/86	RM	....	....	....	....	....	LT 1.000
10/27/86	RM	....	....	....	....	....	LT 1.000
11/03/86	RM	....	....	....	....	....	20.000
11/10/86	RM	....	....	....	....	....	LT 1.000
11/17/86	RM	....	....	....	....	....	LT 1.000
11/24/86	RM	....	....	....	....	....	LT 1.000
12/01/86	RM	....	....	....	....	....	....
12/08/86	RM	....	....	....	....	....	....
12/17/86	RM	....	....	....	....	....	....
12/29/86	RM	....	....	....	....	....	....
01/05/87	RM	....	....	....	....	....	....
01/12/87	RM	....	....	....	....	....	LT 1.000
01/20/87	RM	....	....	....	....	....	LT 1.000
01/26/87	RM	....	....	....	....	....	LT 1.000
02/02/87	RM	....	....	....	....	....	LT 1.000
02/09/87	RM	....	....	....	....	....	LT 1.000
02/17/87	RM	....	....	....	....	....	LT 1.000
02/23/87	RM	....	....	....	....	....	LT 1.000
03/02/87	RM	....	....	....	....	....	LT 1.000
03/09/87	RM	....	....	....	....	LT 1.000	LT 1.000
03/16/87	RM	....	....	....	....	LT 1.000	LT 1.000
03/23/87	RM	....	....	....	....	LT 1.000	LT 1.000
03/30/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/06/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/13/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/20/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/27/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/04/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/11/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/18/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/26/87	RM	....	....	....	....	6.000	LT 1.000
06/01/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/08/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/15/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/22/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/29/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/06/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/13/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/20/87	RM	....	....	....	....	8.000	LT 1.000
07/27/87	RM	....	....	....	....	LT 1.000	LT 1.000
08/05/87	ES	LT 0.046	LT 0.059	200.000	LT 1.800	LT 2.800	LT 1.300
08/12/87	ES	....	....	....	....	....	....
08/19/87	ES	LT 0.046	LT 0.059	139.000	....	....	....
08/26/87	ES	LT 0.046	LT 0.059	153.000	....	....	....
09/02/87	ES	LT 0.046	LT 0.059	156.000	LT 1.800	LT 2.800	LT 1.300
09/16/87	ES	LT 0.046	LT 0.059	164.000	....	....	....
09/23/87	ES	....	....	185.000	....	....	....
09/30/87	ES	LT 0.046	LT 0.059	131.000	LT 1.800	LT 2.800	LT 1.300

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - EFFLUENT FOR FY87

SAMPLE DATE	ORG.	111TCE ug/l	112TCE ug/l	11DCE ug/l	11DCLE ug/l	12DCE ug/l	12DCLE ug/l	ALDRN ug/l	AS ug/l	BTA ug/l
10/06/86	RM	....	....	....	....	....	8.000	LT 0.200	....	....
10/14/86	RM	....	....	....	....	....	40.000	LT 0.200	....	....
10/20/86	RM	....	....	....	....	....	10.000	LT 0.200	....	....
10/27/86	RM	....	....	....	....	....	20.000	LT 0.200	....	....
11/03/86	RM	....	....	....	....	....	6.000	LT 0.200	....	....
11/10/86	RM	....	....	....	....	....	5.000	LT 0.200	....	....
11/17/86	RM	....	....	....	....	....	10.000	LT 0.200	....	....
11/24/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/01/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/08/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/17/86	RM	....	....	....	....	....	....	LT 0.200	....	....
12/29/86	RM	....	....	....	....	....	....	LT 0.200	....	....
01/05/87	RM	....	....	....	....	....	....	LT 0.200	....	....
01/12/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
01/20/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
01/26/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/02/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/09/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/17/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
02/23/87	RM	....	....	....	....	....	8.000	LT 0.200	....	....
03/02/87	RM	....	....	....	....	....	10.000	LT 0.200	....	....
03/09/87	RM	....	....	....	....	....	LT 1.000	LT 0.200	....	....
03/16/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
03/23/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
03/30/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/06/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/13/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/20/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
04/27/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/04/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/11/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/18/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
05/26/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/01/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/08/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/15/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
06/22/87	RM	....	....	....	....	....	....	....	....	....
06/29/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/06/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/13/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/20/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
07/27/87	RM	....	....	....	....	LT 1.000	LT 1.000	LT 0.200	....	....
08/05/87	ES	LT 1.090	LT 1.630	LT 1.850	LT 1.930	....	LT 2.070	LT 0.083	LT 2.500	LT 1.100
08/12/87	ES	....	....	....	....	....	....	....	....	....
08/19/87	ES	....	....	....	....	....	....	LT 0.083	....	....
08/26/87	ES	....	....	....	....	....	....	LT 0.083	....	....
09/02/87	ES	LT 1.090	LT 1.630	LT 1.850	LT 1.930	....	LT 2.070	LT 0.083	LT 2.500	LT 1.100
09/16/87	ES	....	....	....	....	....	....	LT 0.083	....	....
09/23/87	ES	....	....	....	....	....	....	....	....	....
09/30/87	ES	LT 1.090	LT 1.630	LT 1.850	LT 1.930	....	LT 2.070	LT 0.083	LT 2.500	LT 1.100

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - EFFLUENT FOR FY87

SAMPLE DATE	ORG.	C6H6 ug/l	CCL4 ug/l	CH2CL2 ug/l	CHCL3 ug/l	CHLORIDE mg/l	CLC6H5 ug/l	CLDAN ug/l	CPMS ug/l	CPMSO ug/l
10/06/86	RM	....	LT 1.000	....	LT 1.000	324.000	....	....	....	....
10/14/86	RM	....	LT 1.000	....	LT 1.000	431.000	....	....	....	....
10/20/86	RM	....	LT 1.000	....	40.000	324.000	....	....	....	....
10/27/86	RM	....	LT 1.000	....	30.000	362.000	....	....	....	....
11/03/86	RM	....	LT 1.000	....	20.000	348.000	....	....	....	....
11/10/86	RM	....	LT 1.000	....	LT 1.000	337.000	....	....	....	....
11/17/86	RM	....	LT 1.000	....	LT 1.000	344.000	....	....	....	....
11/24/86	RM	....	LT 1.000	....	LT 1.000	336.000	....	....	....	....
12/01/86	RM	....	....	....	....	354.000	....	....	....	....
12/08/86	RM	....	....	....	....	375.000	....	....	....	....
12/17/86	RM	....	....	....	....	377.000	....	....	....	....
12/29/86	RM	....	....	....	....	299.000	....	....	....	....
01/05/87	RM	....	....	....	....	329.000	....	....	....	....
01/12/87	RM	....	LT 1.000	....	10.000	316.000	....	....	....	....
01/20/87	RM	....	LT 1.000	....	30.000	304.000	....	....	....	....
01/26/87	RM	....	LT 1.000	....	7.000	312.000	....	....	....	....
02/02/87	RM	....	LT 1.000	....	LT 1.000	315.000	....	....	....	....
02/09/87	RM	....	LT 1.000	....	8.000	329.000	....	....	....	....
02/17/87	RM	....	LT 1.000	....	10.000	349.000	....	....	LT 20.000	LT 20.000
02/23/87	RM	....	LT 1.000	....	LT 1.000	311.000	....	....	LT 20.000	LT 20.000
03/02/87	RM	....	LT 1.000	....	LT 1.000	290.000	....	....	LT 20.000	LT 20.000
03/09/87	RM	....	LT 1.000	....	6.000	357.000	....	....	LT 20.000	LT 20.000
03/16/87	RM	....	LT 1.000	....	9.000	355.000	....	....	LT 20.000	LT 20.000
03/23/87	RM	....	LT 1.000	....	8.000	331.000	....	....	LT 20.000	LT 20.000
03/30/87	RM	....	LT 1.000	....	10.000	351.000	....	....	LT 20.000	LT 20.000
04/06/87	RM	....	LT 1.000	....	10.000	323.000	....	....	LT 20.000	LT 20.000
04/13/87	RM	....	LT 1.000	....	10.000	380.000	....	....	LT 20.000	LT 20.000
04/20/87	RM	....	LT 1.000	....	10.000	383.000	....	....	LT 20.000	LT 20.000
04/27/87	RM	....	LT 1.000	....	10.000	324.000	....	....	LT 20.000	LT 20.000
05/04/87	RM	....	LT 1.000	....	10.000	343.000	....	....	LT 20.000	LT 20.000
05/11/87	RM	....	LT 1.000	....	20.000	346.000	....	....	LT 20.000	LT 20.000
05/18/87	RM	....	LT 1.000	....	10.000	366.000	....	....	LT 20.000	LT 20.000
05/26/87	RM	....	LT 1.000	....	20.000	400.000	....	....	LT 20.000	LT 20.000
06/01/87	RM	....	LT 1.000	....	10.000	381.000	....	....	LT 20.000	LT 20.000
06/08/87	RM	....	LT 1.000	....	10.000	400.000	....	....	LT 20.000	LT 20.000
06/15/87	RM	....	LT 1.000	....	10.000	400.000	....	....	LT 20.000	LT 20.000
06/22/87	RM	....	....	....	....	....	....	....	....	....
06/29/87	RM	....	LT 1.000	....	10.000	368.000	....	....	LT 20.000	LT 20.000
07/06/87	RM	....	LT 1.000	....	10.000	300.000	....	....	LT 20.000	LT 20.000
07/13/87	RM	....	LT 1.000	....	10.000	365.000	....	....	LT 20.000	LT 20.000
07/20/87	RM	....	LT 1.000	....	20.000	387.000	....	....	LT 20.000	LT 20.000
07/27/87	RM	....	LT 1.000	....	10.000	383.000	LT 1.360	....	LT 20.000	LT 20.000
08/05/87	ES	LT 1.920	LT 1.690	LT 2.480	10.800	108.000	....	LT 0.152	LT 1.080	LT 1.980
08/12/87	ES	....	....	....	....	....	....	....	....	....
08/19/87	ES	....	....	....	....	319.000	....	LT 0.152	....	....
08/26/87	ES	....	....	....	....	326.000	....	LT 0.152	....	....
09/02/87	ES	LT 1.920	LT 1.690	LT 2.480	18.800	320.000	LT 1.360	LT 0.152	LT 1.080	LT 1.980
09/16/87	ES	....	....	....	....	396.000	....	LT 0.152	....	....
09/23/87	ES	....	....	....	....	328.000	....	....	....	....
09/30/87	ES	LT 1.920	LT 1.690	LT 2.480	16.400	279.000	LT 1.360	LT 0.152	LT 1.080	LT 1.980

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - EFFLUENT FOR FY87

SAMPLE DATE	ORG.	CPMSO2 ug/l	DBCP ug/l	DCPD ug/l	DIMP ug/l	DITH ug/l	DLDRN ug/l	DMDS ug/l	DMMP ug/l	ENDRN ug/l
10/06/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
10/14/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
10/20/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
10/27/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
11/03/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
11/10/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
11/17/86	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
11/24/86	RM	....	LT 0.200	5.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
12/01/86	RM	....	LT 0.200	....	LT 10.000	....	LT 0.200	....	....	LT 0.200
12/08/86	RM	....	LT 0.200	....	LT 10.000	....	LT 0.200	....	....	LT 0.200
12/17/86	RM	....	LT 0.200	....	LT 10.000	....	LT 0.200	....	....	LT 0.200
12/29/86	RM	....	LT 0.200	....	LT 10.000	....	LT 0.200	....	....	LT 0.200
01/05/87	RM	....	LT 0.200	....	LT 10.000	....	LT 0.200	....	....	LT 0.200
01/12/87	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
01/20/87	RM	....	LT 0.200	7.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
01/26/87	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
02/02/87	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
02/09/87	RM	....	LT 0.200	LT 1.000	LT 10.000	....	LT 0.200	....	....	LT 0.200
02/17/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
02/23/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
03/02/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
03/09/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	2.300	....	....	LT 0.200
03/16/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
03/23/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
03/30/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
04/06/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
04/13/87	RM	LT 20.000	LT 0.200	2.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
04/20/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
04/27/87	RM	LT 20.000	LT 0.200	2.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
05/04/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
05/11/87	RM	LT 20.000	LT 0.200	2.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
05/18/87	RM	LT 20.000	LT 0.200	2.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
05/26/87	RM	LT 20.000	LT 0.200	2.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
06/01/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
06/08/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
06/15/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
06/22/87	RM	....	....	....	....	....	....	....	....	....
06/29/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
07/06/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
07/13/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
07/20/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
07/27/87	RM	LT 20.000	LT 0.200	LT 1.000	LT 10.000	LT 20.000	LT 0.200	....	....	LT 0.200
08/05/87	ES	LT 2.240	LT 0.130	LT 9.310	LT 10.100	LT 3.340	LT 0.054	LT 1.160	LT 16.300	LT 0.060
08/12/87	ES	....	....	....	LT 10.100	....	....	....	LT 16.300	....
08/19/87	ES	....	LT 0.130	LT 9.310	....	....	LT 0.054	....	....	LT 0.060
08/26/87	ES	....	LT 0.130	LT 9.310	LT 10.100	....	LT 0.054	....	LT 16.300	LT 0.060
09/02/87	ES	LT 2.240	LT 0.130	LT 9.310	LT 10.100	LT 3.340	LT 0.054	LT 1.160	LT 16.300	LT 0.060
09/16/87	ES	....	LT 0.130	LT 9.310	LT 10.100	....	LT 0.054	....	LT 16.300	LT 0.060
09/23/87	ES	....	LT 0.130	LT 9.310	LT 10.100	....	....	....	LT 16.300	....
09/30/87	ES	LT 2.240	LT 0.130	LT 9.310	LT 10.100	LT 3.340	LT 0.054	LT 1.160	LT 16.300	LT 0.060

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - EFFLUENT FOR FY87

SAMPLE DATE	ORG.	ETC6H5 ug/l	FLUORIDE mg/l	HCCPD ug/l	ISODR ug/l	MEC6H5 ug/l	MIBK ug/l	M-XYLENE ug/l	OXAT ug/l	O,P-XYLENE ug/l
10/06/86	RM	....	2.460	....	LT 0.200	....	....	....	....	....
10/14/86	RM	....	2.490	....	LT 0.200	....	....	....	....	....
10/20/86	RM	....	1.710	....	LT 0.200	....	....	....	....	....
10/27/86	RM	....	1.960	....	LT 0.200	....	....	....	....	....
11/03/86	RM	....	2.360	....	LT 0.200	....	....	....	....	....
11/10/86	RM	....	2.220	....	LT 0.200	....	....	....	....	....
11/17/86	RM	....	2.070	....	LT 0.200	....	....	....	....	....
11/24/86	RM	....	2.070	....	LT 0.200	....	....	....	....	....
12/01/86	RM	....	2.030	....	LT 0.200	....	....	....	....	....
12/08/86	RM	....	2.400	....	LT 0.200	....	....	....	....	....
12/17/86	RM	....	2.230	....	LT 0.200	....	....	....	....	....
12/29/86	RM	....	2.000	....	LT 0.200	....	....	....	....	....
01/05/87	RM	....	1.770	....	LT 0.200	....	....	....	....	....
01/12/87	RM	....	2.000	....	LT 0.200	....	....	....	....	....
01/20/87	RM	....	1.600	....	LT 0.200	LT 1.000	....	....	....	....
01/26/87	RM	....	1.520	....	LT 0.200	LT 1.000	....	....	....	....
02/02/87	RM	....	1.490	....	LT 0.200	LT 1.000	....	....	....	....
02/09/87	RM	....	1.420	....	LT 0.200	LT 1.000	....	....	....	....
02/17/87	RM	....	1.490	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
02/23/87	RM	....	1.870	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/02/87	RM	....	1.730	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/09/87	RM	....	1.760	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/16/87	RM	....	2.270	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/23/87	RM	....	1.760	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
03/30/87	RM	....	1.990	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/06/87	RM	....	1.540	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/13/87	RM	....	1.670	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/20/87	RM	....	1.600	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
04/27/87	RM	....	1.430	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/04/87	RM	....	1.680	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/11/87	RM	....	1.610	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/18/87	RM	....	1.800	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
05/26/87	RM	....	1.590	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/01/87	RM	....	1.590	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/08/87	RM	....	1.550	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/15/87	RM	....	1.760	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
06/22/87	RM	....	....	....	....	....	....	....	....	....
06/29/87	RM	....	1.550	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/06/87	RM	....	1.680	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/13/87	RM	....	1.720	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/20/87	RM	....	1.730	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
07/27/87	RM	....	2.000	....	LT 0.200	LT 1.000	....	....	LT 20.000	....
08/05/87	ES	LT 0.620	1.790	LT 0.083	LT 0.056	LT 2.100	LT 12.900	LT 1.040	LT 1.350	LT 1.340
08/12/87	ES	....	....	....	....	....	....	....	....	....
08/19/87	ES	....	1.400	LT 0.083	LT 0.056	....	LT 12.900	....	....	....
08/26/87	ES	....	1.340	LT 0.083	LT 0.056	....	LT 12.900	....	....	....
09/02/87	ES	LT 0.620	1.490	LT 0.083	LT 0.056	LT 2.100	LT 12.900	LT 1.040	LT 1.350	LT 1.340
09/16/87	ES	....	1.750	LT 0.083	LT 0.056	....	LT 12.900	....	....	....
09/23/87	ES	....	1.930	0.002	0.004	....	LT 12.900	....	....	....
09/30/87	ES	LT 0.620	1.580	LT 0.083	LT 0.056	LT 2.100	LT 12.900	LT 1.040	LT 1.350	LT 1.340

LT = LESS THAN The Following Concentration .... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER mg/l = MILLIGRAM PER LITER

NORTHWEST BOUNDARY TREATMENT PLANT - EFFLUENT FOR FY87

SAMPLE DATE	ORG.	PPDDE ug/l	PPDDT ug/l	SO4 mg/l	T12DCE ug/l	TCLEE ug/l	TRCLE ug/l
10/06/86	RM	....	....	....	....	....	LT 1.000
10/14/86	RM	....	....	....	....	....	LT 1.000
10/20/86	RM	....	....	....	....	....	LT 1.000
10/27/86	RM	....	....	....	....	....	LT 1.000
11/03/86	RM	....	....	....	....	....	LT 1.000
11/10/86	RM	....	....	....	....	....	LT 1.000
11/17/86	RM	....	....	....	....	....	LT 1.000
11/24/86	RM	....	....	....	....	....	LT 1.000
12/01/86	RM	....	....	....	....	....	....
12/08/86	RM	....	....	....	....	....	....
12/17/86	RM	....	....	....	....	....	....
12/29/86	RM	....	....	....	....	....	....
01/05/87	RM	....	....	....	....	....	....
01/12/87	RM	....	....	....	....	....	LT 1.000
01/20/87	RM	....	....	....	....	....	LT 1.000
01/26/87	RM	....	....	....	....	....	LT 1.000
02/02/87	RM	....	....	....	....	....	LT 1.000
02/09/87	RM	....	....	....	....	....	LT 1.000
02/17/87	RM	....	....	....	....	....	LT 1.000
02/23/87	RM	....	....	....	....	....	LT 1.000
03/02/87	RM	....	....	....	....	....	LT 1.000
03/09/87	RM	....	....	....	....	LT 1.000	LT 1.000
03/16/87	RM	....	....	....	....	LT 1.000	LT 1.000
03/23/87	RM	....	....	....	....	LT 1.000	LT 1.000
03/30/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/06/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/13/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/20/87	RM	....	....	....	....	LT 1.000	LT 1.000
04/27/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/04/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/11/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/18/87	RM	....	....	....	....	LT 1.000	LT 1.000
05/26/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/01/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/08/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/15/87	RM	....	....	....	....	LT 1.000	LT 1.000
06/22/87	RM	....	....	....	....	....	....
06/29/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/06/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/13/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/20/87	RM	....	....	....	....	LT 1.000	LT 1.000
07/27/87	RM	....	....	....	....	LT 1.000	LT 1.000
08/05/87	ES	LT 0.046	LT 0.059	389.000	LT 1.800	LT 2.800	LT 1.300
08/12/87	ES	....	....	....	....	....	....
08/19/87	ES	LT 0.046	LT 0.059	156.000	....	....	....
08/26/87	ES	LT 0.046	LT 0.059	153.000	....	....	....
09/02/87	ES	LT 0.046	LT 0.059	156.000	LT 1.800	LT 2.800	LT 1.300
09/16/87	ES	LT 0.046	LT 0.059	164.000	....	....	....
09/23/87	ES	....	....	184.000	....	....	....
09/30/87	ES	LT 0.046	LT 0.059	131.000	LT 1.800	LT 2.800	LT 1.300

LT = LESS THAN The Following Concentration

.... INDICATES THAT ANALYSIS WAS NOT PERFORMED

ug/l = MICROGRAM PER LITER

mg/l = MILLIGRAM PER LITER

APPENDIX D

DEWATERING WELL DATA

R.I.C.

FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: ALDRN
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	1	33%	*	0.33	LT DL
2	4	1	25%	*	0.32	LT DL
3	4	0	0%	LT DL	LT DL	LT DL
4	4	1	25%	*	0.32	LT DL
5	4	1	25%	*	0.35	LT DL
6	3	1	33%	*	0.36	LT DL
7	4	0	0%	LT DL	LT DL	LT DL
8	4	0	0%	LT DL	LT DL	LT DL
9	4	0	0%	LT DL	LT DL	LT DL
10	1	0	0%	LT DL	LT DL	LT DL
11	2	0	0%	LT DL	LT DL	LT DL
12	5	0	0%	LT DL	LT DL	LT DL
13	4	1	25%	*	0.27	LT DL
14	5	3	60%	*	0.41	LT DL
15	5	0	0%	LT DL	LT DL	LT DL

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: ALDRN
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	0	0%	*	LT DL	LT DL
2	3	0	0%	*	LT DL	LT DL
3	2	0	0%	*	LT DL	LT DL
4	3	0	0%	*	LT DL	LT DL
5	3	0	0%	*	LT DL	LT DL
6	3	0	0%	*	LT DL	LT DL
7	3	0	0%	*	LT DL	LT DL
8	3	0	0%	*	LT DL	LT DL
9	3	0	0%	*	LT DL	LT DL
10	3	0	0%	*	LT DL	LT DL
11	3	0	0%	*	LT DL	LT DL
12	3	0	0%	*	LT DL	LT DL
13	3	0	0%	*	LT DL	LT DL
14	3	0	0%	*	LT DL	LT DL
15	3	0	0%	*	LT DL	LT DL

R.I.C.

FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: CHLORIDE
DETECTION LIMIT: 20 MGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	3	100%	194.00	200.00	189.00
2	4	4	100%	214.50	272.00	182.00
3	4	4	100%	198.50	274.00	152.00
4	4	4	100%	207.75	285.00	151.00
5	4	4	100%	246.00	314.00	159.00
6	3	3	100%	244.67	307.00	211.00
7	4	4	100%	300.50	353.00	229.00
8	4	4	100%	372.00	497.00	253.00
9	4	4	100%	332.50	376.00	306.00
10	1	1	100%	337.00	337.00	337.00
11	2	2	100%	369.00	407.00	331.00
12	5	5	100%	556.60	665.00	480.00
13	4	4	100%	650.25	748.00	570.00
14	5	5	100%	732.40	850.00	595.00
15	5	5	100%	671.00	852.00	258.00

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: CHLORIDE
DETECTION LIMIT: 20 MGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	2	100%	227.50	255.00	200.00
2	3	3	100%	259.33	334.00	200.00
3	2	2	100%	302.50	305.00	300.00
4	3	3	100%	250.67	300.00	160.00
5	3	3	100%	288.33	328.00	237.00
6	3	3	100%	316.67	326.00	300.00
7	3	3	100%	347.33	400.00	320.00
8	3	3	100%	352.67	367.00	341.00
9	3	3	100%	363.33	400.00	335.00
10	3	3	100%	363.00	400.00	330.00
11	3	3	100%	366.67	400.00	342.00
12	3	3	100%	543.33	600.00	489.00
13	3	3	100%	709.00	750.00	642.00
14	3	3	100%	684.00	742.00	634.00
15	3	3	100%	734.67	755.00	712.00

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: COMB. ORGANO-SULFUR
DETECTION LIMIT: 60 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	0	0%	*	LT DL	LT DL
2	2	0	0%	*	LT DL	LT DL
3	2	0	0%	*	LT DL	LT DL
4	2	0	0%	*	LT DL	LT DL
5	2	0	0%	*	LT DL	LT DL
6	2	0	0%	*	LT DL	LT DL
7	2	0	0%	*	LT DL	LT DL
8	2	0	0%	*	LT DL	LT DL
9	2	0	0%	*	LT DL	LT DL
10	2	0	0%	*	LT DL	LT DL
11	2	0	0%	*	LT DL	LT DL
12	2	0	0%	*	LT DL	LT DL
13	2	0	0%	*	LT DL	LT DL
14	2	0	0%	*	LT DL	LT DL
15	2	0	0%	*	LT DL	LT DL

R.I.C.

FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DBCP
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	0	0%	LT DL	LT DL	LT DL
2	4	0	0%	LT DL	LT DL	LT DL
3	4	0	0%	LT DL	LT DL	LT DL
4	4	0	0%	LT DL	LT DL	LT DL
5	4	0	0%	LT DL	LT DL	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	4	0	0%	LT DL	LT DL	LT DL
8	4	0	0%	LT DL	LT DL	LT DL
9	4	0	0%	LT DL	LT DL	LT DL
10	1	1	100%	2.62	2.62	2.62
11	2	0	0%	LT DL	LT DL	LT DL
12	5	0	0%	LT DL	LT DL	LT DL
13	4	1	25%	*	0.31	LT DL
14	5	1	20%	*	0.29	LT DL
15	5	1	20%	*	0.23	LT DL

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DBCP
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	0	0%	LT DL	LT DL	LT DL
2	3	0	0%	LT DL	LT DL	LT DL
3	2	0	0%	LT DL	LT DL	LT DL
4	3	0	0%	LT DL	LT DL	LT DL
5	3	0	0%	LT DL	LT DL	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	3	0	0%	LT DL	LT DL	LT DL
8	3	0	0%	LT DL	LT DL	LT DL
9	3	0	0%	LT DL	LT DL	LT DL
10	3	0	0%	LT DL	LT DL	LT DL
11	3	0	0%	LT DL	LT DL	LT DL
12	3	0	0%	LT DL	LT DL	LT DL
13	3	1	33%	*	0.20	LT DL
14	3	0	0%	LT DL	LT DL	LT DL
15	3	1	33%	*	0.29	LT DL

R.I.C.

FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DCPD
DETECTION LIMIT: 1.0 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	1	0	0%	LT DL	LT DL	LT DL
2	2	0	0%	LT DL	LT DL	LT DL
3	2	0	0%	LT DL	LT DL	LT DL
4	2	1	50%	*	8.00	LT DL
5	2	0	0%	LT DL	LT DL	LT DL
6	1	0	0%	LT DL	LT DL	LT DL
7	2	0	0%	LT DL	LT DL	LT DL
8	2	1	50%	*	3.00	LT DL
9	2	0	0%	LT DL	LT DL	LT DL
10	1	0	0%	LT DL	LT DL	LT DL
11	1	1	100%	1.00	1.00	1.00
12	3	2	67%	*	2.00	LT DL
13	2	0	0%	LT DL	LT DL	LT DL
14	3	1	33%	*	1.00	LT DL
15	3	0	0%	LT DL	LT DL	LT DL

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DCPD
DETECTION LIMIT: 1.0 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	1	50%	*	3.00	LT DL
2	3	2	67%	*	10.00	LT DL
3	2	1	50%	*	10.00	LT DL
4	3	1	33%	*	5.00	LT DL
5	2	1	50%	*	2.00	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	3	1	33%	*	10.00	LT DL
8	3	0	0%	LT DL	LT DL	LT DL
9	3	2	67%	*	2.00	LT DL
10	3	1	33%	*	3.00	LT DL
11	3	0	0%	LT DL	LT DL	LT DL
12	3	1	33%	*	3.00	LT DL
13	3	1	33%	*	3.00	LT DL
14	3	2	67%	*	1.00	LT DL
15	3	1	33%	*	8.00	LT DL

R.I.C.

FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DIMP
DETECTION LIMIT: 10 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	0	0%	LT DL	LT DL	LT DL
2	4	0	0%	LT DL	LT DL	LT DL
3	4	0	0%	LT DL	LT DL	LT DL
4	4	0	0%	LT DL	LT DL	LT DL
5	4	0	0%	LT DL	LT DL	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	4	0	0%	LT DL	LT DL	LT DL
8	4	0	0%	LT DL	LT DL	LT DL
9	4	0	0%	LT DL	LT DL	LT DL
10	1	0	0%	LT DL	LT DL	LT DL
11	2	0	0%	LT DL	LT DL	LT DL
12	5	2	40%	*	13.10	LT DL
13	4	4	100%	18.55	21.20	15.70
14	5	5	100%	21.28	24.50	19.40
15	5	4	80%	12.50	17.70	LT DL

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DIMP
DETECTION LIMIT: 10 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	0	0%	LT DL	LT DL	LT DL
2	3	0	0%	LT DL	LT DL	LT DL
3	2	0	0%	LT DL	LT DL	LT DL
4	3	0	0%	LT DL	LT DL	LT DL
5	3	0	0%	LT DL	LT DL	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	3	0	0%	LT DL	LT DL	LT DL
8	3	0	0%	LT DL	LT DL	LT DL
9	3	0	0%	LT DL	LT DL	LT DL
10	3	0	0%	LT DL	LT DL	LT DL
11	3	0	0%	LT DL	LT DL	LT DL
12	3	2	67%	*	11.20	LT DL
13	3	3	100%	18.37	22.50	14.00
14	3	3	100%	19.40	21.40	18.00
15	3	3	100%	14.40	15.50	13.20

R.I.C.

FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DLDRN
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	1	33%	*	0.30	LT DL
2	4	2	50%	*	0.60	LT DL
3	4	4	100%	0.36	0.70	0.20
4	4	3	75%	0.37	0.56	LT DL
5	4	3	75%	0.48	0.67	LT DL
6	3	2	67%	*	0.60	LT DL
7	4	3	75%	0.36	0.60	LT DL
8	4	2	50%	*	0.28	LT DL
9	4	4	100%	0.31	0.40	0.21
10	1	1	100%	0.22	0.22	0.22
11	2	2	100%	0.60	0.70	0.50
12	5	5	100%	1.14	1.41	0.60
13	4	3	75%	0.51	0.58	LT DL
14	5	2	40%	*	0.68	LT DL
15	5	5	100%	0.78	2.00	0.40

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: DLDRN
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	1	50%	*	0.37	LT DL
2	3	2	67%	*	0.51	LT DL
3	2	2	100%	0.61	0.84	0.38
4	3	2	67%	*	0.44	LT DL
5	3	2	67%	*	0.52	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	3	2	67%	*	0.60	LT DL
8	3	1	33%	*	0.25	LT DL
9	3	0	0%	LT DL	LT DL	LT DL
10	3	0	0%	LT DL	LT DL	LT DL
11	3	3	100%	0.80	1.13	0.27
12	3	3	100%	1.27	2.00	0.78
13	3	3	100%	1.03	1.50	0.39
14	3	2	67%	*	1.29	LT DL
15	3	3	100%	0.86	1.31	0.41

R.I.C. FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: ENDRN
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	0	0%	LT DL	LT DL	LT DL
2	4	0	0%	LT DL	LT DL	LT DL
3	4	0	0%	LT DL	LT DL	LT DL
4	4	0	0%	LT DL	LT DL	LT DL
5	4	0	0%	LT DL	LT DL	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	4	0	0%	LT DL	LT DL	LT DL
8	4	0	0%	LT DL	LT DL	LT DL
9	4	0	0%	LT DL	LT DL	LT DL
10	1	0	0%	LT DL	LT DL	LT DL
11	2	0	0%	LT DL	LT DL	LT DL
12	5	0	0%	LT DL	LT DL	LT DL
13	4	0	0%	LT DL	LT DL	LT DL
14	5	1	20%	*	0.23	LT DL
15	5	1	20%	*	0.25	LT DL

R.I.C. FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: ENDRN
DETECTION LIMIT: 0.2 UGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	0	0%	LT DL	LT DL	LT DL
2	3	0	0%	LT DL	LT DL	LT DL
3	2	0	0%	LT DL	LT DL	LT DL
4	3	0	0%	LT DL	LT DL	LT DL
5	3	0	0%	LT DL	LT DL	LT DL
6	3	0	0%	LT DL	LT DL	LT DL
7	3	0	0%	LT DL	LT DL	LT DL
8	3	0	0%	LT DL	LT DL	LT DL
9	3	0	0%	LT DL	LT DL	LT DL
10	3	0	0%	LT DL	LT DL	LT DL
11	3	0	0%	LT DL	LT DL	LT DL
12	3	0	0%	LT DL	LT DL	LT DL
13	3	0	0%	LT DL	LT DL	LT DL
14	3	0	0%	LT DL	LT DL	LT DL
15	3	0	0%	LT DL	LT DL	LT DL

R.I.C. FY 86 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: FLUORIDE
DETECTION LIMIT: 0.2 MGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	3	3	100%	1.63	2.20	1.29
2	4	4	100%	2.13	3.90	1.20
3	4	4	100%	1.88	2.50	1.30
4	4	4	100%	2.10	2.90	1.70
5	4	4	100%	2.58	4.00	1.60
6	3	3	100%	2.21	2.70	1.70
7	4	4	100%	2.85	5.00	1.80
8	4	4	100%	2.55	4.70	1.10
9	4	4	100%	2.38	2.80	2.00
10	1	1	100%	2.71	2.71	2.71
11	2	2	100%	2.44	2.60	2.27
12	5	5	100%	2.69	3.00	2.50
13	4	4	100%	2.73	3.70	0.70
14	5	5	100%	2.74	3.60	1.30
15	5	5	100%	3.30	5.20	1.40

R.I.C.

FY 87 STATISTICAL SUMMARY
NORTHWEST BOUNDARY DEWATERING WELLS

ANALYTE: FLUORIDE
DETECTION LIMIT: 0.2 MGL

WELL NO.	TOT SAMP	SAMP >DL	% >DL	MEAN	HIGH VALUE	LOW VALUE
1	2	2	100%	1.15	1.21	1.08
2	3	3	100%	1.39	1.56	1.25
3	2	2	100%	1.57	1.69	1.44
4	3	3	100%	1.76	1.90	1.53
5	3	3	100%	1.75	2.01	1.60
6	3	3	100%	1.82	2.23	1.45
7	3	3	100%	2.11	2.30	1.95
8	3	3	100%	1.91	2.16	1.75
9	3	3	100%	2.14	2.36	1.91
10	3	3	100%	2.09	2.44	1.87
11	3	3	100%	1.96	2.09	1.79
12	3	3	100%	2.46	2.53	2.36
13	3	3	100%	2.65	3.29	2.30
14	3	3	100%	2.56	2.71	2.42
15	3	3	100%	3.05	3.26	2.82