United States Environmental Protection Agency

Final
Remedial Investigation/ Feasibility Study of Remedial Alternatives

Operable Unit No. 2
Brown & Bryant Superfund Site
Arvin, California

Project No. C00-266.2
September 2005

Final
Remedial Investigation/
Feasibility Study of Remedial Alternatives

Operable Unit No. 2
Brown & Bryant Superfund Site
Arvin, California

PANACEA, INC.
Environmental Services

US Army Corps
of Engineers®

PART I
Remedial Investigation

Operable Unit No. 2
Brown & Bryant Superfund Site
Arvin, California

September 2005

Table of Contents

EXECUTIVE SUMMARY FOR THE REMEDIAL INVESTIGATION VIII

1.0 INTRODUCTION 1

1.1 PURPOSE 1

1.2 OBJECTIVE 1

1.3 ORGANIZATION OF REPORT 1

2.0 SITE BACKGROUND 2

2.1 SITE CHARACTERISTICS 2

2.1.1 SITE LOCATION 2

2.1.2 SITE FEATURES 3

2.1.3 SITE OPERATIONAL HISTORY 3

2.1.4 SITE REGULATORY HISTORY 4

2.2 PHYSICAL CHARACTERISTICS OF SITE AND SITE VICINITY 4

2.2.1 ENVIRONMENTAL SETTING AND SURFACE FEATURES 4

2.2.2 METEOROLOGY 4

2.2.3 SURFACE WATER HYDROLOGY 5

2.2.4 GEOLOGY 5

2.2.5 HYDROGEOLOGY 5

2.2.6 ECOLOGY 8

2.2.7 HUMAN POPULATIONS 9

2.2.8 LAND USE 9

2.2.9 SOURCE OF DRINKING WATER SUPPLY 10

3.0 SITE INVESTIGATIONS 10

3.1 STUDY AREA 10

3.2 OU-1 INVESTIGATIONS 10

3.2.1 OU-1 RI/FS 11

3.2.2 OU-1 REMEDIAL ACTION 11

3.3 OU-1 INVESTIGATIONS oF b-ZONE 13

3.3.1 PREVIOUS INVESTIGATIONS 13

3.3.2 SERVICES CONTRACTED BY THE PRPS 14

3.4 GROUNDWATER MONITORING 15

3.5 OU-2 INVESTIGATIONS 16
3.5.1 PHASE I 16
3.5.2 PHASE II 17
3.5.3 GENERAL FINDINGS 17
3.5.4 FATE AND TRANSPORT ANALYSIS 19
3.5.5 ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT 19

4.0 SAMPLE ANALYSIS/VALIDATION 19

4.1 LABORATORY DATA 20
4.2 OPERATING PROCEDURES 21
4.2.1 SAMPLE COLLECTION 21
4.2.2 QA/QC SAMPLES 22
4.2.3 DECONTAMINATION OF FIELD EQUIPMENT 23
4.2.4 REAGENTS/STANDARD PREPARATION 23
4.2.5 SAMPLE MANAGEMENT 23
4.3 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL 23
4.3.1 FACILITY 24
4.3.2 SAMPLE MANAGEMENT 24
4.3.3 REAGENTS/STANDARD PREPARATION 24
4.3.4 TEST METHODS 24
4.4 LABORATORY QA/QC PROCEDURES 25
4.5 DATA MANAGEMENT 26
4.5.1 DATA MANAGEMENT SYSTEM 26
4.5.2 FIELD LOGS 26
4.5.3 CHAIN OF CUSTODY 27
4.5.4 SAMPLE MANAGEMENT 27
4.5.5 INVENTORY PROCEDURES 28
4.6 DATA VALIDATION 31

5.0 NATURE AND EXTENT OF CONTAMINATION 32

5.1 A-ZONE 33
5.1.1 NATURE OF CONTAMINATION 33
5.1.2 EXTENT OF CONTAMINATION 33
5.2 B-ZONE 35
5.2.1 NATURE OF CONTAMINATION 35

5.2.2 EXTENT OF CONTAMINATION 36
5.3 C-ZONE 37
5.3.1 NATURE OF CONTAMINATION 38
5.3.2 EXTENT OF CONTAMINATION 38
5.4 AIR 38
5.5 SURFACE WATER AND SEDIMENTS 38
5.6 SUMMARY 38

6.0 CONTAMINANT FATE AND TRANSPORT 39
6.1 MODELING SOFTWARE 39
6.2 MODEL DEVELOPMENT 39
6.3 DATA USED FOR MODELING 40
6.3.1 PRECIPITATION 40
6.3.2 INFILTRATION 40
6.3.3 SOIL PHYSICAL PROPERTIES 40
6.3.4 SATURATED ZONE PROPERTIES 41
6.4 NUMERICAL MODELING RESULTS 42
6.4.1 SIMULATIONS OF GROUNDWATER FLOW 42
6.4.2 SIMULATIONS OF CONSERVATIVE TRANSPORT OF COCS 42
6.4.3 CONTAMINANT PERSISTENCE 45
6.4.4 POTENTIAL ROUTES OF MIGRATION 46
6.5 SUMMARY 46

7.0 BASELINE HUMAN HEALTH RISK ASSESSMENT 46
7.1 DATA REVIEW AND EVALUATION 47
7.2 EXPOSURE ASSESSMENT 48
7.2.1 CONCEPTUAL EXPOSURE MODEL 48
7.2.2 QUANTIFICATION OF EXPOSURE 49
7.3 TOXICITY ASSESSMENT 53
7.3.1 NON-CARCINOGENIC CONSTITUENTS 53
7.3.2 CARCINOGENIC CONSTITUENTS 54
7.3.3 DERMAL EXPOSURE RISKS 54
7.4 RISK CHARACTERIZATION 54
7.4.1 EXPOSURE QUANTIFICATION 55
7.4.2 RISK CHARACTERIZATION METHODOLOGY 55

7.4.3 HEALTH RISKS FOR SITE 55
7.4.4 UNCERTAINTIES 56
7.5 ECOLOGICAL RISK ASSESSMENT 57

8.0 SUMMARY 57

9.0 REFERENCES 59

TABLES

I-2-1 GROUNDWATER MONITORING WELL INFORMATION
I-3-1 CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
I-3-2 CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER
I-3-3 WELL CONSTRUCTION DETAILS (PHASE I)
I-3-4 WELL CONSTRUCTION DETAILS (PHASE II)
I-3-5 SOIL SAMPLE ANALYTICAL RESULTS – ORGANICS (PHASE I)
I-3-6 SOIL SAMPLE ANALYTICAL RESULTS FOR WELL BORINGS – ORGANICS (PHASE II)
I-3-7 SOIL SAMPLE ANALYTICAL RESULTS – METALS (PHASE I)
I-3-8 SOIL SAMPLE ANALYTICAL RESULTS FOR WELL BORINGS – METALS (PHASE II)
I-3-9 SOIL CHARACTERISTICS (PHASE I)
I-3-10 SOIL CHARACTERISTICS (PHASE II)
I-3-11 SOIL SAMPLE ANALYTICAL RESULTS FOR SOIL BORINGS – ORGANICS (PHASE II)
I-3-12 SOIL SAMPLE ANALYTICAL RESULTS FOR SOIL BORINGS – METALS (PHASE II)
I-4-1 SUMMARY OF EPA TEST METHODS FOR PRIMARY COPCS
I-4-2 SAMPLE CONTAINER SPECIFICATIONS
I-4-3 SUMMARY OF HOLDING TIME REQUIREMENTS
I-4-4 SUMMARIES OF LABORATORY ANALYSIS EQUIPMENT CALIBRATION PROCEDURES AND QC MEASURES
I-4-5 TARGET COMPOUNDS FOR METHODS 504.1, 8151A, AND 8260b
I-4-6 SUMMARY OF QC REQUIREMENTS
I-4-7 INTERNAL STANDARDS (I.S.) FOR METHOD 8260b
I-4-8 SURROGATES FOR METHODS 504.1, 8151A, AND 8260b
I-4-9 DATA REVIEW QUALIFIERS AND DESCRIPTORS
I-4-10 DATA MANAGEMENT SYSTEM QA/QC FIELDS
I-4-11 LABORATORY DATA VALIDATION QUALIFIER NOTES
I-7-1 COPCS FOR THE BROWN & BRYANT SUPERFUND SITE
I-7-2 95-PERCENT UCL CONCENTRATIONS OF SOIL COPCS

I-7-3 CURRENT ON-SITE AVERAGE CONCENTRATIONS OF COPCS IN GROUNDWATER

I-7-4 MODELED MAXIMUM, 30-YEAR AVERAGE CONCENTRATIONS OF COPCS IN GROUNDWATER

I-7-5 CALCULATED SOIL COPC-SPECIFIC VOLATILIZATION ATTENUATION FACTORS

I-7-6 CALCULATED ON-SITE COMMERCIAL/INDUSTRIAL INDOOR AIR CONCENTRATIONS

I-7-7 CALCULATED OFF-SITE INDOOR AIR CONCENTRATIONS

I-7-8 MODELED OUTDOOR AIR CONCENTRATIONS

I-7-9 COPC-SPECIFIC REFERENCE DOSE (RfD) VALUES

I-7-10 COPC-SPECIFIC CANCER SLOPE FACTORS (CSFS)

I-7-11 RME EXPOSURE SCENARIO RECEPTOR EXPOSURE PARAMETERS

I-7-12 CENTRAL TENDENCY EXPOSURE SCENARIO RECEPTOR EXPOSURE PARAMETERS

I-7-13 CALCULATED COPC-SPECIFIC DOSE ABSORBED (DA) FROM DERMAL CONTACT WITH B-ZONE GROUNDWATER

I-7-14 DERMAL ABSORPTION FACTORS (ABS)

I-7-15 SUMMARY OF HEALTH RISK CURRENT SITE CONDITIONS – REASONABLE MAXIMUM EXPOSURE SCENARIOS

I-7-16 SUMMARY OF HEALTH RISK CURRENT SITE CONDITIONS – CENTRAL TENDENCY EXPOSURE SCENARIOS

I-7-17 SUMMARY OF HEALTH RISK FUTURE SITE CONDITIONS – REASONABLE MAXIMUM EXPOSURE SCENARIOS

I-7-17 SUMMARY OF HEALTH RISK FUTURE SITE CONDITIONS – CENTRAL TENDENCY EXPOSURE SCENARIOS

FIGURES

I-1 SITE VICINITY AND THREE-DIMENSIONAL VIEW OF THE TOPOGRAPHIC MAP OF ARVIN

I-2 SITE LOCATION MAP

I-3 WELL LOCATIONS AND SITE PLAN

I-4 CITY WELL LOCATIONS

I-5 HISTORICAL SITE RELEASE AREAS

I-6 DESIGNATION OF THE SOIL LAYERING SYSTEM

I-7 ESTIMATED EXTENT OF A-ZONE AQUIFER

I-8 DRILLER'S LOG FOR CITY WELL NO.1

I-9 WELL INSTALLATIONS BY COMPANY

I-10 STRATOGRAPHIC DETAILS FOR THE A-ZONE AND THE B-ZONE

I-11 GENERALIZED PIEZOMETRIC SURFACE A-ZONE

I-12 GENERALIZED PIEZOMETRIC SURFACE B-ZONE
I-13A 1,2-DCP IN GROUNDWATER (A-ZONE)
I-13B 1,2,3-TCP IN GROUNDWATER (A-ZONE)
I-13C DBCP IN GROUNDWATER (A-ZONE)
I-13D EDB IN GROUNDWATER (A-ZONE)
I-13E CHLOROFORM IN GROUNDWATER (A-ZONE)
I-13F DINOSEB IN GROUNDWATER (A-ZONE)
I-14A 1,2-DCP IN GROUNDWATER (B-ZONE)
I-14B 1,2,3-TCP IN GROUNDWATER (B-ZONE)
I-14C DBCP IN GROUNDWATER (B-ZONE)
I-14D CHLOROFORM IN GROUNDWATER (B-ZONE)
I-14E DINOSEB IN GROUNDWATER (B-ZONE)
I-15 AREAL DISTRIBUTION OF CONTAMINATES IN B-ZONE GROUNDWATER
I-16A CROSS SECTION OF THE ALTERNATIVE CONCEPTUAL HYDROGEOLOGIC MODEL 1
I-16B CROSS SECTION OF THE ALTERNATIVE CONCEPTUAL HYDROGEOLOGIC MODEL 2

APPENDICES

I-A PRELIMINARY FATE AND TRANSPORT ANALYSIS REPORT
I-B BASELINE HUMAN HEALTH RISK ASSESSMENT REPORT
I-C AUTOMATED DATA REVIEW CRITERIA
I-D BIOLOGICAL CONSTRAINTS ANALYSIS REPORT
I-E TOXICITY PROFILES

EXECUTIVE SUMMARY FOR THE REMEDIAL INVESTIGATION

This report presents the findings of a remedial investigation/feasibility study for Operable Unit No. 2 (OU-2) at the former Brown & Bryant (B&B) facility (hereinafter referred to as "the Site") located at 600 South Derby Street in Arvin, California. This report is presented in two parts. The remedial investigation (RI) is presented as Part I and the feasibility study (FS) of remedial alternatives is presented as Part II.

PART I - REMEDIAL INVESTIGATION

The objective of the remedial investigation (RI) is to assess the spatial extent of chemicals of concern (COCs) that may be present at the Site and in its vicinity that may have resulted from historical uses of the site. This RI report has been prepared for the Operable Unit No. 2 (OU-2) investigation, and includes an investigation of the B-zone groundwater, a comprehensive summary of work previously conducted at the Site for the overlying A-zone groundwater (Operable Unit No. 1 [OU-1]), and known information for the underlying C-zone groundwater.

The focus of the OU-2 RI was to delineate the impacted subsurface soil from the base of the first water-bearing unit (A-zone groundwater) to the second water-bearing unit (B-zone groundwater) located approximately 70 to 140 feet below ground surface (bgs) and the B-zone groundwater located below 140 feet bgs. One observation well extending deeper than 300 feet bgs in the C-zone was also considered in this OU-2 RI, as were the analytical results for groundwater samples collected from this well.

IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The Site was a pesticide reformulation and custom application facility from 1960 to 1989. In 1981, the facility was licensed under the Resource Conservation and Recovery Act (RCRA) as a hazardous waste transporter. Contamination of soil and groundwater resulted primarily from facility operations and maintenance practices, including spills and leaks from a surface pond and sumps at the Site. Previous investigations focused on OU-1, which is defined as the surface soil, the subsurface soil to the first water-bearing unit (A-zone soils), and the first water-bearing unit located approximately 65 to 70 feet bgs (A-zone groundwater). These investigations were documented by the U.S. Environmental Protection Agency (USEPA) in the OU-1 *Remedial Investigation/Feasibility Study Report* dated May 28, 1993 (USEPA, 1993a). The seven COCs identified during the OU-1 investigation were the following:

- Chloroform;
- 1,2-dibromo-3-chloropropane (DBCP);
- 1,2-dichloropropane (1,2-DCP);
- 1,3-dichloropropane (1,3-DCP);
- 1,2,3-trichloropropane (1,2,3-TCP);
- Ethylene dibromide (EDB); and
- Dinoseb.

Some of the previous and the most recent investigations (Phase I and Phase II investigations) were focused on OU-2. The OU-2 investigations included the following parts:

- Evaluation of data relating to the B-zone and the OU-2 RI,
- Investigation of 18 additional groundwater monitoring wells (11 in the B-zone), and
- Drilling of three shallow soil borings for soil sampling to collect data for the health risk assessment.

These data have been used in the identification of OU-2 COCs and the characterization of the B-zone groundwater conditions. The COCs identified in OU-2 are the same as those identified in OU-1.

EXTENT OF CONTAMINATION

Distribution of the COCs within the B-zone soil is likely related to transported material from the A-zone. As contaminants are transported to the aqueous phase, some likely remain in the soil pores and are detected in soil samples. This explains the presence of isolated small concentrations of dinoseb and other COCs. The only noticeable concentration of dinoseb above the detection limit is reported for well PWB-7 in the southeast portion of the Site. Other reported values are below the detection limit for dinoseb and less than 10 micrograms per kilogram (µg/kg) for 1,2-DCP.

In the saturated B-zone, February 2003 data show that six of the seven COCs were detected at various concentrations; 1,3-DCP, however, was not detected at the Site. The COCs with the greatest spatial extent and concentrations were 1,2-DCP and 1,2,3-TCP, similar to the A-zone (Figures I-14A and I-14B).

FATE AND TRANSPORT ANALYSES

A groundwater fate and transport analysis was completed for the Site using the T2VOC modeling code developed by Lawrence Berkeley National Laboratory (Falta et al., 1995). The two-dimensional, cross-sectional numerical model was used to simulate a northeast-southwest cross section across the Site.

April 1992 was used as the starting time reference for all simulations where a 100-year period was considered for chemicals fate and transport. The results of these analyses indicate that concentrations of all seven COCs within the B-zone are likely to be less than their respective maximum contaminant levels (MCLs) after 20 years (i.e., after 2012) in the area between the Site boundary and Arvin city well No. 1.

The simulation results also show that the COCs in the saturated B-zone will persist for a maximum of 10 years in the absence of infiltration from the upper contaminated zones. This analysis is to assess the impacts within the B-zone if the A-zone contamination was mitigated to the point that it does not further impact the B-zone. However, if the A-zone is not remedied, contaminant infiltration from the upper zones is observed to persist for more than 100 years. Over this period the upper zones will continue to load contaminants to the B-zone. Even under this condition, concentrations of COCs reaching Arvin city well No. 1 in the B-zone are estimated to be below their respective MCLs with or without contribution from the unsaturated zone.

RISK ASSESSMENTS

A baseline human health risk assessment (BHHRA) was performed to evaluate the potential threat to humans and the environment from metals and volatile organic compounds (VOCs) found in groundwater

and soil in the absence of any remedial action. Under both current and future Site conditions, the risk assessment evaluated potential carcinogenic and non-carcinogenic effects on five receptors:

- On-site maintenance worker,
- On-site commercial/industrial worker,
- Off-site adult resident,
- Off-site child resident, and
- Off-site commercial/industrial worker.

The risk assessment performed making conservative assumptions, shows that current site conditions do not pose significant risk to receptors. However, additional off-site migration of COCs may result in a significant increase in potential risk associated with indoor air exposures because of the absence of any cap off-site. Off-site migration of the plumes in the A-zone beyond their current extent is not likely because of the limited extent of the saturated A-zone which is the main container and carrier of the COCs. Off-site migration of the plumes in the B-zone aquifer beyond their current extent are not expected to increase risk because of the significant dilution that is estimated to occur in this zone as well as the depth of the groundwater in this zone.

Under the current exposure scenario, the carcinogenic risks (ILCR) for all receptors are within the 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000) risk management goal stipulated by the USEPA (1990b) However, the risk for the on-site commercial industrial worker exceeds the “de minimis” risk level of 1 in 1,000,000, typically applied by Cal/EPA, if the cap is disturbed. The projected risks to this receptor are associated with potential indoor air exposures to contaminants originating from the underlying soils and groundwater.

The data do not indicate any ecological risk from site conditions.

List of Acronyms

%RPD = Relative Percent Difference
%RSD = Percent Relative Standard Deviation
1,2,3-TCP = 1,2,3-Trichloropropane
1,2-DCP = 1,2-Dichloropropane
1,3-DCP = 1,3-Dichloropropane
4,4-DDE = dichloroethylene
ACSD = Arvin Community Services District
ARARs = Applicable or Relevant and Appropriate Requirements
AscI = AscI Corporation
ASTM = American Society for Testing and Materials
B&B = Brown & Bryant
bgs = below ground surface
BHHRA = Baseline Human Health Risk Assessment
BRA = Baseline Risk Assessment
CAD = Computer-Aided Design
Cal/EPA = California Environmental Protection Agency
Canonie = Canonie Environmental Services Corporation
CDFG = California Department of Fish and Games
CDPR = California Department of Pesticides Regulation Endangered Species Project
^{0}C = Celsius degrees
CEM = Conceptual Exposure Model
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CERES = California Environmental Resource Evaluation System
cm/sec =centimeters per second
cm^2/sec = square centimeters per second
CNDDB = California Natural Diversity Data Base
COCs = Contaminants of Concern
COPCs = Constituents of Potential Concern
CSFs = Cancer Slope Factors
CT = Central Tendency
DBCP = 1,2-Dibromo-3-chloropropane
DDT = Dichlorodiphenyltrichloroethane
DHS = Department of Health Services
DMS = Data Management System
DQOs = data quality objectives
DTSC = Department of Toxic Substances Control

E&E = Ecology & Environmental
EDB = Ethylene dibromide, also called 1,2-Dibromoethane
EDDs = Electronic Data Deliverables
ELAP = Environmental Laboratory Certification Program
ESRI ArcView GIS™ = GIS software
F = Fahrenheit degrees
FS = Feasibility Study
ft/ft = foot per foot
gpm = gallon per minute
Hargis = Hargis and Associates, Inc.
HEAST = Health Effects Assessment Summary Tables
HI = Hazard Index
HQ = Hazard Quotient
IC = Industrial Compliance
ILCR = Incremental Lifetime Cancer Risk
in/yr = inches per year
IRIS = Integrated Risk Information System
ISCST3 = Industrial Source Complex - Short Term 3
J = Estimated value (laboratory qualifier)
Kd = Distribution coefficient
K_h = horizontal hydraulic conductivity
KJ = Kennedy /Jenks Consultants
K_v = vertical hydraulic conductivity
m^2 = square meter
m^3/kg = cubic meters per kilogram of soil
MCL = Maximum Contaminant Level
MCPP = 2-(2-Methyl-4-chlorophenoxy) propionic acid
mg/kg = milligram per kilogram
MK = Morrison Knudsen Corporation
mph =miles per hour
MULTIMED = Multimedia exposure assessment model
µg/L = micrograms per liter
NCP = National Contingency Plan
NOAA = National Oceanic Atmospheric Administration
NPL = National Priorities List
OEHHA = Office of Environmental Health Hazard Assessment
OU-1 = Operable Unit No.1
OU-2 = Operable Unit No.2

PID = photoionization detector
PRPs = Potentially Responsible Parties
PSBS = Pacific Southwest Biological Services
PWA = Monitoring wells installed in A-zone
PWB = Monitoring wells installed in B-zone
QA = Quality Assurance
QC = Quality Control
RCRA = Resource Conservation and Recovery Act
RfDs = Reference Dose Levels
RI = Remedial Investigation
RME = Reasonable Maximum Exposure
ROD = Record of Decision
SARA = Superfund Amendments and Reauthorization Act
SOP = standard operating procedure
SUMMERS = Computer models used for fate and transport analysis
SVE = soil-vapor extraction
SVOCs = Semi-Volatile Organic Compounds
T2VOC = modeling code developed by Lawrence Berkeley National Laboratory
TAT = Technical Assistance Team
UCL = Upper Confidence Limit
USACE = United States Army Corps of Engineers
USEPA = U.S. Environmental Protection Agency
USEPA SW846 = United States Environmental Protection Agency Solid Waste
USGS = U.S. Geological Survey
UST = Underground Storage Tank
VLEACH = one-dimensional finite-difference vadose zone leaching model
VOCs = Volatile Organic Compounds

PART I

Remedial Investigation

Operable Unit No. 2
Brown & Bryant Superfund Site
Arvin, California

1.0 INTRODUCTION

Part I of the *Remedial Investigation/Feasibility Study of Remedial Alternatives* report presents the findings of a remedial investigation (RI) for Operable Unit No. 2 (OU-2) at the former Brown & Bryant (B&B) facility (hereinafter referred to as "the Site"). The former B&B facility is a U.S. Environmental Protection Agency (USEPA) Superfund site located at 600 South Derby Street in the City of Arvin, California.

All work reported herein has been conducted in general accordance with plans approved by the United States Army Corps of Engineers (USACE) (Section 9), the USEPA guidance document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final* (USEPA, 1988), and the National Contingency Plan (NCP) (Title 40 Code of Federal Regulations, Part 300.430 [40 CFR 300.430]).

1.1 PURPOSE

The purpose of this RI report is to provide a summary of the results of data collection activities, the nature and extent of the contamination, a fate and transport analysis of contaminants of concern (COCs), and a baseline ecological and human health risk assessment. A comprehensive overview of the RI is provided in supporting documents referenced in this part of the report. The combination of this RI report and its supporting site-related documents acts as a tool for decision-makers involved with the remediation process (USEPA, 1988). The data collected during the RI may influence the development of remedial alternatives presented in the feasibililty study (FS).

1.2 OBJECTIVE

The objective of the RI is to assess the spatial extent of COCs that may be present at the Site and in its vicinity that may have resulted from historical uses of the Site. This RI report has been prepared for the operable unit OU-2 investigation, which includes an investigation of the B-zone groundwater, a comprehensive summary of work previously conducted at the Site for the overlying A-zone groundwater (Operable Unit No. 1 [OU-1]), and known information for the underlying C-zone groundwater.

1.3 ORGANIZATION OF REPORT

This RI report contains the following nine sections:

Section 1 – Introduction: Presents the purpose and objective of the report and provides background information about previous studies.

Section 2 – Site Background: Describes initial investigative studies.

Section 3 – Site Investigations: Summarizes previous site investigations.

Section 4 – Sample Analysis/Validation: Details procedures used for collecting, analyzing, and reporting the data.

Section 5 – Nature and Extent of Contamination: Discusses possible sources of and contributing factors to groundwater contamination.

Section 6 – Contaminant Fate and Transport: Describes preliminary modeling of contaminant fate and transport.

Section 7 – Baseline Risk Assessment: Provides an overview of pertinent evaluations and assessments.

Section 8 – Summary: Provides a brief summary of the OU-2 RI investigation results.

Section 9 – References: Documents literature cited in text.

Part II provides a description of the FS and contains the following sections:

Section 1 – Introduction: Presents the purpose of the feasibility study of remedial alternatives and background information for the study.

Section 2 – Identification and Screening of Technologies: Presents the technologies that may be viable for conditions at OU-2 and discusses the possible applicability of the technology. Applicable or Relevant and Appropriate Requirements (ARARs) are identified and remedial action goals are discussed.

Section 3 – Development and Discussion of Screened Alternatives: Identifies the screened alternatives and discusses them in light of the nine EPA criteria—overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; cost; State acceptance; and, community acceptance.

Section 4 – References: Documents literature cited in the text.

2.0 SITE BACKGROUND

2.1 SITE CHARACTERISTICS

2.1.1 *SITE LOCATION*

The Site is located at 600 South Derby Street in the City of Arvin, California, approximately 18 miles southeast of the City of Bakersfield (Figures I-1 and I-2). Arvin is primarily an agricultural community located in a light industrial and commercial area (USEPA, 1993a).

To the west of the Site is the residential community of Arvin. Two schools (Gospel Tabernacle of Arvin and Stepping Stones Child Care Center) and a park (Bear Mountain Recreation and Park Center) are located within 0.5 mile of the Site. The Morning Star Pre-School, located at 416 North Hill Street, is located within 1 mile of the Site (USEPA, 1993a).

2.1.2 *SITE FEATURES*

The Site is currently vacant and secured by a chain-link fence. An engineered bituminous pavement covers the entire Site and acts as a Resource Conservation and Recovery Act (RCRA) cap in the Site's southern portion and as a non-RCRA cap in the Site's northern portion. Structures currently present within the fenced area are an aboveground storage tank (Tank UN-32), groundwater monitoring wells, a warehouse, and an open metal shed, as shown on Figure I-3 (Panacea, 2003).

In total, 54 groundwater monitoring, extraction, and injection wells on-site and on the adjoining properties (off-site) have been used to collect site information. Locations and descriptions of these wells are presented in Table I-2-1. Public wells within 3 miles of the Site provide drinking water to the City of Arvin (Figure I-4).

2.1.3 *SITE OPERATIONAL HISTORY*

The Site operated as a pesticide reformulator and custom applicator facility from 1960 to 1989. This facility formulated agricultural chemicals, including pesticides, herbicides, fumigants, and fertilizers. In 1981, the B&B facility was licensed under RCRA as a hazardous waste transporter (USEPA, 1993a).

Contamination of soil and groundwater resulted from facility operations and maintenance practices that included chemical spills and leaks from a surface wastewater pond and sumps at the Site. The largest releases on-site were from a waste pond, a sump area, and a dinoseb spill area (Figure I-5) (USEPA, 1993a).

The waste pond in the southwest portion of the Site was originally excavated as an unlined earthen pond in 1960. The pond was used to collect runoff water from the yard and two sumps (since excavated). The pond was also used to collect rinse water from rinsing tanks used for fumigants. Excess pond water and rainwater runoff also collected in a topographically low area to the east and south of the pond. In addition, ponded water from precipitation and irrigation from the east has occasionally breached the berm in the southeast corner of the pond and drained into the pond. The pond was double-lined with a synthetic liner in November 1979 (USEPA, 1993a).

In 1960, an unlined earthen sump was constructed in the center of the Site. The sump was used to collect washwater from a pad where equipment and tanks used for liquid fertilizers and fumigants were washed. Water from the sump was drained to the pond through an underground pipeline. In 1980, the unlined sump was replaced with two double-lined sumps (USEPA, 1993a).

Dinoseb was stored in a smaller tank storage area along the eastern fence, just north of the pond. In 1983, there was a significant dinoseb spill in this area. As a result, the soil and groundwater underlying this portion of the Site have been reported to contain the highest concentrations of dinoseb. The USEPA excavated highly contaminated soil from this area in the mid-1990s (USEPA, 1993a).

Between 1983 and 1988, investigations were conducted at the Site to evaluate the nature and extent of chemicals in the soil and groundwater. Limited cleanup work began under the supervision of the California Department of Health Services (DHS). In 1989, the B&B facility ceased operations (USEPA, 1993a).

2.1.4 *SITE REGULATORY HISTORY*

In May 1983, the DHS inspected the Site to determine compliance with hazardous waste laws. At the time of the inspection, several violations involving storage, disposal, and transportation of hazardous waste were noted. Following the inspection, the DHS directed B&B to correct the violations and conduct a site assessment. Between 1983 and 1988, B&B conducted site investigations under the supervision of DHS (USEPA, 1993a).

The Site was listed by USEPA on the National Priorities List (NPL) of Superfund sites on October 4, 1989, and in that same year, all operations at the Site ceased. Subsequently, various emergency and removal actions were initiated to minimize (or eliminate) immediate threats to human health and the environment. The principal threats that formed the basis for USEPA's listing of the Site on the NPL were the presence of groundwater contamination, which could potentially migrate to Arvin drinking water wells, and the potential for exposure to highly contaminated soils on site. In March 1990, EPA's "Emergency Response Section" conducted a site assessment and subsequently performed various tasks to treat the most contaminated on-site soils and remove a number of on-site structures. In December 1990, the USEPA began an RI/FS for Operating Unit 1 (OU-1) at the Site (USEPA, 1993a).

2.2 PHYSICAL CHARACTERISTICS OF SITE AND SITE VICINITY

2.2.1 *ENVIRONMENTAL SETTING AND SURFACE FEATURES*

Arvin is situated in the Tulare River basin on the southeastern edge of California's Central Valley Mountains. Arvin has an average elevation of 440 feet above sea level (U.S. Geological Survey [USGS], 1992).

The Site is topographically flat with only a slight slope towards the south. The Site covers approximately 5 acres and is bordered on the east by irrigated agricultural fields, on the north and south by food packing and shipping facilities, and on the west by South Derby Street, which is a paved two-lane highway separating the Site from a residential area to the west (USEPA, 1993a).

2.2.2 *METEOROLOGY*

The climate in Arvin, as well as in the Great Central Valley, is Mediterranean type (dry summers). Average climatic data for the City of Bakersfield were obtained from the National Weather Service (provided by the National Oceanic Atmospheric Administration) and are consistent with data obtained from weather stations near Arvin (USEPA, 1993a).

Precipitation occurs mainly from November through April, with average annual precipitation ranging from 5 to 10 inches. The mean annual rainfall over the past 30 years reported from meteorological data was 5.87 inches. The temperature range at the Site during the winter is between 40 Fahrenheit (°F) to 50°F and in the summer months is between 70°F and 90°F . The prevailing wind direction for most of the year is to the northwest. However, in February, November, and December, the prevailing wind direction is to the east/northeast. Wind speeds average 5 to 8 miles per hour (mph). Sustained winds reach maximum speeds between 30 and 50 mph, while peak gusts reach maximum speeds between 40 and 60 mph (USEPA, 1993a).

2.2.3 *SURFACE WATER HYDROLOGY*

Precipitation and agricultural irrigation are the two main sources for surface water in Arvin. Natural processes, such as precipitation and infiltration, were contributing factors in the spread of the contamination beneath the Site prior to the installation of the RCRA and non-RCRA caps.

Surface water runoff from irrigation of adjacent agricultural land to the east runs onto the Site and sometimes ponds on the ground surface of the Site. In some locations this surface water flow occurs towards the south and southeast off the site. During site operation, if contaminated soil migrated off-site to the south and southeast, it would potentially contribute to contamination of the subsurface groundwater system in that area. During wet seasons, some ponding of rainwater has been observed on the non-RCRA cap in the northern portion of the Site. This ponding is due to the uneven topography of the Site and the constructed grade of the engineered non-RCRA cap in this area.

There is no known contribution of contamination to the adjacent or nearby surface water bodies from this Site. Following the mitigation measures implemented as part of OU-1 remedial action, the risk of off-site transport of contaminated sediments is significantly reduced.

2.2.4 *GEOLOGY*

2.2.4.1 General Geologic Setting

The Site is located within the southernmost portion of the San Joaquin Valley at an elevation of approximately 440 feet above mean sea level. The San Joaquin Valley is a broad structural downwarp bordered on the east by the granitic complex of the Sierra Nevada and on the west by the complexly folded and faulted Coast Ranges. The top of the basement complex of the Sierra Nevada block dips gently westward beneath the valley. Late Cenozoic continental deposits form the floor of the valley and attain a maximum thickness of 16,000 feet near the south edge of the valley in the Site vicinity (Poland and Lofgren, undated).

The continental deposits in the Site vicinity are primarily of fluvial (river) origin but contain extensive interbeds of lacustrine (lake) origin. The fluvial deposits consist of lenticular bodies of silt, sand, and gravel deposited in stream channels, and sheet-like bodies of silt and clay laid down on flood plains by slow moving overflow waters.

The alluvial deposits beneath the Site vicinity are divided into three units: (1) an upper unit of clay, silt, sand, and gravel (mostly alluvial-fan), and flood-plain deposits of heterogeneous character; (2) a middle unit consisting of a relatively impermeable diatomaceous lacustrine clay (the Corcoran Clay member of the Tulare Formation); and (3) a lower unit of clay, silt, sand, and some gravel, in part lacustrine in origin. The upper and middle units are Pleistocene age, and the lower unit is of Pleistocene and Pliocene age.

The Site is located approximately 2.4 miles northwest of the White Wolf Fault. The last activity along this fault was in 1952 and resulted in a magnitude 7.5 earthquake (the Arvin-Tehachapi earthquake) that caused 4.2 feet of uplift in the Tehachapi Mountains (Jennings, 1994).

2.2.5 *HYDROGEOLOGY*

The Site hydrogeology has been divided into three zones (A-zone, the B-zone, and the C-zone) with respect to site conditions.

The A-zone begins at the ground surface and extends vertically to the bottom of the first saturated zone. Where this saturated zone is absent, the separation between the A-zone and the B-zone is estimated at 85 feet bgs (below ground surface). The B-zone begins at the bottom of the A-zone and ends at the top of the Corcoran Clay Member. The C-zone begins at the top of this clay member and its thickness is several hundred feet to over 1,000 feet. Figure I-6 presents a schematic diagram of the naming conventions used in this report for zone designations.

2.2.5.1 A-Zone

The alluvial soils beneath the Site are comprised of alternating layers and mixtures of unconsolidated sand, silt, and clay to a depth of approximately 300 feet. These soils have been divided into two zones: the A-zone and the B-zone. The A-zone includes unsaturated soil to a depth of between 65 to 85 feet bgs and includes the first water-bearing unit, the A-zone groundwater. The base of the A-zone is a thin sandy clay layer at depths between approximately 75 to 85 feet bgs. The soils in this zone generally consist of silty-fine sand to fine-sandy silt. A 5- to 10-foot-thick layer of calcium carbonate-rich clay is often encountered between 40 and 50 feet bgs (Figure I-10). Clean, well-graded sand lenses and thin seams of silty clay occur locally within the soil above and below this clay. With some exceptions, the soils beneath the Site are generally thinly interbedded, with textural changes occurring every few vertical inches. These textural changes also occur laterally. Figure I-7 depicts the extent of the A-zone in the vicinity of the Site.

The depth to the saturated A-zone varies between 65 and 75 feet bgs according to recent water level measurements in the monitoring wells within and adjacent to the Site. The A-zone groundwater occurs beneath the entire site, but the clay layer at the base of the zone pinches out (becomes thinner) between 500 and 600 feet south of the Site. The layer is also not found within 200 feet east and 300 feet west of the Site. The extent of the A-zone is estimated on the basis of this geological interpretation as shown on Figure I-7.

The saturated thickness of the A-zone groundwater ranges from 0 to 10 feet and varies seasonally as water level fluctuates in this zone. Groundwater in the A-zone flows in a generally southwesterly direction. Periodic and localized changes in flow directions occur beneath the Site. Several groundwater depressions exist south of the Site toward which groundwater flow occurs. These groundwater depressions provide pathways for vertical flow of groundwater from the A-zone into the B-zone. The soils under the A-zone, and at the top of the B-zone, are unsaturated to a depth of approximately 140 feet (Elevation ≈286), where the top of the saturated B-zone occurs.

Slug test results suggest that a yield of less than 100 gallons per day can be expected for wells in the A-zone. Aquifer testing of three of the on-site extraction wells showed a groundwater yield of approximately ¼ gallon per minute (gpm) or 360 gallons per day (Morrison Knudsen Corporation [MK], 1999a). The wells tested during this assessment are located in a portion of the Site that typically yields low water quantities. Based on qualitative observations made during well purging as part of quarterly sampling, it is estimated that wells south of the Site have significantly greater yield. This is probably due to the lateral transition and pinching of the saturated A-zone to the south, which involves gradual increase in permeability of the saturated material to the point that the A-zone clay layer is no longer effective in maintaining a perching condition.

The horizontal groundwater velocity in the A-zone has been estimated at 53 feet/year by previous investigators (Ecology & Environment [E&E], 1992). An average hydraulic conductivity of 1.6×10^{-4}, an effective formation porosity of 26 percent, and a groundwater gradient of 0.034 were used to calculate a groundwater pore velocity of 0.14 feet/day or 53 feet per year. The average hydraulic conductivity values were obtained from a series of slug tests, which were considered accurate within an order of magnitude (E&E, 1992). However, it was acknowledged that the groundwater gradient is not consistent in different

areas of the site based on water table maps. A low yield of 0.025 to 0.1 gpm was reported for wells AP-2 and EPAS-2, respectively. The low yield of wells and the relatively high hydraulic conductivity values obtained from the slug test was not explained (E&E, 1992).

Based on interpretation of recent data (Appendix A), the horizontal velocity in the A-zone is estimated to be smaller than 53 feet/year, on the order of a few feet per year. Locally, especially south of the site, the velocity may be higher because the horizontal component of the piezometric potential gradient increases near the groundwater depressions (Panacea, 2003b).

2.2.5.2 B-Zone

The B-zone includes unsaturated soil beneath the A-zone and the second-water-bearing unit (B-zone groundwater) starting at 140 to 165 feet bgs. The base of the B-zone is at the top of the Corcoran Clay located at a depth of approximately 300 feet bgs. The thickness of the Corcoran Clay is estimated to be at least 27 feet based on the driller's well log for Arvin city well No. 1 (Figure I-8). The alluvial soil types within the B-zone are similar to those encountered within the A-zone and consist of mixtures of clay, silt, sand, and gravel layers. The sandy layers in the B-zone are thicker and more extensive than in the A-zone.

Within the B-zone there is a clay layer that is continuous over the investigated area; it varies in thickness from 5 to 25 feet. The top of this clay layer is encountered at a depth of approximately 180 feet bgs in the south (near the city of Arvin Water Supply Well) and at depth of about 200 feet to the north. The presence of this clay layer has been confirmed in well logs from the water supply wells off site; however, the geologic correlation between the B-zone clay layer and clay layers identified in the water supply wells has not been geologically confirmed.

The B-zone groundwater comprises a series of water-bearing units. All of the wells in the B-zone to date were installed in the water-bearing units located between 140 and 180 feet bgs. The direction of flow in these units is generally toward the south to southwest, with a relatively flat gradient of approximately 0.0004 foot per foot (ft/ft). Transmissivity of these units has been estimated to be 2.66 square centimeters per second (cm^2/sec) and the hydraulic conductivity is estimated to be about 8.7x10-3 centimeters per second (cm/sec). The average groundwater velocity is calculated to be 15 feet/year (E&E, 1993a). This velocity calculation assumes an effective porosity value of 0.25.

It is possible that there is localized groundwater mounding above a discontinuous clay unit near the top of this aquifer. This may influence the groundwater elevation readings in some of the wells that are monitored. Permeability values within the B-zone are much higher than those reported for the A-zone. Past pump tests indicate that wells screened in the B-zone could be pumped at 7 gpm (MK, 1999a, and E&E, 1993a) for an extended period.

The reason for the higher permeability of the B-zone aquifer is the abundance of sandy layers and inclusion of some gravel lenses or strings. The B-zone aquifer is essentially considered to be semi-confined, but locally may consist of several confined/unconfined aquifers, which are separated by relatively continuous clay layers of varying thickness. Within the B-zone aquifer there is a clay layer that is assessed to be continuous and varying in thickness from 5 to 25 feet. The top of this clay layer is encountered at a depth of about 180 feet to the south (near the city of Arvin Water Supply Well) and at a depth of about 200 feet to the north. This clay layer thickens to the north. Below this clay layer, a sandy layer forms a semi-confined aquifer above the Corcoran Clay. Above this clay layer, the B-zone aquifer is mostly unconfined except in certain areas in the vicinity of the Site. Recent drilling has confirmed the presence of several water-bearing zones near the top of this aquifer southeast of the Site.

2.2.5.3 C-Zone

Typically, the C-zone consists of interbedded clay and sand layers. Two clay layers are reported to exist at depths of approximately 275 to302 feet bgs and 322 to 341 feet bgs in the city well log. These layers appear in other well logs outside the area of investigation at similar depth interval. This clay unit is believed to be part of the Corcoran Clay member. Below this clay layer there is a thick sandy sequence that extends from approximately 302 –to 322 feet bgs and again from 341 to –530 feet bgs. These sandy units form the main water supply aquifer in the region.

2.2.6 *ECOLOGY*

The following subsections describe the ecology of the Site.

2.2.6.1 Flora

The area in the immediate vicinity of the B&B Superfund site has been characterized as containing little or no native vegetation (USEPA, 1992a). The Site is fully surfaced with a RCRA cap and a non-RCRA cap; therefore, little vegetation is found on the Site except scattered weedy vegetation occurring along the fence surrounding the Site, around the buildings and in the bare area around the railroad tracks to the west and south of the Site. This vegetation primarily consists of non-native flora including Russian thistle (*Salsola tragus*), brome grasses (*Bromus* spp.), red-stem filaree (*Erodium cicutarium*), and pineapple weed (*Matricaria matricarioides*).

2.2.6.2 Fauna

The fauna observed in the vicinity include such common and widespread species as the American crow (*Corvus brachyrhynchos*), white-crowned sparrow (*Zonotrichia leucophrys*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*) (Pacific Southwest Biological Services [PSBS], 2002).

The Site is located at the southern end of the San Joaquin Valley in the middle of a productive agricultural area. The Site is about 6 miles west of the lower slopes of the Tehachapi Mountains, where isolated patches of native vegetation and native wildlife habitat may persist. The Site is approximately 20 miles northwest of Tehachapi Mountain Park; this is the nearest dedicated open space. The Site is also approximately 29 miles southwest of the nearest segment of Sequoia National Forest (PSBS, 2002).

Vegetation cover in the valley ranges from 10 to 90 percent. There are no wetlands or surface water bodies near the Site that could be adversely impacted by the contamination or cleanup. No protected or native species were previously identified.

A review of the California Department of Fish and Game's (CDFG) California Natural Diversity Data Base (CNDDB) representatives in 1992 yielded the following results for sightings of endangered species within 5 miles of the Site (PSBS, 2002):

- 1990 – Burrowing owl (*Athene cunucularia*), 2.8 miles east-southeast of Arvin,
- 1975 – San Joaquin kit fox (*Vulpes macrotis mutica*), no location given, and
- 1935 – Blunt-nosed leopard lizard (*Gambelia silus*), 5 miles east of Arvin.

The following paragraphs briefly describe each of these species.

Burrowing owls are found in open dry grasslands, desert, and scrublands with low-growing vegetation. They feed primarily on insects but their diet also includes small lizards and mammals, birds, and carrion. The owls are small- to medium-sized and use the abandoned burrows of rodents for nesting sites. This dependency on uncultivated areas and other animals for nesting sites has put their populations at risk and dramatically reduced their historical range (California Department of Pesticides Regulation [CDPR] Endangered Species Project, 2003).

San Joaquin kit foxes hunt for rodents, rabbits, and other prey by night from dens that are typically in loose soil. Individuals may use up to 3 to 24 separate dens. Den entrances may extend into several individual tunnels and chambers reaching depths to 10 feet. Man-made structures such as culverts and pipes may also be used as dens. The CDFG has noted that the San Joaquin kit foxes live and forage in an area of 1 to 2 square miles (CDFG, 1991).

Blunt-nosed leopard lizards occur on sparsely vegetated plains, lower canyon slopes, and valley floors. Associated vegetation may include a variety of grasses, saltbush, goldenbush, and iodine brush. Blunt-nosed leopard lizards are active during the day, usually when air temperatures are between 75°F and 95°F. Most activity occurs between the months of April and early October. Food consists primarily of insects such as grasshoppers, although smaller lizards may also be consumed. Adults are approximately 3.5 to 5 inches in length from snout to vent (CDFG, 1991).

2.2.7 *HUMAN POPULATIONS*

The City of Arvin, and its vicinity, has large agricultural cash crop production areas that attract seasonal workers throughout the year. The general population varies throughout the year due to the presence of these seasonal workers. Arvin's population fluctuates between 12,956 and 17,000 with the peak occupancy occurring during the summer months. According to the 2000 Census, the population comprises 87.5 percent Hispanic and/or Latino, 11.8 percent Caucasian, and 2.5 percent other ethnic groups. Approximately 53 percent of the population is under 25 years of age (U.S. Census, Bureau, 2003).

2.2.8 *LAND USE*

There are seven classifications of land use in and around the city of Arvin:

- orchard,
- grove,
- vineyards and nurseries,
- crop land and pasture,
- residential,
- industrial,
- commercial services,
- transition area, and

- mixed urban or built-up land.

The majority of land in the area is devoted to agricultural purposes. Farms in the Arvin area grow a large variety of crops including carrots, grapes, grains, citrus fruit, and nuts (California Environmental Resource Evaluation System [CERES], 2003). Farming and related enterprises provide the primary source of employment for the community; no other major industries are located in the Arvin area.

2.2.9 *SOURCE OF DRINKING WATER SUPPLY*

The drinking water for the city of Arvin is supplied by the Arvin Community Services District. Arvin's drinking water source is groundwater from five active wells, between 300 to 700 feet deep (Arvin Community Services District [ACSD], 2001). These active wells include Arvin city wells Nos. 1, 5, 6, 8, and 9, all of which are located within less than a 1-mile radius from the Site. Arvin city well No. 1, the closest drinking water well, is located 1,700 feet south-southwest of the Site (Figure I-4).

3.0 SITE INVESTIGATIONS

The Site has been subject to several investigations to assess the nature and extent of contamination. Based on the available documents, summaries of the Site investigation are provided below and have been categorized according to their operable unit (OU-1 or OU-2).

3.1 STUDY AREA

The study area for the OU-1 investigations included surface soil, the unsaturated A-zone, and the A-zone groundwater. The A-zone includes unsaturated soils below ground surface, which may vary in thickness from 65 to 85 feet, and the first water-bearing unit, the A-zone groundwater. The depth to the saturated zone varies between 65 and 75 feet bgs, according to recent groundwater depth measurements (Panacea, 2003). The base of the A-zone is a thin sandy clay layer between 75 and 85 feet bgs. The clay layer and A-zone groundwater occur beneath the entire Site but disappear between 500 and 600 feet south of the Site, 200 feet east of the Site, and 300 feet west of the Site (Figure I-7).

The study area for the OU-2 investigation includes the unsaturated zone beneath the A-zone aquifer and the B-zone aquifer. The B-zone includes unsaturated soil beneath the A-zone and the second lowest water-bearing unit (B-zone groundwater) at 140 to 165 feet bgs. The B-zone extends to at least 250 feet bgs and ends at a clay layer (known as the Corcoran Clay) that confines the drinking water aquifer (the C-zone) beneath it. The Corcoran Clay, also locally known as the "blue clay" or the "E-Clay" is a member of the Tulare Formation and is the predominant aquitard separating the semi-confined water-bearing layers above it and the confined aquifer beneath. It is a regionally extensive lacustrine deposit of low permeability (Johnson et al., 1968) ranging in thickness from 20 feet to over 100 feet. Based on the driller's log for Arvin city well No. 1 (Figure I-8), it is estimated that the Corcoran Clay layer in the area of the Site is at least 27 feet thick.

3.2 OU-1 INVESTIGATIONS

From 1983 through 1988, B&B conducted several soil and groundwater investigations and remedial actions under DHS supervision. The most significant work included the installation of 10 monitoring wells and the removal of some heavily contaminated soil beneath the two sumps and waste pond (USEPA, 1993a).

B&B hired two engineering firms to conduct the Site investigations. During these investigations, soil and groundwater beneath the Site were investigated. Soil impacted with COCs was also removed during one of these investigations (USEPA, 1993a).

During the site investigations, on-site soils were collected and analyzed for organics and trace metals. The results of the analyses indicated high concentrations of pesticides in soil generally within the first few feet of the ground surface to greater depths in portions of the Site. The higher concentrations in the soil appeared to be located beneath the chemical handling areas that are thought to be source areas for contamination. These areas include the former sump location, the former waste pond, and the dinoseb spill area (USEPA, 1993a).

The studies served to provide information on the shallow soil and A-zone characteristics. These studies are comprehensively covered by USEPA as part of the OU-1 RI/FS document (USEPA, 1993a) and are not further detailed in this report except for the parts that may relate to the B-zone and OU-2 characterization.

Additional work was completed by others in support of the Southern Pacific Transportation Company and the Atchison, Topeka and Santa Fe Railway Company (hereinafter referred to as the potentially responsible parties [PRPs]). The groundwater and soil investigations at the Site were conducted in response to the USEPA Unilateral Administrative Order. These studies were also incorporated into the USEPA RI/FS findings (USEPA, 1993a).

3.2.1 *OU-1 RI/FS*

The USEPA prepared the RI/FS report for the Site. The RI focused on the surface soil, subsurface soil to the first water-bearing unit (A-zone soils), and the first water-bearing unit (A-zone groundwater) (USEPA, 1993a).

The USEPA issued a record of decision (ROD) that presented the selected remedial action for OU-1 at the Site (USEPA, 1993d). Subsequently, various cleanup tasks, tank removals, and waste shipments were completed. Remedial design work was completed for the OU-1 remedial action.

The selected remedy for OU-1 was consolidation of contaminated soil, installation of a RCRA/basic cap, and extraction and treatment of the A-zone groundwater. The goal of the remedial action was to prevent exposure to soil contaminated above health-based levels and to control the source of contamination to the B-zone groundwater (USEPA, 1993d).

3.2.2 *OU-1 REMEDIAL ACTION*

As required in the ROD (USEPA, 1993d), the following remedial activities were performed for OU-1.

A groundwater monitoring well completion report was prepared for the Site (MK, 1999b). Also, a closure report was prepared describing the various activities performed at the Site including groundwater, soil, and air sampling and analysis, well construction, removal, and construction activities (MK, 1999c). These activities included demolition, decontamination, and waste disposal tasks.

Excerpts from the various report descriptions of the remedial activities are presented in the following subsections.

3.2.2.1 Construction Activities

From December 28, 1998, to January 5, 1999, contaminated soil piles were compacted in the area of the proposed RCRA cap. From January 6 to March 18, 1999, all on-site concrete structures and berms were demolished except for the concrete slabs contiguous to the warehouse building. During this period, a piece of asphalt covering of 2 to 7 inches was removed, the plastic liner present in the berm was removed, and a 1,200-gallon underground storage tank (UST) was excavated and removed from the Site. Smaller structures (e.g., Tank UN-32 ancillary equipment), rails spurs, existing underground utilities, drums and vessels, and previously generated wastes were removed from the Site. Construction of the RCRA cap began on June 15, 1999, and was completed on August 31, 1999. Between July 13 and August 12, 1999, asphaltic concrete was placed over the entire Site to act as the non-RCRA cap (MK, 1999c).

3.2.2.2 Groundwater Monitoring and Remedial Studies

Four monitoring wells (MW-1, MW-2, MW-3, and MW-4) were drilled and completed (Figure I-9). Soil samples were collected during drilling of the borings for these wells. In total, 27 soil samples were collected from the deeper portions of the borings and analyzed for some or all of the following properties: soil moisture retention (ASTM D 3152), moisture content (ASTM D 4643), total organic carbon (USEPA 415.1), particle-size analysis (ASTM D 422), and effective porosity (triaxial flexible wall method) (MK, 1999b). In addition, three groundwater extraction wells were installed (EW-1, EW-2, and EW-3) at the southern portion of the proposed RCRA cap, and two injection wells were installed (IW-1 and IW-2) north of the proposed RCRA-cap area (approximately 175 feet upgradient from the extraction wells; (MK, 1999c). On Figure I-9, well locations are indicated in light blue. An aquifer test report was prepared that summarizes the results of tests conducted on the extraction and injection wells (MK, 1999a).

The objective of the aquifer tests was to characterize the shallow aquifer (A-zone) in the dinoseb contamination area for potential and successful remediation using pump-and-treat technologies. A series of aquifer tests was performed to determine the sustainable yield, well efficiency, and specific capacity of groundwater at each of the test wells. The test procedure involved three phases: static water level monitoring, step-drawdown tests, and constant rate aquifer tests.

Analysis of test data indicated that the perched aquifer was relatively homogeneous in the horizontal axis but was vertically stratified. Best estimates of horizontal hydraulic conductivity (K_h) ranged from 2.6×10^{-4} cm/sec to 1.5×10^{-3} cm/sec. The estimated K_h values fell within the range typical for silt. The sustainable pumping rates were less than 0.5 gpm in all cases. Sustainable pumping rates for multiple pumping wells would be even less than for a single pumping well because of the interference of drawdown from multiple wells (overlapping cones of depression). Based on the results of the step-drawdown tests, injection rates into wells IW-1 and IW-2 were higher than estimated sustainable withdrawal rates in the pumping wells. Higher injection rates were attributed to flow in the unsaturated zone above the original water table. Furthermore, the water level did not recover to its original level after the long-term extraction tests. This incomplete recovery indicated that the perched aquifer (A-zone) would be dewatered during long-term pumping activities. These results indicated that the pore volume exchange rate would be insufficient for effective use of the pump-and-treat method as a viable short-term alternative for remediating the groundwater in the A-zone.

The results of the tests were affected by several factors. The injection and extraction wells were spaced too far apart considering the relatively low transmissivity of the A-zone aquifer. Aquifer test results were strongly affected by well bore storage during all tests. Therefore, estimates of transmissivity and hydraulic conductivity derived from these tests were considered invalid. As a result of delayed gravity drainage (or delayed yield) effects, many of the aquifer storage estimates fell within the range of storativity values typical for confined aquifers and the specific yields typical for unconfined aquifers. The

estimates were not representative of the long-term response to pumping. Considering the geologic stratification, low but discernable barometric efficiency, and intermediate effective storage coefficients, it was concluded that the A-zone had a lower vertical hydraulic conductivity (K_v) than K_h (MK, 1999a).

3.2.2.3 Vapor Extraction Studies

A pilot soil-vapor extraction (SVE) study was performed consisting of two tests using a low extraction rate. The purpose of the study was to evaluate the effectiveness of contaminant removal efficiency prior to installation of the SVE remedial action. Wells EW-1 and EW-3 were used as the vapor extraction wells. Wells EW-2, MW-1, MW-3, and MW-4 were used to measure the change in water level within the aquifer as a result of the vacuum applied to the vapor extraction wells. Based on the findings of the pilot study, SVE was determined to be an effective remedial method to reduce the volume of volatile organic compounds (VOCs) in the soil on-site, specifically 1,2-dichloropropane (1,2-DCP). Additional data were determined to be needed regarding the total mass and extent of 1,2-DCP in the soil to confirm this premise. SVE was, however, not expected to be effective for removing contaminants that have a low vapor pressure and/or Henry's constant, such as dinoseb; therefore, the work associated with the construction of the treatment system was not implemented for the future work (MK, 1999c).

3.3 OU-1 INVESTIGATIONS OF B-ZONE

The OU-1 investigations also included the collection of data related to the characterization of the B-zone, and are described in this section in support of the OU-2 RI/FS.

3.3.1 *PREVIOUS INVESTIGATIONS*

From year to year, during investigations conducted for OU-1, the B-zone was briefly studied, although formal investigations for OU-2 did not begin until early 2000. This section provides summaries of the relevant portions of the previous investigations that relate to the characterization of the B-zone and are, therefore, pertinent data for the OU-2 RI/FS.

Under contract to the USEPA, E&E performed an evaluation of the data generated during prior investigations of the B-zone aquifer for the OU-1 studies (E&E, 1993a).

Geophysical data were analyzed from six deep boreholes (CB-01, CB-02, CB-03, CB-04, CB-05, and CB-06) (Kennedy Jenks (KJ), 1991). The geophysical logs contained information on the structural composition of the subsurface soils and sands. This information was used to determine the most permeable layers within the B-zone and make recommendations on the locations for new B-zone monitoring wells.

Water-bearing sands, or aquifers, from the shallowest to the deepest were labeled B-1, B-2, B-3, and B-4. The B-1 sand appeared at about 150 feet bgs, and was thickest and best defined at boreholes CB-02 and CB-05. This sand was fully saturated at Borehole CB-05. The B-2 sand is at approximately 170 feet bgs, the B-3 sand at 185 feet bgs, and the B-4 sand at 200 feet bgs. The B-2 sand (best defined at Borehole CB-02) and B-4 sand were the most continuous and the primary focus of the proposed OU-1 workplan (E&E 1993b).

The B-1 aquifer was described as being about 10 feet thick with the depth to the top varying between 170 and 180 feet bgs. The B-2 aquifer was approximately 10 feet thick and occurs at a depth of about 170 to 180 feet bgs. The thickness of B-1 aquifer was estimated to be 5 feet, and the thickness of the B-2 aquifer 10 feet.

It was concluded that the B-zone contained several aquifers, of which the B-2 and B-4 aquifers represented the most continuous throughout the Site. Wells WB2-5 and WB4-1 were to be completed in the same borehole at a background location due to the presence of contamination in all the existing B-zone wells. In total, 31 groundwater samples were collected (including three blanks and three duplicates) on July 20 to 22, 1998. These samples were analyzed for the following:

- SAS (Special Analytical Services) volatiles (routine detection limits) with 1,2-DCP and 1,2,3-trichloropropane (1,2,3-TCP), or
- SAS volatiles (low detection limits) with 1,2-DCP and 1,2,3-TCP,
- SAS ethylene dibromide (EDB) and 1,2-dibromo-3-chloropropane (DBCP), and
- SAS dinoseb (E&E, 1999a).

Well AMW-4R was abandoned because it exceeded the maximum contaminant level (MCL) for DCP and provided a pathway for possible vertical migration of contaminants into the B-zone.

Wells EPAS-1 and AP-5 were dry, and well AP-3 had an obstruction. These wells were, therefore, not sampled.

Analytical results suggested that concentrations of 1,2-DCP decreased in the A-zone and B-zone. Concentrations of 1,2,3-TCP remained stable. Water levels had risen in both zones. The high concentration of chemicals in the A-zone was thought to act as a continuing source of contamination to the B-zone (E&E, 1999a).

Pump test results for the A-zone showed that the transmissivity of the aquifer was approximately 2.66 cm^2/sec and the hydraulic conductivity was approximately 8.7x10-3 cm/sec (near pumping well WB-1). The average groundwater velocity in the A-zone was approximately 15 feet/year when the well was not being pumped. It was determined that well WB-1 could be pumped for an extended period at 7 gpm. It was concluded that extracting groundwater from this well at 7 to 8 gpm should capture (or intercept) all of the groundwater flow in this aquifer flowing south from the Site (E&E, 1993a).

A 6-hour pump test was performed at the Site on January 12, 1993, to evaluate hydrogeologic characteristics of the B-1 and B-2 aquifers (E&E, 1993a).

Evaluation of the available data showed that preliminary investigation of the B-zone aquifer was completed during preparation of the A-zone RI, and included deep soil borings, geophysical logs, seven B-zone well installations (AMW-3R, AMW-4R, AR-1, WB2-1, WB2-2, WB2-4, and WB-3 [Figure I-9]), grab groundwater sampling, quarterly to semiannual groundwater sampling, and a pump test. Analytical results for groundwater samples show that the primary VOCs (1,2-DCP, 1,3-DCP, 1,2,3-TCP, DBCP, EDB, 1,1-dichloroethane [1,1-DCA], and 1,2-dichloroethane [1,2-DCA]) detected in the B-zone were also the most common and most highly concentrated in A-zone (E&E, 1993b).

3.3.2 *SERVICES CONTRACTED BY THE PRPS*

On behalf of the PRPs, a report was prepared for B-zone monitoring well updates and a recommendation for the fourth well location in response to USEPA Administrative Order 106 (Order No. 91-6) dated January 28, 1991 (Industrial Compliance [IC], 1992). Based on a review of the *Technical Assistance Team (TAT) Brown & Bryant Site Assessment* (E&E, 1990), available data, and the groundwater gradient,

the recommended location for the fourth well was downgradient from the former unlined pond, adjacent to Boring CB03 (IC, 1992).

3.4 GROUNDWATER MONITORING

The purpose of quarterly groundwater monitoring of wells in the A-zone and B-zone is to assess the groundwater flow in each zone and to evaluate the changes in concentration and distribution of the seven COCs and other chemicals over time in the aquifers beneath the site and the adjoining properties. For this, a number of wells in A-zone and B-zone were sampled quarterly and data were analyzed to assess the extent of contamination from the COCs and other chemicals in the A-zone and B-zone.

Quarterly monitoring sampling has been performed since July 2000. Data collected up to the February 2003 sampling event are included in this report. The results of these sampling events are tabulated in Tables I-3-1 and I-3-2, which also include the results of previous groundwater sampling from 1987. Table I-3-1 presents groundwater sampling and analyses results for the A-zone groundwater and Table I-3-2 for the B-zone groundwater. Some salient features of these sampling events are presented in the following paragraphs.

July 2000 Sampling. In total, 16 wells in the A-zone, 7 wells in the B-zone, and the Arvin city well No. 1 were sampled. The data collected indicate that the groundwater flow in the A-zone was toward the southwest. Groundwater flow was determined to be uneven, flowing to the south-southwest on a high ridge and west to southeast out from this ridge. The B-zone had a general flow direction to the southwest. In the A-zone, 1,2-DCP, 1,2,3-TCP, chloroform, and 1,3-DCP decreased since the previous sampling event in July 1998; Concentrations of the remaining three COCs increased. In the B-zone, COCs were detected in three of the B-zone wells (AMW-4R, AR-1, and WB2-1), AR-1 and WB2-1 COC concentrations were greater than the respective State of California MCLs. In general, COC concentrations increased (Panacea, 2000e).

November 2000 Sampling. Sixteen wells were sampled in the A-zone and 7 wells in the B-zone. Groundwater flow in the A-zone appeared to be uneven, flowing to the west, southwest, and south. The B-zone had a general flow direction to the southwest, similar to the previous sampling event in July 2000. In the A-zone, 1,2-DCP, 1,2,3-TCP, chloroform, and 1,3-DCP concentrations decreased since the previous sampling event in July 2000. The remaining contaminant concentrations increased. In the B-zone, COCs were detected in four of the B-zone wells (AMW-4R, WB2-1, WB2-2, and WB2-3). The COCs in wells AR-1, AMW-4R, and WB2-1 exceeded MCLs. With the exception of well WB2-1, the COC concentrations in the B-zone wells are similar to those reported in previous sampling events. The COC concentrations in well WB2-1 increased since March 1995 (Panacea, 2001b).

March 2001 Sampling. Sixteen wells were sampled in the A-zone and 7 wells in the B-zone. Groundwater flow in the A-zone was to the west to southwest direction. The B-zone had a general flow direction to the southwest. The groundwater appeared to flow in a trough that trended in a southwesterly direction. In the A-zone, 1,2-DCP, 1,2,3-TCP, and 1,3-DCP concentrations increased from July 1998 sampling event. The remaining contaminant concentrations remained similar or decreased.

July 2001 Sampling. The groundwater flow direction in the A-zone was unchanged. The B-zone had a general flow direction to the northeast, contrary to previous sampling events. In the A-zone, DBCP, 1,2-DCP, EDB, 1,2,3-TCP, chloroform, and 1,3-DCP concentrations increased since the previous sampling event. The remaining contaminant concentrations remained the same or decreased.

October 2001 Sampling. Sixteen wells in the A-zone, 7 wells in the B-zone, and Arvin city well No. 1 were sampled. In October 2001, groundwater flow in the A-zone was toward the west-southwest.

Groundwater flow was uneven, flowing to the west, southwest, and south. Sampling results for the A-zone showed that contaminant concentrations had remained similar to those from previous sampling events. COCs were detected in five of the B-zone wells (AR-1, AMW-4R, WB2-1, WB2-2, and WB2-3). The MCLs of COCs in wells AMW-4R, WB2-1, and WB2-2 were exceeded (Panacea, 2002a).

February 2002 Sampling. Twenty-one wells in the A-zone, 12 wells in the B-zone, and Arvin city well No. 1 were sampled (Panacea, 2002d). Groundwater within the A-zone was encountered between 65.24 and 77.03 feet below the top of the casing. In February 2002, the groundwater within the A-zone had a general flow direction toward the southwest. The groundwater does not flow in an even sheet flow across the site within this zone. PWA-5 was dry and subsequently could not be contoured.

Groundwater within the B-zone was encountered between 143.52 (PWB-5) and 161.29 (WB2-4) feet below the top of the casing. In February 2002, the groundwater within the B-zone was generally neutral, with a slight north-south trending elliptical depression.

COCs were detected within all twelve of the B-zone wells. In wells AMW-4R, WB2-1, WB2-2, PWB-3, and PWB-4 the MCLs of COCs were exceeded.

May 2002 Sampling. Samples were collected from 24 wells in the A-zone, 12 wells in the B-zone, and Arvin city well No. 1. Groundwater flow in the A-zone was toward the southwest. The B-zone groundwater flow direction was toward the south with a slight sinuous, north-south-trending elliptical depression across the Site. In the A-zone, contaminant concentrations have remained similar to those from previous sampling events. COCs were detected in 11 of the 12 B-zone wells. The furthest well, located southwest of the Site, did not contain any COCs. The MCLs of several COCs were exceeded in three of the wells. The concentration of 1,2-DCP in well AMW-4R decreased from the previous quarterly sampling event, and the DBCP concentration increased in well PWB-3.

3.5 OU-2 INVESTIGATIONS

Results of OU-2 investigations pertinent to RI of the site are well construction data, soil characteristics of samples, and the chemical concentrations of organics and metals for soil samples. These data were collected from well borings drilled during Phase I and Phase II investigations and are presented in Tables I-3-3 through I-3-12.

3.5.1 *PHASE I*

Ten wells were drilled from November to December 2001 (Panacea, 2002f) to better characterize the B-zone aquifer and the extent of contamination in this zone. Wells PWA-1 through PWA-5 were completed in the A-zone, and wells PWB-1 through PWB-5 were completed in the B-zone. Pre-well completion activities included collecting soil samples from eight of the new well locations (PWA-1 through PWA-4 and PWB-1 through PWB-4) during drilling. Wells were sampled 1 to 2 weeks after installation and quarterly thereafter. With the exception of on-site well PWB-1, all of these wells were located off site to the south or east of the Site. Well locations are shown on Figure I-9. Well construction data are presented in Table I-3-3.

Soil borings for the A-zone were drilled to a total depth of 85 feet bgs; B-zone wells were drilled to total depths from 160 to 185 feet bgs, depending on the depth where water was encountered. Wells PWA-1 and PWA-5 were drilled to depths of 85 feet without the collection of soil samples. Soil samples were collected during the installation of wells PWA-2, PWA-3, PWA-4, and PWB-1 through PWB-5. Continuous samples were collected from Borings PWB-1 and PWB-2, and the remaining borings/wells

were sampled at 5-foot intervals to the total depth of the borings, starting at 5 feet bgs. Soil samples were analyzed using USEPA Methods 8260B (for VOCs), 8270C (for semivolatile organic compounds [SVOCs]), 8151A (for herbicides), 8081A (for pesticides), and 6000/7000 (for metals) and for soil characteristics (Panacea, 2002f). Chemical and metals concentrations in these samples are presented in Tables I-3-5 and I-3-7, respectively.

Soil samples from each boring were also tested for moisture content, dry density, and grain-size distribution by ASTM D422, and hydraulic conductivity by ASTM D5084. Also, laboratory tests were conducted on selected samples at various depths to estimate unsaturated moisture-characteristic properties, relative permeability, and distribution coefficient (batch adsorption test). Test results are presented in Table I-3-9.

3.5.2 *PHASE II*

In January and February 2003, eight more monitoring wells were installed (two completed in the A-zone [PWA-6 and PWA-7], and six in the B-zone aquifers [PWB-6 through PWB-11]) to complement the OU-2 investigations of the Site. The purpose of drilling these additional wells was to further characterize the B-zone, the extent of the A-zone aquifer, and the extent of the COC plumes off site, and to verify the conceptual hydrogeologic model used for the fate and transport analysis. All of these wells were located off site as shown on Figure I-9.

In addition, three shallow soil borings were drilled and sampled for laboratory analysis of VOCs, SVOCs, herbicides, pesticides, and metals. The purpose of drilling these borings was to further define the extent of the COCs off site for health risk assessment purposes (Panacea, 2003e).

Results of the laboratory analyses were reported in the quarterly groundwater sampling and analysis report for February 2003.

Well construction details are summarized in Table I-3-4. Chemical concentrations, including organics and metals, are presented in Tables I-3-6 and I-3-8, and soil characteristics are presented in Table I-3-10.

3.5.3 *GENERAL FINDINGS*

From November 2001 through February 2003, 18 monitoring wells were drilled as part of the OU-2 investigations. All of these wells were screened in the B-1 and/or B-2 sub-unit of the B-zone at a depth of between 120 feet and 180 feet. Soil samples were collected during these investigations for physical and chemicals analysis. The soil samples were analyzed for VOCs, SVOCs, herbicides, pesticides, and metals. Selected soil samples were also analyzed for physical parameters including hydraulic conductivity, soil moisture content, dry density, and particle size distribution. Results are summarized in Tables I-3-5 through I-3-12.

The primary objectives of the investigation were to define the spatial extent of the COCs at the site and its vicinity, as well as physical parameters for fate and transport analysis.

The soil samples collected during the well installation were analyzed for VOCs and SVOCs and the results are presented in Table I-3-6. Several VOCs and SVOCs—including 1,2,3-TCP, DBCP, EDB, 1,2-DCP, chloroform, acetone, bis(2-ethylhexyl)phatalate, 2-methylnaphthalene, and methyl chloride—were detected in relatively low concentrations in some of the collected and analyzed samples from the unsaturated A- and/or B-zones. Herbicides and pesticides—including dinoseb, 4,4-DDT, and MCPP—were also detected in some of the collected and analyzed soil samples. The detected concentrations of

these compounds were small and isolated. No particular "hot spot" or pattern could be assessed from these results.

The soil samples were also analyzed for heavy metals and the results of these analyses are presented in Table I-3-8. Total metals concentrations were detected in the samples analyzed and these appear typical of California soils in the area. The mercury concentrations average 0.06 mg/kg and this may appear elevated but is still within the general range identified for US soils – 0.04 to 0.28 mg/kg (see Sandia website – www.sandia.gov/eesector/gs/gc/na/mercurysoillevels.html)

A cross-sectional diagram across the Site in the northeast-southwest direction has been prepared to show the stratigraphic details for the A-zone and the B-zone in the study area (Figure I-10). This figure shows the features of the A-zone, including the continuous thin clay layer on which the water in this zone is impeded. This clay "pinches" out about 500 feet southwest of the Site.

The B-zone groundwater elevation is approximately 286.5 feet (about 145 feet bgs). Groundwater in the B-zone is unconfined to semiconfined within the zone and has a shallow gradient towards the southwest. Figures I-11 and I-12 show the groundwater elevation contours for the A-zone and the B-zone, respectively.

Detailed evaluation of the boring logs and the results of laboratory physical properties tests conducted in the B-zone do not reveal a distinct zonation of this aquifer as has been described by previous investigators (see summaries in USEPA, 1993a). On the contrary, evaluation indicates that the B-zone, from a depth of 75 to 180 feet bgs, consists mostly of a sandy unit with interbedded discontinuous clay lenses and layers with limited extent. In this sequence, thick layers of thinly bedded (less than 2 feet thick) silt, sand, and clay units are found in core holes. The installed wells have been screened mostly in what was referred to as B-1 and B-2 sands by previous investigators. The presence and extent of the B-3 and B-4 aquifers are inferred from data obtained by previous investigators.

Part of the reason for this difference in interpretation is the grouping of fine-grained units. Clay layers (as defined by the Unified Soil Classification System) that are more than 2 feet thick have been considered as confining units. In previous investigations, these clay layers were at times grouped together with silt and sandy clay units and were considered as confining units. These confining units have been classified as mixed units, as shown in Figure I-10. Although the mixed units provide semi-confining conditions for piezometric head distribution, they do not provide adequate protection against migration of COCs.

Quarterly monitoring and sampling has continued since May 2002 (Panacea, 2002a, 2002b, 2002c, 2002d, 2002e, 2002f, 2002g, 2002h, 2003f, and 2003g) and the results are summarized in Tables I-3-1 and I-3-2. Preliminary evaluation and analyses of the data collected up to July 2002 were made during preparation of the fate and transport and the risk assessment reports (Appendix A). Some findings are presented in the following paragraphs.

An overall decreasing trend cannot be ascertained using the data collected since 1990. In the B-zone, the COC concentrations gradually increased since March 1995. COCs were detected within three of the B-zone wells (AMW-4R, WB2-1, and WB2-3) and exceeded MCLs in wells AMW-4R and WB2-1 (Panacea, 2002b).

An overall trend of increasing COC concentrations has appeared since August 2000. In the B-zone, COC concentrations gradually increased since March 1995. COCs were detected within three of the B-zone wells (AMW-4R, WB2-1, and WB2-3) and exceeded MCLs (Panacea, 2002c).

Groundwater flow in the A-zone was toward the southwest, consistent with previous observations and as reported in the past (E&E, 1999a). The B-zone groundwater had a slight north-south trending elliptical depression. In the A-zone, contaminant concentrations remained at similar concentrations. An overall decreasing contaminant trend could not be ascertained with the data collected since 1990. COCs were detected in all 12 B-zone wells, with the MCLs of COCs exceeded in five of the wells. No significant changes in COC concentrations were encountered since the last sampling event. In addition to the seven COCs, the following chemicals were identified: acetone, benzene, bromodichloromethane, chloromethane, 1,1-DCA, and 1,2-DCA (Panacea, 2002d).

Figures I-13A through I-13F are plots of contaminant concentrations for the A-zone groundwater based on monitoring completed in May 2003. The six figures are for each of the six COCs: 1,2-DCP, 1,2,3-TCP, DBCP, EDB, chloroform, and dinoseb, respectively. Similarly, the contaminant concentration contour plots for the B-zone groundwater are shown on Figures I-14A through I-14E for the six COCs. Major findings regarding the COC plumes are further discussed in Sections 5.0, 6.0, and 7.0 of this RI report.

3.5.4 *FATE AND TRANSPORT ANALYSIS*

A preliminary fate and transport report was prepared to document the modeling process for some of the COCs in the vadose and saturated zones at the Site to assess the risk of COCs reaching the Arvin water well supply. A more detailed description of the findings of the fate and transport analysis is presented in Section 6.0 of this report. The fate and transport report is also included as Appendix A of this report.

3.5.5 *ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT*

A baseline human health risk assessment (BHHRA) was prepared to provide an evaluation of the potential threats to human health in the absence of any remedial action at the Site. This BHHRA used data generated by the RI to evaluate potential public health risks posed by conditions at the Site, and to formulate goals used in presenting remedial options in the FS. The results of this assessment are summarized in Section 7.0 of this report, and the BHHRA report is included as Appendix B.

The risk assessment methodology consists of the following components: data review and evaluation, identification of chemicals of potential concern (COPC), exposure assessment, toxicity assessment, risk characterization, uncertainty analysis, and findings.

An ecological screening-level risk assessment was prepared as part of the RI/FS. The purpose of this risk assessment was to obtain information necessary to assist risk managers at the Site in making informed decisions regarding potential threats to threatened and endangered biological species. The objectives were to identify and characterize current and potential threats to the environment from a hazardous substance release, and to identify cleanup levels that would protect those natural resources from risk (Panacea, 2003c). This assessment is further discussed in Section 7.5. A copy of the biological constraints analysis report is presented in Appendix D.

4.0 SAMPLE ANALYSIS/VALIDATION

The collected data are subject to various analyses and validation procedures in order to meet the data quality objectives (DQOs). DQOs are established criteria used to ensure that the data collected are of the highest quality.

DQOs include a description of detailed procedures to be followed during the data collection activity. DQOs describe the overall uncertainty that a decision-maker is willing to accept in the results derived from environmental data. This uncertainty is used to specify the quality of the data in terms of precision, bias, representativeness, comparability, and completeness (USEPA, 2003).

The objectives are defined prior to collection of data. The recommended minimum requirements set by USEPA are met to satisfy the minimum criteria for acceptable data quality.

Based on the objectives of the site investigation, the following data quality indicators are defined:

- Laboratory data and analytical documentation,
- Reporting limits, and
- Precision, accuracy, representativeness, comparability, and completeness criteria.

The purpose of the DQOs is to produce reliable data while minimizing potential errors that may occur during collection and analysis of data.

4.1 LABORATORY DATA

Sequoia Analytical Laboratory (Sequoia Analytical) of Petaluma, California, has provided analytical services for samples collected during the Site investigation. Sequoia Analytical is certified by both the USACE and the State of California Environmental Laboratory Certification Program (ELAP). Table I-4-1 summarizes the USEPA Methods used by the laboratory to analyze the samples for the intended target analytes.

To determine if the established DQOs have been met, the laboratory data have undergone a review for the following:

- All the analyses requested for each sample with the corresponding results;
- Complete records for each analysis and the associated quality assurance and quality control (QA/QC) results;
- Evaluation of the data with respect to the expected detection limits (the required quantitation limits are compared to the analytical results);
- Evaluation of data with respect to the control limits (the results of QC samples and the calibration check samples are compared to control limits set by the method);
- Case narratives regarding corrective actions taken (in the event of out-of-control QC data or any irregularity);
- Review of the holding times; and
- Correlation of laboratory data (the results obtained from two related laboratory tests are compared. For example, DBCP is one of the analytes tested by both Methods 8260B and 504.1. Any significant difference will be noted through the comparison of the analytical results for both methods).

4.2 OPERATING PROCEDURES

The procedures presented in this section describe the steps that were taken during the initial phases of sample analysis. These phases include steps that were completed in the field and the laboratory and are as follows:

- Sample collection,
- Control samples,
- Decontamination of field equipment,
- Reagents/standard preparation, and
- Sample management.

4.2.1 *SAMPLE COLLECTION*

Groundwater and soil samples were collected at the Site, and detailed sampling procedures are provided in the following sections.

4.2.1.1 BarCad System

The BarCad® system is a groundwater sampling instrument designed for permanent installation at a fixed elevation in groundwater monitoring wells. The BarCad® system is made up of the BarCad® unit, which consists of a ceramic porous filter (approximately 1.5 inches in diameter and 16 inches long), a 1-inch-diameter polyvinyl chloride (PVC) stinger pipe connecting the BarCad® unit to the top of the well, and a stainless steel probe with polyethylene tubing leading up the inside of the PVC stinger pipe to the well head. At the well head, attached to the top of the PVC riser tube, is a fitting equipped with an airtight SwageLok fitting for the polyethylene tubing to exit the interior of the PVC stinger pipe and a quick-connect fitting to connect the pressurized inert gas supply. The BarCad® system works by applying pressurized inert gas (nitrogen) to the inside of the PVC stinger pipe, which in turn pressurizes the water column inside the BarCad® unit and drives the existing water into the stainless steel probe and up the polyethylene tubing to the surface. Subsequently, the inert gas displaces all of the water in the BarCad® unit and PVC stinger pipe through the stainless steel probe and polyethylene tubing, purging the BarCad® system of all existing water. Once the system is purged, inert gas pressure is removed from the BarCad® system to allow groundwater to flow into the BarCad® unit. Inert gas pressure is then reapplied and the resulting water can be collected for laboratory analysis.

The BarCad® system has been installed on all of the wells at the Site and has been used for the water sampling from the wells.

4.2.1.2 Groundwater Sampling

Prior to sampling the groundwater monitoring wells, water levels in the wells were measured and the wells were purged. All wells were sampled within 24 hours after purging. Supply wells with a dedicated pump had samples collected directly from the tap closest to the wellhead. All aerators, strainers, and hoses were removed from the tap prior to sample collection. The flow was adjusted so that a gentle stream is obtained. Flow rates were less than 100 milliters (mL) per minute to minimize volatilization as recommended for samples to be analyzed for VOCs.

The sample container type, size, and preservative for each specific analysis are provided in Table I-4-2.

At each sampling location, all bottles designated for a particular analysis were filled sequentially before bottles designated for the next analysis were filled. If a duplicate sample was to be collected at a location, all bottles designated for a particular analysis for both the sample and the duplicate designations were filled sequentially before bottles for another analysis were filled. On the fill sequence for duplicate samples, bottles with the two different sample designations were alternated. Groundwater samples were transferred from the tap directly into the appropriate sample containers with preservative (if required), chilled (if appropriate), and processed for shipment to the laboratory. When transferring samples, care was taken not to touch the tap to the sample container.

4.2.1.3 Soil Sampling

A split-spoon sampler was used to collect undisturbed soil at each sampling interval. Three brass tubes (each with a 2-inch diameter and 6-inch length) lined the inside of the split-spoon sampler. Soil was driven into the liners at each planned sampling interval. Immediately upon filling the samplers, they were pulled to the surface via a wire line. After collecting the samples, the sampler was decontaminated (see Section 4.2.3), reassembed, and placed back into the boring.

Immediately upon collection, the bottom soil-filled tube from the sampler was capped, labeled, and sent for possible chemical analyses (at a fixed laboratory). The upper tubes were stored and used for lithologic description in the field as well as testing for the soils physical properties.

A State of California-registered geologist reviewed and described the soil samples collected from each sampling interval. The soil description included a lithologic description (using the Unified Soil Classification System), color (using the Munsell color system), general moisture content, general porosity, mineral content (if visible, including evaporites), fracturing, and shearing. All soil descriptions were recorded on a standardized boring log form that became part of the groundwater monitoring reports.

A portion of each soil sample collected was placed in a glass mason jar or plastic sealable bag and allowed to volatilize. The headspace of each bag was measured in the field for VOCs using a photoionization detector (PID). Headspace measurements were recorded on the boring logs.

Representative soil types from each boring were tested for moisture content, permeability, and particle size distribution. An independent, fixed laboratory conducted this testing. All soil samples scheduled for this testing were placed into a separate cooler at the time of sampling for delivery to the laboratory. Results were used to assess the fate and transport of the COCs.

4.2.2 *QA/QC Samples*

QC samples may consist of field blanks, equipment blanks, matrix spike and matrix spike duplicates, and duplicate samples. These control samples were collected together with the Site samples. QC samples were analyzed by Sequoia Analytical. QA samples were analyzed by USACE laboratory.

QA/QC samples were subjected to the same procedures as the Site samples. This included all steps of shipment, preparation/extraction, and analysis. The results of analysis of these samples enabled an evaluation of the accuracy and precision of the Site samples.

4.2.3 *DECONTAMINATION OF FIELD EQUIPMENT*

Decontamination of sampling equipment was conducted consistently to assure the quality of samples collected. Drilling and sampling equipment was decontaminated by washing with a mild solution of Alconox® and rinsing with tap water between each sampling interval.

During groundwater sampling, the on-site wells equipped with dedicated pumps did not require decontamination. However, all other equipment (e.g., water depth meters) that came into contact with potentially contaminated soil or water was decontaminated. Disposable equipment intended for one-time use was not decontaminated but rather packaged for appropriate disposal. All sampling devices used were decontaminated according to USEPA Region IX-recommended procedures.

Equipment was decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment was stored on plastic sheeting in uncontaminated areas. Cleaned small equipment was stored in plastic bags. Materials to be stored more than a few hours were covered. Disposal methods for decontamination materials and fluids are presented in Section 7.0 of the *Monitoring Well Installation Workplan* (Panacea, 2003a).

4.2.4 *REAGENTS/STANDARD PREPARATION*

The laboratory may have used reagents and/or standards when analyzing the collected samples. The concentrations and identification numbers for all reagents and standards used were printed with each sample raw data computer printout. The identification numbers are traceable to the standard preparation logbook in the corresponding department of the laboratory. The detail of preparation, calculations, and solvents used with the corresponding catalog number and lot numbers were all documented in the standard preparation logbook.

4.2.5 *SAMPLE MANAGEMENT*

Sample management consisted of organizational and procedural steps to manage the transfer of collected site samples from the field to the laboratory. Sample management procedures that have been implemented throughout the duration of this project include the following:

- Chain of custody,
- Holding time (the time, in days, from sampling to extraction and/or analysis without degradation or loss of the target compound. [Table I-4-3 summarizes the holding time criteria for each analytical method]),
- Volume/weight of sample required, and
- Preservatives and concentration/or preservation method.

4.3 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Laboratory QA/QC consists of the procedures implemented to ensure the proper handling and analysis of the samples. QA/QC procedures exist for handling and analytical processes as well as for the actual facility where the analyses are conducted.

4.3.1 *FACILITY*

The Sequoia Analytical facilities in Petaluma, California, are designed so that the laboratory activities have no adverse effect on one another. Extraction rooms with several hoods are separated from the rest of the laboratory to minimize potential environmental contamination. The volatile-analysis room is completely isolated from the rest of the building to prevent any air contamination.

4.3.2 *SAMPLE MANAGEMENT*

The following QA/QC procedures have been implemented for sample management:

- **Sample Receipt**: Upon arrival in the laboratory, each shipment of samples is checked to verify all the information provided on the chain of custody form. Samples are examined for damage, headspace (if applicable), proper preservative, and cooler's temperature. Finally, samples are logged into the logbook and each sample is given a label with a laboratory identification number.

- **Sample Storage**: Samples are stored in refrigerators with control temperature of ±4°C. The temperature of each refrigerator is recorded daily. Separate refrigerators are designated for each matrix. Volatile water containers have their own isolated refrigerator.

- **Holding Time**: Each department of the laboratory is informed properly to schedule the extraction and/or analysis of the sample with regard to the holding time for each analytical method.

4.3.3 *REAGENTS/STANDARD PREPARATION*

The procedures for preparing standards and dilutions of the stock standard solutions are described in detail in the standard operating procedure (SOP) for each analytical method. Information regarding neat standards, stock standard solutions, grades, made, lot number, and manufacturer's label with name, concentration, and expiration date are all documented in the standard preparation logbook. A certificate of analysis generated by the manufacturer for each standard in solution is archived in each department of the laboratory for future reference.

4.3.4 *TEST METHODS*

The following USEPA Methods are used to analyze the samples for the intended target analytes:

- USEPA Method 8260B for VOCs (USEPA, 2003),

- USEPA Method 8151A for dinoseb (USEPA, 2003), and

- USEPA Method 504.1 for EDB.

4.3.4.1 Sample Preparation and Analysis

Prior to laboratory analysis, samples must adhere to the holding time requirements that have been established for the USEPA Methods. A summary of the analytical methods and their respective holding time requirements is presented in Table I-4-3. Holding times apply to all the re-analyses, dilutions, and QC samples.

4.3.4.2 Instrument Calibration

Initial calibration and continuing calibration criteria with the corresponding acceptance limits are summarized in Table I-4-4.

Table I-4-5 lists compounds with reference to three analytical methods.

4.4 LABORATORY QA/QC PROCEDURES

Procedures for presentation proficiency with each method including calibration, accuracy, precision, and method detection limits with corresponding control limits are detailed in the SOP for each laboratory.

The following QC samples are analyzed by the laboratory with each extraction and/or analysis batch. Analytical results for the QC samples show that the laboratory is in control of the data collected. The data generated should fall within the control limits set by the analytical method.

- **Laboratory Control Samples:** The accuracy of a method is demonstrated by spiking a known amount of method target analytes to a blank matrix (interference-free soil or water). The laboratory control samples should be analyzed with each batch of samples. Analytical results for laboratory control samples are compared to control limits established for accuracy and bias to determine usability of the data.

- **Matrix Spike/Matrix Spike Duplicate**: The matrix spike samples are chosen from the real environment samples. The sample and its duplicate are spiked with a known quantity of the method target analytes. Analytical results determine the bias of the method due to the matrix. The closeness of the two matrix spike/matrix spike duplicate results calculated by relative percent difference (% RPD) is used to set up the likelihood of matrix interference.

- **Method Blank**: A blank determination reveals the contamination resulting from the analytical process. Reagents, solvents, glassware, environmental air, or instruments could contribute to this process. A clean, interference-free matrix similar to the one being analyzed is chosen and analyzed with each batch of samples. Analytical results for method blanks increase the usability of the data.

- **Corrective Action**: Errors, deficiencies, deviations, loss during preparation, and/or any practice outside the established criteria are documented in the corrective action record book with reference to the sample and the dates of occurrence. Details of the corrective action become part of the project report.

- **Equipment Maintenance Documentation**: Any maintenance and repair for each instrument is documented in a maintenance record book assigned to each instrument. The detail of the initial problem and how the problem is solved are recorded with reference to calibration being checked or performed.

Table I-4-6 presents a summary of the QC requirements used as part of the laboratory QA/QC process. Table I-4-7 presents the internal standards used by the laboratory for analytes. Table I-4-8 presents surrogate information to calibrate methods to recover analytes.

Sequoia Analytical uses notations in their raw data and result reports. These notations and definitions are presented in Table I-4-9.

4.5 DATA MANAGEMENT

Data management was critical in developing the RI for the Site. Data management includes accurate recording, organization and management of field and electronic data collected from field logs; chain-of-custody forms; implementation of sample management; document control; and inventory procedures.

4.5.1 *DATA MANAGEMENT SYSTEM*

A data management system (DMS) was prepared to provide accurate recording and management of data collected at the Site. Procedures have been implemented to ensure data integrity and security of field data. These procedures include the use of project numbers to index hard copy data for retrieval, and designating personnel to access the hard copy data. Possession and handling of samples are traceable from the time of collection through final disposition via chain-of-custody protocols. Procedures for their use are detailed in the QA project plan for this project. The electronic data are secured on the network systems by assigned log-on accounts and individual passwords to authorized personnel.

4.5.2 *FIELD LOGS*

Field logbooks are used to document where, when, how, and from whom any vital information was obtained. Logbook entries are complete and accurate enough to permit reconstruction of field activities.

The following information is recorded as appropriate during the collection of each sample:

- Sample location and description,
- Site sketch showing sample location and measured distances,
- Sampler's name(s),
- Date and time of sample collection,
- Weather conditions,
- Type of sampling equipment used,
- On-site measurement data (e.g., temperature, pH, conductivity),
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors),
- Preliminary sample descriptions,
- Type(s) of preservation used,
- Sample numbers and chain-of-custody records, and
- Recipient laboratory.

In addition to the sampling information, the following information is recorded as appropriate in the field logbook for each day of sampling:

- Daily log of site activities,
- Deviations from sampling plan or site safety plan,
- Changes in personnel and responsibilities, as well as reasons for the changes,
- Levels of safety protection, and
- Calibration readings for any equipment used and equipment model and serial number(s).

Logbooks are bound with consecutively numbered pages. Each page is dated and the time of entry noted in military time. All entries are written in black ink and signed by a State of California-registered geologist. Language used is factual, objective, and free of personal opinions or other terminology that might prove inappropriate (Panacea, 2001a).

4.5.3 *CHAIN OF CUSTODY*

A chain-of-custody record accompanied each cooler of samples collected and delivered or shipped to the analytical laboratory. The primary purpose of the chain-of-custody procedure is to document the possession of the samples from collection through storage and analysis to reporting. The chain-of-custody forms become the permanent records of all sample handling and shipping. If an express courier was used, the bill of lading served the purpose of the chain of custody record until the shipping container was received by each of the laboratories. Chain-of-custody records are used to document sample collection and shipment to the laboratory for analysis. A chain-of-custody record accompanies all samples shipped for analysis. Forms are completed in the field and sent with the samples to the laboratory daily. If multiple coolers are sent to a single laboratory on a single day, forms are sent with each cooler.

The chain-of-custody record identifies the contents of each shipment and maintains the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped or delivered, custody of the samples is the responsibility of field personnel. The project manager, contractor QC manager, or designee signs the chain-of-custody record. The signer signs the "relinquished by" box and note date and time. The shipping containers in which samples are stored (usually a sturdy ice chest) are sealed before shipping (Panacea, 2001a).

4.5.4 *SAMPLE MANAGEMENT*

A sample collected in the field is sent to certified laboratory for analysis. Management of the sample prior to analysis requires the following:

- Chain of custody record,
- Holding time (holding time is the time, in days, from sampling to extraction and/or analysis without degradation or loss of the target compound. Table I-4-3 summarizes the holding time criteria for each analytical method),
- Volume/weight of sample required, and

- Preservatives and concentration or preservation method.

Documentation and review of sample data is accomplished by means of the following:

- **Chain of Custody**: Verifies the field sample identification with the laboratory sample identification number. The method of analysis requested by the client is compared with the tests performed.

- **Extraction Log**: Details the description of initial volume/weight, final volume/weight, the amount and concentration of the surrogate, and spiking standards added to the samples/QC samples prior to extraction for each extraction batch.

- **Instrument Run Log**: Specifies the sample identification number injection date and time, batch identification number, injection volume, and standards identification numbers.

- **Case Narrative/Corrective Action**: Provides a brief description of the steps taken for complete analysis of the samples with reference to the chain of custody. The corrective action describes the deficiencies and specific procedure followed toward correcting any deficiencies.

4.5.5 *INVENTORY PROCEDURES*

An important aspect of data management is the use of inventory procedures. Proper inventory procedures allow quick and efficient storage and retrieval of collected and analyzed data. Inventory procedures include data storage, control of samples, and hard copy or electronic data.

4.5.5.1 Data Storage

To ensure data integrity and security, procedures were established for every stage of data processing during which a permanent collection of data was stored. Project numbers were used to index hard copy data for retrieval, and designated personnel were responsible for accessing the hard copy data. Hard copy data include all data generated for the required analysis, including ancillary data that may not be required as part of the reportable analytical data package (e.g., extraction logs). Document control personnel for each laboratory are responsible for maintaining custody of the inventory of completed analytical data.

4.5.5.2 Custody and Control of Samples and Hard Copies

Possession and handling of samples is traceable from the time of collection, through analysis, until final disposition. A numbering system was used to allow tracking of sample information and positive identification of sample results. Components of the chain of custody (i.e., sample labels and seals, a field logbook, chain-of-custody record, and sample analysis request form) and procedures for their use are described in the QA project plan for this project.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record was filled out and accompanied every sample. Standard forms were developed for labeling samples and tracing the chain of custody. Information recorded on the chain-of-custody form includes the following:

- Date chain-of-custody form was filled out,

- Page number and total number of pages,

- Name and address of laboratory to which samples are to be shipped,
- Name and address of contractor,
- Project title,
- Project number,
- Method of shipment,
- Project Manager's name,
- Project Manager's telephone and fax numbers,
- Signature of person(s) collecting the samples,
- Complete field sample number,
- Sample depth (if applicable),
- Date and time sample was collected,
- Type of matrix (e.g., soil, groundwater),
- Type or size of sample container,
- Preservation temperature (4 degrees Celsius [°C]),
- Preservation,
- Notation if sample has been filtered in the field,
- Number of sample containers,
- Analysis required,
- Signature and printed name of the person who has the custody of the sample,
- Date and time at which sample was relinquished,
- Signature and printed name of person receiving custody of the sample, and
- Date and time at which sample was received.

Hard copy reports were stored and numbered to maintain strict document control. Document control personnel were responsible for properly storing data.

4.5.5.3 Electronic Data Custody and Control

The network systems for electronic data were secured by using assigned log-on accounts and individual passwords for personnel who are responsible for the DMS. Menu options were available to authorized users only. Users were allowed access only to those portions of the systems that were necessary for them to do their jobs.

All data sent through the DMS was backed up periodically each day. Additional weekly and monthly backup and archiving procedures were performed. Electronic data were stored in a restricted, secured area. Access to the storage area was limited to designated personnel and kept free of debris. Electronic data was provided to USEPA for the project archive.

Software and hardware were tested and validated before using them in production. Numerous forms, worksheets, and sequence run logs were generated from the computer systems, including analytical worksheets and the sample record. Analytical results were reported on certain form templates, either through direct electronic transfer from the instrument, indirect transfer via a local area network linked to the instrument, or through manual data entry

The DMS was implemented to ensure accurate recordkeeping during all phases of sample collection, transport, analysis, and disposition.

The configuration of the DMS is a PC-based platform running Microsoft® Windows and ESRI ArcView GIS™. This combination of software is a standard configuration and facilitates the exchange of data and products between different data platforms or configurations. Benefits of the specified platform include increased capability, widespread use/acceptance, reasonable cost and complexity, and compatibility with advanced DMS configurations.

The DMS provides a framework that ensures QC and standardization of the data and the products created. The DMS is designed to be easy to use and maintain, yet flexible enough to allow for future modifications.

The objectives of the DMS include the following:

- To provide different data users with easy access to the data so that environmental data can be evaluated and processed to fulfill project DQO targets; and
- To maintain data integrity from the time of collection throughout the duration of the project.

Sources of information and media included in the Site's DMS are as follows:

- Base map layers in computer-aided design (CAD) electronic files;
- Environmental data in paper copy (hard copy) and electronic spreadsheet format;
- USGS-registered digital aerial photographs, digital elevation models, geographic and political features; and
- Aerial photographs provided by vendors.

The relational database developed in Microsoft® Access and/or Corel® Paradox contains a comprehensive compilation of environmental data from the Site. Relational database software enabled the user to

maintain and manipulate data stored in the related tables. Data in the tables were manipulated by queries that provided a means for the user to easily retrieve, analyze, generate reports, and present environmental information. The DMS includes comprehensive site data from various sources and enables the user to produce a range of products including hydrographs, contour maps, and thematic maps.

The DMS was customized with interactive forms and reports while maintaining strict data quality controls and procedures. To maintain QC in the database, constraints were placed on the data and relationships in the database. The constraints used in the database are field properties, entity integrity, and referential integrity, defined as follows:

- **Field properties** constrain the data in the database and restrict or control the type of information entered into the database.

- The **entity integrity** constraint is placed on the primary keys in the database and ensures that the primary key (a unique identifier for each table) is complete (i.e., the fields comprising the key cannot contain null values). This constraint is important because the primary key needs to be complete to uniquely identify the record and avoid duplicate records.

- The **referential integrity** constraint is placed on the relationships in the database and ensures that a value in a field of one table that is part of a relationship matches the exact value of a key field contained in another table.

These constraints minimize error during the data entry process. These constraints place restrictions on the types of functions that are allowed. They restrict the data entry person from performing unauthorized functions.

In addition to data constraints, QC of data in the database was maintained through the use of several required QA/QC fields that document record verification and modification. Some of these QA/QC fields are described in Table I-4-10.

A well-designed database provides QC of data and enables fast data analyses. Performance of the database was optimized primarily by reducing data redundancy and by indexing fields. The DMS was updated periodically. Laboratory electronic data deliverables (EDDs) were subjected to a data quality review before being loaded into the environmental database (Panacea, 2001b).

4.6 DATA VALIDATION

The purpose of data validation is to ensure that the QA objectives are met. The data generated by the laboratory should be accurate, precise, complete, and representative of the Site. The documentation review process and the use of QC indicators are means of validating the data from the laboratory.

Data validation is the process of evaluating the data generated by a laboratory against a set of project-specific criteria. This practice ensures that data are reliable and adequate for the intended use. The validation process was accomplished through the detailed guidelines outlined in the USEPA *Contract Laboratory Program for Organic Data Review* (Publication 9240 1-05, Feb. 1994).

All the computer-generated data and datasheet reports were stored electronically and shall be maintained with the laboratory's paper copies for a minimum of 7 years after the completion of all analytical data. A copy of electronic data was submitted to DMS within 2 weeks after completion of the respective analysis. The data submitted were validated by Automatic Data Review software. Appendix C demonstrates the library acceptance criteria for Automated Data Review for each QC item.

The data were delivered in two separate packages at Level III and Level IV. A Level III data package was submitted for all the samples for each analysis method according to the chain of custody. A Level IV data package was presented for 10 percent of the samples. Data submitted at Level III were validated by Automatic Data Review software (Laboratory Data Consultants, Inc.). A detail report was submitted with each data package.

The data validation at Level III elaborates on the critical QA/QC information such as holding time, critical QC measures, completeness of results, and summary of the initial and continuing calibration for each method of analysis. Analytical results, QC results, initial calibration, and related continuing calibration data are comprehensively compared with the corresponding raw data and chromatograms at Level IV data validation. A third independent party was responsible for the data validation.

The laboratory reports generated include data qualifiers that are used to describe any discrepancies that may have occurred during the analyses. Sequoia Analytical uses data review qualifiers in raw data and result reports as listed in Table I-4-10. The laboratory qualifier notes used by Automated Data Review (Laboratory Data Consultants, Inc.) are provided in Table I-4-11.

5.0 NATURE AND EXTENT OF CONTAMINATION

Historical sources of contamination were removed with the closure of the Site and cessation of B&B operations in 1989. The largest contaminant releases on site were from a waste pond, a sump area, and a dinoseb spill area (see Figure I-5). The waste pond, located in the southwest portion of the Site, was used to collect runoff water from the yard and from two sumps. The pond was also used to collect rinse water from rinsing tanks used for fumigants. Excess pond water and rainwater runoff also collected in a topographically low area to the east and south of the pond. In addition, ponded water from precipitation and irrigation from the east of the Site created focused infiltration areas. An unlined earthen sump in the center of the Site (near wells AMW-2P and AMW-4R) was used to collect wash water from a pad where equipment and tanks used for liquid fertilizers and fumigants were washed. Water from the sump was drained to the pond through an underground pipeline. Dinoseb was stored in a smaller tank storage area along the eastern fence, just north of the pond. In 1983, a significant dinoseb spill occurred in this area. As a result, the soil and groundwater underlying this portion of the Site have been reported to contain the highest concentrations of dinoseb.

Groundwater sampling began in September 1987. Subsurface investigations conducted on site to date have confirmed the presence of a number of potentially hazardous contaminants in the groundwater. The following contaminants were identified as the primary COCs to be investigated for OU-1:

- Chloroform,
- DBCP,
- 1,2-DCP,
- 1,3-DCP,
- 1,2,3-TCP,
- EDB, and
- Dinoseb.

Tables I-3-1 and I-3-2 present the results of groundwater sampling that has been conducted since September 1987 for all detected constituents.

5.1 A-ZONE

The A-zone is defined as the surface soils, unsaturated zone (A-zone soils), and the A-zone aquifer (or the saturated section of A-zone) (Figure I-11). The saturated thickness of the A-zone ranges from 0 to 10 feet. The saturated A-zone is not considered a potential drinking water source, but its contamination poses a threat to the underlying aquifers because of the vertical percolation of groundwater from the A-zone to the B-zone. The saturated A-zone occurs because of the nearby agricultural crop irrigation, seasonal rainfall infiltration, and in the past by leakage from the Brown & Bryant pond.

Currently, 30 groundwater-monitoring wells are in the A-zone, including seven new wells that have recently been installed. The A-zone is considered the only major source of currently existing contamination beneath the Site (Table I-2-1).

5.1.1 *NATURE OF CONTAMINATION*

Surface soils were tested for hazardous and nonhazardous metals. Seven organic compounds were detected and consisted of VOCs, SVOCs, and dinoseb. Dinoseb was the only COC detected in the surface soils and was detected at a frequency greater than 5 percent (USEPA, 1993).

In the unsaturated zone (subsurface A-zone soils), a total of 52 different organic chemicals (VOCs, SVOCs, herbicides, and organochlorine pesticides) were detected, including carbon disulfide, bis(2-ethylhexyl)phthalate, heptachlor, and 4,4-DDE, which were detected at greater than 5 percent frequency. These contaminants were not detected in the A-zone aquifer, and it was determined that despite their long presence in the soil, their low concentrations and relative immobility pose no immediate threat to the B-zone aquifer. Tests on water samples from the saturated A-zone were also conducted for hazardous and nonhazardous metals, and the results showed no significant differences between the on-site and the background samples. The highest detected concentrations were found in the background samples (USEPA, 1993).

In the A-zone aquifer, the most common COCs detected include dinoseb, 1,2-DCP, 1,2,3-TCP, EDB, DBCP, and chloroform. Contamination at the Site was noted to consistently occur at significant concentrations in wells AMW-1P, AMW-2P, AP-4, EPAS-2, EPAS-3, WA-6, and WA-7.

There are currently 24 wells, and only 11 of these have shown the presence of a few non-COC chemicals. However, their concentrations are far below their respective MCLs.

5.1.2 *EXTENT OF CONTAMINATION*

Based on information gathered for OU-1, dinoseb was the most prevalent contaminant detected in surface soils.

The extent of dinoseb concentration was investigated from 1 to 7 feet bgs. Four areas were identified as having the highest concentrations of dinoseb and include two locations along the east fence line (including the dinoseb spill area), the northeast corner of the Site, and east of the large storage tank (Tank UN-32). At least one soil sample in each area exceeded the health-based cleanup level for dinoseb, set at 80 milligrams per kilogram (mg/kg). The extent of contamination in each of these areas was not

specifically determined (USEPA, 1993). With the implementation of the OU-1 remedial action completed in 1999, the soil contamination within the A-zone was considered stabilized, requiring no further action.

In the A-zone aquifer, substantially higher concentrations of COCs were observed to persist at wells AMW-1P, AMW-2P, AP-4, EPAS-2, EPAS-3, WA-6, and WA-7. Well AMW-1P had the highest average concentrations for four (dinoseb, EDB, 1,2,3-TCP, and 1,3-DCP) of the seven COCs. Well WA-6 had the highest concentrations for chloroform and 1,2-DCP. Well EPAS-3 had the highest concentration of DBCP. Well AMW-2P had the second highest average concentrations for chloroform, 1,2-DCP, 1,2,3-TCP, and DBCP. Wells EPAS-2, AP-4, and WA-7 also showed consistently high concentrations.

In the A-zone, the impacted groundwater extends approximately 300 feet east and 200 feet west of the Site, and more than 500 feet south of the Site. The COCs with the greatest areal extent and highest concentrations were 1,2-DCP and 1,2,3-TCP. COCs were not detected in the A-zone groundwater monitoring well EPAS-4 located approximately 430 feet north of the Site. Figures I-13A and I-13F show the latest extent of contamination in this zone for 1,2-DCP and dinoseb, respectively.

The COC 1,2-DCP was reported to have the highest concentrations, up to 100,000 micrograms per liter (µg/L). Concentrations of 1,2-DCP increased with time in some wells and decreased in other wells. Increases in 1,2-DCP concentrations were generally reported for the wells located within the Site and immediately southwest of the Site (AMW-1P, AMW-2P, EPAS-1, EPAS-3, AP-1, AP-2, WA-4, WA-5, WA-6, PWA-1, and PWA-2). COC concentrations at other on-site and off-site wells remained at similar or lesser values.

Wells AMW-2P and EPAS-3 contained 4,600 µg/L and 1,900 µg/L of 1,2,3-TCP, respectively. Wells AP-1, AP-4, WA-6, AMW-1P, EPAS-1, EPAS-2, WA-3, WA-7, PWA-1, PWA-2, and AP-1 contained 1,2,3-TCP in concentrations ranging from 16 to 920 µg/L. The remaining wells contained 1,2,3-TCP in concentrations near or below 5 µg/L (the MCL for 1,2,3-TCP) or did not contain detectable concentrations of 1,2,3-TCP. The 1,2,3-TCP concentrations in some of the wells changed significantly since the July 2002 sampling event.

The highest DBCP concentration (1,200 µg/L) was reported for the groundwater sample collected from well EPAS-3. Concentrations of DBCP in wells AMW-1P, AMW-2P, WA-6, PWA-2, and EPAS-3 increased since July 2002. Concentrations of DBCP in the remaining wells did not change significantly since the July 2002 sampling event. Chloroform was not detected in the groundwater samples collected from wells AMW-1P, AP-1, AP-4, EPAS-3, EPAS-4, WA-1, WA-8, and PWA-2. Chloroform was detected in groundwater samples collected from the remaining wells at concentrations ranging from 0.36j ("j flag" means estimated value) and 230 µg/L. The concentration of chloroform in wells AMW-2P and WA-2 increased from less than the detection limit in July 2002 to 230j µg/L in October 2002 (the greatest increase). Chloroform concentrations in the remaining wells did not change significantly after the May 2002 sampling event. It should be noted that many of the chloroform values were "j flagged" in the laboratory report, meaning that the concentrations are estimated values. Wells AMW-1P, AP-4, EPAS-2, EPAS-3, WA-1, and PWA-2 contained 75, 0.28, 0.99, 55, 0.093, and 140 µg/L EDB, respectively. Well WA-7 contained 1ess than 0.05 µg/L of EDB (the MCL for EDB). Concentrations of EDB in wells AMW-1P, EPAS-3, and PWB-2 continued to increase from 32, 33, and 120 µg/L in July 2002 to 75, 55 and 140 µg/L, respectively, in October 2002. The COCs 1,2-DCP, DBCP, 1,2,3-TCP, and chloroform are present beneath most of the Site, extending east, south, and west of the Site. The highest concentrations of these COCs are in groundwater beneath the Site's southern boundary and extending south of this boundary. The COC 1,3-DCP was not detected in any of the wells during the October 2002 sampling event.

The contamination contours for the six COCs are shown on Figures I-13A through I-13F. Each of the compounds have spread southward with some movement in the east and west directions. Concentrations of 1,2-DCP are the highest but they appear to rapidly diminish 200 to 300 feet outside of the Site boundary. Southerly wells at this distance (WA-2 and PWA-7) did not indicate the presence of 1,2-DCP above laboratory detection limits. Chloroform is detected at low concentrations (33 µg/L) in well WA-2 and represents the furthest extent of contamination within A-zone groundwater.

5.2 B-ZONE

The B-zone includes the unsaturated zone beneath the A-zone (B-zone soils) and the second water-bearing unit (B-zone aquifer) at 140 to 165 feet bgs. The B-zone extends to approximately 300 feet bgs and ends at a clay layer known as Corcoran Clay that confines the underlying drinking water aquifer (C-zone aquifer). The B-zone groundwater comprises a series of water-bearing units. These water-bearing zones consist of unconfined and semi-confined aquifers that vary in characteristics, thickness, and extent in the area of investigation. Several clay layers and/or lenses, ranging in thickness up to 15 feet, separate these water-bearing zones. This creates an intermingled system of aquifers within the B-zone that are mostly semi-confined with continuity between the water-bearing layers.

Currently, 17 groundwater-monitoring wells are installed in the B-zone, including eleven new wells that have recently been installed to continue the monitoring efforts (Table I-2-1).

5.2.1 *NATURE OF CONTAMINATION*

Data from the February 2003 sampling event show that all COCs were detected at various concentrations except 1,3-DCP, which was not detected in the B-zone beneath the Site (Table I-3-2; Figures I-14A through I-14E).

There are currently 17 wells completed in the B-zone, and only six of these have shown the presence of non-COC chemicals. However, their concentrations are all below their respective MCLs.

During well installation in January and February 2003 (Panacea, 2003e), soil samples were collected and analyzed for the COCs as well as other organic and inorganic compounds. Data for off-site Boring PWB-7 indicated the presence of 1,2-DCP (260 µg/kg), 1,2,3-TCP (34 µg/kg), and DBCP (23 µg/kg) at a depth of 120 feet. No other compound was detected shallower than this depth (except for an estimated value for 1,2,3-TCP of 2 µg/kg). Resampling of this well in May 2003 did not indicate any detectable levels of COCs. Figure I-15 shows a real distribution of COCs in the B-zone soil. All soil contamination detected in soil samples analyzed in the B-zone are likely related to transported materials from the A-zone. As the contamination is transported in the aqueous phase, some likely remains in the soil pores that is detected in the soil samples. This explains the presence of isolated small concentrations of dinoseb and other COCs.

The B-zone groundwater has been monitored in B-zone wells since 1987. Wells AR-1, AMW-3R, and AMW-4R have been sampled the longest. Wells WB2-1 through WB2-4 have been monitored since 1992; data for these wells has sporadically indicated the presence of some COCs. These COCs are more consistently found in Wells WB2-1 and WB2-2 than in the other two. Wells PWB-1 through PWB-11 have been installed recently and there have been between 1 and 5 rounds of samples collected from these wells since 2002.

During February and May 2003 groundwater investigations, only wells PWB-2 and PWB-4 have shown persistent concentrations of some COCs exceeding their respective MCLs (Table I-3-2). Analytical results

for samples from PWB-2 have only recently shown concentrations of 1,2-DCP exceeding its MCL. PWB-4 is the only well drilled for which concentrations of 1,2-DCP, 1,2,3-TCP, dinoseb, and DBCP exceeding their respective MCLs. Evaluation of concentrations of 1,2-DCP in wells WB2-1 and WB2-2 (which are only screened in the B-2 aquifer) showed that in both wells this COC exceeded its MCL consistently. These two wells are more than 200 feet apart. Data for the two nearby wells PWB-2 and PWB-4, which are screened continuously from the top of the B-1 aquifer to the middle of the B-2 aquifer, indicate smaller concentrations of all COCs than in WB-1 and WB-2 wells. The B-2 aquifer is approximately 15 feet below the B-1 aquifer at these wells. The fact that data for both wells WB2-1 and WB2-2 indicate higher concentrations for 1,2-DCP, 1,2,3-TCP and dinoseb than those reported for wells PWB-1 and PWB-2 has led to the conclusion that the B-1 and B-2 aquifers are not isolated from each other as was formerly conceptualized (USEPA, 1993a).

Based on the February and May 2003 data, COCs were detected at 16 of the 17 B-zone wells (all except well PWB-6). Analysis of groundwater samples from well WB2-4, which is the furthest well in a southwesterly direction from the Site, did not detect any COCs above respective laboratory reporting limits. The MCLs of several COCs (1,2-DCP, 1,2,3-TCP, DBCP) have been exceeded in several wells (see Table I-3-2 for COC MCLs):

- **A-Series Wells (AR-1, AMW-3R, and AMW-4R):** Concentrations of 1,2-DCP, DBCP, and EDB above their respective MCLs have been detected in these wells. 1,2-DCP is most consistently detected, with the highest concentrations reported in AMW-4R between 1995 and 1998 and ranging from 210 to 330 µg/L. EDB was detected at above-MCL concentrations in 1994 and has not been detected in sampled water since then. DBCP was detected in all three wells at above-MCL concentrations (maximum of 12 µg/L in well AR-1) in 1995 and has not been detected in sampled water except in well AMW-4R at below-MCL concentrations.

- **WB-Series Wells (WB2-1 through WB2-4):** These four wells have been monitored since 1992. 1,2-DCP was consistently detected in wells WB2-1 and WB2-2 above its MCL starting in 1992. The highest reported concentration (1,700 µg/L) was detected in well WB2-1 in 1992. The higher concentration from 1992 to 1998 has not been seen in recently sampled groundwater. In the February 2003 samples, the maximum concentration of 1,2-DCP was 88 µg/L in well WB2-1. Dinoseb has also been detected in this well above its MCL since 1998. It is the only well in which dinoseb was detected above its MCL. EDB and DBCP were more consistently reported in these wells above their respective MCLs from 1992 through 1997. However, these compounds are either not detected or are below MCLs except in well WB2-2, where DBCP has been detected above its MCL since October 2002.

- **PWB-series wells (PWB-1 through PWB-10):** Five of these wells have been monitored since 2002 and the other five since 2003, providing for five rounds of samples for five of the wells and one round for the other five. Again 1,2-DCP was found most consistently and was reported above its MCL in wells PWB-2, PWB-4, and PWB-7. The highest concentration of 930 µg/L was reported for the February 2003 sample from PWB-7. Both DBCP and EDB have been reported above their respective MCLs in wells PWB-2 and PWB4. EDB is reported above its MCL in well PWB-8 also.

5.2.2 *EXTENT OF CONTAMINATION*

Isoconcentration contours for the different COCs in the B-zone for May 2003 are presented in Figures I-14A through I-14E, which show the spatial distribution of the COCs in this zone. The COCs with the greatest spatial extent and concentrations were 1,2-DCP and 1,2,3-TCP, similar to the A-zone.

Chloroform at lower concentrations has also been detected over a similar area as the other compounds. The extent of the six COCs is summarized as follows:

- **1,2-DCP (MCL of 5µg/L):** This compound has been most consistently detected and covers the largest area of the COCs within the B-zone (Figure I-14A). According to recent sampling data, the above-MCL concentrations extend southwest from the site to a distance of about 600 feet. The highest concentrations parallel the southern boundary of the Site and extend approximately 100 feet away from the boundary towards the southwest.

- **1,2,3-TCP (No MCL):** Concentrations above 200 µg/L are reported for this compound near the southern boundary of the Site and extend approximately 100 feet southwest of it in the same area as the high 1,2-DCP concentrations (Figure I-14B). The extent of the high concentrations is relatively limited and it is not detected in wells away from WB2-3.

- **DBCP (MCL of 0.2 µg/L):** The higher concentrations of DBCP are also limited to the area just south of the southern site boundary (Figure I-14C). Also, DBCP has relatively limited areal extent and is not detected in wells away from WB2-1. The above-MCL concentrations extend approximately 200 feet away from the Site boundary.

- **Chloroform (MCL of 100 µg/L):** Chloroform has been detected in many wells monitored (Figure I-14D). None of the reported analytical results are above the MCL for chloroform.

- **Dinoseb (MCL of 7 µg/L):** Dinoseb, like the other compounds, is found in an area paralleling the southern boundary (Figure I-14E). The extent of above-MCL concentrations of dinoseb is limited to an area approximately 350 feet south of the site and extending towards the southwest.

- **EDB (MCL of 0.05 µg/L):** EDB has also been detected in above-MCL concentrations in several wells. However, it has been detected only sporadically. EDB has been detected at 0.07 µg/L in well PWB-8, which is approximately 700 feet south of the Site boundary. However, in the most recent round of sampling it was not detected above laboratory reporting limits. Accordingly, no figure was prepared to show the extent of the EDB concentrations in the B-zone groundwater.

In summary, several of the COCs have been detected in concentrations above their respective MCLs, and 1,2-DCP is most consistently detected in the wells. The high concentrations of the compounds are limited to a 200–foot-wide zone south southwest of the Site. Only 1,2-DCP appears to have migrated further to a distance of approximately 600 feet south of the Site.

5.3 C-ZONE

The C-zone aquifer is located beneath the B-zone aquifer, separated by the Corcoran Clay layer, which in the area of the Site is at least 27 feet thick. It is estimated that the C-zone aquifer is located at a depth of approximately 300 feet bgs. Groundwater-monitoring wells in the C-zone were not installed as part of this investigation. Understanding of the C-zone is dependent on knowledge of the deeper zone based on regional information and published sources, as well as data available from City of Arvin installations in the area. Lithology of the C-zone in the area is illustrated by the driller's well log for city well No.1 (Figure I-8).

5.3.1 *NATURE OF CONTAMINATION*

Groundwater contamination in the A-zone and B-zone may impact the C-zone groundwater. City well No. 1 has been sampled during each quarterly groundwater monitoring event and in the past year on a monthly basis. There have been three instances where a COC was detected in city well No. 1. In January 1998, 1,2,3-TCP was detected at 1 µg/L. In February 2002, 1,2,3-TCP was detected at 0.18 µg/L (estimated value). In both instances, the 1,2,3-TCP concentration was less than its MCL of 5 µg/L. In July 2002, dinoseb was detected at 0.29 µg/L. In October 2002, the dinoseb value was rejected due to improper laboratory handling procedures. Analytical results for dinoseb were below its MCL of 7 µg/L.

The isolated and incidental reporting of below MCL level COCs in the sampled water from the city well No. 1 are not an indication that the Site contamination has impacted the well.

5.3.2 *EXTENT OF CONTAMINATION*

Based on current data available for off-site water supply wells, the C-zone groundwater is not impacted by the contaminants found at the Site.

5.4 AIR

Background air quality at the site is significantly affected by seasonal winds that may gust up to 30 and 50 mph. Many of the irrigated and cultivated agricultural lands in the vicinity of the Site are in rotation. During years or seasons when these lands are idle, wind can cause fine particles in portions of the bare soil to become airborne. Any residual pesticide or herbicide that may have remained in the topsoil could potentially become airborne and migrate through the area. The direction of such migration or the potential for the amount of migration in the area is not known and has not been studied as part of these investigations.

Because of the cap cover on the Site, the potential airborne migration of the contaminated particles and vapors are mitigated and are not considered to be a concern. Hence, air quality monitoring was not conducted during the investigation.

5.5 SURFACE WATER AND SEDIMENTS

Surface water on site is limited to runoff from precipitation and surface water ponding in the non-RCRA-capped area. The surface water is not contaminated and does not present a threat by introducing contaminants into the subsurface of the Site. Ponding only occurs in the non-RCRA-capped area, and is primarily caused by the poorly graded cap located at lower elevations than the rest of the Site. Surface drainage patterns are toward the east. Signs of erosion attributed to the rainy season were apparent during a site visit to assess the RCRA and non-RCRA caps (EnvironMonitoring Services, Inc., 2002).

5.6 SUMMARY

In general, the COCs persist longer in the unsaturated zone than in the saturated zone. Based on available data, contamination detected in the saturated B-zone has migrated from the unsaturated and saturated A-zones. The extent of contamination in the A-zone is limited to the Site and its vicinity. The extent of contamination in the saturated B-zone seems to have migrated southwesterly. The nature and extent of air contamination attributable to subsurface contamination at the Site are mitigated by the on-site caps and

are evaluated to be insignificant. Similarly, there are no immediate surface water bodies nearby to have been affected by the contamination at the Site.

6.0 CONTAMINANT FATE AND TRANSPORT

The purpose of the preliminary fate and transport analysis was to evaluate possible mechanisms of transport of the COCs in the vadose and saturated zones at the Site. Suitable conceptual models were considered for the subsurface at and near the Site. Estimates of physical material properties were used in generating the rate of transport for the different COCs over a 100-year period starting in 1992. Results of fate and transport analyses were used (Panacea, 2003b) in a risk assessment to address the issue of potential risks to the city well, the underlying aquifers, and the air near the Site. Risk assessment requires uncertainty and sensitivity analyses to evaluate ranges of potential attenuation of the COCs along their exposure pathways. The most conservative attenuation cases were used for the analyses. The preliminary contaminant fate and transport report is presented as Appendix A to this RI report.

6.1 MODELING SOFTWARE

The fate and transport analysis was completed for the Site using the T2VOC modeling code developed by Lawrence Berkeley National Laboratory (Falta et al., 1995). This code was selected because of its capability to both simulate aqueous-phase and vapor-phase transport as well as its computational efficiency for both saturated and unsaturated zone simulations.

SUMMERS, VLEACH, and MULTIMED codes were previously used to simulate contaminant transport (AscI, 1992). All three codes are substantially more conservative than T2VOC code. SUMMER and MULTIMED codes are analytical/semi-analytical in their formulation, which limits their use for complicated and heterogeneous situations. Volatilization generally reduces aqueous-phase concentrations of VOCs. Neither SUMMER nor MULTIMED allows simulation of the vapor phase from VOCs. VLEACH solves steady-state, one-dimensional unsaturated water flow equations using the finite difference method. The flow of water is solely based on Richard's equation, which ignores mobility of the air phase. Only diffusion of vapor is accounted for, and no advective transport in the air phase is simulated by VLEACH.

T2VOC was used because it provides robust capability for VOC transport, including coupled flow of moisture and air in the unsaturated zone, a three-dimensional grid system, a non-isothermal option, and fully heterogeneous material properties selection.

6.2 MODEL DEVELOPMENT

Existing data from boreholes and wells were evaluated and analyzed to develop two alternative conceptual hydrogeologic models of the Site. These models are referred to as Alternative Conceptual Hydrogeologic Models 1 and 2 (Figures I-16A and I-16B, respectively). The main difference between these models is the northern extent of the existing clay layer in the saturated B-zone aquifer. This clay layer occurs approximately 200 feet bgs (approximately 100 feet above the Corcoran Clay confining layer). The first model (Figure I-16A) considers the clay layer at 200 feet to be discontinuous or present over a part of the area of interest as indicated by interpretation of borings and wells drilled at the Site. The second model (Figure I-16B) considers a more continuous clay layer as another possible interpretation of site geology. In this second interpretation, a base for the B-zone is effectively assumed at the 200-foot clay that provides added protection in the form of an additional 100 feet of isolated zone above the deeper regional C-zone aquifer underlying the Corcoran Clay. In Alternative Hydrogeologic Conceptual Model 1, the saturated B-zone is assumed to consist entirely of sand. In Alternative Hydrogeologic

Conceptual Model 2, the B-zone is assumed to be split by the clay layer at approximately 200 feet with two sandy water-bearing layers in the zone: one above this 200-foot clay and the other below it. Subsurface groundwater flow and the potential paths of the migrating COCs were evaluated using the conceptual numerical models based on these physical models.

The numerical models were represented by a two-stage simulation where the unsaturated zone was simulated in a cross-sectional, two-dimensional mode to estimate the COC input into the B-zone from the overlying A-zone. The results of this scenario were then input as sources into another two-dimensional model in plan view, simulating saturated zone flow and transport in the B-zone. This method allowed for expedient modeling runs.

6.3 DATA USED FOR MODELING

Large amounts of data were available for the fate and transport analyses and were incorporated into a database. SATURN is a database management software tool that is designed to facilitate access to site investigation data. It was used to manage and access the Site investigative data and as the interface for input and output of data for or from the simulations. A summary of the available data is provided in the following paragraphs.

6.3.1 *PRECIPITATION*

Monthly precipitation data for Bakersfield (National Oceanic Atmospheric Administration [NOAA] National Climatic Data Center, 2003) was used as input to the modeling effort. These data provided the frequency patterns for the recurrence of precipitation intensities that were then modeled in the simulations.

6.3.2 *INFILTRATION*

Infiltration rates vary in the area of the Site and are influenced by nearby irrigation practices. Estimates for infiltration were made to bracket the range of infiltration rates considered to be likely for the site and the site vicinity. Based on these estimates, a low rate of 0.4 inch per year and a high rate of 4 inches per year were used in the simulations.

6.3.3 *SOIL PHYSICAL PROPERTIES*

Soil physical properties were estimated via in-situ testing, laboratory analyses of soil samples, or estimates of properties based on generalized descriptions from field investigations. Laboratories that performed the analyses were certified by either the City of Los Angeles, the USACE, or the State of California. American Society for Testing and Materials (ASTM) Methods and Method of Soil Analysis were used for test protocol where applicable. Batch adsorption test methods were developed specifically for these analyses due to the unique properties of dinoseb and the absence of test methods for this compound in the literature.

Where data were available to allow statistical evaluation to obtain most likely estimates for a physical property parameter, such analyses were conducted. The designated values used in the simulations are described in Appendix A and briefly summarizedin the following paragraphs.

The majority of soils sampled at the Site were from silt and clay layers. Saturated hydraulic conductivity values for the soil at the Site range from 3.53 x 10^{-5} to 8.19 x 10^{-9} cm/sec. Directional hydraulic conductivity results (horizontal and vertical) range from 1 x 10^{-8} to 8.5 x 10^{-5} cm/sec.

The harmonic mean for the vertical hydraulic conductivity is calculated to be 9.84 x 10^{-8} cm/sec, and the horizontal mean hydraulic conductivity is 2.42 x 10^{-8} cm/sec (8.03 x 10^{-8} cm/sec for boreholes). A hydraulic conductivity of 1.0x10^{-9} cm/sec is approximately equivalent to a permeability of 1 x 10^{-16} square meter (m^2). It appears that the harmonic mean is almost the same in both horizontal and vertical directions for finer-grained soils (clays and silts).

For flow parallel to the layers, such as in the saturated sections of both the A-zone and the B-zone, the geometric mean is a more appropriate statistical parameter. This is because of the heterogeneous nature of the material. Geometric means of hydraulic conductivity values range between 5.37 x 10^{-7} and 1.6 x 10^{-7} cm/sec (or permeability values between ~5.0 x 10^{-16} and 1 x 10^{-16} m^2) for vertical and horizontal directions, respectively (1.29 x 10^{-6} cm/sec for samples).

In simulations of the unsaturated zone, the harmonic mean (for the horizontal direction) has been assigned, for the base cases, to the clay material. Values of the harmonic mean have also been assigned to the clay material for sensitivity analysis. An upper bound value of 1.0 x 10^{-4} cm/sec (or permeability values between ~1.0 x 10^{-13} m^2) was assigned to the silt and mixed layers. A value of 1.0 x 10^{-5} cm/sec (or permeability values between ~1.0 x 10^{-14} m^2) was also assigned to these layers to evaluate the sensitivity of calculated flow rates in the unsaturated zone.

Results from several laboratory grain-size distribution analyses were used to verify calculated relative permeability and retention curves that were needed for simulations. Analytical results for saturated permeability, porosity, density, and water content from both laboratory tests conducted as well as those reported by previous investigators were used for simulations. A batch test analysis was conducted and the results were analyzed to compare with soil and groundwater measurements. Details of the procedures are described in *Monitoring Well Installation Workplan* (Panacea, 2003a).

Other parameters that were available and evaluated for use in the simulation were:

- Porosity,
- Density,
- Distribution coefficient from laboratory batch tests, and
- Calculated coefficient of distribution from field data.

Although the latter two parameters were evaluated for use with sensitivity analysis, they were not used in the preliminary fate and transport simulations to be conservative.

6.3.4 *SATURATED ZONE PROPERTIES*

Pumping tests have not been recently performed at the Site by Panacea. In the past, pump tests were conducted to evaluate the B-zone aquifer properties and these indicate that wells screened in the B-zone could be pumped at 7 gpm (MK, 1999a, and E&E, 1993a) for an extended period. The hydraulic conductivity assessed in laboratory tests has only been used for the unsaturated zone characterization and calculations. For saturated zone flow calculations both in the A-zone and B-zone, values of previous pumping tests (including slug, pumping injection, and recovery tests) were evaluated and appropriate

representative values were used in the models. For the plan-view saturated-zone model, a hydraulic conductivity value of 9 x 10^{-3} cm/sec was used for the saturated B-zone aquifer. This value is consistent with the value of 8.7x10^{-3} cm/sec reported from the pumping test conducted for well WB-1 (E&E, 1993a).

6.4 NUMERICAL MODELING RESULTS

6.4.1 *SIMULATIONS OF GROUNDWATER FLOW*

6.4.1.1 Vadose Zone

The two-dimensional, cross-sectional numerical model was used to simulate the northeast-southwest cross section. At first, static hydraulic equilibrium for two cases of infiltration rates of 0.4 and 4 inches per year (in/yr) were simulated. The static equilibrium conditions were compared with the moisture content and saturation data, as well as with the piezometric levels in both the A-zone and B-zone monitoring wells. The simulations were calibrated with these conditions. Calibration in this case was limited to visual comparison of the simulation results with the field data (mainly saturation distribution).

6.4.1.2 Saturated B-Zone

To evaluate the effect of changes in the piezometric surface in the B-zone, three water-table configurations were evaluated for the B-zone to test the effects of different infiltration rates on the water table configurations in the B-zone. The variation of the piezometric level in this zone results from the observation of a higher piezometric level in well CB01 (Figure I-1-3 of Appendix A), which is closer to Arvin city well No. 1 (CW-1) than an upgradient monitoring well (WB2-4) (approximately 100 feet to the northeast of city well No. 1). This observation may or may not accurately reflect conditions within the B-zone but was considered in our evaluation of the B-zone hydraulic conditions.

The first case assumed a flat horizontal water table. The second case was set up to correspond to the water level elevations observed in wells CB01 and WB2-4. The third case ignored the water level elevation in well CB01 and assumed that the water-level elevation in WB2-4.

Steady-state equilibrium conditions were established by running simulations for as long as 20 million years. These equilibrium conditions were used as initial hydraulic states to start COC transport simulations.

The third case was used for simulation of transport in the unsaturated zone and the plan-view saturated B-zone. The B-zone piezometric head levels were simulated to correspond to those calculated in the cross-sectional unsaturated zone model as well as the observations of the piezometric levels made in the monitoring wells installed in the B-zone (Figure I-12).

6.4.2 *SIMULATIONS OF CONSERVATIVE TRANSPORT OF COCS*

Available data indicate that adsorption and biodegradation processes may be influencing the mechanism of transport in both the saturated and unsaturated zones at the Site. For preliminary simulations, these parameters were ignored to evaluate the conservative (no adsorption and no biodegradation) transport of the COCs.

Experimental verification was made by comparing the results of simulation of transport of 1,2-DCP with the observed distribution of this COC in both unsaturated and saturated zones. The COC 1,2-DCP was selected because it is more pervasive in both aquifers.

The conservative assumptions used for modeling are as follows:

- No degradation,
- No adsorption,
- Largest value of vertical hydraulic conductivity for clay layers in the A-zone,
- Large infiltration rate (4 in/yr) at the Site throughout the 100-year simulations,
- Largest gradient in the B-zone aquifer (this may not be entirely conservative because of the contribution to the dilution factor), and
- Largest hydraulic conductivity in the B-zone (this may not be entirely conservative because of the contribution to the dilution factor).

The assumptions in the B-zone aquifer were varied for simulations. The last two assumptions listed above result in faster migration of the COCs from the source to city well No. 1 in the B-zone. However, because of the dilution factor, the concentrations are reduced substantially. On the other hand, if lower hydraulic conductivity and smaller gradients were assumed for the B-zone aquifer simulations, larger concentrations would have appeared beneath the source but much longer time would have been required for the plume to reach city well No. 1.

6.4.2.1 Results of Cross-Sectional Unsaturated Zone Transport Simulations

April 1992 was used as the starting time for all simulations that continued for 100 years. The results for the cross-sectional unsaturated zone numerical models are as follows:

- **1,2-DCP** – The results of simulation of 1,2-DCP transport show that the simulated concentrations outside the Site boundary are relatively small (<500 μg/L) and, vertically, the simulated migration of the COC plume beneath the Site reaches the B-zone aquifer after approximately 20 years at concentrations exceeding 100 μg/L.
- **1,3-DCP** – The pattern of migration is similar to that for 1,2-DCP, but concentrations are orders of magnitude smaller (<1 μg/L).
- **1,2,3-TCP** – Lateral distribution is more isolated than for 1,2-DCP and concentrations are within the same order of magnitude. However, vertical migration of this COC is more predominant.
- **Chloroform** – The pattern of migration is similar to that for 1,2,3-TCP, but concentrations are an order of magnitude smaller (<1 μg/L) off site.
- **DBCP** – The pattern of migration is similar to that for 1,2-DCP, and the concentrations are similar (<500 μg/L off site and <1,500 μg/L beneath the site).

- **Dinoseb** – The pattern of migration is similar to that for 1,2-DCP, and the concentrations are similar. (<500 µg/L off site and <2,000 µg/L beneath the site). However, because the center of the plume falls beneath the Site where a higher infiltration rate is applied, vertical migration of the plume to the B-zone is more pronounced.

- **EDB** – The pattern of migration is different from all other COCs. It appears that very little EDB reaches the B-zone.

6.4.2.2 Results of Saturated Zone Transport Simulations for the B-Zone

The calculated concentration fluxes of COCs that vertically entered the B-zone in the cross-sectional (unsaturated zone) simulations were used as the source in the saturated zone (plan view) transport simulations. Due to the dilution factor that occurs as COCs enter the water table from the unsaturated zone, the simulated concentrations in the plan view are much smaller than those shown for the unsaturated zone at the same elevation.

The saturated zone results for the plan view simulations are as follows:

- **1,2-DCP** – The plume from the unsaturated zone does not enter the B-zone until 20 years after the start of simulations. This is not consistent with the observations of contaminant concentrations in the B-zone in 1992. The reason for this inconsistency is that migration in the unsaturated zone started long before April 1991 (which was used as the initial condition for the unsaturated zone simulations). According to site history, the Site was in operation since 1960; however, data from 1960 are not available to set up initial conditions. Therefore, for all saturated zone simulations, a lag time would need to be incorporated to account for the contaminant transport prior to 1992 that is not accounted for in the model.

- **1,3-DCP** – This COC was not detected in the April 1992 data. The flux of contaminant from the unsaturated zone to the saturated zone appears to be very small ($<5 \times 10^{-5}$ µg/L) for the first 60 years after the start of the simulation. For the remainder of the simulation (after 60 years), the concentration of this COC in the B-zone remains small ($<5 \times 10^{-4}$ µg/L).

- **1,2,3-TCP** – Distribution is similar to 1,2-DCP, but the unsaturated zone contribution reaches the B-zone after approximately 9.6 years and continues throughout the entire 100 years of simulation time.

- **Chloroform** – The pre-existing chloroform plume persists for 20 years at very small (<0.5 µg/L) concentrations in the B-zone.

- **DBCP** – No DBCP was detected in April 1992. The unsaturated zone contribution is simulated to start after approximately 40 years at very low concentrations ($<1 \times 10^{-3}$ µg/L). A slight increase in concentration occurs, but the plume continues to persist throughout the 100 years but does not exceed 0.01 µg/L.

- **Dinoseb** – Initial concentrations in the B-zone were not detected in April 1992. The contribution from the unsaturated zone starts at low concentrations ($<0.5 \times 10^{-3}$ µg/L) after 9.6 years, gradually increases and persists throughout the entire 100 years, but does not exceed 0.25 µg/L.

- **EDB** – The initial concentration of EDB in the B-zone was below detection limits in April 1992. The unsaturated zone contribution shows after approximately 40 years at small concentrations

(<5 x 10^{-3} µg/L) in the B-zone. The plume also persists and gradually increases in concentration for 100 years.

6.4.2.3 Sensitivity Analysis

The transport parameters that are expected to have the most significant influence on the results of the simulation of the transport processes of the COCs are listed below.

- Vapor diffusion
- Initial conditions

  - Unsaturated zone

  - Saturated zone
- Boundary conditions

  - Unsaturated zone

  - Saturated zone
- Distribution coefficient (Kd)
- Biodegradation
- Effective porosity

The evaluated parameters affecting flow in the unsaturated zone were infiltration rate, hydraulic conductivity of the unsaturated zone material, and moisture characteristic curves. These parameters were not analyzed for the saturated zone.

Two infiltration rates were assumed for the fate and transport simulations. A lower bound of 0.4 in/yr was assumed to be a natural overall infiltration rate. An infiltration rate of 4 in/yr was assumed as a focused infiltration into the bottom of the pond at the Site. Comparison of the off-site areas of the model with the area beneath the Site shows a substantial difference in the migration of the COCs. In areas with 0.4-in/yr infiltration (off site), COCs migrate less than 25 feet in 100 years, whereas beneath the Site (with 4-in/yr infiltration), the COCs migrate a few hundred feet.

The results of the sensitivity to the changes in hydraulic conductivity were similar to those for the changes in the infiltration rate. Reducing the saturated hydraulic conductivity by an order of magnitude resulted in the same results as reducing the infiltration rate by an order of magnitude (from 4 in/yr to 0.4 in/yr).

6.4.3 *CONTAMINANT PERSISTENCE*

Preliminary fate and transport modeling results suggest that the COCs in the unsaturated zone persist longer than in the saturated zone. Comparison of the A-zone results (Panacea, 2003a) shows a substantial difference between the concentrations in the two aquifers. Concentrations in the A-zone perched aquifer are several orders of magnitude larger than those in the B-zone aquifer.

These modeling results also show that the COCs in the saturated zone may persist for a maximum of 10 years in the absence of vertical leakage from the unsaturated zone. However, leakage from the unsaturated zone is predicted by these results to persist for more than 100 years. The concentrations of chemicals reaching city well No. 1 are estimated to be below their respective MCLs with or without contribution from the unsaturated zone.

6.4.4 *POTENTIAL ROUTES OF MIGRATION*

Conservative scenario modeling results show that transport of COCs occurs primarily in the vertical direction in the unsaturated zone. This is despite the heterogeneous layering of the hydrogeologic units. Very little lateral flow and transport occur in the unsaturated zone. In the saturated zone, flow and transport are mainly southwesterly toward city well No. 1. The direction of flow and transport is based on available information.

Modeling results also indicate that the COC plumes in the unsaturated zone require between 20 and 40 years transporting to the B-zone aquifer from the A-zone. Transport within the B-zone aquifer is relatively fast and, if there were no added contamination from the A-zone, any existing plume in the B-zone would deplete in less than 10 years. However, the slowly moving A-zone unsaturated zone COCs' contribution to the B-zone aquifer will continue to persist beyond 100 years at low concentrations. None of the COCs appear to approach the MCL concentrations near city well No. 1 in the saturated B-zone according to the analyses performed.

6.5 SUMMARY

The evaluation of the data and results of the simulations indicate that synchronization of the flow and transport between the unsaturated zone and the saturated zone would reduce the uncertainty of fate and transport. The flow throughout the unsaturated zone is predominantly vertical, and the layering of the hydrogeologic units does not induce significant lateral migration of the COCs.

Results of the simulations also show that the COCs in the saturated B-zone will persist for a maximum of 10 years in the absence of vertical leakage from the unsaturated zone. However, leakage from the unsaturated zone will persist for more than 100 years. Concentrations of chemicals reaching city well No. 1 are estimated to be below their respective MCLs with or without contribution from the unsaturated zone.

The above results should be interpreted in light of the assumed Site conditions (Section 6.3), and the limitations of modeling software T2VOC (Section 6.1)

7.0 BASELINE HUMAN HEALTH RISK ASSESSMENT

The baseline human health risk assessment (BHHRA) provides an evaluation of the potential threats to humans and the environment in the absence of any remedial action. The goal of the BHHRA is to provide the risk information necessary to assist risk managers at Superfund sites in making informed decisions regarding substances designated hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The BHHRA report in support of the OU-2 RI/FS (Panacea, 2003d) is included as Appendix B of this RI report.

The BHHRA process is divided into the following sections:

- Data review and evaluation

- Exposure assessment
- Toxicity assessment
- Risk characterization

The BHHRA is intended to fulfill the requirements of a risk assessment in accordance with the National Contingency Plan (NCP). The NCP (40 CFR 300) sets forth the manner in which Superfund remediation is to be planned and conducted. The NCP requires development of a BHHRA at sites listed on the NPL under CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The BHHRA was prepared in accordance with California Environmental Protection Agency (Cal/EPA) guidance. The guidance documents and/or information sources used to prepare this risk assessment are presented in Section 8 of Appendix B.

Four activities define the risk assessment methodology:

- **Data Review and Evaluation** – Analysis of site-specific data for usability; provides basis for the risk assessment and identification of chemicals of potential concern.
- **Exposure Assessment** – Development of exposure scenarios to analyze potential contaminant pathways.
- **Toxicity Assessment** – Information on contaminant toxicity to humans.
- **Risk Characterization** – Synthesis of toxicity and exposure assessments summarized into quantitative and qualitative expressions of risk; includes uncertainty analysis and presentation of findings.

7.1 DATA REVIEW AND EVALUATION

Numerous investigations and studies have been completed at the Site to date. These studies include previous investigations (described in Section 4.0) to characterize the nature and extent of contamination associated with historical operations and current site conditions (Panacea, 2003d).

Many studies have been conducted to define the extent of contamination (see Section 5.0). In addition,various historical site documents dated from 1987 through 1999 were reviewed. These reports generally present the results of on-site soil and groundwater investigations, feasibility studies, and remedial action plans (Panacea, 2003d).

Due to the extensive amount of historical data and the number of nondetected analytes reported under standard USEPA Solid Waste 846 methods, a screening methodology was created to identify the COPCs. The objectives of this screening process were to (1) reduce the number of analytes to a manageable size so a detailed quantitative risk analysis could be performed on detected constituents, (2) ensure that the analytes selected represent the Site risk, and (3) ensure that all localized hot spots were addressed (Panacea, 2003d).

The detailed screening methodology was submitted in the BHHRA workplan (Panacea, 2003d). Following the compilation of historical records and more recent investigation results, it was decided that all detected constituents should be conservatively assessed in the BHHRA. Therefore, all detectable analytes in soil and groundwater have been included as COPCs for this assessment and are presented in Table I-7-1.

It is important to note that not all COPCs appear in all environmental media at the Site. Appendix A of the BHHRA report (Appendix B of this report) includes a summary of COPCs and their associated concentrations in the on-site environment (Panacea, 2003d).

7.2 EXPOSURE ASSESSMENT

Exposure assessment involves the development of scenarios to describe potential exposure routes and to provide a basis for quantifying those exposures. The physical and chemical setting of the Site is described with an emphasis on current geological and hydrological conditions, chemical sources, surrounding land use, and potentially exposed populations ("receptors") (Panacea, 2003d). This information is integrated through the development of a conceptual exposure model in which possible exposure pathways are identified, and those pathways that are applicable to the identified receptors are selected for quantitative evaluation. A more detailed description of the Site setting is provided in the BHHRA (Appendix B).

7.2.1 *CONCEPTUAL EXPOSURE MODEL*

The conceptual exposure model provides the basis for a comprehensive evaluation of the risks to human health by identifying the mechanisms by which receptors may be exposed to residual COPCs. The conceptual exposure model traces the Site COPCs in a logical flow from their sources through various release mechanisms and exposure routes to potentially affected receptors. Of particular importance, the conceptual exposure model identifies which exposure routes are potentially complete under the given land use scenarios. These significant pathways are evaluated in the quantitative risk assessment for each receptor. The conceptual exposure model also facilitates the analysis and screening of exposure pathways likely to only pose minor risks.

7.2.1.1 Exposure Setting

For the purpose of defining potential on-site receptor exposures (current and future), this report assumes a single land use for the Site as a controlled commercial/industrial facility. Given this land use, one exposure scenario was examined that is associated with daily operations (the commercial/industrial scenario). The commercial/industrial land use is consistent with existing controls and surrounding land use. Potential off-site receptor exposures include exposure associated with residential and commercial/industrial land use. Residential land use is often associated with the greatest potential exposure for off-site users. Therefore, it is the most conservative off-site land use for establishing risk management conditions at a site. The residential exposure scenario has been developed in accordance with Cal/EPA and USEPA risk assessment guidelines (Cal/EPA 1992, USEPA, 1989a).

7.2.1.2 Reasonable Maximum and Central Tendency Exposures

Reasonable maximum exposure (RME) values have been used to express the highest exposure that could reasonably occur at a site. As a conservative estimate, the RME is within the range of possible exposures but higher than the typical or average exposure. RMEs are estimated for individual pathways. If a population is exposed to more than one pathway, the sum of the exposures across pathways also represents the RME. For comparative purposes, a central tendency (CT) analysis or average has been conducted to quantify the potential uncertainties associated with upper estimates of receptor exposures. The RME values are presented in this report.

7.2.1.3 Conceptual Exposure Model Development

A conceptual exposure model (CEM) was developed to describe the Site exposure setting under current and future site conditions. Given these conditions, there are several potential exposure pathways through which receptors may come into contact with COPCs at the Site. For an exposure pathway to be deemed complete, four elements must be present:

- COPC source(s),
- Release mechanism(s),
- Potential exposure pathway(s), and
- Receptor(s).

Brief summaries of these four elements are provided in the following paragraphs. A more detailed description of the four elements can be found in the BHHRA report (Appendix B).

COPC Sources(s)

Soil and groundwater are identified as the primary COPC sources at the Site. These sources and the resultant CEMs address the primary COPCs identified in at the Site.

Release Mechanism(s)

The typical mechanisms for COPC release and transport for indirect sources are groundwater flow, leaching, volatilization, and dust and particulate emissions from soil. Each of the COPCs has been evaluated for the above-mentioned indirect release mechanisms. A COPC has been quantified for indirect exposure only when one of the pertinent release mechanisms can be established.

Exposure Pathway(s)

Not all release mechanisms lead to exposure pathways under the exposure scenarios. Exposure pathways for current and future site conditions are inhalation, dermal contact, and ingestion.

Receptor(s)

To provide conservative estimates of risk, the BHHRA evaluated the potential health effects on five receptors under both current and future site conditions: the on-site maintenance worker, the on-site commercial/industrial worker, off-site residents (adult and child), and an off-site commercial/industrial worker.

Each receptor group evaluated was chosen to conservatively represent the upper-bound exposures associated with people that have similar lifestyles or perform similar daily activities. If the resultant risk to the receptor group is acceptable, then it is likely that this risk to all other receptors with lesser exposures will also be acceptable. The development and selection of these receptors were based on the RME concept.

7.2.2 *QUANTIFICATION OF EXPOSURE*

The representative concentration of each chemical in the environmental media (groundwater and air) is estimated. Future groundwater concentrations are summarized based on computer-aided fate and transport analysis. The transport of COPCs from environmental media to ambient air and indoor air is presented.

Air dispersion analysis is presented to estimate contaminant concentrations at points of exposure for the selected receptors.

To quantify exposures, statistically representative concentrations were estimated for COPCs in impacted environmental media. These COPC exposure point concentrations are assumed to be equal to the representative concentrations in the medium (direct exposures such as dermal contact and incidental ingestion) or are predicted by transport modeling (indirect exposures). Exposure point concentrations have been derived for direct and indirect exposures.

Statistical methods were used to evaluate the analytical results from the Site sampling to (1) characterize the statistical distribution of COPCs, (2) develop source-term concentrations for fate and transport modeling, and (3) establish exposure point concentrations for direct exposures for applicable receptors. The rationale used to develop this methodology and the statistical techniques is based on the following sources:

- Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual, Part A (USEPA, 1989a),
- Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 1 (USEPA, 1989b), and
- Statistical Methods for Environmental Pollution Monitoring (Gilbert, 1987).

7.2.2.1 Statistical Analysis of Soil Data

For each soil COPC, statistical summaries were developed, including the arithmetic mean, standard error of the arithmetic mean, minimum measured concentration, maximum measured concentration, variance, standard deviation, and 95-percent upper confidence limit (UCL) of the mean.

Due to the uncertainty associated with characterizing potentially heterogeneous media, the 95-percent UCL for either a normal or lognormal distribution is used to represent constituent concentrations. When the underlying data distribution could not be estimated at the 95-percent UCL under normal or lognormal conditions, the maximum detected value was used in this risk assessment. When both 95-percent UCLs exceeded the maximum detected value, the maximum detected value was used. This approach is consistent with State of California Department of Toxic Substances Control (DTSC) guidance. Table I-7-2 presents the 95-percent UCL concentrations of COPCs in site soil. These concentrations are assumed to be representative of concentrations across the entire site. Appendix A of the BHHRA (Appendix B of this report) presents statistical summaries for each of the Site COPCs.

7.2.2.2 Statistical Analysis of Groundwater Data

Average results from collected groundwater samples were used in the derivation of current on-site exposure point concentrations. Due to the lack of complete exposure pathways to the B-zone groundwater under the current exposure scenario, exposure point concentrations have only been calculated for the A-zone. Table I-7-3 summarizes the result of exposure point concentration calculations for the A-zone. Laboratory analytical results of groundwater sampling for A-zone and B-zone are summarized in Tables I-3-1 and I-3-2, respectively.

7.2.2.3 Groundwater Fate and Transport Analysis

The fate and transport analyses of selected COPCs identified in the unsaturated and saturated zones have been assessed (Panacea, 2003b). Specifically, a computer-aided fate and transport analysis has been completed to estimate future concentrations of the COPCs in groundwater at selected locations based on current concentrations in soil and groundwater. The modeling effort was designed in a way that would provide conservative estimates.

Three separate points of compliance were identified in the groundwater fate and transport modeling for use in the risk assessment: on-site, downgradient fence line, and the downgradient Arvin city production well. The maximum 30-year average projected by the model at each predetermined compliance point was used as the exposure point concentration for this risk assessment. These maximum 30-year averages are designed to be conservative yet reasonable based on projected groundwater fate and transport conditions and modeling assumptions. Table I-7-4 summarizes these concentrations. These concentrations are used conservatively to assess the direct and indirect potential future risk to site receptors as described in the following sections. A complete copy of the fate and transport analysis report is presented in Appendix A.

7.2.2.4 Air Transport Analysis

An analysis of the transport of COPCs at the Site through the air pathway was conducted to assess potential receptor exposure concentrations. This section describes the methodologies used in the air transport analysis.

This air transport analysis estimated the airborne COPC concentrations for two emission cases. The first case is applicable to short-term ambient (outside) air; soils were assumed to be uncovered (existing cap breached) during maintenance and construction activities. Source terms were limited to concentrations in surface soils (0 to 10 feet bgs) based on the theoretical potential for increased direct exposure to surface soils by potential maintenance workers.

The second emissions case estimated the long-term airborne COPC concentrations inside residential or commercial/industrial facilities and outside ambient air. It is important to note that the indoor air intrusion model accounts for the attenuation effects of anticipated future site structures on volatile emissions. However, to be conservative, no attenuation of volatiles was assumed for asphalt and vegetation outside of the Site footprint. Due to the long-term nature of this emissions case, all potential soil sources and the A-zone groundwater were evaluated.

In this analysis, site-specific data were used for chemical concentrations. Site-specific data regarding soil properties were also used when available. When site-specific values were not available, conservative assumptions found in appropriate literature were used. Regulatory default options and values were used in the source emission calculations and air models. The intent of assumptions used in this analysis was to make the results relevant to the Site yet conservative, so that the risk associated with this exposure pathway is not underestimated. This approach is consistent with USEPA and Cal/EPA guidance.

Short-Term Emission Case

Inhalation exposures for soil emissions are characterized as indirect, meaning exposures occur away from or in a different medium than the source. The COPC concentrations at the point of exposure are typically lower than the representative values determined for the source medium. Therefore, to quantify exposure through indirect pathways, the reduction in COPC concentrations associated with each transport

mechanism from the source medium to the point of exposure must be characterized in terms of an attenuation factor.

Attenuation factors for the volatilization and particulate resuspension of COPCs were developed for use in the quantification of potential ambient air exposures associated with the Site. These attenuation factors were used to correlate potential exposure point concentrations originating from limited surface areas during construction activities. Site-specific data were used when available, with literature sources serving as a secondary source.

A summary of the calculated volatilization attenuation factors for soil COPCs is presented in Table I-7-5.

Estimating airborne concentrations of COPCs in the particulate phase involves modeling both resuspension and dispersion. The resuspension component provides a rapid assessment procedure applicable to a typical hazardous waste site, whereas the surface contamination provides relatively continuous and constant potential for emission over a period of time.

The calculated particulate attenuation factor is independent of the COPC and represents an estimated rate of resuspension of soil. The calculated value used in this risk assessment is 4.77×10^9 cubic meters per kilogram of soil (m^3/kg). This is the identical particulate emission factor calculated by the USEPA Region IX for use in the preliminary remediation goals (USEPA, 1998a).

Long-Term Emission Case

The long-term emission case consists of three components: (1) indoor air modeling to account for COPCs that may migrate into on-site buildings, (2) emissions of volatile COPCs from on-site soil sources to outdoor ambient air, and (3) emissions of COPC volatiles from groundwater to outdoor ambient air.

7.2.2.5 Indoor Air Emissions

The modeling of on-site vapor intrusion included all soil sources and the underlying A-zone groundwater contamination. The maximum 30-year average fence-line concentrations found in the A-zone groundwater were used for modeling off-site residential and commercial/industrial scenarios. Contamination in the B-zone was found to be insignificant as a result of depth and markedly lower levels of contaminants. The modeled on-site and off-site indoor air concentrations are summarized in Tables I-7-6 and I-7-7).

7.2.2.6 Ambient Air

The maximum annual on-site and off-site COPC concentrations under both current and future exposure scenarios were calculated using the latest release of the Industrial Source Complex – Short Term 3 (ISCST3) air dispersion model. This model is recommended in the USEPA's *California's Risk Assessment Guidance for Air Pathway Analysis at Hazardous Waste Sites*. ISCST3 can calculate short-term as well as annual average COPC concentrations at user-defined receptor locations.

The primary release mechanism identified for COPC air emissions from soils and groundwater is volatilization. Methods for estimating organic COPC emission rates from various hazardous waste media are provided in guidance documents from Cal/EPA. The methods described for estimating organic emissions from landfills without internal gas generation are applicable and appropriate to use to estimate organic emissions from the Site in this assessment. These assumptions provide the largest soil vapor space for volatilization and the highest driving force for COPC flux from the soil.

The ISCST3 modeling results for the maximum on-site and off-site (fence-line) COPC concentrations in ambient air are summarized in Table I-7-8.

7.3 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to provide information on the toxic effects of exposure to COPCs. More specifically, this step of the risk assessment provides a quantitative estimate of the relationship between exposure and severity or probability of human biological effects for each COPC (Panacea, 2003d).

In evaluating the toxicity data, we found toxicity information for 1,3-dichloropropene but none for 1,3-dichloropropane which was a compound detected in the groundwater sample analyses. With the approval of EPA, we substituted the toxicity data for 1,3-dichloropropene in our calculations for 1,3-dichloropropane.

The quantitative estimate of the relationship between exposure to COPCs and the resulting probability and/or severity of human biological effects for each COPC is defined as the dose-response (or toxicity values). The dose-response assessment provides information regarding the potential for receptors' exposures to chemicals detected at the Site to cause adverse health effects.

7.3.1 *NON-CARCINOGENIC CONSTITUENTS*

Dose-response values for non-carcinogenic chemicals are identified as reference dose levels (RfDs). The RfD, expressed in units of milligrams per kilogram-day (mg/kg-d), represents the daily intake of a constituent (averaged over a year) per kilogram of body weight that is below the effect threshold for that constituent. In essence, the RfD represents the receptor-specific threshold dose. The USEPA assumes that non-carcinogenic exposure doses are not cumulative from age group to age group over a lifetime of exposure (USEPA, 1989a). Each RfD is specific to the constituent, route of exposure, and duration over which the exposure occurs.

Inhalation and oral RfDs for the non-carcinogenic COPCs are listed in Table I-7-9. The primary source for toxicological reference values is the IRIS database (USEPA, 2003), which contains current health risk and regulatory information. Provisional RfDs are tabulated in the health effects assessment summary tables (HEAST) (USEPA, 1997b). Chronic RfDs are used to calculate the non-carcinogenic "hazard" for exposures longer than 1 year in duration, while subchronic RfDs are used for shorter exposure periods. When an inhalation RfD is unavailable, the oral RfD is used (Cal/EPA 1999).

The non-carcinogenic hazard associated with a constituent exposure is expressed as the hazard quotient (HQ). The HQ is a ratio of the estimated constituent intake based on the measured or calculated exposure concentration for a constituent (dose) divided by the appropriate oral or inhalation RfD. An HQ greater than 1 indicates the estimated intake exceeds the RfD, and there may be concern for potential noncancer effects. The level of concern increases with increasing HQ. If exposure to multiple contaminants occurs, the potential for noncarcinogenic effects is assessed by summing the individual hazard quotients. The sum of the HQs is designated the hazard index (HI).

Following USEPA guidance (USEPA, 1989a), all non-carcinogenic risk was considered additive for individual receptors. Because the non-carcinogenic COPCs under investigation at the Site are associated with various adverse effects on distinct target organs and systems, the assumption of additivity of effects may overstate the potential for harmful effects. On the other hand, the potential synergistic effects of two

or more COPCs must also be recognized. The combined effects of exposure to two COPCs may be worse than exposure to either COPC alone because of interactions.

7.3.2 *CARCINOGENIC CONSTITUENTS*

The dose-response values for carcinogenic chemicals are identified as cancer slope factors (CSFs). CSFs are upper-bound (95-percent UCL) estimates of the increased cancer risk per unit dose in which risk is expressed as the probability that an individual will develop cancer within his or her lifetime as the result of exposure to a given level of a carcinogen. All cancers or tumors are considered whether or not death results. This approach is inherently conservative because of the no-threshold assumption and the use of the 95-percent UCL of the estimated slope, which is dose versus cancer risk.

The incremental lifetime cancer risk (ILCR) attributed to a carcinogen is calculated as a product of the daily intake (mg/kg-d) and the CSF. USEPA's model of carcinogenesis assumes that the relationship between exposure to a carcinogen and cancer risk is linear over the entire dose range, except at very high doses (USEPA, 1989a). This linearity assumes there is no threshold-of-exposure dose below which harmful effects will not occur. Because of this, carcinogenic effects are considered to be cumulative across age groups when considering lifetime exposures.

The inhalation and oral CSFs are presented in Table I-7-10. The primary source for these toxicological reference values is the cancer potency factor database (Office of Environmental Health Hazard Assessment [OEHHA], 2002), with IRIS (USEPA, 2003) a secondary source.

In addition to the CSF, the toxicity information considered in the assessment of potential carcinogenic risk includes a weight-of-evidence classification. Constituents are grouped according to their potential for carcinogenic effects based on clinical evidence, as follows:

- Group A Human carcinogen
- Group B Probable human carcinogen
- Group C Possible human carcinogen
- Group D Insufficient data to classify as a human carcinogen
- Group E Not a human carcinogen

7.3.3 *DERMAL EXPOSURE RISKS*

Dermal RfDs and CSFs are traditionally derived from the corresponding oral values. However, it is recommended that dermal RfDs and CSFs should not be derived; instead, oral RfDs and CSFs should conservatively be used in place of derived dermal toxicity values (Cal/EPA, 1998a, 1998b).

7.4 RISK CHARACTERIZATION

Risk characterization is the estimate of potential carcinogenic and non-carcinogenic effects of COPCs over a lifetime of exposure. Risk characterization is the final step in the risk quantification process and incorporates the information from the toxicity assessment and the exposure point concentrations.

7.4.1 *EXPOSURE QUANTIFICATION*

The exposure assessment process quantified the magnitude, frequency, and duration of exposure for those populations and pathways selected for quantitative evaluation in the conceptual exposure model in Section 4.0. The exposure parameters for each receptor under study are presented in Tables I-7-11 and I-7-12. These parameters have been prepared in accordance with the RME and CT exposure assumptions.

Table I-7-13 presents the calculated COPC-specific dose-absorbed values, per event, from dermal contact with B-zone groundwater. Dose-absorbed values were only calculated for those COPCs that were projected to reach future off-site B-zone groundwater users.

Table I-7-14 presents the specific absorption factors for each COPC evaluated in this report.

7.4.2 *RISK CHARACTERIZATION METHODOLOGY*

Potential health effects to humans following exposure to site-related COPCs were estimated using methods established by USEPA and Cal/EPA. Key documents used as guidance for preparing this risk assessment are presented in Section 7.0.

Carcinogenic and non-carcinogenic risks resulting from exposure to site-related COPCs were calculated for each of the five receptor groups and are expressed as follows:

- Carcinogenic effects: incremental lifetime cancer risk (ILCR)
- Non-carcinogenic effects: hazard index (HI)

The resultant ILCR and HI values are derived from the intake equation and are used to evaluate potential health impacts.

The ILCR is an upper-bound estimate of the incremental cancer probability for individuals who may have been exposed to site-related, potentially carcinogenic COPCs. The ILCR is compared to a range of acceptable probabilities to determine whether the potential hazard poses an unacceptable health threat. The USEPA currently uses an ILCR of 1.0E-04 to 1.0E-06 as the range of acceptable risks (USEPA, 1990b, 1991a).

The potential health effects resulting from exposure to a non-carcinogenic, hazardous COPC are evaluated by comparing a receptor's exposure or intake level to the RfD of that COPC (USEPA, 1989a). The ratio of intake over the RfD is termed the HQ. An RfD is the daily exposure level likely to cause no appreciable risk of deleterious effects during a lifetime. If the HQ is greater than 1 or “above unity,” there may be concern for potential non-carcinogenic health effects. The level of concern increases as the HQ increases above unity, although the two are not linearly related (USEPA, 1989a). When receptors are exposed to more than one COPC through multiple pathways, it is useful to develop a total HI. The HI is the sum of HQs across pathways (USEPA, 1986). The HI is also compared to a threshold level of unity.

7.4.3 *HEALTH RISKS FOR SITE*

The HI and ILCR results for each receptor studied are presented on Tables I-7-15 through I-7-18. The results include consideration of both current and future exposure scenarios. An RME approach was used to quantify potential health impacts (see Section 4.0 of Appendix B). If the RME values are within acceptable limits, then all other lesser exposures related to the Site are also within these limits.

A summary of health risk calculation results is presented in the tabulation below:

RECEPTORS	CURRENT SITE CONDITIONS		FUTURE SITE CONDITIONS	
	HAZARD INDEX (HI)	INCREMENTAL LIFETIME CANCER RISK (ILCR)	HAZARD INDEX (HI)	INCREMENTAL LIFETIME CANCER RISK (ILCR)
On-Site Maintenance Worker	**5.9E-03**	**1.0E-07**	**5.9E-03**	**1.0E-07**
On-Site Commercial/ Industrial Worker	**1.2E-01**	**7.5E-06**	**1.2E-01**	**7.5E-06**
Off-Site Resident Adult	**8.4E-03**	**4.0E-07**	**6.7E-01**	**1.3E-04**
Off-Site Resident Child	**2.8E-02**	**2.7E-07**	**2.3E+00**	**8.4E-05**
Off-Site Commercial/ Industrial Worker	**2.0E-03**	**8.0E-08**	**1.9E-02**	**4.0E-06**

The risk assessment has shown, in a conservative manner, that current site conditions do not pose significant risk to receptors. However, further off-site migration of COCs may result in a significant increase in potential risk associated with indoor air exposures because of the absence of any cap off-site. Off-site migration of the plumes in the A-zone beyond their current extent is not likely because of the limited extent of the saturated A-zone, which is the main container and carrier of the COCs. Off-site migration of the plumes in the B-zone aquifer beyond their current extent are not expected to increase risk because of the significant dilution that is estimated to occur in this zone as well as the depth of the groundwater in this zone.

Under the current exposure scenario, the carcinogenic risks (ILCR) for all receptors are within the 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000) risk management goal stipulated by the USEPA (1990b) However, the risk for the on-site commercial industrial worker exceeds the “de minimis” risk level of 1 in 1,000,000, typically applied by Cal/EPA, if the cap is disturbed. The projected risks to this receptor are associated with potential indoor air exposures to contaminants originating from the underlying soils and groundwater.

The uncertainties associated with the risk calculations discussed above are further addressed in the following section.

7.4.4 *UNCERTAINTIES*

The goal of a health risk assessment is to provide scientific and objective risk estimates that enable effective risk management. In this section, the calculated risk values are evaluated to identify the type and degree of uncertainty introduced in the risk assessment process.

Reviewers can be misled if they rely only on a simplified numerical presentation without considering the uncertainties, limitations, and assumptions inherent in the health risk assessment process. For example, an insignificant cancer risk may be calculated for an individual from exposure to a particular source of chemicals. However, if the uncertainty in this number is measured in orders of magnitude, then the real risk from this source may in fact be higher than the risk from another contaminated source that has a

higher calculated risk but a small degree of uncertainty. The uncertainties and conservatism inherent in this risk assessment are considered in the evaluation of the risks. For more detailed information about the uncertainties, refer to Section 6 of Appendix B.

7.5 ECOLOGICAL RISK ASSESSMENT

The USEPA Region IX Hazardous Waste Management Division conducted a Phase I ecological risk assessment as part of the OU-1 studies. The main ecological concern noted was the surface soils contaminated with elevated concentrations of dinoseb as well as other contaminants. The purpose of the assessment was to review existing site data, and conduct limited fieldwork, to evaluate the potential for ecological impacts from contaminants on-site and the need for and the nature of any additional ecological assessment activity (USEPA, 1992a).

The USEPA conducted preliminary site surveys on July 2, 1991, with the California Department of Fish and Game (CDFG), and on December 10, 1992, to identify potential habitats and determine species likely to inhabit the area. Analytical results indicate that the toxicity and concentrations of contaminants in soil could have adverse chronic effects on individual and on-site populations of primary and secondary consumers. However, off-site populations were not expected to be significantly impacted because of low potential exposure to contaminants. Exposure of off-site populations to windborne pesticide residues originating from the Site would be insignificant relative to pesticide/herbicide exposure in the surrounding agricultural areas. Based on the existing site, it was determined that there are no substantial risks to wildlife from contaminants, supported by a very low potential exposure of wildlife to contaminants plus removal activities that would reduce potential risks. No further investigations were recommended (USEPA, 1992a).

An environmental evaluation of ecological risks was conducted to quantify the potential risks to the environment as part of OU-2 studies in 2003 (Panacea, 2003c). This analysis consisted of conducting a search of the CDFG California Natural Diversity Database (CNDDB) and performing a site survey to locate any potential ecological receptors and/or sensitive habitats. The findings indicate that there were no potential ecological receptors at or adjacent to the Site. It was determined that they are not expected to occur based on the disturbed nature of the Site, with limited amounts of natural habitats where the identified receptors would be found. Because the identified ecological receptors were not located at or adjacent to the Site, the determination was made that there was no need to conduct an ecological risk assessment (Panacea, 2003c). The biological constraints analysis report (PSBS, 2002) is presented in Appendix D.

8.0 SUMMARY

Remedial investigation studies have been performed at the B&B facility located in the city of Arvin, California. The focus of this RI was the second operable unit (OU-2) at this site.

The primary objective of the RI was to assess the source and extent of COCs, their fate and transport, and their potential risk to human receptors and the environment at the Site and its vicinity. The focus of this OU-2 RI was on the subsurface soil from the bottom of the first water-bearing unit (A-zone groundwater) to the second water-bearing unit (B-zone groundwater). The B-zone groundwater is located at a depth of approximately 140 feet bgs, extending to a depth of approximately 300 feet bgs, the top of the Corcoran Clay.

Geologic material beneath the Site consists mainly of fluvial and lacustrine deposits with complex layering of unconsolidated sands, silts, and clay. The bottom of a water-bearing unit is used to divide the

subsurface soils into the A-zone and B-zone. The A-zone includes unsaturated soil to 65 to 85 feet bgs. The A-zone groundwater occurs beneath the entire site and disappears within about 500 feet south of the Site and at smaller distances east and west of the site (Figure I-7).

The B-zone includes unsaturated soil beneath the A-zone and the second water-bearing unit under the Site at a depth of approximately 140 feet. The B-zone extends to approximately 300 feet bgs and ends at the Corcoran clay that confines the drinking water aquifer (the C-zone aquifer) beneath it. The thickness of this clay layer is estimated to be at least 27 feet based on an interpretation of the driller's log for city well No. 1 (Figure I-8). The B-zone groundwater is a semi-confined water-bearing unit above the Corcoran Clay. It is not known to be used for drinking water but is designated for such use.

Groundwater in the A-zone flows in a generally southerly direction. The B-zone groundwater flows generally to the southwest with a relatively flat gradient (0.0004 ft/ft). Permeabilities of the material in the B-zone aquifer are much higher than the material in the A-zone aquifer.

Several VOCs and SVOCs including 1,2,3-TCP, DBCP, EDB, 1,2-DCP, chloroform, acetone, Bis (2-ethylhexyl) phatalate, 2-methylnaphthalene, and methyl chloride were detected in relatively low concentrations in some of the collected and analyzed samples from the A and/or B unsaturated zones. Herbicides and pesticides—including dinoseb, 4,4-DDT, and MCPP—were also detected in some of the collected and analyzed soil samples.

Up to 13 metals were detected in the some of the samples collected during investigations at the site. With the exception of mercury, the reported metal concentrations are within the general naturally occurring range for soil in southern California.

In the B-zone, 1,2-DCP was observed at concentrations significantly higher than any other contaminant and was observed at least once in every well. The highest observed concentration of 1,2-DCP in the B-zone was 1,700 µg/L in well WB2-1, which is directly south of the Site. Concentrations of COCs in this well have declined considerably over time. All principal contaminants from the A-zone groundwater were also observed in the B-zone. A recently installed well (PWB-7) was sampled once in February 2003 but showed the highest concentrations of 1,2-DCP (930 µg/L), 1,2,3-TCP (110 µg/L), and DBCP (130 µg/L) among all the wells in the B-zone groundwater sampled since 1994. The contaminant concentrations for the six COCs are presented in Figures I-14A through I-14E.

Subsurface groundwater flow and the potential migration paths of the COCs were evaluated using numerical models. The fate and transport modeling results suggest that the COCs in the unsaturated zone persist longer than in the saturated zone. The modeling results showed that transport of the COCs occurs primarily in the vertical direction in the unsaturated zone. In the B-zone groundwater, flow and transport are mainly southwesterly toward the city well. These modeling results also showed that the COCs in the B-zone groundwater might persist for a maximum of 10 years in the absence of vertical leakage from the unsaturated zone. This conclusion is partly supported by the observation that concentrations of COCs have declined in the B-zone groundwater since the installation of the RCRA cap over the site (Panacea, 2003b). Installation of the cap has reduced the infiltration rate and the percolation from the A-zone over the site. Based on results of the fate and transport modeling, the concentrations of COCs would have been expected to diminish to significantly lower values. The reason for persistence of the COC plumes in the B-zone groundwater in recent years is suspected to be continued leakage from the A-zone off site. Although retardation factors for the COCs could also explain the cause of this persistence, the significant differences between the retardation factors of the COCs involved would have resulted in selective persistence of the COCs. That is, concentrations of COCs with smaller retardation factors would have been significantly lower than those observed during recent years. In any case, concentrations of chemicals reaching city well No. 1 are estimated to be below their respective MCLs.

A risk assessment was developed to estimate the potential for risk to human health from the presence of detected residual chemicals at the Site. Risks have been quantified under both current and future controlled conditions and include the potential health risks to future site users in terms of non-carcinogenic HI and ILCR exposure scenarios.

The risk assessment has shown, in a conservative manner, that current site conditions do not pose significant risk to receptors. However, further off-site migration of COCs may result in a significant increase in potential risk associated with indoor air exposures because of the absence of any cap off-site. Off-site migration of the plumes in the A-zone beyond their current extent is not likely because of the limited extent of the saturated A-zone, which is the main container and carrier of the COCs. Off-site migration of the plumes in the B-zone aquifer beyond their current extent are not expected to increase risk because of the significant dilution that is estimated to occur in this zone as well as the depth of the groundwater in this zone.

Under the current exposure scenario, the carcinogenic risks (ILCR) for all receptors are within the 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000) risk management goal stipulated by the USEPA (1990b) However, the risk for the on-site commercial industrial worker exceeds the "de minimis" risk level of 1 in 1,000,000, typically applied by Cal/EPA, if the cap is disturbed. The projected risks to this receptor are associated with potential indoor air exposures to contaminants originating from the underlying soils and groundwater.

9.0 REFERENCES

Arvin Community Services District (ACSD), 2001. *Arvin Community Services District 2001 Annual Drinking Water Quality Report*.

AscI Corporation, 1992. Preliminary Screening Level Modeling to Establish Soil Cleanup Levels at Brown & Bryant Site: A MULTIMED/VLEACH Application. Prepared by Vincent Gorokhovski and E. Zia Hosseinipour of the United States Environmental Protection Agency, AERL, Center for Exposure Assessment Modeling. July 20, 1992.

California Department of Fish and Game (CDFG), 1991. *Biological Opinion on California Portions of Mojave and Kern River Pipeline Projects.* In: Mojave-Kern River Pipeline Projects Environmental Impact Report Final Amendment. California State Lands Commission.

California Department of Pesticides Regulation Endangered Species Project (CDPR), 2003. *Burrowing Owl (Athene cunicularia).* http://www.cdpr.ca.gov/docs/es/espdfs/bowlbio.pdf.

California Environmental Resource Evaluation System (CERES), 2003. *Information Center for the Environment (ICE MAP 2), New Interactive Natural Resources Query System*. http://ceres.ca.gov.

Canonie Environmental, 1987. *Phase I-Investigation Report, Arvin and Shafter Facilities*. Brown & Bryant, Inc., California, November 1987.

Canonie Environmental, 1988. *Remedial Investigation Preliminary Report: Shallow Soil Sampling Program, Arvin Facility, Brown & Bryant, Inc*. July 1988.

Department of Water Resources (DWR), 1999, *Groundwater Management Report (final report) for San Joaquin Valley Drainage Implementation Program*, dated April 1999.

E&E, 1989. *Follow-up Site Assessment: Brown & Bryant, Arvin, California*. March 10, 1989.

Ecology and Environment, Inc. (E&E), 1990. *Technical Assistance Team (TAT),* Brown & Bryant Site Assessment, November 1990.

_____, 1992. *Final Report: Task 9 Slug Testing, Brown & Bryant*, Arvin, California. Prepared for the EPA; July 17, 1992.

_____, 1993a. *B-1 Aquifer Test Report, Task 11, Brown & Bryant, Arvin, California.* Prepared for the USACE; March 31, 1993.

_____, 1993b. *Remedial Investigation/Feasibility Study Work Plan: Groundwater Operable Unit, Brown & Bryant*. Arvin, California, August 24, 1993.

_____, 1997. *Memorandum: Summary of November 1996 Groundwater Sampling, Brown & Bryant*, Arvin. May 14, 1997.

_____, 1998. *Data Needs Recommendations Technical Memorandum, Brown & Bryant, GWOU, Arvin, California*. Prepared for EPA Region IX; March 1998.

_____, 1999a *Memorandum: Summary of July 1998 groundwater sampling, Brown & Bryant, Arvin*, February 25, 1999.

_____, 1999b. *Memorandum: Summary of January 1999 groundwater sampling, Brown & Bryant, Arvin*, February 25, 1999.

EnvironMonitoring Services, Inc., 2002. *Field Observations of RCRA and Non-RCRA Caps, Brown & Bryant, Arvin Facility*, Arvin, California, March 2002.

Falta, R. W., Karsten P., S. Finstrele, and A. Battistelli, 1995, *T2VOC User's Guide*, Lawrence Berkeley Laboratory, Berkeley, California, LBL-36400, 76 pp.

Gilbert, R.O. 1987, *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York, NY.

Hargis and Associates, Inc., 1987. *Remedial Investigation Work Plan, Brown & Bryant Facility*. Arvin, California, June 17, 1987.

Hargis and Associates, Inc., 1988. *Interim Assessment Report: Brown & Bryant Facility*. Arvin, California, July 27, 1988.

Industrial Compliance, 1992. *B-zone Monitoring Well Update and Recommendation for the 4th Well Location Southern Pacific Transportation Company and the Atchison, Topeka and Santa Fe Railway Company Response to EPA Administrative Order 91-6, Former Brown & Bryant Facility, Arvin, California*. Letter Report, March 6, 1992.

Jennings, C.W., 1994, *Fault Activity Map of California and Adjacent Areas with Locations and Ages of Recent Volcanic Eruptions*, Division of Mines and Geology.

Johnson, A.I., R.P. Moston, and D.A. Davis, 1968. *Physical and hydrologic properties of water-bearing materials in subsiding areas in central California, U.S. Geol. Surv. Prof. Pap., 497-A.*

Kennedy Jenks, 1991. *Comprehensive Data Report and Proposed Phase III Well Locations.* Prepared for the USACE; October 1991.

Morrison Knudsen Corporation, Inc. (MK), 1998. *Project Work Plan, Brown & Bryant, Arvin Facility, Superfund Site, First OU, Phase II*. Prepared for the USACE; September 1998.

_____, 1999a, *Aquifer Test Report, Brown & Bryant Superfund Site*, U.S. Army Corps of Engineers, dated August 1999.

_____, 1999b. *Groundwater Monitoring Well Completion Report*. Prepared for the USACE; June 1999.

_____, 1999c. *Draft Closure Report: Brown & Bryant, Arvin Facility Superfund Site, First Operable Unit Remedial Action*. Arvin, California, November 1999.

National Oceanic Atmospheric Administration () National Climatic Data Center, 2003. Internet Site, *National Weather Service Western Region Headquarters.* http://www.wrh.noaa.gov, April 24, 2003, 5:00pm. Last Update: April 11, 2003. Salt Lake City, Utah.

Office of Environmental Health Hazard Assessment (OEHHA), 2002

Pacific Southwest Biological Services (PSBS), 2002. *Biological Constraints Analysis, Brown & Bryant Superfund Site, City of Arvin , Kern County, California.*Letter Report, dated December 5, 2002.

Panacea, Inc., 2000a. *Site Specific Groundwater Sampling and Analysis Plan*. Brown & Bryant Superfund Site, Arvin, California, July 2000

_____, 2000b. *Tank UN-32 Site Specific Workplan*. Brown & Bryant Superfund Site, Arvin, California, March 2000.

_____, 2000c. *Tank UN-32 Closure Report.* Brown & Bryant Superfund Site, Arvin, California, March 2000.

_____, 2000d. *Tank UN-32 Water and Sludge Treatment Design Basis*. Brown & Bryant Superfund Site, Arvin, California, June 2000.

_____, 2000e. *Quarterly Groundwater Sampling & Analysis Report for July 2000*. Brown & Bryant Superfund Site, Arvin, California, October 2001.

_____, 2001a. *Data Management Report;* Operable Unit 2, Brown & Bryant Superfund Site, Arvin, California. July 2001.

_____, 2001b. *Quarterly Groundwater Sampling & Analysis Report for November 2000*. Brown & Bryant Superfund Site. Arvin, California, March 2001.

_____, 2002a. *Quarterly Groundwater Sampling & Analysis Report for October 2001*. Brown & Bryant Superfund Site. Arvin, California, July 2002.

_____, 2002b. *Quarterly Groundwater Sampling & Analysis Report for March 2001*. Brown & Bryant Superfund Site. Arvin, California, March 2002.

_____, 2002c. *Quarterly Groundwater Sampling & Analysis Report for July 2001*. Brown & Bryant Superfund Site. Arvin, California, March 2002.

_____, 2002d. *Quarterly Groundwater Sampling & Analysis Report for February 2002*. Brown & Bryant Superfund Site. Arvin, California, September 2002.

_____, 2002e. *Quarterly Groundwater Sampling & Analysis Report for May 2002*. Brown & Bryant Superfund Site. Arvin, California, February 2003.

_____, 2002f. *Groundwater Monitoring Well Installation Report – 2002:* Operable Unit No. 2, Brown & Bryant Superfund Site. Arvin, California, October 2002.

_____, 2002g. *Quarterly Groundwater Sampling & Analysis Report* for July 2002. Brown & Bryant Superfund Site. Arvin, California, April 2003.

_____, 2002h. *Quarterly Groundwater Sampling & Analysis Report* for October 2002. Brown & Bryant Superfund Site. Arvin, California, May 2003.

_____, 2003a. *Monitoring Well Installation Workplan: Operable Unit No. 2, Brown & Bryant Superfund Site*. Arvin, California, February 2003.

_____, 2003b. *Preliminary Fate and Transport Modeling*. Brown & Bryant Superfund Site, Arvin, California, March 14, 2003.

_____, 2003c. *Ecological Screening Level Risk Assessment Workplan*. Brown & Bryant Superfund Site. Arvin, California, February 2003.

_____, 2003d. *Human Health Risk Assessment*, Brown & Bryant Superfund Site, Arvin, California, May 2003.

_____, 2003e. *Groundwater Monitoring Well Installation Report* – 2003: Operable Unit No. 2, Brown & Bryant Superfund Site. Arvin, California, May 2003.

_____, 2003f. *Quarterly Groundwater Sampling and Analysis Report – February 2003*, Operable Unit No. 2, Brown & Bryant Superfund Site. Arvin, California, July 2003.

_____, 2003g. *Quarterly Groundwater Sampling and Analysis Report – October 2002*, Operable Unit No. 2, Brown & Bryant Superfund Site. Arvin, California,

Poland, J.F., and B.E. Lofgren, undated, *Case History No. 9.13 San Joaquin Valley, California, USA*.

RTAG, 1998. *Treatability Study Workplan Extraction & Treatment System*. Brown & Bryant Arvin Facility Superfund Site, First Operable Unit. Prepared for the EPA Region IX; November 1998.

San Joaquin Valley Air Pollution Control District (SJV-APCD) 2002, *Bakersfield, California, Internet worldwide web site [http://www.valleyair.org/busind/pto/tox_Resources/toxics_ resources.htm]*.

U.S. Environmental Protection Agency (USEPA) 1986, *Guidelines for the Health Risk Assessment of Chemical Mixtures*, 51 Fed. Reg. 34014, Sept. 26.

_____, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. Office of Emergency and Remedial Response, Washington, DC, October 1988.

_____, 1989a, *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual, Part A, Interim Final*, Office of Emergency and Remedial Response, EPA/540/1-89/002.

_____, 1989b, *Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Solid Media*, EPA/230/02-89/042, Office of Policy, Planning, and Evaluation, Statistical Policy Branch, PM-223, Washington, D.C.

_____, 1990. *Remedial Investigation/Feasibility Study Workplan*. December 1990.

_____, 1990b, *National Oil and Hazardous Substances Pollution Contingency Plan*, Final Rule, Federal Register, Vol. 55, No. 46, Rules and Regulations, March 8, 1990.

_____, 1991a. *Draft Review of Existing Data Report for Brown & Bryant Technology Evaluation Process*. Prepared by Vance Fong of EPA Region IX, Hazardous Waste Management Division, Technical Support Section; March 21, 1991.

_____, 1991b. *Letter Report: Recommended Drilling Technique for the Southern Pacific Transportation Company (SPTCo) and Sante Fe, US EPA Order No. 91-6.* July 10, 1991.

_____, 1991c. *Workplan Part I. Prepared for SPTCo/Santa Fe*, March 27, 1991.

_____, 1991d. *Workplan Part II. Prepared for SPTCo/Santa Fe*, April 10, 1991.

_____,1991e. *Comprehensive Data Report and Proposed Phase III Well Locations*. Prepared for the USACE, October 1991.

_____, 1992a. *Brown & Bryant, Inc. Superfund Site: Phase I Ecological Assessment*. April 21, 1992.

_____, 1992b. *Field Sampling Report: Quarterly Groundwater Monitoring, January, 1991. Brown & Bryant Superfund Site, Arvin, California*, September 1992.

_____, 1992c. *Field Sampling Report: Quarterly Groundwater Monitoring, April, 1991. Brown & Bryant Superfund Site, Arvin, California*, September 1992.

_____, 1992d. *Field Sampling Report: Quarterly Groundwater Monitoring, July, 1991. Brown & Bryant Superfund Site, Arvin, California*, September 1992.

_____, 1992e. *Field Sampling Report: Quarterly Groundwater Monitoring, December, 1991. Brown & Bryant Superfund Site, Arvin, California*, September 1992.

_____, 1992f. *Field Sampling Report: Quarterly Groundwater Monitoring, April, 1992. Brown & Bryant Superfund Site, Arvin, California*, September 1992.

_____, 1992g. *Field Sampling Report: Quarterly Groundwater Monitoring, July, 1992. Brown & Bryant Superfund Site, Arvin, California*, October 1992.

_____, 1992h. *Final Report: Evaluation of Treatment Technologies for Contaminated Soil, Brown & Bryant Site.* Prepared by Michael Borst, June 22, 1992.

_____, 1992i. *Memorandum: Cost Analysis on UV Oxidation Treatment.* Prepared by Vance Fong (EPA Region IX), Hazardous Waste Management Division, Technical Support Section, November 20, 1992.

_____, 1993a. *Remedial Investigation Feasibility Study Report: Brown & Bryant, Arvin, California*, May 28, 1993.

_____, 1993b. *Field Sampling Report: Quarterly Groundwater Monitoring, December, 1992. Brown & Bryant Superfund Site, Arvin, California*, January, 1993.

_____, 1993c. *Draft Operable Unit One Feasibility Study Report, Brown & Bryant Superfund Site, Arvin, California*, March 1993.

_____, 1993d. *Brown & Bryant, Arvin Facility First OU, Record of Decision (Part 1, Part 2, Part*, November 8, 1993.

_____, 1994 *Contract Laboratory Program for Organic Data Review* (Publication 9240 1-05, Feb. 1994)

_____, 1997b, *Health Effects Assessment Summary Tables (HEAST)*, Annual Update FY 1997, incl. Nov. suppl., Office of Emergency Remedial Response, OERR9200,6303 (92-1), Washington, D.C.

_____, 1998a, Region 9 *Preliminary Remediation Goals (PRGs)*, Internet worldwide web site [www.epa.gov/region09/waste/superfund/prg/index.html].

_____, 2003, *Integrated Risk Information System (IRIS) database*, March 2003.

U.S. Geological Survey (USGS), 1992. *7.5-minute Topographic Map, Arvin Quadrangle*, 1992.

U.S. Census Bureau, 2003. American FactFinder: *Race, Hispanic or Latino, and Age: 2000.* Arvin, California, April 29, 2003.

Western Regional Climate Center (WRCC) 2002, *Period of Record Monthly Climate Summary – Bakersfield WSO Airport*, Internet worldwide web site [http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?cabake].

Weston, 1990a. *Draft Final Report: UV/Ozonation Treatability Study Brown & Bryant, Arvin, California*, October 16, 1990.

_____, 1990b. *Soil Washing Alternative Evaluation, Brown & Bryant Site*, August 31, 1990.

Tables - Part I

Project No. C00-266.2 September 2005

TABLE I-2-1

GROUNDWATER MONITORING WELL INFORMATION

Well ID	Well Depth (feet btc)	Northing**	Easting**	Well Screen Interval (feet bgs)	Well Diameter (inches)	Depth to Groundwater (feet btc)	Casing Elevation (reamsl)	Groundwater Elevation
A-Zone								
On-Site Wells								
AMW-1P	70.7	620470.58	1754488.24	60.8-70.8	4	69.68	435.38	365.7
AMW-2P	75.3	620656.44	1754456.61	63.6-73.6	4	67.4	433.52	366.12
AP-1	71.15	620962.64	1754559.39	59.5-69.5	4	65.26	434.3	369
AP-2	NR	620663.47	1754591.46	NR	4	67.52	435.34	367.82
AP-4	75.19	620534.46	1754351.88	60-70	4	71.05	435.9	364.85
WA-3	80.08	620794.93	1754179.72	68-78	4	73.71	435.85	362.14
WA-4	78.58	620925.48	1754154.81	66-76	4	74.92	436.73	361.81
WA-5	80±	620915.85	1754276.88	67-77	4	71.01	435.62	364.61
WA-6	78.1	620616.95	1754305.63	64-74	4	70.93	434.6	363.67
PWA-6	83.1	620340.07	1755044.59	63-83	4	66.37	430.25	363.88
PWA-7	78.27	620074.75	1754491.56	58-78	4	62.79	429.32	366.53
EW-1	80	620497.95	1754503.36	65-79.5	4	69.6	439.53	369.93
EW-2	80	620451.99	1754509.50	75-79.5	4	68.4	438.66	370.26
EW-3	80	620474.28	1754463.73	65-79.5	4	67.8	438.18	370.38
MW-1	80	620495.78	1754499.46	75-79.5	2	70.5	437	366.5
MW-2	80±	620467.07	1754507.74	75-80	2	72	437	365
MW-3	80	620484.39	1754468.21	75-79.5	2	74	437	363
MW-4	80	620476.58	1754493.73	75-79.5	2	68.7	433.91	365.21
IW-1	78.5	620688.57	1754424.40	63-77.7	6	68.3	432.77	364.47
IW-2	80	620678.34	1754511.60	63-78	6	NA	432.83	NA
Off-Site Wells								
AP-3*	NR	NA	NA	NR	4	65.41	431.29	365.88
WA-1	78.5	620254.81	1754672.96	63-78	4	63.31	429.35	366.04
WA-2	75.5	620065.66	1754226.67	63-73	4	68.39	430.96	362.57
WA-7	79	620655.02	1754152.55	66-76	4	73.4	434.65	361.05
WA-8	73.5	620405.52	1754958.58	61-71	4	67.53	433.12	365.59
WA-9	78.5	620391.45	1753995.64	68-78	4	69.94	429.07	359.13
EPAS-1	NR	620472.41	1754220.70	NR	4	87.49	433.55	346.06
EPAS-2	86.2	620386.87	1754382.24	64-84	4	69.59	433.69	363.9
EPAS 3	86.3	620362.10	1754483.47	64-86	4	68.4	432.18	363.78
EPAS 4	84.2	621433.54	1754584.24	62-82	4	65.48	435.99	370.51
PWA-1	85.05	620590.09	1754019.27	65-85	4	78	430.2	352.14
PWA-2	84.3	620396.67	1754637.35	64-84	4	67.21	430.82	363.44
PWA-3	84.9	620193.12	1754319.26	64.5-84.5	4	76.22	429.64	353.22
PWA-4	84.65	620436.80	1754219.60	64.5-84.5	4	83.14	430.04	346.75
PWA-5	84.65	620356.97	1755186.09	64.5-84.5	4	DRY	430.46	NA

TABLE I-2-1 (Continued)
GROUNDWATER MONITORING WELL INFORMATION

Well ID	Well Depth (feet btc)	Northing**	Easting**	Well Screen Interval (feet bgs)	Well Diameter (inches)	Depth to Groundwater (feet btc)	Casing Elevation (reamsl)	Groundwater Elevation
B-Zone								
On-Site Wells								
AMW-3R	197.4	620971.76	1754552.97	121.5-201.5	4	151.23	433.51	282.46
AMW-4R	200+	620641.10	1754466.79	138-198	4	150.9	434.75	284
AR-1	186.4	620807.85	1754168.70	140-186	4	151.15	435.03	284.06
PWB-1	186.2	620722.97	1754588.04	166-186	4	149.81	433.85	284.22
PWB-6*	159.29	620471.93	1753765.61	139-159	4	141.71	428.86	287.15
PWB-7	159.5	620067.19	1754491.31	139.5-159.5	4	141.89	429.23	287.34
PWB-8	161.29	619861.50	1754120.90	141-161	4	140.2	427.76	287.56
PWB-11	163.7	620341.89	1755084.57	143-163	4	144	430.27	286.27
Off-Site Wells								
WB2-1	186	620353.72	1754377.66	169.5-179.5	4	148.31	432.29	284.13
WB2-2	180.85	620664.55	1754152.02	168-178	4	151.14	434.88	283.92
WB2-3	186.5	620055.30	1754216.05	172-182	4	146.8	430.7	284.05
WB2-4	180	619492.85	1753960.44	168-178	4	162.24	425.27	263.18
PWB-2	160.2	620354.23	1754116.61	140-160	4	146.06	430.54	284.66
PWB-3	164.9	620409.42	1754637.69	144.5-164.5	4	146.6	430.69	284.27
PWB-4	164.55	620486.76	1754200.12	144.5-164.5	4	146.71	430.82	284.29
PWB-5	164.9	619702.74	1754121.21	144.5-164.5	4	143.24	427.47	284.35
PWB-9	158.6	619589.32	1754022.64	138-158	4	140	426.44	286.44
PWB-10	159.78	619657.46	1753878.23	139-159	4	138.87	424.99	286.12
C-Zone								
Off-Site Wells								
CW-1	730	NA	NA	350-700	Unknown	Unknown	Unknown	NA

Notes:

NR=not recorded
NA=not available
Well AP-3 was abandoned during Phase II
* = screen interval broke, not full 20 feet from bottom of the well.
Phase II wells=screen intervals adjusted to the full 20 feet from bottom of the well due to discrepancies on the boring logs.
**Coordinate System: NAD'27 California Zone 5 Grid Feet

TABLE I-3-1 (Continued)
CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
SELECTED PARAMETERS (MORE LISTED STARTING MAY 1997)

Well		DATE SAMPLED AND CONCENTRATION (µg/l)																														
No.	Chemical	9/87	10/87	12/87	2/88	3/88	4&5/90	1/91	4/91	7&8/91	12/91	4/92	7/92	12/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/02	2/03	5/03
AMW-1P	1,2-DCP	64,000	63,000				30,000	29,000	31,500	25,000	19,000	9,800		15,000	4,700	5,050	1,000	700	500	670	110	112	188	168	254	322	2300	4100	5100	5700	6200	6300
	1,3-DCP	950	1,000				620	550	485	670	600	390		360	130	135	18	9 LJ	5 J	6 L	1.3	--	--	--	--	--	--	--	--	--	--	--
	Chloroform	-1,000	-1,000				--	--	52	38	35	18		22	12	10	2 L	--	--	1 L	--	--	--	--	--	--	--	--	--	--	--	--
	DBCP	30	660				380	694	400	170	180	64		140	48	54	13	10	10 J	4.8	?	--	17	1.27	--	--	12	62	130	160	180	220
	Dinoseb	21,000	3,800					16,350	13,100	6,700	35,000	34,000	40,000	51,000	28,000	83,000	42,000 J	830	1,600 J	15.0	?	432	474	497	547	1710	4300	4400	5000	R	5500	4200
	EDB	10	720				1200	1,564	1,300	605	930	380		30	150	86	19	11	2.9 J	13.8	?	1.26	0.15	1.32	2.3	0.83	4.2	18	32	75	56	51
	1,2,3-TCP	10,000	10,000				7,300	6,800	6,350	11,000	9,000	6,900		5,900	5,700	8,250	1,900	980	840	450	40	36	50	34	75	87	320	430	830	750	1100	1000
	Toluene																					233	44	--	--	--	8.8 J	--	--	--	--	--
	Benzene																					--	--	--	--	--	9.3 J	--	--	--	--	--
	1,1,1-Trichloroethane																															130 J
AMW-2P	1,2-DCP	110,000	82,000					76,000	86,000	89,000	81,000	48,000		50,000	67,000	88,000	84,000	110,000	73,000	51,000	77,000	46500	68900	62800	105000	56200	130000	160000	38000	100,000	92000	100000
	1,3-DCP	-500	200					70	73	78	84	45		52	94	100	96	88	110	50 L	96	--	68	102	163	--	--	--	--	--	--	--
	Chloroform	1,900	1,500					955	1,100	1,100	855	435		390	350	520	560	340	240	110 L	320	164	207	161	197	191 J	--	570 J	--	230J	--	--
	DBCP	-0.1	440					453	320	388	485	268		150	325	350	335	420	320 J	96	?	118	186	188	307	300 J	370	540	270	540	620	670
	Dinoseb	20,000	930					49	--	21	440	240	190	3,000	485	1,100	1,085 J	200	330	85	?	274	220	180	200	250	520	470	NS	R	450	720
	EDB	22	130					1.4	67	2	2	1		51	1	--	--	--	0.053 J	21	?	0.208	0.28	0.13	--	--	--	--	0.029	--	--	--
	1,2,3-TCP	4,800	5,000					3,400	4,100	3,000	3,900	1,700		1,300	2,450	3,500	3,250	3,800	3,800	1,400	3,800	1610	1970	2420	3920	5940	7000	8700	3400	4600	6500	5800
	1,1-Dichloroethane																					14	17	15	18	--	--	--	--	--	--	--
	1,2-Dichloroethane																					60	78	88	147	147 J	--	260 J	--	--	--	--
	Benzene																					6.6	7	6.5	8.1	--	--	--	--	--	--	--
	Bromobenzene																					--	202	--	--	--	--	--	--	--	--	--
	Chlorobenzene																					5.6	9.1	11	14	--	--	--	--	--	--	--
	Toluene																					1760	12	--	--	--	--	--	--	--	--	--
	1,1,2-Trichloroethane																					--	--	7.4	11	--	--	--	--	--	--	--
	1,1,1-Trichloroethane																															1100 J
	Methylene chloride																					--	--	19	26	--	--	--	--	130J	--	--
	Hexachlorobutadiene																					--	--	--	--	--	1700 J	--	--	--	--	--
	Naphthalene																					--	--	--	--	--	780 J	--	--	--	--	--
	1,2,3-Trichlorobenzene																					--	--	--	--	--	1300 J	--	--	--	--	--
	1,2,4-Trichlorobenzene																					--	--	--	--	--	570 J	--	--	--	--	--
AP-1	1,2-DCP			2		1	--	--	--	--	--	--		1	0.9	0.7J	0.7 L	0.4 L	11.0		--	172	8.0	--	--	1.2 J	1.2	1.0	0.91 J	2.0	0.96 J	1.2
	1,3-DCP			-1		-1	--	--	--	--	--	--		1	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--
	Chloroform			-1		-1	--	--	--	--	--	--		--	--	--	--	--	6.0		--	--	--	--	--	--	--	--	--	--	0.078 J	0.15 J
	DBCP			-0.02		-0.02	--	0.01	--	--	--	--		--	--	--	--	--	--		?	--	--	--	--	--	0.045	0.13	0.24	0.22	0.22	0.22
	Dinoseb			-0.5		-0.5	--	45	--	0.3	8	--		11	NS	--	1.2 J	--	NS		?	2.14	1.44	0.81	1.13	13.3	4.5	2.4	7.0	R	4.7	2.5
	EDB			-0.02		-0.02																--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP			8		5	3	--	1	--	1	--		1	0.9	0.5J	1.0	1.0	2.0		3.0	5.7	--	--	--	11	9.0	19	18	16	18	22
	Carbon tetrachloride																					--	--	--	--	--	--	--	--	--	--	--
	2-Butanone																					--	--	--	--	--	--	1.2 J	--	--	--	--
	Methyl tert-butyl ether																					--	--	--	--	--	--	0.087 J	--	--	--	--
	Tetrachloroethene																					--	--	--	--	--	0.35 J	0.26 J	--	--	0.17 J	0.27 J
	Acetone																					--	--	--	--	--	--	--	9.2 J	--	--	33
	Chloromethane																					--	--	--	--	--	--	--	0.27 J	--	--	--
	Toluene																					--	--	--	--	--	--	--	0.43 J	--	0.15 J	--
	1,1,2,2-Tetrachloroethane																															0.35 J
AP-2	1,2-DCP				72	32	--	8	8	10	--	22		7	7	8	6	3	4.0	3.0	3.7	NS	NS	NS	NS	NS	NS	2.5	2.4	2.6	2.5	2.5
	1,3-DCP				-1	-1																NS	NS	NS	NS	NS	NS	--	--	--	--	--
	Chloroform				14	12	6	--	3	4	5	5		4	--	3	4	3	2.0	2.0	3.3	NS	NS	NS	NS	NS	NS	1.3	1.1	1.2	1.0	0.83 J
	DBCP				0.4	1	--	1.8	3	1	2	1		--	0.3	0.2	0.2	0.09 P	0.079	--	?	NS	NS	NS	NS	NS	NS	0.0088 J	0.013	0.0062J	0.0071 J	--
	Dinoseb				-0.5	-0.5	--	--	310		0.4	--		--	--	NS	0.4 J	--	R	--	?	NS	NS	NS	NS	NS	NS	--	--	R	0.82	0.27
	EDB				0.3	1														9.5	9.5	NS	NS	NS	NS	NS	NS	--	--	--	--	--
	1,2,3-TCP				9	9	7	8	8	9	8	8		5	6	5	4.0	3.0	3.0	2.0	4.6	NS	NS	NS	NS	NS	NS	1.9	1.4	2.0	2	2.1
	Toluene																					NS	NS	NS	NS	NS	NS	--	0.12 J	--	--	--
	Bromomethane																					NS	NS	NS	NS	NS	NS	--	--	0.35J	--	--
	Carbon tetrachloride																					NS	NS	NS	NS	NS	NS	0.49 J	0.41 J	0.48 J	0.43 J	--
	1,1- Dichloroethene																					NS	NS	NS	NS	NS	NS	--	0.070 J	--	--	--
	Trichlorofluoromethane																					NS	NS	NS	NS	NS	NS	--	0.082 J	--	--	--
	Chloromethane																					NS	NS	NS	NS	NS	NS	--	--	0.30 J	--	--
	1,1- Dichloropropene																					NS	NS	NS	NS	NS	NS	--	--	0.77 J	--	--
	Tetrachloroethene																					NS	NS	NS	NS	NS	NS	1.9	1.3	1.5	1.2	1.3
AP-3	1,2-DCP				110	81	64	36	22	28	48	86		3,200	2,800	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1,3-DCP				1	1	--	--	--	--	--	--		21	36	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Chloroform				-1	-1	--	--	--	--	1	1		18	6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	DBCP				1.2	12	--	6.2	6.5	2.5	20	61		620	300	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Dinoseb				33	29	--	--	--	16	230	13		9,000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	EDB				0.9	2.3	4	4	0.9	0.9	3.5	3.5		5	550	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1,2,3-TCP				80	70	11	16	16	16.5	33	47		370	520	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

TABLE I-3-1 (Continued)
CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
SELECTED PARAMETERS (MORE LISTED STARTING MAY 1997)

Well No.	Chemical	DATE SAMPLED AND CONCENTRATION (µg/l)																														
		9/87	10/87	12/87	2/88	3/88	4&5/90	1/91	4/91	7&8/91	12/91	4/92	7/92	12/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/02	2/03	5/03
AP-4	1,2-DCP			22,000		18,000	8,800	8,700	9,400	9,800	13,000	11,000		15,000	9,700	17,000	39,000	110,000 J	23,000	53,000	44,000	22600	25600	28600	40900	39900	20000	17000	1800	17000	3200	2200
	1,3-DCP			-500		-500	9	11	11	12	14	15		36	22	25	47	73 J	23	39 L	34	--	21	26	43	53	--	--	--	--	--	--
	Chloroform			-500		-500	--	--	--	--	--	--		74	60	83	150	800 J	140	150 L	230	85	114	81	103	82	--	86 J	--	--	--	23 J
	DBCP			7		57	11	15	42	18	30	57		24	52	33	160	190 J	74 J	71	?	53	--	34	60	37	24	29	24	23	8.1	3.7
	Dinoseb			-0.5		2.3	--	--	--	1	18	10		26	NS	NS	1,700 J	180 J	180	4.2	?	123	96.4	98.8	66.9	84.5	35	5.2	46	R	9.3	3.3
	EDB			5		16	--	--	2	0.3				24	30	5J	8 L	4 J	4 J	50	?	0.845	--	0.10	0.24	0.47	--	--	0.28	0.28	--	--
	1,2,3-TCP			670		900	410	390	400	490	500	460		540	510	890	1,900	6,100 J	1,400	2,200	2,500	1130	1160	1350	2010	1670	800 J	860 J	990 J	920	190 J	99 J
	1,2-Dichloroethane																					23	32	29	47	--	--	--	--	--	--	--
	Benzyl chloride																					--	6.4	--	--	--	--	--	--	--	--	--
	1,1-Dichloroethane																					--	--	5.1	--	4.2 J	--	--	--	--	--	--
	Methylene chloride																					--	--	14	19	--	--	240 J	--	--	--	--
	Benzene																					--	--	--	6.0	5.1	--	--	--	--	--	--
	Chlorobenzene																					--	--	--	5.9	5.1	--	--	--	--	--	--
	cis-1,2-Dichloroethene																					6.0	--	--	--	--	--	--	--	--	--	--
	Ethylbenzene																					--	--	--	--	--	--	910 J	--	--	--	--
	Naphthalene																					--	--	--	--	--	--	140 J	--	--	--	--
	n-Propylbenzene																					--	--	--	--	--	--	320 J	--	--	--	--
	1,3,5-Trimethylbenzene																					--	--	--	--	--	--	670 J	--	--	--	--
	1,2,4-Trimethylbenzene																					--	--	--	--	--	--	2200	--	--	--	--
	m,p-Xylene																					--	--	--	--	--	--	3100	--	--	--	--
	o-Xylene																					--	--	--	--	--	--	1000	--	--	--	--
EPAS-1	1,2-DCP						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	4900	4900	8000	9000	6300
	1,3-DCP						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	47 J	65 J	92J	110 J	97 J
	DBCP						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	17	11	18	17	21
	Dinoseb						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	6.3	NS	R	27	25
	EDB						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	500	470	590	540	470
	Acetone						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	--	--	890J	630 J	--
	Methylene chloride						NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	61 J	--	--	--	--
EPAS-2	1,2-DCP						3,700	--	--	7,400	9,700	9,600		13,000	15,500	18,000	18,000	25,500	48,000	49,000	21,000	5980	6390	6640	7330	9680	9300	6500	5400	4900	3900	3600
	1,3-DCP						11	36	27	21	25	34		44	42	43	44	30	92	58 L	28	--	--	--	--	16	--	--	--	--	--	--
	Chloroform						21	--	38	42	51	60		78	86	96	91	76	160	130 L	66	29	23	20	20	21	22 J	--	--	11J	--	41 J
	DBCP						38	166	92	60	56	74		62	72	77	80	110	100 J	77	?	18	17	17	16	15	9.1	8.8	9.6	9.9	11	9.4
	Dinoseb						--	--	310	140	800	1,050		1,600	1,500	11,000	12,000 J	710	2500 J	67	?	894	955	597	435	741	240	180	270	R	190	230
	EDB						3	51	22	15	38	62		19	67	64	85	34	26 J	66	?	3.89	0.35	3.86	2.2	3.96	0.63	0.55	0.84	0.99	0.86	0.60
	1,2,3-TCP						170	520	440	420	500	600		640	860	800	900	745	2,400	1,650	860	350	260	257	289	390	280	140 J	--	170	170 J	150 J
	1,2-Dichloroethane																					9.0	7.4	6.6	11	11	--	--	--	--	--	--
	1,1-Dichloroethane																					--	--	--	--	1.4 J	--	--	--	--	--	--
	Methylene chloride																					--	--	--	--	--	--	--	--	6.1J	--	--
EPAS-3	1,2-DCP						44,000	34,000	33,000	38,000	37,000	34,000		35,000	38,000	29,000	43,000	86,000	46,000	35,000	38,000	30700	28600	28200	33400	31600	14000	27000	22000	23000	1400	8100
	1,3-DCP						200	200	180	220	200	180		180	170	200	180	150	170	110 L	150	--	64	63	106	86	--	--	--	--	--	24 J
	Chloroform						28	--	22	26	32	31		27	40	36	36	26	44	23 L	39	31	28	24	--	24	--	--	--	--	--	41 J
	DBCP						11,000	10,550	17,000	4,400	5,200	5,100		4,100	4,000	2,900	7,500	3,300	2,200 J	817	?	1300	--	1240	1980	1200	530	1200	1200	1200	110	460
	Dinoseb						--	411	664	680	1,100	1,000		3,900	2,700	17,000	6,400 J	1,600	4900 J	110	?	1520	2980	4000	2930	2900	1800	2200	3800	R	240	1300
	EDB						36	68	214	34	78	32		27	46	41	42	41	40 J	66	?	35.9	31.3	24.2	30.8	34.1	7.4	21	33	55	11	23
	1,2,3-TCP						2,700	2,100	2,200	2,700	2,200	2,500		2,400	4,000	3,500	5,900	3,900	4,900	2,500	3,400	2260	1930	2340	2800	2710	1300	2000	1800 J	1900	180	720
	1,1,2- Trichloroethane																					5.8	5.3	5.1	--	--	--	--	--	--	--	--
	1,2-Dichloroethane																					25	21	20	--	22	--	--	--	--	--	--
	Benzene																					8.3	7.1	6.3	--	7.0	--	--	--	--	--	--
	Bromobenzene																					--	208	--	--	--	--	--	--	--	--	--
	Chlorobenzene																					6.7	6.3	--	--	6.3	--	--	--	--	--	--
	Toluene																					213	40	7.5	--	--	--	--	--	--	--	--
	1,1-Dichloroethane																					--	--	--	--	3.8 J	--	--	--	--	--	--
EPAS-4	1,2-DCP						--	--	--	--	2	1		2	2	2	--	--	0.5 J	0.5 L	--	91	--	--	--	--	--	--	--	0.78J	--	--
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	DBCP																		0.017 J	--	?	10	--	--	--	--	--	--	--	--	--	--
	Dinoseb						--	--	0.2	--	--	--		--	--	--	--	--	R	--	?	1.61	--	--	--	--	--	--	--	R	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						--	--	--	--	--	--		1	3	3	--	--	2.0	1.0	--	5.8	--	--	--	--	--	--	--	--	--	--
	Acetone																					--	--	--	--	--	--	--	3.5 J	1.8 J	--	--
	Methylene chloride																					--	--	--	--	--	--	--	--	0.14 J	--	--
	Hexachlorobutadiene																					--	--	--	--	--	--	--	0.18 J	--	--	--

TABLE I-3-1 (Continued)
CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
SELECTED PARAMETERS (MORE LISTED STARTING MAY 1997)

Well No.	Chemical	DATE SAMPLED AND CONCENTRATION (µg/l)																														
		9/87	10/87	12/87	2/88	3/88	4&5/90	1/91	4/91	7&8/91	12/91	4/92	7/92	12/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/02	2/03	5/03
WA-1	1,2-DCP						NS	NS	NS	NS	NS		2	2.0	12	0.9	0.6 L	0.08 LJ	2.0	1200	4.5	62	24	116	97	5.2	2.8	0.97 J	0.64 J	0.31J	0.32 J	0.48 J
	1,3-DCP						NS	NS	NS	NS	NS		--	--	0.2	--	--	--	--	11	--	--	--	--	--	--	--	--	--	--	--	--
	Chloroform															--	--	--	0.2 J	1.5	--	--	--	--	--	--	0.11 J	--	--	--	--	0.12 J
	DBCP						NS	NS	NS	NS	NS		0.8	--	10	0.6	0.31	0.28	1.7 J	196	?	--	--	10	--	1.7 J	0.40	0.18	0.17	0.10	0.17	0.14
	Dinoseb						NS	NS	NS	NS	NS		7	NS	160	2.0	--	--	--	116	?	14.6	31.5	143	137	9.46	4.4	0.97	0.94	R	1.1	0.70
	EDB						NS	NS	NS	NS	NS		--	--	2	0.05	0.03 L	0.13	0.81 J	149	?	0.800	1.28	7.55	7.4	2.48	0.36	0.20	0.14	0.093	0.083	0.047
	1,2,3-TCP						NS	NS	NS	NS	NS	4	7	10	15	7.0	4.0	5.0	10	460	7.5	5.6	6.4	26	29	8.2	15	13	12	5.6	2.4	2.1
	Acetone																					--	--	--	--	--	--	--	4.2 J	3.9 J	--	12
	Toluene																					104	11	--	--	--	0.081 J	--	--	--	--	--
	Methylene chloride																					--	--	--	--	--	--	--	--	0.55 J	--	--
	Tetrachloroethene																					--	--	--	--	--	--	0.11 J	--	--	--	--
WA-2	1,2-DCP						NS	NS	NS	NS	NS	--	--	0.3	0.3	0.3	0.4 L	--	5.0	0.3 L	--	7.3	--	--	--	--	0.23 J	0.23 J	--	--	--	--
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS	275	330	240	200	230	310	160 J	230	150	210	189	187	169	213	180	170	190	87	200	50	33
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Dinoseb						NS	NS	NS	NS	NS	--	--	--	--	--	1.5 J	--	R	--	?	--	--	--	--	--	--	--	--	R	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	--	--	--	--	--	--	0.2 LJ	--	--	--	--	--	--	--	--	--	--	--	--	--	0.22 J
	Toluene																					19	5.2	--	--	--	--	--	--	--	--	--
	Bromodichloromethane																					--	--	--	--	2.6 J	3.5	3.2	2.0 J	3.0 J	0.52 J	0.43 J
	2-Butanone																					--	--	--	--	--	--	1.9 J	--	--	--	--
	Methylene chloride																					--	--	--	--	--	1.0	0.77 J	0.61 J	1.2 J	0.19 J	--
	Methyl tert-butyl ether																					--	--	--	--	--	--	0.22 J	--	--	--	--
	1,2-Dichloroethane																					--	--	--	--	--	0.17 J	0.18 J	--	--	--	--
WA-3	1,2-DCP						NS	NS	NS	NS	NS	41	37	29	12	12	11	7.0	7.0	9.0	7.8	7.4	5.3	--	5.3	5.9	6.1	5.5	6.0	5.1	5.1	7.6
	1,3-DCP						NS	NS	NS	NS	NS	--	--	--	--	--	0.2 L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS	1.0	1.0	0.9	--	--	0.9 L	0.7	0.6 J	0.6 L	0.8L	--	--	--	--	--	0.76 J	1.0	0.98 J	0.80 J	0.65 J	0.99 J
	DBCP						NS	NS	NS	NS	NS	--	--	--	0.04	--	0.02 L	0.01	0.018 J	--	?	--	--	0.71	--	--	2.0	2.1	1.8	1.7	1.9	1.7
	Dinoseb						NS	NS	NS	NS	NS	--	--	2	--	--	--	--	--	--	?	1.49	2.19	4.49	7.53	10.4	19	9.9	7.7	R	7.9	4.0
	EDB																			3.2	?	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	6.0	7.0	8.0	12.0	7.0	7.0	9.0	8.0	11.0	15.0	24	28	--	--	72	82	84	56 RE	92	75	100 RE
	Acetone																					--	--	--	--	--	--	--	2.2 J	--	--	--
	Toluene																					50	13	5.5	6.8	--	2.2 J	--	--	--	--	--
	Carbon tetrachloride																					--	--	--	--	--	--	0.53 J	0.55 J	--	0.32 J	0.59 J
	Chloromethane																					--	--	--	--	--	--	0.23 J	0.71 J	--	0.80 J	0.43 J
	1,1-Dichloroethene																					--	--	--	--	--	--	0.18 J	--	--	--	--
	1,1-Dichloropropene																					--	--	--	--	--	--	0.11 J	--	--	--	--
	Tetrachloroethene																					--	--	--	--	--	0.72 J	1.2	1.2	--	0.71 J	1.5
WA-4	1,2-DCP						NS	NS	NS	NS	NS		5.0	4.0	6.0	4.0	5.0	5.0	4.0	2.0	3.1	--	--	--	--	--	3.3	4.4	3.8	4.1	3.8	3.8
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS		--	0.3	--	--	0.3 L	--	--		--	--	--	--	--	--	0.12 J	0.16 J	0.26 J	1.0J	0.15 J	0.23 J
	DBCP						NS	NS	NS	NS	NS		--	--	--	--	0.03 L	--	--	--	?	--	--	--	--	--	--	--	--	--	--	--	--
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	R	--	--
	EDB						NS	NS	NS	NS	NS		--	--	--	0.3	--	--	--	--	?	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS		--	--	0.8	0.3	--	0.4 LJ	--		--	--	--	--	--	--	0.13 J	0.20 J	--	--	--	--
	Acetone																					--	--	--	--	--	--	--	2.8 J	--	--	--
	Chloromethane																					--	--	--	--	--	--	--	0.14 J	--	--	--
	Methylene chloride																					--	--	--	--	--	--	--	--	0.13 J	--	--
	Toluene																					83	19	--	--	--	0.13 J	--	--	0.14 J	--	--
	Tetrachloroethene																					--	--	--	--	--	--	0.13 J	--	--	--	--
WA-5	1,2-DCP						NS	NS	NS	NS	NS		2.0	1.0	2.0	1.0	0.6 L	0.7 LJ	0.6	0.9 L	--	--	--	--	--	--	1.2	0.88 J	1.1	1.5	1.9	2.1
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	0.13 J	--	0.11 J	0.36J	0.14 J	0.23 J
	DBCP						NS	NS	NS	NS	NS		--	--	--	--	--	0.02 JP	--	--	?	--	--	--	--	--	--	--	--	--	--	--
	Dinoseb						NS	NS	NS	NS	NS		--	--	--	1.2	--	--	R	--	?	--	--	--	--	--	--	--	--	R	--	--
	EDB																			0.2	?	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS		--	0.8	0.5	0.5	1.0	--	--	0.7 L	--	--	--	--	--	--	0.66 J	0.61 J	0.39 J	0.45J	0.35 J	0.19 J
	Toluene																					43	8.1	--	--	--	0.11 J	--	--	--	--	--
	Tetrachloroethene																					--	--	--	--	--	0.16 J	0.18 J	0.14 J	0.28 J	--	0.17 J
	Acetone																					--	--	--	--	--	1.8 J	--	--	--	3.8 J	--
	Bromomethane																					--	--	--	--	--	--	--	--	0.38 J	--	--
	Chloromethane																					--	--	--	--	--	--	--	0.37 J	--	--	--
	Carbon tetrachloride																					--	--	--	--	--	--	--	0.081J	--	--	--
	1,1-Dichloroethene																					--	--	--	--	--	0.35 J	0.70 J	0.98 J	1.1	1.4	1.6
	1,1- Dichloropropene																					--	--	--	--	--	--	--	--	0.11 J	--	--
	Hexachlorobutadiene																					--	--	--	--	--	0.37 J	--	--	--	--	--
	Naphthalene																					--	--	--	--	--	0.23 J	--	--	--	--	--
	1,2,3-Trichlorobenzene																					--	--	--	--	--	0.35 J	--	--	--	--	--
	1,2,4-Trichlorobenzene																					--	--	--	--	--	0.20 J	--	--	--	--	--

TABLE I-3-1 (Continued)
CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
SELECTED PARAMETERS (MORE LISTED STARTING MAY 1997)

Well		DATE SAMPLED AND CONCENTRATION (µg/l)																														
No.	Chemical	9/87	10/87	12/87	2/88	3/88	4&5/90	1/91	4/91	7&8/91	12/91	4/92	7/92	12/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/02	2/03	5/03
WA-6	1,2-DCP						NS	NS	NS	NS	NS	100,000	91,000	90,000	50,000	140,000	100,000	360 J	20,000	35,000	36,000	4760	8930	7770	13100	20700	11000	11000	8600	15000	6100	7800
	1,3-DCP						NS	NS	NS	NS	NS	90	80	85	59	96	77	--	16	16 L	18	--	--	--	9.1	12	--	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS	1,200	810	900	450	1,700	1,300	11 J	290	240 L	450	53	81	60	106	155	91 J	95 J	--	160J	42 J	59 J
	DBCP						NS	NS	NS	NS	NS	365	160	190	140	320	200	7 J	82 J	60	?	9.3	16	19	33	34	24	29	39	52	64	72
	Dinoseb						NS	NS	NS	NS	NS	420	360	2,800	1,100	2,800	3,100 J	1.4	R	170	?	58.2	89.4	75.1	86.2	137	77	92	51	R	28	30
	EDB						NS	NS	NS	NS	NS	5	3	120	2	3J	2 L	--	0.23 J	44.5	?	0.038	--	--	--	0.17	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	3,700	2,500	3,100	2,800	6,100	5,600	51 J	1,000	1,200	1,900	260	349	345	660	946 J	610	430 J	560 J	920	700	980
	1,2-Dichloroethane																					6.1	9.7	8.2	16	--	--	--	--	--	--	--
	Toluene																					48	6.8	--	--	--	--	--	--	49 J	--	--
	1,1-Dichloroethane																					--	--	--	--	4.3 J	--	--	--	--	--	--
	1,1- Dichloroethene																					--	--	--	--	--	--	--	--	32J	--	--
	trans-1.2 Dichloroethene																					--	--	--	--	--	--	--	--	47 J	--	--
	Benzene																					--	--	--	5.7	11	--	--	--	47 J	--	--
	sec- Butylbenzene																					--	--	--	--	--	--	--	--	46 J	--	--
	Chlorobenzene																					--	--	--	--	--	--	--	--	38 J	--	--
	Chloroethane																					--	--	--	--	--	--	--	--	59 J	--	--
	Chloromethane																					--	--	--	--	--	--	--	--	70 J	--	--
	Xylenes, total																					--	--	--	--	5.8	--	--	--	--	--	--
	Hexachlorobutadiene																					--	--	--	--	--	63 J	--	--	--	--	--
	Methylene chloride																					--	--	--	--	--	--	--	--	54 J	--	--
	Naphthalene																					--	--	--	--	--	38 J	--	--	--	--	--
	Trichloroethene																					--	--	--	--	--	--	--	--	46 J	--	--
	1,1,1-Trichloroethane																					--	--	--	--	--	--	--	--	37 J	--	--
	1,2,3-Trichlorobenzene																					--	--	--	--	--	54 J	--	--	--	--	--
	1,2,4-Trichlorobenzene																					--	--	--	--	--	30 J	--	--	--	--	--
	Vinyl chloride																													45 J	--	--
WA-7	1,2-DCP						NS	NS	NS	NS	NS	24,000	28,000	22,000	15,000	17,000	18,000	27,000	8,100	15,000	18,000	10300	15500	14300	14600	19600	18000	4900	11000	9500	8300	6500
	1,3-DCP						NS	NS	NS	NS	NS	6	5	6	3	3	3	4 LJ	3 J	--	3.3	--	--	--	--	5.5	--	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS	180	185	180	97	76	98	130	57	94 L	110	119	--	119	113	132	160 J	27 J	78 J	68J	--	75 J
	DBCP						NS	NS	NS	NS	NS	38	30	31	15	7.5	9 L	21	74	7.1	?	5.9	11	8.2	9.8	11	9.1	8.5	8.6	0.19	7.5	4.6
	Dinoseb						NS	NS	NS	NS	NS	7	7	220	--	--	1 J	0.2 J	R	--	?	9.4	10.8	9.89	6.60	8.4	7.4	5.2	2.9	R	3.0	1.6
	EDB						NS	NS	NS	NS	NS	--	--	12	--	--	--	--	--	9.3	?	--	--	--	--	--	--	--	--	0.015J	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	540	590	580	480	385	370	420	380	330	440	283	302	282	318	308 J	350 J	240	220 J	250	210 J	180 J
	1,1-Dichloroethane																					8.7	11	9.7	--	9.7	--	--	--	--	--	--
	1,1-Dichloropropene																					--	6.9	--	--	3.0 J	--	--	--	--	--	--
	Bromobenzene																					--	26	--	--	--	--	--	--	--	--	--
	Toluene																					105	29	17	7.8	--	--	--	--	--	--	--
	1,2-Dichloroethane																					6.5	--	7.9	9.0	--	--	--	--	--	--	--
	Methylene chloride																					--	--	--	--	--	--	27 J	--	--	--	--
WA-8	1,2-DCP						NS	NS	NS	NS	NS	4.0	3.0	3.0	4.0	9.0	9.0	--	7.0	4.0	6.2	44	38	--	--	--	1.2	0.53 J	0.45 J	0.47J	0.26 J	--
	1,3-DCP						NS	NS	NS	NS	NS	--	--	--	0.2	0.5	0.5 L	0.5 LJ	0.4J	--	--	--	--	--	--	--	--	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	0.14 J
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Dinoseb						NS	NS	NS	NS	NS	--	--	--	--	54	58 J	13.9 J	13.9J	16	?	13.5	26.5	50.3	36.0	8.93	11	15	180	R	36	20
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	14	15	16	22	26	39	35	40	24	33	20	22	19	35	10	9.0	4.7	2.7	5.4	3.9	3.3
	Acetone																					--	--	--	--	--	--	--	5.9 J	--	--	4.5 A-01,J
	Tetrachloroethene																					--	--	11	--	--	--	--	--	--	--	--
	cis-1,3-Dichloropropene																					--	--	--	--	--	0.25 J	0.22 J	--	--	--	--
WA-9	1,2-DCP						NS	NS	NS	NS	NS	16	23	20	17.5	16	18	12	0.6J	7.0	8.9	7.3	--	--	--	1.6 J	2.6	0.85 J	0.35 J	--	--	--
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Chloroform						NS	NS	NS	NS	NS	27	31	25	15.5	12	9.0	6.0	--	4.0	4.6	--	--	--	--	1.5 J	1.9	1.4	1.0	0.92J	0.62 J	0.86 J
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Dinoseb						NS	NS	NS	NS	NS	1.0	--	--	--	--	--	--	R	--	?	--	31.6	--	--	--	--	--	--	R	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP						NS	NS	NS	NS	NS	--	--	1.0	1.5	1.0	2.0	2.0	--	2.0	2.9	--	--	--	--	--	1.2	0.20 J	--	--	--	--
	Toluene																					18	--	--	--	--	0.097 J	--	0.11 J	--	--	--
	Naphthalene																					--	--	--	--	--	--	0.42 J	--	--	--	--
	Trichlorofluoromethane																					--	--	--	--	--	--		0.15 J	--	--	--
	Acetone																					--	--	--	--	--	3.3 J	--	42	20	160	11
	Methylene chloride																					--	--	--	--	--	0.060 J	--	0.16 J	0.14 J	--	--
	Methyl tert-butyl ether																					--	--	--	--	--	0.50 J	--	--	--	--	--

TABLE I-3-1 (Continued)
CHEMICALS OF CONCERN IN A-ZONE GROUNDWATER
SELECTED PARAMETERS (MORE LISTED STARTING MAY 1997)

Well		DATE SAMPLED AND CONCENTRATION (µg/l)																														
No.	Chemical	9/87	10/87	12/87	2/88	3/88	4&5/90	1/91	4/91	7&8/91	12/91	4/92	7/92	12/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/02	2/03	5/03
PWA-1	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	600	1200	1100	1500	1600	1600
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.21 J	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.9	19 J	20 J	22J	26 J	32 J
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17	0.25	0.39	0.42	0.61	0.62
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	R	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	92	130	90 J	170	140	140
	Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.30 J	34 J	--	--	--	--
	Benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 J	--	--	--	--	--
	1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.59 J	--	--	--	--	--
	1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.30 J	--	--	--	--	--
	1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 J	--	--	--	--	--
	1,1-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1	--	--	--	--	--
	Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.071 J	--	--	--	--	--
PWA-2	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	740	990	1000	1700	2200	2500
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.7 J	--	--	--	--	20 J
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38	45	58	87	71	100
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1200	1300	1900	R	7200	4100
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	67	66	120	140	110	110
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	79	72 J	100	140	190	190
PWA-3	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	170	98	57	25	0.26 J	0.79 J
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.18 J	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5 J	1.6	3.5 J	3.4	0.34 J	1.1
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.72	0.73	0.54	6.2	--	--
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13	9.5	8.1	R	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.058	0.017 J	0.048	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15	8.4	4.1 J	1.8	--	--
	1,2-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.16 J	--	--	--	--
	Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.084 J	0.26 J	0.16 J	--	--
	cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.19 J	--	--	--	--
	Methyl tert-butyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.14 J	--	--	--	--
PWA-4	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400	5900	NS	NS	NS	NS
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	NS	NS	NS	NS
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27 J	46 J	NS	NS	NS	NS
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.2	11	NS	NS	NS	NS
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	73	--	NS	NS	NS	NS
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.37	0.50	NS	NS	NS	NS
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	230	280	NS	NS	NS	NS
	Methylene chloride																					NA	NA	NA	NA	NA	--	69 J	NS	NS	NS	NS
PWA-6	1,2-DCP																															--
	1,3-DCP																															--
	Chloroform																															0.16 J
	DBCP																															--
	Dinoseb																															11
	EDB																															--
	1,2,3-TCP																															3.5
	Acetone																															6.9 A-01,J
	Chloromethane																															0.18 J
	cis-1,3-Dichloropropene																															0.42 J
	Naphthalene																															0.13 A-01,J
	1,2,3-Trichlorobenzene																															0.14 A-01,J
PWA-7	1,2-DCP																														--	--
	1,3-DCP																														--	--
	Chloroform																														--	0.17 J
	DBCP																														--	--
	Dinoseb																														--	--
	EDB																														--	--
	1,2,3-TCP																														3.8	0.20 J
	Methylene chloride																														--	--

Notes:
-- indicates that the analyte was not detected.
1,2-DCP = 1,2-Dichloropropane.
1,3-DCP = 1,3-Dichloropropane.
DBCP = 1,2-Dibromo-3-chloropropane (See Appendix B for analysis value used).
EDB = Ethylene dibromide, also called 1,2-Dibromoethane (8260 analysis value used) (From July 2000, EPA 504 analysis value used)
1,2,3-1,2,3-TCP = 1,2,3-Trichloropropane.
J = Estimated value (laboratory qualifier) for various causes.
E = The concentration indicated for this analyte is an estimated value above the calibration range of the instrument.
L = Data below the required reporting limit.
R = Results rejected during QA/QC due to lab problems
? = EDB, DBCP, and dinoseb data not available by 2/23/99
(-) = Less than; numberical value is Limit of detection for that compound.
NA = Not analyzed.
NS = Well not sampled for this compound. Most blanks mean that the well was not sampled because it was dry or did not exist at that particular date.
Other VOCs (toluene, xylene, benzene, chlorobenzene, cis-1,2-dichloroethene, methylene chloride, benzyl chloride) are occasionally detected at low concentrations.
References:
Data source: Hargis+Associates, Inc. (data collected between 9/87 and 3/88), U.S EPA (data collected between 4&5/90 and 12/92), Ecology and Environment, Inc. (between 8/94 and 7/98), Panacea, Inc. (from 7/00 to present).
Electronic file obtained from Ralph Lambert of Ecology and Environment, Inc., file name ALLCHEM.XLS.

TABLE I-3-2 (Continued)
CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER

Well No.	Chemical	DATE SAMPLED AND CONCENTRATION (µg/l)																											
		9/87	10/87	2/88	3/88	1/91	4/91	7/91	12/91	4/92	7/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/2	2/03	5/03
AR-1	1,2-DCP			18	16	12	10	8	6	5	4	NS	3	62	3	3.0 J	2	5.1	--	--	--	--	2.5 J	1.5	1.3	1.0	1.0	1.3	1.3
	1,3-DCP			-1	-1	--	--	--	--	--	--	NS	--	0.2 L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP			-1	-1	--	--	--	--	--	--	NS	--	7	--	0.3 JL	--	1.2	--	--	--	--	--	0.56 J	0.44 J	--	0.34J	0.54 J	0.49 J
	Chloroform			-1	-1	--	--	--	--	--	--	NS	--	0.3 L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.13 J
	Dinoseb			-0.5	-0.05	--	--	--	--	--	--	--	--	--	--	0.2 J	NA	?	--	--	--	--	--	--	--	--	R	--	--
	DBCP			-0.02	-0.02	--	--	--	--	--	--	NS	--	12	0.01 JP	--	--	?	--	--	--	--	--	--	--	--	--	0.0059 J	--
	EDB			-0.02	-0.02	--	--	--	--	--	--	NS	0.2J	0.31	--	--	--	?	--	--	--	--	--	--	--	--	--	--	--
	Acetone																		--	--	--	--	--	--	--	6.6 J	11	3.1 J	--
	Chloromethane																		--	--	--	--	--	--	--	0.14 J	--	--	--
	Hexachlorobutadiene																		--	--	--	--	--	0.31 J	--	--	--	--	--
	Naphthalene																		--	--	--	--	--	0.24 J	--	--	--	--	--
	Toluene																		--	--	--	--	--	--	--	0.14 J	--	--	--
	1,2,3-Trichlorobenzene																		--	--	--	--	--	0.34 J	--	--	--	--	--
	1,2,4-Trichlorobenzene																		--	--	--	--	--	0.19 J	--	--	--	--	--
AMW-3R	1,2-DCP	5	3			0.7	0.6	0.9	2	1	0.7	4	2	8	3	1	1	--	13	--	--	--	--	1.6	1.9	2.6	2.0	1.3	1.7
	1,3-DCP	-1	3																--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP	-1	8			--	--	--	--	--	--	0.4	--	1	0.9 JL	--		--	--	--	--	--	--	0.36 J	0.38 J	0.31 J	0.36 J	0.34 J	0.43 J
	Chloroform	-1	-1																--	--	--	--	--	--	0.088 J	0.18 J	0.22J	0.17 J	0.25 J
	Dinoseb	-0.05	-0.05				0.4	--	--	--	--	--	--	--	--	0.22 J	--	?	--	--	--	--	--	--	--	--	R	--	--
	DBCP	-0.1	-0.01			--	--	--	--	--	--	--	--	1.9	0.02 JP	--		?	--	--	--	--	--	--	--	--	--	--	--
	EDB	-0.02	0.02			--	--	--	--	--	--	2	--	0.03 L	--	--	--	?	--	--	--	--	--	--	--	--	--	--	--
	Acetone																		--	--	--	--	--	--	--	4.7 J	--	--	--
	Toluene																		--	--	--	--	--	--	--	0.16 J	--	--	--
	Methylene chloride																		--	--	--	--	--	0.13 J	0.12 J	--	0.16 J	0.15 J	0.064 J
AMW-4R	1,2-DCP	6	4			1	2	3	4	2.7	6	2	330	39	0.4 JL	340	210	6.6 F	--	11	34	47	45	36	2.0	3.2	2.5	4.5	3.5
	1,3-DCP	-1	-1																--	--	--	--	--	--		--	--	--	--
	1,2,3-TCP	-1	-1			--	--	--	--	--	--	0.2	0.4J	3	--	--	--	4.6 F	--	--	--	--	1.3 J	1.2	0.27 J	0.30 J	0.38 J	--	--
	Chloroform	-1	1			--	--	--	--	--	--	--	4	0.2 L	--	3	5	--	--	--	--	--	--	0.47 J	0.17 J	0.32 J	0.18 J	0.22 J	0.17 J
	Dinoseb	-0.05	-0.05			--	--	--	--	--	--	--	--	--	--	0.22 JP	--	?	4.76	--	--	--	--	--	--	--	R	--	--
	DBCP	-0.1	-0.01			--	--	--	--	--	--	0.03	0.05	7	0.02 JP	--		?	--	--	0.03	--	--	0.075	0.017	0.017	0.021	0.013	--
	EDB	-0.02	0.03			--	--	--	--	--	--	0.8	--	--		--	--	?	--	--	--	--	--	--	--	0.011 J	--	--	--
	Acetone																		--	--	--	--	--	--	--	6.8 J	--	--	--
	Chloromethane																		--	--	--	--	--	--	--	0.32 J	--	0.16 J	--
	1,2-Dicloroethane																		--	--	--	--	--	--	--	--	--	0.25 J	--
	Methylene chloride																		--	--	--	--	--	--	--	--	0.084J	--	--
	Toluene																		--	--	--	--	--	--	--	1.5	--	--	--
WB2-1	1,2-DCP					NS	NS	NS	NS	1700	890	5	3	4	5	8	18	93	34	44	47	62	72	86	87	110	120	88	64
	1,3-DCP					NS	NS	60	NS	1	1		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP					NS	NS	NS	NS	72	60.5	1	0.7J	0.9 L	0.8 JL	1	8	52	110	143	153	311	283	330	320	330	480	280	240
	Chloroform					NS	NS	NS	NS	--	--	--	--	0.4 L	0.28 J	0.2 J	1	3.9	--	--	--	--	1.5 J	2.0 J	1.9 J	2.0 J	2.0J	1.4 J	1.8 J
	Dinoseb					NS	NS	NS	NS	4	3.5	--	0.2	--	--	--	7.9	?	18.2	20.0	22.1	20.8	22.7	32	45	69	R	78	39
	DBCP					NS	NS	NS	NS	30	27	0.1	--	0.4	0.28 J	0.3	2.5	?	--	--	--	--	--	0.34	0.077	0.093	0.079	--	0.045
	EDB					NS	NS	NS	NS	--	0.6	1	--	--	--	--	0.6	?	--	--	--	--	--	--	--	--	--	--	--
	Bromobenzene																		--	14	--	--	--	--	--	--	--	--	--
	Methylene chloride																		--	--	--	--	--	--	0.65 J	0.61 J	1.1 J	--	--
WB2-2	1,2-DCP					NS	NS	NS	NS	47	40	17	11	8	60	4	5	23	--	--	--	--	3.4 J	2.8	0.83 J	1.2	5.2	7.0	19
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP					NS	NS	NS	NS	19	19	21	20	17	--	2	--	--	--	--	--	--	3.4 J	0.75 J	0.17 J	0.58 J	8.5	21	44
	Chloroform					NS	NS	NS	NS	--	--	--	--	0.8 L	--	--	0.1 L	--	--	--	--	--	--	--	--	--	0.15J	0.18 J	0.60 J
	Dinoseb					NS	NS	NS	NS	2	8	--	0.5	--	--	--	--	?	--	0.15 J	--	--	--	--	--	--	R	2.9	6.5
	DBCP					NS	NS	NS	NS	7	7	5	4.5	5.6	0.75 J	0.3	--	?	--	--	0.122	--	--	0.040	--	0.10	1.2	3.0	6.7
	EDB					NS	NS	NS	NS	--	--	--	--	--	0.07	0.1	--	?	--	--	--	--	--	--	--	--	--	--	--
	Acetone																		--	--	--	--	--	--	--	7.7 J	--	--	--
	Toluene																		--	--	--	--	--	--	--	0.12 J	--	--	--
	Methyl-tert-butylether																		--	--	--	--	--	0.21 J	--	--	--	--	--

TABLE I-3-2 (Continued)
CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER

Well No.	Chemical	DATE SAMPLED AND CONCENTRATION (µg/l)																											
		9/87	10/87	2/88	3/88	1/91	4/91	7/91	12/91	4/92	7/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/2	2/03	5/03
WB2-3	1,2-DCP					NS	NS	NS	NS	0.8	0.8	9	13	6	12 JL	15	14	--	--	--	--	--	4.1 J	3.5	3.9	4.2	4.0	4.3	2.2
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP					NS	NS	NS	NS	--	--	--	0.5	--	--	0.7 J	--	2.6	--	--	--	--	--	0.29 J	0.22 J	--	--	--	--
	Chloroform					NS	NS	NS	NS	--	--	7	6	9	--	6	7	7	--	9.0	9.2	9.9	10	11	9.4	9.9	6.5	5.1	2.1
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	0.32	R	--	0.57
	DBCP					NS	NS	NS	NS	--	--				0.04 J	0.04 J	--	?	--	--	0.03	--	--	0.016	0.0097J	0.0066J	0.0054J	--	--
	EDB					NS	NS	NS	NS	--	--	0.2	0.2	0.11	0.1	0.1J	--	?	--	--	0.03	--	--	0.029	0.023	0.019 J	--	--	--
	Acetone																		--	--	--	--	--	--	--	9.3 J	--	--	1.8 J
	Chloromethane																		--	--	--	--	--	--	--	0.22 J	--	--	--
	Bromodichloromethane																		--	--	--	--	--	0.12 J	0.11 J	--	--	--	--
	Methylene chloride																		--	--	--	--	--	0.43 J	0.26 J	0.23 J	0.38 J	1.4	0.29 J
	Methyl-tert-butyl ether																		--	--	--	--	--	--	0.66 J	0.64 J	0.19 J	--	0.20 J
	Naphthalene																		--	--	--	--	--	0.39 J	--	--	--	--	--
	Toluene																		--	--	--	--	--	0.12 J	--	0.76 J	--	--	--
	m,p-Xylene																		--	--	--	--	--	0.23 J	--	--	--	--	--
	o-Xylene																		--	--	--	--	--	0.17 J	--	--	--	--	--
WB2-4	1,2-DCP					NS	NS	NS	NS		0.3	0.6	--	0.2 L	--	--	0.4 L	--	--	--	--	--	--	--	--	--	--	0.22 J	--
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP																1	--	--	--	--	--	--	0.2 J	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Dinoseb																26	?	--	--	--	--	--	--	--	--	R	--	--
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Acetone																		--	--	--	--	--	--	--	6.9 J	2.4 J	--	--
	Chloromethane																		--	--	--	--	--	--	--	--	0.19 J	--	--
	1,2-Dicloroethane																		--	--	--	--	--	--	--	--	0.17 J	--	--
	Methylene chloride																		--	--	--	--	--	--	--	--	0.066J	--	--
	1,2,4-Trimethylbenzene																		--	--	--	--	--	0.22 J	--	--	--	--	--
	o-Xylene																		--	--	--	--	--	0.13 J	--	--	--	--	--
PWB-1	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1	1.1	1.1	2.2	1.1	0.77 J
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.33 J	0.40 J	1.3	1.3	0.48 J	0.35 J
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.72 J	--	--	--	--	--
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.63	R	--	--
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.0080J	0.22	0.19	0.017	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7900 E	--	8.5 J	--	--	3.2 J
	Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.10J	--	--	--
	Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.99 J	--	--	--	--	--
	Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.26 J	--	--	--	--	--
	Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.12 J	--	--	--	--	--
	Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.22 J	--	--	--	--	--
	1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.31 J	--	--	--	--	--
	1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.18 J	--	--	--	--	--
PWB-2	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2	2.9	4.1	1.3	6.8	8.1
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.1	4.7	7.2	1.7	6.8	6.7
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	R	--	--
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	49	100	6.8 J	--	--	--
	Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.44 J	--	--	--
	Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.16 J	--	--	--
	Methyl-tert-butylether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.17 J	--	--	--	--
	Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.35 J	--	--	--	--	--
	Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.33 J	--	--	--	--	--
	1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.27 J	--	--	--	--	--
	1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.15 J	--	--	--	--	--

TABLE I-3-2 (Continued)
CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER

Well No.	Chemical	DATE SAMPLED AND CONCENTRATION (µg/l)																											
		9/87	10/87	2/88	3/88	1/91	4/91	7/91	12/91	4/92	7/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/2	2/03	5/03
PWB-3	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5	3.0	3.4	3.1	0.69 J	0.54 J
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.4	6.1	7.2	6.2	0.64 J	1.0 J
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.11 J	0.15 J	0.083J	--	--
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.87	0.80	R	--	--
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13	1.2	1.2	1.3	0.090	0.040
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.10	--	--	--	--	--
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	140 E	7.1 J	14	--	--	--
	Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.20 J	--	--	--
	Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.22 J	--	--	--	--
	Methyl tert-butyl ether	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.15 J	--	--	--	--	--
	Vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.060 J	--	--	--	--	--
PWB-4	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50	37	74	80	64	72
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	160	130	200	210	200	220
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5	1.5 J	1.6 J	2.0J	1.5 J	1.6 J
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15	19	21	R	39	33
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	31	32	29	44	40	36
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	0.29 J	--	--	--	--
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.1 J	--	12 J	21 J	--	--
	Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.30 J	--	--	--	--	--
	cis-1,3-Dichloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.23 J	--	--	--	--	--
PWB-5	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5	2.1	0.79 J	2.3	1.9	2.9
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	1,2,3-TCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19 J	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19 J	0.20 J	--	0.25J	0.27 J	0.64 J
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	R	--	--
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.013J	--	--	--
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.8 J	--	9.8 J	--	--	--
	Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.31J	--	--	--
	Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.39 J	--	--	--
	Hexachlorobutadiene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.33 J	--	--	--	--	--
	Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.25 J	--	--	--	--	--
	1,2-Dicloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	0.49 J	--	--	--
	1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.34 J	--	--	--	--	--
	1,2,4-Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.18 J	--	--	--	--	--
PWB-6	1,2-DCP																											--	--
	1,3-DCP																											--	--
	1,2,3-TCP																											--	--
	Chloroform																											--	--
	Dinoseb																											--	--
	DBCP																											--	--
	EDB																											--	--
	Acetone																											--	--
	Chloromethane																											--	--
	Methylene chloride																											--	--
PWB-7	1,2-DCP																											930	--
	1,3-DCP																											--	--
	1,2,3-TCP																											110	--
	Chloroform																											8.1 J	--
	Dinoseb																											--	--
	DBCP																											130	--
	EDB																											--	--
	Acetone																											--	--
	Chloromethane																											--	--
	Methylene chloride																											--	--

TABLE I-3-2 (Continued)
CHEMICALS OF CONCERN IN B-ZONE GROUNDWATER

Well No.	Chemical	DATE SAMPLED AND CONCENTRATION (µg/l)																											
		9/87	10/87	2/88	3/88	1/91	4/91	7/91	12/91	4/92	7/92	8/94	3/95	11/95	11/96	5/97	1/98	7/98	7/00	11/00	3/01	7/01	10/01	2/02	5/02	7/02	10/2	2/03	5/03
PWB-8	1,2-DCP																											4.0	2.9
	1,3-DCP																											--	--
	1,2,3-TCP																											0.73 J	0.76 J
	Chloroform																											0.091 J	0.091 J
	Dinoseb																											--	--
	DBCP																											--	--
	EDB																											0.070	--
	Acetone																											--	--
	Chloromethane																											--	--
	Methylene chloride																											--	--
PWB-9	1,2-DCP																											--	--
	1,3-DCP																											--	--
	1,2,3-TCP																											--	--
	Chloroform																											2.3	2.9
	Dinoseb																											--	--
	DBCP																											--	--
	EDB																											--	--
	Acetone																											--	--
	Chloromethane																											--	--
	Methylene chloride																											--	--
PWB-10	1,2-DCP																											0.20 J	--
	1,3-DCP																											--	--
	1,2,3-TCP																											--	--
	Chloroform																											4.3	4.9
	Dinoseb																											--	--
	DBCP																											--	--
	EDB																											--	--
	Acetone																											--	--
	Chloromethane																											--	--
	Methylene chloride																											--	--
PWB-11	1,2-DCP																												0.27 J
	1,3-DCP																												--
	1,2,3-TCP																												0.18 J
	Chloroform																												0.12 J
	Dinoseb																												--
	DBCP																												--
	EDB																												--
	Acetone																												1500 RE
	Chloromethane																												0.31 J
CW-1	1,2-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,3-DCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	1,2,3-TCP												--	--	--	--	1	poor data	--	--	--	--	--	0.18 J	--	--	--	--	--
	Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--		--	0.27 J
	Dinoseb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	0.29	R	--	--
	DBCP	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	EDB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--
	Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	7.7 J	--	--	--
	Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	0.16 J	--	--	--
	Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	--	--	--	--	--	--	--	--	0.084J	--	--

Notes:
-- indicates that the analyte was not detected.
1,2-DCP = 1,2-Dichloropropane.
1,3-DCP = 1,3-Dichloropropane.
DBCP = 1,2-Dibromo-3-chloropropane (See Appendix B for analysis value used).
EDB = Ethylene dibromide, also called 1,2-Dibromoethane (8260 analysis value used) (From July 2000, EPA 504 analysis value used).
1,2,3-TCP = 1,2,3-Trichloropropane.
J = Estimated value (laboratory qualifier) for various causes.
E = The concentration indicated for this analyte is an estimated value above the calibration range of the instrument.
F = Contaminated due to carryover from preceding analysis.
L = Data below the required reporting limit.
R = Results rejected during QA/QC due to lab problems
(-) = Less than; numberical value is Limit of detection for that compound.
P = High % difference between 1st and 2nd column.
? = EDB, DBCP, and dinoseb data not available by 2/23/99.
NA = Not analyzed.
NS = Well not sampled for this compound.

References:
Data source: Hargis+Associates, Inc. (data collected between 9/87 and 3/88), U.S EPA (data collected between 1/91 and 12/92), Ecology and Environment, Inc. (between 8/94 and 7/98), Panacea, Inc. (from 7/00 to present
Electronic file obtained from Ralph Lambert of Ecology and Environment, Inc., file name ALLCHEM.XLS

TABLE I-3-3

WELL CONSTRUCTION DETAILS
(PHASE I)

	Well PWA-1	Well PWA-2	Well PWA-3	Well PWA-4	Well PWA-5	Well PWB-1	Well PWB-2	Well PWB-3	Well PWB-4	Well PWB-5
Installed By:	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling	BC^2 Drilling
Driller:	Cameron	Cameron	Cameron	Cameron	Cameron	Cameron	Cameron	Cameron	Cameron	Cameron
Method of Installation:	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Mud Rotary	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger
Boring Diameter:	10”	10”	10”	10”	10”	10”	10”	10”	10”	10”
Boring Depth:	85’	85’	85’	85’	85’	185’	161’	166’	166’	166’
Casing Interval:	0-65’	0-65’	0-65’	0-65’	0-65’	0-165’	0-140’	0-145’	0-145’	0-145’
Casing Diameter:	4”	4”	4”	4”	4”	4”	4”	4”	4”	4”
Casing Type:	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC	Schedule 40 PVC
Grout Type:	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)
Grout Interval:	~2 to 58’ 15 bags cement (94 lb bags)	~2 to 58’ 15 bags cement (94 lb bags)	~3 to 58’ 15 bags cement (94 lb bags)	~2 to 58’ 15 bags cement (94 lb bags)	~2 to 58’ 15 bags cement (94 lb bags)	~2 to 158’ 15 bags cement (94 lb bags)	~2 to 133’ 15 bags cement (94 lb bags)	~2 to 138’ 15 bags cement (94 lb bags)	~2 to 138’ 15 bags cement (94 lb bags)	~2 to 138’ 15 bags cement (94 lb bags)
Seal Type:	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Medium coarse chips (Enviroplus medium)	Medium coarse chips (Enviroplus medium)
Seal Interval:	58 to 62 feet 2 bags bentonite chips	58 to 62 feet 2 bags bentonite chips	58 to 62 feet 2 bags bentonite chips	58 to 62 feet 2 bags bentonite chips	58 to 62 feet 2 bags bentonite chips	158 to 162 feet 2 bags bentonite chips	133 to 138 feet 2 bags bentonite chips	138 to 145 feet 2 bags bentonite chips	138 to 143 feet 3 bags bentonite chips	138 to 143 feet 2 bags bentonite chips
Filter Type:	Montery 2/12 sand	Montery 2/12 sand	Montery 2/12 sand	Monterey 2/12 sand	Monterey 2/12 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand
Filter Interval:	62-85’ 13 bags (100 lb bags) sand	62-85’ 13 bags (100 lb bags) sand	62-85’ 13 bags (100 lb bags) sand	62-85’ 13 bags (100 lb bags) sand	62-85’ 13 bags (100 lb bags) sand	162-185’ 13 bags (100 lb bags) sand	138-161’ 13 bags (100 lb bags) sand	143-166’ 13 bags (100 lb bags) sand	143-166’ 12 bags (100 lb bags) sand	143-166’ 12 bags (100 lb bags) sand
Screen Interval:	65-85’	65-85’	65-85’	65-85’	65-85’	165-185’	140-160’	145-165’	145-165’	145-165’
Screen Diameter:	4”	4”	4”	4”	4”	4”	4”	4”	4”	4”
Screen Type:	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)
Slot Size:	0.01”	0.01”	0.01”	0.01”	0.01	0.01	0.020	0.020	0.020	0.020

TABLE I-3-4

WELL CONSTRUCTION DETAILS
(PHASE II)

	Well PWA-6	Well PWA-7	Well PWB-6	Well PWB-7	Well PWB-8	Well PWB-9	Well PWB-10	Well PWB-11
Installed By:	West Hazmat	West Hazmat	West Hazmat	West Hazmat	West Hazmat	West Hazmat	West Hazmat	West Hazmat
Driller:	Troy Robinson	Troy Robinson	Troy Robinson	Troy Robinson	Troy Robinson	Troy Robinson	Troy Robinson	Troy Robinson
Method of Installation:	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Hollow Stem Auger	Mud Rotary	Hollow Stem Auger	Hollow Stem Auger
Boring Diameter:	10”	10”	10”	10”	10”	10”	10”	10”
Boring Depth:	86.5’	85’	161.5’	160’	180’	161.5’	161.5’	226.5’
Casing Interval:	0.5-63’	0.5-65’	0.5-140’	0.5-139.5’	0.5-140’	0.5-140’	0.5-140’	0.5-145’
Casing Diameter:	4”	4”	4”	4”	4”	4”	4”	4”
Casing Type:	Schedule 40 PVC	Schedule 40 PVC	Schedule 80 PVC	Schedule 80 PVC	Schedule 80 PVC	Schedule 80 PVC	Schedule 80 PVC	Schedule 80 PVC
Grout Type:	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)	Cement Slurry (Portland w/~5% Bent)
Grout Interval:	~2 to 56’ 15 bags cement (94 lb bags)	~2 to 59’ 15 bags cement (94 lb bags)	~1.5 to 135’ 15 bags cement (94 lb bags)	~2 to 134’ 15 bags cement (94 lb bags)	~1.5 to 135’ 15 bags cement (94 lb bags)	~1.5 to 135’ 15 bags cement (94 lb bags)	~2 to 135’ 15 bags cement (94 lb bags)	~2 to 136’ 15 bags cement (94 lb bags)
Seal Type:	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)	Bentonite chips (Enviroplus medium)
Seal Interval:	58 to 61.2 feet 2 bags bentonite chips	59 to 63 feet 2 bags bentonite chips	135 to 138 feet 2 bags bentonite chips	134 to 138 feet 2 bags bentonite chips	135 to 140 feet 2 bags bentonite chips	132 to 137 feet 2 bags bentonite chips	135 to 138 feet 2 bags bentonite chips	136 to 141 feet 2 bags bentonite chips
Filter Type:	Monterey 2/12 sand	Monterey 2/12 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand	Monterey # 3 sand
Filter Interval:	61.2-86.5’ 13 bags (100 lb bags) sand	63-85’ 13 bags (100 lb bags) sand	138-160’ 13 bags (100 lb bags) sand	137-160’ 13 bags (100 lb bags) sand	138-160’ 13 bags (100 lb bags) sand	138-160’ 13 bags (100 lb bags) sand	138-160’ 13 bags (100 lb bags) sand	141-165’ 13 bags (100 lb bags) sand
Screen Interval:	63-83’	65-85’	140-160’	139.5-159.5’	140-160’	140-160’	140-160’	145-165’
Screen Diameter:	4”	4”	4”	4”	4”	4”	4”	4”
Screen Type:	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 40 PVC)	Johnson wire-wrap (sch. 80 PVC)	Johnson wire-wrap (sch. 80 PVC)	Johnson wire-wrap (sch. 80 PVC)	Johnson wire-wrap (sch. 80 PVC)	Johnson wire-wrap (sch. 80 PVC)	Johnson wire-wrap (sch. 80 PVC)
Slot Size:	0.01”	0.01”	0.02”	0.02”	0.02”	0.02”	0.02”	0.02”

TABLE I-3-5
SOIL SAMPLE ANALYTICAL RESULTS - ORGANICS
(PHASE I)

Well No.	Depth	Date Sampled	EPA Method 8151A Herbicides	EPA Method 8260B Volatile Organic Compounds				
			Dinoseb	TCP	DBCP	EDB	1,2-DCP	Chloroform
			Concentrations Reported as milligrams per kilogram, mg/kg					
			MCL=7	MCL=5	MCL=0.2	MCL=0.05	MCL=5	MCL=100
PWA-1	WELL NOT SAMPLED							
PWA-2	20'	11/7/01	ND	ND	ND	ND	ND	ND
	40'	11/7/01	ND	ND	ND	ND	ND	ND
	60'	11/7/01	ND	2.10	ND	ND	ND	ND
	80'	11/7/01	ND	12.00	11.00	ND	65.00	ND
PWA-3	20'	11/8/01	ND	ND	ND	ND	ND	ND
	40'	11/8/01	ND	ND	ND	ND	ND	ND
	60'	11/8/01	ND	ND	ND	ND	ND	ND
	80'	11/8/01	ND	ND	ND	ND	2.10	ND
PWA-4	20'	11/8/01	ND	ND	ND	ND	ND	ND
	40'	11/8/01	ND	ND	ND	ND	ND	ND
	60'	11/8/01	ND	ND	ND	ND	ND	ND
	80'	11/8/01	ND	48.00	ND	ND	301.00	3.00
PWA-5	WELL NOT SAMPLED							
PWB-1	25'	11/13/01	ND	ND	ND	ND	ND	ND
	50'	11/13/01	ND	ND	ND	ND	ND	ND
	75'	11/14/01	ND	ND	ND	ND	ND	ND
	100'	11/14/01	ND	ND	ND	ND	1.30	ND
PWB-2	25'	11/30/01	ND	ND	ND	ND	ND	ND
	50'	11/30/01	ND	ND	ND	ND	ND	ND
	100'	12/3/01	ND	ND	ND	ND	ND	ND
	125'	12/3/01	ND	ND	ND	ND	5.50	ND
	150'	12/3/01	ND	ND	ND	ND	ND	ND
PWB-3	25'	12/5/01	ND	ND	ND	ND	ND	ND
	50'	12/5/01	ND	ND	ND	ND	ND	ND
	75'	12/5/01	0.5	74	90.00	45.00	268.00	ND
	100'	12/5/01	ND	15.00	44.00	ND	13.00	ND
PWB-4	25'	11/26/01	ND	ND	ND	ND	ND	ND
	50'	11/26/01	ND	ND	ND	ND	ND	ND
	75'	11/27/01	ND	118.00	ND	ND	444.00	24.00
	100'	11/27/01	ND	ND	ND	ND	ND	ND
	125'	11/27/01	ND	1.40	ND	ND	107.00	3.4 J
	150'	11/27/01	ND	ND	ND	ND	ND	ND
PWB-5	25'	11/28/01	ND	ND	ND	ND	ND	ND
	50'	11/28/01	ND	ND	ND	ND	ND	ND
	75'	11/28/01	ND	ND	ND	ND	ND	ND
	100'	11/28/01	ND	ND	ND	ND	ND	ND
	125'	11/28/01	ND	ND	ND	ND	4.80	ND
	155'	11/28/01	ND	ND	ND	ND	ND	ND

Notes:
DBCP = 1,2-Dibromo-3-chloropropane (8260 analysis value used).
TCP = 1,2,3-Trichloropropane.
1,2-DCP = 1,2-Dichloropropane.
EDB = Ethylene dibromide, also called 1,2-Dibromoethane
Only detected species are listed; see attached laboratory report for full list of tested species.
MCL values only provided for reference and not to suggest that the results are for water samples.
Analysis done by Associated Laboratories, Orange, Ca.

TABLE I-3-6
SOIL SAMPLE ANALYTICAL RESULTS FOR WELL BORINGS - ORGANICS
(PHASE II)

Well No.	Depth	Date Sampled	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8141A Organophosphorus Pesticides	EPA Method 8151A Chlorinated Herbicides	EPA Method 8151A Chlorinated Herbicides	EPA Method 8151A Chlorinated Herbicides	EPA Method 8260B Volatile Organic Compounds										EPA Method 8270C Semivolatile Organic Compounds	EPA Method 8270C Semivolatile Organic Compounds
			4,4´-DDD	4,4´-DDE	4,4´-DDT	Dieldrin	Endosulfan II	Endrin	Endrin aldehyde	Toxaphene	Monocrotophos	Dinoseb	MCPA	MCPP	1,2,3-TCP	DBCP	EDB	1,2-DCP	1,3-DCP	Chloroform	Acetone	2-Butanoe	Methylene chloride	Naphthalene	Bis(2-ethylhexyl) phthalate	2-Methyl naphthalene
			Concentrations Reported as micrograms per kilogram dry (µg/kg dry)																							
PWA-6	10	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	20	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2000J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	40	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1200J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	60	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2J	ND	ND	ND
	80	1/22/03	ND	1.2J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3J	ND	120J	ND
PWB-6	5	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0J	ND	ND	ND
	10	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.85J	ND	ND	ND
	20	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	40	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	180J
	60	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	80	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	100	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	120	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.96J	ND	ND	ND
	140	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.97J	ND	ND	ND
	160	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PWB-7	5	1/6/03	ND	1.3J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.4J	ND	ND	ND	ND	ND
	10	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.1J	ND	ND	ND	ND	ND
	20	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.4J	ND	ND	ND	ND	ND
	40	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0J	ND	ND	ND	ND	ND	7.3J	ND	ND	ND	ND	ND
	60	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	65	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	70	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.9J	ND	ND	ND	ND	ND
	75	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.6J	ND	ND	ND	ND	ND
	80	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.8J	ND	ND	ND	ND	ND
	100	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.1J	ND	ND	ND	ND	ND
	120	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34	23	ND	260 *	ND	1.4J	ND	ND	ND	ND	ND	ND
	140	1/6/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PWB-8	5	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	20	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.4J	ND	ND	ND	ND	ND
	40	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	60	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	80	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4J	ND	ND	ND
	100	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5J	ND	ND
	120	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7J	ND	ND	ND
	140	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3J	ND	ND	ND
	155	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	180	1/8/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PWB-9	5	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.83J	ND	ND	ND
	20	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	27J	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.87J	ND	ND	ND
	40	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9J	ND	ND	ND
	60	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7J	ND	ND	ND
	80	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0J	ND	ND	ND
	100	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND *	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.80J	ND	ND	ND
	120	1/13/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.2	ND	ND	ND	ND	1.4J	ND	ND	ND
	140	1/13/03	ND	ND	2.7J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	160	1/13/03	ND	ND	3.0J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.8J	ND	ND	ND
PWB-10	5	1/15/03	ND	ND	1.9J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	10	1/15/03	ND	ND	2.7J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.97J	ND	ND	ND
	20	1/15/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1J	ND	ND	ND
	40	1/15/03	ND	ND	2.3J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3J	ND	ND	ND
	60	1/15/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1100J	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4J	ND	ND	ND
	80	1/15/03	ND	ND	2.7J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2J	ND	ND	ND	ND	1.3J	ND	ND	ND
	100	1/15/03	ND	ND	2.3J	ND	ND	ND	ND	ND	ND	ND	1600J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	120	1/15/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	140	1/15/03	ND	ND	3.0J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	160	1/15/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.9J	ND	ND	ND	ND	ND
PWB-11	5	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	25	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	55	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	75	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	100	3/25/03	ND	1.4J	2.4J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	530	ND
	125	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	150	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1J	1.8J	ND	ND
	175	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	200	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4000	ND	ND	ND	ND	ND	ND	ND	2.7J	ND	2.0J	ND	ND
	225	3/25/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	390J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
1,2-DCP = 1,2-Dichloropropane.
1,3-DCP = 1,3-Dichloropropane.
DBCP = 1,2-Dibromo-3-chloropropane (8260 analysis value used).
1,2,3-TCP = 1,2,3-Trichloropropane.
EDB = Ethylene dibromide, also called 1,2-Dibromoethane.
MCPA = 2-Methyl-4-chlorophenoxy-acetic acid
MCPP = 2-(2-Methyl-4-chlorophenoxy)-propionic acid
ND = Not detected.
J = Estimated value.
* The continuing calibration standard for this compound is outside acceptance limits. The average of all compounds evaluated is within acceptance limits; the data are usable according to method criteria (A-01).
Only detected species are listed; see attached laboratory report for full list of tested species.

Analysis done by Sequoia Analytical.

TABLE I-3-7
SOIL SAMPLE ANALYTICAL RESULTS - METALS
(PHASE I)

Well No.	Depth	Date Sampled	Mercury	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdeum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			Concentrations Reported as milligrams per kilogram																
PWA-1	WELL NOT SAMPLED																		
PWA-2	20'	11/7/01	ND	ND	17.40	81	ND	ND	8.83	7.73	1.98	2.95	ND	4.59	ND	ND	3.00	25.70	44.40
	40'	11/7/01	ND	ND	3.52	177	ND	ND	22.40	14.90	10.70	3.79	ND	9.51	ND	ND	5.82	54.10	77.00
	60'	11/7/01	0.12	ND	29.00	219	ND	ND	23.00	19.70	7.13	5.60	ND	10.60	ND	ND	6.77	78.80	82.00
	80'	11/7/01	ND	ND	6.16	84	ND	ND	14.80	8.91	2.79	1.64	ND	4.50	ND	ND	3.14	37.20	33.30
PWA-3	20'	11/8/01	ND	ND	15.60	182	ND	ND	10.10	9.74	2.60	5.88	ND	5.51	ND	ND	4.05	34.00	46.80
	40'	11/8/01	ND	ND	2.87	122	ND	ND	16.50	11.50	4.90	2.17	ND	6.07	0.56	ND	3.95	41.00	45.40
	60'	11/8/01	ND	4.18	16.70	153	ND	ND	15.10	12.30	3.95	5.07	ND	7.53	ND	ND	4.57	45.90	66.50
	80'	11/8/01	ND	ND	8.54	173	ND	ND	16.10	14.00	10.20	3.02	ND	7.23	ND	ND	5.11	57.10	50.30
PWA-4	20'	11/8/01	0.15	3.07	36.80	250	ND	ND	17.80	14.90	5.95	5.16	ND	8.57	ND	ND	5.59	52.60	77.70
	40'	11/8/01	ND	3.79	2.72	206	ND	ND	20.00	13.80	7.47	2.50	ND	7.22	ND	ND	4.47	49.00	53.90
	60'	11/8/01	ND	3.36	4.36	127	ND	ND	16.80	12.60	4.46	4.12	ND	7.19	ND	ND	3.66	42.90	66.30
	80'	11/8/01	ND	ND	4.96	123	ND	ND	12.20	10.00	1.85	1.70	ND	5.94	ND	ND	3.98	38.40	35.70
PWA-5	WELL NOT SAMPLED																		
PWB-1	25'	11/13/01	ND	ND	22.90	131	ND	ND	12.20	9.50	5.15	4.27	ND	5.87	ND	ND	4.16	37.10	45.60
	50'	11/13/01	0.14	4.12	4.68	173	ND	ND	17.10	9.74	7.80	3.91	ND	9.03	ND	ND	3.81	38.30	47.90
	75'	11/14/01	ND	ND	9.85	228	0.60	ND	29.60	18.50	15.70	8.16	ND	13.00	ND	ND	7.25	72.00	80.40
	100'	11/14/01	ND	ND	5.96	75	ND	ND	6.90	6.35	2.05	2.09	ND	3.37	ND	ND	2.22	21.30	28.30
PWB-2	25'	11/30/01	ND	ND	10.90	183	0.66	ND	17.10	10.50	7.28	2.14	ND	7.65	4.29	ND	ND	41.80	63.20
	50'	11/30/01	0.12	ND	6.26	139	ND	ND	10.30	5.95	4.75	1.12	ND	4.48	1.57	ND	ND	22.20	58.30
	100'	12/3/01	ND	ND	5.52	72	ND	ND	3.63	2.65	2.56	1.53	ND	2.23	1.35	ND	ND	13.10	21.10
	125'	12/3/01	ND	ND	ND	250	0.54	ND	19.60	11.30	9.07	3.09	ND	9.25	4.06	ND	ND	44.10	61.60
	150'	12/3/01	ND	ND	4.71	75	ND	ND	8.59	5.08	4.41	1.46	ND	4.27	1.52	ND	ND	20.40	45.40
PWB-3	25'	12/5/01	ND	ND	7.97	105	ND	ND	7.57	5.91	4.94	2.30	ND	3.96	1.54	ND	ND	26.30	42.50
	50'	12/5/01	ND	ND	7.12	191	ND	ND	17.30	9.51	8.05	3.21	ND	6.54	1.88	ND	ND	48.40	58.90
	75'	12/5/01	0.40	ND	27.40	362	0.60	ND	23.80	14.50	9.46	4.65	ND	10.80	2.30	ND	ND	81.70	83.60
	100'	12/5/01	ND	ND	7.19	151	ND	ND	12.50	9.26	4.92	3.05	ND	6.19	1.88	ND	ND	35.10	66.00
PWB-4	25'	11/26/01	ND	ND	10.40	183	0.67	ND	14.60	11.40	3.88	2.37	ND	6.33	2.52	ND	ND	40.10	56.10
	50'	11/26/01	0.18	ND	11.50	254	0.62	ND	18.40	10.30	5.39	2.09	ND	8.74	1.63	ND	ND	45.90	48.30
	75'	11/27/01	ND	ND	15.30	237	0.78	ND	25.10	15.20	11.20	4.07	ND	10.80	2.05	ND	ND	66.30	83.40
	100'	11/27/01	0.15	ND	3.32	60	ND	ND	7.22	3.75	2.90	0.99	ND	3.27	0.68	ND	ND	13.80	44.80
	125'	11/27/01	ND	ND	7.88	189	0.68	ND	19.60	11.80	5.75	3.17	ND	8.71	2.25	ND	ND	50.60	58.20
	150'	11/27/01	ND	ND	1.18	185	ND	ND	11.90	8.24	5.85	1.06	ND	6.61	2.80	ND	ND	29.90	44.30
PWB-5	25'	11/28/01	ND	ND	1.22	184	0.72	ND	19.10	13.40	7.44	4.06	ND	9.03	2.77	ND	ND	47.70	72.20
	50'	11/28/01	ND	ND	8.98	112	ND	ND	8.45	6.05	3.97	1.45	ND	4.28	1.41	ND	ND	26.20	31.00
	75'	11/28/01	ND	ND	ND	265	0.76	ND	24.50	16.10	15.20	5.20	ND	11.10	3.86	ND	ND	62.70	64.30
	100'	11/28/01	ND	ND	16.10	154	0.51	ND	16.10	10.30	7.58	4.51	ND	7.79	1.90	ND	ND	48.60	57.50
	125'	11/28/01	ND	ND	2.43	222	0.59	ND	25.80	15.20	13.10	2.16	ND	9.77	1.78	ND	ND	67.80	57.80
	155'	11/28/01	ND	ND	3.60	105	ND	ND	10.30	6.08	6.06	1.80	ND	4.64	1.90	ND	ND	24.60	35.00

Notes:
Mercury found using 245.5 mercury in soilds by manual cold vapor testing, remaining metals found using 6010B metals testing.

Analysis done by Associated Laboratories, Orange, Ca.

TABLE I-3-8
SOIL SAMPLE ANALYTICAL RESULTS FOR WELL BORINGS - METALS
(PHASE II)

Well No.	Depth	Date Sampled	Total Metals - EPA 6000/7000 Series Methods																EPA Method 7471A
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdeum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
			Concentrations Reported as milligrams per kilogram dry (mg/kg dry)																mg/kg
PWA-6	10	3/26/03	ND	14	200	0.45	ND	20	9.0	9.7	ND	1.3J	11	ND	ND	ND	50	61	0.036
	20	3/26/03	ND**	29	240	0.52	ND**	17	8.8	13	3.4J**	1.5J**	11	ND**	ND**	ND**	49	66	0.097
	40	3/26/03	3.8J**	15J**	360	0.39	ND**	24	10	13	ND**	1.3J**	13	ND**	ND**	ND**	67	51	0.019J
	60	3/26/03	ND	5.0J	73	0.12	ND	3.2	1.5	2.6	1.7J	ND	2.1J	ND	ND	ND	9.6	12	0.016J
	80	3/26/03	ND	7.0J	230	0.19	ND	7.2	3.5	4.6	ND	0.94J	3.4	ND	ND	ND	24	23	0.024
PWB-6	5	1/22/03	3.1J	19	440	0.59	ND	22	11	17	2.2J	1.8J	10	ND	ND	ND	59	77	0.081
	10	1/22/03	ND	3.4J	26	0.063J	ND	2.4	0.82	1.4J	ND	0.78J	2.3J	ND	ND	ND	6.6	7.7	0.013J
	20	1/22/03	3.0J	47	110	0.25	0.35J	11	6.3	5.8	ND	0.69J	6.0	ND	ND	ND	32	44	0.025
	40	1/22/03	6.0J	17	250	0.50	ND	22	9.8	17	ND	0.83J	12	ND	ND	ND	52	75	0.083
	60	1/22/03	ND	6.5J	130	0.19	ND	8.2	3.3	5.7	1.4J	ND	4.6	ND	ND	ND	21	27	0.025
	80	1/22/03	2.6J	11	300	0.62	ND	33	15	23	1.5J	1.3J	15	ND	ND	ND	71	84	0.029
	100	1/23/03	ND	4.2J	58	0.10	ND	4.6	2.1	3.1	1.4J	ND	2.2J	ND	ND	ND	13	14	0.051
	120	1/23/03	2.7J	23	300	0.58	ND	28	11	21	3.8J	2.0J	14	ND	ND	ND	63	76	0.062
	140	1/23/03	ND	ND	130	0.20	ND	9.4	4.1	6.7	ND	ND	5.9	ND	ND	ND	19	31	0.014J
	160	1/23/03	2.9J	17	150	0.31	ND	13	6.0	10	ND	0.69J	8.1	ND	ND	ND	43	47	0.057
PWB-7	5	1/6/03	2.9J	14	170	0.26	ND	12	6.2	8.3	3.6J	0.93J	7.5	ND	ND	ND	33	41	0.024
	10	1/6/03	2.6J	8.9J	83	0.13	ND	6.9	4.1	4.3	3.5J	0.69J	4.5	ND	0.24J	ND	21	26	0.019J
	20	1/6/03	5.6J**	31	120	0.36	ND**	16	8.2	9.8	15J**	1.5J**	9.3	9.2J**	0.65J**	ND**	40	54	0.026
	40	1/6/03	3.9J	14	210	0.27	ND	24	10	14	6.1J	0.81J	10	ND	ND	ND	59	53	0.020J
	60	1/6/03	ND	7.0J	100	0.17	ND	8.0	4.2	4.9	2.6J	ND	4.3	ND	ND	ND	20	32	0.053
	65	1/6/03	2.6J	13	180	0.27	ND	15	8.2	8.3	3.9J	ND	8.0	ND	ND	ND	39	52	0.041
	70	1/6/03	4.8 J**	18J**	180	0.28	ND**	16	8.9	8.6	7.0J**	ND**	7.3	ND**	ND**	ND**	46	64	0.039
	75	1/6/03	4.4J	24	230	0.36	0.45J	28	10	11	5.6J	0.64J	9.8	ND	ND	ND	66	72	0.12
	80	1/6/03	7.0J	20	340	0.44	ND	33	16	25	8.7J	1.1J	14	ND	ND	ND	93	73	0.034
	100	1/6/03	1.5J	13	99	0.16	ND	16	3.9	5.8	3.1J	ND	5.6	ND	ND	ND	25	29	0.076
	120	1/6/03	1.7J	38	690	0.52	ND	21	13	16	5.3J	1.3J	12	ND	ND	ND	77	68	0.020J
	140	1/6/03	2.0J	4.7J	44	0.076J	ND	4.3	1.8	2.4	2.2J	ND	2.6J	ND	ND	ND	11	16	0.021
PWB-8	5	1/8/03	2.1J	18	130	1.3	0.32J	15	6.2	48	3.7J	1.3J	30	ND	ND	ND	33	41	0.017J
	10	1/8/03	ND	9.0J	84	0.22	ND	7.5	3.8	6.5	2.0J	ND	6.2	ND	ND	ND	20	25	0.011J
	20	1/8/03	5.0J	58	350	0.64	0.57J	23	13	23	4.7J	1.9J	14	ND	ND	ND	71	87	0.074
	40	1/8/03	3.7J	20	290	0.27	ND	27	12	18	2.1J	ND	12	ND	ND	ND	66	61	0.020J
	60	1/8/03	2.6J	15	140	0.31	0.37J	16	6.8	9.1	5.1J	ND	7.0	ND	ND	ND	37	52	0.052
	80	1/8/03	4.7J	14	330	0.62	ND	33	15	29	4.8J	0.89J	17	ND	ND	ND	76	86	0.025
	100	1/8/03	ND	5.0J	53	0.094	0.36J	3.0	2.0	3.0	ND	ND	2.4J	ND	ND	ND	10	14	0.019
	120	1/8/03	2.9J	11	210	0.31	ND	16	7.6	9.2	3.4J	1.1J	8.4	ND	ND	ND	37	51	0.060
	140	1/8/03	ND	9.2J	250	0.30	ND	22	10	13	4.0J	0.89J	10	ND	ND	ND	49	51	0.014J
	155	1/8/03	ND	ND	28	0.073J	ND	3.5	1.6	2.6	1.8J	ND	2.5J	ND	ND	ND	6.8	49	0.011J
	180	1/8/03	ND	5.1J	24	0.070J	ND	2.2	1.0	1.5	2.5J	ND	1.5J	ND	ND	ND	6.0	9.7	0.014J
PWB-9	5	1/13/03	2.4J	13	120	0.24	ND	9.9	5.0	5.9	ND	0.88J	5.0	ND	ND	ND	31	37	0.047
	10	1/13/03	1.4J	10	130	0.17	ND	8.1	4.7	4.2	1.4J	1.1J	3.8	ND	ND	ND	26	33	0.020
	20	1/13/03	3.6J	52	450	0.72	ND	39	19	29	2.3J	2.5	21	ND	ND	ND	83	100	0.018
	40	1/13/03	2.4J	16	190	0.28	0.29J	14	5.6	7.2	1.5J	0.92J	6.6	ND	ND	ND	34	42	0.018J
	60	1/13/03	3.1J	29	190	0.32	ND	19	8.6	12	ND	0.91J	8.9	ND	ND	ND	65	62	0.046
	80	1/13/03	ND	11	170	0.26	ND	13	6.1	7.8	ND	1.1J	6.5	ND	ND	ND	35	48	0.058
	100	1/13/03	ND	5.2J	96	0.16	ND	7.0	3.4	4.6	ND	ND	4.5	ND	ND	ND	22	27	0.041
	120	1/13/03	4.3J	9.0J	290	0.28	0.31J	29	12	16	1.9J	ND	14	ND	ND	ND	66	59	0.015J
	140	1/13/03	3.2J	8.2J	110	0.19	ND	9.1	4.5	7.0	ND	ND	4.7	ND	ND	ND	33	33	0.027
	160	1/13/03	2.9J	21	300	0.47	ND	28	11	14	2.8J	0.98J	12	ND	ND	ND	62	85	0.035

TABLE I-3-8
SOIL SAMPLE ANALYTICAL RESULTS FOR WELL BORINGS - METALS
(PHASE II)

Well No.	Depth	Date Sampled	Total Metals - EPA 6000/7000 Series Methods																EPA Method 7471A
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdeum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
			Concentrations Reported as milligrams per kilogram dry (mg/kg dry)																mg/kg
PWB-10	5	1/15/03	ND	29	220	0.45	ND	16	9.1	11	1.8J	3.4	9.7	ND	ND	ND	53	58	0.026
	10	1/15/03	2.9J	15	160	0.33	ND	15	7.2	7.9	3.5J	1.3J	9.0	ND	ND	ND	40	58	0.088
	20	1/15/03	3.6J	110	180	0.96	0.42J	30	16	24	5.9J	2.8	18	ND	ND	ND	78	100	0.095
	40	1/15/03	2.7J	18	140	0.21	ND	9.9	5.3	5.5	ND	0.74J	5.6	ND	ND	ND	33	37	0.045
	60	1/15/03	1.7J	11	270	0.36	ND	15	9.0	13	1.6J	1.3J	12	ND	ND	ND	40	57	0.076
	80	1/15/03	3.0J	16	170	0.29	ND	17	8.3	10	ND	1.2J	8.5	ND	ND	ND	41	53	0.042
	100	1/15/03	2.7J	5.5J	200	0.20	ND	19	7.8	11	ND	ND	8.3	ND	ND	ND	49	44	0.0057J
	120	1/15/03	2.2J	6.9J	190	0.32	ND	17	6.7	8.6	ND	ND	6.6	ND	ND	ND	37	50	0.028
	140	1/15/03	2.5J	11J	130	0.23	ND	11	5.2	5.8	ND	0.83J	5.7	ND	ND	ND	34	38	0.027
	160	1/15/03	ND	3.6J	72	0.12	ND	8.2	2.9	3.6	ND	ND	3.8	ND	ND	ND	19	21	0.024
PWB-11	5	3/25/03	3.9J	16	190	0.34	ND	14	7.2	8.8	ND	1.1J	7.0	ND	ND	ND	39	48	0.066
	25	3/25/03	6.5J**	29	200	0.42	ND**	17	9.5	9.6	ND**	ND**	7.4	ND**	ND**	ND**	49	63	0.056
	55	3/25/03	3.8J	12J	280	0.66	ND	25	9.3	14	2.3J	0.85J	12	ND	ND	ND	49	82	0.097
	75	3/25/03	3.8J	27	270	0.69	0.40J	31	13	18	6.3J	ND	13	ND	ND	ND	74	85	0.068
	100	3/25/03	1.8J	7.0J	63	0.13	ND	13	2.3	4.8	2.2J	2.0	2.2J	ND	ND	ND	13	30	0.024
	125	3/25/03	ND	3.5J	46	0.10	ND	4.3	1.7	2.5	ND	ND	ND	3.4J	ND	ND	10	14	0.018J
	150	3/25/03	ND	8.9J	160	0.34	ND	15	5.2	9.3	ND	0.89J	6.3	ND	ND	ND	36	41	0.032
	175	3/25/03	ND	8.5J	77	0.19	ND	6.6	2.5	4.6	ND	1.3J	3.5	ND	ND	ND	18	17	0.035
	200	3/25/03	ND	30	420	0.84	ND	27	12	19	3.0J	2.0J	14	ND	ND	ND	91	87	0.19
	225	3/25/03	4.1J	47	500	0.94	0.38J	27	15	24	7.7J	1.6J	17	ND	ND	ND	93	92	0.057

Notes:
ND = Not detected.
J = Estimated value.
** The reporting Limit for this analyte has been raised to account for matrix interference (R-01).

Analysis done by Sequoia Analytical.

TABLE I-3-9
SOIL CHARACTERISTICS
(PHASE I)

Sample	ASTM 5084 Hydraulic Conductivity cm/sec	Soil Description	USCS (visual)	Percent Passing No. 4 Sieve %	Moisture Content %	Dry Density pcf
PWA-2-45	2.39E-08	Olive Brn Sandy Clay	CL	67.9	17.27	112.33
PWA-2-65	5.47E-06	Olive Brn Silty Sand	SM	22.5	21.90	101.87
PWA-4-65	1.68E-05	Gray Brown Silty Sand	SM	37.6	10.21	109.34
PWA-4-80	5.05E-07	Gray Brown Silty Sand	SM	18.8	17.08	113.47
PWB-1-70	3.53E-05	Drk Gray Silty Sand	SM	20.4	16.84	97.95
PWB-3-70	1.03E-06	Olive Silty Sand	SM	27.0	28.32	97.32
PWB-3-85	1.05E-06	Drk Olive Silty Sand	SM	15.1	14.12	119.02
PWB-3-150	6.15E-07	Olive Sandy Silt	ML	62.0	22.55	103.94
PWB-4-45	7.86E-06	Olive Sandy Clay	CL	75.6	18.28	97.75
PWB-4-65	1.67E-06	Olive Sandy Silt	ML	83.0	32.64	90.32
PWB-4-150	6.76E-06	Brown Silty Sand	SM	15.7	15.22	113.04
PWB-5-40	8.19E-09	Olive Lean Clay	CL	81.3	21.47	106.80
PWB-5-95	6.93E-06	Olive Brn Silt w/fine sand	ML	82.4	16.22	95.69
PWB-5-135	2.76E-07	Olive Brn Sandy Silt	ML	58.4	21.57	108.20

Notes:
cm/sec = centimeters per second.
pfc = pounds per cubic foot of material
Percent Passing No. 4 Sieve is based on Grain Size Distribution Curve by test method ASTM D 422.

TABLE I-3-10
SOIL CHARACTERISTICS
(PHASE II)

Sample	ASTM 5084 Hydraulic Conductivity (cm/sec)	Soil Description	USCS (visual)	Percent Passing No. 200 Sieve (%)	Moisture Content (%)	Dry Density (pcf)
PWA-6/45	5.98×10^{-9}	Sandy Clay	CL	55.21	13.64	118.34
PWA-6/85	1.16×10^{-6}	Clayey Sand	SC	29.83	14.4	119.48
PWB-6/20	2.16×10^{-6}	Sandy Silt	ML	61.33	28.09	100.93
PWB-6/150	1.08×10^{-3}	Poorly-Graded Sand	SP	1.11	9.45	107.29
PWB-7/125	1.23×10^{-7}	Sandy Clay	CL	52.92	17.24	116.84
PWB-7/135	9.84×10^{-6}	Silty Sand	SM	37.23	17.76	116.08
PWB-7a/205	2.23×10^{-6}	Silty Sand	SM	23.93	18.12	116.46
PWB-9/55	Not tested	Sandy Clay	CL	61.8	27.71	98.81
PWB-9/130	Not tested	Silty Clay	SM	27.33	9.71	127.15
PWB-11/165	Not tested	Well-Graded Sand w/ clay lense	SW/SM	15.43	16.77	110.16
PWB-11/190	Not tested	Clay	CH	92.91	24.07	104.55
PWB-11/210	Not tested	Clay	CH	96.48	35.45	88.72

Notes:
cm/sec = centimeters per second
visual = visual observation
% = percent
pcf = pounds per cubic foot

TABLE I-3-11
SOIL SAMPLE ANALYTICAL RESULTS FOR SOIL BORINGS - ORGANICS
(PHASE II)

Well No.	Depth	Date Sampled	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8081A Organochlorine Pesticides	EPA Method 8151A Chlorinated Herbicides	EPA Method 8151A Chlorinated Herbicides	EPA Method 8151A Chlorinated Herbicides	EPA Method 8260B Volatile Organic Compounds						
			4,4´-DDD	4,4´-DDE	4,4´-DDT	Dieldrin	Endosulfan II	Endrin	Endrin aldehyde	Toxaphene	Dinoseb	MCPA	MCPP	1,2,3-TCP	DBCP	EDB	1,2-DCP	1,3-DCP	Chloroform	Acetone
			Concentrations Reported as micrograms per kilogram dry (µg/kg dry)																	
PB-1	5	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	10	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	20	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	30	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	5.1J
	40	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	50	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
PB-2	5	1/22/03	4.2***	210	120	11	1.9J	10	3.2J	210	ND	ND*	250J	ND	ND	ND	ND	ND	ND	5.4J
	10	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	7.8J
	20	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	5.4J
	30	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	40	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	50	1/22/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
PB-3	5	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	10	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	20	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	30	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	40	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND
	50	1/23/03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND*	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
1,2-DCP = 1,2-Dichloropropane.
1,3-DCP = 1,3-Dichloropropane.
DBCP = 1,2-Dibromo-3-chloropropane (8260 analysis value used).
1,2,3-TCP = 1,2,3-Trichloropropane.
EDB = Ethylene dibromide, also called 1,2-Dibromoethane.
MCPA = 2-Methyl-4-chlorophenoxy-acetic acid
MCPP = 2-(2-Methyl-4-chlorophenoxy)-propionic acid
ND = Not detected.
J = Estimated value.
*** Primary and confirmation results varied by greater than 40% RPD. The results may still be useful for their intended purpose (QR-04).
* The continuing calibration standard for this compound is outside acceptance limits. The average of all compounds evaluated is within acceptance limits; the data are usable according to method criteria (A-01).
Only detected species are listed; see attached laboratory report for full list of tested species.

Analysis done by Sequoia Analytical.

TABLE I-3-12
SOIL SAMPLE ANALYTICAL RESULTS FOR SOIL BORINGS - METALS
(PHASE II)

Well No.	Depth	Date Sampled	Total Metals - EPA 6000/7000 Series Methods																EPA Method 7471A
			Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdeum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
			Concentrations Reported as milligrams per kilogram dry (mg/kg dry)																mg/kg
PB-1	5	1/22/03	5.0J	21	240	0.46	0.40J	20	9.4	13	ND	1.5J	8.5	ND	ND	ND	51	63	0.065
	10	1/22/03	2.8J	13	130	0.24	ND	10	5.5	7.1	1.5J	1.1J	5.1	ND	ND	ND	28	36	0.036
	20	1/22/03	3.8J	25	140	0.31	ND	15	8.1	10	3.6J	1.5J	8.9	ND	ND	ND	40	56	0.058
	30	1/22/03	2.1J	22	180	0.31	ND	14	6.9	8.9	2.6J	0.85J	6.6	ND	ND	ND	42	45	0.045
	40	1/22/03	4.6J	15	280	0.56	ND	39	16	26	ND	1.1J	17	ND	ND	ND	99	90	0.035
	50	1/22/03	4.2J	16	410	0.57	ND	24	10	15	2.5J	1.1J	14	ND	ND	ND	48	68	0.048
PB-2	5	1/22/03	4.5J	13	140	0.26	ND	15	6.1	10	6.8J	1.2J	8.3	ND	ND	ND	33	73	2.9
	10	1/22/03	1.9J	12	110	0.21	ND	9.3	4.7	5.6	2.0J	0.91J	4.5	ND	ND	ND	25	33	0.035
	20	1/22/03	6.9	61	300	0.56	0.80J	25	13	18	3.1J	1.8J	13	ND	ND	ND	77	94	0.068
	30	1/22/03	4.7J	25	180	0.34	0.33J	17	8.3	8.3	ND	1.1J	8.7	ND	ND	ND	49	62	0.040
	40	1/22/03	3.6J	8.5J	240	0.21	ND	19	8.1	11	ND	ND	7.5	ND	ND	ND	44	44	0.033
	50	1/22/03	3.7J	32	310	0.50	ND	25	12	21	3.8J	1.2J	14	ND	ND	ND	68	76	0.042
PB-3	5	1/23/03	2.9J	19	200	0.34	ND	14	6.7	9.4	2.8J	0.81J	6.4	ND	ND	ND	37	44	0.036
	10	1/23/03	4.2J	20	200	0.37	ND	18	9.3	11	ND	1.1J	7.7	ND	ND	ND	50	61	0.053
	20	1/23/03	5.8J	42	250	0.57	ND	27	14	20	1.9J	ND	13	ND	ND	ND	70	93	0.070
	30	1/23/03	3.2J	39	300	0.97	ND	28	16	25	6.9J	1.9J	17	ND	ND	ND	84	100	0.15
	40	1/23/03	3.8J	13	230	0.31	ND	25	10	22	ND	ND	10	ND	ND	ND	62	64	0.023
	50	1/23/03	3.3J	18	480	0.38	ND	19	8.6	12	ND	1.1J	11	ND	ND	ND	54	55	0.057

Notes:
ND = Not detected.
J = Estimated value.

Analysis done by Sequoia Analytical.

TABLE I-4-1

SUMMARY OF EPA TEST METHODS FOR PRIMARY COPCs

CONSTITUENTS	EPA TEST METHOD
Chloroform	8260B*
1,2-Dibromo-3-chloro propane (DBCP)	8260B or 504.1
1,2-Dichloropropane (1,2-DCP)	8260B
1,3-Dichloropropane (1,3-DCP)	8260B
1,2,3-Trichloro propane (1,2,3-TCP)	8260B
Ethylene dibromide (EDB)	504.1
Dinoseb	8151A

***** The full method of analysis with full lists of compounds was conducted for volatiles analyzed by method 8260B.

TABLE I-4-2

SAMPLE CONTAINER SPECIFICATIONS

CONSTITUENT	ANALYTICAL METHOD	CONTAINER TYPE	CONTAINER SIZE	VOLUME REQUIRED	PRESER-VATIVE
Chloroform	EPA 8260B	Glass (VOA vial)	40 mL	80 mL (2 to 3 vials)	HCL
1,2-DCP					
1,3-DCP					
1,2,3-TCP					
DBCP					
EDB	EPA 504	Glass (VOA vial)	40 mL	80 mL (2 to 3 vials)	Sodium thiosulfate
Dinoseb	EPA 8151	Amber glass	1L	1L	None

Notes (where applicable):

mL = milliliter
L = liter
HCL = hydrochloric acid
VOA vials = volatile organic analysis vials
Preservatives were added to containers by laboratory

TABLE I-4-3

SUMMARY OF HOLDING TIME REQUIREMENTS

ANALYSIS	MATRIX	HOLDING TIME REQUIREMENT
EPA 8260B	Water	14 days to analysis
EPA 8151A	Water	7 days to extraction 40 days to analysis
EPA 504.1	Water	28 days to analysis
EPA 8260B	Soil	14 days to analysis
EPA 8151A	Soil	14 days to analysis
EPA 8081A	Soil	14 days to analysis
EPA 8141A	Soil	14 days to analysis
EPA 8270C	Soil	14 days to analysis
EPA 6000/7000	Soil	6 month to analysis
EPA 7471A	Soil	28 days to analysis

TABLE I-4-4
SUMMARIES OF LABORATORY ANALYSIS EQUIPMENT CALIBRATION PROCEDURES AND QC MEASURES

CRITICAL FACTOR	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Tuning Criteria	Every 12 hours	SW-846 tune criteria	Correct problem then repeat tune
5 Point Calibration	Prior to sample analysis	%RSD ≤15% for all "Target" compounds correlation coefficient of >0.995 for linear regression fit %RSD for CCCs ≤30% (8260B) only.	If the %RSD of any compound is 15% or less, the average response factor is used for quantitation. If the %RSD is grater than 15%, a curve using first or higher order regression fit is generated. If quadratics is used, six points are needed to evaluate the curve.
2nd Source Calibration Verification (ICV)	After each initial calibration curve	%Difference ≤20% for all "Target" compounds 10% may exceed the 20% criteria, but must be within 40% D.	Investigate the problem and if warranted, analyze a new analytical curve for the out-of-limits compounds.
Detection Limit Verification (DLV)	With each MDL study	±50% of the expected value	Check the system and reanalyze the standard. Notify QA department via a corrective action form if the criteria cannot be met.
Continuing Calibration Verification (CCV)	At the start of each analysis shift and every 12 hours	%Difference ≤20% for all "Target" compounds 10% may exceed the 20% criteria, but must be within 40% D.	Perform maintenance and repeat test. If the system still fails the CCV, perform a anew 5 point calibration curve.
Internal Standard (IS)	As each standard, blank, and sample is being loaded	Retention time for the blanks and samples must be within ±30 seconds of the mid point level R.T in the last initial calibration. The IS area must be within ±50% of the mid point IS area for the samples.	**For blanks:** inspect the system and reanalyze the blank. **For samples:** reanalyze the sample unless obvious matrix interference is documented. If the IS are within limits in the re-analysis, report the second analysis. If IS are out of limits a second time, report data from first analysis and narrate.

TABLE I-4-5

TARGET COMPOUNDS FOR METHODS 504.1, 8151A, AND 8260B

TARGET COMPOUNDS	ANALYTICAL METHOD	CASS #	RL (µG/L)	ACCEPTANCE CRITERIA	
				ICAL (%RSD)	ICV/CCV (%D)
1,2-Dibromoethane (EDB)	504.1	106-93-4	0.020	≤20	±20
Dinoseb	8151A	88-85-7	0.50	≤15	±20
Acetone	8260B	67-64-1	≤10	≤15	±20
Benzene	8260B	71-43-2	1	≤15	±20
Bromobenzene	8260B	108-86-1	1	≤15	±20
Bromochloromethane	8260B	74-97-5	1	≤15	±20
Bromodichloromethane	8260B	75-27-4	1	≤15	±20
Bromoform	8260B	75-25-2	1	≤15	±20
Bromomethane	8260B	74-83-9	1	≤15	±20
2-Butanone	8260B	78-93-3	10	≤15	±20
n-Butylbenzene	8260B	104-51-8	1	≤15	±20
sec-Butylbenzene	8260B	135-98-8	1	≤15	±20
tert-Butylbenzene	8260B	98-06-6	1	≤15	±20
Carbon Disulfide	8260B	75-15-0	10	≤15	±20
Carbon Tetrachloride	8260B	56-23-5	1	≤15	±20
Chlorobenzene	8260B	108-90-7	1	≤15	±20
Chloroethane	8260B	75-00-3	1	≤15	±20
2-Chloroethyl Vinyl ether	8260B	110-75-8	10	≤15	±20
Chloroform	8260B	67-66-3	1	≤15	±20
Chloromethane	8260B	74-87-3	1	≤15	±20
2-Chlorotoluene	8260B	95-49-8	1	≤15	±20
4-Chlorotoluene	8260B	106-43-4	1	≤15	±20
1,2-Dibromo-3-Chloropropane	8260B	96-12-8	1	≤15	±20
Dibromochloromethane	8260B	124-48-1	1	≤15	±20
1,2-Dibromoethane(EDB)	8260B	106-93-4	1	≤15	±20
Dibromomethane	8260B	74-95-3	1	≤15	±20
1,2-Dichlorobenzene	8260B	95-50-1	1	≤15	±20
1,3-Dichlorobenzene	8260B	541-73-1	1	≤15	±20
1,4-Dichlorobenzene	8260B	106-46-7	1	≤15	±20
Dichlorodifluoromethane	8260B	75-71-8	1	≤15	±20
1,1-Dichloroethane	8260B	75-35-4	1	≤15	±20
1,2-Dichloroethane	8260B	107-06-2	1	≤15	±20
1,1-Dichloroethene	8260B	75-35-4	1	≤15	±20
cis-1,2-Dichloroethene	8260B	156-59-2	1	≤15	±20
trans-1,2-Dichloroethene	8260B	156-60-5	1	≤15	±20
1,2-Dichloropropane	8260B	78-87-5	1	≤15	±20
1,3-Dichloropropane	8260B	142-28-9	1	≤15	±20
2,2-Dichloropropane	8260B	594-20-7	1	≤15	±20
1,1-Dichloropropene	8260B	563-58-6	1	≤15	±20
cis-1,3-Dichloropropene	8260B	10061-01-5	1	≤15	±20
Trans-1,3-Dichloropropene	8260B	10061026	1	≤15	±20
Ethylbenzene	8260B	100-41-4	1	≤15	±20
Freon 113	8260B	76-13-1	1	≤15	±20
Hexachlorobutadiene	8260B	87-68-3	1	≤15	±20

TABLE I-4-5 (Continued)

LIST OF THE TARGET COMPOUNDS FOR METHODS 504.1, 8151A, AND 8260B

TARGET COMPOUNDS	ANALYTICAL METHOD	CASS #	RL (µG/L)	ACCEPTANCE CRITERIA	
				ICAL (%RSD)	ICV/CCV (%D)
2-Hexanone	8260B	591-78-6	10	≤15	±20
Isopropylbenzene	8260B	98-82-8	1	≤15	±20
p- Isopropyltoluene	8260B	99-87-6	1	≤15	±20
Methyl tert butyl ether	8260B	1634-044	1	≤15	±20
4-Methyl-2-Pentanone	8260B	108-10-1	10	≤15	±20
Methylene Chloride	8260B	75-09-2	1	≤15	±20
Naphthalene	8260B	91-20-3	1	≤15	±20
n- Propylbenzene	8260B	104-51-8	1	≤15	±20
Styrene	8260B	100-42-5	1	≤15	±20
1,1,1,2-Tetrachloroethane	8260B	630-20-6	1	≤15	±20
1,1,2,2-Tetrachloroethane	8260B	79-34-5	1	≤15	±20
Tetrachloroethene	8260B	127-18-4	1	≤15	±20
Toluene	8260B	108-88-3	1	≤15	±20
1,2,3-Trichlorobenzene	8260B	87-61-6	1	≤15	±20
1,2,4-Trichlorobenzene	8260B	120-82-1	1	≤15	±20
1,1,1-Trichloroethane	8260B	71-55-6	1	≤15	±20
1,1,2-Trichloroethane	8260B	79-00-5	1	≤15	±20
Trichloroethene	8260B	79-01-6	1	≤15	±20
Trichlorofluoromethane	8260B	75-69-4	1	≤15	±20
1,2,3-Trichloropropane	8260B	96-18-4	1	≤15	±20
1,2,4-Trimethylbenzene	8260B	95-63-6	1	≤15	±20
1,3,5-Trimethylbenzene	8260B	108-67-8	1	≤15	±20
Vinyl Acetate	8260B	108-05-4	20	≤15	±20
Vinyl Chloride	8260B	75-01-4	1	≤15	±20
o-Xylene	8260B	95-47-6	1	≤15	±20
m-& p-Xylenes	8260B	136777-61-2	1	≤15	±20

TABLE I-4-6

SUMMARY OF QC REQUIREMENTS

QC Check	QC Check	Minimum Frequency	Corrective Action
Surrogate	As each standard, blank, and sample is being analyzed	8260B: Dibromoflouoromethane 84-118% 1,2-Dichloroethane 74-135% p-Bromofluorobenzene 86-110% 2,2-DCAA(8151A): 30-150% 1,3-Dibromopropane(504.1): 50-118%	For blanks: inspect the system and reanalyze the blanks. For samples: reanalyze sample unless obvious matrix interference is documented. If the %R is within limits in the re-analysis, report the second analysis. If %R are out of limits in the re-analysis, narrate.
Matrix spike/Matrix spike duplicate	5% of the samples	8260B:%R =65-135 RPD≤35% 8151A %R=30-150;RPD ≤20% 504.1 %R=70-130; RPD ≤20%	Reanalyze the sample. If the limit is exceeded again Investigate the cause and bring the system back to working order. If no problem is found with the system, flag the data, or reanalyze the whole batch.
Lab Control Sample (Subset of the target components)	With each analysis/ Extraction batch of ≤20 samples	8260B:%R =65-135 RPD≤35% 8151A %R=30-150;RPD ≤20% 504.1 %R=70-130; RPD ≤20%	Check the system and reanalyze the standard. Re-prepare the standard if necessary. Recalibrate the instrument if the criteria cannot be met. If no problem is found with the system, flag the data, or reanalyze the whole batch.
Method Blanks	After the CCV	Results less than the laboratory detection limit	Inspect the system and reanalyze the blank.

TABLE I-4-7

INTERNAL STANDARDS (I.S.) FOR METHOD 8260B

ANALYTE	METHOD	%RECOVERY
Pentafluorobenzene	8260B	50-150
1,4-Difluorobenzene	8260B	50-150
Chlorobenzene-d_5	8260B	50-150
1,4-Dichlorobenzene-d_4	8260B	50-150

TABLE I-4-8

SURROGATES FOR METHODS 504.1, 8151A, AND 8260B

ANALYTE	METHOD	%RECOVERY
1,2-Dichloroethane-d_4	8260B	74-135
Toluene-d_8	8260B	84-119
4-Bromofluorobenzene	8260B	86-119
Dibromofluoromethane	8260B	84-122
2,4-DCAA	8151A	30-150
1,3-Dibromopropane	504.1	50-118

TABLE I-4-9
DATA REVIEW QUALIFIERS AND DESCRIPTORS

NOTATION	DEFINITION
E	The concentration indicated for this analyte is an estimated value
HT-04	The sample was analyzed beyond the EPA recommended holding
J	Estimated value.
Q-LIM	The percent recovery was outside of the control limits. The
QR-07	The RPD was outside the control limits. The samples results may
S-LIM	The surrogated recovery was outside control limits. The sample
DET	Analyte detected.
ND	Analyte not detected.
NR	Not Reported.
Dry Sample	Results reported on a dry weight basis.

TABLE I-4-10

DATA MANAGEMENT SYSTEM QA/QC FIELDS

FIELD	DESCRIPTION
QA_Code	Indicates the level of verification conducted on the record.
QA_Init	Indicates the initials of the person who most recently modified the record.
QA_Date	Indicates the date the record was most recently modified.
QA_Source	Indicates the source of the record (e.g., the author and title of the electronic file or hard copy report).

TABLE I-4-11
LABORATORY DATA VALIDATION QUALIFIER NOTES

NOTATION	DEFINITION
*	Surrogate values outside of contract required QC limits.
A	Tentatively identified compounds (TIC) was a suspected aldol
B	Compound is found in the associated blank as well as in the sample.
C	Analyte presence confirmed by GC/MS.
D	Result from and analysis at a secondary dilution factor.
E	Concentration exceeded the calibration range of the instrument.
H	Analysis performed outside method or client
J	Estimated value
N	Presumptive evidence of a compound
P	Difference between results from two GC columns unacceptable. (>25% Difference).
U	Compound was analyzed for but not detected. Analyte result was below the reporting

TABLE I-7-1

COPCs FOR THE BROWN & BRYANT SUPERFUND SITE

VOCS	METALS
benzene	antimony
benzyl chloride	arsenic
bromobenzene	barium
chlorobenzene	beryllium
chloroform	chromium
1,2-dibromo-3-chloropropane	cobalt
1,2-dibromoethane	copper
1,1-dichloroethane	lead
1,2-dichloroethane	mercury
1,2-dichloroethene-cis	nickel
1,2-dichloropropane	selenium
1,1-dichloropropene	thallium
1,3-dichloropropane	vanadium
2,4-dinitro-6-sec-butylphenol	zinc
1,1,2-trichloroethane	
1,2,3-trichloropropane	
1,2,4-trimethylbenzene	
methylene chloride	
tetrachloroethene	
toluene	

TABLE I-7-2
95 PERCENT UCL CONCENTRATIONS OF SOIL COPCs

COPC	0-10 Feet BGS (mg/kg)	10 Feet BGS - A-Zone (mg/kg)
1,1,2-trichloroethane	ND	ND
1,1-dichloroethane	ND	ND
1,1-dichloropropene	ND	ND
1,2,3-trichloropropane	1.00E-01	1.96E-01
1,2,4-trimethylbenzene	ND	ND
1,2-dibromo-3-chloropropane	9.10E-03	2.09E-02
1,2-dibromoethane	6.00E-03	7.10E-03
1,2-dichloroethane	ND	ND
1,2-dichloroethene-cis	ND	ND
1,2-dichloropropane	8.00E-02	2.48E-01
1,3-dichloropropane	ND	1.40E-01
2,4-dinitro-6-sec-butylphenol	1.05E-01	3.60E-02
Antimony	NA	4.12E+00
Arsenic	NA	1.52E+01
Barium	NA	2.02E+02
Benzene	ND	6.95E-01
benzyl chloride	ND	ND
Beryllium	NA	ND
Bromobenzene	ND	ND
Chlorobenzene	ND	ND
Chloroform	ND	1.24E-01
Chromium	NA	1.90E+01
Cobalt	NA	1.27E+01
Copper	NA	7.64E+00
Lead	NA	3.76E+00
Mercury	NA	2.64E-01
methylene chloride	ND	ND
Nickel	NA	8.28E+00
Selenium	NA	2.79E+00
Tetrachloroethene	ND	ND
Thallium	NA	5.60E+00
Toluene	ND	ND
Vanadium	NA	5.06E+01
Zinc	NA	6.34E+01

Notes:

ND - Not Detected in media
NA – Not Analyzed
5.0E-03 = 5.00×10^{-3} = 0.005

TABLE I-7-3

CURRENT ONSITE AVERAGE CONCENTRATIONS OF COPCs IN GROUNDWATER

COPC	A-Zone (mg/L)
1,1,2-trichloroethane	9.26E-03
1,1-dichloroethane	1.15E-02
1,1-dichloropropene	4.16E-03
1,2,3-trichloropropane	1.57E+00
1,2,4-trimethylbenzene	2.20E+00
1,2-dibromo-3-chloropropane	7.34E-01
1,2-dibromoethane	1.07E-01
1,2-dichloroethane	6.23E-02
1,2-dichloroethene-cis	6.00E-03
1,2-dichloropropane	2.32E+01
1,3-dichloropropane	1.37E-01
2,4-dinitro-6-sec-butylphenol	ND
antimony	NA
arsenic	NA
barium	NA
benzene	1.43E-02
benzyl chloride	6.40E-03
beryllium	NA
bromobenzene	3.19E-01
chlorobenzene	1.66E-02
chloroform	1.98E-01
chromium	NA
cobalt	NA
copper	NA
lead	NA
mercury	NA
methylene chloride	8.06E-02
nickel	NA
selenium	NA
tetrachloroethene	1.02E-03
thallium	NA
toluene	1.99E-01
vanadium	NA
zinc	NA

Notes:

ND – Not Detected in media
NA – Not Analyzed
5.00E-03 = 5.00×10^{-3} = 0.005

TABLE I-7-4
MODELED MAXIMUM, 30-YEAR AVERAGE
CONCENTRATIONS OF COPCs IN GROUNDWATER

COPC	A-ZONE FENCE LINE (mg/l)	B-ZONE FENCE LINE (mg/l)	B-ZONE CITY WELL (mg/l)
1,1,2-trichloroethane	NC	NC	NC
1,1-dichloroethane	NC	NC	NC
1,1-dichloropropene	NC	NC	NC
1,2,3-trichloropropane	2.08E+00	8.13E-02	4.90E-07
1,2,4-trimethylbenzene	NC	NC	NC
1,2-dibromo-3-chloropropane	1.33E+00	0.00E+00	4.59E-23
1,2-dibromoethane	1.04E-03	0.00E+00	1.53E-23
1,2-dichloroethane	NC	NC	NC
1,2-dichloroethene-cis	NC	NC	NC
1,2-dichloropropane	2.04E+01	6.23E-05	3.76E-07
1,3-dichloropropane	1.01E-02	0.00E+00	5.84E-17
2,4-dinitro-6-sec-butylphenol	2.78E+00	0.00E+00	1.53E-21
antimony	NC	NC	NC
arsenic	NC	NC	NC
barium	NC	NC	NC
benzene	NC	NC	NC
benzyl chloride	NC	NC	NC
beryllium	NC	NC	NC
bromobenzene	NC	NC	NC
chlorobenzene	NC	NC	NC
chloroform	2.16E-01	0.00E+00	1.10E-22
chromium	NC	NC	NC
Cobalt	NC	NC	NC
copper	NC	NC	NC
Lead	NC	NC	NC
mercury	NC	NC	NC
methylene chloride	NC	NC	NC
Nickel	NC	NC	NC
selenium	NC	NC	NC
tetrachloroethene	NC	NC	NC
thallium	NC	NC	NC
toluene	NC	NC	NC
vanadium	NC	NC	NC
Zinc	NC	NC	NC

Notes:

NC - Not Calculated – model simulations not completed

5.00E-03 = 5.00×10^{-3} = 0.005

TABLE I-7-5
CALCULATED SOIL COPC-SPECIFIC
VOLATILIZATION ATTENUATION FACTORS (m^3/kg)

COPC	MAINTENANCE WORKER
1,1,2-trichloroethane	ND
1,1-dichloroethane	ND
1,1-dichloropropene	ND
1,2,3-trichloropropane	1.07E+04
1,2,4-trimethylbenzene	ND
1,2-dibromo-3-chloropropane	1.45E+04
1,2-dibromoethane	4.22E+03
1,2-dichloroethane	ND
1,2-dichloroethene-cis	ND
1,2-dichloropropane	2.98E+03
1,3-dichloropropane	ND
2,4-dinitro-6-sec-butylphenol	ND
antimony	NA
arsenic	NA
barium	NA
benzene	ND
benzyl chloride	ND
beryllium	NA
bromobenzene	ND
chlorobenzene	ND
chloroform	ND
chromium	NA
cobalt	NA
copper	NA
lead	NA
mercury	NA
methylene chloride	ND
nickel	NA
selenium	NA
tetrachloroethene	ND
thallium	NA
toluene	ND
vanadium	NA
zinc	NA

Notes:

NA - Not Analyzed
ND – Not Detected
1.00E-01 = 1.00×10^{-1} = 0.1

TABLE I-7-6
CALCULATED ON-SITE COMMERCIAL/INDUSTRIAL
INDOOR AIR CONCENTRATIONS (mg/m^3)

COPC	CI SURFACE SOILS	CI SUBSURFACE SOILS	CI A-ZONE GROUNDWATER	CI TOTAL
1,1,2-trichloroethane	ND	ND	3.90E-07	3.90E-07
1,1-dichloroethane	ND	ND	3.00E-06	3.00E-06
1,1-dichloropropene	ND	ND	2.62E-06	2.62E-06
1,2,3-trichloropropane	2.72E-05	1.00E-05	2.24E-05	5.96E-05
1,2,4-trimethylbenzene	ND	ND	4.27E-04	4.27E-04
1,2-dibromo-3-chloropropane	1.80E-06	7.77E-07	9.21E-06	1.18E-05
1,2-dibromoethane	8.00E-06	1.78E-06	6.66E-06	1.64E-05
1,2-dichloroethane	ND	ND	3.90E-06	3.90E-06
1,2-dichloroethene-cis	ND	ND	1.12E-06	1.12E-06
1,2-dichloropropane	2.24E-04	1.29E-04	3.01E-03	3.36E-03
1,3-dichloropropane	ND	3.14E-07	8.57E-05	8.57E-05
2,4-dinitro-6-sec-butylphenol	NV	NV	NV	NV
Antimony	NV	NV	NV	NV
Arsenic	NV	NV	NV	NV
Barium	NV	NV	NV	NV
Benzene	ND	ND	4.20E-06	4.20E-06
benzyl chloride	ND	ND	1.36E-06	1.36E-06
Beryllium	NV	NV	NV	NV
Bromobenzene	ND	ND	9.05E-06	9.05E-06
Chlorobenzene	ND	ND	2.48E-06	2.48E-06
Chloroform	ND	1.20E-04	4.70E-05	1.67E-04
Chromium	NV	NV	NV	NV
Cobalt	NV	NV	NV	NV
Copper	NV	NV	NV	NV
Lead	NV	NV	NV	NV
Mercury	NV	NV	NV	NV
methylene chloride	ND	ND	1.16E-05	1.16E-05
Nickel	NV	NV	NV	NV
Selenium	NV	NV	NV	NV
Tetrachloroethene	ND	ND	7.47E-07	7.47E-07
Thallium	NV	NV	NV	NV
Toluene	ND	ND	6.52E-05	6.52E-05
Vanadium	NV	NV	NV	NV
Zinc	NV	NV	NV	NV

Notes:

ND - Not Detected in media
NV = Not volatile
1.00E-04 = 1.00×10^{-4} = 0.0001

TABLE I-7-7
CALCULATED OFF-SITE
INDOOR AIR CONCENTRATIONS (mg/m^3)

COPC	COM/IND.	RESIDENTIAL
1,1,2-trichloroethane	NC	NC
1,1-dichloroethane	NC	NC
1,1-dichloropropene	NC	NC
1,2,3-trichloropropane	2.97E-05	6.59E-05
1,2,4-trimethylbenzene	NC	NC
1,2-dibromo-3-chloropropane	1.67E-05	3.71E-05
1,2-dibromoethane	6.43E-08	1.43E-07
1,2-dichloroethane	NC	NC
1,2-dichloroethene-cis	NC	NC
1,2-dichloropropane	2.65E-04	5.89E-04
1,3-dichloropropane	6.35E-06	1.41E-02
2,4-dinitro-6-sec-butylphenol	NC	NC
Antimony	NV	NV
Arsenic	NV	NV
Barium	NV	NV
Benzene	NC	NC
benzyl chloride	NC	NC
Beryllium	NV	NV
Bromobenzene	NC	NC
Chlorobenzene	NC	NC
Chloroform	5.13E-05	1.14E-04
Chromium	NV	NV
Cobalt	NV	NV
Copper	NV	NV
Lead	NV	NV
Mercury	NV	NV
methylene chloride	NC	NC
Nickel	NV	NV
Selenium	NV	NV
tetrachloroethene	NC	NC
Thallium	NV	NV
Toluene	NC	NC
Vanadium	NV	NV
Zinc	NV	NV

Notes:
Source limited to A-Zone groundwater
NC - Not Calculated – modeling not completed for COPC
NV – Not Volatile
1.00E-04=1.00x10-4=0.0001

TABLE I-7-8
MODELED OUTDOOR AIR CONCENTRATIONS (mg/m^3)

COPC	ON-SITE	FENCELINE
1,1,2-trichloroethane	5.16E-09	3.81E-09
1,1-dichloroethane	4.97E-08	3.67E-08
1,1-dichloropropene	3.50E-08	2.59E-08
1,2,3-trichloropropane	3.28E-07	2.42E-07
1,2,4-trimethylbenzene	6.69E-06	4.94E-06
1,2-dibromo-3-chloropropane	1.25E-07	9.23E-08
1,2-dibromoethane	9.73E-08	7.18E-08
1,2-dichloroethane	4.99E-08	3.68E-08
1,2-dichloroethene-cis	1.37E-08	1.01E-08
1,2-dichloropropane	3.87E-05	2.86E-05
1,3-dichloropropane	8.90E-08	6.57E-08
2,4-dinitro-6-sec-butylphenol	NV	NV
Antimony	NV	NV
Arsenic	NV	NV
Barium	NV	NV
Benzene	3.37E-07	2.49E-07
benzyl chloride	2.04E-08	1.50E-08
Beryllium	NV	NV
Bromobenzene	1.38E-07	1.02E-07
Chlorobenzene	3.41E-08	2.52E-08
Chloroform	6.32E-07	4.67E-07
Chromium	NV	NV
Cobalt	NV	NV
Copper	NV	NV
Lead	NV	NV
Mercury	NV	NV
methylene chloride	1.35E-07	1.00E-07
Nickel	NV	NV
Selenium	NV	NV
tetrachloroethene	1.03E-08	7.57E-09
Thallium	NV	NV
Toluene	8.75E-07	6.46E-07
Vanadium	NV	NV
Zinc	NV	NV

Notes:

ND - Not Detected
NV - Not volatile
1.00E-04 = 1.00x10-4 = 0.0001

TABLE I-7-9
COPC-SPECIFIC REFERENCE DOSE (RFD) VALUES (mg/kg-d)

COPC	INHALATION[A]		ORAL[A]	
	SUBCHRONIC[C]	CHRONIC	SUBCHRONIC[C]	CHRONIC
1,1,2-trichloroethane	4.00E-02	4.00E-03	4.00E-02	4.00E-03
1,1-dichloroethane	1.40E+00	1.43E-01	1.00E+00	1.00E-01
1,1-dichloropropene	NA	NA	NA	NA
1,2,3-trichloropropane	6.00E-02	6.00E-03	6.00E-02	6.00E-03
1,2,4-trimethylbenzene	NA	1.71E-03	NA	5.00E-02
1,2-dibromo-3-chloropropane	NA	5.71E-05	NA	NA
1,2-dibromoethane	5.70E-04	5.71E-05	NA	NA
1,2-dichloroethane	NA	NA	NA	NA
1,2-dichloroethene-cis	1.00E-01	1.00E-02	1.00E-01	1.00E-02
1,2-dichloropropane	3.70E-03	1.14E-03	NA	NA
1,3-dichloropropane*	5.70E-03	5.71E-03	3.00E-02	3.00E-03
2,4-dinitro-6-sec-butylphenol	1.00E-03	1.00E-03	1.00E-03	1.00E-03
antimony	1.10E-04	4.00E-04	2.00E-04	4.00E-04
arsenic	3.00E-04	3.00E-04	3.00E-04	3.00E-04
barium	1.40E-03	1.43E-04	7.00E-02	7.00E-02
benzene	NA	NA	NA	NA
benzyl chloride	NA	NA	NA	NA
beryllium	5.00E-03	5.71E-06	5.00E-03	2.00E-03
bromobenzene	NA	NA	NA	NA
chlorobenzene	2.00E-01	5.71E-03	2.00E-01	2.00E-02
chloroform	1.00E-02	1.00E-02	1.00E-02	1.00E-02
chromium	2.00E-02	2.86E-05	2.00E-02	3.00E-03
cobalt	NA	NA	NA	NA
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
mercury	3.00E-04	3.00E-04	3.00E-04	3.00E-04
methylene chloride	8.60E-01	8.57E-01	6.00E-02	6.00E-02
nickel	2.00E-02	2.00E-02	2.00E-02	2.00E-02
selenium	5.00E-03	5.00E-03	5.00E-03	5.00E-03
tetrachloroethene	1.00E-01	1.71E-01	1.00E-01	1.00E-02
thallium	NA	NA	NA	NA
toluene	2.60E-01	1.14E-01	2.00E+00	2.00E-01
vanadium	7.00E-03	7.00E-03	7.00E-03	7.00E-03
zinc	3.00E-01	3.00E-01	3.00E-01	3.00E-01

Notes:

NA = Not available
2.00E-01 = 2x10-1 = 0.2
*Because there is no toxicity factor for 1,3-dichloropropane, 1,3-dichloropropene toxicity values were used as a surrogate for 1,3-dichloropropane toxicity.

Sources: a IRIS (EPA 2003); b HEAST (EPA 1997b)

TABLE I-7-10
COPC-SPECIFIC CANCER SLOPE FACTORS (CSFs), 1/(mg/kg-d)

COPC	INHALATION	ORAL
1,1,2-trichloroethane	5.70E-02	7.20E-02
1,1-dichloroethane	5.70E-03	5.70E-03
1,1-dichloropropene	NA	NA
1,2,3-trichloropropane	7.00E+00	7.00E+00
1,2,4-trimethylbenzene	NA	NA
1,2-dibromo-3-chloropropane	7.00E+00	7.00E+00
1,2-dibromoethane	2.50E-01	3.60E+00
1,2-dichloroethane	7.20E-02	4.70E-02
1,2-dichloroethene-cis	NA	NA
1,2-dichloropropane	3.60E-02	6.30E-02
1,3-dichloropropane*	5.50E-02	9.10E-02
2,4-dinitro-6-sec-butylphenol	NA	NA
antimony	NA	NA
arsenic	1.20E+01	1.50E+01
barium	NA	NA
benzene	1.00E-01	1.00E-01
benzyl chloride	1.70E-01	1.70E-01
beryllium	8.40E+00	NA
bromobenzene	NA	NA
chlorobenzene	NA	NA
chloroform	1.90E-02	3.10E-02
chromium	5.10E+02	NA
cobalt	NA	NA
copper	NA	NA
lead	4.20E-02	8.50E-03
mercury	NA	NA
methylene chloride	3.50E-03	1.40E-02
nickel	9.10E-01	NA
selenium	NA	NA
tetrachloroethene	2.10E-02	5.40E-02
thallium	NA	NA
toluene	NA	NA
vanadium	NA	NA
zinc	NA	NA

Notes:

NA = Not available, i.e., not established as a carcinogen by any government agency

2.00E-01 = $2x10^{-1}$ = 0.2

*Because there is no toxicity factor for 1,3-dichloropropane, 1,3-dichloropropene toxicity values were used as a surrogate for 1,3-dichloropropane toxicity.

Sources:

a-IRIS (EPA 2003); b-California Cancer Potency Factors Update (OEHHA 2002)

TABLE I-7-11
RME EXPOSURE SCENARIO
RECEPTOR EXPOSURE PARAMETERS

PATHWAY	PARAMETER	OFF-SITE ADULT	OFF-SITE CHILD	MAINTENANCE WORKER	COM/IND. WORKERS
Inhalation	IR - Inhalation Rate (m^3/h)	0.83	0.6	2.5	0.83
	EF - Exposure Frequency (d/y)	350	350	250	250
	ED - Exposure Duration (y)	30	6	1	25
	ET - Exposure Time, Outdoors (h/d)	8	8	8	4
	ET - Exposure Time, Indoors (h/d)	16	16	0	4
	BW - Body Weight (kg)	70	15	70	70
	AT - Averaging Time, Carcinogen (d)	25,550	25,550	25,550	25,550
	AT - Averaging Time, Noncarcinogen (d)	10,950	2,190	365	9,125
Incidental Ingestion of Soil	IR - Ingestion Rate (mg/d)	NA	NA	480	NA
	EF - Exposure Frequency (d/y)	NA	NA	250	NA
	ED - Exposure Duration (y)	NA	NA	1	NA
	BW - Body Weight (kg)	NA	NA	70	NA
	AT - Averaging Time, Carcinogen (d)	NA	NA	25,550	NA
	AT - Averaging Time, Noncarcinogen (d)	NA	NA	365	NA
	CF - Conversion Factor (kg/mg)	NA	NA	1.00E-06	NA
Ingestion of Water	IR - Ingestion Rate (L/d)	2	1	1	1
	EF - Exposure Freq. outdoors (d/y)	350	350	250	250
	ED - Exposure Duration (y)	30	6	1	25
	BW - Body Weight (kg)	70	15	70	70
	AT - Averaging Time, Carcinogen (d)	25,550	25,550	25,550	25,550
	AT - Averaging Time, Noncarcinogen (d)	10,950	2,190	365	9125
Dermal Contact with Soil	SA - Surface Area (cm^2/d)	NA	NA	5800	NA
	ABS - Absorption Coefficient	NA	NA	CSV	NA
	AF - Adherence Factor (mg/cm^2)	NA	NA	0.8	NA
	ED - Exposure Duration (y)	NA	NA	1	NA
	EF - Exposure Freq. outdoors (d/y)	NA	NA	250	NA
	BW - Body Weight (kg)	NA	NA	70	NA
	AT - Averaging Time, Carcinogen (d)	NA	NA	25,550	NA
	AT - Averaging Time, Noncarcinogen (d)	NA	NA	365	NA
	CF - Conversion Factor (kg/mg)	NA	NA	1.00E-06	NA
Dermal Contact with Water	SA - Surface Area (cm^2/d)	23000	2000	NA	NA
	ED - Exposure Duration (y)	30	6	NA	NA
	EF - Exposure Freq. outdoors (d/y)	350	350	NA	NA
	BW - Body Weight (kg)	70	6	NA	NA
	AT - Averaging Time, Carcinogen (d)	25,550	25,550	NA	NA
	AT - Averaging Time, Noncarcinogen (d)	10,950	2,190	NA	NA

Notes:
CSV = Constituent-specific value
NA = Not Applicable
Sources:
RAGS (EPA 1989a), Exposure Factors Handbook (EPA 1990a, 1997a), Supplemental Guidance for Human Health Multimedia Risk Assessment (Cal/EPA 1992)

TABLE I-7-12
CENTRAL TENDENCY EXPOSURE SCENARIO
RECEPTOR EXPOSURE PARAMETERS

PATHWAY	PARAMETER	OFF-SITE ADULT	OFF-SITE CHILD	MAINTENANCE WORKER	COM/IND. WORKERS
Inhalation	IR - Inhalation Rate (m^3/h)	0.83	0.6	0.83	0.83
	EF - Exposure Frequency (d/y)	350	350	250	250
	ED - Exposure Duration (y)	9	6	1	9
	ET - Exposure Time, Outdoors (h/d)	8	8	8	4
	ET - Exposure Time, Indoors (h/d)	16	16	0	4
	BW - Body Weight (kg)	70	15	70	70
	AT - Averaging Time, Carcinogen (d)	25,550	25,550	25,550	25,550
	AT - Averaging Time, Noncarcinogen (d)	3,285	2,190	365	3,285
Incidental Ingestion of Soil	IR - Ingestion Rate (mg/d)	NA	NA	50	NA
	EF - Exposure Frequency (d/y)	NA	NA	250	NA
	ED - Exposure Duration (y)	NA	NA	1	NA
	BW - Body Weight (kg)	NA	NA	70	NA
	AT - Averaging Time, Carcinogen (d)	NA	NA	25,550	NA
	AT - Averaging Time, Noncarcinogen (d)	NA	NA	365	NA
	CF - Conversion Factor (kg/mg)	NA	NA	1.00E-06	NA
Ingestion of Water	IR - Ingestion Rate (L/d)	1.4	0.7	0.7	0.7
	EF - Exposure Freq. outdoors (d/y)	350	350	250	250
	ED - Exposure Duration (y)	9	6	1	25
	BW - Body Weight (kg)	70	15	70	70
	AT - Averaging Time, Carcinogen (d)	25,550	25,550	25,550	25,550
	AT - Averaging Time, Noncarcinogen (d)	3,285	2,190	365	3,285
Dermal Contact with Soil	SA - Surface Area (cm^2/d)	NA	NA	3120	NA
	ABS - Absorption Coefficient	NA	NA	CSV	NA
	AF - Adherence Factor (mg/cm^2)	NA	NA	0.8	NA
	ED - Exposure Duration (y)	NA	NA	1	NA
	EF - Exposure Freq. outdoors (d/y)	NA	NA	250	NA
	BW - Body Weight (kg)	NA	NA	70	NA
	AT - Averaging Time, Carcinogen (d)	NA	NA	25,550	NA
	AT - Averaging Time, Noncarcinogen (d)	NA	NA	365	NA
	CF - Conversion Factor (kg/mg)	NA	NA	1.00E-06	NA
Dermal Contact with Water	SA - Surface Area (cm^2/d)	19400	9310	NA	NA
	ED - Exposure Duration (y)	9	6	NA	NA
	EF - Exposure Freq. outdoors (d/y)	350	350	NA	NA
	BW - Body Weight (kg)	70	6	NA	NA
	AT - Averaging Time, Carcinogen (d)	25,550	25,550	NA	NA
	AT - Averaging Time, Noncarcinogen (d)	3285	2,190	NA	NA

Notes:

CSV = Constituent-specific value
NA = Not Applicable
Sources:
RAGS (EPA 1989a), Exposure Factors Handbook (EPA 1990a, 1997a), Supplemental Guidance for Human Health Multimedia Risk Assessment (Cal/EPA 1992)

TABLE I-7-13
CALCULATED COPC-SPECIFIC DOSE ABSORBED (DA)
FROM DERMAL CONTACT WITH B-ZONE GROUNDWATER

COPC	DA (mg/cm2-event)
1,1,2-trichloroethane	NC
1,1-dichloroethane	NC
1,1-dichloropropene	NC
1,2,3-trichloropropane	1.42E-09
1,2,4-trimethylbenzene	NC
1,2-dibromo-3-chloropropane	NC
1,2-dibromoethane	NC
1,2-dichloroethane	NC
1,2-dichloroethene-cis	NC
1,2-dichloropropane	8.94E-10
1,3-dichloropropane	NC
2,4-dinitro-6-sec-butylphenol	NC
antimony	NC
arsenic	NC
barium	NC
benzene	NC
benzyl chloride	NC
beryllium	NC
bromobenzene	NC
chlorobenzene	NC
chloroform	NC
chromium	NC
cobalt	NC
copper	NC
lead	NC
mercury	NC
methylene chloride	NC
nickel	NC
selenium	NC
tetrachloroethene	NC
thallium	NC
toluene	NC
vanadium	NC
zinc	NC

Notes:

NC – Not Calculated
– Not modeled in future B-Zone groundwater

TABLE I-7-14
DERMAL ABSORPTION FACTORS (ABS)

COPC	ABS (unitless)
1,1,2-trichloroethane	1.00E-01
1,1-dichloroethane	1.00E-01
1,1-dichloropropene	9.00E-01
1,2,3-trichloropropane	1.00E-01
1,2,4-trimethylbenzene	1.00E-01
1,2-dibromo-3-chloropropane	1.00E-01
1,2-dibromoethane	1.00E-01
1,2-dichloroethane	1.00E-01
1,2-dichloroethene-cis	1.00E-01
1,2-dichloropropane	1.00E-01
1,3-dichloropropane	1.00E-01
2,4-dinitro-6-sec-butylphenol	9.00E-01
antimony	1.00E-02
arsenic	3.00E-02
barium	1.00E-02
benzene	1.00E-01
benzyl chloride	1.00E-01
beryllium	1.00E-02
bromobenzene	9.00E-01
chlorobenzene	1.00E-01
chloroform	1.00E-01
chromium	1.00E-02
cobalt	1.00E-02
copper	1.00E-02
lead	1.00E-02
mercury	1.00E-02
methylene chloride	1.00E-01
nickel	1.00E-02
selenium	1.00E-02
tetrachloroethene	1.00E-01
thallium	1.00E-01
toluene	1.00E-01
vanadium	1.00E-01
zinc	1.00E-02

SOURCE: Cal/EPA 1994

TABLE I-7-15
SUMMARY OF HEALTH RISK
CURRENT SITE CONDITIONS
REASONABLE MAXIMUM EXPOSURE SCENARIOS

RECEPTORS	HAZARD INDEX (HI)	INCREMENTAL LIFETIME CANCER RISK (ILCR)
On-Site Maintenance Worker	**5.9E-03**	**1.0E-07**
Incidental Ingestion of Soils	5.0E-04	5.3E-08
Dermal Contact with Soils	5.4E-03	5.1E-08
Inhalation Outdoor Air	1.4E-06	1.1E-10
On-Site Commercial/Industrial Worker	**1.2E-01**	**7.5E-06**
Inhalation Indoor Air (Vapor Intrusion)	1.2E-01	7.4E-06
Inhalation of Indoor Air (Ventilation System)	1.4E-03	5.4E-08
Inhalation of Outdoor Air	1.4E-03	5.4E-08
Ingestion of B-Zone Groundwater (City Well)	NC	NC
Off-Site Resident Adult	**8.4E-03**	**4.0E-07**
Inhalation Indoor Air (Vapor Intrusion)	NC	NC
Inhalation of Indoor Air (Ventilation System)	5.6E-03	2.7E-07
Inhalation Outdoor Air	2.8E-03	1.3E-07
Ingestion of B-Zone Groundwater (Fenceline)	NC	NC
Dermal Contact B-Zone Groundwater (Fenceline)	NC	NC
Off-Site Resident Child	**2.8E-02**	**2.7E-07**
Inhalation Indoor Air (Vapor Intrusion)	NC	NC
Inhalation of Indoor Air (Ventilation System)	1.9E-02	1.8E-07
Inhalation Outdoor Air	9.5E-03	9.0E-08
Ingestion of B-Zone Groundwater (Fenceline)	NC	NC
Dermal Contact B-Zone Groundwater (Fenceline)	NC	NC
Off-Site Commercial/Industrial Worker	**2.0E-03**	**8.0E-08**
Inhalation of Indoor Air (Vapor Intrusion)	NC	NC
Inhalation of Indoor Air (Ventilation System)	1.0E-03	4.0E-08
Inhalation Outdoors	1.0E-03	4.0E-08
Ingestion of B-Zone Groundwater (City Well)	NC	NC

Notes:

UCL = Upper confidence limit
NA = Not Applicable
NC = Pathway not complete under current site conditions
4.2E-06 = 4.2×10^{-6} = 0.0000042

TABLE I-7-16
SUMMARY OF HEALTH RISK
CURRENT SITE CONDITIONS
CENTRAL TENDENCY EXPOSURE SCENARIOS

RECEPTORS	HAZARD INDEX (HI)	INCREMENTAL LIFETIME CANCER RISK (ILCR)
On-Site Maintenance Worker	**3.0E-03**	**3.3E-08**
Incidental Ingestion of Soils	5.2E-05	5.5E-09
Dermal Contact with Soils	2.9E-03	2.8E-08
Inhalation Outdoor Air	4.5E-07	3.6E-11
On-Site Commercial/Industrial Worker	**1.2E-01**	**2.7E-06**
Inhalation Indoor Air (Vapor Intrusion)	1.2E-01	2.6E-06
Inhalation of Indoor Air (Ventilation System)	1.4E-03	1.9E-08
Inhalation of Outdoor Air	1.4E-03	1.9E-08
Ingestion of B-Zone Groundwater (City Well)	NC	NC
Off-Site Resident Adult	**8.4E-03**	**1.2E-07**
Inhalation Indoor Air (Vapor Intrusion)	NC	NC
Inhalation of Indoor Air (Ventilation System)	5.6E-03	8.0E-08
Inhalation Outdoor Air	2.8E-03	4.0E-08
Ingestion of B-Zone Groundwater (Fenceline)	NC	NC
Dermal Contact B-Zone Groundwater (Fenceline)	NC	NC
Off-Site Resident Child	**2.8E-02**	**2.7E-07**
Inhalation Indoor Air (Vapor Intrusion)	NC	NC
Inhalation of Indoor Air (Ventilation System)	1.9E-02	1.8E-07
Inhalation Outdoor Air	9.5E-03	9.0E-08
Ingestion of B-Zone Groundwater (Fenceline)	NC	NC
Dermal Contact B-Zone Groundwater (Fenceline)	NC	NC
Off-Site Commercial/Industrial Worker	**2.0E-03**	**2.9E-08**
Inhalation of Indoor Air (Vapor Intrusion)	NC	NC
Inhalation of Indoor Air (Ventilation System)	1.0E-03	1.4E-08
Inhalation Outdoors	1.0E-03	1.4E-08
Ingestion of B-Zone Groundwater (City Well)	NC	NC

Notes:

UCL = Upper confidence limit
NA = Not Applicable
NC = Pathway not complete under current site conditions
4.2E-06 = 4.2×10^{-6} = 0.0000042

TABLE I-7-17
SUMMARY OF HEALTH RISK
FUTURE SITE CONDITIONS
REASONABLE MAXIMUM EXPOSURE SCENARIOS

RECEPTORS	HAZARD INDEX (HI)	INCREMENTAL LIFETIME CANCER RISK (ILCR)
On-Site Maintenance Worker	**5.9E-03**	**1.0E-07**
Incidental Ingestion of Soils	5.0E-04	5.3E-08
Dermal Contact with Soils	5.4E-03	5.1E-08
Inhalation Outdoor Air	1.4E-06	1.1E-10
On-Site Commercial/Industrial Worker	**1.2E-01**	**7.5E-06**
Inhalation Indoor Air (Vapor Intrusion)	1.2E-01	7.4E-06
Inhalation of Indoor Air (Ventilation System)	1.4E-03	5.4E-08
Inhalation of Outdoor Air	1.4E-03	5.4E-08
Ingestion of B-Zone Groundwater (City Well)	8.0E-07	1.2E-08
Off-Site Resident Adult	**6.7E-01**	**1.3E-04**
Inhalation Indoor Air (Vapor Intrusion)	6.7E-01	1.2E-04
Inhalation of Indoor Air (Ventilation System)	5.6E-03	2.7E-07
Inhalation Outdoor Air	2.8E-03	1.3E-07
Ingestion of B-Zone Groundwater (Fenceline)	3.7E-04	6.7E-06
Dermal Contact B-Zone Groundwater (Fenceline)	7.5E-05	1.4E-06
Off-Site Resident Child	**2.3E+00**	**8.4E-05**
Inhalation Indoor Air (Vapor Intrusion)	2.2E+00	8.0E-05
Inhalation of Indoor Air (Ventilation System)	1.9E-02	1.8E-07
Inhalation Outdoor Air	9.5E-03	9.0E-08
Ingestion of B-Zone Groundwater (Fenceline)	8.7E-04	3.1E-06
Dermal Contact B-Zone Groundwater (Fenceline)	1.5E-04	5.4E-07
Off-Site Commercial/Industrial Worker	**1.9E-02**	**4.0E-06**
Inhalation of Indoor Air (Vapor Intrusion)	1.7E-02	3.9E-06
Inhalation of Indoor Air (Ventilation System)	1.0E-03	4.0E-08
Inhalation Outdoors	1.0E-03	4.0E-08
Ingestion of B-Zone Groundwater (City Well)	8.0E-07	1.2E-08

Notes:

UCL = Upper confidence limit
NA = Not Applicable
4.2E-06 = 4.2×10^{-6} = 0.0000042

TABLE I-7-18
SUMMARY OF HEALTH RISK
FUTURE SITE CONDITIONS
CENTRAL TENDENCY EXPOSURE SCENARIOS

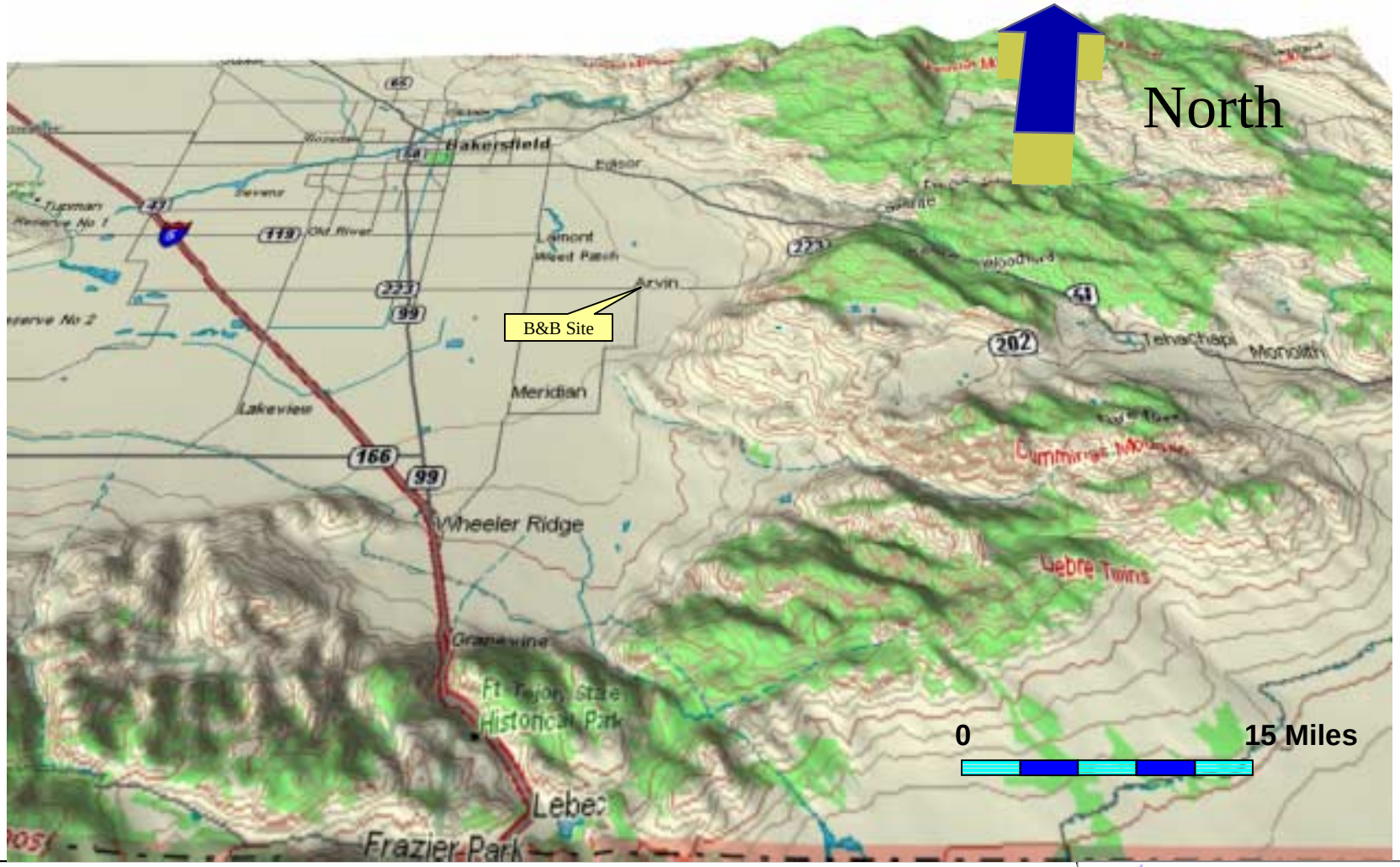
RECEPTORS	HAZARD INDEX (HI)	INCREMENTAL LIFETIME CANCER RISK (ILCR)
On-Site Maintenance Worker	**3.0E-03**	**3.3E-08**
Incidental Ingestion of Soils	5.2E-05	5.5E-09
Dermal Contact with Soils	2.9E-03	2.8E-08
Inhalation Outdoor Air	4.5E-07	3.6E-11
On-Site Commercial/Industrial Worker	**1.2E-01**	**2.7E-06**
Inhalation Indoor Air (Vapor Intrusion)	1.2E-01	2.6E-06
Inhalation of Indoor Air (Ventilation System)	1.4E-03	1.9E-08
Inhalation of Outdoor Air	1.4E-03	1.9E-08
Ingestion of B-Zone Groundwater (City Well)	5.6E-07	3.0E-09
Off-Site Resident Adult	**6.7E-01**	**3.7E-05**
Inhalation Indoor Air (Vapor Intrusion)	6.7E-01	3.6E-05
Inhalation of Indoor Air (Ventilation System)	5.6E-03	8.0E-08
Inhalation Outdoor Air	2.8E-03	4.0E-08
Ingestion of B-Zone Groundwater (Fenceline)	2.6E-04	1.4E-06
Dermal Contact B-Zone Groundwater (Fenceline)	6.3E-05	3.4E-07
Off-Site Resident Child	**2.3E+00**	**8.3E-05**
Inhalation Indoor Air (Vapor Intrusion)	2.3E+00	8.0E-05
Inhalation of Indoor Air (Ventilation System)	1.9E-02	1.8E-07
Inhalation Outdoor Air	9.5E-03	9.0E-08
Ingestion of B-Zone Groundwater (Fenceline)	6.1E-04	2.2E-06
Dermal Contact B-Zone Groundwater (Fenceline)	1.4E-04	5.1E-07
Off-Site Commercial/Industrial Worker	**1.9E-02**	**1.4E-06**
Inhalation of Indoor Air (Vapor Intrusion)	1.7E-02	1.4E-06
Inhalation of Indoor Air (Ventilation System)	1.0E-03	1.4E-08
Inhalation Outdoors	1.0E-03	1.4E-08
Ingestion of B-Zone Groundwater (City Well)	5.6E-07	3.0E-09

Notes:

UCL = Upper confidence limit
NA = Not Applicable
4.2E-06 = 4.2×10^{-6} = 0.0000042

Figures - Part I

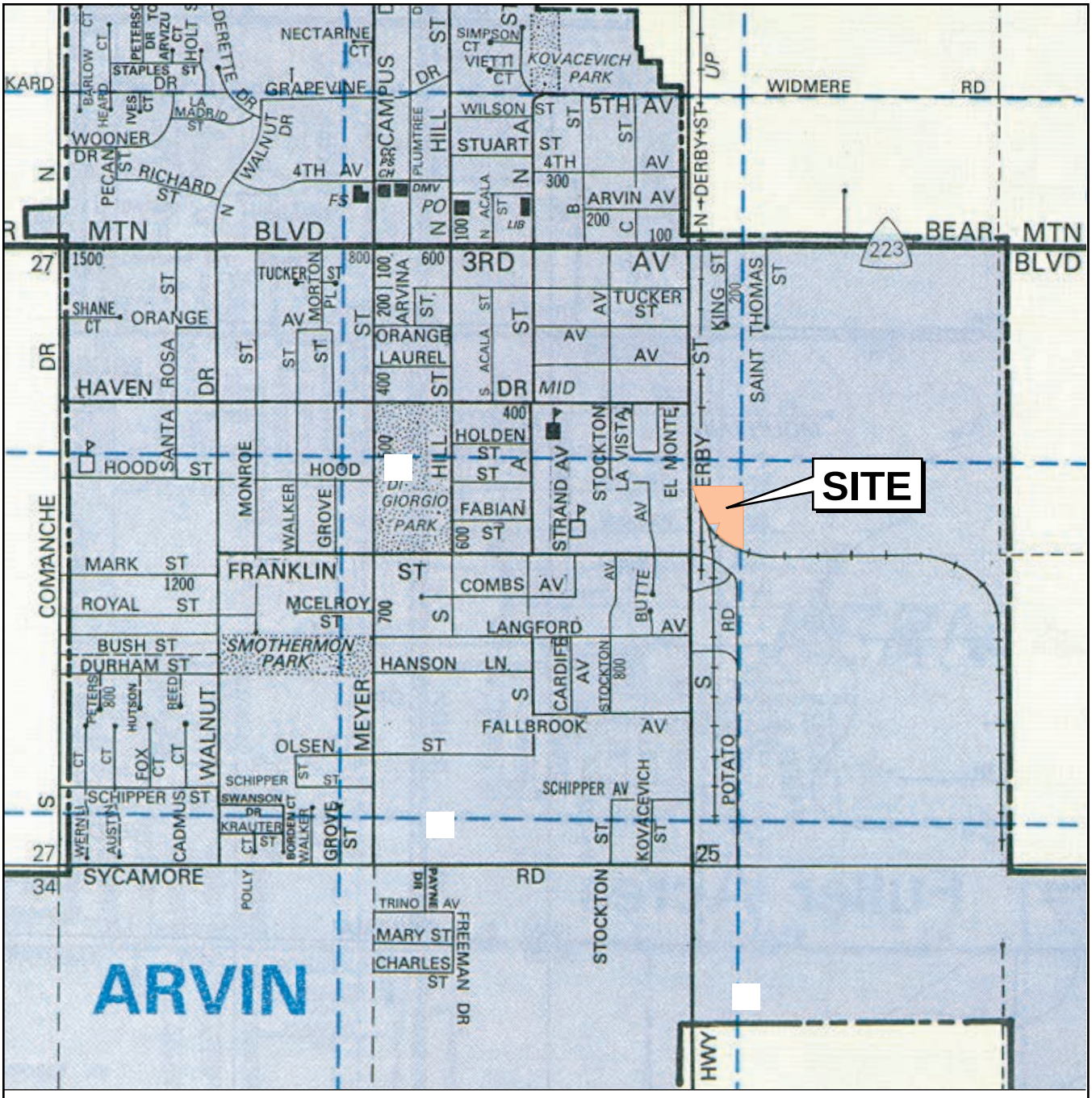
Project No. C00-266.2 September 2005



Site Vicinity and Three-Dimensional View of the Topographic Map of Arvin

PANACEA, INC.
Environmental Services

Project No. C00-266.2	Figure I-1



Base map from *The Thomas Guide, 1998 Central Valley Cities Street Guide and Directory.* Reproduced with permission granted by THOMAS BROS. MAPS®. This map is copyrighted by THOMAS BROS. MAPS®. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission. All rights reserved.

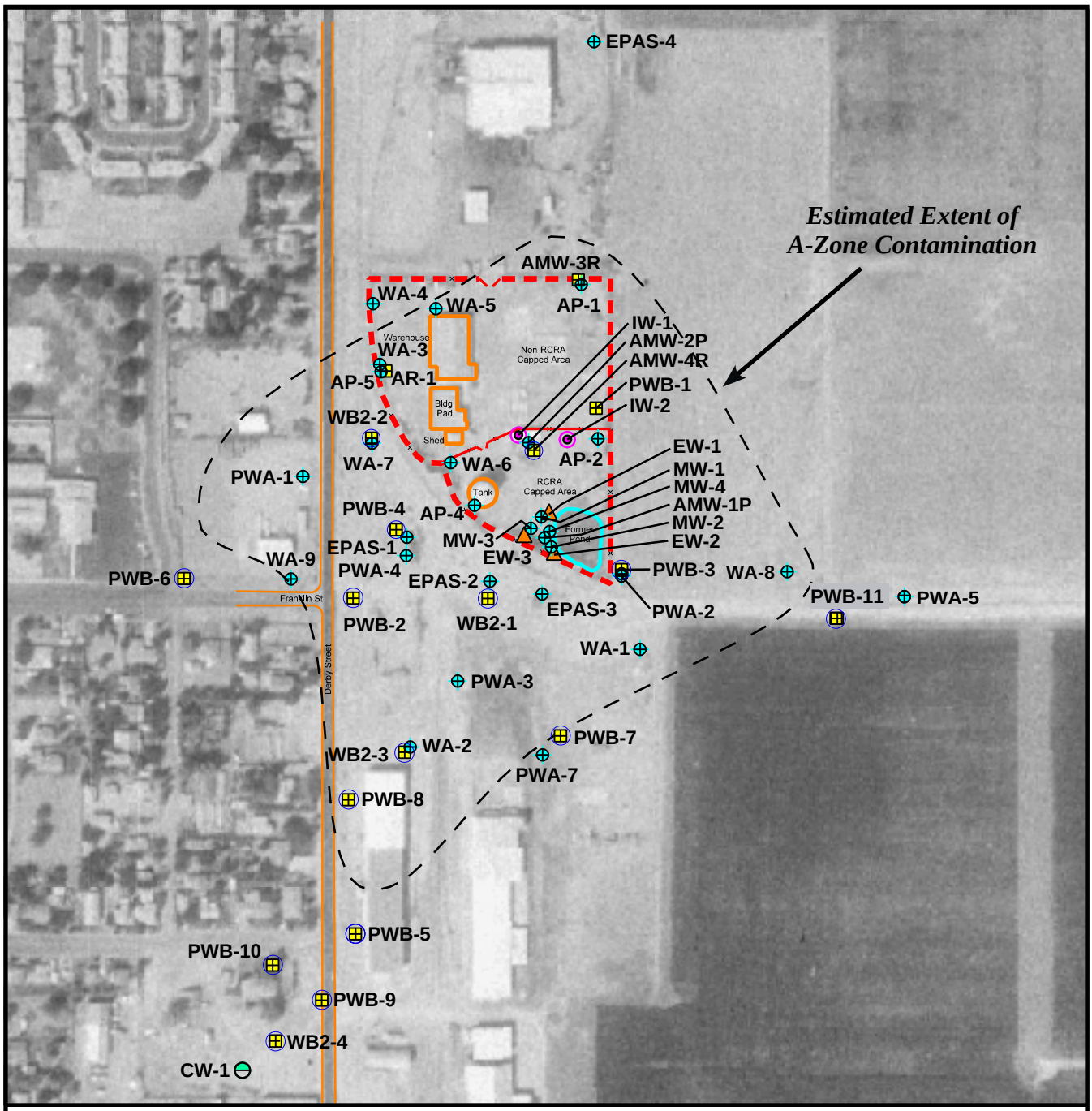
0 0.25 Mile

S:\67006750_fig_01(01).ai

Site Location Map
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

Project No.	Figure
C00-266.2	I-2



Source:
Aerial photo taken from ww.terraserver.com

Notes:
Well locations based on NAD 27 coordinates.
All other locations area approximate.

LEGEND

- A-Zone Monitoring Well
- B-Zone Monitoring Well
- Arvin City Well
- Injection Well
- Extraction Well

N

0 300

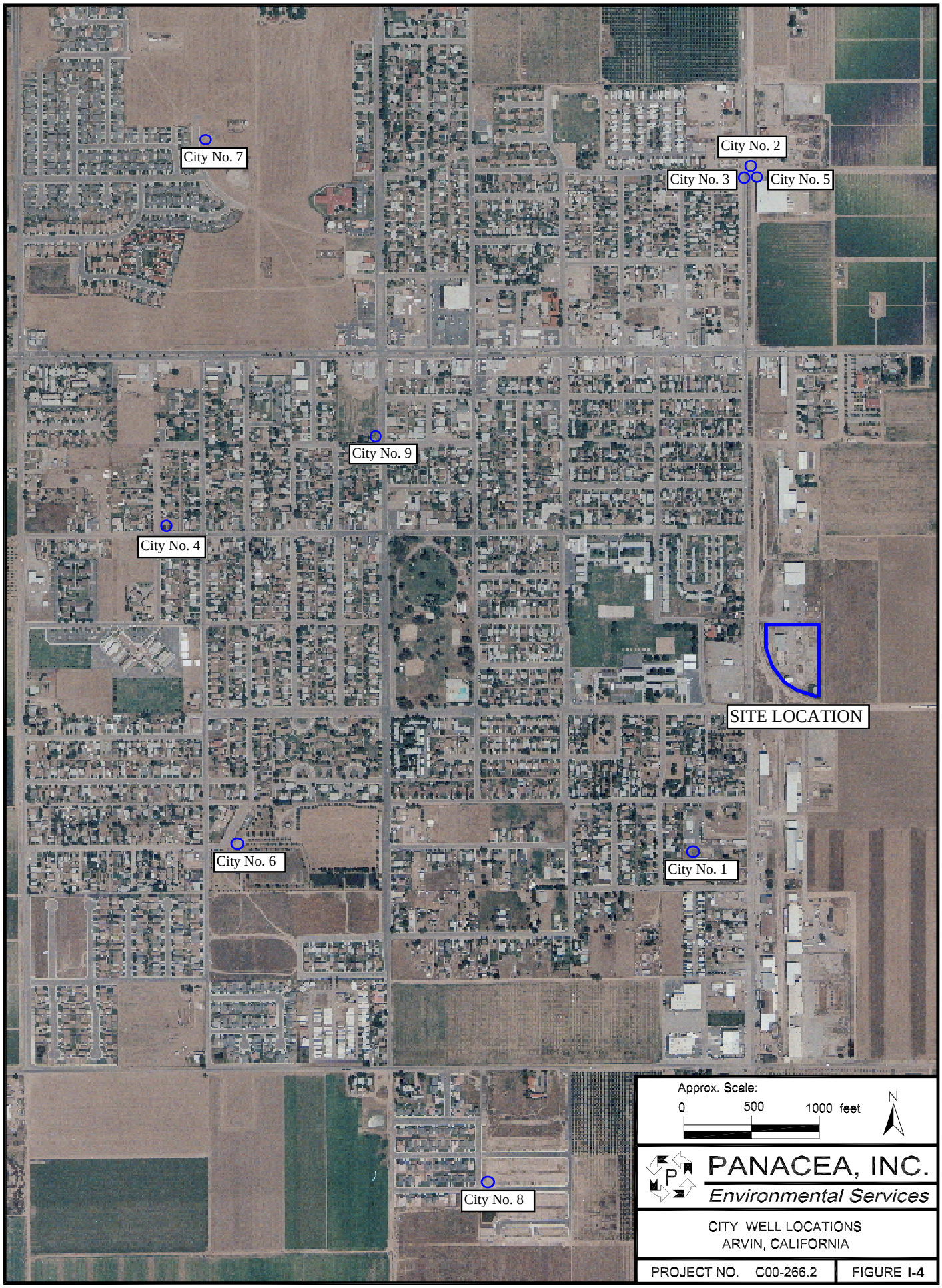
SCALE IN FEET

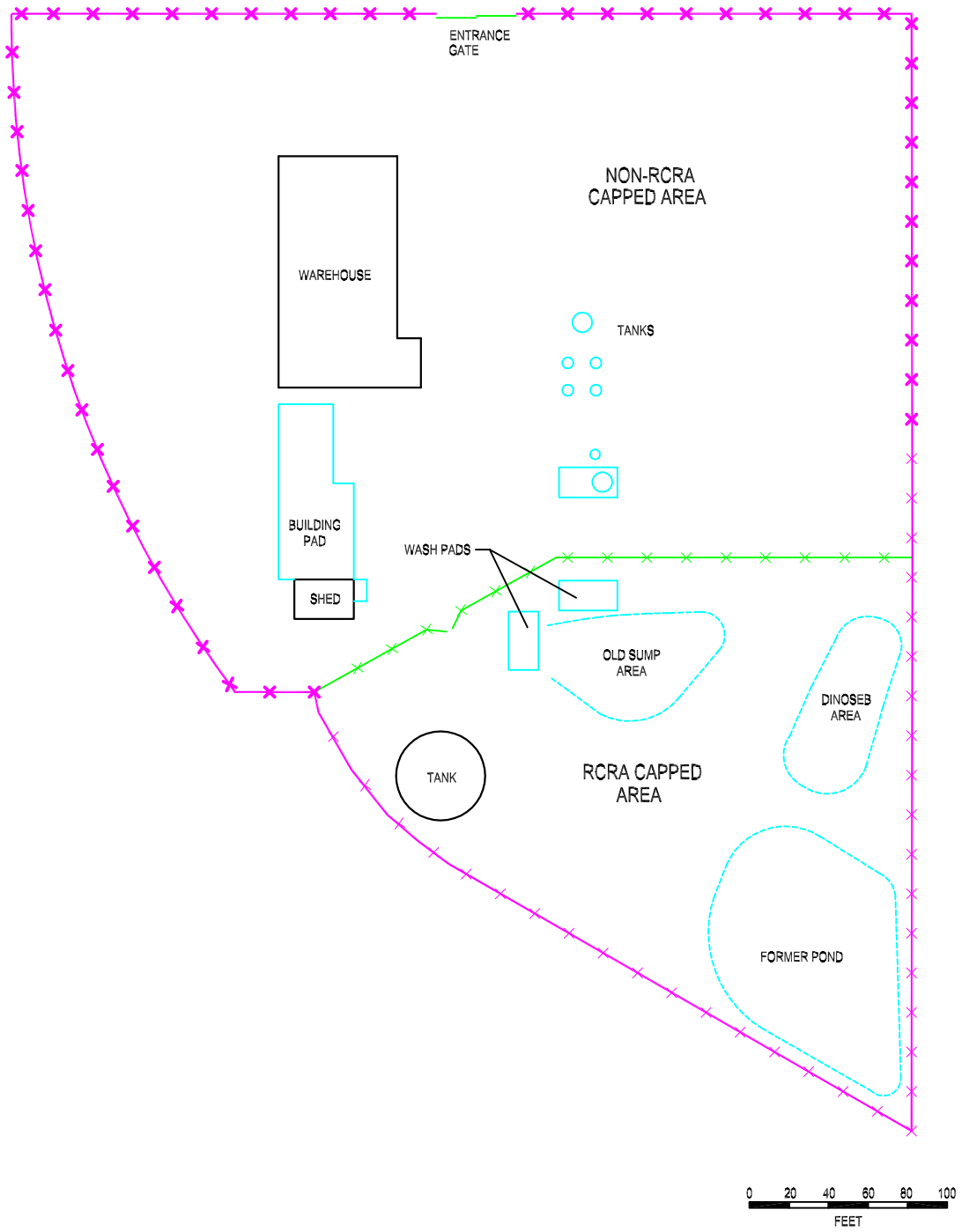
Well Locations and Site Plan

Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

Project No.	Figure
C00-266.2	I-3


City No. 7
City No. 2
City No. 3
City No. 5
City No. 9
City No. 4
SITE LOCATION
City No. 6
City No. 1
City No. 8
Approx. Scale:
0
500
1000 feet
N
PANACEA, INC.
Environmental Services
CITY WELL LOCATIONS
ARVIN, CALIFORNIA
PROJECT NO. C00-266.2
FIGURE I-4

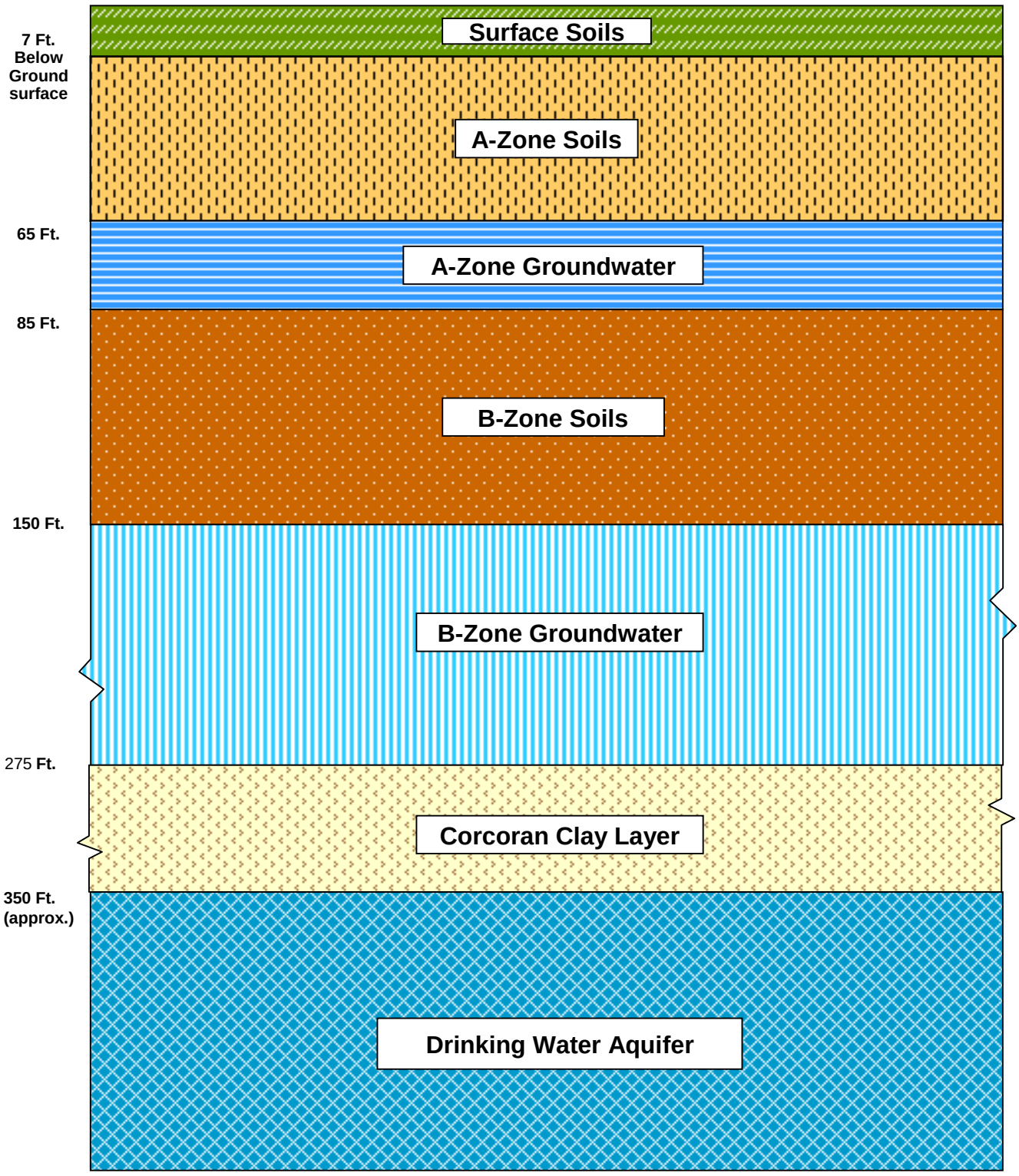


N

PANACEA, INC.
Environmental Services

HISTORICAL SITE RELEASE AREAS
ARVIN, CALIFORNIA

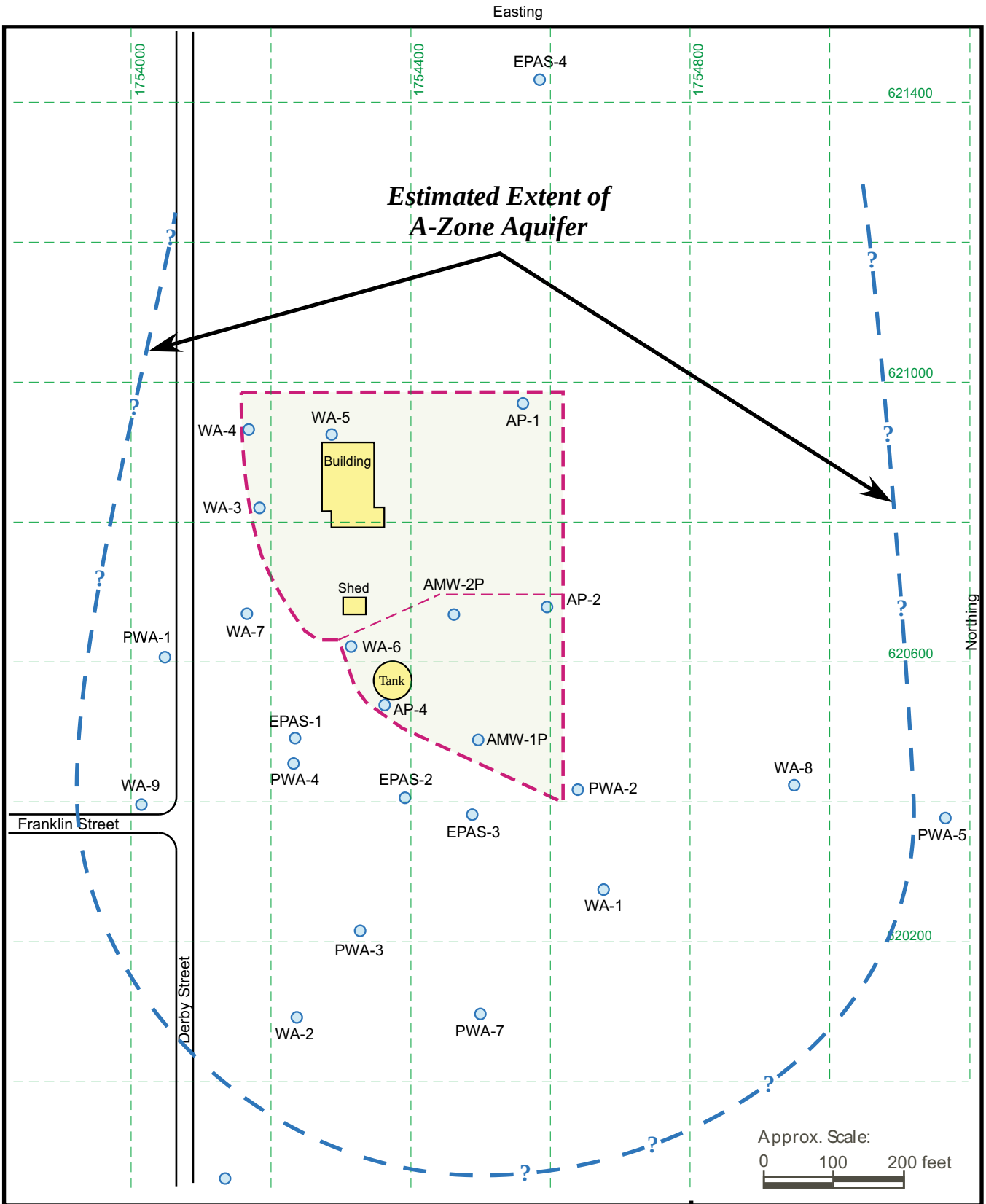
PROJECT NO. C00-266.2	FIGURE I-5



Designation of the of the Soil Layering System
Brown and Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

Project No.	Figure
C00-266.2	I-6



Estimated Extent of A-Zone Aquifer
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

Project No.	Figure
C00-266.2	I-7

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

ORIGINAL
File with DWR

Do Not Fill In

№ 66520

State Well No. 31S/29E-26

Other Well No.

city water well #1

(1) OWNER:

Name Arvin Comm. Service Dist.

Address P.O. Box 333

Arvin, Calif.

(2) LOCATION OF WELL:

County Kern Owner's number, if any

Township, Range, and Section T31S R29E Sec. 26 1 blk

Distance from cities, roads, railroads, etc. west of Berby Rd. &

& ½ Blk. South of Lonford Rd. on West

side of Butte St.

(3) TYPE OF WORK *(check)*:

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE *(check)*:

Domestic ☒ Industrial ☐ Municipal ☐

Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☒

Cable ☐

Other ☐

(6) CASING INSTALLED:

STEEL: SINGLE ☒ DOUBLE ☐ OTHER:

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	If gravel packed From ft.	To ft.
0	700	14	¼	24	50	730

Size of shoe or well ring: Size of gravel: Birds Eye

Describe joint Collared and welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen Sawed

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
350	700	14	30	1/8 x 2

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth 50 ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing ft.

(10) WELL TESTS:

Was pump test made? Yes ☐ No ☒ If yes, by whom? Not yet

Yield: gal./min. with ft. drawdown after hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☒ No ☐ If yes, attach copy

(11) WELL LOG:

Total depth 730 ft. Depth of completed well 700 ft.

Formation: *Describe by color, character, size of material, and structure*

ft.	to ft.	
0ft.	to 50ft.	Conductor
50	118	Sand & gravel
118	130	Sand & clay
130	198	Sand & gravel
198	241	Sand & clay
241	275	Sand
275	302	Clay
302	314	Sandy clay
314	322	Sand
322	341	Clay
341	453	Sand
453	469	Sand & clay
469	488	Sand
488	515	Sand & clay
515	530	Coarse sand
530	552	Clay
552	588	Fine sand clay
588	647	Med- sand clay
647	664	Sticky clay
664	680	Sand
680	699	Sticky clay
699	710	Sand
710	730	Clay

PRESSURE

CONFIDENTIAL
Water Code Sec. 13752

Work started 7-26 1970 Completed 7-29 1970

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Johnson Drilling Co.
(Person, firm, or corporation) (*Typed or printed*)

Address P.O. Box 1853
Bakersfield, Calif.

[SIGNED]
(*Well Driller*)

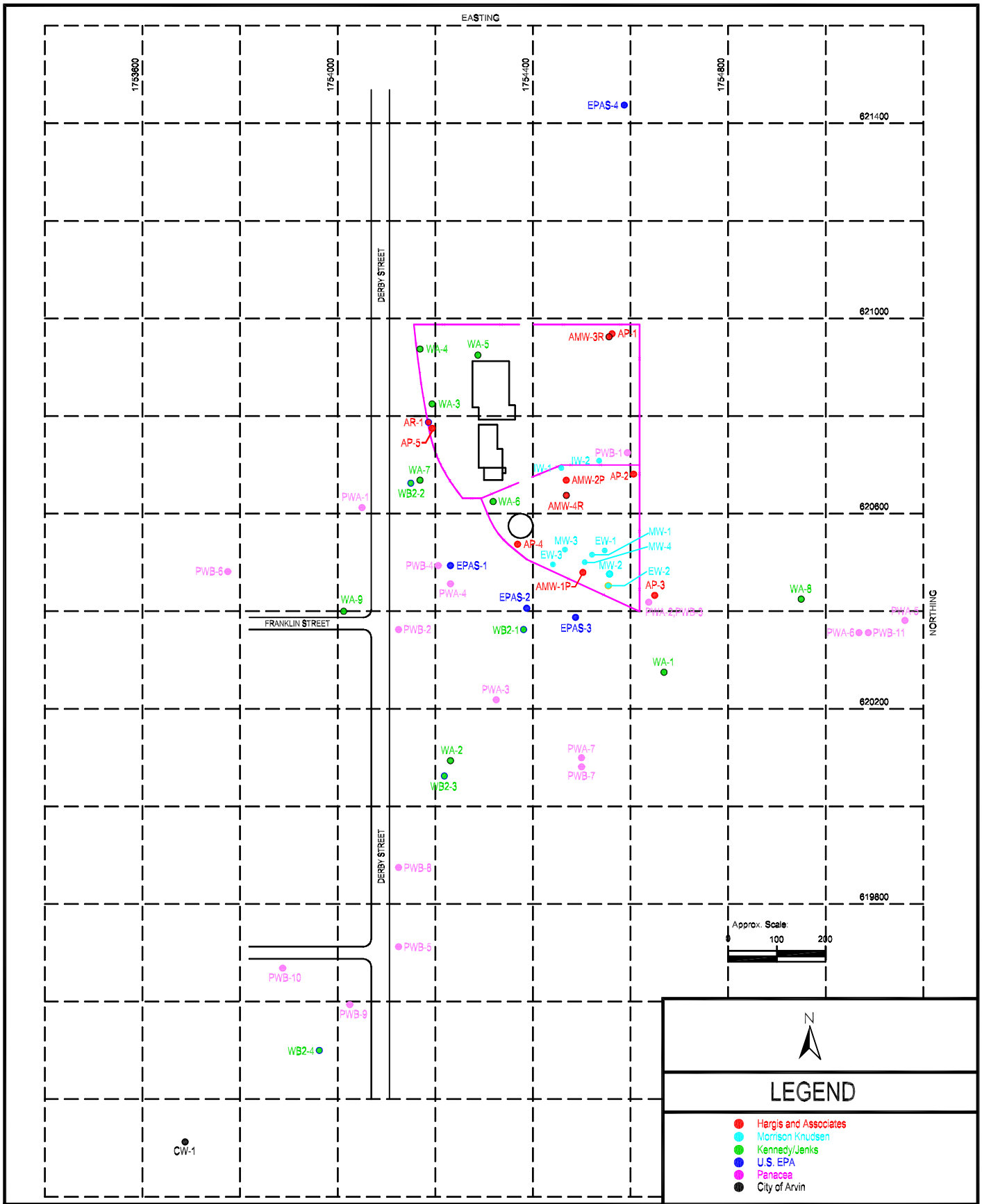
License No. 251601 Dated June 29, 1970

SKETCH LOCATION OF WELL ON REVERSE SIDE

DRILLER'S LOG FOR CITY WELL NO. 1
BROWN & BRYANT SUPERFUND SITE
600 SOUTH DERBY STREET
ARVIN, CALIFORNIA

PANACEA, INC.
Environmental Services

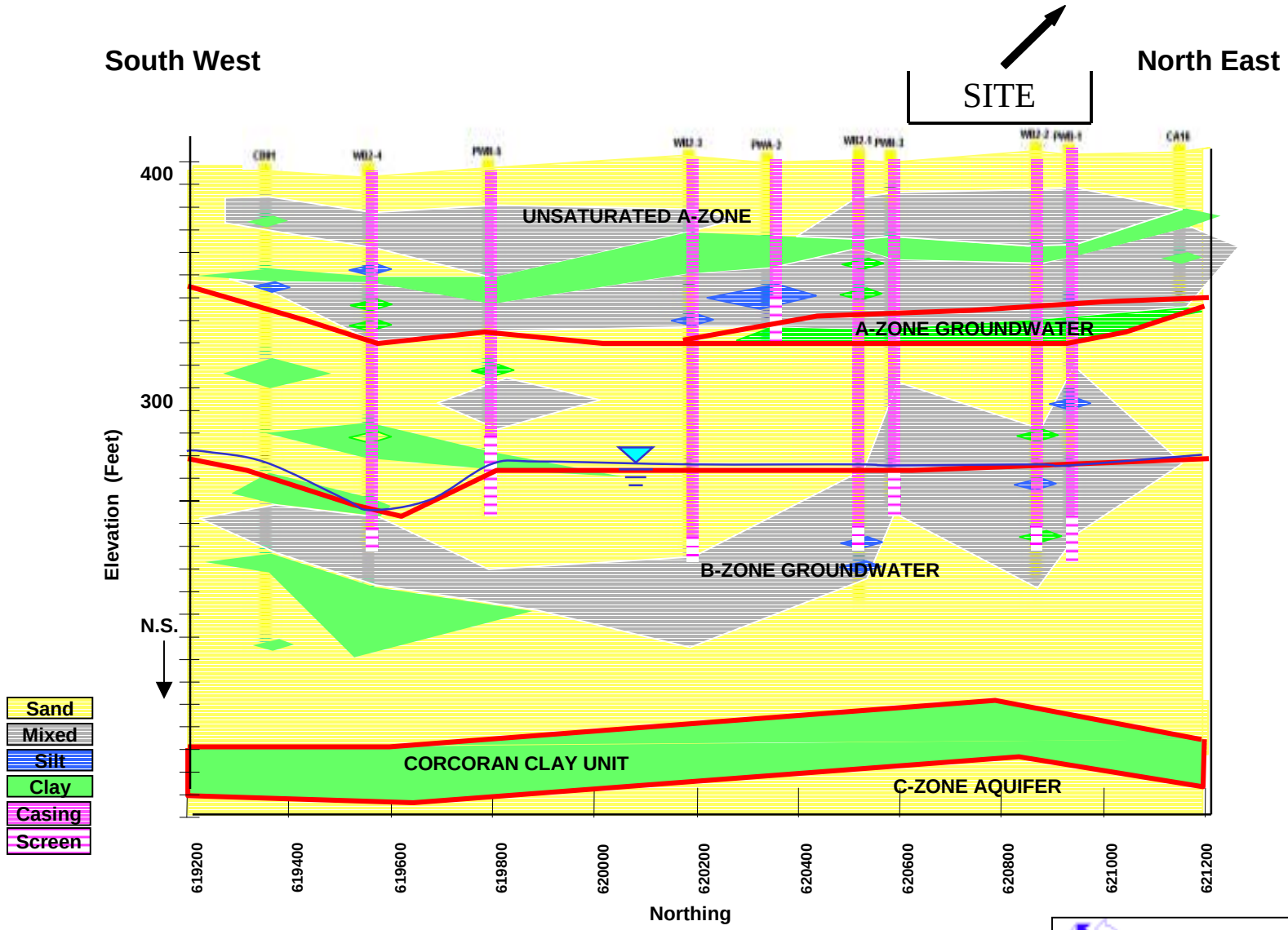
PROJECT NO.	FIGURE
C00-266.2	I-8



WELL INSTALLATIONS BY COMPANY
BROWN & BRYANT SUPERFUND SITE
600 SOUTH DERBY STREET
ARVIN, CALIFORNIA

PANACEA, INC.
Environmental Services

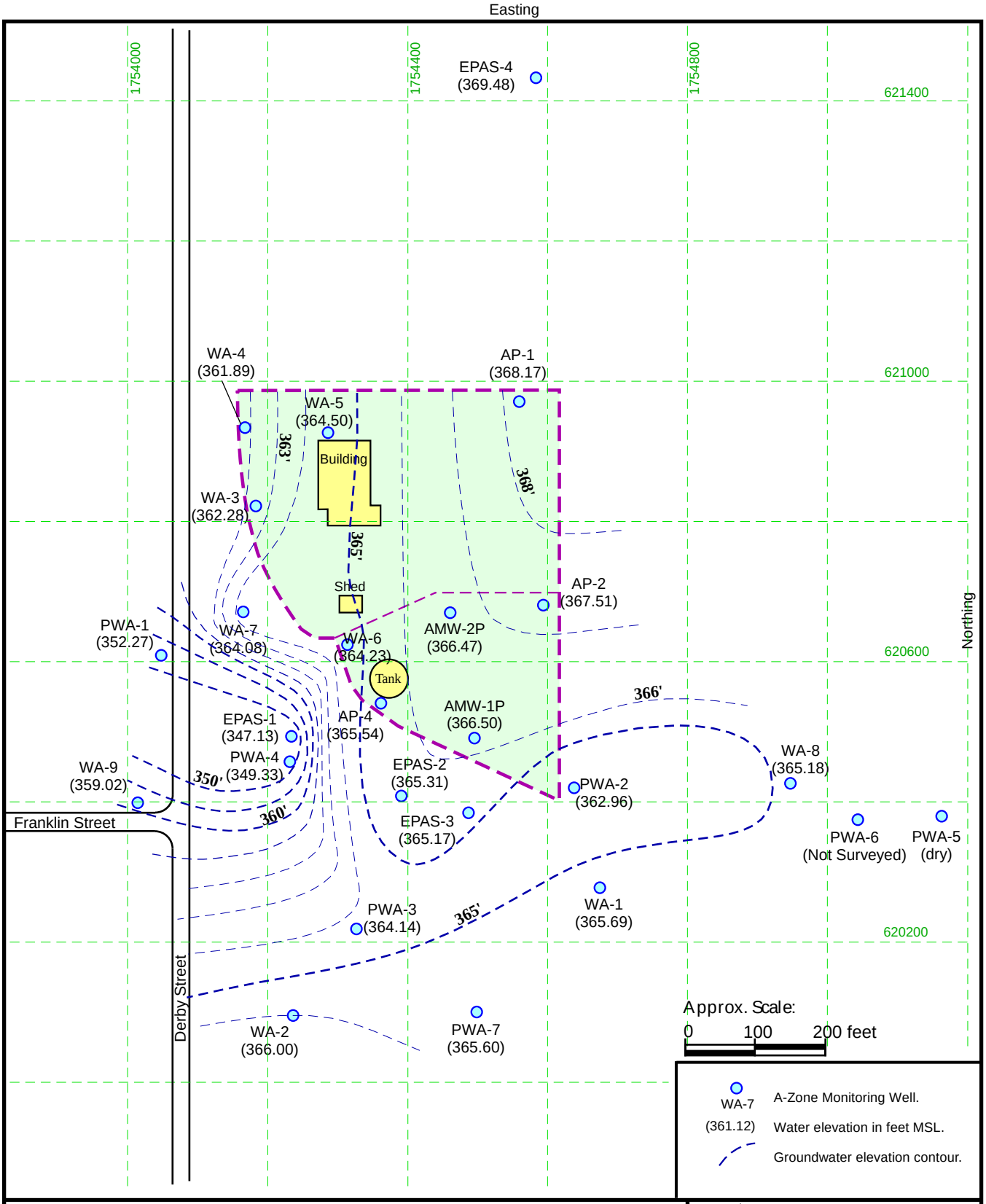
PROJECT NO.	FIGURE
C00-266.2	I-9



Stratographic Details for the A-Zone and the B-Zone

PANACEA, INC.
Environmental Services

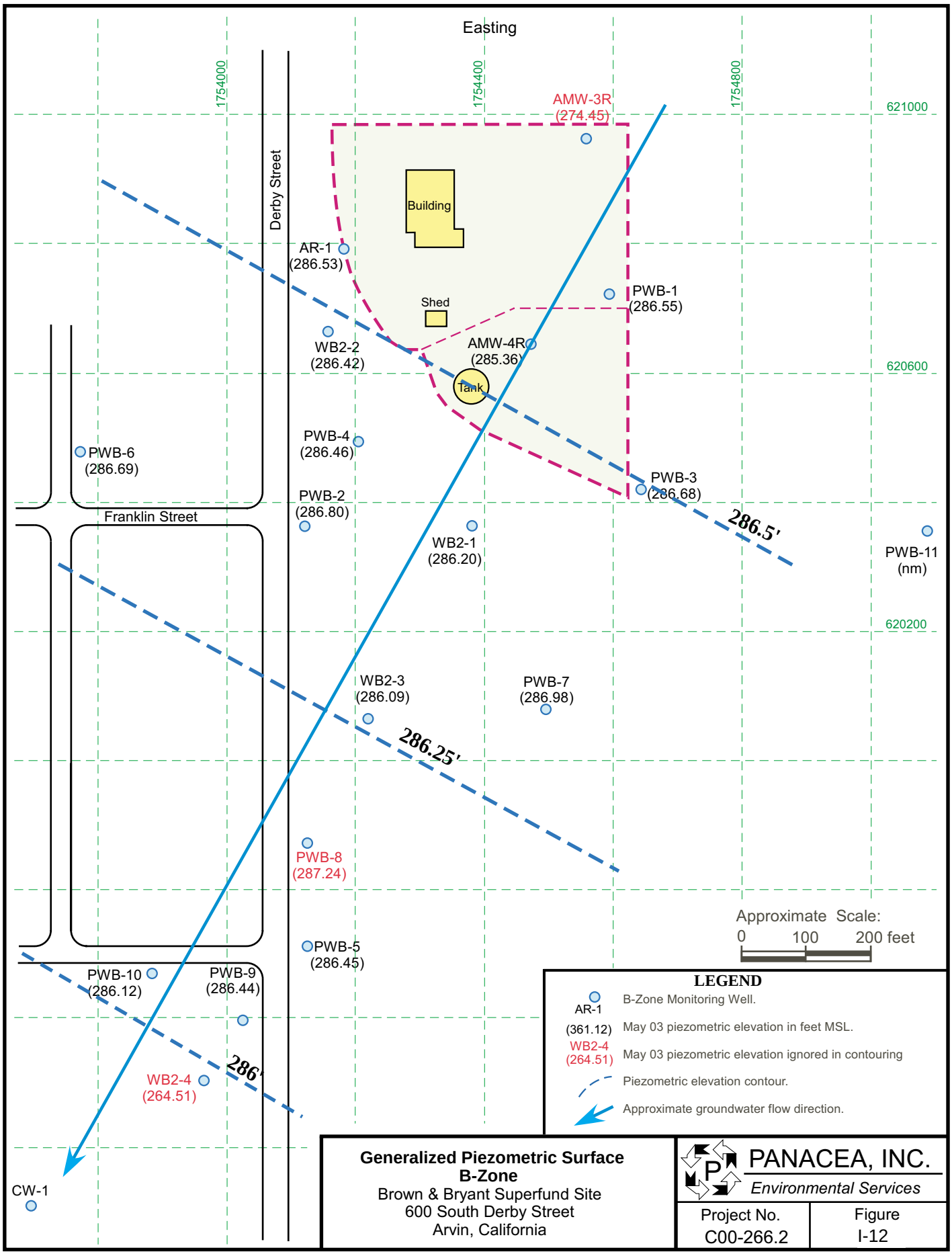
Project No. C00-266.2	**Figure** I-10



Generalized Piezometric Surface
A-Zone
Brown & Bryant Superfund SIte
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

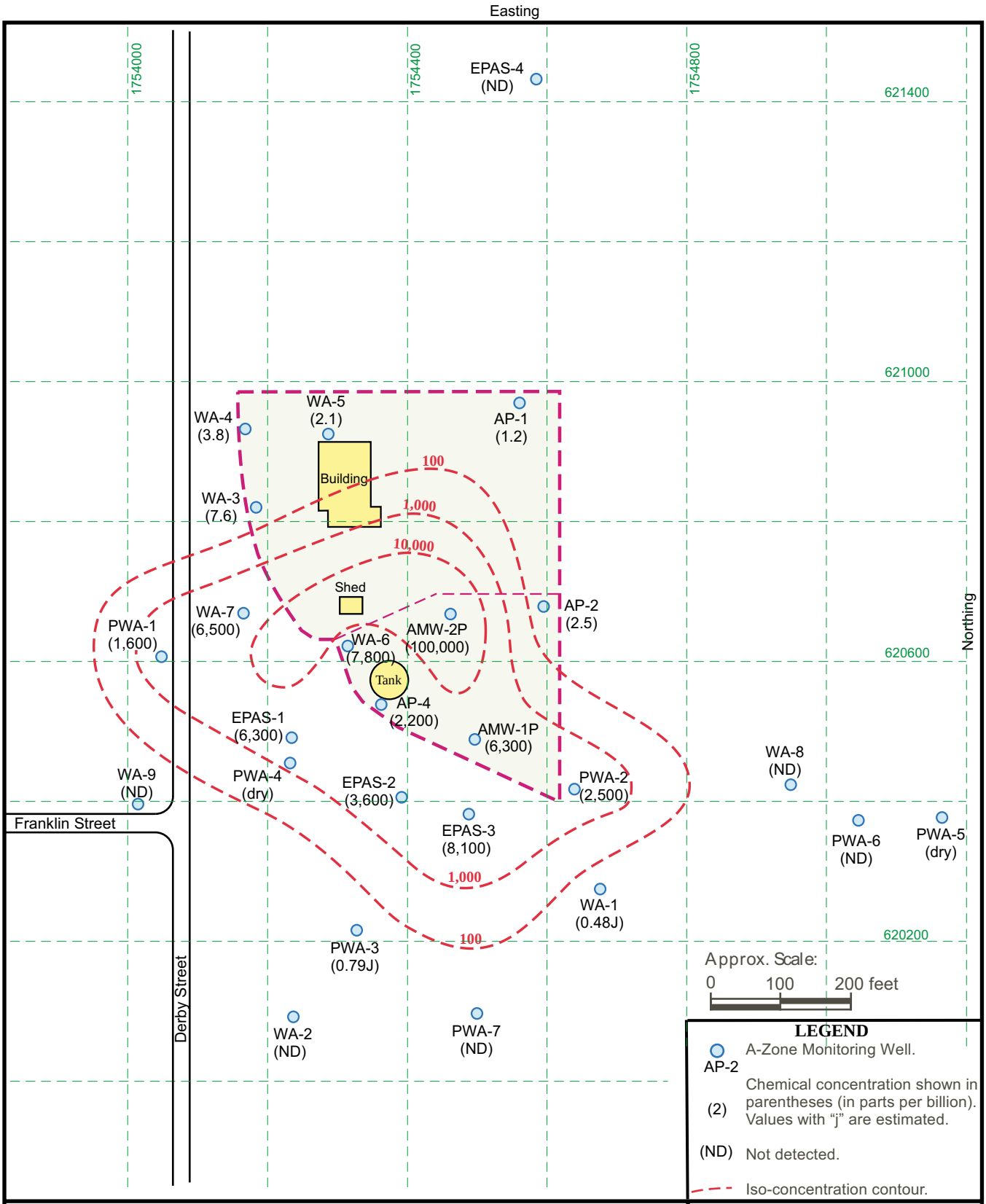
Project No.	Figure
C00-266.2	I-11



Generalized Piezometric Surface
B-Zone
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

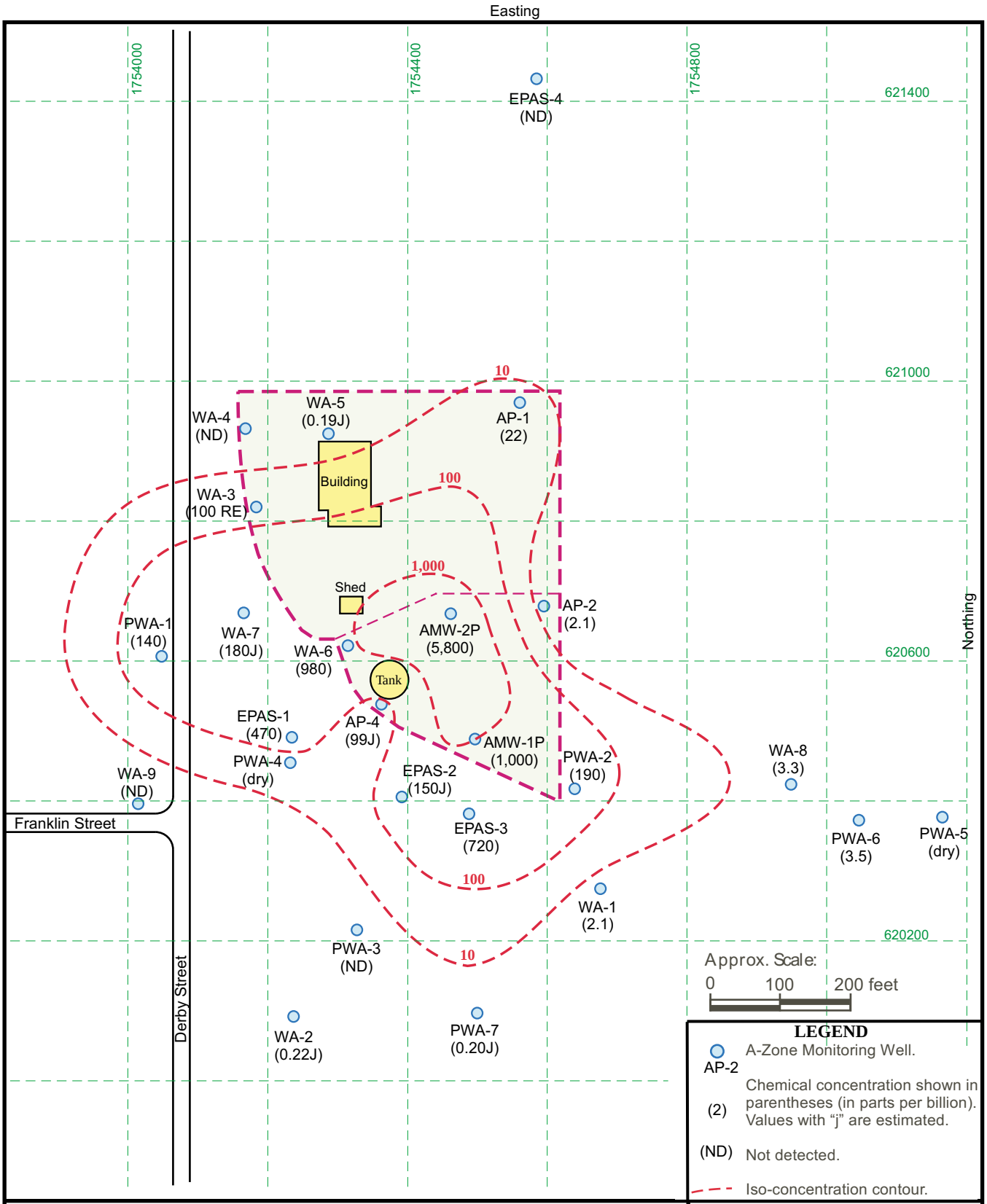
Project No.	Figure
C00-266.2	I-12



1,2-DCP in Groundwater
A-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

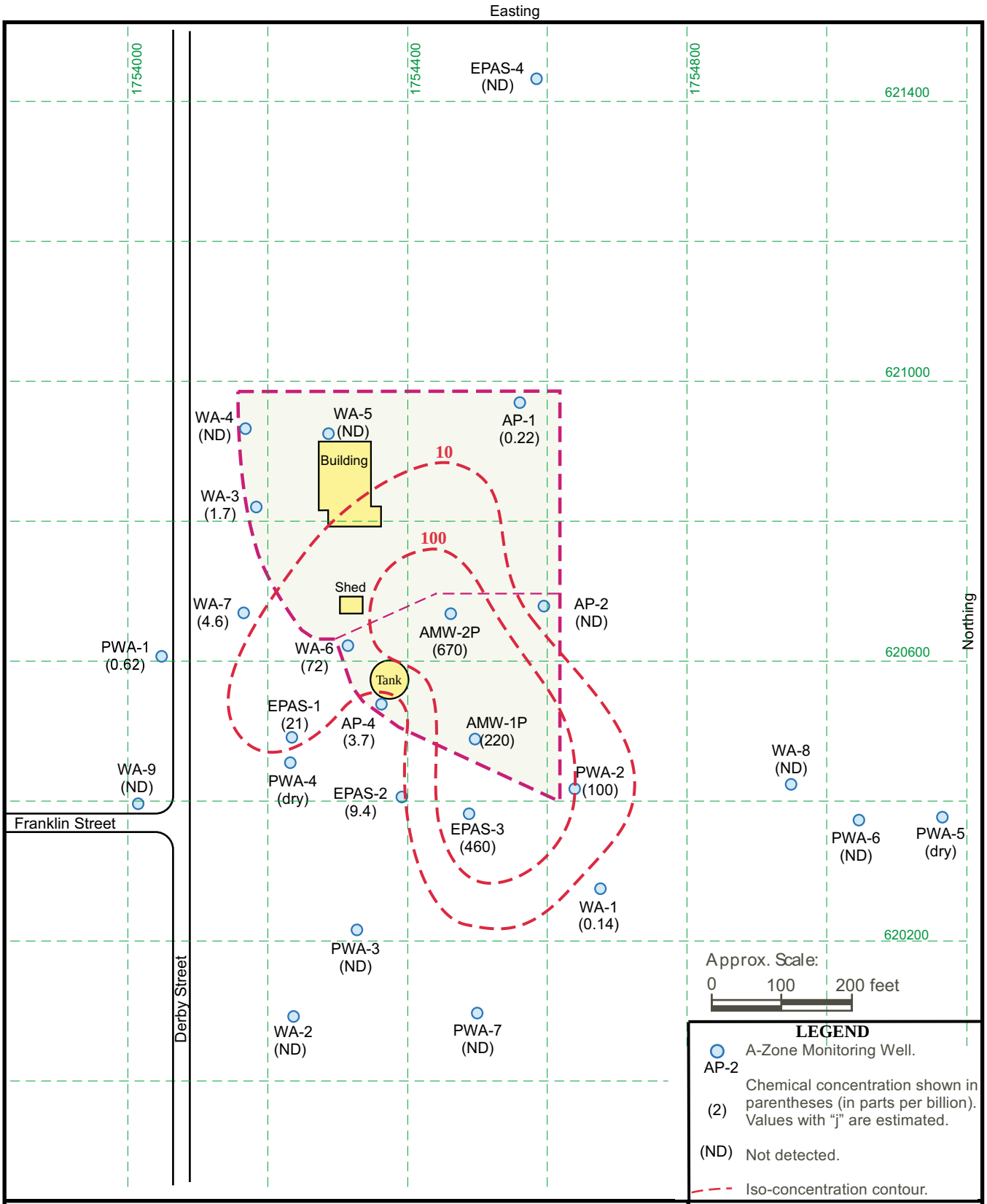
Project No.	Figure
C00-266.2	I- 13A



1,2,3-TCP in Groundwater
A-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

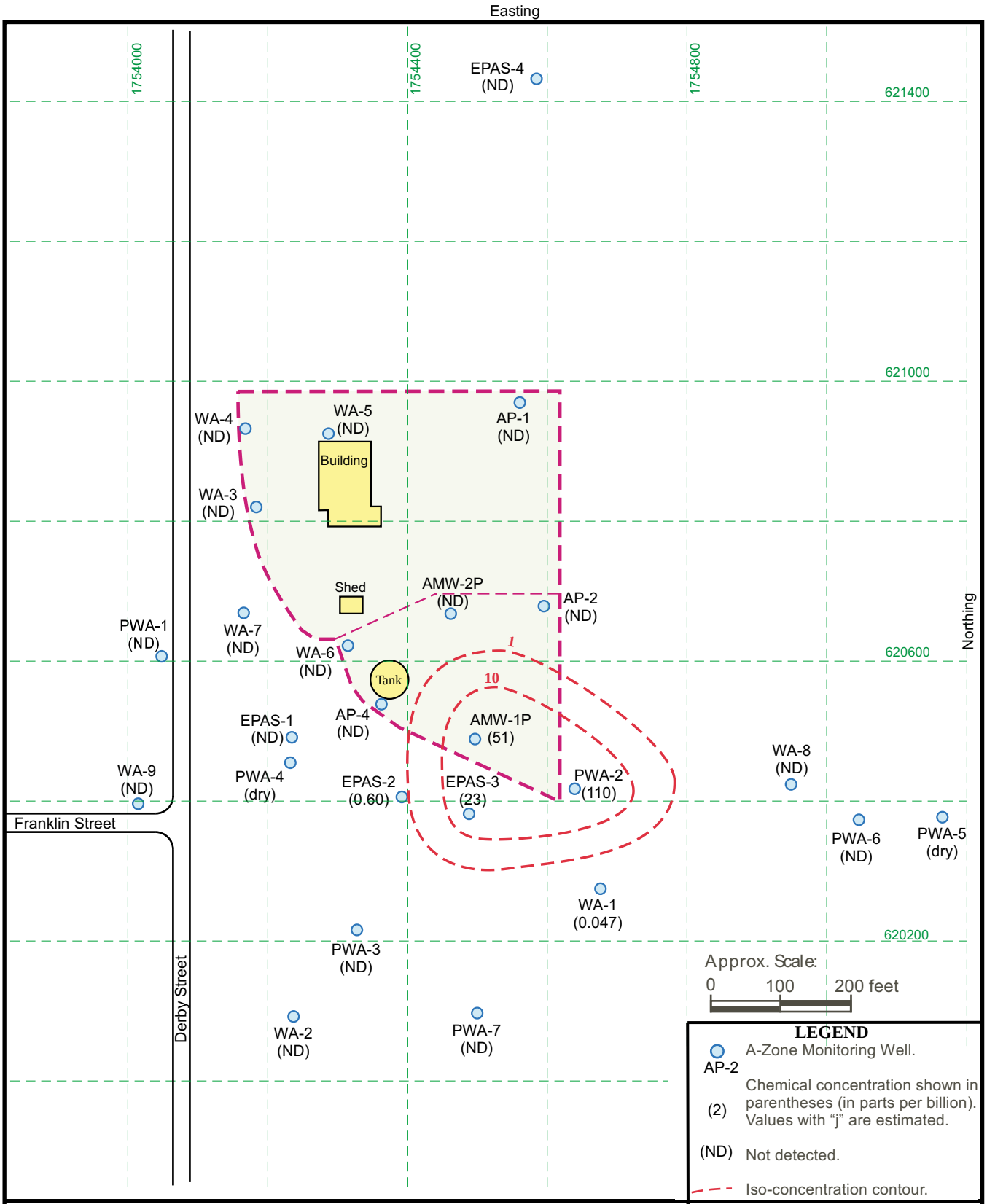
Project No.	Figure
C00-266.2	I- 13B



DBCP in Groundwater
A-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

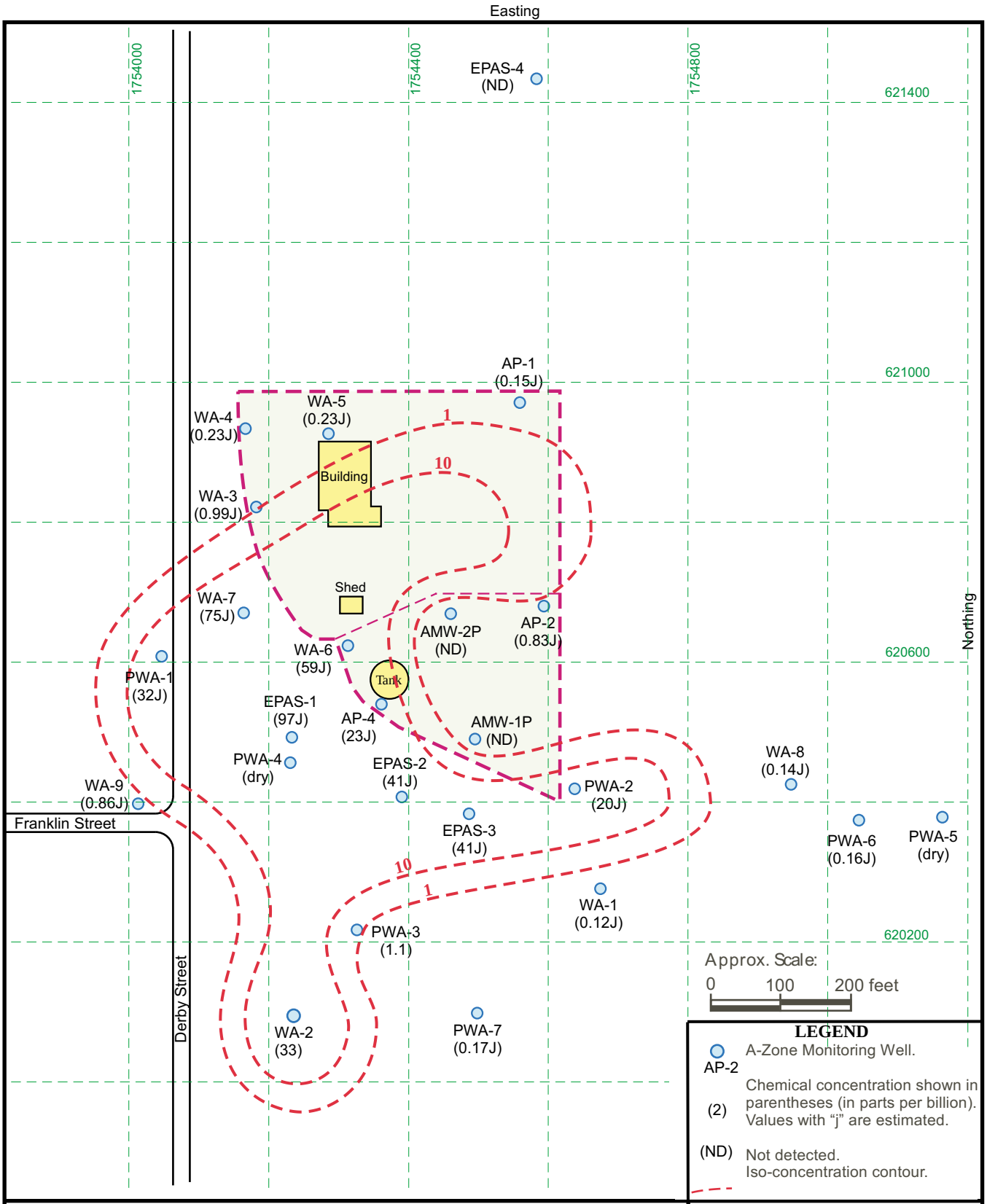
Project No.	Figure
C00-266.2	I- 13C



EDB in Groundwater
A-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

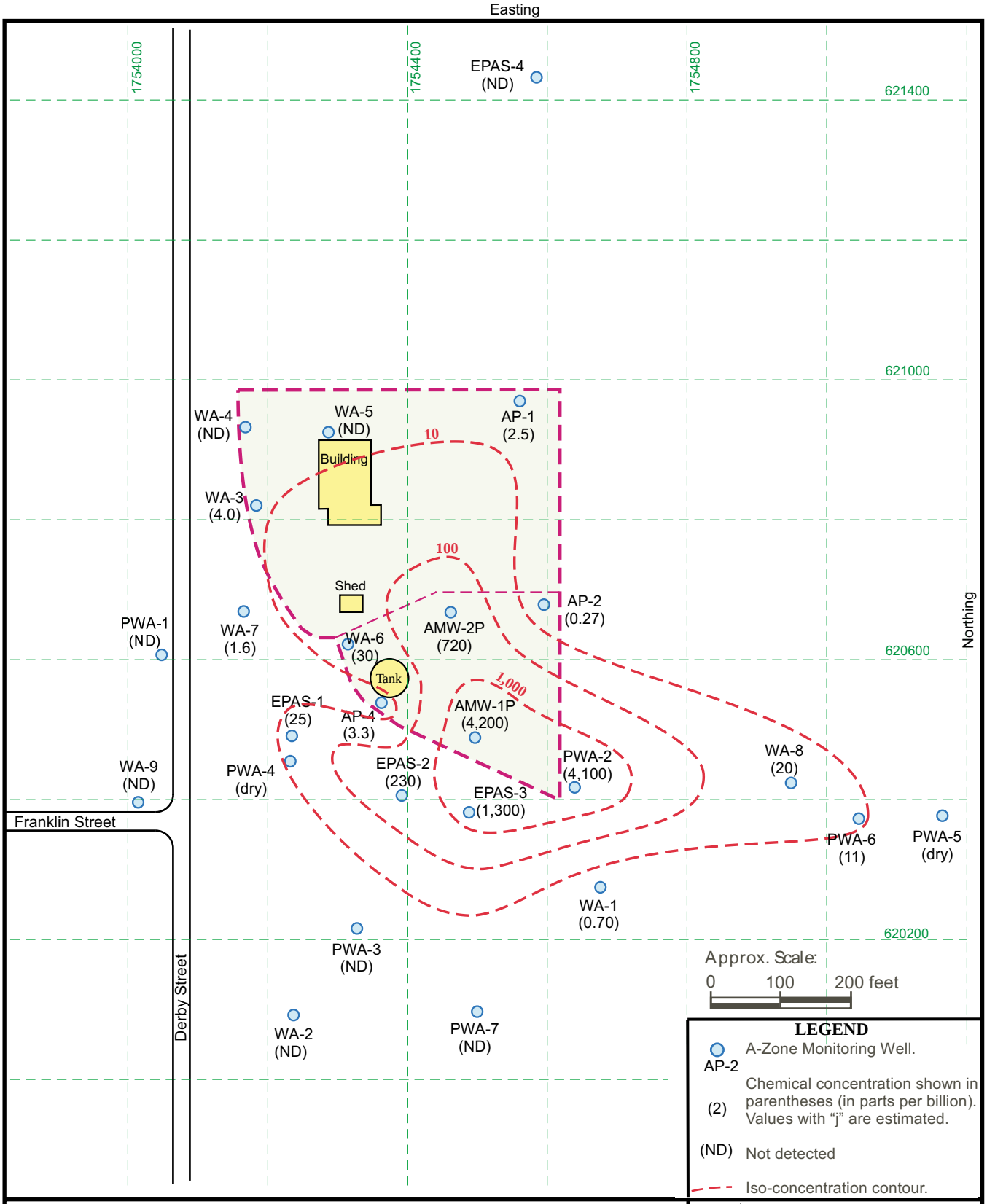
Project No.	Figure
C00-266.2	I- 13D



Chloroform in Groundwater
A-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

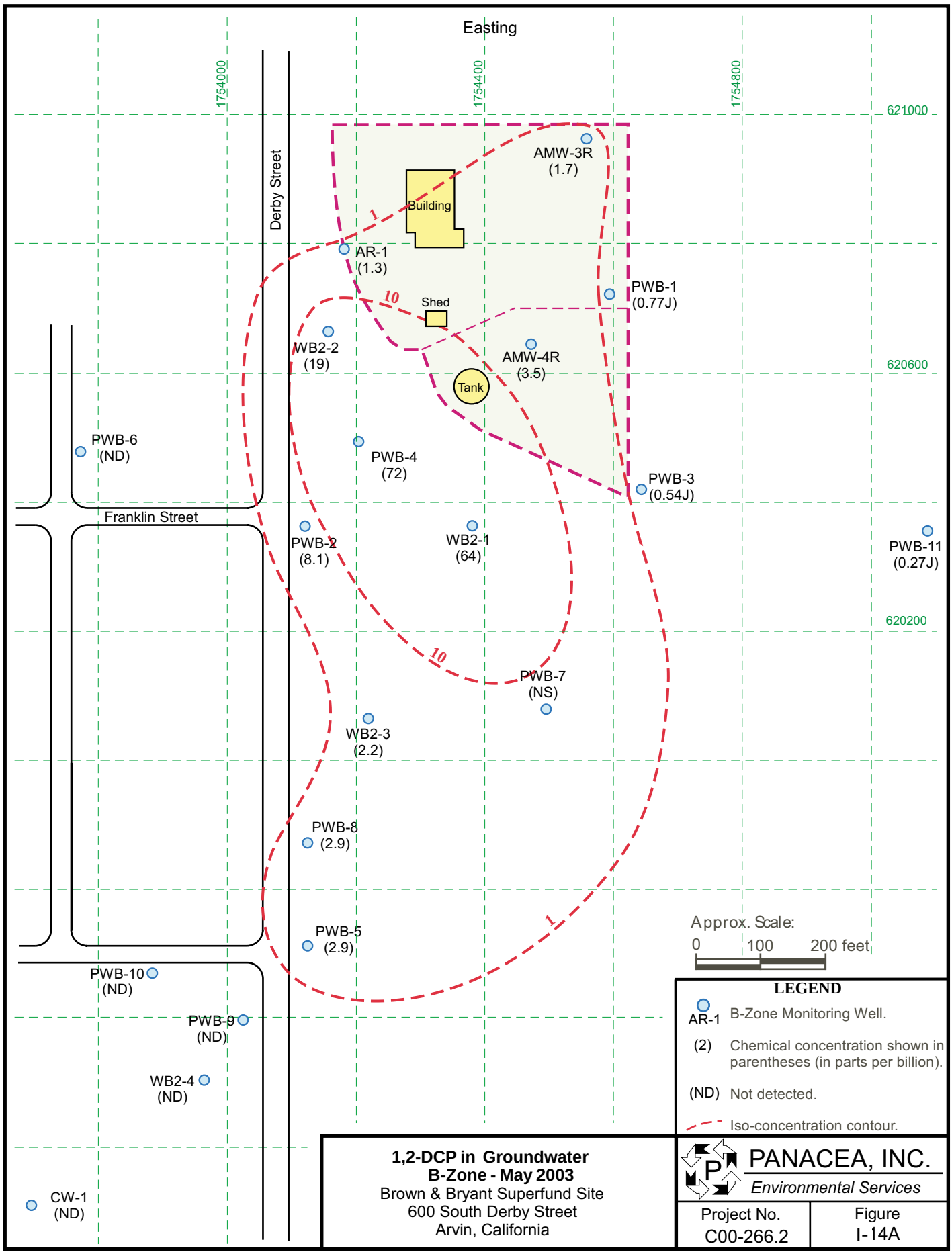
Project No.	Figure
C00-266.2	I- 13E



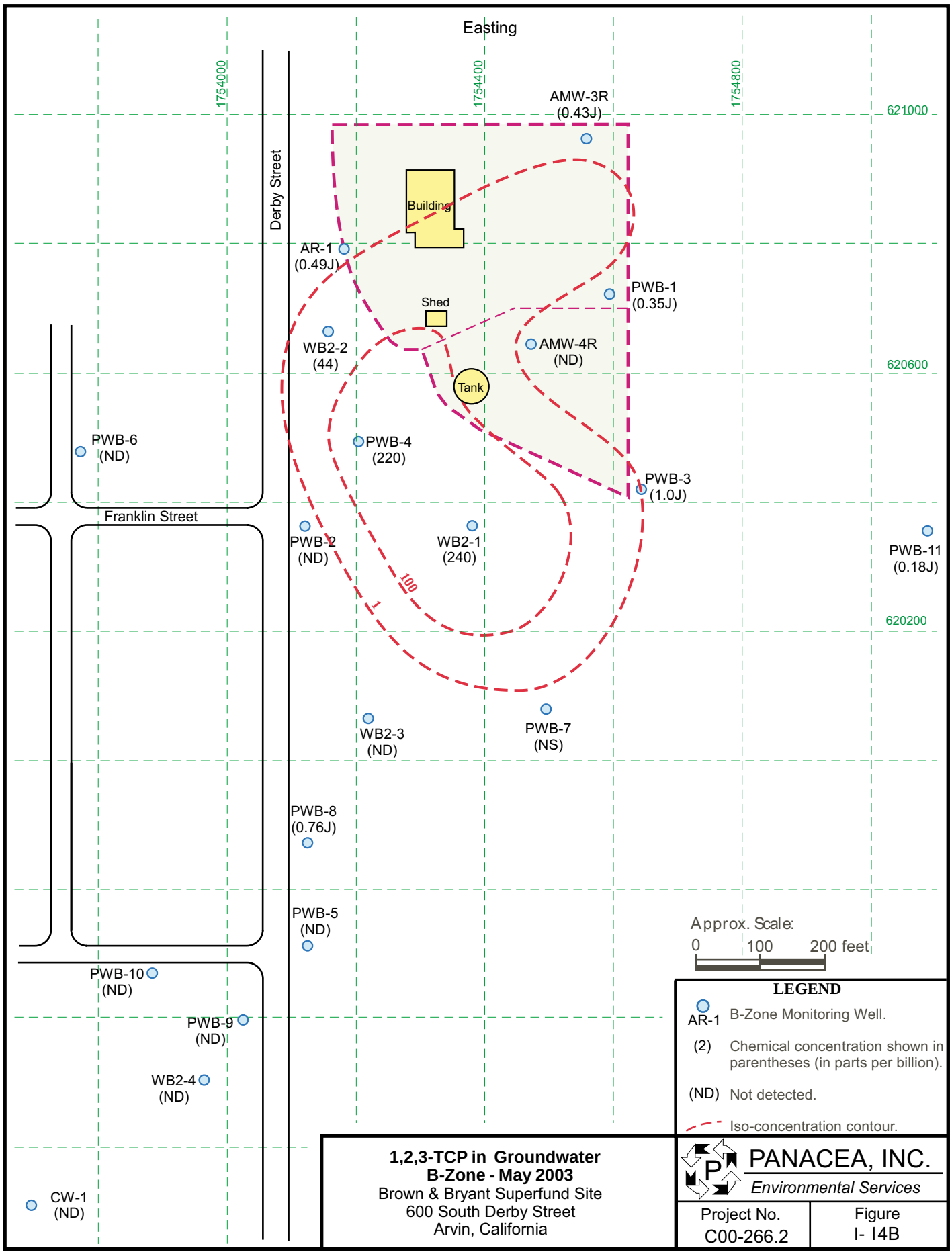
Dinoseb in Groundwater
A-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

PANACEA, INC.
Environmental Services

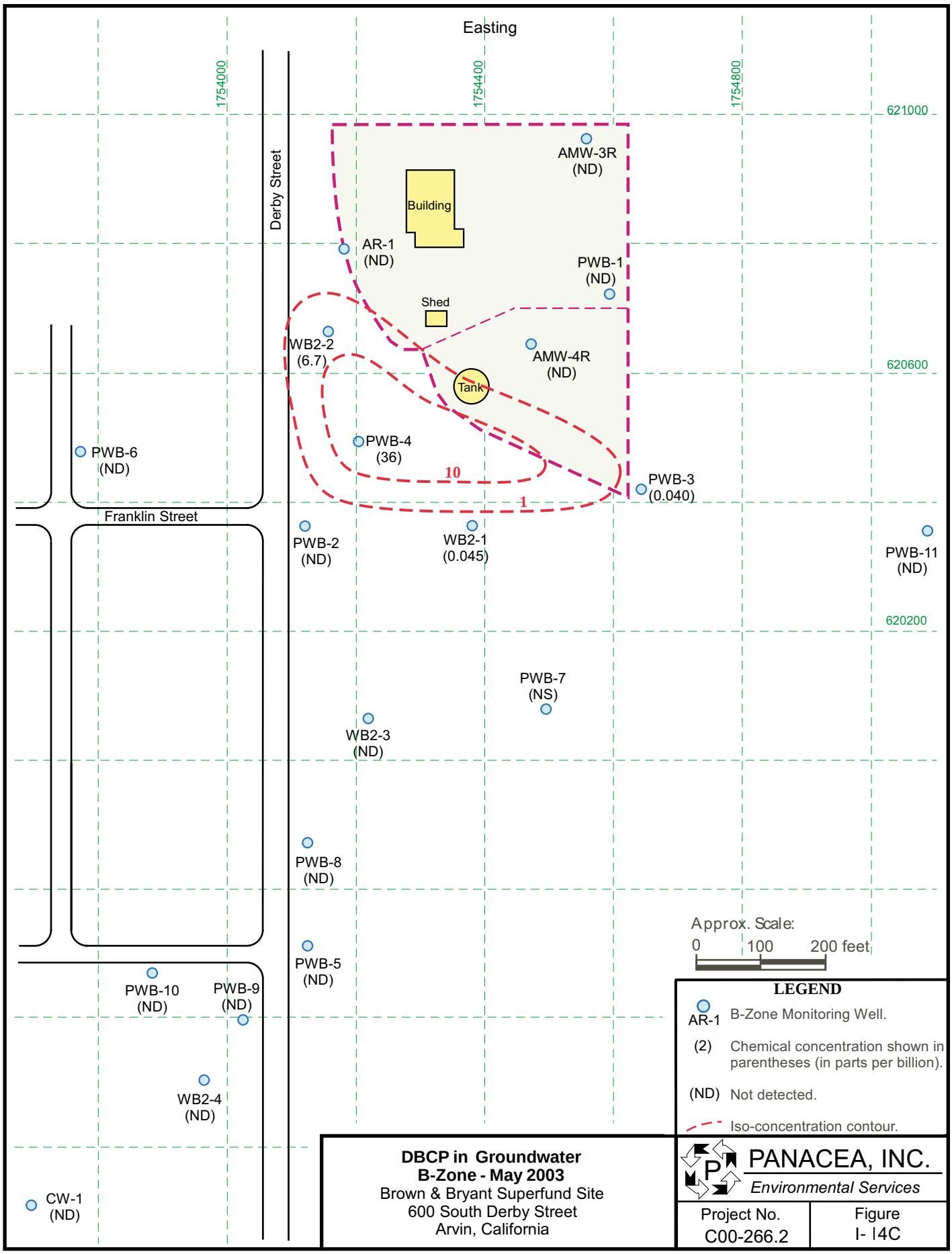
Project No.	Figure
C00-266.2	I- 13F



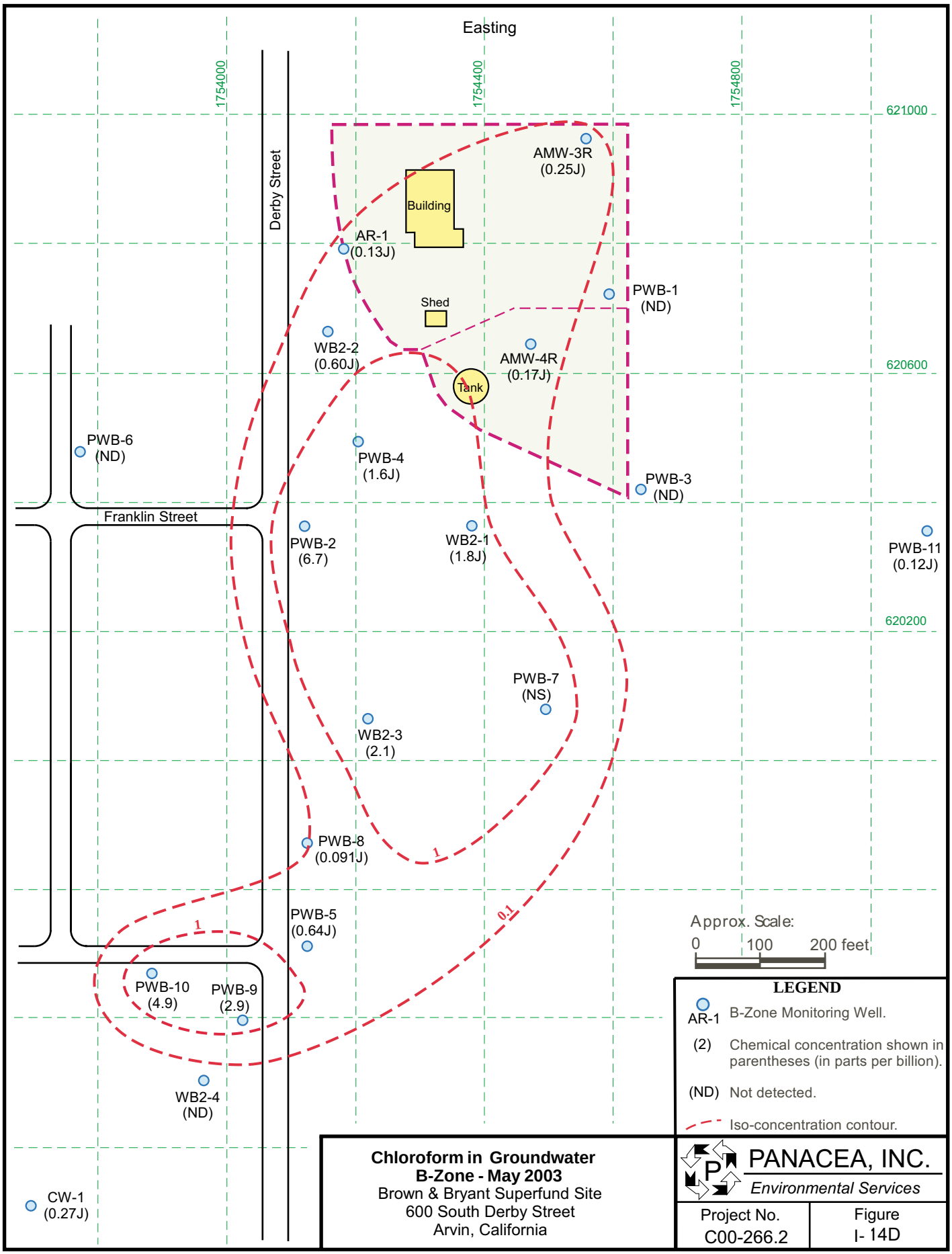
1,2-DCP in Groundwater
B-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California



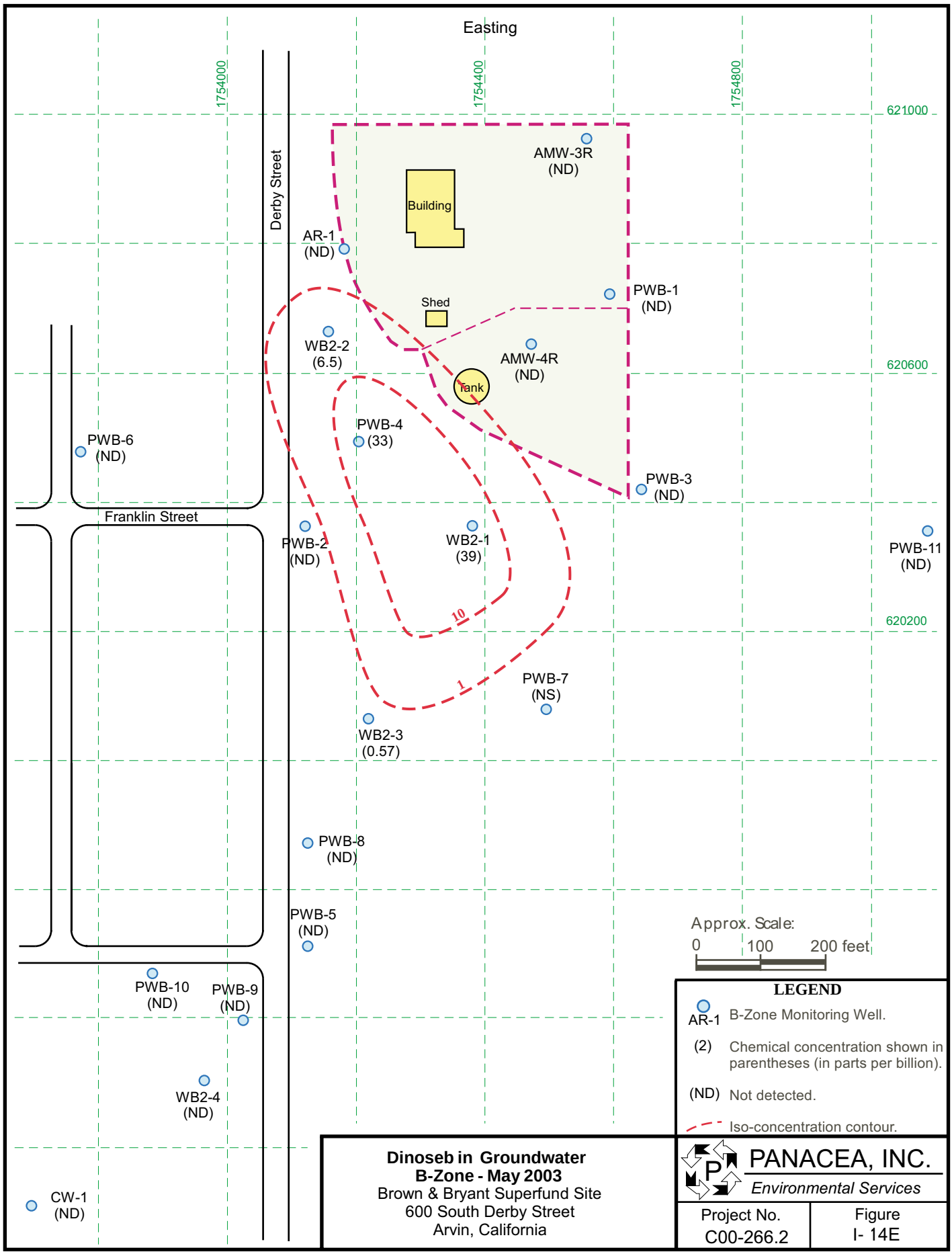
1,2,3-TCP in Groundwater
B-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California



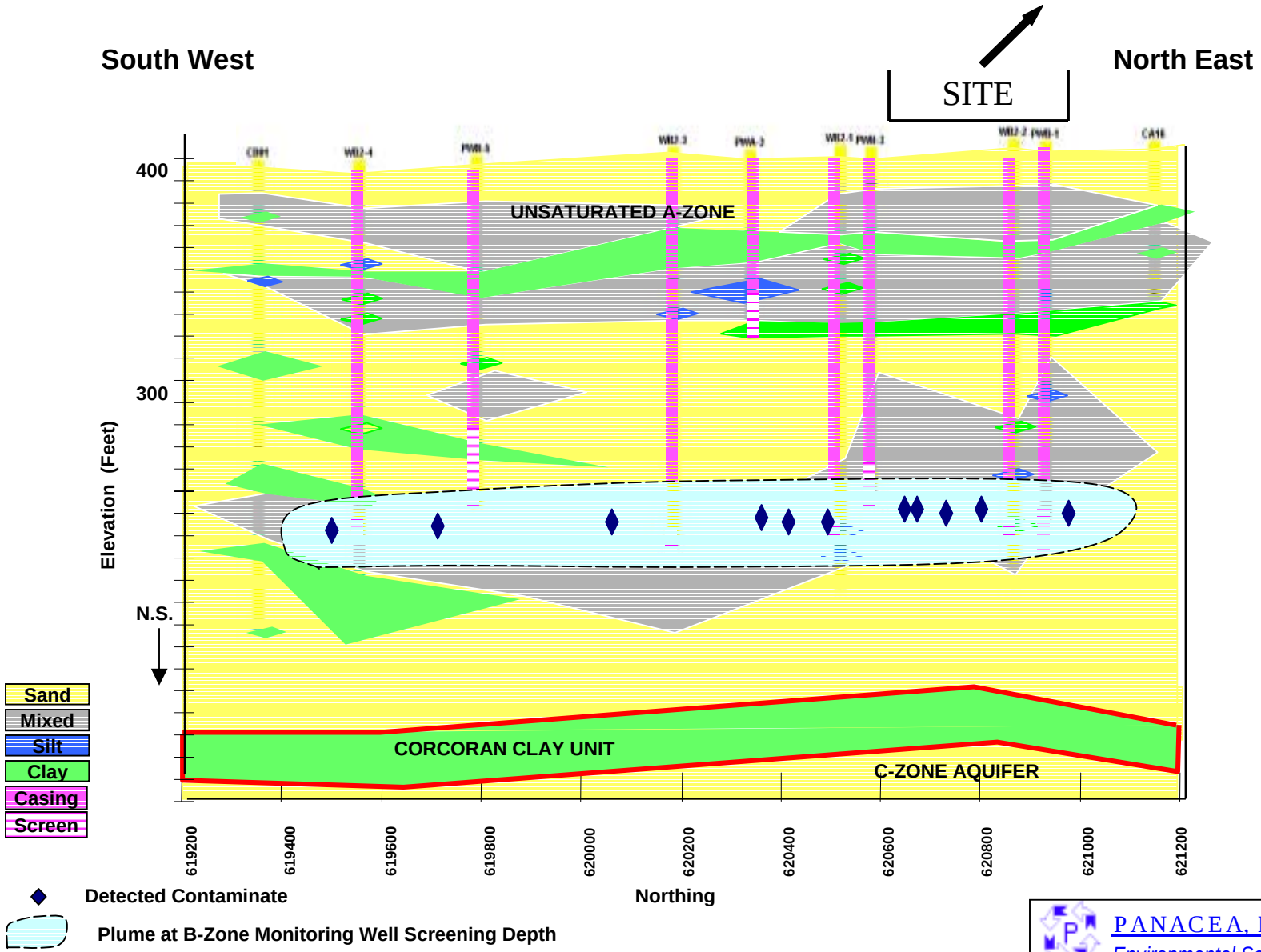
DBCP in Groundwater
B-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California



Chloroform in Groundwater
B-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California



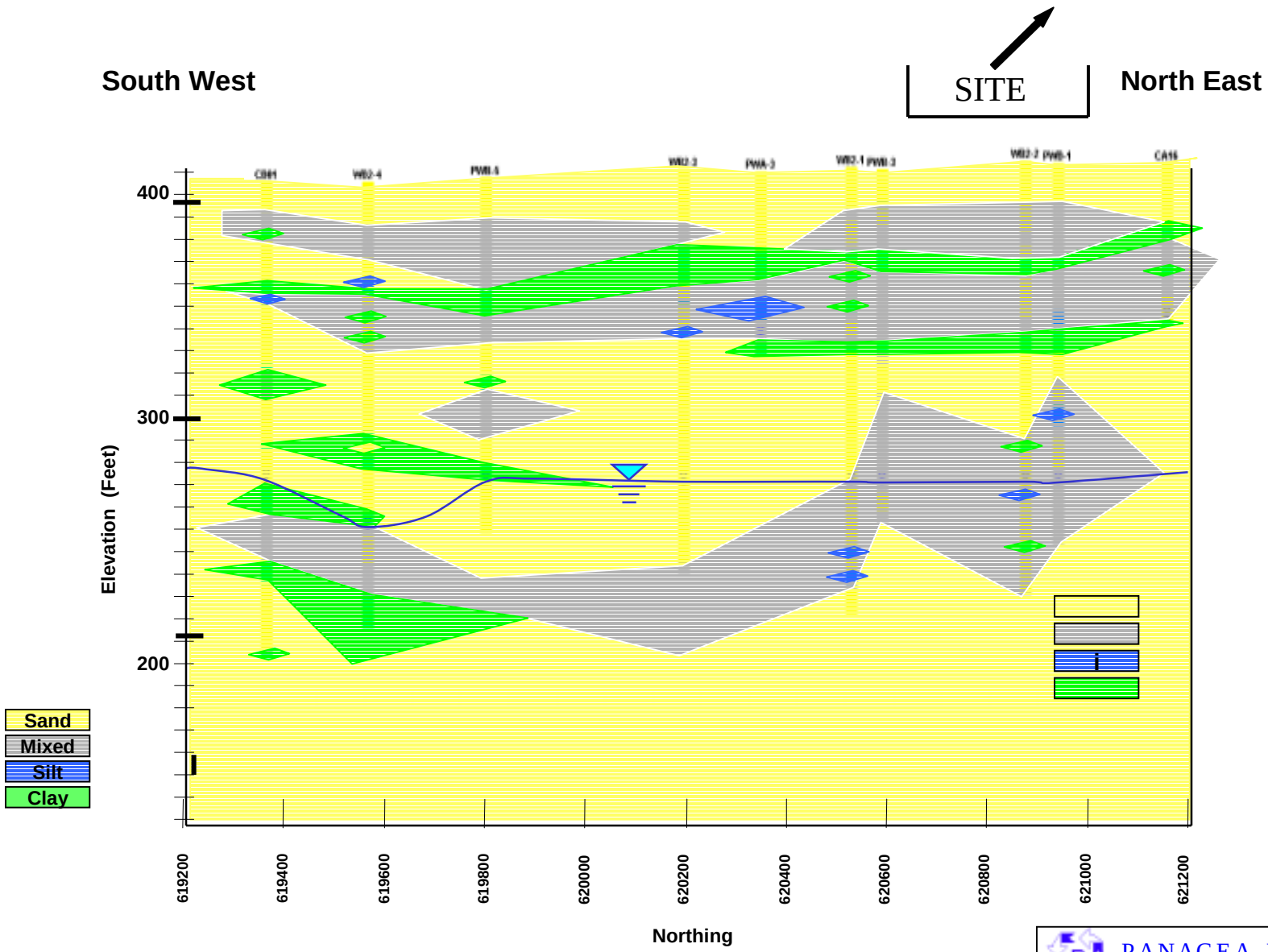
Dinoseb in Groundwater
B-Zone - May 2003
Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California



Areal Distribution of Contaminates in B-Zone Groundwater

PANACEA, INC.
Environmental Services

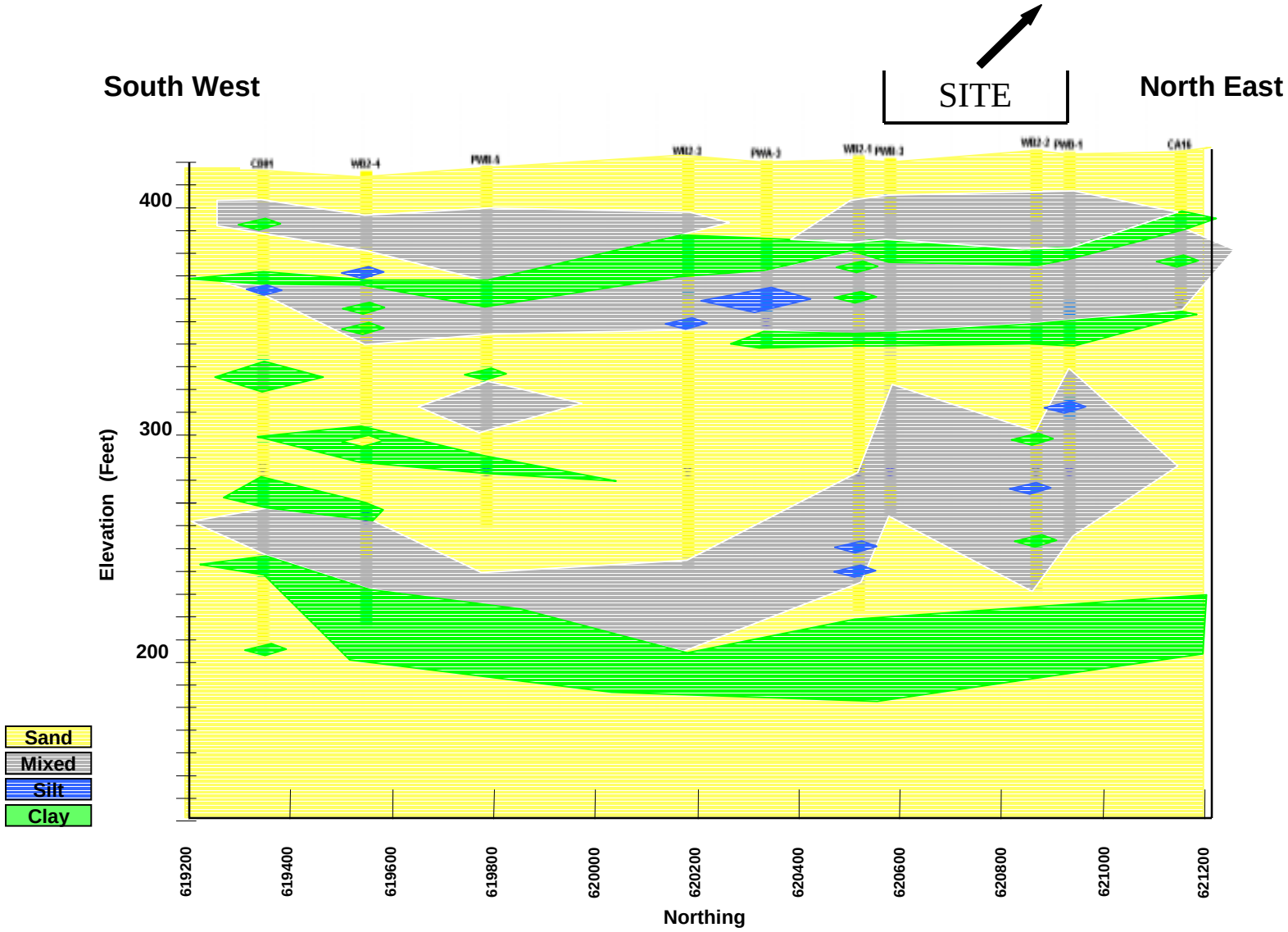
Project No. C00-266.2	Figure I-15



Cross Section of the Alternative Conceptual Hydrogeologic Model 1

PANACEA, INC.
Environmental Services

Project No. C00-266.2	Figure I-16 A



Cross Section of the Alternative Conceptual Hydrogeologic Model 2

PANACEA, INC.
Environmental Services

Project No. C00-266.2	Figure I-16 B