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PHASE I
HYDROGEOLOGY INVESTIGATION
FINAL REPORT
VOLUME I

OPERATING INDUSTRIES, INC. LANDFILL
900 POTRERO GRANDE DRIVE
MONTEREY PARK, CALIFORNIA 91754

EPA Contract No. 68-01-7251
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CH2M HILL Project No. LAO63737.RR

Prepared for:

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September 28, 1990

REM IV

Remedial Planning Activities
at Selected Uncontrolled
Hazardous Waste Sites–Zone II

Environmental Protection Agency
Hazardous Site Control Division
Contract No. 68-01-7251

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CH2M HILL

Black & Veatch
ICF
PRC
Ecology and Environment

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PREFACE

This Draft Report summarizes the field methods, observations, analyses, and conclusions of the OII Landfill Phase I Hydrogeology Investigation. The report consists of three volumes. Volume I contains the main text and Appendix A, which describes the field procedures. For most readers, Volume I will provide sufficient detail for a good understanding of the investigation.

Volume II contains Appendix B (lithologic logs), Appendix C (Geophysical Logs), Appendix D (Well Completion Diagrams), Appendix E (Aquifer Test and Analysis), Appendix F (Water Level Data), Appendix G (Soil Headspace VOC Analyses), Appendix H (Soil Laboratory Analyses -- Detected Values Only), Appendix I (Soil Analysis Cross-Sections), Appendix J (Soil Sieve Analyses), Appendix K (Geochemical Modeling), and Appendix L (Water Quality Plots).

A complete listing of the water quality data base (Appendix M) and the soils data base (Appendix N) are provided in Volume 3. This data may be needed for a detailed review of observed contaminant concentrations.

All water quality data from the three samplings included in the scope of work for this project have been included in the summary tables, graphics, and analyses except for the metals (both filtered and unfiltered), TOC, POC, TOX, and POX analyses for the last round of groundwater sampling, completed from April 24 to May 10, 1990.

A summary of the report is provided in Section 11 of this volume.

CONTENTS

VOLUME I

		Page
1	Introduction	
1.1	Background	1-1
1.1.1	Regulatory Basis	1-1
1.1.2	Project History	1-1
1.2	Goals and Objectives of Investigation	1-3
1.3	Scope of Investigation	1-4
1.4	Regional and Site Setting	1-5
1.4.1	Physiography	1-5
1.4.2	Climatic Conditions	1-6
1.4.3	Land Use	1-8
2	Field Activities and Procedures	2-1
2.1	Drilling of Monitoring Wells	2-1
2.2	Soil Sampling During Drilling	2-4
2.3	Monitoring Well Installation	2-7
2.4	Aquifer and Slug Tests	2-9
2.5	Well Sampling	2-10
3	Geology	3-1
3.1	Prior Investigations	3-1
3.2	Site Stratigraphy	3-1
3.2.1	Pico Time Unit	3-2
3.2.2	San Pedro Formation	3-5
3.2.3	Lakewood Formation	3-5
3.3	Site Depositional History	3-6
3.4	Hydrogeologic Units	3-6
3.4.1	Lakewood/San Pedro Hydrogeologic Unit	3-7
3.4.2	Pico Hydrogeologic Unit	3-7

CONTENTS (Continued)

		Page
3.5	Site Structural Geology	3-10
3.5.1	Folding	3-10
3.5.2	Faulting	3-10
3.6	Geologic Cross-Sections	3-11
3.6.1	Development of Cross-Sections	3-11
4	Hydrogeology	4-1
4.1	Regional Hydrogeology	4-1
4.1.1	San Gabriel Basin	4-1
4.1.2	Central Basin	4-1
4.2	Occurrences of Groundwater	4-2
4.2.1	Unconfined Aquifer	4-3
4.2.2	Confined Aquifers	4-9
4.2.3	Confined Layers	4-10
4.2.4	Potentially Perched Groundwater	4-10
4.3	Hydrogeologic Properties	4-13
4.3.1	Lakewood/San Pedro Hydrogeologic Unit	4-13
4.3.2	Pico Sandstone and Conglomerate Units	4-21
4.3.3	Pico Silt	4-21
4.4	Groundwater Levels and Flow Conditions	4-22
4.4.1	Groundwater Levels in the OII Site Vicinity	4-22
4.4.2	Groundwater Flow in the OII Site Vicinity	4-29
4.4.3	Local Hydraulic Gradients	4-30
4.4.4	Alternative Interpretation of Shallow Water Levels at the Site Perimeter	4-34
4.4.5	Regional Groundwater Flow	4-35
4.4.6	Estimated Groundwater Flow Velocities	4-36

CONTENTS (Continued)

		Page
5	Waste Characterization	5-1
5.1	Disposal Methods and Areas	5-1
5.1.1	Historical Disposal Operations	5-1
5.1.2	Landfill Development	5-2
5.2	Waste Types and Quantities	5-15
5.3	Leachate	5-25
5.3.1	Leachate Occurrences	5-25
5.3.2	Leachate Composition	5-34
5.4	Landfill Gas	5-46
5.4.1	Gas Migration Mechanisms	5-46
5.4.2	Landfill Gas Occurrences	5-49
5.4.3	LFG Composition	5-56
6	Groundwater Chemistry	6-1
6.1	Summary of Available Water Quality Data	6-1
6.1.1	Number of Samples	6-1
6.1.2	Analytes	6-1
6.1.3	Data Management, Quality Assurance, and Analysis	6-3
6.2	Groundwater Hydrogeochemical Facies	6-15
6.2.1	Introduction	6-15
6.2.2	Hydrochemical Facies	6-15
6.2.3	Dissolved Metals	6-31
6.2.4	Mineral Saturation	6-37
6.2.5	Geochemical Reaction Modelling	6-40
6.3	Nature and Extent of Groundwater Contamination	6-42
6.3.1	Metals	6-42
6.3.2	Volatile Organic Compounds (VOCs)	6-42
6.3.3	Semivolatile (BNA) Organic Compounds	6-58

CONTENTS (Continued) Page

6.3.4 Pesticides and PCBs 6-59
6.3.5 Tentatively Identified Organic Compounds 6-59

6.4 Exceedances of Water Quality Standards 6-60

6.4.1 Organics 6-65
6.4.2 Inorganics 6-68

6.5 Stable Isotope Analyses Introduction 6-74

6.5.1 Background 6-77
6.5.2 Carbon and Sulfur Isotope Results 6-78
6.5.3 Tritium Results 6-81

7 Soil Contamination 7-1

7.1 Field Soil Vapor Analysis 7-1

7.1.1 Objectives of Field Soil Vapor Analysis 7-1
7.1.2 Field Methods and Procedures 7-1
7.1.3 Section of Soil Vapor Indicator Compounds 7-2
7.1.4 Interpretation of Soil Vapor Concentrations 7-3
7.1.5 Results of Vapor Headspace Analysis 7-3

7.2 Laboratory Analyses of Soil Samples 7-5

7.2.1 Laboratory Indicator Parameters 7-6
7.2.2 Results of Laboratory Analysis by Parameter 7-15
7.2.3 Comparison of Soil Laboratory Valves to Available Standards 7-23

7.3 Comparison of Field Soil Headspace Analyses Results of Laboratory Analyses Results for Soil Samples 7-24

7.4 Nature and Extent of Soil Contamination 7-24

7.4.1 Extent of Soil Contamination by Organic Compounds 7-24
7.4.2 Extent of Soil Contamination by Metals 7-25

CONTENTS (Continued)

		Page
8	Assessment of Potential Contaminant Migration	8-1
8.1	Potential Contaminant Release Mechanisms	8-1
8.1.1	Direct Contact of Solid Waste and Ground Water	8-1
8.1.2	Vertical Leachate Migration	8-2
8.1.3	Lateral Leachate Migration	8-3
8.1.4	Vertical DNAPL Migration	8-4
8.1.5	Landfill Gas Migration	8-4
8.2	Potential Contaminant Migration Pathways	8-6
8.2.1	Lakewood/San Pedro Unit	8-6
8.2.2	Pico Siltstone	8-7
8.2.3	A-Sand	8-8
8.2.4	Undifferentiated Pico Sandstone and Conglomerate Units	8-8
9	Identification of Potential Exposure Points	9-1
10	Recommendations	10-1
10.1	Routine Data Collection Activities	10-2
10.2	Recommended Additional Drilling	10-2
10.3	Additional Data Analysis	10-7
10.4	Other Field Activities	10-8
11	Summary	11-1
11.1	Goals of Investigation	11-1
11.2	Scope	11-1
11.3	Geology	11-2
11.4	Hydrogeology	11-2
11.5	Waste Characterization	11-3
11.5.1	Leachate	11-3
11.5.2	Landfill Gas	11-4

CONTENTS (Continued)

		Page
11.6	Groundwater Chemistry	11-4
	11.6.1 Major Ion Chemistry	11-4
	11.6.2 Nature and Extent of Groundwater Contamination	11-5
	11.6.3 Exceedances of ARARs	11-5
11.7	Soil Contamination	11-6
11.8	Assessment of Potential Contaminant Migration	11-7
11.9	Potential Exposure Points	11-8
11.10	Recommendations	11-8

BIBLIOGRAPHY

TABLES

		Page
2-1	Well Construction Details for Phase I Groundwater Monitoring Wells	2-2
3-1	Correlation Chart of Shallow Geologic Units, OII Site	3-2
4-1	OII Monitoring Well Construction Detail Summary	4-4
4-2	Potential Perched Water Occurrences	4-12
4-3	Potential Hydraulic Parameters Lakewood/San Pedro Unit	4-14
4-4	Hydraulic Parameters--Pico Sandstone and Conglomerate Unit Wells	4-16
4-5	Hydraulic Parameters--Pico Silt Units	4-18
4-6	Laboratory Analysis of Soil Cores Collected During Drilling of Monitoring Wells for OII North Parcel Hydrogeology Investigations	4-19
4-7	Vertical Gradients	4-33
4-8	Estimated Groundwater Flow Velocities	4-37
5-1	Generic Wastes Disposed at OII from 1976 to 1984	5-16
5-2	Generic Liquid Wastes Disposed at OII from 1976 to 1984	5-17
5-3	OII Yearly Receipt of Refuse	5-19
5-4	Estimated Mass of Refuse Disposed at OII	5-22
5-5	Summary of Leachate Composition at Municipal Landfills	5-38
5-6	Metals and Other Parameters Concentrations in OII and Average Landfill Leachate	5-42
5-7	Selected List of Organic Compounds Present in OII Leachate Ranked by Maximum Concentration	5-44
5-8	LFG Data from the Perimeter Gas Extraction System (September 1986)	5-57
5-9	LFG Data for Perimeter Gas Extraction System (Wells with High Methane Percentages versus Wells with High Oxygen Percentages) (September 1986)	5-58
6-1	List of Parameters for Analysis of Groundwater Samples	6-2
6-2	Number of Analytical Values in TDM II Data Base	6-5
6-3	List of Inorganic Compounds in OII Data Base with Concentration Range and Total Observations	6-7
6-4	List of Volatile Compounds in OII Data Base with Concentration Range and Total Observations	6-9
6-5	List of Semivolatile Organic Compounds in OII Data Base with Concentration Range and Total Observations	6-10
6-6	List of Pesticides and PCBs in OII Data Base with Concentration Range and Total Observations	6-12
6-7	List of Tentatively Identified Compounds in OII Data Base with Concentration Range and Total Observations	6-13

TABLES (Continued) Page

6-8 Minerals and Their Calculated Equilibrium Status with Groundwater from the Monitoring Wells Calculated by EQ3NR 6-38
6-9 Number of VOCs Detected at Least Once in Each Groundwater Monitoring Well 6-43
6-10 Monitoring Wells with Detected VOCs 6-45
6-11 Summary Concentrations of TICs in Groundwater 6-61
6-12 Selected ARARS for Compounds of Concern Operating Industries, Inc. 6-63
6-13 Observed Concentration of Lead 6-66
6-14 Inorganic Standard Exceedances in Water Wells 6-69
6-15 Isotope Analytical Results from Methane and Hydrogen Sulfide Gases at the OII Landfill Site 6-78
6-16 Summary of Inorganic and Indicator Parameters in Groundwater OII Landfill Site 6-82
6-17 Summary of Volatile Organic Compounds in Groundwater OII Landfill Site 6-93
6-18 Summary of Semivolatile Organic Compounds in Groundwater OII Landfill Site 6-99
6-19 Summary of Pesticides and PCBs in Groundwater OII Landfill Site 6-105
6-20 Summary of Tentatively Identified Compounds in Groundwater OII Landfill Site 6-108

7-1 Maximum Concentrations of Contaminants Detected in Soil Vapor Head Space Samples by Field Gas Chromatography Analysis 7-4
7-2 Maximum Concentrations of Selected Compounds Detected in Laboratory Analysis of Soil Samples 7-16
7-3 Detected Organic Compounds 7-20
7-4 Constituents that are Regulated Under the Toxicity Characteristic Rule 7-23

8-1 Comparison of Actual and Calculated Concentrations of VOCs in OI-20A Using Henry's Law 8-6

9-1 Annual Pumping Totals for Production Wells Within 3 Miles of the OII Site 9-5

10-1 Recommended Additional Drilling 10-3

FIGURES

		Page
1-1	Site Location Map	1-2
1-2	Regional Geology and Physiography of OII Vicinity	1-7
1-3	Adjacent Properties	1-9
1-4	Land Use in the Vicinity of OII	1-11
2-1	Locations of Field Activities	2-5
3-1	Diagrammatic Representation of Ancient Topography and Depositional Environments Along the San Gabriel Mountains	3-3
3-2	Locations of Hydrogeologic Cross-Sections	3-13
3-3	Hydrogeologic Cross-Section A-A'	3-15
3-4	Hydrogeologic Cross-Section B-B'	3-17
3-5	Hydrogeologic Cross-Section C-C'	3-19
3-6	Hydrogeologic Cross-Section D-D'	3-21
3-7	Hydrogeologic Cross-Section E-E'	3-23
3-8	Hydrogeologic Cross-Section F-F'	3-25
3-9	Hydrogeologic Cross-Section G-G'	3-27
3-10	Hydrogeologic Cross-Section H-H'	3-29
4-1	Monitoring Well Locations, Depths, and Hydrogeologic Unit	4-7
4-2A	Well Hydrographs	4-23
4-2B	Well Cluster Hydrographs	4-25
4-3	Water Level Changes	4-27
4-4	Estimated Water Table	4-31
4-5	Generalized Equipotential Contours (Section A-A')	4-39
4-6	Generalized Equipotential Contours (Section B-B')	4-41
4-7	Generalized Equipotential Contours (Section C-C')	4-43
4-8	Generalized Equipotential Contours (Section D-D')	4-45
4-9	Generalized Equipotential Contours (Section E-E')	4-47
4-10	Generalized Equipotential Contours (Section F-F')	4-49
4-11	Generalized Equipotential Contours (Section G-G')	4-51
4-12	Generalized Equipotential Contours (Section H-H')	4-53
4-13	Locations of Hydrogeologic Cross-Sections	4-55
4-14	Hydrogeologic Cross-Section I-I'	4-57
4-15	Hydrogeologic Cross-Section J-J'	4-59
4-16	Hydrogeologic Cross-Section K-K'	4-61
4-17	Fall 1986 Potentiometric Surface and Wells Having Water Level Data Within a 3-Mile Radius of OII	4-63
5-1	Location of Leachate Seeps and Permitted Liquid Disposal Area	5-3
5-2	Landfill Development	5-4
5-3	Predevelopment Topography of OII Site	5-7

FIGURES (Continued)

		Page
5-4	1849 Aerial Photograph of OII Site Vicinity	5-9
5-5	1960 Aerial Photograph of OII Site Vicinity	5-11
5-6	1968 Aerial Photograph of OII Site Vicinity	5-13
5-7	OII Landfill Volume and Rate of Filling	5-21
5-8	Thickness of Landfill Waste in 1986	5-23
5-9	Leachate Collection System	5-26
5-10	Available Leachate Levels	5-29
5-11	Moisture Conditions in PRP Wells	5-31
5-12	Leachate Hydrogeochemical Facies	5-35
5-13	Approximate Landfill Gas Monitoring Probe and Gas Extraction Well Locations	5-47
5-14	Average Methane Concentrations at Depths of 30 Feet or Less	5-51
5-15	Average Methane Concentrations at Depths Greater than 30 Feet	5-53
6-1	Groundwater Hydrogeochemical Facies	6-17
6-2	Relationship Between Mid-Screen Depth and the Measured Oxidation-Reduction Potential in the Groundwater Monitoring Wells	6-19
6-3	Median Concentrations of TDS	6-23
6-4	Median Concentrations of Total Organic Carbon is Groundwater	6-25
6-5	Median Concentrations of Total Organic Halogens in Groundwater	6-27
6-6	Stiff Diagram Map	6-33
6-7	Median Concentrations of Iron Of Groundwater	6-35
6-8	Observed Concentrations of TCE	6-47
6-9	Observed Concentrations of PCE	6-49
6-10	Observed Concentrations of 1,4-Dioxane	6-51
6-11	Observed Concentrations of Total Xylenes	6-53
6-12	Vinyl Chloride Median Concentrations in Groundwater	6-55
6-13	Observed Concentrations of Lead	6-75
6-14	Isotopic Fractionation of Stable Carbon Isotopes of Methane and Sulfur Isotopes of Hydrogen Sulfide	6-80
7-1	Distribution of Benzene in Soil Based on Laboratory and Field Soil Vapor Headspace Analyses	7-7
7-2	Distribution of Toluene in Soil Based on Laboratory and Field Soil Vapor Headspace Analyses	7-9
7-3	Distribution of Trichloroethylene in Soil Based on Laboratory and Field Soil Vapor Headspace Analyses	7-11
7-4	Distribution of Perchloroethylene in Soil Based on Laboratory and Field Soil Vapor Headspace Analyses	7-13

FIGURES (Continued) Page

9-1 Fall 1986 Potentiometric Surface and Status of Production Wells Within a Three Mile Radius of OII 9-3

10-1 Proposed Additional Wells 10-5

PLATES

1 Site Vicinity Topographic Map

2 Geology in the Vicinity of OII

3 Exceedances of Drinking Water Standards for Organic Chemicals in Groundwater

4 Exceedances of Drinking Water Standards for Inorganic Chemicals in Groundwater

APPENDICES

VOLUME I

Appendix A.	Field Procedures

VOLUME II

Appendix B.	Lithologic Logs
Appendix C.	Geophysical Logs
Appendix D.	Well Completion Diagrams
Appendix E.	Aquifer Test Data and Analysis
Appendix E-1.	Aquifer Test Graphs
Appendix E-2.	Aquifer Test Data
Appendix F.	Water Level Data
Appendix F-1.	Tabular Water Level Data
Appendix F-2.	Hydrographs
Appendix G.	Soil Vapor Screening
Appendix G-1.	Soil Vapor Screening -- Standard Operating Procedures
Appendix G-2.	Validated Soil Vapor Headspace Screening Data
Appendix G-3.	Field Soil Vapor Headspace Analyses Results By Boring
Appendix H.	Results of Laboratory Soil Analyses
Appendix H-1.	Laboratory Soil Analyses -- Detected Values Only
Appendix H-2.	Results of Laboratory Soil Analyses by Boring
Appendix I.	Cross-Sections Showing the Vertical Distribution of Selected Volatile Organic Compounds in Soil Samples
Appendix J.	Sieve Analyses for Soil Samples

APPENDICES (Continued)

Appendix K. Geochemical Modeling

Appendix K-1. Aquifer Mineralogy
Appendix K-2. EQ3NR/EQ6 Modeling Calculations

Appendix L. Water Quality Plots

Appendix L-1. Water Quality Plots of Selected Inorganic Parameters
Appendix L-2. Water Quality Plots of Selected Volatile Organic Compounds
Appendix L-3. Water Quality Plots of Selected Semivolatile Organic Compounds

VOLUME III

Appendix M. Groundwater Quality Data

Appendix M-1. Inorganic, Field, and Indicator Parameters
Appendix M-2. Volatile Organic Compounds
Appendix M-3. Semivolatile Organic Compounds
Appendix M-4. Pesticides and PCBs
Appendix M-5. Tentatively Identified Compounds
Appendix M-6. Additional TOC, POC, TOX, and POX Data

Appendix N. Soils Analyses - Complete Data Reports

Appendix N-1. Organic Parameters
Appendix N-2. Volatile Organic Compounds
Appendix N-3. Semivolatile Organic Compounds
Appendix N-4. Tentatively Identified Compounds

ABBREVIATIONS

AL	Action Levels
ARAR	Applicable or Relevant and Appropriate Requirements
BAS	Brian A. Stirrat & Associates
bgs	Below Ground Surface
BETX	Benzene, ethylbenzene, toluene, and xylene
BNA	Base/Neutral and Acid Extractable Organic Compounds
BOD	Biological Oxygen Demand
°C	Degrees Celsius
CDD	Converse-Davis-Dixon Associates
CDHS	California Department of Health Services
CDWR	California Department of Water Resources
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLP	Contract Laboratory Programs
cm/sec	Centimeters per Second
COD	Chemical Oxygen Demand
CRQL	Contract Required Quantification Limit
CTC	Carbon Tetrachloride
DNAPL	Dense Nonagaeous Phase Liquids
DOC	Dissolved Organic Compound
E&E	Ecology and Environment, Inc.
ECD	Electron Capture Detector
Eh	Oxidation-Reduction Potential
E-logs	Electric Logs
EPA	U.S. Environmental Protection Agency
ESI	Environmental Solutions, Inc.
fasl	Feet Above Sea Level
FID	Flame Ionization Detector
FSP	Field Sampling Plan
ft/day	Feet per Day
ft/year	Feet per Year
GC	Gas Chromatograph
GC/MS	Gas Chromatography/Mass Spectroscopy
gpm	Gallons per Minute
GMW	Gas Monitoring Wells

ABBREVIATIONS
(continued)

HQA	High Quality Analysis
HSL	Hazardous Substance List
H_2S	Hydrogen Sulfide Gas
IDL	Instrument Detection Limit
LACDPW	Los Angeles County Department of Public Works
LARWQCB	Los Angeles Regional Water Quality Control Board
LCS	Leachate Collection System
LFG	Landfill Gas
mg/l	Milligrams per Liter
MPD	Monterey Park Disposal Company
msl	Mean Sea Level
m.y.	Million Years
mV	Millivolts
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	Milligrams per Kilogram
meg/l	Millequivalents per Liter
NEIC	EPA National Enforcement Investigation Center
NGVD	National Geodedic Vertical Datum
OII	Operating Industries, Inc.
OUFS	Operable Unit Feasibility Study
ppb	Parts per Billion
ppm	Parts per Million
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene (perchloroethylene)
POC	Purgeable Organic Carbon
POX	Purgeable Organic Halogens
PRPs	Potentially Responsible Parties
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study

ABBREVIATIONS
(continued)

SARA	Superfund Amendments and Reauthorization Act
SC	Specific Conductivity
SoCalGas	Southern California Gas
SOP	Standard Operating Procedure
SP	Spontaneous Potential
STLC	Soluble Threshold Limit Concentration
TCA	Trichloroethane
TCE	Trichloroethylene
TCL	EPA Target Compound List (of contaminants)
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TS	Total Solids
TSS	Total Suspended Solids
TTLC	Total Threshold Limit Concentration
ug/kg	Micrograms/kilogram
ug/l	Micrograms per Liter
umhos	Micro mhos
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VSS	Volatile Suspended Solids
WDC	Water Development Corporation
WET Test	Waste Extraction Test

Section 1
INTRODUCTION

Section 1
INTRODUCTION

This report describes the field methods, results, and conclusions of the Phase I Hydrogeology Investigation for the Operating Industries, Inc. Landfill (OII) Superfund Site in Monterey Park, California, completed in 1990 by CH2M HILL under contract to the U.S. Environmental Protection Agency (EPA).

1.1 BACKGROUND

The OII site is located at 900 Potrero Grande Drive in Monterey Park, Los Angeles County, California (Figure 1-1), approximately 6 miles east of downtown Los Angeles. The site covers 190 acres and is divided by California Highway 60 (the Pomona Freeway). The 45 acres to the north are called the North Parcel, and the 145 acres to the south are called the South Parcel. The City of Montebello borders on the southern side of the South Parcel.

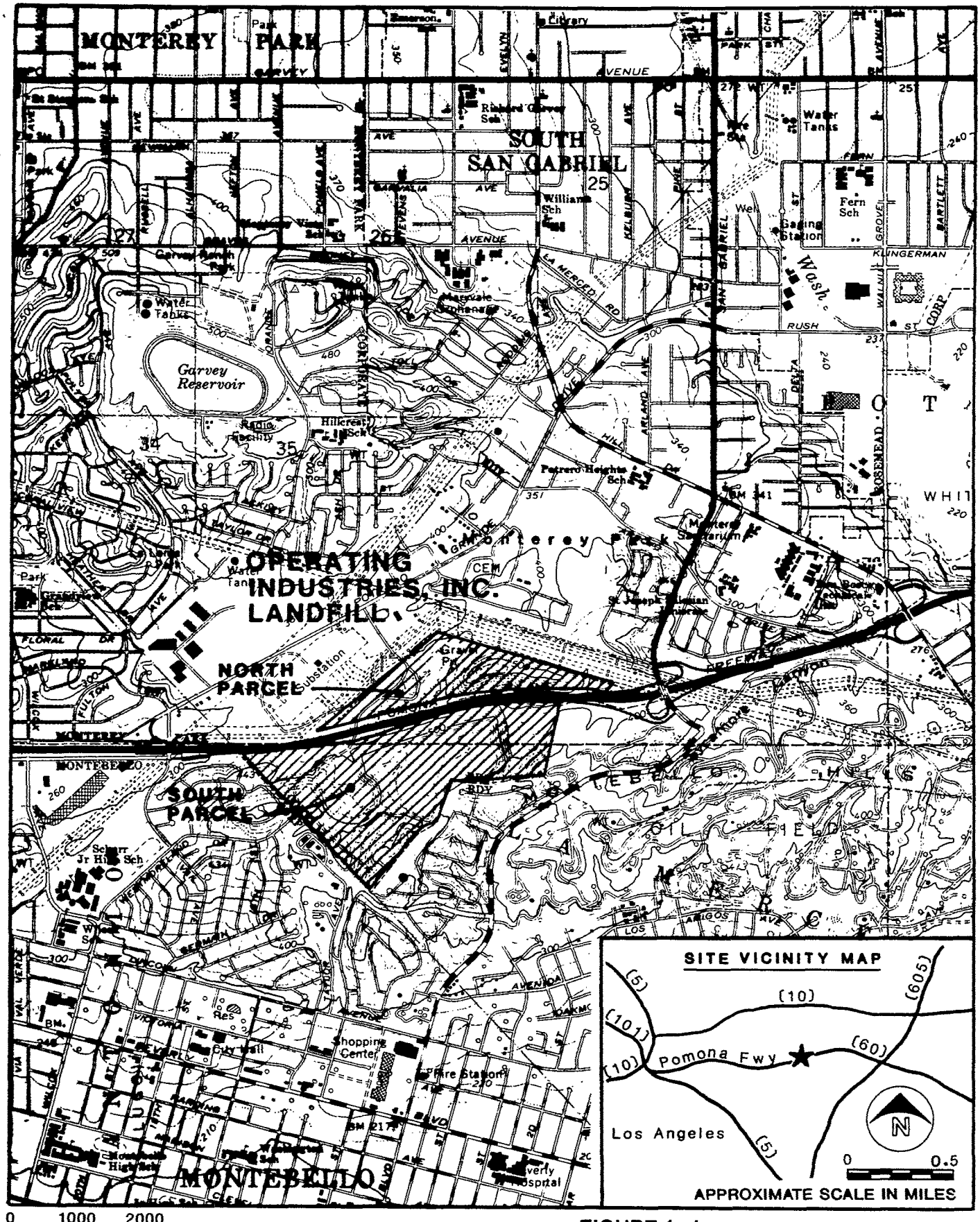
The OII Landfill Phase I Hydrogeology Investigation is the third hydrogeologic investigation completed at the OII site. Previous investigations have concentrated on the South Parcel (EPA, June 20, 1985) and the North Parcel (EPA, January 29, 1988) of the OII site. The goal of the Phase I Investigation was to fill data gaps from previous investigations for the entire OII site and to define data gaps for a planned Phase II Investigation.

1.1.1 REGULATORY BASIS

This investigation has been planned and executed to meet the requirements of the Remedial Investigation/Feasibility Study (RI/FS) process of the EPA Superfund Program. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) created the EPA Superfund Program to protect the public from exposure to hazardous chemicals from uncontrolled hazardous waste sites. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986. The RI/FS process represents the methodology that the Superfund program has established for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and for evaluating potential remedial options.

1.1.2 PROJECT HISTORY

In 1988, EPA tasked CH2M HILL to prepare a report summarizing the existing hydrogeologic data and conclusions for the South Parcel. That report, The South Parcel Hydrogeology Existing Data Technical Memorandum, Operating Industries, Inc., Monterey Park, California (EPA, October 12, 1988), summarized hydrogeologic data from previous



0 1000 2000

Scale In Feet

Base Map: USGS 7.5 Min.
El Monte Quadrangle 1966
Photorevised 1981

FIGURE 1-1
SITE LOCATION MAP
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

LAO63737.RR

investigations, presented detailed hydrogeologic cross sections, and proposed recommendations for monitoring well locations and depths.

EPA authorized CH2M HILL to proceed on a field sampling plan (FSP) for the Phase I Hydrogeology Investigation in early May 1989. The final approved FSP (EPA, September 14, 1989) was submitted to EPA on September 14, 1989.

Drilling began on September 18, 1989, and continued through March 14, 1990. All aquifer and slug tests, well development, and well-head completions were completed by March 30, 1990. The last round of well samplings, including all new and previously existing monitoring wells, occurred from April 24 to May 10, 1990.

A Phase II Hydrogeology Investigation will be planned and completed within the next 18 months based on recommendations in this report, additional monitoring data, and input from EPA, their contractors, and the potentially responsible parties (PRPs) for the OII site. The goal of the Phase II Investigation will be to provide the remaining hydrogeologic data needed to complete the feasibility study for the overall site remedy.

Numerous technical exchange meetings with EPA, CH2M HILL, the PRPs, and their consultants (Environmental Solutions, Inc. [ESI] and Brian A. Stirrat & Associates [BAS]) on the hydrogeology of the OII site have occurred over the past 2 years. These meetings served as a productive forum for the presentation and discussion of the original and updated work plan for the hydrogeology investigation and the content of the South Parcel Hydrogeology Existing Data Technical Memorandum. Based on these meetings, EPA and the PRPs agreed upon the final locations and depths of the proposed monitoring wells included in the Phase I Hydrogeology Investigation. Progress meetings were held during the drilling and analysis stages of the Phase I Hydrogeology Investigation to discuss new findings, updated geologic interpretations, and proposed locations for additional wells.

Based on suggestions for a more detailed study of the stratigraphy of the site, the PRPs hired Dr. John Minch to review existing literature and use biostratigraphic techniques to evaluate: 1) the age and formation names for the lithologic units found at the OII site and 2) the mode and style of deposition of the bedrock units. The results of his study are presented in Minch (1990).

1.2 GOALS AND OBJECTIVES OF INVESTIGATION

The goals of the OII Landfill Phase I Hydrogeology Investigation were to characterize the site hydrogeology and to assess the effect of past waste disposal activities on the quality of the groundwater in the site vicinity.

Specific objectives for the investigation are listed below:

1. Characterize subsurface geology, including lithologic units and geologic structure

2. Evaluate hydrogeologic properties of hydrogeologic units by conducting aquifer tests or slug tests at each new interval

3. Characterize hydrogeologic units, groundwater migration pathways, and groundwater flow directions and velocities

4. Assess the chemical composition (including major ions, trace metals, organic contaminants, and indicator parameters) of groundwater in selected hydrogeologic units and in perched intervals encountered during drilling

5. Assess the nature and extent of groundwater contamination at the site vicinity

6. Evaluate the nature and extent of soil contamination

7. Provide a monitoring well network and water quality data necessary for the long-term groundwater monitoring

8. Evaluate the potential for contaminant migration to potential exposure points

1.3 SCOPE OF INVESTIGATION

The scope of this investigation included the tasks listed below:

1. Continuous coring of two coreholes to depths of 360 and 450 feet

2. Drilling, installation, and development of 25 new monitoring wells ranging in depth from 30 to 540 feet

3. Collection of soil samples at specified depths during drilling for lithologic description, laboratory chemical analysis, field measurement of soil headspace volatile organic compound (VOC) concentrations, and mineralogical and grain-size analysis

4. Geophysical logging of coreholes and monitoring well boreholes drilled by the mud-rotary method

5. Installation of permanent sampling pumps in all new monitoring wells

6. Testing of new wells by short-term pumping tests or slug tests

7. Three groundwater samplings of all new wells and analysis of these samples for major ions, EPA Hazardous Substance List (HSL) compounds, and selected indicator parameters

8. Surveying of all new well head locations and elevations

9. Periodic water-level measurements of all OII groundwater monitoring wells

10. Entering of all groundwater quality data into a data base for data management and analysis

11. Video logging of inactive well no. 2897, owned by Southern California Gas Company, to evaluate its condition and the location of its perforated interval

12. Installation of an inner casing and gravel pack into existing well OI-7C and redevelopment of the well

13. Redevelopment of existing monitoring well OI-6

14. Preparation of updated hydrogeologic cross-sections utilizing the new borehole logs

15. Analysis of landfill gas and groundwater sample headspace to evaluate the source of H_2S in groundwater

16. Geochemical modeling to evaluate geochemical reactions controlling groundwater chemistry and contaminant fate and transport

17. Development of computerized displays of hydrogeologic and water quality data to summarize available data for the site

18. Evaluation of the nature and extent of groundwater and soil contamination

19. Data analysis to evaluate groundwater flow directions and rates and potential contaminant transport

1.4 REGIONAL AND SITE SETTING

1.4.1 PHYSIOGRAPHY

The OII Landfill is on the northwestern flank of the Montebello Hills (also known as the La

Merced Hills) in central Los Angeles County (Figure 1-2, Plate 1). The Montebello Hills are one of a series of low-lying hills (the Repetto, Montebello, and Puente) that separate the San Gabriel Valley (San Gabriel Basin) to the north from the Los Angeles Coastal Plain (Central Basin) to the south (Figure 1-2). The Montebello Hills rise about 400 feet above the surrounding areas. Elevations of the OII site range from approximately 380 feet on the North Parcel to 640 feet above National Geodetic Vertical Datum (NGVD) at the top of the South Parcel.

The San Gabriel Valley is a piedmont plain that slopes gently to the south. The San Gabriel Mountains, located 12 miles to the north of the site, form the northern boundary of the San Gabriel Valley; their elevation exceeds 10,000 feet above NGVD. The Central Basin, to the south of the site, is a coastal plain sloping towards the Pacific Ocean.

The Montebello Hills are bounded on the south by the Montebello Plain, which lies within the Central Basin. The Montebello Plain is also referred to as the Montebello Forebay Area. The Montebello Plain extends south of the Repetto and Montebello Hills between the Los Angeles and the Rio Hondo Rivers. In the vicinity of the study area, the northern margin of the Montebello Hills is marked by a topographic low.

The San Gabriel and Rio Hondo Rivers flow from the San Gabriel Basin to the Central Basin through Whittier Narrows, located about 2 miles east of the OII site.

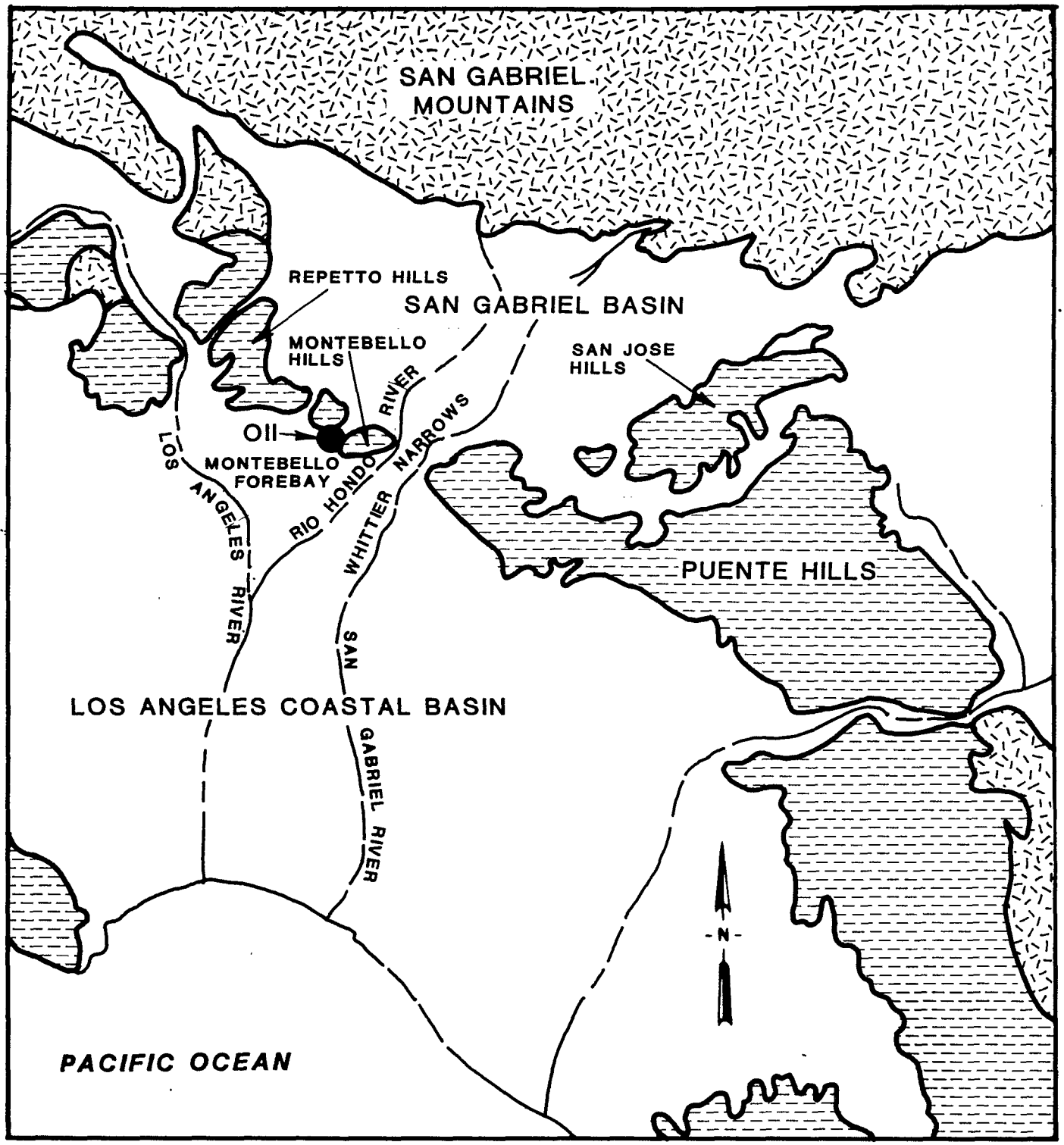
1.4.2 CLIMATIC CONDITIONS

The Los Angeles Basin climate is Mediterranean to semiarid (California Department of Water Resources [CDWR], 1966). The climate consists of temperate winters with intermittent rain and hot, dry summers.

The climatic conditions of the Los Angeles Basin are strongly influenced by the geographic setting. The Los Angeles Basin is bordered on the southwest by the Pacific Ocean, on the north by the San Gabriel Mountains, and on the east by the San Bernardino and San Jacinto Mountains. These mountain ranges trap airborne pollutants within the basin during periods of onshore winds resulting in greatly reduced visibility.

The average annual precipitation for the period 1930 to 1984 is 15.99 inches at Los Angeles County Flood Control District Station 290B, located 1.5 miles west-northwest of the site (U.S. Department of Commerce, 1988). The maximum yearly total of 36.99 inches occurred in 1982-83. The lowest yearly total of 7.00 inches occurred in 1958-59. Approximately 90 percent of the annual rainfall occurs from November to April. The greatest precipitation generally occurs from December through March. The Los Angeles Basin is currently in the third consecutive year of below average precipitation.

The monthly average temperature in Los Angeles for the period 1955 to 1984 ranges from 55.2°F to 69.8°F throughout the year (U.S. Department Commerce, 1955 to 1984). The



LEGEND

CONSOLIDATED SEDIMENTARY ROCKS

GRANITIC ROCKS

UNCONSOLIDATED SEDIMENTS

0 5
APPROXIMATE SCALE IN MILES

FIGURE 1-2
REGIONAL GEOLOGY AND PHYSIOGRAPHY OF OII VICINITY
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

LAO63737.RR

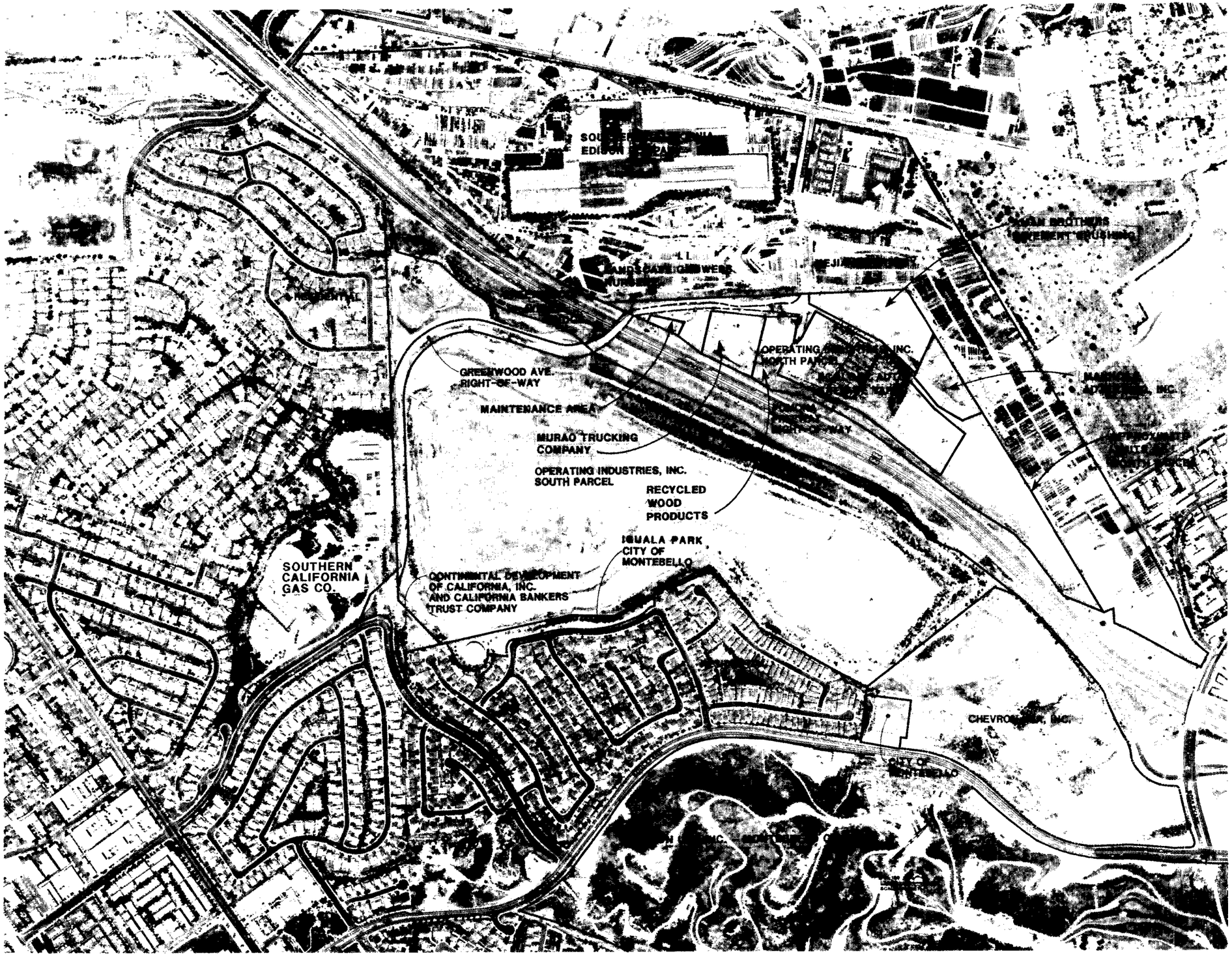
maximum monthly average high temperature is 77°F and occurs in August; the minimum monthly average low temperature (46°F) occurs in January. Additional data on site climatic conditions can be found in EPA (June 1988).

1.4.3 LAND USE

The San Gabriel and Central Basins are heavily urbanized. Figure 1-3 shows the boundaries, adjacent properties, and rights-of-way for the OII site and Figure 1-4 shows land use in the site vicinity. The surface facilities for an underground natural gas storage reservoir owned by the Southern California Gas Company facility adjoins the southwest portion of the site. A small piece of property to the south is jointly owned by Continental Development of California, Inc. and California Bankers Trust Company. A narrow strip of land on the south side of the South Parcel is the City of Montebello's Iguala Park. Portions of this park are currently closed to the public due to previous leachate seeps. Land east of the South Parcel is owned by Chevron and has been vacant up to this time, but is currently being graded in preparation for the construction of an auto mall. To the southeast of the site, the Montebello Hills oil field, owned by Chevron, has been active for the last 50 years. The remaining land adjacent to the landfill is primarily residential with privately-owned single-family homes. The houses along the southern and western OII boundary are built directly adjacent to the landfill.

Portions of the North Parcel are leased by several businesses including a pavement crushing operation and an auto salvage yard.

The land north of the OII site is owned by Southern California Edison Company (SCE). The SCE substation complex is located south of Potrero Grande Drive on the west side of Greenwood Avenue. The remainder of the SCE property is leased to two nurseries. The Landscape Growers Nursery is located to the west of Greenwood Avenue. The land to the east of Greenwood Avenue is operated by Mejia's Nursery.



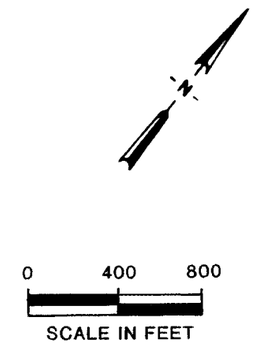
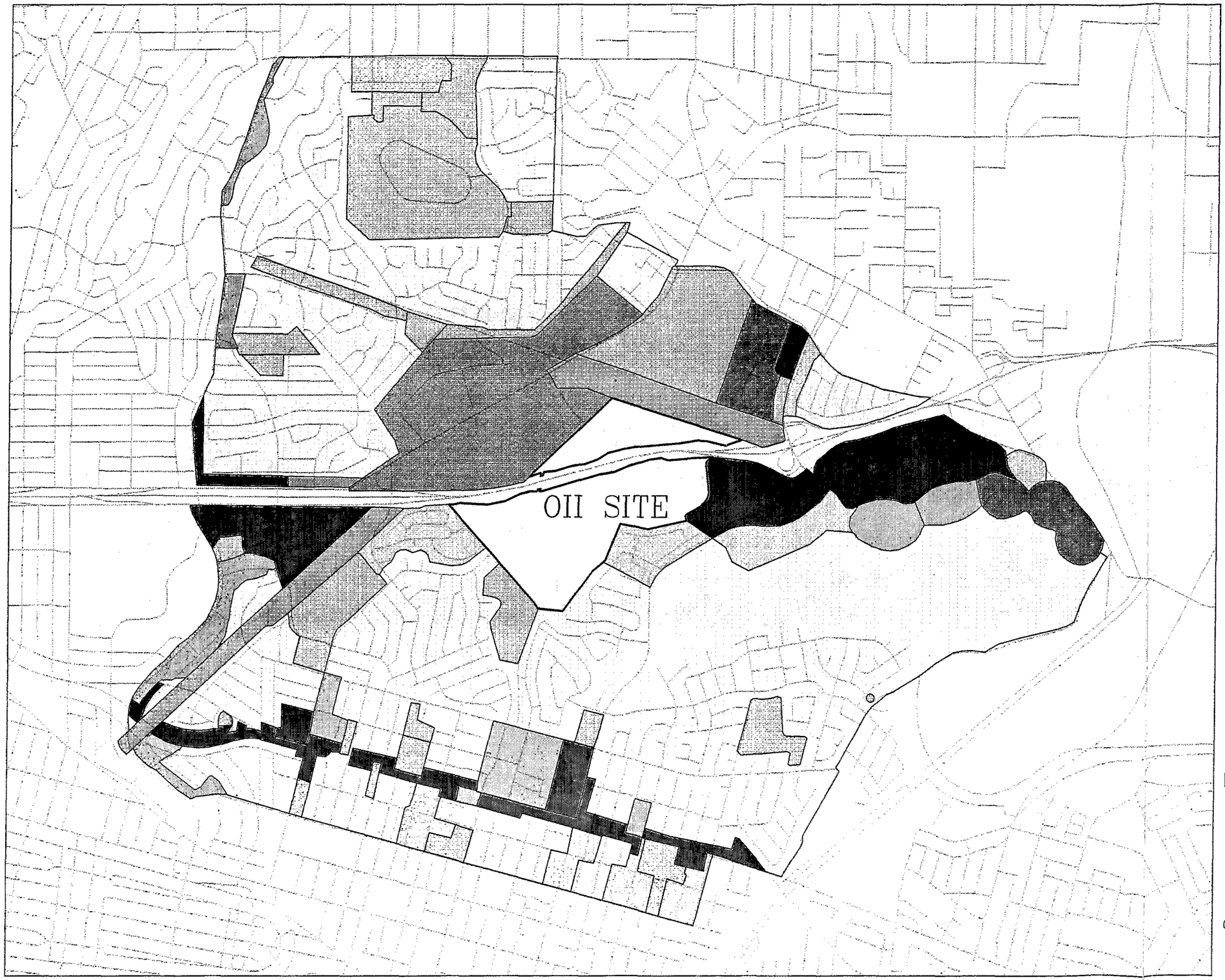
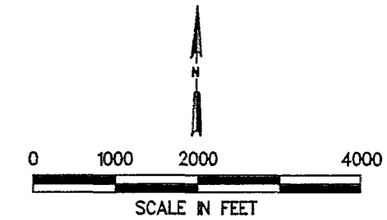


FIGURE 1-3
ADJACENT PROPERTIES
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

SOURCES: OPERABLE UNIT FEASIBILITY STUDY FOR LANDFILL GAS MIGRATION CONTROL, CH2M HILL 1988
PRELIMINARY NORTH PARCEL SITE CHARACTERIZATION, CH2M HILL 1988





EXPLANATION

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- VERY HIGH DENSITY RESIDENTIAL
- COMMERCIAL; GENERAL BOULEVARD
- INDUSTRIAL
- INSTITUTIONAL/RECREATIONAL OPEN SPACE
- UTILITY RIGHT-OF-WAY

SOURCE:
City of Monterey Park, Land Use and Circulation Map, and
City of Montebello, General Plan.

FIGURE 1-4

LANDUSE IN THE VICINITY OF OII

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

Section 2
FIELD ACTIVITIES AND PROCEDURES

Section 2
FIELD ACTIVITIES AND PROCEDURES

This Section briefly summarizes field procedures for drilling, installation, and sampling of the 25 monitoring wells and 2 coreholes installed at the OII site as part of the Phase 1 Hydrogeology Investigation. A detailed description of field procedures is provided in Appendix A. The fieldwork was completed between September 1989 and May 1990. Monitoring well and corehole locations are shown in Figure 2-1.

2.1 DRILLING OF MONITORING WELLS

CH2M HILL subcontracted Water Development Corporation (WDC) of Woodland, California, to perform monitoring well drilling, installation, and development activities for this hydrogeology investigation. Two coreholes were drilled and 25 monitoring wells were installed at locations shown in Figure 2-1. The well numbers, borehole and well depths, drilling methods, screened zones, casing diameters, and pump types for the 25 monitoring wells are summarized in Table 2-1. Boreholes ranged in depth from 67 to 611 feet and monitoring well depths ranged from 30 to 540 feet. Well installation field work began on September 18, 1989, and ended on March 30, 1990.

Fourteen of the monitoring wells were drilled using the direct mud-rotary drilling technique. Borehole depths ranged from 208 to 611 feet. Initially, a 6-inch-diameter pilot hole was drilled at each site to a specified depth and geophysically logged. The depth of the monitoring well screen interval was selected based on interpretation of the lithologic and geophysical logs from the pilot holes. The pilot holes were then reamed to a diameter of 12-1/4 inches and completed as monitoring wells.

At six locations (OI-15A, OI-15B, OI-17B, OI-18B, OI-20B, and OI-22B), prior to starting the pilot hole, a 14-inch-diameter steel conductor casing was installed through the trash prism or perched water intervals to minimize the potential for cross-contamination during drilling. A bucket auger rig, equipped with an 18-inch-diameter bucket, was used to install three of the conductor casings (OI-15A, OI-15B, and OI-17B). The others were installed by the mud-rotary method.

Coreholes were drilled at two locations (Corehole 20 and Corehole 23). Continuous core samples were collected using the Christensen 94-millimeter wireline core barrel system and a 5-foot core barrel. The Christensen system allows for the collection of continuous core samples without tripping the drill string in and out of the borehole.

Table 2-1
Well Construction Details for Phase I Groundwater Monitoring Wells

Well No.	Well Comp. Date (1)	Drilling Method		Elev. of Concrete Pad (Ft.)	Borehole Depth (Ft.)	Well Depth (Ft.)	Well Screen Zone (Ft.)	Casing Diam. (In.)	Dedicated Pumps		Remarks
		Mud Rotary	Dual-Tube						Type	Set Depth (Ft.)	
Corehole 20	09/29/89	X		---	450	---	---	---	---	---	Grouted to surface
Corehole 23	10/06/89	X		---	360	---	---	---	---	---	Grouted to surface
OI-13C	12/03/89		X	384.78	160	155	110-150	4	Submersible	90	
OI-14C	03/09/90	X		357.06	540	540	485-535	6	Submersible	140	
OI-15A	01/04/90		X	444.38	122	115.5	105.5-115.5	3	Bladder	111	Conductor casing to 50 feet
OI-15B	12/21/89	X		444.76	400	395	370-390	6	Submersible	230	Conductor casing to 50 feet
OI-16A	01/21/90		X	527.21	130	129	109-129	3	Bladder	125	
OI-17A	11/18/89		X	513.04	196	70	60-70	4	Submersible	65	
OI-17B	01/26/90	X		513.38	450	395	340-390	6	Submersible	270	Conductor casing to 70 feet
OI-18A	01/23/90		X	483.36	67	30	20-30	3	Bladder	26	
OI-18B	10/31/89	X		483.74	475	301	256-296	6	Submersible	250	Conductor casing to 57 feet
OI-19A	10/28/89		X	414.31	190	181	156-176	4	Submersible	120	
OI-19B	10/26/89	X		370.91	455	245	200-240	6	Submersible	140	
OI-19C	10/30/89		X	414.78	113	113	88-108	4	Submersible	85	
OI-20A	11/10/89		X	426.48	174	174	139-169	4	Submersible	140	

Table 2-1
(Continued)

Well No.	Well Comp. Date (1)	Drilling Method		Elev. of Concrete Pad (Ft.)	Borehole Depth (Ft.)	Well Depth (Ft.)	Well Screen Zone (Ft.)	Casing Diam. (In.)	Dedicated Pumps		Remarks
		Mud Rotary	Dual-Tube						Type	Set Depth (Ft.)	
OI-20B	12/20/89	X		428.25	288	285	250-280	6	Submersible	150	Conductor casing to 60 feet
OI-21A	03/07/90		X	544.64	241	241	231-241	3	---	---	No pump, well dry
OI-21B	11/21/89	X		545.10	500	390	345-385	6	Submersible	340	
OI-22B	12/06/89	X		442.36	420	240	185-235	6	Submersible	150	Conductor casing to 30 feet
OI-23B	01/11/90	X		478.38	343	333	288-328	6	Submersible	220	
OI-25A	11/22/89		X	370.28	180	179	134-174	2	Bladder	170	
OI-25B	01/09/90	X		369.65	600	366.5	321.5-361.5	6	Submersible	100	
OI-26A	02/01/90	X		301.80	208	205	160-200	4	Submersible	90	
OI-26B	01/25/90	X		302.13	611	350	295-345	6	Submersible	70	
OI-27A	01/25/90		X	480.23	90	89	59-89	3	Bladder	85	
OI-28B	02/15/90	X		505.63	360	343	288-338	5/4	Submersible	230	Casing changes from 5- to 4-inch diameter at 273 feet
OI-29B	02/16/90	X		448.27	600	460	415-455	6	Submersible	220	

Notes:
1. Date well construction completed, pump installation and wellhead completion excluded
2. See Figure A-1 for plan and location of monitoring wells
3. All depth measurements are from ground surface
4. For additional well construction details, see Appendix D

Eleven of the monitoring well boreholes were drilled using the dual-tube/percussion hammer drilling technique. The dual-tube casing had a 10-inch outside diameter and 6-inch inside diameter. Drilling with this method allows for detection and potential sampling of perched water intervals.

Core samples, drive samples, or grab samples from drill cuttings were collected at regular intervals for description of the subsurface lithology. If available, core or drive samples were used for the logging because they are more representative of actual subsurface conditions. Boring logs describing the lithology were developed based on visual examination of these samples. A complete set of boring logs is in Appendix B.

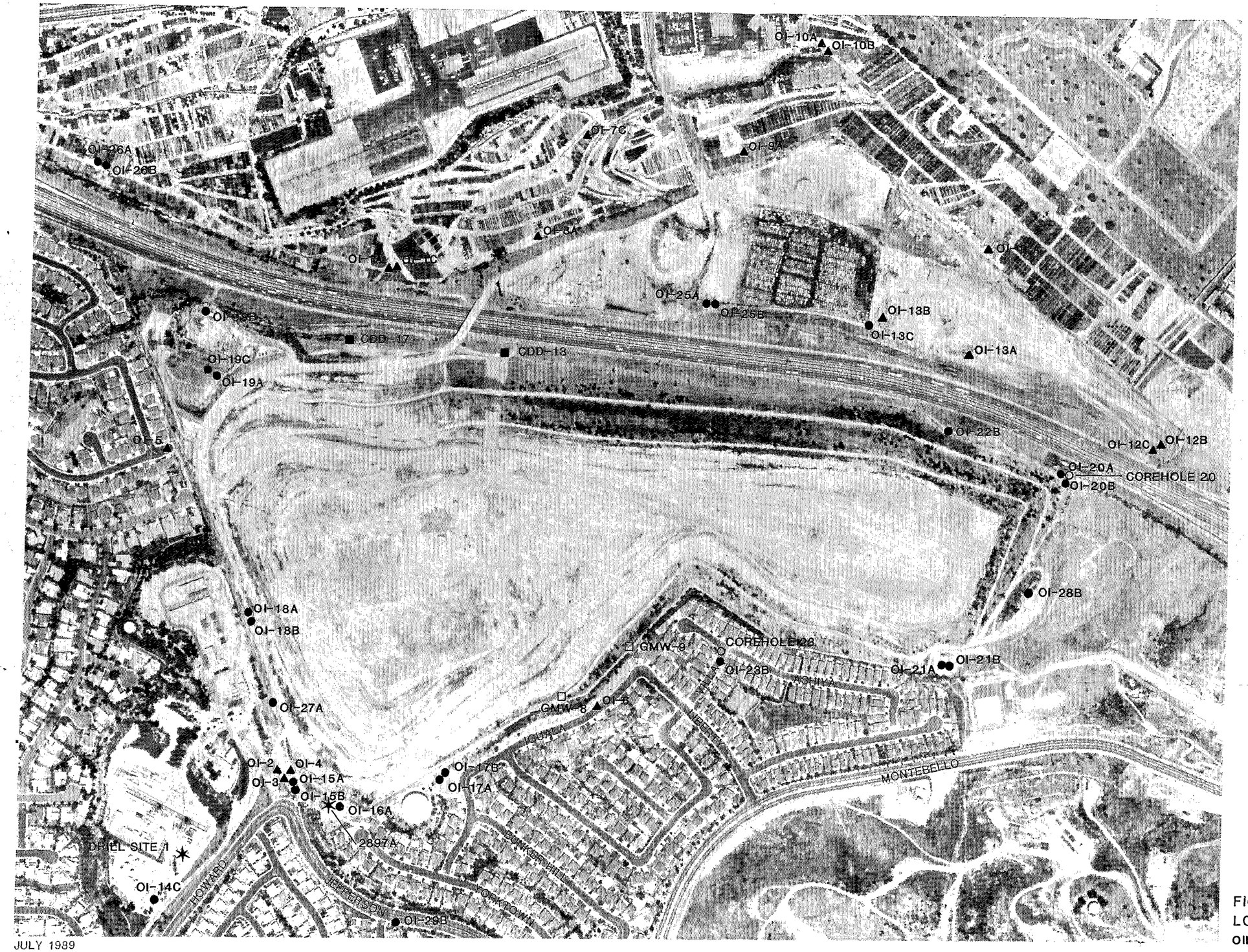
The pilot hole (or corehole) at each mud rotary location was geophysically logged immediately after reaching total depth. Geophysical logs were used to confirm subsurface lithology recorded on the boring logs and to aid in selecting appropriate monitoring well depths and screen intervals. Appendix C contains copies of all geophysical logs. The following suite of geophysical logs was completed at each borehole.

- Resistivity (16- and 64-inch normal)
- Spontaneous potential (SP)
- Focused resistivity
- Natural gamma
- Caliper

2.2 SOIL SAMPLING DURING DRILLING

Soil samples were collected for analysis at specified intervals during drilling. Samples were collected with a Modified California split-spoon sampler (either 18 or 24 inches long) on a downhole hammer or by coring into specified depth zones. The sample barrel was filled with either six or eight 2-inch by 3-inch stainless steel sleeves. Upon retrieval, one of the sleeves was emptied into a soil headspace jar for field GC analysis; the remaining sleeves were sealed and saved for possible shipment to a laboratory for detailed chemical analysis. Samples were selected for shipment to the laboratory based on field gas chromatograph (GC) results, number of sleeves available, and lithology.

The FSP specified that samples were to be taken every 20 feet up to 200 feet (every 10 feet from 0 to 100 feet with the dual-tube rig), then every 40 to 60 feet thereafter. The drilling contractor (WDC) originally planned on collecting drive samples with a downhole hammer suspended on a sand line; however, substantial difficulties in sample driving and recovery with this technique were encountered at the first borehole (OI-19B). In subsequent boreholes, the Speedstar 15TH rig was equipped with the



0 400 800

APPROXIMATE SCALE IN FEET

EXPLANATION

- ● CH2M HILL MONITORING WELL
- ○ CH2M HILL COREHOLE
- □ CH2M HILL LANDFILL GAS MONITORING WELL
- ▲ ECOLOGY AND ENVIRONMENT MONITORING WELL
- ■ CONVERSE, DAVIS, DIXON, & ASSOC. MONITORING WELL
- ✶ SOUTHERN CALIFORNIA GAS MONITORING WELL

FIGURE 2-1
LOCATIONS OF FIELD ACTIVITIES
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

JULY 1989

Christensen 94 millimeter wireline assembly for retrieving samples. A second Christensen assembly was not available for the Simco rig, consequently, very few samples were collected from OI-15B, OI-17B, OI-23B, and OI-28B.

To analyze for all desired parameters, seven full sample sleeves were required (soil headspace analysis by field GC, VOCs, 1,4-dioxane, semivolatiles, metals, soil pH and cation exchange capacity (CEC), and total organic carbon (TOC). Few samples contained enough full sleeves to complete all analyses. Consequently, for most samples only some of the desired analyses were requested. Very poor recovery was experienced when driving or coring samples in gravelly intervals. Therefore, soil samples are unfortunately missing in many of the permeable intervals.

2.3 MONITORING WELL INSTALLATION

After each borehole was drilled or reamed to the prescribed depth, well construction activities commenced. Typical well construction procedures and materials are described in this section. Detailed well completion diagrams for each monitoring well are contained in Appendix D, as is a typical wellhead completion diagram.

Conductor casing (present at six wells), set at depths ranging from 30 to 70 feet, was grouted into place with cement grout (containing 5 percent bentonite). The grout was allowed to set up overnight before drilling activities resumed.

Five different casing diameters (2-inch, 3-inch, 4-inch, 5-inch, and 6-inch) were used to construct the monitoring wells. Table 2-1 lists the casing diameter of each well. Four- or 6-inch-diameter casing is used in most of the wells. These larger diameters facilitate placement of a submersible pump in the well. Four-inch-diameter casing was limited to wells less than 200 feet deep, because of the difficulty in placing submersible pumps deeper than that in this size casing. The wells were constructed of either polyvinyl chloride (PVC) casing and slotted PVC well screen or a combination of PVC casing, stainless steel casing, and stainless steel wire-wrapped well screen. The typical casing sequence from well bottom to ground surface for both types is described below.

Small-diameter PVC Well:

1. Two- or 3-inch-diameter PVC slotted screen, (10 to 40 feet)
2. Two- or 3-inch-diameter blank PVC casing to surface, (20 to 231 feet)

Intermediate-diameter PVC and Stainless Steel Well Combination:

1. Four- or 6-inch-diameter stainless steel sump (5 feet)
2. Four- or 6-inch-diameter stainless steel screen
3. Four- or 6-inch-diameter blank stainless steel casing (15 feet)
4. Four- or 6-inch-diameter blank PVC casing to surface

The typical installation sequence is described below:

- The borehole annulus of the screened interval, from the bottom of the borehole to at least 10 feet above the screen, was filled with Monterey No. 3 sand to form a gravel pack.

- At least 2 feet of fine-grained transition sand (Grade 60-Golden Flint) was added on top of the gravel pack.

- A bentonite seal (at least 5 feet thick) consisting of either pellets or a thick bentonite slurry was emplaced.

- An annular well seal consisting of cement (with 5 percent bentonite) or volclay grout was tremmied to the surface.

Dedicated pumps are installed in 24 of the 25 monitoring wells completed in this investigation. A pump was not set in OI-21A because the well is dry. Nineteen wells contain submersible pumps and five wells have bladder pumps.

Bladder pumps are installed in the wells with 2- or 3-inch-diameter casing, all of which are low-yield wells. The pumps are generally positioned within a few feet of the well base to maximize the volume of water that can be purged before the well goes dry. The bladder pumps are the GEOGUARD model, made by American Sigma.

The submersible pumps are Grundfos stainless steel environmental pumps. These pumps are fabricated with solely stainless steel and Teflon parts. Pumps range from 0.33 to 1.5 hp and are equipped with a 3-phase, 230-volt motor. A Grundfos control box designed for the particular pump size is required to start the pumps. Most of the pumps are set between 10 and 25 feet below the pumping level from the aquifer test but above the top of the screened interval. For water level measurements, a PVC sounding tube is installed to a total depth of 5 feet above the pump in each of the wells furnished with a submersible pump.

Each wellhead is fitted with a well seal or cap and the necessary appurtenances for purging and sampling. For wells with a bladder pump, there is a fitting for attaching the control box and a plastic discharge line. There is a hole in the cap for water level sounder access.

In wells equipped with a submersible pump, the stainless steel discharge pipe is fitted with a stainless steel tee fitting. One side of the tee features a spigot for attaching a discharge (garden) hose. The other side has a 0.25-inch-diameter stainless steel ball valve for sample collection. A 20-amp male plug is provided, for connection to an external 220-volt, 3-phase power source. The end of the sounding tube also extends through the well seal.

To provide wellhead protection, 22 of the wells have a concrete pad around the well casing with a locking metal box attached to the concrete pad. Depending on location of the well, up to three bollards are installed around the concrete pad to provide additional protection to the wellhead.

Three wells (OI-19B, OI-23B, and OI-29B) are located in roadways, and instead of the concrete pad and metal box, they are completed in a 2-foot by 2-foot by 9-inch-deep flush-mounted, traffic-rated steel box.

Following well completion, monitoring wells were fully developed with a Smeal (truck-mounted) well development rig using repeated bailing, swabbing, pumping, and surging techniques until the discharge was clear and free of fines, as determined by the site hydrogeologist.

Five of the low yield wells (OI-15A, OI-16A, O-17A, OI-18A, and OI-27A) were developed by cycles of bailing dry, waiting for recovery, and swabbing. Three wells (OI-13C, OI-21A, and OI-25A) were developed by air-lift techniques. Well development routinely took between 10 and 20 hours per well.

Each new monitoring well and an existing Southern California Gas Company well (2897A) were surveyed to establish their location and elevation. Data collected included x-y position of the well (northing, easting), elevation of the concrete pad at the surface, and elevation of either the well cap or the sounding tube (if installed). The steel rim at ground surface was surveyed for the Gas Company well.

2.4 AQUIFER AND SLUG TESTS

Following well development, short-term (4-hour) constant discharge aquifer tests were performed at 18 of the 25 monitoring wells. Slug tests were completed on the six low-

yielding wells (OI-15A, OI-16A, OI-17A, OI-18A, OI-25A, and OI-27A). OI-21A is dry and could not be tested. The tests were run to provide an estimate of the hydraulic conductivity and transmissivity of the unit screened by each well. Results from the tests are provided in the discussion of hydrogeologic properties in Section 4.4. Details on the analysis of data from each test, including the associated graphs, is included in Appendix E.

Aquifer tests consisted of a 4-hour constant flow rate pumping test (5 hours at OI-22B), followed by a recovery test. The flow rate selected for each test was based on the well capacity and drawdown observed during well development activities. The maximum flow rate (27 to 31 gallons per minute [gpm] depending on the surface discharge arrangement) for many of the tests was limited by the size of the available pump and discharge pipe. Field parameters were monitored throughout the test, including temperature, pH, electrical conductivity, and, in some cases oxidation-reduction potential (Eh). Water levels, flow rates, and field parameters for each test are provided on the aquifer test data sheets included in Appendix E.

Slug tests were completed in wells that could not sustain a constant flow rate (greater than 1 gpm) for 4 hours. Five of the six wells slug tested have bladder pumps and one (OI-17A) has a submersible pump. Slug tests entailed removing a known volume of water from the well with a bailer (except for OI-17A), then measuring water levels with a data logger as the well recovered to the pretest water level. OI-17A was evacuated by rapidly pumping it dry with the installed submersible pump. Readings were recorded from 4 to 24 hours depending on the recovery rate. Water levels and other pertinent information from the tests are included on slug test data sheets in Appendix E.

2.5 WELL SAMPLING

Groundwater samples were collected during: 1) drilling if significant quantities of perched water were detected, 2) aquifer testing, and 3) routine sampling of completed wells.

Details on sampling methods, volumes, containers, field procedures, and requested analyses are covered in the Field Sampling Plan for the Hydrogeology Investigation, Operating Industries, Inc. Landfill (EPA; September 14, 1989). Sampling activities occurred between November 15, 1989, and May 10, 1990.

Perched water was detected in several of the boreholes installed with the dual-tube rig. However, in only two borings, OI-13C and OI-17A, did enough liquid accumulate to permit sampling during drilling.

During aquifer tests of each new well, groundwater samples were gathered for both field GC and laboratory analysis. Field GC samples were taken at four times during the test: after 0.5, 1, 2, and 4 hours of pumping. The time dependant samples were to be used to evaluate concentration trends over time. For the most part, no contaminants were detected by the field GC, so potential trends could not be examined. At the conclusion of the test (4 hours), samples were collected for laboratory analysis of VOCs and 1,4-dioxane.

Three routine samples from each new monitoring well were collected for complete routine analysis. Camp Dresser and McKee, Inc. (CDM) provided a field crew to sample wells CDD-13, CDD-17, and Drillsite No. 1 during December 1989. Well 2897A was sampled by CH2M HILL during March 1990.

Analyses requested for the routine sampling were:

- VOCs
- 1,4-Dioxane
- Ammonia-N
- Anions
- Total Dissolved Solids (TDS)
- Semivolatile Organic Compounds
- Pesticides and polyvinylchlorinated byphenyls (PCBs)
- Total Organic Halides (TOX)
- Purgeable Organic Halides (POX)
- Cyanide
- Metals
- Total Organic Carbon (TOC)
- Purgeable Organic Carbon (POC)

Sulfides analysis was added to the list in the middle of the program. In the first two rounds of routine sampling, samples for metals were filtered. In the last round of routine sampling, both filtered and unfiltered samples were sent for total metals analysis. The final sampling event encompassed all wells (including the 17 monitoring wells installed previous to this investigation) and took place between April 24 and May 10, 1990.

Wells fitted with submersible pumps were typically sampled immediately following the purging of three well volumes from the well. Wells with bladder pumps were purged dry on one day and sampled the following day. Throughout purging, field parameters of the discharge water were measured. Parameters measured include temperature, pH, conductivity, and in some instances oxidation-reduction potential (Eh) and dissolved oxygen. Additional detail on sampling procedures is provided in Section A-13 (Appendix A).

Section 3
GEOLOGY

Section 3
GEOLOGY

3.1 PRIOR INVESTIGATIONS

Previous investigations have provided useful data for analyses of the OII site geology as summarized in the South Parcel Hydrogeology Existing Data Technical Memorandum, Operating Industries, Inc., Monterey Park, California (EPA, October 12, 1988), and the Operating Industries, Inc., Landfill South Parcel Geotechnical Task--Existing Data and Literature Review (EPA, November 16, 1987).

John Minch (1990) reviewed existing published geologic literature and utilized biostratigraphic techniques to determine the age and formation names of the shallow (less than 2,000 feet) lithologic units at the OII site. Depositional models of Yeo (1984), Normark (1978), Walker (1984), and Nelson and Kulm (1973) were used to interpret the paleo environments of these shallow lithologic units.

3.2 SITE STRATIGRAPHY

The upper Tertiary generalized stratigraphic sequence in the San Gabriel and Central Basins, from oldest to youngest, is the Repetto Formation (early Pliocene), Pico Formation (late Pliocene), San Pedro Formation (early Pleistocene), and Lakewood Formation (late Pleistocene).

The Repetto Formation is of marine origin and consists primarily of siltstone with interbedded sandstone and conglomerate. The Repetto Formation is estimated to be 5,000 feet thick in the Central Basin and over 2,000 feet thick in the San Gabriel Basin (CDWR 1961, 1966). The Repetto Formation occurs at depths greater than 1,400 feet below the OII Landfill.

Several shallow formations (Table 3-1) have been defined and used to describe the rocks in the area of the OII site. These formations include the Pliocene Pico Formation or Pico Time Unit, the Pleistocene San Pedro Formation, the upper Pleistocene Lakewood Formation, upper Pleistocene terrace deposits, and upper Pleistocene older alluvium (including terrace deposits).

Table 3-1
Correlation Chart of Shallow Geologic Units, OII Site

Geologic Age	Correlative Units				
Upper Pleistocene	Terrace Deposits	Older alluvium Lakewood Formation	Fernando Formation	Lakewood Formation	Lakewood/ San Pedro/ Hydrogeologic Unit
Lower Pleistocene	Saugus Formation	San Pedro Formation	Fernando Formation	San Pedro Formation (Marine)	
Pliocene	Pico Formation	Pico Formation	Fernando Formation	Pico Time Unit	Pico Hydrogeologic Unit
Source	Quarles, (1941)	CDWR, (1961)	Lamar, (1970)	Minch (1990)	This Report

Minch (1990) proposed the following formation names for the shallow lithologic units at the OII site:

- Pico Time Unit for all Pliocene deep marine turbidite facies
- San Pedro Formation for all Pleistocene shallow marine facies
- Lakewood Formation for all nonmarine fluvial-alluvial fan facies

Lithofacies and deep water fauna indicate deposition of the Pico Time Unit within a submarine fan environment. This report will use Pico Time Unit and Pico Formation interchangeably with the understanding that the interval is a biostratigraphic time unit. The presence of shallow-water marine Pleistocene foraminifera and mollusks within the local San Pedro Formation suggests shallow marine deposition. Transported shallow-water fauna as well as outer shelf to deep water fauna are found in the Pico Time Unit in the vicinity of the OII site. The Lakewood Formation at the OII site was deposited by braided streams and alluvial fans according to Minch (1990) (Figure 3-1).

3.2.1 PICO TIME UNIT

The regionally extensive upper Pliocene Pico Formation underlies portions of the OII Landfill (Plate 1), and surface exposures are common in the OII site vicinity. The local Pico formation is of marine origin and can be divided into upper, middle, and lower members based on lithology and paleontology (CDWR, 1966 and Minch, 1990).

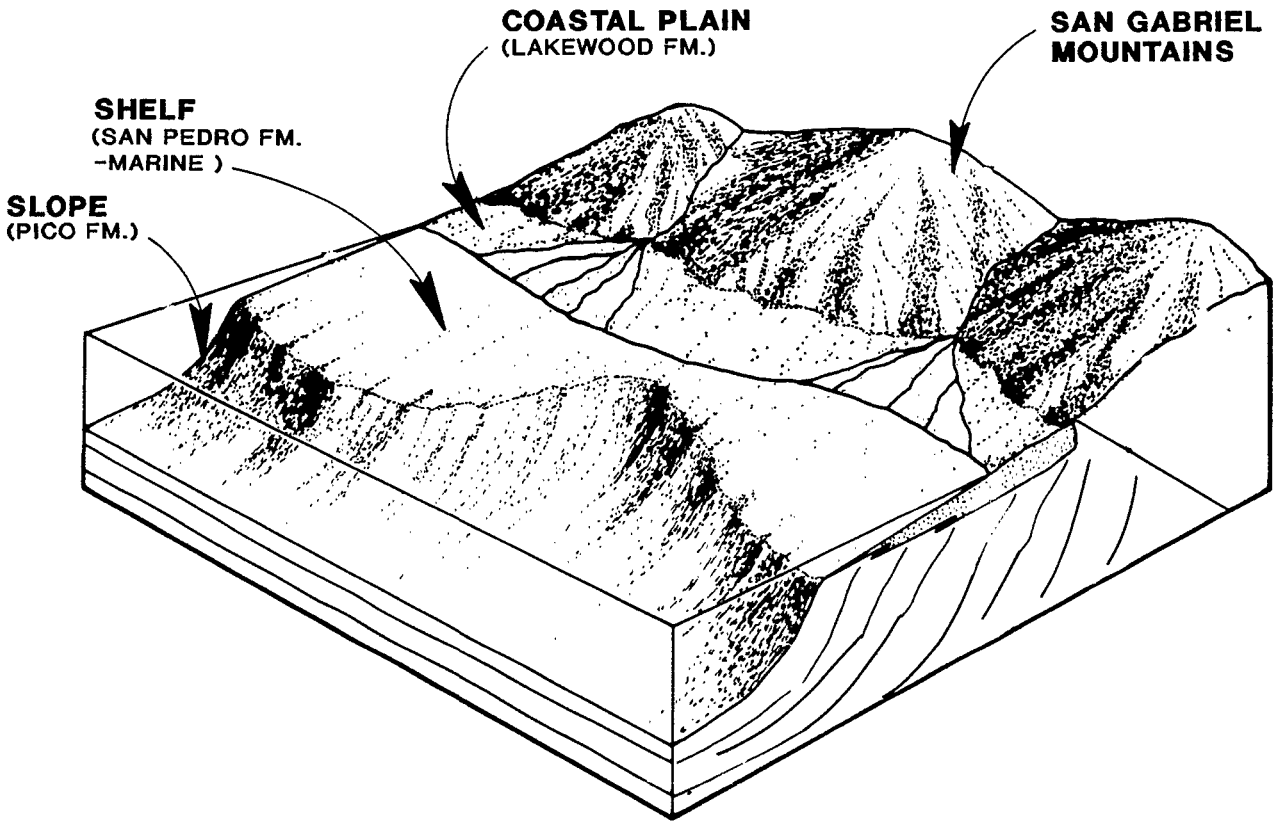


FIGURE 3-1
DIAGRAMMATIC REPRESENTATION OF
ANCIENT TOPOGRAPHY AND
DEPOSITIONAL ENVIRONMENTS
ALONG THE SAN GABRIEL MOUNTAINS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

Marine Pliocene rocks of the Pico consist of alternating sandstones, sandy shales, clayey shales, and siltstones, and range in bed thickness from less than an inch to several hundred feet. The shales and siltstones grade in color from light grayish olive in the upper Pliocene to dark brown in the lower. Trask and Hamar (1935) noted that the color gradation corresponds with an increase in the quantity of organic matter present.

Foraminiferal remains are abundant throughout the shaley portions of the section, megafossils are present, but are not in sufficient abundance to make detailed correlations (Minch, 1990).

According to Minch (1990), foraminifera are numerous in upper Pliocene rocks and mollusks are locally abundant. These fossils indicate a late Pliocene age in the downtown Los Angeles-Elysian Hills area and Repetto Hills (Soper and Grant, 1932; Wissler, 1941; Natland and Rothwell, 1954). The upper Pico is characterized by two foraminiferal assemblages, the upper is the *Uvigerina aff. tenuistriata* fauna and the lower is the *Cibicides mckannai-Gyroidina altiformis* fauna (Minch, 1990). The middle Pico is comprised of the *Uvigerina peregrina* faunal assemblage, which is divided into a number of zones and subzones. In general, the middle section is predominantly shale. The lower Pico age strata are characterized by the *Bulimina subacuminata* faunal assemblage (Minch, 1990). The sediments contain a higher percentage of sand than those of the overlying middle Pico.

The lower Pico consists predominantly of greenish-gray massive siltstone with interbedded fine- to coarse-grained, light gray, feldspathic sandstone, claystone, and shale. The upper Pico consists of predominantly fine-grained micaceous silt and clay deposits interbedded with marine sand and gravel. CDWR (1966) reports that the thickness of the marine sand and gravel deposits range from 20 feet to over 100 feet. Minch (1990) reported that these marine sand and gravel deposits may be up to 300 feet thick. Deep-sea conglomerates, similar to those found in the Pico Time Unit, are mainly graded, with less common ungraded conglomerates and rare inversely graded beds (Hein, 1984). Deep-sea conglomerates have a-axis flow-parallel, a-axis upstream imbricate fabrics. Fining units are concave-up lenses bounded by lower scour surfaces as seen in outcrop south of the OII site. The major scour surfaces are 3 to 33 feet deep (Hein, 1984). Vertical sequences such as at the Garfield Avenue outcrop, are generally 16 to 33 feet thick and typically fine upward. Sedimentary structures are dominantly massive.

The upper Pico is at least 700 feet thick in the Montebello Hills, and the overall thickness of the Pico is approximately 1,500 feet (Quarles, 1941). The upper and lower members of the Pico Formation are indistinguishable (based solely on lithology) in the OII Landfill vicinity and are not treated separately in this report.

3.2.2 SAN PEDRO FORMATION

The San Pedro Formation occurs throughout the San Gabriel and Central Basins (CDWR 1961, 1966). The early Pleistocene San Pedro Formation unconformably overlies the Pico Time Unit. The San Pedro contains coarse sand and conglomerate of both marine and fluvial origin interbedded with dark gray sandy marine siltstone. The continental deposits typically are tan colored.

The San Pedro Formation is less than 100 feet thick along the western boundary of the OII site and thickens rapidly to over 1,500 feet near Garfield Avenue one mile west of the site (Quarles, 1941). The San Pedro Formation is 2.000 feet thick in the southern portion of the San Gabriel Basin (CDWR, 1966).

3.2.3 LAKEWOOD FORMATION

The Lakewood Formation, Older alluvium, terrace deposits of late Pleistocene age, and Recent alluvium deposits are extensive throughout the low-lying areas and stream channels of the San Gabriel and Central Basins. These fluvial (stream deposited) nonmarine deposits consist of coarse sand, gravel, cobbles, and, in areas of the San Gabriel Basin, boulders. The differences between deep-sea and fluvial conglomerates are mainly based on the type of grading, fabric, and type of stratification and crossbedding present. Grading of individual beds in the Lakewood Formation and nonmarine San Pedro is not common. The fluvial sandstones are generally ungraded and stratified. Fluvial gravel units form convex-up lenses bounded by lower flat surfaces. Vertical sequences of gravel and sand commonly fine upward and are typically 1 to 6 feet thick. Imbricated clasts generally dip upstream. The thickness of the alluvial deposits in the San Gabriel Basin range from 30 to 2,000 feet. In general, the thickness increases from north to south. The thickness in the Central Basin ranges from 0 to 200 feet (Section D-D').

Based on available information, it has not been possible to determine if the surface Pleistocene material adjacent to portions of the OII Landfill are Lakewood or San Pedro Formation. Therefore, for this Phase I Hydrogeologic Investigation, the material is included as the Lakewood/San Pedro Hydrogeologic Unit, listed in Table 3-1 and described in Section 3.5.1. The Lakewood/San Pedro Hydrogeologic Unit outcrops at the western, northern, and easter perimeter of the South Parcel and throughout the North Parcel.

3.3 SITE DEPOSITIONAL HISTORY

Subsidence of the Los Angeles Basin (of which the OII site is located in) started approximately 20 million years (m.y.) ago in middle Miocene time (Sharp, 1976). Subsidence was associated with the extrusion of volcanic material. The oldest formation within the basin is the Topanga Formation and is locally over 10,000 feet thick. Uplift and erosion occurred in the basin prior to renewed subsidence in Miocene time. Marine sedimentation continued with the deposition of the Pliocene Repetto siltstones and sandstones which are now exposed in the Repetto Hills, northwest of the OII site. Erosion of the uplifted granitic San Gabriel mountains north of the OII site provided detritus to the ocean. Fine-grained sediments were deposited onto the shelf and slope with sands and gravels being deposited by turbidity currents out onto submarine fans. The Marine San Pedro Formation was deposited near shore while sediments of Pico deeper water facies were transported seaward onto the oceanic slope approximately 2 m.y. in Pliocene time. Uplift of the Merced and Montebello Hills and San Gabriel continued to supply detritus to the depositional basin. During middle Pleistocene time (1 m.y.) the Merced and Montebello Hills formed a highland that locally divided the Los Angeles Basin into two distinct areas: the San Gabriel Basin to the north and Central Basin to the south. As sea level regressed and the San Gabriel Basin filled, continental sediments of the San Pedro Formation were deposited over the marine facies. Erosion of the uplifted Merced and Montebello Hills and San Gabriel mountains provided material for the fluvial (stream-laid) sand and gravel deposits of the Lakewood Formation during late Pleistocene and Holocene time (0.5 m.y. to present) (Figure 3-1).

3.4 HYDROGEOLOGIC UNITS

Two hydrogeologic units, the Lakewood/San Pedro Hydrogeologic Unit and the Pico Hydrogeologic Unit, have been defined utilizing lithologic descriptions, subsurface geophysical logs and field and laboratory test data. These units were defined based on similar hydrogeologic properties. The Pico Unit has been further subdivided into the Pico silt and the Pico sandstone and conglomerate units. The apparent thickness and lateral continuity of the hydrogeologic units across the OII site are shown on hydrogeologic cross-sections A-A' through H-H' (Figures 3-3 through 3-10). The cross-section base map is Figure 3-2. Figures 3-2 through 3-10 are located at the end of this section.

3.4.1 LAKEWOOD/SAN PEDRO HYDROGEOLOGIC UNIT

The Lakewood/San Pedro Hydrogeologic Unit (Lakewood/San Pedro Unit) includes the coarse-grained San Pedro Formation and the overlying fluvial Lakewood Formation. The Lakewood/San Pedro Unit ranges in thickness from 30 feet on the western boundary of the South Parcel to 200 feet northeast of the OII site (Section A-A'). The Lakewood/San Pedro Hydrogeologic Unit is an unconfined aquifer in the study area. Where the unit is saturated, the saturated thickness ranges from approximately 10 feet to 100 feet.

The Lakewood/San Pedro Unit contains the five major drinking water aquifers of the Central Basin. The Lakewood/San Pedro Unit also occurs in the San Gabriel Valley and is a source of groundwater used for drinking and irrigation (CDWR, 1966). The Lakewood/San Pedro Unit, however, is not the primary source of drinking water in the San Gabriel Basin as it is in the Central Basin.

At the OII site, the Lakewood/San Pedro Unit consists predominantly of weakly cemented sandy conglomerate of marine and continental origin with occasional interbedded sandy siltstone and sandstone. The lithofacies of the Lakewood/San Pedro Unit consist of fine- and coarse-grained interfingering zones; however, as a whole, the unit is laterally continuous and highly permeable. The sandstone is grayish orange, fine- to coarse-grained, poorly to well sorted, weakly to moderately cemented, massive to thinly bedded, and contains quartz, feldspar, and mica. Sandstone grades to dark yellowish-orange pebble conglomerate. The conglomerate is clast supported, contains medium- to coarse-grained sand matrix, with pebbles of weathered dark grey schist, granite, and Ca-feldspar rich plutonic rocks. The siltstone is a minor component that is light gray-brown, micaceous, weakly cemented and contains abundant orange mottling. Grain size analyses (ASTM D422) were performed on representative samples of the Lakewood/San Pedro Unit and are presented in Appendix I. These analyses corroborate field descriptions of the Lakewood/San Pedro Unit.

3.4.2 PICO HYDROGEOLOGIC UNIT

The Pico Hydrogeologic Unit (Pico Unit) is a weakly cemented massive marine sandy siltstone with very fine interlaminated micaceous sandstone. Interbedded massive permeable units ranging from sandy conglomerate to silty coarse sandstone occur in the Pico Unit and are described in the following section. The permeable beds within the Pico Unit are separated and confined by the Pico siltstone.

3.4.2.1 Pico Unit Siltstone

The Pico siltstone outcrops on the southern boundary of the South Parcel (Plate 2). At the surface, the siltstone is generally moderate yellowish-brown or light brown. At depth the color is more commonly olive-gray. The color transition is distinct and occurs at a depth of 46 feet in OI-25A, 32 feet in OI-25B, 58 feet in OI-13C, and 70 feet in OI-17B. The color change represents the historical average transition from an oxidizing to a reducing environment.

The percentage of fine sand in the Pico siltstone varies with depth. The fine sand content of siltstone samples analyzed for grain-size ranges from 22 to 30 percent (Appendix I). The fine sand is observable in core and drive samples as 1- to 2-millimeter thick laminations. Cross-bedding and convoluted laminations can be seen.

3.4.2.2 Pico Unit Sandstone and Conglomerate

Minch (1990) interpreted the Pico Unit sandstone and conglomerate units to be submarine channel deposits (turbidites). A turbidite is the deposit of a turbidity current. A turbidity current is more dense than the ambient fluid (sea water) due to the presence of dispersed sediment. As a turbidity current flows down a submarine fan, the coarsest debris is deposited as the current wanes. The finest fraction of the bed load is deposited farther down gradient. The submarine channels in which turbidity currents flow, migrate similarly to that of a braided stream on a subaerial alluvial fan. The resulting deposits are very lenticular and discontinuous. The channels on the submarine fan migrate laterally as the fan aggrades into the depositional basin. This results in many sandstone and conglomerate units being isolated.

Classic turbidite deposits, in outcrop, consist of very regularly bedded, alternating coarse-grained and fine-grained strata. The coarse-grained strata are typically sandstones and fine-grained strata are shales. The sandstone/shale ratio can be highly variable. Coarse-grained massive pebbly sandstones and conglomerates are resedimented deposits associated with the classic turbidite.

The size of a turbidite depends on the number of turbidity currents depositing sediment consecutively. Episodic turbidity flow will result in turbidites that are separated by relatively thicker sequences of pelagic sediments. The bed geometry of sandstones and conglomerates in the slope-channel environment is determined by the scale of the channel and the volume of debris being deposited.

Interbedded coarse-grained beds ranging from silty sandstone to sandy conglomerate occur within the Pico siltstone. These Pico sandstone and conglomerate units range in thickness from 20 feet to approximately 350 feet near Wheeler No. 102 (Figure 3-3).

For the purposes of this report, we have limited discussion to the three uppermost units in ascending order: the "A" Sand, the Upper Sand, and the Lower Sand (Figure 3-3). Numerous other unnamed lenticular coarse-grained beds occur within the Pico unit. The Upper Sand was previously called the Upper Silty Sand and the Lower Sand was called the Lower Silty Sand in the South Parcel Hydrogeology Existing Data Technical Memorandum, Operating Industries, Inc., Monterey Park, California (EPA, October 12, 1988).

3.4.2.2.1 The "A" Sand. The "A" Sand underlies the shallow sandstones (upper and lower sands) and is commonly separated from the lower sand by approximately 50 to 100 feet of siltstone (Figure 3-3). The unit is typically 300 feet thick south of the site; it has an apparent maximum thickness of 350 feet near Wheeler No. 102 and rapidly thins to the north. The "A" Sand appears to be laterally continuous in the vicinity of the OII site for approximately 3,600 feet on Section A-A' (Figure 3-3). However, the lateral continuity to the north and south (Figures 3-5, 3-7, and 3-9) is limited. This structure is consistent with the interpretation of the Pico Unit sandstone and conglomerates as turbidite deposits. The "A" Sand consists of sandy conglomerates with interbedded fine- to coarse-grained arkosic sandstone and silty fine-grained sandstone. The color is olive gray. The conglomerates are clast-supported, poorly sorted, rounded to subangular clasts (maximum less than 2-inch diameter [maximum diameter of the recovered clasts is a function of the coring tool]) with fine- to coarse-grained quartz, feldspar, and micaceous matrix. The unit is weakly cemented.

3.4.2.2.2 Shallow Sandstones. The shallow sandstones (Upper Sand and Lower Sand) of the Pico Unit consist of interbedded sandstone, sandy siltstone, and conglomerate units. The color varies from light olive gray to dark greenish gray. The sand fraction is fine- to coarse-grained and is composed of quartz, feldspar, and mica. The sandstone is typically loose and massive, whereas the siltstone is laminated. The sandstone grades to a sandy conglomerate which is clast-supported, dark greenish gray, and poorly sorted with a fine- to coarse-grained sand matrix. Pebble clasts are round to subangular and are less than 2-inch maximum diameter. The shallow sandstones of the Pico Unit are typically less than 100 feet thick and vary from laterally continuous to discontinuous from 100 feet to greater than 1,000 feet (Section E-E'). Grain size analysis (ASTM D 422) was performed on representative soil samples from selected intervals within the shallow Pico sandstones (Appendix I). These analyses corroborate field descriptions of the Pico sandstones.

3.5 SITE STRUCTURAL GEOLOGY

This section describes the structural geology of the OII site. The occurrence of folding and faulting is shown on the geologic map (Plate 2) and the hydrogeologic cross-sections (Figures 3-3 to 3-10), located at the end of this chapter.

3.5.1 FOLDING

The present topography of the Montebello Hills was formed by erosion of the uplifted, folded, and faulted east-west trending Montebello Anticline (Plate 2). The Montebello Hills and the Repetto Hills to the northwest are essentially continuous, but are separated structurally by the western trending Potrero Grande Syncline (Plate 2). The axis of the Montebello Anticline plunges westward and roughly parallels the Montebello Fault (Quarles, 1941 [Figures 3-5 and 3-10]). The South Parcel is underlain by the West Montebello Anticline which trends westerly and plunges to the west (Plate 2). Previous reports (EPA, February 12, 1987, and CDWR, 1966) reported that the West Montebello anticline appeared to splay off from the Montebello Anticline approximately 1,000 feet south of the eastern end of the site. This interpretation is not consistent with the new subsurface lithologic and structural data obtained during this investigation. Structural measurements and geologic cross-sections, developed from the new well log data, indicate that the West Montebello anticline may be a separate structural feature from the Montebello Anticline southeast of the OII site. Plate 2 and Figure 3-3 show the apparent axis of the West Montebello Anticline. The general structural trend southwest of Baldwin No. 135 is to the south, and is north as you proceed northeast from GMW-11. Section E-E' (Figure 3-7) also shows the anticlinal form of the West Montebello Anticline.

3.5.2 FAULTING

The Montebello Fault was originally mapped by Quarles (1941). The fault has been located in different positions relative to the Montebello Anticline on geologic maps by investigators who have worked in the area. Quarles (1941) mapped the Montebello Fault approximately 400 feet south of the Montebello Anticline and described it as a normal fault (northside downthrown). The CDWR (1966) located the fault virtually on top of the Montebello Anticline axis. E&E located the fault about 200 feet north of the axis of the Montebello Anticline (EPA, February 12, 1987). In this report, the Montebello Fault and the Montebello Anticline are placed in approximately the same location as they were originally mapped by Quarles (1941). As displayed in Plate 2, the fault is shown between Baldwin No. 125 and Baldwin No. 165 with the northside downthrown as described by Quarles.

E&E mapped two north-south trending faults transecting the OII site on the south side of the landfill (EPA, February 12, 1987). Neither of these faults is evident in the deeper units on the geologic cross-sections A-A' and B-B'. In a preliminary field survey, CH2M HILL found no evidence of these faults in the surface geology; therefore, these two faults have not been shown in Plate 2. A northeast-southwest trending fault (S31W) was observed by CH2M HILL near the interior flare station (FS2) facility and is approximately located on cross-section E-E' (Figure 3-7) near OI-19B. At this exposure, the Lakewood/San Pedro Unit is down-dropped on the north side of the fault relative to the Pico Unit. The lateral and vertical extent of this feature is unknown.

Faults tentatively identified by E&E (EPA, February 12, 1987) on the North Parcel are not apparent in the geologic cross-sections nor were they observed in outcrop in a preliminary field survey by CH2M HILL.

3.6 GEOLOGIC CROSS-SECTIONS

3.6.1 DEVELOPMENT OF CROSS-SECTIONS

Cross-sections A-A' through H-H' (Figures 3-3 through 3-10) were constructed to aid in understanding the site geology, groundwater flow pathways from the site, and the relation between the OII site and water supply aquifers in the San Gabriel Valley and the Central Basin. The locations of the cross-sections are shown in Figure 3-2. This report section outlines the data sources, assumptions, and areas of poor control with the cross-sections.

The geologic cross-sections were constructed predominantly with available borehole electric logs (E-logs) to delineate lithologic units with differing hydrogeologic properties. Electric logs are borehole geophysical logs that typically include an SP log and resistivity log for the wells in the vicinity of OII. Variations in lithologic units were delineated by studying the resistivity plot on the logs, and by determining a baseline resistivity value for the low resistivity siltstone units of the area. Deviations from the baseline indicate a change in lithology. The higher resistivity intervals are assumed to be indicative of coarse-grained units. These units were then correlated from well to well. Lithologic logs were used to fill in the data gaps where E-log data were lacking.

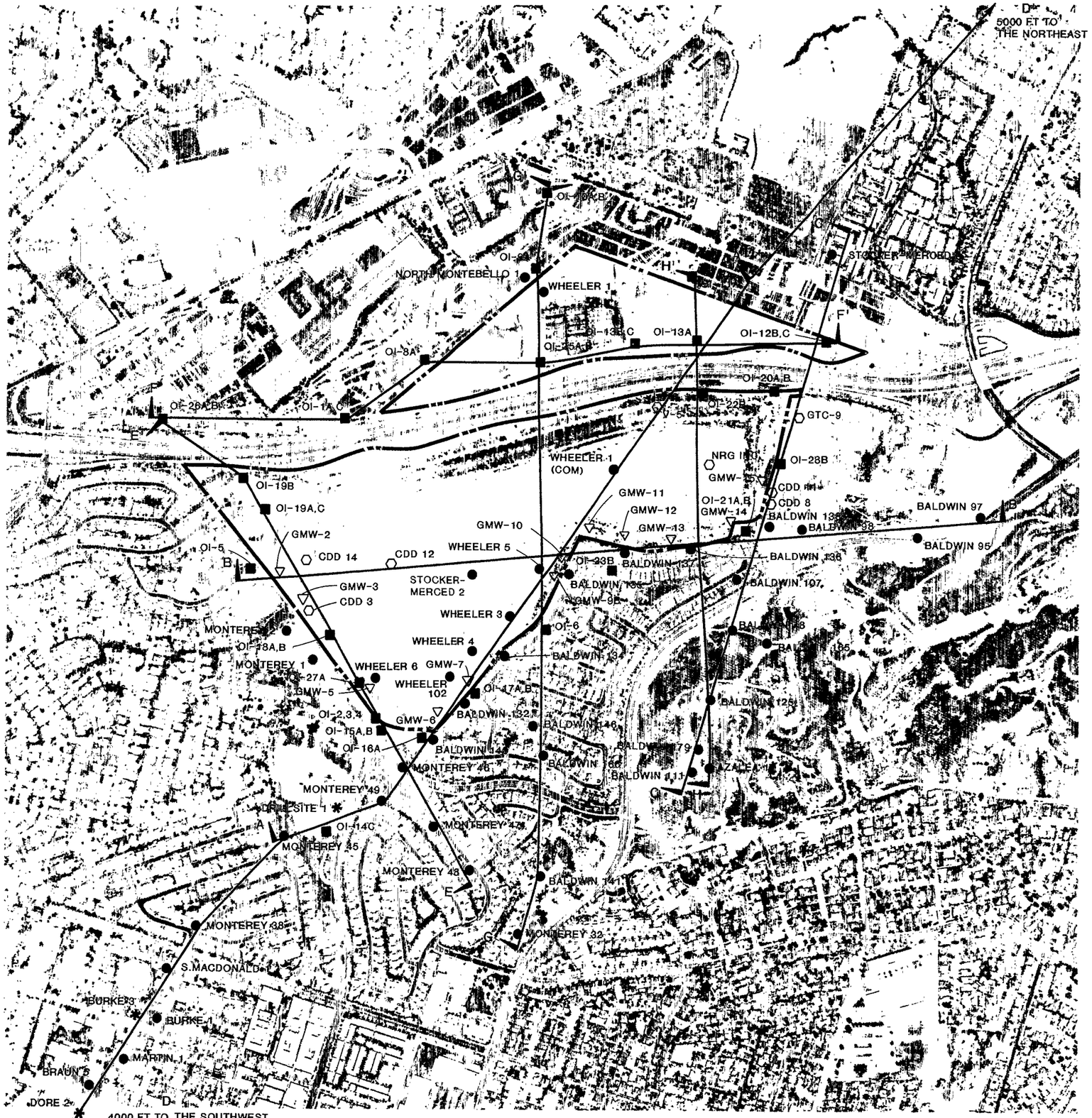
There are general differences in the resistivity of various saturated formations. Silt, clay, and shale have the lowest resistivity; sand and gravel formations containing fresh water have moderate to high resistivity. Assuming the overall water quality remains the same, deviations from a low resistivity baseline indicate higher sand and gravel content. These units are assumed to have a higher permeability.

The geophysical logs of wells used to construct the cross-sections are from both monitoring wells, and exploratory oil and gas wells. The highest elevation for which an E-log is available for each boring is indicated in the cross-sections. The E-logs for the oil and gas wells commonly start at depths of approximately 100 to 500 feet. Lithologic descriptions (drillers' logs) for the oil and gas wells above the E-log are commonly very generalized and do not provide good detail for lithologic correlation.

Data available for new wells drilled as part of this investigation include SP, electrical resistivity, and gamma ray logs (Appendix C), as well as field classification of soil samples according to the Visual-Manual Procedure for Description of Soils (ASTM D 2488) [Appendix B].

The cross-sections were constructed to depths several hundred feet below the base of the landfill. This depth was necessary to assess the geologic structure beneath the site. Some sections (A-A', C-C', D-D', E-E') are not drawn perpendicular or parallel to structure. The orientation of the sections was based mainly on the density of available data. The dips represented on these sections do not represent actual dips. For consistency, all cross-sections, except D-D', were constructed without vertical exaggeration. The cross-sections were based on mean sea level (msl) datum and are not balanced sections with respect to formation thickness.

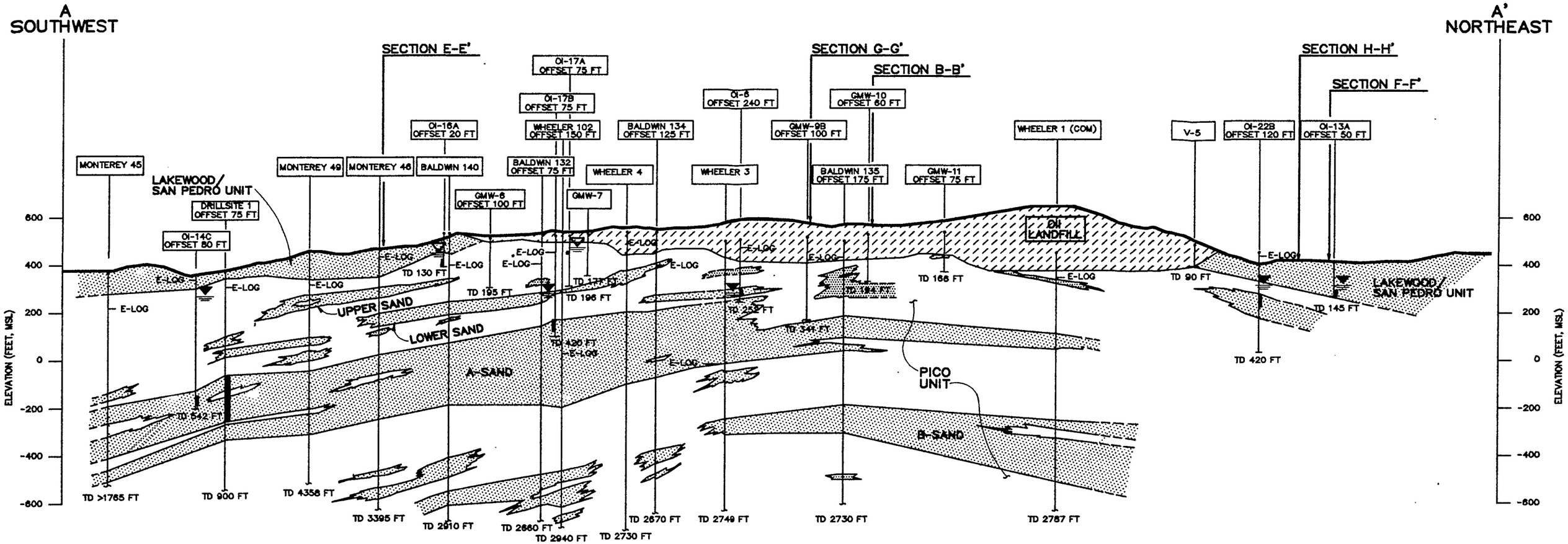
Thin (less than 10 feet) sandstone and conglomerate units within the Pico Time Unit were grouped as siltstone for the purposes of general correlation. Elevations of some borehole tops were based off United States Geological Survey (USGS) topographic quadrangles, although most were surveyed to MSL datum. The lateral extent of coarse-grained sediments, as shown on the cross-sections is inferred due to the lenticular and discontinuous nature of sandstone and conglomerate units.



LEGEND:

- ■ OII GROUNDWATER MONITORING WELLS (E & E, CH2M HILL)
- ● OIL AND GAS WELL
- ✱ SO. CALIFORNIA CO. MONITORING WELL
- ○ GEOTECHNICAL SOIL BORINGS (CDD - CONVERSE, DAVIS, DIXON & ASSOC., V-LOCKMAN & ASSOC., GTC-GEOTECHNICAL CONSULTANTS, INC.)
- ▽ LANDFILL GAS MONITORING WELLS (CH2M HILL)
- SITE BOUNDARY
- A A' LOCATION OF HYDROGEOLOGIC CROSS SECTION

FIGURE 3-2
LOCATIONS OF HYDROGEOLOGIC CROSS SECTIONS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION



LOOKING NORTHWEST

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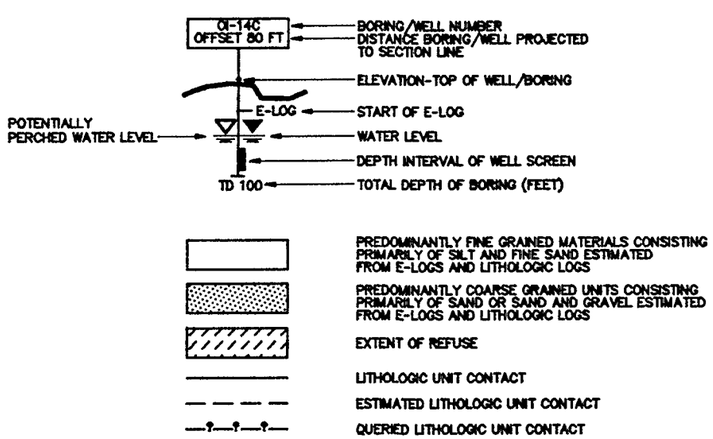
HORIZONTAL AND VERTICAL



NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

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FIGURE 3-3
HYDROGEOLOGIC CROSS SECTION A-A'
OH SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

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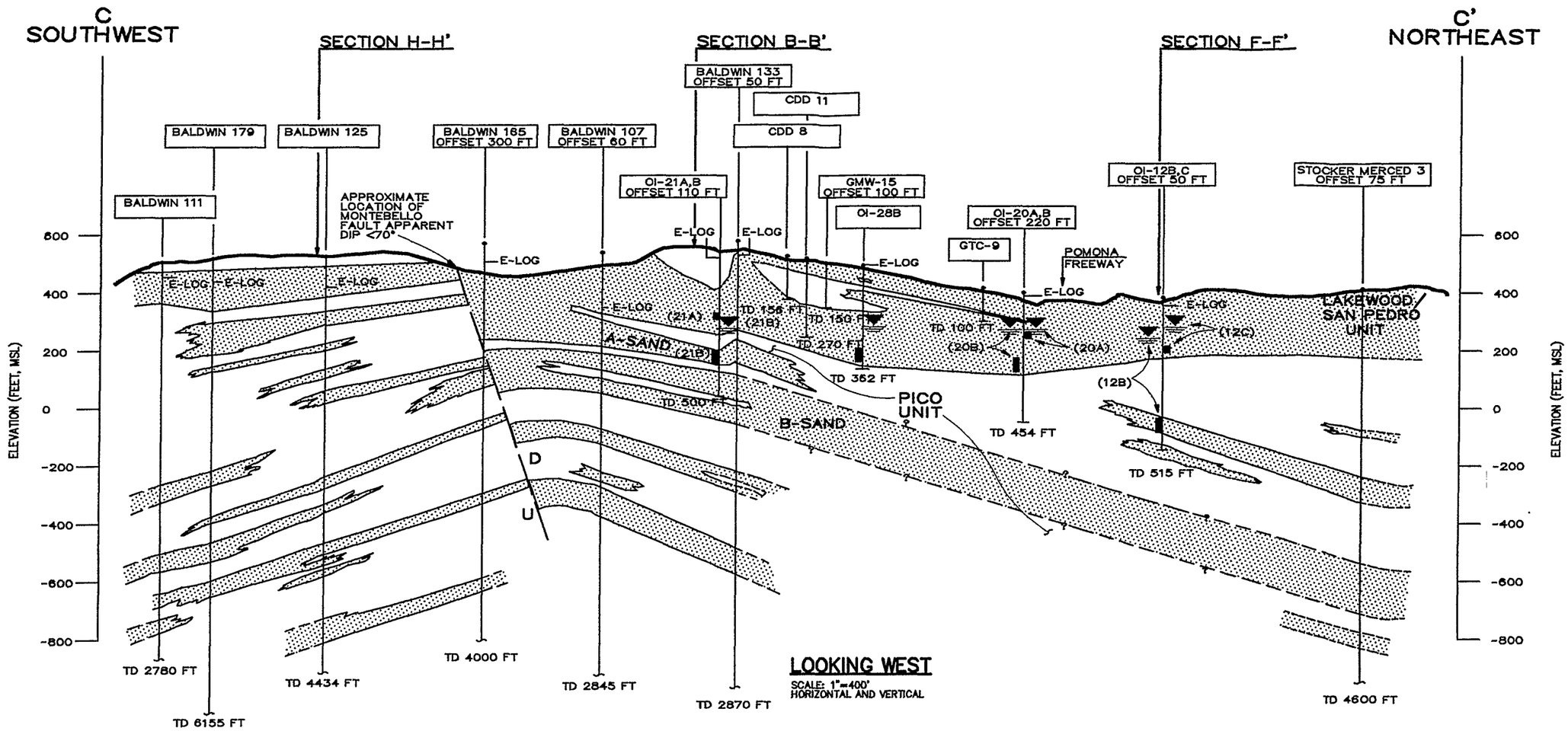

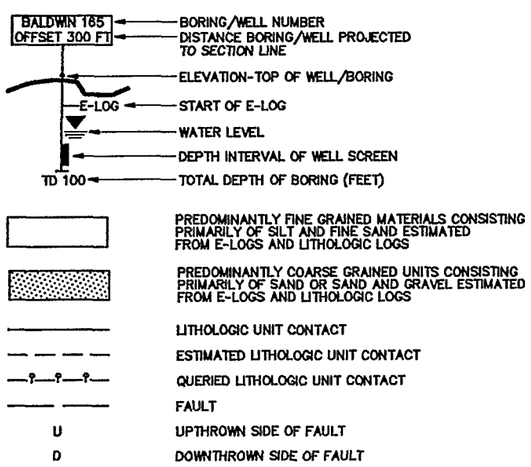

NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

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FIGURE 3-5
HYDROGEOLOGIC CROSS SECTION C-C'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

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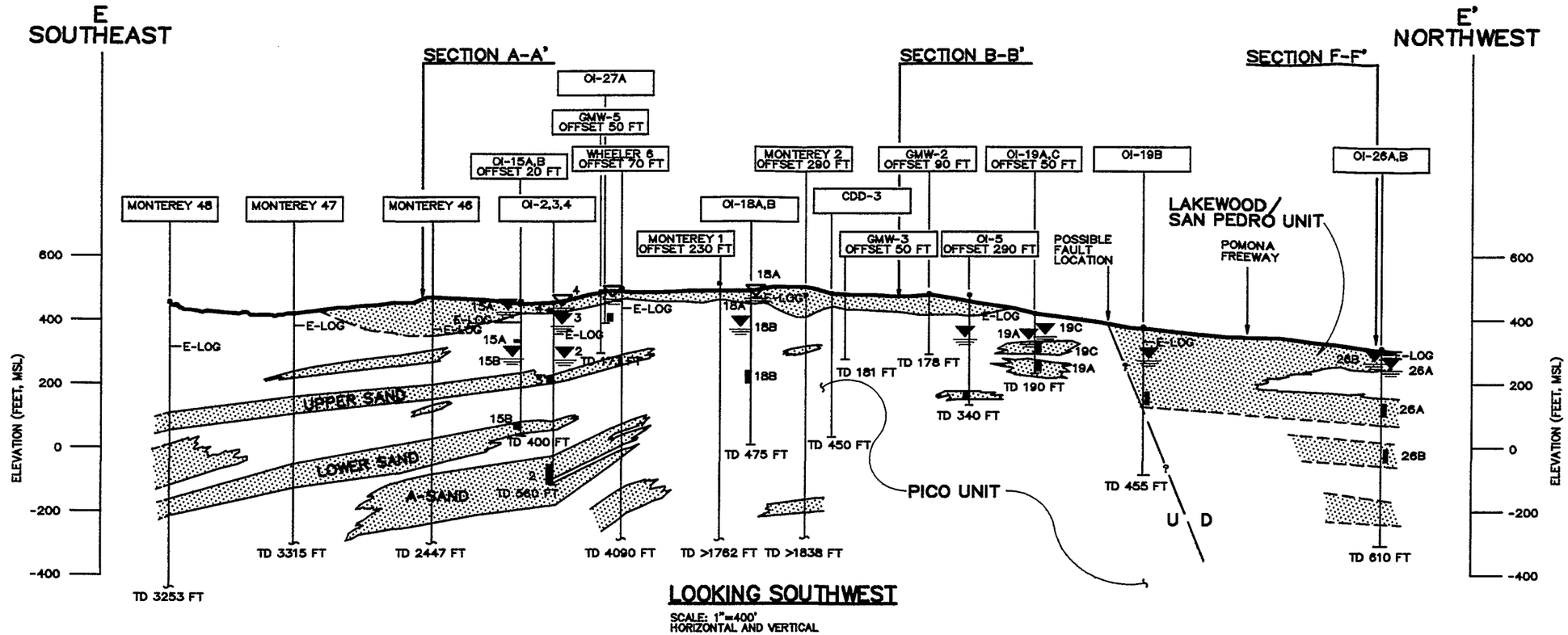

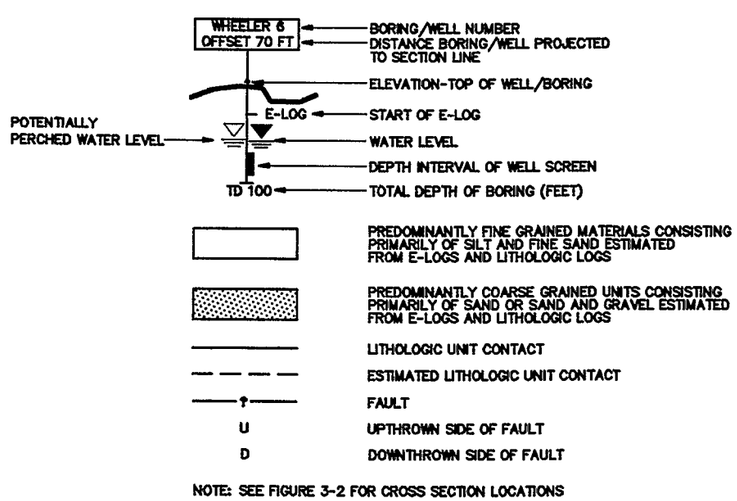

NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

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FIGURE 3-7
HYDROGEOLOGIC CROSS SECTION E-E'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

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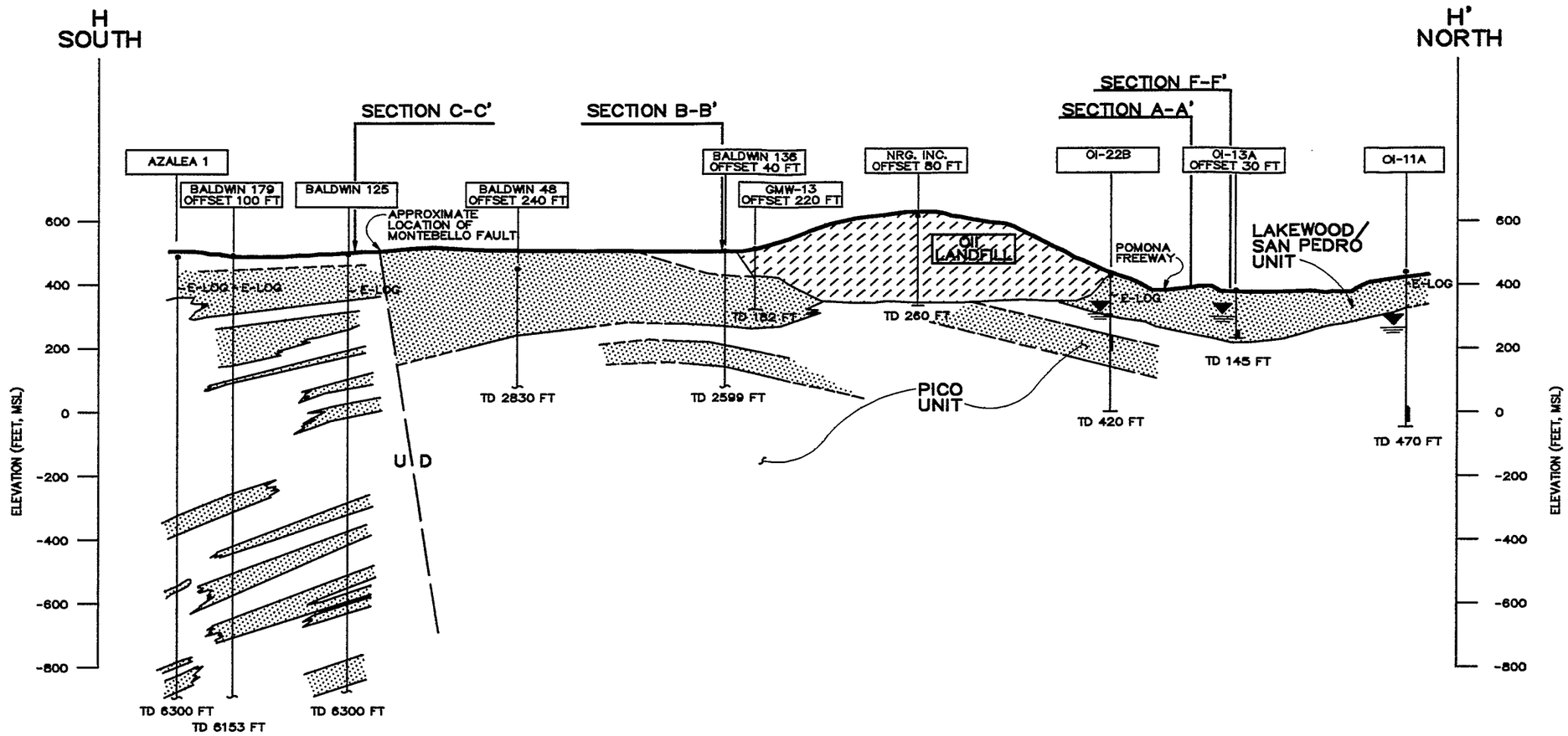
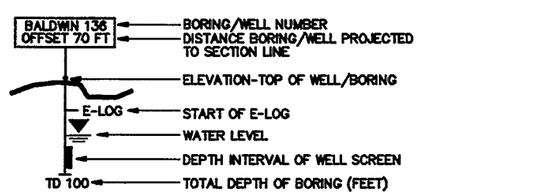




PREDOMINANTLY FINE GRAINED MATERIALS CONSISTING PRIMARILY OF SILT AND FINE SAND ESTIMATED FROM E-LOGS AND LITHOLOGIC LOGS

PREDOMINANTLY COARSE GRAINED UNITS CONSISTING PRIMARILY OF SAND OR SAND AND GRAVEL ESTIMATED FROM E-LOGS AND LITHOLOGIC LOGS

EXTENT OF REFUSE

LITHOLOGIC UNIT CONTACT

ESTIMATED LITHOLOGIC UNIT CONTACT

FAULT

NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

LOOKING WEST

SCALE: 1"=400'
HORIZONTAL AND VERTICAL

H:\FIGURES\LA063737.RR\SEC_H.DWG 9-12-90

FIGURE 3-10
HYDROGEOLOGIC CROSS SECTION H-H'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

Section 4
HYDROGEOLOGY

Section 4
HYDROGEOLOGY

The regional hydrogeology and OII site hydrogeologic units, hydrogeologic properties, groundwater levels, and groundwater flow conditions are discussed in this section.

4.1 REGIONAL HYDROGEOLOGY

The OII site is located in the Montebello Hills, one of a series of low-lying hills that separate the San Gabriel Basin from the Central Basin (Figure 1-1). The watershed divide between the two basins runs directly through the east end of the site (CDWR, 1966). CDWR (1961, 1966) described the Montebello hills to be nonwater-bearing (yielding less than 5 to 15 gpm); however, aquifer tests from many of the monitoring wells at the OII site demonstrate yields near 30 gpm with less than 5 feet of drawdown.

The Central Basin and San Gabriel Basin are composed of thick sequences of permeable sediments that constitute productive regional aquifers. These aquifers are the primary source of domestic water supply for the basins. Groundwater flows from the OII site vicinity towards these two basins. A brief description of the hydrogeology of the Central Basin and San Gabriel Basin is provided below.

4.1.1 SAN GABRIEL BASIN

The San Gabriel Basin is composed primarily of alluvial basin-fill sediments derived from the San Gabriel Mountains to the north. The sediments consist of thick sand and gravel sequences with some layers or lenses of silts or clays. For the most part, these low permeability zones can not be correlated over approximately 1,000 feet. Individual aquifers are not identified as they are in the Central Basin. The thickest portion of the San Gabriel Basin, located about 3 miles northwest of the OII site, is over 4,000 feet deep (CDWR, 1966). The Lakewood/San Pedro Unit, which occurs at the OII site, is the lowest stratigraphic unit of the San Gabriel Basin sediments, and most of the drinking water wells are completed in the overlying Older and Recent alluvium. Groundwater is the primary source of the water supply for the San Gabriel Valley.

4.1.2 CENTRAL BASIN

The subsurface of the Central Basin contains multiple distinct aquifers and aquitards. The aquifers range in thickness from tens to hundreds of feet (CDWR, 1961). The five major drinking water aquifers of the Central Basin, from deepest to shallowest, are the Sunnyside, Silverado, Lynwood, Jefferson, and Hollydale aquifers (CDWR, 1961).

These aquifers occur in the San Pedro Formation. The Hollydale aquifer is the only one of the five aquifers not present in the portion of the basin closest to the site (Section D-D', Figure 3-6).

The aquifers of the San Pedro Formation are separated by low-permeability silt, clay, and sandy clay materials over much of the basin. The thickness of these layers in Figure 3-6 ranges from 0 to 80 feet. Throughout much of the Central Basin, the Bellflower Aquiclude, composed of low-permeability materials, occurs as a confining unit to the underlying aquifers. However, in most of the Montebello Forebay, the Bellflower Aquiclude is not present. Consequently, surface deposits may be in hydraulic connection with the Central Basin drinking water aquifers.

The portion of the Central Basin immediately south of the Montebello Hills is known as the Montebello Forebay Area (CDWR, 1961). The Montebello Forebay area is the primary recharge area for the Central Basin. Included in the Montebello Forebay is Whittier Narrows, which is the only area of subsurface flow from the San Gabriel Basin into the Central Basin. The Rio Hondo and San Gabriel Rivers, which represent all of the surface water flow from the San Gabriel Basin to the Central Basin, are also located in Whittier Narrows. The Rio Hondo and San Gabriel River spreading grounds, located 1.5 and 2.5 miles southeast of the site, respectively, recharged approximately 100,000 acre-feet of water per year to the Central Basin during the period from 1977 to 1987 (Los Angeles County Department of Public Works, 1977 to 1987). The location of these spreading grounds is shown in Plate 1.

4.2 OCCURRENCES OF GROUNDWATER

Occurrences of unconfined, confined, and potentially perched groundwater at the OII site vicinity are described in this section. In general, groundwater occurring in the Lakewood/San Pedro Unit is unconfined. Pico Unit sandstone and conglomerate units are, in most cases, confined aquifers, but on the east end of the South Parcel, the A-Sand and Lower Sand transition into a thick accumulation of coarse-grained deposits that represent an unconfined aquifer.

The Lakewood/San Pedro Unit is saturated on the North Parcel and on the eastern, western, and southern boundaries of the South Parcel. The groundwater levels in the Lakewood/San Pedro Unit on the western and southern boundary of the South Parcel are above the piezometric surface of wells completed into the Pico Unit. This water may represent groundwater perched at the contact of the Lakewood/San Pedro Unit, as discussed in Section 4.2.4. An alternative interpretation of the water-level data, provided in Section 4.4.3, suggests that the geologic formations may be fully saturated up to the levels observed in the shallow wells along the boundary.

There may be another significant mode of groundwater occurrence, and that is the unsaturated zone. Significant movement of groundwater or leachate could occur in the unsaturated zone above the water table adjacent to and underneath the landfill and within the landfill itself. It is important to emphasize that water or leachate is not irreversibly "adsorbed" by refuse or soil. Even in the unsaturated zone, groundwater or leachate is in motion.

A summary of the construction details, including the hydrogeologic and lithologic unit of the screened interval, for all 47 groundwater monitoring wells in the OII site vicinity is provided in Table 4-1. Figure 4-1 shows the locations, depths, and hydrogeologic unit for each of the OII groundwater monitoring wells.

4.2.1 UNCONFINED AQUIFERS

The Lakewood/San Pedro Hydrogeologic Unit is an unconfined aquifer in the study area. The Lakewood/San Pedro Unit is saturated on portions of the North Parcel and the eastern, western, and southern boundaries of the South Parcel. This unit is present on only the western third of the southern boundary of the South Parcel (Plate 2). The saturated thickness throughout the site ranges from approximately 10 to 100 feet.

On the North Parcel, the thickness of the Lakewood/San Pedro Unit ranges from 60 at OI-25A to 200 feet at OI-12A and OI-9A (Figure 3-8). The majority of wells completed into the Lakewood/San Pedro Unit are on the North Parcel, including OI-01A, OI-1C, OI-7C, OI-8A, OI-9A, OI-12C, OI-13A, and OI-13C.

Two non-EPA monitoring wells, CDD-13 and CDD-17, are completed into the Lakewood/San Pedro Unit on the northern boundary of the South Parcel. The refuse within the landfill is thought to contact the Lakewood/San Pedro in this area.

Up to 350 feet of coarse-grained sediments occur on the eastern end of the South Parcel (Figures 3-4 and 3-5). Whether the entire sequence is composed of Lakewood/ San Pedro Unit deposits is unclear, but the coarse-grained sediments comprise an unconfined aquifer that is directly connected to the Lakewood/San Pedro Unit on the North Parcel. Monitoring wells OI-20A, OI-20B, and OI-28B are completed in this sequence. At OI-20B, the saturated thickness is approximately 160 feet.

Shallow groundwater occurrences within the Lakewood/San Pedro Unit along the western border of the South Parcel may represent perched water occurrences or a shallow unconfined aquifer, as described in Sections 4.2.4 and 4.4.3.

On the North Parcel, the Lakewood/San Pedro Unit thickens considerably due to fault displacement in the vicinity of OI-29 and the northward dip of the strata on the South Parcel. On the North Parcel, the thickness ranges from 60 feet at OI-25A to 200 feet

Table 4-1
OII Monitoring Well Construction Detail Summary

Well No.2	Surface Elev. (Ft)	Borehole Depth (Ft)	Well Depth (Ft)	Casing Diameter (inches)	Screened Interval			
					Depth (Ft)	Elevation (Ft)	Hydro-geologic Unit	Lithologic Unit
OI-1A	327	115	110	2	80-110	247-217	L/SP	Coarse-grained
OI-1C	327	155	118	4.5	110-115	217-212	L/SP	Coarse-grained
OI-2	446	560	545	6	495-545	-49-(-99)	Pico	A-Sand
OI-3	446	255	250	2	220-250	226-196	Pico	Upper Sand
OI-4	446	40	25.5	2	15.5-25.5	431-421	L/SP	Coarse-grained
OI-5	465	340	330	6	310-330	155-135	Pico	Undifferentiated conglomerate
OI-6	495	252	227	6	187-227	308-268	Pico	Undifferentiated conglomerate
OI-7B	347	102	101	4.5	88-98	259-249	L/SP	Coarse-grained
OI-7C	347	137	135	4.5	102-132	245-215	L/SP, Pico	Fine-grained
OI-8A	344	105	105	4.5	72-102	272-242	L/SP	Fine-grained
OI-9A	399	124	116	4.5	83-113	316-286	L/SP	Fine-grained
OI-10A	385	535	298	6	265-295	120-90	Pico	Undifferentiated conglomerate
OI-10B	385	165	163	6	140-160	245-225	Pico	Undifferentiated sandstone
OI-11A	443	470	465	6	422-462	21-(-19)	Pico	Silt
OI-12B	403	456	453	6	410-450	-7-(-47)	Pico	Undifferentiated sandstone
OI-12C	403	195	193	4.5	170-190	233-203	L/SP	Coarse-grained
OI-13A	395	148	143	4.5	120-140	275-255	L/SP	Coarse-grained
OI-13B	385	560	400	6	358-397	27-(-13)	Pico	Silt
OI-13C	385	160	155	4	110-150	275-235	L/SP	Coarse-grained
OI-14C	357	540	540	6	485-535	-128-(-178)	Pico	A-Sand

Table 4-1
(Continued)

Well No.2	Surface Elev. (Ft)	Borehole Depth (Ft)	Well Depth (Ft)	Casing Diameter (inches)	Screened Interval			
					Depth (Ft)	Elevation (Ft)	Hydro-geologic Unit	Lithologic Unit
OI-15A	444	122	115.5	3	105.5-115.5	329-319	Pico	Silt
OI-15B	445	400	395	6	370-390	75-55	Pico	Lower Sand
OI-16A	527	130	129	3	109-129	418-398	Pico	Silt
OI-17A	513	196	70	4	60-70	453-443	Pico	Silt
OI-17B	513	450	395	6	340-390	173-123	Pico	A-Sand
OI-18A	483	67	30	3	20-30	463-453	L/SP	Coarse-grained
OI-18B	484	475	301	6	256-296	228-188	Pico	Silt
OI-19A	414	190	181	4	156-176	258-238	Pico	Undifferentiated conglomerate
OI-19B	371	455	245	6	200-240	171-131	L/SP	Coarse-grained
OI-19C	415	113	113	4	88-108	327-307	Pico	Undifferentiated sand
OI-20A	426	174	174	4	139-169	287-257	L/SP	Coarse-grained
OI-20B	428	288	285	6	250-280	178-148	L/SP	Coarse-grained
OI-21A	545	241	241	3	231-241	314-304	Pico	Undifferentiated conglomerate
OI-21B	545	500	390	6	345-385	200-160	Pico	A-Sand
OI-22B	442	420	240	6	185-235	257-207	Pico	Undifferentiated conglomerate
OI-23B	478	343	333	6	288-328	190-150	Pico	A-Sand
OI-25A	370	180	179	2	134-174	236-196	Pico	Siltstone
OI-25B	370	600	366.5	6	321.5-361.5	48-8	Pico	Undifferentiated conglomerate
OI-26A	302	208	205	4	160-200	142-102	Pico	Undifferentiated conglomerate
OI-26B	302	611	350	6	295-345	7-(-43)	Pico	Undifferentiated conglomerate
OI-27A	480	90	89	3	59-89	421-391	Pico	Siltstone

Table 4-1
(Continued)

Well No.2	Surface Elev. (Ft)	Borehole Depth (Ft)	Well Depth (Ft)	Casing Diameter (inches)	Screened Interval			
					Depth (Ft)	Elevation (Ft)	Hydro-geologic Unit	Lithologic Unit
OI-28B	506	360	343	5/4	288-338	218-168	L/SP	Coarse-grained
OI-29B	448	600	460	6	415-455	33-(-7)	Pico	A-Sand
CDD-13	378	86	63.5	6	48-63	330-315	L/SP	Coarse-grained
CDD-17	354	135.5	87	6	69-86.5	284-267	L/SP	Coarse-grained
2897A*	512	488	488	16	448-488	64-24	Pico	Lower Sand
Drillsite 1* (DS-01)	373	888	611	8.6/5.5	431-610	-58-(-237)	Pico	A-Sand

Note:
SP - Lakewood/San Pedro Hydrogeologic Unit
*Well owned by Southern California Gas Company

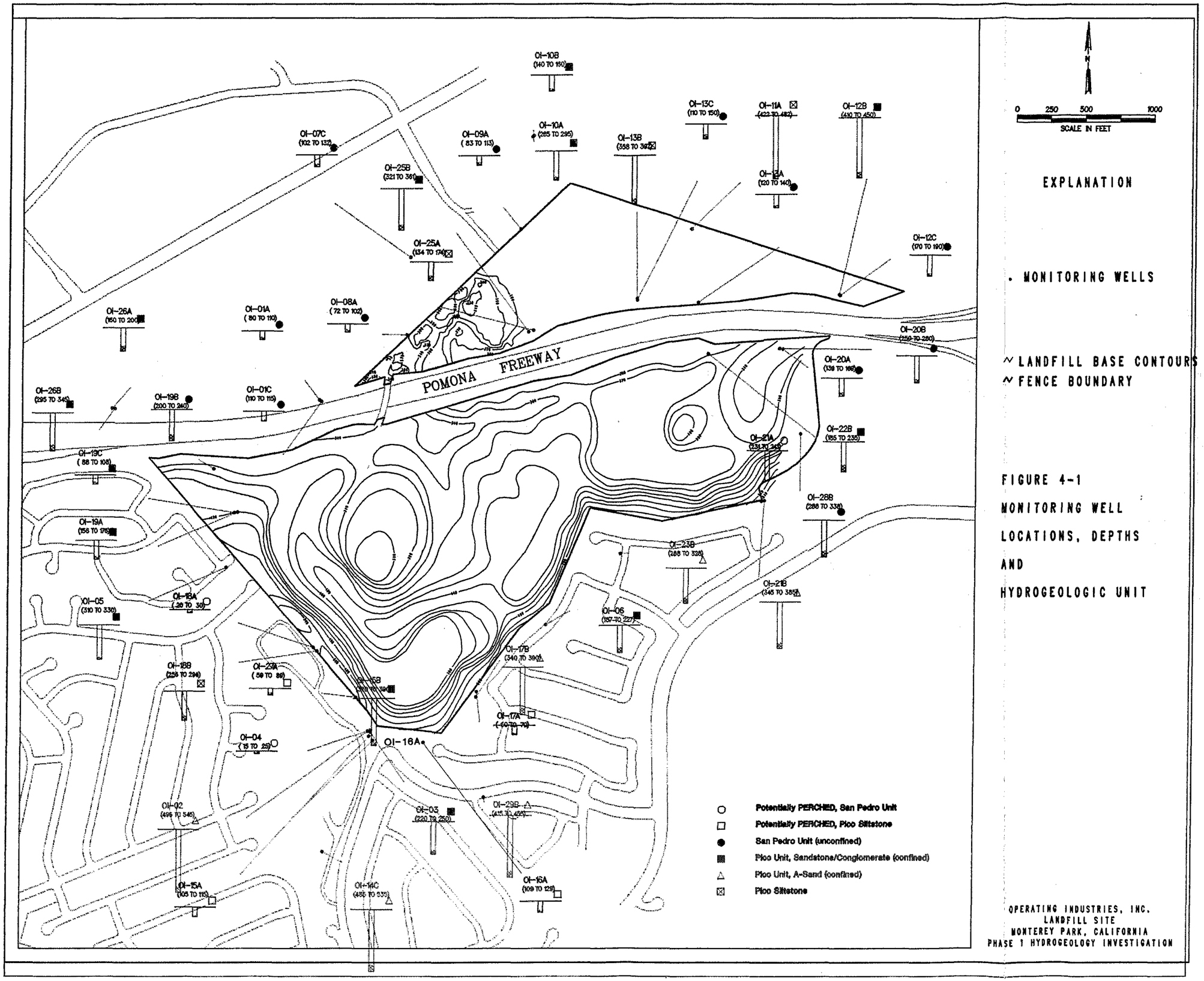


FIGURE 4-1
MONITORING WELL
LOCATIONS, DEPTHS
AND
HYDROGEOLOGIC UNIT

OPERATING INDUSTRIES, INC.
LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

at OI-12B and OI-9A (Figure 3-8). The saturated thickness on the North Parcel ranges from approximately 40 feet at OI-25A to approximately 120 feet at OI-12B.

4.2.2 CONFINED AQUIFERS

The lenticular sandstone and conglomerate units within the Pico Hydrogeologic Unit are in most cases confined aquifers in the OII vicinity. As previously discussed in Section 3.5.3, the laterally continuity of these permeable Pico Unit sands and gravels is variable and consistent with the interpretation of turbidite deposits (Minch, 1990). Turbidite deposits are described in Section 3.5.3.

The largest of these confined aquifers is the A-Sand. The A-Sand can be easily traced across the entire southern boundary of the site from OI-21B to Monterey 45 (Figure 3-4). Monitoring wells completed into this unit are OI-21B, OI-23B, OI-17B, OI-29B, OI-2, Drillsite 1, and OI-14C (Table 4-1). The A-Sand is only 40 feet thick at OI-23B on the east end of the site. The thickness increases to 250 feet at Wheeler 3 (adjacent to OI-6) and 360 feet at Wheeler 102 (adjacent to OI-17B). Southwest of the site at Drillsite 1 and OI-14C, the A-Sand appears to split into a few separate permeable units (Figures 3-3 and 3-4). To the south of the site at OI-29B the A-Sand thins to 30 feet thick.

The A-Sand appears to be a turbidite channel deposit that trends northeast/southwest. The A-Sand can be traced to the northeast with reasonable certainty to Wheeler 1 (Figure 3-3). The next potentially correlative unit is 1,320 feet to the northeast in well Stocker-Merced 3 (Figure 3-6). The A-Sand appears to thin to the south and to the north of the southern boundary of the South Parcel. Along the western boundary of the South Parcel, the A-Sand cannot be correlated to the north beyond Wheeler 6 (Figure 3-7), a distance of approximately 500 feet. To the south of the site at OI-29B, the A-Sand thins to 30 feet thick.

Numerous thinner, confined, permeable units of smaller lateral extent occur above the A-Sand. Two of these units, the Upper Sand and Lower Sand, can be traced to the southeast over a distance of approximately 800 feet in the southwest corner of the South Parcel (Figure 3-3). The Upper Sand and Lower Sand were previously referred to as the Upper Silty Sand and Lower Silty Sand, respectively, in EPA (October 12, 1988). The name for these units has been changed, since the drilling included in this investigation has demonstrated that these units contain coarse sand and some gravel.

The Upper Sand and Lower Sand were shown to extend further to the northeast on Hydrogeologic Section A-A' in EPA (October 12, 1988) than in the current interpretation (Figure 3-3), which shows the units to be more discontinuous.

Some of the Pico sandstone and conglomerate units intersect the piezometric surface and are unsaturated above that elevation. These units are, therefore, unconfined in

their uppermost extent and confined downdip. The Upper Sand and the unit in which OI-6 is screened fall into this category.

4.2.3 CONFINING LAYERS

The Pico sandstone and conglomerate units are confined by a very fine sandy siltstone within the Pico Unit, referred to as the Pico siltstone or Pico silt. Soil core and drive samples of the siltstone reveal that it is composed of alternating, 1- to 2-millimeter-thick laminations of silt and very fine silty sand. The Pico silt thus appears to represent a significant barrier to downward groundwater flow, and, therefore, acts as an effective confining layer. Nonetheless, measurable flow can occur parallel to bedding, as discussed in Section 4.4.2. Grain-size analyses of the Pico silt (Appendix J) demonstrate that the silt contains between 4 and 30 percent fine sand. The average sand content is 19 percent.

4.2.4 POTENTIALLY PERCHED GROUNDWATER

Perched groundwater is separated from the regional unconfined aquifer by a less permeable stratum. Groundwater moving vertically by unsaturated flow will form a discontinuous saturated lense of groundwater above the low-permeability layer, commonly referred to as an aquitard. As the groundwater flows through or around the aquitard, it may revert again to unsaturated flow until another low-permeability layer is encountered. Thus, multiple saturated layers may occur in a variably saturated sequence of sediments. Due to the dynamic nature of the sequence, perched water commonly does not exist year round at specific locations.

Zones of potentially perched groundwater have been identified along the western boundary and the western third of the southern boundary of the South Parcel. The presence of perched water at the landfill perimeter is suspected for four reasons:

1. The water levels of some of the shallow wells are 25 to 150 feet higher than the estimated water table derived from deeper wells, which are completed into the Pico Unit at these locations.

2. If the shallowest water levels are assumed to represent the water table, then the water table at the southwest boundary of the site would be 170 feet higher than the elevation of the deepest part of the landfill (300 fasl). The landfill is known to not be fully saturated over this interval.

3. Three of the potentially perched zone wells are completed into the base of the Lakewood/San Pedro Unit, just above the contact with the Pico siltstone. Leachate that flows laterally into the Lakewood/San Pedro would be expected to perch on the low permeability siltstone.

4. During drilling of OI-18A, the contact of the Lakewood/San Pedro Unit conglomerate and the Pico Unit siltstone was observed at a depth of 30 feet. The dual-tube drilling casing was advanced to a depth of 70 feet and allowed to sit overnight. No liquid accumulated in the casing. The next day the bottom of the well was sealed with bentonite and the well was completed with a well screen from a depth of 20 to 30 feet. The casing filled with groundwater to a depth of 20 feet.

Table 4-2 summarizes potentially perched water occurrences. Included in this table are water levels from shallow groundwater monitoring wells installed during this investigation, soil borings on the North Parcel, and observations of subsurface water encountered while drilling the landfill gas monitoring wells (GMW-series wells), as described in EPA (March 21, 1988).

The following wells may represent perched zones: OI-4, OI-16A, OI-17A, OI-18A, and OI-27A. Elevations of perched water in these wells range from 429 to 478 fasl (Table 4-2, Appendix F), approximately 10 to 60 feet above the estimated water table. A discussion of how the water table was estimated is provided in Section 4.4.1. The water levels in these wells are shown as open triangles on Hydrogeologic Cross-Sections A-A' (Figure 3-3) and E-E' (Figure 3-7). Deeper water levels, which are not potentially perched, are shown as solid triangles.

Many of the occurrences of water observed during the drilling of the gas monitoring wells may now be identified as potentially perched water based on our current understanding of the estimated water table elevation adjacent to the OII site. Potentially perched water occurrences were observed in GMW-1, GMW-4, GMW-6, GMW-13, and GMW-14, as listed in Table 4-2. Observations of water in the borehole at depths below that of the estimated regional water table are not listed. Since many of these gas monitoring wells were drilled into siltstone, it is important to realize that a borehole may appear dry, even though it is below the water table, because of the limited ability of the siltstone to transmit water.

Table 4-2 also listed occurrences of potentially perched water on the western third of the North Parcel in borings B-4a and B-6a and in the northern corner of the North Parcel in B-16 (EPA, March 4, 1988).

Evaluation of water levels in air dike wells and leachate collection wells at the site perimeter has generated an alternative interpretation of the shallow water level data, which is presented in Section 4.4.3.

Table 4-2
Potential Perched Water Occurrences

Well	Date	Depth of Observed Water	Elev. of Observed Water	Actual or Estimated Regional Water Level	Lithologic Unit	Ref.
South Parcel						
OI-4	6/8/90	18.0	428.9	420.1 (OI-15A)	Base Lakewood/ San Pedro	a
OI-16A	6/8/90	76.2	452.0	340	Pico Siltstone	b
OI-17A	6/8/90	36.8	477.9	315	Pico Siltstone	b
OI-18A	6/8/90	19.8	464.3	390	Base Lakewood/ San Pedro	b
OI-27A	6/8/90	12.1	469.1	390	Pico Siltstone	b
GMW-1	3/25/87	56.5	362.5	330	Pico Siltstone	c
GMW-4	4/2/87	25	459	380	Base Lakewood/ San Pedro	c
	4/6/87	56	428	380	Pico Siltstone	c
GMW-6	7/6/87	29	479	335	Refuse	c
	7/7/87	52	456	335	Base Refuse	c
	7/16/87	133	375	335	Pico Siltstone	c
GMW-7	7/16/87	53	476	330	Pico Siltstone	c
GMW-13	5/21/87	139.2	374.8	320	Pico Conglomerate	c
GMW-14	5/15/87	88	457	310	Pico Siltstone	c
North Parcel						
B-4a	6/27/87	11.5	361.6	315	Base of refuse	c
B-6a	6/28/87	8.6	360.3	310	Base of refuse	c

Notes:

Ref. a - EPA, June 20, 1985.
b - This Report.
c - EPA, March 4, 1988.
Water levels in air dike wells (Figures 4-14 and 4-15) also represent potentially perched zones.

Perched water was also encountered on the western third of the North Parcel in borings B-4a and B-6a and in the northern corner of the North Parcel in B-16 (EPA, March 4, 1988), as summarized in Table 4-2.

4.3 HYDROGEOLOGIC PROPERTIES

This section summarizes estimates of hydrogeologic properties (transmissivity and hydraulic conductivity) for the identified hydrogeologic units at the OII site. The estimates are from this investigation and other reports. A description of the field methods used for the aquifer tests included in this investigation is provided in Appendix A. The aquifer test data and analysis is provided in Appendix E.

Aquifer tests (either pumping/recovery tests or slug tests) were completed for all monitoring wells at the OII site except OI-1A, OI-3, OI-4, and OI-6. The description of the field and data analysis procedures for wells completed previous to this investigation is provided in EPA (June 20, 1985) for wells OI-1A through OI-6 and EPA (January 29, 1988) for wells OI-1C and OI-7C through OI-13B. Due to the lack of appropriate observation wells, estimates of storativity are not available. Aquifer test results have been listed in three categories: Lakewood/San Pedro Unit (Table 4-3), Pico Unit sandstones and conglomerates (Table 4-4), and Pico Unit siltstone (Table 4-5). Laboratory analyses of soil permeability and porosity core samples from the OII North Parcel Hydrogeology Investigation (EPA, November 1988) are presented in Table 4-6. Converse, Davis, Dixon (1975) reported permeability values for core samples from the western portion of the South Parcel.

4.3.1 LAKEWOOD/SAN PEDRO HYDROGEOLOGIC UNIT

The hydraulic conductivity of the Lakewood/San Pedro Unit conglomerate ranges from 0.1 to 169 feet per day (ft/day) [Table 4-3]. In the western corner of North Parcel, the hydraulic conductivity in OI-1A and OI-1C ranges from 5 to 18 ft/day. The estimated conductivity for wells OI-7C and OI-9A (EPA, November 1988) is very low (0.007 and 0.53 ft/day, respectively). OI-7C is screened across the bottom of the Lakewood/San Pedro Unit into the underlying siltstone and OI-9A is screened in San Pedro siltstone. Therefore, these hydraulic conductivity estimates are considered unrepresentative of the Lakewood/San Pedro conglomerate. On the eastern half of the North Parcel, the hydraulic conductivity of OI-12C and OI-13A ranges from 1.5 to 5.5 ft/day. OI-13A and OI-13C are screened at the same depth and 500 feet apart, yet OI-13C has a hydraulic conductivity an order of magnitude higher (26 to 28 ft/day). OI-18A is a potentially perched zone well on the west side of the South Parcel; the hydraulic conductivity is estimated to be 0.1 to 1.5 ft/day.

The hydraulic conductivity of the Lakewood/San Pedro Unit is much higher adjacent to the South Parcel than the North Parcel. OI-19B is screened into a thick sequence of

Table 4-3
Hydraulic Parameters
Lakewood/San Pedro Unit Wells

Well	Screened Interval	Lithologic Unit	Aquifer Type[1]	Test Type	Pumping Rate (gpm)	Analysis Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)	Comments	Reference[2]
OI-1A	80-110	Coarse-Grained	U	Drawdown	13.5	Cooper & Jacob	550	18	Observation well for OI-1C	a
OI-1C	110-115	Coarse-Grained	U	Drawdown Recovery	13.5	Cooper & Jacob Theis	40 25	8 5	--	b
OI-4	15.5-25.5	Coarse-Grained	P	--	<3	--	--	--	Estimated production rate	a
OI-7C	102-132	Fine-Grained	U	Slug	--	Cooper, et al	0.2	0.007	Screened across San Pedro/Pico contact	b
OI-8A	72-102	Fine-Grained	U	Slug	--	Hvorslev, et al Bouwer & Rice	--	--	Data could not be analyzed by any method	b
OI-9A	83-113	Fine-Grained	U	Slug	--	Hvorslev, et al	--	0.53	Screened across conglomerate/silt contact	b
OI-12C	170-190	Coarse-Grained	U	Drawdown Recovery	24	Cooper & Jacob Theis	67 29	3.3 1.5	Includes well bore storage correction	b
OI-13A	120-140	Coarse-Grained	U	Drawdown Drawdown Drawdown Recovery	14	Theis Cooper & Jacob Cooper & Jacob Theis	71 110 70 32	3.55 5.5 3.5 1.6	Includes well bore storage correction	b
OI-13C	110-150	Coarse-Grained	U	Drawdown Recovery	29.8	Cooper & Jacob	1130 1050	28 26	Includes well bore storage correction	c
OI-18A	20-30	Coarse-Grained	P	Slug	--	Bouwer & Rice Hvorslev, et al	0.95 14.2	0.1 1.5	--	c
OI-19B	200-240	Coarse-Grained	U	Drawdown Recovery	26.5	Cooper & Jacob	3350 4100	84 103	Includes well bore storage correction	c
OI-20A	139-169	Coarse-Grained	U	Drawdown Recovery	26.7	Cooper & Jacob	1500 4700	50 157	Includes well bore storage correction	c
OI-20B	250-280	Coarse-Grained	U	Drawdown Recovery	31.7	Cooper & Jacob	3400 2400	113 80	Includes well bore storage correction	c

Table 4-3
(Continued)

Well	Screened Interval	Lithologic Unit	Aquifer Type[1]	Test Type	Pumping Rate (gpm)	Analysis Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)	Comments	Reference[2]
OI-28B	288-338	Conglomerate	U	Drawdown Recovery	31.1	Cooper & Jacob	1000 8450	20 169	Includes well bore storage correction	c

[1]Aquifer Type: c = confined; s = semiconfined; u = unconfined; p = perched
[2]Reference for complete description: a = EPA (June 20, 1985); b = EPA (November, 1988); c = This report, Appendix E

Table 4-4
Hydraulic Parameters
Pico Sandstone and Conglomerate Unit Wells

Well	Screened Interval	Lithologic Unit	Aquifer Type[1]	Test Type	Pumping Rate (gpm)	Analysis Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)	Comments	Reference[2]
I. A-Sand										
OI-2	495-545	A-Sand	C	Drawdown Recovery	35	Cooper & Jacob	160	3.2		a
OI-14C	495-535	A-Sand	C	Drawdown Recovery	25.2	Cooper & Jacob	200 370	4 7	Includes well bore storage correction	c
OI-17B	340-390	A-Sand	C	Drawdown Recovery	16.	Cooper & Jacob	105 650	2 13	Includes well bore storage correction	c
OI-21B	345-385	A-Sand	C	Drawdown Recovery Drawdown Recovery	4.41 4.6	Cooper & Jacob Cooper & Jacob	5 23 4 21	0.1 0.6 0.1 0.5	First aquifer test, suspected grout in gravel pack. Second aquifer test. Includes well bore storage correction.	c
OI-23B	288-328	A-Sand	C	Drawdown Recovery	13	Cooper & Jacob	120 130	3 3	Includes well bore storage correction	c
OI-29B	415-455	A-Sand	C	Drawdown Recovery	25.4	Cooper & Jacob	180 200	5 5	Includes well bore storage correction	c
II. Other Pico Sandstone and Conglomerate Units										
OI-3	220-250	Upper Sand	C	-	20-25	-	-	-	No test run, estimated well production	a
OI-5	310-330	Undifferentiated Conglomerate	C	Drawdown Recovery	23	Cooper & Jacob Theis	251 209	12.6 10.5		a
OI-6	187-227	Undifferentiated Conglomerate	S	Drawdown Recovery	<1	-	-	-	No test run, estimated well production	a
OI-10A	265-295	Undifferentiated Conglomerate	C	Drawdown Recovery	17	Cooper & Jacob Theis	16 11	0.53 0.36	Includes well bore storage correction	b
OI-10B	140-160	Undifferentiated Conglomerate	S	Drawdown Recovery	21.5	Cooper & Jacob Theis	96 110	2.4 2.8	Includes well bore storage correction	b

Table 4-4
(Continued)

Well	Screened Interval	Lithologic Unit	Aquifer Type[1]	Test Type	Pumping Rate (gpm)	Analysis Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)	Comments	Reference[2]
OI-12B	410-450	Undifferentiated Sand	C	Drawdown Recovery	16	Cooper & Jacob Theis	96 110	2.4 2.8	Includes well bore storage correction	b
OI-15B	370-390	Lower Sand	C	Drawdown Recovery Recovery	11.8	Cooper & Jacob	220 240	11 12	Includes well bore storage correction	c
OI-19A	156-176	Undifferentiated Conglomerate	C	Drawdown Recovery	27.9	Cooper & Jacob	500 760	25 38	Includes well bore storage correction	c
OI-19C	88-108	Undifferentiated Sand	S	Drawdown Recovery	1.7	Cooper & Jacob	80 70	4 4	Includes well bore storage correction	c
OI-22B	185-235	Undifferentiated Conglomerate	C	Drawdown Recovery	23.7	Cooper & Jacob	209 131	4.2 2.6	No values recorded	c
OI-25B	321.5- 361.5	Undifferentiated Conglomerate	C	Drawdown Recovery	25.8	Cooper & Jacob	70 90	2 2	Includes well bore storage correction	c
OI-26A	160-200	Undifferentiated Conglomerate	S	Drawdown Recovery	34	Cooper & Jacob	9,600 1,650	240 41	Includes well bore storage correction	c
OI-26B	295-345	Undifferentiated Conglomerate	C	Drawdown Recovery	34.2	Cooper & Jacob	600 830	12 17	Includes well bore storage correction	c

[1]Aquifer Type: c = confined; s = semiconfined; u = unconfined; p = perched
[2]Reference for complete description: a = EPA (June 20, 1985); b = EPA (November, 1988); c = This report, Appendix E

Table 4-5
Hydraulic Parameters
Pico Silt Units

Well	Screened Interval	Lithologic Unit	Aquifer Type[1]	Test Type	Pumping Rate (gpm)	Analysis Method	Transmissivity (ft^2/day)	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/sec)	Comments	Reference[2]
OI-11A	422-462	Silt	C	Slug	--	Hvorslev	0.68	0.017	6.0E-06		b
OI-13B	358-397	Silt	C	Slug	--	Hvorslev	0.40	0.01	3.5E-06		b
OI-15A	105.5-115.5	Silt	P	Slug	--	Bouwer & Rice Hvorslev	0.05 0.06	0.0024 0.0025	8.5E-07 8.8E-07	Perched Zone	c
OI-16A	109-129	Silt	P	Slug	--	Bouwer & Rice Hvorslev	0.05 0.11	0.0013 0.0031	4.6E-07 1.1E-06	Perched Zone	c
OI-17A	60-70	Silt	P	Slug	--	Bouwer & Rice Hvorslev	0.22 0.19	0.0093 0.0078	3.3E-06 2.8E-06	Perched Zone	c
OI-18B	256-296	Silt	C	Drawdown Recovery	2.8	Cooper & Jacob	3.00 4.00	0.10 0.10	2.6E-05 3.5E-05	Includes well bore storage correction	c
OI-25A	134-174	Silt	C	Slug	--	Bouwer & Rice Hvorslev	0.21 0.24	0.0037 0.0041	1.3E-06 1.4E-06		c
OI-27A	59-89	Silt	P	Slug	--	Bouwer & Rice Hvorslev	0.27 0.33	0.0063 0.0078	2.2E-06 2.8E-06	Perched Zone	c

[1]Aquifer Type: C = confined; S = semiconfined; U = unconfined; P = potentially perched
[2]Reference for complete description: a = EPA (June 20, 1985); b = EPA (November, 1988); c = This report, Appendix E

Table 4-6
Laboratory Analysis of Soil Cores Collected During Drilling of Monitoring Wells for OII North Parcel Hydrogeology Investigation

Well	Approximate Elevation of Sample Collection (mean sea level)	Permeability (cm/sec)	Cation Exchange Capacity (meq/100 gms)	Bulk Density (lbs/ft)	Porosity (%)	Lithology	Hydrogeologic Unit
OI-1B	81	--	11.7	--	--	gray clayey silt/ silty sand	Pico
OI-1B	6	4.00×10^{-8}	--	--	--	"	Pico
OI-7A	207	1.36×10^{-7}	--	101.9	38.4	"	Pico
OI-7A	102	2.69×10^{-7}	--	108.3	34.6	"	Pico
OI-7A	101.5	--	13.3	--	--	"	Pico
OI-7A	101	--	9.6	--	--	"	Pico
OI-7A	-3	--	12.4	--	--	"	Pico
OI-7A	-3.5	--	13.5	--	--	"	Pico
OI-7A	-4	3.39×10^{-8}	--	110.5	33.2	"	Pico
OI-10A	294	1.05×10^{-6}	--	108.9	34.2	brown sandy clay	Lakewood/ San Pedro
OI-10A	293.5	--	15.0	--	--	"	Lakewood/ San Pedro
OI-12A	201.5	1.94×10^{-7}	--	--	--	gray clayey silt/ silty sand	Pico
OI-12A	157	3.02×10^{-7}	--	--	--	"	Pico

Table 4-6
(Continued)

Well	Approximate Elevation of Sample Collection (mean sea level)	Permeability (cm/sec)	Cation Exchange Capacity (meq/100 gms)	Bulk Density (lbs/ft)	Porosity (%)	Lithology	Hydrogeologic Unit
OI-12A	156.5	--	11.5	--	--	"	Pico
OI-12A	52	--	12.4	--	--	"	Pico
OI-12A	51.5	7.62×10^{-9}	--	--	--	"	Pico
OI-13B	109.05	--	7.0	--	--	"	Pico
OI-13B	109	2.10×10^{-7}	--	106.0	23.0	"	Pico
Lakewood/ San Pedro Unit		1.05×10^{-6}	15.0	108.2	34.2		
Pico Unit							
Range		7.62×10^{-9} to 3.02×10^{-7}	7.0-13.5	101.9-110.5	23.0-38.4		
Average		1.49×10^{-7}	11.4	106.6	32.2		

Source: Report of the North Parcel Hydrogeology Investigation, Operating Industries, Inc. (EPA, January 29, 1988, updated November 1988).

conglomerate at the northwest corner of the South Parcel. The hydraulic conductivity of the conglomerate at OI-19B is 84 to 103 ft/day. Although the upper 150 feet appears to be Lakewood/San Pedro Unit, the bottom 100 feet of the conglomerate (in which this well is screened) may represent a Pico sandstone and conglomerate unit (Figure 3-7).

The thick sandstone and conglomerate sequence on the northeast corner of the South Parcel also has a relatively high hydraulic conductivity. The conductivity measured for OI-20A, in the top of the sequence is 50 to 157 ft/day, and the conductivity for OI-20B, in the bottom of the sequence is 80 to 113 ft/day. The hydraulic conductivity for OI-28B on the eastern end of the South Parcel is 20 to 169 ft/day.

4.3.2 PICO SANDSTONE AND CONGLOMERATE UNITS

The hydraulic conductivity of the undifferentiated Pico sandstone and conglomerate units generally ranges from 2 to 17 ft/day. The more permeable units include those screened by OI-19A (25 to 38 ft/day) on the northwest corner of the South Parcel and OI-26A (41 to 240 ft/day), located west of the North Parcel.

The hydraulic conductivity of the A-Sand generally ranges from 2 to 13 ft/day and averages 5 ft/day (Table 4-4). The listed conductivities for OI-21B (0.1 to 0.6 ft/day) are not included in the average. These values are considered unrepresentative, since invasion of grout into the gravel pack is suspected.

4.3.3 PICO SILT

The hydraulic conductivity of the Pico silt is 2 to 3 orders of magnitude lower than that of the Pico sand and gravel units. The hydraulic conductivity of the Pico silt, as measured by aquifer tests, ranges from 0.0013 ft/day to 0.1 ft/day (4.6×10^{-7} to 3.5×10^{-5} cm/sec) and averages 0.020 ft/day (6.9×10^{-6} cm/sec) (Table 4-6). These values are higher than those reported for laboratory hydraulic conductivity measurements of soil core samples from the North Parcel (EPA, November 1988) using the falling head permeameter method (average 1.5×10^{-7} cm/sec), as reported in Table 4-6. The aquifer test values represent the horizontal hydraulic conductivity over a fairly large area, while the laboratory values for the core samples represent vertical hydraulic conductivities of small samples. OI-18B can produce a constant 3 gpm from 40 feet of well screen completed into the Pico silt. This demonstrates the significant potential for horizontal movement of groundwater within the Pico silt.

Fractures within siltstone may potentially impart a significant fracture permeability. Well-developed orthogonal fracture systems in siltstone are frequently common in geologic environments similar to that of OII. Fractures within the Pico Unit siltstone were observed at the surface, as described in Section 8.1.4, but were not observed at depth in core samples. The hydraulic conductivity values measured for the siltstone

from aquifer or slug tests would include the effect of fractures; therefore, fracture permeability of the silt appears to be low.

4.4 GROUNDWATER LEVELS AND FLOW CONDITIONS

This section includes discussion of both regional and site specific groundwater levels and flow conditions.

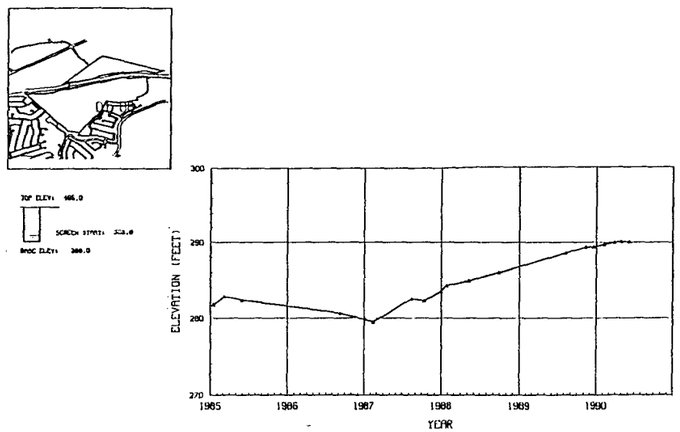
4.4.1 GROUNDWATER LEVELS IN THE OII SITE VICINITY

Groundwater level data for wells in the vicinity of OII are summarized in Table F-1 (Appendix F). Groundwater elevations are available for the 42 monitoring wells installed by EPA (OI-1A to OI-29B) and 2 previously installed OII monitoring wells (CDD-13 and CDD-17). One water level reading is available from 5 wells owned by Southern California Gas Company (Burke 3, Dore 2, Monterey 39A, Schnakenberg 1, and 2897A). Two water level readings are available for another Gas Company well, Drillsite 1. The readings for these wells are from late 1984 and early 1985. Current water levels at these wells could have changed by more than 10 feet since then based on water level changes in monitoring wells at the site.

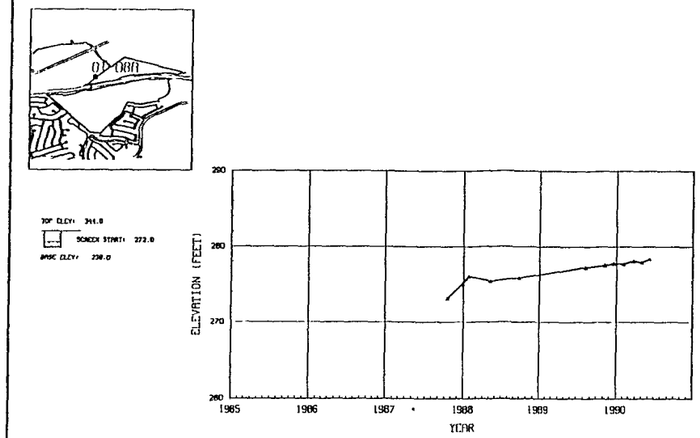
The depth-to-water varies greatly around the site. In potentially perched interval wells, it ranges from 12 feet in OI-27A to 76 feet in OI-16A. The depth to the estimated water table ranges from 40 feet at CDD-17 to 249 feet at OI-21B. The depth-to-water is generally the greatest along the southern boundary of the South Parcel (ranging from 172 feet at OI-29B to 249 feet at OI-21B). The depth is the smallest in the northwest portion of the site (ranging from 40 feet at CDD-17 to 67 feet at OI-8A).

Groundwater elevation hydrographs have been prepared for each monitoring well at the OII site. A complete set of hydrographs is included in Appendix F. Selected hydrographs are shown in Figures 4-2A and 4-2B. Of the 17 wells with more than 2 years of water level data, 9 wells show a definite upward trend in water levels over a period of 2 years or more (OI-1A, OI-1C, OI-2, OI-6, OI-7C, OI-8A, OI-9A, OI-13A, and OI-13B). The rise in water levels was as much as 15 feet in 5.5 years at OI-1A and OI-2. Three wells show a downward trend in water levels over the past 2 years (OI-3, OI-10B, and OI-11A). The largest decline is 13 feet in OI-3. Many of the Phase I Investigations also show definite trends in water levels, but they may be short term. The changes in water levels are shown in Figure 4-3. The overall rise in groundwater levels does not coincide with the below average precipitation experienced in the area in recent years and indicates that a secondary source of water may be present in the area. The cause for the overall rise in water levels is unknown; however, irrigation in the nursery and developed area is one likely source of additional recharge in recent years. A water line near GMW-2 (Figure 3-2) has been leaking since 1988.

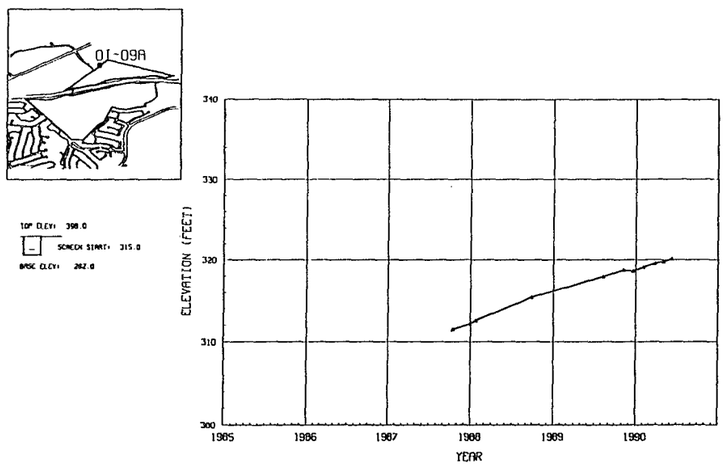
OPERATING INDUSTRIES INC. LANDFILL - WELL #OI-06



OPERATING INDUSTRIES INC. LANDFILL - WELL #OI-08A



OPERATING INDUSTRIES INC. LANDFILL - WELL #OI-09A



OPERATING INDUSTRIES INC. LANDFILL - WELL #OI-11A

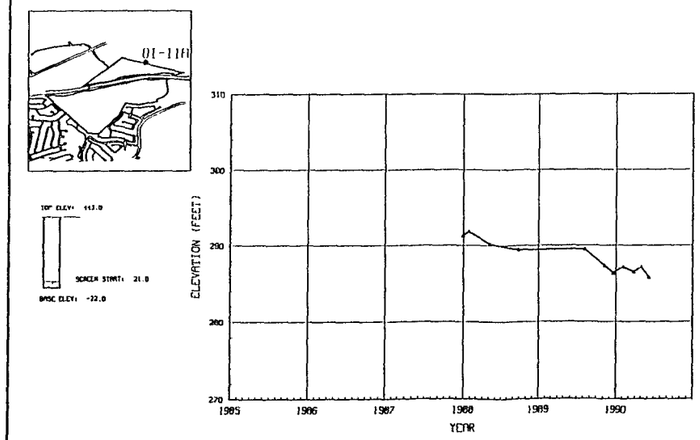
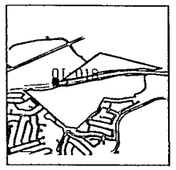
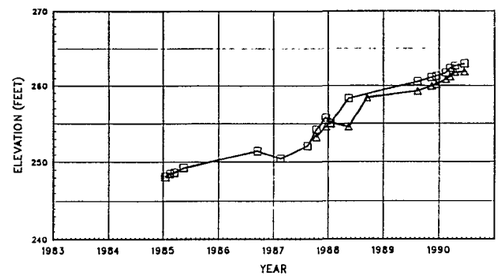


FIGURE 4-2A
WELL HYDROGRAPHS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

OPERATING INDUSTRIES INC. LANDFILL - WELL CLUSTER OI-01

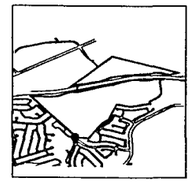


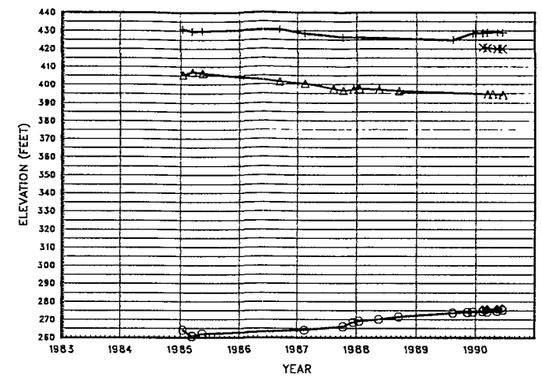


LEGEND:

- OI-01A
- OI-01C

OPERATING INDUSTRIES INC. LANDFILL - WELL CLUSTER OI-02

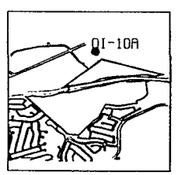


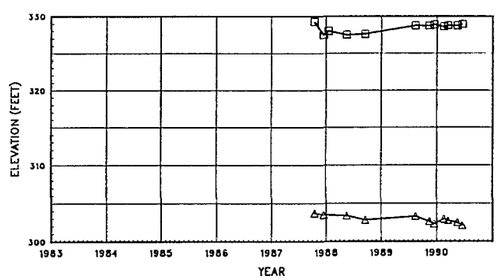


LEGEND:

- OI-02
- OI-03
- OI-04
- OI-15A
- OI-15B

OPERATING INDUSTRIES INC. LANDFILL - WELL CLUSTER OI-10

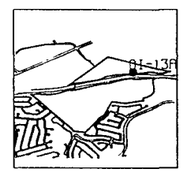


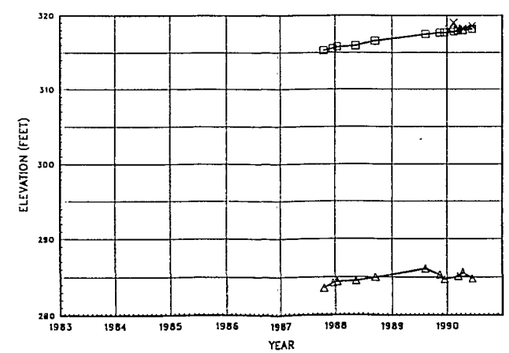


LEGEND:

- OI-10A
- OI-10B

OPERATING INDUSTRIES INC. LANDFILL - WELL CLUSTER OI-13

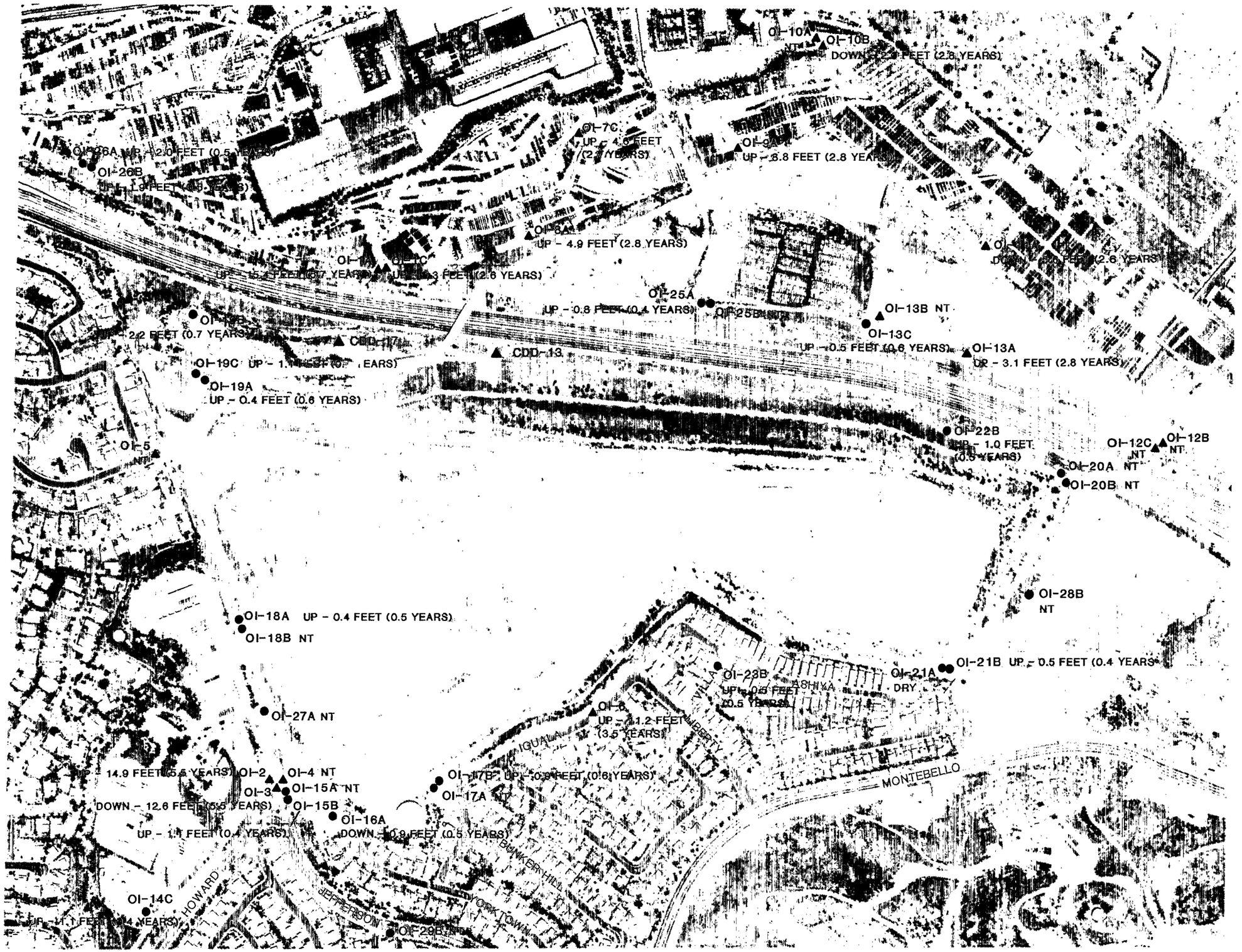




LEGEND:

- OI-13A
- OI-13B
- OI-13C

FIGURE 4-2B
WELL CLUSTER HYDROGRAPHS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION



EXPLANATION

- ● CH2M HILL MONITORING WELL
- ▲ PREVIOUSLY EXISTING MONITORING WELL

UP - 15.4 FEET (5.7 YEARS)

- TIME PERIOD
- WATER LEVEL CHANGE
- INCREASE OR DECREASE

NT NO TREND

FIGURE 4-3
WATER LEVEL CHANGES
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

JULY 1989

The four well cluster hydrographs displayed in Figures 4-2A and 4-2B show large groundwater elevation differences between some cluster wells completed in different geologic units. These differences result in significant vertical gradients; as discussed in Section 4.4.3.2.

Due to the many separate and frequently discontinuous permeable units in the OII site vicinity, it is not possible to directly contour the observed water levels. Therefore, lines of equal groundwater potential (equipotentials) were contoured on each of the hydrogeologic cross-sections utilizing available water levels for wells completed in different units and depths. Each well's groundwater elevation was marked on the cross-sections at the midpoint of the well screen interval, then equipotential lines were approximated utilizing the water levels and the lithology shown on the cross-section. The equipotentials were adjusted to account for observed vertical gradients and to match at intersections of cross-sections. The water table was assumed to be the highest groundwater level that was interpreted to represent the regional water table, not perched conditions. These cross-sections, with generalized equipotential contours, are shown in Figures 4-5 through 4-12 at the end of this chapter.

A map of estimated water table contours (Figure 4-4) was prepared by contouring the intersection of the equipotential lines and the estimated water table shown on the cross-sections. The estimated water table contours represent generalized hydraulic gradients for flow directions, but may not be representative of actual gradients within specific hydrogeologic units.

4.4.2 GROUNDWATER FLOW IN THE OII SITE VICINITY

The estimated water table contours in Figure 4-4 indicate that groundwater flows away from the OII site in nearly all directions. A north-south flow divide runs northeast through the center of the South Parcel. An east-west flow divide trends northwest across the eastern end of the site. Groundwater from the southern half of the South Parcel flows to the south and southwest into the Central Basin. Based on limited data, groundwater on the east end of the South Parcel appears to flow to the northeast, east, and southeast. Groundwater from the northern half of the South Parcel and from the North Parcel flows away from the site to the west towards the Central Basin or to the east and, to a lesser degree, northeast towards the San Gabriel Basin.

A "mound" of groundwater appears to be present along the southwestern boundary of the South Parcel. High water level elevations are observed in OI-3, OI-5, OI-15A, OI-18B, OI-19A, and OI-19C along this boundary. The groundwater elevation contours of the mound must close, so they have been assumed to extend into the landfill. The contours of the mound, as displayed in Figure 4-4, intersect the base of the landfill, implying that the base of the landfill is saturated, as discussed in Section 8.1.1. If the mound contours close outside of the landfill, then groundwater flows both away from and into the landfill as indicated.

The mound suggests a secondary source of water along the landfill perimeter, which may be the landfill itself. As discussed in Section 6.4, the majority of observed groundwater contamination at the site occurs in the shallow wells adjacent to the site in the area of the mound. This corner of the site is the location of the greatest amount of liquid disposal and previously observed leachate seeps. A second potential source of water is reportedly a leaking buried water pipe at the at the western boundary of the site near OI-5.

Groundwater elevations from the new wells installed on the east end of the site (OI-20A, OI-20B, OI-21B, OI-22B, and OI-28B) appear to confirm that flow below this end of the site is predominantly easterly towards the San Gabriel Basin. Previous reports (EPA, October 12, 1988 and EPA, November 1988) had suggested flow in this direction, but insufficient data existed to verify the flow direction.

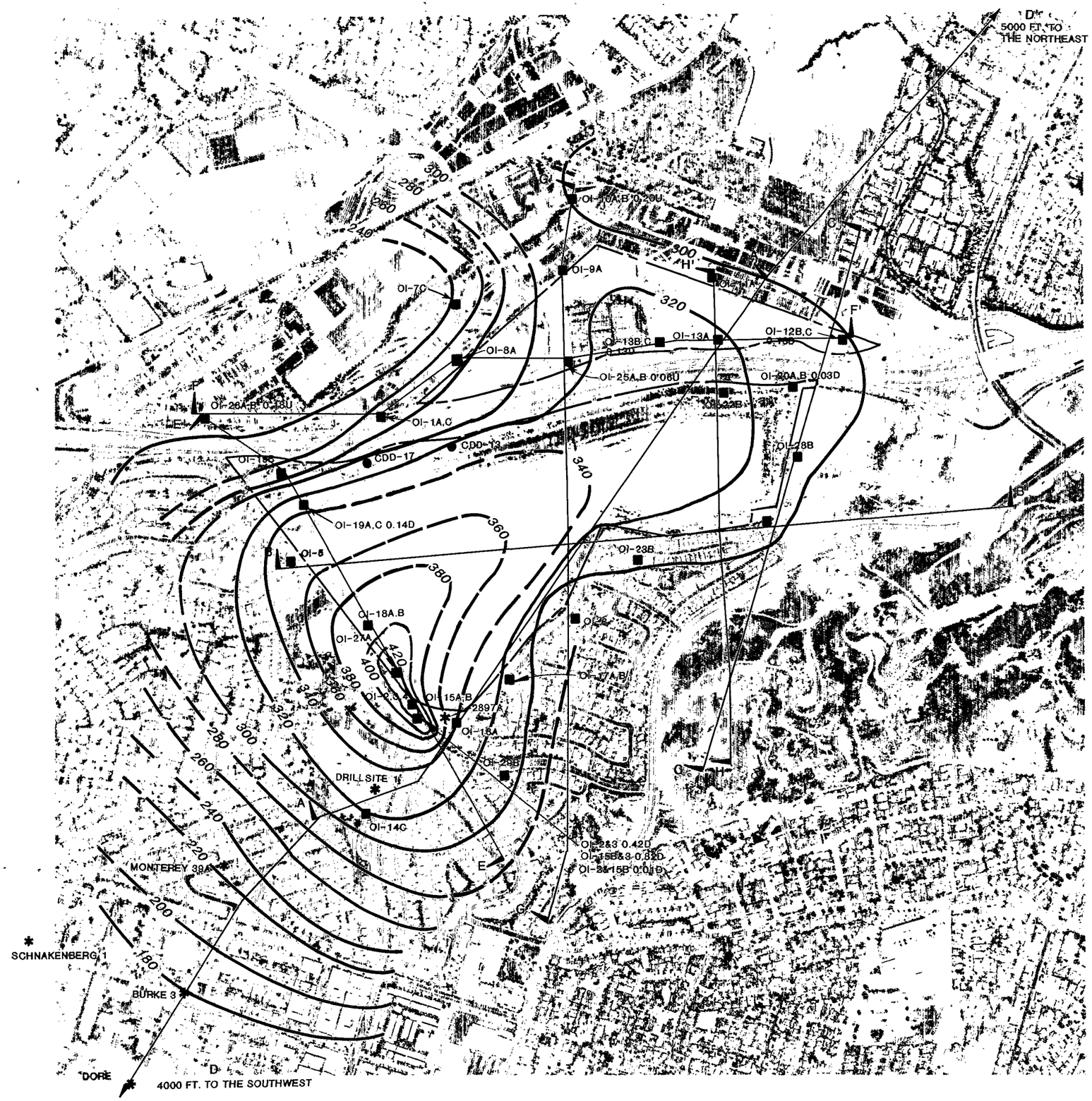
The presence of surface outcrops of Pico Unit siltstone, approximately 1,600 feet northeast of the North Parcel (Plate 2), indicates that Pico siltstone occurs at shallow depth on the northeastern boundary of the North Parcel. This conclusion is supported by Cross-Section H-H' (Figure 3-10), which shows that the contact of the Lakewood/San Pedro Unit and the Pico Unit siltstone is above the water table at OI-11A. At OI-10A,B, which is located directly north of the North Parcel, the Lakewood/San Pedro Unit is once again saturated (Figure 3-9). This information indicates that due to the much greater hydraulic conductivity of the Lakewood/San Pedro Unit than the Pico Unit, groundwater flow from the eastern half of the North Parcel and the northeastern portion of the South Parcel would be primarily to the east. Groundwater flow to the northeast would be impeded by the presence of the siltstone.

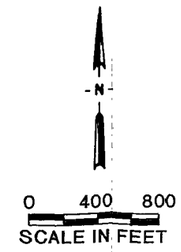
4.4.3 LOCAL HYDRAULIC GRADIENTS

The estimated water table contour map (Figure 4-4) was used to estimate average horizontal hydraulic gradients in the site vicinity. Water levels from wells within the same unit were used to calculate gradients, if possible (e.g., A-Sand). Differences in groundwater elevations from individual wells at cluster sites were used to calculate vertical hydraulic gradients.

4.4.3.1 Horizontal Gradients

The horizontal gradients are fairly consistent away from the mound on the western end of the South Parcel. The gradients are 0.09 to the south and southwest. The gradients are generally lower in other areas of the site. On the eastern side of the site, gradients are 0.05 to the northeast, 0.02 to the east, and 0.06 to the southeast. The gradients to the northwest and west, away from the site, are 0.06 and 0.08, respectively. The gradient towards the southwest in the A-Sand beneath the southern side of the site is approximately 0.01. The estimated flow velocities in the different units in various locations around the site are discussed in Section 4.4.5.





LEGEND

- OII GROUNDWATER MONITORING WELLS (E & E, CH2M HILL)
- OII GROUNDWATER MONITORING WELLS (CONVERSE, DAVIS, DIXON, & ASSOCIATES)
- SO. CALIFORNIA CO. MONITORING WELL
- SITE BOUNDARY
- A A' — LOCATION OF HYDROGEOLOGIC CROSS SECTION
- 180 — ESTIMATED WATER TABLE CONTOURS
- QUERIED ESTIMATED WATER TABLE CONTOURS
- 0.18D — DOWNWARD VERTICAL GRADIENT
- 0.20U — UPWARD VERTICAL GRADIENT

FIGURE 4-4
ESTIMATED WATER TABLE
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE1 HYDROGEOLOGY INVESTIGATION

4.4.3.2 Vertical Gradients

Vertical gradients have been calculated at each well cluster (excluding perched interval wells) using June 8, 1990 water levels. The calculated gradients are shown in Table 4-7. Both upward and downward gradients are observed at the site. The well clusters and vertical gradients are shown on the water level contour map (Figure 4-4). The downward gradient at OI-2 and OI-15B is very high (up to 0.82). Although the vertical gradient is very high at this location, the intervening siltstone strata greatly reduce vertical flow rates. In general, downward gradients are present at the hilltop locations and upward gradients are present at the base of the hill.

Table 4-7
Vertical Gradients

Well Cluster	Wells	Vertical Gradient	Direction
2	OI-2 and OI-3	0.42	Down
2	OI-2 and OI-15B	0.01	Down
2	OI-15B and OI-3	0.82	Down
10	OI-10A and OI-10B	0.20	Up
12	OI-12B and OI-12C	0.18	Down
13	OI-13B and OI-13C	0.13	Down
19	OI-19A and OI-19C	0.14	Down
20	OI-20B and OI-20A	0.03	Down
25	OI-25B and OI-25A	0.06	Up
26	OI-26B and OI-26A	0.18	Up

Upward gradients are present at well clusters OI-10, OI-25, and OI-26. These clusters are all located in the northwest portion of the site or site vicinity. These widely varying vertical gradients can be explained by the equipotential lines on the cross-sections (Figures 4-5 through 4-12).

4.4.4 ALTERNATIVE INTERPRETATION OF SHALLOW WATER LEVELS AT SITE PERIMETER

In an effort to better characterize the presence of potentially perched zones along the western and southwestern perimeter of the South Parcel, water level data from air dike and leachate collection wells were plotted on hydrogeologic cross-sections along with the water levels from all other groundwater monitoring wells. The locations of the cross-sections are shown in Figure 4-13. The Hydrogeologic Cross-Sections I-I', J-J', and K-K' are shown in Figures 4-14, 4-15, and 4-16 at the end of the chapter.

The air dike wells are small diameter wells that are used to inject compressed air into the subsurface along the site perimeter to produce a pressure barrier that inhibits landfill gas migration. Water levels were taken inside the air dike wells during February 12-14, 1990. The wells had been operating at approximately 1 pound per square inch (psi) pressure since July 17, 1989. One well at a time was disconnected from the system to measure the water levels and sound the bottom of the well. The air in the air dike system is relatively dry, because it passes through a compressor and cooler.

Liquid levels were also obtained from leachate collection wells in the Iguala Park area. The water levels were taken on August 31, 1990.

The water levels measured in the air dike and leachate collection wells are generally consistent with the levels measured in the shallow groundwater monitoring wells (OI-18A, OI-27A, OI-4 on Section I-I'; and OI-4, OI-16A, and OI-17A on Section J-J'). Water levels for wells completed into the Pico silt also seem to be consistent with those completed into the Lakewood/San Pedro Unit, indicating that water at the base of the Lakewood/San Pedro is not simply perched on top of the silt.

On Section I-I' a series of wells with overlapping well screen intervals suggests that the Pico silt may be fully saturated and that the water levels in the Lakewood/San Pedro Unit represent the water table. Based on this interpretation, a mound of groundwater exists along Cross-Section I-I' with an elevation of approximately 460 fasl, an elevation approximately 100 feet higher than that estimated from the deeper monitoring wells. This interpreted water table dips downward at the southwest corner of the landfill, indicating flow to this location. This higher interpreted water table would indicate a greater rate of water flowing into the mound.

Similarly, on Cross-Section J-J', the water levels in air dike and leachate collection wells are reasonably consistent and indicate that the water table may be from 60 to 160 feet higher than that based on the interpretation of water levels from the deeper wells.

The variability of the water levels may be the result of uneven flow within the siltstone, different rates of groundwater, leachate inflow at different locations, or a variable saturated-unsaturated sequence.

Hydrogeologic Cross-Section K-K' (Figure 4-16) extends into the landfill and shows the relationship between observed leachate levels in the landfill and groundwater levels adjacent to the site. A complete description of the leachate levels observed in wells S-GITP-1, S-GITP-2, S-GITW-1, S-GITW-2 and S-LSW-1 is provided in Section 5.3.1. The variable leachate levels within the landfill and the lack of horizontal continuity of these levels suggests a flow system within the landfill that is mostly unsaturated, with discontinuous perched leachate on the intermediate soil cover layers. The leachate levels within the landfill are sufficient to provide the hydraulic head needed for leachate discharge at the site perimeter.

This alternative interpretation would significantly effect estimates of groundwater flow directly adjacent to the site, but would not change the overall interpretation of regional groundwater flow from the OII site.

4.4.5 REGIONAL GROUNDWATER FLOW

The Los Angeles County Department of Public Works (LACDPW) collects water level data from wells throughout the San Gabriel and Central Basins. Wells that are located within 3 miles of the OII site and have recent (post-1985) water levels are shown in Figure 4-17 at the end of the chapter. Aside from the Southern California Gas Company wells, there are very few data points within 1.5 miles of the OII site. LACDPW prepares annual regional water level contour maps for the San Gabriel and Central Basins. Figure 4-17 shows the regional contours modified from the Fall 1986 LACDPW Contour Maps. The LACDPW contours do not extend into the Montebello Hills where OII is situated. LACDPW treats the series of hills between the San Gabriel and Central Basins as a no-flow boundary based on CDWR's (1961, 1966) categorization of these hills as nonwater-bearing. Therefore, groundwater level contours in the groundwater basins are drawn perpendicular to the Montebello Hills on the LACDPW maps. For Figure 4-17, the Fall 1986 contours were modified near the base of the hills using water level data from wells in the Central and San Gabriel Basins and the water levels in the OII site vicinity.

The water level contours indicate that the gradients flatten considerably from the base of the hills into the adjacent groundwater basins. In the OII site vicinity, groundwater flow from the OII site towards the San Gabriel Basin is expected to occur predominantly to the east within the Lakewood/San Pedro Unit and to a lesser degree to the northeast within the Pico Unit siltstone. Based on very limited water level data in this portion of the San Gabriel Basin, groundwater would continue moving to the east towards Whittier Narrows or northeast towards a pumping center in the San

Gabriel Basin. Groundwater flow from the site towards the Central Basin is generally towards the west and southwest, away from Whittier Narrows.

4.4.6 ESTIMATED GROUNDWATER FLOW VELOCITIES

The average groundwater flow velocity in various units at different locations around the site was estimated based on the horizontal gradients discussed in Section 4.4.3.1, estimated porosities of 25 percent in the conglomerate and 32 percent in the silt, (Table 4-6) and hydraulic conductivities from wells in the particular area and lithologic unit (averaged from Tables 4-3, 4-4, and 4-5). Estimated groundwater flow velocities are presented in Table 4-8.

Groundwater flow velocities in the Lakewood/San Pedro Unit range from 0.6 ft/day to 8 ft/day. Pico siltstone velocities range from 0.002 to 0.03 ft/day. The highest estimated flow velocity is 28 ft/day between OI-19B and OI-26B to the northwest away from the South Parcel. This high value is primarily the result of the high hydraulic conductivities observed in OI-19B (94 ft/day) and OI-26A (141 ft/day). The high hydraulic gradient (0.06) between OI-19B and OI-26A is not consistent with the high average hydraulic conductivity for these two wells. This suggests that the hydraulic continuity between the two wells may be interrupted by a low-conductivity layer. The actual flow velocity may be less if limited continuity exists between the units screened by these two wells.

The observed hydraulic gradient is the highest directly adjacent to the site due to its hilltop location. The hydraulic gradient flattens considerably away from the site. Therefore, groundwater flow velocities would decrease significantly within the Central or San Gabriel Basin. For comparative purposes, the average groundwater velocity in the San Gabriel Basin is 1.4 ft/day (EPA, August 8, 1989).

Table 4-8
Estimated Groundwater Flow Velocities

Hydrogeologic Unit	k Average Hydraulic Conductivity (ft/day)	i Gradient	θ Porosity	v Average Linear Groundwater Flow Velocity (ft/day)	Direction and Location
Lakewood/ San Pedro	8.25[a]	.08	.25	2.6	West from North Parcel
Lakewood/ San Pedro Pico	117[b]	.06	.25	28	Northwest from South Parcel
Lakewood/ San Pedro	3.0[c]	.05	.25	0.6	Northeast from North Parcel
Undifferentiated Pico Conglomerate	2.3[d]	.05	.25	0.5	Northeast from North Parcel
Pico Siltstone	0.014[e]	.05	.32	0.002	Northeast from North Parcel
Lakewood/ San Pedro	98.2[f]	.02	.25	8	East from North Parcel
A-Sand	4.8[g]	.01	.25	0.2	Southwest along southern boundary
Pico Siltstone	0.10[h]	.09	.32	0.03	West and Southwest from western "mound"
Pico Siltstone (Perched)	0.006[i]	.09	.32	0.002	West and Southwest from western "mound"

[a]Avg. of 1A, 1C
[b]Avg. of 26A, 19B
[c]Avg. of 12C, 13A
[d]Avg. of 12B, 22B
[e]Avg. of 11A, 13B
[f]Avg. of 20A, 20B, 28B
[g]Avg. of 2, 14C, 17B, 23B, 29B
[h]OI-18B
[i]Avg. of 16A, 17A, 27A
[j]Avg. linear groundwater velocity, $V = \frac{ki}{\theta}$

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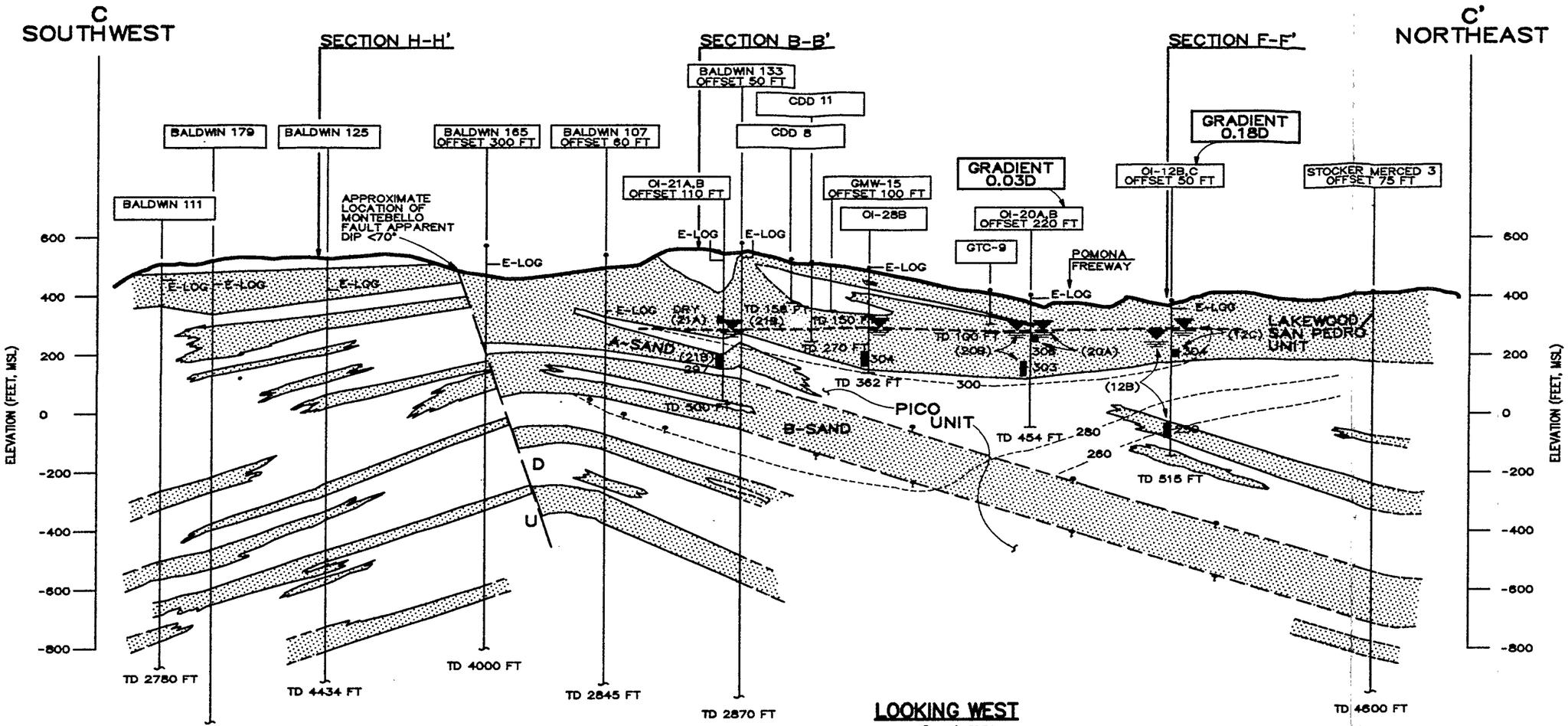

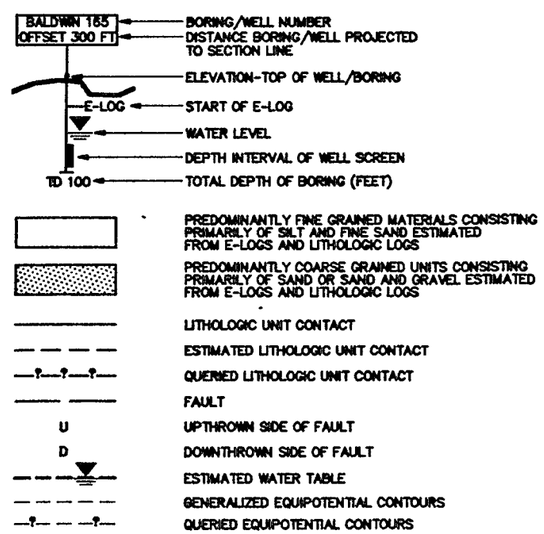

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NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

FIGURE 4-7
GENERALIZED EQUIPOTENTIAL CONTOURS
(SECTION C-C')
OH SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

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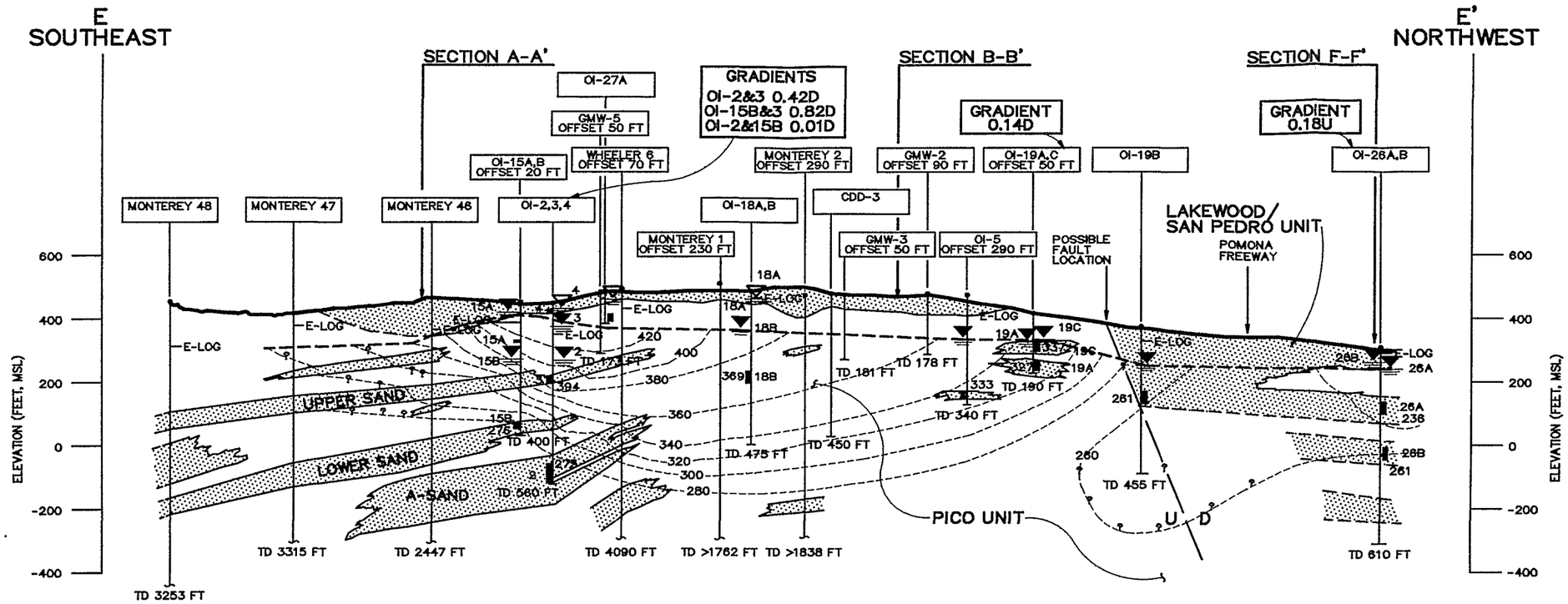

LOOKING SOUTHWEST

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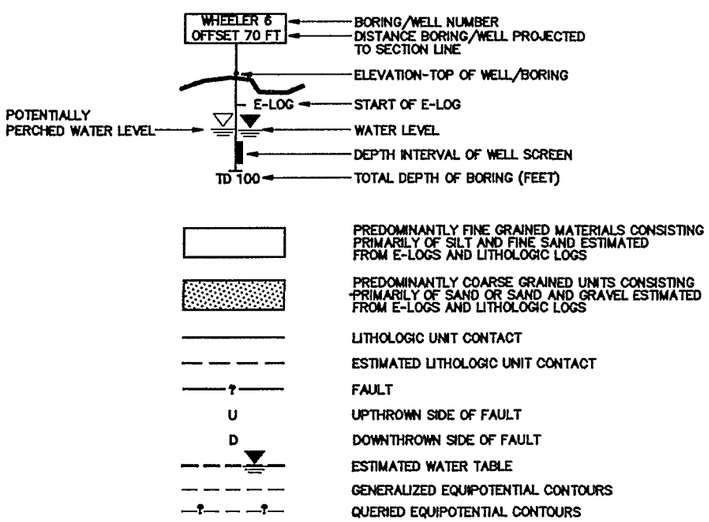
HORIZONTAL AND VERTICAL



NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

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FIGURE 4-9
GENERALIZED EQUIPOTENTIAL CONTOURS (SECTION E-E')
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

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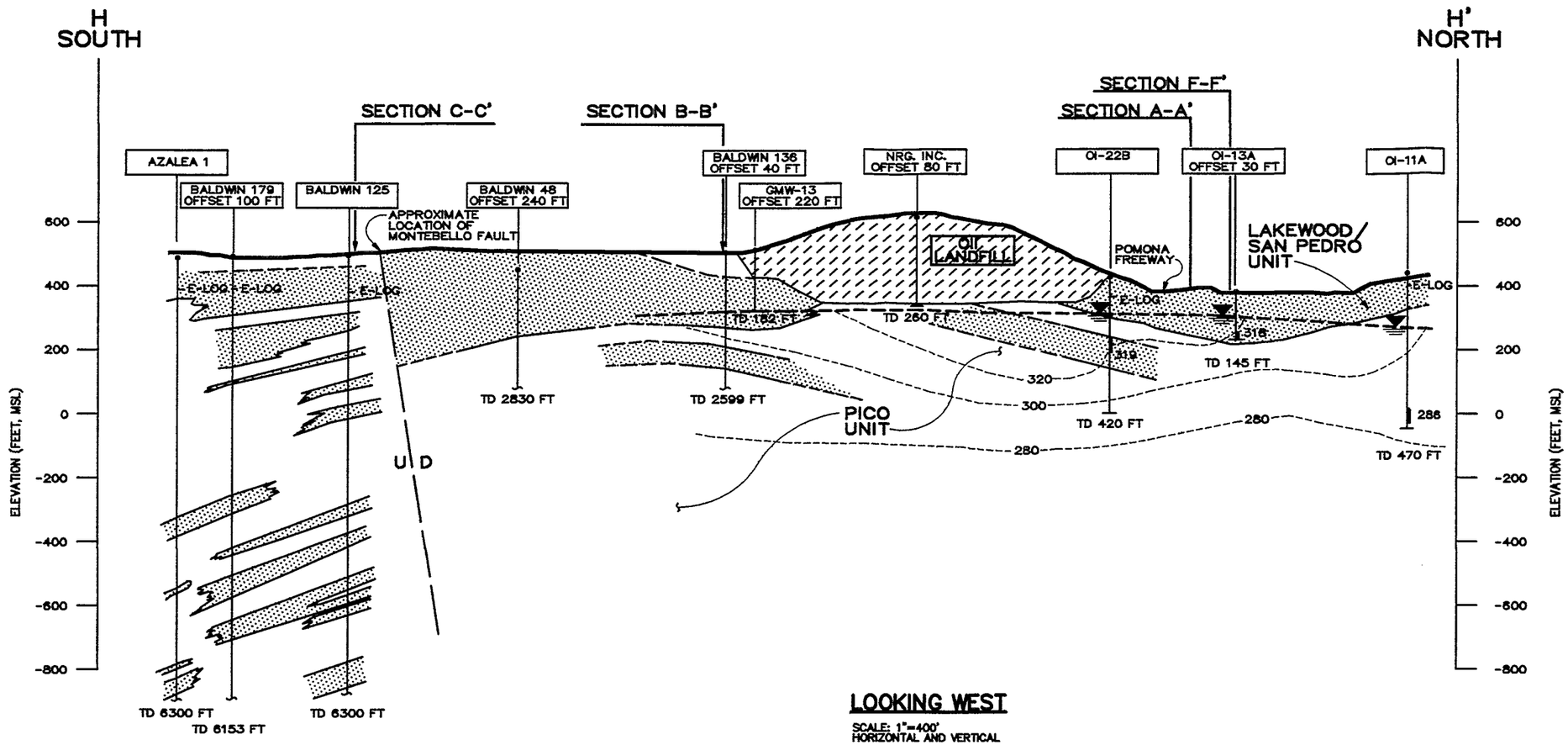

LOOKING WEST

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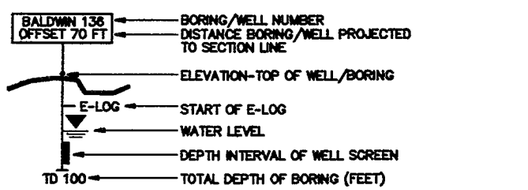

PREDOMINANTLY FINE GRAINED MATERIALS CONSISTING PRIMARILY OF SILT AND FINE SAND ESTIMATED FROM E-LOGS AND LITHOLOGIC LOGS

PREDOMINANTLY COARSE GRAINED UNITS CONSISTING PRIMARILY OF SAND OR SAND AND GRAVEL ESTIMATED FROM E-LOGS AND LITHOLOGIC LOGS

EXTENT OF REFUSE

LITHOLOGIC UNIT CONTACT

ESTIMATED LITHOLOGIC UNIT CONTACT

FAULT

ESTIMATED WATER TABLE

GENERALIZED EQUIPOTENTIAL CONTOURS

QUERIED EQUIPOTENTIAL CONTOURS

NOTE: SEE FIGURE 3-2 FOR CROSS SECTION LOCATIONS

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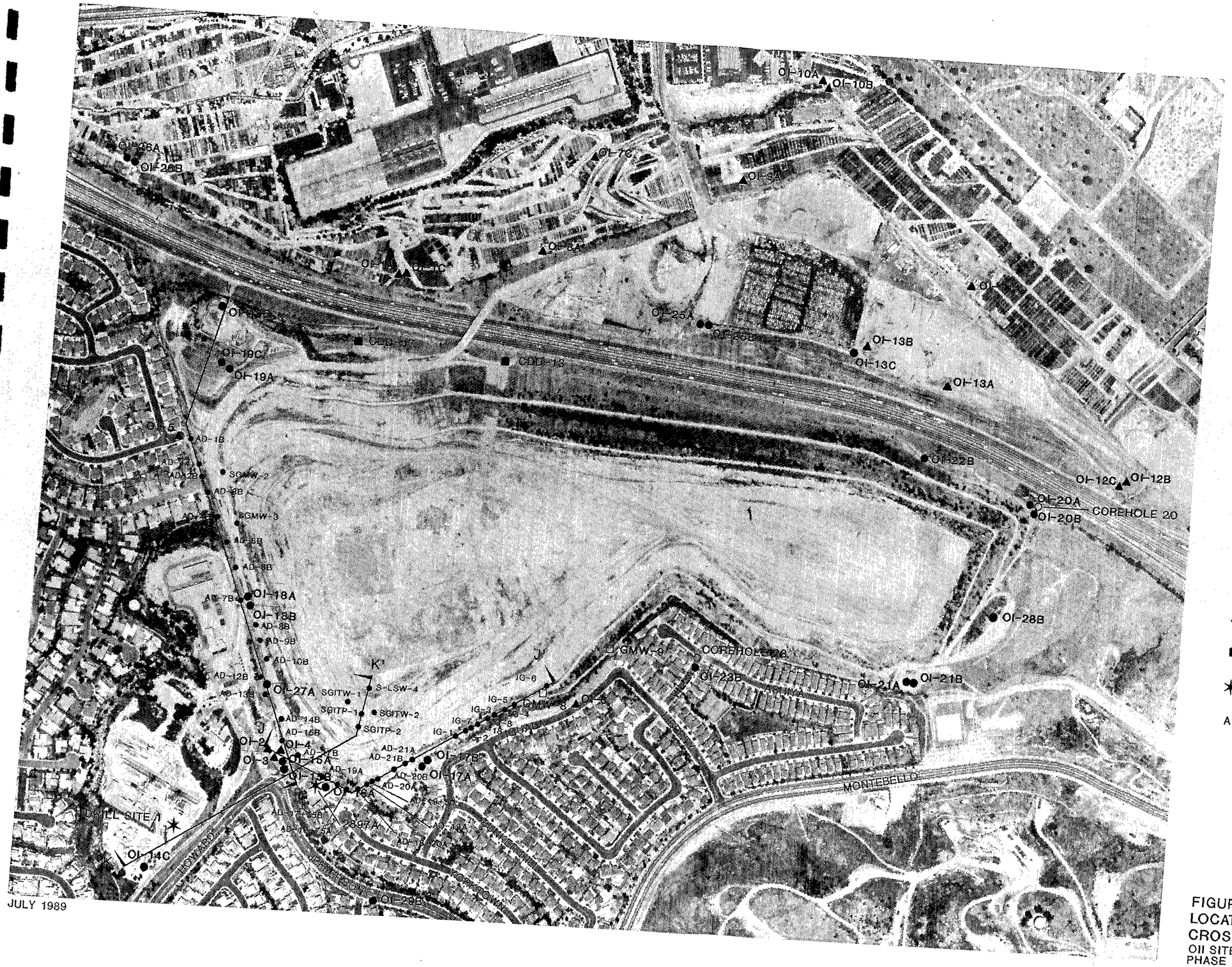
FIGURE 4-12
GENERALIZED EQUIPOTENTIAL CONTOURS (SECTION H-H')
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

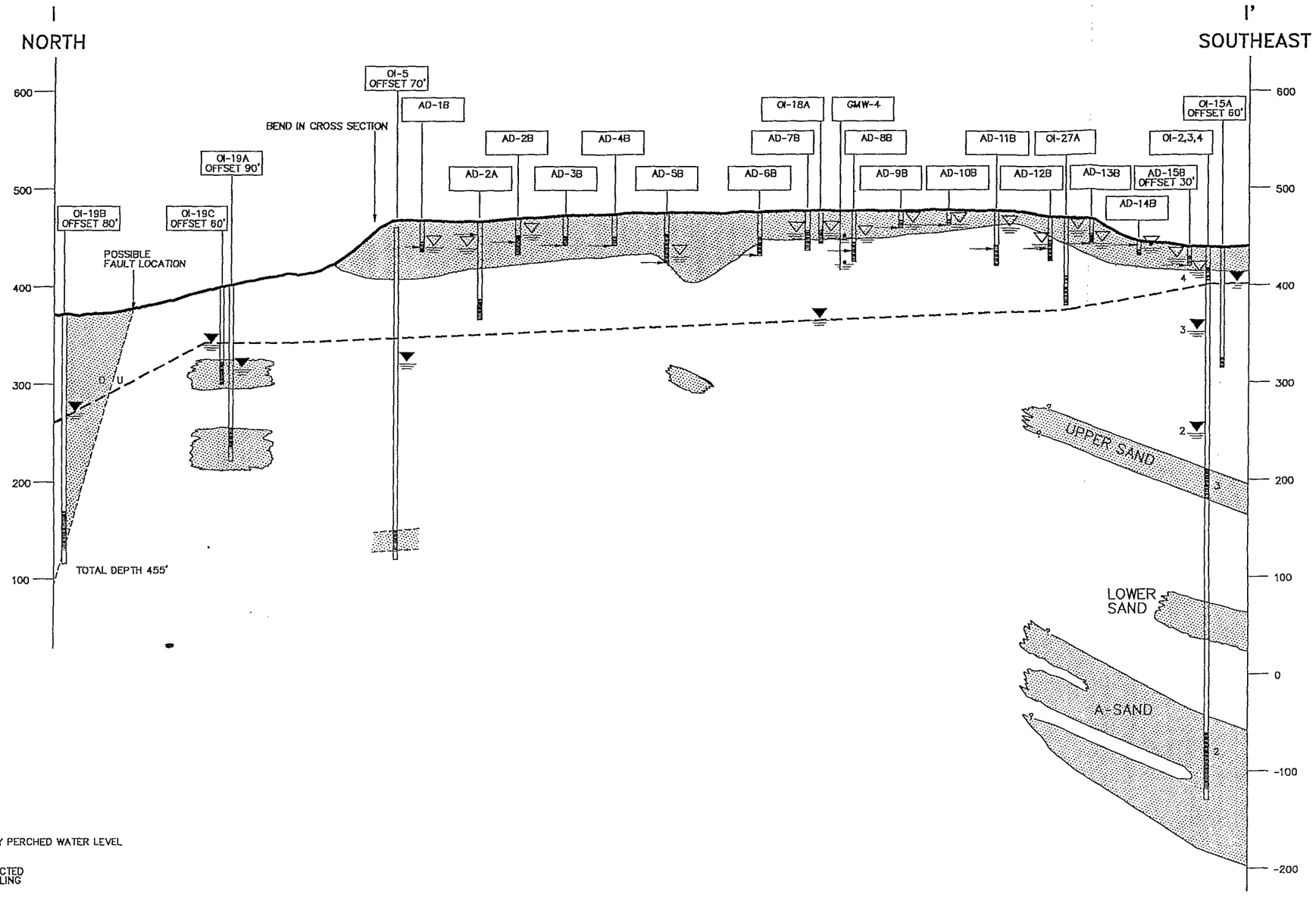


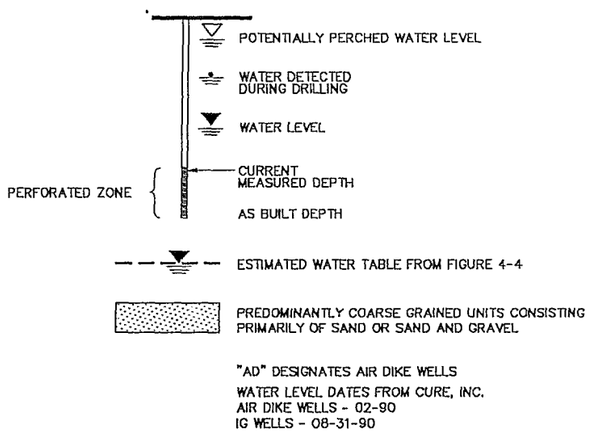
EXPLANATION

- ● CH2M HILL MONITORING WELL
- ○ CH2M HILL COREHOLE
- □ CH2M HILL LANDFILL GAS MONITORING WELL
- ▲ ECOLOGY AND ENVIRONMENT MONITORING WELL
- ■ CONVERSE, DAVIS, DIXON, & ASSOC. MONITORING WELL
- ✶ SOUTHERN CALIFORNIA GAS MONITORING WELL
- AD - AIR DIKE WELL

JULY 1989

FIGURE 4-13
LOCATIONS OF HYDROGEOLOGIC CROSS SECTIONS I-I', J-J', AND K-K'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION





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1"=120' VERTICAL

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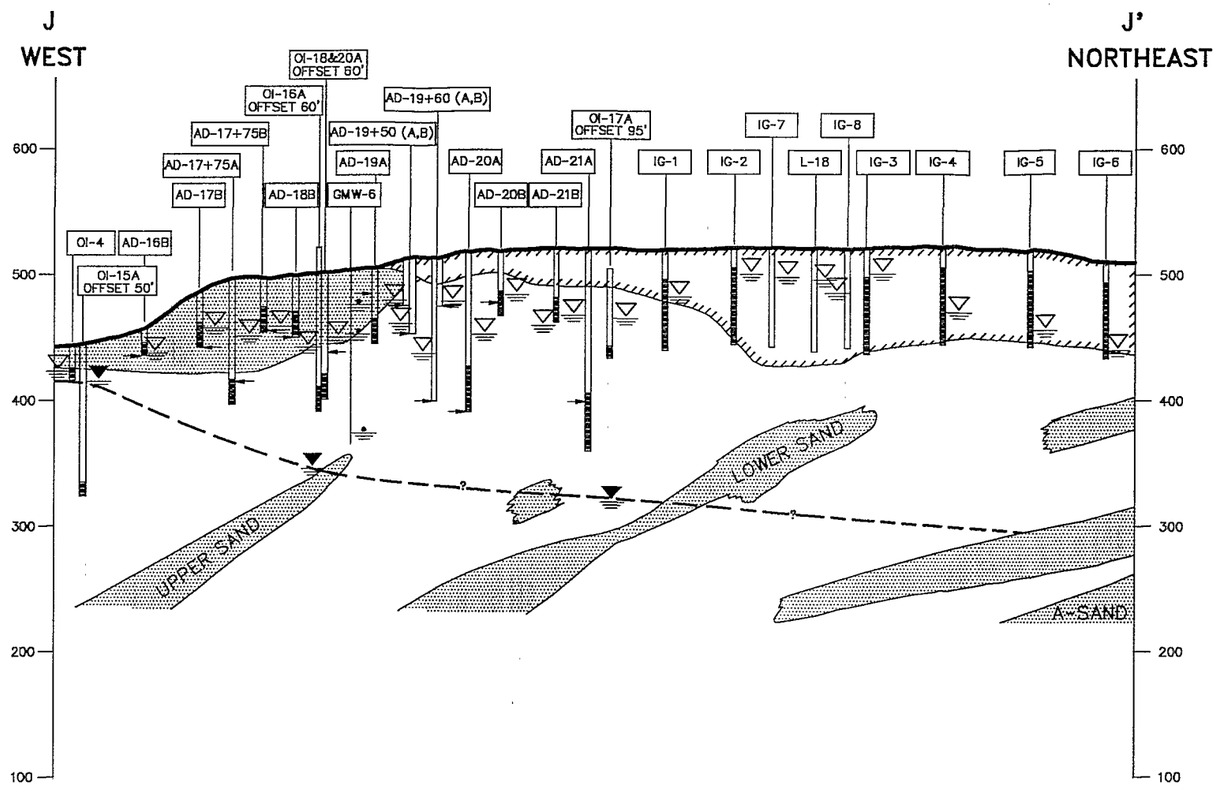
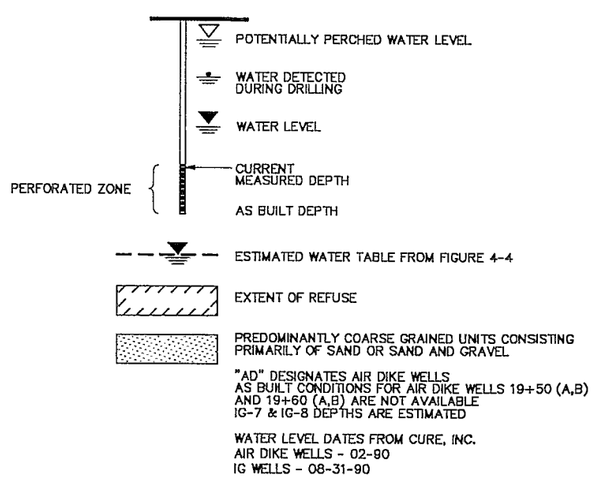
FIGURE 4-14
HYDROGEOLOGIC CROSS SECTION I-I'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION





SCALE: 1"=120' VERTICAL
1"=240' HORIZONTAL

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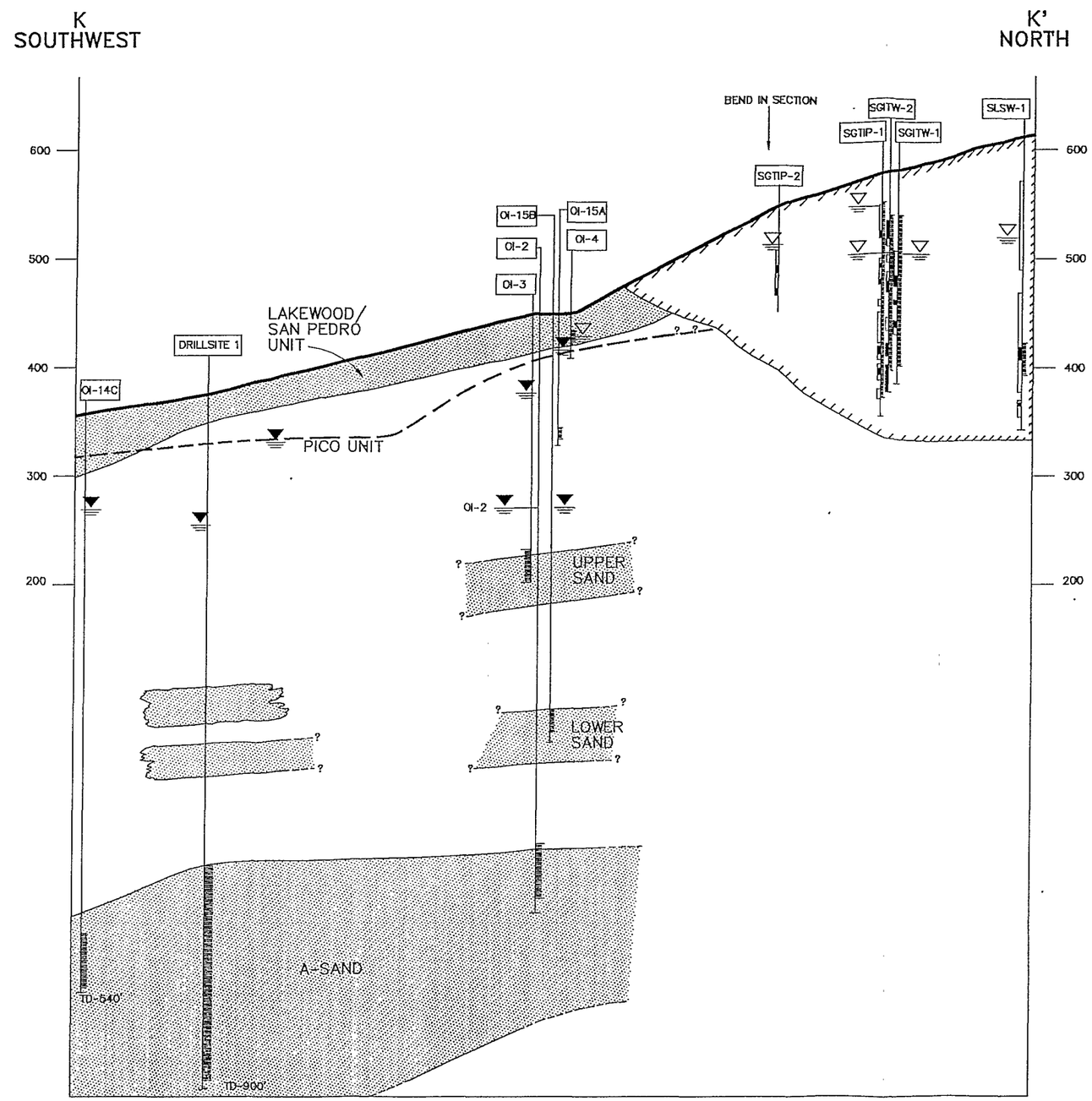
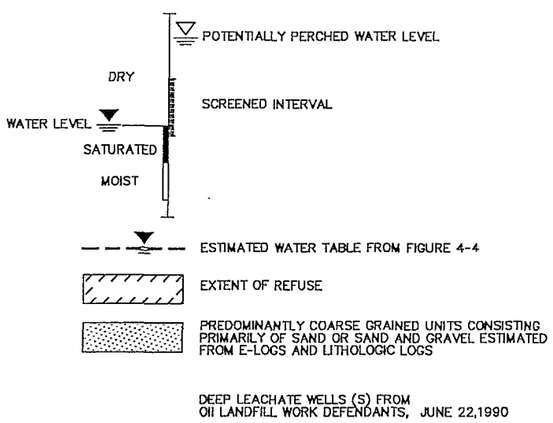
FIGURE 4-15
HYDROGEOLOGIC CROSS SECTION J-J'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION





SCALE: 1"=120' VERTICAL
1"=200' HORIZONTAL

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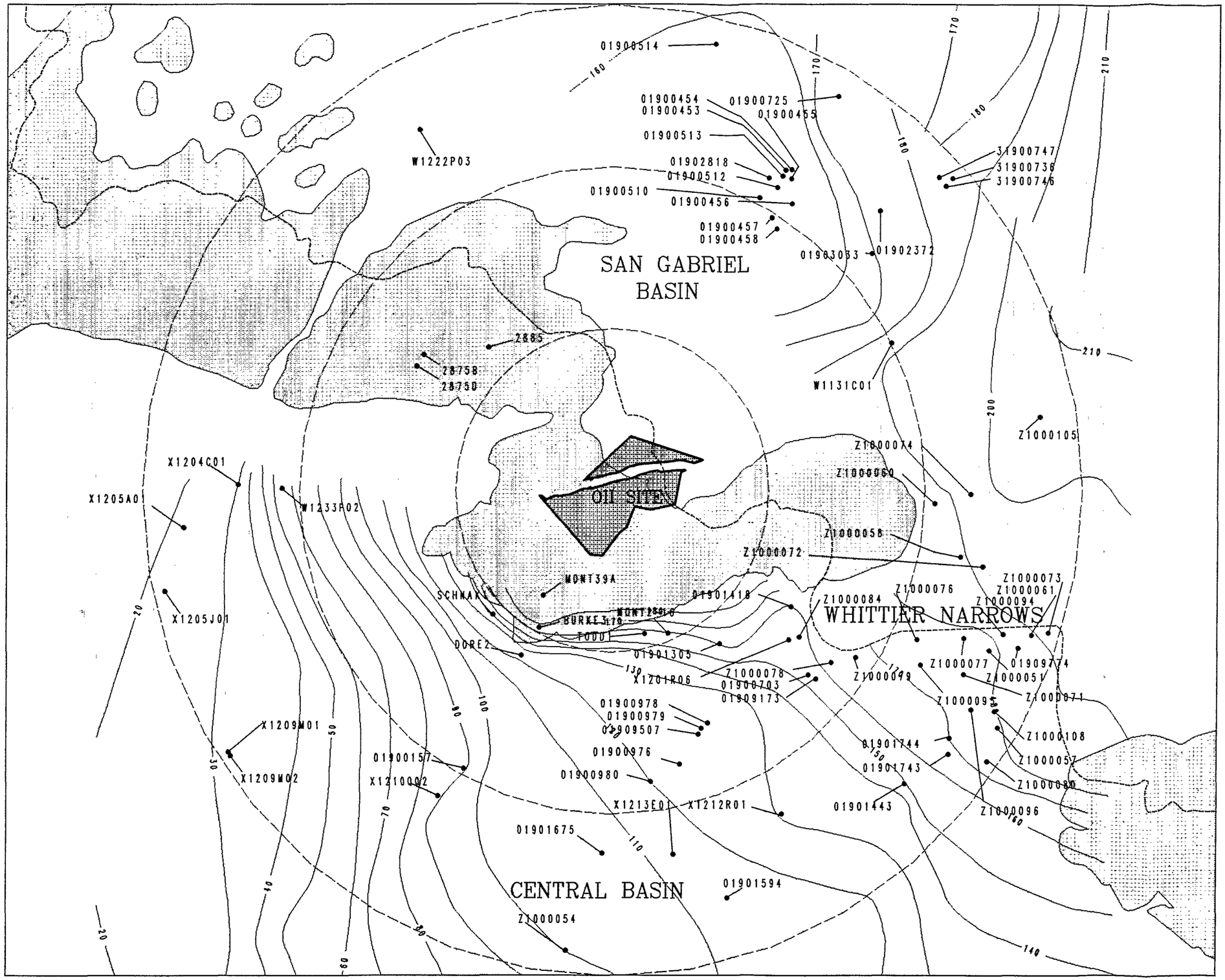
FIGURE 4-16
HYDROGEOLOGIC CROSS SECTION K-K'
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION



EXPLANATION

- WELL WITH WATER LEVEL DATA
- FALL 1986 POTENTIOMETRIC SURFACE CONTOURS
- 1- 2- & 3-MILE RADIUS AROUND OII
- HYDROLOGIC BOUNDARY
- APPROXIMATE BOUNDARY OF CONSOLIDATED GEOLOGIC UNITS

NOTE:
Bedrock and hydrologic boundary source: CDWR (1961,1966)

FIGURE 4-17

FALL 1986 POTENTIOMETRIC SURFACE AND WELLS HAVING WATER LEVEL DATA WITHIN A THREE MILE RADIUS OF OII

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

Section 5
WASTE CHARACTERIZATION

Section 5
WASTE CHARACTERIZATION

The potential for groundwater contamination at the OII site is dependent on the hydrogeology of the site and the quantity, location, and chemical content of disposed wastes. This chapter summarizes waste types, locations, and quantities, disposal methods and locations, and the occurrence and chemical composition of two potential sources of groundwater contamination: leachate and landfill gas.

5.1 DISPOSAL METHODS AND AREAS

5.1.1 HISTORICAL DISPOSAL OPERATIONS

Prior to 1946, the OII site was a sand and gravel quarry. Disposal operations at the OII Landfill site began in October 1948 when the Monterey Park Disposal Company (MPD) leased 14 acres from Henry H. Wheeler. An operations agreement between the City of Monterey Park and MPD provided that MPD would operate a municipal landfill on behalf of the City.

The landfill reverted to private ownership by OII in early 1952 when zoning variances for operating the landfill were not obtained by MPD. The site expanded to 218 acres as additional Wheeler property was obtained in 1953 and again in 1958.

The California Regional Water Pollution Control Board No. 4, Los Angeles Region (CRWPCB) first permitted disposal of liquids at the site in October 1954, (Resolution No. 54-15). The site was permitted as a Class II-1 waste site. It was permitted to accept Group 2 wastes (ordinary household refuse, decomposable organic refuse, and selected scrap metal), Group 3 wastes (nondecomposable inert solids), and various liquid industrial wastes, including paint sludge, acetylene sludge, and refinery tank bottoms (leaded). Permitted liquids were to be deposited only in virgin soil and not distributed over refuse. The board's resolution noted that liquid industrial wastes had been previously accepted for disposal along what was then the south boundary of the landfill. In 1956, CRWPCB modified the permit to allow mixing of liquid wastes at the moving face of the landfill, provided that there would be no ponding within or around the deposited refuse (Resolution No. 56-25).

In 1959, OII Landfill was permitted by the CRWPCB to dispose of specified semiliquid wastes with the refuse limited in quantity to 10 gallons per cubic yard of refuse (Resolution No. 59-9). The semiliquid wastes were to be immediately mixed with refuse in a manner to prevent runoff to adjoining areas.

The state of California purchased 28 acres for the construction of the Pomona Freeway (completed in 1964), which separated the site into a 45-acre North Parcel and a 145-acre South Parcel. In August 1975, the Monterey Park City Council adopted Resolution 78-76, which eliminated solid waste disposal, other than clean soil, on the North Parcel and a 15-acre area in the northwestern section of the South Parcel. Thus, after 1975, solid waste disposal was limited to a 130-acre section in the South Parcel.

The height of the landfill was first limited to 540 feet in 1957 (Los Angeles County Zoning Board Zone Exception 29711-1) based on the height of the surrounding hills. To account for the loss of the 60 acres eliminated from the waste disposal, the city of Monterey Park increased the height limit to 605 feet in June 1975. The height limit was again increased to 640 feet in August 1975 with the adoption of resolution 78-76.

In March 1976, the Los Angeles Regional Water Quality Control Board (LARWQCB) formerly the CRWPCB, limited disposal of liquids to a 32-acre area in the western portion of the South Parcel (Order No. 76-30), as shown in Figure 5-1. This order allowed OII to mix liquids with solid refuse at a ratio of 10 gallons per cubic yard; the ratio was increased to 20 gallons per cubic yard in September 1976 with Order 76-133. Leachate generated at the site was collected and redisposed back onto the working face of the landfill.

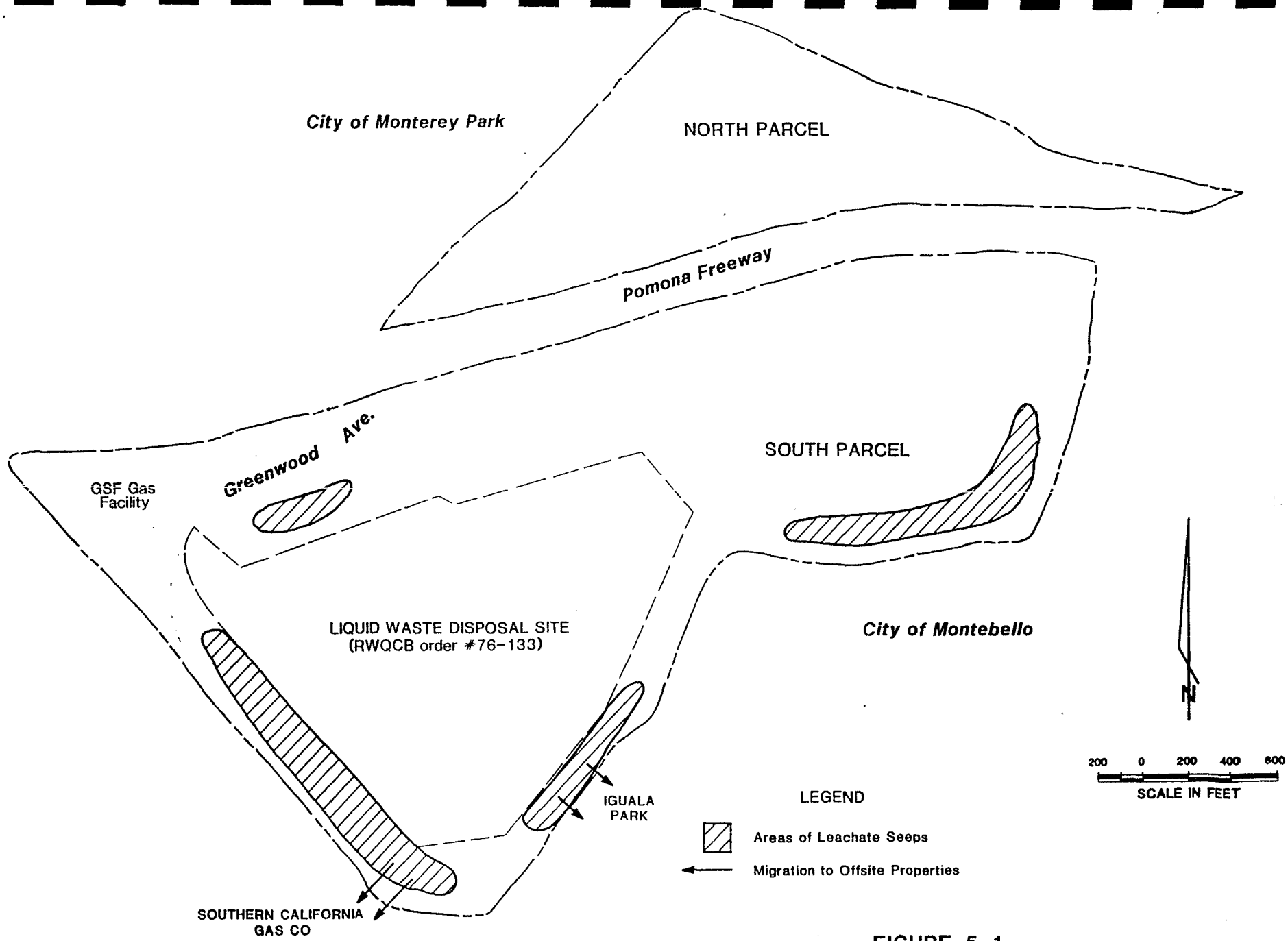
In 1982, leachate was observed seeping offsite (LARWQCB, 1984).

OII ceased accepting hazardous liquid waste in January 1983 and all liquid waste in April 1983. A leachate collection system was installed to collect leachate seeping form the landfill. Collected leachate was disposed of by mixing it with incoming refuse (LARWQCB, 1984). The California Department of Health Services (CDHS) classified leachate generated at the site as hazardous and prohibited redisposal effective October 1984. Violations of operations, maintenance, and disposal practices were noted by local and federal agencies during 1978 to 1983. Borings drilled by Pacific Soils Engineering, Inc. (1978) at the interior flare station (FS2) plant location indicate the presence of refuse in the northwest corner of the South Parcel, the area excluded from waste disposal per Resolution 78-76. Chevron (1985) data verify the presence of waste beyond the east boundary of the South Parcel.

Liquid disposal wells were located in the southeast corner of the South Parcel, in an area where leachate seeps had occurred (Figure 5-1). There are no records available that document disposal practices at these wells (EPA, October 10, 1988).

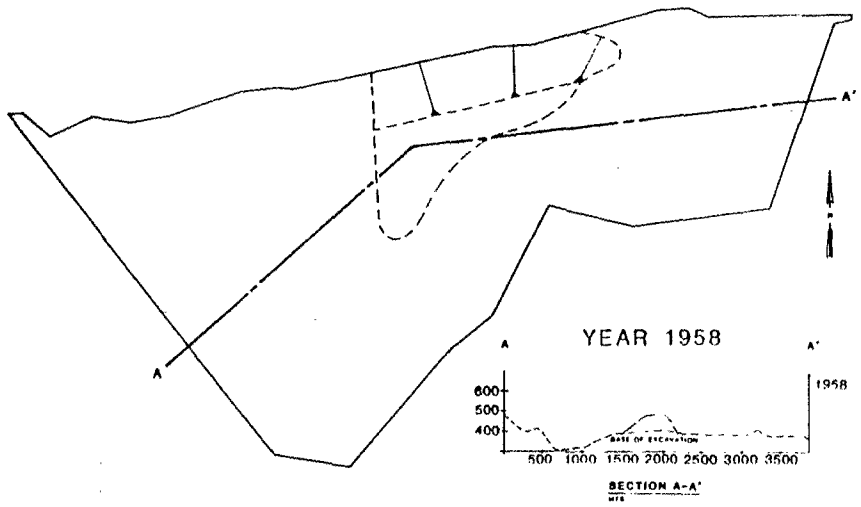
5.1.2 LANDFILL DEVELOPMENT

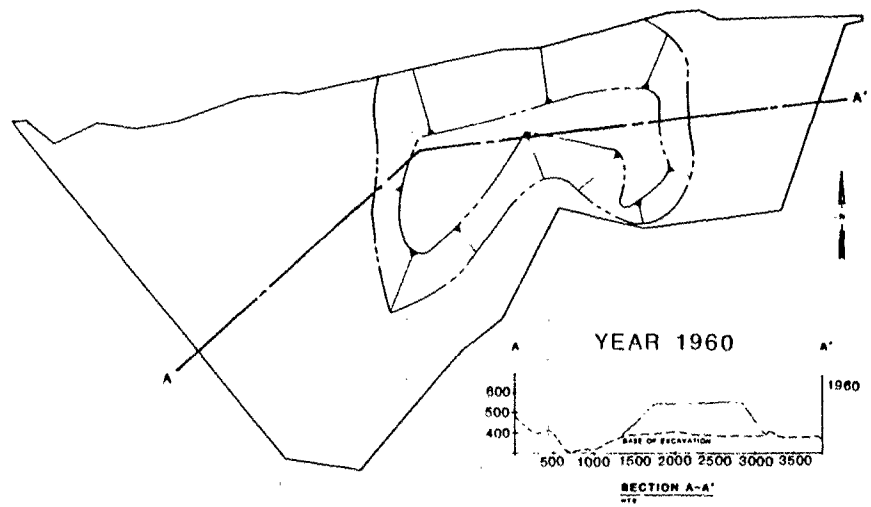
The landfill appears to have developed in six basic stages (EPA, June 1988). The approximate areas associated with these stages are shown in Figure 5-2.

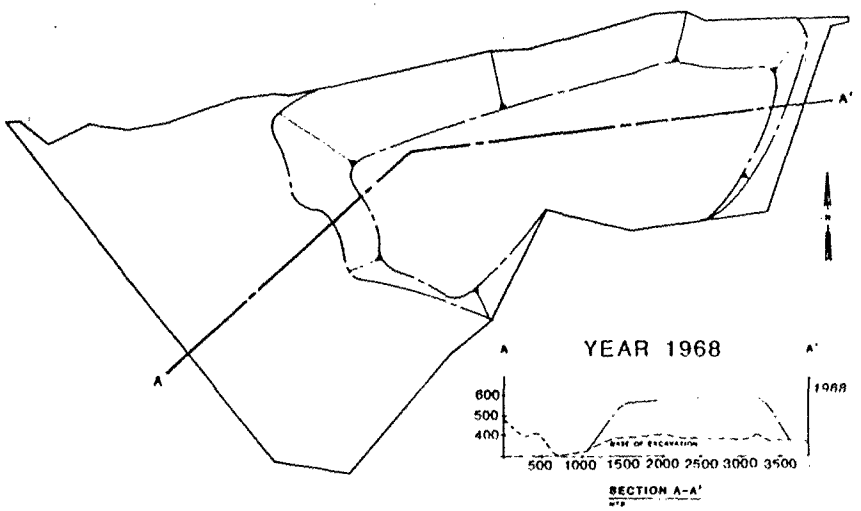


SOURCE: U.S. EPA. Interim Leachate Management Feasibility Study Report for the Oil Landfill Site. Prepared by Camp Dresser and McKee. DECEMBER 1987

FIGURE 5-1
LOCATION OF LEACHATE SEEPS AND PERMITTED LIQUID DISPOSAL AREA
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION







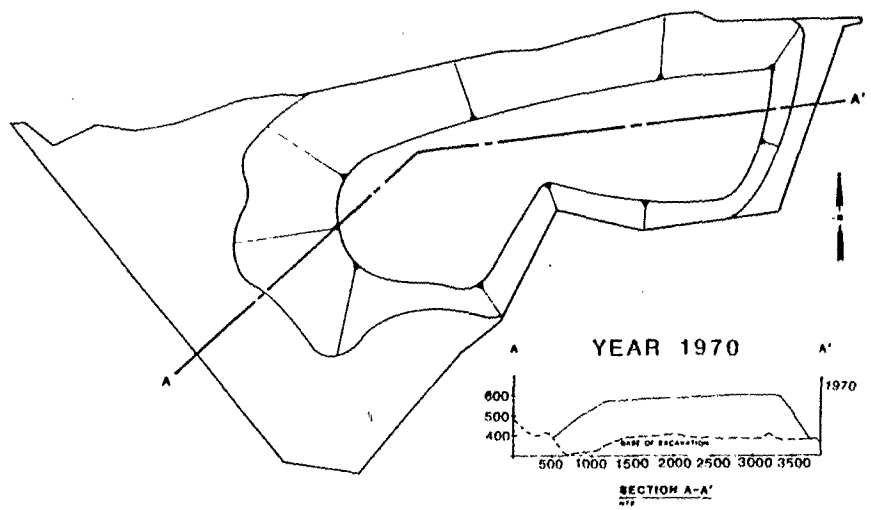
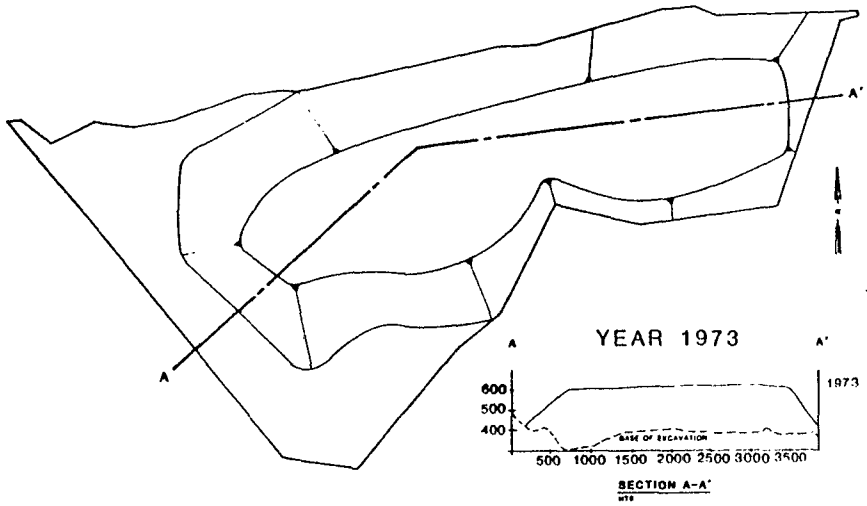
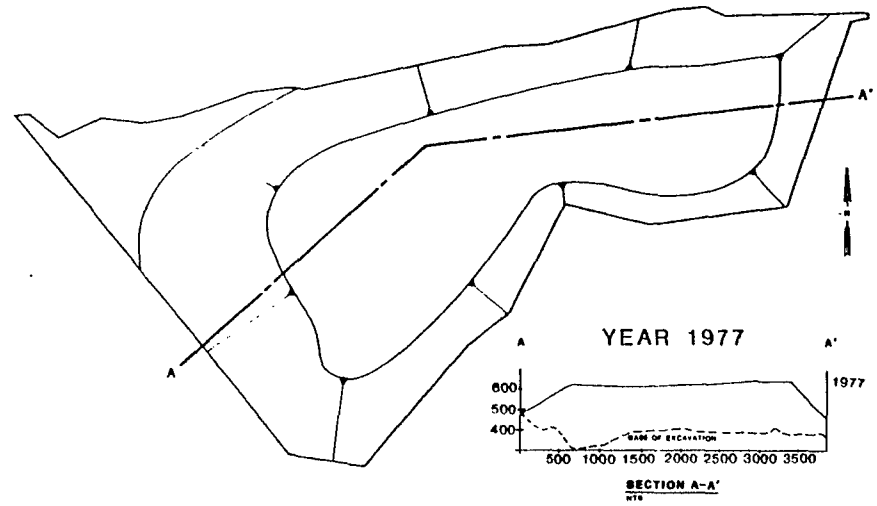
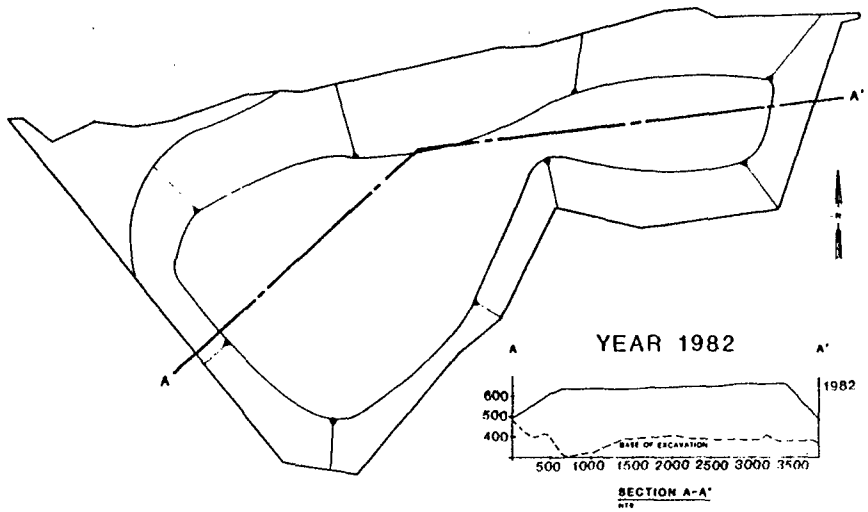


FIGURE 5-2
LANDFILL DEVELOPMENT (PAGE 1 OF 2)
OII SITE, MONTEREY PARK, CALIFORNIA

SOURCE: EPA (JUNE 1988)







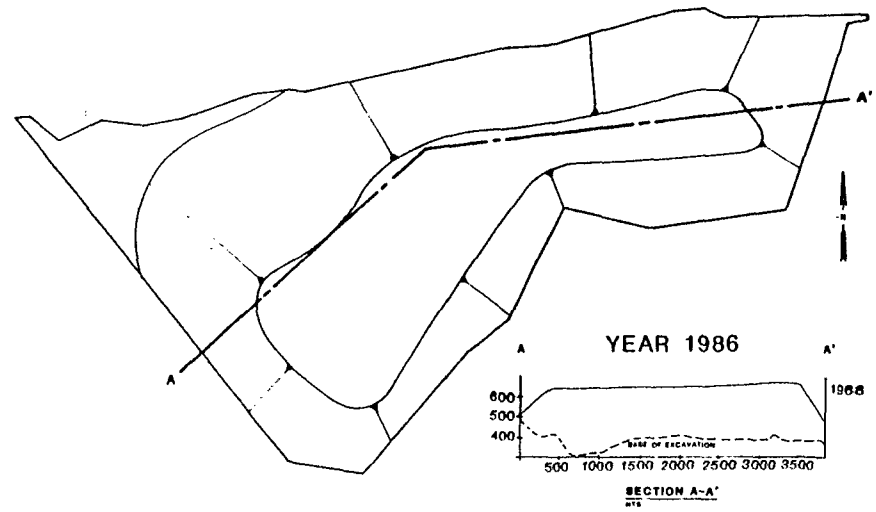


FIGURE 5-2
LANDFILL DEVELOPMENT (PAGE 2 OF 2)
OII SITE, MONTEREY PARK, CALIFORNIA

SOURCE: EPA (JUNE 1988)

Landfilling operations began in 1948 by filling existing natural canyons with refuse. The canyons are shown on the map of predevelopment topography (Figure 5-3). Figures 5-4, 5-5, and 5-6 are aerial photos of the site vicinity from 1949, 1960, and 1968, respectively. This early filling occurred in the area presently occupied by a portion of the Pomona Freeway and north-central portions of the South Parcel (Figures 5-2 and 5-4). Caltrans subsurface information, collected in 1955 and 1957 as part of the investigation for the Pomona Freeway, verified the reported early canyon filling. In addition, Caltrans' (January 31, 1964) materials report for construction of the Pomona Freeway indicates that approximately 170,000 cubic yards of refuse within the freeway alignment were excavated and redeposited on the north side of the South Parcel.

Cut and cover filling operations began in the early 1950s. Excavated soil was temporarily stockpiled for use as intermediate landfill cover during filling. By 1958, South Parcel filling had occurred over an approximate 25-acre portion of the central part ("neck") of the parcel to an elevation of approximately 500 feet above sea level (fasl). This early filling established a north-facing fill slope; subsequent filling expanded the landfill to the south, east, and west by sequentially excavating and covering wastes with native soils.

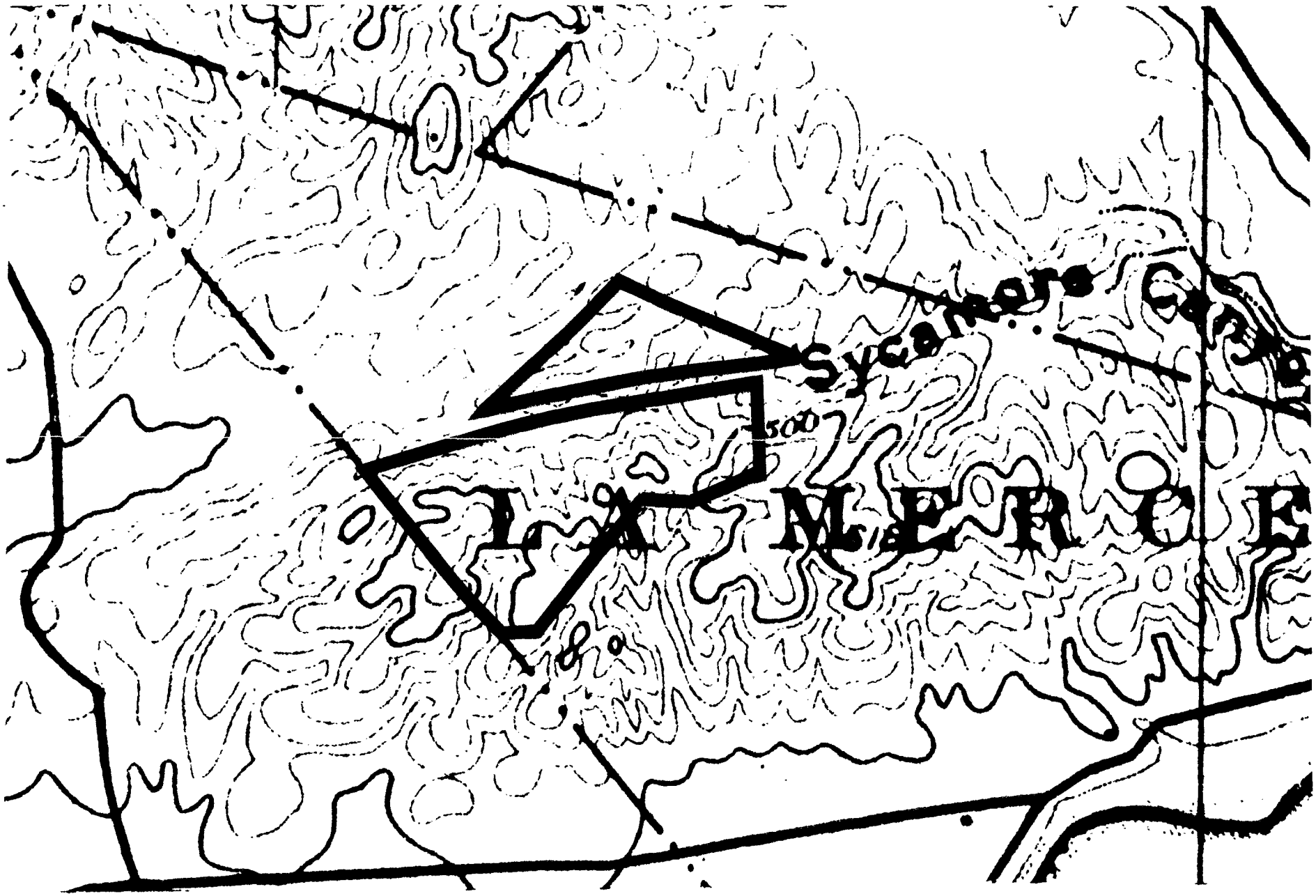
Between 1958 and 1960, filling continued in the neck portion of the parcel. The area of filling increased to approximately 50 acres and to an elevation of 540 feet.

Between 1960 and 1968, the landfill continued to expand to the east and south. By 1968, filling reached the southern boundary of the eastern half of the South Parcel, and expanded nearly to the eastern parcel boundary (Figures 5-2 and 5-6). The elevation of the top of the landfill remained at approximately 540 feet in 1968.

Between 1968 and 1970, the landfill was expanded toward the west, and waste was deposited in a narrow strip along the eastern boundary of the South Parcel. The landfill operations during this period included filling a portion of the adjacent Chevron property (east boundary) that had experienced a slope failure in 1964. The maximum landfill elevation remained at approximately 540 feet during this period.

Between 1970 and 1973, the landfill was expanded toward the west and encompassed the Livingston Rock and Quarry Company quarry area, while maintaining a maximum elevation of approximately 540 feet.

Between 1973 and 1977, landfilling operations expanded to the western boundary of the parcel and, after the permitted elevation was increased in 1975, operations raised the top of the landfill to an elevation of approximately 600 feet. Prior to the permitted elevation increase in 1975, portions of the eastern half of the landfill received quantities of soil cover materials in preparation for closing operations; these cover materials were reportedly buried by waste as the landfill was raised to the new height limit.

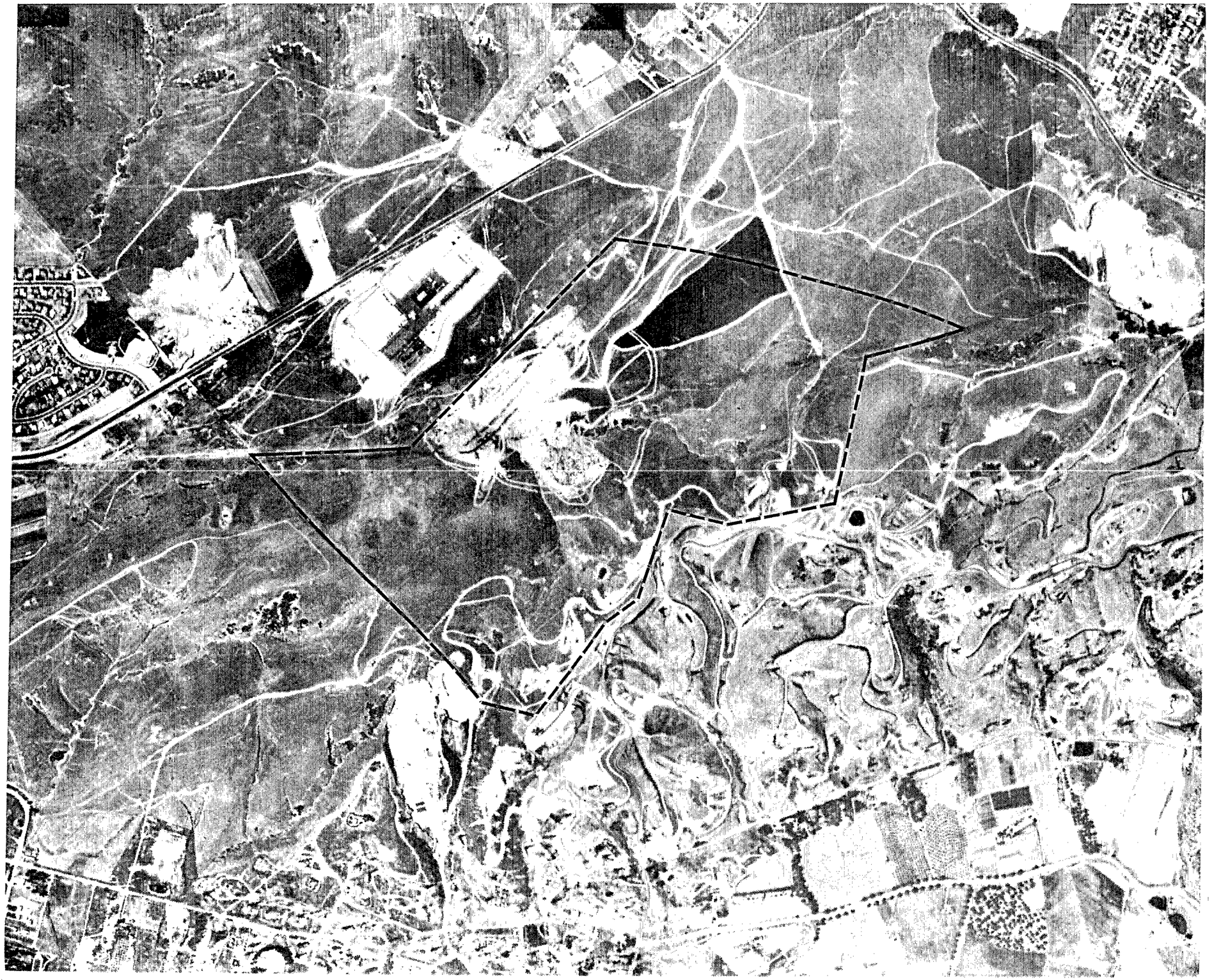


SOURCE: USGS 15' TOPOGRAPHIC QUADRANGLE,
PASADENA SHEET, APRIL 1900 EDITION

SCALE IN MILES

0 .25

FIGURE 5-3
PRE-DEVELOPMENT
TOPOGRAPHY OF OII SITE
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION



N

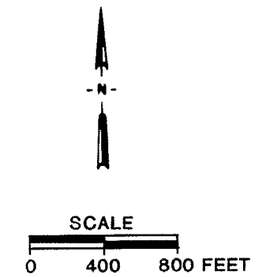
SCALE

0 400 800 FEET

LEGEND

APPROXIMATE CURRENT SITE BOUNDARY

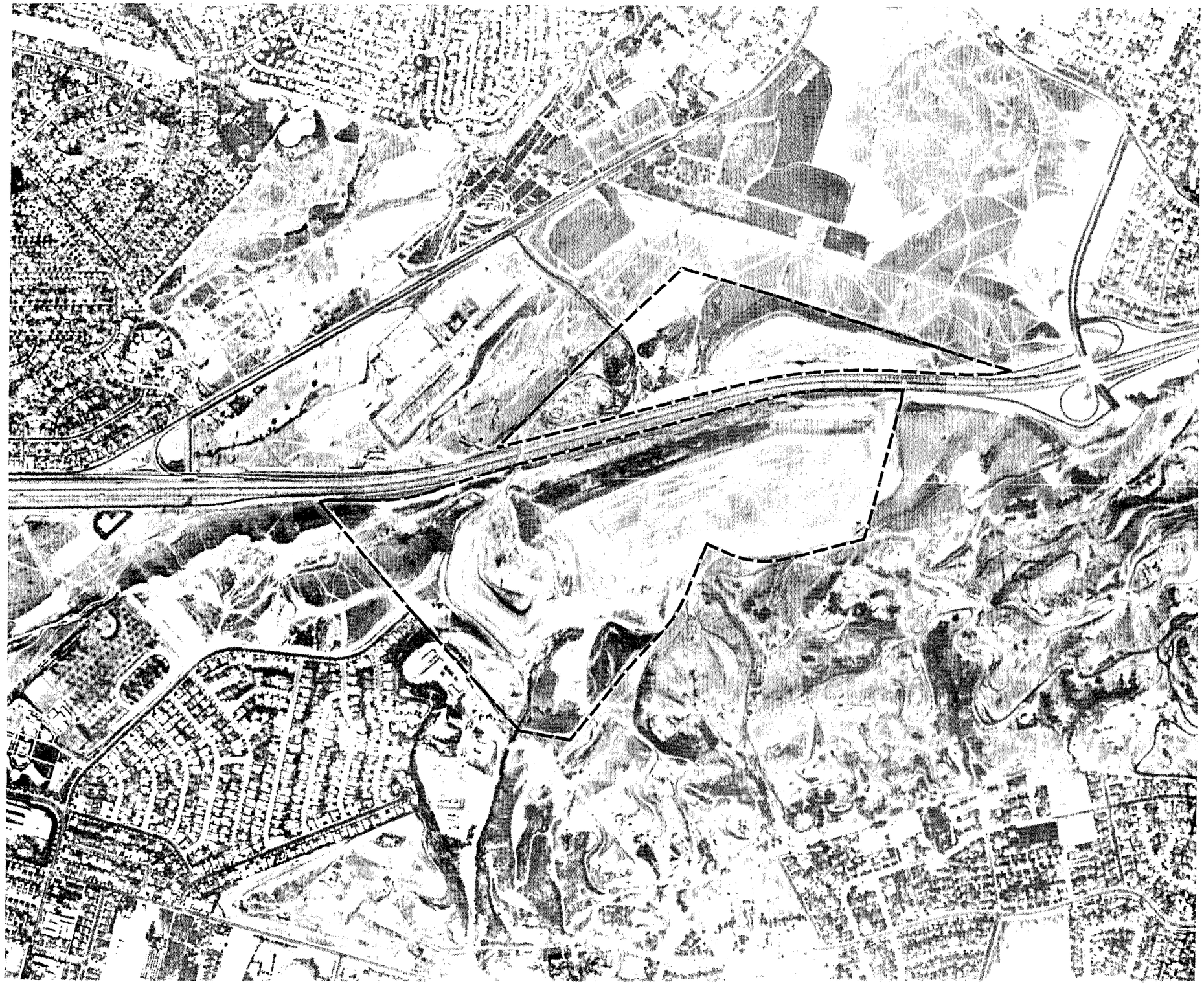
FIGURE 5-4
1949 AERIAL PHOTOGRAPH
OF OII SITE VICINITY
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

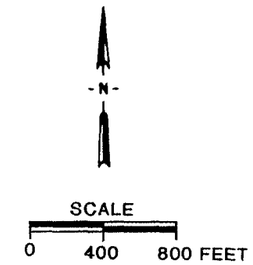


LEGEND

APPROXIMATE CURRENT SITE BOUNDARY

FIGURE 5-5
1960 AERIAL PHOTOGRAPH OF OII SITE VICINITY
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION





LEGEND

APPROXIMATE CURRENT SITE BOUNDARY

FIGURE 5-6
1968 AERIAL PHOTOGRAPH OF OII SITE VICINITY
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

Between 1977 and 1982, landfilling continued primarily along the western boundary of the parcel and across the landfill top (filling from east to west to an elevation of approximately 620 feet).

Between 1982 and 1984, the landfill was raised to an average elevation of approximately 640 feet. In addition, soil cover materials were imported to allow regrading and cover on the slopes. Landfilling operations ceased in 1984.

5.2 WASTE TYPES AND QUANTITIES

Records of the mass of refuse accepted at the site begin in 1976. The types of waste permitted for disposal at the OII site from 1976 to 1985 are listed in Tables 5-1 and 5-2.

Estimates of the yearly receipt of refuse from 1948 through 1986 are given in Table 5-3; graphical representations of cumulative landfill volume increases are shown in Figure 5-7. The mass of waste disposed prior to 1976 was estimated by first determining the volume of waste placed between 1948 and 1976, and multiplying by estimated inplace density factors (EPA, June 1988). A range of tonnages is presented since a range of inplace densities was used for two of the time periods. The total estimated volume and mass of refuse landfilled at OII over specific time periods is summarized in Table 5-4.

The mass of refuse disposed of during each year of operation was estimated using truck counts, a limited amount of scale data, a series of topographic maps, empirically derived correction factors, and estimates of inplace density. More than three-fourths of the refuse was landfilled before 1974, prior to the period for which truck counts and delivered weight were recorded. The depth of cut at the landfill, which served as the base for volume calculations, was determined for a majority of the site, but estimated for a number of areas.

Liquid wastes were disposed of at the OII site throughout its history. More than 300 million gallons of liquids are recorded as having been disposed between 1976 and 1983. Liquids were excluded from the refuse mass calculations. The presence of moisture in refuse increases the landfill gas (LFG) generation rate and facilitates the production of leachate. In addition, due to the hazardous nature of the liquid wastes disposed of at OII, they represent a potential source of the hazardous constituents present in the leachate and LFG at OII.

Figure 5-8 shows the elevation of the base of the landfill in the South Parcel and the thickness of the waste in both the North and South Parcel. The base of the landfill is excavated below the elevation of the site boundary. The thickness of solid waste in the South Parcel averages from approximately 200 to 325 feet. In the western half of the

Table 5-1
Generic Wastes Disposed at OII from 1976 to 1984

Natural earth
Rock, sand, and gravel
Paving fragments
Concrete
Brick
Plastic and plaster products
Steel mill slag
Clay base rotary mud
Mud cake from oil field sumps
Street sweepings
Glass
Asbestos fiber and products therefrom
Metals and metal products except magnesium and its alloys
Paper and paper products including roofing and tar paper
Cloth and clothing
Wood and wood products
Lawn clippings, sod, and shrubbery
Cold ashes
Manufactured rubber products
Solid plastic products
Paint sludge received from water-circulating paint spray booths not transported in vacuum tanks
Rotary drilling mud from oil field drilling operations
Cleanings from production tanks
Acetylene sludge
Sludge from automobile wash racks and steam-cleaning products
Mud and water from laundries
Liquid latex waste
Ceramic, pottery, and glaze wastes
Lime and soda water
Paint sludge recovered from water circulated in paint spray
Water containing not more than 0.5 percent molasses
Market refuse

Not acceptable for disposal: spent acid waste; spent caustic waste; common chemically stable salts from manufacturing or industrial processes; and market refuse, except in limited quantities.

Source: U.S. Environmental Protection Agency. Interim Leachate Management Feasibility Study Report for the OII Landfill Site. Prepared by Camp Dresser & McKee Inc. December 30, 1987.

Table 5-2
Generic Liquid Wastes Disposed at OII from 1976 to 1984

(Percent figures are approximate values based on general descriptions appearing on OII Monthly Reports to the LARWQCB)

Mud and water	60%
Mud, water, and oil	12%
Drilling mud	4%
Tank bottom	6%
Latex wastes	2%
Paint sludge	2%
Coolant	1.5%
Carbon black and water	1%
Remaining generic types	11.5%

Alkaline solution
Aluminum sludge and flocculent
Animal fat and water
Asbestos pulp and water
Asphalt and water
Brake fluid
Brine
Burnishing media
Burner (baghouse) dust
Carpet material and water
CAT CR catalyst
Caustic soda
Caustic solution
Cement and water
Ceramic glaze
Cleaning compound
Coconut
Corn syrup
Creosote
Dairy wastes
Diamogion silica
Dough and water
FCC fines and water
Fiber glass
Film gelatin
Lint and water
Liquor
Metal dust and water
Mineral water
Molasses and water
Nickel, copper, and water
Oxides (Al, Pb, Si, Zr)
Organic wastes
Perlite
Petroleum industry sludge
Plastic dust
Polymer sludge
Rain water
Resin, PVC, and water
Rouge and water
Rust sludge
Sand and water
Sawdust and water
Setting basin sludge
Slurry
Soap and water
Sodium silicate
Starch and water
Stretford solution
Sulfur fines in water

Table 5-2
(Continued)

Filter clay	Tank sludge
Fish and water	Tar pit sludge
Food-processing wastes	Tile glaze
Glass dust and water	Waste paper
Glue and water	Waste water
Grease waste and water	Wax (polishing compound) and water
Ink and water	Welding flux
Lime and water	

Source: U.S. Environmental Protection Agency. Interim Leachate Management Feasibility Study Report for the OII Landfill Site. Prepared by Camp Dresser & McKee Inc. December 30, 1987.

Table 5-3
OII Yearly Receipt of Refuse

	Higher Estimate (10^6 tons)		Lower Estimate (10^6 tons)	
Year	Cumulative	Annual	Cumulative	Annual
1948	0.0	-	0.0	-
1949	0.2	0.2	0.2	0.2
1950	0.4	0.2	0.4	0.2
1951	0.6	0.2	0.5	0.1
1952	0.9	0.3	0.7	0.2
1953	1.3	0.4	0.9	0.2
1954	1.6	0.3	1.2	0.3
1955	2.0	0.4	1.5	0.3
1956	2.5	0.5	1.8	0.3
1957	3.1	0.6	2.0	0.2
1958	3.9	0.8	2.5	0.5
1959	4.8	0.9	3.0	0.5
1960	5.8	1.0	3.5	0.5
1961	6.9	1.1	4.1	0.6
1962	8.3	1.4	5.0	0.9
1963	9.8	1.5	6.0	1.0
1964	11.3	1.5	7.0	1.0
1965	12.8	1.5	8.2	1.2
1966	14.4	1.6	9.3	1.1
1967	16.0	1.6	10.4	1.1
1968	17.5	1.5	11.5	1.1
1969	19.0	1.5	12.5	1.0
1970	20.5	1.5	13.6	1.1

Table 5-3
(Continued)

	Higher Estimate (10^6 tons)		Lower Estimate (10^6 tons)	
Year	Cumulative	Annual	Cumulative	Annual
1971	22.0	1.5	14.8	1.2
1972	23.5	1.5	15.7	0.9
1973	24.9	1.4	16.6	0.9
1974	26.2	1.3	17.5	0.9
1975	27.1	0.9	18.3	0.3
1976	27.9	0.8	19.1	0.8
1977	28.5	0.6	19.7	0.6
1978	29.0	0.5	20.2	0.5
1979	29.4	0.4	20.6	0.4
1980	29.7	0.3	20.9	0.3
1981	30.0	0.3	21.3	0.4
1982	30.3	0.3	21.6	0.3
1983	30.5	0.2	21.8	0.2
1984	30.7	0.2	22.0	0.2
1985	30.8	0.1	22.0	0.0
1986	30.8	0.0	22.0	0.0

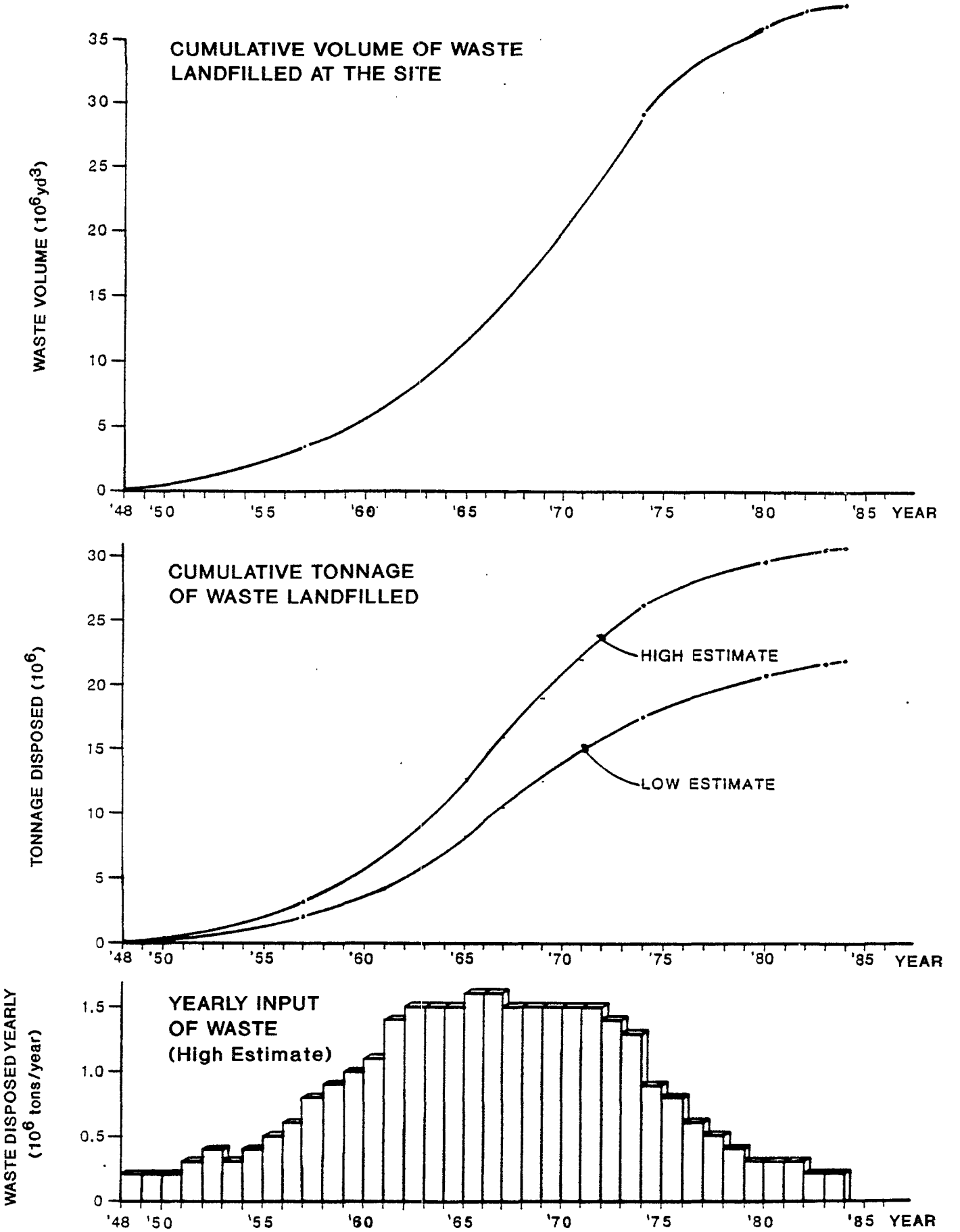


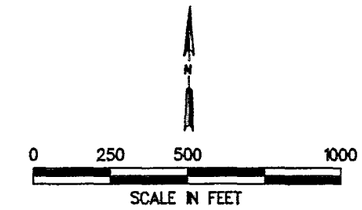
FIGURE 5-7
OII LANDFILL VOLUME AND RATE OF FILLING
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

SOURCE: EPA (JUNE 1988)

Table 5-4
Estimated Mass of Refuse Disposed at OII

Period	Recorded Refuse Delivered (10^6 tons)	Change in Landfill Volume[a] (10^6 yd^3)	Estimated Refuse Volume[b] (10^6 yd^3)	Estimated Inplace Density (lb/yd^3)	Landfilled Tonnage (10^6 tons)
1948 - 57	N/A	+3.4	3.4	1,200 - 1,800[c]	2.0 - 3.1
1957 - 74	N/A	+24.8	25.7	1,200 - 1,800[c]	15.4 - 23.1
1974 - 80	3.46[d]	+6.5	6.9	1,000[e]	3.5
1980 - 83	0.89	+1.2	1.4	1,300[e]	0.9
1983 - 86[f]	0.15	-0.1	0.2	1,500[e]	0.2
					22.0 - 30.8

[a]Calculated by Intergraph program using contour maps.
[b]Includes adjustments for volume lost by biodecomposition and excludes cover.
[c]Estimated from limited field measurements and literature values.
[d]Mass of refuse delivered between 1974-80 was established from weight data and truckload data converted to weight.
[e]Calculated for comparative purposes. Derived from known mass and estimated refuse volume.
[f]Topographic maps for 1983 and 1986 were used in the volume estimate, but filling actually ended in 1984.
N/A = not available
Source: EPA Operable Unit Feasibility Study for Landfill Gas Migration Control (Public Comment Draft). Prepared by CH2M HILL. June 1988.



EXPLANATION

THICKNESS OF LANDFILL WASTE

- 0 TO 25 FEET
- 25 TO 50 FEET
- 50 TO 100 FEET
- 100 TO 150 FEET
- 150 TO 200 FEET
- 200 TO 250 FEET
- 250 TO 300 FEET
- 300 TO 325 FEET

LANDFILL BASE CONTOURS

FIGURE 5-8

THICKNESS OF LANDFILL WASTE IN 1986

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

South Parcel, the base of the landfill (elevation 300 feet) is approximately 180 feet lower than the elevation of the surrounding landfill perimeter. The total thickness of solid waste at that location is approximately 325 feet.

Previous investigations indicate that the western portion of the North Parcel contains 11 acres of solid waste ranging in depth up to 55 feet (EPA, March 4, 1988). The landfill is covered by 1 to 15 feet of silty sand, although most of the cover material is 1 to 3 feet thick. The total volume of refuse, cover, and fill material is 400,000 yards (EPA, March 4, 1988).

5.3 LEACHATE

Leachate within a landfill is generated by the contact of water with refuse and other disposed wastes. The potential sources of water include disposed liquid wastes, infiltrating rainfall and irrigation water, groundwater underflow, and the initial moisture content of refuse. This section describes the occurrences of leachate and the chemical composition of leachate at the OII Landfill.

5.3.1 LEACHATE OCCURRENCES

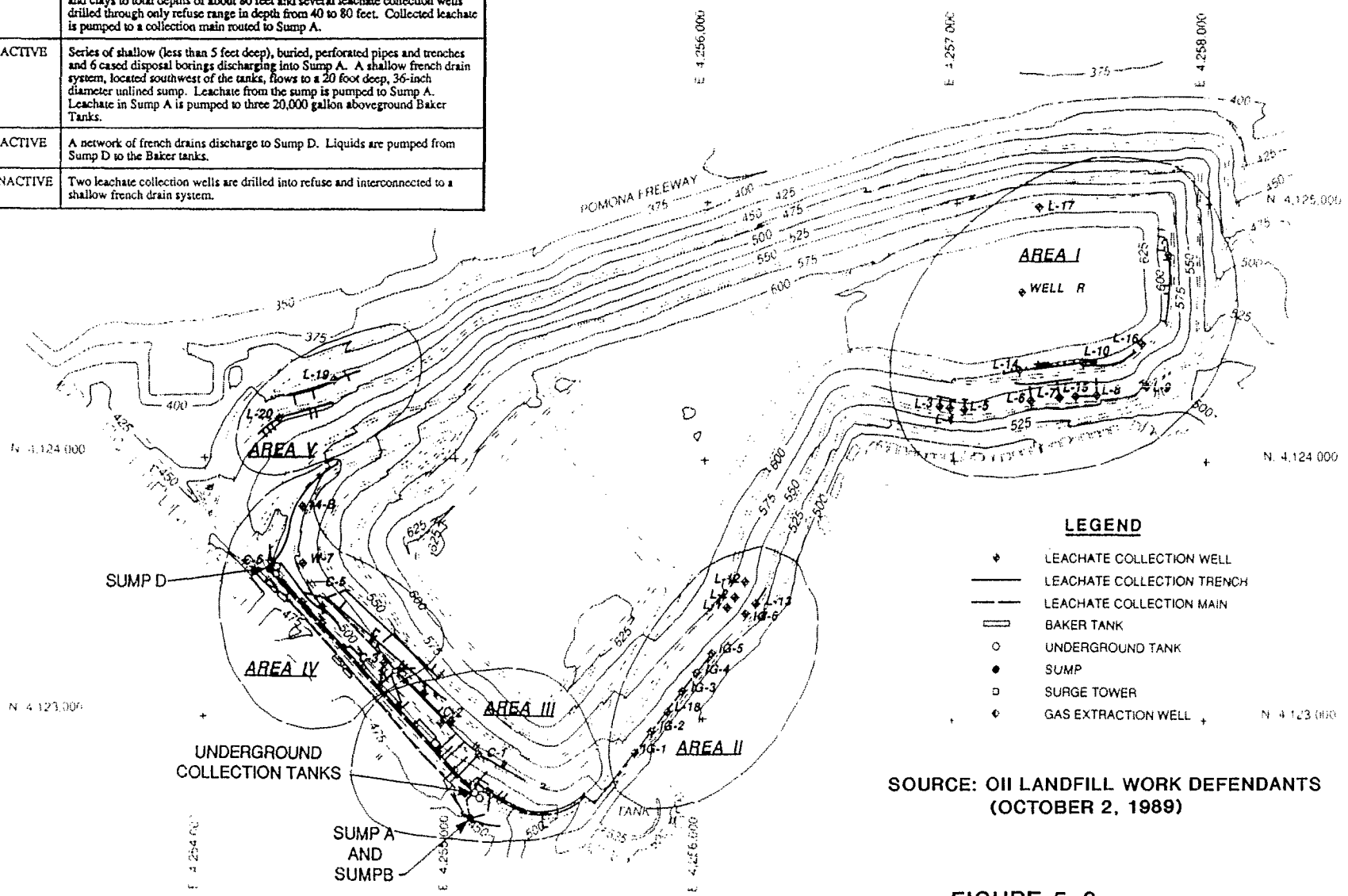
Leachate was noted on the landfill surface at various times from 1978 to 1986. During this time period, seeps were observed issuing from the landfill slopes along the west and southwest perimeter of the South Parcel (Figure 5-1). Leachate has also been observed in wells, probes, and piezometers installed in the landfill or around its perimeter.

5.3.1.1 Leachate Collection System

A leachate collection system (LCS) has been installed around a portion of the South Parcel perimeter. Construction of the LCS began in 1980. The LCS collects leachate from the shallow portions of the landfill through a series of french drains, collection trenches, wells, and sumps. The LCS is broken down into 5 areas called Areas I, II, III, IV, and V. The 5 areas, shown in Figure 5-9, are divided by location.

The Area I LCS (Figure 5-9) was originally installed to eliminate surface seepage from the upper portions of the slopes along the south perimeter of the eastern end of the South Parcel. The system consists of shallow french drains leading to 36-inch disposal borings drilled into dry trash at depths ranging from about 30 to 95 feet (OII Landfill Work Defendants, October 2, 1989). The borings carry any liquids collected back into the landfill. At the base of the slope, as part of the toe buttress, leachate collection pipes and three 1,000-gallon storage tanks were installed to intercept leachate moving past the site boundary. No leachate has been detected in these tanks since their installation in 1987 (OII Landfill Work Defendants, October 2, 1989).

AREA	STATUS	SYSTEM DESCRIPTION
I	INACTIVE	Shallow french drains leading to 36-inch disposal borings drilled into dry trash at depths ranging from about 30 to 95 feet. The borings convey liquids back into the landfill to deeper levels.
II	ACTIVE	Eight Iguala Wells extend through about 15 feet of refuse and into native silts and clays to total depths of about 80 feet and several leachate collection wells drilled through only refuse range in depth from 40 to 80 feet. Collected leachate is pumped to a collection main routed to Sump A.
III	ACTIVE	Series of shallow (less than 5 feet deep), buried, perforated pipes and trenches and 6 cased disposal borings discharging into Sump A. A shallow french drain system, located southwest of the tanks, flows to a 20 foot deep, 36-inch diameter unlined sump. Leachate from the sump is pumped to Sump A. Leachate in Sump A is pumped to three 20,000 gallon aboveground Baker Tanks.
IV	ACTIVE	A network of french drains discharge to Sump D. Liquids are pumped from Sump D to the Baker tanks.
V	INACTIVE	Two leachate collection wells are drilled into refuse and interconnected to a shallow french drain system.



SOURCE: OII LANDFILL WORK DEFENDANTS (OCTOBER 2, 1989)

0 500 1000 FEET
SCALE

NOTE

TOPOGRAPHY FROM JUNE 16, 1987.

FIGURE 5-9
LEACHATE COLLECTION SYSTEM
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

The LCS in Area II (Figure 5-9) was originally installed to control offsite leachate seepage near the landfill toe along the southeast perimeter of the South Parcel. The Area II LCS consists of eight leachate extraction wells, known as the Iguala wells. The Iguala wells extend through 10 to 15 feet of refuse and into native silt to total depths of about 80 feet. The wells are spaced at approximately 100-foot intervals along the southern edge of the South Parcel. Leachate is pumped from these wells to Sump A in Area III.

The LCS in Area III (Figure 5-9) was originally installed to eliminate surface seepage conditions along the southwest tip of the Southwest Parcel. The Area III LCS consists of a series of shallow (less than 5 feet below surface) gravel filled trenches, some with perforated PVC pipe, which drain by gravity to Sump A. Sump B is also located in Area III (Figure 5-9) and receives leachate from a system of shallow french drains situated between Sump A and the landfill boundary.

The LCS in Area IV (Figure 5-5) consists of a series of shallow french drains that feed Sump D. Sump D was reconstructed in 1988 and now consists of a 36-inch-diameter concrete vault, which is 40 feet deep and fitted with three 6-inch PVC casings. Area IV also has four inactive leachate collection wells. The four wells have been reported to contain an oily liquid ranging in depth from 35 to 50 feet (OII Landfill Work Defendants, October 2, 1989).

The LCS in Area V was installed to control surface seeps along the northwest perimeter of the South Parcel. The LCS in this area consists of shallow french drains leading to two disposal borings that terminate approximately 100 feet into the trash.

5.3.1.2 Leachate Collection Rates

Leachate collected at the OII site between 1981 and 1984 was returned to the landfill without treatment by mixing with incoming solid wastes. Initially, approximately 30,000 gallons of leachate were collected and recycled each day. Offsite leachate treatment and disposal began in October 1984. Leachate collection decreased to approximately 18,000 gallons per day at this time. Since offsite disposal began, the rate of collection has declined fairly steadily. Rates declined from the 18,000 gallons per day in October 1984 to about 5,000 gallons per day in August, 1986. The rate of leachate collection in the LCS during 1990 has ranged from approximately 2,400 to 3,000 gallons per day. This value does not include anticipated increases from recent improvements to the Iguala wells. The Iguala wells are expected to produce a combined flow of 1,500 gallons per day when new pumps are installed in nine wells (OII Landfill Work Defendants, June 22, 1990). However, some of this increase may be offset by lower production rates in other areas induced by the installation of final cover in areas with shallow french drains.

Quantities of deep leachate are unknown. Pumping rates for deep leachate wells recently installed into the landfill range from 0.5 to 4 gpm (OII Landfill Work Defendants, June 22, 1990). This would result in each well producing from about 720 to 6,000 gallons per day. However, the long-term production capacity of these deep wells has not been tested. These wells are described in more detail in the following section.

5.3.1.3 Leachate Levels

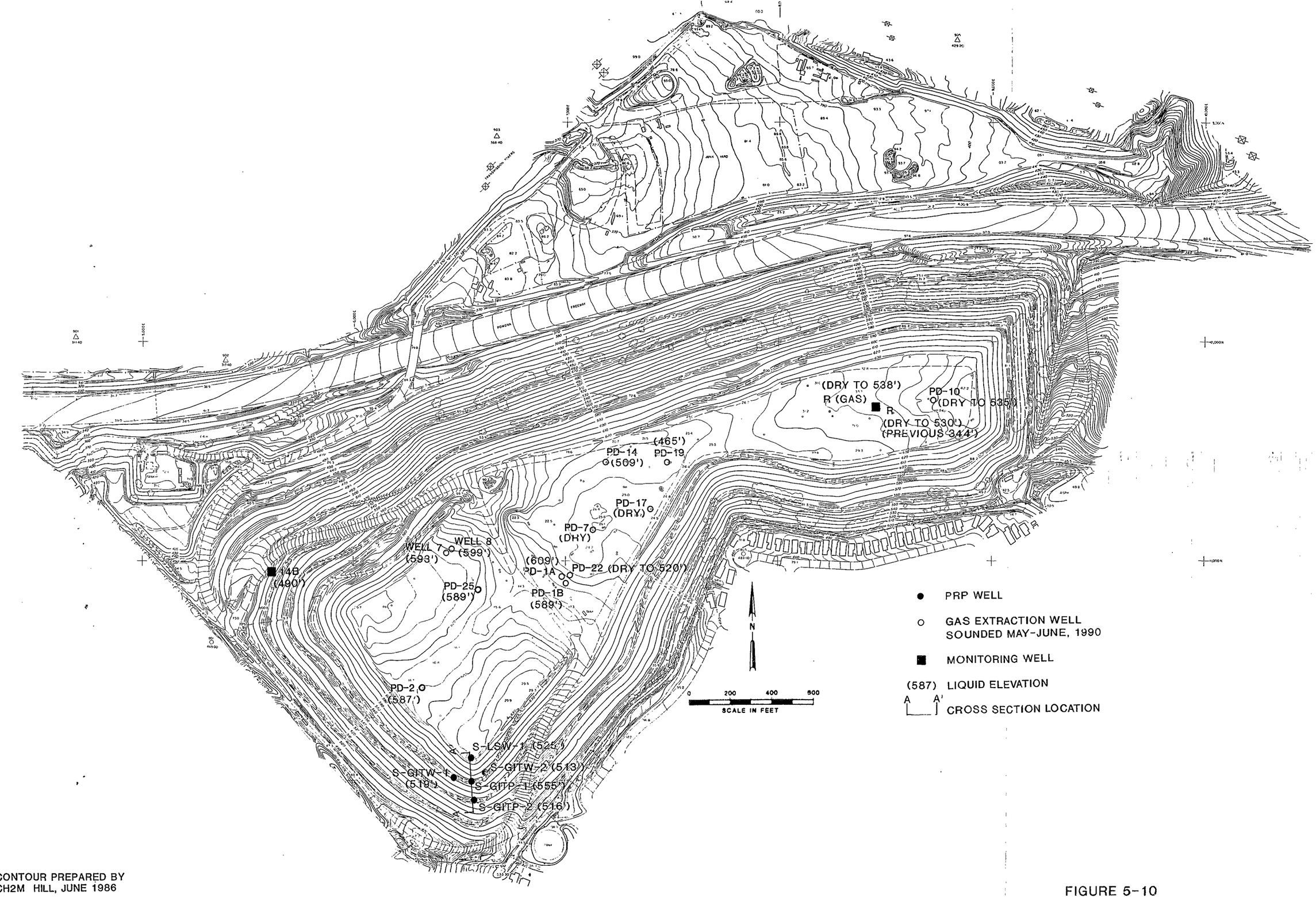
The PRPs installed 5 wells into the refuse on the western portion of the South Parcel in December 1990. The location of these wells (S-LSW-1, S-GITW-1, S-GITW-2, S-GITP-1, and S-GITP-2) as shown in Figure 5-10.

Well S-LSW-1 was installed to provide deep leachate to the pilot leachate treatment plant. The elevation of the top of the screened interval is 425 fasl. The top of the leachate column is about 100 feet above the top of the screen at an elevation of 525 fasl. Leachate samples were collected for chemical analysis and drawdown and recovery tests have been completed at this well. Short-term pumping of the well indicates a potential pumping rate of about 1 gpm.

Saturated leachate zones were encountered in the PRP's gas recovery wells, S-GITW-1 and S-GITW-2 interior gas probes S-GITP-1 and S-GITP-2. Several other zones were reported as moist. Figure 5-11 is a cross-section showing moist and saturated zones encountered during drilling of the 5 wells installed by the PRPs in the southwest corner of the landfill. The presence of saturated zones separated by dry and moist zones indicates that low permeability layers are causing perched accumulation of leachate on intermediate soil cover layers. The elevations of the zones that are either moist or saturated above 475 feet elevation are fairly consistent between S-GITP-1, S-GITW-1, and S-GITW-2, which are located within approximately 100 feet of each other. The deeper saturated zones occur in two of the three wells between approximately 380 and 430 feet.

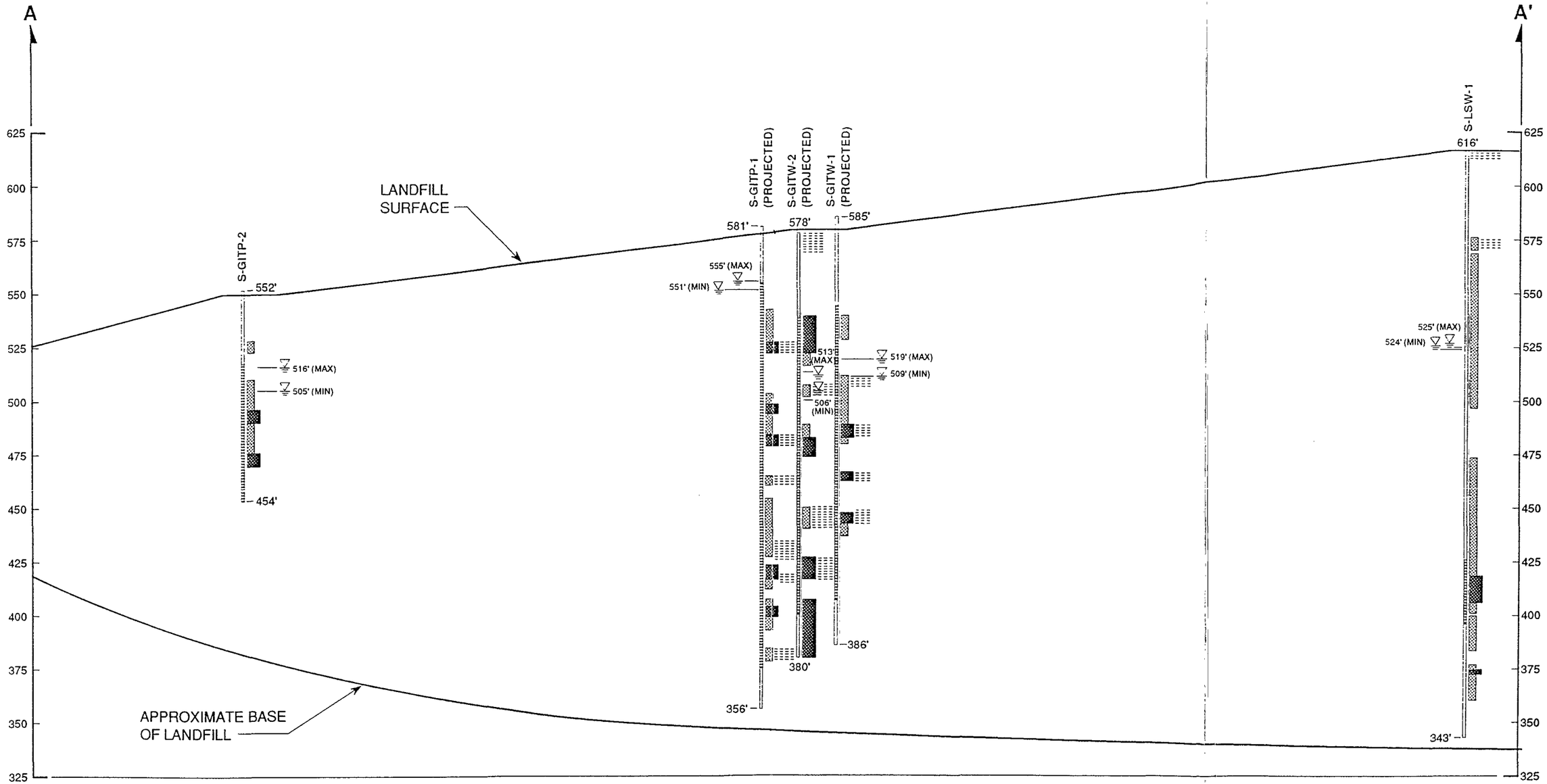
Gas monitoring wells (GMWs) were installed along the south and southwest perimeter of the South Parcel. Only GMW-6, located at the southern tip of the landfill, encountered fluids in the trash prism. The elevations of fluids encountered within the trash prism in GMW-6 were 479 and 456 feet. The elevation of the base of trash is about 450 feet.

A monitoring well, Well R, was installed through the top of the landfill in Area I to a depth of 293 below ground surface. Well R encountered fluids at 283 feet below top of casing. The well has since sheered off about 105 feet below top of casing and does not contain liquid above this point. Fluid levels were measured in 14 gas extraction wells on the top deck of the South Parcel in May and June 1989 for identification of wells for leachate sampling (EPA, April 6, 1990). The liquid elevation from each well is



CONTOUR PREPARED BY
CH2M HILL, JUNE 1986

FIGURE 5-10
AVAILABLE LEACHATE LEVELS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION



NOTE: LOCATION OF CROSS-SECTION IS SHOWN IN FIGURE 5-10

LEGEND:

- STATIC LIQUID LEVEL
- PERFORATED INTERVAL
- ≥ 50% CLAY/SILT CONTENT
- SATURATED
- MOIST (DRY WHERE NO SYMBOL IS INDICATED)

0 20 40 FEET

HORIZONTAL SCALE

1" = 50 FEET
VERTICAL SCALE

SOURCE: OII LANDFILL WORK DEFENDANTS (JUNE 22, 1990)

FIGURE 5-11
MOISTURE CONDITIONS IN PRP WELLS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

shown in Figure 5-10. The elevations in the six wells toward the western end are all within approximately 20 feet of one another and are approximately 70 feet above the elevation of liquid in S-LSW-1, located at the southwest corner of the top deck. Only two of eight wells sounded in the central and eastern portions of the landfill contained liquid. Well 14B (Figure 5-10), which is located on the landfill slope near the western perimeter, has a liquid level elevation of 490 feet.

Fluid levels in the PRP wells and gas extraction wells indicate that several saturated zones exist within the landfill. Fluid levels in the PRP wells fall within a common range, yet correlation of the screened intervals and the fluid levels in most of the wells is not possible.

Comparably impermeable layers of soil representing the top of each lift of refuse and the daily soil cover within the landfill seem to limit fluid flow. During drilling of wells S-LSW-1, S-GITW-1, S-GITP-1, and S-GITP-2, when the drive casing intersected saturated intervals, fluid levels rose above overlying intervals, which did not appear to be saturated during drilling. This indicates that the perforated zones were under pressure due to refuse consolidation and landfill gas production.

5.3.1.4 Leachate Migration

Leachate can potentially migrate vertically into underlying geologic formations or laterally into surrounding native materials. Leachate may contact the regional groundwater system directly by this pathway or may contact perched water that eventually could reach the regional groundwater. Areas where the base or perimeter of the landfill is underlain by permeable materials are more likely pathways for offsite leachate migration. Areas underlain by permeable materials include the eastern end of the South Parcel, the northern perimeter of the South Parcel and the North Parcel. The remainder of the South Parcel is underlain by Pico siltstone.

Very little information is available regarding the presence of liquids at the base of the eastern end of the South Parcel. No recent borings (except OI-20A at the northeast corner) have been installed to the base of the trash along the northern boundary of the South Parcel. During drilling of OI-20A (at the northeast corner of the South Parcel), no liquids were encountered and the trash was dry. At the base of the trash prism, drilling was halted to see if any liquids would accumulate in the borehole; no liquid was observed. OI-20A is located on the edge of the landfill and is not representative of the landfill interior. Also, as stated in Section 6.3.1.1, no liquids have been observed in the collection tanks at the toe buttress on the southern side of the eastern end of the landfill.

Some liquids were detected at the base of the waste fill on the western end of the North Parcel. It is not expected that large amounts of leachate are present in this area, since the majority of liquids were disposed on the South Parcel.

Evidence of shallow leachate migration along the south and southwest perimeter of the South Parcel is seen in the previous seeps and the continued collection of considerable quantities of shallow leachate at the site boundary in that area. The base of the landfill in this area is underlain by silt and recent (PRP wells) borings indicate that the base of the landfill is not saturated. However, saturated zones are present within 40 feet of the base, and lateral saturated flow out of the sides of the landfill or vertical unsaturated flow to the base of the landfill is possible.

Evidence seems to indicate that leachate exists in zones with limited hydraulical continuity. The PRP wells have encountered deep leachate under sufficient pressure to raise the liquid about 100 feet in the well casing. However, the well is not capable of sustaining continuous pumping at 1 gpm, and full recovery takes at least 24 hours after only short periods of pumping. Fluid levels in closely spaced wells are variable indicating limited continuity between individual saturated zones (Figure 5-11). However, discontinuities in saturation do not imply a total absence of leachate flow, because of the likely movement of leachate in unsaturated conditions.

5.3.2 LEACHATE COMPOSITION

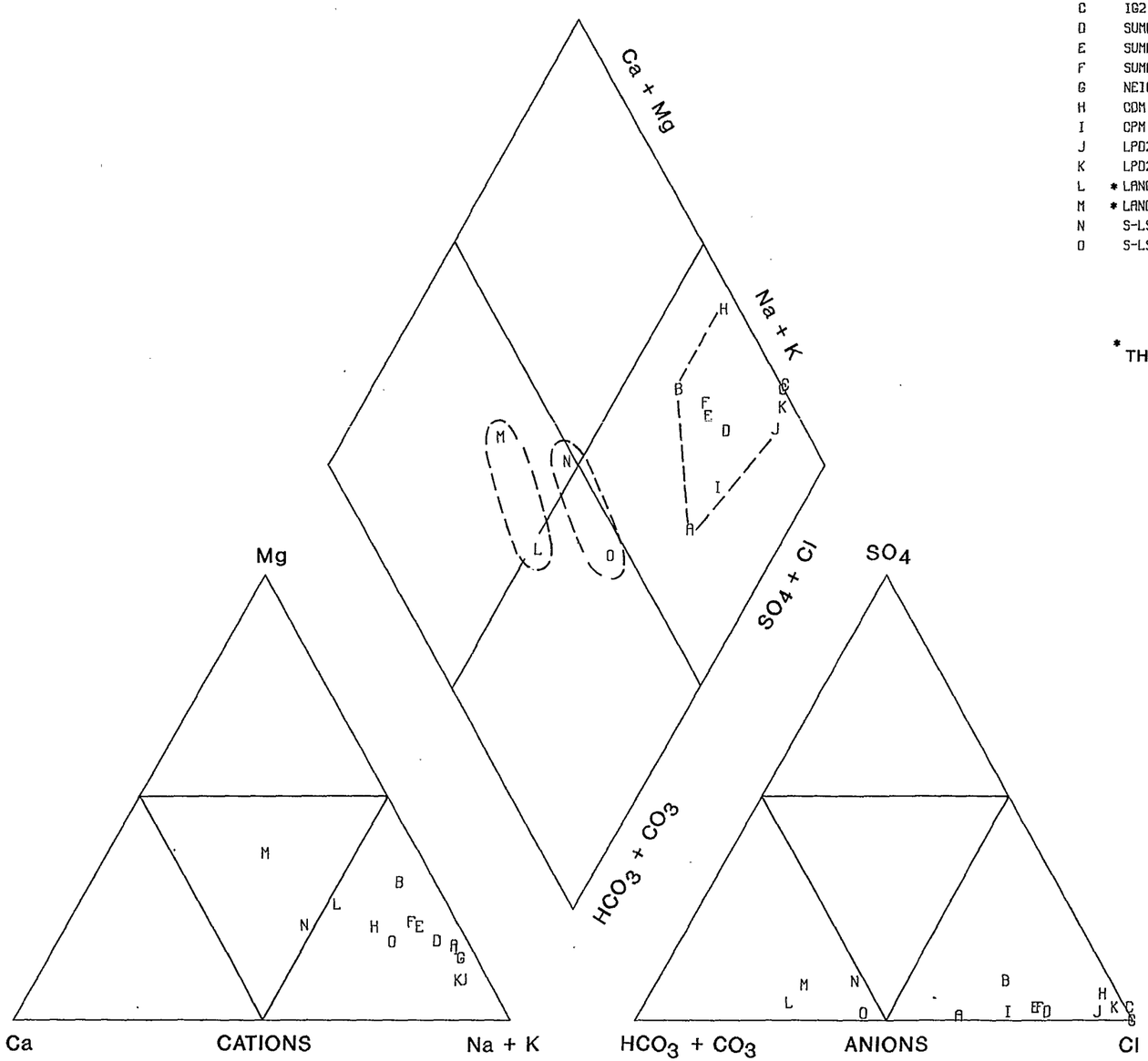
Leachate composition results are available from records documenting samples collected in 1986 (EPA, September 16, 1986) through 1989 (EPA, April 6, 1990). Ecology and Environment, Inc. sampled the leachate tanks at the OII facility in triplicate in July 1986 for the EPA National Enforcement Investigations Center (NEIC). CH2M HILL collected condensate from the LFG collection system and leachate from the LCS and two interior gas extraction wells (PD2 and PD25) in June and July 1989. Additional leachate data are summarized in EPA (October 14, 1988). A deep leachate well (S-LSW-1) was drilled and sampled in December 1989 (Environmental Solutions Inc., July 12, 1990). A tabular summary of concentration data of concentration data for all detected chemicals in OII leachate samples in the CH2M HILL data base is provided in EPA (September 28, 1990).

5.3.2.1 Major Parameter Composition of Leachate

Major leachate composition for the South Parcel is illustrated in a trilinear diagram (Figure 5-12). This diagram shows the percent of total millequivalents per liter for each of the major cations (sodium + potassium, calcium, and magnesium) and the major ions (sulfate, chloride, and bicarbonate + carbonate). The cations and anions are plotted on separate triangular fields, then those positions are projected upwards into a diamond-shaped filed that summarizes both cation and anion content. Similar leachate or water samples plot in similar locations on the graphs. In addition to the OII leachate samples plotted in Figure 5-12, two data points representing average leachate composition were added to the trilinear diagram based on landfill leachate chemistry compiled by CH2M HILL from the technical literature on municipal leachate

TRILINEAR DIAGRAM

(Percent of total milliequilivalents per liter)



WELL DATA - LEACHATE

	FULL ID	DATE	TDS (mg/L)	TOC (mg/L)	TOX (ug/L)
A	IG2	06/09/87	15300	1700	3970
B	IG2	10/28/87	17000	1430	2600
C	IG2	02/03/88	13600	1980	5570
D	SUMP B	08/11/87	11700	609	4130
E	SUMP B	10/28/87	12700	676	4140
F	SUMP B	02/03/88	11800	605	5120
G	NEIC PROJECT LEACHATE	1986	16200	1100	10700
H	CDM (condensate-interior)	1989	765	1690	300
I	CPM (condensate-perimeter)	1989	1670	2670	710
J	LPD2 (Leachage PD-2)	1989	7870	2210	3500
K	LPD25 (Leachate PD-25)	1989	6930	2600	7500
L	* LANDFILL (OVER 10 YEARS)		1460	1234	
M	* LANDFILL (AVERAGE)		11300	3593	
N	S-LSW-1	12/08/89	18000		
O	S-LSW-2	12/11/89	15000		

* THESE VALVES ARE FROM LEACHATE DATA AT MUNICIPAL LANDFILLS

FIGURE 5-12
LEACHATE
HYDROGEOCHEMICAL FACIES
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

data (Table 5-5). Table 5-5 summarizes the chemical content of leachate from many landfills as a function of the age of the refuse.

The 1986 NEIC leachate sample from the Leachate Tank had a total dissolved solids (TDS) of 16,200 milligrams per liter (mg/l). This TDS is nearly the same as the 17,000 mg/l in a sample collected from the leachate extraction well, Iguala 2 (IG2), in 1987. All 1986 and 1987 TDS concentrations exceeded the average municipal leachate TDS of 11,300 mg/l, but the results are mostly within 10 percent of this TDS. Sump B, which drains a small section of Area III (Figure 5-9), lower than Sump A, contains approximately 1,000 mg/l higher TDS than either Sump A or Sump D.

The TDS values of the PD-2 and PD-25 samples (shown on Figure 5-9) are significantly lower than both the previous shallow samples and the subsequent deep samples. TDS values in the literature for landfills indicate a significant decrease in TDS over time (11,300 to 1,230 mg/l) [Table 5-5]. Based on available data, it is not possible to see if this is occurring at OII.

The TDS of the deep leachate well samples range from approximately 31,000 to 42,000 mg/l (Environmental Solutions, Inc., July 12, 1990). A comparison of this data with the above data suggest a considerable variability in TDS with depth and from one location to another. There is also a considerable change in water chemistry with the changes in TDS in these deep leachate samples.

Total organic carbon (TOC) concentrations of OII leachate samples generally range between the TOC of the average landfill leachate (3593 mg/l) and that of a leachate from landfill refuse of greater than 10 years in age (1234 mg/l). The samples from Sump B are significantly lower than other analyses (605 to 676 mg/l versus 1,430 to 2,670 mg/l). These data do not indicate that the TOC is decreasing as is seen in the average landfill data. The TOC concentration from the leachate sample analyzed by the EPA National Enforcement Investigation Center (NEIC) in 1986 is among the lowest TOC concentrations. There does not appear to be a correlation between TOC values and TDS values. This is not unexpected, because organic parameters have a different fate and transport than inorganic parameters through microbiological reactions.

The total organic halogens (TOX) concentrations for the presented data have a broad range (710 to 10,700 micrograms per liter [ug/l]). The TOX for the NEIC sample is the highest concentration in the data set shown on the trilinear diagram (Figure 5-12).

Unlike the TOC data for Sump B, TOX data for Sump B do not indicate a consistent lower concentration than the other samples. Even though there is a general organic

Table 5-5
SUMMARY OF LEACHATE COMPOSITION AT MUNICIPAL LANDFILLS

Component	Units	Overall Leachate Average	Average Leachate Composition as a Function of Age of Refuse (Years)								
			<1	1 - 2	<2	2 - 3	2 - 4	3 - 5	4 - 10	5 - 10	>10
COD	(mg/l)	15,110	27,781	12,104	18,134	23,347	19,429	15,275	7,900	7,056	6,361
BOD	(mg/l)	10,504	24,939	7,390	14,215	15,335	11,375	7,289	4,253	3,470	6,231
TOC	(mg/l)	3,593	9,237	2,971	5,059	4,951	4,253	1,810	1,598	1,598	1,234
pH	(mg/l)	6.29	5.83	6.12	6.00	5.46	6.11	6.65	6.25	6.25	6.66
TS	(mg/l)	15,698	41,032	--	41,032	15,085	10,099	7,250	6,167	6,167	--
TDS	(mg/l)	11,298	26,497	15,952	21,224	14,940	13,633	12,161	5,856	5,856	1,459
TSS	(mg/l)	497	348	661	505	330	540	669	340	361	310
VSS	(mg/l)	303	256	602	371	210	273	308	406	496	170
TVS	(mg/l)	8,835	25,378	--	25,378	4,152	3,320	2,904	--	--	--
Spec. Cond.	(umohs/cm	6,760	7,467	8,237	7,775	8,294	7,789	6,780	4,779	4,779	3,417
Alkalinity	(mg/l as CaCO3)	3,664	7,169	2,282	5,214	3,793	3,307	2,431	3,379	3,379	1,482
Hardness	(mg/l as CaCO3)	4,255	7,865	1,927	5,886	2,598	5,581	7,073	3,613	3,613	577
Tot PO_4	(mg/l)	6.97	16.85	6.72	12.51	10.74	8.58	2.82	2.48	2.48	2.42
Ortho PO_4	(mg/l)	22.55	66.23	0.17	42.20	5.97	8.50	12.73	6.18	6.18	1.40
PO_4 (inorg)	(mg/l)	3.49	9.15	2.28	4.57	2.35	2.23	1.29	0.89	1.20	8.90
NH4-N	(mg/l)	300.55	434.7	235.4	319.29	325.3	319.32	302.1	220.89	209.7	87.73
NO3+NO2-N	(mg/l)	3.65	8.73	4.68	6.15	1.46	2.15	3.73	0.77	0.74	0.74
Organic-N	(mg/l)	145.63	448.38	90.89	259.12	167.00	132.95	43.18	32.08	37.90	27.38
TKN	(mg/l)	449.45	883	339	580.76	492	452.33	345	217.81	206	200.06
Ca	(mg/l)	1,004	2,456	622	1,377	1,163	1,343	1,705	598	598	166
Mg	(mg/l)	717	308	224	258	348	1,154	2,766	2,010	2,010	115

Table 5-5
(Continued)

Component	Units	Overall Leachate Average	Average Leachate Composition as a Function of Age of Refuse (Years)								
			<1	1 - 2	<2	2 - 3	2 - 4	3 - 5	4 - 10	5 - 10	>10
Na	(mg/l)	702	1,046	920	972	576	577	580	643	643	331
K	(mg/l)	654	1,720	516	998	599	550	387	300	300	172
SO4	(mg/l)	382	667	281	461	674	632	576	51	51	64
Cl	(mg/l)	980	1,356	1,106	1,224	982	997	1,022	1,024	1,024	354
Fe	(Tot-mg/1)	427	1,360	223	691	452	559	717	219	211	121
Mn	(Tot-mg/l)	17.28	28.89	12.60	18.71	22.69	23.94	31.13	9.55	0.07	2.29
Zn	(Tot-mg/l)	20.89	104.00	17.68	30.01	29.13	26.05	16.07	3.50	1.60	25.99
Cu	(Tot-mg/l)	0.48	0.27	0.54	0.45	0.20	0.44	0.90	0.24	0.29	0.78
Cd	(Tot-mg/l)	0.051	0.075	0.061	0.066	0.037	0.037	0.034	0.071	0.079	0.029
Pb	(Tot-mg/l)	0.517	1.250	0.630	0.754	0.431	0.429	0.248	0.362	0.396	0.684
Hg	(Tot-mg/l)	0.018	--	0.006	0.006	0.014	0.012	0.006	0.005	0.005	0.037
Se	(Tot-mg/l)	0.641	2.700	--	2.700	0.290	0.290		0.100	0.100	0.058
Cr	(Tot-mg/1)	0.944	9.100	0.060	4.580	0.207	0.198	0.153	0.155	0.167	0.568
Ni	(Tot-mg/l)	1.21	13.00	0.04	4.36	0.32	0.49	0.75	0.21	0.10	0.65

TDS - Total Volatile Solids
Note: Based on a CH2M HILL search of technical literature on municipal leachate data.
Source: EPA (October 14, 1988b).

relationship between TOC and TOX, one cannot be used as a surrogate parameter for the other.

The OII landfill leachate analyses shown in Figure 5-12 indicate that the major ions in the leachate are sodium plus potassium and chloride. Potassium makes up approximately 5 to 12 percent of the dissolved cations. This is a higher proportion of potassium than most natural waters, but sodium is the dominant cation. The analyses for the overall average leachate composition for published data on municipal landfills, however, indicate a mixed cation (magnesium dominant) and bicarbonate as major ions. The deep OII landfill leachate contains 10 to 30 percent more sodium plus potassium and 10 to 15 percent more chloride than values published for municipal landfill leachate. Shallow leachate and condensate percentage differences are even higher.

The major ion chemistry for leachate from refuse greater than 10 years in age from Table 5-5 is also plotted on the trilinear diagram (Figure 5-12). Bicarbonate is still the major anion but there is a relative increase in the sodium percentage in older landfill refuse leachate. From this comparison, there does appear to be a significant difference in anion composition in the OII landfill than in the "average" municipal landfill. The OII landfill is higher in chloride. The shallow leachate and condensate chloride percentages are considerably higher than the deep leachate. This difference may reflect a degradation of chlorinated organics that would increase the dissolved chloride concentration.

Liquid wastes were deposited in the OII landfill in much greater amounts than are deposited in a typical municipal landfill. Therefore, moisture levels at OII are expected to be greater than that from "average" municipal landfill. The chemical composition of OII leachate is also expected to partially represent the composition of the disposed liquids.

The sodium and chloride may be a result of both what was placed in the landfill and previous leachate redisposal practices. The wastes may have contained a high proportion of sodium and chloride, which would become part of the leachate collected at the sumps. Both sodium and chloride percentages would be further increased by redisposing the collected leachate back into the landfill.

The lack of sulfate in the leachate is typical of landfill leachates. The landfill is under extremely reducing oxidation-reduction conditions (negative Eh) created by the microbiological activity that produces methane gas. The sulfur is reduced to sulfide under reducing conditions. The sulfide combines with both organics and other metals (particularly iron). Carbon disulfide gas in one form of mobile sulfide. Sulfide is also incorporated into other gases (mostly odiferous) and both mobile and immobile organic compounds (thiophenes, for example). The metals and other immobilized sulfur compounds will eventually become mobile as the landfill becomes more oxidizing.

Beside acting to reduce metals concentrations, sulfur is also mobile as sulfide in the leachate. Dissolved sulfide in the leachates ranges from undetected to as much as 64.8 mg/l in leachate from PD-2 (EPA, April 6, 1990). Although this level of sulfide will limit the concentration of many metals by forming metal sulfides, individual metals concentrations can still be in the hundreds to thousands of micrograms per liter. Complexing with other dissolved ions and dissolved organics (particularly sulfur containing organic molecules) can still transport appreciable metals concentrations.

5.3.2.2 Metals Concentrations in Leachate

Table 5-6 is a compilation of trace metals concentrations and additional parameters in the OII landfill leachates from EPA (September 16, 1986; October 14, 1988a; and April 6, 1990). The metals, ranked from highest to lowest concentrations observed in shallow leachate, are:

Fe>Mn>Ba>Zn>Cu>Cr(T)>As>Pb>Ni>Sb>V>Hg>Co>Cd

Iron and manganese are present in milligrams per liter concentrations. Barium through arsenic are between 100 and 1,000 micrograms per liter (ug/l) and lead through cadmium are between 4 and 100 ug/l.

Trace elements in the deep leachate well sample generally agree with the above distribution. However, copper and arsenic are lower and lead and antimony are higher in the ranking. The combination of reducing conditions and a relatively higher organic concentration are probably responsible for the difference in the ranking order.

The maximum concentration of iron is less than the average municipal landfill concentration but about equal to the average landfill refuse greater than 10 years of age. Although both iron and manganese are lower than would be expected from a landfill leachate, they are considerably higher than natural groundwater. As previously stated, the sulfide would have a tendency to reduce iron and other metals-dissolved concentrations through the precipitation of metal sulfides.

Silver, beryllium, selenium, and thallium were not detected above detection limits (5 ug/l or less). Maximum cadmium, nickel, and zinc are lower than the averages for the published landfill leachate data. Lead is approximately the same as the published data. Copper and mercury are higher than the published data. Both copper and mercury form strong organometallic compounds that may be responsible for their higher mobility.

Table 5-6
Metals and Other Parameters Concentrations in OII and Average Landfill Leachate

Parameter	Shallow OII[1] Leachate (range) (ug/l)	Average[2] Landfill (ug/l)	>10 Year[2] Landfill (ug/l)	Deep OII[3] Leachate (ug/l)	
Silver	4U-20			ND	ND
Arsenic	90-1,200			19	82
Barium	245-3,850			740	3,100
Beryllium	1U-2J			--	--
Cadmium	0.27-4	51	29	50	70
Cobalt	8J-170			--	--
Chromium (T)	39-420			70	90
Copper	6.6-480	480	780	170	220
Mercury	27-307	18	37	ND	5
Nickel	2U	1,210	650	500	590
Lead	5U	517	684	230	640
Antimony	9-279			120	NA
Selenium	60-2,100	641	58	ND	ND
Thallium	5U			ND	ND
Vanadium	9-297			--	--
Zinc	60-2,100	20,900	26,000	9,000	33,000
	(mg/l)	(mg/l)	(mg/l)	(mg/l)	
Iron	7.0-138	427	121	1,900	5,300
Manganese	1.4-14.8	17.3	2.3	28	85
Sulfide	ND-64.8	--	--	--	--
Ammonia-N	78-1,810	300	88	--	--
Nitrate-N	0.03U-9.79	3.6	3.6	ND	25

[1]EPA: September 16, 1986; October 14, 1988; April 6, 1990.
[2]EPA: October 14, 1988.
[3]Environmental Solutions, Inc., July 12, 1990.

U - Undetected, value is detection limit
J - Estimated value for qualitative use
ND - Not detected, unknown detection limit

Metals concentrations in the leachate reflect the refuse composition coupled with the inorganic, organic, and microbiological interreactions that are occurring in the landfill.

The landfill is currently in a very reduced state as evidenced by the high sulfide versus sulfate and ammonia versus nitrate. As the landfill refuse ages, microbiological activity will continue to degrade the organics to residual compounds, carbon dioxide, and water. Metal sulfides will become oxidized and more mobile and adsorption processes will be the dominant form of metals immobilization. Therefore, dissolved metals concentrations will change with time. The changes will occur first in the areas of the landfill that are most effective in degrading and removing the organic through bacterial activity.

A comparison of the average landfill leachate composition and the leachate from refuse greater than 10 years in age indicates increases in copper, mercury, lead, and zinc. This is an incomplete list of metals and metals concentrations upon which to base the eventual metals concentrations. Metal adsorption is both pH and substrate (iron oxyhydroxide, manganese oxyhydroxides, aluminum oxides, etc.) dependent. The geochemical computer model EQ6 can be used to model the expected change in leachate composition with changes in the oxidation-reduction conditions.

5.3.2.3 Organics Concentrations in Leachate

The landfill leachate contains a rich spectra of organic compounds. Table 5-7 contains a preliminary list of target volatile and semivolatile organic compounds ranked by concentration.

1,4-Dioxane is present at maximum concentrations exceeding 10,000 ug/l; 2-propanone to toluene, from 1,000 to 10,000 ug/l; and 2-hexanone to 1,2 dichloroethane, from 100 to 1,000 ug/l. Other organic compounds are present at less than 100 ug/l. Potential adsorption, degradation, and dilution may reduce the concentrations of the organic compounds present at less than 100 ug/l.

This list of volatiles includes compounds detected in 11 (1,2-dichloroethane) to over 80 percent of the samples (xylene and 1,4-dioxane) for which they were analyzed. Most of these volatile compounds exceed a 50 percent detection ratio. These compounds have a relatively high probability of being detected in leachate contamination of groundwater.

The list of semivolatile organic compounds are also ranked in order of their maximum concentrations. Bis(2-ethylhexyl)phthalate and benzoic acid are present at maximum concentrations exceeding 10,000 ug/l; 4-methylphenol to 1,2-dichlorobenzene, from 1,000 to 10,000 ug/l; and phenanthrene to dibenzofuran, from 100 to 1,000 ug/l. The semivolatile organic compounds listed in Table 5-7 were detected in 3 (acenapthene) to 51 percent (napthalene) of the samples for which they were analyzed. Only one-third

Table 5-7
Selected List of Organic Compounds Present in OII Leachate Ranked by Maximum Concentration

Parameter	Number of Detections	Number of Observations
VOLATILE ORGANIC COMPOUNDS		
1,4-Dioxane	75	93
2-Propanone	24	92
2-Butanone	33	77
4-Methyl-2-Pentanone	33	85
trans-1,1-Dichloroethene	51	93
Xylene (Total)	76	93
Dichlorobenzene	31	39
Toluene	55	93
2-Hexanone	16	63
Vinyl Chloride	45	93
1,1-Dichloroethane	66	93
Benzene	66	93
Ethylbenzene	54	92
1,2-Dichloroethane	10	92
SEMIVOLATILE ORGANIC COMPOUNDS		
Bis(2-Ethylhexyl)Phthalate	38	90
Benzoic Acid	11	85
4-Methylphenol	18	119
Phenol	20	90
2,4-Dimethylphenol	41	90
2-Methylphenol	24	90
Di-N-Octyl Phthalate	20	90
2-Methylnapthalene	41	90
1,2-Dichlorobenzene	44	92

Table 5-7
(Continued)

Parameter	Number of Detections	Number of Observations
SEMIVOLATILE ORGANIC COMPOUNDS (Continued)		
Phenanthrene	30	90
Napthalene	46	90
Chrysene	5	82
Acenanapthene	2	60
Fluorene	20	89
Pyrene	10	90
Benzo(a)Anthracene	4	92
Fluoranthrene	13	90
1,4-Dichlorobenzene	37	92
1,3-Dichlorobenzene	14	92
Bibenzofuran	12	83

of the semivolatiles exceed a 25 percent detection ratio. The semivolatiles have a lower probability of being detected in the groundwater than the volatiles.

5.4 LANDFILL GAS

This section details the extent of landfill gas (LFG) occurrences at the OII site. The information is summarized from previous investigations (Public Comment Draft, Operable Unit Feasibility Study for Landfill Gas Migration Control, OII, EPA June 1988) and from recent monitoring data (OII SCM/LMS, Monthly Progress Report, May, 1990).

For discussion purposes, the landfill area is divided into three sections (east, west, and central) as shown in Figure 5-13. The west section includes the 32-acre area permitted for increased disposal of hazardous liquid wastes.

A brief discussion of gas migration mechanisms is included below. Locations of LFG occurrences are also discussed with respect to the LFG extraction and control system and the site geology. The geology discussion emphasizes pathways that may bring LFG in contact with perched water or the regional water table.

5.4.1 GAS MIGRATION MECHANISMS

Landfill gas is generated by bacterial decomposition of organic and hazardous wastes. LFG migrates by both diffusion and convection upwards and toward the perimeter of the landfill where it is released as surface emissions. It also leaves the landfill by subsurface migration in a gaseous or vapor phase in the unsaturated zone above the groundwater system and in an aqueous phase within the groundwater system.

The major composition, controlling factors, and production cycle of LFG is fairly well known (Farquhar and Rovers, 1973; Pohland and Harper, 1986; and Barlaz et al., 1989). Factors affecting gas production in sanitary landfills (Farquhar and Rovers, 1973) include:

- Temperature (30 to 35 degrees celsius optimum)
- Aeration (minimum, low oxidation-reduction condition required)
- Moisture content (increases with moisture)
- pH (7.0 optimum, ceases at 6.0)
- Nutrition (nitrogen, phosphorous, potassium)
- Toxic compounds (reduce gas production)

Gas extraction wells and air injection wells have been installed at OII to control LFG migration. LFG extraction wells capture migrating subsurface LFG by means of vacuum. An air dike along the western boundary of the South Parcel consists of a line

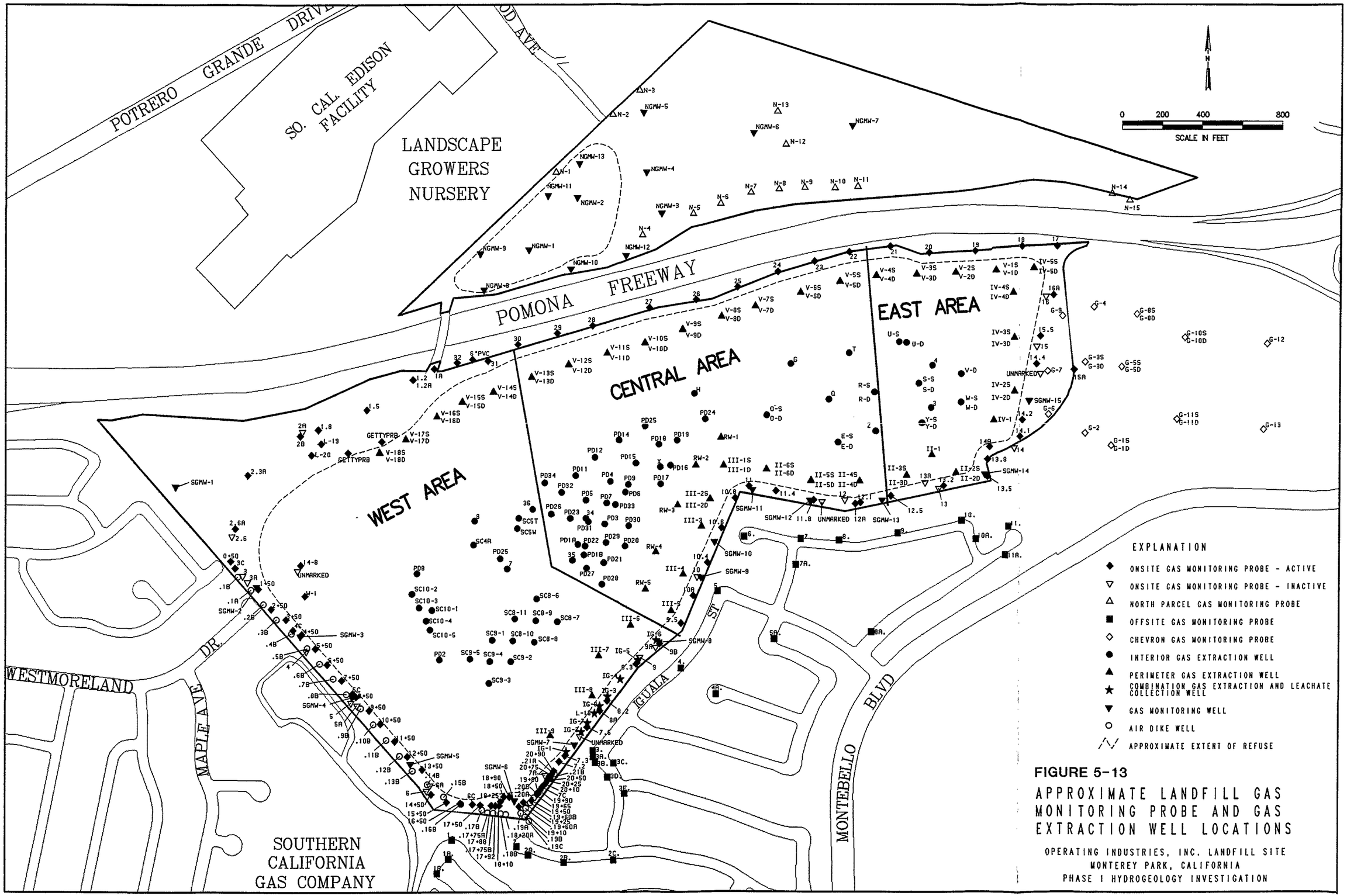


FIGURE 5-13

APPROXIMATE LANDFILL GAS MONITORING PROBE AND GAS EXTRACTION WELL LOCATIONS

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

of air injection wells designed to create a high pressure barrier that reduces subsurface LFG migration. Interior extraction wells are located across most of the top deck of the South Parcel.

5.4.2 LANDFILL GAS OCCURRENCES

An LFG monitoring network is present at the landfill, including onsite gas monitoring probes around the perimeter of the landfill, offsite gas monitoring probes, water meter boxes, and LFG monitoring wells (Figure 5-13).

Migrating LFG contains volatile organic compounds (VOCs) that dissolve into groundwater when LFG contacts the water table or perched water (Section 8.1.5). VOCs in the LFG partition into groundwater until the liquid and gas concentrations are in equilibrium according to Henry's Law. The OII LFG contains approximately 0.5 percent VOCs. Permeable geologic units are potential pathways for LFG migration to groundwater sources. Geologic units, which may act as potential pathways, are the Lakewood/San Pedro Hydrogeologic Unit and the Pico Hydrogeologic Unit sands, silty sands, and conglomerates.

Monitoring probe and extraction well locations are shown in Figure 5-13. Multiple depth probe clusters are present at most locations. At each location, the methane concentrations of the probes 30 feet or less in depth were averaged and plotted (Figure 5-14) to determine shallow occurrences of LFG for May 1990 (OII Landfill Work Defendants, June 14, 1990). The average methane concentrations of the probes below 30 feet in depth have been plotted to examine deep occurrences of LFG (Figure 5-15). Concentrations have been defined as low (<10 percent), moderate (10 to 25 percent), or high (>25 percent) depending on the percentage of methane at each probe or well.

5.4.2.1 West Area

The west area contains the deepest portion of the landfill. The lowest elevation of the base of the landfill at this area is 300 feet above mean sea level (fasl) and the maximum refuse depth is approximately 320 feet (Figure 5-8). The bottom of the air dike injection wells are above 400 fasl along the west side and above 450 fasl in the southwest corner. The base of the perimeter extraction wells is above 410 fasl. Therefore, the horizontal migration of LFG generated in the lower 100 feet of the landfill may potentially not be controlled by the existing LFG control system. No offsite probes are located along the western boundary to monitor this potential migration.

Potential pathways for LFG migration are the permeable sands of the Lakewood/San Pedro Hydrogeologic Unit, which occur along most of the perimeter of the west area (Sections A-A', B-B', and E-E'). The regional water table is located near the landfill

base ranging from 320 to 380 feet above msl. Additionally, potentially perched water has been encountered along much of the site boundary in the west area.

Long-term and recent data indicate offsite LFG migration in the southwest corner of the West area (EPA, June 1988 and OII Landfill Work Defendants, June 14, 1990). Perimeter gas monitoring probes and wells range from zero to 50 percent methane in shallow probes (Figure 5-14). Gas monitoring probes 7.2 and 7.3 and South Parcel gas monitoring well GMW-7 supply the only deep monitoring data and have average methane concentrations of 48.0, 14.5, and 52.0 percent, respectively (Figure 5-15).

Recent offsite probe data demonstrate offsite LFG migration. Methane levels in the southwest corner are greater than 25 percent in 9 of 13 shallow offsite probes (Figure 5-11). Methane concentrations are particularly high in shallow offsite probes 3, 3A (shallow), and 3C (Figure 5-14 and 5-15) with methane percentages of 52.8, 36.3, and 48.3, respectively. These probes are located adjacent to perimeter extraction wells IG-1 and IG-2 (Figure 5-13). Methane concentrations in other shallow offsite probes, located south of the air dike, range from 7.8 to 36.8 percent. Deep offsite probes 3A (deep) and 2C have 53.0 and 7.5 percent methane (Figure 5-15). These concentrations in the deep probes indicate that subsurface offsite migration is occurring below 30 feet.

Low average methane concentrations from recent data (OII Landfill Work Defendants, June 14, 1990) suggest shallow LFG migration is mostly controlled on the west side. However, high average methane concentrations in the deep probes in South Parcel gas monitoring wells, GMW-1 and GMW-4, indicate the potential for migration below the air dike probes in the northwest corner and west side, respectively. Wells GMW-1 and GMW-4 had average deep concentrations of 60 and 56 percent methane, respectively. Shallow well methane concentrations in the northwest corner are low (<1 percent) even though long-term data suggest that low to high concentrations should be seen. Long-term data indicate that concentrations for these probes fluctuate with time and may occasionally be zero. No offsite subsurface probes exist adjacent to this section. It is possible that offsite migration is occurring beneath the onsite monitoring probes, because approximately 1,000 feet of the northwest section are not equipped with air injection or LFG extraction wells.

Shallow migration adjacent to the freeway overpass on the northeast side of the West area is indicated by methane concentrations of 31 and 41 percent in shallow perimeter probes 1.2 and 1.5. Deep perimeter probe 32 has 2.0 percent methane indicating some deep methane migration. Five Phase V LFG extraction wells are located adjacent to the freeway overpass and extend to the refuse depth at the perimeter, but not to the maximum refuse depth within 1,000 feet of the perimeter. This indicates that deep LFG migration would not be controlled.

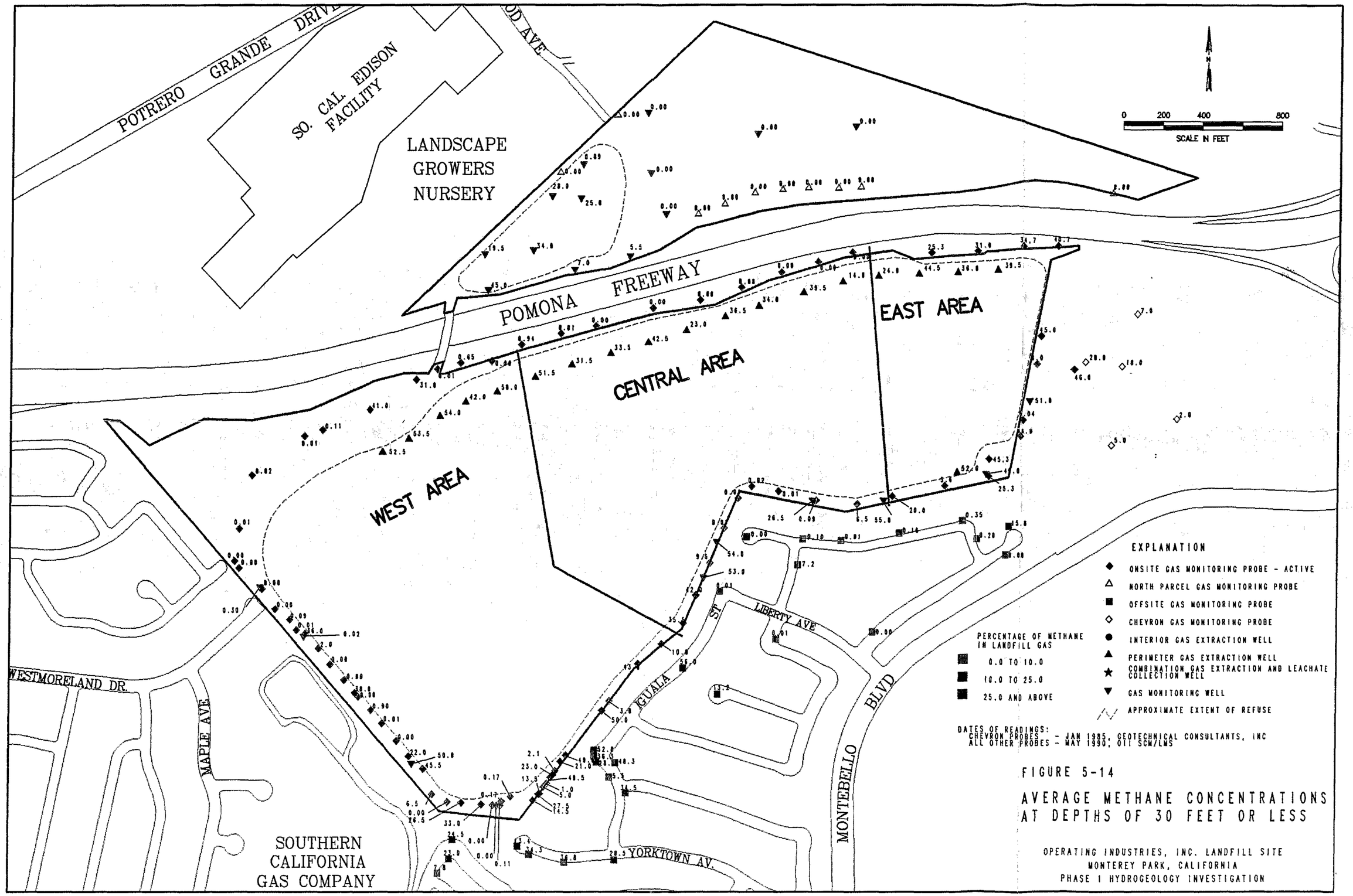


FIGURE 5-14

AVERAGE METHANE CONCENTRATIONS AT DEPTHS OF 30 FEET OR LESS

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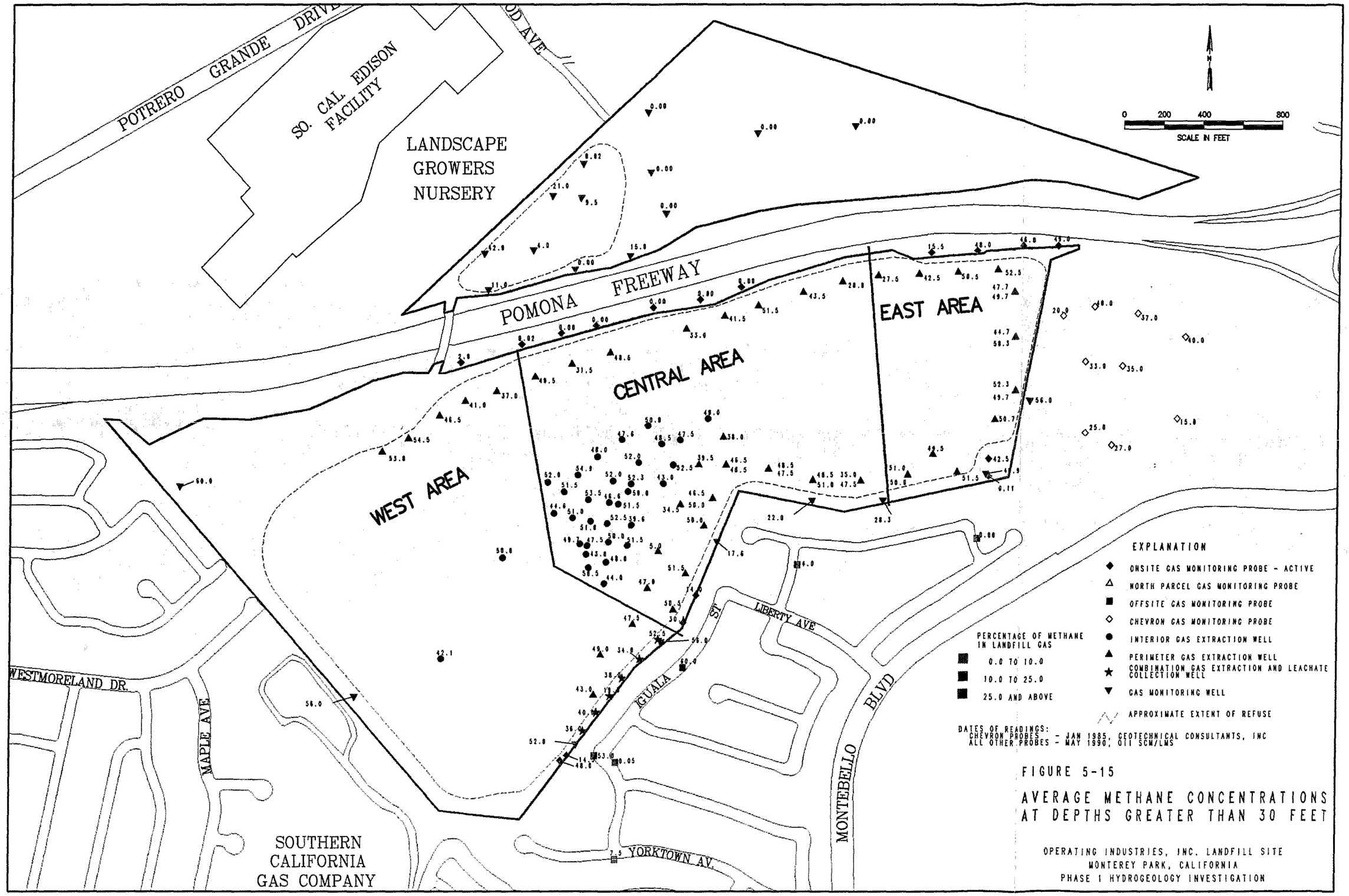


FIGURE 5-15

AVERAGE METHANE CONCENTRATIONS AT DEPTHS GREATER THAN 30 FEET

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

5.4.2.2 Central Area

The LFG migration control system in the Central area includes perimeter extraction wells on the south and north sides and deep interior extraction wells with depths in the lower two-thirds to three-fourths of the landfill.

Available LFG monitoring data in the Central area indicate that the collection system likely controls subsurface migration on the north side and may reduce methane concentrations on the south side. On the north side, the majority of methane readings in perimeter monitoring probes have been zero percent. Methane is occasionally detected in onsite probes on the north boundary. Methane concentrations are less than 1 percent, and usually zero percent, in the deep and shallow perimeter probes (Figures 5-14 and 5-15). Along the south side, South Parcel perimeter gas monitoring wells GMW-9, GMW-10, and GMW-11 have high methane concentrations (>25 percent) in shallow zones and moderate concentrations (10 to 25 percent) in deep zones. However, most deep and shallow offsite probes on the south side of the Central area have low concentrations of methane. Five of eight shallow probes have 0.01 or zero percent methane. Gas monitoring probe 7A is the only probe with a methane concentration greater than 0.16 percent. It has shallow and deep methane concentrations of 7.2 and 4.0 percent methane.

A potential LFG migration pathway may exist at the base of the landfill on the south side of the neck area. The upper and lower sands of the Pico formation may contact the base of the landfill in this area (Figure 3-4). Though methane concentrations are predominantly low, this does provide a permeable pathway for LFG migration.

5.4.2.3 East Area

The East area contains approximately 12 percent of the total refuse and has a maximum depth of 275 feet. The bottom elevations range from 370 to 340 feet above msl. As with the other areas, surface emissions mainly occur on the slopes rather than the top deck. Based on LFG monitoring probe data, the extraction system in the East area does not effectively control subsurface LFG migration.

Deep subsurface migration is indicated in offsite probes east of the landfill by methane concentrations as high as 50 percent. Methane concentrations increase with depth up to 100 feet in offsite probes east of the landfill (Geotechnical Consultants, Inc., March, 1985). The Phase IV perimeter LFG extraction wells on the east side are spaced further apart than other perimeter wells, and do not extend to the depth of the landfill at the perimeter. Depending on the horizontal and vertical influence of these wells, LFG may migrate under or between the extraction wells. The deep and shallow perimeter wells and probes have methane concentrations generally above 25 percent along the north and east sides. Along the south side, perimeter wells and probes also have significant amounts of methane, ranging from 5.6 to 52 percent. Offsite migration

is indicated by a 15.8 percent methane concentration in shallow probe 11. Limited offsite migration is also indicated by 0.35 and 0.20 percent methane in probes 10 and 10A. The deepest probe (222 to 242 feet deep) in GMW-14, located at the southeastern corner of the South Parcel, has had methane concentrations as high as 56 percent (EPA, March 21, 1988).

The base of the landfill in the east area is underlain by permeable Lakewood/San Pedro Unit sediments. Also, the upper, lower, and "A" sands of the Pico Unit grade into a thick sequence of coarse-grained sediments at the east end (Sections B-B' and C-C'). Both of these units could act as permeable pathways for LFG migration.

5.4.2.4 North Parcel

Only the west end of the North Parcel contains landfill material (see Figure 5-8). Recent data on the west side of the North Parcel indicate methane concentrations from about 20 to 45 percent in deep probes and from 4 to 42 percent in the shallow probes. The rest of the North Parcel generally has methane concentrations near or equal to zero percent. The high concentrations may be due to LFG generation on the North Parcel or subsurface LFG migration from the West area adjacent to the freeway overpass.

No LFG collection system exists on the North Parcel. The North Parcel is underlain by permeable Lakewood/San Pedro Unit sediments, which are a potential LFG migration pathway to perched water and the regional water table.

5.4.3 LFG COMPOSITION

LFG is a product of bacterial decomposition of organic waste materials and potentially hazardous wastes deposited in the landfill. Several groups of bacteria combine to cause the buried wastes to become anaerobic (oxygen deficient through consumption) and generate LFG typically composed of 50 to 60 percent methane, 40 to 50 percent carbon dioxide, and part per million (ppm) concentrations of additional gases.

The additional gases occurring in ppm concentrations are typically hydrogen sulfide (mercaptans and other odiferous sulfur gases), hydrogen, other alkane gases (ethane, etc.), and volatilized natural and potentially hazardous organic compounds. The natural compounds include organic (fatty) acids that are part of the degradation and fermentation products of organic materials. The potentially hazardous organic constituents include volatilized solvents and their degradation products (PCE, TCE, vinyl chloride, etc.) and degraded hydrocarbon products (benzene, phenols, etc.). The OII LFG has been documented and described in several publications (EPA, March 21, 1988; June 1988; June 27, 1990; and OII Landfill Work Defendants, April 6, 1990, and EPA, September 28, 1990).

Most of the OII landfill is within the Methane Fermentation phase or Phase IV of Pohland and Harper (1986). Methane and carbon dioxide are being generated, the pH is characteristic of bicarbonate buffering systems, oxidation-reduction potentials are at their lowest values, and metals are being both complexed and precipitated. Segments of the landfill may be approaching the Final Maturation phase (Phase V) in which natural environmental conditions slowly begin to be reinstated, measurable gas production decreases, oxidizing conditions, and aerobic species reappear with a corresponding increase in oxidation-reduction potential, and the possible production of humic acid substances begins which complex and remobilize the above precipitated metals.

A complete set of data from September 1986 is available for 80 individual wells in the perimeter gas extraction system. Data collected includes temperature, percent methane, percent carbon dioxide, percent oxygen, and percent nitrogen. Table 5-8 lists the range of temperatures and methane, carbon dioxide and oxygen concentrations. Table 5-9 lists the same constituents for the perimeter gas extraction wells containing 50 or greater percent methane contrasted both with wells containing 10 or more percent oxygen and surface atmospheric conditions. The temperature of the gases are approximately 9 degrees celsius (16 degrees fahrenheit) higher, carbon dioxide 26 percent higher, and oxygen 14.4 percent lower for the 28 wells producing more than 50 percent methane. These relationships are typical of LFG. Methane and carbon dioxide are produced by the bacteria and their activity produces heat. The presence of underground fires in the landfill would effect these relationships.

Table 5-8
LFG Data from the Perimeter Gas Extraction System
(September 1986)

Parameter	Range
Temperature	14 to 135 degrees fahrenheit
Methane	0 to 75 percent
Carbon Dioxide	0 to 46 percent
Oxygen	0 to 20 percent

Table 5-9
LFG Data for the Perimeter Gas Extraction System (Wells With High Methane Percentages versus Wells with High Oxygen Percentages) (September 1986)

Wells	No. of Wells	Average Temperature (°F)	Methane %	Carbon Dioxide %	Oxygen %	Nitrogen %
Methane >50 Percent	28	108	56	38	0.6	5
Oxygen >10 Percent	16	92	14	12	15	59
Average Atmospheric Conditions	--	--	--	0.03	20.95	78.08
Source: (EPA, June 1988)						

Highly active decomposition zones within the landfill produce heat energy and the highest methane concentrations. Higher temperatures volatilize more of the potentially hazardous gases than lower temperatures. Extraction well (V16S), which produces the highest temperature gases (57.2 degrees celsius, 135 degrees fahrenheit), also produces the highest amount of methane (75 percent). In contrast, the extraction well (V11S), which produces the highest oxygen concentration (20 percent), has one of the lowest temperatures (23.4 degrees celsius, 81 degrees fahrenheit) and produces nondetectable concentrations of methane and carbon dioxide. Both wells are perforated in the 20- to 30-foot-depth interval. Zones of high heat production and high oxygen concentration indicate aerobic decomposition of refuse. Approximately one-third of the extraction wells exceed a depth of 100 feet. Unlike natural conditions of increasing temperature with depth, the temperature of gases from the gas extraction wells show little relationship with depth.

Even though both the high methane and high oxygen producing gas extraction wells are extracting gases from a depth interval of only 20 to 30 feet, the average gas composition is considerably different than atmospheric gases in both cases. Both the oxygen and the nitrogen are extremely low (0.6 and 5.4 percent) when compared to surface conditions. Almost all the oxygen is consumed and displaced by LFG production, and the nitrogen is lower than surface conditions by more than an order of magnitude. Using these percentages, oxygen would indicate approximately 3 percent atmospheric and nitrogen approximately 7 percent atmospheric gases in the average LFG containing more than 50 percent methane. Oxygen is lower because it is consumed and nitrogen is produced by bacterial activity.

Methane is a general indicator of other landfill gases, particularly carbon dioxide, ethane, and hydrogen. Carbon dioxide and water are the end products of the degradation of all organic compounds. Both carbon dioxide and hydrogen are produced along with the methane during the microbial breakdown of organic matter in the landfill refuse. Hydrogen is common at ppm concentrations. Hydrogen concentrations in the OII LFG are less than 100 ppm, ranging from undetected to 51 ppm in GMW-12A (EPA, June 27, 1990). Ethane and higher molecular weight alkane gases are also common in LFG at total concentrations of less than 0.2 percent (Schoell, 1983). Ethane ranges from undetected to 92 ppm in GMW-6C (EPA, June 27, 1990) in OII LFG.

Carbon dioxide, ethane, and hydrogen are commonly highest where methane is highest. All three gases are commonly detected in LFG containing more than 50 percent methane. However, carbon dioxide is highly variable in both distribution and concentration. Its distribution is greater than methane because it is produced by both aerobic and anaerobic bacteria as well as the abiotic degradation of organic matter.

Hydrogen sulfide (and dissolved sulfide) is a common product of the anaerobic reduction of sulfate. Hydrogen sulfide is commonly produced before methane in time and in distribution. Hydrogen sulfide is produced at the upper anaerobic levels of the landfill refuse and methane at lower levels where the sulfate has been reduced to sulfide. Hydrogen sulfide ranges from undetected to as much as 250 ppm (GMW-6B) in the OII landfill gas monitoring wells (EPA, June 27, 1990).

Hydrogen sulfide, unlike methane at these temperatures, is also produced by inorganic reactions. Hydrogen sulfide is produced when iron and other metal sulfides are oxidized. It is produced instead of the bisulfide ion in an acidic solution. Therefore, hydrogen sulfide is produced by bacteria as the landfill reaches an anaerobic state and potentially again as the landfill reaches a mature oxidized state.

Helium is not commonly present in LFG, but it was detected at a concentration of 43 ppm in GMW-6C at a depth interval of 60 to 80 feet and an estimated concentration of 320 ppm in GMW-12A (EPA, June 27, 1990). This is the same well and depth interval with the highest ethane concentration (92 ppm). The lower depth interval, 93 to 113 feet, had 49 percent methane but no detected concentrations of carbon dioxide, ethane, hydrogen, hydrogen sulfide, or helium.

The GMW-6 series wells represent a good vertical sequence of LFG compositions. Hydrogen sulfide is present with methane and carbon dioxide in the upper depth interval and methane, carbon dioxide, ethane, and hydrogen in the lower interval with lower oxygen concentration (0.8 percent) than in the upper interval (1.7 percent). Vinyl chloride is present in both intervals (40 and 35 ppm, respectively), indicating the production of additional gases from the landfill. Vinyl chloride is also absent from the deepest depth interval.

Vinyl chloride is commonly used as an indicator VOC for solvents. PCE forms a degradation series through TCE to DCE, dichloroethylene series, to vinyl chloride as a final product before conversion to carbon dioxide and water. PCE, TCE, 1,1-DCE and vinyl chloride are all present in the gas monitoring wells at ppm concentrations (CURE, April 25, 1990). Vinyl chloride and 1,1-DCE are both higher in concentration and occur in more gas monitoring wells than PCE and TCE.

Vinyl chloride was detected in 15 of the 20 samples collected in March 1990 (CURE, April 25, 1990) in concentrations as high as 59 ppm (GMW-7E); 1,1-DCE in 11 of 20 samples, as high as 45 ppm (GMW-4E). PCE, on the other hand, was detected in only 3 of the 20 samples in concentrations as high as 22 ppm (GMW-15B) and TCE in 4 of the 20, as high as 22 ppm (GMW-15B). Gas vapor pressure differences characteristic of the gases cannot account for the relative differences in these volatilized organic compounds.

These data indicate that OII is a maturing landfill. However, the order listed here is for the sample with the highest concentration for each constituent. The landfill can be in various stages of maturation at any one time and the type of refuse in any one location of the landfill is probably different. The PCE and TCE high concentrations are coming from the oldest refuse area (Area I in the South Parcel), and the DCE and vinyl chloride from the younger refuse area (Areas III and IV). The refuse type, as well as the other controlling factors, must also be considered in the analysis of maturity.

Additional gases typical of degradation products from hydrocarbon sources are more abundant than the PCE series. Benzene, toluene, ethylbenzene, and total xylene distribution and concentrations exceed those of the PCE series. Total xylene is detected in 19 of the 20 samples in concentrations as high as 230 ppm (GMW-12C). Toluene, although detected in fewer samples than ethylbenzene and benzene, had one concentration as high as 182 ppm (GMW-6C) versus the highest concentration for ethylbenzene of 84 ppm (GMW-12C) and 6.7 ppm (GMW-7E) for benzene.

Other additional gases detected include 1,1-dichloroethane (1,1-DCA) in 5 of the 20 samples, and both chlorobenzene and 1,1,1-trichloroethane (1,1,1-TCA) in two samples. 1,1-DCA concentration ranges from 0.62 to 7.2 ppm (GMW-7E); 1,1,1-TCA from 0.011 to 0.012 ppm (GMW-11C); and chlorobenzene from 0.45 to 0.57 ppm (GMW-2B). Similar to the PCE series, 1,1,1-TCA forms a degradation series through 1,1-DCA to chloroethane. The dominance of 1,1-DCA over 1,1,1-TCA also suggests that the landfill is maturing.

Section 6
GROUNDWATER CHEMISTRY

Section 6
GROUNDWATER CHEMISTRY

This section discusses the observed major ion, contaminant, and stable isotope concentrations in groundwater samples from all existing and new monitoring wells at the OII site. The major ion data are used to define hydrogeochemical facies that can be used to indicate separate aquifers, change in aquifer geochemistry, or potential contamination with leachate or landfill gas. The contaminant concentrations are used to characterize the nature and extent of groundwater contamination and exceedances of regulatory standards for groundwater quality. Stable isotope concentrations are used to evaluate potential sources of hydrogen sulfide in groundwater adjacent to the OII site and to evaluate the relative age of groundwater in selected hydrogeologic units.

6.1 SUMMARY OF AVAILABLE WATER QUALITY DATA

6.1.1 NUMBERS OF SAMPLES

The 25 monitoring wells installed during this investigation (OI-13C through OI-29B) were sampled three times for a complete analysis. In addition, a sample was taken for VOC analysis during each aquifer test for a total of four VOC analyses from each new well.

Previously existing wells OI-1A and OI-2 through OI-6 were sampled approximately 15 times between March 1985 and May 1990. Wells OI-7C through OI-13B were sampled eight times between October 1987 and May 1990. Two analyses are available for CDD-13 and CDD-17. The Southern California Gas Company (SoCalGas) wells Drill-site No. 1 and 2897A were sampled once. All existing and new wells were included during the last sampling round of this investigation.

6.1.2 ANALYTES

The list of analytes for groundwater from the new groundwater monitoring wells and from existing wells sampled during this investigation is presented in Table 6-1. The last round of sampling included analysis of sulfide, which had not been previously tested, and both dissolved and total metals. All previous samples for metals analysis were dissolved concentrations using filtered samples. The oxidation-reduction potential (Eh), dissolved oxygen, and ferrous iron concentrations were also measured in the field during the final sampling.

Changes in analytical procedures used for groundwater samples from OII have occurred over the past 5 years. These changes were made in response to recommendations from the EPA National Enforcement Investigations Center (NEIC).

Table 6-1
List of Parameters for Analysis of Groundwater Samples

Parameter	CLP Analyses Classification	Analytical Method (EPA)
Metals, Cations	RAS	ICAP-OES
Cyanide	RAS	335.3
Ammonia-N	SAS	350.3
TDS	SAS	160.1
pH	RAS	
Anions		
Chloride	SAS	325.1, 325.2, 325.3
Sulfate	SAS	375.1, 375.2
Carbonate Alkalinity	SAS	Standard Method 403
Bicarbonate Alkalinity	SAS	Standard Method 403
Nitrate	SAS	352.1
Fluoride	SAS	340.1, 340.2, 340.3
TOC	SAS	415.1
POC	SAS	415.1
TOX	SAS	450.1
POX	SAS	450.1
VOCs	RAS+SAS	524.2[1]
1,4-dioxane	SAS	NEIC Procedure[2]
Semivolatile Organic Compounds	RAS	625[3]
Pesticides and PCBs	RAS	608

[1]ppb detection limit, HQA procedures.
[2]Appendix C.
[3]Separate analyses of base/neutral and acid extractable fractions.

RAS - Routine analytical services
SAS - Special analytical services

Source: EPA (September 14, 1989)

In 1986, NEIC analyzed leachate and groundwater samples from the OII Landfill using standard EPA Contract Laboratory Program (CLP) protocol. NEIC determined matrix interferences and other analytical difficulties and recommended modifications to CLP protocol. These recommendations, referred to as the High Quality Analysis (HQA) protocol, were instituted in 1986. For details concerning the development of these analytical methods, refer to the technical memoranda prepared by NEIC (September 16, 1986; November 20, 1986; and January 12, 1987) and included as Appendix A of the field sampling plan for this investigation (EPA, September 14, 1989).

The modifications recommended by NEIC were further revised based on input from analytical laboratories, CLP data validators, and EPA. The HQA procedures that were used for the analysis of groundwater samples taken during this investigation are listed below:

- 1 ppb detection limit for 1,2-dichloroethane, benzene, and vinyl chloride
- Separate analysis of 1,4-dioxane as a VOC with a detection limit of 5 ppb
- Analysis of 1,2-dichlorobenzene, 1.3-dichlorobenzene, and 1,4-dichlorobenzene as VOCs with a 1 ppb detection limit
- Separate analyses of the base/neutral and acid extractable fractions of the semivolatile organic compounds

The changes in analytical procedures are expected to have impacted reported concentrations of some chemical parameters. Changes in analytical procedures for the analysis of OII groundwater samples and an evaluation of the potential impacts on the chemical analyses will be summarized in EPA (September 26, 1990). Changes in analytical procedures are expected to affect the VOC, 1,4-dioxane, and semivolatile organic concentrations. Data collected during the last two years are considered directly comparable, since the analytical procedures did not change over this time.

6.1.3 DATA MANAGEMENT, QUALITY ASSURANCE, AND ANALYSIS

Groundwater quality data are an important component of site characterization. The data are used to:

- Define the nature and extent of contamination
- Understand historical (time-dependent) migration of chemicals, if any, from the landfill site
- Identify preferential pathways, if any, of chemical migration

- Develop remedial alternative analyses under a Remedial Investigation and Feasibility Study (RI/FS)

- Assess the effectiveness of future remedial and abatement measures

Available groundwater quality data for OII monitoring wells were entered into the Technical Data Management (TDM II) data base for analysis. TDM II is a data base for microcomputers developed by CH2M HILL for the storage and manipulation of environmental chemical data. The data base allows selective retrieval of chemical concentration data or statistical summaries by user-specified location, sampling date range, chemical parameter, concentration limits, and laboratory.

TDM II was designed to:

- Ease data entry

- Check consistency of well and chemical names at each data entry level

- Assure entry of all components of each data entry (e.g., sampling date, concentration, analytical laboratory, concentration flags, and units)

- Develop a standardized data base

These quality assurance checks minimized the usual data discrepancies and assisted considerably in computerized data processing and graphic display of the groundwater quality data.

Many of the laboratory analysis concentration values in the data base are followed by a flag, which are defined below. Lab values with no qualifiers are above the detection limit and can be used for quantitative analysis.

J Estimated value for qualitative use only

T Tentatively identified compound

K "T" and "J" apply

L Values between the instrument detection limit (IDL) and the EPA contract-required quantification limit (CRQL)

U Less than listed value (nondetected)

P "J" and "U" apply, estimated detection limit

All chemical parameters in the data base are grouped into the following categories:

1. Inorganic, field, and indicator parameters
2. Volatile Organic Compounds (VOCs)
3. Semivolatile Organic Compounds
4. Pesticides and PCBs
5. Tentatively Identified Organic Compounds (TICs)

The complete listings of all groundwater quality data are provided in Appendix M. All chemical data is listed by well first and chemical second. Individual analyses are then listed chronologically. The data are organized into five main categories: Inorganic, field, and indicator parameters (Appendix M-1); VOCs (Appendix M-2); semivolatile organics (Appendix M-3); pesticides and PCBs (Appendix M-4); and TICs (Appendix M-5). Graphic displays summarizing reported concentrations of selected parameters are provided in Appendix L.

Several alternative methods (listed below) were used in this report to present and analyze the groundwater quality data.

Table 6-2 summarizes the number of analytical data values under each of the above categories and their subdivisions into "above detection limit" and "below detection limit." At the conclusion of this Phase I Investigation, more than 47,000 groundwater quality values are in the TDM II data base.

Table 6-2
Number of Analytical Values in
TDM II Data Base

	VOAs	**Semi-Volatiles**	**Inorganics**	**Pesticides**	**Tentatively Identified Compounds**
Data					
Above Detection Limit	746	152	4,837	19	457
Below Detection Limit	11,324	18,335	4,232	6,755	284
Total	12,070	18,487	9,069	6,774	741
Total Data Points 47,141					

Tables 6-3 through 6-7 list the minimum, maximum, number of detected values, and number of nondetected values for each chemical in the data base without regard to well. These tables summarize the basic data needed for data analysis activities, the number of records for each chemical, and the concentration range.

Summary tables of concentrations of inorganic and indicator parameters, VOCs, semivolatile organics, pesticides and PCBs, and TICs for each well are provided at the end of this section in Tables 6-16, 6-17, 6-18, 6-19, and 6-20, respectively. These tables summarize only those chemical parameters that have been detected at least once in the data base. For each chemical parameter, the tables list the concentration units, minimum and maximum values, the median, the number of detected values, and the number of observations (total number of samples). Undetected values are considered equal to the laboratory detection limit for the calculation of median values.

A comparison of median values is a robust statistical method of determining if there are similarities in many parameters. The median is the central value of a concentrations ranked from the highest to the lowest value. It is the same concentration as the mean if the data are normally distributed. However, if more concentrations are undetected than detected, the median concentration is an undetected value. Also, if one (or a few) concentrations are very high, and most concentrations are very low or undetected values, the median concentration would be a very low or undetected value.

Bar concentration plots for each detected chemical were prepared for visual analysis of the water quality data. These plots are organized by chemical and by well. Selected plots have been included in this chapter to illustrate specific conclusions. A more comprehensive collection of the bar-concentration plots is provided in Appendix L. A complete set of the plots for all detected chemicals is available in EPA (September 29, 1990).

All chemical analyses of the groundwater samples taken during this investigation are included in the data base (Appendix K) and the tables and figures in this report, except for the metals (both filtered and unfiltered), TOC, POC, TOX, and POX values for the last round of groundwater sampling (completed from April 24 to May 10, 1990). The TOC, POC, TOX, and POX data are included in Appendix M-6. EPA will receive the validated metals analyses in early October 1990.

Table 6-3
LIST OF INORGANIC COMPOUNDS IN OII DATA BASE
WITH CONCENTRATION RANGE AND TOTAL OBSERVATIONS

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
AG SILVER,DISSOLVED	100.0	2.70	60	154	UG/L
AL ALUMINUM,DISSOLVED	197000.0	16.40	165	56	UG/L
ALK TOTAL ALKALINITY (AS CACO3)	2140000.0	70.00	174	2	MG/L
AS ARSENIC,DISSOLVED	227.0	2.00	81	140	UG/L
BA BARIUM,DISSOLVED	2050.0	9.00	180	41	UG/L
BE BERYLLIUM,DISSOLVED	20.0	0.30	25	189	UG/L
CA CALCIUM,DISSOLVED	1420000.0	0.18	216	2	MG/L
CD CADMIUM,DISSOLVED	49.0	0.20	34	179	UG/L
CL CHLORIDE	7800000.0	50.80	189	1	MG/L
CN CYANIDE	2730.0	3.70	28	188	UG/L
CO COBALT,DISSOLVED	342.0	3.80	42	179	UG/L
CR CHROMIUM,DISSOLVED	216.0	2.20	64	157	UG/L
CU COPPER,DISSOLVED	543.0	1.70	95	126	UG/L
FE IRON,DISSOLVED	160000.0	0.01	164	55	MG/L
FL FLUORIDE	891000.0	0.36	188	2	MG/L
HG MERCURY,DISSOLVED	38.5	0.10	54	159	UG/L
K POTASSIUM,DISSOLVED	264000.0	0.59	195	23	MG/L
MG MAGNESIUM,DISSOLVED	525000.0	13.60	201	17	MG/L
MN MANGANESE,DISSOLVED	32300.0	0.00	194	27	MG/L
N NITRATE (AS N)	1380000.0	0.01	70	49	MG/L
N2N NITRITE (ASN)	1370.0	0.01	8	103	MG/L
NA SODIUM,DISSOLVED	3360000.0	9.00	214	4	MG/L
NH3 AMMONIA NITROGEN (AS N)	64500.0	0.01	133	49	MG/L
NI NICKEL,DISSOLVED	520.0	8.00	69	152	UG/L
PB LEAD,DISSOLVED	4860.0	1.00	51	162	UG/L
PHF PH - FIELD	12.6	5.85	196	0	UNIT
POC PURGEABLE ORGANIC CARBON	55400.0	0.06	73	135	UG/L
POX PURGEABLE ORGANIC HALOGENS	3640.0	1.60	73	115	UG/L
SB ANTIMONY,DISSOLVED	760.0	2.00	19	195	UG/L
SC SPEC COND (UMHO/CM X 10-6),DISSOLVED	23600.0	2.00	191	3	UMHO
SE SELENIUM,DISSOLVED	68.0	2.00	51	147	UG/L
SN TIN	400.0	4.20	4	51	UG/L
SO4 SULFATE	1440000.0	8.79	188	2	MG/L
TDS TOTAL DISSOLVED SOLIDS	16300000.0	100.00	183	1	MG/L
TL THALLIUM,DISSOLVED	100.0	0.70	2	211	UG/L
TMC TEMPERATURE (DEG C)	30.0	19.00	105	0	DEG
TOC TOTAL ORGANIC CARBON	1771000.0	0.47	129	78	MG/L
TOX TOTAL ORGANIC HALOGENS	360000.0	2.20	180	30	UG/L
V VANADIUM,DISSOLVED	800.0	3.30	64	157	UG/L
ZN ZINC,DISSOLVED	49700.0	0.00	156	65	MG/L
AGT SILVER TOTAL	10.0	10.00	0	3	UG/L
ALT ALUMINUM TOTAL	3200.0	100.00	2	1	UG/L
AST ARSENIC TOTAL	77.0	32.00	3	0	UG/L
BAT BARIUM TOTAL	1080.0	551.00	3	0	UG/L
BR BROMIDE	71000.0	28000.00	3	0	MG/L
BRT BERYLLIUM TOTAL	6.0	6.00	0	3	UG/L
CAT CALCIUM TOTAL	510000.0	478000.00	3	0	MG/L
CDT CADMIUM TOTAL	4.0	4.00	0	3	UG/L
COT COBALT TOTAL	70.0	20.00	3	0	UG/L
CRT CHROMIUM TOTAL	30.0	30.00	0	3	UG/L
CUT COPPER TOTAL	131.0	66.00	3	0	UG/L
FCN FREE CYANIDE	40.0	20.00	3	0	UG/L
FET IRON TOTAL	29400.0	17000.00	3	0	MG/L
GAA GROSS ALPHA ACTIVITY	76.0	-1.40	3	0	PCI/
GBA GROSS BETA ACTIVITY	254.0	-8.70	3	0	PCI/
HGT MERCURY TOTAL	0.5	0.50	0	3	UG/L
I IODINE DISSOLVED	2390.0	2330.00	3	0	MG/L
KT POTASSIUM TOTAL	186000.0	7.42	3	0	MG/L
MAB METHYLENE BLUE ACTIVE SUBSTANCES	620.0	0.67	2	0	MG/L
MGT MAGNESIUM TOTAL	553000.0	305.00	3	0	MG/L
MO MOLYDENUM DISSOLVED	20.0	20.00	0	3	UG/L
MOT MOLYDENUM TOTAL	20.0	20.00	0	3	UG/L
NAT SODIUM TOTAL	3120000.0	1130000.00	3	0	MG/L
NIT NICKEL TOTAL	460.0	40.00	3	0	UG/L
PBT LEAD TOTAL	14.0	11.00	3	0	UG/L
PO4 PHOSPHATE (TOTAL)	10000.0	50.00	3	20	MG/L
SBT ANTIMONY TOTAL	8.0	8.00	0	3	UG/L
SCT SCANDIUM TOTAL	2.0	2.00	0	3	UMHO
SET SELENIUM TOTAL	7.0	7.00	0	3	UG/L
SRT STRONTIUM TOTAL	7530.0	4650.00	3	0	MG/L

Table 6-3
(Continued)

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
TI TITANIUM DISSOLVED	20.0	10.00	3	0	UG/L
TIT TITANIUM TOTAL	271.0	39.00	3	0	UG/L
TLT THALLIUM TOTAL	0.7	0.70	0	3	UG/L
VT VANADIUM TOTAL	187.0	67.00	3	0	UG/L
Y YTTRIUM DISSOLVED	6.0	6.00	0	3	UG/L
YT YTTRIUM TOTAL	6.0	6.00	0	3	UG/L
ZNT ZINC TOTAL	178.0	147.00	3	0	MG/L
ALA CARB ALKALINITY (AS CACO3)	736000.0	1.00	24	46	MG/L
ALB BICARB ALKALINITY (AS CACO3)	2140000.0	70.00	75	9	MG/L
ALH HYDROX ALKALINITY (AS CACO3)	1472000.0	1.00	4	22	MG/L
PH PH - LAB	12.3	1.60	25	0	UNIT

Table 6-4
LIST OF VOLATILE ORGANIC COMPOUNDS IN OII DATA BASE
WITH CONCENTRATION RANGE AND TOTAL OBSERVATIONS

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
111 1,1,1-TRICHLOROETHANE	10.0	0.20	14	295	UG/L
112 1,1,2-TRICHLOROETHANE	10.0	0.90	2	306	UG/L
11A 1,1-DICHLOROETHANE	180.0	0.30	40	268	UG/L
11E 1,1-DICHLOROETHYLENE	30.0	0.20	26	282	UG/L
12A 1,2-DICHLOROETHANE	220.0	0.60	9	298	UG/L
12P 1,2-DICHLOROPROPANE	10.3	0.20	19	289	UG/L
14A 1,4-DIOXANE	30000.0	0.20	46	251	UG/L
2BN 2-BUTANONE	150.0	0.74	4	291	UG/L
2CV 2-CHLOROETHYLVINYLETHER	200.0	2.00	0	86	UG/L
2HN 2-HEXANONE	128.0	1.00	2	300	UG/L
4M2 4-METHYL-2-PENTANONE	50.0	0.52	15	287	UG/L
ACT 2-PROPANONE (ACETONE)	200.0	1.00	7	284	UG/L
BDM BROMODICHLOROMETHANE	10.0	1.00	0	302	UG/L
BEN BENZENE	40.0	0.20	51	257	UG/L
BFM BROMOFORM (TRIBROMOMETHANE)	10.0	1.00	0	308	UG/L
BMT BROMOMETHANE	20.0	1.00	0	308	UG/L
C13 CIS-1,3-DICHLOROPROPENE	25.0	1.00	0	308	UG/L
CBN CHLOROBENZENE	10.0	0.60	24	284	UG/L
CCL CARBON TETRACHLORIDE	10.0	1.00	0	308	UG/L
CDS CARBON DISULFIDE	437.0	0.20	17	286	UG/L
CET CHLOROETHANE	30.0	1.00	0	308	UG/L
CFM CHLOROFORM	30.0	0.20	9	300	UG/L
CMT CHLOROMETHANE	470.0	1.00	1	307	UG/L
DCM DIBROMOCHLOROMETHANE	10.0	1.00	0	302	UG/L
EBN ETHYLBENZENE (PHENYLETHANE)	340.0	0.20	33	278	UG/L
MCL METHYLENE CHLORIDE	1200.0	0.20	21	281	UG/L
PCE TETRACHLOROETHENE (PCE)	510.0	0.10	65	244	UG/L
STY STYRENE	50.0	0.30	2	301	UG/L
T12 TRANS-1,2-DICHLOROETHYLENE	64.0	0.20	36	161	UG/L
T13 TRANS-1,3-DICHLOROPROPENE	25.0	1.00	0	308	UG/L
TCA 1,1,2,2-TETRACHLOROETHANE	30.0	1.00	0	291	UG/L
TCE TRICHLOROETHYLENE	370.0	0.20	45	263	UG/L
TOL TOLUENE (METHYL BENZENE)	110.0	0.20	40	268	UG/L
TX TOTAL XYLENES(M+O+P)	64.0	0.20	60	239	UG/L
VAC VINYL ACETATE	50.0	2.00	0	295	UG/L
VC VINYL CHLORIDE	552.0	0.30	45	263	UG/L
12D 1,2-DIBROMOETHANE	50.0	1.00	0	29	UG/L
12E 1,2-DICHLOROETHENE	73.0	0.50	9	122	UG/L
2BU 2-BUTANOL	200.0	200.00	0	3	UG/L
2MO 2-METHYL-2-PROPANOL	260.0	200.00	2	1	UG/L
2PL 2-PROPANOL	300.0	300.00	0	3	UG/L
4ML 4-METHYL-2-BUTANOL	100.0	100.00	0	3	UG/L
4MO 4-METHYL-2-PENTEN-2-OL	500.0	500.00	0	3	UG/L
4PL 4-METHYL-2-PENTANOL	100.0	100.00	0	3	UG/L
EET ETHYL ETHER	50.0	50.00	0	3	UG/L
PYD PYRIDINE	500.0	500.00	0	3	UG/L
DCB TOTAL DICHLOROBENZENES	5.0	1.00	0	79	UG/L
TMZ TRIMETHYL BENZENE	27.0	1.00	11	0	UG/L

Table 6-5
LIST OF SEMIVOLATILE ORGANIC COMPOUNDS IN OII DATA BASE
WITH CONCENTRATION RANGE AND TOTAL OBSERVATIONS

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
124 1,2,4-TRICHLOROBENZENE	15.6	5.00	0	251	UG/L
12B 1,2-DICHLOROBENZENE	15.6	0.20	16	351	UG/L
13B 1,3-DICHLOROBENZENE	15.6	1.00	5	362	UG/L
14B 1,4-DICHLOROBENZENE	60.7	0.30	33	335	UG/L
246 2,4,6-TRICHLOROPHENOL	15.6	10.00	0	251	UG/L
24C 2,4-DICHLOROPHENOL	15.6	10.00	0	251	UG/L
24L 2,4-DINITROPHENOL	78.0	20.00	0	244	UG/L
24M 2,4-DIMETHYLPHENOL	20.0	10.00	0	251	UG/L
24P 2,4,5- TRICHLOROPHENOL	78.0	10.00	0	251	UG/L
24T 2,4-DINITROTOLUENE	16.0	10.00	0	251	UG/L
26T 2,6-DINITROTOLUENE	16.0	10.00	0	251	UG/L
2CN 2-CHLORONAPHTHALENE	50.0	5.00	0	251	UG/L
2CP 2-CHLOROPHENOL	15.6	5.00	0	251	UG/L
2MN 2-METHYLNAPHTHALENE	50.0	1.90	4	241	UG/L
2MP 2-METHYLPHENOL	15.6	5.00	0	251	UG/L
2NA 2-NITROANILINE	78.0	10.00	0	245	UG/L
2NP 2-NITROPHENOL	15.6	10.00	0	251	UG/L
33B 3,3'-DICHLOROBENZIDINE	31.2	10.00	0	241	UG/L
3NA 3-NITROANILINE	78.0	10.00	0	244	UG/L
462 4,6-DINITRO-2-METHYLPHENOL	78.0	10.00	0	239	UG/L
4BP 4-BROMOPHENYL-PHENYL ETHER	15.6	10.00	0	251	UG/L
4C3 4-CHLORO-3-METHYLPHENOL	15.6	8.00	0	245	UG/L
4CA 4-CHLOROANILINE	15.6	10.00	0	245	UG/L
4CP 4-CHLOROPHENYL-PHENYL ETHER	15.6	10.00	0	251	UG/L
4MP 4-METHYLPHENOL	15.6	5.00	0	251	UG/L
4NA 4-NITROANILINE	78.0	18.00	0	245	UG/L
4NP 4-NITROPHENOL	78.0	20.00	0	250	UG/L
ACN ACENAPHTHENE	15.6	5.00	0	251	UG/L
ACY ACENAPHTHYLENE	50.0	5.00	0	251	UG/L
ATR ANTHRACENE	15.6	5.00	0	251	UG/L
BAA BENZO(A)ANTHRACENE	15.6	10.00	0	250	UG/L
BAL BENZYL ALCOHOL	20.0	4.00	3	243	UG/L
BAP BENZO(A)PYRENE	15.6	10.00	0	251	UG/L
BBF BENZO(B)FLUORANTHENE	22.0	10.00	0	251	UG/L
BBP BUTYLBENZYL PHTHALATE (BBP)	15.6	2.00	3	249	UG/L
BEM BIS(2-CHLOROETHOXY)METHANE	15.6	5.00	0	251	UG/L
BET BIS(2-CHLOROETHYL)ETHER	15.6	2.50	0	251	UG/L
BGP BENZO(G,H,I)PERYLENE	18.0	10.00	0	251	UG/L
BIT BIS(2-CHLOROISOPROPYL)ETHER	15.6	5.00	0	251	UG/L
BKF BENZO(K)FLUORANTHENE	15.6	10.00	0	251	UG/L
BPH BIS(2-ETHYLHEXYL)PHTHALATE	730.0	1.80	28	224	UG/L
BZA BENZOIC ACID	1200.0	1.00	10	242	UG/L
BZD BENZIDINE	50.0	10.00	0	66	UG/L
CRY CHRYSENE	15.6	8.00	0	251	UG/L
DBA DIBENZO(A,H)ANTHRACENE	20.0	10.00	0	251	UG/L
DBF DIBENZOFURAN	15.6	10.00	0	245	UG/L
DBP DI-N-BUTYLPHTHALATE	63.0	1.70	8	243	UG/L
DEP DIETHYL PHTHALATE (DEP)	29.0	0.50	4	247	UG/L
DMP DIMETHYL PHTHALATE	30.0	2.00	4	247	UG/L
DOP DI-N-OCTYL PHTHALATE	18.0	0.40	4	247	UG/L
FLA FLUORANTHENE (IDRYL)	15.6	2.00	2	249	UG/L
FLE FLUORENE	50.0	5.00	0	251	UG/L
HBE HEXACHLOROETHANE	16.0	10.00	0	245	UG/L
HBU HEXACHLOROBUTADIENE	28.0	10.00	0	251	UG/L
HCB HEXACHLOROBENZENE	50.0	10.00	0	250	UG/L
HCP HEXACHLOROCYCLOPENTADIENE	25.0	10.00	0	245	UG/L
IPY INDENO(1,2,3-C,D)PYRENE	15.6	10.00	0	251	UG/L
ISP ISOPHORONE	15.6	5.00	0	251	UG/L
NAP NAPHTHALENE (TAR CAMPHOR)	15.6	1.00	4	247	UG/L
NPH N-NITROSODIPHENYLAMINE	20.0	8.00	1	242	UG/L
NPR N-NITROSODI-N-PROPYLAMINE	15.6	10.00	0	251	UG/L
NTB NITROBENZENE	15.6	10.00	0	251	UG/L
PAN PHENANTHRENE	15.6	5.00	0	251	UG/L
PCP PENTACHLOROPHENOL (PCP)	78.0	10.00	0	251	UG/L
PHN PHENOL	50.0	1.00	10	242	UG/L
PYR PYRENE	15.6	1.00	2	248	UG/L
ANL ANILINE (PHENYLAMINE)	12.0	10.00	0	50	UG/L
BZ BENZYL CHLORIDE	8.0	8.00	0	3	UG/L
OAC ORGANIC ACIDS	2800.0	400.00	2	0	UG/L

Table 6-5
(Continued)

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
TCB 1,2,4,5-TETRACHLOROBENZENE	10.0	10.00	0	3	UG/L
TCN 1,2,3,4-TETRACHLOROBENZENE	8.0	8.00	0	3	UG/L
123 1,2,3-TRIMETHYLBENZENE	13.0	5.00	3	0	UG/L
NME N-NITROSODIMETHYLAMINE	10.0	8.00	1	49	UG/L
TEB 1,2,4,5-TETRAMETHYLBENZENE	6.0	6.00	1	0	UG/L
TME 1,3,5-TRIMETHYLBENZENE	3.0	1.00	2	0	UG/L

Table 6-6
LIST OF PESTICIDES AND PCBs IN OII DATA BASE
WITH CONCENTRATION RANGE AND TOTAL OBSERVATIONS

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
ALD ALDRIN (HHDN)	2.5	0.02	4	233	UG/L
BHA ALPHA-BHC (A-BHC)	2.5	0.05	0	237	UG/L
BHB BETA-BHC (B-BHC)	34.0	0.05	3	234	UG/L
BHD DELTA-BHC (C-BHC)	2.5	0.04	2	235	UG/L
BHG GAMMA-BHC (LINDANE)	2.5	0.05	0	237	UG/L
CRD CHLORDANE (ALPHA-CHLORDANE)	25.0	0.48	1	236	UG/L
DDD 4,4'-DDD	5.0	0.10	0	237	UG/L
DDE 4,4'-DDE	5.0	0.10	0	237	UG/L
DDT 4,4'-DDT	5.0	0.10	1	236	UG/L
DIE DIELDRIN	5.0	0.10	0	237	UG/L
EDA ENDRIN ALDEHYDE	0.5	0.10	0	67	UG/L
EDK ENDRINE KETONE	5.0	0.10	2	229	UG/L
EDR ENDRIN	5.0	0.10	0	237	UG/L
EN1 ENDOSULFAN I	2.5	0.05	1	236	UG/L
EN2 ENDOSULFAN II	5.0	0.10	1	236	UG/L
ENS ENDOSULFAN SULFATE	5.0	0.10	0	231	UG/L
HPC HEPTACHLOR	2.5	0.05	1	236	UG/L
HPE HEPTACHLOR EPOXIDE	10.0	0.05	1	236	UG/L
MXC METHOXYCHLOR (DMDT)	25.0	0.48	2	229	UG/L
PC1 PCB-1016 (AROCLOR 1016)	25.0	0.05	0	237	UG/L
PC2 PCB-1221 (AROCLOR 1221)	25.0	0.05	0	237	UG/L
PC3 PCB-1232 (AROCLOR 1232)	25.0	0.05	0	237	UG/L
PC4 PCB-1242 (AROCLOR 1242)	25.0	0.05	0	237	UG/L
PC5 PCB-1248 (AROCLOR 1248)	25.0	0.05	0	237	UG/L
PC6 PCB-1254 (AROCLOR 1254)	50.0	0.96	0	237	UG/L
PC7 PCB-1260 (AROCLOR 1260)	50.0	0.96	0	231	UG/L
TXP TOXAPHENE	50.0	0.05	0	237	UG/L

Table 6-7
LIST OF TENTATIVELY IDENTIFIED COMPOUNDS IN OII DATA BASE
WITH CONCENTRATION RANGE AND TOTAL OBSERVATIONS

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
2MP 2-METHYLPHENOL	15.6	5.00	0	251	UG/L
HDA HEXADECANOIC ACID	60.0	5.00	6	6	UG/L
SUL MOLECULAR SULFUR	2000.0	13.00	8	0	UG/L
13X 1,3-OXATHIOLANE	151.0	151.00	1	0	UG/L
25D 2,5-DIETHYLTETRAHYDRO FURAN	55.0	17.00	3	0	UG/L
261 2,6,10,15-TETRAMETHYL HEPTADECANE	60.0	8.00	3	0	UG/L
44B 4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	10.0	7.00	2	0	UG/L
BCH BICYCLO-2,2,1-HEPTAN-2-ONE,1,	144.0	10.00	4	0	UG/L
BSN BENZENESULFONAMIDE, N-BUTYL-4	810.0	32.00	4	0	UG/L
C10 C10H18 HYDROCARBON	3.0	3.00	2	0	UG/L
C3B C3-BENZENE	13.0	0.40	10	0	UG/L
C4B C4-BENZENE	25.0	2.00	5	0	UG/L
C6C C6H12 HYDROCARBON	5.0	1.00	8	0	UG/L
C9C C9H16 HYDROCARBON	2.0	2.00	2	0	UG/L
UNB TOTAL UNKNOWN BNA TIC	1300.0	3.00	69	0	UG/L
UNH TOTAL UNKNOWN BNA HYDROCARBONS	360.0	2.00	18	0	UG/L
UNK UNKNOWN VOA TIC	22.0	0.10	42	0	UG/L
C8H C8H16 HYDROCARBON	1.0	1.00	1	0	UG/L
C9B C9H18 HYDROCARBON	3.0	3.00	1	0	UG/L
2CH 2-CYCLOHEN-1-ONE	7.0	7.00	1	0	UG/L
442 4-HYDROXY-4-METHYL-2-PENTANONE	100.0	30.00	5	0	UG/L
DOD DODECANOIC ACID	300.0	50.00	3	0	UG/L
NON NONANOIC ACID	10.0	5.00	2	0	UG/L
TDA TETRADECANOIC ACID	50.0	16.00	3	0	UG/L
11M 1,1-METHYLETHYL BENZENE	20.0	20.00	1	0	UG/L
13D 1,3-DIOXOLANE-2METHANOL, 2,4-DIMETHYL	280.0	120.00	2	0	UG/L
1PE 1-PHENYL-ETHANONE	50.0	20.00	3	0	UG/L
22P 2,2-DIMETHYLPROPANE	8.0	8.00	1	0	UG/L
6DD 6-DODECANONE	30.0	30.00	1	0	UG/L
B1M BENZENE,(1-METHYLETHENYL)-	20.0	20.00	1	0	UG/L
BHT BUTYLATED HYDROXYTOLUENE	10.0	8.00	5	0	UG/L
DBM ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	100.0	20.00	3	0	UG/L
E1P ETHANONE,1-PHENYL	10.0	10.00	3	0	UG/L
HXN HEXANE (N-HEXANE)	40.0	1.00	6	0	UG/L
MCP METHYL CYCLOPENTANE	5.0	3.00	2	0	UG/L
S8 SULFUR (S8)	1500.0	90.00	4	0	UG/L
15T 15-TETRACOSENOIC ACID, METHYL ESTER	20.0	20.00	1	0	UG/L
2E1 2-ETHYL-1-HEXANOL	100.0	10.00	2	0	UG/L
90D 9-OCTADECANOIC ACID	100.0	100.00	1	0	UG/L
AMD AMIDE	20.0	20.00	1	0	UG/L
CHC CYCLOHEXANECARBOXYLIC ACID	50.0	50.00	1	0	UG/L
DEC DECANOIC ACID	90.0	24.00	2	0	UG/L
H2H HEXAHYDRO-2H-AZEPIN-2-ONE	100.0	100.00	1	0	UG/L
HEX HEXANOIC ACID	41.0	10.00	2	0	UG/L
NND N,N-DIMETHYLMETHAN AMINE	100.0	100.00	1	0	UG/L
NPL NONYLPHENOL	10.0	10.00	1	0	UG/L
OCT OCTANOIC ACID	20.0	20.00	1	0	UG/L
TMB 1,2,4-TRIMETHYL BENZENE	30.0	10.00	2	0	UG/L
11D 1,1-DIMETHYL HYDRAZINE	1564.0	812.00	2	0	UG/L
135 1,3,5-TRIOXANE	30.0	30.00	2	0	UG/L
14D 1,4-DIMETHYLBENZENE	3.0	3.00	1	0	UG/L
23H 2(3H)-BENZOTHIAZOLONE	40.0	40.00	1	0	UG/L
2HP 2H-PYRAN-2-CARBOXYLIC ACID,5-	450.0	424.00	2	0	UG/L
2PE 2-PHENOXY ETHANOL	792.0	372.00	2	0	UG/L
2PN 2-PENTANONE,4,4-DIMETHYL	40.0	4.00	4	0	UG/L
44D 4,4-DIMETHYL-2-PENTANONE	1.0	1.00	2	0	UG/L
BS4 BENZENESULFONAMIDE, 4,4,4-TRIM	752.0	752.00	1	0	UG/L
BSA BENZENESULFAMIDE	30.0	30.00	1	0	UG/L
BST BENZENESULFONAMIDE,N,N,4-TRIM	1044.0	30.00	2	0	UG/L
BUT BUTANOIC ACID, 3-METHYL-BUTYL	3084.0	2256.00	2	0	UG/L
C11 C10H12 HYDROCARBON	2.0	2.00	1	0	UG/L
C14 C10H14 HYDROCARBON	2.0	2.00	1	0	UG/L
C7C C7H14 HYDROCARBON	3.0	1.00	4	0	UG/L
C7H C7H14O HYDROCARBON	60.0	9.00	3	0	UG/L
C9H C9H12 HYDROCARBON	10.0	10.00	1	0	UG/L
CHO CYCLOHEXANOL	300.0	10.00	2	0	UG/L
CTS CYCLOTETRASILOXANE,OCTAMETHYL	142.0	142.00	1	0	UG/L
DCA DICHLOROBENZOIC ACID	100.0	100.00	1	0	UG/L
DEE 1,2-DIETHOXYETHANE	14.0	14.00	1	0	UG/L
E11 ETHANE,1,1'-OXYBIX 2-ETHOXY	66.0	66.00	1	0	UG/L

Table 6-7
(Continued)

CHEM-ID/FULL CHEMICAL NAME	MAX	MIN	TOTAL DETECT	TOTAL UNDETECTS	UNITS
EMB ETHYL METHYL BENZENE	40.0	1.00	9	0	UG/L
MPB METHYL PROPYL BENZENE	2.0	2.00	1	0	UG/L
ODA OCTADECANOIC ACID	30.0	20.00	2	0	UG/L
OXI OXIRANE,2,2'-OXYBISIME	4196.0	3306.00	2	0	UG/L
P44 PHENOL,4,4-(1-METHYLETHYLIDE	12.0	12.00	1	0	UG/L
PET POLY-ETHER	30.0	30.00	2	0	UG/L
PMA PALMITIC ACID	20.0	10.00	3	0	UG/L
PTA PALMITOLEIC ACID	20.0	20.00	2	0	UG/L
TES TRIETHYL SILANE	200.0	200.00	1	0	UG/L
TIM THIOBIS METHANE	8.0	8.00	1	0	UG/L
TMU TETRAMETHYLUREA	80.0	8.00	3	0	UG/L
UAH UNKNOWN AROMATIC HYDROCARBON	1.0	1.00	3	0	UG/L
XDB X,Y-DIMETHYL BENZENE	20.0	20.00	1	0	UG/L
XYB X-ETHYL-Y-METHYL BENZENE	20.0	20.00	1	0	UG/L
2EH 2-ETHYL HEXANOIC ACID	6.0	6.00	1	0	UG/L
441 4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	4.0	4.00	1	0	UG/L
CPM CYCLOPENTANE,METHYL	20.0	8.00	3	0	UG/L
BCL BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	10.0	10.00	1	0	UG/L
C6H C6H14 HYDROCARBON	3.0	1.00	7	0	UG/L
CAL CAPROLACTAM	40.0	40.00	1	0	UG/L
H2E HEXANIOCACID,2-ETHYL	6.0	6.00	1	0	UG/L
SAH SATURATED ALIPHATIC HYDROCARBON	6.0	6.00	1	0	UG/L
XYZ X,Y,Z-TRICHLORO-1-PROPENE	10.0	10.00	1	0	UG/L
UNA UNKNOWN ALKANE	0.1	0.10	1	0	UG/L
C9P C9-PHENOL ISOMER	120.0	22.00	2	0	UG/L
EHL ETHYL HEXANOL	47.0	47.00	1	0	UG/L
EPB ETNANONE, (PHENYLENE) BIS-	33.0	9.00	2	0	UG/L
P24 PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4-METHYL	94.0	94.00	1	0	UG/L
UNF UNKNOWN FREON TIC	2.0	2.00	1	0	UG/L
2MA 2-METHYLPROPANOIC ACID	7.0	7.00	1	0	UG/L
C7N C7H5NS	14.0	14.00	1	0	UG/L
DER DIETHYL ETHER	10.0	4.00	3	0	UG/L
MMC METHYL(METHYLETHYLIDENE)-CYCLOHEXANE	5.0	5.00	1	0	UG/L

6.2 GROUNDWATER HYDROGEOCHEMICAL FACIES

6.2.1 INTRODUCTION

Trilinear diagrams, Stiff diagrams, and thermodynamic computer modeling were used to characterize the groundwater hydrogeochemical facies at the OII landfill. Trilinear diagrams and Stiff diagrams use the major ion chemistry to determine water quality types or hydrogeochemical facies. They allow the interrelationships of calcium, magnesium, sodium plus potassium, bicarbonate plus carbonate, sulfate and chloride plus nitrate to be shown on one figure. The hydrogeochemical facies form a framework within which potential chemical reaction pathways can be determined that ultimately indicate the potential factors controlling the concentrations of trace metals and organic compounds. The characterization of the hydrochemical facies is also a useful tool to evaluate the extent of potential leachate migration. In this section, the leachate and the groundwater hydrogeochemical facies are compared.

Thermodynamic computer modeling of the groundwater chemistry determines the potential mineralogical controls on both the major and trace inorganic ions. Minerals and compounds with which the water chemistry are in equilibrium are the solid phases that potentially control the inorganic water chemistry. The geochemical modeling of the OII site used the EQ3NR/EQ6 software package created at Lawrence Livermore Laboratory (Wolery, 1979). EQ3NR is an advanced code for calculating thermodynamic equilibrium with respect to over 750 minerals and compounds. It determines the potential for a particular water to precipitate, dissolve or be in equilibrium with these minerals and compounds. EQ3NR prepares the water chemistry data for entry into EQ6.

EQ6 allows the determination of the water chemistry under defined environmental conditions. For example, the changes in the water chemistry as the leachate and LFG interact with both the aquifer and the in-situ groundwater under both oxidizing and reducing conditions can be modeled over time. The solid phases formed, their order of formation, and the resulting water chemistry can be predicted. Adsorption by solid phases can be assessed. Definition of the oxidation-reduction conditions essentially incorporates many aspects of bacteriological activity since such activity largely determines the Eh.

The combination of the EQ3NR and EQ6 allow the effect of a remedial activity on the inorganic chemistry to be assessed. The results of EQ3NR modeling are discussed in Section 6.2.4. The results of the EQ6 analysis are provided in Section 6.2.5.

6.2.2 HYDROGEOCHEMICAL FACIES

The sample analysis for each well was selected on the basis of the analytical completeness and representativeness of the analysis compared to all other analyses. A representative chemical analysis was selected to use for both the trilinear diagram and

for the computer modeling (EQ3NR). The hydrogeochemical facies of 44 wells at the OII site is demonstrated by their position on the trilinear diagram (Figure 6-1). The basic physical and chemical parameters that affect the chemical facies are listed on the upper right side of the trilinear diagram including specific conductivity (SC), temperature, TDS, TOC, TOX, Eh, and field pH. The location of each well is shown in Figure 2-1. Field measurements of pH, Eh, specific conductance, and temperature are necessary for both the interpretation of the hydrogeochemical facies and any computer modeling from equilibrium to fate and transport modeling. The TOC and halogen concentrations also can have a significant effect on the major ion chemistry, therefore, their concentrations are also shown on the upper right hand side of the trilinear diagram. Each of these parameters is discussed individually in the following sections.

6.2.2.1 pH

The pH ranges from slightly acidic 6.08 (OI-01A) to a highly alkaline 11.07 (OI-03). Refuse deposited in the landfill includes alkaline materials that could cause a highly alkaline groundwater. However, the groundwater from OI-03 probably reflects a grout problem in the well. Grout problems affect the major ion chemistry but will not have a major effect on the organic composition.

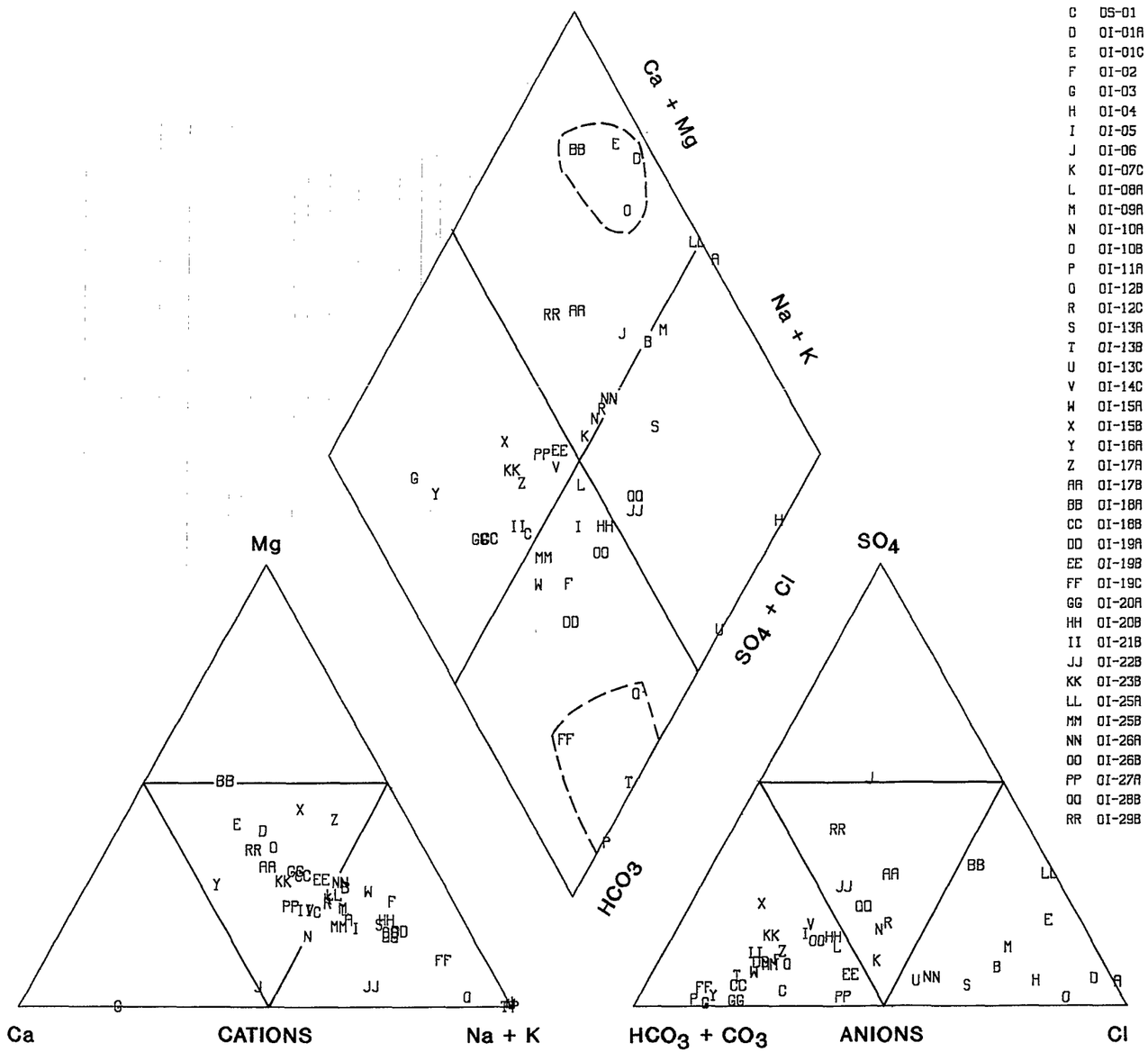
6.2.2.2 Oxidation-Reduction Potential

Eh ranges from a reducing minus 108 mv in OI-15B to an oxidizing condition of plus 497 mv (OI-08A). Eh measures the overall oxidation-reduction condition of the groundwater, which, along with pH, organic compounds, and concentration, control the dissolved metals concentrations. Bacterial activity is the major controlling factor on Eh. Therefore, Eh is an indirect measure of bacterial activity. The bacteria control Eh by consuming oxygen, degrading organic compounds, and producing additional gases and simpler organic compounds. Natural reactions consume oxygen also but at a much smaller rate.

For groundwater near the surface interacting with little bacterial activity, Eh is commonly in the range of plus 500 mv. Figure 6-2 shows the Eh relationship with depth. The least square correlation coefficient between Eh and depth is a minus 0.7 for all the wells, indicating a reasonal degree of fit. However, when the least square fit line is extrapolated to zero depth, a surface Eh of only 370 mv is indicated. If environmental conditions within the aquifer are adequate for bacterial activity, the Eh may be decreased to the range of plus or minus 100 mv. Only the deeper wells (OI-02 and OI-15B) are in this range. These are the only two wells at OII that contain dissolved hydrogen sulfide gas in the groundwater. Negative values of Eh represent reducing conditions and usually require bacterial activity in most groundwater systems. The amount of bacterial activity, and the increasing degree of reducing conditions, corresponds to the decreasing Eh value below plus 100 to increasing negative numbers.

TRILINEAR DIAGRAM

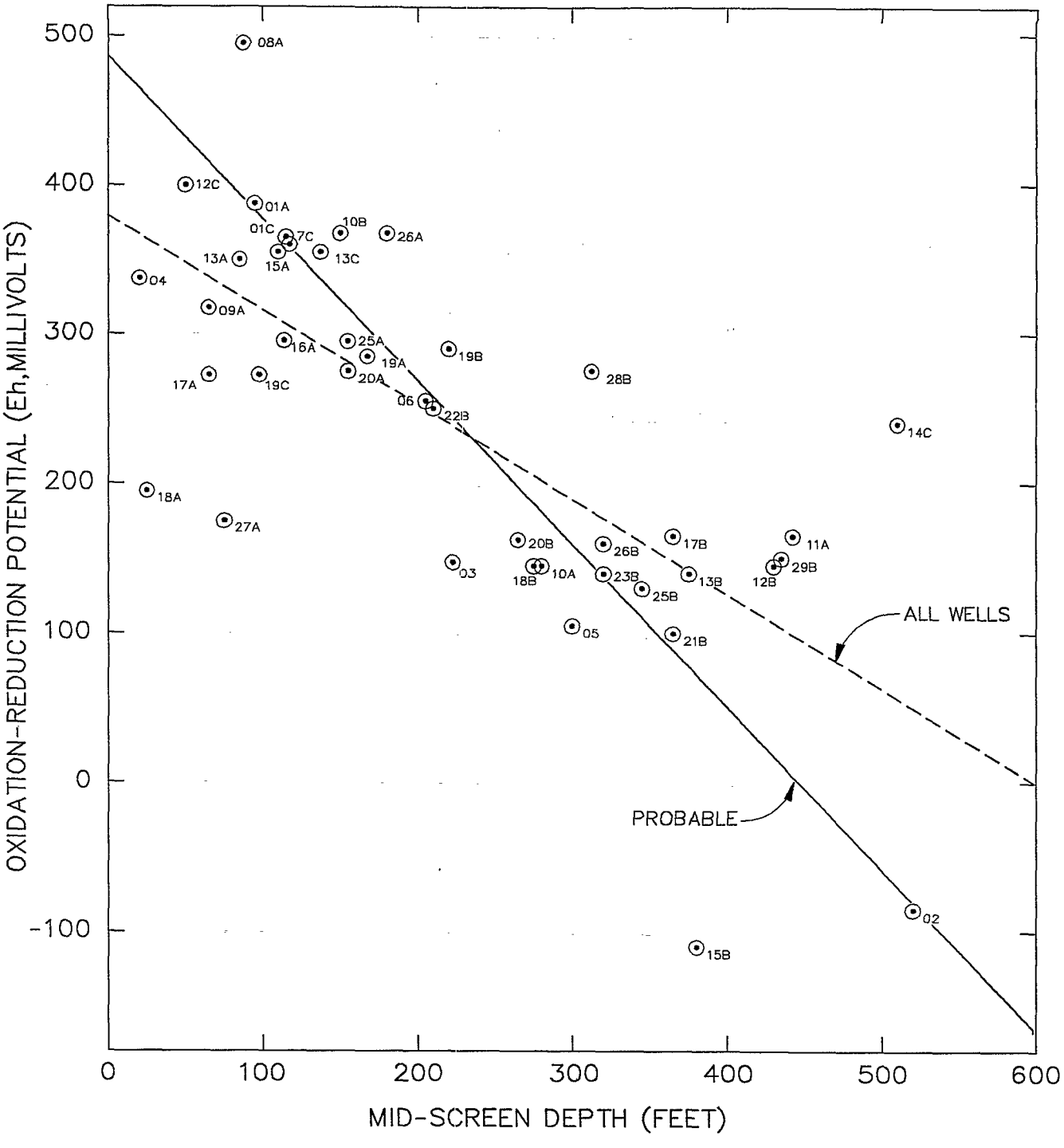
(Percent of total milliequilivalents per liter)



WELL DATA

	WELLID	SC	Temp	TDS	TOC (MG/L)	TOX (UG/L)	Eh	pH-F	DATE
A	CDD-13	9685.71	35.00	6780.00	1771.00	400.00		7.00	7/15/86
B	CDD-17			568.00	0.47	7.20			12/11/89
C	DS-01			401.00	0.47	7.20			12/11/89
D	OI-01A	2820.00	21.00	2000.00	2.00	48.00	390.70	6.08	08/09/89
E	OI-01C	3620.00	22.80	2510.00	4.00	106.00	365.50	6.41	08/08/89
F	OI-02	990.00	27.00	631.00	5.30	5.00 U	-79.00	7.85	09/26/88
G	OI-03	1500.00	26.00	429.00	1.90	12.00	151.00	11.10	09/26/88
H	OI-04	23600.00	28.00	16300.00	318.00	3520.00	341.30	6.53	08/11/89
I	OI-05	550.00	27.00	353.00	4.10	7.10	104.30	8.40	09/26/88
J	OI-06	880.00	25.00	704.00	3.20	46.00	259.30	7.50	09/26/88
K	OI-07C	425.00	23.60	266.00	2.00	16.00	362.00	6.66	08/08/89
L	OI-08A	340.00	24.00	255.00	2.80	7.40	497.00	7.80	09/28/88
M	OI-09A	600.00	23.50	488.00	1.40	16.00	289.30	7.23	09/27/88
N	OI-10A	395.00	30.00	285.00	1.30	11.00	146.30	8.15	09/27/88
O	OI-10B	1450.00	28.00	1320.00	1.60	14.00	364.30	6.80	09/27/88
P	OI-11A	1000.00	22.40	384.00	32.00	16.00	170.30	10.02	08/11/89
Q	OI-12B	440.00	25.00	281.00	1.00 U	7.00	145.70	8.97	08/10/89
R	OI-12C	320.00	22.00	255.00	1.00 U	5.00 U	273.00	7.40	08/10/89
S	OI-13A	330.00	22.00	250.00	1.00 U	17.00	308.00	7.18	08/09/89
T	OI-13B	1450.00	19.00	702.00	9.50	14.00	142.70	11.07	09/27/88
U	OI-13C	345.00	23.50	300.00	1.00 U	5.00 U	260.70	6.94	03/20/90
V	OI-14C	500.00	24.50	400.00			243.70	7.24	03/29/90
W	OI-15A	850.00	25.00	500.00	2.50	34.40	327.30	7.64	03/20/90
X	OI-15B	810.00	24.00	600.00	1.30	10.20	-108.00	7.74	03/22/90
Y	OI-16A	1330.00	25.00	800.00			296.00	6.44	03/29/90
Z	OI-17A	1150.00	22.50	800.00	209.00	6.00	273.50	7.30	01/26/90
AA	OI-17B	680.00	24.50	300.00			170.50	6.47	03/22/90
BB	OI-18A	5800.00	23.00	5400.00	75.50	586.00	197.70	6.35	03/20/90
CC	OI-18B	510.00	23.00	300.00	1.70	5.00 U	78.70	8.12	02/26/90
DD	OI-19A	880.00	21.00	500.00	1.00 U	189.00	285.50	7.57	02/26/90
EE	OI-19B	930.00	22.50	600.00	1.90	31.20	293.30	6.92	02/27/90
FF	OI-19C	1100.00	20.00	600.00	36.90	156.00	276.70	7.65	02/26/90
GG	OI-20A	570.00	24.00	500.00	1.90	105.00	288.70	6.29	02/27/90
HH	OI-20B	295.00	23.50	200.00	1.00 U	5.00 U	182.30	7.32	03/21/90
II	OI-21B	500.00	23.50	300.00	1.00 U	11.80	103.00	7.40	02/27/90
JJ	OI-22B	325.00	23.00	200.00	1.00 U	45.70	253.30	9.47	02/28/90
KK	OI-23B	500.00	24.00	300.00	1.00 U	12.40	142.70	7.02	03/22/90
LL	OI-25A	540.00	23.00	400.00	14.00	11.30	297.50	8.48	03/20/90
MM	OI-25B	450.00	24.00	200.00	1.00	17.10	129.50	7.46	03/21/90
NN	OI-26A	570.00	21.00	400.00			371.00	7.53	03/21/90
OO	OI-26B	440.00	23.00	300.00			163.00	7.07	03/21/90
PP	OI-27A	500.00	23.50	400.00	1.00 U	50.00	177.30	7.16	03/02/90
QQ	OI-28B	300.00	22.00	200.00			276.70	7.23	03/22/90
RR	OI-29B	1180.00	25.00	800.00			154.30	6.97	03/29/90

FIGURE 6-1
GROUNDWATER
HYDROGEOCHEMICAL FACIES
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION



LEGEND:

15B WELL NUMBER

FIGURE 6-2
RELATIONSHIP BETWEEN MID-SCREEN DEPTH AND THE MEASURED OXIDATION-REDUCTION POTENTIAL (Eh) IN THE GROUNDWATER MONITORING WELLS
OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

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There appear to be two groups of groundwaters between the well representing the most oxidizing condition (OI-8A) and the two wells representing the most reducing conditions (OI-02 and OI-15B). The group of wells representing the more oxidizing condition, 250 to 400 mv, is a common range for groundwater. The reducing conditions in OI-02 and OI-15B suggest potential leachate contamination in the A-sand and lower sand at the southwest corner of the site. With the exception of wells OI-18A and OI-27A, the potentially perched groundwater of both the Lakewood/San Pedro Unit and Pico Unit are in the upper group. With the exception of well OI-20B, the Lakewood/San Pedro groundwaters are also in the upper group. Part of the Pico sandstone and conglomerate unit groundwaters, one A-Sand (OI-14C) and one Pico silt groundwater (OI-25A) are also in the upper group.

The lower group of groundwaters, from an Eh of 100 to 200 mv, is more reduced than would be expected unless there is: 1) an agent to reduce the oxygen flux (an aquitard or bacterial activity upgradient from the well) or 2) bacterial activity within the aquifer. Most of the Pico sandstone and Pico siltstone, conglomerate, and A-sand units are in this group. However, two potentially perched groundwaters (OI-18A and OI-27A) are also in this group. Approximately five groundwaters (OI-04, OI-17A, OI-18A, OI-19C, OI-27A, and possibly OI-09A) are more reducing than would be expected for their depths, and one A-sand well water (OI-14C) is too oxidizing for its depth. The A-Sand groundwater in well OI-14C probably receives a higher proportion of surface recharge than the other A-Sand well locations. The five groundwaters are among the wells producing groundwater that contains the higher concentrations of organic contaminants.

There is another group of three wells (OI-11A, OI-12B and OI-29B) that also produce groundwaters more oxidizing than their depth would indicate to be true values. OI-11A and OI-12B are very slow to recharge after purging. Purging the well and having to wait 24 hours to allow the well to recover for 24 hours in order to have enough water for analysis, raises the Eh in the sampled groundwater. The groundwater accumulates oxygen as it slowly enters and sits in the wellbore, thus raising the Eh.

If the above groundwaters are subtracted from the correlation analysis, the correlation coefficient between Eh and depth increases to a minus 0.9. This gives an excellent fit and results in a much more reasonable surface Eh of 480 mv. The analysis indicates that leachate is probably responsible for the reduction in Eh in potentially perched groundwater and potentially in the San Pedro (OI-09A) well and Pico sandstone and conglomerate (OI-19C) well.

6.2.2.3 Specific Conductance and Total Dissolved Solids

Specific conductance or conductivity and TDS are good indicators of total dissolved inorganic species in groundwater. Conductivity can usually be used to approximate the inorganic TDS. It is also used as a quality assurance/quality control (QA/QC) factor to determine the stability of TDS during well sampling and to check the analytical

concentrations of the total cations and anions when the chemical analysis is received. Field conductivity for the groundwater analyses range from 295 micromhos per cm (umhos) in OI-20B to 23,600 umhos in OI-04 (Figure 6-1). TDS ranges from 200 mg/l in four wells (OI-20B, OI7-22B, OI-25B, and OI-28B) to 16,300 mg/l (OI-04).

Most wells (36 of the 44) have a TDS of less than 1000 mg/l and more than half (28 of the 44) have a TDS equal or less than 500 mg/l. TDS normally increases with depth in natural groundwater systems. TDS at this site decreases exponentially with depth. Well OI-4, with a mean screen depth of 20.5 feet, has the highest concentration. OI-4 is known to be contaminated with leachate. TDS decreases to 5,100 mg/l at well OI-18A with a mean screen depth of only 25 feet (and a very low Eh). Well CDD-13, with a mean screen depth of 56 feet, has a TDS of 6,780 mg/l. Wells OI-01A and OI-01C, with mean screen depths of 95 and 112 feet, respectively, have TDS concentrations of 2,000 and 2,500 mg/l, respectively. The decrease of TDS with depth suggests leachate contamination into at least perched groundwater. Median concentrations of TDS are shown in Figure 6-3.

6.2.2.4 Temperature

Temperature affects the rate of chemical reactions and volatization of volatile organic compounds. Temperature ranges from 19 degrees Celsius (°C) in OI-13B to 30 °C in OI-10A. Temperatures for the wells have a considerable variability. For example, field temperatures for OI-10A have been as low as 23 °C, and OI-19B is commonly in the 22 °C range. Temperatures normally increase with depth in natural groundwater systems. The trend at this site is not uniform in the depth range of surface to 520 feet (OI-02) suggesting a potential mixing of water sources that equilibrates the temperature.

6.2.2.5 Total Organic Carbon (TOC) and Total Organic Halide (TOX) Concentration

TOC and TOX are commonly used indicator parameters for the presence of organic compounds in water samples. In a TOC analysis, organic carbon in a sample is converted to carbon dioxide by catalytic combustion or wet chemical oxidation. The CO_2 is measured directly by an infrared detector or converted to methane and measured by a flame ionization detector. The detection limit is usually 1 mg/l.

TOX measures all halogenated organic compounds that are absorbed on granular activated carbon, both purgeable and nonpurgeable. Due to the relatively low sensitivity of this method (5 to 60 ug/l), TOX is a useful screening test for halogenated volatile organic solvents. In addition, TOX detects polar, nonvolatile, and high molecular weight compounds which are not amenable to detection by gas chromatography.

Available median TOC concentrations range from less than 1 mg/l on 10 wells (OI-12B, OI-12C, OI-13A, OI-13C, OI-19A, OI-20B, OI-21B, OI-22B, OI-23B, and OI-27A) to 1121 mg/l (CDD-13) as displayed in Figure 6-4. Available TOX concentrations range from undetected at five micrograms per liter (ug/l) on four wells (OI-02, OI-12C, OI-13C, OI-18B, and OI-20B) to 3,520 ug/l (OI-04). Median TOX concentrations are shown in Figure 6-5.

The TOC concentration includes the TOX, but there is little other correspondence between the TOC and TOX at the OII site except for the undetected concentrations. TOC includes the fatty acids, alcohols, etc., degradation products from the refuse, but the TOX includes only the halogenated organic compounds. TOC is most closely related to the bacterial activity and TOX to refuse composition. Thurman (1985) states that the hydrophilic acid concentration in groundwater associated with the fermentation of solid waste ranges from 50 to 1,000 mg/l and that the average groundwater contains 0.1 to 2.0 mg/l dissolved organic carbon (DOC, sample filtered through a 0.45 micron filter).

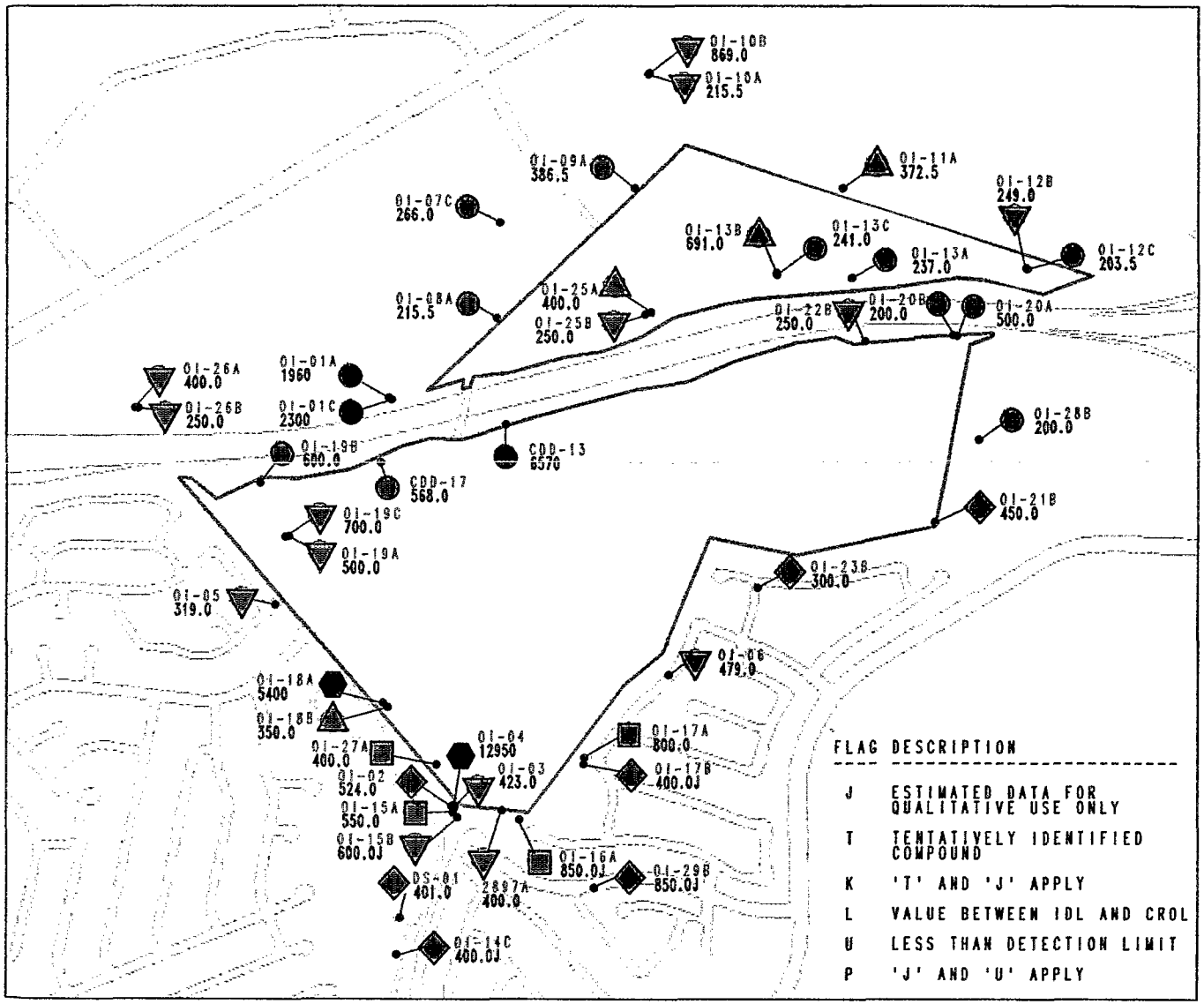
Other wells with elevated TOC (and their median TOC) include OI-19C (18.9 mgd), OI-25A (145 mg/l), OI-13B (12.3 mg/l), and OI-11A (32.5 mg/l). OI-25A, OI-13B, and OI-11A are completed into the Pico silt on the North Parcel. These wells do not have other indications of contamination, so the elevated TOC may originate from the siltstone.

In approximately 10 percent of the groundwaters (4 of the 37) TOC concentrations exceed 50 mg/l (CDD-13, OI-04, OI-17A, and OI-18A). These wells are contaminated with leachate. One-third (12 of the 37) exceed 2.0 mg/l. Therefore, TOC suggests that groundwater from as much as a third of the wells have an elevated TOC. Median TOX concentrations are shown in Figure 6-4.

6.2.2.6 Major Ion Chemistry Cations

The major ion inorganic groundwater chemistry for 44 wells at the OII landfill are illustrated on three parts of the trilinear diagram (Figure 6-1). The three parts are the cation and anion triangles on either side of the hydrogeochemical facies diamond. The relative percentages of anions and cations in millequivalents per liter (meg/l) are shown in the well water position in the anion and cation fields. The points are then projected upwards into the diamond-shaped field to characterize groups of wells representing separate hydrogeochemical facies. The cation triangle (lower left) indicates a grouping of most wells trending from sodium as the major cation facies toward a mixed cation, magnesium-calcium-sodium, facies.

With the exception of the Pico sandstone and conglomerate unit waters, the geologic units do not indicate a particular position in the cation facies. The wells generally exhibit a typical pattern for ion exchange. This pattern consists of a line that trends between the sodium end towards a mixed calcium-magnesium composition. The Pico



EXPLANATION

MEDIAN CONCENTRATIONS (MG/L)

- 0
- >0 TO 1
- >1 TO 2
- >2 TO 5
- >5 TO 10
- >10 TO 100
- >100 TO 500
- >500 TO 1000
- >1000 TO 10000
- >10000 AND UP

- Potentially PERCHED, San Pedro Unit
- Potentially PERCHED, Pico Siltstone
- San Pedro Unit (unconfined)
- Pico Unit, Sandstone/ Conglomerate (confined)
- Pico Unit, A-Sand (confined)
- Pico Siltstone

N

0 500 1000 2000

SCALE IN FEET

FIGURE 6-3

TOTAL DISSOLVED SOLIDS

MEDIAN CONCENTRATIONS (MG/L) IN GROUNDWATER

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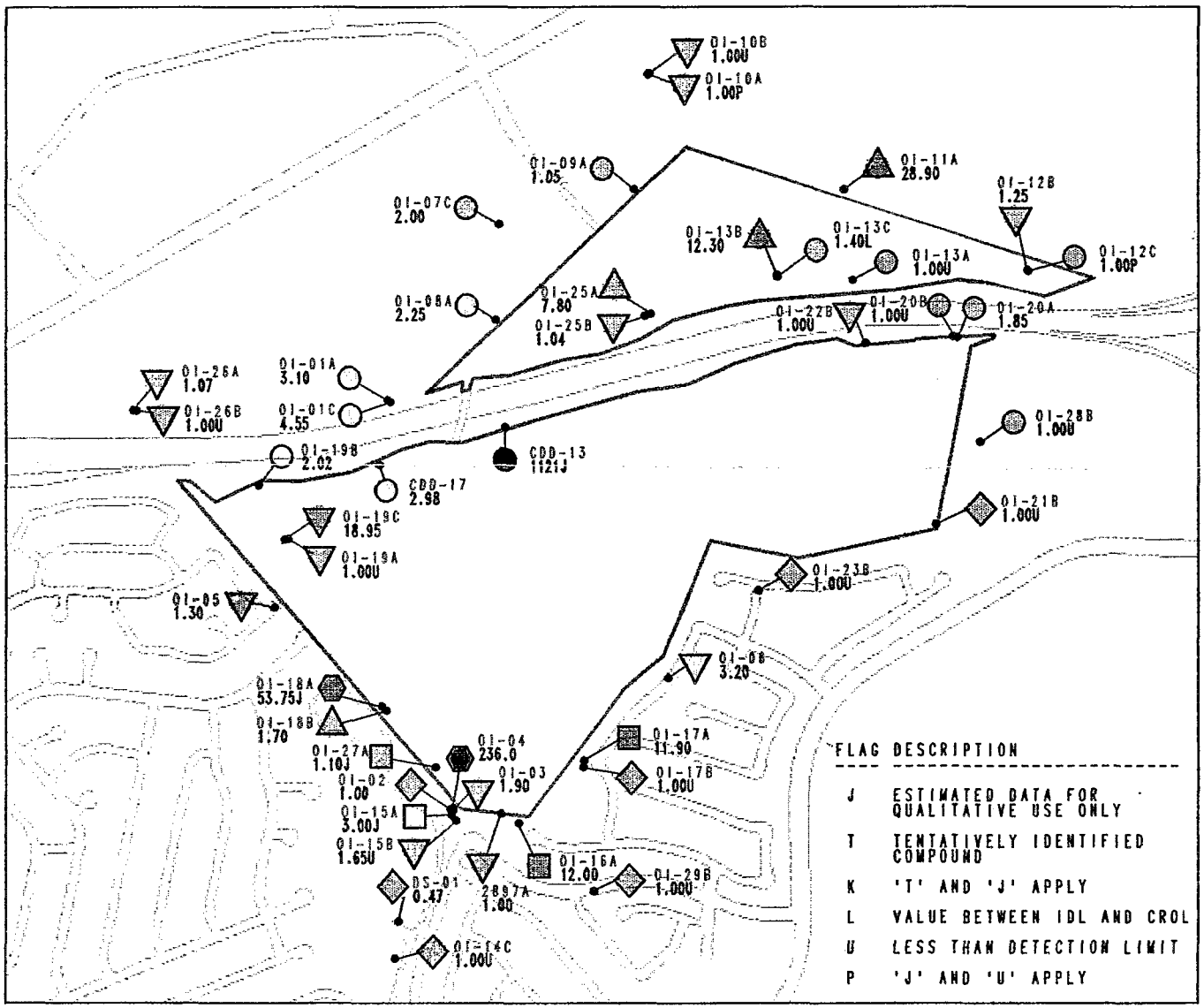


EXPLANATION

MEDIAN CONCENTRATIONS (MG/L)

- 0
- >0 TO 1
- >1 TO 2
- >2 TO 5
- >5 TO 10
- >10 TO 100
- >100 TO 500
- >500 TO 1000
- >1000 TO 10000
- >10000 AND UP

- Potentially PERCHED, San Pedro Unit
- Potentially PERCHED, Pico Siltstone
- San Pedro Unit (unconfined)
- Pico Unit, Sandstone/ Conglomerate (confined)
- Pico Unit, A-Sand (confined)
- Pico Siltstone

N

0 500 1000 2000

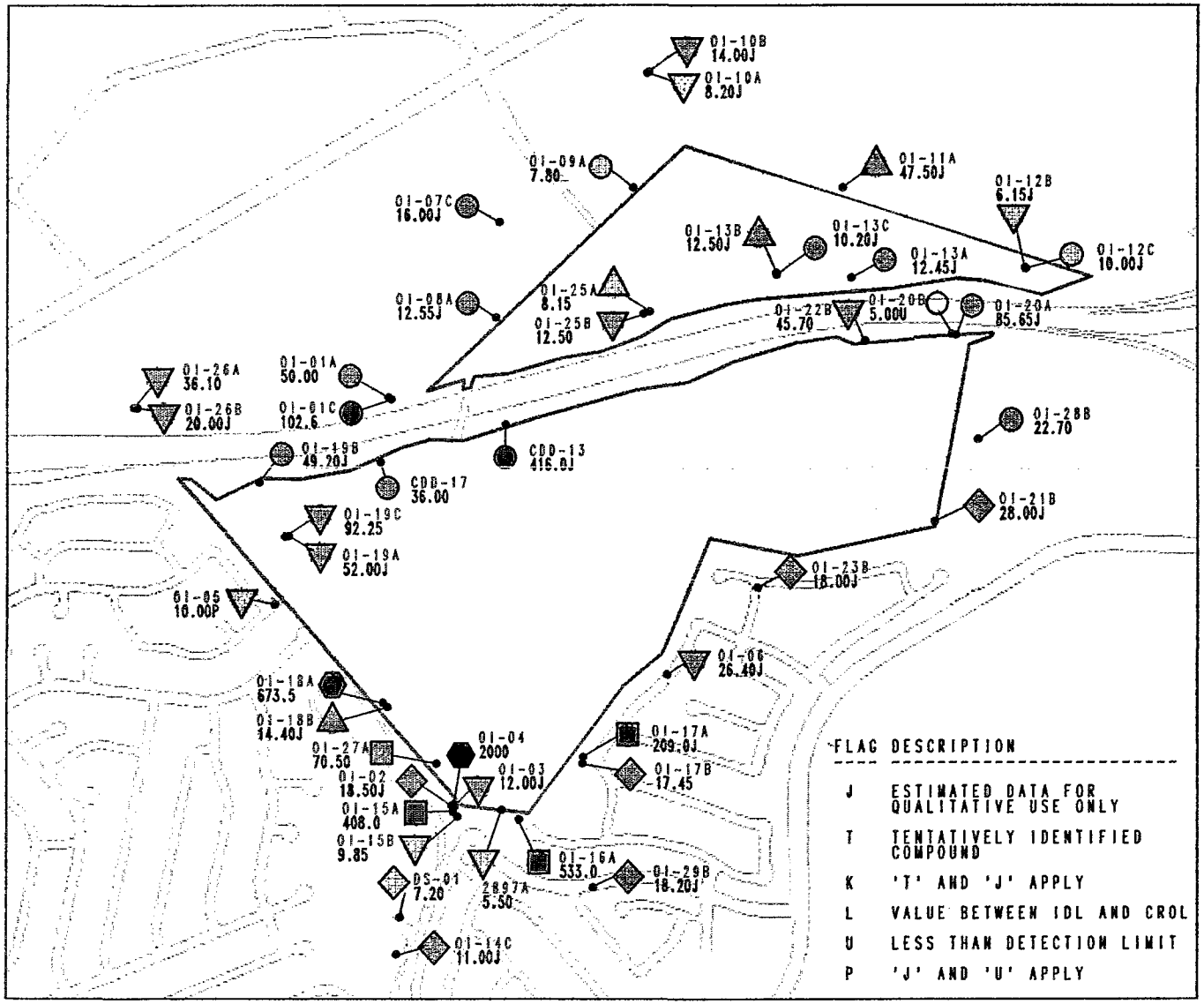
SCALE IN FEET

FIGURE 6-4

TOTAL ORGANIC CARBON

MEDIAN CONCENTRATIONS (MG/L) IN GROUNDWATER

OPERATING INDUSTRIES, INC.
LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION



EXPLANATION

MEDIAN CONCENTRATIONS (UG/L)

- 0
- >0 TO 1
- >1 TO 2
- >2 TO 5
- >5 TO 10
- >10 TO 100
- >100 TO 500
- >500 TO 1000
- >1000 TO 10000
- >10000 AND UP

- Potentially PERCHED, San Pedro Unit
- Potentially PERCHED, Pico Siltstone
- San Pedro Unit (unconfined)
- Pico Unit, Sandstone/ Conglomerate (confined)
- Pico Unit, A-Sand (confined)
- Pico Siltstone

N

0 500 1000 2000

SCALE IN FEET

FIGURE 6-5

TOTAL ORGANIC HALOGENS MEDIAN CONCENTRATIONS (UG/L) IN GROUNDWATER

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Unit groundwaters typically contain lower magnesium than the other geologic units, commonly less than 20 percent. With the exception of the three analyses at the extreme sodium percentage end, all the wells with analyses containing less than 20 percent magnesium come from the Pico sand and gravel units.

Ion exchange would be very effective in the landfill and landfill leachate. The bacteria in the landfill produce acetate, thus creating a slightly acidic reducing environment. Most of the ammonia would be present in the leachate as the ammonium ion (Hem, 1985). Ammonium acetate is a common analytical reagent used to exchange with all the other major cations on exchange positions. Therefore, the leachate is capable of replacing the sodium, calcium, magnesium and potassium as it moves through permeable sedimentary units. Sodium would potentially be the easiest ion to replace, but if the ammonia is high enough all the other cations would be released. The ammonia in the groundwater ranges from undetected to 98 mg/l in OI-03. It is the major form of nitrogen in 21 of the 44 well analyses. Ammonia exceeds one mg/l in groundwater from 8 wells (CDD-13, OI-03, OI-04, OI-11A, OI-12B, OI-13B, OI-13C, and OI-15B). Ammonia, alone, however, does not indicate leachate contamination.

6.2.2.7 Anions

The anion triangle (lower right) indicates a dominance of bicarbonate plus carbonate and chloride over sulfate. The pH of 35 of the 42 groundwaters range from 6.08 to 8.2, indicating that most of the alkalinity is bicarbonate. Carbonate is present in only 7 groundwaters. More groundwater analyses group in the bicarbonate sector than the chloride. All geologic units are represented in the bicarbonate facies but, with the exception of the analysis for OI-26A (Pico sandstone and conglomerate), all the analyses in the chloride facies are San Pedro units.

The trend of anion compositional changes is more diffuse than the cations. There is a group of groundwater analyses trending from approximately 90 percent bicarbonate plus 10 percent chloride toward increasing sulfate and chloride and decreasing bicarbonate percentages. Most of these analyses are from wells completed in the Pico but San Pedro analyses are present in the trend. The lone sulfate facies analysis is from the Pico sandstone and gravel unit (OI-6). The high sulfate indicates an oxidizing condition at this well. However, this unit has the most variability of the six groundwater units in hydrogeochemical facies. This variability suggests multiple sources of different water chemistry contributing to this particular unit.

6.2.2.8 Hydrogeochemical Facies

Projecting the cation and anion chemical percentages into the hydrogeochemical facies diamond indicates a considerable range in hydrogeochemical facies. The diamond is divided into 4 equidimensional diamonds by projecting the 50 percent boundaries from the cation and anion triangles. These four diamonds represent the four hydrogeochemical facies. The northern diamond represents the calcium-magnesium-

sulfate-chloride facies; southern diamond, the sodium-bicarbonate facies; eastern diamond, the sodium-sulfate-chloride facies; and western diamond, the calcium-magnesium-bicarbonate facies.

Most of the analyses group in the central part of the facies diamond. Four groundwater analyses, however, are clearly separated from the central group, in the lower part of the diamond, into the sodium-bicarbonate hydrogeochemical facies (OI-11A, OI-12B, OI-13B, and OI-19C). Sodium-bicarbonate groundwater facies are most commonly associated with alkaline volcanic rocks and in aquifers above oil and gas reservoirs. OI-11A and OI-13B are suspected of being contaminated with grout. OI-19C is contaminated with VOCs, as discussed in Section 6.4.2.

In the upper part of the diamond, four groundwater analyses are separated into the calcium-magnesium-sulfate-chloride facies (OI-1A, OI-1C, OI-10B and OI-18A). These analyses do not include sulfate as a dominant anion, therefore, they represent a calcium-magnesium-chloride facies groundwaters, a very unusual water hydrogeochemical facies. Sulfate is normally the dominant anion for natural groundwater in this facies. The calcium-magnesium-chloride brine is relatively rare in oilfield brines but is known to occur in surface brines under extreme conditions of evaporation (beyond potash precipitation).

An alternate method of displaying major ion content of groundwaters is the Stiff diagram (Figure 6-6). The shape of the Stiff diagrams reflects the relative major ion content in meg/l, and the size is proportional to the TDS. With this method of displaying the data, the separate hydrogeochemical facies discussed in this section can be easily identified.

The shallow leachate and condensate are in the sodium-chloride hydrogeochemical facies. The shallow leachate may be reflecting the emplacement of sodium chloride as part of a waste product and the increase in sodium chloride from the recycled leachate pumped back into the waste. The deep leachate from the OII landfill, in agreement with the shallow leachate, has a sodium as the dominant cation, but the dominant anion is bicarbonate. The deep leachate is a sodium bicarbonate type groundwater, suggesting that it may represent a mixture of leachate with the groundwater.

The trilinear diagram of hydrogeochemical facies suggests that a sodium bicarbonate facies natural groundwater is mixing with a mixed cation and anion leachate facies. The mixed cation bicarbonate facies of most of the analyses is within the facies of "average" landfill leachates and the two deep leachate samples from this site. The high chloride is typical of the shallow leachate and condensate. The anionic facies is the most definitive of mixing. The two leachates from the OII landfill are central to the other analyses.

The major ion chemistry, therefore, indicates that in many locations the shallow groundwater system, particularly of the San Pedro units, probably represents a mixture of landfill leachate with the in situ groundwater. The metals and the organics contribute to the definition of mixture.

6.2.3 DISSOLVED METALS

The dissolved metals concentrations in the groundwater are listed in Appendix M-1. The metals concentrations are summarized by well in Table 6-16 at the end of Section 6. The well summary lists the maximum, minimum, and median metals concentrations (and other parameters) in addition to the number of detected versus the number of samples collected from each well. These data show similar metals associations with each other that suggest a similar source or sources. Graphics summarizing concentrations of selected metals are in this section and Appendix L.

Metals ranked in order of the number of wells in which the median concentration of the metals are detected (including concentrations flagged with J and L) results in the following distribution:

Al=Mn>Fe>Ba>Zn>As>Cu>Ag>Ni>Cr=Hg>Co=V>Pb>Se>Cd>Sb

Aluminum and manganese are detected in 45 wells and antimony in only 2 wells (OI-4 and OI-7C). Ranking by median maximum metals concentrations produces a very similar distribution:

Fe>Mn>Al>Ni>Ba>Zn>As>Cu>Co>Cr>V>Sb>Ag>Se>Pb>Cd>Hg

The maximum median concentration of iron is 53,800 ug/l and of manganese is 25,300 ug/l, both in OI-18A. Mercury has a maximum median concentration of only 2.7 ug/l (CDD-13).

The similarity between the two distributions listed above is in three groups of elements: aluminum, manganese, and iron; barium, zinc, arsenic, and copper; and nickel, chrome cobalt, and vanadium. Aluminum, iron and manganese are common metals in groundwater but not usually found in milligram per liter concentrations in groundwater. All three commonly occur in the tens of micrograms per liter without organic complexing. Aluminum, at these pH values) is commonly much less than the median concentration of 1.87 mg/l (OI-4) without organic complexing. For example, as much as 90 percent of the aluminum in water from peat bogs occurs as an organic complex.

More wells contain manganese than iron. This is indicative of groundwater transport from a nearby source. In most sources (including landfills), iron is more common and occurs in higher concentrations than manganese. However, manganese precipitation is kinetically much slower than iron, particularly at these pH values. Iron precipitates

within a few minutes to an hour if it is not complexed with organics. Manganese, on the other hand, can remain in solution for one week or more. Median iron concentrations in groundwater are shown in Figure 6-7.

Barium concentrations are commonly controlled by dissolved sulfate in natural groundwater systems, particularly in shallow groundwater systems (less than 500 feet). Dissolved barium precipitates as barium sulfate. The prevalence of barium at the OII site, therefore, is a result of sulfate reducing bacteria, which converts sulfate into inorganic and organic sulfides. Coupling the sulfate reduction with the prevalence of ammonia (33 of the 45 wells) as opposed to nitrate (27 of the 45 wells) indicates a linkage with landfill leachate for the barium, zinc, arsenic, and copper series. Arsenic and copper are also capable of being strongly complexed with organics. In addition to complexing, arsenic can be converted into a methylated arsine gas by bacteria. The methylated arsine gases are very stable to oxidation, requiring months to become oxidized in the groundwater. When they do oxidize, they form arsenates (anions) that have the potential to be transported through the aquifer at a faster rate than the cations. Most mineral surfaces are negatively charged and retard cations. Likewise, in addition to organic complexing, copper can be incorporated into bacterial membranes, fragments of which can be transported in coarse-grained aquifers.
The nickel, cobalt, chrome, and vanadium are common constituents of organic sources. Nickel and vanadium are particularly prevalent in hydrocarbons. Chrome and vanadium are present as chromates and vanadates (anions). Therefore, they can be potentially transported through the aquifer somewhat faster than cationic metals. In addition to the importance of organic complexing to aid transport of these metals, the prevalence of these metals also indicates a potential series of organic constituents as sources.

The comparatively low concentrations of lead, selenium, and cadmium may be indicative of lack of source material rather than transport. Cadmium, for example, is similar to copper in its accumulation in bacterial membranes and organic complexing. The highest median is 5.7 ug/l in CDD-13. It is also possible that the carbonate chemistry controls lead and cadmium but carbonate would have little effect on the selenium concentration.

Detectable median concentrations of antimony occur in only two wells (OI-4 and OI-7C), but at a relatively high concentration (82 ug/l in OI-4). Silver, on the other hand, occurs in almost one-third of the groundwater from the wells but at relatively low concentrations (highest median 30 ug/l in OI-16A). The similarity in number of wells with detectable silver and copper (17 and 18, respectively) is a common transport relationship. The two metals have similar transport mechanisms but different abundances. Finally, mercury occurs in almost 25 percent (10 of 45) of the medians for the groundwater in the wells but at concentrations lower than other metals.

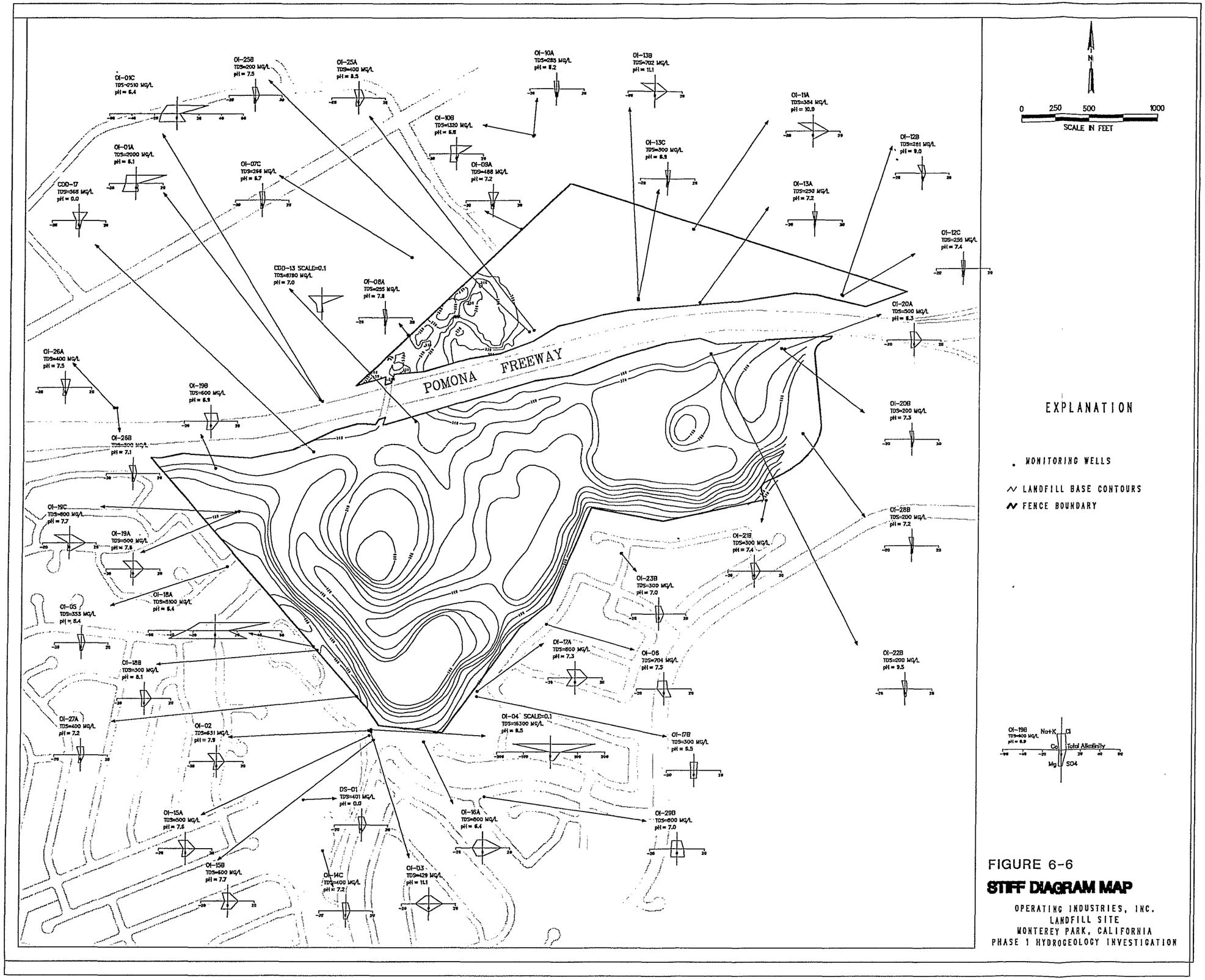

FIGURE 6-6

STIFF DIAGRAM MAP

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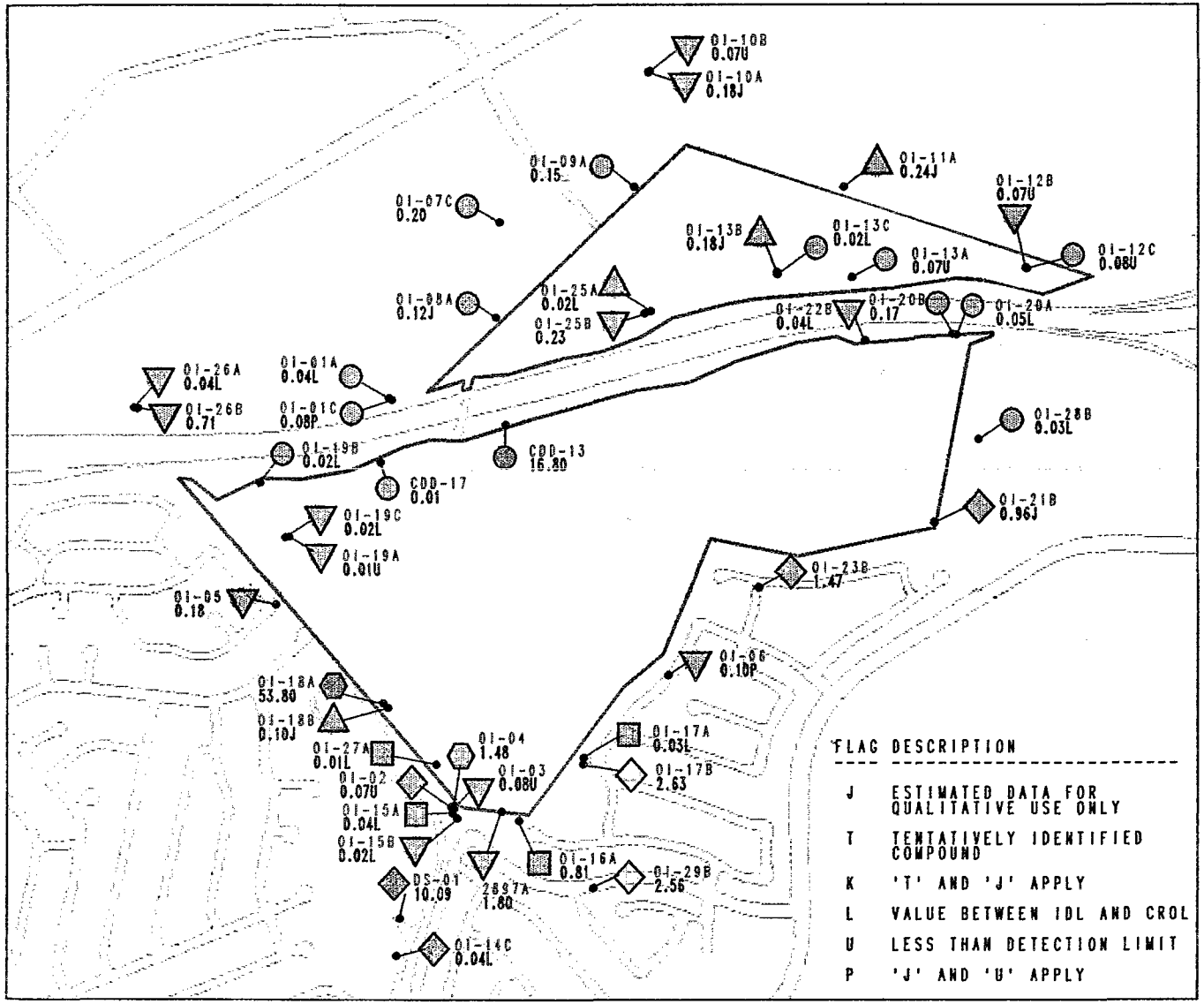

EXPLANATION

MEDIAN CONCENTRATIONS (MG/L)

- 0
- >0 TO 1
- >1 TO 2
- >2 TO 5
- >5 TO 10
- >10 TO 100
- >100 TO 500
- >500 TO 1000
- >1000 TO 10000
- >10000 AND UP

- Potentially PERCHED, San Pedro Unit
- Potentially PERCHED, Pico Siltstone
- San Pedro Unit (unconfined)
- Pico Unit, Sandstone/ Conglomerate (confined)
- Pico Unit, A-Sand (confined)
- Pico Siltstone

N

0 500 1000 2000

SCALE IN FEET

FIGURE 6-7

IRON, DISSOLVED

MEDIAN CONCENTRATIONS (MG/L) IN GROUNDWATER

OPERATING INDUSTRIES, INC.
LANDFILL SITE
MONTEREY PARK, CALIFORNIA
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The similarity in both concentration and distribution of these metals in the groundwater indicate a source high in both bacterial activity and organic compounds. The organic material is both a source and an aid in transporting the metals. The bacterial activity creates an environment that selectively stimulates the mobility of the metals. The landfill supplies all these conditions.

6.2.4 MINERAL SATURATION

The thermodynamic computer model EQ3NR was used to calculate the saturation index for each OII groundwater and leachate sample with respect to over 750 minerals and compounds. The saturation index for each mineral species is defined as the ratio of the ion activity product and solubility product of the constituents making up the mineral or compound. A groundwater sample is considered in equilibrium with respect to a particular mineral if the log of the saturation index is between plus or minus 0.5. Supersaturation is defined where the ratio is greater than 0.5 and undersaturated as below minus 0.5 but above minus 1.0. A summary of the number of groundwater monitoring wells which are in equilibrium, undersaturated, and supersaturated with respect to specific minerals are listed in Table 6-8. Undersaturated mineral and compound species with a saturation index less than 1.0 were not included in Table 6-8, because below this level, the mineral or compound will exert little if any control on the water chemistry.

These results from the EQ3NR analysis provide the following conclusions:

- Most of the OII groundwaters are in a reduced state.
- Organic complexing agents increase the solubility of many metals.
- Calcium, magnesium, barium, ferrous iron, and manganese, and to a lesser extent, zinc and lead concentrations are apparently controlled by carbonate mineral species.
- Sulfide minerals control the concentrations of iron, copper, zinc, and lead.
- Calcium fluoride controls the fluoride concentration.
- Two analyses of silica indicate magnesium silicates (kerolite) and quartz control the silica concentration.
- Aluminum concentrations are controlled by the precipitation as the oxide (boehmite and diaspora).

The presence of minerals and compounds which are supersaturated indicate that either reaction kinetics or organic compounds limit the precipitation of the metals. In the

Table 6-8
Minerals and Their Calculated Equilibrium Status with Groundwater from the Monitoring Wells Calculated by EQ3NR

MINERAL	NUMBER OF WELLS		
	Equilibrium	Undersaturated	Supersaturated
Carbonates			
Dolomite (Ca,Mg)	17	6	9*
Calcite (Ca)	13	7	7*
Witherite (Ba)	9	--	26*
Dawsonite (Na,Al)	13	7	3
Magnesite (Mg)	10*	7	--
Siderite (Fe)	9	5	1*
Rhodochrosite (Mn)	7	8	2*
Alstonite (Ba,Ca)	6*	2	--
Smithsonite (Zn)	1*	2	2
Cerrusite (Pb)	--	2	--
Sulfides			
Pyrite (Fe)	--	--	2*
Chalcopyrite (Cu)	--	--	1*
Chalcocite (Cu)	--	--	7*
Sphalerite (Zn)	--	--	3*
Galena (Pb)	--	--	2*
Acanthite (Ag)	--	--	8*
Cinnabar (Hg)	--	--	6*
Oxides			
Goethite (Fe)	4*	4	22*
Iron Oxyhydroxide	8	4	12
Boehmite (Al)	19	5	1
Diaspore (Al)	19	--	8

Table 6-8
(Continued)

MINERAL	NUMBER OF WELLS		
	Equilibrium	Undersaturated	Supersaturated
Gibbsite (Al)	4	--	23
Chromates (Cr)	--	--	15*
Zincite (Zn, Mn)	1	1	2*
Sulfates			
Barite (Ba)	17	7	5*
Alunite (K, A1)	2	1	--

*Leachate samples included

case of the metals listed in Table 6-8, the kinetics are sufficiently rapid that most of the supersaturated compounds should precipitate. Therefore, organic constituents that complex with the metals are the expected explanation for the supersaturated states. The mineral saturation indexes for the groundwater and deep leachate are very similar. Carbonate and sulfide minerals and compounds control the major ions and metals. More supersaturated states exist in the leachate than the groundwater, as would be expected by the high organic content of the leachate, but the suite of controlling minerals and compounds are essentially the same.

6.2.5 GEOCHEMICAL REACTION MODELING

The thermodynamic computer model EQ3NR equilibrium results are used in EQ6 computer modeling code to determine the potential inorganic water chemistry changes resulting from the following five reactions:

1. Deep leachate (S-LSW-1) reacts with the aquifer mineralogy.

2. Deep leachate containing carbon dioxide reacts with the aquifer mineralogy.

3. Deep leachate mixes with a groundwater (OI-20B), but minerals are not allowed to precipitate.

4. Deep leachate mixes with a groundwater, and minerals are allowed to precitate.

5. Deep leachate mixes with a groundwater and reacts with the aquifer mineralogy.

The chemical reaction paths calculated by EQ6 represent the inorganic water chemistry resulting from deep leachate moving from the refuse into the aquifer mineralogy without (Reaction 1) and with (Reaction 2) carbon dioxide. These two potential reaction paths represent leachate in a perched condition within the unsaturated zone. The deep leachate chemical analysis (S-LSW-1) was selected because it has the higher TDS of the two analyses and is closer to an average landfill composition (Figure 5-8). The latter three reaction paths involve leachate mixing with groundwater with increasing degrees of complexity. Reaction paths for (Reaction 3 and Reaction 4) determine the potential water chemistry resulting from simply mixing increasing amounts of groundwater with the leachate until a 50-50 mixture is achieved. These paths allow an evaluation of inorganic water chemistry changes resulting from the mixture in which chemical reaction kinetics are not fast enough (Reaction 3) and are fast enough (Reaction 4) to precipitate supersaturated minerals. Well OI-20B was selected because the water analysis indicates groundwater from the well contains low TDS (200 mg/l) and has a chemical composition that approximates a near average hydrogeochemical facies (Figure 6-1). Finally, the potential chemical reaction with the aquifer is added in reaction path 5 assuming kinetics allow precipitation of minerals as they become supersaturated.

The aquifer mineralogy for 10 stratigraphic depth intervals was determined by x-ray diffraction (Appendix K). Plagioclase (a sodium, calcium aluminosilicate) and quartz (silica) comprise 60 to 95 percent of the mineralogy. Plagioclase equals or exceeds 50 percent in half of the samples. The clay minerals make up the remainder of the sample composition. Illite (a micaceous clay) is the dominant clay mineral ranging from less than 5 percent to 25 percent. Kaolinite (a residual soil type clay) ranges from less than 5 percent to 15 percent. Calcium smectite, a swelling clay, commonly the initial clay resulting from the chemical breakdown of plagioclase, ranges from less than 5 percent to 10 percent. Micaceous illite is commonly part of an original sediment before any chemical changes occur in the sediment following burial. It is relatively resistant to natural groundwater chemistry. Kaolinite is a simple aluminosilicate containing no structural cations, and having a low cation exchange capacity. The most reactive mineral phase in the aquifer mineralogy would be the plagioclase. Therefore, the EQ6 model was performed using only plagioclase balanced with quartz to represent the aquifer.

Precipitated minerals were essentially the same under each of the reaction paths. Carbonate minerals dominated the precipitated minerals. Siderite, an iron carbonate along with variable percentages of calcium, magnesium, zinc and manganese carbonates, precipitate in the early phases of the reaction paths. Simple calcium and calcium-magnesium carbonates precipitate in increasing amounts toward the later phases. Smectite and kaolinite clays were products of the reaction paths. Sulfides occur in the later phases. Carbon dioxide (Reaction 2) delayed the precipitation of sulfide minerals. Allowed to continue, the reaction path would result in the ultimate destruction of the sulfides to form dissolved metals and sulfate as well as sulfate minerals.

The water chemistry in each reaction path except (Reaction 2) result in lower TDS. r The reaction path for Reaction 2 includes carbon dioxide which forms carbonic acid, which increases the attack on the plagioclase. The modeled plagioclase and quartz do not include carbon dioxide, sulfur, chloride or other anion that would affect the water chemistry; therefore, changes in anion chemistry are slight in all reaction path calculations. Reaction 3 and Reaction 4 indicate little change in major ion chemistry would be expected when the deep leachate and groundwater are mixed. TDS decreases as the two are mixed but the precipitated phases do not change the water chemistry.

The water chemistry changes as a result of chemical reactions with the plagioclase in the aquifer. In each case, calcium concentration decreases and sodium concentration increases. The molar sodium percentage increases from approximately 40 percent to 95 percent of the cations in the reaction path mixing deep leachate with groundwater and reacting with the aquifer mineralogy (Reaction 5). Sodium increases to 90 percent in reaction path (Reaction 1) in which the leachate alone reacts with the aquifer mineralogy. Sodium increases to 80 percent in Reaction 2 in which the carbon dioxide creates a lower pH and retains more calcium and magnesium in the groundwater.

Changes in water chemistry resulting from the geochemical modeling of chemical reactions with the aquifer suggest that hydrogeochemical facies shifts toward higher sodium percentages are a result of this reaction. For example, on Figure 6-1, groundwater from well OI-4 (along with a number of other groundwater analyses) has sodium as essentially the only cation, but most of the groundwater contains a mixture of calcium, magnesium and sodium. The shift of groundwater chemistry toward higher sodium may be a result of chemical reaction with the aquifer.

6.3 NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

6.3.1 METALS

The nature and extent of groundwater contamination is discussed by the following chemical groups in this section: VOCs, semivolatile organic compounds, pesticides and PCBs, and TICs. A discussion of metals and indicator parameters in groundwater was provided in Section 6.2.3. The exceedences of water quality standards are discussed in Section 6.5. These exceedences also help to define the nature and extent of contamination.

6.3.2 VOLATILE ORGANIC COMPOUNDS (VOCs)

VOCs are the most common groundwater contaminants at the OII Landfill. Twenty-six VOCs were detected in groundwater samples from OII monitoring wells. Fifteen wells produce groundwater that contain detectable median concentrations of one or more VOCs. Six wells have never had a detected VOC (2897A, OI-17B, OI-22B, OI-23B, OI-25B, and OI-29B); however, 29 wells have had only infrequent occurrences of VOC detections. The frequency of occurrence of the detected VOCs for these wells is generally less than 20 percent.

VOC concentrations are, in general, the highest in the shallow potentially perched zone wells along the southwest perimeter of the OII site: OI-4, OI-18A, OI-16A, OI-17A, and OI-27A. These wells appear to sample leachate-contaminated groundwater. Detectable median concentrations of VOCs are also present at the northeast corner of the South Parcel in OI-20A, at the northwest corner of the South Parcel in OI-19A, OI-19B, and OI-19C, west of the North Parcel in OI-1A, OI-1B, and OI-26A, and at the northern perimeter of the South Parcel in CDD-13 and CDD-17. A complete listing of VOC analyses is presented in Appendix M-2. A statistical summary of VOC data for each well is provided in Table 6-17 at the end of the chapter.

Table 6-9 summarizes the number of detected VOCs in groundwater from each monitoring well in decreasing order of occurrence. Seven wells contained more than 10 VOCs.

Table 6-9
Number of VOCs Detected at Least Once in Each Groundwater Monitoring Well

Well	No. Detected VOCs	Well	No. Detected VOCs
OI-4	20	OI-18B	4
OI-17A	20	OI-21B	4
OI-20A	16	OI-12B	3
OI-18A	15	CDD-17	3
OI-27A	14	OI-8A	2
OI-19A	12	OI-10B	2
OI-5	11	OI-12C	2
OI-2	9	OI-13A	2
OI-3	9	OI-14C	2
OI-13B	8	OI-15B	2
CDD-13	8	OI-25A	2
OI-1A	7	OI-26A	2
OI-6	7	OI-20B	1
OI-11A	7	OI-26B	1
OI-15A	6	OI-28B	1
OI-16A	6	2897A	1
OI-19B	6	OI-13C	0
OI-19C	6	OI-17B	0
DS-01	5	OI-22B	0
OI-1C	4	OI-23B	0
OI-7C	4	OI-25B	0
OI-9A	4	OI-29B	0
OI-10A	4		

Table 6-10, for each VOC, summarizes the number of monitoring wells which detected each VOC in decreasing order of occurrence. Five or more VOCs were detected at least once in 16 different water wells. These wells can be subdivided into 4 areas of concern at OII: 1) wells OI-2, OI-3, OI-4, OI-6, OI-17A, OI-18A, and OI-27A in the southwest part of the South Parcel, 2) wells OI-5, OI-19A, OI-19B, and OI-19B in the northwest corner of the South Parcel, 3) wells OI-1A and CDD-13 adjacent to the Pomona freeway overpass, and 4) wells OI-11A, OI-13B, and OI-20A in the northeast area. The northeast area of OII includes the northeast corner of the South Parcel and the east end of the North Parcel.

The median concentrations of organic compounds in groundwater from the various wells suggest a potential difference in the distribution of organic compounds at the site. For example, three wells have a prevalence of 1,4-dioxane (CDD-13, OI-03, and OI-18A). A separate group of wells have a prevalence for the PCE and TCE (CDD-17, OI-01C, OI-17A, OI-19A, OI-20A, OI-26A, and OI-27A).

All analyses of TCE, PCE, 1,4-dioxane, and total xylenes for each well are graphically displayed with bar concentration graphs on Figures 6-8, 6-9, 6-10, and 6-11, respectively. Bar concentration graphs for additional VOCs are in Appendix L-2. The hydrogeologic unit in which each well is completed is color-coded in Figures 6-8 and 6-9. An alternative data presentation is Figure 6-12, which displays the vinyl chloride concentration for each hydrogeologic unit on a separate map.

Many of the detected compounds were not detected in the majority of the samples; therefore, the median concentration for those compounds is a detection limit. The presence of VOCs in the those wells is uncertain. Median concentrations discussed below summarize representative detected concentrations of VOCs. The detected presence of VOCs, regardless of the number of detections, will also be summarized.

6.3.2.1 Southwest Area

Wells that have detectable median concentrations of VOCs in the southwest area (and their median concentrations) are:

- OI-2 (1.7 ug/l carbon disulfide)
- OI-4 (10 ug/l 1,2-DCE, 1300 ug/l 1,4-dioxane, 255 ug/l 2-methyl-2-propanol, 17.5 ug/l 2-propanone, 3.4 ug/ chlorobenzene, 2.7 ug/l ethylbenzene, 1.4 ug/l toluene 6.7 ug/l total xylenes, 7 ug/l benzene, 5 ug/l 1,1-DCA, 10.7 ug/l t-1,2-DCE, 3 ug/l 1,2-dichloropropane)
- OI-15A (0.5 ug/l total xylenes, 0.7 ug/l benzene, 2 ug/l ethylbenzene, 0.2 ug/l PCE)
- OI-16A (0.3 ug/l benzene)

Table 6-10
Monitoring Wells with Detected VOCs*

Volatile Organic Compound (VOC)	No. of Wells
Total Xylenes	24
1,4-Dioxane	19
Trichloroethene (TCE)	17
Benzene	16
Methylene Chloride	14
Perchloroethylene (PCE)	13
Toluene	13
Ethylbenzene	12
Carbon Disulfide	12
1,1-Dichloroethane	9
1,1-Dichloroethene	8
1,2-Dichloroethene	7
4-Methyl-2-pentanone	7
trans-1,2-dichloroethene	7
Vinyl Chloride	7
1,1,1-Trichloroethane	6
1,2-Dichloroethane	6
2-Propanone (acetone)	5
2-Butanone	4
Chlorobenzene	4
1,2-Dichloropropane	4
Trimethylbenzene	3
1,1,2-Trichloroethane	1
2-Hexanone	1
2-Methyl-2-propanol	1
Chloromethane	1
Styrene	1

*Note: Number of monitoring wells in which each volatile organic compound has been detected at least once.

- OI-17A (4 ug/l 1,1-DCE, 13 ug/l 1,4-dioxane, 3 ug/l chlorobenzene, 2 ug/l ethylbenzene, 3 ug/l total xylenes, 300 ug/l TCE, 33 ug/l benzene, 21 ug/l methylene chloride, 420 ug/l PCE, 130 ug/l 1,1-DCA, 7.5 ug/l t-1,2-DCE, 20 ug/l vinyl chloride, 180 ug/l 1,2-DCA, 3 ug/l, 1,2-dichlorobenzene)

- OI-18A (3950 ug/l 1,4-dioxane, 4.0 ug/l chlorobenzene, 105 ug/l ethylbenzene, 14.5 ug/l trimethylbenzene, 44 ug/l toluene, 33 ug/l total xylenes, 6.5 ug/l TCE, 16.0 ug/l benzene, 2 ug/l PCE, 4.5 ug/l t-1,2-DCE, 24 ug/l vinyl chloride, 16.0 ug/l 1,1-DCA)

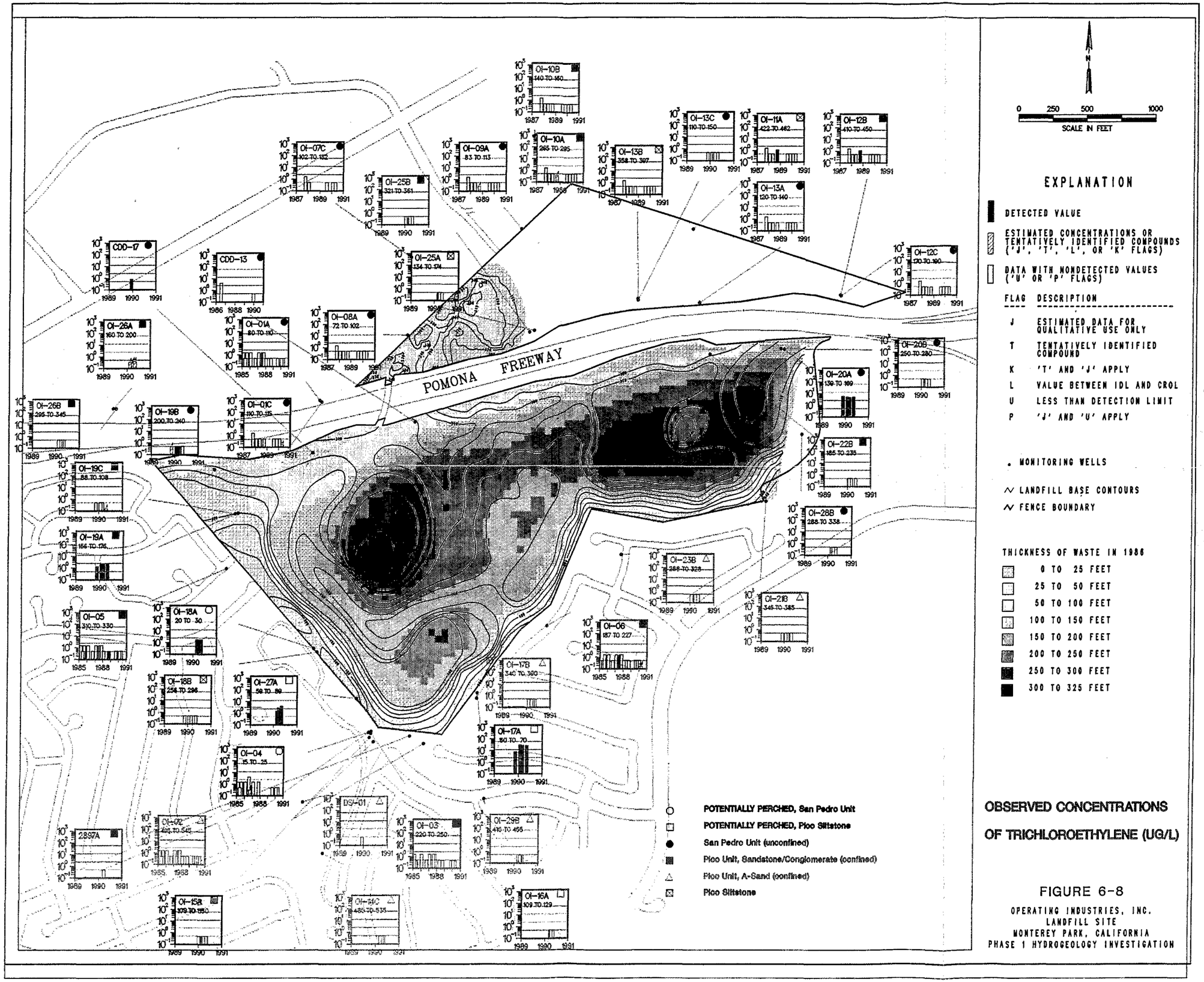
- OI-18B (.3 ug/l total xylenes)

- OI-27A (3 ug/l 1,1-DCE, 1.5 ug/l 1,4-dioxane, 0.7 ug/l chlorobenzene, 1.9 ug/l ethylbenzene, 0.4 ug/l total xylenes, 8.5 ug/l TCE, 2 ug/l benzene, 0.65 ug/l methylene chloride, 8.5 ug/l PCE, 52 ug/l 1,1-DCA, 3.5 ug/l vinyl chloride)

Several other VOCs were detected at least once, as listed in Table 6-17. The frequency of detection is commonly only 1 or 2 detections out of 5 to 20 samples. Toluene and TCE were detected in 4 of the 5 wells. Carbon disulfide, ethyl benzene, 1,1-DCE, 1,2-DCE, 1,1-DCA, t-1,2-DCE, 1,2-DCA, and 1,2-dichloropropane were detected in wells OI-4 and OI-17A. Ethyl benzene, 1,1-DCE, PCE, 1,1-DCA, t-1,2-TCE, vinyl chloride and 1,2-DCA were detected in wells OI-18A and OI-27A. 4-methyl-2-propanone and acetone were detected in wells OI-2, OI-3, and OI-4. Additional total xylenes were detected in wells OI-6 and OI-18B. Other detections include: 1,4-dioxane in wells OI-4, OI-14C, and OI-15B, toluene in wells OI-6, OI-15A, and OI-18B, carbon disulfide in wells OI-2, OI-3, OI-15B, and OI-16A, ethylbenzene in wells OI-16A and OI-18B, 1,1-DCE in wells OI-14C and OI-16A, chlorobenzene in wells OI-18A and OI-27A, benzene in wells OI-6, OI-15A, and OI-16A, methylene chloride in wells OI-3, OI-17A, 1,1,1-TCA at wells OI-6 and OI-17A, and OI-27A, 2-butanone at wells OI-2 and OI-6, and 1,1-dioxane in wells OI-15A and OI-18B. Additional organic compounds which were detected at only one additional well in the southwest area include: 1,2-DCE at well DS-01, trimethylbenzene at OI-18A, 1,1,2-TCA at OI-17A, 2-hexanone, TCE, benzene, and 2-Methyl-2-propanol at well OI-4, PCE at well OI-17A, t-1,2-DCE at OI-15A, and 1,2-dichloropropane at OI-27A.

6.3.2.2 Northwest Corner

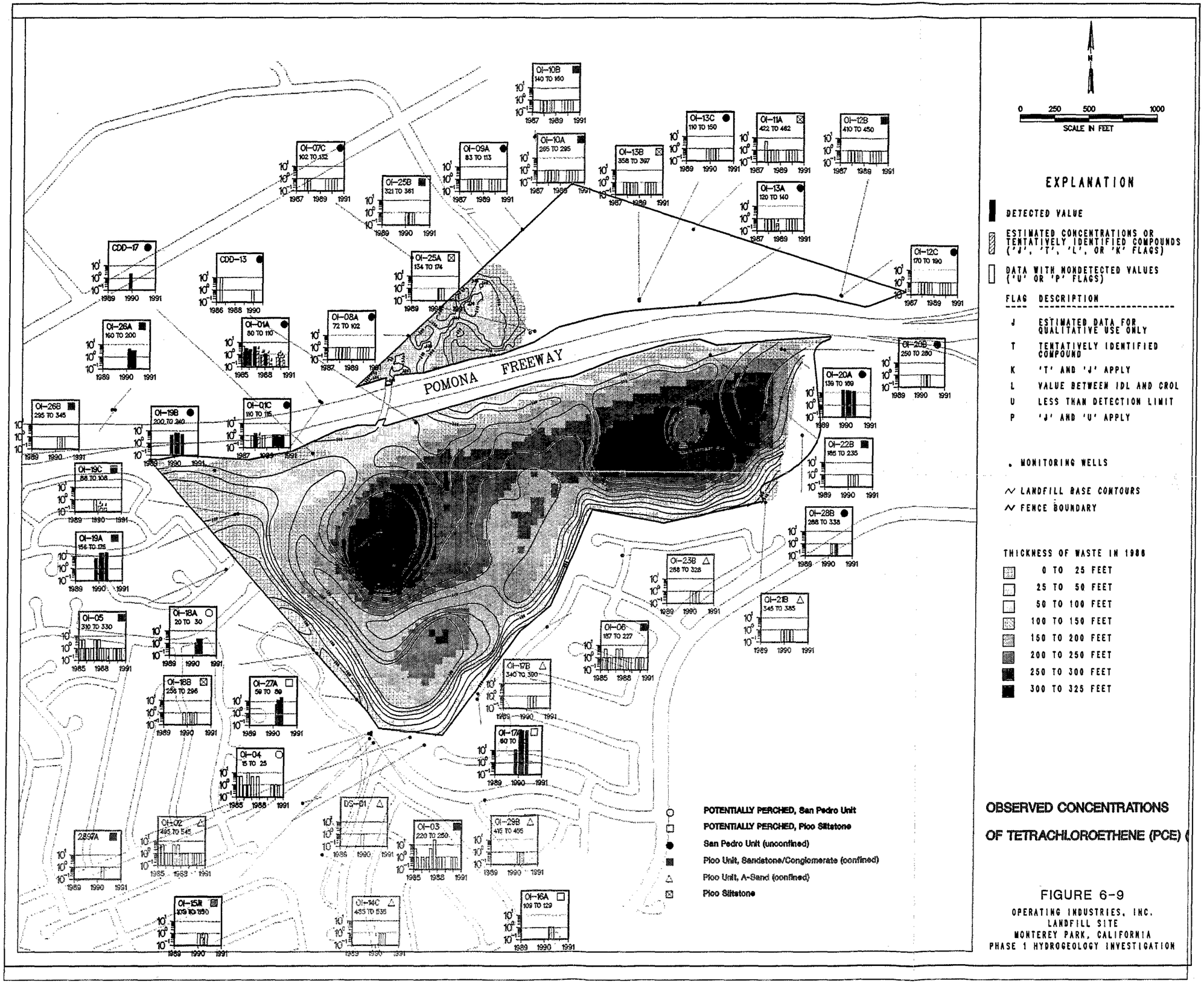
The wells in the northwest corner of the South Parcel that produce groundwater with detectable median concentrations of volatile organic compounds (VOCs) (and their median concentrations) are OI-5 (2.7 ug/l 4-methyl-2-pentanone), OI-19A (0.6 ug/l benzene, 8 ug/l TCE, 16 ug/l PCE, 5.5 ug/l 1,1-DCA, 0.3 ug/l t-1,2-DCE, 0.75 ug/l vinyl chloride), OI-19B (5.5 ug/l PCE), OI-19C (0.3 ug/l PCE, 0.7 ug/l 1,1-DCA), and OI-26A (0.7 ug/l TCE, 3.0 ug/l PCE).



OBSERVED CONCENTRATIONS OF TRICHLOROETHYLENE (UG/L)

FIGURE 6-8

OPERATING INDUSTRIES, INC.
LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

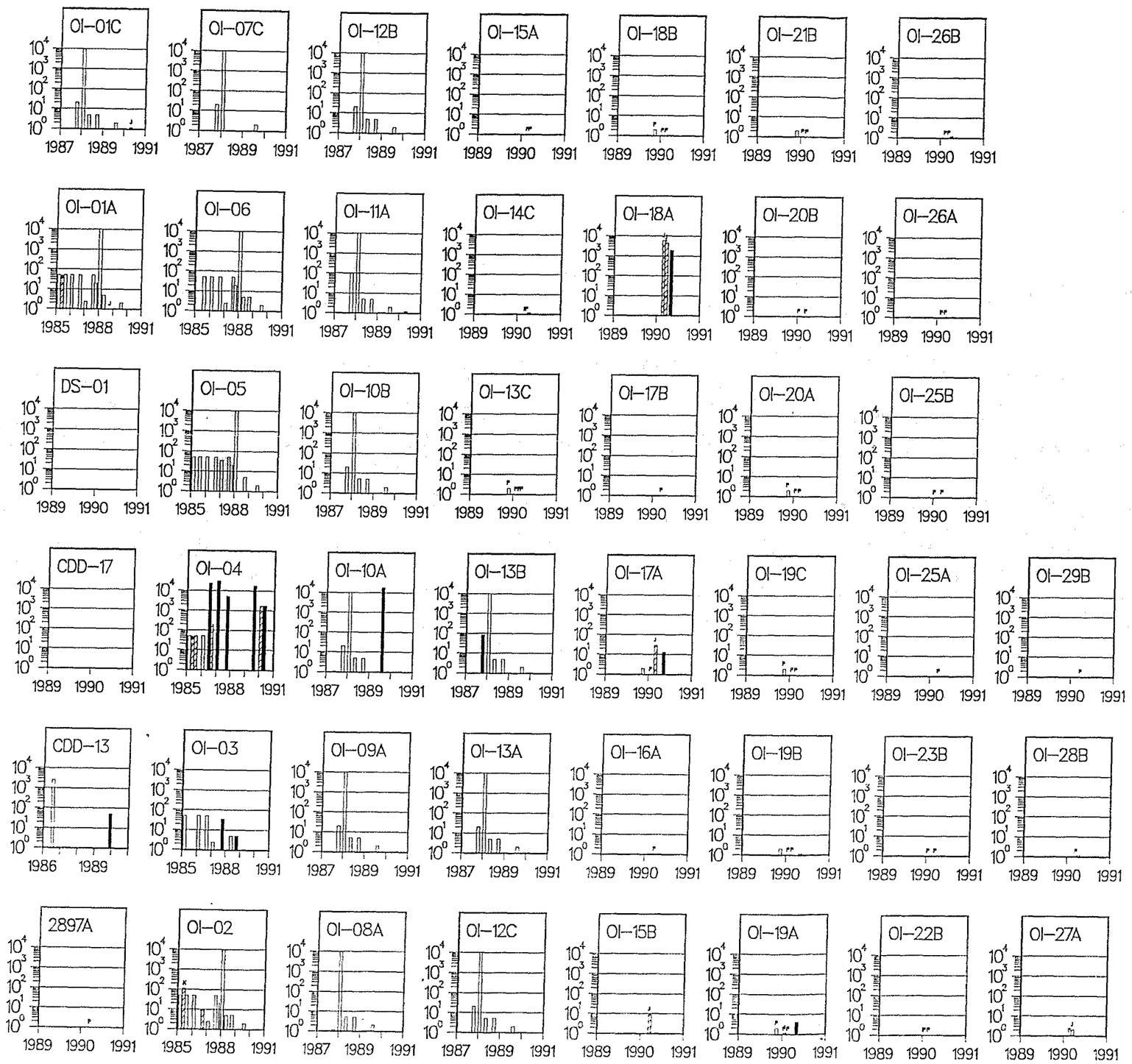


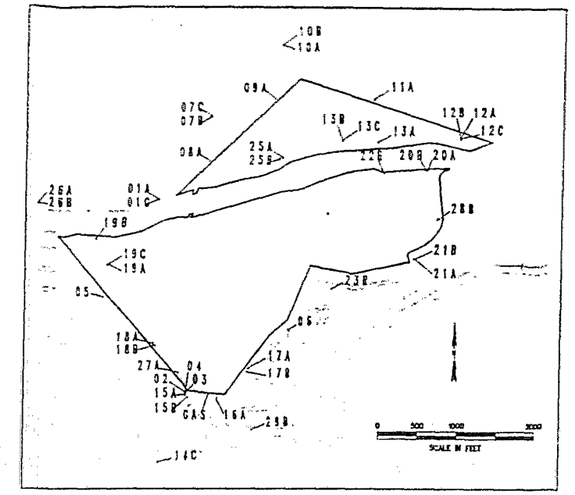
OBSERVED CONCENTRATIONS OF TETRACHLOROETHENE (PCE)

FIGURE 6-9

OPERATING INDUSTRIES, INC.
LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

OBSERVED CONCENTRATIONS OF 1,4-DIOXANE (UG/L)





WELL LOCATIONS

EXPLANATION

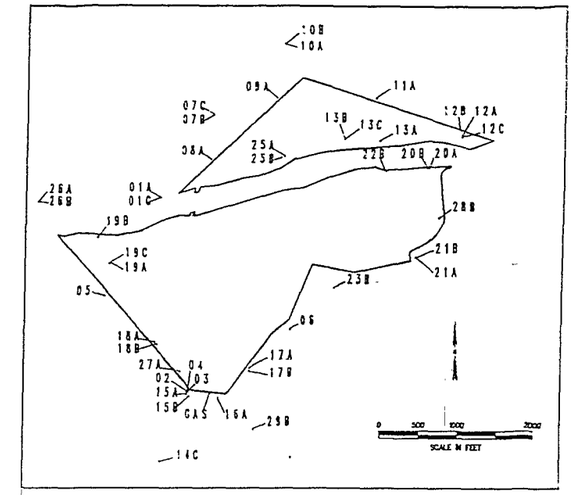
- DETECTED VALUE
- ESTIMATED CONCENTRATION OR TENTATIVELY IDENTIFIED COMPOUND ("J", "T", "L", OR "K" FLAGS)
- NONDETECTED VALUE ("P" FLAG)

QUALIFIER	DESCRIPTION
J	ESTIMATED DATA FOR QUALITATIVE USE ONLY
T	TENTATIVELY IDENTIFIED COMPOUND
K	"T" AND "J" APPLY
L	VALUE BETWEEN IDL AND CROL
P	"J" AND "U" APPLY

FIGURE 6-10

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

OBSERVED CONCENTRATIONS OF TOTAL XYLENES(M+O+P) (UG/L)



WELL LOCATIONS

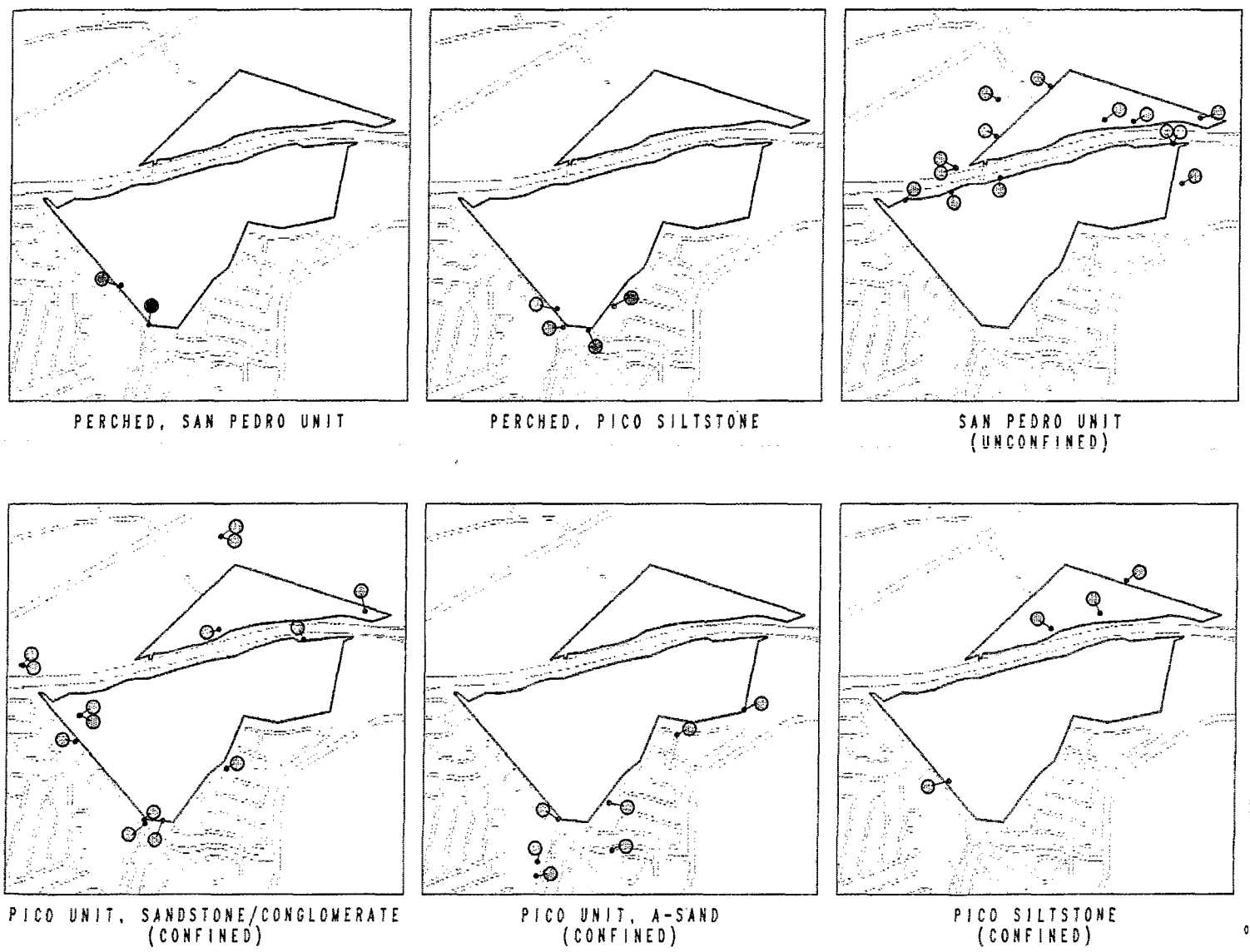
EXPLANATION

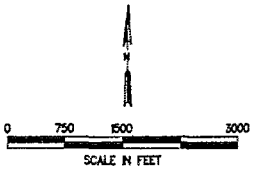
- DETECTED VALUE
- ESTIMATED CONCENTRATION OR TENTATIVELY IDENTIFIED COMPOUND ("J", "T", "L", OR "K" FLAGS)
- NONDETECTED VALUE ("P" FLAG)

QUALIFIER	DESCRIPTION
J	ESTIMATED DATA FOR QUALITATIVE USE ONLY
T	TENTATIVELY IDENTIFIED COMPOUND
K	"T" AND "J" APPLY
L	VALUE BETWEEN IDL AND CROL
P	"J" AND "U" APPLY

FIGURE 6-11

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION





EXPLANATION

MEDIAN CONCENTRATIONS (UG/L)

- 0
- >0 TO 1
- >1 TO 2
- >2 TO 5
- >5 TO 10
- >10 TO 100
- >100 TO 500
- >500 TO 1000
- >1000 TO 10000
- >10000 AND UP

FIGURE 6-12

VINYL CHLORIDE MEDIAN CONCENTRATIONS (UG/L) IN GROUNDWATER

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

Several other VOCs were detected at least once, as described below, and presented in Table 6-12. The frequency of detection is commonly only one or two samples per 5 to 20 samples. Total xylenes, TCE, benzene, methylene chloride, and PCE were detected in wells OI-5, OI-19A, OI-19B, and OI-19C with the following exceptions: total xylenes not in OI-19A, methyl chloride not in OI-19B, and benzene not in OI-19B and OI-19C. Additional detections in OI-5 include toluene, carbon disulfide, 4-methyl-2-pentanone, acetone, 2-butanone, and 1,2-DCA. Other detections in well OI-19A include: 1,4-dioxane, ethyl benzene, 1,1-DCE, 1,2-DCE, 1,1,1-TCA, 1,1-DCA, t-1,2-DCE, and vinyl chloride. Additional detections in well OI-19B include 1,4-dioxane, toluene, and ethyl benzene. Other detections in well OI-19C include 1,1,1-TCA, 1,1-DCA, and vinyl chloride. 1,4-Dioxane was detected in OI-26B.

6.3.2.3 Freeway Overpass Area

The wells that have detectable median concentrations of VOCs (and their median concentrations) are CDD-13 (0.6 ug/l 1,2-DCE, 52 ug/l 1,4-dioxane, 2 ug/l carbon disulfide, 2 ug/l ethylbenzene, 1 ug/l benzene, 1 ug/l methyl chloride 2 ug/l t-1,2-DCE), CDD-17 (0.5 ug/l 1,2-DCE, 2 ug/l TCE, 2 ug/l PCE), OI-1A (1 ug/l PCE), and OI-1C (1 ug/l PCE).

Carbon disulfide and 1,4-dioxane were detected in wells OI-1A and CDD-13. TCE and PCE were detected in CDD-17 and OI-1C. 1,2-DCE was detected in wells CDD-13 and CDD-17. Additional detections in well OI-1A include total xylenes, acetone, 2-butanone, and PCE. Other organic compounds detected in well CDD-13 include carbon disulfide, benzene, and methyl chloride. Additional detections include trimethylbenzene in well CDD-17 and total xylenes and 1,4-dioxane in well OI-1C.

6.3.2.4 Northeast Area

Only well OI-20A has detectable median concentrations of VOCs. The compounds (and their median concentrations) are TCE (26 ug/l), benzene (1 ug/l), methylene chloride (1 ug/l), PCE (13 ug/l), 1,1-DCA (0.7 ug/l), t-1,2-DCE (1 ug/l), vinyl chloride (4 ug/l), and 1,2-dichloropropane (1 ug/l).

Several other VOCs were detected at least once, as described below and summarized in Table 6-12. The frequency of occurrence is commonly one or two detections out of 5 to 20 samples. Total xylenes and methylene chloride were detected in wells OI-12B, OI-12C, OI-13B, and OI-20A. Toluene and benzene were detected in wells 13B and 20A. TCE was detected in wells OI-12B and OI-20A. Toluene was detected wells OI-13B and OI-20A. Additional detections in well OI-20A include ethyl benzene, 1,1-DCE, 1,2-DCE, 1,1,1-TCE, chloroform, trimethylbenzene, PCE, 1,1-DCA, t-1,2-DCE, vinyl chloride, 1,2-DCA, and 1,2-dichloropropane. Other detections in OI-13B include 1,4-DCA, carbon disulfide, 4-methyl-2-propanone, acetone, and 2-butanone. Additional detections in well OI-20B include carbon disulfide and styrene. Other detections in well OI-11A include 1,4-DCA and toluene.

6.3.2.5 Other Occurrences

Total xylenes were detected on the North Parcel in wells OI-7C, OI-8A, OI-9A, OI-10A, OI-10B, OI-13A, and OI-25A. Additional detections include 1,4-dioxane in wells OI-8A and OI-10A and TCE and methylene chloride in wells OI-9A and OI-10A. Other detections include carbon disulfide, 1,2-DCE, 1,1,1-TCA in well OI-7C. Other detections include chloromethane in well OI-10B, toluene in well OI-25A, benzene in well OI-9A, and PCE in well OI-13A. None of these wells had detectable median concentrations for any of the VOCs.

Organic compounds also occurred in isolated locations. On the east side of the South Parcel in well OI-28B, 1,4-dioxane was detected. On the southeast corner of the South Parcel, toluene and 1,2-DCA were detected in well OI-21B.

6.3.3 SEMIVOLATILE (BNA) ORGANIC COMPOUNDS

Seventeen semivolatile (base/neutral- and acid-extractable [BNA]) compounds were detected in groundwater samples from OII monitoring wells. The most commonly occurring chemicals were 1,4-dichlorobenzene, bis(2-ethylhexyl)phthalate, phenol, 1,2-dichlorobenzene, and benzoic acid. Table 6-18 summarizes the maximum, minimum, and median concentrations of these compounds for each well as well as the number of times the compound was detected and the number of observations (samples) for each well and compound. Median concentrations were generally less than 10 ug/l. Selected bar concentration plots are provided in Appendix L-3.

The wells that have detectable median concentrations of semivolatile compounds (and their median concentrations) are:

- CDD-13 (5 ug/l 1,4-dichlorobenzene, 2,800 mg/l organic acids)
- OI-4 (6 ug/l 1,2,4,5-tetramethylbenzene, 2 ug/l 1,3,5-trimethylbenzene, 400 mg/l organic acids)
- OI-13C (8 ug/l n-nitrosodimethylamine)
- OI-17A (1 ug/l 1,2-dichlorobenzene, 3 ug/l 1,4-dichlorobenzene, 435 mg/l benzoic acid)
- OI-18A (4 ug/l 1,2-dichlorobenzene, 3 ug/l 1,3-dichlorobenzene, 5 ug/l 2-methyl naphthalene, 19 ug/l diethyl phthalate)
- OI-20A (4 ug/l 1,4-dichlorobenzene)

These wells sample potentially perched zones (OI-4, OI-17A, and OI-18A), the northern perimeter of the South Parcel (CDD-13), the southern boundary of the North Parcel (OI-13C), and the Lower Sand (OI-15B).

Many of the detected compounds were not detected in the majority of the samples; therefore, the median concentration for those compounds is a detection limit. The presence of specific semivolatile contaminants in those wells is uncertain. Nonetheless, some wells exhibit a low frequency detection of semivolatile organics that is much higher than the remainder of the wells. Included in this group are OI-5, OI-6, OI-11A, OI-13B, and OI-13C. Groundwater samples from these wells also contain higher frequencies of tentatively identified compounds.

Also listed in Table 6-13 is the concentration of organic acids from the NEIC analysis of CDD-13 (2800 ug/l) and OI-04 (400 ug/l). Organic acids are common constituents of leachate. Their presence in CDD-13 and OI-04 at elevated concentrations confirms the conclusion that these two wells are contaminated with leachate. Benzoic acid is a common form of the organic acids present in leachate. Benzoic acid was reported as an estimated concentration once in OI-02, OI-04, OI-09A, OI-13B, and OI-20A and twice in OI-11A.

6.3.4 PESTICIDES AND PCBs

Isolated occurrences of pesticides have been detected in groundwater samples from monitoring wells OI-1C, OI-02, OI-04, OI-06, OI-07C, OI-08A, and OI-11A, as summarized in Table 6-19. The detected concentrations have, however, been close to the detection limit and subsequent analyses have not confirmed the presence of the pesticides. In all cases except OI-02, the pesticide was detected in only one sample from each well. In OI-02, beta-benzenehexachloride (beta-BHC) [also known as Lindane] has been detected in 2 out of 13 samples.

PCBs have not been detected in groundwater samples from OII monitoring wells.

6.3.5 TENTATIVELY IDENTIFIED ORGANIC COMPOUNDS

Tentatively identified compounds (TICs) are compounds detected during sample analysis by gas chromatography/mass spectroscopy (GC/MS) that are not included in the standard EPA Target Compound List (TCL) analysis. Since the identity of the compounds is not known during the analysis, the compounds are tentatively identified by matching the mass spectrum for the compound with a library of chemical spectra.

TICs may indicate the presence of groundwater contamination not detected by the standard analytical tests. The number of TICs identified in a GC/MS analysis may be dependent on the amount of time spent by the analytical chemist on the spectra matching. Therefore, the number of reported TICs and the identification of those TICs may vary greatly from analysis to analysis.

The data entry of TICs for groundwater samples prior to September 1988 used the following procedures. TICs that were identified by name were entered into the data base by that name. Unknown TICs, which are listed by retention time only, were not entered into the data base. For data starting with the August 1989 sampling, additional categories were entered into the data base to accommodate the unknown TICs. If a TIC was listed as an unknown hydrocarbon, unknown aromatic hydrocarbon, unknown freon, or other specified class of compounds, the class name and concentration was entered into the data base. All other unidentified unknowns within the TICs portion of the VOC analysis were summed together and entered as Unknown VOA TICs. Similarly all other unidentified unknowns within the TICs portion of the semivolatile organics analysis were summed together and entered Total Unknown BNA TICs. A third category is Total Unknown BNA Hydrocarbons.

A detailed summary of the occurrences of individual TICs is provided in Table 6-20, at the end of this chapter. Since TICs are only added to the TDM II data base when they are detected, the number of detected values equals the number of observations in all cases.

Numerous TICs have been detected in groundwater samples from OII monitoring wells, including wells that have not contained reproducible concentrations of VOCs. TICs have been reported in most of the OII monitoring wells; however, they are much more prevalent in CDD-13, OI-2, OI-4, OI-5, OI-6, OI-11A, OI-17A, OI-18A, and OI-27A. The reported concentrations may indicate contamination in those wells.

Table 6-11 provides estimates of the total relative concentrations of TICs in groundwater from OII monitoring wells. For each well, the number of TICs that have been detected (over the total sampling record); the mean concentrations of Unknown BNA TICs, Unknown VOA TICs, and Unknown BNA Hydrocarbons; and the sum of the median concentrations of each TIC listed on Table 6-20 for each well are provided. Table 6-11 demonstrates that the number of TICs observed in OII monitoring well samples ranges from 1 (2897A, OI-18B, OI-19A, OI-28B) to 75 (OI-4). Nine wells have 10 or more TICs (CDD-13, OI-2, OI-3, OI-4, OI-5, OI-6, OI-16A, OI-17A, and OI-18A). The highest total concentrations are observed in OI-4, CDD-13, and OI-15B. OI-4 and CDD-13 are known to be contaminated with leachate. OI-15B is free of detected HSL contaminants, but contains significant hydrogen sulfide concentrations, as does OI-2. Both OI-15B, and OI-2 list sulfur (S8) and molecular sulfur under the TICs.

6.4 EXCEEDANCES OF WATER QUALITY STANDARDS

Selected drinking water standards for compounds of concern at OII are summarized in Table 6-12, including recent standards from the EPA (Fact Sheet, Drinking Water Regulations Under the Safe Drinking Water Act, March 1990, Criteria and Standards Division, Office of Drinking Water, U.S. EPA) and the CDHS (Memorandum,

Table 6-11
Summary Concentrations of TICs in Groundwater

Well	Number of Detected TICs	Total Unknown BNA TICs (ug/l)	Total Unknown VOA TICs (ug/l)	Total Unknown BNA Hydrocarbons (ug/l)	Sum of Median Concentrations of all Listed TICs
2897A	1	0.0	0.0	0.0	5.0
CDD-13	27	885.0	1.0	305.0	1,375.0
CDD-17	2	0.0	0.0	0.0	0.0
DS-01	3	0.0	0.0	0.0	0.0
OI-01A	6	58.5	0.0	0.0	58.5
OI-01C	6	0.0	0.0	0.0	0.0
OI-02	24	0.0	1.0	0.0	593.5
OI-03	19	0.0	0.0	0.0	0.0
OI-04	75	725.0	0.0	100.0	10,940.8
OI-05	17	0.0	1.0	0.0	168.5
OI-06	26	38.0	1.0	0.0	40.0
OI-07C	3	0.0	1.0	0.0	3.0
OI-08A	5	13.0	0.0	0.0	13.0
OI-09A	3	0.0	0.0	0.0	0.0
OI-10A	2	0.0	0.0	0.0	0.0
OI-10B	3	0.0	0.0	0.0	0.0
OI-11A	9	0.0	0.0	0.0	0.0
OI-12B	4	0.0	1.0	0.0	1.0
OI-12C	3	38.0	0.0	0.0	38.0
OI-13A	2	0.0	0.0	0.0	0.0
OI-13B	6	88.0	1.0	0.0	90.5
OI-13C	5	0.0	0.0	0.0	0.0
OI-14C	2	0.0	0.0	0.0	3.5
OI-15A	3	0.0	1.0	0.0	3.0

Table 6-11
(Continued)

Well	Number of Detected TICs	Total Unknown BNA TICs (ug/l)	Total Unknown VOA TICs (ug/l)	Total Unknown BNA Hydrocarbons (ug/l)	Sum of Median Concentrations of all Listed TICs
OI-15B	7	10.5	1.0	0.0	1,490.5
OI-16A	10	208.0	1.0	0.0	210.8
OI-17A	18	62.0	1.0	0.0	85.1
OI-17B	3	4.0	0.0	0.0	4.0
OI-18A	15	573.0	1.0	177.5	773.5
OI-18B	1	0.0	0.0	0.0	0.0
OI-19A	1	0.0	0.0	0.0	0.0
OI-19B	4	17.0	0.0	0.0	17.0
OI-19C	2	0.0	0.0	0.0	0.0
OI-20A	6	0.0	0.0	0.0	0.0
OI-20B	2	0.0	0.0	0.0	0.0
OI-21B	4	8.5	0.0	0.0	8.5
OI-22B	3	0.0	0.0	0.0	0.0
OI-23B	3	0.0	0.0	0.0	16.0
OI-25A	4	0.0	0.0	4.0	4.0
OI-25B	2	0.0	0.0	0.0	0.0
OI-26A	2	0.0	0.0	0.0	0.0
OI-26B	2	0.0	0.0	0.0	0.0
OI-27A	4	0.0	0.0	0.0	0.0
OI-28B	1	0.0	0.0	0.0	0.0
OI-29B	2	0.0	0.0	0.0	0.0

Table 6-12
Selected Standards for Compounds of Concern
Operating Industries, Inc.

Compound	Federal MCL (a)		Federal MCLG (a) (mg/l)	State MCL (b) (mg/l)	State AL (b) (ppm)
	Existing (mg/l)	Proposed/ Other (mg/l)			
Benzene	0.005	--	0	0.001	0.0007
Bis(2-EH)phthalate	--	0.004 T	0 T	0.004	--
Carbon tetrachloride	0.005	--	0	0.0005	--
Chlorobenzene	--	0.1 P	0.1 P	--	0.03
Chloroform	0.1 (c)	--	--	--	--
Dichlorobenzene	--	--	--	--	0.13 (d)
1,1-Dichloroethane	--	--	--	0.005	0.005
1,1-Dichloroethene	0.007	--	0.007	0.006	0.006
1,2-Dichloroethane	0.005	--	0	0.0005	0.001
1,2-Dichlorobenzene	--	0.6 P	0.6 P	--	0.130
1,2-Dichloropropane	--	0.005 P	0 P	0.005	0.01
1,3-Dichlorobenzene	--	--	--	--	0.13 (e)
1,4-Dichlorobenzene	0.075	--	0.075	0.005	0.0005 (f)
2,4-Dimethylphenol	--	--	--	--	
Ethylbenzene	--	0.7 P	0.7 P	0.68	0.68
Methylene chloride	--	0.005 T	0 T	--	0.04
Phenol	--	--	--	--	0.005 (g)
Tetrachloroethene	--	0.005 P	0 P	0.005	0.004
Toluene	--	2 P	2 P	--	0.1
t-1,2-Dichloroethylene	--	0.1 P	0.1 P	0.01	0.01
Trichloroethene	0.005	--	0	0.005	0.005
1,1,1-Trichloroethane	0.2	--	0.2	0.2	0.2
1,2,4-Trichlorobenzene	--	0.009 T	0.009 T	--	--
Vinyl Chloride	0.002	--	0	0.0005	--
Xylenes, Total	--	10 P	10 P	1.75 (h)	--
Aldrin	--	--	--	--	0.00005
Chlordane	--	0.002 P	0 P	0.0001	0.0001
Endrin	0.002	--	0.002	--	--
Heptachlor	--	0.0004 P	0 P	0.00001	0.00001
Lindane	0.004	0.0002	0.0002 P	--	--
Methoxychlor	0.1	0.4	0.4	--	--
Styrene	--	0.005/0.1(i)	0/0.1 (i)	--	--
Toxaphene	0.005	0.005	0	--	--
2,4-D	0.1	0.07	0.07 P	--	--
2,4,5-TP (Silvex)	0.01	0.05	0.05 P	--	--
Aluminum	--	0.05 PS	--	1	--
Antimony	--	0.01/0.005 (i)	0.003 T	--	--
Arsenic	0.05	--	0.05	--	--
Barium	1	5	5 P	--	--
Beryllium	--	0.001 T	0 T	--	--
Cadmium	0.01	0.005 P	0.005 P	--	--
Chromium	0.05	0.1 P	0.1 P	--	--
Copper	1 S	1.3	1.3 P	--	--
Cyanide	0.2	0.2 T	0.2 T	--	--
Iron	0.3 S	--	--	--	--

Table 6-12
(Continued)

Compound	Federal MCL (a)		Federal MCLG (a) (mg/l)	State MCL (b) (mg/l)	State AL (b) (ppm)
	Existing (mg/l)	Proposed/ Other (mg/l)			
Lead	0.05	0.005 P	0 P	--	--
Manganese	0.05 S	--	--	--	--
Mercury	0.002	0.002 P	0.002 P	--	--
Nickel	--	0.1 T	0.1 T	--	--
Nitrate	10	10	10	--	--
Nitrite	--	1	1	--	--
Selenium	0.01	0.05 P	0.05 P	--	--
Silver	0.05	--	--	--	--
Sulfate	400.0	--	400.0	--	--
Thallium	--	0.002/0.001 (i)	0.0005 T	--	--
Total Dissolved Solids	500 S	--	--	--	--
Zinc	5 S	--	--	--	--

Notes:

MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
AL = Action Level

(a) Maximum Contaminant Levels; Maximum Contaminant Level Goals
Source: U.S. EPA Office of Driking Water, Fact Sheet,
Drinking Water Regulations Under the Safe Drinking Water Act.
March 1990.
(b) California Department of Health Services, Office of Drinking Water,
Memorandum on California State Standards for Drinking Water,
February 23, 1990.
(c) Total trihalomethanes
(d) 10 ppb is taste and odor threshold
(e) 20 ppb is taste and odor threshold
(f) 400 ppb is taste and odor threshold
(g) For chlorinated systems
(h) For single isomer, or sum of isomers
(i) EPA proposes 2 MCLs based on DQLs of 5 and 10 times the MDL

P = Proposed
T = Tentative
S = Secondary MCL

Compounds not listed on this table had no listed values in the references.

California State Standards for Drinking Water, June 6, 1990, Office of Drinking Water, California Department of Health Services). EPA standards include existing and proposed maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs). California Department of Health Services (CDHS) standards include MCLs and action levels (ALs). An MCL is the maximum permissible level of a contaminant in drinking water that is delivered to the consumer's tap and used by the general public for drinking. The MCLG is the maximum level of a contaminant at which no known or anticipated adverse human health effects would occur, and which include an adequate margin of safety. ALs are promulgated by the CDHS. MCLs are enforceable health goals, MCLGs and ALs are not.

The lowest nonzero standard for each compound in Table 6-12 was used as a standard value of comparison to groundwater analyses from OII monitoring wells. Organic and inorganic compound concentrations at OII, which exceed the standard, are summarized at each well in Tables 6-13 and 6-14, respectively. The tables include the number of standard exceedances over the number of samples and the range of concentrations that exceed the standard.

6.4.1 ORGANICS

Twenty-five wells have exceeded a drinking water standard for an organic compound, as summarized in Table 6-13. Six of those wells exceeded only the standard for bis(2-ethylhexyl phthalate, and that occurred infrequently. Plate 3 sumamrizes exceedences of organic compound drinking water standards.

The organic compounds which exceed water quality standards three or more times in these wells include vinyl chloride, benzene, 1,2-dichloroethane, PCE, TCE, bis(2-ethyhexyl)phthalate, 1,4-dichlorobenzene, methylene chloride and 1,1-dichloroethane. Other organic compounds whose standard was exceeded less frequently include: 1,1-dichloro-ethene and phenol. Aldrin, Chlordane, Heptachlor, toluene, 1,2-dichloro-propane, and trans-1,2-dichloroethylene exceed the standard in only one well.

Wells OI-4, OI-17A, OI-18A, OI-19A, OI-20A, and OI-27A exceed the standard for 4 or more organic compounds. These wells can be subdivided into 3 areas of concern within the South Parcel: wells OI-4, OI-17A, OI-18A, and OI-27A in the southwest corner, well OI-19A in the northwest corner, and well OI-20A in the northeast corner.

6.4.1.1 Southwest Corner

Groundwater from wells OI-4, OI-17A, OI-18A, and OI-27A exceed the standards for vinyl chloride, benzene, 1,2-dichloroethane, and 1,1-dichloroethane, and all but well OI-4 exceed the standard for TCE . Additionally, well OI-16A exceeds the standards for vinyl chloride. The vinyl chloride concentrations, which exceed the standard (CDHS MCL equals 0.5), range from 2 to 552 ug/l. The benzene concentrations over the

Table 6-13
Organic Standard Exceedances in Water Wells

Compound	1,1-Dichloroethane			1,1-Dichloroethylene			1,2-Dichloroethane			1,2-Dichloropropane			1,4-Dichlorobenzene			Benzene			Bis(2-EH)Phthalate		
Standard[a]	5.0[d] ug/l			6.0[d] ug/l			0.5[d] ug/l			5.0[d] ug/l			5.0[d] ug/l			0.7[e] ug/l			4.0[d] ug/l		
Well	Samples Over Std. # Samples	Min.[x] ug/l	Max.[x] ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l
OI-1A																			2/15	5.0J	6.0J
OI-1C																			3/8	7.0J	26.0
OI-2																			2/15	5.0J	6.0J
OI-3																			2/11	6.0J	6.0J
OI-4**	5/17	6.0	15.0	2/17	14.1	16.3	1/16	1.2J	1.2J	2/17	9.0	10.3	7/19	8.4J	60.7J	15/17	3.0J	18.0	1/17	730.0	730.0
OI-5							1/20	0.7J	0.7J										1/18	26.0	26.0
OI-6**																			1/12	8.0J	8.0J
OI-8A																			2/8	5.0J	7.0J
OI-9A																1/8	0.8J	0.8J			
OI-10A																			1/6	11.0	11.0
OI-10B																			1/6	9.0J	9.0J
OI-11A																					
OI-12B																			1/6	13.0	13.0
OI-13B																					
OI-15B																					
OI-16A																					
OI-17A	5/5	27.0	180.0				4/5	180.0	220.0							5/5	6.0	40.0			
OI-18A**	4/4	11.0	19.0				1/4	0.6J	0.6J				5/7	8.0J	10.0	4/4	13.0	18.0			
OI-19A	3/6	6.0	6.0																		
OI-19B																					
OI-20A							1/5	0.7J	0.7J							4/5	1.0	2.0			
OI-20B																					
OI-27A	4/4	29.0	82.0	1/4	8.0	8.0	1/4	0.6J	0.6J							4/4	1.0	3.0			
CDD-13																4/5	0.9J	6.0J			
DS-01																					

Table 6-13
(Continued)

Compound	Aldrin			Methylene Chloride			Tetrachloroethene			Phenol			t-1,2-Dichloroethylene			Trichloroethene			Vinyl Chloride		
Standard*	0.05[c] ug/l			5.0[b] ug/l			4.0[c] ug/l			5.0[c] ug/l			10.0[d] ug/l			5.0[d] ug/l			0.5[d] ug/l		
Well	Samples Over Std. # Samples	Min.[x] ug/l	Max.[x] ug/l	Samples Over Std. # Samples	Min.[x] ug/l	Max.[x] ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l	Samples Over Std. # Samples	Min. ug/l	Max. ug/l
OI-1A							1/17	4.3	4.3												
OI-1C																					
OI-2																					
OI-3																			2/12	1.5	3.1J
OI-4**	1/12	0.7J	0.7J										8/16	11.4	64.0				16/17	89.0	552.0
OI-5																					
OI-6**										1/12	5.9J	5.9J									
OI-8A																					
OI-9A																					
OI-10A																					
OI-10B																					
OI-11A										1/6	40.0	40.0									
OI-12B																					
OI-13B				1/11	8.0	8.0				1/8	12.0	12.0									
OI-15B										1/4	9.0J	9.0J									
OI-16A																			3/3	20.0	89.0
OI-17A				4/5	20.0	150.0	5/5	11.0	510.0							5/5	53.0	370.0	5/5	16.0	33.0
OI-18A**																4/4	6.0	7.0	4/4	12.0	33.0
OI-19A							6/6	6.0	18.0							5/6	8.0	9.0	2/6	1.0J	1.0J
OI-19B							3/4	5.0	6.0												
OI-20A							5/5	12.0	15.0							5/5	22.0	32.0	5/5	4.0	8.0
OI-20B	1/3	0.1	0.1																		
OI-27A							3/4	5.0	19.0							2/4	12.0	19.0	4/4	2.0	8.0
CDD-13				1/1	1,200.0	1,200.0															
DS-01							1/2	8.0J	8.0J							1/2	5.5J	5.5J			

**Compounds with only one sample over standard:

Well OI-4: Heptachlor	= 0.32 ug/l	Standard: 0.01[d] ug/l	1/11 Samples
Well OI-4: Aldrin	= 0.69 ug/l	Standard: 0.05[c] ug/l	1/11 Samples
Well OI-6: Chlordane	= 1.0 ug/l	Standard: 0.1[d] ug/l	1/9 Samples
Well OI-18A: Toluene	= 110.0 ug/l	Standard: 100.0[c] ug/l	1/4 Samples

[x]Min. and Max. are minimum and maximum concentrations which exceed the standard (ug/l).

*Standard is the lowest value among those listed for each compound in Table 6-7.

[a]EPA MCL
[b]EPA proposed or tentative MCL
[c]EPA MCL Goal
[d]CAL-DHS MCL
[e]CAL-DHS Action Level
J: Estimated value
P: Estimated value below detection limit
L: Value between Instrument Detection Limit and Contract Required Quantification Limit

standard (CDHS AL equals 0.7) range from 1 to 40 ug/l. 1,2-DCA concentrations over the standard (CDHS MCL equals 0.5 ug/l) range from 0.6 to 220 ug/l. The range of 1,1-dichloroethane concentrations over the standard (CDHS MCL equals 5.0 ug/l) is from 6 to 180 ug/l. The CDHS MCL for TCE is 5.0 ug/l and the well concentrations range from 6 to 370 ug/l.

Exceedances of methylene chloride, 1,1-dichloroethene, aldrin, 1,2-dichloropropane, bis(2-EH)phthalate, 1,4-dichlorobenzene, and phenol standards also occur in the southwest corner. Methylene chloride surpasses the standard (EPA proposed MCL = 5.0 ug/l) in well OI-17A with a range of 20.0 to 150.0 ug/l. The concentrations in wells OI-4 and OI-27A exceed the minimum standard for 1,1-dichloroethene. Wells OI-4 and OI-18A exceed the standard for 1,4-dichloro-benzene. Wells OI-15B and OI-6 exceed the standard for phenol. The bis(2-EH)phthalate standard is exceeded in wells OI-2, oi)3, OI-4, and OI-6.

6.4.1.2 Northwest Corner

Wells OI-19A and OI-5 have compound concentrations that exceed the minimum standards for multiple compounds. Well OI-19A exceeds the minimum standards of vinyl chloride, PCE, TCE, and 1,1-dichloroethane (Table 6-8). Well OI-5 exceeds the standards for 1,2-dichloroethane and bis(2-ethylexhl)phthalate. Additionally, well OI-19B exceeds the standard for PCE. Although well OI-26A contains 3 to 4 ug/l of PCE, it does not exceed the standard of 4 ug/l.

6.4.1.3 Northeast Corner

Well OI-20A exceeds the minimum standard for vinyl chloride, benzene, 1,2-dichloro-ethane, PCE, and TCE (Table 6-8). The concentration ranges for each compound with each minimum standard in parentheses are as follows: 4.0 to 8.0 ug/l vinyl chloride (0.5 ug/l), 1.0 to 2.0 ug/l benzene (0.7 ug/l), 0.7 ug/l 1,2-dichloroethane in 1 sample (5.0 ug/l), 22.0 to 32.0 ug/l TCE (5.0 ug/l), 12.0 to 15.0 ug/l PCE (4.0 ug/l).

6.4.1.4 North Parcel

Phenol and bis(2-EH)phthalate concentrations exceed the standard in at least two wells each on the North Parcel of OII (Table 6-8). The compound and the wells they occur in follow, including the value and source of the standard in parentheses: phenol in wells OI-11A and OI-13B (5.0 ug/l, CDHS AL), benzene in wells OI-9A (0.7 ug/l, CDHS AL), and methylene chloride in well OI-13B and (5.0 ug/l, proposed EPA MCL). Well OI-1A is located west of the North Parcel and exceeds the standard for PCE and bis(2-EH)phthalate.

Table 6-14 Inorganic Standard Exceedances in Water Wells

Metal	Aluminum			Arsenic			Barium			Cadmium			Cyanide			Chromium			Selenium			Silver			Beryllium			Iron			Manganese		
Standard*	50.0[b] ug/l			50.0[a] ug/l			1,000.0[a] ug/l			5.0[b] ug/l			200.0[b] ug/l			50.0[a] ug/l			0.1[a] mg/l			50.0[a] ug/l			1.0[b] ug/l			300.0[a] ug/l			0.1 mg/l		
Well	Over Std. # Samples	Min.[x] ug/l	Max.[x] ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. mg/l	Max. mg/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min.[x] ug/l	Max.[x] ug/l	Over Std. # Samples	Min. mg/l	Max. mg/l
OI-1A	6/14	51.0J	3,870.0							3/13	5.4J	12.6																2/13	400.0J	6,100.0F	3/14	0.1J	0.5
OI-1C	4/8	426.0J	714.0J							2/8	10.8	10.9																2/8	600.0J	700.0J	7/8	0.4J	0.7
OI-2	8/16	67.0J	750.0																						1/15	1.7J	1.7J	4/16	500.0	1,500.0	10/16	0.1	0.4
OI-3	11/11	292.0	2,690.0				1/11	1,380.0	1,380.0	1/9	5.2	5.2													1/10	2.0J	2.0J	2/10	400.0J	500.0			
OI-4	12/16	110.0J	34,500.0	2/16	69.0	69.0	3/16	1,140.0	1,520.0	4/14	6.0	49.0	7/16	262.0	2,730.0	3/16	56.0	76.0	1/10	68.0	68.0	2/14	64.0	67.0	3/14	3.7J	5.0	11/16	400.0	55,400.0	16/16	1.2	7.2
OI-5	10/17	52.0J	263.0							1/16	6.0	6.0																			2/17	0.1	0.1J
OI-6	11/13	81.9L	197,000.0				1/13	2,050.0	2,050.0	1/12	9.8	9.8				2/13	89.0	216.0							1/2	3.0J	3.0J	5/13	700.0	160,000.0	3/13	0.5	11.5
OI-7C	3/3	55.0J	202.0																						1/3	1.4J	1.4J				3/3	0.1J	0.3
OI-8A	6/8	79.2L	2,420.0							1/8	6.0	6.0																1/8	4,800.0	4,800.0	1/8	0.1	0.1
OI-9A	4/6	69.2L	516.0J							1/6	6.0	6.0																1/6	400.0	400.0	2/6	0.1J	0.1
OI-10A	4/6	97.0	500.0J																									1/6	600.0J	600.0J	2/6	0.1	0.1J
OI-10B	1/6	370.0	370.0							1/6	8.7J	8.7J																1/6	600.0J	600.0J	2/6	0.1	0.1J
OI-11A	5/6	67.0L	500.0J							1/6	8.0	8.0																3/6	300.0J	600.0J			
OI-12B	3/6	59.0J	70.6L							1/6	6.3J	6.3J				1/6	56.0J	56.0J							1/6	1.4J	1.4J	1/6	700.0J	700.0J			
OI-12C	2/6	62.0J	70.0L							1/6	5.8J	5.8J													1/6	1.4J	1.4J						
OI-13A	1/6	400.0J	400.0J							1/6	7.0	7.0																					
OI-13B	7/8	105.0L	915.0							2/8	7.4J	11.0													1/8	1.4J	1.4J	2/8	700.0J	1,000.0J			
OI-13C	1/3	35,800.0	35,800.0													1/3	56.5	56.5										1/3	63,400.0	63,400.0	3/3	0.1	0.5
OI-14C	2/2	63.3L	128.0L																												2/2	0.1	0.1
OI-15A	2/2	62.4L	96.0L																												2/2	0.2J	0.2
OI-15B	3/3	79.3L	101.0L																												2/3	0.1	0.1
OI-16A	2/2	205.0	361.0																									2/2	400.0	1,300.0	2/2	1.5	1.6
OI-17A	2/3	94.5L	105.0L	1/3	90.5	90.5																						1/3	2,200.0	2,200.0	3/3	0.3	0.3
OI-17B	3/3	79.0L	175.0L																									3/3	2,600.0	2,600.0	3/3	0.3	0.3
OI-18A	3/3	512.0	556.0																			2/3	75.0J	76.0J				3/3	53,500.0	54,100.0	3/3	23.8	32.3
OI-18B	2/2	56.4L	76.3L																												1/2	0.1	0.1
OI-19A	3/3	56.2L	66.7L													3/3	88.7	96.2															
OI-19B	2/2	105.0L	833.2J																												2/2	0.2	0.2
OI-19C	1/2	63.6L	63.6L																														
OI-20A	3/3	74.6L	82.4L																												3/3	0.3	0.3
OI-20B																															2/2	0.1	0.1
OI-21B	2/2	62.1L	78.8L																									2/2	700.0	1,300.0J	2/2	0.2	0.2
OI-22B	2/2	69.0L	85.8L																														
OI-23B	2/2	75.0L	88.9L																									2/2	1,400.0	1,500.0	2/2	0.2	0.2
OI-25A	2/2	68.0L	232.0																												1/2	0.1J	0.1J
OI-25B	1/2	59.6L	59.6L																												2/2	0.1	0.1
OI-26A	2/2	64.5L	134.0L																												2/2	0.1	0.1
OI-26B																												2/2	700.0	700.0	2/2	0.01	0.01
OI-27A	1/3	77.0L	77.0L																									1/3	900.0J	900.0J	1/3	0.6J	0.6J
OI-29B	2/2	157.0L	219.0																									2/2	2,600.0	2,600.0	2/2	0.3	0.3
CDD-13	2/3	431.0	440.0	3/3	55.0	227.0J				2/3	5.7	5.9																3/3	8,700.0	16,800.0	3/3	11.0	13.2
CDD-17	1/1	73.9L	73.9L																														
DS-01	2/2	64.9L	2,230.0																									2/2	300.0	19,500.0	2/2	0.1	0.4
2897A	1/3	61.0	61.0																									3/3	1,600.0	1,800.0	3/3	0.2	0.2

Table 6-14 (Continued)

Metal	Mercury			Nickel			Nitrate			Nitrite			Lead			Antimony			Sulfate			Thallium			Total Dissolved Solids			Zinc		
Standard*	2.0[a] ug/l			100.0[b] ug/l			10[a] mg/l			1.0[b] mg/l			5.0[b] ug/l			3.0[c] ug/l			400.0[a] mg/l			0.5[c] ug/l			500.0[d] mg/l			500.0[d] ug/l		
Well	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. mg/l	Max. mg/l	Over Std. # Samples	Min. mg/l	Max. mg/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min.[x] mg/l	Max.[x] mg/l	Over Std. # Samples	Min. ug/l	Max. ug/l	Over Std. # Samples	Min. mg/l	Max. mg/l	Over Std. # Samples	Min. ug/l	Max. ug/l
OI-1A	4/13	2.7	4.3				1/5	25.0	25.0				1/13	9.7	9.7	1/13	84.0J	34.0J				1/13	1.3J	1.3J	7/9	1,790.0	2,720.0			
OI-1C	2/8	2.2	3.1	1/8	111.0J	111.0J	2/2	13.0	14.1							2/8	128.0J	128.0J	2/8	427.0	450.0				5/8	2,290.0	2,510.0			
OI-2													2/15	32.0	40.0										8/11	503.0	631.0	2/16	4,390.0	5,242.0
OI-3													4/10	11.0	52.0	2/10	14.0J	145.0							2/7	736.0	1,565.0			
OI-4				15/16	247.0	520.0	6/6	250.0J	468.0	2/4	1.1	1.3	9/14	5.8J	140.0J	7/14	7.8L	156.0J	4/10	457.0	631.0				6/8	12,100.0	16,300.0			
OI-5													2/15	5.8	8.6	1/16	18.0J	18.0J												
OI-6	2/13	31.2J	38.5J	1/13	376.0	376.0							4/12	6.0	4,860.0F	2/12	3.6L	1.0J	1/10	426.0	426.0				3/9	558.0	704.0	1/13	1,370.0	1,370.0
OI-7C																														
OI-8A													1/8	7.5J	7.5J										1/8	504.0	504.0			
OI-9A				5/6	117.0	301.0																								
OI-10A																						1/6	2.0J	2.0J						
OI-10B				5/6	132.0	284.0																			4/6	851.0	1,320.0			
OI-11A										1/2	1.4	1.4	2/6	6.2	7.7										2/6	657.0	674.0			
OI-12B																														
OI-12C																														
OI-13A													1/6	7.4J	7.4J															
OI-13B													1/8	6.9	6.9										5/8	690.0	929.0	1/8	49,700.0	49,700.0
OI-13C													1/3	10.9	10.9															
OI-14C																														
OI-15A																									1/2	600.0	600.0			
OI-15B																									3/3	600.0	800.0			
OI-16A																									2/2	800.0	900.0J			
OI-17A										1/3	1.1	1.1													2/3	800.0	800.0			
OI-17B																														
OI-18A				3/3	120.0	214.0	2/3	144.0	1,380.0							1/3	26.6L	26.6L	3/3	1,380.0	1,440.0				3/3	5,100.0	5,700.0	1/3	579.0J	579.0J
OI-18B																														
OI-19A													2/3	6.9J	7.3J										1/3	600.0	600.0			
OI-19B																									2/2	600.0	600.0			
OI-19C																									2/2	600.0	800.0			
OI-20A	3/3	2.1J	4.0J																											
OI-20B																														
OI-21B																									1/2	600.0	600.0			
OI-22B																														
OI-23B																														
OI-25A													1/2	13.4	13.4															
OI-25B																														
OI-26A																														
OI-26B																														
OI-27A																												1/3	652.0J	652.0J
OI-28B													1/2	6.3	6.3															
OI-29B																									2/2	800.0	900.0J			
CDD-13				2/3	116.0	134.0																			3/3	643.0	6,780.0			
CDD-17	1/1	2.7J	2.7J																						1/1	568.0	568.0			
DS-01													1/2	35.0	35.0															
2897A																														

[x]Min. and Max. are minimum and maximum concentrations that exceed the standard (ug/l).

*Standard is the lowest value among those listed for each metal in Table 6-7.

[a]EPA MCL
[b]EPA proposed or tentative MCL
[c]EPA MCL Goal
[d]CAL-DHS MCL
[e]CAL-DHS Action Level
J: Estimated value
L: Value between Instrument Detection Limit and Contract Required Quantification Limit

6.4.2 INORGANICS

Exceedances of minimum water quality standards for inorganics are summarized in Table 6-9 and on Plate 4. Inorganic compounds, which exceed standards, are widespread across the South and North Parcels at OII. The metals, which most commonly exceed the standards, with the number of wells in parentheses, are: aluminum (42), manganese (34), iron (26), total dissolved solids (22), cadmium (15), and lead (15). Other inorganics of concern, which do not occur as often, include beryllium (8), antimony (7), nickel (7), mercury (5), chromium (5), zinc (5), sulfate (4), nitrate (4), arsenic (3), barium (3), thallium (2), nitrate (3), and silver (2). Inorganics, which exceed the ARAR in only one well include cyanide, and selenium. A bar concentration plot of lead, one the metals most commonly exceeded by OII well samples, is provided in Figure 6-13. Additional bar concentration plots are in Appendix L-1.

The wells, which have more than 5 inorganic compounds which exceed the ARAR standard, with the number of exceedances in parentheses, include: OI-4 (18), OI-6 (13), OI-1A (10), OI-1C (10), OI-2 (7), OI-3 (8), OI-8A (6), OI-10B (6), OI-13B (7), OI-18A (10), CDD-13 (7), OI-17A (6) and OI-11A (6). Wells with 4 or 5 exceedances include: OI-5, OI-9A, OI-10A, OI-12B, OI-13C, OI-16A, OI-19A, OI-21B, OI-27A, OI-29B, DS-01. Wells with 3 exceedances include: OI-7C, OI-13A, OI-12, OI-15A, OI-15B, OI-17B, OI-19B, OI-20A, OI-23B, OI-25A, CDD-17, and 2897A. Wells with 1 or 2 exceedances will be discussed in relation to its particular inorganic exceedance.

Note that the concentrations in Table 6-9 include samples that may not have been field filtered before analysis. If this is the case, the maximum standard exceedances in Table 6-9 may include suspended, as well as, dissolved solids. Therefore, the maximum standard exceedances listed in the table may exceed the actual dissolved inorganic concentration.

A brief summary of the locations and concentration ranges for the most commonly occurring inorganics follows. All of the wells at OII, except wells OI-20B and OI-28B, exceed the standard for aluminum (50 ug/l; EPA proposed MCL). The standard for iron (300 ug/l; EPA MCL) is exceeded at all of the North and South Parcel wells except OI-5, OI-15A, OI-15B, OI-18B, OI-19A, OI-20A, OI-22B, OI-25A, OI-25B, OI-28B, and CDD-17. Cadmium (5.0 ug/l; EPA proposed MCL) exceedances occur in the North Parcel and in some of the western wells of the South Parcel. Lead exceedances (5.0 ug/l; EPA proposed MCL) are found across the west side of the South Parcel in wells CDD-13, OI-2, OI-3, OI-4, OI-5, OI-6, OI-13A, OI-13B, OI-13C, and OI-19A and across the North Parcel in wells OI-1A, OI-8A, OI-11A, OI-13A, OI-13B, OI-13C, and OI-25A. Manganese exceedances (0.1 mg/l; EPA MCL) are widespread across the South Parcel, west side of the North Parcel, and in offsite wells. Total dissolved solids standards (500.0 mg/l; EPA MCL) are exceeded across OII, especially in the west par of the South Parcel. Antimony exceedances (3.0 ug/l; EPA MCLG) commonly occur in the southwest corner of the South Parcel. The range of

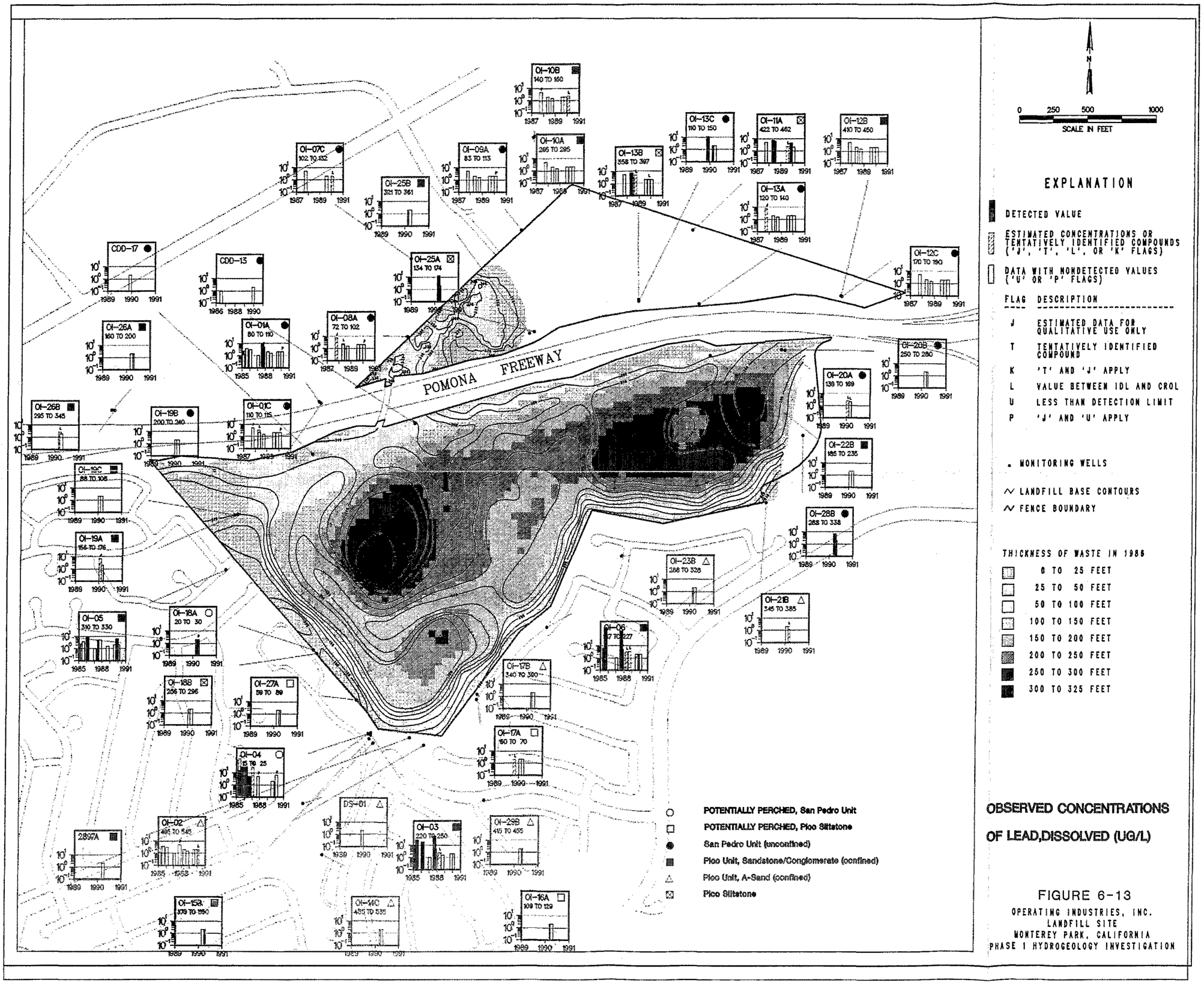
exceedances of these widespread inorganics are as follows: aluminum from 51 to 197,000 ug/l, iron from 326 to 160,000 ug/l, cadmium from 5.2 to 20.0 ug/l, and lead from 5.8 to 302 ug/l. manganese from 0.1 to 32.3 mg/l, antimony from 3.6 to 156 ug/l, and total dissolved solids from 503 to 16,300 mg/l.

The range of concentrations, which exceed the standard for inorganics that occur in moderate numbers of wells (3-8) follows. Antimony standard exceedances (3.0 ug/l; EPA tentative MCLG) range from 3.6 to 156 ug/l. Exceedances occur in wells OI-3, OI-4, OI-6, and OI-18A in the southwest corner, and in wells OI-1A, OI-1C, and OI-5 near the northwest corner. Nickel standard exceedances (100.0 ug/l; EPA tentative MCL) range from 111 to 520 ug/l in wells OI-1C, OI-4, OI-6, OI-9A, OI-10B, OI-18A, and CDD-13. Beryllium standard exceedances (1.0 ug/l; EPA proposed MCL) range from 1.4 to 5.0 ug/l in wells OI-2, OI-3, OI-4, OI-6, OI-7C, OI-12B, OI-12C, and OI-13B. Mercury standard exceedances (2.0 ug/l; EPA MCL) range from 2.1 to 38.5 ug/l in wells OI-1A, OI-1C, OI-6, OI-20A, and CDD-17. Chromium standard exceedances (50.0 ug/l; EPA MCL) range from 56.0 to 216.0 ug/l in wells OI-4, OI-6, OI-12B, OI-13C, and OI-19A. Zinc standard exceedances (500.0 ug/l; EPA MCL) range from 579.0 to 49,700 ug/l in wells OI-2, OI-6, OI-13B, OI-18A, and OI-27A. Sulfate standard exceedances (400.0 mg/l; EPA MCL) range from 426 to 1,400 mg/l in wells OI-1C, OI-4, OI-6, and OI-18A. Nitrate standard exceedances (10 mg/l; EPA MCL) range from 13.0 to 1,380.0 mg/l in wells OI-1A, OI-1C, OI-4, and OI-18A. Arsenic standard exceedances (50.0 ug/l; EPA MCL) range from 55 to 227 ug/l in wells OI-4, OI-17A, and CDD-13. Barium standard exceedances (1,000 ug/l; EPA MCL) range from 1,140 to 1,520 ug/l in wells OI-3, OI-4, and OI-6. Nitrite standard exceedances (1.0 mg/l; EPA MCLG) range from 1.1 to 1.4 mg/l in wells OI-4, OI-11A, and OI-17A. Sliver standard exceedances (50 ug/l; EPA MCL) range from 64.0 to 76.0 ug/l in wells OI-4 and OI-18A.

Thallium standard exceedances range from 1.3 to 2.0 ug/l in wells OI-1A and OI-10A. Cyanide and selenium occur in only well OI-4.

6.5 STABLE ISOTOPE ANALYSES INTRODUCTION

The presence of hydrogen sulfide gas (H_2S) in groundwater from monitoring wells OI-2 and OI-15B in the southwest corner of the OII Landfill prompted a stable isotope investigation to evaluate whether the gas originated from the landfill or whether it was naturally occurring. Methane and hydrogen sulfide are produced during the degradation of organic matter in landfills. A secondary objective of the isotope analyses was to provide information on the source of methane in the subsurface. The location of the OII Landfill above an oilfield and a gas storage facility raises the possibility that some methane at the site may originate from these two sources. The presence of helium in LFG in two landfill gas moinitoring well samples supports this



OBSERVED CONCENTRATIONS OF LEAD,DISSOLVED (UG/L)

FIGURE 6-13

OPERATING INDUSTRIES, INC.
LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE I HYDROGEOLOGY INVESTIGATION

interpretation. Helium is present in the natural gas stored in the *Montebello* underground storage reservoir, and would not be expected in LFG.

The isotopic composition of carbon in methane and sulfur in hydrogen sulfide gas was analyzed in headspace gas samples from groundwater from OI-2 and OI-15B and in LFG samples from gas monitoring probes GMW-8B and GMW-9D. The gas monitoring wells were chosen based on their elevated H_2S concentrations relative to the rest of the landfill.

Samples were also submitted for analysis of tritium from wells OI-2, OI-3, OI-15B, OI-21B, OI-18A, OI-20A, OI-20B, and OI-13A to assess whether the age of these groundwaters is pre- or post-1951.

6.5.1 BACKGROUND

Stable isotopes of carbon (^{12}C and ^{13}C) are well known in the petroleum industry (Sackett, 1968; Rice and Claypool, 1981; Schoell, 1983; Duchscherer, 1984; Tissot and Welte, 1984; Philp, 1987) where they are used for exploration and correlation between oilfields. Tek (1987) in his text on the underground storage of natural gas states that isotopic analysis of methane to identify storage gas has been most successful. He states:

> "One definite advantage of isotopic analysis over chemical analysis is that chemical composition is subject to fractionation while the gas in transit through porous media is not."

This statement is essentially true for carbon in methane and for sulfur in hydrogen sulfide but becomes less true of the hydrogen/deuterium/tritium series. This is an ongoing subject of research. As the instruments have become more sophisticated and accurate, changes in isotopic composition (called shifts in isotopic analysis) are becoming less significant.

6.5.1.1 Carbon Isotopes

Carbon isotopes are expressed as a ratio of $^{13}C/^{12}C$ in the sample compared to the same ratio for a standard. Almost every reference gives the method of calculating the ratio, and therefore, the complete description is not repeated.

The result is called "$\delta^{13}C$" and is expressed in units of measurement called "per mil". For example, a $\delta^{13}C$ value of minus 48 per mil means that the sample is 48 parts per thousand (mil) lighter than the standard.

The standard commonly used for the two stable carbon isotopes is a fossil of Cretaceous age from the Peedee Formation, South Carolina called Belemnitella americana. This standard is generally noted on the analysis sheet as "PDB" and is the

standard used in this report. If the data are to be compared with other data, the standard must be known. Other standards include NBS No. 20 (Solenhofen limestone, -1.1 per mil shift from PDB), NBS No. 21 (Graphite, -21.8 per mil), and NBS No. 22 (Petroleum standard, -29.4 per mil).

6.5.1.2 Sulfur Isotopes

Much less work has been done on sulfur isotopes in the petroleum industry (Tissot and Welte, 1984; Orr, 1974), but much work has been done on the sulfate-sulfide species in marine sciences, environmental work, and the mining industry (Ault and Kulp, 1959; and Kellogg et al., 1972). Most of the work does not involve hydrogen sulfide gas directly but includes the gas along with the other sulfur species to get a total sulfur flux.

The two stable isotopes of sulfur, ^{32}S and ^{34}S, are calculated in the same manner as the carbon isotopes and compared to a standard. The standard for the sulfur isotopes is the Canon Diablo troilite (a meteorite). The calculated values are called "$\delta^{34}S$" expressed in the same units of measurement as carbon "per mil."

6.5.2 CARBON AND SULFUR ISOTOPE RESULTS

Table 6-15 shows the analytical results from the determination of the carbon isotopes in methane and the sulfur isotopes in hydrogen sulfide gas from the groundwater and gas monitoring wells.

Table 6-15
Isotope Analytical Results
From Methane and Hydrogen Sulfide Gases
At the OII Landfill Site

Well	Methane $\delta^{13}C$ (per mil)	Hydrogen Sulfide $\delta^{34}S$ (per mil)
OI-2	-57.72	-3.50
OI-15B	---	-23.01
GMW-8B	-55.98	---
GMW-9D	-56.78	---

-- Unable to determine

Methane $\delta^{13}C$ was not determined for the groundwater monitoring well OI-15B, because there was not enough methane in the sample. The other three samples are remarkably consistent, ranging from minus 55.98 to minus 57.72 per mil. The duplicate

carbon isotope measurement on LFG from GMW-8B indicates an excellent agreement of only 0.01 per mil difference between the two analyses.

The sulfur isotopes were determined only on the groundwater monitoring well samples, because there was not enough hydrogen sulfide in the gas monitoring well samples. There is a definite shift in the sulfur isotopes of the two groundwater monitoring well samples. The sample from the shallower monitoring well (OI-15), which is screened from 370 to 390 feet, is minus 23.02 per mil and the deeper monitoring well (screened from 495 to 545 feet) sample is minus 3.50 per mil, a shift of 19.5 mil. This indicates that the shallow monitoring well hydrogen sulfide gas is very enriched in the isotope ^{32}S.

Only five carbon values and no sulfur isotope data for landfills are available. The $\delta^{13}C$ values for landfills range from minus 48.5 to minus 52.1 per mil in three samples of landfills in Columbus, Indiana (Games and Hayes, 1976) and from minus 50.5 to minus 54.8 per mil in two samples from a landfill in Denver, Colorado (Tyler, 1986). The average value for the five $\delta^{13}C$ values is 51.2 per mil. The OII Landfill samples are slightly lighter (higher in ^{32}C) than these samples at an average of 56.8 per mil. These data suggest, however, that the gases in the groundwater monitoring well may be biogenic in origin. (Thermogenic gases are formed by the cracking of hydrocarbons. Biogenic gases are formed by the degradation of sulfur-bearing hydrocarbons.).

Figure 6-14 was constructed to summarize both the sulfur and the carbon isotope information from the literature and to compare the isotope analyses with the biogenic and the thermogenic gas environments and the few landfill data in the literature.

Tissot and Welte (1984) separate the carbon isotopes into three groups: diagenic, catagenic, and the dry gas. The $\delta^{13}C$ disgenic group ranges from minus 90 to minus 55; the catagenic (oil and higher molecular weight hydrocarbon gases associations) from minus 55 to minus 30; and the dry gas group, from minus 40 to minus 20. The diagenic group includes methane and hydrogen sulfide gases generated at shallow depth by bacterial activity. The catagenic group includes methane and hydrogen sulfide usually generated by thermal cracking of hydrocarbons at considerable depth.

The sparse sulfur data indicate a $\delta^{34}S$ range from minus 23 to plus 6 (Kellogg, et al., 1972) for biogenic hydrogen sulfide. The range for thermogenic gases is approximated from Tissot and Welte (1984), Kellogg, et al. (1972), Ault and Kulp (1959), and Orr (1974). The larger range dashed boundary is Kellogg, et al.'s estimate for the $\delta^{34}S$ for petroleum. The smaller range solid line is from Orr's actual measurements of $\delta^{34}C$.

The landfill gas $\delta^{13}C$ is the range for the five landfill gases previously described. The $\delta^{34}S$ range is approximated as beginning at minus 23 and projected upward to heavier $\delta^{34}S$ values. The upper limit of the ^{34}S may extend into the thermogenic gas region, but it is more likely to remain at least in the minus $\delta^{34}S$ values. Sulfur^{32} bonds are more easily broken than the ^{34}S, therefore, bacterial activity within the landfill would

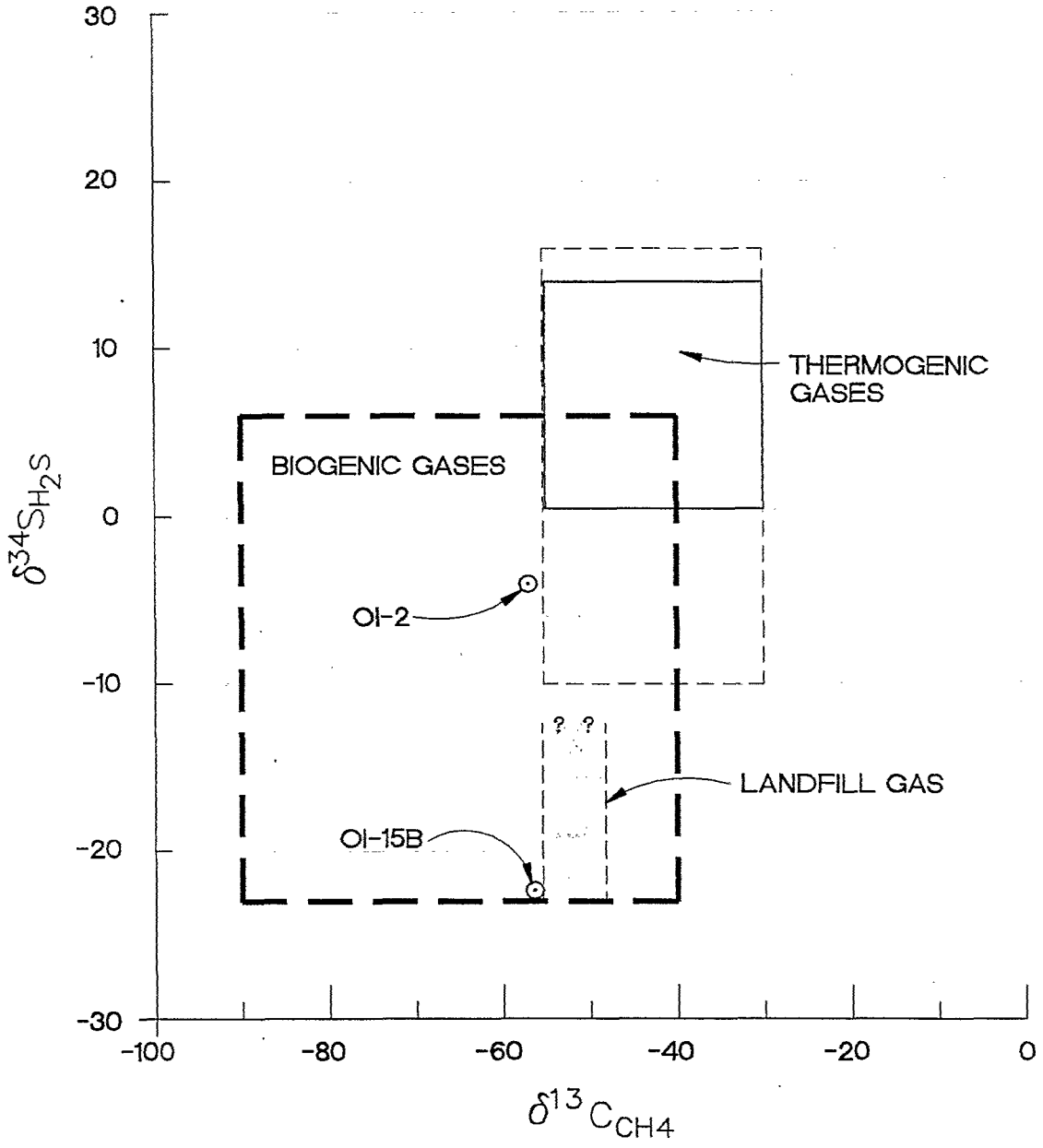


FIGURE 6-14
ISOTOPIC FRACTIONATION OF STABLE CARBON ISOTOPES OF METHANE AND SULFUR ISOTOPES OF HYDROGEN SULFIDE
OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

H:\FIGURES\LA063737.DE\FIG1.DWG

have a tendency to produce more ^{32}S than ^{34}S. Petroleum wastes, which are known to be a component of OII waste, would push the $\delta^{34}S$ value close to zero.

Both samples are plotted on Figure 6-10. The sample from OI-02 is on the boundary of Kellogg et al.'s projected boundary for petroleum but within the boundary for biogenic gas. The sample for OI-15B is plotted with the average methane $\delta^{13}C$ value. All three methane $\delta^{13}C$ values are very close, therefore, this is a reasonable approximation. The sample plots in the extreme boundary for biogenic hydrogen sulfide gas. Proximity to the landfill gas range and very light sulfur isotopes suggest that the H_2S gas in monitoring well OI-15B is of landfill origin.

These data are not conclusive relative to the source of the H_2S gas, but they indicate that the gas is not thermogenic in origin. More conclusive data would include a sample of gas from the deep leachate, the oilfield gas, and the storage gas.

6.5.3 TRITIUM RESULTS

Tritium was analyzed on 8 groundwater samples (OI-2, OI-3, OI-15B, OI-13A, OI-18B, OI-20A, OI-20B, and OI-21B) representing a spectra of location and total depths at the landfill. Tritium has been used to date groundwater and to determine the rate of recharge received by an aquifer (Nir, 1964, Foster and Smith-Carington, 1980; and Thorpe, 1989, to name a few of the many articles in the literature). Tritium, an isotope of hydrogen, is created at very low concentrations under natural conditions but was released to the atmosphere by atomic weapons testing dating from the 1950s. Tritium is generally reported in tritium units (TU) which is defined as one tritium atom per 10 to the 18th power atoms of all hydrogen species in the water. Tritium is not a stable isotope like carbon-13 or sulfur-34. It has a half-life of 12.3 years (half of the TU decay in 12.3 years). One TU represents a radioactivity of approximately 0.003 picocuries per liter.

The tritium concentrations range from 0.0, plus or minus 0.6, TU to 1.0, plus or minus 0.4, TU. These values are all very low, too near the detection limit to be of much quantitative use, and do not appear to have any relationship to well depth. This data should be compared with recently determined tritium values in the Southern California area to evaluate if there is some relationship with groundwater age; however, at this time, we were unable to locate any such data. Since groundwater from OI-13A and OI-20A would be expected to contain recently recharged water, and no detectable tritium concentrations were observed, the tritium data appears to be of limited value.

TABLE 6 16
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D = number of detected values
O = number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD-13				SAMPLING LOCATION: CDD-17				SAMPLING LOCATION: DS-01			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	8.0 L	0.0	6.0 U	1/ 3	10.0 U	4.0 L	5.2 L	2/ 3	4.0 U	4.0 U	4.0 U	0/ 1	6.0 U	4.0 U	5.0 U	0/ 2
ALUMINUM,DISSOLVED	ug/l	61.0	29.0 L	31.0	3/ 3	440.0	100.0 U	431.0	2/ 3	73.9 L	73.9 L	73.9 L	1/ 1	2230.0	64.9 L	1147.4	2/ 2
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	136.0	136.0	136.0	1/ 1	1110.0	19.1	0.1 U	3/ 3	108.0	108.0	0.0	1/ 1	181.0	181.0	181.0	1/ 1
ALUMINUM TOTAL	ug/l					100.0 U	100.0 U	0.0	0/ 1								
ARSENIC,DISSOLVED	ug/l	6.0 U	2.0 P	6.0 U	0/ 3	227.0 J	55.0	165.0 J	3/ 3	2.0 P	2.0 P	0.0	0/ 1	6.0 U	2.0 P	4.0 U	0/ 2
ARSENIC TOTAL	ug/l					77.0	77.0	77.0	1/ 1								
BARIUM,DISSOLVED	ug/l	91.0	74.0 L	85.0	3/ 3	885.0	415.0	878.0	3/ 3	64.5 L	64.5 L	0.0	1/ 1	117.0	102.0 L	109.5	2/ 2
BARIUM TOTAL	ug/l					1080.0	1080.0	1080.0	1/ 1								
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	6.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	0.0	0/ 1	1.0 U	1.0 U	1.0 U	0/ 2
BROMIDE	ug/l					28.0	28.0	28.0	1/ 1								
CALCIUM,DISSOLVED	mg/l	26.8	26.8	26.8	1/ 1	425.0	313.0	478.0	3/ 3	37.9	37.9	0.0	1/ 1	31.0	31.0	31.0	1/ 1
CALCIUM TOTAL	ug/l					478.0	478.0	0.0	1/ 1								
CADMIUM,DISSOLVED	ug/l	3.9 U	0.5 U	0.5 U	0/ 3	5.9	4.0 U	5.7	2/ 3	4.0 U	4.0 U	0.0	0/ 1	4.0 U	0.5 U	2.3 U	0/ 2
CHLORIDE	mg/l	58.1	58.1	58.1	1/ 1	2780.0	2640.0	2640.0	3/ 3	227.0	227.0	0.0	1/ 1	50.8	50.8	50.8	1/ 1
CYANIDE	ug/l	10.0 U	4.0 U	4.0 U	0/ 3	110.0	23.7	26.3	3/ 3	10.0 U	10.0 U	0.0	0/ 1	10.0 U	4.0 U	7.0 U	0/ 2
COBALT,DISSOLVED	ug/l	10.0 U	9.0 U	10.0 U	0/ 3	62.7	20.0	55.7	3/ 3	10.0 U	10.0 U	0.0	0/ 1	10.0 U	10.0 U	10.0 U	0/ 2
COBALT TOTAL	ug/l					20.0	20.0	20.0	1/ 1								
CHROMIUM,DISSOLVED	ug/l	4.0 U	3.0 U	4.0 U	0/ 3	31.0	29.1	30.0 U	2/ 3	6.0 U	6.0 U	0.0	0/ 1	6.0 U	4.0 U	5.0 U	0/ 2
COPPER,DISSOLVED	ug/l	6.0 U	2.0 U	2.0 U	0/ 3	4.3 L	3.1 L	4.0 U	2/ 3	10.8 L	10.8 L	0.0	1/ 1	3.2 L	2.0 U	2.6 L	1/ 2
COPPER TOTAL	ug/l					66.0	66.0	66.0	1/ 1								
FREE CYANIDE	ug/l					40.0	40.0	40.0	1/ 1								
IRON,DISSOLVED	mg/l	1.8	1.6	1.8	3/ 3	16.8	8.7	29.4	3/ 3	0.0 L	0.0 L	0.0	1/ 1	19.5	0.3	0.7 L	2/ 2
IRON TOTAL	ug/l					29.4	29.4	0.0	1/ 1								
FLUORIDE	mg/l	80.8 L	80.8 L	80.8 L	1/ 1	0.4	0.4 L	0.4 L	3/ 3	0.6 L	0.6 L	0.0	1/ 1	0.7 L	0.7 L	0.0	1/ 1
GROSS ALPHA ACTIVITY	ug/l					1.4	1.4	1.4	1/ 1								
GROSS BETA ACTIVITY	ug/l					8.7	-8.7	8.7	1/ 1								
MERCURY,DISSOLVED	ug/l	0.3 U	0.2 U	0.2 U	0/ 3	2.0 J	1.0 J	1.5 J	2/ 2	2.7 J	2.7 J	0.0	1/ 1	0.2 U	0.2 U	0.2 P	0/ 2
IODINE DISSOLVED	ug/l					2.4	2.4	2.4	1/ 1								
POTASSIUM,DISSOLVED	mg/l	5.0 U	5.0 U	5.0 U	0/ 1	7.4	6.8	7.0	3/ 3	2.5 L	2.5 L	0.0	1/ 1	2.8 L	2.8 L	2.8 L	1/ 1
POTASSIUM TOTAL	ug/l					7.4	7.4	7.4	1/ 1								
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l					0.7	0.7	0.7	1/ 1								
MAGNESIUM,DISSOLVED	mg/l	21.0	21.0	21.0	1/ 1	240.0	210.0	305.0	3/ 3	29.4	29.4	0.0	1/ 1	13.6	13.6	13.6	1/ 1
MAGNESIUM TOTAL	ug/l					305.0	305.0	0.0	1/ 1								
MANGANESE,DISSOLVED	mg/l	0.2	0.2	0.2	3/ 3	13.2	11.0	13.0	3/ 3	0.0	0.0	0.0	1/ 1	0.4	0.1	0.3	2/ 2
NITRATE (AS N)	mg/l	0.0 U	0.0 U	0.0 U	0/ 1	1.2 U	1.2 U	1.2 U	0/ 2	3.7	3.7	0.0	1/ 1	0.0 U	0.0 U	0.0 U	0/ 1
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 1	0.6 U	0.6 U	0.6 U	0/ 2	0.1 U	0.1 U	0.0	0/ 1	0.0 U	0.0 U	0.0 U	0/ 1
SODIUM,DISSOLVED	mg/l	66.0	66.0	0.2 J	1/ 1	1120.0	0.0 U	1130.0	1/ 3	104.0	104.0	0.0	1/ 1	56.5	56.5	0.1	1/ 1
SODIUM TOTAL	ug/l					1130.0	1130.0	0.0	1/ 1								
AMMONIA NITROGEN (AS N)	mg/l	0.2 J	0.2 J	0.0	1/ 1	1.8	1.5	1.6	3/ 3	0.0 U	0.0 U	0.0	0/ 1	0.1	0.1	0.0	1/ 1
NICKEL,DISSOLVED	ug/l	15.0 U	15.0 U	15.0 U	0/ 3	134.0	40.0	116.0	3/ 3	31.0 U	31.0 U	0.0	0/ 1	31.0 U	15.0 U	23.0 U	0/ 2
NICKEL TOTAL	ug/l					40.0	40.0	40.0	1/ 1								
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	1.0 U	2.0 U	0/ 3	2.0 U	2.0 U	0.0	0/ 1	35.0	2.0 U	18.5	1/ 2
LEAD TOTAL	ug/l					14.0	14.0	14.0	1/ 1								
PH - LAB	ug/l																
PH - FIELD	ug/l	7.1	7.1	7.1	1/ 1												
PHOSPHATE (TOTAL)	ug/l					0.3 U	0.3 U	0.3 U	0/ 1								
PURGEABLE ORGANIC CARBON	mg/l	1.0 U	1.0 U	1.0 U	0/ 1	0.6	0.5	0.5	3/ 3	0.1	0.1	0.0	1/ 1	2.5	2.5	2.5	1/ 1
PURGEABLE ORGANIC HALOGENS	ug/l	5.0 U	5.0 U	5.0 U	0/ 1	38.0 J	22.7 J	30.4 J	2/ 2	5.0 P	5.0 P	0.0	0/ 1	5.0 P	5.0 P	5.0 P	0/ 1
ANTIMONY,DISSOLVED	ug/l	20.2 U	6.0 U	6.0 U	0/ 3	21.0 U	8.0 U	21.0 U	0/ 3	21.0 U	21.0 U	0.0	0/ 1	21.0 U	6.0 U	13.5 U	0/ 2
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	530.0	530.0	530.0	1/ 1	2.0 U	2.0 U	2.0 U	0/ 1								
SELENIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0	1/ 3	7.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	0.0	0/ 1	2.0 U	2.0 U	2.0 U	0/ 2
TIN	ug/l	20.0 U	20.0 U	20.0 U	0/ 2									20.0 U	20.0 U	20.0 U	0/ 1
SULFATE	mg/l	97.8	97.8	400.0	1/ 1	220.0	117.0	4.7	3/ 3	39.9	39.9	0.0	1/ 1	8.8	8.8	8.8	1/ 1
STRONTIUM TOTAL	ug/l					4.7	4.7	0.0	1/ 1								
TOTAL DISSOLVED SOLIDS	mg/l	400.0	400.0	0.0	1/ 1	6780.0	643.0	0.0	3/ 3	568.0	568.0	0.0	1/ 1	401.0	401.0	401.0	1/ 1
TITANIUM DISSOLVED	ug/l					20.0	20.0	0.0	1/ 1								
TITANIUM TOTAL	ug/l					39.0	39.0	0.0	1/ 1								
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	0.7 U	2.0 U	0/ 3	2.0 U	2.0 U	0.0	0/ 1	2.0 U	2.0 U	2.0 U	0/ 2
TEMPERATURE (DEG C)	ug/l	24.5	24.5	24.5	1/ 1												
TOTAL ORGANIC CARBON	mg/l	1.0 U	1.0 U	1.0 U	0/ 1	1771.0 J	471.6 J	1121.3 J	2/ 2	3.0 J	3.0 J	0.0	1/ 1	0.5 J	0.5 J	0.5 J	1/ 1
TOTAL ORGANIC HALOGENS	ug/l	5.5	5.5	5.5	1/ 1	434.1 J	400.0	416.0 J	3/ 3	36.0 J	36.0 J	0.0	1/ 1	7.2 J	7.2 J	7.2 J	1/ 1
VANADIUM,DISSOLVED	ug/l	18.0 U	4.0 U	4.0 U	0/ 3	41.0	22.9 L	28.2 L	3/ 3	5.5 L	5.5 L	0.0	1/ 1	5.0 U	4.0 U	4.5 U	0/ 2
VANADIUM TOTAL	ug/l					67.0	67.0	67.0	1/ 1								
ZINC,DISSOLVED	mg/l	0.5	0.0 U	0.4	2/ 3	0.1	0.0	0.1	3/ 3	0.0	0.0	0.0	1/ 1	0.0	0.0 L	0.0	2/ 2
ZINC TOTAL	ug/l					0.2	0.2	0.2	1/ 1								

TABLE 6-16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-01A				SAMPLING LOCATION: OI-01C				SAMPLING LOCATION: OI-02				SAMPLING LOCATION: OI-03			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	41.0	2.7 U	5.2 J	2/13	46.0	4.0 U	7.5 U	2/ 8	14.0	2.8 U	5.0 U	3/15	25.0 U	3.2 L	9.8 U	3/10
ALUMINUM,DISSOLVED	ug/l	3870.0	16.4 U	88.5 U	9/14	714.0 J	32.0 J	121.6 P	5/ 8	750.0	16.4 U	68.0 J	9/16	2690.0	292.0	746.0	11/11
CARB ALKALINITY (AS CACO3)	mg/l	5.0 U	1.0 U	1.5 U	0/ 6	5.0 U	1.0 U	3.5 U	0/ 4	16.0	1.0 U	5.0 U	3/ 7	736.0	42.0	72.0	5/ 5
BICARB ALKALINITY (AS CACO3)	mg/l	177.0	70.0	78.0	7/ 7	197.0	96.0	1.0 U	6/ 6	417.0	350.0	377.0	8/ 8	87.0	1.0 U	1.0 U	1/ 5
HYDROX ALKALINITY (AS CACO3)	mg/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	0.0	0/ 1	1.0 U	1.0 U	1.0 U	0/ 4	1472.0	235.0	853.5	2/ 2
TOTAL ALKALINITY (AS CACO3)	mg/l	177.0	70.0	77.5	8/ 8	197.0	96.0	175.5	8/ 8	436.0	366.0	386.0	10/10	1544.0	111.4	320.0	6/ 6
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	10.0 U	2.0 U	5.1 U	1/14	10.0 U	2.0 U	2.0 U	1/ 8	10.0 U	2.0 U	5.1 U	0/16	10.0 U	2.0 U	4.0 U	0/11
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	506.0	88.4 L	292.5	13/14	475.0	48.9 L	135.2 J	7/ 8	220.0	105.0 U	123.5 J	12/16	1380.0	75.0 L	330.0	10/11
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	5.5 U	0.3 U	2.0 U	1/13	5.5 U	0.3 U	1.8 U	0/ 8	5.5 U	0.4 U	1.7 J	2/15	5.5 U	0.3 U	2.0 J	2/10
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	262.0	0.2	165.5	14/14	332.0	32.3	290.0	8/ 8	35.4	0.0	26.3	16/16	673.5	0.2	194.0	11/11
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	12.6	0.2 U	4.0 U	3/13	10.9	2.4 U	4.0 U	2/ 8	5.0 U	0.2 U	4.0 U	0/15	5.2	2.4 U	4.0 U	2/ 9
CHLORIDE	mg/l	1260.0	611.0	839.0	10/10	2280.0	180.0	1000.0	8/ 8	80.0	9.8 J	64.4	12/12	212.0	46.1	68.8	8/ 8
CYANIDE	ug/l	20.0 U	3.7 U	10.0 U	0/13	10.0 U	10.0 U	10.0 U	0/ 8	20.0 U	3.7 U	10.0 U	1/15	10.0 U	5.0 U	10.0 U	0/10
COBALT,DISSOLVED	ug/l	50.0 U	3.8 U	19.5 U	1/14	52.4	3.8 U	15.9 U	2/ 8	50.0 U	3.8 U	14.0 U	0/16	50.0 U	3.8 U	25.8 L	1/11
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	30.0 U	2.2 U	7.1 U	4/14	49.7 J	3.4 U	8.2 L	4/ 8	19.5 J	3.4 U	7.6 U	4/16	30.0 U	3.4 U	7.2 U	3/11
COPPER,DISSOLVED	ug/l	40.0 U	1.7 U	10.3 U	7/14	25.0 U	5.8 L	10.3 U	4/ 8	25.0 U	1.7 U	10.0 U	5/16	40.0 U	4.8 L	11.1 U	5/11
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	6.1	0.0 U	0.0 L	6/13	0.7 J	0.0 U	0.1 P	6/ 8	1.5	0.0 U	0.1 U	8/16	0.5	0.0 L	0.1 U	5/10
IRON TOTAL	ug/l																
FLUORIDE	mg/l	1.2	0.4	0.5 L	10/10	2.0	0.3 L	0.4	8/ 8	1.2	0.7 L	0.8	12/12	0.6	0.1	0.4	7/ 8
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	4.3	0.3	1.1	12/13	3.1	0.1 L	0.6	5/ 8	0.3 U	0.1 U	0.2 U	2/15	0.3 U	0.1 U	0.2 U	1/10
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	7.6	0.6 U	5.4	12/14	9.5	1.9 L	9.1	8/ 8	38.5	10.2	15.9	16/16	82.1	5.9	9.0 U	10/11
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	184.0	65.3	115.0	14/14	223.0	24.3	209.0	8/ 8	33.1	15.4	25.1	16/16	11.2	0.1 L	0.7 J	8/11
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.5	0.0 J	0.0	13/14	0.7	0.0 L	0.5	8/ 8	0.4	0.0 U	0.1	15/16	0.0 U	0.0 U	0.0 U	2/11
NITRATE (AS N)	mg/l	25.0	5.1	6.7	5/ 5	14.1	13.0	13.6	2/ 2	0.1 J	0.0 U	0.1 U	4/ 7	0.4	0.0 U	0.1 J	3/ 5
NITRITE (ASN)	mg/l	0.1 U	0.0 U	0.0 U	0/ 4	0.1 U	0.0 U	0.1 U	0/ 2	0.1 U	0.0 U	0.0 U	0/ 6	0.1 U	0.0 U	0.0 U	0/ 4
SODIUM,DISSOLVED	mg/l	209.0	111.0	156.5	14/14	229.0	79.0	204.5	8/ 8	173.0	113.0	138.0	16/16	160.0	43.4	71.6	11/11
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.1 J	0.0 U	0.1	5/ 9	0.2 J	0.0 U	0.1 U	3/ 8	0.4	0.3	0.3 J	11/11	1.0	0.5	0.7	7/ 7
NICKEL,DISSOLVED	ug/l	65.0 U	8.0 U	23.6 U	3/14	111.0 J	13.0 J	32.5 U	6/ 8	40.0 U	8.0 U	18.0 U	0/16	65.0 U	8.0 U	24.0 U	1/11
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	9.7	1.0 U	2.0 U	1/13	5.0 P	1.5 U	2.0 U	1/ 8	40.0	1.0 U	2.0 L	3/15	52.0	1.0 U	3.8 P	5/10
LEAD TOTAL	ug/l																
PH - LAB	ug/l	7.5	6.6	7.0	3/ 3	7.9	7.9	7.9	1/ 1	8.5	8.1	8.4	4/ 4	12.3	11.4	11.9	2/ 2
PH - FIELD	ug/l	6.9	5.8	6.3	8/ 8	6.9	6.4	6.7	7/ 7	8.4	7.4	7.8	7/ 7	12.0	9.7	11.3	7/ 7
PHOSPHATE (TOTAL)	mg/l	10.0 P	0.1 U	0.1 U	0/ 3					0.2 U	0.1 U	0.1	1/ 4	0.2 U	0.1 U	0.1 U	0/ 3
PURGEABLE ORGANIC CARBON	mg/l	2.4	0.1 U	1.0 U	2/ 9	21.5	1.0 U	1.5	4/ 8	55.4	1.0 U	3.9	8/12	10.8	0.3	1.0 U	4/ 7
PURGEABLE ORGANIC HALOGENS	ug/l	200.0 U	5.0 U	6.9 J	2/ 8	30.0 P	5.0 P	5.0 P	1/ 7	2800.0 J	5.0 P	21.0 P	5/10	200.0 U	5.0 P	5.0 P	1/ 6
ANTIMONY,DISSOLVED	ug/l	190.0 U	2.6 L	25.0 U	2/13	128.0 J	2.0 U	8.9 U	1/ 8	60.0 U	2.0 U	25.0 U	0/15	190.0 U	3.0 U	48.0 U	2/10
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	3350.0	290.0	2605.0	8/ 8	3620.0	330.0	2815.0	6/ 6	990.0	800.0	900.0	9/ 9	1500.0	380.0	1135.0	8/ 8
SELENIUM,DISSOLVED	ug/l	50.0 U	2.0 P	3.7 U	2/11	5.0 U	2.0 U	2.0 P	0/ 7	50.0 U	2.0 J	3.7 U	1/13	5.0 U	2.0 U	2.1 P	0/ 9
TIN	ug/l	40.0 U	4.2 U	22.0 U	0/ 7	22.0 U	22.0 U	22.0 U	0/ 1	400.0	4.2 U	20.0 U	1/ 8	40.0 U	4.2 U	22.0 U	0/ 5
SULFATE	mg/l	325.0	14.0	71.5	10/10	450.0	12.7	340.0	8/ 8	58.9	1.4	15.9	10/12	71.0	1.3	4.1	8/ 8
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	2720.0	1.8	1960.0	9/ 9	2510.0	2.8	2300.0	8/ 8	631.0	0.4	524.0	11/11	1565.0	0.2	423.0	7/ 7
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	100.0 U	0.9 U	3.0 U	1/13	100.0 U	0.9 U	2.0 U	0/ 8	10.0 U	0.9 U	3.0 U	0/15	10.0 U	0.9 U	2.8 U	0/10
TEMPERATURE (DEG C)	ug/l	22.0	20.0	21.0	2/ 2	23.0	21.0	22.0	2/ 2	27.0	25.0	26.0	2/ 2	26.0	24.0	25.0	2/ 2
TOTAL ORGANIC CARBON	mg/l	13.9	2.0	3.1	9/ 9	5.8	1.6	4.6	8/ 8	5.5 J	1.0 J	1.0	8/12	7.9	1.0 U	1.9	6/ 7
TOTAL ORGANIC HALOGENS	ug/l	145.0 J	34.5 J	50.0	9/ 9	530.0 J	19.0 J	102.6	8/ 8	167.0 J	5.0 U	18.5 J	8/12	59.0	5.0 U	12.0 J	6/ 7
VANADIUM,DISSOLVED	ug/l	800.0 U	4.7 L	17.4 U	5/14	800.0 U	7.0 U	19.0 U	1/ 8	800.0 U	3.3 U	11.4 U	1/16	800.0 U	6.5 L	24.0 U	3/11
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	mg/l	0.1 J	0.0 J	0.0 J	12/14	0.0 J	0.0 J	0.0 J	5/ 8	5.2	0.0 J	0.0 U	11/16	0.1	0.0 L	0.0 J	7/11
ZINC TOTAL	ug/l																

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-04				SAMPLING LOCATION: OI-05				SAMPLING LOCATION: OI-06				SAMPLING LOCATION: OI-07C			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	100.0 U	5.0 U	15.0 U	5/14	11.0 J	2.9 J	5.1 L	7/16	17.0 J	2.8 U	6.1 L	4/12	12.0	4.0 U	5.0 U	1/ 3
ALUMINUM,DISSOLVED	ug/l	3.45E+04	4.00E+01 U	1.87E+03 J	11/16	263.0	19.0 L	110.0 U	11/17	1.97E+05	4.50E+01 J	2.29E+02	12/13	202.0	55.0 J	101.0 L	3/ 3
CARB ALKALINITY (AS CACO3)	mg/l	5.0 U	1.0 U	5.0 U	0/ 3	32.0	1.0 U	4.1	3/ 6	106.0	1.0 U	2.0 U	1/ 5	1.0 U	1.0 U	1.0 U	0/ 1
BICARB ALKALINITY (AS CACO3)	mg/l	2140.0	700.0	1.0 U	4/ 4	180.0	163.0	170.0	7/ 7	428.0	1.0 U	141.5	5/ 6	132.0	120.0	1.0 U	2/ 2
HYDROX ALKALINITY (AS CACO3)	mg/l	1.0 U	1.0 U	0.0	0/ 1	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	0.0	0/ 1
TOTAL ALKALINITY (AS CACO3)	mg/l	2140.0	32.0	844.0	6/ 6	180.0	169.0	170.0	7/ 7	205.0	1.0 U	152.0	7/ 8	132.0	96.0	120.0	3/ 3
ALUMINUM TOTAL	ug/l	3200.0	3100.0	3150.0	2/ 2												
ARSENIC,DISSOLVED	ug/l	69.0	6.0 U	26.6 J	13/16	10.0 U	2.0 U	6.1 U	1/17	50.0	4.2 L	8.3	10/13	10.0 P	2.0 U	2.0 U	0/ 3
ARSENIC TOTAL	ug/l	36.0	32.0	34.0	2/ 2												
BARIUM,DISSOLVED	ug/l	1520.0	10.0 U	705.0 J	15/16	220.0	63.0 J	86.0 J	15/17	2050.0	15.7 L	54.0	11/13	106.0 L	43.0 J	82.0 L	3/ 3
BARIUM TOTAL	ug/l	557.0	551.0	554.0	2/ 2												
BERYLLIUM,DISSOLVED	ug/l	20.0 U	1.5 U	5.0	3/14	5.5 U	0.4 U	1.3 U	3/16	5.5 U	0.9 J	2.0 U	3/12	2.1 U	1.4 J	1.5 U	1/ 3
BROMIDE	ug/l	71.0	71.0	71.0	2/ 2												
CALCIUM,DISSOLVED	mg/l	611.0	0.4	362.5	16/16	37.1	0.0	25.6	17/17	1420.0	0.1	80.0 J	13/13	26.2	16.9	21.2	3/ 3
CALCIUM TOTAL	ug/l	510.0	502.0	506.0	2/ 2												
CADMIUM,DISSOLVED	ug/l	49.0	2.2 J	4.0 U	6/14	6.0	0.3 J	3.3 U	4/16	9.8	0.2 U	3.3 U	2/12	4.0 U	2.4 U	4.0 U	0/ 3
CHLORIDE	mg/l	7800.0	4670.0	5040.0	10/10	47.9	4.3	43.1	9/ 9	85.2	8.2	62.0	10/10	82.9	53.0	65.0	3/ 3
CYANIDE	ug/l	2730.0	59.0 J	181.0	16/16	10.0 U	3.7 U	10.0 U	0/16	10.0 U	3.7 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 3
COBALT,DISSOLVED	ug/l	160.0 U	37.0 L	105.0	14/16	50.0 U	3.8 U	13.0 U	0/17	342.0	3.8 U	18.9 U	4/13	18.9 U	9.0 U	13.0 U	0/ 3
COBALT TOTAL	ug/l	70.0	70.0	70.0	2/ 2												
CHROMIUM,DISSOLVED	ug/l	120.0 U	7.2 U	25.0 U	8/16	10.0 U	2.2 U	7.0 U	2/17	216.0	3.4 U	7.2 U	5/13	7.2 U	4.0 U	4.0 U	0/ 3
COPPER,DISSOLVED	ug/l	160.0 U	6.0 U	109.0	13/16	25.0 U	1.7 U	8.0 U	5/17	543.0	6.0 U	15.4 L	7/13	11.1 U	6.0 U	8.7 J	1/ 3
COPPER TOTAL	ug/l	131.0	114.0	122.5	2/ 2												
FREE CYANIDE	ug/l	40.0	20.0	30.0	2/ 2												
IRON,DISSOLVED	mg/l	55.4	0.0 L	1.5	14/16	0.3	0.0 L	0.2	15/17	160.0	0.0 J	0.1 P	9/13	0.3	0.0 U	0.2	2/ 3
IRON TOTAL	ug/l	22.3	17.0	19.7	2/ 2												
FLUORIDE	mg/l	10.0	0.3 L	0.6	10/10	1.1	0.6	0.7	9/ 9	0.8	0.3	0.6	10/10	1.2	1.0	1.1	3/ 3
GROSS ALPHA ACTIVITY	ug/l	76.0	75.0	75.5	2/ 2												
GROSS BETA ACTIVITY	ug/l	254.0	219.0	236.5	2/ 2												
MERCURY,DISSOLVED	ug/l	1.8 J	0.1 U	0.3	7/13	0.3 U	0.1 U	0.2 U	1/16	38.5 J	0.1 U	0.2 U	5/13	0.3 U	0.1 U	0.2 U	0/ 3
IODINE DISSOLVED	ug/l	2.4	2.3	2.4	2/ 2												
POTASSIUM,DISSOLVED	mg/l	264.0	64.7	185.0	16/16	56.4	13.9	22.1	17/17	45.6	3.9 L	6.9	13/13	3.6 J	2.5 L	2.9 L	3/ 3
POTASSIUM TOTAL	ug/l	186.0	182.0	0.6	2/ 2												
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l	0.6	0.6	0.0	1/ 1												
MAGNESIUM,DISSOLVED	mg/l	525.0	17.5	424.0	16/16	110.0	4.7 J	9.5	17/17	166.0	0.2	5.5	12/13	14.6	10.3	12.1	3/ 3
MAGNESIUM TOTAL	ug/l	553.0	545.0	549.0	2/ 2												
MANGANESE,DISSOLVED	mg/l	7.2	1.2	3.1	16/16	0.1 J	0.0 J	0.0	16/17	11.5	0.0 J	0.0	13/13	0.3	0.1 J	0.3	3/ 3
NITRATE (AS N)	mg/l	468.0	250.0 J	375.0 J	6/ 6	0.1 U	0.0 U	0.1 U	0/ 7	0.9	0.0 U	0.9	5/ 6	1.1	1.1	1.1	1/ 1
NITRITE (ASN)	mg/l	1.3	0.6 U	0.9	2/ 4	0.2	0.0 U	0.1 U	1/ 5	0.1 U	0.0 U	0.0 U	0/ 5	0.0 U	0.0 U	0.0 U	0/ 1
SODIUM,DISSOLVED	mg/l	3360.0	308.0	2750.5	16/16	85.3	50.0	54.1	17/17	111.3	79.4	95.5	13/13	54.7	44.4	52.7 J	3/ 3
SODIUM TOTAL	ug/l	3120.0	3070.0	3095.0	2/ 2												
AMMONIA NITROGEN (AS N)	mg/l	44.0	1.0	30.7	8/ 8	0.7	0.1 J	0.6	7/ 7	0.7	0.0	0.1 U	6/ 9	0.1 U	0.0 U	0.1 U	0/ 3
NICKEL,DISSOLVED	ug/l	520.0	12.4 L	425.5	16/16	40.0 U	8.0 U	16.0 U	0/17	376.0	8.0 U	25.8	4/13	64.3	8.0 U	24.0 U	1/ 3
NICKEL TOTAL	ug/l	460.0	450.0	455.0	2/ 2												
LEAD,DISSOLVED	ug/l	140.0 J	1.2 U	6.0 P	9/14	8.6	1.0 U	2.4 U	2/15	4860.0	1.0 U	3.3 L	6/12	5.0 U	2.0 L	2.0 U	1/ 3
LEAD TOTAL	ug/l	11.0	11.0	11.0	2/ 2												
PH - LAB	ug/l	7.0	7.0	7.0	1/ 1	8.4	8.3	8.4	2/ 2	7.5	1.6	4.6	2/ 2	7.3	7.3	7.3	1/ 1
PH - FIELD	ug/l	6.7	6.3	6.5	4/ 4	8.6	7.8	8.1	7/ 7	7.5	6.9	7.2	7/ 7	8.1	6.7	7.1	5/ 5
PHOSPHATE (TOTAL)	ug/l	10.0 P	0.1 U	0.3 U	0/ 6	0.2 U	0.1 U	0.2 U	0/ 3	4.0	0.1 U	0.4	2/ 3				
PURGEABLE ORGANIC CARBON	mg/l	18.0	1.0 U	2.6	8/ 9	1.0 P	0.1 J	1.0 U	3/ 9	20.7	0.1 J	1.0 U	3/ 9	1.0 U	0.0 U	1.0 P	0/ 3
PURGEABLE ORGANIC HALOGENS	ug/l	200.0 U	14.0 J	120.0 J	4/ 7	380.0 J	5.0 P	55.0 J	2/ 8	200.0 U	5.0 P	24.0 P	3/ 8	30.0 P	5.0 P	5.0 P	0/ 3
ANTIMONY,DISSOLVED	ug/l	760.0 U	7.8 L	82.0	7/14	60.0 U	2.0 U	38.0 U	1/16	60.0 U	3.0 U	31.5 U	2/12	44.1 U	2.7 L	25.0 U	1/ 3
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	2.36E+04	2.00E+00 U	4.02E+03	6/ 8	550.0	460.0	495.0	6/ 6	880.0	600.0	745.0	8/ 8	470.0	400.0	432.5	4/ 4
SELENIUM,DISSOLVED	ug/l	68.0	2.1 P	7.0 U	3/10	28.0	2.0 U	3.7 U	3/14	28.0 U	2.7 L	5.3 J	8/11	5.0 P	3.1 L	4.1 P	1/ 2
TIN	ug/l	400.0 P	4.2 U	34.0 U	1/ 7	400.0	4.2 U	22.0 U	2/ 9	400.0 P	10.0 U	22.0 U	0/ 5	22.0 U	22.0 U	22.0 U	0/ 1
SULFATE	mg/l	631.0	280.0 J	378.5 J	10/10	76.4	4.1	37.8	9/ 9	426.0	111.0	175.0 J	10/10	21.0	18.6	20.0	3/ 3
STRONTIUM TOTAL	ug/l	7.5	7.4	7.5	2/ 2												
TOTAL DISSOLVED SOLIDS	mg/l	1.63E+04	1.51E+01	1.30E+04	8/ 8	359.0	0.4	319.0	9/ 9	704.0	0.5	479.0	9/ 9	499.0	0.1 U	266.0	2/ 3
TITANIUM DISSOLVED	ug/l	11.0	10.0	10.5	2/ 2												
TITANIUM TOTAL	ug/l	271.0	261.0	266.0	2/ 2												
THALLIUM,DISSOLVED	ug/l	100.0 U	0.7 U	3.7 U	0/14	10.0 P	0.9 U	2.6 U	0/15	10.0 U	0.9 U	2.3 U	0/12	10.0 P	2.0 U	2.0 P	0/ 3
TEMPERATURE (DEG C)	ug/l	24.5	24.5	24.5	1/ 1	27.0	23.0	25.0	2/ 2	25.0	22.5	23.8	2/ 2	21.0	21.0	21.0	1/ 1
TOTAL ORGANIC CARBON	mg/l	520.0	104.0 J	236.0	7/ 7	4.2 J	1.0 U	1.3	6/ 9	8.8	1.0 P	3.2	8/ 9	2.6	1.0 P	2.0	2/ 3
TOTAL ORGANIC HALOGENS	ug/l	3.60E+05 J	1.04E+03 J	2.00E+03	9/ 9	12.0	2.2	10.0 P	7/ 9	454.0	21.0	26.4 J	9/ 9	16.0 J	5.0 P	16.0 J	2/ 3
VANADIUM,DISSOLVED	ug/l	197.5	35.0 U	84.0	11/16	50.0 U	3.3 U	7.0 U	4/17	800.0 U	14.6 L	50.0 U	9/13	24.0 U	7.0 U	14.0 U	0/ 3
VANADIUM TOTAL	ug/l	187.0	166.0	176.5	2/ 2												
ZINC,DISSOLVED	mg/l	0.4	0.0	0.2	16/16	0.1	0.0 U	0.0 J	12/17	1.4	0.0 J	0.0 J	10/13	0.1	0.0 U	0.0	2/ 3
ZINC TOTAL	ug/l	0.2	0.1	0.2	2/ 2												

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-08A				SAMPLING LOCATION: OI-09A				SAMPLING LOCATION: OI-10A				SAMPLING LOCATION: OI-10B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	10.0 U	2.7 U	6.3 U	1/ 8	10.0 U	2.7 U	6.3 U	0/ 6	10.0 U	4.0 U	6.7 L	2/ 6	30.0 J	4.0 U	10.0 U	3/ 6
ALUMINUM,DISSOLVED	ug/l	2420.0	40.0 U	146.5 P	5/ 8	516.0 J	16.4 U	134.6 P	4/ 6	500.0 J	37.9 L	108.5 L	4/ 6	370.0	16.4 U	120.0 P	2/ 6
CARB ALKALINITY (AS CACO3)	mg/l	5.0 U	1.0 U	2.0 U	0/ 5	5.0 U	1.0 U	2.0 U	0/ 3	5.0 U	2.0 U	4.0	1/ 3	5.0 U	1.0 U	2.0 U	0/ 3
BICARB ALKALINITY (AS CACO3)	mg/l	144.0	85.9	1.0 U	6/ 6	91.0	69.2	1.0 U	4/ 4	102.0	90.0	1.0 U	4/ 4	132.0	99.0	1.0 U	4/ 4
HYDROX ALKALINITY (AS CACO3)	mg/l	1.0 U	1.0 U	0.0	0/ 1	1.0 U	1.0 U	0.0	0/ 1	1.0 U	1.0 U	0.0	0/ 1	1.0 U	1.0 U	0.0	0/ 1
TOTAL ALKALINITY (AS CACO3)	mg/l	144.0	85.9	99.2	8/ 8	91.0	69.2	72.8	6/ 6	102.0	90.0	98.8	6/ 6	132.0	99.0	102.0	6/ 6
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	10.0 U	2.0 U	2.4 L	3/ 8	10.0 P	2.0 U	2.0 U	0/ 6	10.0 P	2.0 U	2.0 L	2/ 6	10.0 U	2.0 U	2.0 U	0/ 6
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	200.0 U	10.0 U	20.4 J	4/ 8	200.0 U	15.0 J	41.0 L	4/ 6	200.0 U	30.1 L	67.0 L	4/ 6	339.0	198.0 J	239.0	6/ 6
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	5.5 U	0.3 U	1.8 U	1/ 8	5.5 U	0.8 L	1.8 U	1/ 6	5.5 U	0.8 L	1.8 U	1/ 6	5.5 U	0.8 L	1.8 U	1/ 6
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	19.5	13.3	16.0	8/ 8	30.4	21.6 J	26.5	6/ 6	26.6	23.9	25.3	6/ 6	106.0	80.2	87.3	6/ 6
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	6.0	2.4 U	4.2 J	3/ 8	6.0	2.4 U	4.0 U	1/ 6	5.0 U	2.4 U	4.0 U	0/ 6	8.7 J	2.4 U	4.0 U	2/ 6
CHLORIDE	mg/l	32.9	29.0	30.2	8/ 8	148.0	72.0	113.5	6/ 6	52.8	48.3	50.1	6/ 6	483.0	321.0	409.5	6/ 6
CYANIDE	ug/l	10.0 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 6	10.0 U	10.0 U	10.0 U	0/ 6	10.0 U	10.0 U	10.0 U	1/ 6
COBALT,DISSOLVED	ug/l	50.0 U	3.8 U	14.0 U	1/ 8	50.0 U	4.6 L	14.3 L	2/ 6	50.0 U	3.8 U	14.0 U	0/ 6	50.0 U	3.8 U	15.9 U	1/ 6
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	39.4 J	3.4 U	6.8 U	3/ 8	45.0 J	4.0 U	8.6 U	3/ 6	39.4 J	3.4 U	5.6 U	1/ 6	49.2 J	3.4 U	6.9 U	2/ 6
COPPER,DISSOLVED	ug/l	25.0 U	6.0 U	11.7 L	5/ 8	25.0 U	6.0 U	10.6 U	3/ 6	25.0 U	6.0 U	11.1 U	2/ 6	25.0 U	5.8 L	11.1 U	3/ 6
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	4.8	0.0 U	0.1 J	5/ 8	0.4	0.0 U	0.2	4/ 6	0.6 J	0.0 L	0.2 J	6/ 6	0.6 J	0.0 U	0.1 U	3/ 6
IRON TOTAL	ug/l																
FLUORIDE	mg/l	0.8	0.5	0.6	8/ 8	0.8	0.7 L	0.7	6/ 6	0.7	0.5 L	0.6 L	6/ 6	1.1	0.4 L	0.5	6/ 6
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.3 U	0.1 U	0.2 U	0/ 8	0.3 U	0.1 U	0.2 U	0/ 6	0.3 U	0.1 U	0.2 U	0/ 6	0.3 U	0.1 U	0.3	2/ 6
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	5.0 U	2.0 L	2.4 L	7/ 8	5.0 U	2.4 L	3.1 J	5/ 6	5.0 U	2.2 L	2.7 J	5/ 6	5.0 U	3.7 J	4.5 L	5/ 6
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	12.1	6.9	8.9	8/ 8	18.3	11.7	15.3	6/ 6	8.5	6.3	7.2	6/ 6	78.8	54.1	64.9	6/ 6
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.1	0.0 J	0.0	8/ 8	0.1	0.0 J	0.0	5/ 6	0.1 J	0.0 J	0.0	6/ 6	0.1 J	0.0 J	0.0	6/ 6
NITRATE (AS N)	mg/l	3.0	2.5	2.8	2/ 2	2.2	1.8	2.0	2/ 2	0.0 U	0.0 U	0.0 U	0/ 2	9.7	8.6	9.1	2/ 2
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2
SODIUM,DISSOLVED	mg/l	42.5	35.3	41.1	8/ 8	80.2	60.4	67.2 J	6/ 6	42.6 J	36.1	41.8	6/ 6	102.0	88.0	97.7	6/ 6
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.1	0.0 P	0.0 U	1/ 8	0.5 U	0.0 P	0.0 U	1/ 6	0.3	0.2	0.2	6/ 6	0.1 U	0.0	0.0 U	3/ 6
NICKEL,DISSOLVED	ug/l	59.4	13.0 J	23.7 U	7/ 8	301.0	14.0 J	173.5	6/ 6	41.4 J	8.0 U	19.0 U	1/ 6	284.0	17.0 J	207.0	6/ 6
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	7.5 J	1.5 U	2.0 U	2/ 8	5.0 U	1.5 U	2.0 U	0/ 6	5.0 U	1.5 U	2.0 U	0/ 6	5.0 P	1.5 U	2.0 U	1/ 6
LEAD TOTAL	ug/l																
PH LAB	ug/l	7.2	7.2	7.2	1/ 1	7.5	7.5	7.5	1/ 1	8.4	8.4	8.4	1/ 1	7.1	7.1	7.1	1/ 1
PH - FIELD	ug/l	8.3	6.5	7.3	8/ 8	7.3	6.6	7.1	8/ 8	8.9	7.2	7.8	8/ 8	7.0	6.5	6.7	8/ 8
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	18.4	1.0 P	1.0 U	3/ 8	11.5	1.0 U	1.0 U	1/ 6	10.8	0.0 U	1.0 U	1/ 7	15.4	1.0 U	1.0 P	2/ 7
PURGEABLE ORGANIC HALOGENS	ug/l	30.0 P	5.0 U	5.0 P	0/ 7	56.0 J	5.0 P	5.0 P	1/ 5	30.0 P	5.0 U	5.0 P	1/ 6	30.0 P	5.0 P	11.5 J	3/ 6
ANTIMONY,DISSOLVED	ug/l	60.0 P	2.0 U	14.7 U	0/ 8	60.0 P	2.0 U	19.9 U	0/ 6	60.0 P	2.0 U	19.9 U	0/ 6	60.0 P	2.6 L	19.9 U	1/ 6
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	350.0	240.0	330.0	7/ 7	730.0	395.0	560.0	7/ 7	420.0	253.0	385.0	7/ 7	1810.0	990.0	1440.0	7/ 7
SELENIUM,DISSOLVED	ug/l	50.0 U	2.0 P	2.0 P	0/ 7	50.0 P	2.3 L	3.1 L	3/ 5	50.0 P	2.0 P	2.0 U	0/ 6	50.0 U	2.0 P	2.0 P	0/ 6
TIN	ug/l	22.0 U	22.0 U	22.0 U	0/ 1	22.0 U	22.0 U	22.0 U	0/ 1	22.0 U	22.0 U	22.0 U	0/ 1	22.0 U	22.0 U	22.0 U	0/ 1
SULFATE	mg/l	62.7	16.9	17.3	8/ 8	70.1	16.3	26.5	6/ 6	29.7	26.7	28.6	6/ 6	15.3	12.3	14.6	6/ 6
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	504.0	0.2	215.5	8/ 8	488.0	0.4	386.5	6/ 6	351.0	0.4 J	215.5	6/ 6	1320.0	1.2	869.0	6/ 6
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	10.0 U	0.9 U	2.0 P	0/ 8	100.0 P	0.9 U	2.0 U	0/ 6	100.0 P	0.9 U	2.0 U	1/ 6	10.0 U	0.9 U	2.0 U	0/ 6
TEMPERATURE (DEG C)	ug/l	24.0	22.0	23.0	2/ 2	23.5	21.0	22.3	2/ 2	30.0	23.0	26.5	2/ 2	28.0	21.0	24.5	2/ 2
TOTAL ORGANIC CARBON	mg/l	6.9	1.0	2.3	7/ 8	2.8	1.0 U	1.1	3/ 6	10.0 U	1.0 U	1.0 P	1/ 7	2.0 U	1.0 U	1.0 U	3/ 7
TOTAL ORGANIC HALOGENS	ug/l	50.0 U	5.0 U	12.6 J	4/ 8	18.0 J	4.0 J	7.8	4/ 6	44.0 J	5.0 P	8.2 J	6/ 7	37.0 J	9.0	14.0 J	7/ 7
VANADIUM,DISSOLVED	ug/l	800.0 U	5.8 L	19.0 U	3/ 8	800.0 U	3.5 L	19.0 U	1/ 6	800.0 U	3.3 U	19.0 U	0/ 6	800.0 U	4.4 L	19.0 U	1/ 6
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	mg/l	0.1 J	0.0 L	0.0 L	5/ 8	0.0	0.0 L	0.0	5/ 6	0.0 J	0.0 U	0.0 L	3/ 6	0.0 J	0.0 U	0.0 L	3/ 6
ZINC TOTAL	ug/l																

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-13B				SAMPLING LOCATION: OI-13C				SAMPLING LOCATION: OI-14C				SAMPLING LOCATION: OI-15A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	10.0 U	3.1 L	6.3 P	1/ 8	10.0 U	4.0 U	6.0 L	1/ 3	9.3 L	4.0 U	6.7 L	1/ 2	7.0 L	4.0 U	5.5 L	1/ 2
ALUMINUM,DISSOLVED	ug/l	915.0	40.0 U	479.0 J	6/ 8	3.58E+04	2.70E+01 U	4.69E+01 L	2/ 3	128.0 L	63.3 L	95.7 L	2/ 2	96.0 L	62.4 L	79.2 L	2/ 2
CARB ALKALINITY (AS CACO3)	ug/l	328.0	170.0	268.0	5/ 5												
BICARB ALKALINITY (AS CACO3)	ug/l	390.0	1.0 U	400.0	2/ 5												
HYDROX ALKALINITY (AS CACO3)	ug/l	400.0	400.0	0.0	1/ 1												
TOTAL ALKALINITY (AS CACO3)	mg/l	721.0	485.0	564.0	8/ 8	72.2	53.6	69.4	3/ 3	185.0	179.0	182.0	2/ 2	378.0	369.0	373.5	2/ 2
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	24.0 J	5.9 L	8.9 L	8/ 8	2.4 L	2.0 U	2.0 P	1/ 3	2.0 P	2.0 P	2.0 U	0/ 2	16.3	12.3 J	14.3	2/ 2
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	200.0 U	10.0 U	47.0 J	3/ 8	200.0 U	10.5 L	24.0 U	1/ 3	94.3 L	92.0 L	93.2 L	2/ 2	54.0 L	52.0 L	53.0 L	2/ 2
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	5.5 U	0.8 L	1.8 U	2/ 8	5.5 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	5.8 J	0.0 L	4.1 L	7/ 8	14.3	11.5	13.5	3/ 3	36.3	35.2	35.8	2/ 2	32.9	32.0	32.5	2/ 2
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	11.0	2.4 U	4.7 U	3/ 8	5.0 U	3.9 U	4.0 U	0/ 3	5.0 U	4.0 U	4.5 U	0/ 2	4.0 U	3.9 U	4.0 U	0/ 2
CHLORIDE	mg/l	130.0	60.0	66.9	8/ 8	64.3	26.1	61.6	3/ 3	58.1	53.9	56.0	2/ 2	76.5	72.0	74.3	2/ 2
CYANIDE	ug/l	10.0 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 2	12.6	10.0 U	11.3	1/ 2
COBALT,DISSOLVED	ug/l	50.0 U	3.8 U	15.9 U	1/ 8	50.0 U	9.0 U	10.0 U	0/ 3	10.0 U	9.0 U	9.5 U	0/ 2	11.0 L	10.0 U	10.5 L	1/ 2
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	31.4 J	3.4 U	7.4 L	2/ 8	56.5	4.0 L	6.0 U	2/ 3	6.0 U	3.0 U	4.5 U	0/ 2	6.0 U	3.0 U	4.5 U	0/ 2
COPPER,DISSOLVED	ug/l	25.8 L	6.0 U	15.6 J	3/ 8	39.3	5.3 L	20.0 L	3/ 3	17.7 L	3.0 U	10.4 L	1/ 2	6.0 U	3.0 P	4.5 U	0/ 2
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	1.0 J	0.0 U	0.2 J	6/ 8	63.4	0.0 U	0.0 L	2/ 3	0.0 L	0.0 L	0.0 L	2/ 2	0.1 L	0.0 L	0.0 L	2/ 2
IRON TOTAL	ug/l																
FLUORIDE	mg/l	1.1	0.4 L	0.4	8/ 8	0.9 L	0.6 L	0.8 L	3/ 3	0.7 L	0.5 L	0.6 L	2/ 2	891.0 L	0.8 L	445.9 L	2/ 2
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	1.3	0.1 U	0.2 U	3/ 8	1.3	0.3 U	0.3 P	1/ 3	0.3 U	0.3 U	0.3 U	0/ 2	0.3 P	0.3 P	0.3 U	0/ 2
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	79.9	5.7	7.7	8/ 8	5.0 U	1.9 L	5.0 U	1/ 3	5.0 U	3.3 L	4.1 U	1/ 2	9.7	8.2	9.0	2/ 2
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	5.0 U	0.1 U	0.1 U	1/ 8	20.7	10.4	10.6	3/ 3	15.7	15.2	15.5	2/ 2	29.9	29.8	29.9	2/ 2
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.0 J	0.0 U	0.0 P	3/ 8	0.5	0.1	0.1 J	3/ 3	0.1	0.1	0.1	2/ 2	0.2	0.2 J	0.2	2/ 2
NITRATE (AS N)	mg/l	0.1	0.0 U	0.1	2/ 3	5.7	3.3	4.3	3/ 3	0.2	0.0 U	0.1	1/ 2	0.0 U	0.0 U	0.0 U	0/ 2
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2	0.5	0.1 U	0.3	1/ 2
SODIUM,DISSOLVED	mg/l	302.0 J	216.0	252.0	8/ 8	46.3	31.3	42.0	3/ 3	63.4	60.0	61.7	2/ 2	138.0	117.0	127.5	2/ 2
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	64.5	1.6 J	4.2	8/ 8	42.2 J	0.0 U	0.0	2/ 3	0.4 J	0.3	0.3 J	2/ 2	0.5	0.5	0.5	2/ 2
NICKEL,DISSOLVED	ug/l	50.4 J	8.0 U	19.0 U	1/ 8	40.0 U	28.0 L	31.0 U	1/ 3	31.0 U	15.0 U	23.0 U	0/ 2	31.0 U	17.0 L	24.0 U	1/ 2
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	6.9	2.0 U	2.1 L	3/ 8	10.9	2.0 U	2.0 U	1/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2
LEAD TOTAL	ug/l																
PH - LAB	ug/l	11.9	11.9	11.9	1/ 1												
PH - FIELD	ug/l	12.1	9.1	9.9	7/ 7	7.1	6.9	7.0	3/ 3	7.6	7.2	7.6	3/ 3	8.1	7.6	7.9	3/ 3
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	4.0	1.0 P	1.0 U	3/ 8	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 3
PURGEABLE ORGANIC HALOGENS	ug/l	30.0 P	5.0 P	15.0 J	1/ 6	51.2 J	5.0 U	28.1 J	1/ 2	6.0	5.0 U	5.0 U	1/ 3	59.8 J	5.0 U	6.0 J	2/ 3
ANTIMONY,DISSOLVED	ug/l	60.0 U	2.0 U	19.9 U	1/ 8	60.0 U	20.2 U	21.0 U	0/ 3	54.0 U	21.0 P	37.5 U	0/ 2	21.0 U	20.2 U	20.6 U	0/ 2
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	1800.0	980.0	1070.0	7/ 7	345.0	340.0	340.0	3/ 3	550.0	500.0	530.0	3/ 3	850.0	770.0	800.0	3/ 3
SELENIUM,DISSOLVED	ug/l	5.0 P	2.0 U	2.0 U	0/ 8	4.0 U	2.2	2.2 L	2/ 3	2.0	2.0	2.0 P	1/ 2	2.0	2.0	2.0 U	1/ 2
TIN	ug/l	22.0 U	22.0 U	22.0 U	0/ 1												
SULFATE	mg/l	41.0	4.3	5.8	8/ 8	9.5	9.4	9.4 J	3/ 3	57.0	44.9	51.0	2/ 2	51.3	38.7	45.0	2/ 2
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	929.0	0.9	691.0	8/ 8	300.0	200.0	241.0	3/ 3	400.0	400.0	400.0 J	2/ 2	600.0	500.0	550.0	2/ 2
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	10.0 P	0.9 U	2.0 U	0/ 8	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2
TEMPERATURE (DEG C)	ug/l	23.0	19.0	21.0	2/ 2	23.5	22.0	23.0	3/ 3	26.0	24.5	24.5	3/ 3	25.0	22.0	24.0	3/ 3
TOTAL ORGANIC CARBON	mg/l	49.7 J	5.0	12.3	8/ 8	57.5	1.0 U	1.4 L	2/ 3	2.0 U	1.0 U	1.0 U	0/ 3	3.1	2.5	3.0 J	3/ 3
TOTAL ORGANIC HALOGENS	ug/l	71.0 J	3.2	12.5 J	7/ 8	162.0 I	5.0 U	10.2 J	2/ 3	30.2 J	5.0 U	11.0 J	2/ 3	892.0	34.4	408.0	3/ 3
VANADIUM,DISSOLVED	ug/l	800.0 U	10.6 L	26.8 J	4/ 8	169.0	5.0 U	18.0 U	1/ 3	18.0 U	5.0 U	11.5 U	0/ 2	18.0 U	5.0 U	11.5 U	0/ 2
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	ug/l	49.7	0.0 U	0.0 U	3/ 8	0.1	0.0 I	0.0 I	3/ 3	0.0 U	0.0 L	0.0 U	1/ 2	21.0	20.4 J	20.7	2/ 2
ZINC TOTAL	ug/l																

TABLE 6-16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI-15B				SAMPLING LOCATION: OI-16A				SAMPLING LOCATION: OI-17A				SAMPLING LOCATION: OI-17B			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	15.0 J	4.0 U	12.0 J	2/ 3	33.0 J	4.0 U	18.5 J	1/ 2	10.0 U	4.0 U	4.0 U	0/ 3	14.0 J	4.0 U	4.0 U	1/ 3
ALUMINUM,DISSOLVED	ug/l	101.0 L	79.3 L	89.0 L	3/ 3	361.0	205.0	283.0	2/ 2	200.0 U	94.5 L	105.0 L	2/ 3	175.0 L	79.0 L	83.5 L	3/ 3
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	404.0	388.0	392.0	3/ 3	741.0	707.0	724.0	2/ 2	517.0	175.0	474.0	3/ 3	123.0	116.0	122.0	3/ 3
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	2.0 P	2.0 P	2.0 U	0/ 3	5.4 L	3.5 L	4.5 L	2/ 2	90.5	32.7	39.0	3/ 3	2.0 P	2.0 P	2.0 U	0/ 3
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	430.0	424.0	425.0	3/ 3	234.0	213.0	223.5	2/ 2	200.0 U	29.7 L	33.2 L	2/ 3	47.0 L	44.3 L	45.2 L	3/ 3
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2	5.5 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 3
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	46.0	45.3	45.9	3/ 3	154.0	138.0	146.0	2/ 2	53.9	25.6	45.3	3/ 3	46.7	45.7	46.0	3/ 3
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	4.0 U	3.9 U	3.9 U	0/ 3	5.0 U	4.0 U	4.5 U	0/ 2	5.0 U	4.0 U	4.0 U	0/ 3	4.0 U	3.9 U	4.0 U	0/ 3
CHLORIDE	mg/l	58.3	54.8	56.5	3/ 3	84.5	76.1	80.3	2/ 2	119.0	65.2	110.0	3/ 3	97.3	91.9	96.7	3/ 3
CYANIDE	ug/l	10.2	10.0 U	10.0 U	1/ 3	10.0 U	10.0 U	10.0 U	0/ 2	16.6	10.0 U	10.0 U	1/ 3	10.0 U	10.0 U	10.0 U	0/ 3
COBALT,DISSOLVED	ug/l	14.0 L	9.0 U	10.0 U	1/ 3	17.0 L	10.0 U	13.5 L	1/ 2	50.0 U	10.0 U	10.0 U	0/ 3	10.0 U	9.0 U	10.0 U	0/ 3
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	6.0 U	3.0 U	5.0 L	1/ 3	6.0 U	3.7 L	4.8 U	1/ 2	10.0 U	6.0 U	6.0 U	0/ 3	6.0 U	3.0 U	6.0 U	0/ 3
COPPER,DISSOLVED	ug/l	6.0 U	5.2 L	6.0 U	1/ 3	12.3 L	3.0 U	7.7 L	1/ 2	25.0 U	3.0 U	5.2 L	1/ 3	7.0 L	3.0 U	3.0 U	1/ 3
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	0.0 L	0.0 U	0.0 L	2/ 3	1.3	0.4	0.8	2/ 2	2.2	0.0 L	0.0 L	3/ 3	2.6	2.6	2.6	3/ 3
IRON TOTAL	ug/l																
FLUORIDE	mg/l	0.5 L	0.5 L	0.5 L	3/ 3	0.4 L	0.3 L	0.4 L	2/ 2	0.5 L	0.1 L	0.5 L	3/ 3	0.6 L	0.6 L	0.6 L	3/ 3
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.3 U	0.3 U	0.3 U	0/ 3	0.3 U	0.3 U	0.3 U	0/ 2	0.5 J	0.2	0.3 P	2/ 3	0.3 U	0.3 U	0.3 U	0/ 3
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	7.1	5.8	5.8	3/ 3	24.0	22.0	23.0	2/ 2	6.2	5.0 U	5.9	2/ 3	5.0 U	3.6 L	3.6 L	2/ 3
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	57.7	53.9	57.6	3/ 3	55.1	51.8	53.5	2/ 2	73.4	22.2	67.7	3/ 3	27.2	25.9	26.0	3/ 3
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.1	0.0	0.1	3/ 3	1.6	1.5	1.5	2/ 2	0.3	0.3	0.3	3/ 3	0.3	0.3	0.3	3/ 3
NITRATE (AS N)	mg/l	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2	1.2	0.1 L	0.2	3/ 3	0.0 U	0.0 U	0.0 U	0/ 3
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2	1.1	0.0 U	0.9	2/ 3	0.0 U	0.0 U	0.0 U	0/ 3
SODIUM,DISSOLVED	mg/l	87.2	78.0 U	78.0 U	1/ 3	86.5	81.0	83.8	2/ 2	138.0	63.3	133.0	3/ 3	57.4	54.0	57.3	3/ 3
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	1.2	1.1 J	1.1 J	3/ 3	0.6 J	0.5	0.5 J	2/ 2	0.2 J	0.1 L	0.1	3/ 3	0.1 J	0.1 L	0.1 L	3/ 3
NICKEL,DISSOLVED	ug/l	31.0 U	15.0 U	15.0 U	0/ 3	31.0 U	15.0 U	23.0 U	0/ 2	40.0 U	31.0 U	31.0 U	0/ 3	31.0 U	15.0 U	31.0 U	0/ 3
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.1 L	2.0 U	2.0 U	1/ 3	2.0 U	2.0 U	2.0 U	0/ 3
LEAD TOTAL	ug/l																
PH - LAB	ug/l																
PH - FIELD	ug/l	8.1	7.7	7.9	3/ 3	7.6	6.4	6.6	3/ 3	7.3	6.8	7.1	3/ 3	6.9	6.5	6.8	3/ 3
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	5.7	1.3	1.5	4/ 4	1.0 U	1.0 U	1.0 U	0/ 3	6.2 J	1.3	3.5 J	4/ 4	4.3 J	1.0 U	1.0 U	1/ 4
PURGEABLE ORGANIC HALOGENS	ug/l	3640.0	5.0 U	12.7 J	3/ 4	36.6	7.4	19.0 J	3/ 3	1390.0	1050.0	1154.0 J	4/ 4	26.0	5.0 U	5.0 U	1/ 4
ANTIMONY,DISSOLVED	ug/l	21.0 U	20.2 U	20.2 U	0/ 3	54.0 U	21.0 P	37.5 U	0/ 2	60.0 U	21.0 U	21.0 U	0/ 3	21.0 P	20.2 U	21.0 P	0/ 3
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	810.0	750.0	800.0	3/ 3	1330.0	1250.0	1280.0	3/ 3	1190.0	1150.0	1170.0	3/ 3	680.0	620.0	630.0	3/ 3
SELENIUM,DISSOLVED	ug/l	2.0	2.0	2.0 U	2/ 3	2.0 P	2.0 P	2.0	1/ 2	2.0 P	2.0 P	2.0 U	0/ 3	2.0 P	2.0 P	2.0 P	1/ 3
TIN	ug/l																
SULFATE	mg/l	144.0 J	133.0	138.0	3/ 3	20.2	16.7	18.5	2/ 2	88.4	12.8	87.9 J	3/ 3	103.0	98.7	102.0	3/ 3
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	800.0	600.0	600.0 J	3/ 3	900.0 J	800.0	850.0 J	2/ 2	800.0	365.0	800.0	3/ 3	500.0 J	300.0	400.0 J	3/ 3
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 3
TEMPERATURE (DEG C)	ug/l	24.0	23.0	23.0	3/ 3	25.0	22.0	25.0	3/ 3	23.5	22.0	22.5	3/ 3	24.5	23.0	23.0	3/ 3
TOTAL ORGANIC CARBON	mg/l	4.1	1.0 U	1.7 U	2/ 4	31.3	2.6	12.0	3/ 3	24.0	3.1	11.9	5/ 5	2.0 U	1.0 U	1.0 U	0/ 4
TOTAL ORGANIC HALOGENS	ug/l	42.0 J	5.0 J	9.9	4/ 4	4140.0	151.0 J	533.0	3/ 3	1340.0 J	56.0 J	209.0 J	5/ 5	43.0 J	5.0 U	17.5	2/ 4
VANADIUM,DISSOLVED	ug/l	18.0 U	5.0 U	18.0 U	0/ 3	18.0 U	5.0 U	11.5 U	0/ 2	50.0 U	5.0 U	6.0 L	1/ 3	18.0 U	5.0 U	5.0 U	0/ 3
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	mg/l	235.0	3.0 P	212.0	2/ 3	0.0 J	0.0	0.0 J	2/ 2	0.1 J	0.0 U	0.0 J	2/ 3	0.0 U	0.0 U	0.0 L	1/ 3
ZINC TOTAL	ug/l																

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 18A				SAMPLING LOCATION: OI 18B				SAMPLING LOCATION: OI 19A				SAMPLING LOCATION: OI-19B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	76.0 J	6.1 L	75.0 J	3/ 3	4.0 U	4.0 U	4.0 U	0/ 2	4.0 U	4.0 U	4.0 U	0/ 3	4.0 U	4.0 U	4.0 U	0/ 2
ALUMINUM,DISSOLVED	ug/l	556.0	512.0	541.0	3/ 3	76.3 L	56.4 L	66.4 L	2/ 2	66.7 L	56.2 L	66.7 L	3/ 3	833.2 J	105.0 L	469.1 J	2/ 2
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	634.0	523.0	596.0	3/ 3	272.0	259.0	265.5	2/ 2	391.0	365.0	371.0	3/ 3	276.0	272.0	274.0	2/ 2
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	40.1 J	33.9	39.0 J	3/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 3	2.4 L	2.0 U	2.2 L	1/ 2
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	78.1 L	72.0 L	73.0 L	3/ 3	87.9 L	87.0 L	87.5 L	2/ 2	59.9 L	58.4 L	58.6 L	3/ 3	84.2 L	83.5 L	83.8 L	2/ 2
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	520.0	463.0	517.0	3/ 3	35.5	35.0	35.3	2/ 2	29.1	27.3	27.6	3/ 3	50.0	49.6	49.8	2/ 2
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	4.0 U	3.9 U	3.9 U	0/ 3	4.0 U	4.0 U	4.0 U	0/ 2	4.0 U	4.0 U	4.0 U	0/ 3	4.0 U	4.0 U	4.0 U	0/ 2
CHLORIDE	mg/l	1730.0	1700.0	1720.0	3/ 3	49.8	44.9 U	47.4	1/ 2	86.7	77.0	78.3	3/ 3	160.0	156.0	158.0	2/ 2
CYANIDE	ug/l	11.3	10.0 U	10.0 U	1/ 3	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 3	19.2	10.0 U	14.6	1/ 2
COBALT,DISSOLVED	ug/l	94.4	83.0	90.0	3/ 3	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 2
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	7.0 L	5.0 L	6.0 U	2/ 3	6.0 U	6.0 U	6.0 U	0/ 2	96.2	88.7	94.8	3/ 3	6.8 L	6.0 U	6.4 L	1/ 2
COPPER,DISSOLVED	ug/l	6.0 U	3.0 U	6.0 U	0/ 3	3.0 U	3.0 U	3.0 U	0/ 2	3.0 U	3.0 U	3.0 U	0/ 3	3.0 U	3.0 U	3.0 U	0/ 2
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	54.1	53.5	53.8	3/ 3	0.1 J	0.1 L	0.1 J	2/ 2	0.0 L	0.0 U	0.0 U	1/ 3	0.0 L	0.0 L	0.0 L	2/ 2
IRON TOTAL	ug/l																
FLUORIDE	mg/l	0.4 L	0.4 L	0.4 L	3/ 3	0.5 L	0.4 L	0.5 L	2/ 2	1.5	1.4	1.5	3/ 3	0.8 L	0.6 L	0.7 L	2/ 2
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.6	0.3 U	0.4	2/ 3	0.3 P	0.3 P	0.3 U	0/ 2	0.7 J	0.3 P	0.3 U	1/ 3	0.3 U	0.3 U	0.3 P	0/ 2
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	15.0	14.6	14.8	3/ 3	7.2	6.2	6.7	2/ 2	7.7	5.7	7.1	3/ 3	3.5 L	3.4 L	3.5 L	2/ 2
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	504.0	494.0	502.0	3/ 3	23.5	22.4	23.0	2/ 2	22.4	19.3	19.4	3/ 3	37.1	34.1	35.6	2/ 2
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	32.3	23.8	25.3	3/ 3	0.1	0.0	0.0	2/ 2	0.0 L	0.0 L	0.0 L	3/ 3	0.2	0.2	0.2	2/ 2
NITRATE (AS N)	mg/l	1380.0	0.0 U	144.0	2/ 3	0.0 U	0.0 U	0.0 U	0/ 2	2.4	2.1	2.3	3/ 3	1.7	0.7	1.2	2/ 2
NITRITE (ASN)	mg/l	0.6 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2
SODIUM,DISSOLVED	mg/l	340.0	308.0	308.0	3/ 3	63.9	60.7	62.3	2/ 2	167.0	162.0	165.0	3/ 3	115.0	113.0	114.0	2/ 2
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.8	0.7 J	0.7 J	3/ 3	1.4	1.4 J	1.4	2/ 2	0.1 J	0.0 U	0.1 J	2/ 3	0.0 J	0.0 U	0.0 J	1/ 2
NICKEL,DISSOLVED	ug/l	214.0	120.0	121.0	3/ 3	31.0 U	31.0 U	31.0 U	0/ 2	31.0 U	31.0 U	31.0 U	0/ 3	31.0 U	31.0 U	31.0 U	0/ 2
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 P	1/ 3	2.0 U	2.0 U	2.0 U	0/ 2	7.3 J	2.0 U	6.9 J	2/ 3	2.0 U	2.0 U	2.0 U	0/ 2
LEAD TOTAL	ug/l																
PH - LAB	ug/l																
PH - FIELD	ug/l	6.9	5.9	6.3	3/ 3	8.1	7.5	7.9	3/ 3	7.6	7.5	7.6	3/ 3	6.9	6.6	6.8	3/ 3
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	8.7	2.1	2.5	4/ 4	1.0 U	0.0 J	1.0 U	1/ 3	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3
PURGEABLE ORGANIC HALOGENS	ug/l	215.0	5.0 U	83.3 J	3/ 4	9.1 J	5.0 U	5.0 U	1/ 3	302.0	29.4	34.4 J	5/ 5	17.0 J	5.0 P	5.4	2/ 3
ANTIMONY,DISSOLVED	ug/l	26.6 L	20.2 U	20.2 U	1/ 3	21.0 U	21.0 U	21.0 U	0/ 2	21.0 U	21.0 U	21.0 U	0/ 3	21.0 U	21.0 U	21.0 U	0/ 2
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	6000.0	5800.0	6000.0	3/ 3	580.0	510.0	530.0	3/ 3	900.0	880.0	890.0	3/ 3	950.0	920.0	930.0	3/ 3
SELENIUM,DISSOLVED	ug/l	12.0	2.0	12.0	2/ 3	2.0 P	2.0 P	2.0 P	0/ 2	4.6 L	2.2 L	3.4 L	3/ 3	2.0 P	2.0 P	2.0 P	0/ 2
TIN	ug/l																
SULFATE	mg/l	1440.0	1380.0	1430.0	3/ 3	17.6	16.4	17.0	2/ 2	54.8	53.7	54.6	3/ 3	42.5	37.2	39.9	2/ 2
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	5700.0	5100.0	5400.0	3/ 3	400.0	400.0	150.0	2/ 2	600.0	400.0	500.0	3/ 3	600.0	600.0	600.0	2/ 2
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2
TEMPERATURE (DEG C)	ug/l	25.0	23.0	23.0	1/ 3	23.0	23.0	23.0	3/ 3	21.5	21.0	21.0	3/ 3	22.5	22.0	22.5	3/ 3
TOTAL ORGANIC CARBON	mg/l	75.5	1.0 P	53.8 J	3/ 4	2.0 U	1.3	1.7	2/ 3	2.0 U	1.0 U	1.0 U	0/ 5	2.3	1.9	2.0	3/ 3
TOTAL ORGANIC HALOGENS	ug/l	898.0	586.0	673.5	4/ 4	19.0 J	5.0 U	14.4 J	2/ 3	189.0	28.0 J	52.0 J	5/ 5	87.0 J	31.2	49.2 J	3/ 3
VANADIUM,DISSOLVED	ug/l	35.0 L	5.0 U	30.0 L	2/ 3	5.0 U	5.0 U	5.0 U	0/ 2	8.7 L	5.6 L	7.6 L	3/ 3	10.5 L	8.5 L	9.5 L	2/ 2
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	ug/l	579.0 J	16.0 L	17.0 L	1/ 3	18.9 L	4.2 L	11.6 L	2/ 2	26.3 J	16.5 L	26.2 J	3/ 3	221.0	17.0 L	119.0	2/ 2
ZINC TOTAL	ug/l																

TABLE 6-16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-19C				SAMPLING LOCATION: OI-20A				SAMPLING LOCATION: OI-20B				SAMPLING LOCATION: OI-21B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	4.0 U	4.0 U	4.0 U	0/ 2	4.0 U	4.0 U	4.0 U	0/ 3	4.0 U	3.0 P	3.5 U	0/ 2	4.0 U	4.0 U	4.0 U	0/ 2
ALUMINUM,DISSOLVED	ug/l	63.6 L	43.9 L	53.8 L	2/ 2	82.4 L	74.6 L	80.8 L	3/ 3	27.0 U	26.6 L	26.8 U	1/ 2	78.8 L	62.1 L	70.5 L	2/ 2
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	619.0	577.0	598.0	2/ 2	280.0	275.0	276.0	3/ 3	75.5	70.3	72.9	2/ 2	207.0	197.0	202.0	2/ 2
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	1/ 3	3.4 L	3.2 L	3.3 L	2/ 2	2.9 L	2.4 L	2.7 L	2/ 2
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	36.8 L	35.7 L	36.3 L	2/ 2	86.7 L	83.0 L	84.9 L	3/ 3	24.0 U	14.0 L	19.0 U	1/ 2	66.1 L	62.1 L	64.1 L	2/ 2
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	23.1	22.2	22.7	2/ 2	40.2	38.7	39.2	3/ 3	8.2	8.1	8.2	2/ 2	34.3	33.4	33.9	2/ 2
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	4.0 U	4.0 U	4.0 U	0/ 2	4.0 U	4.0 U	4.0 U	0/ 3	4.0 U	3.9 U	4.0 U	0/ 2	4.0 U	4.0 U	4.0 U	0/ 2
CHLORIDE	mg/l	83.0	68.6	75.8	2/ 2	53.4	47.7	52.5	3/ 3	33.6	32.7	33.2	2/ 2	41.7	41.2	41.5	2/ 2
CYANIDE	ug/l	10.0 U	10.0 U	10.0 U	0/ 2	10.2	10.0 U	10.0 U	1/ 3	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2
COBALT,DISSOLVED	ug/l	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	9.0 U	9.5 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	20.1	13.7	16.9	2/ 2	6.0 U	6.0 U	6.0 U	0/ 3	6.0 U	5.0 L	5.5 U	1/ 2	6.0 U	6.0 U	6.0 U	0/ 2
COPPER,DISSOLVED	ug/l	3.0 U	3.0 U	3.0 U	0/ 2	75.5 J	3.0 U	4.2 L	2/ 3	6.0 U	3.0 P	4.5 U	0/ 2	3.0 U	3.0 U	3.0 U	0/ 2
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	0.0 L	0.0 L	0.0 L	2/ 2	0.1 L	0.0 L	0.0 L	3/ 3	0.2	0.2	0.2	2/ 2	1.3 J	0.7	1.0 J	2/ 2
IRON TOTAL	ug/l																
FLUORIDE	mg/l	1.8	1.6	1.7	2/ 2	0.5 L	0.4 L	0.4 L	3/ 3	0.8 L	0.7 L	0.7 L	2/ 2	0.7 L	0.6 L	0.6 L	2/ 2
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.3 U	0.3 U	0.3 P	0/ 2	4.0 J	2.1 J	3.9 J	3/ 3	0.3 P	0.3 P	0.3 U	0/ 2	0.3 P	0.3 P	0.3 U	0/ 2
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	7.7	7.1	7.4	2/ 2	3.4 L	3.1 L	3.4 L	3/ 3	5.0 U	1.5 L	3.3 U	1/ 2	5.5	5.1	5.3	2/ 2
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	18.0	17.5	17.8	2/ 2	26.3	25.0	25.7	3/ 3	6.5	6.4	6.5	2/ 2	15.0	14.0	14.5	2/ 2
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.0	0.0 L	0.0	2/ 2	0.3	0.3	0.3	3/ 3	0.1	0.1	0.1	2/ 2	0.2	0.2	0.2	2/ 2
NITRATE (AS N)	mg/l	2.9	2.8	2.9	2/ 2	2.1	1.8	1.8	3/ 3	0.5	0.5	0.5	2/ 2	0.0 L	0.0 U	0.0 L	1/ 2
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2
SODIUM,DISSOLVED	mg/l	265.0	258.0	261.5	2/ 2	64.5	62.8	63.2	3/ 3	43.3	38.0	40.7	2/ 2	61.8	58.3	60.1	2/ 2
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.0 U	0.0 P	0.0 U	0/ 2	0.0 J	0.0 L	0.0 L	3/ 3	0.1 J	0.0 L	0.1 J	2/ 2	0.2	0.2 J	0.2	2/ 2
NICKEL,DISSOLVED	ug/l	31.0 U	31.0 U	31.0 U	0/ 2	31.3 L	31.0 U	31.0 U	1/ 3	31.0 U	15.0 U	23.0 U	0/ 2	31.0 U	31.0 U	31.0 U	0/ 2
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.4 I	2.0 U	2.0 L	2/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 L	2.0 L	2.0 U	1/ 2
LEAD TOTAL	ug/l																
PH - LAB	ug/l																
PH - FIELD	ug/l	7.7	7.6	7.6	3/ 3	6.4	6.3	6.3	3/ 3	7.4	7.2	7.3	3/ 3	7.6	7.3	7.4	3/ 3
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2
PURGEABLE ORGANIC HALOGENS	ug/l	10.5 J	5.0 U	7.8 J	1/ 2	97.0 J	74.1 J	80.8	4/ 4	35.0 J	5.0 U	5.0 U	1/ 3	5.0 U	5.0 U	5.0 P	0/ 2
ANTIMONY,DISSOLVED	ug/l	21.0 U	21.0 U	21.0 U	0/ 2	21.0 U	21.0 U	21.0 U	0/ 3	21.0 U	20.2 U	20.6 U	0/ 2	21.0 U	21.0 U	21.0 U	0/ 2
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	1200.0	1100.0	1180.0	3/ 3	610.0	570.0	570.0	3/ 3	295.0	250.0	270.0	3/ 3	500.0	495.0	500.0	3/ 3
SELENIUM,DISSOLVED	ug/l	9.7 J	8.3 J	9.0 J	2/ 2	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0	1/ 2	2.0 P	2.0 P	2.0 P	0/ 2
TIN	ug/l																
SULFATE	mg/l	31.7	30.4	31.1	2/ 2	4.6	2.9 J	4.6	3/ 3	21.6 J	20.9	21.3 J	2/ 2	36.6	35.2	35.9	2/ 2
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	800.0	600.0	700.0	2/ 2	500.0	400.0	500.0	3/ 3	200.0	200.0	200.0	2/ 2	600.0	300.0	450.0	2/ 2
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2
TEMPERATURE (DEG C)	ug/l	22.0	20.0	22.0	3/ 3	26.0	24.0	24.0	3/ 3	23.5	22.0	23.0	3/ 3	25.0	23.5	23.5	3/ 3
TOTAL ORGANIC CARBON	mg/l	36.9	1.0 U	19.0	1/ 2	2.0 U	1.0 U	1.9	2/ 4	2.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2
TOTAL ORGANIC HALOGENS	ug/l	156.0	28.5 J	92.3	2/ 2	130.0	80.5	85.7 J	4/ 4	8.8 J	5.0 U	5.0 U	1/ 3	44.2 J	11.8	28.0 J	2/ 2
VANADIUM,DISSOLVED	ug/l	5.0 U	5.0 U	5.0 U	0/ 2	5.0 U	5.0 U	5.0 U	0/ 3	18.0 U	5.0 U	11.5 U	0/ 2	5.0 U	5.0 U	5.0 U	0/ 2
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	ug/l	27.5 J	13.4 L	20.5 J	2/ 2	80.5 J	31.2 J	38.4 J	3/ 3	12.0 U	4.6 I	8.3 U	1/ 2	9.0 L	3.4 L	6.2 L	2/ 2
ZINC TOTAL	ug/l																

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 22B				SAMPLING LOCATION: OI 23B				SAMPLING LOCATION: OI 25A				SAMPLING LOCATION: OI-25B			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	4.0 U	4.0 U	4.0 U	0/ 2	13.0 J	4.0 U	8.5 J	1/ 2	4.0 L	4.0 L	4.0 U	1/ 2	7.0 L	4.0 U	5.5 L	1/ 2
ALUMINUM,DISSOLVED	ug/l	85.8 L	69.0 L	77.4 L	2/ 2	88.9 L	75.0 L	82.0 L	2/ 2	232.0	68.0 L	150.0	2/ 2	59.6 L	27.0 U	43.3 L	1/ 2
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	87.7	72.3	80.0	2/ 2	189.0	185.0	187.0	2/ 2	206.0	0.1 U	103.1	1/ 2	158.0	156.0	157.0	2/ 2
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	2.8 L	2.1 L	2.5 L	2/ 2	2.0 U	2.0 U	2.0 P	0/ 2	9.4 L	8.0 L	8.7 L	2/ 2	2.0 U	2.0 U	2.0 P	0/ 2
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	16.6 L	13.3 L	15.0 L	2/ 2	115.0 L	114.0 L	114.5 L	2/ 2	74.0 L	66.1 L	70.1 L	2/ 2	65.0 L	64.7 L	64.8 L	2/ 2
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	20.0	17.5	18.8	2/ 2	35.8	35.5	35.7	2/ 2	29.4	27.5	28.5	2/ 2	22.4	22.0	22.2	2/ 2
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	4.0 U	4.0 U	4.0 U	0/ 2	4.0 U	3.9 U	4.0 U	0/ 2	4.0 U	3.9 U	4.0 U	0/ 2	4.0 U	3.9 U	4.0 U	0/ 2
CHLORIDE	mg/l	35.5	31.5	33.5	2/ 2	43.3	21.9	32.6	2/ 2	66.9	65.2	66.1	2/ 2	39.2	38.8	39.0	2/ 2
CYANIDE	ug/l	10.0 U	10.0 U	10.0 U	0/ 2	10.2	10.0 U	10.1	1/ 2	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2
COBALT,DISSOLVED	ug/l	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	9.0 U	9.5 U	0/ 2	10.0 U	9.0 U	9.5 U	0/ 2	10.0 U	9.0 U	9.5 U	0/ 2
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	6.0 U	6.0 U	6.0 U	0/ 2	6.0 U	3.0 U	4.5 U	0/ 2	6.0 U	3.0 U	4.5 U	0/ 2	6.0 U	3.0 U	4.5 U	0/ 2
COPPER,DISSOLVED	ug/l	5.1 L	3.0 U	4.1 L	1/ 2	6.0 U	5.5 L	5.8 U	1/ 2	6.0 U	3.3 L	4.7 U	1/ 2	6.0 U	3.8 L	4.9 U	1/ 2
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	0.1 L	0.0 L	0.0 L	2/ 2	1.5	1.4	1.5	2/ 2	0.0 L	0.0 U	0.0 L	1/ 2	0.2	0.2	0.2	2/ 2
IRON TOTAL	ug/l																
FLUORIDE	mg/l	1.2	1.0	1.1	2/ 2	0.5 L	0.5 L	0.5 L	2/ 2	0.7 L	0.7 L	0.7 L	2/ 2	0.8 L	0.7 L	0.7 L	2/ 2
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.3 P	0.3 P	0.3 P	0/ 2	0.3 P	0.3 P	0.3 U	0/ 2	0.3 P	0.3 P	0.3 U	0/ 2	0.3 U	0.3 U	0.3 P	0/ 2
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	2.7 L	2.1 L	2.4 L	2/ 2	5.0 U	3.9 L	4.4 U	1/ 2	11.4	8.0	9.7	2/ 2	5.0 U	3.3 L	4.1 U	1/ 2
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	4.7 L	2.0 L	3.3 L	2/ 2	19.6	18.7	19.2	2/ 2	20.5	19.9	20.2	2/ 2	9.8	9.4	9.6	2/ 2
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.0	0.0 L	0.0	2/ 2	0.3	0.2	0.3	2/ 2	0.1 J	0.0	0.1 J	2/ 2	0.1	0.1	0.1	2/ 2
NITRATE (AS N)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2	0.0 L	0.0 U	0.0 L	1/ 2
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2	0.7	0.0 U	0.3	1/ 2	0.0 U	0.0 U	0.0 U	0/ 2
SODIUM,DISSOLVED	mg/l	52.9	43.8	48.4	2/ 2	54.2	49.0	51.6	2/ 2	79.2	72.0	75.6	2/ 2	58.2	54.0	56.1	2/ 2
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.1	0.0 J	0.1	2/ 2	0.3 J	0.2	0.3 J	2/ 2	0.7 J	0.6	0.7 J	2/ 2	0.4	0.4 J	0.4	2/ 2
NICKEL,DISSOLVED	ug/l	31.0 U	31.0 U	31.0 U	0/ 2	31.0 U	15.0 U	23.0 U	0/ 2	31.0 U	15.0 U	23.0 U	0/ 2	31.0 U	15.0 U	23.0 U	0/ 2
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2	13.4	2.0 U	7.7	1/ 2	2.0 U	2.0 U	2.0 U	0/ 2
LEAD TOTAL	ug/l																
PH - LAB	ug/l																
PH - FIELD	ug/l	9.6	8.8	9.5	3/ 3	7.0	6.9	7.0	3/ 3	8.5	8.2	8.5	3/ 3	7.7	7.5	7.6	3/ 3
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	1.1 J	1.0 U	1.0 U	1/ 3	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
PURGEABLE ORGANIC HALOGENS	ug/l	15.0	1.6 J	5.0 U	2/ 3	58.0 J	5.0 U	5.0 U	1/ 3	5.0 P	5.0 P	5.0 U	0/ 2	5.0 U	5.0 U	5.0 U	0/ 2
ANTIMONY,DISSOLVED	ug/l	21.0 U	21.0 U	21.0 U	0/ 2	21.0 U	20.2 U	20.6 U	0/ 2	21.0 U	20.2 U	20.6 U	0/ 2	21.0 U	20.2 U	20.6 U	0/ 2
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	325.0	315.0	320.0	3/ 3	500.0	470.0	485.0	3/ 3	550.0	500.0	540.0	3/ 3	450.0	370.0	410.0	3/ 3
SELENIUM,DISSOLVED	ug/l	2.0 P	2.0 P	2.0 U	0/ 2	2.0 U	2.0 U	2.0	1/ 2	2.0	2.0	2.0 U	1/ 2	2.0	2.0	2.0 U	1/ 2
TIN	ug/l																
SULFATE	mg/l	43.8 J	28.6	36.2 J	2/ 2	45.8	26.0	35.9	2/ 2	42.7 J	38.1	40.4 J	2/ 2	22.3 J	21.3	21.8 J	2/ 2
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	300.0	200.0	250.0	2/ 2	300.0	300.0	300.0	2/ 2	400.0 J	400.0 J	400.0	2/ 2	300.0	200.0	250.0	2/ 2
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2
TEMPERATURE (DEG C)	ug/l	23.0	22.5	23.0	3/ 3	24.0	22.5	24.0	3/ 3	23.0	20.0	22.5	3/ 3	24.5	22.5	24.0	3/ 3
TOTAL ORGANIC CARBON	mg/l	2.0 U	1.0 U	1.0 U	0/ 3	6.1	1.0 U	1.0 U	1/ 3	14.0	1.6 J	7.8	2/ 2	1.1	1.0	1.0	2/ 2
TOTAL ORGANIC HALOGENS	ug/l	189.0 J	17.0 J	45.7	3/ 3	42.3	12.4	18.0 J	3/ 3	11.3	5.0 U	8.2	1/ 2	17.1	7.9	12.5	2/ 2
VANADIUM,DISSOLVED	ug/l	5.0 U	5.0 U	5.0 U	0/ 2	18.0 U	5.0 U	11.5 U	0/ 2	18.0 U	5.0 U	11.5 U	0/ 2	18.0 U	5.0 U	11.5 U	0/ 2
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	ug/l	14.5 L	4.2 L	9.4 L	2/ 2	12.0 U	9.5 L	10.8 U	1/ 2	0.0 U	0.0 L	0.0 U	1/ 2	12.0 U	3.0 P	7.5 U	0/ 2
ZINC TOTAL	ug/l																

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 26A				SAMPLING LOCATION: OI 26B				SAMPLING LOCATION: OI-27A				SAMPLING LOCATION: OI-28B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	9.0 L	4.0 U	6.5 L	1/ 2	6.0 L	4.0 U	5.0 L	1/ 2	13.0 J	4.0 U	4.0 U	1/ 3	4.0 L	4.0 L	4.0 U	1/ 2
ALUMINUM,DISSOLVED	ug/l	134.0 L	64.5 L	99.3 L	2/ 2	41.0 L	31.3 L	36.2 L	2/ 2	77.0 L	38.4 L	39.1 L	3/ 3	39.5 L	31.0 L	35.3 L	2/ 2
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	120.0	117.0	118.5	2/ 2	138.0	130.0	134.0	2/ 2	167.0	127.0	133.0	3/ 3	66.0	65.0	65.5	2/ 2
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 P	0/ 2	2.6 L	2.0 U	2.3 L	1/ 2	3.5 L	2.1 L	3.0 L	3/ 3	7.1 L	6.3 L	6.7 L	2/ 2
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	32.0 L	31.3 L	31.6 L	2/ 2	24.0 U	20.4 L	22.2 U	1/ 2	24.0 U	10.9 L	11.0 L	2/ 3	24.0 U	9.0 L	16.5 U	1/ 2
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 2
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	25.5	24.3	24.9	2/ 2	13.9	13.5	13.7	2/ 2	40.6	19.3	19.6	3/ 3	10.3	9.8	10.0	2/ 2
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	4.0 U	3.9 U	4.0 U	0/ 2	4.0 U	3.9 U	4.0 U	0/ 2	4.0 U	3.9 U	4.0 U	0/ 3	4.0 U	3.9 U	4.0 U	0/ 2
CHLORIDE	mg/l	134.0	126.0	130.0	2/ 2	54.0	51.3	52.7	2/ 2	89.8	81.8	83.2	3/ 3	40.2	38.7	39.5	2/ 2
CYANIDE	ug/l	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 2
COBALT,DISSOLVED	ug/l	10.0 U	9.0 U	9.5 U	0/ 2	10.0 U	9.0 U	9.5 U	0/ 2	14.0 L	10.0 U	10.0 U	1/ 3	10.0 U	9.0 U	9.5 U	0/ 2
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	6.0 U	3.0 U	4.5 U	0/ 2	6.0 U	3.0 U	4.5 U	0/ 2	7.0 L	6.0 U	6.0 U	1/ 3	6.0 U	3.0 U	4.5 U	0/ 2
COPPER,DISSOLVED	ug/l	6.0 U	3.0 U	4.5 U	0/ 2	6.0 U	3.0 U	4.5 U	0/ 2	12.0 L	3.0 U	3.0 U	1/ 3	6.0 U	3.0 U	4.5 U	0/ 2
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	0.1 L	0.0 L	0.0 L	2/ 2	0.7	0.7	0.7	2/ 2	0.9 J	0.0 L	0.0 L	3/ 3	0.0 L	0.0 L	0.0 L	2/ 2
IRON TOTAL	ug/l																
FLUORIDE	mg/l	0.8 L	0.7 L	0.8 L	2/ 2	0.6 L	0.5 L	0.6 L	2/ 2	1.0 L	0.9 L	1.0 L	3/ 3	0.5 L	0.5 L	0.5 L	2/ 2
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.3 U	0.3 U	0.3 P	0/ 2	0.3 P	0.3 P	0.3 U	0/ 2	0.3 U	0.3 U	0.3 U	0/ 3	0.3 U	0.3 U	0.3 P	0/ 2
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	5.0 U	1.9 L	3.5 U	1/ 2	5.0 U	2.1 L	3.6 U	1/ 2	5.6	5.0	5.5	3/ 3	5.0 U	1.6 L	3.3 U	1/ 2
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	21.7	20.5	21.1	2/ 2	9.1	8.7	8.9	2/ 2	36.4	17.2	17.6	3/ 3	6.2	5.8	6.0	2/ 2
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.1	0.1	0.1	2/ 2	0.1	0.1	0.1	2/ 2	0.6 J	0.0	0.0	3/ 3	0.0	0.0	0.0	2/ 2
NITRATE (AS N)	mg/l	3.3	3.1	3.2	2/ 2	0.0 L	0.0 U	0.0 L	1/ 2	5.2	4.4	4.8	3/ 3	1.3	1.2	1.3	2/ 2
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 2	0.0 U	0.0 U	0.0 U	0/ 3	0.0 U	0.0 U	0.0 U	0/ 2
SODIUM,DISSOLVED	mg/l	81.4	72.0	76.7	2/ 2	72.4	66.0	69.2	2/ 2	60.0	58.3	59.2	3/ 3	47.4	47.0	47.2	2/ 2
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.0 J	0.0 U	0.0 J	1/ 2	0.1 J	0.0 U	0.0 J	1/ 2	0.0 P	0.0 U	0.0 L	1/ 3	0.1 L	0.0 J	0.1 L	2/ 2
NICKEL,DISSOLVED	ug/l	46.0	31.0 L	38.5	2/ 2	31.0 U	15.0 U	23.0 U	0/ 2	31.0 U	15.0 U	31.0 U	0/ 3	31.0 U	15.0 U	23.0 U	0/ 2
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.9 L	2.0 U	2.5 L	1/ 2	2.0 U	2.0 U	2.0 U	0/ 3	6.3	2.0 U	4.2	1/ 2
LEAD TOTAL	ug/l																
PH - LAB	ug/l																
PH - FIELD	ug/l	7.5	6.8	7.0	3/ 3	7.1	7.0	7.1	3/ 3	7.8	7.2	7.5	3/ 3	7.6	7.2	7.3	3/ 3
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	1.0 U	1.0 U	1.0 U	0/ 3	4.7	1.0 U	1.0 U	1/ 3	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
PURGEABLE ORGANIC HALOGENS	ug/l	14.0 J	5.0 U	5.0 U	1/ 3	65.0 J	5.0 U	5.0 U	1/ 3	142.0 J	28.4	56.1 J	4/ 4	409.0	5.0 U	5.0 U	1/ 3
ANTIMONY,DISSOLVED	ug/l	21.0 P	20.2 U	20.6 P	0/ 2	21.0 P	20.2 U	20.6 P	0/ 2	21.0 U	20.2 U	21.0 U	0/ 3	21.0 P	20.2 U	20.6 P	0/ 2
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	600.0	570.0	570.0	3/ 3	450.0	415.0	440.0	3/ 3	520.0	490.0	500.0	3/ 3	340.0	300.0	315.0	3/ 3
SELENIUM,DISSOLVED	ug/l	12.0 P	2.0	7.0 P	1/ 2	2.0	2.0	2.0 P	1/ 2	12.0	2.0 P	2.0 P	1/ 3	19.8	17.6 J	18.7	2/ 2
TIN	ug/l																
SULFATE	mg/l	21.5	20.7	21.1	2/ 2	34.8	33.7	34.3	2/ 2	7.3	6.3	6.9	3/ 3	34.1	29.6	31.9	2/ 2
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	400.0 J	400.0 J	400.0	2/ 2	300.0	200.0 J	250.0	2/ 2	400.0	300.0	400.0	3/ 3	200.0 J	200.0 J	200.0	2/ 2
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 2	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 2
TEMPERATURE (DEG C)	ug/l	22.0	21.0	21.5	3/ 3	23.0	23.0	23.0	3/ 3	26.0	23.5	24.0	3/ 3	23.0	22.0	22.0	3/ 3
TOTAL ORGANIC CARBON	mg/l	2.0 U	1.0 U	1.3	1/ 3	2.0 U	1.0 U	1.0 U	0/ 3	2.0 U	1.0 U	1.1 J	1/ 4	2.0 U	1.0 U	1.0 U	0/ 3
TOTAL ORGANIC HALOGENS	ug/l	50.0 J	18.2	36.1	3/ 3	20.8	5.0 U	20.0 J	2/ 3	258.0	50.2	70.5	4/ 4	48.0 J	5.0 U	22.7	2/ 3
VANADIUM,DISSOLVED	ug/l	18.0 U	5.0 U	11.5 U	0/ 2	18.0 U	5.0 U	11.5 U	0/ 2	18.0 U	5.0 U	5.0 U	0/ 3	18.0 U	5.0 U	11.5 U	0/ 2
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	mg/l	0.0 U	0.0 L	0.0 U	1/ 2	0.0	0.0 U	0.0	1/ 2	652.0 J	6.6 L	316.0	3/ 3	0.0 U	0.0 L	0.0 U	1/ 2
ZINC TOTAL	ug/l																

TABLE 6 16 (continued)
Summary of INORGANIC and INDICATOR PARAMETERS in Groundwater
OIT Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-298				SAMPLING LOCATION:											
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
SILVER,DISSOLVED	ug/l	18.7 J	4.0 U	11.4 J	1/ 2												
ALUMINUM,DISSOLVED	ug/l	219.0	157.0 L	188.0	2/ 2												
CARB ALKALINITY (AS CACO3)	ug/l																
BICARB ALKALINITY (AS CACO3)	ug/l																
HYDROX ALKALINITY (AS CACO3)	ug/l																
TOTAL ALKALINITY (AS CACO3)	mg/l	289.0	262.0	275.5	2/ 2												
ALUMINUM TOTAL	ug/l																
ARSENIC,DISSOLVED	ug/l	2.0 P	2.0 P	2.0 U	0/ 2												
ARSENIC TOTAL	ug/l																
BARIUM,DISSOLVED	ug/l	47.4 L	45.7 L	46.6 L	2/ 2												
BARIUM TOTAL	ug/l																
BERYLLIUM,DISSOLVED	ug/l	1.0 U	1.0 U	1.0 U	0/ 2												
BROMIDE	ug/l																
CALCIUM,DISSOLVED	mg/l	87.6	83.1	85.4	2/ 2												
CALCIUM TOTAL	ug/l																
CADMIUM,DISSOLVED	ug/l	5.0 U	4.0 U	4.5 U	0/ 2												
CHLORIDE	mg/l	108.0	102.0	105.0	2/ 2												
CYANIDE	ug/l	10.0 U	10.0 U	10.0 U	0/ 2												
COBALT,DISSOLVED	ug/l	14.0 L	10.0 U	12.0 L	1/ 2												
COBALT TOTAL	ug/l																
CHROMIUM,DISSOLVED	ug/l	6.0 U	3.0 U	4.5 U	0/ 2												
COPPER,DISSOLVED	ug/l	10.7 L	3.0 U	6.8 L	1/ 2												
COPPER TOTAL	ug/l																
FREE CYANIDE	ug/l																
IRON,DISSOLVED	mg/l	2.6	2.6	2.6	2/ 2												
IRON TOTAL	ug/l																
FLUORIDE	mg/l	0.8 L	0.7 L	0.7 L	2/ 2												
GROSS ALPHA ACTIVITY	ug/l																
GROSS BETA ACTIVITY	ug/l																
MERCURY,DISSOLVED	ug/l	0.3 U	0.3 U	0.3 U	0/ 2												
IODINE DISSOLVED	ug/l																
POTASSIUM,DISSOLVED	mg/l	5.1	5.0 U	5.1	1/ 2												
POTASSIUM TOTAL	ug/l																
METHYLENE BLUE ACTIVE SUBSTANCES	ug/l																
MAGNESIUM,DISSOLVED	mg/l	55.6	55.6	55.6	2/ 2												
MAGNESIUM TOTAL	ug/l																
MANGANESE,DISSOLVED	mg/l	0.3	0.3	0.3	2/ 2												
NITRATE (AS N)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2												
NITRITE (ASN)	mg/l	0.0 U	0.0 U	0.0 U	0/ 2												
SODIUM,DISSOLVED	mg/l	101.0	87.0	94.0	2/ 2												
SODIUM TOTAL	ug/l																
AMMONIA NITROGEN (AS N)	mg/l	0.5 J	0.4	0.4 J	2/ 2												
NICKEL,DISSOLVED	ug/l	31.0 U	15.0 U	23.0 U	0/ 2												
NICKEL TOTAL	ug/l																
LEAD,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2												
LEAD TOTAL	ug/l																
PH - LAB	ug/l																
PH - FIELD	ug/l	7.2	7.0	7.0	3/ 3												
PHOSPHATE (TOTAL)	ug/l																
PURGEABLE ORGANIC CARBON	mg/l	1.4	1.0 U	1.0 U	1/ 3												
PURGEABLE ORGANIC HALOGENS	ug/l	410.0	5.0 U	5.0 U	1/ 3												
ANTIMONY,DISSOLVED	ug/l	54.0 U	21.0 P	37.5 U	0/ 2												
SPEC COND (UMHO/CM X 10 6),DISSOLVED	ug/l	1180.0	1110.0	1180.0	3/ 3												
SELENIUM,DISSOLVED	ug/l	2.0 P	2.0 P	2.0	1/ 2												
TIN	ug/l																
SULFATE	mg/l	266.0	254.0	260.0	2/ 2												
STRONTIUM TOTAL	ug/l																
TOTAL DISSOLVED SOLIDS	mg/l	900.0 J	800.0	850.0 J	2/ 2												
TITANIUM DISSOLVED	ug/l																
TITANIUM TOTAL	ug/l																
THALLIUM,DISSOLVED	ug/l	2.0 U	2.0 U	2.0 U	0/ 2												
TEMPERATURE (DEG C)	ug/l	25.0	23.5	25.0	3/ 3												
TOTAL ORGANIC CARBON	mg/l	2.0 U	1.0 U	1.0 U	0/ 3												
TOTAL ORGANIC HALOGENS	ug/l	24.0 J	16.4	18.2 J	3/ 3												
VANADIUM,DISSOLVED	ug/l	18.0 U	5.0 U	11.5 U	0/ 2												
VANADIUM TOTAL	ug/l																
ZINC,DISSOLVED	mg/l	0.0 U	0.0 L	0.0 U	1/ 2												
ZINC TOTAL	ug/l																

TABLE 6 17
Summary of VOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD-13				SAMPLING LOCATION: CDD 17				SAMPLING LOCATION: DS-01			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	5.0 U	0.0	5.0 U	0/ 3	10.0 U	1.0 U	5.0 U	0/ 5	5.0 U	1.0 U	3.0 U	0/ 2	5.0 U	1.0 U	3.0 U	0/ 2
1,1,2-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	10.0 U	1.0 U	5.0 U	0/ 5	5.0 U	1.0 U	3.0 U	0/ 2	5.0 U	1.0 U	3.0 U	0/ 2
1,1-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	20.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 2	3.0 J	1.0 U	2.0 J	1/ 2
1,1-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	30.0 U	1.0 U	5.0 U	0/ 5	5.0 U	1.0 U	3.0 U	0/ 2	5.0 U	1.0 U	3.0 U	0/ 2
1,2-DICHLOROETHANE	ug/l	20.0 U	1.0 U	20.0 U	0/ 3	20.0 U	1.0 U	20.0 U	0/ 5	20.0 U	1.0 U	10.5 U	0/ 2	20.0 U	1.0 U	10.5 U	0/ 2
1,2-DICHLOROETHENE	ug/l					0.6 J	0.5 J	0.6 J	2/ 2	0.5 J	0.5 J	0.5 J	1/ 1	1.3 J	1.3 J	1.3 J	1/ 1
1,2-DICHLOROPROPANE	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	10.0 U	1.0 U	5.0 U	0/ 5	5.0 U	1.0 U	3.0 U	0/ 2	5.0 U	1.0 U	3.0 U	0/ 2
1,4-DIOXANE	ug/l	1.0 P	1.0 P	1.0 P	0/ 1	2500.0 U	42.0	52.0	2/ 3	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 1
2-BUTANONE	ug/l	2.0 P	2.0 P	2.0 P	0/ 1	150.0 U	2.0 P	2.0 P	0/ 3	2.0 P	2.0 P	2.0 P	0/ 1	2.0 P	2.0 P	2.0 P	0/ 1
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 1	100.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 1	2.0 U	2.0 U	2.0 U	0/ 1
2-METHYL-2-PROPANOL	ug/l					200.0 U	200.0 U	200.0 U	0/ 1								
4-METHYL-2-PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 1	50.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 1	2.0 U	2.0 U	2.0 U	0/ 1
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 1	200.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 1	2.0 U	2.0 U	2.0 U	0/ 1
BENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	6.0 J	0.9 J	1.0	4/ 5	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
CHLOROBENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	10.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
CARBON DISULFIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 1	25.0 U	1.0	2.0	2/ 3	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 1
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	30.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
CHLOROMETHANE	ug/l	10.0 U	2.0 U	10.0 U	0/ 3	50.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	6.0 U	0/ 2	10.0 U	2.0 U	6.0 U	0/ 2
ETHYLBENZENE (PHENYLETHANE)	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	10.0 U	2.0	5.0 U	2/ 5	5.0 U	1.0 U	3.0 U	0/ 2	5.0 U	1.0 U	3.0 U	0/ 2
METHYLENE CHLORIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	1200.0	1.0 U	1.0 U	1/ 5	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
TETRACHLOROETHENE (PCE)	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	10.0 U	1.0 U	5.0 U	0/ 5	5.0 U	2.0	3.5 U	1/ 2	8.0 J	1.0 U	4.5 J	1/ 2
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 1	50.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 1
TRANS-1,2-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	30.0 U	1.6 J	1.7 J	2/ 3	5.0 U	5.0 U	5.0 U	0/ 1	8.4 J	8.4 J	8.4 J	1/ 1
TRICHLOROETHYLENE	ug/l	5.0 U	1.0 U	5.0 U	0/ 3	20.0 U	1.0 U	5.0 U	0/ 5	5.0 U	2.0	3.5 U	1/ 2	5.5 J	1.0 U	3.3 J	1/ 2
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	1.7 J	1.0 U	1.0 U	1/ 3	10.0 U	0.6 J	1.0 U	2/ 5	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
TOTAL XYLENES(M+O+P)	ug/l	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 1
VINYL CHLORIDE	ug/l	10.0 U	2.0 U	10.0 U	0/ 3	50.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	6.0 U	0/ 2	10.0 U	2.0 U	6.0 U	0/ 2

		SAMPLING LOCATION: OI-01A				SAMPLING LOCATION: OI-01C				SAMPLING LOCATION: OI-02				SAMPLING LOCATION: OI-03			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	5.7	0.3 J	1.0 U	5/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/18	5.0 U	1.0 U	1.0 U	0/13
1,1,2-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	3.0 U	0/18	5.0 U	1.0 U	3.0 U	0/12
1,1-DICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	1/18	5.0 U	1.0 U	1.0 U	0/12
1,1-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	3.0 U	0/18	5.0 U	1.0 U	3.0 U	0/12
1,2-DICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/17	1.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/18	5.0 U	1.0 U	1.0 U	0/12
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 7	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 3
1,2-DICHLOROPROPANE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/18	5.0 U	1.0 U	1.0 U	0/12
1,4-DIOXANE	ug/l	1.00E+04 U	1.00E+00 U	2.00E+01 U	2/17	1.00E+04 U	3.00E-01 J	2.00E+00 U	2/11	1.00E+04 U	1.00E+00 P	1.50E+01 U	2/18	430.0	1.0 U	5.0 U	3/11
2-BUTANONE	ug/l	20.0 P	0.7 P	2.0 U	1/16	20.0 P	2.0 P	2.0 U	0/11	20.0 P	0.8 P	2.0 P	1/17	20.0 P	1.6 P	2.5 P	0/12
2-HEXANONE	ug/l	10.0 U	1.0 U	2.0 U	0/17	10.0 U	2.0 U	2.0 U	0/11	10.0 U	1.0 U	3.5 U	0/18	10.0 U	1.0 U	3.5 U	0/12
2-METHYL 2 PROPANOL	ug/l																
4-METHYL-2 PENTANONE	ug/l	10.0 U	1.0 U	2.0 U	0/17	2.0 P	2.0 P	2.0 U	0/11	10.0 U	1.0 U	2.0 U	2/18	10.0 U	0.5 J	2.0 U	2/12
2-PROPANONE (ACETONE)	ug/l	30.0 P	1.0 J	2.0 U	1/15	20.0 P	2.0 U	2.0 U	0/11	39.1 J	1.6 J	4.9 P	2/17	58.0 P	2.0 U	10.0 U	1/11
BENZENE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	0.3 P	1.0 U	1/18	5.0 U	0.3 J	1.0 U	1/12
CHLOROBENZENE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/18	5.0 U	1.0 U	1.0 U	0/12
CARBON DISULFIDE	ug/l	5.0 U	0.3 J	1.0 U	1/17	5.0 U	1.0 U	1.0 U	0/11	437.0	1.0 U	1.7	2/18	32.3	1.0 U	1.0 U	1/13
CHLOROFORM	ug/l	5.0 U	0.2 P	1.0 U	0/17	1.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 P	1.0 U	0/18	25.0 U	1.0 P	1.0 U	0/13
CHLOROMETHANE	ug/l	10.0 U	1.0 U	2.0 U	0/17	10.0 U	2.0 U	2.0 U	0/11	10.0 U	1.0 U	6.0 U	0/18	470.0	1.0 U	6.0 U	1/12
ETHYLBENZENE (PHENYLETHANE)	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	0.3 P	1.0 U	0/11	5.0 U	0.4 P	1.0 U	0/18	5.0 U	0.6 P	1.0 U	0/13
METHYLENE CHLORIDE	ug/l	23.0 P	1.0 U	1.5 U	0/16	5.0 U	1.0 U	1.0 U	0/11	20.0 P	1.0 U	2.0 U	0/17	13.5 P	1.0 U	2.0 U	0/12
TETRACHLOROETHENE (PCE)	ug/l	5.0 U	0.2 J	1.0 J	15/17	1.4	0.8 J	1.0	9/11	5.0 U	1.0 U	1.0 U	0/18	25.0 U	1.0 U	1.0 U	0/13
STYRENE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	3.0 U	0/18	5.0 U	1.0 U	1.0 U	0/13
TRANS-1,2-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	5.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 4	5.0 U	1.0 U	5.0 U	0/12	5.0 U	1.0 U	1.0 U	0/ 9
TRICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/17	5.0 U	0.2 J	1.0 U	2/11	5.0 U	1.0 U	1.0 U	0/18	5.0 U	1.0 U	1.0 U	0/12
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	5.0 U	0.2 P	1.0 U	0/17	1.0 P	0.2 P	1.0 U	0/11	5.0 U	0.3 P	1.0 U	4/18	49.0	0.6 J	4.0 U	6/13
TOTAL XYLENES(M+O+P)	ug/l	5.0 U	0.5 J	1.0 U	2/16	1.0 U	0.9 J	1.0 U	1/11	5.0 U	0.5 J	1.0 U	1/18	26.0	0.6 J	1.0 U	3/13
VINYL CHLORIDE	ug/l	10.0 U	1.0 U	2.0 U	0/17	2.0 U	1.0 U	2.0 U	0/11	10.0 U	1.0 U	2.0 U	0/18	10.0 U	1.0 U	2.0 U	2/12

TABLE 6 17 (continued)
Summary of VOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-04				SAMPLING LOCATION: OI 05				SAMPLING LOCATION: OI 06				SAMPLING LOCATION: OI-07C			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	10.0 U	1.0 U	1.0 U	0/17	5.0 U	1.0 U	1.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	0.2 J	1.0 U	1/ 5
1,1,2-TRICHLOROETHANE	ug/l	10.0 U	1.0 U	5.0 U	0/17	5.0 U	1.0 U	5.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
1,1-DICHLOROETHANE	ug/l	20.0 U	1.0 U	5.0 U	9/17	5.0 U	1.0 U	1.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
1,1-DICHLOROETHYLENE	ug/l	30.0 U	1.0 U	5.0 U	2/17	5.0 U	1.0 U	5.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROETHANE	ug/l	20.0 U	1.0 U	5.0 U	1/16	5.0 U	0.7 J	3.0 U	1/20	5.0 U	1.0 U	1.0 U	0/15	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROETHENE	ug/l	15.0	5.0 J	10.0	2/ 2	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 2
1,2-DICHLOROPROPANE	ug/l	10.3	0.6 J	3.0 J	12/17	5.0 U	1.0 U	1.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
1,4-DIOXANE	ug/l	3.00E+04	2.00E+01 K	1.30E+03 J	13/17	1.00E+04 U	1.00E+00 P	3.30E+01 P	0/17	1.00E+04 U	1.00E+00 U	5.00E+00 U	0/14	1.00E+04 U	1.00E+00 U	2.00E+00 U	0/ 5
2-BUTANONE	ug/l	150.0 U	2.0 P	5.0 U	0/16	10.0 U	1.0	2.0 P	1/17	20.0 P	1.9 P	2.0 U	1/14	2.0 P	2.0 P	2.0 U	0/ 5
2-HEXANONE	ug/l	128.0	1.0 U	10.0 U	2/17	10.0 U	1.0 U	5.0 U	0/20	10.0 U	1.0 U	2.0 U	0/15	10.0 U	2.0 U	2.0 U	0/ 5
2-METHYL-2 PROPANOL	ug/l	260.0	250.0	255.0	2/ 2												
4-METHYL-2-PENTANONE	ug/l	50.0 U	1.0 U	5.0 U	4/17	10.0 U	1.0 J	2.7	3/20	10.0 U	1.0 U	2.0 U	2/15	6.0	2.0 U	2.0 U	1/ 5
2-PROPANONE (ACETONE)	ug/l	200.0 U	2.0 U	17.5	2/14	15.1 P	2.0 U	3.3 P	0/17	20.0 P	2.0 U	2.5 U	0/14	10.0 U	2.0 U	2.0 U	0/ 5
BENZENE	ug/l	18.0	1.0 U	7.0	15/17	5.0 U	0.2 J	1.0 U	1/20	5.0 U	0.6 J	1.0 U	1/15	5.0 U	1.0 U	1.0 U	0/ 5
CHLOROBENZENE	ug/l	10.0 U	0.9 J	3.4 J	13/17	5.0 U	1.0 U	1.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
CARBON DISULFIDE	ug/l	101.0	1.0 U	5.0 U	2/17	5.0 U	1.0 U	3.6 U	2/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	0.2 J	1.0 U	1/ 5
CHLOROFORM	ug/l	30.0 U	0.6 J	5.0 U	1/17	5.0 U	1.0 U	1.0 P	0/20	10.0	1.0 U	1.0 U	3/15	1.0 U	0.6 P	1.0 U	0/ 5
CHLOROMETHANE	ug/l	50.0 U	1.0 U	10.0 U	0/17	10.0 U	1.0 U	10.0 U	0/20	10.0 U	1.0 U	2.0 U	0/15	10.0 U	2.0 U	2.0 U	0/ 5
ETHYLBENZENE (PHENYLETHANE)	ug/l	31.8	0.6 J	2.7 J	7/17	5.0 U	0.8 J	1.0 U	1/20	5.0 U	0.4 P	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
METHYLENE CHLORIDE	ug/l	30.0 U	1.0 U	3.4 P	0/15	11.0 P	1.0 U	2.7 P	1/18	20.0 U	1.0 U	1.0 U	0/15	7.0 U	1.0 U	1.0 U	0/ 5
TETRACHLOROETHENE (PCE)	ug/l	10.0 U	1.0 U	1.0 U	0/17	5.0 U	0.1 J	1.0 U	1/20	5.0 U	1.0 U	1.0 U	0/15	1.0 U	1.0 U	1.0 U	0/ 5
STYRENE	ug/l	50.0 U	1.0 U	5.0 U	0/17	5.0 U	1.0 U	5.0 U	0/20	5.0 U	1.0 U	1.0 U	0/15	5.0 U	1.0 U	1.0 U	0/ 5
TRANS-1,2-DICHLOROETHYLENE	ug/l	64.0	1.0 U	10.7	14/16	5.0 U	1.0 U	5.0 U	0/15	5.0 U	1.0 U	1.0 U	0/10	5.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	20.0 U	0.6 J	5.0 U	1/17	5.0 U	0.2 J	1.0 U	2/20	5.0 U	0.2 J	1.0 U	2/15	5.0 U	1.0 U	1.0 U	0/ 5
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	10.0 U	0.8 J	1.4 J	9/17	5.0 U	0.6 J	1.0 U	2/19	5.0 U	0.2 P	1.0 U	2/15	3.0 P	1.0 U	1.0 U	0/ 5
TOTAL XYLENES(M+O+P)	ug/l	60.7	2.0	6.7	12/15	5.0 U	1.0 U	1.0 U	2/20	5.0 U	1.0 U	1.0 U	2/15	1.0 U	0.4 J	1.0 U	1/ 5
VINYL CHLORIDE	ug/l	552.0	1.0 U	160.0	16/17	10.0 U	1.0 U	2.0 U	0/20	10.0 U	1.0 U	2.0 U	0/15	2.0 U	2.0 U	2.0 U	0/ 5

		SAMPLING LOCATION: OI-08A				SAMPLING LOCATION: OI-09A				SAMPLING LOCATION: OI-10A				SAMPLING LOCATION: OI-10B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,1,2-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,1-DICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,1-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROPROPANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,4-DIOXANE	ug/l	1.00E+04 U	1.00E+00 P	5.00E+00 U	1/11	1.00E+04 U	1.00E+00 U	3.50E+00 U	0/ 8	1.78E+04	1.00E+00 U	5.00E+00 U	1/ 8	1.00E+04 U	1.00E+00 U	3.50E+00 U	0/ 8
2-BUTANONE	ug/l	20.0 P	2.0 P	2.0 U	0/11	20.0 P	1.0 U	2.0 P	0/ 8	20.0 P	2.0 P	2.0 P	0/ 8	20.0 P	2.0 U	2.0 P	0/ 8
2-HEXANONE	ug/l	10.0 U	2.0 U	2.0 U	0/11	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8
2-METHYL-2 PROPANOL	ug/l																
4-METHYL-2 PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/11	2.0 U	2.0 U	2.0 U	0/ 8	2.0 U	2.0 U	2.0 U	0/ 8	4.0 P	2.0 U	2.0 U	0/ 8
2-PROPANONE (ACETONE)	ug/l	20.0 P	2.0 U	2.0 U	0/11	20.0 P	2.0 U	2.0 U	0/ 8	20.0 P	2.0 U	2.0 U	0/ 8	20.0 P	2.0 U	2.0 U	0/ 8
BENZENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	0.8 J	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
CHLOROBENZENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
CARBON DISULFIDE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
CHLOROFORM	ug/l	1.0 U	0.9 P	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	0.2 J	1.0 U	1/ 8
CHLOROMETHANE	ug/l	10.0 U	2.0 U	2.0 U	0/11	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 P	0/ 8
ETHYLBENZENE (PHENYLETHANE)	ug/l	5.0 U	0.4 P	1.0 U	0/11	5.0 U	0.4 P	1.0 U	0/ 8	5.0 U	0.3 P	1.0 U	0/ 8	5.0 U	0.4 P	1.0 U	0/ 8
METHYLENE CHLORIDE	ug/l	5.0 U	0.3 P	1.0 U	0/11	5.0 U	0.2 P	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	0/ 8
TETRACHLOROETHENE (PCE)	ug/l	1.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8
STYRENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
TRANS-1,2-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/ 3	5.0 U	1.0 U	1.0 U	0/ 3	5.0 U	1.0 U	1.0 U	0/ 3	5.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	5.0 U	0.4 J	1.0 U	1/ 8	5.0 U	0.7 J	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	0/ 8
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	1.0 U	0.2 P	1.0 U	0/11	1.0 U	0.2 P	1.0 U	0/ 8	1.0 U	0.3 P	1.0 U	0/ 8	3.0 P	0.2 P	1.0 U	0/ 8
TOTAL XYLENES(M+O+P)	ug/l	1.2	0.6 J	1.0 U	2/11	1.0 U	0.6 J	1.0 U	1/ 8	1.0 U	0.3 J	1.0 U	1/ 8	1.0 U	0.8 J	1.0 U	1/ 8
VINYL CHLORIDE	ug/l	2.0 U	1.0 U	2.0 U	0/11	2.0 U	1.0 U	2.0 U	0/ 8	2.0 U	1.0 U	2.0 U	0/ 8	2.0 U	1.0 U	2.0 U	0/ 8

TABLE 6-17 (continued)
Summary of VOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-11A				SAMPLING LOCATION: OI-12B				SAMPLING LOCATION: OI-12C				SAMPLING LOCATION: OI-13A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,1,2-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,1-DICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,1-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,2-DICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROPROPANE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
1,4-DIOXANE	ug/l	1.00E+04 U	7.00E-01 J	3.50E+00 U	1/ 8	1.00E+04 U	1.00E+00 P	3.50E+00 U	0/ 8	1.00E+04 U	1.00E+00 P	3.50E+00 U	0/ 8	1.00E+04 U	1.00E+00 P	3.50E+00 U	0/ 8
2-BUTANONE	ug/l	20.0 P	2.0 P	2.0 U	0/ 8	20.0 P	1.0 U	2.0 P	0/ 8	20.0 P	1.0 U	2.0 P	0/ 8	20.0 P	2.0 U	2.0 P	0/ 8
2-HEXANONE	ug/l	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8
2-METHYL-2-PROPANOL	ug/l																
4-METHYL-2-PENTANONE	ug/l	10.0 U	2.0 U	2.0 U	0/ 8	2.0 U	1.0 P	2.0 U	0/ 8	2.0 U	0.9 P	2.0 U	0/ 8	2.0 U	1.0 P	2.0 U	0/ 8
2-PROPANONE (ACETONE)	ug/l	24.0 U	2.0 P	2.0 U	0/ 8	20.0 P	2.0 U	2.0 U	0/ 8	20.0 P	2.0 U	2.0 U	0/ 8	20.0 P	2.0 U	2.0 U	0/ 8
BENZENE	ug/l	5.0 U	0.2 P	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
CHLOROBENZENE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
CARBON DISULFIDE	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 8	1.0 P	1.0 P	1.0 U	0/ 8	1.0 U	0.7 P	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8
CHLOROMETHANE	ug/l	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8	10.0 U	2.0 U	2.0 U	0/ 8
ETHYLBENZENE (PHENYLETHANE)	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	0.3 P	1.0 U	0/ 8	5.0 U	0.5 P	1.0 U	0/ 8	5.0 U	0.3 P	1.0 U	0/ 8
METHYLENE CHLORIDE	ug/l	5.0 U	1.0 U	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	1/ 8	5.0 U	0.6 P	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	0/ 8
TETRACHLOROETHENE (PCE)	ug/l	5.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	1.0 U	1.0 U	0/ 8	1.0 U	0.4 J	1.0 U	1/ 8
STYRENE	ug/l	5.0 U	0.3 J	1.0 U	2/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
TRANS-1,2-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/ 3	5.0 U	1.0 U	1.0 U	0/ 3	5.0 U	1.0 U	1.0 U	0/ 3	5.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	1/ 8	5.0 U	1.0 U	1.0 U	0/ 8	5.0 U	1.0 U	1.0 U	0/ 8
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	4.0 U	0.3 J	1.0 P	1/ 8	1.0 P	1.0 P	1.0 U	0/ 8	1.0 U	0.4 P	1.0 U	0/ 8	1.0 U	0.2 P	1.0 U	0/ 8
TOTAL XYLENES(M+O+P)	ug/l	5.0 U	0.2 J	1.0 U	2/ 8	1.0 U	0.4 J	1.0 U	1/ 8	1.0 U	0.9 J	1.0 U	1/ 8	1.1	1.0 U	1.0 U	1/ 8
VINYL CHLORIDE	ug/l	10.0 U	1.0 U	2.0 U	0/ 8	2.0 U	1.0 U	2.0 U	0/ 8	2.0 U	1.0 U	2.0 U	0/ 8	2.0 U	1.0 U	2.0 U	0/ 8

		SAMPLING LOCATION: OI-13B				SAMPLING LOCATION: OI-13C				SAMPLING LOCATION: OI-14C				SAMPLING LOCATION: OI-15A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
1,1,2-TRICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
1,1-DICHLOROETHANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.3 J	1.0 U	1/ 3
1,1-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.5 J	1.0 U	1/ 4	1.0 U	1.0 U	1.0 U	0/ 3
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 7	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 1
1,2-DICHLOROPROPANE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
1,4-DIOXANE	ug/l	1.00E+04 U	1.00E+00 P	2.00E+00 U	1/11	2.0 P	1.0 P	1.0 U	0/ 5	1.0 P	0.5 J	1.0 U	1/ 4	1.0 P	1.0 P	1.0 P	0/ 3
2-BUTANONE	ug/l	20.0 P	2.0 U	2.0 P	0/11	2.0 P	2.0 P	2.0 P	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 P	2.0 P	2.0 U	0/ 3
2-HEXANONE	ug/l	10.0 U	2.0 U	2.0 U	0/11	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3
2-METHYL-2 PROPANOL	ug/l																
4-METHYL-2 PENTANONE	ug/l	7.0	2.0 U	2.0 U	1/11	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3
2-PROPANONE (ACETONE)	ug/l	20.0 P	2.0 U	2.0 U	1/11	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3
BENZENE	ug/l	5.0 U	0.5 P	1.0 U	1/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.3 J	0.7 J	2/ 3
CHLOROBENZENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
CARBON DISULFIDE	ug/l	5.0 U	0.2 J	1.0 U	2/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 P	0/ 4	1.0 U	1.0 U	1.0 P	0/ 3
CHLOROFORM	ug/l	1.0 P	1.0 P	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
CHLOROMETHANE	ug/l	10.0 U	2.0 U	2.0 U	0/11	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3
ETHYLBENZENE (PHENYLETHANE)	ug/l	5.0 U	0.7 P	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	3.0	1.0 U	2.0	2/ 3
METHYLENE CHLORIDE	ug/l	8.0	1.0 U	1.0 U	1/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
TETRACHLOROETHENE (PCE)	ug/l	1.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.2 J	0.5 J	2/ 3
STYRENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
TRANS-1,2-DICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	0.2 J	1.0 U	1/ 3
TRICHLOROETHYLENE	ug/l	5.0 U	1.0 U	1.0 U	0/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	10.0	0.9 J	1.0 P	4/11	1.0 U	1.0 U	1.0 P	0/ 5	5.0 P	1.0 U	1.0 P	0/ 4	3.0 P	1.0 P	3.0 P	0/ 3
TOTAL XYLENES(M+O+P)	ug/l	1.3	0.3 J	1.0 U	2/11	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	0.6 J	0.5 J	0.5 J	3/ 3
VINYL CHLORIDE	ug/l	2.0 U	1.0 U	2.0 U	0/11	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3

TABLE 6 17 (continued)
Summary of VOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 15B Max	Min	Median	D / O	SAMPLING LOCATION: OI 16A Max	Min	Median	D / O	SAMPLING LOCATION: OI 17A Max	Min	Median	D / O	SAMPLING LOCATION: OI-17B Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	0.3 J	1.0 U	2/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,1,2-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	0.9 J	1.0	2/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,1-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	180.0	27.0	130.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,1-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.4 J	1.0 U	1/ 3	4.0	0.5 J	4.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	220.0	1.0 U	180.0	4/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 2					16.0 J	1.0 U	8.5 J	1/ 2	1.0 U	1.0 U	1.0 U	0/ 1
1,2-DICHLOROPROPANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	3.0	1.0 U	3.0	3/ 5	1.0 U	1.0 U	1.0 U	0/ 5
1,4-DIOXANE	ug/l	9.0 J	1.0 P	1.0 U	2/ 5	1.0 U	1.0 U	1.0 U	0/ 3	29.0 J	1.0 P	13.0	3/ 5	1.0 U	1.0 U	1.0 P	0/ 5
2-BUTANONE	ug/l	2.0 P	2.0 P	2.0 P	0/ 5	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 P	0/ 5	2.0 U	2.0 U	2.0 U	0/ 5
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 5
2-METHYL-2-PROPANOL	ug/l																
4-METHYL-2-PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 5
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 5
BENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.2 J	0.3 J	2/ 3	40.0	6.0	33.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 5
CHLOROBENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	3.0	1.0 U	3.0	4/ 5	1.0 U	1.0 U	1.0 U	0/ 5
CARBON DISULFIDE	ug/l	1.0 U	0.4 J	1.0 P	1/ 5	1.0 U	1.0 U	1.0 U	1/ 3	1.0 U	0.2 J	1.0 U	1/ 5	1.0 U	1.0 U	1.0 U	0/ 5
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	0.7 J	1.0 U	2/ 5	1.0 U	1.0 U	1.0 U	0/ 5
CHLOROMETHANE	ug/l	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 5
ETHYLBENZENE (PHENYLETHANE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.2 J	1.0 U	1/ 3	11.0	0.7 J	2.0	4/ 5	1.0 U	1.0 U	1.0 U	0/ 5
METHYLENE CHLORIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	150.0	1.0 U	21.0	4/ 5	1.0 P	1.0 P	1.0 U	0/ 5
TETRACHLOROETHENE (PCE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	510.0	11.0	420.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 5
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 5
TRANS-1,2-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	8.0	7.0	7.5	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TRICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 3	370.0	53.0	300.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 5
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	1.0 U	1.0 U	1.0 P	0/ 5	2.0 P	1.0 P	1.0 P	0/ 3	9.0	2.0 P	3.0 P	1/ 5	1.0 U	1.0 U	1.0 U	0/ 5
TOTAL XYLENES(M+O+P)	ug/l	1.0 U	1.0 U	1.0 U	0/ 5	1.0	0.6 J	1.0	2/ 3	3.0	1.0	2.0 P	4/ 5	1.0 U	1.0 U	1.0 U	0/ 5
VINYL CHLORIDE	ug/l	2.0 U	2.0 U	2.0 U	0/ 5	89.0	20.0	38.0	3/ 3	33.0	16.0	25.0	5/ 5	2.0 U	2.0 U	2.0 U	0/ 5

Chemical	Units	SAMPLING LOCATION: OI-18A Max	Min	Median	D / O	SAMPLING LOCATION: OI-18B Max	Min	Median	D / O	SAMPLING LOCATION: OI-19A Max	Min	Median	D / O	SAMPLING LOCATION: OI-19B Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.2 J	1.0 U	2/ 6	1.0 U	1.0 U	1.0 U	0/ 4
1,1,2-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 4
1,1-DICHLOROETHANE	ug/l	19.0	11.0	16.0	4/ 4	1.0 U	0.4 J	1.0 U	1/ 5	6.0	2.0	5.5	6/ 6	1.0 U	1.0 U	1.0 U	0/ 4
1,1-DICHLOROETHYLENE	ug/l	0.7 J	0.6 J	0.6 J	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	3.0	0.8 J	2.0	6/ 6	1.0 U	1.0 U	1.0 U	0/ 4
1,2-DICHLOROETHANE	ug/l	1.0 U	0.6 J	1.0 U	1/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 4
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 3	2.0 J	1.0 U	1.5 J	1/ 2	1.0 U	1.0 U	1.0 U	0/ 2
1,2-DICHLOROPROPANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 4
1,4-DIOXANE	ug/l	5600.0 J	1900.0	3950.0 J	4/ 4	2.0 P	1.0 P	1.0 P	0/ 5	4.0	0.3 J	1.5 P	3/ 6	2.0 P	0.2 J	1.0 P	1/ 4
2-BUTANONE	ug/l	2.0 P	2.0 P	2.0 P	0/ 4	2.0 P	2.0 P	2.0 U	0/ 5	2.0 P	2.0 P	2.0 P	0/ 6	2.0 P	2.0 P	2.0 P	0/ 4
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 6	2.0 U	2.0 U	2.0 U	0/ 4
2-METHYL-2-PROPANOL	ug/l																
4-METHYL-2-PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 6	2.0 U	2.0 U	2.0 U	0/ 4
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 6	2.0 U	2.0 U	2.0 U	0/ 4
BENZENE	ug/l	18.0	13.0	16.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 P	0.4 J	0.6 J	4/ 6	1.0 U	1.0 U	1.0 U	0/ 4
CHLOROBENZENE	ug/l	5.0	4.0	4.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 4
CARBON DISULFIDE	ug/l	1.0 P	1.0 P	1.0 U	0/ 4	1.0 U	1.0 U	1.0 P	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 P	1.0 P	1.0 U	0/ 4
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 4
CHLOROMETHANE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 6	2.0 U	2.0 U	2.0 U	0/ 4
ETHYLBENZENE (PHENYLETHANE)	ug/l	340.0	40.0 K	105.0	6/ 6	1.0	1.0	1.0 P	2/ 5	1.0 P	0.4 J	1.0 P	1/ 6	1.0	1.0	1.0 U	1/ 4
METHYLENE CHLORIDE	ug/l	1.0 P	1.0 P	1.0 P	1/ 4	1.0 U	1.0 U	1.0 U	0/ 5	2.0 P	1.0 P	1.5 P	2/ 6	1.0 U	1.0 U	1.0 U	0/ 4
TETRACHLOROETHENE (PCE)	ug/l	2.0	1.0	2.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	18.0	6.0	16.0	6/ 6	6.0	4.0	5.5	4/ 4
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	1.0 U	1.0 U	0/ 4
TRANS-1,2 DICHLOROETHYLENE	ug/l	5.0	3.0	4.5	4/ 4	1.0 U	1.0 U	1.0 U	0/ 3	0.3 J	0.2 J	0.3 J	5/ 5	1.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	7.0	6.0	6.5	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	9.0	4.0	8.0	6/ 6	1.0 U	0.9 J	1.0 U	3/ 4
TRIMETHYL BENZENE	ug/l	27.0 K	10.0 K	14.5 K	6/ 6												
TOLUENE (METHYL BENZENE)	ug/l	110.0	36.0	44.0	4/ 4	1.0 P	0.3 J	1.0 P	2/ 5	1.0 U	1.0 U	1.0 U	0/ 6	2.0 P	0.8 J	1.0 P	1/ 4
TOTAL XYLENES(M+O+P)	ug/l	64.0	29.0	33.5	4/ 4	1.0 U	0.2 J	0.3 J	3/ 5	1.0 U	1.0 U	1.0 U	0/ 6	1.0 U	0.3 J	1.0 U	1/ 4
VINYL CHLORIDE	ug/l	33.0	12.0	24.0	4/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	0.5 J	0.8 J	5/ 6	2.0 U	2.0 U	2.0 U	0/ 4

TABLE 6 17 (continued)
Summary of VOLATILE ORGANIC COMPOUNDS in Groundwater
OIT Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-19C				SAMPLING LOCATION: OI-20A				SAMPLING LOCATION: OI-20B				SAMPLING LOCATION: OI-21B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	2.0	0.4 J	0.8 U	3/ 4	1.0 U	1.0 U	1.0 U	1/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,1,2-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,1-DICHLOROETHANE	ug/l	1.0 U	0.4 J	0.7 J	3/ 4	0.8 J	0.6 J	0.7 J	5/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,1-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.2 J	0.2 J	3/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.7 J	1.0 U	1/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 2	73.0 J	1.0 U	1.0 U	1/ 3	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2
1,2-DICHLOROPROPANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	2.0	1.0 U	1.0 U	3/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,4-DIOXANE	ug/l	2.0 P	1.0 P	1.0 P	0/ 4	2.0 P	1.0 P	1.0 P	0/ 5	1.0 P	1.0 P	1.0 U	0/ 4	2.0 P	1.0 U	1.0 P	0/ 4
2-BUTANONE	ug/l	2.0 P	2.0 P	2.0 P	0/ 4	2.0 P	2.0 P	2.0 U	0/ 5	2.0 P	2.0 P	2.0 P	0/ 4	2.0 P	2.0 P	2.0 P	0/ 4
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
2-METHYL-2-PROPANOL	ug/l																
4-METHYL-2 PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
BENZENE	ug/l	1.0 U	1.0 U	1.0 P	0/ 4	2.0	1.0 P	1.0	4/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
CHLOROBENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
CARBON DISULFIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.4 J	1.0 P	1/ 4	1.0 P	1.0 P	1.0 U	0/ 4
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.2 J	1.0 U	2/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
CHLOROMETHANE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
ETHYLBENZENE (PHENYLETHANE)	ug/l	2.0 P	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 P	1/ 5	1.0 U	1.0 U	1.0 U	0/ 4	2.0	1.0 P	1.0 U	1/ 4
METHYLENE CHLORIDE	ug/l	3.0 P	0.6 J	1.0 P	1/ 4	1.0 P	1.0 P	1.0	3/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TETRACHLOROETHENE (PCE)	ug/l	1.0 U	0.2 J	0.3 J	3/ 4	15.0	12.0	13.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TRANS-1,2-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	1.0	0.9 J	1.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	1.0 U	0.2 J	1.0 U	1/ 4	32.0	22.0	26.0	5/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TRIMETHYL BENZENE	ug/l					3.5 K	2.0 K	3.0 K	4/ 4					1.0 K	1.0 K	1.0 K	1/ 1
TOLUENE (METHYL BENZENE)	ug/l	1.0 U	1.0 U	1.0 P	0/ 4	1.0 U	1.0 U	1.0 P	0/ 5	4.0 P	1.0 U	1.5 P	0/ 4	2.0	1.0 P	1.0 U	1/ 4
TOTAL XYLENES(M+O+P)	ug/l	2.0 P	1.0 U	1.0 U	0/ 4	1.0 P	0.2 J	1.0 U	1/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.6 J	1.0 U	1/ 4
VINYL CHLORIDE	ug/l	2.0 U	0.3 J	2.0 U	1/ 4	8.0	4.0	4.0	5/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4

		SAMPLING LOCATION: OI 22B				SAMPLING LOCATION: OI-23B				SAMPLING LOCATION: OI-25A				SAMPLING LOCATION: OI-25B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
1,1,2-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
1,1-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
1,1-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 3
1,2-DICHLOROPROPANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
1,4-DIOXANE	ug/l	1.0 U	1.0 U	1.0 P	0/ 4	1.0 U	1.0 U	1.0 P	0/ 4	1.0 P	1.0 P	1.0 U	0/ 3	1.0 P	1.0 P	1.0 P	0/ 5
2-BUTANONE	ug/l	2.0 P	2.0 P	2.0 U	0/ 4	2.0 P	2.0 P	2.0 P	0/ 4	2.0 P	2.0 P	2.0 P	0/ 3	2.0 P	2.0 P	2.0 P	0/ 5
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5
2-METHYL-2-PROPANOL	ug/l																
4-METHYL-2-PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5
BENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
CHLOROBENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
CARBON DISULFIDE	ug/l	1.0 P	1.0 P	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
CHLOROMETHANE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5
ETHYLBENZENE (PHENYLETHANE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	2.0	1.0 U	1.0 U	1/ 3	1.0 U	1.0 U	1.0 P	0/ 5
METHYLENE CHLORIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
TETRACHLOROETHENE (PCE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
TRANS-1,2 DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	2.0 P	1.0 U	1.0 P	0/ 4	1.0 P	1.0 P	1.0 P	0/ 4	2.0 P	1.0 U	1.0 P	0/ 3	1.0 U	1.0 U	1.0 U	0/ 5
TOTAL XYLENES(M+O+P)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	0.3 J	1.0 U	1/ 3	1.0 U	1.0 U	1.0 U	0/ 5
VINYL CHLORIDE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 3	2.0 U	2.0 U	2.0 U	0/ 5

TABLE 6 17 (continued)
Summary of VOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 26A Max	Min	Median	D / O	SAMPLING LOCATION: OI 26B Max	Min	Median	D / O	SAMPLING LOCATION: OI 27A Max	Min	Median	D / O	SAMPLING LOCATION: OI-28B Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,1,2-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,1-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	82.0	29.0	52.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,1-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	8.0	1.0	3.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.6 J	1.0 U	1/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 1	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 2	1.0 U	1.0 U	1.0 U	0/ 1
1,2-DICHLOROPROPANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.2 J	1.0 U	1/ 4	1.0 U	1.0 U	1.0 U	0/ 4
1,4-DIOXANE	ug/l	1.0 P	1.0 P	1.0 P	0/ 4	1.0 U	0.3 J	1.0 U	1/ 5	2.0 J	1.0	1.0 P	2/ 4	1.0 P	0.6 J	1.0 U	1/ 4
2-BUTANONE	ug/l	2.0 U	2.0 U	2.0 P	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 P	2.0 P	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
2-METHYL-2-PROPANOL	ug/l																
4-METHYL-2-PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
BENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	3.0	1.0	2.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
CHLOROBENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.6 J	0.7 J	3/ 4	1.0 U	1.0 U	1.0 U	0/ 4
CARBON DISULFIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 P	0/ 4	1.0 U	1.0 U	1.0 P	0/ 4
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
CHLOROMETHANE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 4
ETHYLBENZENE (PHENYLETHANE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	3.0	0.8 J	0.9 U	3/ 4	1.0 U	1.0 U	1.0 U	0/ 4
METHYLENE CHLORIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	0.3 J	0.7 U	2/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TETRACHLOROETHENE (PCE)	ug/l	4.0	3.0	3.0	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	19.0	4.0	8.5	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TRANS-1,2-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	1.0 U	1.0 U	0/ 3	1.0 U	0.4 J	1.0 U	1/ 4	1.0 U	1.0 U	1.0 U	0/ 3
TRICHLOROETHYLENE	ug/l	0.7 J	0.5 J	0.7 J	4/ 4	1.0 U	1.0 U	1.0 U	0/ 5	19.0	5.0	8.5	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	1.0 P	1.0 P	1.0 U	0/ 4	1.0 P	1.0 P	1.0 U	0/ 5	2.0 P	1.0 P	1.5 P	0/ 4	2.0 P	1.0 U	1.0 P	0/ 4
TOTAL XYLENES(M+O+P)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4	1.0 U	1.0 U	1.0 U	0/ 5	1.0	0.3 J	0.4 J	4/ 4	1.0 U	1.0 U	1.0 U	0/ 4
VINYL CHLORIDE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4	2.0 U	2.0 U	2.0 U	0/ 5	8.0	2.0	3.5	4/ 4	2.0 U	2.0 U	2.0 U	0/ 4

Chemical	Units	SAMPLING LOCATION: OI-29B Max	Min	Median	D / O	SAMPLING LOCATION: Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1,1-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
1,1,2-TRICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
1,1-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
1,1-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
1,2-DICHLOROETHANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
1,2-DICHLOROETHENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 1												
1,2-DICHLOROPROPANE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
1,4-DIOXANE	ug/l	1.0 P	1.0 P	1.0 P	0/ 4												
2-BUTANONE	ug/l	2.0 P	2.0 P	2.0 P	0/ 4												
2-HEXANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4												
2-METHYL-2 PROPANOL	ug/l																
4-METHYL-2-PENTANONE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4												
2-PROPANONE (ACETONE)	ug/l	2.0 U	2.0 U	2.0 U	0/ 4												
BENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
CHLOROBENZENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
CARBON DISULFIDE	ug/l	1.0 P	1.0 P	1.0 U	0/ 4												
CHLOROFORM	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
CHLOROMETHANE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4												
ETHYLBENZENE (PHENYLETHANE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
METHYLENE CHLORIDE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
TETRACHLOROETHENE (PCE)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
STYRENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
TRANS-1,2-DICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 3												
TRICHLOROETHYLENE	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
TRIMETHYL BENZENE	ug/l																
TOLUENE (METHYL BENZENE)	ug/l	1.0 P	1.0 P	1.0 P	0/ 4												
TOTAL XYLENES(M+O+P)	ug/l	1.0 U	1.0 U	1.0 U	0/ 4												
VINYL CHLORIDE	ug/l	2.0 U	2.0 U	2.0 U	0/ 4												

TABLE 6-18
Summary of SEMIVOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD-13				SAMPLING LOCATION: CDD-17				SAMPLING LOCATION: DS-01			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l													13.0 K	13.0 K	13.0 K	1/ 1
1,2-DICHLOROBENZENE	ug/l	10.0 U	0.0	5.0 U	0/ 4	8.0 U	1.0 J	5.0 U	2/ 5	5.0 U	2.0 U	3.5 U	0/ 2	5.0 U	2.0 U	3.5 U	0/ 2
1,3-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	5.0 U	0/ 4	10.0 U	5.0 U	8.0 U	0/ 5	10.0 U	5.0 U	7.5 U	0/ 2	10.0 U	5.0 U	7.5 U	0/ 2
1,4-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	5.0 U	0/ 4	8.0 U	1.4	5.0	3/ 5	5.0 U	2.0 U	3.5 U	0/ 2	5.0 U	2.0 U	3.5 U	0/ 2
2-METHYLNAPHTHALENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 1	10.0 U	8.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 1	10.0 U	10.0 U	10.0 U	0/ 1
BENZYL ALCOHOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 1	10.0 U	8.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 1	10.0 U	10.0 U	10.0 U	0/ 1
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	12.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	16.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2
BENZOIC ACID	ug/l	50.0 U	10.0 U	10.0 U	0/ 3	50.0 U	10.0 U	44.0 U	0/ 5	50.0 U	10.0 U	30.0 U	0/ 2	50.0 U	10.0 U	30.0 U	0/ 2
DI-N-BUTYLPHTHALATE	ug/l	10.0 U	2.5 U	2.5 U	0/ 3	10.0 U	2.0	8.0 U	1/ 5	10.0 U	2.5 U	6.3 U	0/ 2	10.0 U	2.5 U	6.3 U	0/ 2
DIETHYL PHTHALATE (DEP)	ug/l	10.0 U	5.0 U	5.0 U	0/ 3	16.0 U	5.0 U	10.0 U	0/ 5	10.0 U	5.0 U	7.5 U	0/ 2	10.0 U	5.0 U	7.5 U	0/ 2
DIMETHYL PHTHALATE	ug/l	10.0 U	5.0 U	5.0 U	0/ 3	30.0 U	5.0 U	10.0 U	0/ 5	10.0 U	5.0 U	7.5 U	0/ 2	10.0 U	5.0 U	7.5 U	0/ 2
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	18.0 U	0.4	10.0 U	1/ 5	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2
FLUORANTHENE (IDRYL)	ug/l	10.0 U	5.0 U	5.0 U	0/ 3	12.0 U	2.0 J	5.0 U	2/ 5	10.0 U	5.0 U	7.5 U	0/ 2	10.0 U	5.0 U	7.5 U	0/ 2
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	1.0 U	1.0 U	0/ 3	10.0 U	1.0 U	8.0 U	0/ 5	10.0 U	1.0 U	5.5 U	0/ 2	10.0 U	1.0 U	5.5 U	0/ 2
N NITROSODIMETHYLAMINE	ug/l																
N-NITROSODIPHENYLAMINE	ug/l	20.0 U	10.0 U	20.0 U	0/ 3	20.0 U	10.0 U	10.0 U	0/ 5	20.0 U	10.0 U	15.0 U	0/ 2	20.0 U	10.0 U	15.0 U	0/ 2
ORGANIC ACIDS	ug/l					2800.0	2800.0	2800.0	1/ 1								
PHENOL	ug/l	10.0 U	5.0 U	5.0 U	0/ 3	10.0 U	5.0 U	10.0 U	0/ 5	10.0 U	5.0 U	7.5 U	0/ 2	10.0 U	5.0 U	7.5 U	0/ 2
PYRENE	ug/l	10.0 U	5.0 U	5.0 U	0/ 3	14.0 U	1.0 J	5.0 U	2/ 5	10.0 U	5.0 U	7.5 U	0/ 2	10.0 U	5.0 U	7.5 U	0/ 2
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5-TRIMETHYLBENZENE	ug/l																

		SAMPLING LOCATION: OI-01A				SAMPLING LOCATION: OI-01C				SAMPLING LOCATION: OI-02				SAMPLING LOCATION: OI-03			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2-DICHLOROBENZENE	ug/l	12.0 U	1.0 U	10.0 U	0/18	12.2 U	1.0 U	2.0 U	0/13	10.8 U	1.0 U	10.0 U	0/19	11.5 U	1.0 U	10.0 U	0/13
1,3-DICHLOROBENZENE	ug/l	12.0 U	1.0 U	10.0 U	0/18	12.2 U	1.0 U	2.0 U	0/13	10.8 U	1.0 U	10.0 U	0/19	11.5 U	1.0 U	10.0 U	0/13
1,4-DICHLOROBENZENE	ug/l	12.0 U	1.0 U	10.0 U	0/18	12.2 U	1.0 U	2.0 U	0/13	10.8 U	1.0 U	10.0 U	0/19	11.5 U	1.0 U	10.0 U	0/13
2-METHYLNAPHTHALENE	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	11.5 U	10.0 U	10.0 U	0/10
BENZYL ALCOHOL	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	20.0 U	10.0 U	10.0 U	0/11
BUTYLBENZYL PHTHALATE (BBP)	ug/l	12.0 U	10.0 U	10.0 U	1/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	2.0 J	10.0 U	1/15	11.5 U	10.0 U	10.0 U	0/11
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	12.0 U	5.0 U	10.0 U	2/15	26.0	7.0 J	10.0 U	2/ 8	11.0 U	3.0 J	10.0 U	3/15	20.0 U	2.0 J	10.0 U	3/11
BENZOIC ACID	ug/l	60.0 U	50.0 U	50.0 U	0/15	61.0 U	10.0 U	50.0 U	0/ 8	54.0 U	10.0 J	50.0 U	1/15	100.0 U	50.0 U	50.0 U	0/11
DI-N-BUTYLPHTHALATE	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	11.5 U	10.0 U	10.0 U	0/10
DIETHYL PHTHALATE (DEP)	ug/l	12.0 U	5.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	5.0 U	10.0 U	0/15	11.5 U	5.0 U	10.0 U	0/10
DIMETHYL PHTHALATE	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.0 U	10.0 U	10.0 U	0/ 8	11.0 U	2.0 J	10.0 U	1/15	12.0 U	10.0 U	10.0 U	0/10
DI-N-OCTYL PHTHALATE	ug/l	12.0 U	10.0 U	10.0 U	0/15	10.0 U	0.5 J	10.0 U	1/ 8	11.0 U	10.0 U	10.0 U	0/15	12.0 U	10.0 U	10.0 U	0/10
FLUORANTHENE (IDRYL)	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	11.5 U	10.0 U	10.0 U	0/10
NAPHTHALENE (TAR CAMPHOR)	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	11.5 U	10.0 U	10.0 U	0/10
N-NITROSODIMETHYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 6					10.0 U	10.0 U	10.0 U	0/ 7	10.0 U	10.0 U	10.0 U	0/ 5
N-NITROSODIPHENYLAMINE	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 U	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	11.5 U	10.0 U	10.0 U	0/10
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	12.0 U	2.0 J	10.0 U	2/15	12.2 U	10.0 U	10.0 U	0/ 8	13.0 P	2.8 P	10.0 U	0/15	20.0 U	2.8 J	10.0 U	1/11
PYRENE	ug/l	12.0 U	10.0 U	10.0 U	0/15	12.2 U	10.0 P	10.0 U	0/ 8	10.8 U	10.0 U	10.0 U	0/15	11.5 U	10.0 U	10.0 U	0/10
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

TABLE 6-18 (continued)
Summary of SEMIVOLATILE ORGANIC COMPOUNDS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI-04				SAMPLING LOCATION: OI-05				SAMPLING LOCATION: OI-06				SAMPLING LOCATION: OI-07C			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l	7.0 J	5.0 J	6.0 J	2/ 2												
1,2-DICHLOROBENZENE	ug/l	10.0 U	0.2 J	10.0 U	2/18	11.0 U	1.0 U	10.0 U	0/20	11.5 U	1.0 U	10.0 U	0/15	10.0 U	1.0 U	6.0 U	0/ 6
1,3-DICHLOROBENZENE	ug/l	10.0 U	1.0 U	10.0 U	0/18	11.0 U	1.0 U	10.0 U	0/20	11.5 U	1.0 U	10.0 U	0/15	10.0 U	1.0 U	6.0 U	0/ 6
1,4-DICHLOROBENZENE	ug/l	60.7 J	3.0 J	10.0 U	11/19	11.0 U	1.0 U	10.0 U	0/20	11.5 U	1.0 U	3.4 U	0/15	10.0 U	1.0 U	2.0 U	0/ 6
2-METHYLNAPHTHALENE	ug/l	50.0 U	8.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 U	0/18	11.5 U	1.9 J	10.0 U	1/12	10.0 U	10.0 U	10.0 U	0/ 5
BENZYL ALCOHOL	ug/l	10.0 U	8.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 P	0/18	11.5 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
BUTYLBENZYL PHTHALATE (BBP)	ug/l	12.0 U	10.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 U	0/18	11.5 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	730.0	2.2 J	10.0 U	3/17	26.0	3.0 J	10.0 U	4/18	20.0 P	1.8 J	10.0 U	4/12	10.0 P	10.0 P	10.0 U	0/ 5
BENZOIC ACID	ug/l	50.0 U	18.0 J	50.0 U	1/17	55.0 U	50.0 U	50.0 U	0/18	58.0 U	10.0 U	50.0 U	0/12	50.0 U	50.0 U	50.0 U	0/ 5
DI-N-BUTYLPHTHALATE	ug/l	10.0 U	1.7 J	10.0 U	5/17	11.0 U	2.0 P	10.0 U	0/18	11.5 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
DIETHYL PHTHALATE (DEP)	ug/l	16.0 U	5.0 J	10.0 U	1/17	11.0 U	0.5 J	10.0 U	1/18	11.5 U	5.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
DIMETHYL PHTHALATE	ug/l	30.0 U	10.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 U	0/18	12.0 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
DI-N-OCTYL PHTHALATE	ug/l	18.0 U	2.0 J	10.0 U	1/17	11.0 U	0.4 J	10.0 U	1/18	12.0 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
FLUORANTHENE (IDRYL)	ug/l	12.0 U	10.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 U	0/18	11.5 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	1.0 J	10.0 U	3/17	11.0 U	10.0 U	10.0 U	0/18	11.5 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
N-NITROSODIMETHYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 9	10.0 U	10.0 U	10.0 U	0/ 9	10.0 U	10.0 U	10.0 U	0/ 5				
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 U	0/18	11.5 U	10.0 U	10.0 U	0/12	10.0 U	10.0 U	10.0 U	0/ 5
ORGANIC ACIDS	ug/l	400.0	400.0	400.0	1/ 1												
PHENOL	ug/l	50.0 U	10.0 U	10.0 U	0/17	11.0 U	2.1 J	10.0 U	2/18	11.5 U	1.0 P	10.0 U	1/12	10.0 U	10.0 U	10.0 U	0/ 5
PYRENE	ug/l	14.0 U	10.0 U	10.0 U	0/17	11.0 U	10.0 U	10.0 U	0/18	11.5 U	10.0 U	10.0 U	0/11	10.0 U	10.0 U	10.0 P	0/ 5
1,2,4,5-TETRAMETHYLBENZENE	ug/l	6.0 J	6.0 J	6.0 J	1/ 1												
1,3,5-TRIMETHYLBENZENE	ug/l	3.0 J	1.0 J	2.0 J	2/ 2												

Chemical	Units	SAMPLING LOCATION: OI-08A				SAMPLING LOCATION: OI-09A				SAMPLING LOCATION: OI-10A				SAMPLING LOCATION: OI-10B			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2-DICHLOROBENZENE	ug/l	11.8 U	1.0 U	6.0 U	0/12	15.6 U	1.0 U	2.0 U	0/ 9	11.4 U	1.0 U	2.0 U	0/ 9	11.6 U	1.0 U	2.0 U	0/ 9
1,3-DICHLOROBENZENE	ug/l	11.8 U	1.0 U	6.0 U	0/12	15.6 U	1.0 U	2.0 U	0/ 9	11.4 U	1.0 U	2.0 U	0/ 9	11.6 U	1.0 U	2.0 U	0/ 9
1,4-DICHLOROBENZENE	ug/l	11.8 U	1.0 U	2.0 U	0/12	15.6 U	1.0 U	2.0 U	0/ 9	11.4 U	1.0 U	2.0 U	0/ 9	11.6 U	1.0 U	2.0 U	0/ 9
2-METHYLNAPHTHALENE	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
BENZYL ALCOHOL	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
BUTYLBENZYL PHTHALATE (BBP)	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	12.0 U	5.0 J	10.0 P	2/ 8	16.0 U	10.0 U	10.0 U	0/ 6	11.0 U	10.0 U	10.0 U	1/ 6	12.0 U	9.0 J	10.0 U	1/ 6
BENZOIC ACID	ug/l	59.0 U	50.0 U	50.0 U	0/ 8	50.0 U	12.0 J	50.0 U	1/ 6	57.0 U	50.0 U	50.0 U	0/ 6	58.0 U	10.0 U	50.0 U	0/ 6
DI-N-BUTYLPHTHALATE	ug/l	11.8 U	2.0 J	10.0 P	1/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
DIETHYL PHTHALATE (DEP)	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
DIMETHYL PHTHALATE	ug/l	12.0 U	10.0 U	10.0 U	0/ 8	16.0 U	10.0 U	10.0 U	0/ 6	11.0 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6
DI-N-OCTYL PHTHALATE	ug/l	12.0 U	10.0 U	10.0 U	0/ 8	16.0 U	10.0 U	10.0 U	0/ 6	11.0 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6
FLUORANTHENE (IDRYL)	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
NAPHTHALENE (TAR CAMPHOR)	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
N-NITROSODIMETHYLAMINE	ug/l																
N-NITROSODIPHENYLAMINE	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6
PYRENE	ug/l	11.8 U	10.0 U	10.0 U	0/ 8	15.6 U	10.0 U	10.0 U	0/ 6	11.4 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 P	10.0 U	0/ 6
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5-TRIMETHYLBENZENE	ug/l																

TABLE 6-18 (continued)
Summary of SEMIVOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-11A				SAMPLING LOCATION: OI-12B				SAMPLING LOCATION: OI-12C				SAMPLING LOCATION: OI-13A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	10.6 U	1.0 U	2.0 U	0/ 9	12.0 U	1.0 U	2.0 U	0/ 9	11.6 U	1.0 U	2.0 U	0/ 9	13.3 U	1.0 U	2.0 U	0/ 9
1,3-DICHLOROBENZENE	ug/l	10.6 U	1.0 U	2.0 U	0/ 9	12.0 U	1.0 U	2.0 U	0/ 9	11.6 U	1.0 U	2.0 U	0/ 9	13.3 U	1.0 U	2.0 U	0/ 9
1,4-DICHLOROBENZENE	ug/l	10.6 U	1.0 U	2.0 U	0/ 9	12.0 U	1.0 U	2.0 U	0/ 9	11.6 U	1.0 U	2.0 U	0/ 9	13.3 U	1.0 U	2.0 U	0/ 9
2-METHYLNAPHTHALENE	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
BENZYL ALCOHOL	ug/l	10.6 U	6.0 J	10.0 U	1/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	11.0 U	3.0 J	10.0 U	1/ 6	13.0	10.0 U	10.0 U	1/ 6	12.0 U	4.0 J	10.0 U	1/ 6	13.0 U	10.0 U	10.0 U	0/ 6
BENZOIC ACID	ug/l	53.0 U	13.0 J	50.0 U	2/ 6	60.0 U	50.0 U	50.0 U	0/ 6	58.0 U	50.0 U	50.0 U	0/ 6	67.0 U	50.0 U	50.0 U	0/ 6
DI-N-BUTYLPHTHALATE	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
DIETHYL PHTHALATE (DEP)	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
DIMETHYL PHTHALATE	ug/l	10.0 U	3.0 J	10.0 U	1/ 6	10.0 U	2.0 J	10.0 U	1/ 6	12.0 U	10.0 U	10.0 U	0/ 6	13.0 U	10.0 U	10.0 U	0/ 6
DI-N-OCTYL PHTHALATE	ug/l	11.0 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	13.0 U	10.0 U	10.0 U	0/ 6
FLUORANTHENE (IDRYL)	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
N NITROSODIMETHYLAMINE	ug/l																
N-NITROSODIPHENYLAMINE	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	40.0	7.0 P	10.0 U	1/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 U	0/ 6	13.3 U	4.0 J	10.0 U	1/ 6
PYRENE	ug/l	10.6 U	10.0 U	10.0 U	0/ 6	12.0 U	10.0 U	10.0 U	0/ 6	11.6 U	10.0 U	10.0 P	0/ 6	13.3 U	10.0 U	10.0 U	0/ 6
1,2,4,5 TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

		SAMPLING LOCATION: OI-13B				SAMPLING LOCATION: OI-13C				SAMPLING LOCATION: OI-14C				SAMPLING LOCATION: OI-15A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	12.3 U	1.0 U	2.0 U	0/13	10.0 U	1.0 U	2.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 5
1,3-DICHLOROBENZENE	ug/l	12.3 U	1.0 U	2.0 U	0/13	10.0 U	1.0 U	10.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	10.0 U	0/ 5
1,4-DICHLOROBENZENE	ug/l	12.3 U	1.0 U	2.0 U	0/13	10.0 U	2.0 U	2.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 5
2-METHYLNAPHTHALENE	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BENZYL ALCOHOL	ug/l	12.3 U	6.0 J	10.0 U	1/ 8	10.0 U	4.0 J	10.0 U	1/ 4	10.0 U	10.0 U	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BUTYLBENZYL PHTHALATE (BBP)	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	3.0 J	10.0 U	1/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	130.0 P	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 P	0/ 3
BENZOIC ACID	ug/l	50.0 U	2.0 J	50.0 U	2/ 8	50.0 U	50.0 U	50.0 U	0/ 4	50.0 U	50.0 U	50.0 U	0/ 3	50.0 U	50.0 U	50.0 U	0/ 3
DI-N-BUTYLPHTHALATE	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DIETHYL PHTHALATE (DEP)	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DIMETHYL PHTHALATE	ug/l	14.0	10.0 U	10.0 U	1/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DI-N-OCTYL PHTHALATE	ug/l	12.0 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
FLUORANTHENE (IDRYL)	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
NAPHTHALENE (TAR CAMPHOR)	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
N NITROSODIMETHYLAMINE	ug/l					8.0 J	8.0 J	8.0 J	1/ 1	10.0 U	10.0 U	10.0 U	0/ 1				
N-NITROSODIPHENYLAMINE	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	8.0 J	10.0 U	1/ 4	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 3
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	18.0 P	10.0 U	10.0 U	1/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 P	10.0 P	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
PYRENE	ug/l	12.3 U	10.0 U	10.0 U	0/ 8	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

TABLE 6 18 (continued)
Summary of SEMIVOLATILE ORGANIC COMPOUNDS in Groundwater
Oil Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 15B				SAMPLING LOCATION: OI-16A				SAMPLING LOCATION: OI-17A				SAMPLING LOCATION: OI-17B			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	10.0 U	2.0 U	2.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	1.0 U	1.0 J	4/ 8	10.0 U	2.0 U	10.0 U	0/ 6
1,3-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	1.0 U	6.0 U	0/ 8	10.0 U	2.0 U	10.0 U	0/ 6
1,4-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	2.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	3.0 J	5/ 8	10.0 U	2.0 U	10.0 U	0/ 6
2-METHYLNAPHTHALENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
BENZYL ALCOHOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 P	0/ 4
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	100.0 P	10.0 U	10.0 U	0/ 4	27.0 P	10.0 P	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
BENZOIC ACID	ug/l	50.0 U	50.0 U	50.0 U	0/ 4	50.0 P	50.0 P	50.0 U	0/ 3	1200.0	50.0 U	435.0	2/ 4	50.0 P	50.0 P	50.0 U	0/ 4
DI-N-BUTYLPHTHALATE	ug/l	63.0	10.0 U	10.0 P	1/ 4	10.0 U	10.0 U	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
DIETHYL PHTHALATE (DEP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 P	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
DIMETHYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
FLUORANTHENE (IDRYL)	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
N NITROSODIMETHYLAMINE	ug/l					10.0 U	10.0 U	10.0 U	0/ 1					10.0 U	10.0 U	10.0 U	0/ 2
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 2
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	10.0 U	9.0 J	10.0 U	1/ 4	10.0 U	10.0 U	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 P	10.0 P	10.0 U	0/ 4
PYRENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 4
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

Chemical	Units	SAMPLING LOCATION: OI 18A				SAMPLING LOCATION: OI-18B				SAMPLING LOCATION: OI-19A				SAMPLING LOCATION: OI-19B			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	10.0 U	2.0	4.0	6/ 7	10.0 U	1.0 U	2.0 U	0/ 7	10.0 U	1.0 U	2.0 U	0/10	10.0 U	1.0 U	2.0 U	0/ 6
1,3-DICHLOROBENZENE	ug/l	10.0 U	2.0 J	3.0	5/ 7	10.0 U	1.0 U	2.0 U	0/ 7	10.0 U	1.0 U	6.0 U	0/10	10.0 U	1.0 U	6.0 U	0/ 6
1,4-DICHLOROBENZENE	ug/l	10.0	4.0 J	9.0 U	6/ 7	10.0 U	2.0 U	2.0 U	0/ 7	10.0 U	2.0 U	2.0 U	0/10	10.0 U	0.3 J	2.0 U	1/ 6
2-METHYLNAPHTHALENE	ug/l	10.0 U	5.0 J	6.0 J	3/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
BENZYL ALCOHOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	10.0 P	10.0 P	10.0 P	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
BENZOIC ACID	ug/l	50.0 U	50.0 U	50.0 U	0/ 4	50.0 U	50.0 U	50.0 P	0/ 3	50.0 U	50.0 U	50.0 U	0/ 5	50.0 U	50.0 U	50.0 U	0/ 3
DI-N-BUTYLPHTHALATE	ug/l	10.0 U	10.0 U	10.0 P	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
DIETHYL PHTHALATE (DEP)	ug/l	29.0 P	10.0 P	19.0	2/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
DIMETHYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
FLUORANTHENE (IDRYL)	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	1.0 J	10.0 U	1/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
N-NITROSODIMETHYLAMINE	ug/l																
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
PYRENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 5	10.0 U	10.0 U	10.0 U	0/ 3
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

TABLE 6-18 (continued)
Summary of SEMIVOLATILE ORGANIC COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI-19C Max	Min	Median	D / O	SAMPLING LOCATION: OI-20A Max	Min	Median	D / O	SAMPLING LOCATION: OI-20B Max	Min	Median	D / O	SAMPLING LOCATION: OI-21B Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	10.0 U	1.0 U	2.0 U	0/ 6	10.0 U	0.2 J	2.0 U	2/ 7	10.0 U	2.0 U	2.0 U	0/ 5	10.0 U	1.0 U	2.0 U	0/ 6
1,3-DICHLOROBENZENE	ug/l	10.0 U	1.0 U	6.0 U	0/ 6	10.0 U	1.0 U	10.0 U	0/ 7	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	1.0 U	6.0 U	0/ 6
1,4-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	2.0 U	0/ 6	4.0	3.0 J	4.0	7/ 7	10.0 U	2.0 U	2.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 6
2-METHYLNAPHTHALENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BENZYL ALCOHOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	20.0 P	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BENZOIC ACID	ug/l	50.0 U	50.0 U	50.0 U	0/ 3	50.0 U	1.0 J	50.0 P	1/ 4	50.0 U	50.0 U	50.0 U	0/ 3	50.0 U	50.0 U	50.0 P	0/ 3
DI-N-BUTYLPHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DIETHYL PHTHALATE (DEP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DIMETHYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
FLUORANTHENE (IDRYL)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
N-NITROSODIMETHYLAMINE	ug/l																
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
PYRENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

Chemical	Units	SAMPLING LOCATION: OI-22B Max	Min	Median	D / O	SAMPLING LOCATION: OI-23B Max	Min	Median	D / O	SAMPLING LOCATION: OI-25A Max	Min	Median	D / O	SAMPLING LOCATION: OI-25B Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	2.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 6	10.0 U	2.0 U	2.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 5
1,3 DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	6.0 U	0/ 6	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	10.0 U	0/ 5
1,4-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	2.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 6	10.0 U	2.0 U	2.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 5
2-METHYLNAPHTHALENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BENZYL ALCOHOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
BENZOIC ACID	ug/l	50.0 P	50.0 P	50.0 U	0/ 3	50.0 U	50.0 U	50.0 U	0/ 3	50.0 U	50.0 U	50.0 U	0/ 3	50.0 U	50.0 U	50.0 U	0/ 3
DI-N-BUTYLPHTHALATE	ug/l	10.0 U	10.0 U	10.0 P	0/ 3	10.0 P	10.0 P	10.0 U	0/ 3	10.0 P	10.0 P	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DIETHYL PHTHALATE (DEP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DIMETHYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
FLUORANTHENE (IDRYL)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
N-NITROSODIMETHYLAMINE	ug/l																
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
PYRENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

TABLE 6-18 (continued)
Summary of SEMIVOLATILE ORGANIC COMPOUNDS in Groundwater
OIT Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 26A				SAMPLING LOCATION: OI-26B				SAMPLING LOCATION: OI 27A				SAMPLING LOCATION: OI-28B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 6	10.0 U	2.0 U	10.0 U	0/ 5
1,3-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	10.0 U	0/ 6	10.0 U	2.0 U	10.0 U	0/ 5
1,4-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	10.0 U	0/ 5	10.0 U	2.0 U	2.0 U	0/ 6	10.0 U	2.0 U	10.0 U	0/ 5
2-METHYLNAPHTHALENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
BENZYL ALCOHOL	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 P	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 P	10.0 P	10.0 U	0/ 3
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	47.0 P	10.0 P	28.0 P	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
BENZOIC ACID	ug/l	50.0 P	50.0 P	50.0 U	0/ 3	50.0 P	50.0 P	50.0 U	0/ 3	50.0 U	50.0 U	50.0 U	0/ 4	50.0 P	50.0 P	50.0 U	0/ 3
DI-N-BUTYLPHTHALATE	ug/l	10.0 P	10.0 P	10.0 U	0/ 3	10.0 P	10.0 P	10.0 U	0/ 3	10.0 U	10.0 U	10.0 P	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
DIETHYL PHTHALATE (DEP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
DIMETHYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
FLUORANTHENE (IDRYL)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
N-NITROSODIMETHYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 1	10.0 U	10.0 U	10.0 U	0/ 1					10.0 U	10.0 U	10.0 U	0/ 1
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 2	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 2
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	10.0 U	10.0 U	10.0 P	0/ 3	10.0 P	10.0 P	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 P	10.0 P	10.0 U	0/ 3
PYRENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 3	10.0 U	10.0 U	10.0 U	0/ 4	10.0 U	10.0 U	10.0 U	0/ 3
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

		SAMPLING LOCATION: OI-29B				SAMPLING LOCATION:											
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,2,3-TRIMETHYLBENZENE	ug/l																
1,2 DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5												
1,3-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5												
1,4-DICHLOROBENZENE	ug/l	10.0 U	2.0 U	10.0 U	0/ 5												
2-METHYLNAPHTHALENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
BENZYL ALCOHOL	ug/l	10.0 P	10.0 P	10.0 U	0/ 3												
BUTYLBENZYL PHTHALATE (BBP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
BIS(2-ETHYLHEXYL)PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
BENZOIC ACID	ug/l	50.0 U	50.0 U	50.0 U	0/ 3												
DI-N-BUTYLPHTHALATE	ug/l	10.0 U	10.0 U	10.0 P	0/ 3												
DIETHYL PHTHALATE (DEP)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
DIMETHYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
DI-N-OCTYL PHTHALATE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
FLUORANTHENE (IDRYL)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
NAPHTHALENE (TAR CAMPHOR)	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
N-NITROSODIMETHYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 1												
N-NITROSODIPHENYLAMINE	ug/l	10.0 U	10.0 U	10.0 U	0/ 2												
ORGANIC ACIDS	ug/l																
PHENOL	ug/l	10.0 P	10.0 P	10.0 U	0/ 3												
PYRENE	ug/l	10.0 U	10.0 U	10.0 U	0/ 3												
1,2,4,5-TETRAMETHYLBENZENE	ug/l																
1,3,5 TRIMETHYLBENZENE	ug/l																

TABLE 6 19
Summary of PESTICIDES and PCBS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD 13				SAMPLING LOCATION: CDD-17				SAMPLING LOCATION: DS-01			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.1 U	0.0	0.1 U	0/ 3|	0.5 U	0.1 U	0.1 U	0/ 5|	0.1 U	0.1 U	0.1 U	0/ 2|	0.1 U	0.1 U	0.1 U	0/ 2|
BETA-BHC (B-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.5 U	0.1 U	0.1 U	0/ 5|	0.1 U	0.1 U	0.1 U	0/ 2|	0.1 U	0.1 U	0.1 U	0/ 2|
DELTA-BHC (C-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.5 U	0.1 U	0.1 U	0/ 5|	0.1 U	0.1 U	0.1 U	0/ 2|	0.1 U	0.1 U	0.1 U	0/ 2|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	2.5 U	0.5 U	2.5 U	0/ 3|	2.5 U	0.5 U	2.0 U	0/ 5|	2.5 U	0.5 U	1.5 U	0/ 2|	2.5 U	0.5 U	1.5 U	0/ 2|
4,4'-DDT	ug/l	0.5 U	0.1 U	0.5 U	0/ 3|	1.0 U	0.1 U	0.5 U	0/ 5|	0.5 U	0.1 U	0.3 U	0/ 2|	0.1 U	0.1 U	0.1	1/ 2|
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 U	0/ 1|	0.5 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 1|	0.1 U	0.1 U	0.1 U	0/ 1|
ENDOSULFAN I	ug/l	0.5 U	0.1 U	0.5 U	0/ 3|	0.5 U	0.1 U	0.5 U	0/ 5|	0.5 U	0.1 U	0.3 U	0/ 2|	0.5 U	0.1 U	0.3 U	0/ 2|
ENDOSULFAN II	ug/l	0.5 U	0.1 U	0.5 U	0/ 3|	0.5 U	0.1 U	0.5 U	0/ 5|	0.5 U	0.1 U	0.3 U	0/ 2|	0.5 U	0.1 U	0.3 U	0/ 2|
HEPTACHLOR	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	1.0 U	0.1 U	0.1 U	0/ 5|	0.1 U	0.1 U	0.1 U	0/ 2|	0.1 U	0.1 U	0.1 U	0/ 2|
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.5 U	0.1 U	0.1 U	0/ 5|	0.1 U	0.1 U	0.1 U	0/ 2|	0.1 U	0.1 U	0.1 U	0/ 2|
METHOXYCHLOR (DMDT)	ug/l	0.5 U	0.5 U	0.5 U	0/ 1|	1.0 U	0.5 U	0.5 U	0/ 3|	0.5 U	0.5 U	0.5 U	0/ 1|	0.5 U	0.5 U	0.5 U	0/ 1|

		SAMPLING LOCATION: OI-01A				SAMPLING LOCATION: OI-01C				SAMPLING LOCATION: OI-02				SAMPLING LOCATION: OI-03			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.5 U	0.0 U	0.1 U	0/14|	0.1 U	0.1 P	0.1 U	0/ 9|	2.5 U	0.1 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|
BETA-BHC (B-BHC)	ug/l	0.5 U	0.0 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 P	0/ 9|	34.0	0.1 U	0.1 U	2/14|	0.1 U	0.1 U	0.1 U	0/ 9|
DELTA-BHC (C-BHC)	ug/l	0.5 U	0.0 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 P	0/ 9|	2.5 U	0.1 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.6 U	0.5 U	0.5 U	0/14|	0.6 U	0.5 U	0.5 U	0/ 9|	25.0 U	0.5 U	0.5 U	0/14|	1.1 U	0.5 U	0.5 U	0/ 9|
4,4'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|	5.0 U	0.1 U	0.1 U	0/14|	0.2 U	0.1 U	0.1 U	0/ 9|
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 P	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|	5.0 U	0.1 U	0.1 U	0/14|	0.2 U	0.1 U	0.1 U	1/ 9|
ENDOSULFAN I	ug/l	0.5 U	0.0 U	0.1 P	0/14|	0.1	0.1 U	0.1 P	1/ 9|	2.5 U	0.1 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|
ENDOSULFAN II	ug/l	0.1 U	0.1 U	0.1 U	0/14|	0.1	0.1 U	0.1 U	1/ 9|	5.0 U	0.1 U	0.1 U	0/14|	0.2 U	0.1 U	0.1 U	0/ 9|
HEPTACHLOR	ug/l	0.5 U	0.0 U	0.1 U	0/14|	0.1 U	0.1 P	0.1 U	0/ 9|	2.5 U	0.1 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|
HEPTACHLOR EPOXIDE	ug/l	0.5 U	0.0 P	0.1 U	0/14|	0.1 U	0.1 U	0.1 P	0/ 9|	10.0 P	0.1 U	0.1 U	0/14|	0.1 U	0.1 U	0.1 U	0/ 9|
METHOXYCHLOR (DMDT)	ug/l	0.6 U	0.0 U	0.5 U	0/14|	0.6 U	0.0 U	0.5 U	0/ 9|	25.0 U	0.0 U	0.5 U	0/14|	1.1 U	0.0 U	0.5	1/ 9|

		SAMPLING LOCATION: OI 04				SAMPLING LOCATION: OI 05				SAMPLING LOCATION: OI-06				SAMPLING LOCATION: OI-07C			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.7 J	0.1 U	0.1 P	1/12|	0.5 U	0.1 U	0.1 U	0/15|	0.1 U	0.1 P	0.1 U	0/10|	0.1 U	0.1 U	0.1 U	0/ 4|
BETA-BHC (B-BHC)	ug/l	0.5 U	0.1 U	0.1 P	0/12|	0.5 U	0.1 U	0.1 U	0/15|	0.1 U	0.1 U	0.1 U	0/10|	0.1 U	0.1 U	0.1 U	0/ 4|
DELTA-BHC (C-BHC)	ug/l	0.5 U	0.1 U	0.1 U	0/12|	0.5 U	0.1 U	0.1 U	0/15|	0.1 U	0.1 U	0.1 U	0/10|	0.1 U	0.0 J	0.1 P	1/ 4|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	2.0 U	0.5 U	0.5 U	0/12|	1.0 U	0.5 P	0.5 U	0/15|	1.2 U	0.5 U	0.5 U	1/10|	0.5 U	0.5 U	0.5 P	0/ 4|
4,4'-DDT	ug/l	1.0 U	0.1 U	0.1 U	0/12|	0.2 U	0.1 P	0.1 U	0/15|	0.2 U	0.1 U	0.1 U	0/10|	0.1 U	0.1 P	0.1 U	0/ 4|
ENDRINE KETONE	ug/l	0.5 U	0.1 U	0.1 U	0/12|	0.2 U	0.1 U	0.1 U	0/15|	0.2 U	0.1 U	0.1 U	0/10|	0.1 U	0.1 U	0.1 P	0/ 4|
ENDOSULFAN I	ug/l	0.5 U	0.1 U	0.1 U	0/12|	0.5 U	0.1 U	0.1 P	0/15|	0.1 U	0.1 P	0.1 U	0/10|	0.1 U	0.1 U	0.1 U	0/ 4|
ENDOSULFAN II	ug/l	0.5 U	0.1 U	0.1 U	0/12|	0.2 U	0.1 U	0.1 U	0/15|	0.2 U	0.1 U	0.1 U	0/10|	0.1 U	0.1 U	0.1 P	0/ 4|
HEPTACHLOR	ug/l	1.0 U	0.1 U	0.1 P	1/12|	0.5 U	0.1 U	0.1 U	0/15|	0.1 U	0.1 U	0.1 U	0/10|	0.1 U	0.1 U	0.1 P	0/ 4|
HEPTACHLOR EPOXIDE	ug/l	0.5 U	0.1 U	0.1 U	0/12|	0.5 U	0.1 U	0.1 U	1/15|	0.1 U	0.1 U	0.1 U	0/10|	0.1 P	0.1 U	0.1 P	0/ 4|
METHOXYCHLOR (DMDT)	ug/l	1.0 U	0.0 U	0.5 U	0/12|	1.0 U	0.0 U	0.5 U	0/15|	1.2 U	0.0 U	0.5 U	0/10|	0.5 U	0.0 U	0.5 U	0/ 4|

		SAMPLING LOCATION: OI 08A				SAMPLING LOCATION: OI-09A				SAMPLING LOCATION: OI-10A				SAMPLING LOCATION: OI-10B			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.1 U	0.0 U	0.1 U	0/ 9|	0.1 U	0.0 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.0 U	0.1 U	0/ 6|
BETA-BHC (B-BHC)	ug/l	0.1 U	0.0 U	0.1 U	0/ 9|	0.1 U	0.0 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.0 U	0.1 U	0/ 6|
DELTA-BHC (C-BHC)	ug/l	0.1 U	0.0 U	0.1 U	0/ 9|	0.1 U	0.0 U	0.1 U	0/ 6|	0.1 U	0.1 P	0.1 U	0/ 6|	0.1 U	0.0 U	0.1 U	0/ 6|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.6 U	0.5 U	0.5 U	0/ 9|	0.6 U	0.5 U	0.5 U	0/ 6|	0.6 U	0.5 U	0.5 U	0/ 6|	0.6 U	0.5 U	0.5 U	0/ 6|
4,4'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0/ 9|	0.1 U	0.1 U	0.1 P	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 U	0/ 9|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 P	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|
ENDOSULFAN I	ug/l	0.1 U	0.0 U	0.1 U	0/ 9|	0.1 U	0.0 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.0 U	0.1 U	0/ 6|
ENDOSULFAN II	ug/l	0.1 U	0.1 U	0.1 U	0/ 9|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|	0.1 U	0.1 U	0.1 U	0/ 6|
HEPTACHLOR	ug/l	0.5 U	0.0 U	0.1 U	0/ 9|	0.1 U	0.0 U	0.1 U	0/ 6|	0.1 U	0.1 P	0.1 U	0/ 6|	0.1 U	0.0 U	0.1 U	0/ 6|
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.0 P	0.1 U	0/ 9|	0.1 U	0.0 P	0.1 U	0/ 6|	0.1 U	0.1 P	0.1 U	0/ 6|	0.1 U	0.0 P	0.1 U	0/ 6|
METHOXYCHLOR (DMDT)	ug/l	0.6 U	0.0 U	0.5 U	0/ 9|	0.6 U	0.0 U	0.5 U	0/ 6|	0.6 U	0.0 U	0.5 P	0/ 6|	0.6 U	0.0 U	0.5 P	0/ 6|

TABLE 6-19 (continued)
Summary of PESTICIDES and PCBS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 11A Max	Min	Median	D / O	SAMPLING LOCATION: OI 12B Max	Min	Median	D / O	SAMPLING LOCATION: OI 12C Max	Min	Median	D / O	SAMPLING LOCATION: OI-13A Max	Min	Median	D / O
ALDRIN (HHDN)	ug/l	0.5 U	0.1 U	0.1 P	0/ 5	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.1 P	0.1 U	0/ 6
BETA-BHC (B BHC)	ug/l	0.5 U	0.1 P	0.1 U	1/ 5	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.1 U	0.1 U	0/ 6
DELTA-BHC (C-BHC)	ug/l	0.5 U	0.1 U	0.1 U	1/ 5	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.1 U	0.1 U	0/ 6
CHLORDANE (ALPHA-CHLORDANE)	ug/l	5.2 U	0.5 U	0.5 P	0/ 5	0.6 U	0.5 U	0.5 U	0/ 6	0.6 U	0.5 U	0.5 U	0/ 6	0.8 U	0.5 U	0.5 U	0/ 6
4,4'-DDT	ug/l	1.0 U	0.1 U	0.1 U	0/ 5	0.1 U	0.1 U	0.1 P	0/ 6	0.1 U	0.1 U	0.1 U	0/ 6	0.2 U	0.1 U	0.1 U	0/ 6
ENDRINE KETONE	ug/l	1.0 U	0.1 U	0.1 U	0/ 5	0.1 U	0.1 U	0.1 U	1/ 6	0.1 U	0.1 U	0.1 P	0/ 6	0.2 U	0.1 U	0.1 U	0/ 6
ENDOSULFAN I	ug/l	0.5 U	0.1 U	0.1 U	0/ 5	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.1 U	0.1 U	0/ 6
ENDOSULFAN II	ug/l	1.0 U	0.1 U	0.1 U	0/ 5	0.1 U	0.1 U	0.1 P	0/ 6	0.1 U	0.1 U	0.1 U	0/ 6	0.2 U	0.1 U	0.1 U	0/ 6
HEPTACHLOR	ug/l	0.5 U	0.1 U	0.1 U	0/ 5	0.1 U	0.0 U	0.1 U	0/ 6	0.1 U	0.0 U	0.1 P	0/ 6	0.5 U	0.1 U	0.1 U	0/ 6
HEPTACHLOR EPOXIDE	ug/l	0.5 U	0.1 U	0.1 P	0/ 5	0.1 U	0.0 P	0.1 P	0/ 6	0.1 U	0.0 P	0.1 U	0/ 6	0.1 U	0.1 U	0.1 U	0/ 6
METHOXYCHLOR (DMDT)	ug/l	5.2 U	0.0 U	0.5 U	0/ 5	0.6 U	0.0 U	0.5	1/ 6	0.6 U	0.0 U	0.5 U	0/ 6	0.8 U	0.0 U	0.5 U	0/ 6

Chemical	Units	SAMPLING LOCATION: OI-13B Max	Min	Median	D / O	SAMPLING LOCATION: OI-13C Max	Min	Median	D / O	SAMPLING LOCATION: OI-14C Max	Min	Median	D / O	SAMPLING LOCATION: OI-15A Max	Min	Median	D / O
ALDRIN (HHDN)	ug/l	0.6 U	0.1 U	0.1 U	0/ 8	0.1 U	0.1 U	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 3	0.1 U	0.1 U	0.1 U	0/ 3
BETA-BHC (B-BHC)	ug/l	0.6 U	0.1 U	0.1 U	0/ 8	0.1 U	0.1 U	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 U	0/ 3
DELTA-BHC (C-BHC)	ug/l	0.6 U	0.1 P	0.1 U	0/ 8	0.1 U	0.1 U	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3
CHLORDANE (ALPHA-CHLORDANE)	ug/l	6.0 U	0.5 U	0.5 U	0/ 8	0.5 P	0.5 P	0.5 U	0/ 3	0.5 U	0.5 U	0.5 U	0/ 3	0.5 U	0.5 U	0.5 P	0/ 3
4,4'-DDT	ug/l	1.2 U	0.1 U	0.1 U	0/ 8	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 3
ENDRINE KETONE	ug/l	1.2 U	0.1 P	0.1 P	0/ 8	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 3
ENDOSULFAN I	ug/l	0.6 U	0.1 U	0.1 P	0/ 8	0.1 U	0.1 U	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 3	0.1 U	0.1 U	0.1 U	0/ 3
ENDOSULFAN II	ug/l	1.2 U	0.1 P	0.1 U	0/ 8	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 U	0/ 3
HEPTACHLOR	ug/l	0.6 U	0.1 P	0.1 U	0/ 8	0.1 U	0.1 U	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3
HEPTACHLOR EPOXIDE	ug/l	0.6 U	0.1 P	0.1 P	0/ 8	0.1 U	0.1 U	0.1 P	0/ 3	0.1 P	0.1 P	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 3
METHOXYCHLOR (DMDT)	ug/l	6.0 U	0.0 U	0.5 P	0/ 8	0.5 U	0.5 U	0.5 U	0/ 3	0.5 U	0.5 U	0.5 P	0/ 3	0.5 P	0.5 P	0.5 U	0/ 3

Chemical	Units	SAMPLING LOCATION: OI 15B Max	Min	Median	D / O	SAMPLING LOCATION: OI 16A Max	Min	Median	D / O	SAMPLING LOCATION: OI 17A Max	Min	Median	D / O	SAMPLING LOCATION: OI-17B Max	Min	Median	D / O
ALDRIN (HHDN)	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 P	0/ 4	0.1 P	0.1 P	0.1 U	0/ 4
BETA-BHC (B-BHC)	ug/l	0.1 P	0.1 P	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 4	0.1 U	0.1 U	0.1 U	0/ 4
DELTA-BHC (C-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 P	0.1 P	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 4
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.5 U	0.5 U	0.5 U	0/ 4	0.5 P	0.5 P	0.5 U	0/ 3	0.5 U	0.5 U	0.5 U	0/ 4	0.5 P	0.5 P	0.5 U	0/ 4
4,4'-DDT	ug/l	0.1 P	0.1 P	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 4	0.1 U	0.1 U	0.1 U	0/ 4
ENDRINE KETONE	ug/l	0.1 P	0.1 P	0.1 U	0/ 4	0.1 U	0.1 U	0.1 U	0/ 3	0.1 P	0.1 P	0.1 P	0/ 4	0.1 P	0.1 P	0.1 U	0/ 4
ENDOSULFAN I	ug/l	0.1 U	0.1 U	0.1 P	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 P	0.1 P	0.1 P	0/ 4	0.1 U	0.1 U	0.1 P	0/ 4
ENDOSULFAN II	ug/l	0.1 U	0.1 U	0.1 P	0/ 4	0.1 U	0.1 U	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 4	0.1 U	0.1 U	0.1 U	0/ 4
HEPTACHLOR	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 P	0.1 P	0.1 P	0/ 4	0.1 U	0.1 U	0.1 U	0/ 4
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 4
METHOXYCHLOR (DMDT)	ug/l	0.5 U	0.5 U	0.5 U	0/ 4	0.5 P	0.5 P	0.5 U	0/ 3	0.5 P	0.5 P	0.5 U	0/ 4	0.5 U	0.5 U	0.5 U	0/ 4

Chemical	Units	SAMPLING LOCATION: OI 18A Max	Min	Median	D / O	SAMPLING LOCATION: OI 18B Max	Min	Median	D / O	SAMPLING LOCATION: OI-19A Max	Min	Median	D / O	SAMPLING LOCATION: OI-19B Max	Min	Median	D / O
ALDRIN (HHDN)	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 P	0/ 5	0.1 U	0.1 U	0.1 P	0/ 3
BETA-BHC (B-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 5	0.1 U	0.1 U	0.1 P	0/ 3
DELTA-BHC (C-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 5	0.1 P	0.1 P	0.1 U	0/ 3
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.5 U	0.5 U	0.5 U	0/ 4	0.5 P	0.5 P	0.5 U	0/ 3	0.5 P	0.5 P	0.5 P	0/ 5	0.5 U	0.5 U	0.5 U	0/ 3
4,4' DDT	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 U	0.1 U	0.1 U	0/ 3	0.1 U	0.1 U	0.1 P	0/ 5	0.1 U	0.1 U	0.1 U	0/ 3
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 P	0/ 4	0.1 P	0.1 P	0.1 U	0/ 3	0.1 P	0.1 P	0.1 U	0/ 5	0.1 P	0.1 P	0.1 U	0/ 3
ENDOSULFAN I	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 P	0.1 P	0.1 U	0/ 5	0.1 U	0.1 U	0.1 P	0/ 3
ENDOSULFAN II	ug/l	0.1 P	0.1 P	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 P	0.1 P	0.1 U	0/ 5	0.1 U	0.1 U	0.1 U	0/ 3
HEPTACHLOR	ug/l	0.1 U	0.1 U	0.1 U	0/ 4	0.1 U	0.1 U	0.1 P	0/ 3	0.1 U	0.1 U	0.1 P	0/ 5	0.1 U	0.1 U	0.1 U	0/ 3
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.1 U	0.1 P	0/ 4	0.1 U	0.1 U	0.1 U	0/ 3	0.1 P	0.1 P	0.1 P	0/ 5	0.1 U	0.1 U	0.1 P	0/ 3
METHOXYCHLOR (DMDT)	ug/l	0.5 U	0.5 U	0.5 P	0/ 4	0.5 P	0.5 P	0.5 U	0/ 3	0.5 U	0.5 U	0.5 U	0/ 5	0.5 P	0.5 P	0.5 U	0/ 3

TABLE 6 19 (continued)
Summary of PESTICIDES and PCBS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 19C				SAMPLING LOCATION: OI 20A				SAMPLING LOCATION: OI-20B				SAMPLING LOCATION: OI-21B			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 4|	0.1	0.1 U	0.1 P	1/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
BETA-BHC (B-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
DELTA-BHC (C-BHC)	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.5 U	0.5 U	0.5 P	0/ 3|	0.5 U	0.5 U	0.5 U	0/ 4|	0.5 U	0.5 U	0.5 U	0/ 3|	0.5 U	0.5 U	0.5 P	0/ 3|
4,4'-DDT	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
ENDRINE KETONE	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|
ENDOSULFAN I	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
ENDOSULFAN II	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 4|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
HEPTACHLOR	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|
METHOXYCHLOR (DMDT)	ug/l	0.5 U	0.5 U	0.5 P	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 4|	0.5 U	0.5 U	0.5 U	0/ 3|	0.5 U	0.5 U	0.5 U	0/ 3|

		SAMPLING LOCATION: OI-22B				SAMPLING LOCATION: OI-23B				SAMPLING LOCATION: OI-25A				SAMPLING LOCATION: OI-25B			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.0 J	0.1 U	1/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
BETA-BHC (B-BHC)	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
DELTA-BHC (C-BHC)	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.5 P	0.5 P	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 3|
4,4'-DDT	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
ENDOSULFAN I	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
ENDOSULFAN II	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|
HEPTACHLOR	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|
METHOXYCHLOR (DMDT)	ug/l	0.5 P	0.5 P	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 3|

		SAMPLING LOCATION: OI 26A				SAMPLING LOCATION: OI-26B				SAMPLING LOCATION: OI 27A				SAMPLING LOCATION: OI-28B			
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 P	0.0 J	0.1 U	1/ 3|
BETA-BHC (B-BHC)	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 4|	0.1 U	0.1 U	0.1 U	0/ 3|
DELTA-BHC (C-BHC)	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 4|	0.1 P	0.1 P	0.1 U	0/ 3|
CHLORDANE (ALPHA-CHLORDANE)	ug/l	0.5 U	0.5 U	0.5 U	0/ 3|	0.5 U	0.5 U	0.5 U	0/ 3|	0.5 P	0.5 P	0.5 U	0/ 4|	0.5 U	0.5 U	0.5 U	0/ 3|
4,4'-DDT	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|
ENDOSULFAN I	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 3|	0.1 U	0.1 U	0.1 P	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|
ENDOSULFAN II	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 P	0/ 3|
HEPTACHLOR	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 P	0.1 P	0.1 U	0/ 3|
HEPTACHLOR EPOXIDE	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 P	0.1 P	0.1 U	0/ 3|	0.1 U	0.1 U	0.1 U	0/ 4|	0.1 U	0.1 U	0.1 U	0/ 3|
METHOXYCHLOR (DMDT)	ug/l	0.5 U	0.5 U	0.5 U	0/ 3|	0.5 U	0.5 U	0.5 U	0/ 3|	0.5 U	0.5 U	0.5 U	0/ 4|	0.5 U	0.5 U	0.5 U	0/ 3|

		SAMPLING LOCATION: OI 29B				SAMPLING LOCATION:											
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
ALDRIN (HHDN)	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|				|				|				|
BETA-BHC (B-BHC)	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|				|				|				|
DELTA-BHC (C-BHC)	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|				|				|				|
CHLORDANE (ALPHA CHLORDANE)	ug/l	0.5 U	0.5 U	0.5 P	0/ 3|				|				|				|
4,4'-DDT	ug/l	0.1 U	0.1 U	0.1 U	0/ 3|				|				|				|
ENDRINE KETONE	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|				|				|				|
ENDOSULFAN I	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|				|				|				|
ENDOSULFAN II	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|				|				|				|
HEPTACHLOR	ug/l	0.1 P	0.1 P	0.1 U	0/ 3|				|				|				|
HEPTACHLOR EPOXIDE	ug/l	0.1 U	0.1 U	0.1 P	0/ 3|				|				|				|
METHOXYCHLOR (DMDT)	ug/l	0.5 U	0.5 U	0.5 U	0/ 3|				|				|				|

TABLE 6-20
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD-13				SAMPLING LOCATION: CDD-17				SAMPLING LOCATION: DS-01			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4-DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l					151.0 K	151.0 K	151.0 K	1/ 1								
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l					55.0 K	31.0 K	43.0 K	2/ 2								
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l					60.0 K	10.0 K	35.0 K	2/ 2	8.0 K	8.0 K	8.0 K	1/ 1				
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5-	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l					10.0 K	7.0 K	8.5 K	2/ 2								
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l					46.0 K	39.0 K	42.5 K	2/ 2								
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l					34.0 K	32.0 K	33.0 K	2/ 2								
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l					3.0 K	3.0 K	3.0 K	2/ 2								
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l					3.0 K	3.0 K	3.0 K	2/ 2								
C4-BENZENE	ug/l					2.0 K	2.0 K	2.0 K	2/ 2								
C6H12 HYDROCARBON	ug/l					2.0 K	1.0 K	1.5 K	2/ 2								
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l													1.0 K	1.0 K	1.0 K	1/ 1
C9H18 HYDROCARBON	ug/l													3.0 K	3.0 K	3.0 K	1/ 1
C9H16 HYDROCARBON	ug/l					2.0 K	2.0 K	2.0 K	2/ 2								
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2-ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2 ETHYL	ug/l																
HEXAHYDRO 2H AZEPIN 2 ONE	ug/l																

TABLE 6 20
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD-13				SAMPLING LOCATION: CDD-17				SAMPLING LOCATION: DS-01			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1 DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3 DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3 OXATHIOLANE	ug/l					151.0 K	151.0 K	151.0 K	1/ 1								
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1 PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5 DIETHYLTETRAHYDRO FURAN	ug/l					55.0 K	31.0 K	43.0 K	2/ 2								
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l					60.0 K	10.0 K	35.0 K	2/ 2	8.0 K	8.0 K	8.0 K	1/ 1				
2 CYCLOHEN-1-ONE	ug/l																
2 ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2 PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1 DIMETHYLETHYL)	ug/l					10.0 K	7.0 K	8.5 K	2/ 2								
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1 METHYLETHENYL)	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l					46.0 K	39.0 K	42.5 K	2/ 2								
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l					34.0 K	32.0 K	33.0 K	2/ 2								
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l					3.0 K	3.0 K	3.0 K	2/ 2								
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3 BENZENE	ug/l					3.0 K	3.0 K	3.0 K	2/ 2								
C4-BENZENE	ug/l					2.0 K	2.0 K	2.0 K	2/ 2								
C6H12 HYDROCARBON	ug/l					2.0 K	1.0 K	1.5 K	2/ 2								
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l													1.0 K	1.0 K	1.0 K	1/ 1
C9H18 HYDROCARBON	ug/l													3.0 K	3.0 K	3.0 K	1/ 1
C9H16 HYDROCARBON	ug/l					2.0 K	2.0 K	2.0 K	2/ 2								
C9H12 HYDROCARBON	ug/l																
C9 PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2 DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1' OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1 PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2 ETHYL	ug/l																
HEXAHYDRO 2H AZEPIN 2 ONE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: 2897A				SAMPLING LOCATION: CDD 13				SAMPLING LOCATION: CDD-17				SAMPLING LOCATION: DS-01			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l	5.0 U	0.0	5.0 U	0/ 2	5.0 U	5.0 U	5.0 U	0/ 2	5.0 U	5.0 U	5.0 U	0/ 1	5.0 U	5.0 U	5.0 U	0/ 1
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE)-CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4 METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l	13.0 K	13.0 K	13.0 K	1/ 1												
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l					990.0 K	780.0 K	885.0 K	2/ 2								
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l					360.0 K	250.0 K	305.0 K	2/ 2	30.0 K	30.0 K	30.0 K	1/ 1				
UNKNOWN VOA TIC	ug/l					7.0 K	6.0 K	6.5 K	2/ 2					3.0 K	3.0 K	3.0 K	1/ 1
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO-1-PROPENE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 01A				SAMPLING LOCATION: OI-01C				SAMPLING LOCATION: OI-02				SAMPLING LOCATION: OI-03			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l									20.0 T	20.0 T	20.0 T	1/ 1				
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l									280.0 T	280.0 T	280.0 T	1/ 1	120.0 T	120.0 T	120.0 T	1/ 1
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l													20.0 T	20.0 T	20.0 T	1/ 1
1-PHENYL-ETHANONE	ug/l									20.0 K	20.0 K	20.0 K	1/ 1				
2,2-DIMETHYLPROPANE	ug/l									8.0 K	8.0 K	8.0 K	1/ 1				
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l	17.0 T	17.0 T	17.0 T	1/ 1												
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l	7.0 K	7.0 K	7.0 K	1/ 1												
2-ETHYL 1 HEXANOL	ug/l													100.0 T	100.0 T	100.0 T	1/ 1
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l	60.0 T	60.0 T	60.0 T	1/ 1					60.0 T	30.0 T	45.0 T	2/ 2	100.0 T	100.0 T	100.0 T	1/ 1
4,4'-BUTYLIDENE BIS[2-1,1 DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l									30.0 T	30.0 T	30.0 T	1/ 1				
9-OCTADECANOIC ACID	ug/l													100.0 T	100.0 T	100.0 T	1/ 1
AMIDE	ug/l													20.0 T	20.0 T	20.0 T	1/ 1
BENZENE,(1-METHYLETHENYL)-	ug/l									20.0 K	20.0 K	20.0 K	1/ 1				
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE-	ug/l									9.0 T	9.0 T	9.0 T	1/ 1	10.0 T	10.0 T	10.0 T	1/ 1
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l																
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l													50.0 K	50.0 K	50.0 K	1/ 1
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l									20.0 K	20.0 K	20.0 K	1/ 1				
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l													90.0 T	90.0 T	90.0 T	1/ 1
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l					50.0 K	50.0 K	50.0 K	1/ 1					300.0 T	300.0 T	300.0 T	1/ 1
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l									10.0 K	10.0 K	10.0 K	1/ 1				
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETNANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2-ETHYL	ug/l																
HEXAHYDRO 2H AZEPIN 2 ONE	ug/l													100.0 T	100.0 T	100.0 T	1/ 1

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OTI Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 01A				SAMPLING LOCATION: OI 01C				SAMPLING LOCATION: OI 02				SAMPLING LOCATION: OI-03			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l					18.0 K	18.0 K	18.0 K	1/ 1					10.0 T	10.0 T	10.0 T	1/ 1
HEXANOIC ACID	ug/l													10.0 T	10.0 T	10.0 T	1/ 1
HEXANE (N-HEXANE)	ug/l									10.0 T	10.0 T	10.0 T	1/ 1				
METHYL CYCLOPENTANE	ug/l									5.0 T	5.0 T	5.0 T	1/ 1				
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l													100.0 T	100.0 T	100.0 T	1/ 1
NONANOIC ACID	ug/l					10.0 K	10.0 K	10.0 K	1/ 1					5.0 T	5.0 T	5.0 T	1/ 1
NONYLPHENOL	ug/l													10.0 T	10.0 T	10.0 T	1/ 1
OCTANOIC ACID	ug/l													20.0 T	20.0 T	20.0 T	1/ 1
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4-METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l									400.0 T	90.0 K	245.0 T	2/ 2				
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l									2000.0 K	110.0 K	300.0 T	6/ 6				
TETRADECANOIC ACID	ug/l					16.0 K	16.0 K	16.0 K	1/ 1					50.0 T	50.0 T	50.0 T	1/ 1
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l													10.0 T	10.0 T	10.0 T	1/ 1
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	107.0 K	10.0 K	58.5 K	2/ 2	251.0 K	251.0 K	251.0 K	1/ 1	16.0 K	16.0 K	16.0 K	1/ 1				
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l																
UNKNOWN VOA TIC	ug/l	1.0 K	1.0 K	1.0 K	1/ 1	1.0 K	1.0 K	1.0 K	1/ 1	4.1 K	3.0 K	3.5 K	2/ 2				
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO 1 PROPENE	ug/l																

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 04				SAMPLING LOCATION: OI-05				SAMPLING LOCATION: OI-06				SAMPLING LOCATION: OI-07C			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l	1564.0 T	812.0 T	1188.0 T	2/ 2												
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l	30.0 T	30.0 T	30.0 T	2/ 2												
1,3-DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l	3.0 K	3.0 K	3.0 K	1/ 1												
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l					50.0 K	40.0 K	45.0 K	2/ 2								
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l	40.0 K	40.0 K	40.0 K	1/ 1												
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l					6.0 T	6.0 T	6.0 T	1/ 1								
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l	450.0 T	424.0 T	437.0 T	2/ 2												
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l	792.0 T	372.0 T	582.0 T	2/ 2												
2 PENTANONE,4,4-DIMETHYL	ug/l	40.0 K	4.0 T	12.0 K	4/ 4												
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l					4.0 T	4.0 T	4.0 T	1/ 1								
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l									60.0 T	60.0 T	60.0 T	1/ 1				
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2 PENTANONE	ug/l	1.0 K	1.0 K	1.0 K	2/ 2												
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l	144.0 T	144.0 T	144.0 T	1/ 1					10.0 T	10.0 T	10.0 T	1/ 1				
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l									10.0 T	10.0 T	10.0 T	1/ 1				
BUTYLATED HYDROXYTOLUENE	ug/l	10.0 T	10.0 T	10.0 T	2/ 2					8.0 T	8.0 T	8.0 T	1/ 1				
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l	752.0 T	752.0 T	752.0 T	1/ 1												
BENZENESULFAMIDE	ug/l	30.0 K	30.0 K	30.0 K	1/ 1												
BENZENESULFONAMIDE, N-BUTYL-4	ug/l	810.0 T	528.0 T	669.0 T	2/ 2												
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l	1044.0 T	30.0 K	537.0 T	2/ 2												
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l	3084.0 T	2256.0 T	2670.0 T	2/ 2												
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l	2.0 K	2.0 K	2.0 K	1/ 1												
C10H14 HYDROCARBON	ug/l	2.0 K	2.0 K	2.0 K	1/ 1												
C3-BENZENE	ug/l	13.0 K	13.0 K	13.0 K	2/ 2	0.4 K	0.4 K	0.4 K	1/ 1								
C4-BENZENE	ug/l	7.0 K	7.0 K	7.0 K	2/ 2												
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l									2.0 K	2.0 K	2.0 K	1/ 1	2.0 K	2.0 K	2.0 K	1/ 1
C7H14 HYDROCARBON	ug/l	2.0 K	2.0 K	2.0 K	1/ 1												
C7H14O HYDROCARBON	ug/l	60.0 T	9.0 K	45.0 T	3/ 3												
C7H5N5	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l	10.0 K	10.0 K	10.0 K	1/ 1												
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l									40.0 T	40.0 T	40.0 T	1/ 1				
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l	10.0 T	10.0 T	10.0 T	1/ 1					300.0 T	300.0 T	300.0 T	1/ 1				
CYCLOPENTANE,METHYL	ug/l					10.0 T	8.0 T	9.0 T	2/ 2	20.0 T	20.0 T	20.0 T	1/ 1				
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l	142.0 T	142.0 T	142.0 T	1/ 1												
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l					100.0 K	80.0 K	90.0 K	2/ 2								
DICHLOROBENZOIC ACID	ug/l	100.0 K	100.0 K	100.0 K	1/ 1												
DECANOIC ACID	ug/l									24.0 K	24.0 K	24.0 K	1/ 1				
1,2-DIETHOXYETHANE	ug/l	14.0 K	14.0 K	14.0 K	1/ 1												
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l									150.0 K	150.0 K	150.0 K	1/ 1				
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l	66.0 T	66.0 T	66.0 T	1/ 1												
ETHANONE,1-PHENYL	ug/l					10.0 K	10.0 K	10.0 K	2/ 2								
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l	11.0 K	4.5 K	7.8 K	2/ 2												
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2-ETHYL	ug/l									6.0 K	6.0 K	6.0 K	1/ 1				
HEXAHYDRO 2H AZEPIN 2 ONE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-04				SAMPLING LOCATION: OI 05				SAMPLING LOCATION: OI 06				SAMPLING LOCATION: OI-07C			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l	60.0 K	20.0 K	50.0 K	3/ 3					9.0 K	9.0 K	9.0 K	1/ 1				
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l					20.0 T	5.0 T	12.5 T	2/ 2	40.0 T	40.0 T	40.0 T	1/ 1				
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l	2.0 K	2.0 K	2.0 K	1/ 1												
N,N DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l	30.0 K	20.0 K	25.0 K	2/ 2												
OXIRANE,2,2'-OXYBISIME	ug/l	4196.0 T	3306.0 T	3751.0 T	2/ 2												
PHENOL, 2-(2H-BENZOTRIZOL-2-YL) 4-METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l	12.0 T	12.0 T	12.0 T	1/ 1												
POLY-ETHER	ug/l	30.0 T	30.0 T	30.0 T	2/ 2												
PALMITIC ACID	ug/l	20.0 K	10.0 T	10.0 T	3/ 3												
PALMITOLEIC ACID	ug/l	20.0 T	20.0 T	20.0 T	2/ 2												
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l									6.0 K	6.0 K	6.0 K	1/ 1				
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l									27.0 K	27.0 K	27.0 K	1/ 1				
TRIETHYL SILANE	ug/l	200.0 T	200.0 T	200.0 T	1/ 1												
THIOBIS METHANE	ug/l	8.0 K	8.0 K	8.0 K	1/ 1												
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l	80.0 T	8.0 K	20.0 K	3/ 3												
UNKNOWN AROMATIC HYDROCARBON	ug/l	1.0 K	1.0 K	1.0 K	2/ 2												
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	1300.0 K	150.0 K	725.0 K	2/ 2	18.0 K	18.0 K	18.0 K	1/ 1	82.0 K	10.0 K	38.0 K	4/ 4				
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l	250.0 K	50.0 K	100.0 K	3/ 3					28.0 K	28.0 K	28.0 K	1/ 1				
UNKNOWN VOA TIC	ug/l					18.0 K	1.0 K	2.0 K	3/ 3	5.0 K	0.2 K	2.0 K	5/ 5	4.0 J	2.0 K	3.0 J	2/ 2
X,Y-DIMETHYL BENZENE	ug/l	20.0 K	20.0 K	20.0 K	1/ 1												
X-ETHYL-Y-METHYL BENZENE	ug/l	20.0 K	20.0 K	20.0 K	1/ 1												
X,Y,Z-TRICHLORO 1-PROPENE	ug/l									10.0 K	10.0 K	10.0 K	1/ 1				

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 08A				SAMPLING LOCATION: OI-09A				SAMPLING LOCATION: OI-10A				SAMPLING LOCATION: OI-10B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1 METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4-DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2 PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l																
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l	2.0 K	2.0 K	2.0 K	1/ 1	1.0 K	1.0 K	1.0 K	1/ 1					3.0 K	3.0 K	3.0 K	1/ 1
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1' OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANOIC ACID 2 ETHYL	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 08A				SAMPLING LOCATION: OI 09A				SAMPLING LOCATION: OI-10A				SAMPLING LOCATION: OI-10B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YI) 4 METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l	0.1 K	0.1 K	0.1 K	1/ 1												
TOTAL UNKNOWN BNA TIC	ug/l	22.0 K	4.0 K	13.0 K	2/ 2	46.0 K	3.0 K	0.0	2/ 2					14.0 K	14.0 K	14.0 K	1/ 1
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l																
UNKNOWN VOA TIC	ug/l	1.0 K	1.0 K	1.0 K	1/ 1					0.6 K	0.6 K	0.6 K	1/ 1	2.0 K	2.0 K	2.0 K	1/ 1
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y METHYL BENZENE	ug/l																
X,Y,Z TRICHLORO 1 PROPENE	ug/l																

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-11A				SAMPLING LOCATION: OI-12B				SAMPLING LOCATION: OI-12C				SAMPLING LOCATION: OI-13A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3 DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3 OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5-	ug/l																
2 METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1 DIMETHYLETHYL]	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7 DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l	1.0 K	1.0 K	1.0 K	1/ 1												
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l									2.0 K	2.0 K	2.0 K	1/ 1	1.0 K	1.0 K	1.0 K	1/ 1
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l	120.0 K	120.0 K	120.0 K	1/ 1												
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1' OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l	47.0 K	47.0 K	47.0 K	1/ 1												
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l	33.0 K	33.0 K	33.0 K	1/ 1												
HEXANIOCACID,2 ETHYL	ug/l																
HEXAHYDRO 2H AZEPIN 2 ONE	ug/l																

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-11A				SAMPLING LOCATION: OI 12B				SAMPLING LOCATION: OI-12C				SAMPLING LOCATION: OI-13A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l	41.0 K	41.0 K	41.0 K	1/ 1												
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL) 4-METHYL	ug/l	94.0 K	94.0 K	94.0 K	1/ 1												
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	507.0 K	12.0 K	0.0	3/ 3					67.0 K	9.0 K	38.0 K	2/ 2	24.0 K	24.0 K	24.0 K	1/ 1
UNKNOWN FREON TIC	ug/l					2.0 K	2.0 K	2.0 K	1/ 1								
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l																
UNKNOWN VOA TIC	ug/l					2.0 K	0.1 K	1.0 K	2/ 2								
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z TRICHLORO 1 PROPENE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI-13B				SAMPLING LOCATION: OI 13C				SAMPLING LOCATION: OI-14C				SAMPLING LOCATION: OI 15A			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l					10.0 K	10.0 K	10.0 K	1/ 1								
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5-	ug/l																
2-METHYLPROPANOIC ACID	ug/l					7.0 K	7.0 K	7.0 K	1/ 1								
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l																
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l					14.0 K	14.0 K	14.0 K	1/ 1								
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l	22.0 K	22.0 K	22.0 K	1/ 1												
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2-ETHOXY	ug/l																
ETHANONE,1 PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l	9.0 K	9.0 K	9.0 K	1/ 1												
HEXANIOCACID,2-ETHYL	ug/l																
HEXAHYDRO-2H-AZEPIN-2-ONE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-13B				SAMPLING LOCATION: OI-13C				SAMPLING LOCATION: OI-14C				SAMPLING LOCATION: OI-15A			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H BENZOTRIZOL-2-YL) 4 METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (SR)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	98.0 K	78.0	88.0 K	2/ 2	14.0 K	14.0 K	14.0 K	1/ 1					608.0 K	608.0 K	608.0 K	1/ 1
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l																
UNKNOWN VOA TIC	ug/l	3.0 K	2.0 K	2.5 K	2/ 2	2.0 K	2.0 K	0.0	1/ 1					3.0 K	3.0 K	3.0 K	2/ 2
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z TRICHLORO 1-PROPENE	ug/l																

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 15B				SAMPLING LOCATION: OI-16A				SAMPLING LOCATION: OI-17A				SAMPLING LOCATION: OI-17B			
		Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1 DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4-DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2 CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2 ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4 HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4' BUTYLIDENE BIS[2-1,1 DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2 PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7 DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3 BENZENE	ug/l									12.0 K	12.0 K	12.0 K	1/ 1				
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l					1.0 K	1.0 K	1.0 K	1/ 1	5.0 K	5.0 K	5.0 K	3/ 3				
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l					1.0 K	1.0 K	1.0 K	1/ 1	3.0 K	3.0 K	3.0 K	1/ 1				
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l									10.0 K	4.0 K	7.0 K	2/ 2				
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l									5.0 K	2.0 K	3.5 K	2/ 2				
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2-ETHYL	ug/l																
HEXAHYDRO 2H-AZEPIN 2 ONE	ug/l																

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 15B				SAMPLING LOCATION: OI-16A				SAMPLING LOCATION: OI-17A				SAMPLING LOCATION: OI-17B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l					1.0 K	1.0 K	1.0 K	1/ 1	5.0 K	5.0 K	5.0 K	1/ 1				
METHYL CYCLOPENTANE	ug/l					3.0 K	3.0 K	3.0 K	1/ 1								
METHYL(METHYLETHYLIDENE)-CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4-METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l	1500.0 K	1450.0 K	1475.0 K	2/ 2												
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l	500.0 K	500.0 K	500.0 K	1/ 1												
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l									1.0 K	1.0 K	1.0 K	1/ 1				
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	11.0 K	10.0 K	10.5 K	2/ 2	430.0 K	22.0 K	208.0 K	3/ 3	92.0 K	14.0 K	62.0 K	4/ 4	5.0 K	3.0 K	4.0 K	3/ 3
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l					8.0 K	8.0 K	8.0 K	1/ 1	10.0 K	10.0 K	10.0 K	1/ 1				
UNKNOWN VOA TIC	ug/l	5.0 K	5.0 K	5.0 K	2/ 2	4.0 K	1.5 K	2.8 K	2/ 2	8.0 K	7.2 K	7.6 K	2/ 2				
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO 1-PROPENE	ug/l																

TABLE 6-20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-18A				SAMPLING LOCATION: OI 18B				SAMPLING LOCATION: OI 19A				SAMPLING LOCATION: OI-19B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1 METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5-	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l													1.0 K	1.0 K	1.0 K	1/ 1
C4-BENZENE	ug/l	25.0 K	25.0 K	25.0 K	1/ 1												
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9 PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l	5.0 K	5.0 K	5.0 K	1/ 1												
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2-ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l	40.0 K	14.0 K	15.0 K	3/ 4												
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2-ETHYL	ug/l																
HEXAHYDRO 2H-AZEPIN-2 ONE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 18A				SAMPLING LOCATION: OI 18B				SAMPLING LOCATION: OI-19A				SAMPLING LOCATION: OI-19B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l	5.0 K	5.0 K	5.0 K	1/ 1												
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4-METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l	30.0 K	30.0 K	30.0 K	1/ 1												
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	725.0 K	509.0 K	573.0 K	4/ 4									24.0 K	11.0 K	17.0 K	3/ 3
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l	310.0 K	45.0 K	177.5 K	2/ 2	12.0 K	12.0 K	0.0	1/ 1								
UNKNOWN VOA TIC	ug/l	8.0 K	8.0 K	8.0 K	2/ 2												
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO-1-PROPENE	ug/l																

TABLE 6 20 (continued) .
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 19C				SAMPLING LOCATION: OI 20A				SAMPLING LOCATION: OI-20B				SAMPLING LOCATION: OI-21B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4-DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l	1.0 K	1.0 K	1.0 K	1/ 1	6.0 K	6.0 K	6.0 K	1/ 1								
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l																
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l					1.0 K	1.0 K	1.0 K	1/ 1					1.0 K	1.0 K	1.0 K	1/ 1
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANTOCACID 2 ETHYL	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 19C				SAMPLING LOCATION: OI-20A				SAMPLING LOCATION: OI 20B				SAMPLING LOCATION: OI-21B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE)-CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL) 4 METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l					15.0 K	6.0 K	0.0	4/ 4					10.0 K	7.0 K	8.5 K	2/ 2
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l	6.0 K	6.0 K	6.0 K	1/ 1									5.0 K	5.0 K	5.0 K	1/ 1
UNKNOWN VOA TIC	ug/l									1.0 K	1.0 K	1.0 K	1/ 1				
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO-1-PROPENE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 22B				SAMPLING LOCATION: OI-23B				SAMPLING LOCATION: OI-25A				SAMPLING LOCATION: OI-25B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2 ETHYL- 1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5-	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l																
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l									1.0 K	1.0 K	1.0 K	1/ 1				
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l																
C7H140 HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 22B				SAMPLING LOCATION: OI-23B				SAMPLING LOCATION: OI 25A				SAMPLING LOCATION: OI-25B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE)-CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4 METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	100.0 K	20.0 K	0.0	3/ 3					3.0 K	3.0 K	3.0 K	1/ 1	5.0 K	5.0 K	5.0 K	1/ 1
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l									6.0 K	2.0 K	4.0 K	2/ 2				
UNKNOWN VOA TIC	ug/l					3.0 K	3.0 K	3.0 K	1/ 1					2.0 K	2.0 K	2.0 K	1/ 1
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL Y METHYL BENZENE	ug/l																
X,Y,Z TRICHLORO 1-PROPENE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

Chemical	Units	SAMPLING LOCATION: OI 26A Max	Min	Median	D / O	SAMPLING LOCATION: OI 26B Max	Min	Median	D / O	SAMPLING LOCATION: OI 27A Max	Min	Median	D / O	SAMPLING LOCATION: OI-28B Max	Min	Median	D / O
1,1-DIMETHYL HYDRAZINE	ug/l																
1,1-METHYLETHYL BENZENE	ug/l																
1,3,5-TRIOXANE	ug/l																
1,3-DIOXOLANE-2METHANOL, 2,4 DIMETHYL	ug/l																
1,3-OXATHIOLANE	ug/l																
1,4-DIMETHYLBENZENE	ug/l																
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l																
1-PHENYL-ETHANONE	ug/l																
2,2-DIMETHYLPROPANE	ug/l																
2(3H)-BENZOTHIAZOLONE	ug/l																
2,5-DIETHYLTETRAHYDRO FURAN	ug/l																
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l																
2-CYCLOHEN-1-ONE	ug/l																
2-ETHYL-1-HEXANOL	ug/l																
2-ETHYL HEXANOIC ACID	ug/l																
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l																
2-METHYLPROPANOIC ACID	ug/l																
2-PHENOXY ETHANOL	ug/l																
2-PENTANONE,4,4-DIMETHYL	ug/l																
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l																
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l																
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l																
4,4-DIMETHYL-2-PENTANONE	ug/l																
6-DODECANONE	ug/l																
9-OCTADECANOIC ACID	ug/l																
AMIDE	ug/l																
BENZENE,(1-METHYLETHENYL)-	ug/l																
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l																
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l																
BUTYLATED HYDROXYTOLUENE	ug/l																
BENZENESULFONAMIDE,-4,4,4-TRIM	ug/l																
BENZENESULFAMIDE	ug/l																
BENZENESULFONAMIDE, N-BUTYL-4	ug/l																
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l																
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l																
C10H18 HYDROCARBON	ug/l																
C10H12 HYDROCARBON	ug/l																
C10H14 HYDROCARBON	ug/l																
C3-BENZENE	ug/l																
C4-BENZENE	ug/l																
C6H12 HYDROCARBON	ug/l									2.5 K	2.5 K	2.5 K	1/ 1				
C6H14 HYDROCARBON	ug/l																
C7H14 HYDROCARBON	ug/l									1.5 K	1.5 K	1.5 K	1/ 1				
C7H14O HYDROCARBON	ug/l																
C7H5NS	ug/l																
C8H16 HYDROCARBON	ug/l																
C9H18 HYDROCARBON	ug/l																
C9H16 HYDROCARBON	ug/l																
C9H12 HYDROCARBON	ug/l																
C9-PHENOL ISOMER	ug/l																
CAPROLACTAM	ug/l																
CYCLOHEXANECARBOXYLIC ACID	ug/l																
CYCLOHEXANOL	ug/l																
CYCLOPENTANE,METHYL	ug/l																
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l																
ALPHA, ALPHA DIMETHYL BENZENEMETHANOL	ug/l																
DICHLOROBENZOIC ACID	ug/l																
DECANOIC ACID	ug/l																
1,2-DIETHOXYETHANE	ug/l																
DIETHYL ETHER	ug/l																
DODECANOIC ACID	ug/l																
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l																
ETHANONE,1-PHENYL	ug/l																
ETHYL HEXANOL	ug/l																
ETHYL METHYL BENZENE	ug/l																
ETHANONE, (PHENYLENE) BIS	ug/l																
HEXANIOCACID,2-ETHYL	ug/l																
HEXAHYDRO 2H AZEPIN-2 ONE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 26A				SAMPLING LOCATION: OI 26B				SAMPLING LOCATION: OI-27A				SAMPLING LOCATION: OI-28B			
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE)-CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2-YL)-4-METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l	20.0 K	3.0 K	0.0	2/ 2					50.0 K	50.0 K	50.0 K	1/ 1	4.0 K	4.0 K	0.0	1/ 1
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l					4.0 K	4.0 K	4.0 K	1/ 1								
UNKNOWN VOA TIC	ug/l									22.0 K	22.0 K	22.0 K	1/ 1				
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO 1-PROPENE	ug/l																

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI-29B				SAMPLING LOCATION:											
Chemical	Units	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|	Max	Min	Median	D / O|
1,1-DIMETHYL HYDRAZINE	ug/l				|				|				|				|
1,1-METHYLETHYL BENZENE	ug/l				|				|				|				|
1,3,5-TRIOXANE	ug/l				|				|				|				|
1,3-DIOXOLANE-2METHANOL, 2,4-DIMETHYL	ug/l				|				|				|				|
1,3-OXATHIOLANE	ug/l				|				|				|				|
1,4-DIMETHYLBENZENE	ug/l				|				|				|				|
15-TETRACOSENOIC ACID, METHYL ESTER	ug/l				|				|				|				|
1-PHENYL-ETHANONE	ug/l				|				|				|				|
2,2-DIMETHYLPROPANE	ug/l				|				|				|				|
2(3H)-BENZOTHIAZOLONE	ug/l				|				|				|				|
2,5-DIETHYLTETRAHYDRO FURAN	ug/l				|				|				|				|
2,6,10,15-TETRAMETHYL HEPTADECANE	ug/l				|				|				|				|
2-CYCLOHEN-1-ONE	ug/l				|				|				|				|
2-ETHYL-1-HEXANOL	ug/l				|				|				|				|
2-ETHYL HEXANOIC ACID	ug/l				|				|				|				|
2H-PYRAN-2-CARBOXYLIC ACID,5	ug/l				|				|				|				|
2-METHYLPROPANOIC ACID	ug/l				|				|				|				|
2-PHENOXY ETHANOL	ug/l				|				|				|				|
2-PENTANONE,4,4-DIMETHYL	ug/l				|				|				|				|
4,4'-(1-METHYLETHYLIDENE) BIS PHENOL	ug/l				|				|				|				|
4-HYDROXY-4-METHYL-2-PENTANONE	ug/l				|				|				|				|
4,4'-BUTYLIDENE BIS[2-1,1-DIMETHYLETHYL)	ug/l				|				|				|				|
4,4-DIMETHYL-2-PENTANONE	ug/l				|				|				|				|
6-DODECANONE	ug/l				|				|				|				|
9-OCTADECANOIC ACID	ug/l				|				|				|				|
AMIDE	ug/l				|				|				|				|
BENZENE,(1-METHYLETHENYL)-	ug/l				|				|				|				|
BICYCLO-2,2,1-HEPTAN-2-ONE,1,	ug/l				|				|				|				|
BICYCLO(4,1,0)HEPTANE,7,7-DICHLORO	ug/l				|				|				|				|
BUTYLATED HYDROXYTOLUENE	ug/l				|				|				|				|
BENZENESULFONAMIDE, 4,4,4-TRIM	ug/l				|				|				|				|
BENZENESULFAMIDE	ug/l				|				|				|				|
BENZENESULFONAMIDE, N-BUTYL-4	ug/l				|				|				|				|
BENZENESULFONAMIDE,N,N,4-TRIM	ug/l				|				|				|				|
BUTANOIC ACID, 3-METHYL-BUTYL	ug/l				|				|				|				|
C10H18 HYDROCARBON	ug/l				|				|				|				|
C10H12 HYDROCARBON	ug/l				|				|				|				|
C10H14 HYDROCARBON	ug/l				|				|				|				|
C3-BENZENE	ug/l				|				|				|				|
C4-BENZENE	ug/l				|				|				|				|
C6H12 HYDROCARBON	ug/l				|				|				|				|
C6H14 HYDROCARBON	ug/l				|				|				|				|
C7H14 HYDROCARBON	ug/l				|				|				|				|
C7H14O HYDROCARBON	ug/l				|				|				|				|
C7H5N5	ug/l				|				|				|				|
C8H16 HYDROCARBON	ug/l				|				|				|				|
C9H18 HYDROCARBON	ug/l				|				|				|				|
C9H16 HYDROCARBON	ug/l				|				|				|				|
C9H12 HYDROCARBON	ug/l				|				|				|				|
C9 PHENOL ISOMER	ug/l				|				|				|				|
CAPROLACTAM	ug/l				|				|				|				|
CYCLOHEXANECARBOXYLIC ACID	ug/l				|				|				|				|
CYCLOHEXANOL	ug/l				|				|				|				|
CYCLOPENTANE,METHYL	ug/l				|				|				|				|
CYCLOTETRASILOXANE,OCTAMETHYL	ug/l				|				|				|				|
ALPHA, ALPHA-DIMETHYL BENZENEMETHANOL	ug/l				|				|				|				|
DICHLOROBENZOIC ACID	ug/l				|				|				|				|
DECANOIC ACID	ug/l				|				|				|				|
1,2-DIETHOXYETHANE	ug/l				|				|				|				|
DIETHYL ETHER	ug/l				|				|				|				|
DODECANOIC ACID	ug/l				|				|				|				|
ETHANE,1,1'-OXYBIX 2 ETHOXY	ug/l				|				|				|				|
ETHANONE,1 PHENYL	ug/l				|				|				|				|
ETHYL HEXANOL	ug/l				|				|				|				|
ETHYL METHYL BENZENE	ug/l				|				|				|				|
ETNANONE, (PHENYLENE) BIS	ug/l				|				|				|				|
HEXANIOCACID,2-ETHYL	ug/l				|				|				|				|
HEXAHYDRO 2H-AZEPIN 2 ONE	ug/l				|				|				|				|

TABLE 6 20 (continued)
Summary of TENTATIVELY IDENTIFIED COMPOUNDS in Groundwater
OII Landfill Site

NOTES: Calculations include "U" and "J" flagged data and duplicates
D - number of detected values
O - number of observations
This table summarizes only those compounds that have been detected at least once.

		SAMPLING LOCATION: OI 29B				SAMPLING LOCATION:											
Chemical	Units	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O	Max	Min	Median	D / O
HEXADECANOIC ACID	ug/l																
HEXANOIC ACID	ug/l																
HEXANE (N-HEXANE)	ug/l																
METHYL CYCLOPENTANE	ug/l																
METHYL(METHYLETHYLIDENE) CYCLOHEXANE	ug/l																
METHYL PROPYL BENZENE	ug/l																
N,N-DIMETHYLMETHAN AMINE	ug/l																
NONANOIC ACID	ug/l																
NONYLPHENOL	ug/l																
OCTANOIC ACID	ug/l																
OCTADECANOIC ACID	ug/l																
OXIRANE,2,2'-OXYBISIME	ug/l																
PHENOL, 2-(2H-BENZOTRIZOL-2 YL) 4 METHYL	ug/l																
PHENOL,4,4-(1-METHYLETHYLIDE	ug/l																
POLY-ETHER	ug/l																
PALMITIC ACID	ug/l																
PALMITOLEIC ACID	ug/l																
SULFUR (S8)	ug/l																
SATURATED ALIPHATIC HYDROCARBON	ug/l																
MOLECULAR SULFUR	ug/l																
TETRADECANOIC ACID	ug/l																
TRIETHYL SILANE	ug/l																
THIOBIS METHANE	ug/l																
1,2,4-TRIMETHYL BENZENE	ug/l																
TETRAMETHYLUREA	ug/l																
UNKNOWN AROMATIC HYDROCARBON	ug/l																
UNKNOWN ALKANE	ug/l																
TOTAL UNKNOWN BNA TIC	ug/l																
UNKNOWN FREON TIC	ug/l																
TOTAL UNKNOWN BNA HYDROCARBONS	ug/l																
UNKNOWN VOA TIC	ug/l	4.0 K	4.0 K	4.0 K	1/ 1												
X,Y-DIMETHYL BENZENE	ug/l																
X-ETHYL-Y-METHYL BENZENE	ug/l																
X,Y,Z-TRICHLORO-1-PROPENE	ug/l																

Section 7
SOIL CONTAMINATION

Section 7
SOIL CONTAMINATION

Soil contamination at the OII site has been characterized using both field GC screening of vapor headspace off soil samples and laboratory analysis of soil samples collected during drilling. This section briefly describes the methods and procedures used, summarizes data collected, and provides an evaluation and comparison of field and laboratory data.

7.1 FIELD SOIL VAPOR ANALYSIS

7.1.1 OBJECTIVES OF FIELD SOIL VAPOR ANALYSIS

The objectives of soil vapor headspace screening were to:

- Aid in evaluating potential aqueous phase contaminant migration pathways for selected indicator VOCs
- Evaluate the relative concentration of selected VOCs as a function of depth in boreholes drilled during the Hydrogeology Investigation
- Aid in selecting soil samples to be sent for Laboratory analysis
- Aid in selecting well perforation intervals for detection of contaminated hydrogeologic units

7.1.2 FIELD METHODS AND PROCEDURES

Screening of soil vapor headspace samples was conducted in the field using gas chromatography equipment. Discrete soil samples were collected using a California-modified soil sampler. Soil samples were collected for both field headspace screening and laboratory analysis. Soil vapor headspace analyses were performed in the field using two GCs. One GC was configured with an electron capture detector (ECD) for the analysis of selected halogenated hydrocarbons, and one GC was configured with a flame ionization detector (FID) for the analysis of selected petroleum hydrocarbons.

Standard Operating Procedures (SOPs) for the soil vapor headspace method were submitted to EPA as part of the FSP for the OII Hydrogeology Investigation (EPA, September 14, 1989). Several modifications to the original SOPs were made during the seven-month investigation. Some modifications were initiated by field personnel (with concurrence and approval by the EPA project manager), and others were initiated

based on recommendations from the Quality Assurance Management Section of EPA Region IX. The revised SOPs are included as Appendix G-1 of this Draft Report.

Several problems were identified in the field analysis protocol that render the data usable as preliminary screening data only. Problems concerning calibration, peak identification, and equipment performance are discussed in a memorandum to EPA prepared by CH2M HILL dated June 25, 1990. Though the field data does not meet all data quality objectives outlined for an EPA close support laboratory, the data does aid in identifying zones of potential soil and aqueous phase contamination and may be used to aid in verifying the presence of contamination when complimented by laboratory data.

7.1.3 SELECTION OF SOIL VAPOR INDICATOR COMPOUNDS

One objective of this Phase I Hydrogeology Investigation is the evaluation of the potential migration of leachate, groundwater, or other aqueous phase contamination away from the landfill site. It is important to select indicator compounds that are likely to be indicative of aqueous phase contamination rather than contamination derived from the offsite migration of contaminated landfill gas. For this reason, some VOCs were rejected for use as indicators of aqueous phase contamination.

The consistent detection of low level contamination by some VOCs throughout the unsaturated zone suggests a landfill gas source. Vinyl chloride (VC) is known to be present at high concentrations in landfill gas. Concentrations of VC detected in soil vapor headspace samples may be the result of offsite landfill gas migration rather than aqueous phase contamination. Other compounds are known to "prefer" the gaseous phase under equilibrium conditions. TCA (1,1,1-trichloroethane) is another compound that has been shown to partition readily into the gaseous component of the vadose zone. These compounds do not make good tracers or indicators of aqueous phase contamination, and, therefore, were not targeted for analysis during soil vapor headspace screening.

In contrast, some compounds "prefer" the aqueous phase due to their higher aqueous solubility and lower vapor pressure. These compounds, if present in an aqueous phase source, are volatile enough to be present and detected in the gaseous component of the vadose zone.

Compounds identified for use as indicator compounds or tracers for this investigation include:

Aromatic Hydrocarbons:

- Benzene
- Toluene

- Ortho-xylene
- Ethyl benzene

Halogenated Hydrocarbons:

- Chloroform
- TCE
- PCE

The compounds listed above were identified and selected based on a review of historical laboratory data for the OII site and on preliminary field analyses of soil vapor headspace samples. Benzene, toluene, TCE, and PCE were selected as primary indicator compounds for use in the evaluation of contaminant migration pathways. Estimated concentrations of ethylbenzene, ortho-xylene, and chloroform were used as supporting data when possible. The identification and quantification of 1,1-dichloroethylene and 1,2-dichloroethane were found to be questionable and are not used in the discussions presented in this section. These data were questionable due to the potential for misidentification of co-eluting peaks.

7.1.4 INTERPRETATION OF SOIL VAPOR CONCENTRATIONS

Soil samples were heated at a temperature of 80°C for a period of 20 to 30 minutes prior to withdrawing a soil vapor headspace sample for analysis. Elevated temperature was used to drive the VOCs into the headspace of the sample jar. The concentration of VOC detected in a soil vapor headspace sample may be derived from a number of sources including contaminated gas in soil pores, contaminated water in soil pores, or sorbed phase contaminant chemically adhering to the surface of soil particles. The quantity of contaminant entering the gas phase in a sample headspace jar is determined by a number of variables including chemical concentrations and properties of the contaminant; grain size and gradation of the soil matrix; mineral content, moisture content and organic content of the soil; and gas-filled porosity and permeability.

Because of these variables, it is difficult to interpret soil vapor headspace data to identify the source of the contaminant detected and to correlate soil vapor concentrations (in ug/l of gas) with soil concentrations (in micrograms/kilograms [ug/kg]).

7.1.5 RESULTS OF SOIL VAPOR HEADSPACE ANALYSIS

Results of field soil vapor headspace analyses are provided in Appendix G-2. Maximum concentrations of contaminants detected in soil vapor headspace samples by field gas chromatography analysis are provided in Table 7-1. A discussion of soil vapor headspace analyses of indicator compounds for each boring is provided in Appendix G-3.

Table 7-1
Maximum Concentrations of Contaminants Detected in Soil Vapor Headspace Samples by Field Gas Chromatography Analysis

Parameter	Date Sampled	Boring Number	Depth (feet)	Value or Conc.	Units
Volatile Organic Compound					
Aromatic Hydrocarbons:					
Benzene	11/21/89	OI-25A	80	3,940	ug/l of gas
Toluene	2/1/90	OI-28B	120	2,760	ug/l of gas
Ethylbenzene	2/1/90	OI-28B	120	2,522	ug/l of gas
Ortho-Xylene	2/1/90	OI-28B	120	3,950	ug/l of gas
Halogenated Hydrocarbons:					
PCE	1/31/90	OI-28B	60	36.74	ug/l of gas
TCE	11/30/89	OI-22B	50	3.28	ug/l of gas

The distribution of benzene, toluene, TCE, and PCE in soil samples from both laboratory and field soil vapor headspace analyses are shown in Figures 7-1 through 7-4. At each well location a bar concentration graph shows the concentration of the specified chemical with laboratory analyses on the left side and field soil vapor headspace analyses on the right side. The concentrations are displayed on a log scale to allow comparison of a wide range of concentrations. The fine- and coarse-grained lithologic intervals in each boring are displayed in the center of the graph. This display permits comparison of the laboratory and field soil vapor headspace analyses as a function of depth, location, and lithology. Cross-sections prepared with these bar concentration plots are provided in Appendix I.

Results of field soil vapor headspace analyses suggest the presence of elevated levels of indicator VOCs in many areas around the landfill perimeter. Soil vapor headspace concentrations of benzene appear to be highest in the upper 150 feet of most borings where benzene was detected (except in Borings OI-15A and OI-18A, which contained maximum concentrations of benzene at depths of 300 to 400 feet below ground surface [bgs]). The maximum field soil vapor headspace concentration of benzene was detected at a depth of 80 feet bgs in Boring OI-25A located in the southern portion of the North Parcel. Field soil vapor headspace concentrations of toluene, ethylbenzene, orthoxylene, TCE, and PCE, were spatially distributed around the entire perimeter of the landfill site. Maximum field soil vapor headspace concentrations of these compounds were detected in Boring OI-28B located in the eastern portion of the landfill site.

Concentrations of VOCs in soil (particularly benzene and toluene) appear to correlate with the shallow water table, the capillary fringe, and just below the water.

Low concentrations of TCE and PCE in soil vapor headspace samples may be the result of interactions with contaminated landfill gas. Higher concentrations of these compounds (>1.00 ug/lg) may be the result of leachate interaction with soil and groundwater.

7.2 LABORATORY ANALYSES FOR SOIL SAMPLES

Depth-specific soil samples were collected for laboratory analysis of various chemical parameters. A total of 87 soil samples were sent for laboratory analysis. Analytical parameters include:

- Soil pH
- Total Organic Carbon (TOC)
- Cation Exchange Capacity (CEC)
- Volatile Organic Compounds
- Base/Neutral, Acid (semivolatile) Compounds

- Tentatively Identified Compounds
- Metals

Complete data listings for laboratory soil analyses are provided in Appendix N. Data listings for detected values only are provided in Appendix H-1.

7.2.1 LABORATORY INDICATOR PARAMETERS

Based on a review of laboratory analysis data, several compounds (and soil pH) have been identified for use as indicators of contamination. These indicator compounds include:

Volatile Organic Compounds

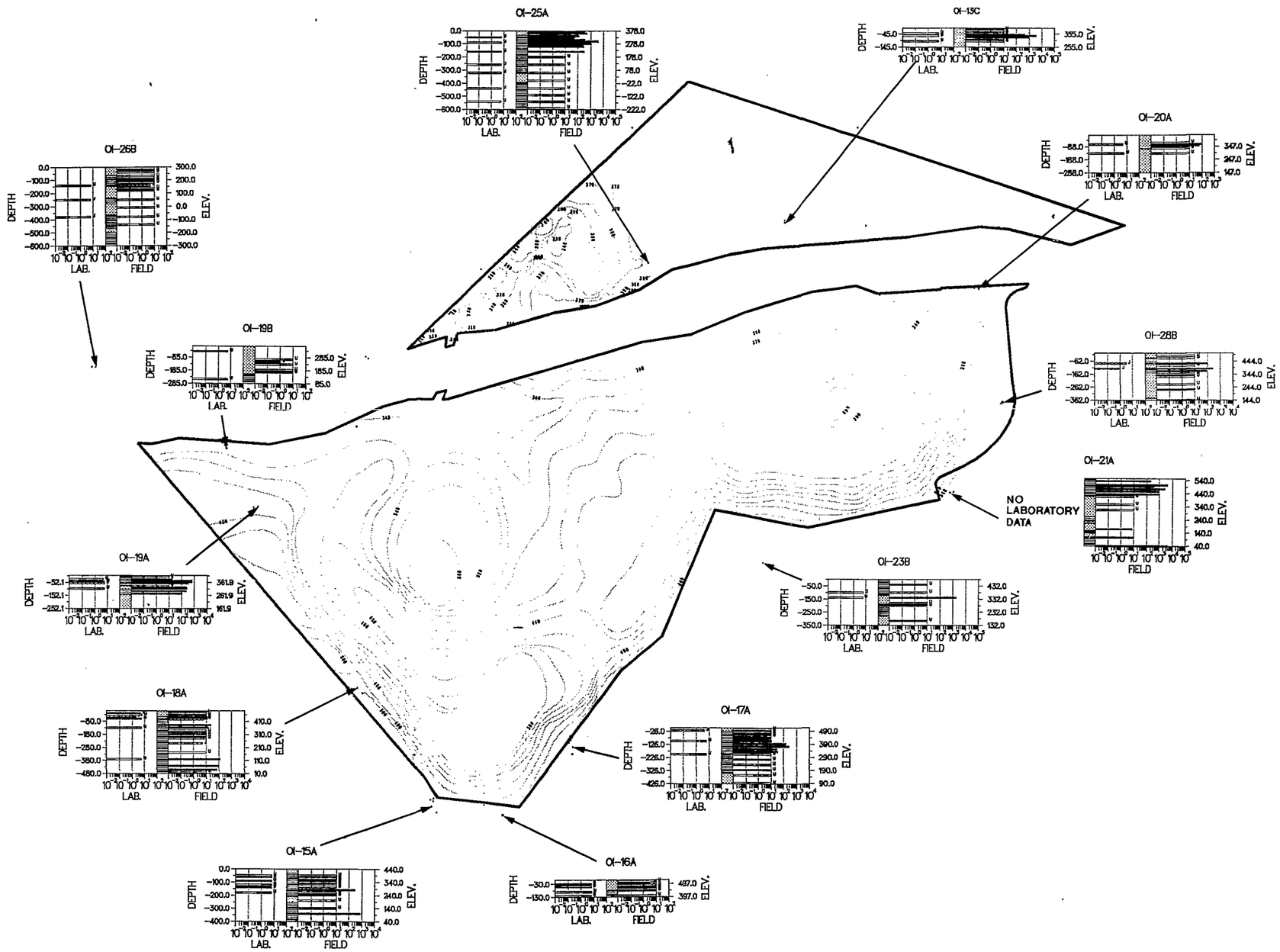
- Benzene
- Toluene
- Total xylenes
- Ethylbenzene
- TCE
- PCE
- 1,4-Dioxane

Semivolatile Organic Compounds

- Bis (2-ethylhexyl) phthalate
- Pentachlorophenol
- 3,3 - Dichlorobenzidine
- 1,4 - Dichlorobenzene
- 1,2 - Dichlorobenzene
- Benzyl Alcohol
- Benzoic Acid
- Butylbenzyl Phthalate

Tentatively Identified Compounds

- Total Unknown BNA TIC
- Total Unknown BNA Hydrocarbon
- Unknown VOA TIC
- Hexanedioic Acid
- Sulfur
- C3 - Benzene
- C4 - Benzene



CONTOURS PRESENT ESTIMATED ELEVATION OF LANDFILL BASE

EXPLANATION

DATA WITH NO FLAGS
SEMIQUANTITATIVE DATA

DATA FLAGGED "J"
J "J" FLAGGED DATA ARE FOR QUALITATIVE USE ONLY

U NONE DETECTED, BELOW METHOD DETECTION LIMIT

FIELD RESULTS - MICROGRAMS PER LITER OF GAS (ug/lg)

LABORATORY RESULTS - MICROGRAMS PER KILOGRAM OF SOIL (ug/kg)

GENERALIZED LITHOLOGY

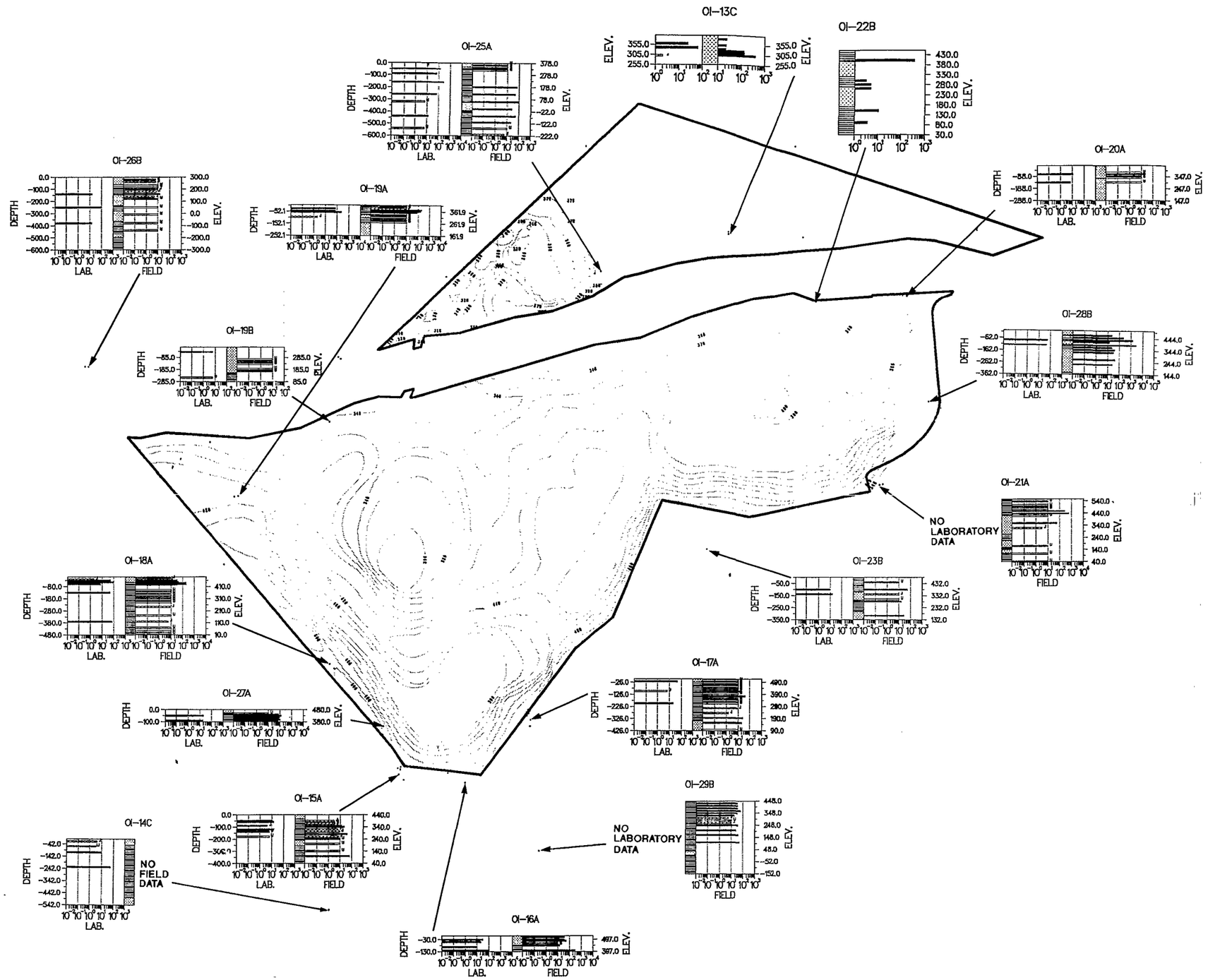
COARSE-GRAINED INTERVALS

FINE-GRAINED INTERVALS

N

0 250 500 1000
SCALE IN FEET

FIGURE 7-1
DISTRIBUTION OF BENZENE
IN SOIL BASED ON LABORATORY AND
FIELD SOIL VAPOR HEADSPACE ANALYSES
OII HYDROGEOLOGY IN INVESTIGATION
SEPTEMBER 1989 THROUGH APRIL 1990



CONTOURS PRESENT ESTIMATED ELEVATION OF LANDFILL BASE

EXPLANATION

DATA WITH NO FLAGS
SEMIQUANTITATIVE DATA

DATA FLAGGED "J"

J "J" FLAGGED DATA ARE FOR QUALITATIVE USE ONLY

U NONE DETECTED, BELOW METHOD DETECTION LIMIT

FIELD RESULTS - MICROGRAMS PER LITER OF GAS (ug/lg)

LABORATORY RESULTS - MICROGRAMS PER KILOGRAM OF SOIL (ug/kg)

GENERALIZED LITHOLOGY

COARSE-GRAINED INTERVALS

FINE-GRAINED INTERVALS

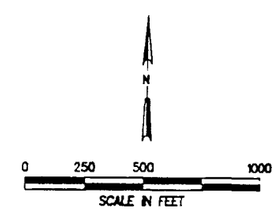
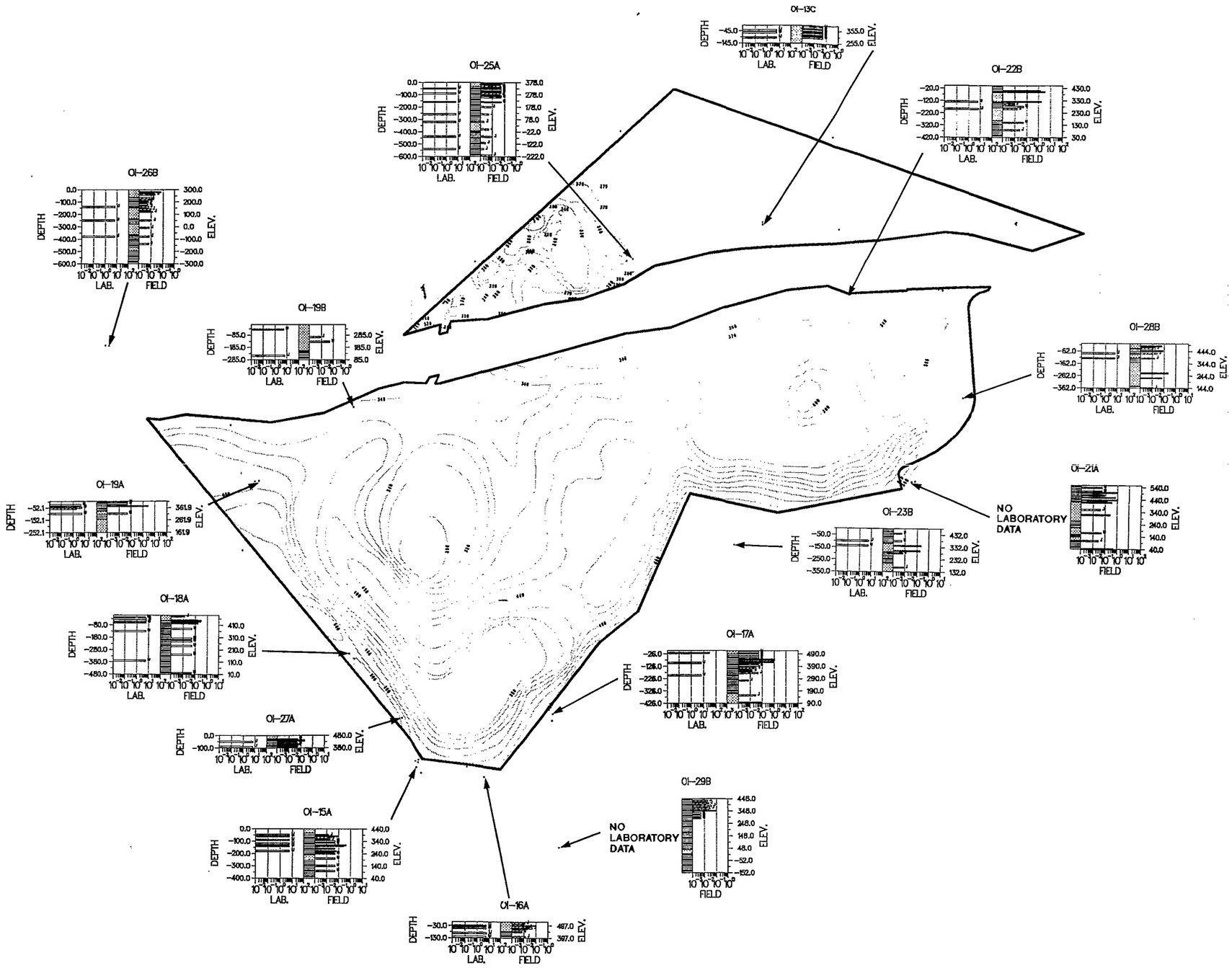


FIGURE 7-2
DISTRIBUTION OF TOLUENE IN SOIL BASED ON LABORATORY AND FIELD SOIL VAPOR HEADSPACE ANALYSES
OII HYDROGEOLOGY IN INVESTIGATION
SEPTEMBER 1989 THROUGH APRIL 1990



CONTOURS PRESENT ESTIMATED ELEVATION OF LANDFILL BASE

EXPLANATION

DATA WITH NO FLAGS
SEMIQUANTITATIVE DATA

DATA FLAGGED "J"
J "J" FLAGGED DATA ARE FOR QUALITATIVE USE ONLY

U NONE DETECTED, BELOW METHOD DETECTION LIMIT

FIELD RESULTS - MICROGRAMS PER LITER OF GAS (ug/lg)

LABORATORY RESULTS - MICROGRAMS PER KILOGRAM OF SOIL (ug/kg)

GENERALIZED LITHOLOGY

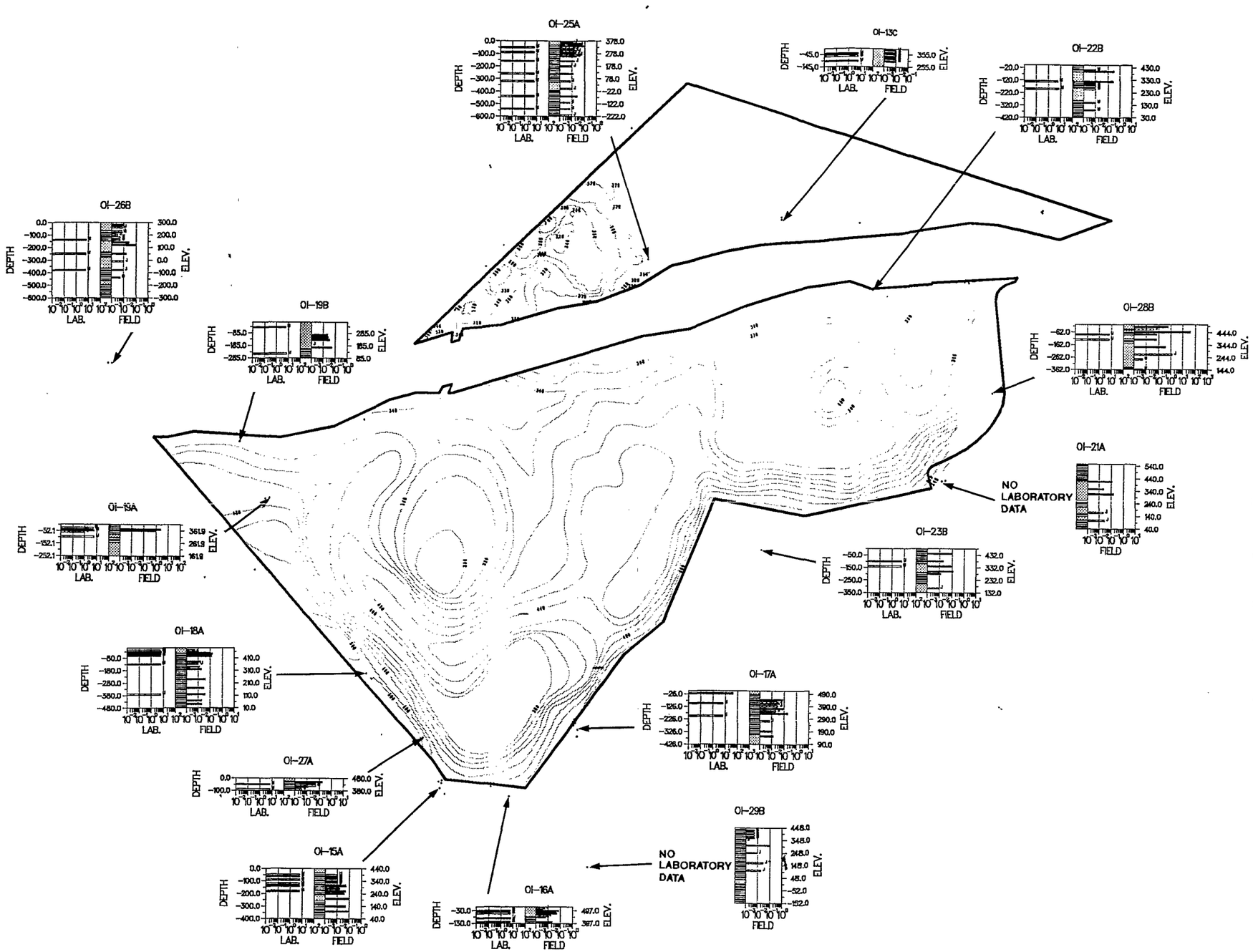
COARSE-GRAINED INTERVALS

FINE-GRAINED INTERVALS

N

0 250 500 1000
SCALE IN FEET

FIGURE 7-3
DISTRIBUTION OF TRICHLOROETHYLENE IN SOIL BASED ON LABORATORY AND FIELD SOIL VAPOR HEADSPACE ANALYSES
OII HYDROGEOLOGY INVESTIGATION
SEPTEMBER 1989 THROUGH APRIL 1990



CONTOURS PRESENT ESTIMATED ELEVATION OF LANDFILL BASE

EXPLANATION

DATA WITH NO FLAGS
SEMIQUANTITATIVE DATA

DATA FLAGGED "J"

J "J" FLAGGED DATA ARE FOR QUALITATIVE USE ONLY

U NONE DETECTED, BELOW METHOD DETECTION LIMIT

FIELD RESULTS - MICROGRAMS PER LITER OF GAS (ug/lg)

LABORATORY RESULTS - MICROGRAMS PER KILOGRAM OF SOIL (ug/kg)

GENERALIZED LITHOLOGY

COARSE-GRAINED INTERVALS

FINE-GRAINED INTERVALS

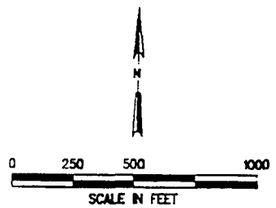


FIGURE 7-4
DISTRIBUTION OF PERCHLOROETHYLENE IN SOIL BASED ON LABORATORY AND FIELD SOIL VAPOR HEADSPACE ANALYSES
OII HYDROGEOLOGY INVESTIGATION
SEPTEMBER 1989 THROUGH APRIL 1990

Tentatively Identified Compounds (Continued)

- 2 - Methyl Propanol
- $C_{10}H_{18}O$
- C_6H_{12} Hydrocarbon
- C_6H_{14} Hydrocarbon

Metals

- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Silver
- Zinc

A description of contaminant concentrations as a function of depth in each borehole is provided in Appendix H-2. The distribution of benzene, toluene, TCE, and PCE in soil samples, based on laboratory and field soil vapor headspace analyses, are shown in Figures 7-1 through 7-4. Cross-sections showing the cross-sectional distribution of VOCs based on laboratory and field soil vapor headspace analyses are shown in Appendix I.

Maximum concentrations of contaminants detected by laboratory analyses of soil samples are shown in Table 7-2. Maximum concentrations of one or more contaminants from laboratory analyses were detected in Borings OI-13C, OI-17A, OI-18A, OI-18B, OI-19A, OI-20A, OI-22B, OI-23B, and OI-25A.

7.2.2 RESULTS OF LABORATORY ANALYSES BY PARAMETER

Soil pH

Laboratory measured pH values for soil samples collected during the OII Hydrogeology Investigation ranged from 5.28 to 9.85 pH units. These values are within the range for natural soils. However, some samples with low pH contained organic contaminants, suggesting that the low pH may also be the result of contamination rather than natural conditions.

Table 7-2
Maximum Concentrations of Selected Compounds
Detected in Laboratory Analysis of Soil Samples

Compound or Parameter	Date Sampled	Boring Number	Depth (feet)	Value or Conc. µg/kg	MCL (water) µg/kg	STLC (mg/l)	TCLP (Soil Extract) mg/kg	Proposed Action Level (Soil) (mg/kg)
Soil pH								
Maximum	12/14/89	OI-15B	40	9.85			NL	NL
Minimum	11/03/89	OI-22B	130	5.28			NL	NL
Total Organic Carbon	01/03/90	OI-25B	260	8,750	NL			
Cation Exchange Capacity	01/24/90	OI-27A	50	20.9				NL
Volatile Organic Compound								
Aromatic Hydrocarbons:								
Benzene	10/24/89	OI-19A	60	6.0 J	5		0.50	NL
Toluene	11/21/89	OI-25A	160	260	2,000 P		NL	20,000
Ethylbenzene	10/24/89	OI-19A	60	230	700 P		NL	8,000
Total Xylenes	10/24/89	OI-19A	60	62	10,000 P		NL	200,000
1,4-Dioxane	10/11/89	OI-18B	20	840	NL		NL	60
Halogenated Hydrocarbons:								
1,1-Dichloroethane	11/14/89	OI-17A	20	18	5		NL	NL
1,2-Dichloroethene	11/14/89	OI-17A	20	52 J			NL	NL
PCE	11/14/89	OI-17A	20	42	5		0.7	10
TCE	11/14/89	OI-17A	20	35	5		0.5	60

Table 7-2
(Continued)

Compound or Parameter	Date Sampled	Boring Number	Depth (feet)	Value or Conc. µg/kg	MCL (water) µg/kg	STLC (mg/l)	TCLP (Soil Extract) mg/kg	Proposed Action Level (Soil) (mg/kg)
Semivolatile Organic Compounds								
Bis (2-ethylhexyl) phthalate	11/28/89	OI-13L	60	3200 P	NL		NL	50
	10/12/89	OI-19B	252	3200 P	NL		NL	50
3,3 - Dichlorobenzidine	01/22/90	OI-18B	30	838.2 P	NL		NL	2
1,4 - Dichlorobenzene	10/24/89	OI-19A	60	3.0 J	75		7.5	NL
1,2 - Dichlorobenzene	10/11/89	OI-18B	20	1.0 JD	620(G)		NL	NL
Pentachlorophenol	11/30/89	OI-22B	130	2100 P	220(G)		100.0	2,000
Benzyl Alcohol	10/12/89	OI-19B	252	432.30 P	NL		NL	NL
Benzoic Acid	10/25/89	OI-19A	100	140 J	NL		NL	NL
Butyl/Benzyl Phthalate	10/25/89	OI-19A	100	85 J	NL		NL	20,000
Tentatively Identified Compounds								
Total Unknown BNA TIC	11/28/89	OI-13C	60	8100 K	NL		NL	NL
Total Unknown BNA Hydrocarbon	11/28/89	OI-13C	60	600 K	NL		NL	NL
Unknown VOA TIC	11/06/89	OI-20A	70	14 K	NL		NL	NL
Total Unknown VOA Hydrocarbon	01/05/90	OI-23B	140	50 K	NL		NL	NL
Hexanedioic Acid	10/12/89	OI-19B	252	400 K	NL		NL	NL
Sulfur	10/12/90	OI-18B	130	30,000 K	NL		NL	NL
C3 - Benzene	10/24/89	OI-19A	60	95 K	5.0		0.50	NL
C4 - Benzene	10/24/89	OI-19A	60	35 K	5.0		0.50	NL
2 - Methyl Propanol	11/28/89	OI-13C	60	400 K	NL		NL	NL
$C_{10}H_{18}O$	11/06/89	OI-20A	70	37 K	NL		NL	NL
C_6H_{12} Hydrocarbon	01/05/90	OI-23B	140	30 K	NL		NL	NL
C_6H_{14} Hydrocarbon	01/05/90	OI-23B	140	70 K	NL		NL	NL

Table 7-2
(Continued)

Compound or Parameter	Date Sampled	Boring Number	Depth (feet)	Value or Conc. µg/kg	MCL (water) µg/kg	STLC (mg/l)	TCLP (Soil Extract) mg/kg	Proposed Action Level (Soil) (mg/kg)
Metals								
Arsenic	11/14/89	OI-17A	20	13.9	500	5	5.0	80
Barium	11/14/89	OI-17A	20	235	10,000	100	100.0	NL
Cadmium	10/11/89	OI-18B	45	194	100	1	1.0	40
Chromium	11/28/89	OI-13C	100	46.2	2,500	5	5.0	400(Cr^{+6})
Copper	01/22/89	OI-18A	60	53.1	2,500	25		NL
Iron	11/14/89	OI-17A	20	45,000	NL	NL		NL
Lead	11/14/89	OI-17A	20	16	1,000	5	5.0	NL
Manganese	11/14/89	OI-17A	20	2,060	NL	NL		NL
Mercury	11/30/89	OI-22B	130	0.99	20	0.2	0.2	20
Nickel	10/11/89	OI-18B	45	337	2,000	20	NL	2,000
Selenium	01/22/90	OI-18A	60	3.9	100	1	1.0	NL
Silver	01/22/90	OI-18A	60	6	500	5	5.0	200
Zinc	01/22/90	OI-18A	60	143	5,000	250	NL	NL

TCLP - Toxicity Characteristic Leaching Procedure
MCL - Maximum Contaminant Level
NL - Not Listed
J - Estimated trace value
P - Proposed
D - Duplicate Sample
K - Tentatively Identified Compound
(G) - EPA MCL Goal

Total Organic Carbon and Cation Exchange Capacity

Soil samples were analyzed for TOC and CEC to evaluate the ability of subsurface geologic material to attenuate or retard the migration of selected contaminant in the subsurface.

Organic contaminants sorb on clayey soils or soils containing high organic content. This process may act to retard or attenuate the migration of these contaminants in the subsurface at the OII site. Soil samples collected from the OII site and analyzed for TOC contained concentrations ranging from 120 mg/kg in Boring OI-17A to 8,750 mg/kg in Boring OI-25B. The average TOC value for soil samples collected during the investigation was 2,451 mg/kg.

CEC results ranged from 1.16 milliequivalents/100 grams (mg/100g) in Corehole 20 to 20.9 mg/100g in OI-27A. The average CEC value was 10.7 mg/100g.

Organic Compounds

Organic compounds detected in soil samples collected from the OII site are listed in Table 7-3. In general, soil contamination was most prevalent in samples collected from relatively shallow depths (less than 100 feet below ground surface). Borings containing elevated concentrations of one or more organic compounds include: OI-17A, OI-19A, OI-20A, OI-23B, OI-25A, and OI-28B.

Aromatic hydrocarbons were found to be most prevalent in borings OI-17A, OI-18B, OI-19A, and OI-28B. Concentrations of benzene, toluene, ethylbenzene, and total xylenes were found to co-exist in many cases, suggesting a potentially common source.

Toluene was the most commonly detected volatile soil contaminant at the site. Toluene was detected in 49 soil samples collected from 19 different borings. Concentrations ranged from an estimated trace value of 2.0 ug/kg to 260 ug/kg. The maximum toluene concentration was detected in a soil sample collected from a depth of 240 feet in Boring OI-25A. Concentrations greater than, or equal to, 100 ug/kg were detected in Borings OI-25A, OI-16A, OI-19A, and OI-21B.

Halogenated hydrocarbons were detected in several soil samples collected during the hydrogeology investigation (Table 7-3). Boring OI-17 contained the maximum concentrations of 1,1-dichloroethane, 1,2-dichloroethylene, PCE, and TCE detected in soil samples collected during the investigation. Maximum concentrations were detected in a soil sample collected from a depth of 20 feet in Boring OI-17A. This sample contained concentrations of 52 ug/kg 1,2-dichloroethylene; 42 ug/kg PCE; and 35 ug/kg TCE.

Table 7-3
Detected Organic Compounds

Compound	Number of Detected Values	Borings Detected (OI-)	Detected Range (ug/kg)
Benzene	5	17A,18B,19A,28B	1.0 J - 6.0 J
Toluene	49	19 borings	2.0 J - 260
Ethylbenzene	6	18B,19A,28B	5.0 J - 230
Total Xylenes	6	18B,19A,28B	3.0 J - 62
PCE	4	17A, 19A, 21B	1.0 J - 42
TCE	3	17A, 19A, 21B	2.0 J - 35
1,1-Dichloroethane	3	17LA,19A	2.0 J - 18
1,2-Dichloroethene	6	16A,17A,18A,19A,20A	2.0 J - 52 J
1,4-Dioxane	3	17A,18A,18B	18 - 840
2-Butanone	1	20A	660
4-Methyl-2-Pentone	1	20A	270
Methylene Cloride	9	17A,18B,19A,19B,28B	2.0 J - 46
cis-1,2-Dichloroethene	3	18B,28B	4.0 J 0- 10 J
2-Propanone	1	20A	810
Carbon Disulfide	2	25A	1.0 J - 2.0 J
Total VOC TICS	4	18B,20A,23B	5.0 - 130
Benzoic Acid	3	18B,19A	50 J - 140 J
1,2-Dichlorobenzene	1	18B	1.0J
1,4-Dichlorobenzene	2	17A,19A	2.0 J - 3.0 J
Butylbenzyl Phthalate	1	19A	85J
Di-N-Butylphthatlate	2	19A,29B	43J - 320J
Total BNA TICS	28	16 borings	2.0 - 30800
J - Estimated value, for qualitative use only.			

Metals

Maximum concentrations of metals detected in soil samples collected during this investigation are summarized in Table 7-2. Maximum concentrations of metals were detected in Borings OI-13C, OI-17A, OI-18A, OI-18B, and OI-22B. A soil sample collected from a depth of 20 feet bgs in Boring OI-17A contained the maximum concentrations of As, Ba, Fe, Pb, and Mn. This is an area of known leachate seepage. Maximum concentrations include 13.9 milligrams per kilogram (mg/kg) As; 235 mg/kg Ba; 45,000 mg/kg Fe; 16 mg/kg Pb; and 2,060 mg/kg Mn.

A sample collected from a depth of 60 feet in Boring OI-18A showed the maximum values of Cu, Se, Ag, and Zn. This is an area of known leachate seepage. Maximum concentrations include: 53.1 mg/kg Cu, 3.9 mg/kg Se, 6.0 mg/kg Ag, and 143 mg/kg Zn. Contaminated groundwater was detected at OI-184.

Other maximum metals concentrations in soils were detected in Borings OI-18B and OI-22B. A soil sample collected from a depth of 45 feet in Boring OI-18B showed the highest concentrations of Cd and Ni. Concentrations include 194 mg/kg Cd and 337 mg/kg Ni. A soil sample collected from a depth of 130 in Boring OI-22B showed a concentration of 0.99 mg/kg Hg. In general, metals were most prevalent in the upper 100 feet of soil profile suggesting a shallow perched leachate or seepage source.

7.2.3 COMPARISON OF SOIL LABORATORY VALUES TO AVAILABLE STANDARDS

An evaluation of the environmental impact of soil contamination by organic compounds and metals is difficult to perform due to the lack of applicable soil concentration standards for these compounds. On July 27, 1990, EPA proposed requirements under RCRA for corrective action for solid waste management units (SWMUs) [40 CFR Parts 264, 265, 270, and 271]. The proposal will establish technical requirements for implementing corrective action under Section 3004(u) of RCRA. It also proposes to establish standards for states to become authorized to administer corrective action requirements. Section 264.521 of the proposal establishes the general principles by which action levels would be established for each medium (groundwater, soil, surface water, and air). To provide guidance for RCRA permit writers, industry, and the public, the July 27, 1990, proposal includes a list of values that the Agency believes may be appropriate as action levels for a number of hazardous constituents in different environmental media. These proposed action levels for constituents detected at the OII site are provided in Table 7-2. Soil concentrations of constituents including 1,4-dioxane, PCE, and Cd were detected at levels above the EPA proposed Action Levels. The appropriateness and relevance of the proposed standards to the OII site are currently undetermined.

Organic chemicals and metals detected in soil are commonly evaluated based on how the soil contamination may contribute to groundwater contamination. This may be done by evaluating the leaching potential of the contaminant from the soil matrix. One way to compare concentrations of metals in soils is to compare them to the Total Threshold Limit Concentration (TTLC) and Soluble Threshold Limit Concentration (STLC) for that metal (if listed). If the metal concentration detected in a soil sample exceeds 10 times that of the listed STLC for the specific metal, then it is recommended that a Waste Extraction Test (WET Test) be performed on the soil sample (California Department of Health Services, July 1987). If the contaminant concentration measured in the extract exceeds the STLC, then the soil is considered hazardous according to Title 22 of the California Administrative Code. The WET test also provides a means of evaluating the leaching potential of contaminants in soil and provides a means of assessing the potential impact of soil contamination on underlying groundwater. In March 1990, the Federal government adopted the use of a Toxicity Characteristic Leaching Procedure (TCLP) to characterize solid wastes. The TCLP replaced the former EP tox procedure for toxicity characterization. The TCLP is used to characterize RCRA waste for toxicity. This procedure will cover 25 additional organic compounds, establish regulatory limits for these organic compounds, and retain the existing limits for 8 metals and 6 organic compounds.

A list of constituents that are now regulated under the Toxicity Characteristic rule are shown in Table 7-4. Soil samples collected during this investigation were not analyzed by the TCLP. The TCLP regulatory levels for metals are essentially the same as those from the former EP tox criteria.

7.3 COMPARISON OF FIELD SOIL HEADSPACE ANALYSES RESULTS TO LABORATORY ANALYSES RESULTS FOR SOIL SAMPLES

Field analyses of soil vapor headspace provided a semiquantitative assessment of VOCs in the subsurface. Field screening data are not to be used for enforcement purposes and should only be used as potential indication of contamination. Laboratory analyses provide confirmation of field screening data.

Overall, field soil vapor headspace analyses results agree reasonably well with laboratory soil analyses results, where available. Soil vapor headspace data suggest that VOC contamination is present in the shallow profile of several borings drilled during the investigation. The field detection of VOCs in soil vapor headspace samples does not verify the presence of contamination unless supported by laboratory data. However, the presence of contamination in soil vapor headspace samples may be used to aid in identifying areas in need of further investigation.

Table 7-4
Constituents that are Regulated Under the Toxicity Characteristic Rule

New Constituents	Regulatory Levels	Old EP Constituents	Regulatory Levels
Benzene	0.50 mg/l	Arsenic	5.0 mg/l
Carbon Tetrachloride	0.50 mg/l	Barium	100.0 mg/l
Chlordane	0.03 mg/l	Cadmium	1.0 mg/l
Chlorobenzene	100.0 mg/l	Chromium	5.0 mg/l
Chloroform	6.0 mg/l	Lead	5.0 mg/l
m-Cresol	200.0 mg/l*	Mercury	0.2 mg/l
o-Cresol	200.0 mg/l	Selenium	1.0 mg/l
p-Cresol	200.0 mg/l	Silver	5.0 mg/l
1,4-Dichlorobenzene	7.5 mg/l	Endrin	0.02 mg/l
1,2-Dichloroethane	0.50 mg/l	Lindane	0.4 mg/l
1,1-Dichloroethylene	0.70 mg/l	Methoxychlor	10.0 mg/l
2,4-Dinitrotoluene	0.13 mg/l**	Toxaphene	0.5 mg/l
Heptachlor (and its hydroxide)	0.008 mg/l	2,4-Dichlorophenoxycetic Acid	10.0 mg/l
Hexachloro-1,3-butadiene	0.5 mg/l	2,4,5-Trichlorophenoxypropionic Acid	1.0 mg/l
Hexachlorobenzene	0.13 mg/l**		
Hexachloroethane	3.0 mg/l		
Methyl ethyl ketone	200.0 mg/l		
Nitrobenzene	2.0 mg/l		
Pentachlorophenol	100.0 mg/l***		
Pyridine	5.0 mg/l		
Tetrachloroethylene	0.7 mg/l		
Trichloroethylene	0.5 mg/l		
2,4,5-Trichlorophenol	400.0 mg/l		
2,4,6-Trichlorophenol	2.0 mg/l		
Vinyl chloride	0.20 mg/l		

* If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol concentration is used. The regulatory level for total cresol is 200.0 mg/l.
** Quantitation limit is greater than the calculated regulatory level. The quantitation limit, therefore, becomes the regulatory level.
*** The Agency will propose a new regulatory level for this constituent, based on the latest toxicity information.

7.4 NATURE AND EXTENT OF SOIL CONTAMINATION

The results of laboratory and field soil vapor headspace analyses appear to indicate elevated levels of contamination in many areas around the landfill perimeter.

Soil contamination appears to be most prevalent in the upper 150-foot profile of unsaturated and saturated soils in borings drilled during this investigation. Indicators of soil contamination include soil pH and elevated concentrations of VOCs, semivolatile organic compounds (base/neutral, acid compounds), TICs, and metals.

The laboratory-measured pH of soil samples collected during this investigation ranged from 5.28 pH units at a depth of 130 feet bgs in Boring OI-22B to 9.85 at a depth of 340 feet bgs in Boring OI-15B. These values are within the range of pH values characteristic of natural soils; however, values less than 6 and greater than 8 may be considered indicators of potential contamination.

7.4.1 EXTENT OF SOIL CONTAMINATION BY ORGANIC COMPOUNDS

The results of laboratory and field soil vapor headspace analyses appear to indicate elevated levels of VOC contamination in most areas around the landfill perimeter. Volatile organic compounds detected in soil samples by laboratory analyses include: benzene; toluene; ethyl benzene; total xylenes; 1,4-dioxane; benzoic acid; methylene chloride; 1,1-dichloroethane; 1,2-dichloroethene; cis-1,2-dichloroethylene; trichloroethylene; tetrachloroethylene; 2-butanol; 2-propanone (acetone); 2-butanone (methyl ethyl ketone); 4-methyl-2-pentone (methyl isobutyl ketone); C3-benzene; C4-benzene; C_6H_{12} hydrocarbon and $C_{10}H_{18}0$ hydrocarbon; and carbon disulfide.

The nature and extent of soil contamination by VOCs at the OII landfill site may be derived from components including contamination adsorbed to soil matrix, contamination in soil pore moisture or liquids, and contamination existing in the soil gas. Soil samples collected in the vadose zone may contain contamination derived from migrating landfill gas or leachate. Soil samples collected below the water table are considered saturated and it is assumed that there is no soil gas component. Soil contamination detected below the water table is most likely derived from contaminated soil and liquid (leachate or groundwater). However, contaminants in landfill gas just above the water table also may act to contaminate shallow groundwater.

Field soil vapor headspace analyses provide an assessment of the spatial distribution of VOCs in the subsurface. Soil vapor concentration values less than about 1.00 ug/lg most likely indicate areas influenced by landfill gas migration or low level contamination of soil and/or groundwater. Concentrations greater than 1.00 ug/lg may be indicative of leachate or groundwater contamination by leachate. The grain size of the soil matrix is the most important factor that determines the release of VOCs into the soil vapor headspace screening jars when heated. A contaminated clayey or silty

soil sample may show less contamination than a coarser sample when screened using the soil vapor headspace method. This is due to the low gas permeability and the small exposed surface area of the finer grained soil sample.

The indicator compounds used in this evaluation include benzene, toluene, TCE, and PCE. Highest concentrations of benzene and toluene were typically detected in the upper 150 feet of the soil profile. Concentrations of benzene and toluene were detected at deeper depths in several borings. In many areas, the contaminated soil horizon coincides with the water table, the capillary fringe, or just below the water table.

Concentrations of TCE and PCE were more dispersed through the vadose zone suggesting a more mobile nature and the influence of migrating contaminated landfill gas. High concentrations in the vadose zone may indicate a spill or other vadose zone source. Concentrations of TCE and PCE appear to indicate low level contamination by halocarbons around the entire landfill perimeter. Concentrations detected below the water table may also be partially due to the partitioning of contaminants from landfill gas into groundwater. Contamination detected below the water table may also be derived from the mixture of leachate with groundwater.

Semivolatile organic compounds detected in soil samples collected during this investigation include concentrations of 1,4-dichlorobenzene, 1,2-dichlorobenzene, benzoic acid, butylbenzylphthalate, and di-n-butyl-phthalate. These compounds were found in borings located in the west and southwest perimeter of the landfill site.

7.4.2 EXTENT OF SOIL CONTAMINATION BY METALS

Soil concentrations of many metals were detected in concentrations that exceed the STLC for that specific metal. Only cadmium and nickel were detected in concentrations that exceed 10 times the STLC. The maximum concentration of cadmium was 194 mg/kg detected in a soil sample from 45 feet bgs in Boring OI-18B. This concentration exceeds 10 times the STLC of 1 mg/kg for this metal. The maximum concentration of cadmium appears to occur above the saturated zone. Therefore, soil contamination by cadmium exists in the vadose zone and most likely is derived from migrating leachate contamination. Groundwater from well OI-184, which is screened from 20 to 30 feet, is contaminated with leachate.

A maximum concentration of 337 mg/kg nickel was also detected in the soil sample from 45 feet bgs in Boring OI-18B. This concentration exceeds ten times the STLC for nickel. Similar to cadmium, soil concentrations of nickel exist above the water table in Well OI-18B. Therefore, soil contamination by nickel exists in the vadose zone and appears to be derived from a migrating leachate source.

A maximum total chromium concentration of 46.2 mg/kg was detected in a soil sample from 100 feet in Boring OI-13C. Assuming that the total chromium detected may potentially exist in the hexavalent state, this concentration nearly exceeds 10 times the STLC of 5 mg/kg for hexavalent chromium. The depth to groundwater in Well OI-13C is about 67 feet bgs. Therefore, soil contamination by chromium appears to be present below the water table.

Section 8
ASSESSMENT OF POTENTIAL CONTAMINANT MIGRATION

Section 8
ASSESSMENT OF POTENTIAL CONTAMINANT MIGRATION

This section discusses the potential mechanisms and pathways for the release of contaminants from the OII Landfill into the groundwater beneath and adjacent to the site.

8.1 POTENTIAL CONTAMINANT RELEASE MECHANISMS

Five potential mechanisms for the release of contaminants from the OII site to groundwater are considered in this report:

1. Direct contact of solid waste and groundwater

2. Vertical migration of leachate into geologic units (primarily within the Pico Unit) that may be exposed beneath the waste mass, followed by lateral migration within those units

3. Lateral leachate migration into pathways (potentially perched) in both the Lakewood/San Pedro and Pico Hydrogeologic Units

4. Vertical migration of dense, nonaqueous phase liquids (DNAPLs) through the siltstone underlying the landfill

5. Contact of landfill gas with groundwater

8.1.1 DIRECT CONTACT OF SOLID WASTE AND GROUNDWATER

Comparison of available water level data from perimeter groundwater monitoring wells with elevations of the base of the OII Landfill from borings and aerial photographs (Figure 5-8) suggests that the deepest part of the landfill on the western half of the South Parcel may be approximately 60 to 70 feet below the regional water table (Figures 4-4 and 4-6). The estimated depth of saturation is dependent upon how far the contours from the groundwater mound on the west side of the landfill (Figure 4-4) extend into the landfill. The elevation of the landfill at the deepest part is approximately 300 fasl. May 1990 groundwater elevations in OI-5 and OI-18B, which are west and southwest of the deepest disposal area, are 333 and 369 fasl, respectively. Two wells completed in the San Pedro Unit north of the deep disposal area also contain water levels above 300 feet: CDD-13 (333 fasl) and CDD-17 (314 fasl). If the elevation of the base of a landfill is below the water table, then soluble contaminants

may be leached from the waste into the groundwater. The potential for contaminant transport is greatest if groundwater flows through the waste, thus transporting the soluble contaminants away from the landfill.

Prior to disposal of hazardous waste on the western part of the South Parcel, geotechnical investigations of the area were conducted by Converse Davis Dixon Associates [CDD] (1975, 1976). Water was not observed in CDD-12 (Figure 3-2, Figure 4-6), even though the total depth drilled was approximately 198 feet below the current base of the landfill (CDD, 1976). This data is inconsistent with current observations. Insufficient time may have been allowed for groundwater to collect in the corehole due to the low permeability of the siltstone. CDD (1976) reported that the site foreman at OII during the excavation of the pit indicated that "no groundwater or conglomerate was encountered, although wet sand seams within the siltstone were present in the northerly portion of the waste pit area."

The estimated water level contours for the mound of groundwater along the western boundary of the South Parcel have been drawn extending into the landfill. This interpretation suggests a source of water beneath the western third of the South Parcel. The landfill is the most likely source of a mound of this size. If the mound is interpreted to occur more locally along the western boundary of the South Parcel, then a gradient would exist into the landfill. Although the individual solid waste cells within the landfill would reduce the amount of groundwater flowing through the landfill, the potential exists for groundwater to flow into the solid waste at the base of the landfill, and then to the northwest and southeast. Permeable pathways in direct contact with the solid waste on the south side of the deep disposal area are not currently known; however, groundwater flowing to the north can flow into the Lakewood/San Pedro Unit conglomerate that underlies the northern edge of the South Parcel solid waste. Current data shows that groundwater from monitoring wells CDD-13 and CDD-17, which are screened into that interval, has been affected by leachate.

If the shallow water levels adjacent to the western and southern perimeter of the landfill are interpreted to represent the water table, then additional water table contours extending into the landfill would have to be added to Figure 4-4. Since the data on moisture conditions within the landfill provided by the PRP wells (Figure 5-11) shows discontinuous saturated and sometimes pressurized intervals down to a depth of 380 feet, the landfill may represent a continuum of saturated-unsaturated flow. Individual cells of solid waste may remain unsaturated due in part to the internal pressures within the cells.

8.1.2 VERTICAL LEACHATE MIGRATION

Leachate at the base of the OII Landfill has the potential to infiltrate the underlying native soil and subsequently flow away from the site. Since disposed liquids can perch on top of the individual layers of disposed waste, it is currently unknown if free liquids

are present at the base of the landfill. Leachate collection well S-LSW-1, completed in early 1990, did not detect free liquids at the base of the landfill in the southern corner of the South Parcel. Leachate, if present, would more likely be found at the deepest part of the base of the landfill (Figure 5-8), which is located another 700 to 800 feet north, since a portion of the leachate would likely flow downhill at the contact of the siltstone and solid waste. If liquids are present, the low permeability of the Pico Unit siltstone would result in relatively slow rates of groundwater movement. The estimated average vertical groundwater velocity into the siltstone at the base of the landfill ranges from 0.1 to 0.5 feet/year (ft/year) using a hydraulic conductivity of 1.5×10^{-7} cm/sec (average of core samples [Table 4-6]) to 6.9×10^{-6} cm/sec (average for aquifer tests [Table 4-5]), a vertical hydraulic gradient of 0.23 (from hydrogeologic cross section B-B' [Appendix F, Figure F-2]), and an estimated porosity of 0.32.

The potential contact of a permeable geologic unit beneath the site with the refuse is a cause for concern. CDD (1975, 1976) reported that with the exception of a band of conglomerate on the northern boundary of the South Parcel, the permitted hazardous waste disposal area was underlain by siltstone. Although they reported 198 feet of siltstone beneath the depth of the landfill at its deepest point, the thickness of siltstone at other areas may be less. For comparative purposes, it would take an estimated 100 to 500 years for leachate to flow through a 50-foot layer of siltstone beneath the site.

As discussed in Section 4, the average horizontal hydraulic conductivity of the siltstone is assumed to be greater than the vertical hydraulic conductivity. This anisotropy will result in increased horizontal flow relative to vertical flow in the siltstone. Assuming a maximum localized horizontal hydraulic gradient of 0.08 from Figure 4-9, a hydraulic conductivity of 6.9×10^{-6} cm/sec (0.019 ft/day), and a porosity of 0.32, the estimated average linear horizontal groundwater velocity is 1.7 ft/year.

8.1.3 LATERAL LEACHATE MIGRATION

Lateral leachate migration may occur from leachate that infiltrates into the subsurface geologic formations adjacent to the refuse and then moves off laterally in response to the regional gradient. Due to the apparent perching of leachate within the landfill, it is likely that leachate could flow laterally from the landfill into geologic formations above the water table at the perimeter of the landfill, thus creating perched intervals or contaminating existing perched intervals.

The most contaminated wells at OII are those completed into potentially perched zones along the western and the western third of the southern boundary of the OII site. This supports the conclusion that lateral leachate movement into potentially perched zones is occurring along the western and southern boundary of the South Parcel. Lateral leachate migration would also help to explain the presence of the groundwater mound along the site perimeter in this area. Potentially perched zones are present in both Pico siltstone and at the contact of the Lakewood/San Pedro Unit and the Pico Unit.

The offsite extent of these perched zones is currently unknown. Additional wells are proposed in the Phase II Investigation (Section 10) to evaluate the extent of potentially perched intervals observed at the site boundary and to evaluate if the water levels represent the water table on perched intervals. Potential offsite leachate migration would occur more quickly in perched zones within or at the base of the San Pedro Unit rather than within the siltstone. Zones within the Pico siltstone that contain a higher percentage of sand would act as preferential pathways within the silt. OI-15A is perforated in such an interval.

8.1.4 VERTICAL DNAPL MIGRATION

DNAPLs such as pure chlorinated solvents may migrate vertically in the subsurface much more rapidly than water due to their higher density and lower viscosity (Roberts, Cherry, and Schwartz, 1982). DNAPLs may cause groundwater contamination by groundwater flow through DNAPL residue in the vadose zone or below the water table. DNAPLs can readily enter fractures. In this case, the migration is controlled by fracture orientation and interconnection. The retention on fractures is low, but the extent of migration can be much greater than for porous media. The presence of DNAPLs at the OII site has not been documented; they are discussed in this section as part of a comprehensive consideration of potential contaminant release mechanisms. DNAPLs are not considered to be a problem at the site at this time.

The primary concern of DNAPLs at the OII site is their potential to migrate through the base of the landfill the Pico Unit siltstone, if the siltstone is fractured. Surface exposures of the siltstone at the southern site boundary contain some vertical jointing. Jointing planes in the siltstone extend at least to the bottom of a 5-foot deep trench at an apparent fault contact, which is adjacent to the interior Flare Station Facility (FS2) at the northwest corner of the South Parcel. The presence of fractures or jointing planes in the siltstone beneath the landfill is unknown, but is not expected, based on the lack of visible fractures or joints in the core samples of siltstone from Corehole 23 and Corehole 20 and from drive samples obtained at the other boreholes. It should be noted that fractures are usually oriented vertically, and are, therefore, not always easily observed in coreholes. Most siltstone of the type observed at OII would be expected to exhibit an orthogonal fracture system. The potential presence of the these fractures does not, however, change the estimates of groundwater flow that are included in this chapter, since the hydraulic conductivity estimates from the aquifer tests would include the effects of fractures if they exist.

8.1.5 LANDFILL GAS MIGRATION

Subsurface migration of LFG may result in contamination of groundwater with VOCs if the LFG contacts groundwater in perched intervals or at the water table or if infiltrating groundwater passes through LFG in the unsaturated zone. Landfill gas at OII contains ppm concentrations of gas phase VOCs. Some LFG samples contain up

to 0.5 percent gas phase VOCs. The VOCs contained in the LFG will dissolve into the groundwater until the concentrations in the liquid and gas phases are in equilibrium based on Henry's Law (Stephens, Ball, and Mar, 1986).

VOCs can also pass from the aqueous to the gas phase. VOCs dissolved in groundwater will diffuse into the vadose zone and achieve equilibrium concentrations based on Henry's Law. This is the principle used in soil gas monitoring. Thus, when VOCs are found in both the vadose zone and the groundwater, it may be unclear whether the source of the VOCs is from the migration of contaminated groundwater or from LFG migration. This is particularly true of potentially perched intervals at the landfill perimeter that may be contaminated from either leachate migration or from contact with LFG. Elevated methane concentrations are diagnostic of landfill gas and support the interpretation of groundwater contamination from LFG.

The presence of nonvolatile contaminants such semivolatile organic compounds, TOC, or a large increase in metals concentrations may indicate advective transport rather than LFG migration. In general, groundwater contamination caused primarily by LFG is suspected in areas where: 1) LFG migration is documented, 2) VOCs represent the primary contaminants in the groundwater and 3) VOC contamination occurs near the water table, but not at a greater depth. The carbon dioxide in landfill gas can also lower the pH of groundwater. This may have the effect of increasing the dissolution of aquifer minerals, leading to an increase in TDS or metals concentrations. LFG may also contribute to observed groundwater contamination in areas not fitting this description, but it would not likely be the only source of groundwater contamination.

Based on these criteria, the VOC contamination at OI-20A may be due in part to LFG migration. Groundwater from OI-20A contains median concentrations of 13 ug/l PCE, 26 ug/l TCE, and 4 ug/l vinyl chloride. OI-20A is screened in the Lakewood/San Pedro Unit at the water table from a depth of 139 to 169 feet bgs. OI-20B is screened at the base of the Lakewood/San Pedro Unit at a depth of 250 to 280 feet bgs. VOCs are not detectable in groundwater from OI-20B. OI-20A has a considerably higher TDS concentration and lower pH (500 mg/l TDS, pH 6.3) than OI-20B (200 mg/l TDS, pH 7.3). This may be due to dissolution of carbon dioxide into the groundwater at the water table, which would decrease the pH and permit additional dissolution of acid-soluble minerals. Comparatively, small median concentrations of two semivolatiles were also observed in OI-20A (3.5 ug/l 1,4-dichlorobenzene and 1 ug/l benzoic acid), suggesting a potential small leachate component.

Table 8-1 summarizes calculations of estimated concentrations of VOCs in groundwater at the location of OI-20A using Henry's Law and soil gas concentrations from soil probe GMW-15B, located approximately 700 feet south of OI-20A. It can be seen that the actual concentrations agree with the calculated concentrations within one order of magnitude. The calculations for vinyl chloride have been completed using a value for the Henry's Law constant from Kavanaugh and Trussel (1980) and from Environmental

Solutions, Inc. [ESI], 1987. The agreement between the actual vinyl chloride concentrating in OI-20A and that calculated using the Kavanaugh and Trussel (1980) value for the Henry's Law constant is poor. ESI (1987) proposed that the Henry's Law constant should be approximately 100 times less than that reported in the literature based on a comparison of the activities of similar chemical compounds. Using the ESI range of values for the Henry's Law constant, the vinyl chloride concentration in the groundwater of OI-20A is also within one order of magnitude of the concentration predicted by Henry's Law and the soil gas concentration.

Table 8-1
Comparison of Actual and Calculated Concentrations of VOCs in OI-20A Using Henry's Law

Compound	H (atm/mol/m^3)	Molecular Wt. (g/gmol)	GMW-15B Conc. (ppbv)	Calc. Equil. Water Conc. (ug/l)	Actual Ave. Conc.in OI-20A (ug/l)	Ratio Actual/ Calc.
Vinyl Chloride	6.38[a]	62.5	3800	0.037	4	108
	0.036[b]	62.5	3800	6.6	4	0.61
Benzene	4.3×10^{-3}[a]	78.1	305	5.5	1	0.18
PCE	2.0×10^{-2}[a]	131.4	620	4.1	13	3.2
TCE	9.9×10^{-3}[a]	165.8	620	10.4	26	2.5

Ref: [a]Kavanaugh and Trussel (1980)
[b]Environmental Solutions (1987)

8.2 POTENTIAL CONTAMINANT MIGRATION PATHWAYS

The potential contaminant migration pathways identified at the OII site that have the highest permeability are the Lakewood/San Pedro Unit and the sandstone/conglomerate units within the Pico Unit siltstone, including the A-Sand, the Upper Sand, the Lower Sand, and other undifferentiated sandstone/conglomerate units. The Pico siltstone, with lower permeability, represents a potential pathway of less concern.

8.2.1 LAKEWOOD/SAN PEDRO UNIT

Contaminated shallow groundwater within the Lakewood/San Pedro Unit adjacent to the western and southern boundary of the South Parcel represents either perched groundwater or the water table. Commonly these potentially perched zones occur at the base of the Lakewood/San Pedro Unit at the contact with the Pico silt. Wells OI-4 and OI-18A are completed in this unit. The extent of these potentially perched intervals is not known. A surface seep was reported within the Southern California Gas Company property west of the South Parcel at the contact of the San Pedro

conglomerate and the Pico Siltstone. The thickness of the potentially perched zones varies; in OI-4 it has varied from zero to 9 feet. The current depth at OI-18A is 10 feet.

The Lakewood/San Pedro Unit appears laterally continuous with the aquifers within the Central Basin approximately 3,500 feet to the southwest of the site (Figure 4-8). Therefore, leachate flow within the Lakewood/San Pedro Unit could potentially reach the Central Basin aquifers through this pathway. The rate of leachate leaving the site within the Lakewood/San Pedro Unit is unknown. Given the ephemeral nature of the potentially perched water at OI-4, it is not known whether the perched water could travel that far.

The Lakewood/San Pedro Unit at the northwest corner of the South Parcel may be approximately 250 feet thick. The hydraulic conductivity as measured by OI-19B, ranges from 84 to 103 ft/day. As previously discussed in Section 4.4.6, this high conductivity combined with an apparent steep hydraulic gradient gives the potential for a high groundwater velocity toward the west. Given the documented presence of VOCs in the groundwater at this location, the Lakewood/San Pedro Unit represents a significant potential pathway for contaminated groundwater. Water from this location would flow to the west. The nearest active well is approximately 1.6 miles to the west (See Section 9). Further discussion of this pathway is provided in Seciton 8.2.4.

The Lakewood/San Pedro Unit is also contaminated with VOCs in OI-20A at the northeast corner of the South Parcel. The lateral continuity of the thick sequence of coarse-grained deposits in this area is unknown, but it may potentially be connected to the San Gabriel Basin (Figure 4-8). Additional geologic characterization northeast of the site is needed to answer this question. As previously discussed in Section 4.4.2, groundwater flow from the vicinity of OI-20A is expected to be primarily to the east. The presence of a saddle of Pico siltstone northeast of the North Parcel would limit groundwater flow in that direction. Based on very limited water-level data, it appears that groundwater flow would continue east toward Whittier Narrows or northeast towards a pumping center in the San Gabriel Basin (Figure 4-17).

8.2.2 PICO SILTSTONE

Saturated intervals within the Pico siltstone are common adjacent to the site. OI-17A, OI-27A, and OI-16A are completed into saturated Pico zones that are potentially perched. These zones are contaminated with leachate, as shown by the concentrations of organic contaminants in groundwater. Estimated average linear groundwater velocities within the Pico siltstone of 0.002 to 0.03 ft/day (0.7 to 11 ft/year) [Section 4.4.6] indicate that since the start of liquid disposal in 1954, leachate may have travelled from approximately 25 to 400 feet in the siltstone. It is likely that additional time may have been required before leachate production began; in this case the estimated travel distance would be less. The estimated travel distance within the siltstone is not great

enough to have impacted water supplies. It is possible, however, that leachate flow through the siltstone could lead to a more permeable unit with greater groundwater velocities.

8.2.3 A-SAND

The A-Sand is the largest of the sandstone/conglomerate units within the Pico siltstone. Organic TCL contaminants have not been detected within the A-Sand at the locations monitored by OI-17B, OI-29B, OI-14C, OI-23B, and OI-21B. Metals concentrations do not appear to be anomalous in this unit. The presence of TICs in OI-2 and OI-17B suggest that leachate components may be present at low concentrations, but the data are not conclusive.

Groundwater from OI-2 has occasionally contained VOCs. OI-2 also contains hydrogen sulfide gas (H_2S). The source of the H_2S is inconclusive based on stable isotope data (Section 6-6). TICs are also occasionally reported. This information suggests that OI-2 may be contaminated by the OII landfill. All other A-Sand wells appear to be clean, including OI-14C, which is downgradient of OI-2.

The current interpretation of the continuity of the A-Sand (Figures 4-8 and 4-9) indicates that this unit is not continuous with the permeable aquifers of the Central Basin. The A-Sand appears to terminate within the Pico silt below the Central Basin aquifers.

The average linear groundwater velocity in the A-Sand was estimated to be 0.2 ft/day (73 ft/year) in Section 4.4.6. Assuming that no flow constriction occurs within the A-Sand, a total estimated travel distance of approximately 2,600 feet is calculated since the start of liquids disposal in 1954. The actual groundwater travel distance is likely much less. The A-Sand has an almost constant head over much of its extent, as measured by the OII monitoring wells, but there is a 120-foot head drop between this sand and the Sunnyside aquifer to the southwest. This head difference indicates that the Pico siltstone may be an effective continuous aquitared separating the two.

8.2.4 UNDIFFERENTIATED PICO SANDSTONE AND CONGLOMERATE UNITS

Many individual sandstone/conglomerate units have been identified within the Pico Unit. The lateral continuity of most of these units is unknown. Some of them may potentially intersect the refuse beneath or along the perimeter of the landfill. The turbidite depositional model for these units predicts that the lateral continuity and the connectivity of the individual layers may be limited. If this is true, then the potential for contaminant transport through the Pico Unit sandstone and conglomerate units is greatly reduced.

OI-19A contains TCE, PCE, and other VOCs, as described in Section 6. It appears likely that this unit is connected to the San Pedro Unit at OI-19B and further downgradient to the Pico sandstone unit at OI-26A. The presence of TCE and PCE in these three wells indicates a plume of VOCs moving to the northwest. The downgradient (west/northwest) extent of the unit screened by OI-26A is currently unknown.

The Lower Sand unit at the southern perimeter of the South Parcel is monitored by OI-15B. This well contains no detectable VOCs. It does contain H_2S, which appears to originate from the landfill (Figure 6.6). No other indications of landfill contamination are present. The geologic cross section A-A (Figure 3-3) suggests that this unit may potentially intersect the solid waste.

Groundwater from the Upper Sand, which is monitored by OI-3, has infrequently contained VOCs and TICs, which suggests potential landfill contamination. The thickness of the upper sand is generally less than 50 feet. The pH of groundwater from OI-3 is over 11. This is suspected to be caused by grout contamination. The very high pH affects groundwater chemistry, and may result in inaccurate analyses.

Section 9
INDENTIFICATION OF POTENTIAL EXPOSURE POINTS

Section 9
IDENTIFICATION OF POTENTIAL EXPOSURE POINTS

The locations of existing active and inactive groundwater production wells within a 3-mile radius of OII are shown in Figure 9-1. There are 50 active production wells within this area. None of the active wells are within a 1-mile radius and only 11 are within 2 miles. The closest active production wells in the Central Basin are located 1.5 miles to the southeast of the OII site. In the San Gabriel Basin, the nearest active wells are 2 miles to the northeast.

According to LACDPW records, a number of wells that previously existed in the vicinity of OII (within 1.5 miles) have been abandoned or destroyed. This was largely due to the availability of water from the cities of Monterey Park and Montebello. Land use in the area around the OII site is primarily residential and commercial (Figure 1-4). Adjacent property owners and land use were discussed in Section 1.4.3.

Well construction data for the production wells within the 3-mile radius is included in Table 9-1. The yearly pumping data for these wells over the period from 1977 through June 1988 is also tabulated in Table 9-1. A majority of the production is from the three well groups located between 2 and 3 miles northeast of site in the San Gabriel Basin.

The City of Monterey Park operates 3 artesian wells (2875B, 2875D, and 2885) for dewatering the groundwater table. These three wells are located approximately 1 mile northwest of the site (Figure 9-1). The water produced from these wells is discharged directly into the storm drain system.

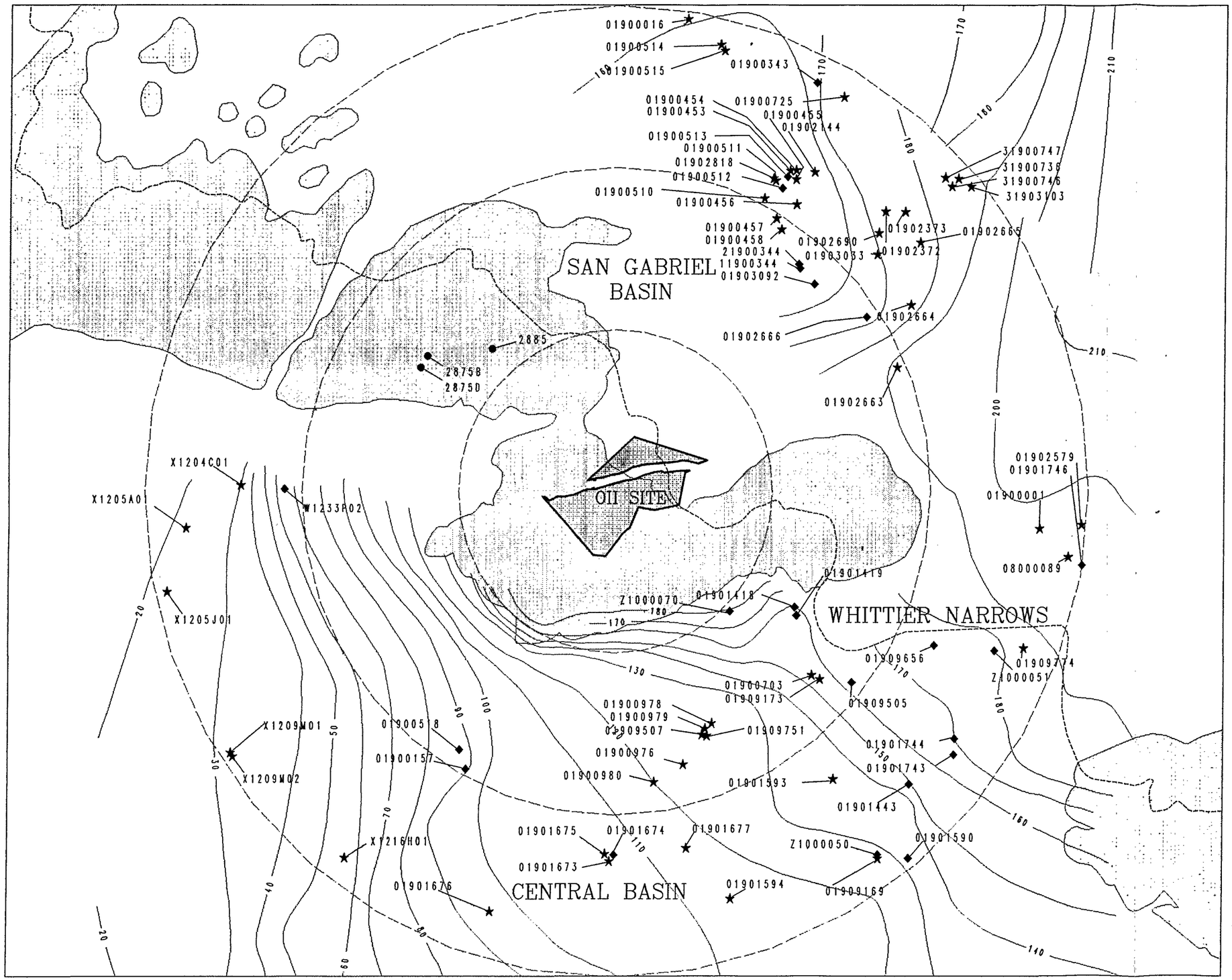
Groundwater contamination from industrial sources already exists above federal or state drinking water standards (MCLs) across much of the San Gabriel Basin. The San Gabriel groundwater basin is currently undergoing cleanup through EPA's Superfund program. To the northeast, the closest contaminant data is from production wells located about 2 miles away. Most of these wells have contaminant levels below MCLs, although one well, 01902666 (Figure 9-1), has had PCE detected above the MCL of 5 ug/l.

As part of the San Gabriel Basin Superfund cleanup, EPA is performing an operable unit feasibility study (OUFS) in Whittier Narrows (located about 2 miles east of the site). Whittier Narrows is the only area of subsurface outflow from the San Gabriel Basin (CDWR, 1966). VOC contamination is prevalent on the San Gabriel (upgradient) side of Whittier Narrows. Six compounds (TCE, PCE, trans-1,2-dichloroethene, 1,1-dichloroethene, carbon tetrachloride [CTC], and 1,2-dichloroethane) have been detected at or above MCLs (Central and West Basin

Replenishment District, 1990). TCE and PCE are the two VOCs detected most frequently in the area.

No organic compounds exceeding MCLs have been detected in Central Basin production wells located within a 3-mile radius of the OII site (Central and West Basin Water Replenishment District, April 1990). However, several organic compounds have been detected at levels between detection limits and MCLs. TCE and PCE, in particular, have been detected in several monitoring and production wells sampled as part of the Whittier Narrows OUFS (Central and West Basin Water Replenishment District, April 1990).

No evidence exists that indicates contamination from the OII site is affecting groundwater quality at any production well. Additional monitoring wells are needed to assess the extent of contamination downgradient from the VOC contamination detected at OI-26A and OI-20A and to evaluate the extent of shallow groundwater contamination adjacent to the western and southern perimeter of the South Parcel.



EXPLANATION

- ★ ACTIVE PRODUCTION WELL
- ◆ INACTIVE PRODUCTION WELL
- ● ARTESIAN WELL
- FALL 1986 POTENTIOMETRIC SURFACE CONTOURS
- 1- 2- & 3-MILE RADIUS AROUND OII
- HYDROLOGIC BOUNDARY
- APPROXIMATE BOUNDARY OF CONSOLIDATED GEOLOGIC UNITS

NOTE:
Bedrock and hydrologic boundary source: CDWR (1961,1966)

FIGURE 9-1

FALL 1986 POTENTIOMETRIC SURFACE AND STATUS OF PRODUCTION WELLS WITHIN A THREE MILE RADIUS OF OII

OPERATING INDUSTRIES, INC. LANDFILL SITE
MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

TABLE 9-1
ANNUAL PUMPING TOTALS FOR PRODUCTION WELLS
WITHIN 3 MILES OF THE OII SITE

WELL RECORDATION NO. (a)	WELL COMPLETION DATE	DEPTH (ft)	SCREEN INTERVAL (ft)	PUMPAGE DATA (AC-FT) 1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988 (b)
01900001	NA	50	NA	42.6	39.9	37.3	50.5	53.9	55.9	64.2	69.9	64.8	89.1	79.9	24.2
01900016	8/55	790	207 - 760	555.8	392.1	680.8	1093.3	568.8	1147.2	884.2	1532.5	1466.0	1805.8	1501.4	956.4
01900157	5/38	440	370 - 424				34.3	47.5	80.0	6.9	85.2	74.3	25.0	0.1	0.1
01900343	NA	272	NA	2.7	1.0	1.4	1.0	1.1	1.6	0.8	0.9	0.1	1.0	1.4	0.9
01900453	NA	410	NA	604.2	614.5	767.9	763.1	629.5	761.2	693.2	618.6	715.5	648.8	746.5	220.5
01900454	05/23/24	450	209 - 422	270.1	273.2	546.8	651.8	457.9	430.3	478.4	354.0	433.2	435.4	421.0	207.7
01900455	03/15/46	1505	210 - 1110	233.6	262.9	131.8	141.4	128.3	129.8	133.9	144.6	160.9	142.1	41.8	11.1
01900456	07/09/45	480	194 - 456	266.0	307.8	256.2	250.5	199.6	135.7	174.4	152.2	106.9	118.5	134.4	1.0
01900457	07/23/72	600	170 - 570	1555.0	905.9	1169.4	1544.2	2674.2	2010.3	1543.7	2669.8	2599.8	2668.7	2578.1	1282.1
01900458	10/19/53	600	150 - 586	46.8	89.1	50.9	29.9	261.4	287.4	747.6	670.9	578.4	483.1	365.7	309.5
01900510	1956	472	209 - 393	288.3	616.6	1063.8	695.9	815.2	641.4	383.6	775.3	550.7	823.2	703.0	302.3
01900511	1948	464	190 - 411	532.6	162.8	778.1	720.6	850.0	763.9	744.7	791.0	820.1	1051.6	510.0	
01900512	1940	428	377 - 406	129.8	150.0	229.6	215.2	154.5	103.4	92.7	124.7	85.1	0.9	75.5	0.0
01900513	1902	429	12 - 415	54.9	35.7	54.0	47.4	61.1	46.5	34.0	62.1	35.9	4.6	61.1	0.0
01900514	1946	650	205 - 585	558.4	541.7	516.3	674.5	690.7	478.5	679.0	651.5	673.6	590.7	554.7	290.9
01900515	1922	644	46 - 598	500.9	390.3	408.3	466.6	548.9	655.9	611.4	591.3	481.6	554.6	662.6	319.9
01900518	NA	NA	NA		84.2	313.7	73.8	24.1	WELL ABANDONED						
01900703	3/56	400	147 - 314			0.0	1443.5	1592.3	2030.2	1315.3	1964.7	3197.4	3046.3	2703.9	387.0
01900725	9/42	402	240 - 504	648.1	726.0	656.5	872.2	938.7	1300.7	1279.2	1238.2	1262.3	1194.3	1043.6	467.0
01900976	NA	500	156 - 378	123.5	543.5	430.0	523.5	557.4	620.9	397.6	453.5	636.4	387.2	239.1	371.7
01900978	7/44	304	155 - 214	128.7	517.9	567.7	798.3	752.2	545.3	480.6	779.4	750.9	895.7	607.5	2450.2
01900979	8/48	275	160 - 234	179.2	739.8	792.8	563.2	0.0	306.5	579.1	633.5	573.7	344.0	691.6	320.0
01900980	3/56	492	247 - 334	56.4	306.4	359.4	140.8	428.0	510.3	299.5	201.3	164.7	328.1	278.9	113.5
01901419	NA	NA	NA	80.6	0.5	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
01901443	9/25	605	101 - 455	310.0	1439.6	1454.5	1378.1	1387.8	1406.4	996.8	1099.4	243.6	0.0	0.0	0.0
01901590	NA	NA	NA	38.8	96.7	46.2	90.8	33.2	69.5	23.1	0.0	WELL ABANDONED			
01901593	3/52	374	122 - 334	25.3	246.9	354.1	401.8	298.7	422.4	463.1	825.6	525.1	242.6	85.5	145.5
01901594	2/55	474	294 - 456	49.0	63.4	226.4	248.5	197.7	107.1	232.2	560.5	978.4	539.9	111.4	96.2
01901673	NA	398	NA								0.0	26.4	308.6	6.5	190.7
01901675	NA	364	90 - 352	86.9	392.1	242.6	392.9	358.5	382.1	179.3	296.1	516.7	428.5	680.9	264.3
01901676	9/47	500	132 - 300	85.7	371.6	380.7	356.7	333.6	221.5	359.7	373.6	347.7	382.3	360.8	142.4
01901677	3/54	425	148 - 399	188.9	849.5	962.9	1041.7	1212.1	1144.4	1204.7	1456.7	1127.8	956.6	670.1	427.6
01901743	12/39	911	55 - 722	5.1	0.0	0.0	0.0	5.4	7.8	7.3	4.0	15.2	13.5	99.4	7.2
01901744	1931	302	25 - 260	7.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.5	0.0	0.0
01902144	1935	630	327 - 424	97.0	91.7	27.1	149.1	199.5	210.8	434.2	475.51	511.7	434.0	381.8	216.8
01902372	03/09/56	1560	254 - 1502	563.6	564.6	645.7	505.6	400.6	310.4	363.5	283.2	166.0	150.4	83.9	45.6
01902373	12/15/56	1548	240 - 504	608.3	684.8	984.3	1059.5	974.7	926.8	1021.0	1427.4	1641.4	1722.9	1632.8	865.3
01902579	NA	702	264 - 683	867.1	269.1	170.9	358.1	354.2	161.1	169.1	293.8	422.0	993.1	1228.3	23.7
01902663	NA	800	208 - 701	132.9	213.8	212.7	216.5	164.3	167.32	9.9	104.5	141.8	96.6	19.5	25.1
01902664	NA	948	260 - 752	52.4	13.5	36.6	0.0	0.0	103.2	159.2	189.7	198.8	39.5	230.1	74.7
01902665	NA	800	250 - 702			97.8	197.1	274.3	151.7	0.0	163.4	246.0	159.0	9.2	53.6

TABLE 9-1 (cont)
ANNUAL PUMPING TOTALS FOR PRODUCTION WELLS
WITHIN 3 MILES OF THE OII SITE

WELL RECORDATION NO. (a)	WELL COMPLETION DATE	DEPTH (ft)	SCREEN INTERVAL (ft)	PUMPAGE DATA (AC-FT) 1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988 (b)
01902666	NA	504	210 - 495	3.1	3.5	4.3	3.7	3.8	4.4	5.3	4.4	4.1	2.3	0.1	0.0
01902690	03/30/60	1600	230 - 1404	957.7	1168.2	1282.5	1150.1	1229.1	1425.3	1303.4	1571.4	2035.4	2317.7	2263.3	1201.7
01902818	08/24/61	671	180 - 624	692.3	924.0	657.5	735.1	554.2	724.3	1087.3	1026.0	678.5	612.1	699.4	272.3
01903033	07/12/68	817	201 - 771	1369.0	2039.8	2018.8	2058.4	1885.3	2012.1	1656.6	1969.2	1609.1	1697.8	2196.0	975.3
01903092	07/25/70	897	200 - 867	118.5	91.3	36.0	27.0	82.5	0.6	3.0	0.0	0.0	113.4	23.3	
01909169	NA	NA	NA							187.8	22.1	52.0	49.3	69.1	79.2
01909173	NA	NA	NA	3.2	144.3	1227.9	340.8	550.9	177.3	558.6	783.6	184.1	277.7	352.9	1051.5
01909507	NA	NA	NA	94.7	444.2	405.2	429.1	735.1	646.3	591.7	700.9	586.5	870.8	626.3	341.6
01909751	NA	NA	NA	15.4	144.5	147.8	357.4	550.3	323.8	628.9	702.1	639.8	513.4	803.9	337.7
01909774	NA	NA	NA		181.3	860.0	818.5	725.1	1417.1	397.2	1151.2	461.9	1293.3	805.2	362.3
08000089	NA	NA	NA						215.4	235.2	369.9	804.3	887.7	942.9	387.8
11900344	NA	NA	NA	10.6	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21900344	NA	NA	NA	31.6	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31900736	1931	301	260 - 295	1572.0	2468.0	3140.1	4338.4	4378.5	251.9	610.7	589.0	879.5	1000.7	1071.4	403.5
31900746	12/37	312	260 - 300						1141.4	1213.8	1739.1	1678.2	1759.7	1422.8	575.2
31900747	7/54	534	234 - 518						656.15	481.58	959.56	1028.46	954.48	774.96	391.5
31903103	1973	580	250 - 560						611.1	705.0	589.3	599.9	716.3	957.6	395.6
Z1000050	2/27	435	NA	27.8	87.2	35.7	78.2	147.0	67.0	52.6	0.0	0.0	0.0	0.0	0.0
Z1000051	11/52	152	NA	0.2	0.7	0.7	0.7	0.7	0.3	0.3	0.7	0.7	0.7	0.2	0.0
Z1000070	NA	NA	NA	14.2	104.6	153.1	157.9	156.7	85.3	0.0	0.0	0.0	0.0	0.0	0.0
W1233P02	NA	NA	NA	375.1	71.2	0.2	15.8	4.4	0.0	0.0	0.0	0.0	0.0	0.0	29.7
X1204C01	NA	NA	NA	243.12	125.2	248.2	215.1	133.2	247.7	140.6	76.6	70.9	16.2	86.8	0.5
X1205A01	NA	NA	NA	326.0	203.6	267.5	262.5	305.6	279.1	368.0	217.5	218.0	131.2	304.9	154.5
X1205J01	NA	NA	NA	697.5	704.7	64.7	439.5	214.9	404.1	168.3	280.0	197.8	220.0	550.8	54.4
X1209M01	NA	NA	NA				38.4	137.1	241.1	149.6	119.1	52.2	142.0	0.2	0.7
X1209M02	NA	NA	NA	379.8	235.1	269.4	290.3	54.4	44.4	7.8	47.3	0.3	15.5	0.1	0.3
X1216H01	NA	NA	NA	0.6	0.0	0.0	0.0	0.0	0.0	297.5	19.2	5.7	1.2	0.8	0.4

Notes: (a) WELL LOCATIONS SHOWN ON FIGURE 9 - 1
(b) DATA THROUGH 6/88

Section 10
RECOMMENDATIONS

Section 10
RECOMMENDATIONS

Based on the experiences during the field portion of this investigation, data deficiencies identified during analysis, and the conclusions presented in this report, recommendations for further field investigations and analysis during the Phase II Hydrogeology Investigation are presented in this section. These recommendations represent a starting point for the discussion of specific tasks that will be included in the Phase II Investigation. The scope of work is not fully defined at this time and will be developed by EPA and their contractors with input from the PRPs and other interested parties.

The objectives for the Phase II Investigation will include those listed below:

1. Characterize the extent of the VOC plumes observed at (1) OI-20A and (2) OI-19A, OI-19B, and OI-26A.

2. More fully characterize the occurrence of shallow groundwater adjacent to the western and southern boundary of the South Parcel to see if it is perched or part of the water table.

3. Evaluate the extent of shallow groundwater contamination along the South Parcel perimeter and estimate the quantity of leachate that may be leaving the site by this pathway.

4. Develop the data necessary to evaluate whether a change in storage of leachate within the landfill is occurring.

5. Develop a more detailed understanding of the geology east and northeast of the site by additional geologic mapping.

6. Characterize the geology on the northern perimeter of the South Parcel by installing a deep boring/well east of the Greenwood Avenue overpass.

7. Continue routine sampling of existing groundwater monitoring wells to monitor known potential contaminant pathways.

The recommendations are discussed in four categories: (1) routine data collection activities, (2) additional drilling, (3) additional data analysis, and (4) other field activities.

10.1 ROUTINE DATA COLLECTION ACTIVITIES

The activities listed below should be continued on a routine basis.

- Quarterly measurement of water levels in all OII monitoring wells
- Periodic sampling of groundwater monitoring wells
- Semiannual measurement of water levels in the Southern California Gas Company (SoCalGas) monitoring wells (Drillsite 1 [DS-01], Monterey 39A, Schnakenberg No. 1, Burke No. 3, and Dore No. 2)
- Periodic measurement of water levels in GMW, air dike, gas extraction, and leachate wells

Periodic water level measurements in all groundwater monitoring wells are needed to evaluate trends in water levels that are required to further interpret the site hydrogeology. Water levels in the GMW, air dike, gas extraction, and leachate wells would be invaluable to understanding the shallow (potentially perched) groundwater adjacent to the South Parcel. Water levels from leachate or gas wells within the landfill would help to evaluate changes in storage of leachate within the landfill.

SoCalGas checks their monitoring wells quarterly for the presence of methane in groundwater by lowering a probe down the well. An EPA representative should accompany SoCalGas on their monitoring round to take the water levels. Access for a water level sounder is only available in the SoCalGas monitoring wells listed above.

The frequency of groundwater sampling and the specific analytes should be evaluated to develop a comprehensive and cost-effective monitoring program. All analyses will not be required during each sampling event. For example, because of the small number of detected values of pesticides and PCBs and the low concentrations of the values detected, the frequency of pesticide and PCBs analysis could be reduced to every second or third sampling round.

10.2 RECOMMENDED ADDITIONAL DRILLING

The recommended monitoring well installations summarized in Table 10-1 and shown in Figure 10-1 constitute a starting point for the scope of the OII Phase II Hydrogeology Investigation. Other monitoring wells may be needed based on further analysis.

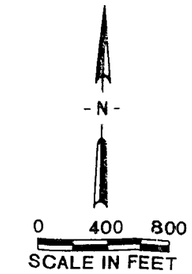
Table 10-1
Recommended Additional Drilling

Well	Location	Estimated Depth (ft)	Target Zone	Recommended Drilling Method	Rationale for Well
OI-3A	Redrill of OI-3	250	Upper Sand	Mud rotary	Current well appears to be contaminated with grout
OI-6A	Near OI-6 location	150	Perched zone in Pico Unit	Dual tube	Monitor potential perched zones at site perimeter
OI-14A	OI-14C location	100	Perched zone at contact of Lakewood/San Pedro and Pico or water table in Pico siltstone	Dual tube	Monitor downgradient extent of perched interval at OI-4 or potential shallow contamination
OI-19D	OI-19B location	150	Water table	Dual tube; air rotary	Characterize shallow contamination at location of OI-19B
OI-24B	Deep boring 200 feet east of CDD-13	600	Pico sandstone or conglomerate	Mud-rotary	Define geology and monitor potential permeable unit on north side of South Parcel
OI-26C	OI-26 well cluster	100	Potential perched zone in Lakewood/San Pedro or water table in Pico siltstone	Dual tube	Characterize shallow contamination downgradient of OI-19B
OI-30A	East of OI-20A near Pomona Freeway and Paramount Boulevard	350	Base of Lakewood/San Pedro Unit	Mud-rotary	Geology and groundwater contamination downgradient of OI-20A
OI-31A	West end of SCE property (nursery)	300	Upper Pico Sand	Mud-rotary	Geology and water quality downgradient of OI-26A

Table 10-1
(Continued)

Well	Location	Estimated Depth (ft)	Target Zone	Recommended Drilling Method	Rationale for Well
OI-32A	Between OI-6 and OI-17A	150	Perched zone in Pico Unit	Dual tube	Monitor potential perched zones at site perimeter
OI-33A	West side of SoCalGas Facility	100	Perched zone present at OI-18A	Dual tube	Monitor downgradient extent of observed perched interval
OI-34A	Southeast of OI-17A	100	Perched zone present at OI-17A	Dual tube	Monitor downgradient extent of observed perched interval

Notes: SCE - Southern California Edison Company
SoCalGas - Southern California Gas Company



LEGEND

- ■ OII GROUNDWATER MONITORING WELLS (E & E, CH2M HILL)
- ● OII GROUNDWATER MONITORING WELLS (CONVERSE, DAVIS, DIXON, & ASSOCIATES)
- ✱ PROPOSED ADDITIONAL WELLS
- —— — SITE BOUNDARY

FIGURE 10 -1
PROPOSED ADDITIONAL WELLS
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

Eleven additional wells are proposed in Table 10-1. Three of the wells (OI-14A, OI-33A, and OI-34A) are located downgradient of highly contaminated potentially perched intervals. These wells will monitor the extent and quality of these perched water zones downgradient of the site boundary. Two other wells (OI-6A and OI-32A) are proposed to detect the presence of any additional perched intervals along the southern boundary of the South Parcel.

Two of the additional wells (OI-19D and OI-26C) are located at existing well clusters. These two wells are proposed as water table wells to assess the shallow contamination at clusters where deeper contamination has been observed. Additional wells OI-30A and OI-31A are in locations downgradient of OI-20A and OI-26A, respectively. Both OI-20A and OI-26A are contaminated with VOCs.

OI-24B is a deep well located along the northern boundary of the South Parcel. This well will be used to further refine the understanding of the geology in this area and to assess the extent of the Pico sandstone and conglomerate units observed in wells OI-25B and OI-22B.

OI-3A is proposed to replace OI-3. The consistently high pH (greater than 11) in OI-3 indicates that this well is contaminated with grout. Water samples from the well may not be indicative of actual conditions in the Upper Sand unit monitored by OI-3.

10.3 ADDITIONAL DATA ANALYSIS

Due to the compressed schedule of the OII Landfill Phase I Hydrogeology Investigation, some data analysis could not be included within the available schedule for this investigation. Additional analysis of existing data either before or after the Phase II Investigation may help to further characterize the complex hydrogeology of the OII site. Suggestions for further analysis are listed below:

1. Mounding calculations to evaluate how much water is needed to produce the mound of groundwater adjacent to the western and southern boundary of the South Parcel, and, conversely, how long a mound of this size would take to dissipate with no additional water added.

2. An updated water budget for the landfill would provide a better estimate of the potential volumes of leachate in storage and flowing from the site.

3. A groundwater model would provide a more complete understanding of the flow system and would give more accurate estimates of flow rates and directions.

4. A comparison of the metals concentrations for filtered and unfiltered groundwater samples from the OII site.

5. Re-evaluation of water quality data based on the results of the NEIC analysis of groundwater samples sent to the NEIC laboratory in May 1990. Specific organic indicator parameters may be identified from their detailed sample analysis.

10.4 OTHER FIELD ACTIVITIES

The SoCalGas Well No. 2897A should be formally abandoned. Based on the elevation of the well perforations, this well appears to be completed in the Lower Sand. OI-15B was completed into the Lower Sand in the same general vicinity during this field investigation. Well No. 2897A is constructed with a 16-inch-diameter casing steel casing; therefore, approximately 8,000 gallons of water must be pumped, contained, and disposed (three well volumes) each time this well is sampled. The condition of the well seal above and below the perforated interval is also not known and the steel casing is fairly rusted. In addition, no permanent pump is installed in the well, so a pump contractor would have to be used to install and remove a pump each time a sample was needed. For these reasons, SoCalGas should be requested to properly abandon the well. A replacement monitoring well could be installed into the Lower Sand unit at the same location if it is determined that one is needed.

In order to investigate the continuity and connectivity of the high-permeability sands at the site, it would be advantageous to complete a long-term pumping test at a location where drawdown measurements could be made in a number of wells completed in different units. OI-2 and OI-15B would be the best for this purpose, since five permeable intervals are monitored in this corner of the landfill; however, groundwater from both of these wells contain significant concentrations of hydrogen sulfide. The groundwater would, therefore, likely have to be treated before disposal. Other locations may produce useful data for a long-term test; however, the required pumping rate and time, and the associated cost of water treatment and disposal should be evaluated before starting this activity.

Section 11
SUMMARY

Section 11
SUMMARY

11.1 GOALS OF INVESTIGATION

The Phase I Hydrogeology Investigation for the OII Landfill Superfund Site in Monterey Park, California, was conducted from September 1989 to March 1990. The objectives of the investigation were to characterize the site hydrogeology and to assess the effect of past waste disposal activities on the quality of groundwater in the site vicinity. The goal of the investigation was to fill data gaps from previous hydrogeologic investigations of the OII site and to define data gaps for a planned Phase II Hydrogeologic Investigation.

11.2 SCOPE

The major tasks of the investigation were:

- Drilling of two coreholes to depths of 360 and 450 feet
- Drilling, geophysical logging, installing, and developing 25 new monitoring wells ranging in depth from 30 to 540 feet
- Collecting of soil samples at specified depths and performing laboratory and field GC analyses of soil samples
- Conducting aquifer testing of new wells by short-term pumping tests or slug tests
- Three complete samplings of each new well for the EPA Hazardous Substance List (HSL) compounds and other selected indicator parameters
- Redevelopment and repair of existing monitoring wells
- Groundwater quality data base management and analysis
- Geologic, hydrogeologic, and geochemical analysis of data

11.3 GEOLOGY

The OII site consists of a complex stratigraphic sequence of discontinuous high-permeability sandstone and conglomerate formations in a regional matrix of lower-permeability siltstones. Two hydrogeologic units have been defined at the OII site: 1) The Lakewood/San Pedro Hydrogeologic Unit, consisting primarily of weakly cemented, sandy conglomerate of marine and continental origin, and 2) the Pico Hydrogeologic Unit, a massive marine siltstone with interlaminated, very fine sand. Within the Pico Unit are sandstone and conglomerate units interpreted to be turbidites (i.e., submarine channel deposits). Based on updated geologic cross-sections, the turbidite deposits appear to be lenticular and discontinuous. One of the largest of these turbidite deposits, the A-Sand, can be traced along the entire southern boundary of the OII site, but, with the exception of the eastern end of the South Parcel, does not appear to extend to the north under the South Parcel.

11.4 HYDROGEOLOGY

The OII site is located in the Montebello Hills, one of a series of low-lying hills that separate the San Gabriel Basin to the north from the Central Basin to the south. Based on the location, the potential exists for migration of contaminated groundwater into both groundwater basins, which are used as sources of water supply.

Groundwater at the OII Landfill occurs in potentially perched, unconfined, and confined aquifers. Shallow groundwater that may be perched is present in multiple zones along the western and southern boundaries of the OII South Parcel and within the solid waste on the western third of the North Parcel. The Lakewood/San Pedro Unit is an unconfined aquifer on the North Parcel and the northern and eastern boundary of the South Parcel. The lenticular sandstone and conglomerate units within the Pico Hydrogeologic Unit are confined aquifers in most cases. The largest of these, the A-Sand, can be traced along the entire southern boundary of the OII site. Other thinner, confined Pico sandstone and conglomerate units are present and may be in contact with the solid waste in the eastern end of the South Parcel. The Pico Unit siltstone has a low vertical permeability and is, therefore, an effective confining layer, but the presence of fine sand laminations results in a significant horizontal permeability.

The hydraulic conductivity of the Lakewood/San Pedro Unit ranges from 0.1 to 158 ft/day. The highest values occur at the northeast and northwest corners of the South Parcel. The hydraulic conductivity of the Pico sandstone and conglomerate units ranges from 2 to 17 ft/day. The horizontal hydraulic conductivity of the Pico silt averages 0.019 ft/day (6.9×10^{-6} cm/sec). One monitoring well (OI-18B), which has 40 feet of well screen in the silt, can produce a constant 3 gpm.

Water levels have risen in 9 of the 17 OII monitoring wells over the last 2 years. The overall rise in groundwater levels does not coincide with the below average precipitation experienced in the area in recent years and suggests that a secondary source of water is present in the area.

Generalized groundwater level contours indicate that groundwater flows away from the OII site in all directions. The majority of groundwater from the South Parcel flows to the south and southwest towards the Central Basin. Based on limited data, groundwater from the east end of the South and North Parcels flows primarily to the east. Groundwater from the western half of the North Parcel flows west into the Central Basin. An apparent mound of groundwater is present along the western and southern boundary of the South Parcel. Leachate flow from the landfill is a potential source of the water generating this mound. The mound may induce groundwater flow into the waste prism.

Average linear groundwater velocities away from the OII site range from 0.6 to 28 ft/day in the Lakewood/San Pedro Unit and from 0.002 to 0.03 ft/day in the silt. Groundwater flow velocities decrease significantly away from the OII site.

11.5 WASTE CHARACTERIZATION

The OII Landfill contains an estimated 22 to 31 million tons of solid waste. Liquid wastes were disposed at OII throughout its history. More than 300 million gallons of liquid waste are recorded as having been disposed at the site between 1976 and 1983. The South Parcel solid waste covers 130 acres and averages approximately 200 to 325 feet in thickness. The North Parcel waste is less than 50 feet thick and covers 11 acres. Leachate and landfill gas (LFG) migration are the two most important mechanisms of groundwater contamination at the site.

11.5.1 LEACHATE

Previous surface leachate seeps on the southeastern, southern, western, and northwestern portions of the South Parcel perimeter have been controlled by the installation of subsurface leachate extraction wells and horizontal collection pipes. Leachate production has been decreased from approximately 30,000 gallons per day in 1981 to approximately 2,400 gallons per day in June 1990.

Deep wells installed into the South Parcel refuse indicate the presence of apparently discontinuous saturated zones of leachate ranging in elevation from 380 to 599 fasl. The landfill elevation ranges from approximately 300 feet to 640 fasl. One observed leachate zone within the landfill has 100 feet of pressure head. Dry solid waste was observed at the base of the landfill at this location.

The composition of OII leachate was characterized for use in assessing groundwater contamination by leachate. The total dissolved solids (TDS) concentrations are variable and range from approximately 7,000 to 42,000 mg/l. The major ions are sodium and chloride. Sulfate is not present, since it is converted to sulfide in the reducing landfill environment. Ammonia is present in concentrations from 78 to 1,810 mg/l due to the reduction of nitrogen. Iron and manganese are present in mg/l concentrations. Barium, zinc, copper, chromium (total), and arsenic are present between 100 and 1,000 ug/l. The leachate contains a large number of volatile organic compounds (VOCs) and semivolatile organic compounds.

11.5.2 LANDFILL GAS

LFG at OII contains approximately 0.5 percent VOCs, which may dissolve into and contaminate groundwater at the water table or in perched intervals. Based on long-term and recent monitoring data, LFG migration has occurred in the southwest corner of the South Parcel, near the freeway overpass, on the southern perimeter, and along the eastern border of the site. Deep LFG migration beneath the air dike may be occurring. LFG occurs in the solid waste of the North Parcel in concentrations between 4 and 45 percent methane.

Sulfide concentrations in the LFG range from nondetected to 250 parts per million (ppm). Vinyl chloride, which is used as an indicator compound for VOCs, was detected in 15 of 20 South Parcel LFG samples collected in March 1990. Perchloroethylene (PCE), trichloroethylene (TCE), 1,1-dichloroethene, and vinyl chloride are all present in the gas monitoring wells at ppm concentrations. Additional gases typical of degradation products of hydrocarbon sources (benzene, toluene, ethylbenzene, and total xylenes) are more prevalent than solvent series degradation products.

11.6 GROUNDWATER CHEMISTRY

11.6.1 MAJOR ION CHEMISTRY

TDS are elevated in shallow and perched zone wells. Total organic carbon (TOC) concentrations in groundwater from one-third of the wells are elevated and exceed 2.0 mg/l. The individual well waters from monitoring wells range from a sodium to a mixed cation, magnesium-calcium-sodium water type. Major anion content ranges from bicarbonate plus carbonate to chloride with minor and variable sulfate content. The variability in major ion content suggests multiple sources of water in the aquifers. The major ion chemistry indicates that the shallow groundwater system at the landfill perimeter, particularly in the Lakewood/San Pedro Unit, represents a mixture of landfill leachate with the in situ groundwater.

11.6.2 NATURE AND EXTENT OF GROUNDWATER CONTAMINATION

VOCs are the most common contaminants in groundwater adjacent to the OII site. Twenty-six VOCs have been detected in groundwater from OII monitoring wells. The most commonly detected VOCs are total xylenes, 1,4-dioxane, TCE, benzene, PCE, toluene, ethyl benzene, and carbon disulfide.

VOC concentrations are, in general, the highest in the shallow potentially perched zone wells along the southwest perimeter of the OII site (OI-4, OI-17A, OI-18A, and OI-27A). OI-4, OI-17A, and OI-18A contain total median VOC concentrations greater than 1,000 ug/l. OI-27A contains approximately 50 ug/l VOCs. VOCs are also present in groundwater at the northeast (OI-20A) and northwest (OI-19A, OI-19B, and OI-19C) corners of the South Parcel, on the north side of the South Parcel (CDD-13), and offsite approximately 800 feet west of the North Parcel (OI-26A). VOCs have been infrequently detected in many other monitoring wells at the site. Total VOC concentrations average 33 ug/l in OI-19A, 6 ug/l in OI-19B, 1 ug/l in OI-19C, 48 ug/l in OI-20A, and 4 ug/l in OI-26A.

Seventeen semivolatile organic compounds were detected in groundwater samples from OII monitoring wells. The most commonly occurring chemicals are 1,4-dichlorobenzene, bis(2-ethylhexyl) phthalate, phenol, 1,2-dichlorobenzene, and benzoic acid. Median concentrations are generally less than 10 ug/l. Semivolatile organics were detected monitoring wells in the following areas: 1) potentially perched zones along the southwest perimeter of the South Parcel, 2) the northern perimeter of the South Parcel (CDD-13), 3) a Pico sandstone unit at the southwest corner of the South Parcel (OI-15B), and 4) the southern boundary of the North Parcel (OI-13C).

Isolated occurrences of pesticides were detected in groundwater samples from OII monitoring wells. The detected concentrations are, however, close to the detection limit, and subsequent analyses did not confirm the presence of these compounds. No PCBs were detected.

Numerous tentatively identified compounds (TICs) were detected in groundwater samples, including those from wells that contain no consistently detectable concentrations of other contaminants. The total concentrations of TICs are greatest in wells adjacent to OII, suggesting the landfill is the primary source.

11.6.3 EXCEEDANCES OF WATER QUALITY STANDARDS

Selected drinking water standards for groundwater were compiled including federal MCLs, proposed federal MCLs, federal MCLGs, state MCLs, and state action levels. The concentration of chemicals in groundwater were compared to the lowest standard. Standards for 17 organic compounds were exceeded at least once. The most commonly occurring exceedances were for 1,1-dichloroethane, 1,4-dichlorobenzene, benzene,

perchloroethylene, TCE, and vinyl chloride. The exceedances of standards occurred for potentially perched zone wells along the western and southern perimeter of the South Parcel (OI-4, OI-17A, OI-18A, OI-27A), at the northern perimeter of the South Parcel (CDD-13), at the northwest corner of the South Parcel (OI-19A, OI-19B), and at the northeast corner of the South Parcel (OI-20A). The offsite occurrence of VOCs at OI-26B did not exceed the standard for PCE. Four detected pesticide concentration values in groundwater exceeded standards; however, the nondetected concentrations that constitute the majority of the analyses were below standards.

Exceedances of standards for inorganic parameters are widespread across the South and North Parcels. Metals concentrations are highly variable and occasionally elevated by one or two orders of magnitude in some wells. Maximum values may be due to the effects of suspended sediment in some samples. The metals, which have exceeded the lowest standard, with the number of wells exceeding that standard in parentheses, are: aluminum (40); manganese (34); iron (26); TDS (22); cadmium (15); lead (15); beryllium (8); antimony (7); nickel (7); mercury (5); total chromium (5); zinc (5); sulfate (4); nitrate (4); nitrite (3); arsenic (3); and barium (3); silver (2); thallium (2); cyanide (2); and selenium (1).

11.7 SOIL CONTAMINATION

Soil contamination at the OII site was characterized using field gas chromatograph (GC) screening of vapor headspace from soil samples and laboratory analysis soil samples collected during drilling. The objective of soil headspace analysis was to evaluate the relative concentration distribution of selected VOCs as a function of depth in drilled boreholes and to aid in selecting: 1) soil and groundwater samples sent for laboratory analysis, and 2) well perforation intervals of monitoring wells.

Soil contamination appears to be most prevalent in the upper 150 feet of unsaturated and saturated soils in borings. Indicators of soil contamination include soil pH and elevated concentrations of VOCs, semivolatile organic compounds, TICs, and metals. The results of both field soil vapor analyses and laboratory analyses indicate elevated concentrations of VOCs in most areas around the landfill. The highest concentrations of benzene and toluene were typically detected in the upper 150 feet of the soil profile. Concentrations of TCE and PCE were more dispersed through the vadose zone suggesting a more mobile nature and the potential influence of migrating landfill gas. Toluene was detected in laboratory analyses of 49 soil samples from 19 borings in concentrations ranging from 2 to 260 ug/kg. No other VOC was detected in more than 10 samples or more than 5 borings. The TCE and PCE laboratory soil values ranged from 2 to 35 ug/kg and 1 to 42 ug/kg, respectively. Total metals concentrations of soil samples did not exceed California State Title TTLCs.

11.8 ASSESSMENT OF POTENTIAL CONTAMINANT MIGRATION

Five potential mechanisms for the release of contaminants from the OII site were identified:

1. **Direct contact of solid waste and groundwater.** Comparison of available water level data from perimeter monitoring wells with elevations of the base of the landfill suggests that the deepest part of the South Parcel may be approximately 30 feet below the regional water table.

2. **Vertical migration of leachate into permeable geologic units that may be exposed beneath the solid waste.** This mechanism is a cause for concern along the northern boundary and eastern end of the South Parcel. The estimated average vertical flow rate into the siltstone underlying the western half of the South Parcel is 0.1 ft/year, indicating slow rates of infiltration in that area.

3. **Lateral leachate migration into permeable pathways (possibly perched) in both the Lakewood/San Pedro and Pico Units.** Lateral leachate migration into both the Lakewood/San Pedro and Pico Units is confirmed by the presence of semivolatile organic compounds and metals in contaminated perched zones along the western and southern perimeter of the South Parcel. The estimated average linear groundwater velocity of the siltstone is approximately 1.7 ft/year. Actual flow rates within the fine sand laminations would be greater than this figure.

4. **Vertical migration of dense, non-aqueous phase liquids (DNAPLs) through the silt underlying the landfill.** The presence of DNAPLs has not been confirmed at the site. Fractures and jointing planes within the siltstone have not been observed at depth, therefore, this mechanism is not expected to be of major concern at the OII site.

5. **Contact of landfill gas with groundwater.** LFG likely contributes to VOC contamination of groundwater at the OII site. Observed groundwater contamination appears to be a mixture of LFG and leachate contaminants.

11.9 POTENTIAL EXPOSURE POINTS

There are 50 active groundwater production wells within a 3-mile radius of the OII site. None of the wells are within a 1-mile radius. The closest active production wells in the San Gabriel Basin are 2 miles to the northeast. The closest active production well in the Central Basin is located 1.5 miles to the southeast of the OII site. There is no apparent danger of contamination to any existing production well at this time.

11.10 RECOMMENDATIONS

Recommended routine activities at the OII site include: 1) quarterly measurement of water levels in all OII monitoring wells, 2) periodic sampling of all OII monitoring wells, and 3) semiannual measurement of water levels in Southern California Gas (SoCalGas) monitoring wells. The analytes and frequency of groundwater sampling should be reevaluated. The SoCalGas well no. 2897A should be properly abandoned.

In order to fill existing data gaps, seven additional shallow (less than 150 feet) monitoring wells and 4 deep (250 to 600 feet deep) monitoring wells are recommended as a starting point for discussion of the scope of the Phase II Hydrogeology Investigation.

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Appendix A
FIELD PROCEDURES

Appendix A
FIELD PROCEDURES

This Appendix describes field procedures for drilling, installation, and sampling of the 25 monitoring wells and 2 coreholes installed at the Operating Industries, Inc. (OII) site as part of the Phase 1 Hydrogeology Investigation. The fieldwork was completed between September 1989 and May 1990. Monitoring well and corehole locations are shown on Figure A-1.

A.1 ACCESS AND WELL DRILLING PERMITS

Prior to commencing fieldwork, CH2M HILL obtained the required permit from Los Angeles County Department of Health Services for installation of monitoring wells. This process took approximately two months. Site access agreements were secured from the property owners for monitoring well sites not located on the OII site. The landowners included Southern California Gas Company, Southern California Edison, Chevron, and the City of Montebello. In compliance with these agreements, representatives of the various landowners, regulatory agencies, and organizations responsible for each well site were informed at least two days prior to the start of actual field work at the site.

A.2 PERSONAL SAFETY REQUIREMENTS

Field work for this investigation was primarily completed in Level D personal protection with relatively few exceptions. When an upgrade from Level D protection was needed, field personnel went directly from Level D to Level B to eliminate the need for periodic vinyl chloride measurements by Draeger tube, as required by Level C. Level B protection was used when drilling through trash due to landfill gas emissions. Typical attire for Levels B, C, and D is described in the Site Safety Plan included as Appendix F to the Field Sampling Plan for the Hydrogeology Investigation, Operating Industries, Inc. Landfill (EPA, September 19, 1989). The Site Safety Plan also details the types of health and safety monitoring equipment utilized during this investigation and action levels associated with this equipment. As described below, elevated readings were observed in several borings.

Drilling through refuse was limited to the three boreholes drilled at cluster site 20 (Corehole 20, OI-20A, OI-20B). OI-20A was installed with the dual-tube rig and much of the drilling and completion had to be done in Level B. During grouting activities, in addition to elevated hNu readings (up to 30 parts per million [ppm]), extremely high explosimeter readings were observed (over 50 percent of the lower explosive limit [LEL]). High explosimeter readings coincide with the presence of large amounts of

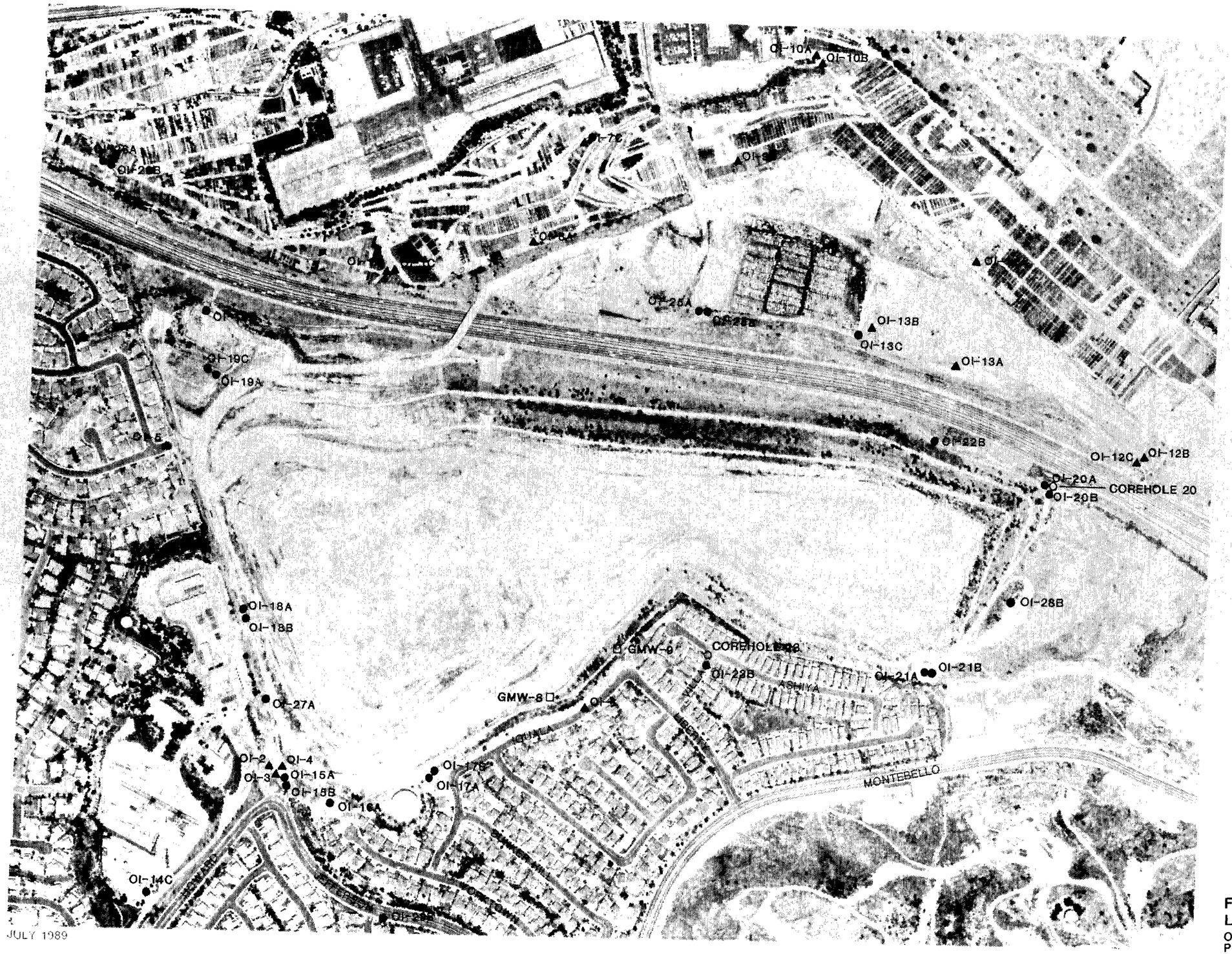
landfill gas. Level B was required for only a short time in the first 30 feet at Corehole 20 and not at all in OI-20B. These two borings were drilled by the direct mud-rotary method which effectively prevented most organic vapor emissions from the borehole. Very high explosimeter (over 50 percent of the LEL) readings were observed while installing OI-18A with the dual-tube rig.

Drilling mud circulation was lost at a depth of 90 feet while drilling OI-28B. When work resumed the next morning, elevated hNu and explosimeter readings were recorded above the borehole. The readings subsided after the borehole was refilled with mud. High hNu readings were recorded off the drilling mud at OI-17B and OI-29B. Elevated readings began at a depth of about 240 feet in both wells. An increase in level of protection was not required because readings in the breathing zone remained below action levels.

All well development and sampling activities were performed in Level D. Gas concentrations exceeding background readings were not observed in the groundwater monitoring wells except from OI-2, OI-15B, and OI-18B. H_2S readings were measured off of the discharge from both OI-15B and OI-2. These wells are at the same location. H_2S readings remain low (2 ppm or less) in the breathing zone, but are quite high (up to 30 ppm) inside containers holding the water (i.e. drums, tanks, and sample bottles). Slightly elevated hNu readings (3 to 5 ppm) have been recorded at the wellhead of OI-18B, at times high-pressure landfill gas in this area can be heard venting from the seal around the conductor casing. Though water from OI-4 is highly contaminated, readings in the breathing zone, while bailing and sampling the well, are not above background.

A.3 DECONTAMINATION OF DRILLING AND SAMPLING EQUIPMENT

Following initial mobilization to the OII site, each drill rig, its support equipment, drill bits, drill rods, and other miscellaneous equipment were steam cleaned with pressurized tap water to remove potential contaminants. After installing each well and before moving to the next location, the rig and all other equipment was again thoroughly steam cleaned with tap water. Also, all well screen and casing were steam cleaned prior to installation. Before being put to use at each location, all geophysical logging tools, well development and pump testing equipment were decontaminated in this manner.



EXPLANATION

- ● CH2M HILL MONITORING WELL
- ▲ PREVIOUSLY EXISTING MONITORING WELL
- ○ CH2M HILL COREHOLE
- □ CH2M HILL LANDFILL GAS MONITORING WELL

JULY 1989

FIGURE A-1
LOCATIONS OF FIELD ACTIVITIES
OII SITE, MONTEREY PARK, CALIFORNIA
PHASE 1 HYDROGEOLOGY INVESTIGATION

The Modified California split-spoon sampler was decontaminated between each trip into the borehole using the following procedure:

- Wash with nonphosphate detergent
- Rinse with tap water
- Air dry
- Rinse with hexane
- Air dry

Bailers used in collection of groundwater samples underwent a more rigorous decontamination procedure:

- Wash with nonphosphate detergent
- Rinse with tap water
- Rinse with nitric acid
- Rinse with deionized water
- Rinse with hexane
- Rinse twice with deionized water
- Final rinse with certified organic-free water

A.4 WELL DRILLING PROCEDURES

Water Development Corporation (WDC) of Woodland, California, was subcontracted to perform all monitoring well drilling, installation, and development activities for this hydrogeology investigation. WDC subcontracted out the coring to Exploration Drilling Services of Redwood City, California and bucket auger drilling used for some conductor casing installations to Datum Exploration of Long Beach, California. Two coreholes were drilled and 25 monitoring wells were installed at locations shown in Figure A-1. The well numbers, borehole and well depths, drilling methods, screened zones, casing diameters, and pump types for the 25 monitoring wells are summarized in Table A-1. Boreholes ranged in depth from 65 to 611 feet and monitoring well depths ranged from 30 to 540 feet. Well installation field work began on September 18, 1989, and ended on March 30, 1990. Section A.10 provides a summary of each individual well installation, including drilling and well construction problems and other notable findings.

A.4.1 DIRECT MUD-ROTARY

At fourteen monitoring well locations, boreholes were advanced using either a Speedstar-15TH or Simco-5000 truck-mounted well drilling rig, employing the direct mud-rotary drilling technique. Boreholes ranged from 208 to 611 feet deep. Drilling mud was used to prevent borehole collapse and to circulate cuttings from the borehole. Drilling mud consisted of bentonite and water; no other additives were permitted in the mud. Mud viscosity increased rapidly when drilling through the fine

Table A-1
Summary of Monitoring Wells

Well No.	Well Comp. Date (1)	Drilling Method		Elev. of Concrete Pad (Ft.)	Borehole Depth (Ft.)	Well Depth (Ft.)	Well Screen Zone (Ft.)	Casing Diam. (In.)	Dedicated Pumps		Remarks
		Mud Rotary	Dual-Tube						Type	Set Depth (Ft.)	
Corehole 20	09/29/89	X		---	450	---	---	---	---	---	Grouted to surface
Corehole 23	10/06/89	X		---	360	---	---	---	---	---	Grouted to surface
OI-13C	12/03/89		X	384.78	160	155	110-150	4	Submersible	90	
OI-14C	03/09/90	X		357.06	540	540	485-535	6	Submersible	140	
OI-15A	01/04/90		X	444.38	122	115.5	105.5-115.5	3	Bladder	111	Conductor casing to 50 feet
OI-15B	12/21/89	X		444.76	400	395	370-390	6	Submersible	230	Conductor casing to 50 feet
OI-16A	01/21/90		X	527.21	130	129	109-129	3	Bladder	125	
OI-17A	11/18/89		X	513.04	196	70	60-70	4	Submersible	65	
OI-17B	01/26/90	X		513.38	450	395	340-390	6	Submersible	270	Conductor casing to 70 feet
OI-18A	01/23/90		X	483.36	67	30	20-30	3	Bladder	26	
OI-18B	10/31/89	X		483.74	475	301	256-296	6	Submersible	250	Conductor casing to 57 feet
OI-19A	10/28/89		X	414.31	190	181	156-176	4	Submersible	120	
OI-19B	10/26/89	X		370.91	455	245	200-240	6	Submersible	140	
OI-19C	10/30/89		X	414.78	113	113	88-108	4	Submersible	85	
OI-20A	11/10/89		X	426.48	174	174	139-169	4	Submersible	140	

Table A-1
(Continued)

Well No.	Well Comp. Date (1)	Drilling Method		Elev. of Concrete Pad (Ft.)	Borehole Depth (Ft.)	Well Depth (Ft.)	Well Screen Zone (Ft.)	Casing Diam. (In.)	Dedicated Pumps		Remarks
		Mud Rotary	Dual-Tube						Type	Set Depth (Ft.)	
OI-20B	12/20/89	X		428.25	288	285	250-280	6	Submersible	150	Conductor casing to 60 feet
OI-21A	03/07/90		X	544.64	241	241	231-241	3	---	---	No pump, well dry
OI-21B	11/21/89	X		545.10	500	390	345-385	6	Submersible	340	
OI-22B	12/06/89	X		442.36	420	240	185-235	6	Submersible	150	Conductor casing to 30 feet
OI-23B	01/11/90	X		478.38	343	333	288-328	6	Submersible	220	
OI-25A	11/22/89		X	370.28	180	179	134-174	2	Bladder	170	
OI-25B	01/09/90	X		369.65	600	366.5	321.5-361.5	6	Submersible	100	
OI-26A	02/01/90	X		301.80	208	205	160-200	4	Submersible	90	
OI-26B	01/25/90	X		302.13	611	350	295-345	6	Submersible	70	
OI-27A	01/25/90		X	480.23	90	89	59-89	3	Bladder	85	
OI-28B	02/15/90	X		505.63	360	343	288-338	5/4	Submersible	230	Casing changes from 5- to 4-inch diameter at 273 feet
OI-29B	02/16/90	X		448.27	600	460	415-455	6	Submersible	220	

Notes:
1. Date that well construction completed, pump installation and well head completion excluded.
2. See Figure A-1 for plan and location of monitoring wells.
3. All depth measurements are from ground surface.
4. For additional well construction details, see Appendix D.

grained units (Pico silt) around the site; water was added regularly at these locations to reduce the viscosity. Water used for drilling fluid was obtained from either on- or off-site fire hydrants.

Initially, a 6-inch-diameter pilot hole was drilled at each site to a specified depth and geophysically logged, as described in Section A.7. Two of the pilot holes were coreholes (Section A.4.2) where continuous core samples were collected (Coreholes 20 and 23). The depth of the well screen interval for each monitoring well was selected based on interpretation of the lithologic and geophysical logs from the pilot holes. After the well screen interval was selected, any portion of the pilot hole below the selected interval was grouted from the bottom up using a tremie pipe and cement or Volclay grout. The pilot holes were then reamed to a diameter of about 12-1/4 inches and completed as monitoring wells.

At six locations (OI-15A, OI-15B, OI-17B, OI-18B, OI-20B, and OI-22B), 14-inch-diameter steel conductor casing was installed through the trash prism or perched water intervals to minimize the potential for cross-contamination during drilling and to stabilize the borehole. Three of the conductor casings were installed with a bucket auger rig (Section A.4.4). The other three were installed by the Speedstar-15TH rig with a 17-inch diameter bit prior to starting the pilot hole.

A.4.2 CORING

Two coreholes (Coreholes 20 and 23) were drilled with a Failing-1500 truck-mounted coring rig. After geophysical logging each corehole, they were grouted to the surface with cement/bentonite grout. The coring rig was also used to drill the pilot hole at OI-18B; however, samples were cored only at specified sampling intervals. Exploration Drilling Services of Redwood City, California, performed this drilling. Continuous core samples were collected using the Christensen 94-millimeter wireline core barrel system and a 5-foot core barrel. This system allows the collection of continuous core samples with minimal reduction in drilling rate because the core barrel is tripped in and out of the hole using a wireline system. Cores are retrieved without removing the drill string from the borehole. Bentonite drilling mud was used as the circulating fluid.

The typical length of a core run was five feet. In very coarse material, the run length was shortened to two feet to increase core recovery. In gravelly zones, most of which exhibited cobble sizes in excess of two inches, the recovery was poor, commonly less than 50 percent. When a cobble jammed in the core barrel, recovery was 10 percent or less. Coring was so difficult at some depth intervals that a small tricone drillout bit had to be substituted for the core barrel to drill through the obstruction. In some of the silty zones, it was extremely difficult to remove the core from the core barrel. As a result, the core was broken apart during removal.

A.4.3 DUAL-TUBE PERCUSSION

Eleven 10-inch diameter boreholes (65 to 240 feet deep) were installed using the dual-tube percussion hammer drilling technique. The dual-tube diameters were outer tube, 10-inch outside diameter and inner tube, 6-inch inside diameter. A Drilltech D40K truck-mounted drilling rig was used for this type of drilling. Drilling with this method allows for detection and potential sampling of perched water intervals.

To advance the borehole, the dual-tube drill casing is driven into the ground by the percussion hammer as compressed air, circulating between the two "tubes", lifts the cuttings from the borehole. The dual-tube casing was flush threaded, and every ten feet, another section of casing is screwed onto the casing string already in the hole. After reaching the desired total depth, the monitoring well is constructed inside of the inner tube. As well construction progresses, the dual-tube casing is jacked back out of the borehole with hydraulic rams.

In three of the borings (OI-13C, OI-19A, and OI-19C), the driller had trouble keeping the formation from entering the drill casing after reaching total depth and before beginning construction of the well. Each of these borings was completed in saturated, unconsolidated sand or sand and gravel units. Because of this problem, the initial borehole for OI-13C had to be completely grouted up and redrilled.

A.4.4 BUCKET AUGER

A bucket auger rig, equipped with an 18-inch bucket, was used to install 14-inch conductor casing at three locations (OI-15A, OI-15B and OI-17B). Datum Exploration of Long Beach, California, completed this work. The borehole is advanced by successive trips in and out of the hole with the bucket, continuing until total depth is reached. Perched water was present at each of the three wells. The perched water caused significant sloughing in the open borehole associated with this drilling method, thereby considerably slowing progress. At OI-15A and 15B, the open hole was filled with potable water to reduce the amount of caving.

A.5 FORMATION SAMPLING

Soil samples were collected for analysis at specified intervals during drilling. Samples were collected with a Modified California split-spoon sampler (either 18 or 24 inches long) on a downhole hammer or by coring into specified depth zones. The sample barrel was loaded with either six or eight 2-inch by 3-inch stainless steel sleeves (or tubes). Upon retrieval, one of the sleeves was emptied into a soil headspace jar for field gas chromatography (GC) analysis, the remaining sleeves were sealed with teflon, a plastic cap, and electrical tape. The sealed sleeves were saved for possible shipment to a laboratory to undergo detailed chemical analysis. The Field Sampling Plan for the

Hydrogeology Investigation, Operating Industries, Inc. Landfill (EPA, September 14, 1989) provides details on sample packaging, requested analyses, and analytical methods for soil samples collected during drilling. Samples selected for shipment to the laboratory were chosen based on field GC results, the number of sleeves available, and the lithology.

Samples were planned to be taken every 20 feet up to 200 feet (every 10 feet from 0 to 100 feet with the dual-tube rig), then every 40 to 60 feet thereafter. The drilling contractor (WDC) originally planned on collecting drive samples with a downhole hammer suspended on a sand line; however, substantial difficulties with this technique were encountered at the first borehole (OI-19B). Because of the viscosity of the drilling mud and tough character of the sediments, the equipment was inadequate for driving samples below about 200 feet. The sampler could only be driven a few inches, with very poor recovery. For subsequent boreholes, the Speedstar-15TH rig was equipped for sampling with the Christensen 94 millimeter wireline set up. At the specified sampling intervals, a core would be collected using the 24-inch split spoon sample barrel furnished with stainless steel sleeves. An additional Christensen apparatus was not available for the Simco-5000 rig, consequently, very few samples were collected below 200 feet in OI-15B, OI-17B, OI-23B and OI-28B.

To analyze for all desired parameters, seven full sleeves were required (soil headspace analysis by field GC, VOCs, 1,4-dioxane, semivolatiles, metals, soil pH and CEC, and TOC). Few samples contained enough full sleeves to complete all analyses. Consequently, for most samples only some of the desired analyses were requested. Very poor sample recovery was experienced when driving or coring samples in gravelly intervals. Therefore, soil samples are unfortunately missing in many of the permeable intervals. In many cases, sample collection was not even attempted in these zones.

Grab samples of drill cuttings were collected at regular intervals (usually every 10 feet) where a drive or core sample was not taken. The cuttings were placed in plastic bags that were labeled with boring number and depth. All samples are stored at the OII site for future reference. Grab samples were used for lithologic logging, as described below in Section A.6.

For drilling with the bucket auger rig, grab samples were collected from the cuttings pile. At the dual-tube rig, the samples were collected as cuttings left the cyclone. At the mud rotary rigs, a bucketful of drilling mud was collected as the mud moved from the borehole to the shale shaker. The drill cuttings were separated from the mud by the following process:

- Allowing the sample to settle
- Pouring some of the mud back into the mud tank
- Adding water to the bucket to reduce the viscosity

- Pouring the mud/water mixture back into the mud tank
- Removing the cuttings from the bucket

A.6 LITHOLOGIC LOGGING

Either core samples, drive samples, or grab samples of drill cuttings were collected at regular intervals for description of the subsurface lithology. If available, core or drive samples were used for the logging because they are more representative of actual subsurface conditions. Otherwise, grab samples of drill cuttings were used. Boring logs describing the lithology were developed based on visual examination of these samples. Occasionally, additional information on subsurface lithology was identified based on drilling rates and rig reaction (chatter). A complete set of boring logs is included in Appendix B.

The boring logs also show the surface elevation of the boring, dates on which the boring was started and finished, type of drill rig used, drilling rate, name of the field geologist logging the borehole, and information on soil sampling. The United Soil Classification System classification of the logged material is recorded in addition to the more detailed lithologic descriptions.

In some of the deeper mud-rotary borings, logging was complicated by the difficulty in separating the fine silt drill cuttings from the drilling mud. Also, in some instances, loose sand or gravel from higher up in a boring continued to slough into the circulating drilling mud from which grab samples of drill cuttings were collected. This may mask the actual subsurface lithology.

A.6.1 LOGGING OF CONTINUOUS CORES

The continuous core samples were handled and logged in a somewhat different manner than described above. Following removal of the core from the core barrel, each core was color photographed. A data card describing the date, corehole number, and depth of core run was included in the photograph. Each core was then logged in detail for geologic structure, lithology and mineralogy. Following logging, the core was placed in labeled core boxes, wood spacers were inserted detailing any core loss or core removed for samples. All continuous core samples are stored at the OII site for future reference.

A.7 GEOPHYSICAL LOGGING

Immediately after reaching total depth of the pilot hole (or corehole) at each mud rotary location, geophysical logs were run by Welenco, of Bakersfield, California. Geophysical logs were used to confirm subsurface lithology recorded on the boring

logs. Also, they were used in conjunction with the lithologic logs to select appropriate monitoring well depths and screen intervals. The following suite of geophysical logs was run at each location:

- Resistivity (16- and 64-inch normal)
- Spontaneous potential (SP)
- Focused resistivity
- Natural gamma
- Caliper

Geophysical logging was completed at the 13 locations listed below:

- OI-14C
- OI-15B
- OI-17B
- OI-18B
- OI-19B
- Corehole 20
- OI-21B
- OI-22B
- Corehole 23
- OI-25B
- OI-26B
- OI-28B
- OI-29B

Focused resistivity and caliper logs were not run in Corehole 23. Copies of all geophysical logs are included in Appendix C.

A.8 WELL CONSTRUCTION

Immediately after each borehole was drilled or reamed to the prescribed depth, well construction activities commenced. To reduce cave-in and keep the hole clean in mud-rotary boreholes, drilling mud was kept circulating through the system until the well casing was ready to be installed. Typical well construction procedures and materials are described in the following sections. Detailed well completion diagrams for each monitoring well are contained in Appendix D, as is a typical wellhead completion diagram.

A.8.1 CONDUCTOR CASING

To prevent cross-contamination, 14-inch steel conductor casing was installed in wells where either refuse or perched water intervals were anticipated. The casing, set at

depths ranging from 30 to 70 feet, came in 20- to 30-foot sections. The sections were welded together to reach the desired depth, then the entire string was grouted into place with cement grout (containing at least 5 percent bentonite). The grout was allowed to set up overnight before drilling activities resumed.

A.8.2 WELL SCREEN AND CASING INSTALLATION

Five different casing diameters (2-inch, 3-inch, 4-inch, 5-inch and 6-inch) were used in the monitoring wells. Table A-1 lists the casing diameter of each well. Four- or six-inch diameter casing is used in most of the wells. These larger diameters facilitate placement of a submersible pump in the well. Submersible pumps allow aquifer tests to be run (providing for more accurate estimates of hydrogeologic parameters) and decrease purge time required for groundwater sampling. Four-inch diameter casing was limited to wells less than 200 feet deep because of the difficulty in placing submersible pumps deeper than that. The wells were constructed of either polyvinyl chloride (PVC) casing and slotted screen or a combination of PVC casing, stainless steel casing, and stainless steel wire-wrapped screen. The typical casing sequence from well bottom to ground surface for both types is described below.

Small Diameter PVC Well:

1. Two- or three-inch diameter PVC slotted well screen, 0.02-inch slot size (10 to 40 feet)

2. Two- or three-inch diameter blank PVC casing to surface (20 to 231 feet), schedule 40 casing

Intermediate Diameter PVC and Stainless Steel Well Combination:

1. Four- or six-inch diameter stainless steel sump (5 feet)

2. Four- or six-inch diameter stainless steel screen, 0.03-inch slot size (10 to 50 feet)

3. Four- or six-inch diameter blank stainless steel casing (15 feet)

4. Four- or six-inch diameter blank PVC casing to surface (45 to 470 feet), 4-inch casing is schedule 40 and 6-inch is schedule 80

All casing was flush-threaded, and a crossover joint was used to connect the PVC and stainless steel casing so lubricant or glue would not be necessary. Stainless steel centralizers were generally placed above and below the screen, near the surface, and at minimum 100-foot intervals between.

A.8.3 GRAVEL PACK AND WELL SEAL INSTALLATION

Once the casing was set to the specified depth, the annulus of the borehole was filled with sand to form a gravel pack, then bentonite and grout to form a well seal. All materials were placed in the well using a tremie pipe. The typical installation process is described below:

- The exterior of the screened interval was filled with thoroughly washed, rounded, hard, siliceous sand (Monterey #3 Sand). This gravel pack was extended from the bottom of the borehole to at least 10 feet above the screen. Potable water was used to flush the sand down the tremie pipe.

- At least 2 feet of fine-grained transition sand (Grade 60-Golden Flint), was set on top of the gravel pack to form an additional barrier between the grout and gravel pack.

- A bentonite seal, consisting of either pellets or a thick bentonite slurry, was put on top of the transition sand to separate grout from sand. The seal was at least 5 feet thick.

- The remainder of the annulus was filled to the surface with either cement (with 5 percent bentonite) or Volclay grout. If the interval to be grouted was large (greater than about 250 feet), the grout was installed in stages. Time was left between each stage so the grout could begin to set up.

A.8.4 PUMP SELECTION AND INSTALLATION

Dedicated pumps are installed in 24 of the 25 monitoring wells completed in this investigation. A pump was not set in OI-21A because the well is dry. Nineteen wells contain submersible pumps and 5 wells have bladder pumps. Table A-2 includes data used to select pump models and depths, as well as the selected pump type, model, and depth for each well.

Bladder pumps are stationed in the wells with 2- or 3-inch diameter casing, all of which are low-yield wells. The pumps are generally positioned within a few feet of the well base to maximize the volume of water that can be purged before the well goes dry. The bladder pumps are the GEOGUARD model, made by American Sigma.

For the submersible pumps, several factors were considered in selecting the pump model and depth. These factors include static water level, observed well yield and drawdown from the aquifer test, top of the screened interval, purge volume required for sampling (at least three well volumes), and capacity of surface discharge assembly. Most of the pumps are set between 10 and 25 feet below the pumping level from the aquifer test but above the top of the screened interval. The goal was to select a model

Table A-2
Pump Selection Data

Well No.	Top of Screen (ft)	Depth to Water (ft)	Aquifer Test		Pump Depth (ft)	Pump Type	Pump Model
			Yield (gpm)	Pumping Level (ft)			
OI-13C	110	67	31	79	90	Sub.(1)	Grundfos 5E5 (0.33 HP)
OI-14C	485	83	25	116	140	Sub.	Grundfos 16E9 (1 HP)
OI-15A	105.5	25	-	-	111	Bladder	Geoguard
OI-15B	370	170	12	214	230	Sub.	Grundfos 16E9 (1 HP)
OI-16A	109	76	-	-	125	Bladder	Geoguard
OI-17A	60	37	-	-	65	Sub.	Grundfos 5E5 (0.33 HP)
OI-17B	340	225	16	254	270	Sub.	Grundfos 10E14 (1 HP)
OI-18A	20	20	-	-	26	Bladder	Geoguard
OI-18B	256	116	3	250	250	Sub.	Grundfos 5E12 (0.5 HP)
OI-19A	156	88	27	100	120	Sub.	Grundfos 5E8 (0.33 HP)
OI-19B	200	109	27	117	140	Sub.	Grundfos 10E8 (0.5 HP)
OI-19C	88	78	2.5	85	85	Sub.	Grundfos 5E5 (0.33 HP)
OI-20A	139	123	27	140	140	Sub.	Grundfos 5E5 (0.33 HP)
OI-20B	250	125	31.5	138	150	Sub.	Grundfos 10E14 (1 HP)
OI-21A	231	Dry	-	-	-	-	---
OI-21B	345	249	4.5	340	340	Sub.	Grundfos 5E21 (1 HP)
OI-22B	185	125	24	144	150	Sub.	Grundfos 10E8 (0.5 HP)
OI-23B	288	183	13.5	204	220	Sub.	Grundfos 10E14 (1 HP)
OI-25A	134	55	-	-	170	Bladder	Geoguard
OI-25B	321.5	44	26	88	100	Sub.	Grundfos 16E9 (1 HP)
OI-26A	160	42	34	73	90	Sub.	Grundfos 10E8 (0.5 HP)
OI-26B	295	66	34	56	70	Sub.	Grundfos 16E4 (0.5 HP)
OI-27A	59	12	-	-	85	Bladder	Geoguard
OI-28B	288	203	31	218	230	Sub.	Grundfos 10E14 (1 HP)
OI-29B	415	172	25	211	220	Sub.	Grundfos 16E13 (1.5 HP)

(1) Submersible pump, stainless steel with teflon seals, 3-wire with control box.

with large enough capacity to keep sampling purge time to one hour or less; however, the available rate is limited by the capacity of the surface well head pipe fittings (approximately 16 gallons per minute [gpm]).

All of the submersible pumps are stainless steel Grundfos environmental pumps. These pumps are fabricated with solely stainless steel and teflon parts. Pumps range from 0.33 to 1.5 horsepower (HP) and are equipped with a three-phase, 240-volt motor. A Grundfos control box designed for the particular pump size is required to start the pumps. Each pump is fitted with 1- or 1.25-inch diameter stainless steel discharge pipe from the pump head to the surface. All Grundfos pumps model 10E and above (Table A-2) are designed for 1.25-inch diameter discharge pipe, but at seven of these models 1-inch diameter pipe was used. This resulted in less than anticipated flow rates and increased purge times for these wells. For measuring water levels, a 0.75- or 1-inch diameter PVC sounding tube is installed to a total depth of five feet above the pump depth in each of the wells furnished with a submersible pump.

A.8.5 WELLHEAD COMPLETION

The top of the well casing is fitted with a well seal or cap and the necessary appurtenances for purging and sampling. For wells with a bladder pump, there is a quick-connect fitting for attaching the control box and a 0.5-inch diameter plastic discharge tube. For water level sounder access, there is a hole in the well cap.

In wells equipped with a submersible pump, the stainless steel discharge pipe extends from the well up through the well seal. The end of the discharge pipe is fitted with a stainless steel tee fitting. One side of the tee features a spigot with a shut-off valve for attaching a discharge (garden) hose. The other side has a 0.25-inch diameter ball valve for sample collection. Electrical wiring from the pump continues through the well seal and is fitted with a 20 amp male plug, for connecting to an external 220 volt 3-phase power source. The end of the sounding tube also extends through the well seal.

Upon completion of each well, a 30-inch by 48-inch by 4-inch thick concrete pad was placed around the casing. A metal box (2-foot by 3-foot by 18-inches) with a locking hasp is attached to the concrete pad to protect the well casing. The protective boxes are painted bright yellow to make them highly visible to equipment and vehicle operators. Well numbers are stencilled on the exterior of each box.

Three wells (OI-19B, OI-23B, and OI-29B) are located in roadways and do not have the metal box. They are completed in a 2-foot by 2-foot by 9-inch deep flush mounted traffic-rated steel box.

Depending on location of the well, up to three protective bollards are installed to protect the wellhead and protective metal box from damage. The bollards extend to three feet above the ground and are painted bright yellow.

A.9 WELL DEVELOPMENT

Monitoring wells were fully developed with a Smeal (truck-mounted) well development rig using repeated bailing, swabbing, pumping, and surging techniques. The basic procedure consisted of the following:

- Bailing the accumulated solids, including heavy drilling mud, from the well
- Swabbing the screened interval
- Continued bailing and swabbing cycles until only a minimal amount of sand (gravel pack or formation) was present in the well following swabbing
- Pumping (and occasional surging) with a submersible pump until the discharge was clear and free of fines, as determined by the site hydrogeologist

Low yield wells (OI-15A, OI-16A, OI-17A, OI-18A, and OI-27A) were developed with a slightly different process that included:

- Bailing accumulated solids and water until the well goes dry
- Swabbing the screened interval after recovery
- Repeating another cycle of bailing dry, recovery, then swabbing
- Bailing the well dry a third time

Three wells (OI-13C, 21A, and 25A) were developed by air-lift techniques. Well development routinely took between 10 and 20 hours per well.

A.10 INDIVIDUAL WELL INSTALLATION SUMMARIES

A summary of notable findings on the subsurface lithology encountered at each well and of drilling and completion problems is provided in this section. Details on well drilling and completion are included in Table A-1.

OI-13C

The original borehole at this location had to be grouted to the surface because the formation entered the dual-tube casing, preventing construction of the monitoring well. Attempts to clear out the casing were unsuccessful, so the hole was redrilled approximately 10 feet away. The contact with Pico silt occurs at a depth of 160 feet. The well is completed just above this elevation in the San Pedro unit.

OI-14C

The San Pedro/Pico contact occurred at 40 feet; no additional permeable zones were encountered between that depth and the top of the A-sand at 475 feet. The well is screened in the top of the A-sand. During well completion, the entire casing string slipped and was dropped into the borehole to a depth of 20 feet below ground surface. The cap on the casing broke off during attempts to retrieve the casing string, so, 25 additional feet of casing (extending to 5 feet above ground surface) were fitted over the end of the lost casing with a PVC slip collar joint. Eight-inch diameter steel casing was then lowered around the well casing to 23 feet and set in-place with dry volclay grout and bentonite pellets to provide additional protection at the slip collar joint. The entire annulus above the bentonite seal was then grouted to the surface.

OI-15A

The target for this well was a 10-foot thick permeable interval visible on the E-log of OI-2 at a depth of approximately 100 feet. A conductor casing was set to a depth of 50 feet. The base of the San Pedro unit occurs at 50 feet. Perched water was not detected below the conductor casing to a total depth of 120 feet. The well was completed in Pico silt from 105.5 to 115.5 feet. Following purging, the well is very slow to recharge. The static water level (perched) is about 25 feet. The well was completely redrilled and completed at the same location after grout was discovered in the casing during development.

OI-15B

The well is completed in the Lower Sand, Pico sand/conglomerate unit about 80 feet above the top of the A-sand. The water produced from the well has a strong hydrogen sulfide odor, similar to OI-2 at this same cluster site.

OI-16A

During drilling, shallow perched liquid was not detected as it had been in previous borings (GMW-6 and OI-4) in the area. The San Pedro/Pico contact is at 50 feet, and the well is screened in Pico silt (109 to 129 feet). The depth to water (perched) is 76 feet.

OI-17A

Only 15 feet of coarse-grained San Pedro sediments were encountered at the surface. No other coarse-grained intervals were detected in the underlying Pico siltstone to a total depth of 196 feet; therefore, the bottom of the borehole was grouted and the well was screened in a perched zone observed at 65 to 70 feet. The color change from

yellowish brown to olive gray also occurs at 70 feet. The depth to water (perched) is 37 feet.

OI-17B

Only one small sand unit (10 to 15 feet thick) was encountered between the base of the San Pedro Unit at a depth of 18 feet and the top of the A-sand at 350 feet. Based on nearby well logs, additional Pico sand intervals were expected above the A-sand. The well is screened in the top of the A-sand. Elevated hNu readings were detected off of the drilling mud starting at about 280 feet. The highest readings (20 ppm) from the borehole occurred at 280 feet, the highest readings (200 ppm) off of drilling mud headspace were between 380 and 410 feet.

OI-18A

Perched water was detected at the San Pedro/Pico contact, which occurs at 30 feet. Drilling continued to a depth of 67 feet, where perched water had been encountered in nearby GMW-4. No liquid accumulated in the casing at this depth overnight, so the well was completed in the base of the San Pedro unit. The depth to water is 20 feet and the well will yield nearly 3 well volumes before going dry.

OI-18B

No permeable units were encountered in the Pico silt to a depth of 475 feet. The well is screened in the silt from 256 to 296 feet. Although completed in the silt, the well is capable of producing approximately 3 gpm from 40 feet of well screen.

OI-19A

A coarse sand and gravel unit was encountered at 145 feet. The boring had to be terminated in this unit at 181 feet, because, while drilling, the dual-tube rig was generating 1000 gallons of water with every 10 feet of drilling. The well was completed in the sand and gravel unit. The annular well seal had to be grouted to the surface on three consecutive days, due to grout loss to the formation. No evidence of grout leakage to the gravel pack was observed.

OI-19B

Conglomerate was present to a depth of 250 feet underlain by Pico silt to 450 feet. The well was completed near the base of the San Pedro unit. Considerable difficulty was experienced in collecting drive samples with the downhole hammer. The split spoon sample barrel was lost in the borehole twice. The second time it could not be retrieved and drilling resumed with a 12-1/4-inch diameter reaming bit, which drilled past the lost barrel.

OI-19C

This well was installed to monitor a sand unit located above the gravel unit monitored by OI-19A. The well is screened from 88 to 108 feet.

OI-20A

The borehole was drilled with the dual-tube rig through trash and into underlying conglomerate to a total depth of 174 feet. The top of the screened interval is about 15 feet below the water level. Liquids were not observed while drilling in the trash or at the base of the trash. Driving the dual-tube drill casing was extremely difficult through portions of the trash prism, since the dual-tube casing would bounce rather than penetrate. Large amounts of landfill gas were venting from the borehole as grout was pumped into the annulus and the drill casing was removed. Removal of the dual-tube casing during well completion was also very difficult, due to the skin friction of the conglomerate on the casing. While jacking the casing from the borehole, the ground caved to a depth of a few feet from the downward pressure and had to be reinforced with alternate layers of railroad ties. It took substantial amounts of grout to get the grout level to ground surface. Much of the drilling and completion of OI-20A was done with the personnel in Level B protection.

OI-20B

Drilling was performed with a mud-rotary rig. The well was set at the base of the San Pedro sand and gravel sequence present from beneath the trash to a depth of 290 feet. A color change from yellowish brown to olive gray occurs at 252 feet in the middle of the conglomerate.

OI-21A

This borehole was drilled to detect any occurrences of perched water to the base of a coarse-grained unit at 240 feet, as observed in the logs from OI-21B. No liquid was detected. A perched-zone well with a 3-inch diameter PVC casing was installed at the base of the unit to detect any future accumulation of perched water or to monitor landfill gas. During well completion, removal of the dual-tube drill casing was very difficult and the casing separated underground at a depth of 30 feet, leaving the base of the drill casing at 210 feet below ground surface. An unsuccessful attempt was made to overdrill the casing with the Speedstar-15Th rig and retrieve the lost casing. Eventually, the annulus between the dual-tube casing and well casing was grouted to form a well seal and the dual-tube casing was left in-place.

OI-21B

Sand, gravel, and conglomerate units were observed from 130 to 240 feet and from 340 to 390 feet. This well was screened in the A-sand, which occurs between 340 and 390 feet at this location. Drilling the pilot hole and reaming through the conglomerate was very slow. The initial pH of the water from this well was very high, apparently the result of grout contamination. The pH gradually dropped into a normal range, however, production from the well is far lower than expected based on performance of other wells in the same unit. It appears that a large portion of the gravel pack may have been sealed off from the formation by grout.

OI-22B

No trash was encountered while drilling at this location. The San Pedro/Pico contact occurs at 135 feet. The well is screened in a thick permeable unit within the Pico, from 185 to 280 feet. This unit is underlain by silt to total depth of 420 feet.

OI-23B

The San Pedro/Pico contact occurs at 20 feet. There is a thick sand and gravel unit from 125 to 175 feet, and the A-sand from 290 to 335. The well is completed in the A-sand.

OI-25A

Only 26 feet of San Pedro Unit conglomerate were encountered at the surface; no other coarse-grained units were located to a total depth of 180 feet, in contrast to nearby wells. At Cluster Site 13, about 400 feet to the east, 160 feet of San Pedro sediments are present. At Cluster Site 1, approximately 800 feet to the west, 110 feet of San Pedro Unit sediments were observed. The well is completed in Pico silt from 134 to 174 feet.

OI-25B

Approximately 30 feet of San Pedro Unit sand and gravel was observed at this location. This well is screened at a depth of 320 to 360 feet in the only permeable unit found between 30 feet and 600 feet. This unit is not present at either Cluster Site 1 or 13.

OI-26A

The contact of sandy conglomerate and silt occurs at 65 feet. Three thick sandy gravelly units are present within the silt from 160 to 235 feet, 290 to 365 feet, and 470 to 540 feet. This well is completed in the uppermost sand unit.

OI-26B

This well is completed in the second of the three sand units discussed above (OI-26A).

OI-27A

The contact between San Pedro Unit and Pico Unit occurs at 22 feet. This well is completed in silt from 59 to 89 feet. The static water level (perched) is just 12 feet below ground surface. Two well volumes can be pumped before the well goes dry.

OI-28B

Interbedded silty sand, sandy gravel, and clayey silt are present to 115 feet. Lost circulation problems occurred at 90 feet. hNu and explosimeter readings at the borehole were quite high (hNu-30 ppm, explosimeter-100 percent of the LEL) when there was not any drilling mud in the borehole, indicating the presence of significant concentrations of landfill gas. The well was screened from 288 to 338 feet in a sandy gravel present from 180 to 345 feet. The blank PVC casing for this well is 5-inch diameter, while the stainless steel casing and screen are 4-inch diameter. A reducing crossover joint is located between the PVC and stainless steel at 273 feet.

OI-29B

Silt was present from the surface to 415 feet. The A-sand occurs from 415 to 445 feet and is underlain by silt to 600 feet. The A-sand is much thinner here than it is at the OII site boundary to the north. The well is screened in the A-sand. High hNu readings (up to 250 ppm) off of the drilling mud and soil samples were detected between 240 and 300 feet.

A.11 AQUIFER AND SLUG TESTS

Following well development, short-term (4-hour) aquifer tests were performed at 18 of the 25 monitoring wells. Slug tests were completed on the 6 low-yielding wells (OI-15A, OI-16A, OI-17A, OI-18A, OI-25A and OI-27A). OI-21A is dry and could not be tested. The tests were run to provide an estimate of the hydraulic conductivity and transmissivity of the unit screened by each well. Analysis and results of the testing are summarized in Appendix E.

Aquifer tests consisted of a 4-hour constant flow rate pumping test (five hours at OI-22B), followed by a recovery test. The flow rate for each test was based on the well capacity and drawdown observed during well development activities. The maximum flow rate (27 to 31 gpm depending on the surface discharge arrangement) for many of

the tests was limited by the size of the available pump and discharge pipe. The same pumps and pipe used for well development were used for aquifer testing.

During the test, water levels were measured at regular intervals with an electric well sounder. In eleven of the tests, a pressure transducer and data logger were also used to provide more frequent and accurate water level readings. The flow rate was measured using a stop watch and an in-line totalizer flow meter (accurate to 0.1 gallons). The flow rate was checked periodically and adjusted to maintain a constant rate, if possible. The rate generally varied by less than 2 gpm over the test. Field parameters were monitored throughout the test, including temperature, pH, electrical conductivity, and, in some cases, oxidation-reduction potential (Eh). Water levels, flow rates, and field parameters for each test are shown on the aquifer test data sheets included in Appendix E.

Slug tests were completed in wells that could not sustain a constant flow rate (greater than 1 gpm) for an extended period of time. Slug tests entailed removing a known volume of water from the well, then measuring water levels as the well recovered to the pre-test water level. Slug tests were run after the wells had been completed and dedicated pumps had been installed. Five of the six wells slug tested have bladder pumps and one (OI-17A) has a submersible pump.

For wells equipped with a bladder pump, the pump was removed prior to starting the test. Following pump removal, the pressure transducer for the data logger was set in the well, then a bailer with known capacity was lowered to just below the water surface in the well. As the bailer was removed from the well, the data logger was started. Water levels were measured for anywhere from 4 to 24 hours depending on the recovery rate.

At OI-17A, the dedicated submersible pump was pumped at its maximum rate for about five minutes to purge the well dry. The volume pumped was measured and recorded. The data logger began recording water levels as soon as the pump was shut off. Water levels were measured for approximately 5-1/2 hours. Water levels and other pertinent information from the tests are included on the slug test data sheets in Appendix E.

A.12 DISPOSAL OF DRILLING AND SAMPLING WASTES

Monitoring well installation and sampling activities produced solid and liquid wastes. Solids consisted of cuttings either removed dry from the borehole (dual-tube rig), or separated from the drilling fluid (mud rotary rig) by means of a "shale-shaker" and desander. Liquid wastes consisted of drilling fluid, well development and aquifer test water, decontaminant rinsate, and purge water from sampling.

At each drill site, the solid and liquid waste generated was containerized in roll-off dumpsters and Baker tanks certified by the California Department of Transportation for containerizing and transporting hazardous waste. As storage containers were filled, Water Development Corporation (WDC) transported the waste to the designated areas of the OII site.

Solid waste was temporarily stored in large open-topped bins on the top deck of the south parcel. The moisture content of the solid waste was reduced by pumping free liquids off of the mud mixture, and allowing excess water to evaporate from the surface. The solids were disposed of on the top deck after the mixture had thickened sufficiently to pass the paint filter test (ASTM Method 9095). Wastes were compacted and covered with fresh dirt by site control and maintenance personnel.

All liquid wastes were transferred by WDC to the onsite leachate collection system storage tanks for continued storage until transported, by others, to an offsite treatment facility.

A.13 WELL SAMPLING

Groundwater from each well was sampled three times for complete laboratory analysis. Additional sampling was done, if an aquifer test was run on a well or if significant perched water was detected during drilling. Details on sampling methods, containers, volumes, field procedures, and requested analyses are covered in the Field Sampling Plan for the Hydrogeology Investigation, Operating Industries, Inc. Landfill (EPA; September 14, 1989). Sampling activities occurred between November 15, 1989 and May 10, 1990.

A.13.1 PERCHED WATER SAMPLING WHILE DRILLING

Perched water was detected in several of the boreholes installed with the dual-tube rig. However, in only two borings, OI-13C and OI-17A, did enough liquid accumulate to sample during drilling. The samples were retrieved using a teflon bailer lowered into the perched water that collected in the dual-tube casing. Sample results at each well are included in the water quality data appendix (Appendix H).

A.13.2 GROUNDWATER SAMPLING DURING AQUIFER TESTING

Samples were gathered for both field GC and laboratory analysis during the aquifer test of each new well. For field GC analysis, 40-milliliter (ml) vials were collected at four times during the test: after 0.5, 1, 2, and 4 hours of pumping. The time-dependant samples were taken to see if any trends in concentration over time were discernible. For the most part, volatile organic compounds were not detected by the field GC in any of the samples, so potential trends could not be evaluated. At the conclusion of

the test (4 hours), samples were collected for laboratory analysis of VOCs and 1,4-dioxane. Because of the high flow rate during the tests, some of these samples were slightly aerated.

A.13.3 ROUTINE GROUNDWATER SAMPLING

Each well was sampled three times for complete laboratory analysis. Analyses requested for the routine sampling were:

- VOCs
- 1,4-Dioxane
- Semivolatiles
- Pesticides and PCBs
- Ammonia-N
- Anions, TDS
- Metals
- Cyanide
- POX
- TOX
- TOC
- POC

Sulfides analysis was added to the list in the middle of the program. In the first two rounds of routine sampling, samples for metals were filtered. During the last round of sampling (Round 3), both filtered and unfiltered samples were sent for total metals analysis. In collecting the first two routine samples, smaller groups of wells were sampled periodically between January 24 and April 21, 1990. The final sampling event encompassed all wells (including the 17 monitoring wells installed previous to this investigation) and took place between April 24 and May 10, 1990. Sampling dates for each well are provided in Table A-3.

Wells fitted with submersible pumps were typically sampled immediately following the purging of three well volumes from the well. Wells with bladder pumps are purged dry on one day and sampled the following day. Notes on differing procedures at individual wells are included in Table A-3. The purge volume, flow rate, and purge time for all 41 monitoring wells (new and previously installed) are tabulated in Table A-4. Throughout purging, field parameters of the discharge water were measured. Parameters measured included: temperature, pH, conductivity, and in some instances Eh and dissolved oxygen. Table A-5 provides a summary of the values measured immediately prior to sampling for all routine samples collected during this investigation.

A.13.4 GAS SAMPLING FOR STABLE ISOTOPES ANALYSIS

During the final sampling event, landfill gas from South Parcel landfill gas monitoring wells GMW-8B and GMW-9D and gas headspace from groundwater monitoring wells OI-2 and OI-15B were sampled and sent for analysis of C1-C5 hydrocarbons, helium, hydrogen, C^{13}/C^{12} in methane, S^{34}/S^{32} in H_2S, CO_2, nitrogen, argon, and oxygen (described in Section 6.5).

The gas wells were sampled on May 9, 1990, by CURE Inc. personnel in the presence of CH2M HILL. Samples were collected using a vacuum pump and bucket to extract the landfill gas and fill 10-liter Tedlar sample bags. It took approximately 75 minutes to collect 40 liters from GMW-8B and 30 liters from GMW-9D. The wells were not purged prior to sample collection.

The headspace from the groundwater wells was collected May 8, 1990, during purging for groundwater sampling. The discharge hose was placed into a covered 55-gallon drum until the drum was about half full. After allowing the drum to sit for approximately one minute, the vacuum pump intake tubing was set just above the water and purging began. The line was purged for 10 seconds prior to the start of sample collection. During purging, the hydrogen sulfide detector indicated readings of 15 and 25 ppm for OI-15B and OI-2, respectively. Three 10-liter tedlar sample bags were filled from each drum.

A.14 SURVEYING OF WELL LOCATION AND ELEVATION

The 25 new monitoring wells, as well as existing Southern California Gas Company well (2897A), were surveyed on March 19 and 20, 1990 to establish their location and elevation. For the monitoring wells, data collected includes: x-y position of the well (northing, easting), elevation of the concrete pad at the surface, and elevation of either the well cap or the sounding tube (if installed). The steel rim at ground surface was surveyed for the Gas Company well. Table A-6 contains the data collected from the surveying effort.

Table A-3
Summary of Monitoring Well Sampling

Well No.	Sampling Dates				Pump Type	Notes On Sampling
	Aquifer Test	Round 1	Round 2	Round 3		
OI-13C	01/31/90	02/28/90	03/20/90	04/26/90	Submersible	Purge three well volumes, sample
OI-14C	03/16/90	03/29/90	04/12/90	05/09/90	Submersible	Purge three well volumes, sample
OI-15A	---	02/28/90	03/20/90	05/02/90	Bladder	Purge well dry (one well volume), sample following day
OI-15B	01/09/90	03/02/90	03/22/90	05/08/90	Submersible	Purge three well volumes, sample; strong H2S odor
OI-16A	---	03/29/90	04/10/90	05/04/90	Bladder	Purge well dry (one well volume), sample following day
OI-17A	---	01/26/90	02/28/90	05/09/90	Submersible	Purge well dry (one well volume), sample later the same day
OI-17B	02/03/90	03/22/90	04/11/90	05/09/90	Submersible	Purge three well volumes, sample
OI-18A	---	02/26/90	03/20/90	05/03/90	Bladder	Purge well dry (two to three well volumes), sample following day
OI-18B	11/17/89	01/26/90	02/26/90	05/10/90	Submersible	Purge three well volumes, sample; takes about 4 hours to purge
OI-19A	11/18/89	01/25/90	02/26/90	05/02/90	Submersible	Purge three well volumes, sample; discharge very aerated
OI-19B	11/15/89	01/24/90	02/27/90	05/03/90	Submersible	Purge three well volumes, sample
OI-19C	11/17/89	01/25/90	02/26/90	04/26/90	Submersible	Purge three well volumes, sample
OI-20A	11/19/89	01/24/90	02/27/90	05/04/90	Submersible	Purge three well volumes, sample
OI-20B	01/21/90	03/02/90	03/21/90	05/04/90	Submersible	Purge three well volumes, sample
OI-21B	12/01/89	01/25/90	02/27/90	04/26/90	Submersible	Purge three well volumes, sample
OI-22B	01/20/90	01/26/90	02/28/90	05/04/90	Submersible	Purge three well volumes, sample
OI-23B	01/24/90	03/02/90	03/22/90	05/03/90	Submersible	Purge three well volumes, sample

Table A-3
(Continued)

Well No.	Sampling Dates				Pump Type	Notes On Sampling
	Aquifer Test	Round 1	Round 2	Round 3		
qOI-25A	---	03/02/90	03/20/90	04/27/90	Bladder	Purge well dry (one well volume), sample following day
OI-25B	01/18/90	03/02/90	03/21/90	04/26/90	Submersible	Purge three well volumes, sample
OI-26A	02/17/90	03/21/90	04/10/90	05/07/90	Submersible	Purge three well volumes, sample
OI-26B	02/20/90	03/21/90	04/10/90	05/07/90	Submersible	Purge three well volumes, sample
OI-27A	---	02/26/90	03/02/90	05/08/90	Bladder	Purge well dry (about two well volumes), sample following day
OI-28B	03/01/90	03/22/90	04/11/90	05/04/90	Submersible	Purge three well volumes, sample
OI-29B	03/06/90	03/29/90	04/11/90	05/07/90	Submersible	Purge three well volumes, sample

Table A-4
Purge Volumes and Times for Groundwater Sampling

Well No.	Number of Well Volumes Purged	Approximate Purge Volume (gallons)	Average Flow Rate[1] (gpm)	Approximate Purge Time (minutes)
OI-1A	1	20	Bail	120
OI-1C	3	120	5.2	20
OI-2	3	1625	10.0	165
OI-3	3	100	Bladder	510
OI-4	1	5	Bail	30
OI-5	3	880	10.5	85
OI-6	1	25	Bail	80
OI-7C	3	95	Bladder	300
OI-8A	3	90	1.5	60
OI-9A	3	80	5.0	16
OI-10A	3	1055	13.0	80
OI-10B	3	350	7.8	45
OI-11A	1 (2X)	460 (2x)	Avg 7.7	60 (2x)
OI-12B	3	1355	13.4	100
OI-12C	3	230	9.0	25
OI-13A	3	155	5.5	30
OI-13B	1 (2X)	440 (2x)	Avg 6.5	65 (2x)
OI-13C	3	170	5.8	30
OI-14C	3	1995	15.5	130
OI-15A	1	35	Bladder	200
OI-15B	3	1005	9.0	110
OI-16A	1	20	Bladder	110

Table A-4
(Continued)

Well No.	Number of Well Volumes Purged	Approximate Purge Volume (gallons)	Average Flow Rate(1) (gpm)	Approximate Purge Time (minutes)
OI-17A	1	25	5.0	5
OI-17B	3	745	7.5	100
OI-18A	1	5	Bladder	80
OI-18B	3	815	3.5	230
OI-19A	3	185	4.5	40
OI-19B	3	595	6.3	95
OI-19C	3	70	4.5	15
OI-20A	3	95	3.0	30
OI-20B	3	710	11.5	60
OI-21B	3	620	4.5	140
OI-22B	3	500	6.5	75
OI-23B	3	660	8.3	80
OI-25A	1	20	Bladder	105
OI-25B	3	1425	15.0	95
OI-26A	3	270	6.2	45
OI-26B	3	1355	11.3	120
OI-27A	1	30	Bladder	180
OI-28B	3	350	9.3	40
OI-29B	3	1270	13.2	95

(1) Flow rate is averaged over the entire purge time as well as different sampling rounds.

Table A-5
Field Parameters Measured in Monitoring Wells
Prior to Sampling

Well Name	Date	Time	pH	Temp (C)	EC (umhos /cm)	EH (mv)	Diss. Oxygen (mg/l)	Date	Time	pH	Temp (C)	EC (umhos /cm)	EH (mv)	Diss. Oxygen (mg/l)	Date	Time	pH	Temp (C)	EC (umhos /cm)	EH (mv)	Diss. Oxygen (mg/l)
OI-13C	02/28/90	1207	7.07	22	340	134.7	--	03/20/90	1506	6.94	23.5	345	--	3.1	04/26/90	1109	6.97	23	340	37.7	3.7
OI-14C	03/29/90	1318	7.62	24.5	530	--	--	04/12/90	0952	7.24	24.5	500	--	1.6	05/09/90	1530	7.55	26	550	20.7	1.6
OI-15A	02/28/90	1520	7.95	22	800	133.5	--	03/20/90	1037	7.64	25	850	--	2.6	05/02/90	1428	8.14	24	770	104.3	5.7
OI-15B	03/02/90	1419	8.12	23	750	-325.0	--	03/22/90	1600	7.74	24	810	--	1.3	05/08/90	0938	7.94	23	800	-331	1.4
OI-16A	03/29/90	1500	6.64	22	1250	--	--	04/10/90	1318	6.44	25	1330	--	3.8	05/04/90	1330	7.63	25	1280	73.0	5.7
OI-17A	01/26/90	1515	7.10	22	1190	--	--	02/28/90	1411	7.30	22.5	1150	144.0	--	05/09/90	1627	6.83	23.5	1170	50.5	2.3
OI-17B	03/22/90	1250	6.88	23	630	--	1.1	04/11/90	1404	6.47	24.5	680	--	1.5	05/09/90	1225	6.77	23	620	-52.5	1.8
OI-18A	02/26/90	1550	6.89	23	6000	-26.7	--	03/20/90	0806	6.35	23	5800	--	2.2	05/03/90	1352	5.93	25	6000	-25.3	1.7
OI-18B	01/26/90	1319	7.87	23	580	--	--	02/26/90	1528	8.12	23	510	-75.5	--	05/10/90	1320	7.46	23	530	-144.3	1.2
OI-19A	01/25/90	1236	7.59	21	900	--	--	02/26/90	0959	7.57	21	880	89.3	--	05/02/90	1229	7.51	21.5	890	62.5	7.4
OI-19B	01/24/90	1610	6.57	22	920	--	--	02/27/90	1323	6.92	22.5	930	109.7	--	05/03/90	1005	6.80	22.5	950	70.3	1.8
OI-19C	01/25/90	1408	7.57	22	1200	--	--	02/26/90	1046	7.65	20	1100	106.0	--	04/26/90	1548	7.57	22	1180	53.7	1.7
OI-20A	01/24/90	0955	6.43	24	610	--	--	02/27/90	1508	6.29	24	570	101.7	--	05/04/90	0942	6.32	26	570	65.7	1.9
OI-20B	03/02/90	1140	7.38	22	250	-57.5	--	03/21/90	1647	7.32	23.5	295	--	1.5	05/04/90	0842	7.17	23	270	-40.7	2.2
OI-21B	01/25/90	1100	7.57	23.5	495	--	--	02/27/90	1057	7.40	23.5	500	-125.5	--	04/26/90	0936	7.25	25	500	-120.0	2.1
OI-22B	01/26/90	1211	8.81	22.5	315	--	--	02/28/90	0952	9.47	23	325	62.3	--	05/04/90	0847	9.62	23	320	30.3	2.0
OI-23B	03/02/90	1610	6.98	22.5	470	-100.0	--	03/22/90	1056	7.02	24	500	--	1.5	05/03/90	1219	6.88	24	485	-80.3	1.4
OI-25A	03/02/90	0829	8.52	20	500	-76.7	--	03/20/90	1342	8.48	23	540	--	1.2	04/27/90	1417	8.21	22.5	550	74.5	1.5
OI-25B	03/02/90	0944	7.67	22.5	370	-89.5	--	03/21/90	0907	7.46	24	450	--	1.7	04/26/90	1342	7.62	24.5	410	-93.3	1.4
OI-26A	03/21/90	1150	7.02	22	600	--	3.0	04/10/90	0821	7.53	21	570	--	3.3	05/07/90	0929	6.78	21.5	570	148.0	3.1
OI-26B	03/21/90	1440	7.29	23	450	--	1.6	04/10/90	1040	7.07	23	440	--	1.5	05/07/90	1144	6.99	23	415	-60.0	1.7
OI-27A	02/26/90	1414	7.78	24	490	79.5	--	03/02/90	0931	7.16	23.5	500	--	4.1	05/08/90	1256	7.52	26	520	-45.7	2.5
OI-28B	03/22/90	0825	7.55	22	340	--	1.8	04/11/90	0900	7.23	22	300	--	2.0	05/04/90	1104	7.27	23	315	53.7	2.3
OI-29B	03/29/90	0950	7.16	23.5	1110	--	--	04/11/90	1122	6.97	25	1180	--	1.1	05/07/90	1445	6.98	25	1180	-68.7	1.5

Table A-5 (cont.)
Field Parameters Measured in Monitoring Wells
Prior to Sampling

Well Name	Date	Time	pH	Temp (C)	EC (umhos/ cm)	EH (mV)	Diss. Oxygen (mg/l)
OI-1A	04/30/90	0934	6.28	20	3000	167.7	3.2
OI-1C	04/30/90	1009	6.68	21	3420	142.5	1.6
OI-2	05/08/90	1339	7.75	25	820	-302	0.8
OI-3	04/24/90	1630	9.67	24	380	-71.5	1.4
OI-4	05/02/90	1520	6.42	24.5	18300	118.3	1.5
OI-5	04/27/90	1043	7.82	23	500	-118.7	1.0
OI-6	05/01/90	1400	7.46	22.5	700	36.3	2.2
OI-7C	04/30/90	1344	6.96	21	440	139.0	1.2
OI-8A	05/01/90	0856	8.34	22	320	274	4.4
OI-9A	05/01/90	1011	7.31	21	480	66.3	4.3
OI-10A	05/02/90	0945	7.50	23	350	-76.7	1.8
OI-10B	05/02/90	0800	6.66	21	1440	141.3	4.9
OI-11A	05/03/90	0738	8.88	23	1080	-52.7	1.3
OI-12B	04/25/90	0959	8.59	24	420	-77.3	1.9
OI-12C	04/25/90	0813	6.63	22	390	50.0	3.7
OI-13A	04/25/90	1135	6.91	22	320	85.0	4.0
OI-13B	04/27/90	0739	9.09	23	1030	-80.3	1.7
2897A	03/23/90	1412	7.10	24.5	530	--	1.3

Table A-6
Surveyed Well Locations and Elevations

Well No.	Northing	Easting	Elevation	Notes
OI-13C	4125686.9	4256949.7	385.84 384.78	Sounding tube Concrete pad
OI-14C	4121683.8	4256949.7	357.67 357.06	Top of casing Concrete pad
OI-15A	4122519.8	4255029.9	444.90 444.38	Well cap Concrete pad
OI-15B	4122489.0	4255059.2	445.94 444.76	Sounding tube Concrete pad
OI-16A	4122478.9	4255432.8	528.18 527.21	Well cap Concrete Pad
OI-17A	4122850.3	4255819.4	514.10 513.04	Sounding tube Concrete pad
OI-17B	4122812.3	4255816.4	514.68 513.38	Sounding tube Concrete pad
OI-18A	4123153.4	4254599.1	484.13 483.36	Well cap Concrete pad
OI-18B	4123127.7	4254627.7	484.59 483.74	Sounding tube Concrete pad
OI-19A	4124120.5	4254018.0	415.03 414.31	Sounding tube Concrete pad
OI-19B	4124431.3	4253836.8	370.60 370.91	Sounding tube Street cover
OI-19C	4124116.8	4253995.8	415.46 414.78	Sounding tube Concrete pad
OI-20A	4125348.6	4258038.6	427.53 426.48	Sounding tube Concrete pad
OI-20B	4125351.7	4258013.3	429.43 428.25	Sounding tube Concrete pad
OI-21A	4124249.8	4257899.7	545.63 544.64	Top of casing Concrete pad

Table A-6
(Continued)

Well No.	Northing	Easting	Elevation	Notes
OI-21B	4124254.7	4257922.0	545.94 545.10	Sounding tube Concrete pad
OI-22B	4125305.5	4257487.3	443.65 442.36	Sounding tube Concrete pad
OI-23B	4123857.8	4256861.4	478.09 478.38	Sounding tube Street cover
OI-25A	4125459.4	4256184.5	371.39 370.28	Well cap Concrete pad
OI-25B	4125447.0	4256148.9	370.70 369.65	Sounding tube Concrete pad
OI-26A	4124857.7	4253071.6	302.50 301.80	Sounding tube Concrete pad
OI-26B	4124856.8	4253092.0	303.24 302.13	Sounding tube Concrete pad
OI-27A	4122798.6	4254927.8	481.26 480.23	Well cap Concrete pad
OI-28B	4124739.5	4258182.8	506.72 505.63	Sounding tube Concrete pad
OI-29B	4122090.5	4255888.8	447.73 448.27	Top of casing Street cover
So. Cal. Gas Co. 2897A	4122533.1	4255328.2	511.76	Steel rim at surface

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