FINAL
RECORD OF DECISION/REMEDIAL ACTION PLAN
OPERABLE UNIT 1B
IRP-3 – PAINT STRIPPER DISPOSAL AREA
IRP-12 – DRUM STORAGE AREA NO. 2
FORMER MARINE CORPS AIR STATION
TUSTIN, CALIFORNIA

OCTOBER 2004

DECLARATION

DECLARATION

SITE NAME AND LOCATION

Site Installation Restoration Program (IRP)-3, Paint Stripper Disposal Area – Operable Unit (OU)-1B

Site IRP-12, Drum Storage Area No. 2 – OU-1B

Former Marine Corps Air Station (MCAS) Tustin
Orange County, California

National Superfund Database Identification Number: CA9170090022

STATEMENT OF BASIS AND PURPOSE

This final Record of Decision (ROD)/Remedial Action Plan (RAP) presents the selected remedial action for groundwater at OU-1B Sites IRP-3 and IRP-12 at Former MCAS Tustin, located in Orange County, California.

This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 *United States Code* Section [§] 9602 et seq.) and in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (40 *Code of Federal Regulations* § 300 et seq.). The decision for these sites is based on information contained in the administrative record. A site-specific administrative record index for IRP-3 and IRP-12 is included as Attachment A.

The state of California (through the California Environmental Protection Agency Department of Toxic Substances Control [DTSC] and the Regional Water Quality Control Board Santa Ana Region) and the United States Environmental Protection Agency concur on the selected remedy.

REMEDIAL ACTION PLAN

This ROD/RAP satisfies the DTSC requirements for a RAP for hazardous substance release sites pursuant to *California Health and Safety Code* § 25356.1. The RAP requirements are summarized in Attachment C.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from groundwater at IRP-3 and IRP-12, if not addressed by implementing the remedial action selected in this ROD/RAP, may present a potential threat to public health and welfare or to the environment.

DESCRIPTION OF THE REMEDY

The impacted medium at IRP-3 and IRP-12 is groundwater. The chemicals of concern (COCs) in groundwater are volatile organic compounds (VOCs), which are present in separate groundwater plumes originating at each of the sites. Although these plumes are

not commingled, the sites are being addressed together in one OU because they share the same type of contamination and the remedy for both sites is the same.

Risks due to contaminated soil at IRP-3 and IRP-12 were evaluated during the remedial investigation and feasibility study. The feasibility study recommended no further action for soil at IRP-3 and IRP-12, since the contaminated soil does not pose a significant risk to human health and the environment. However, limited soil removal would further enhance contaminant mass removal, lessen the time needed to achieve remedial action objectives, and remove a potential continuing source of trichloroethene to groundwater resulting in concentrations exceeding the maximum contaminant level. Therefore, the selected remedy includes excavation and off-site disposal of soil hot spots (the most highly contaminated source areas). The selected remedy for groundwater at IRP-3 and IRP-12 includes:

- construction, operation, and maintenance of a groundwater extraction and treatment system to reduce elevated (i.e., hot spot) concentrations of VOCs in groundwater and to prevent or limit VOC migration beyond the current OU-1B plume boundaries (stabilize the plumes);
- groundwater extraction using extraction wells located in the hot spot areas of the plumes and hydraulic containment wells located on the margins of each of the plumes;
- treatment of extracted groundwater and either discharge of the treated groundwater to a nearby storm drain or disposal by another method based on a reevaluation of disposal options to be conducted during the remedial design phase;
- excavation and off-site disposal of VOC-contaminated soil to reduce the amount of this material, which could potentially act as an ongoing source of residual contamination to groundwater;
- performance monitoring throughout the remedial action;
- confirmatory groundwater sampling at the end of the remedial action to confirm that VOC concentrations have met remediation goals;
- protection of the integrity of groundwater extraction wells and remediation equipment;
- prevention of inadvertent use of or exposure to contaminated groundwater; and
- allowing the Department of the Navy (DON), DON contractors, and regulatory personnel access to install, operate, and maintain remediation equipment and to monitor the remedial action.

Extracted groundwater will be pumped through a cartridge filtration system followed by two-stage granular activated carbon adsorption. When the activated carbon in a canister becomes saturated with VOCs and is no longer effective, it is replaced with new carbon. The saturated carbon is then returned to the manufacturer, where it is regenerated and the VOCs are destroyed. Contaminated soil that is excavated will be transported to a permitted off-site disposal facility. Clean fill will be used to backfill excavated areas.

The remedial action addresses the risk posed by VOC contamination (which has been characterized as the primary threat at these sites) by removing and permanently destroying the contaminants, thereby significantly reducing the toxicity, mobility, and volume of hazardous substances in soil and groundwater.

Institutional controls, in the form of lease restrictions (if the property is leased) or restrictive covenants (if the property is transferred by deed), will be used to protect the integrity of the groundwater extraction wells and remediation equipment. Institutional controls are also necessary to prevent inadvertent use of contaminated groundwater and to allow the DON, DON contractors, and regulatory personnel access to install, operate, and maintain equipment and to monitor the remedial action.

The proposed alternative in the Proposed Plan included thermal treatment and reuse of the soil for the soil disposal component. Since the Feasibility Study Report and Proposed Plan were issued, this approach has been determined to be infeasible, and off-site disposal has been included in the selected remedy. Section 12 provides the rationale for the change in the soil disposal component.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective. The selected remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies employing treatment that reduces toxicity, mobility, and/or volume as a principal element.

The effectiveness of the selected remedial action discussed in this ROD/RAP will be reviewed at a minimum of 5 years to assure that it continues to provide adequate protection of human health and the environment and is achieving remediation goals. Once remediation goals have been achieved, the 5-year review will no longer apply to this action because hazardous substances will not remain above human-health-based levels.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary:

- COCs and their respective concentrations (Section 5)
- baseline risk represented by the COCs (Section 7)
- remediation goals established for COCs and the basis for these goals (Section 8)
- how source materials constituting principal threats are addressed (Section 8)
- current and reasonably anticipated future land-use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD/RAP (Sections 6 and 7)

- estimated capital, annual operation and maintenance, and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (Section 10)
- key factors that led to selecting the remedy (Sections 8, 9, and 10)

Additional information can be found in the administrative record files for these sites.

Signature: _____ Date: 12/22/04

Mr. Jerry Dunaway
Base Realignment and Closure Environmental Coordinator
Former Marine Corps Air Station Tustin

Signature: _____ Date: 11/10/04

Mr. John E. Scandura, Chief
Southern California Operations
Office of Military Facilities
Department of Toxic Substances Control

Signature: _____ Date: November 4, 2004

Mr. Gerard Thibeault, Executive Officer
California Regional Water Quality Control Board Santa Ana Region

TABLE OF CONTENTS

Section Page

DECLARATION 1

ACRONYMS/ABBREVIATIONS ix

DECISION SUMMARY

1 SITE NAME, LOCATION, AND DESCRIPTION

1.1 Site Name 1-1
1.2 Site Location 1-1
1.3 Lead and Support Agencies 1-1
1.4 Site Description 1-5

2 SITE HISTORY AND INVESTIGATION ACTIVITIES

2.1 Site History 2-1
2.2 Investigation Activities 2-2
2.2.1 Soil and Groundwater Investigations 2-2
2.2.2 Feasibility Studies 2-8

3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

3.1 Restoration Advisory Board 3-1
3.2 Public Mailings 3-2
3.3 Community Participation for OU-1B 3-2

4 SCOPE AND ROLE OF OPERABLE UNIT

5 SITE CHARACTERISTICS

5.1 Regional Characteristics 5-1
5.1.1 Geology and Hydrogeology 5-1
5.1.2 Surface Water Hydrology 5-2
5.2 IRP-3, Paint Stripper Disposal Area 5-9
5.2.1 Site History 5-9
5.2.2 Site Investigations 5-11
5.2.2.1 Initial Assessment Study 5-11
5.2.2.2 Site Inspection 5-11

Section Page

5.2.2.3 Remedial Investigation 5-11
5.2.2.4 Post-RI Soil Sampling and Feasibility Study..... 5-13
5.2.2.5 Groundwater Monitoring 5-14

5.3 IRP-12, Drum Storage Area No. 2..... 5-25

5.3.1 Site History..... 5-25
5.3.2 Site Investigations 5-26

5.3.2.1 Initial Assessment Study..... 5-26
5.3.2.2 Site Inspection..... 5-26
5.3.2.3 Remedial Investigation 5-26
5.3.2.4 Post-RI Soil Sampling and Feasibility Study..... 5-36
5.3.2.5 Groundwater Monitoring 5-36

5.4 Exposure Pathways 5-41

5.5 Mass of TCE 5-42

6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

6.1 Land Uses..... 6-1

6.2 Groundwater Uses..... 6-2

6.3 Surface Water Uses..... 6-2

7 SUMMARY OF SITE RISKS

7.1 Baseline Human-Health Risk Assessment..... 7-1

7.2 Chemicals of Potential Concern..... 7-1

7.2.1 Soil Data and Chemicals of Potential Concern 7-6
7.2.2 Groundwater Data and Chemicals of Potential Concern..... 7-7

7.3 Exposure Assessment..... 7-8

7.3.1 Exposure Point Concentrations for COPCs in Soil..... 7-9
7.3.2 Exposure Point Concentrations for COPCs in Groundwater 7-9
7.3.3 Exposure Point Concentrations for COPCs in Air 7-9
7.3.4 Exposure Point Concentrations for Future Conditions 7-9
7.3.5 Exposure Assumptions..... 7-10

7.4 Toxicity Assessment 7-11

7.5 Risk Characterization..... 7-11

7.5.1 Estimated Risk Under Current Conditions..... 7-12
7.5.2 Estimated Risk Under Future Conditions..... 7-15

Section Page

7.6 Recommendations and Basis for Risk Management Decision 7-16

7.7 Evaluation of Future Risks..... 7-17

8 DESCRIPTION OF ALTERNATIVES

8.1 Chemicals of Concern and Remediation Goals 8-1

8.2 Development of Remedial Alternatives..... 8-4

8.2.1 Alternative 1: No Action 8-5
8.2.2 Alternative 2: Monitored Natural Attenuation 8-6
8.2.3 Alternative 3: Hydraulic Containment 8-7
8.2.4 Alternatives 4/4A: Aggressive Groundwater Extraction With Off-Site Soil Disposal/On-Site Soil Treatment 8-8
8.2.5 Alternative 5: Permeable Reaction Wall 8-9
8.2.6 Alternatives 6/6A: Vacuum-Enhanced Extraction With Off-Site Soil Disposal/On-Site Soil Treatment 8-9
8.2.7 Alternative 7: Hydraulic Containment With Hot Spot Removal 8-11

9 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

9.1 Threshold Criteria 9-3

9.1.1 Overall Protection of Human Health and the Environment 9-3
9.1.2 Compliance With Applicable or Relevant and Appropriate Requirements..... 9-4

9.2 Primary Balancing Criteria 9-5

9.2.1 Long-Term Effectiveness and Permanence..... 9-5
9.2.2 Reduction of Toxicity, Mobility, or Volume 9-8
9.2.3 Short-Term Effectiveness..... 9-9
9.2.4 Implementability 9-12
9.2.5 Cost..... 9-12

9.3 Modifying Criteria 9-14

9.3.1 State Acceptance 9-14
9.3.2 Community Acceptance 9-14

10 SELECTED REMEDY

10.1 Soil Hot Spot Excavation..... 10-1

10.2 Groundwater Extraction..... 10-2

10.3 Performance Monitoring..... 10-8

10.4 Institutional Controls 10-12

Section Page

10.5 Periodic Reviews 10-18

10.6 Operation and Maintenance Plan 10-18

10.7 Extraction Well Shutdown Criteria 10-21

10.7.1 Hot Spot Extraction Wells 10-21
10.7.2 Hydraulic Containment Wells 10-21

10.8 Rationale for Remedy Selection 10-22

11 STATUTORY DETERMINATIONS

11.1 Protection of Human Health and the Environment 11-1

11.2 Compliance With ARARs 11-1

11.2.1 Chemical-Specific ARARs 11-14

11.2.1.1 Groundwater Classification 11-15
11.2.1.2 Safe Drinking Water Act 11-15
11.2.1.3 RCRA Groundwater Protection Standards 11-16
11.2.1.4 Water Quality Control Plan (Surface Water) 11-16
11.2.1.5 National Toxics Rule and California Toxics Rule 11-16
11.2.1.6 Inland Surface Waters Plan 11-17
11.2.1.7 National Pollutant Discharge Elimination System Permit 11-17
11.2.1.8 State Water Resources Control Board Resolutions 92-49 and 68-16 11-18
11.2.1.9 Remediation Goals 11-20

11.2.2 Location-Specific ARARs 11-20
11.2.3 Action-Specific ARARs 11-22

11.2.3.1 Federal 11-22
11.2.3.2 State 11-24

11.3 Cost-Effectiveness 11-27

11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable 11-28

11.5 Preference for Treatment as a Principal Element 11-28

12 DOCUMENTATION OF SIGNIFICANT CHANGES

13 REFERENCES

RESPONSIVENESS SUMMARY

ATTACHMENTS

Attachment

A ADMINISTRATIVE RECORD FOR OU-1B

B TRANSCRIPT FROM PUBLIC MEETING

C REMEDIAL ACTION PLAN REQUIREMENTS

FIGURES

Figure		Page
1-1	Former MCAS Tustin Location Map	1-2
1-2	Location of IRP-3 and IRP-12	1-3
5-1	Groundwater Contour Map (Regional Aquifer)	5-3
5-2	Former MCAS Tustin Conceptual Hydrogeological Model	5-5
5-3	Former MCAS Tustin Topography, Surface Drainage, Wetlands, and Former Agricultural Areas	5-7
5-4	IRP-3 and Nearby AOCs	5-10
5-5	IRP-3 TCE Plumes in Groundwater in the First WBZ, Based on RI Data	5-15
5-6	IRP-3 TCE Plumes in Groundwater in the Second WBZ, Based on RI Data	5-17
5-7	Vertical Extent of VOC Plumes in Groundwater at IRP-3 and IRP-12, Based on RI Data	5-19
5-8	Extent of TCE Soil Contamination > 400 μg/kg at IRP-3	5-21
5-9	IRP-3 Groundwater Monitoring Results for the First WBZ in 2001	5-23
5-10	IRP-3 Groundwater Monitoring Results for the Second WBZ in 2001	5-27
5-11	IRP-12 and Nearby AOCs	5-29
5-12	IRP-12 TCE Plumes in Groundwater in the First WBZ, Based on RI Data	5-31

Figure Page

5-13 IRP-12 TCE Plumes in Groundwater in the Second WBZ, Based on RI Data 5-33

5-14 Extent of TCE Soil Contamination > 400 μg/kg at IRP-12 5-37

5-15 IRP-12 Groundwater Monitoring Results for the First WBZ in 2001 5-39

5-16 Potential Routes of Exposure, IRP-3 and IRP-12 5-43

6-1 Proposed Future Land Use at Former MCAS Tustin..... 6-3

9-1 Maximum TCE Concentrations in First WBZ at IRP-12 9-6

9-2 Maximum TCE Concentrations in Second WBZ at IRP-12 9-6

9-3 Maximum TCE Concentrations in First WBZ at IRP-3 9-7

9-4 Maximum TCE Concentrations in Second WBZ at IRP-3 9-7

9-5 Residual TCE Mass at IRP-3 After 30 Years 9-10

9-6 Residual TCE Mass at IRP-12 After 30 Years 9-10

10-1 Alternative 7: Extent of TCE Soil Contamination > 400 μg/kg and Excavation Areas at IRP-3..... 10-3

10-2 Alternative 7: Extent of TCE Soil Contamination > 400 μg/kg and Excavation Area at IRP-12 10-5

10-3 Volume of Soil to Be Excavated Under Alternative 7..... 10-7

10-4 Alternative 7: Hydraulic Containment With Hot Spot Source Removal, Site Layout 10-9

10-5 Alternative 7: Hydraulic Containment With Hot Spot Source Removal, Simulated TCE Concentrations in the First WBZ at IRP-3 and IRP-12 10-13

10-6 Alternative 7: Hydraulic Containment With Hot Spot Source Removal, Simulated TCE Concentrations in the Second WBZ at IRP-3 and IRP-12 10-15

10-7 Approximate Extent of Contaminated Soil and Groundwater Within Scope of OU-1B Feasibility Study..... 10-19

TABLES

Table		Page
2-1	Summary of Environmental Activities at Former MCAS Tustin	2-3
3-1	Summary of Former MCAS Tustin Updates, Fact Sheets, and Proposed Plans	3-3
5-1	Primary Chemicals of Potential Concern Reported in IRP-3 Groundwater	5-14
5-2	Primary Chemicals of Potential Concern Reported in IRP-12 Groundwater	5-36
5-3	Estimated Plume Dimensions, Maximum Reported TCE Concentrations, and Estimated TCE Mass in Groundwater	5-45
7-1	Chemicals of Potential Concern at Former MCAS Tustin IRP-3	7-2
7-2	Chemicals of Potential Concern at Former MCAS Tustin IRP-3 TOW-X3 and TOW-X4	7-4
7-3	Chemicals of Potential Concern at Former MCAS Tustin IRP-12	7-5
7-4	Chemicals of Potential Concern at Former MCAS Tustin IRP-12 STD-1 and MDA-07	7-7
7-5	Summary of Lifetime Cancer Risk and Hazard Index for Current Conditions Under a Residential Scenario	7-13
7-6	Summary of Lifetime Cancer Risk and Hazard Index for Future Conditions Under a Residential Scenario	7-14
8-1	Chemicals of Concern in OU-1B Groundwater	8-2
8-2	Remediation Goals for OU-1B Groundwater	8-3
9-1	Summary of Comparative Analysis of OU-1B Remedial Alternatives	9-2
9-2	Summary of Cost Estimates for OU-1B Remedial Alternatives	9-13
10-1	Extraction Well Details for Hydraulic Containment With Hot Spot Removal	10-11
10-2	Performance Monitoring for Hydraulic Containment With Hot Spot Removal	10-17
10-3	Summary of Cost Estimate for Alternative 7	10-24
11-1	Chemical-Specific ARARs for Selected Remedy	11-2

Table Page

11-2 Location-Specific ARARs for Selected Remedy 11-7

11-3 Action-Specific ARARs for Selected Remedy 11-8

ACRONYMS/ABBREVIATIONS

ANL	Argonne National Laboratory
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
BCT	BRAC Cleanup Team
BEI	Bechtel Environmental, Inc.
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
Cal. Civ. Code	*California Civil Code*
Cal. Code Regs.	*California Code of Regulations*
Cal/EPA	California Environmental Protection Agency
Cal. Health & Safety Code	*California Health and Safety Code*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
C.F.R.	*Code of Federal Regulations*
ch.	chapter
COC	chemical of concern
COPC	chemical of potential concern
CTR	California Toxics Rule
CWA	Clean Water Act
DCA	dichloroethane
DCE	dichloroethene
div.	division
DON	Department of the Navy
DTSC	(Cal/EPA) Department of Toxic Substances Control
EIR	environmental impact report
EIS	environmental impact statement
EPC	exposure point concentration
ESI	expanded site inspection
Fed. Reg.	*Federal Register*
FFSRA	Federal Facility Site Remediation Agreement
FS	feasibility study
GAC	granular activated carbon
gpm	gallons per minute

HHRA	human-health risk assessment
HI	hazard index
HQ	hazard quotient
HUD	Department of Housing and Urban Development
IAS	initial assessment study
IDL	instrument detection limit
IRP	Installation Restoration Program
ISWP	Inland Surface Waters Plan
JEG	Jacobs Engineering Group Inc.
JMM	James M. Montgomery Engineers, Inc.
LRA	Local Redevelopment Authority
LTA	lighter than air
LUC	land-use control
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
MCAF	Marine Corps Air Facility
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOA	memorandum of agreement
MPE	multiphase extraction
MSL	mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants
National Register	National Register of Historic Places
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
O&M	operation and maintenance
OMP	operation and maintenance plan
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
O/W	oil/water
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl

PRG	preliminary remediation goal
PRMP	paleontological resources management plan
RAB	restoration advisory board
RAO	remedial action objective
RAP	remedial action plan
RCRA	Resource Conservation and Recovery Act
Res.	Resolution
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
RWQCB	(California) Regional Water Quality Control Board (Santa Ana Region)
§	section
SARA	Superfund Amendments and Reauthorization Act of 1986
SCAQMD	South Coast Air Quality Management District
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SI	site inspection
SV	site visit
SVE	soil vapor extraction
SWDIV	Southwest Division Naval Facilities Engineering Command
SWRCB	(California) State Water Resources Control Board
TCA	trichloroethane
TCE	trichloroethene
TCRA	time-critical removal action
TDS	total dissolved solids
TDU	thermal desorption unit
tit.	title
TPH	total petroleum hydrocarbons
UCI	University of California, Irvine
UCL	upper confidence limit
USACE	United States Army Corps of Engineers
U.S.C	*United States Code*
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USMC	United States Marine Corps
UST	underground storage tank

VC	vinyl chloride
VEE	vacuum-enhanced extraction
VOC	volatile organic compound
WBZ	water-bearing zone
WQCP	water quality control plan
WQO	water quality objective

DECISION SUMMARY

Section 1
SITE NAME, LOCATION, AND DESCRIPTION

This Record of Decision (ROD)/Remedial Action Plan (RAP) presents the selected remedial action for groundwater at Operable Unit (OU)-1B Installation Restoration Program (IRP) Sites IRP-3 and IRP-12 at Former Marine Corps Air Station (MCAS) Tustin in Orange County, California. The National Superfund Database Identification Number for this former station is CA9170090022. This ROD/RAP satisfies the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) requirements for a RAP for hazardous substance release sites pursuant to *California Health and Safety Code* (Cal. Health & Safety Code) Section (§) 25356.1.

This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for these sites is based on information contained in the administrative record. The site-specific administrative record index for OU-1B is provided in Attachment A.

1.1 SITE NAME

This decision document addresses groundwater at two sites at Former MCAS Tustin: IRP-3, Paint Stripper Disposal Area, and IRP-12, Drum Storage Area No. 2. Groundwater is the only medium that presents a risk to human health at these sites. Soil, however, is also being addressed as part of the groundwater remedy because of the potential for residual contaminants in soil to act as a continuing source of groundwater contamination.

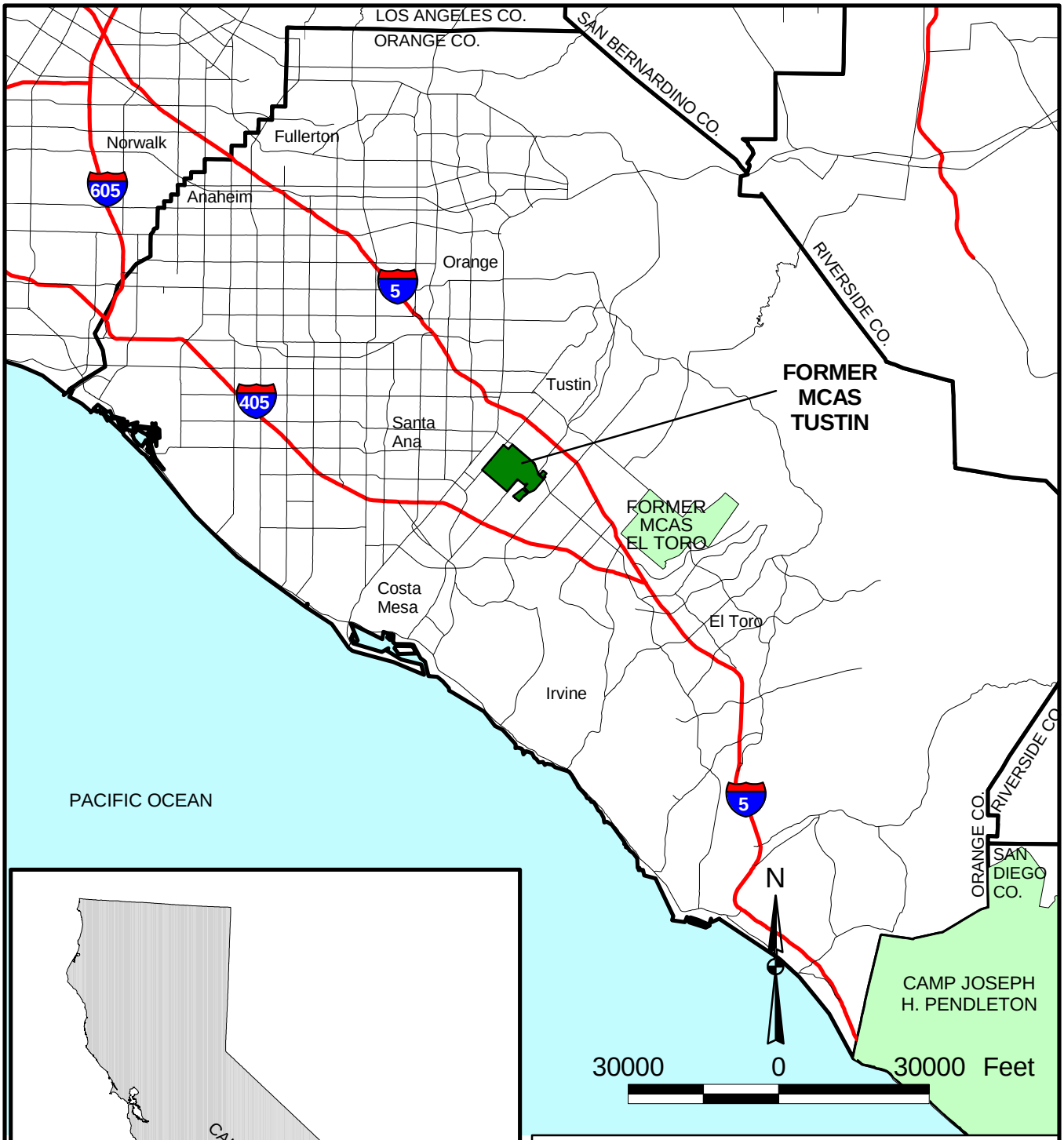
Groundwater contamination at IRP-3 and IRP-12 occurs in separate volatile organic compound (VOC) plumes. Groundwater at both sites is being addressed in a single ROD/RAP because the sites have a similar type of contamination that can be addressed using the same remedy.

1.2 SITE LOCATION

Former MCAS Tustin is located in southern California in Orange County, approximately 40 miles south of downtown Los Angeles and more than 100 miles north of the California-Mexico border (Figure 1-1). IRP-3 and IRP-12 are located in the approximate center of the Former MCAS Tustin property (Figure 1-2).

1.3 LEAD AND SUPPORT AGENCIES

Former MCAS Tustin is not listed on the National Priorities List. A Federal Facility Site Remediation Agreement (FFSRA) between the Department of the Navy (DON) and the DTSC was signed for Former MCAS Tustin on 18 August 1999. The FFSRA defines the DON's corrective action and response obligations under the Resource Conservation and Recovery Act (RCRA) and CERCLA.



Record of Decision/Remedial Action Plan

Figure 1-1

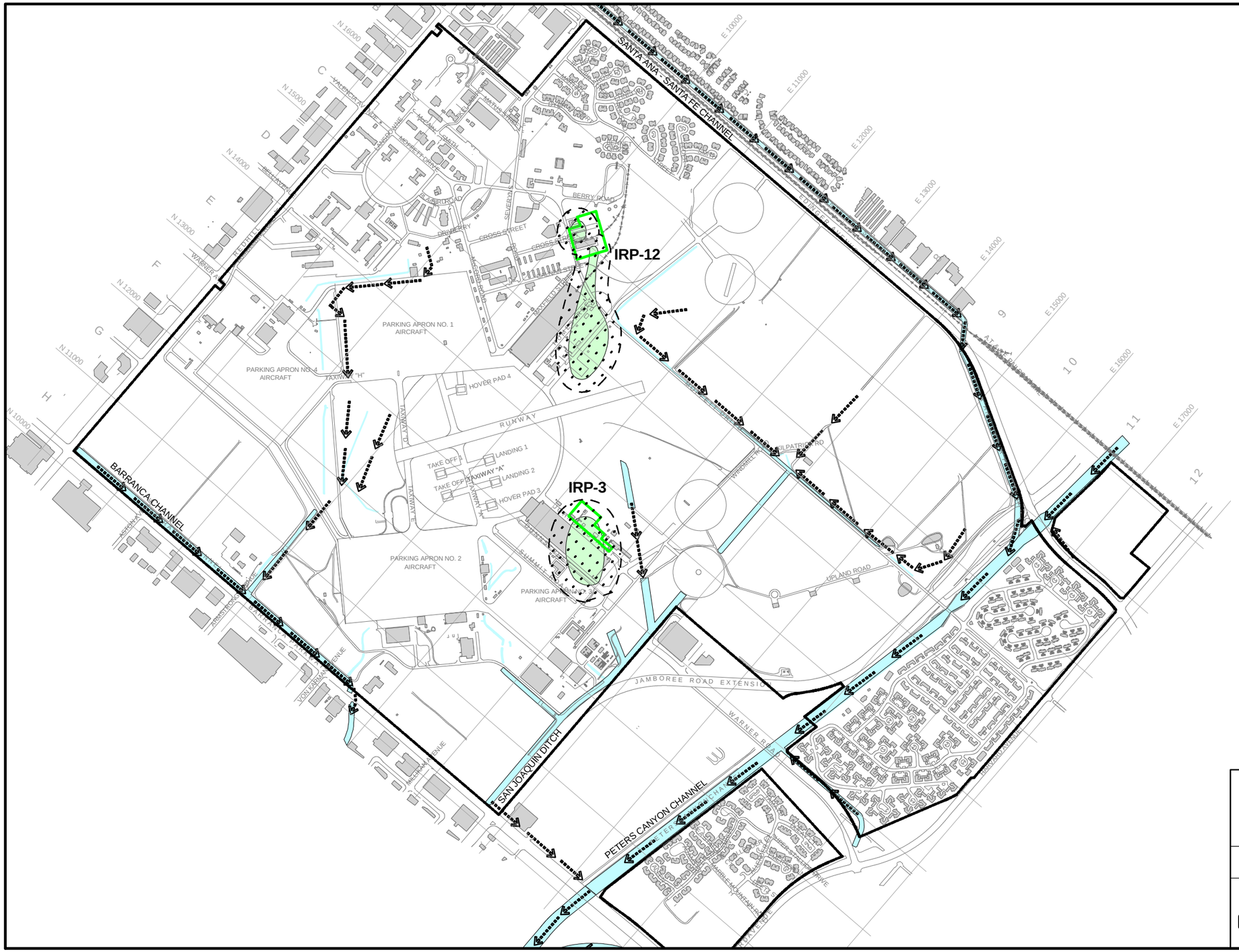
Former MCAS Tustin Location Map

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/21/02
File No.: 035R8857
Job No.: 23818-035
Rev No.: A



LEGEND

- FORMER MCAS TUSTIN BOUNDARY
- ROAD OR PAVED AREA
- DRAINAGE DITCH
- RAILROAD
- SURFACE CHANNEL FLOW DIRECTION
- SURFACE CHANNEL
- BUILDING OR STRUCTURE
- IRP SITE
- APPROXIMATE PLUME BOUNDARIES, BASED ON QUARTERLY DATA OBTAINED DURING 2001 MONITORING
- PROPOSED AREA OF INSTITUTIONAL CONTROLS (INCLUDING GROUNDWATER EXTRACTION)

NOTE:

EXTENT OF CONTAMINANT PLUMES BASED ON 2001 MONITORING REPORTS

SOURCES:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990, REVISED BY BECHTEL TO REFLECT CURRENT CONDITIONS, NOVEMBER 1997

N

1200 0 1200 Feet

Record of Decision/Remedial Action Plan

Figure 1-2

Location of IRP-3 and IRP-12

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/25/04
File No.: 035L11370
Job No.: 23818-035
Rev No.: C

Since 1993 the Base Realignment and Closure (BRAC) Cleanup Team (BCT) has coordinated cleanup and closure activities at Former MCAS Tustin. The BCT consists of representatives from the DON, the United States Environmental Protection Agency (U.S. EPA), the Regional Water Quality Control Board (RWQCB) Santa Ana Region, and the DTSC. The DON is the lead federal agency for environmental restoration at Former MCAS Tustin, and the DTSC is the lead regulatory agency providing oversight.

1.4 SITE DESCRIPTION

During previous active operations, the mission of MCAS Tustin was to maintain and operate facilities and to provide services and materials to support operations of a Marine wing, or units thereof, and other activities and units designated by the commandant of the United States Marine Corps (USMC) in conjunction with the Chief of Naval Operations.

To support this mission, operations at the station were expanded over the years to include more than 200 structures and various facilities, including a 3,000-foot-long runway, aircraft parking aprons, and numerous aircraft maintenance shops. Prior to its closure, Former MCAS Tustin occupied approximately 1,595 acres of land, of which approximately 212 acres was used for station housing and 1,383 acres was used for nonhousing purposes. All of the property at the station is developed, except for approximately 674 acres that was previously used for commercial farming. The land around Former MCAS Tustin has residential, commercial/business, industrial, and recreational uses.

This page left blank intentionally

Section 2
SITE HISTORY AND INVESTIGATION ACTIVITIES

This section provides an overview of the history of Former MCAS Tustin and summarizes the investigation activities that have taken place at the station.

2.1 SITE HISTORY

MCAS Tustin was initially established during World War II as a Navy lighter-than-air (LTA) facility to support air patrols off the southern California coast. The station was commissioned in the fall of 1942, upon completion of the construction of two blimp hangars (currently national historic landmarks), and served as an LTA facility until 1949, when it was decommissioned. The station was then used as an outlying field for other military operations in the area, primarily those of MCAS El Toro.

In 1951, MCAS Tustin was reactivated to support the Korean Conflict and was used solely for helicopter operations. The station was officially designated the "Santa Ana Marine Corps Air Facility (MCAF)." As the station expanded its operations, the name was changed on 01 September 1969 to "MCAS (Helicopter[H]) Santa Ana." In 1978, the station name was changed to "MCAS (H) Tustin" to reflect its annexation by the city of Tustin. In 1986, the station was renamed "MCAS Tustin," and in October 1997, the station name was changed to "MCAF Tustin." In 2000, the "MCAF Tustin" designation was dropped, and use of "MCAS Tustin" was officially resumed.

Former MCAS Tustin was initially included on the BRAC II list in 1991; further realignment and complete closure was ordered for the station under the BRAC III list (1993). To facilitate the closure and environmental restoration processes, the DON organized a BCT in 1993. The BCT is composed of representatives of the DON, U.S. EPA, and DTSC, with support from the RWQCB. The BCT has been collectively managing and coordinating cleanup and closure activities at Former MCAS Tustin since its inception.

MCAS Tustin was closed on 02 July 1999. An FFSRA between the DON and DTSC was signed in August 1999. This legal agreement defines the DON's corrective action and response action obligations under CERCLA and RCRA for 16 IRP sites and 288 areas of concern (AOCs) that have been identified at Former MCAS Tustin. A site management plan is used to establish schedules and deadlines for remaining environmental restoration activities and reports (BNI 2001a).

On 14 May 2002, the DON transferred all Former MCAS Tustin property under various conveyance documents to various public agencies. The city of Tustin, recognized as the Local Redevelopment Authority (LRA), received the majority of station property. Carve-out areas delineated within the transferred property were transferred via separate lease documents so that remediation could continue as these areas are redeveloped (Figure 6-1). Two of these carve-out areas, CO-6 and CO-5, surround groundwater plumes at IRP-3 and IRP-12, respectively. The aforementioned lease documents are used to protect the integrity of groundwater extraction wells and remediation equipment, prevent inadvertent use of or exposure to contaminated groundwater, and allow the DON,

DON contractors, and regulatory personnel access to install, operate, and maintain equipment and to monitor the remedial action.

2.2 INVESTIGATION ACTIVITIES

There are no enforcement activities related to the OU-1B IRP sites. Environmental investigation and remediation activities associated with OU-1B are implemented under a stationwide environmental program. The purpose of this program is to identify, investigate, assess, characterize, and clean up or control releases of hazardous substances, as well as to cost-effectively reduce the risk to human health and the environment from past waste disposal operations and hazardous material spills at Navy/Marine Corps stations. The program is administered in accordance with:

- CERCLA, as amended by SARA, and the Community Environmental Response Facilitation Act;
- RCRA;
- National Environmental Policy Act; and
- Cal. Health & Safety Code.

The following subsections describe investigations, studies, and removal actions conducted at IRP-3 and IRP-12. Table 2-1 summarizes investigation activities conducted at Former MCAS Tustin.

2.2.1 Soil and Groundwater Investigations

During 1983 and 1984, the DON performed an initial assessment study (IAS) to locate potentially contaminated sites at MCAS Tustin (Brown and Caldwell 1985). The IAS report identified 14 potentially contaminated sites (IRP-1 through IRP-14) based on record searches and employee interviews. The report recommended sampling locations and analytical parameters to confirm the suspected contamination at the sites.

Following completion of the IAS, the Marine Corps contracted for a review of the IAS to produce the Site Inspection Plan of Action (JMM 1988a). The plan recommended nine IRP sites for study and amended the site sampling plans proposed in the IAS Report.

IRP-15 was identified in the Site Inspection Plan of Action (JMM 1988a), which recommended nine IRP sites (including IRP-15) for study and amended the site sampling plans proposed in the IAS Report. IRP-16 was identified in the Fuel Farm Area Remedial Investigation (JMM 1988b).

Site inspections (SIs) were conducted from 1987 to 1988 (JMM 1988b) and in 1992 (JEG 1993). Based on the results of the SIs, IRP sites were further evaluated through remedial investigations (RIs) and/or expanded site inspections (ESIs). IRP-3 and IRP-12 were included in the OU-1/OU-2 RI.

Table 2-1
Summary of Environmental Activities at Former MCAS Tustin

Date	Investigation/Activity	Objective	Summary of Findings
1983–1984	Initial assessment study	Identify and assess sites posing a potential threat to human health or to the environment due to contamination from past hazardous materials operations.	Identified all sites studied as potentially contaminated. Recommended IRP-3 and IRP-12 for a confirmation study (Brown and Caldwell 1985).
1987–1988	Former Fuel Farm investigation	Identify COPCs present in groundwater at IRP-16.	Three monitoring wells were installed and sampled. Several VOCs, including TCA, DCA, and toluene, were reported in groundwater (JMM 1988b).
1990–1993	Site inspection	Evaluate nine of the sites (IRP-2, IRP-3, IRP-5, IRP-7, IRP-8, IRP-9, IRP-12, IRP-13, and IRP-15) identified during the initial assessment study.	Further evaluation of IRP-2 and IRP-8 was recommended. An RI/FS was recommended for IRP-3, IRP-5, IRP-7, IRP-9, IRP-12, and IRP-13. No further action was recommended at IRP-15. Removal actions were not recommended for any sites (JEG 1993).
1992	Former Fuel Farm investigation	Identify COPCs present in soil and groundwater at IRP-16.	No VOCs were reported in groundwater. High concentrations of TRPH were reported in soil (JEG 1992).
1994–1995	Expanded site characterization	Determine background levels of COPCs in groundwater and establish baseline geochemistry of MCAS Tustin.	Installed more than 20 wells and drilled more than 30 HydroPunch® borings to determine baseline geochemistry (ANL 1994, 1995).
1994–1995	Expanded site inspection	Evaluate nine IRP/AOC sites (IRP-2, IRP-6, IRP-8, IRP-9, IRP-11, IRP-15, MMS-03, MMS-04, and MMS-05), including soil and groundwater sampling, fate and transport analysis, baseline risk assessment, and screening risk assessment associated with future impacts on groundwater (due to leaching of COPCs in soil).	No further action was recommended for soil at IRP-8, IRP-11, IRP-15, MMS-03, MMS-04, and MMS-05. NTCRA was recommended for soil at IRP-2 and IRP-9. Further evaluation was recommended for soil at IRP-6. No further action was recommended for groundwater at IRP-9, IRP-15, and MMS-03. IRP-2, IRP-6, IRP-8, IRP-11, and MMS-04 and MMS-05 were recommended for further evaluation in the RI stationwide groundwater program, based on the risk assessment and evaluation of COPCs in groundwater (BNI 1996a).

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1995–1997	OU-1/OU-2 RI	Evaluate seven sites (IRP-3, IRP-5, IRP-12, IRP-13E, IRP-13W, IRP-13S, and IRP-16). Also perform stationwide groundwater study to evaluate impact of sources of contamination at 29 areas of potential concern identified under the RI, ESI, and RFA programs.	No further action was recommended for 23 of the 29 areas of potential concern (IRP-2, IRP-5, IRP-6, IRP-8, IRP-11, IRP-13E, IRP-13W, and IRP-16 and AOCs AD-04, AS-06, AS-08, AST-02, AST-04, DSS-01, DSS-02, MDA-02, MDA-04, MDA-07, MMS-01, MWA-03, MMS-04, MMS-05, and ST-67). An FS was recommended for IRP-3 (which includes TOW-X3 and TOW-X4), IRP-12, and IRP-13S (BNI 1997a).
1996	OU-3 RI/FS	Assess nature and extent of contamination at IRP-1 and evaluate remedial action.	Further action was recommended for IRP-1). Recommended remedial action is containment of waste left in place using an existing cover and containment wall for contaminated groundwater (BNI 1996b,c).
1996	Removal action at IRP-16	Excavate and treat petroleum-contaminated soil under a petroleum corrective action.	Approximately 15,000 tons of soil was excavated, of which 6,000 tons of contaminated soil was treated and used to backfill and restore the site. Activities were completed in August 1996 (OHM 1997).
1997	Removal action at IRP-2	Excavate and treat PAH-contaminated soil.	Approximately 569 tons of PAH-contaminated soil was excavated and treated. Activities were completed in June 1997 (BNI 1996d, OHM 1998).
1997–1999	Removal action at IRP-9A and IRP-9B	Excavate and treat PAH-contaminated soil.	Approximately 701 tons and 6,837 tons of soil was excavated and treated from IRP-9A and IRP-9B, respectively, for a total of 7,538 tons. Activities were completed at IRP-9A in September 1997 and IRP-9B in December 1998 (BNI 1996d, OHM 2000a,b).

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1997	Removal action at IRP-13W	Excavate and treat TPH- and PAH-contaminated soil.	Approximately 4,000 tons of soil was removed, and site restoration activities (paving and fencing) were performed as part of a NTCRA at IRP-13W. Activities were completed in November 1997. Following this RA, IRP-13W was recommended for NFA in the OU-1/OU-2 RI.
1997	Post-RI field program at IRP-12	Verify the distribution of TCE in soil at IRP-12.	Confirmed the data interpretations presented in the RI Report: additional TCE source areas were not identified at IRP-12, and the boundary of TCE-contaminated soil at IRP-12 was not modified (BNI 1998a).
1998	VEE pilot-scale tests for OU-1	Evaluate the effectiveness of a VEE system for groundwater extraction and treatment at OU-1.	VEE was demonstrated to produce a slight increase in the effectiveness of TCE mass removal and to achieve a slightly wider radius of influence in comparison with conventional extraction technology. Based on this finding, it was recommended that VEE be considered as an alternative in the OU-1 FS (BNI 1999a).
1999	OU-1 FS	Evaluate remedial alternatives for IRP-3, IRP-12, and IRP-13S.	Six remedial alternatives were evaluated: no action, natural attenuation, hydraulic containment, groundwater extraction, iron wall, and vacuum-enhanced groundwater extraction (BNI 1999b).
1999	BCT meeting 23 September 1999	Modify recommended action for six IRP sites and six AOCs.	Recommended a focused FS for IRP-5, IRP-6, IRP-8, IRP-11, IRP-13W, and IRP-16 and AOCs DSS-01, DSS-02, MDA-02, MMS-04, MMS-05, and ST-67 due to the presence of contaminants in shallow groundwater at concentrations exceeding regulatory limits. These sites/AOCs are now included in OU-4.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
1999	Removal of TOW-X3 and TOW-X4	Remove O/W separators and TPH/TCE-contaminated soil.	Based on confirmation soil sampling results, TOW-X3 and TOW-X4 are considered potential sources of IRP-3 groundwater contamination. It was recommended that closure for these AOCs be conducted under the CERCLA program (IT 2000, OHM 2001).
1999–2001	Stationwide groundwater monitoring at IRP-1, -3, -6, -12, and -13S, mingled plumes area, and UST Site 222	Evaluate groundwater contamination and plume movement through RIs and FSs, remedial design, and remedial action phases for various OUs at MCAS Tustin.	Groundwater monitoring results supported interpretations of stationwide groundwater flow patterns, groundwater chemistry, and contaminant distributions developed from monitoring conducted during the RI and subsequent interim monitoring (BNI 2000a, 2001b; BEI 2003a).
2000	ROD/RAP for OU-2	Select remedy for OU-2 sites and AOCs.	The selected remedy for the three IRP sites and nine AOCs that comprise OU-2 was no action.
2001	ROD/RAP for OU-3	Select remedy for IRP-1.	Selected remedial action consists of institutional controls; groundwater, surface water, and landfill gas monitoring; and inspection and maintenance of the existing containment wall and cover, French drain systems, monitoring wells, and security features.
2001–2002	TCRA at IRP-13S	Coordinate with petroleum corrective action being conducted for MTBE plume migration at adjacent UST Site 222.	In December 2001, installation of a groundwater extraction and treatment system including seven extraction wells and ten monitoring wells was completed at IRP-13S. The purpose of the treatment system was to hydraulically contain VOC contamination within the current plume boundary at IRP-13S and prevent or minimize crossgradient migration of contaminants from IRP-13S that might occur as a result of a petroleum corrective action being conducted at adjacent UST Site 222. Interim removal at IRP-13S began in January 2002, and performance monitoring is being used to evaluate the effectiveness of the removal action.

(table continues)

Table 2-1 (continued)

Date	Investigation/Activity	Objective	Summary of Findings
2001–2002	OU-1B FS	Evaluate remedial alternatives for IRP-3 and IRP-12.	Nine remedial alternatives were evaluated: no action, monitored natural attenuation, hydraulic containment, aggressive groundwater extraction with off-site soil disposal, aggressive groundwater extraction with on-site soil treatment, permeable iron wall, VEE with off-site disposal, VEE with on-site soil treatment, and hydraulic containment with hot spot removal (BNI 2002).
2003–2004	OU-4 Technical Memorandum	Shallow groundwater investigation of selected sites.	Recommended IRP-5N, IRP-5S(b), IRP-8, IRP-11 (Area A), IRP-16, and MMS-04 (Areas A and C) for NFA; these sites became OU-4A. Recommended IRP-5S(a), IRP-6, IRP-11 (Area B), IRP-13W, MMS-04 (Area B), and Mingled Plumes Area for further action; these sites became OU-4B.
2004	OU-4A NFA ROD/RAP	Select NFA for OU-4A sites.	Issued draft NFA ROD/RAP to present the selected remedy of no action for the OU-4A sites.
2004	OU-4B FFS	Evaluate remedial alternatives for OU-4B.	In preparation.

Acronyms/Abbreviations:
AOC – area of concern
AST – aboveground storage tank
BCT – Base Realignment and Closure Cleanup Team
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
COPC – chemical of potential concern
DCA – dichloroethane
ESI – expanded site inspection
FFS – focused feasibility study
FS – feasibility study
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station
MDA – minimum detectable activity
MMS – miscellaneous major spill
MTBE – methyl tert-butyl ether
NFA – no further action
NTCRA – non-time-critical removal action
O/W – oil/water
OU – operable unit
PAH – polynuclear aromatic hydrocarbon
RA – removal action
RAP – remedial action plan

(table continues)

Table 2-1 (continued)

Acronyms/Abbreviations: (continued)
RCRA – Resource Conservation and Recovery Act
RFA – RCRA facility assessment
RI – remedial investigation
ROD – record of decision
TCA – trichloroethane
TCE – trichloroethene
TCRA – time-critical removal action
TPH – total petroleum hydrocarbons
TRPH – total recoverable petroleum hydrocarbons
UST – underground storage tank
VEE – vacuum-enhanced extraction
VOC – volatile organic compound

The OU-1/OU-2 RI was conducted from 1995 through 1997. It consisted of a field investigation followed by an evaluation of the nature and extent of contamination, a fate and transport analysis, and a baseline risk assessment. In addition, the RI included a stationwide groundwater study to evaluate the impact of chemicals of potential concern (COPCs) present in soil and groundwater at several sites and AOCs. In 1997, a post-RI field program was conducted at IRP-12 to verify the trichloroethene (TCE) distribution in soil at this site (BNI 1998a).

In 1999, oil/water (O/W) separators were removed and soil was excavated at two AOCs (TOW-X3 and TOW-X4) associated with IRP-3.

Ongoing interim groundwater monitoring has been conducted at Former MCAS Tustin since 1997 to evaluate the stationwide hydrogeologic setting and changes in contaminant distribution at each of the sites originally investigated during the RI (BNI 1997a).

2.2.2 Feasibility Studies

A draft OU-1 Feasibility Study (FS) Report was issued in 1999 (BNI 1999b). This report identified and screened six remedial alternatives for IRP-3, IRP-12, and IRP-13S. In 2001, while the FS Report was being finalized, a petroleum corrective action was proposed for a methyl tert-butyl ether (MTBE) plume associated with underground storage tank (UST) Site 222. Because groundwater extraction proposed as part of the MTBE removal action had the potential to cause westward or crossgradient migration of the IRP-13S groundwater plume, OU-1 was separated into OU-1A (IRP-13S) and OU-1B (IRP-3 and IRP-12). This allowed the DON to coordinate the petroleum corrective action at UST Site 222 with a time-critical removal action (TCRA) at IRP-13S while proceeding to develop a separate remedy for IRP-3 and IRP-12.

In January 2002, the final FS Report was issued for OU-1B that identified and screened nine potential remedial alternatives developed for IRP-3 and IRP-12 (BNI 2002). An FS Report for OU-1A was finalized in August 2003 (BEI 2003b).

Section 3
HIGHLIGHTS OF COMMUNITY PARTICIPATION

A community relations plan was developed to document concerns identified during community interviews and to provide a detailed description of community relations activities planned in response to information received from the community. Initially prepared in 1991, the plan was revised in 1993 and again in 1995 and was updated in 2002 to incorporate the most recent assessment of community issues, concerns, and informational needs about the ongoing environmental investigation and remediation program at Former MCAS Tustin (BEI 2002).

The community relations program includes specific activities for obtaining community input and keeping the community informed. These activities include conducting interviews, holding public meetings, issuing fact sheets to provide updates on current investigations and remediation activities, maintaining an information repository where the public can access technical documents and program information, disseminating information to local and regional media, and making presentations to local groups.

Community members and local government agencies have also participated in planning for the reuse of Former MCAS Tustin through development of the MCAS Tustin Specific Plan as adopted by the Tustin City Council on 03 February 2003.

3.1 RESTORATION ADVISORY BOARD

In 1994, establishment of the Restoration Advisory Board (RAB) gave individuals from local communities a channel for increasingly significant participation in the environmental restoration process. Original membership on the board, which was solicited by the USMC and the DON through paid newspaper notices, included business and homeowners' association representatives, locally elected officials and local regulatory agencies, and interested residents.

Currently, the RAB is composed of 20 registered members: 11 community members or private citizens and 9 representatives from various government agencies. RAB meetings are held every 2 months and are scheduled in the evenings after normal working hours (7:00 to 9:00 p.m.) at either of two locations, depending upon availability: the Clifton Miller Center at the city of Tustin City Hall; or the Tustin Senior Center, 200 South C Street, in downtown Tustin. The meetings are open to the public and include representatives from the USMC and the DON, city and county offices, and regulatory agencies. By sharing information from the regular meetings with the groups they represent, RAB members help increase awareness and progress of the IRP process; in addition, members of the public can contact RAB members to obtain information or express concerns to be discussed at subsequent meetings.

Copies of the RAB meeting minutes are available at the Former MCAS Tustin information repository, located at the University of California, Irvine (UCI) Main Library, Government Publication Department. RAB meeting minutes are also located on the DON's Southwest Division Naval Facilities Engineering Command (SWDIV) environmental website: http://www.efdsw.navfac.navy.mil/environmental/Tustin.htm.

VOC-contaminated soil and groundwater at OU-1B have been a key topic for presentations and discussions at several RAB meetings. Early presentations focused on

the RI and provided background and educational information to RAB members on the extent of groundwater contamination. Subsequent meetings concentrated on the remedial alternatives under consideration for the sites.

3.2 PUBLIC MAILINGS

Public mailings, including information updates, fact sheets, and proposed plans/draft RAPs, have been used to broaden the dissemination of information within the local community. The first information update announcing the IRP process at Former MCAS Tustin was delivered in February 1993 to MCAS Tustin area residents and mailed to city, state, and federal officials; agencies; local groups; and individuals identified in the Community Relations Plan. Subsequent fact sheets were mailed to the community as significant remediation milestones were reached (Table 3-1). These publications included information concerning the status of site investigations, the upcoming remedy selection process, ways for the public to participate in the investigation and remediation of Former MCAS Tustin, and the availability of the MCAS Tustin administrative record.

Proposed plans or proposed plans/draft RAPs are summaries of remedial alternatives proposed for a site or group of sites. These plans describe each alternative, evaluate each alternative against nine criteria, and identify the preferred alternative. Proposed plans/draft RAPs are issued to the public before the beginning of a public comment period to provide information and solicit public input on the remedial options that underwent detailed evaluation in feasibility studies. Once the public comment period closes, the comments are compiled, reviewed by the BCT, and used to refine the remedial action. The final decision and response to comments (known as a "Responsiveness Summary") are presented in this ROD/RAP.

To reach as many community members as possible, the updates, fact sheets, and proposed plans/draft RAPs are mailed to approximately 400 households, businesses, public officials, and agencies. Copies are also made available at the information repository at the UCI Library and in the administrative record at Former MCAS El Toro (which contains the MCAS Tustin administrative record file).

3.3 COMMUNITY PARTICIPATION FOR OU-1B

During 2001, OU-1 was divided into OU-1A (IRP-13S) and OU-1B (IRP-3 and IRP-12). The final FS Report for OU-1B was issued in January 2002. The Proposed Plan/draft RAP for OU-1B, which describes the DON's preferred alternative, was communicated to the public in April 2002.

The RI Report for OU-1, the FS Report for OU-1B, the Proposed Plan/draft RAP for OU-1B, and other key documents related to IRP-3 and IRP-12 were made available to the public at the information repository at the UCI Library. Notices of availability of these site-related documents were published in the *Orange County Register* and the

Table 3-1
Summary of Former MCAS Tustin Updates, Fact Sheets, and Proposed Plans

Fact Sheet Number	Date	Summary of Contents
—*	02/93	The Environmental Cleanup of MCAS Tustin
—	06/94	New Environmental Committee to Hold Workshop
1	02/95	Soil Treatment Process Selected for Cleanup of Former Fuel Farm Area
2	12/95	It's Official: Excavation and Treatment of Contaminated Soil Is Under Way
3	01/96	Fast-Track Studies Focus on Reducing Cost and Schedule at MCAS Tustin
—	10/96	Proposed Plan for Landfill Trenches and Crash Crew Burn Pits
4	04/97	Cleanup Activities Complete at Former Fuel Tank Farm
5	10/97	Groundwater Contamination and Cleanup – An Overview
6	01/98	Identifying and Selecting Technologies and Alternatives for Groundwater Treatment
—	01/00	Proposed Plan/Draft Remedial Action Plan for No Further Action at Three IRP Sites and Nine AOCs
7	10/01	The Environmental Cleanup of MCAS Tustin, Status Update
—	04/02	Proposed Plan/draft Remedial Action Plan for OU-1B
—	02/04	Fact Sheet for Change in Soil Disposal Component of Selected Remedies at OU-1A and OU-1B

Note:
* dash indicates updates or proposed plans that are not given fact sheet numbers

Acronyms/Abbreviations:
AOC – area of concern
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station
OU – operable unit

Los Angeles Times (Orange County Edition) on 10 April 2002. The notices also announced the availability of the complete administrative record file at the SWDIV BRAC office in San Diego and at Former MCAS El Toro. Because of space limitations at the library, only a partial administrative record file is available for review at the information repository, but the information repository contains a complete index of the administrative record file along with information about how to access the complete file at Former MCAS El Toro.

The public comment period for the Proposed Plan/draft RAP for OU-1B was held from 10 April to 09 May 2002, and a public meeting was held on 23 April 2002. The public meeting was announced in the *Orange County Register* and the *Los Angeles Times (Orange County Edition)* on 16 April 2002 and in the Proposed Plan/draft RAP. At the public meeting, representatives from the DON, Former MCAS Tustin, and environmental regulatory agencies answered questions about site conditions and the preferred remedial alternative under consideration. A court reporter recorded public comments. Comment forms were provided to encourage submittal of written comments during or after the meeting. Responses to the comments received during this period are included in the Responsiveness Summary, which is part of this ROD/RAP.

Section 4
SCOPE AND ROLE OF OPERABLE UNIT

There are currently six OUs at MCAS Tustin: OU-1A, OU-1B, OU-2, OU-3, OU-4A, and OU-4B. Each OU has been or will be addressed in separate ROD/RAPs. OU-1A focuses on groundwater contamination at IRP-13S, and OU-1B focuses on groundwater contamination at IRP-3 and IRP-12. OU-1B is addressed in this ROD/RAP.

OU-1 originally addressed groundwater contamination at IRP-3, IRP-12, and IRP-13S. In 2001, OU-1 was divided into OU-1A and OU-1B to accommodate implementation of a TCRA at IRP-13S under OU-1A while work progressed separately on the remedial action for IRP-3 and IRP-12 under OU-1B. Interim groundwater removal under the TCRA, which does not represent the final remedy for groundwater contamination at OU-1A, began in January 2002. An FS report for OU-1A was finalized in August 2003. The ROD/RAP for OU-1A is anticipated to be signed and become final in the spring of 2004.

OU-2 comprises IRP-2, IRP-9 (A/B), and IRP-13E; and AOCs AD-04, AS-06, AS-08, AST-02, AST-04, MDA-04, MDA-07, MMS-01, and MWA-03. These OU-2 sites and AOCs were addressed in a No Action ROD/RAP that was finalized in September 2000.

OU-3 comprises all contaminated media at the former Moffett Trenches and Crash Crew Burn Pits Site (IRP-1). The ROD/RAP for OU-3 was finalized in December 2001. A final Operation and Maintenance Plan (OMP) for this site was issued in May 2003 (BEI 2003c). In March 2004, the BCT approved the site to be Operating Properly and Successfully.

OU-4 was created in 1999 from OU-2 sites that required further evaluation due to relatively low concentrations of VOCs reported in groundwater. OU-4 was initially divided into OU-4A and OU-4B in 2003. Sites recommended for no further action (NFA) were placed in OU-4A, which consists of IRP-5 North, IRP-5 South(b), IRP-8, IRP-11 (Area A), IRP-16, and AOC MMS-04 (Areas A and C). A draft NFA ROD/RAP for OU-4A was issued in August 2004.

Sites recommended for further action were place in OU-4B, which consists of IRP-5 South(a), IRP-6, IRP-11 (Area B), IRP-13W, MMS-04 (Area B), and the Mingled Plumes Area. Potential remedial alternatives for OU-4B sites are being evaluated in a focused feasibility study.

In addition to the sites included within the six OUs, there are three IRP sites that are not included in a designated OU.

- IRP-4 was designated for a RCRA facility assessment site visit (SV). Based on the results of the SV, this site was redesignated by the BCT as AOC MMS-03. AOC MMS-03 received a no further action determination by the BCT on 24 July 1997 (MCAS Tustin BCT 1997).
- IRP-7 was investigated in the OU-1/OU-2 RI. Based on the results of this investigation, the site was redesignated by the BCT as AOC MFL-1 and was transferred out of the CERCLA process because of a petroleum exclusion. Contamination at MFL-1 was addressed under the RWQCB Petroleum Corrective Action Program and AOC MFL-1 received a no further action concurrence from RWQCB on 21 December 1999.
- IRP-15 was purported to be a disposal site for creosote-treated timber dating from 1942. SIs and document reviews failed to confirm the existence of this site, and it was eliminated from further study before the ESI. During a 20 March 1996 BCT

meeting, it was agreed that IRP-15 required no further action, and a closure letter was signed by the members of the BCT. A copy of the closure letter is included in Appendix A of the ESI Report (BNI 1996a).

Section 5
SITE CHARACTERISTICS

This section describes the regional characteristics of Former MCAS Tustin, provides a brief history of the sources of contamination at IRP-3 and IRP-12, and summarizes results of monitoring performed at these sites. This section also discusses potential current and future migration of contaminants identified at these sites and presents estimates of the mass of TCE present in groundwater. The interpretation of the nature and extent of contamination at IRP-3 and IRP-12 is based on data from the SI, RI, post-RI soil study, and interim groundwater monitoring. The SI and RI Reports, draft Technical Memorandum summarizing the post-RI soil sampling results, and FS Report contain complete discussions of the sampling locations and methodologies, the site-related chemicals identified at each site, and the nature and extent of contamination (JEG 1993; BNI 1997a, 1998a, 2002).

5.1 REGIONAL CHARACTERISTICS

Former MCAS Tustin lies at the eastern edge of a broad coastal plain (an essentially planar, alluviated flatland) that is bounded on the east-northeast by the gentle slopes of Lomas de Santiago (along the foothills of the Santa Ana Mountains) and on the south by the San Joaquin Hills. The coastal plain slopes gently southwestward toward the Pacific Ocean. The ground surface at the former station is essentially flat, with an average elevation of approximately 54 feet above mean sea level (MSL). The ground surface slopes gradually from approximately 75 feet above MSL at the northern portion of the station to approximately 45 feet above MSL at the southern portion. The geology, hydrogeology, and surface water hydrology of Former MCAS Tustin are briefly described below.

5.1.1 Geology and Hydrogeology

A groundwater-level contour map for the regional aquifer is provided on Figure 5-1. In the vicinity of Former MCAS Tustin, the coastal plain overlies approximately 1,300 feet of unconsolidated sediments. Sediments from the ground surface to depths from approximately 90 feet to 150 feet below ground surface (bgs) consist of massive silt, clayey silt, clay, and silty clay deposits with laterally discontinuous lenses of sand and gravel. Collectively, the permeable water-bearing sediments of these floodplain and fluvial deposits within the upper 90 to 150 feet bgs are referred to as the “shallow aquifer.” Below approximately 150 feet bgs, the top of the “regional aquifer,” a transmissive sand zone is encountered (Figure 5-2).

Three water-bearing zones (WBZs) constitute the shallow aquifer beneath Former MCAS Tustin. These WBZs are identified in part by the depth intervals at which they occur. The first WBZ occurs from approximately 5 to 30 feet bgs, the second WBZ occurs from approximately 30 to 60 feet bgs, and the third WBZ occurs from approximately 60 feet bgs to between 90 and 120 feet bgs. The boundaries between the WBZs vary from location to location, reflecting the heterogeneity of the sediments within each depth range (Figure 5-2).

Groundwater at Former MCAS Tustin is first encountered at depths from approximately 5 to 15 feet bgs (30 to 60 feet above MSL). Hydraulic testing completed during the RI indicated that groundwater in the uppermost sand zone in the first WBZ is pressurized, indicating semiconfined conditions within the first WBZ. Groundwater within the second and third WBZs is also semiconfined.

Groundwater within the first WBZ contains total dissolved solids (TDS) at elevated concentrations, averaging approximately 6,000 milligrams per liter (mg/L). Field data suggest that the first and second WBZs are hydraulically interconnected. However, TDS concentrations in the second WBZ are typically lower than those in the first WBZ and average approximately 2,400 mg/L. Field data also suggest that the third WBZ is usually separated hydraulically from the second WBZ and appears to be a transitional zone between the shallow aquifer and the underlying regional aquifer.

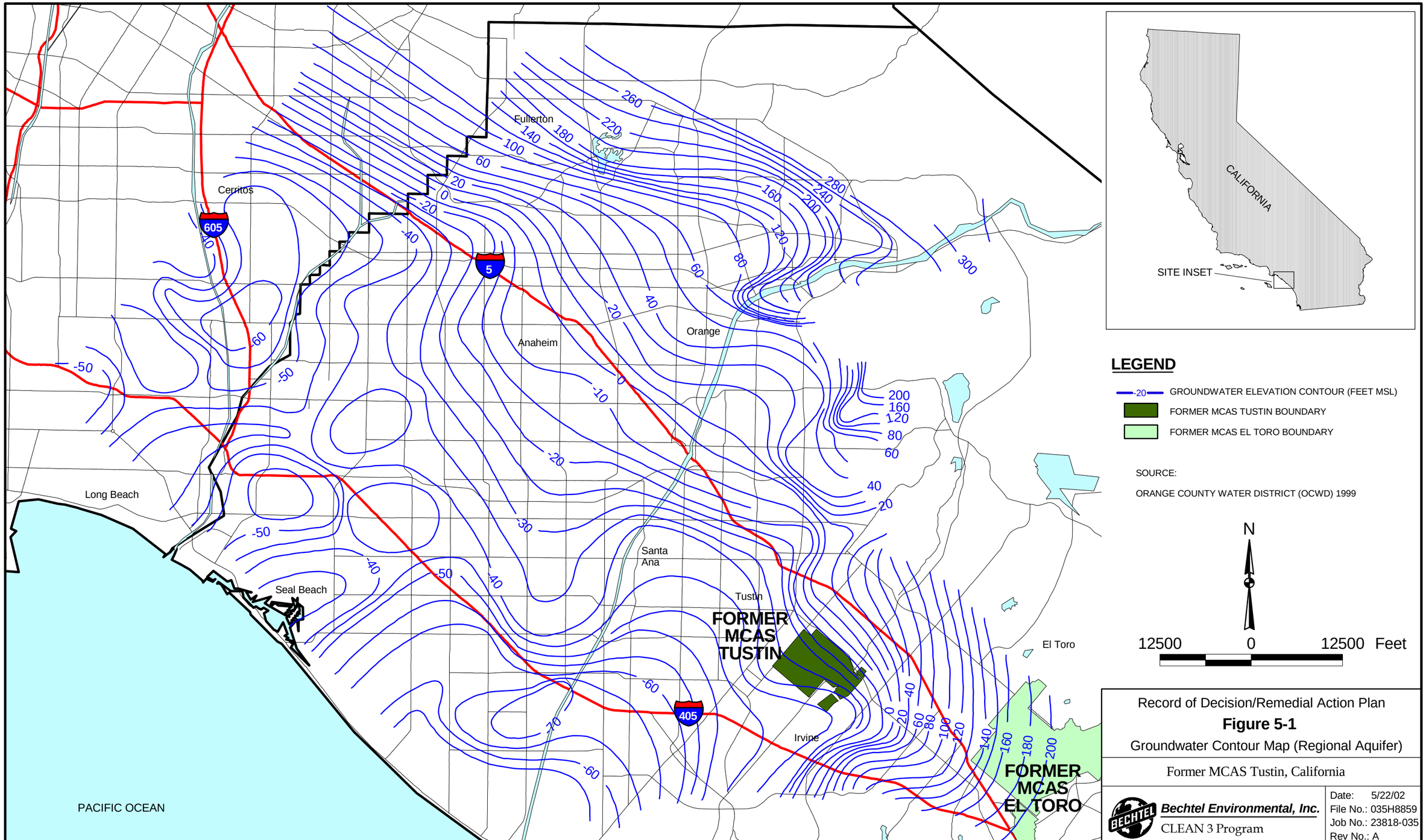
Groundwater flow in the three WBZs has been monitored with monitoring well clusters located throughout Former MCAS Tustin. Groundwater in the first and second WBZs generally flows in the same direction, from north to south across the station. In localized areas where the shallow aquifer intercepts the land surface at Peters Canyon Channel, Barranca Channel, and Santa Ana-Santa Fe Channel, groundwater from the first WBZ discharges into these surface water drainages. Groundwater from the third WBZ generally flows toward the southwest and is apparently not influenced by the surface drainages at Former MCAS Tustin.

5.1.2 Surface Water Hydrology

Former MCAS Tustin is located within the Irvine Forebay Pressure groundwater subbasin. Surface waters in this subbasin consist typically of small streams, flood channels, and water-storage reservoirs. Three man-made channels bound Former MCAS Tustin: Barranca Channel to the south, Santa Ana-Santa Fe Channel to the north, and Peters Canyon Channel to the east (Figure 5-3). These unlined channels are incised approximately 10 to 20 feet below the surrounding land surface and permit flow between groundwater and surface water. These channels and the San Joaquin Ditch, which is located in the southern portion of the station, typically contain water year-round.

Data obtained during the RI indicate that both Barranca and Peters Canyon Channels are “gaining” streams in the reach of Former MCAS Tustin, while Santa Ana-Santa Fe Channel loses water in its western reach and gains water in its eastern reach. The San Joaquin Ditch is a main on-site drainage ditch, portions of which have been designated as U.S. Army Corps of Engineers (USACE) jurisdictional wetlands (Figure 5-3). The San Joaquin Ditch collects stormwater in the central and eastern portions of Former MCAS Tustin and discharges the water into Peters Canyon Channel through a conduit beneath Barranca Parkway.

Surface drainage at the station is controlled by local topography and by various man-made drainages. Surface runoff at Former MCAS Tustin originates almost entirely from within the station, because surface runoff flowing toward the station from the north and



Record of Decision/Remedial Action Plan

Figure 5-1

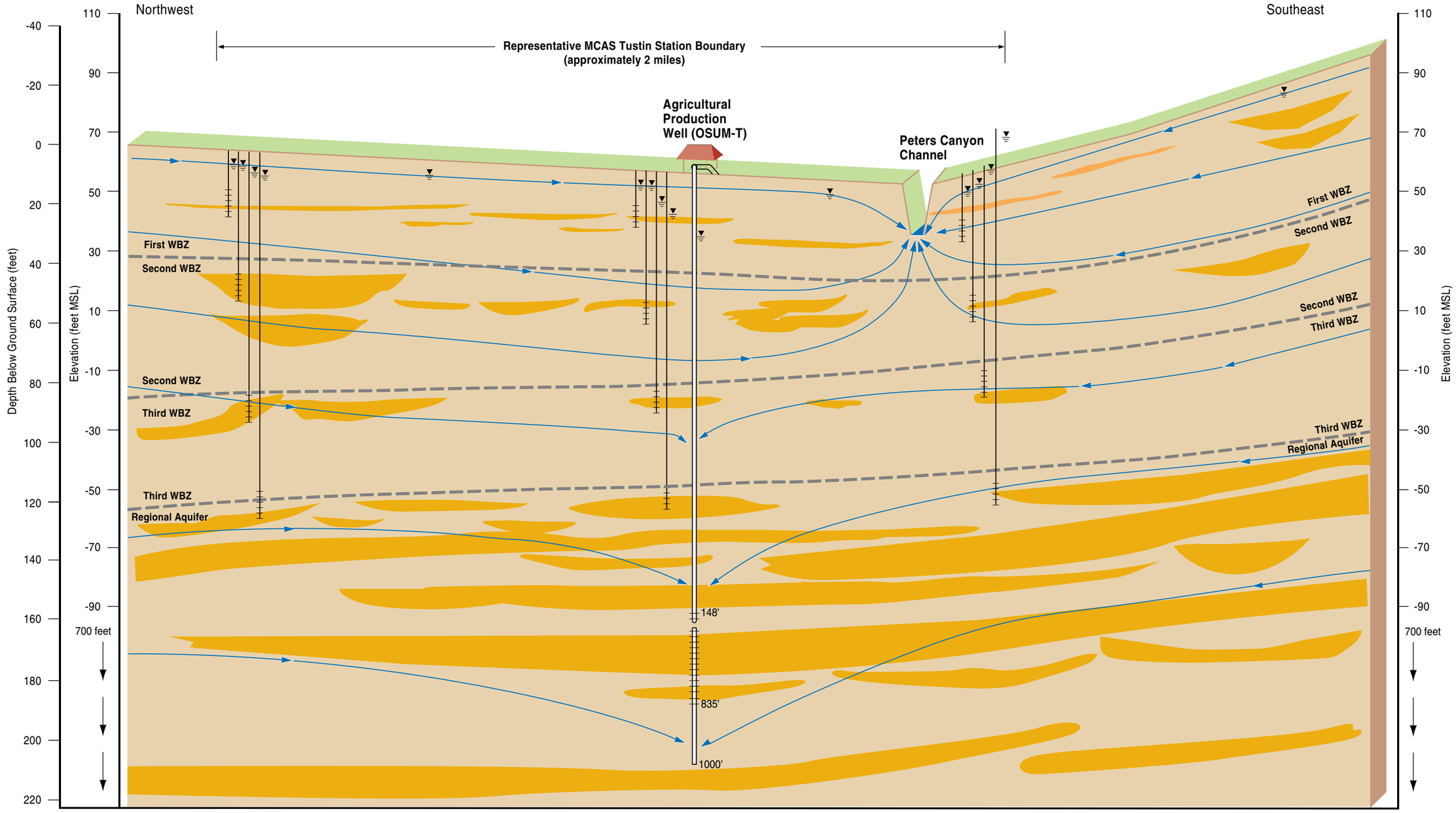
Groundwater Contour Map (Regional Aquifer)

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 5/22/02
File No.: 035H8859
Job No.: 23818-035
Rev No.: A



Legend

- Clayey Silt and Clay
- Silty Sand and Sand
- Water Level
- Groundwater Flow Direction
- Monitoring Well
- Production Well

Acronyms/Abbreviations:

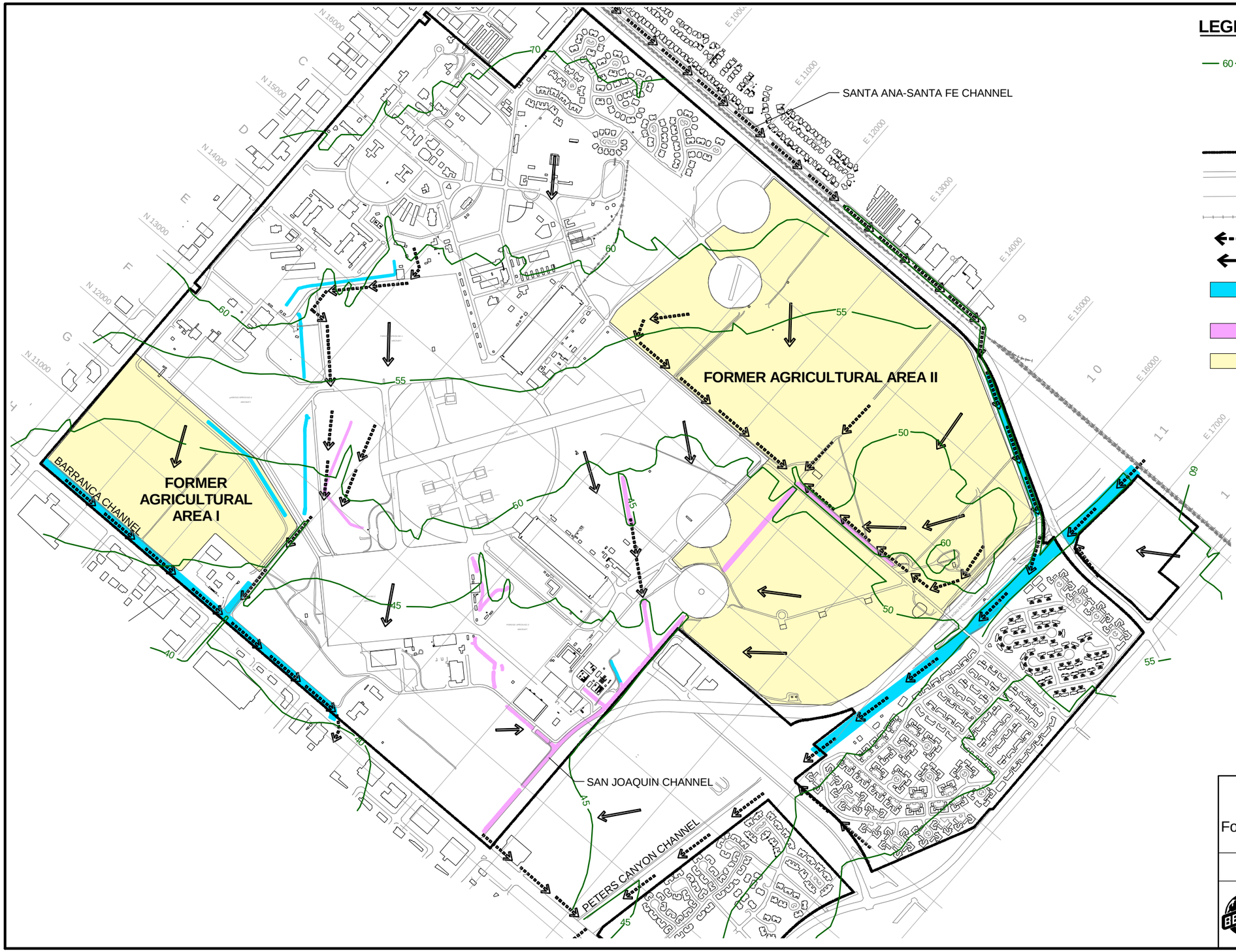
MSL mean sea level
WBZ water-bearing zone

Record of Decision/Remedial Action Plan
Figure 5-2
Former MCAS Tustin
Conceptual Hydrogeologic Model

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/9/04
File No. 035X11404
Job No. 23818-035
Rev No. B



LEGEND

60 — GROUND SURFACE ELEVATION CONTOUR (FEET ABOVE MSL)
TOPOGRAPHY FROM USGS 7.5 MINUTE TUSTIN SHEET
1932 PLANETABLE SURVEY
1946 PHOTOGRAMMETRY
1960 THE IRVINE COMPANY
1965 PLANETABLE SURVEY

FORMER MCAS TUSTIN BOUNDARY

ROAD OR PAVED AREA

DRAINAGE DITCH

RAILROAD

DRAINAGE TRENCH AND STORM DRAIN CHANNEL

SURFACE RUNOFF

VEGETATED OR SEASONAL WETLANDS (WITHIN JURISDICTIONAL WATERS OF THE UNITED STATES) (DON 1999; TIERRA MADRE CONSULTANTS 1993)

JURISDICTIONAL WATERS OF THE UNITED STATES (DON 1999; TIERRA MADRE CONSULTANTS 1993)

FORMER AGRICULTURAL AREA APPROXIMATE BOUNDARY

N

SOURCES:

SITE DRAINAGE PATTERNS BASED ON: BNI. 1997. DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU-1 AND OU-2, MCAS TUSTIN, CALIFORNIA. NOVEMBER

NONJURISDICTIONAL/POTENTIAL WETLANDS AND JURISDICTIONAL WETLANDS BASED ON: DON. 1999. FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS)/ENVIRONMENTAL IMPACT REPORT(EIR) FOR MCAS TUSTIN, CALIFORNIA. DECEMBER

TIERRA MADRE CONSULTANTS. 1993. REPORT FOR A BIOLOGICAL ASSESSMENT, MARINE CORPS AIR STATION TUSTIN. 11 MARCH

COTTON/BELAND/ASSOCIATES, INC. 1994. ENVIRONMENTAL SETTINGS REPORT EIS/EIR. JANUARY

ARMY CORPS OF ENGINEERS. 1996. LETTER DATED 29 JANUARY 1996 TO BRAC ENVIRONMENTAL COORDINATOR

1100 0 1100 Feet

Record of Decision/Remedial Action Plan

Figure 5-3

Former MCAS Tustin Topography, Surface Drainage Wetlands, and Former Agricultural Areas

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/26/04
File No.: 035H11369
Job No.: 23818-035
Rev No.: C

northeast is intercepted by ditches running parallel to the Santa Fe Railroad tracks located along the northeast side of the station. Surface runoff as excess precipitation leaves the former station in two ways: through the underground storm drainage system or through open ditches and channels. Peters Canyon Channel and Barranca Channel receive surface runoff and storm drain discharge from Former MCAS Tustin.

Surface water generally flows south and southwest, away from Former MCAS Tustin (Figure 5-3). Along two boundaries of the station, however, Santa Ana-Santa Fe Channel and Barranca Channel carry flow southeast toward Peters Canyon Channel. Short ditches running along the Santa Fe Railroad tracks and along Warner Avenue and a culvert beneath Edinger Avenue carry flow northwest toward Peters Canyon Channel. Peters Canyon Channel receives runoff from Santa Ana-Santa Fe Channel on the northeast side of the station and from San Joaquin Ditch in the center of the station. Peters Canyon Channel merges with San Diego Creek approximately 1 mile southwest of the station. Barranca Channel merges with San Diego Creek approximately 2 miles southwest of the station. San Diego Creek empties into upper Newport Bay approximately 5 miles southwest of the station.

5.2 IRP-3, PAINT STRIPPER DISPOSAL AREA

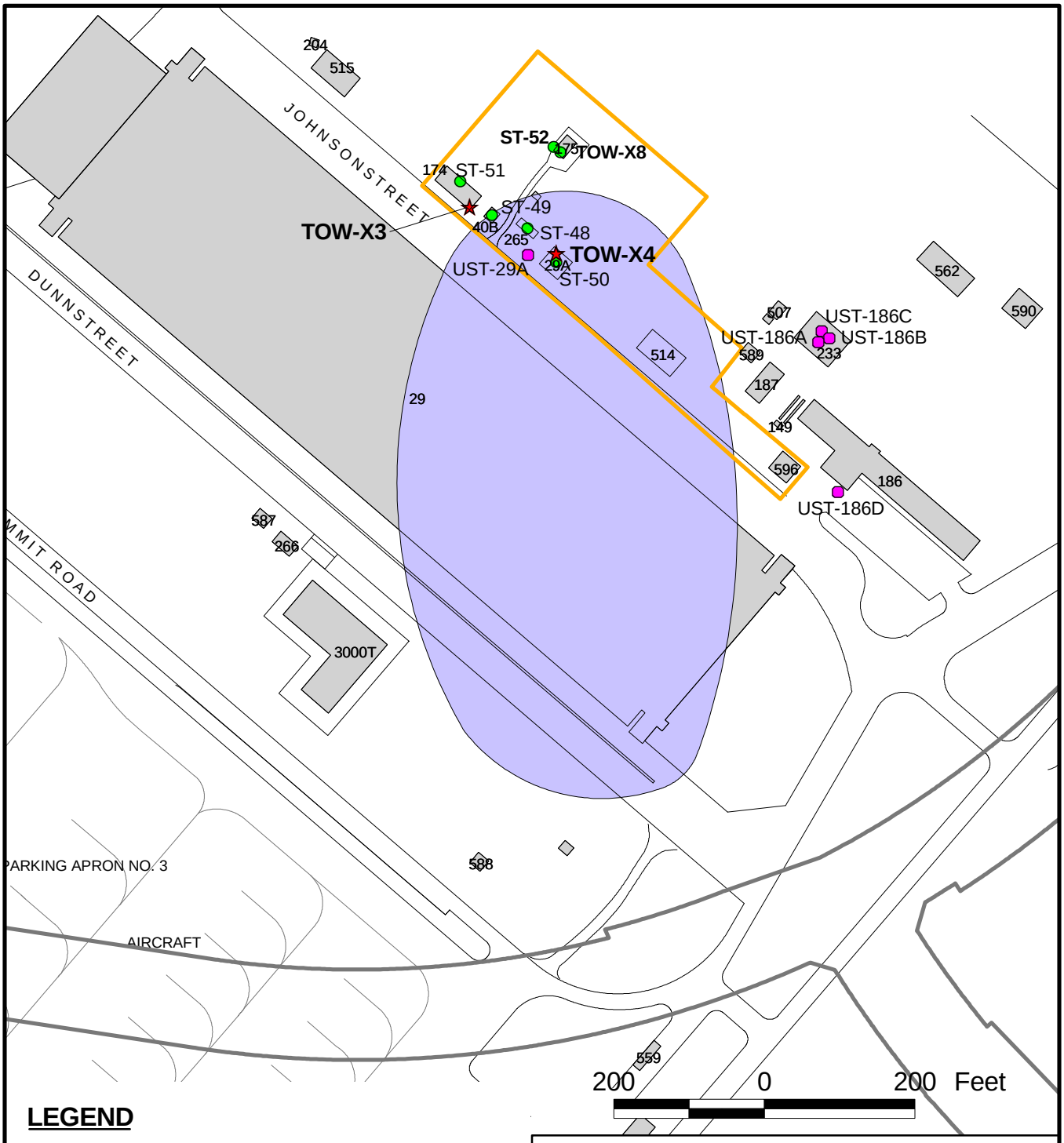
IRP-3 is located in the central portion of the Former MCAS Tustin property, north of Building 29 (Hangar No. 2) and east of Building 174 (Figures 1-2 and 5-4). IRP-3 occupies approximately 1.4 acres and encompasses buildings (including Buildings 29A, 174, and 265) formerly used for chemical storage and painting operations that began in 1967. IRP-3 also includes the site of former UST-29A as well as eight AOCs (ST-48 through -52 and TOW-X3, -X4, and -X8) (Figure 5-4).

5.2.1 Site History

The Marine Corps reportedly used four waste disposal areas, which could only be located approximately within the boundaries of IRP-3 (BNI 1997a). Other potential sources of subsurface contamination include two O/W separators (O/W-29A and -174) as well as a former fuel-oil UST (UST-29A).

Available information suggests that approximately 3,750 gallons of liquid wastes were released directly onto the ground outside storage and painting operation Buildings 265 and 174, respectively (BNI 1996e). These liquid wastes included solvents, paint strippers, and battery acids. Washwater used to remove waste material from the paint-stripping dip tank was also reportedly released directly onto the ground.

Building 265 was built in 1985 and was used to store hazardous materials, including lubricating oil, propellant, epoxy paint, polyurethane-based paints, enamel, paint thinners, corrosion-prevention compounds, lacquers, and solvents.



LEGEND

- UNDERGROUND STORAGE TANK
- LOCATION OF AREA OF CONCERN (AOC)
- AOC INCORPORATED INTO RISK ASSESSMENT
- IRP-3 CONTAMINANT PLUME
- IRP-3 BOUNDARY
- FUTURE ROAD
- ROAD
- BUILDING

N

Record of Decision/Remedial Action Plan

Figure 5-4

IRP-3 and Nearby AOCs

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035L8863
Job No.: 23818-035
Rev No.: B

Building 174 was built in 1967 and used primarily for painting and welding operations. It also provided storage for batteries, hazardous materials, and miscellaneous equipment. AOC TOW-X3 includes O/W-174, a separator formerly located adjacent to the southeast corner of Building 174, which received solvent-contaminated discharges from a wash rack (BNI 1997a). O/W-174 was removed in 1999. TCE-contaminated soil remaining at TOW-X3 is being addressed under the CERCLA Program.

Building 29A is currently used to store empty boxes, although it originally housed a boiler that provided heat to Building 29. Fuel oil for the boiler was stored in UST-29A, formerly located west of Building 29A. UST-29A was installed in 1942 and had a storage capacity of 7,000 gallons (BNI 1997a). It was removed in August 1993. Some contaminated soil associated with this tank is still in place (BNI 1997a).

AOC TOW-X4 included O/W-29A, a separator formerly located on the north side of Building 29A. O/W-29A was removed in 1999. TCE-contaminated soil remaining beneath TOW-X4 is being addressed under the CERCLA Program. Residual TCE concentrations in soil exceeded the residential preliminary remediation goal (PRG), and the soil is considered to be a potential continuing source of groundwater contamination.

5.2.2 Site Investigations

The following subsections serve as a summary of previous investigations related to IRP-3.

5.2.2.1 INITIAL ASSESSMENT STUDY

IRP-3 was recommended for a confirmation study based on the results of an IAS completed under the Navy Assessment and Control of Installation Pollutants (NACIP) Program in 1985 in which IRP-3 was first identified as a potentially contaminated area (Brown and Caldwell 1985).

5.2.2.2 SITE INSPECTION

In 1991, an SI including a soil gas survey and shallow soil and groundwater investigations was performed at IRP-3 (JEG 1993). SI results confirmed reported releases of hazardous constituents in the area now identified as IRP-3. TCE and chloroform were reported in soil gas and groundwater samples collected across the site. TCE was reported in groundwater samples at concentrations ranging from 10 to approximately 3,000 micrograms per liter (μg/L). TCE, total petroleum hydrocarbons (TPH), bis(2-ethylhexyl)phthalate, pesticides, and polychlorinated biphenyls (PCBs) were reported in soils. Heavy metals including lead, cadmium, chromium, and zinc were also reported in soils but at concentrations near expected background values (JEG 1993).

5.2.2.3 REMEDIAL INVESTIGATION

In 1995, Bechtel National, Inc., conducted an RI to confirm the findings of the SI and to evaluate the nature and extent of soil and groundwater contamination at IRP-3 (BNI 1997a). TCE, a solvent commonly used for degreasing, was the most frequently

reported and widely distributed contaminant in soil and groundwater samples. TCE contamination was attributed to sources such as historical surface spills and past waste disposal activities as well as the inactive O/W separators at AOCs TOW-X3 (O/W-174) and TOW-X4 (O/W-29A).

Soil

TCE and three of its degradation products including 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), and 1,2-DCE were reported in shallow soils in several areas at IRP-3 (BNI 1997a, 1998a). Other VOCs reported in soils included methylene chloride, acetone, methyl ethyl ketone, ethylbenzene, and total xylenes.

Maximum reported TCE concentrations and the largest areal extent of TCE-contaminated soil occur at depths from 7 to 13 feet bgs within saturated silts and clays in the upper portion of the first WBZ (BNI 1997a, 1998a). In general, concentrations of TCE reported in soil at IRP-3 decrease with depth. TCE was reported at a maximum concentration of 2,679 micrograms per kilogram (μg/kg) in a soil sample collected from the saturated zone at 12 feet bgs in the vicinity of inactive separator O/W-29A. Reported TCE concentrations were less at 15 to 20 feet bgs, depths that are also generally within the saturated silts and silty sands of the first WBZ. TCE was reported in soil samples collected from 20 to 40 feet bgs, within the second WBZ, at concentrations ranging to 1,539 μg/kg. Only trace concentrations of TCE were reported in soil samples taken from depths below about 40 feet bgs.

TPH-contaminated soils also containing elevated concentrations of metals and polynuclear aromatic hydrocarbons (PAHs) were reported in some areas at IRP-3 (BNI 1997a). TPH contamination was reported in shallow vadose-zone soils (typically shallower than 3 feet bgs) at concentrations approximately 10 to 30 milligrams per kilogram (mg/kg). Fifteen PAHs were also reported in soil samples, with maximum concentrations reported in a sample collected at 7 feet bgs that was associated with a fuel-oil release from a pipeline connected to former UST-29A.

Other organic compounds reported in the upper 1 foot of soil included the solvent bis(2-chloroisopropyl)ether and two plasticizers, bis(2-ethylhexyl)phthalate and butyl benzyl phthalate. Three phenolic compounds (phenol, 2-methyl phenol, and 4-methyl phenol) were also reported in upper vadose-zone soil samples.

Site-related metal contamination was limited to the upper 2 feet of soil (BNI 1997a). Lead, the most frequently reported metal, was reported in 25 percent of the shallow soil samples at concentrations exceeding the background concentration of 23.4 mg/kg. Lead was reported at a maximum concentration of 621 mg/kg. Other metals exceeding background concentrations and, therefore, identified as COPCs for soil included cadmium, chromium (total), hexavalent chromium, copper, silver, and zinc.

Groundwater

On the basis of sampling results obtained during the RI, TCE and three of its degradation products (1,2-DCE, 1,1-DCA, and 1,1-DCE) were identified as the primary COPCs for groundwater (Table 5-1) (BNI 1997a,b).

Four commingled VOC plumes originating from several TCE-contaminated soil areas were interpreted to exist in the first WBZ at IRP-3 (Figure 5-5) (BNI 1997a, 1998a). TCE was reported in groundwater samples from the first WBZ at concentrations ranging from 10 μg/L to 1,742 μg/L. TCE reported in groundwater at concentrations exceeding 5 μg/L was interpreted to extend approximately 1,000 feet in a south-southwest and north-northeast direction and approximately 600 feet in a west-northwest and south-southeast direction.

Two VOC plumes were interpreted to exist in the second WBZ, extending downgradient from separators O/W-29A and O/W-174 (Figure 5-6) (BNI 1997a, 1998b). TCE was reported in groundwater samples from both plumes at concentrations in excess of 1,000 μg/L. Based on RI data, TCE in these plumes was interpreted to extend laterally approximately 600 and 800 feet in a south-southwest direction, approximately 100 to 125 feet in a northwest-southeast direction, and vertically to depths of approximately 40 feet bgs, respectively (Figure 5-7).

5.2.2.4 POST-RI SOIL SAMPLING AND FEASIBILITY STUDY

A post-RI soil sampling program was conducted in 1997 to further evaluate the extent of TCE-contaminated soil in the saturated zone at IRP-3 (BNI 1998a). Two additional potential TCE source areas extending approximately 50 and 75 feet south (downgradient) from O/W-174 and O/W-29A, respectively, were identified in the uppermost saturated silts and clays of the first WBZ. Post-RI sampling results also indicated that TCE in the upper silts and clays of the first WBZ was slightly more extensive south of Building 514 than originally determined during the RI (BNI 1998a). Overall, the occurrence of TCE in saturated-zone soils at IRP-3 has been found to parallel the general direction of groundwater flow (i.e., toward the south and southwest).

An FS was conducted for OU-1B that included development and evaluation of remedial action alternatives for groundwater (BNI 2002). Computer modeling performed during this FS indicated that TCE remaining in soil at concentrations exceeding 400 μg/kg within the vadose zone and in the upper confining layers of the first WBZ could potentially act as a continuing source of contamination to groundwater, resulting in concentrations of TCE exceeding the maximum contaminant level (MCL). Based on soil sampling results obtained during the RI and post-RI soil sampling programs, four areas with TCE concentrations in soil exceeding 400 μg/kg were identified at IRP-3 (Figure 5-8).

Table 5-1
Primary Chemicals of Potential Concern Reported in IRP-3 Groundwater

Contaminant	Detection Frequency[a]	Concentration Range[b] (micrograms per liter)
IRP-3		
trichloroethene	19/52	3–1,742
1,2-dichloroethene	11/52	6–290
1,1-dichloroethane	3/52	6–12
1,1-dichloroethene	2/52	11–110

Notes:
[a] number of samples in which the contaminant was detected/total number of groundwater samples collected during the RI and RFA (BNI 1997a,b)
[b] range of concentrations for samples reported above laboratory detection limits

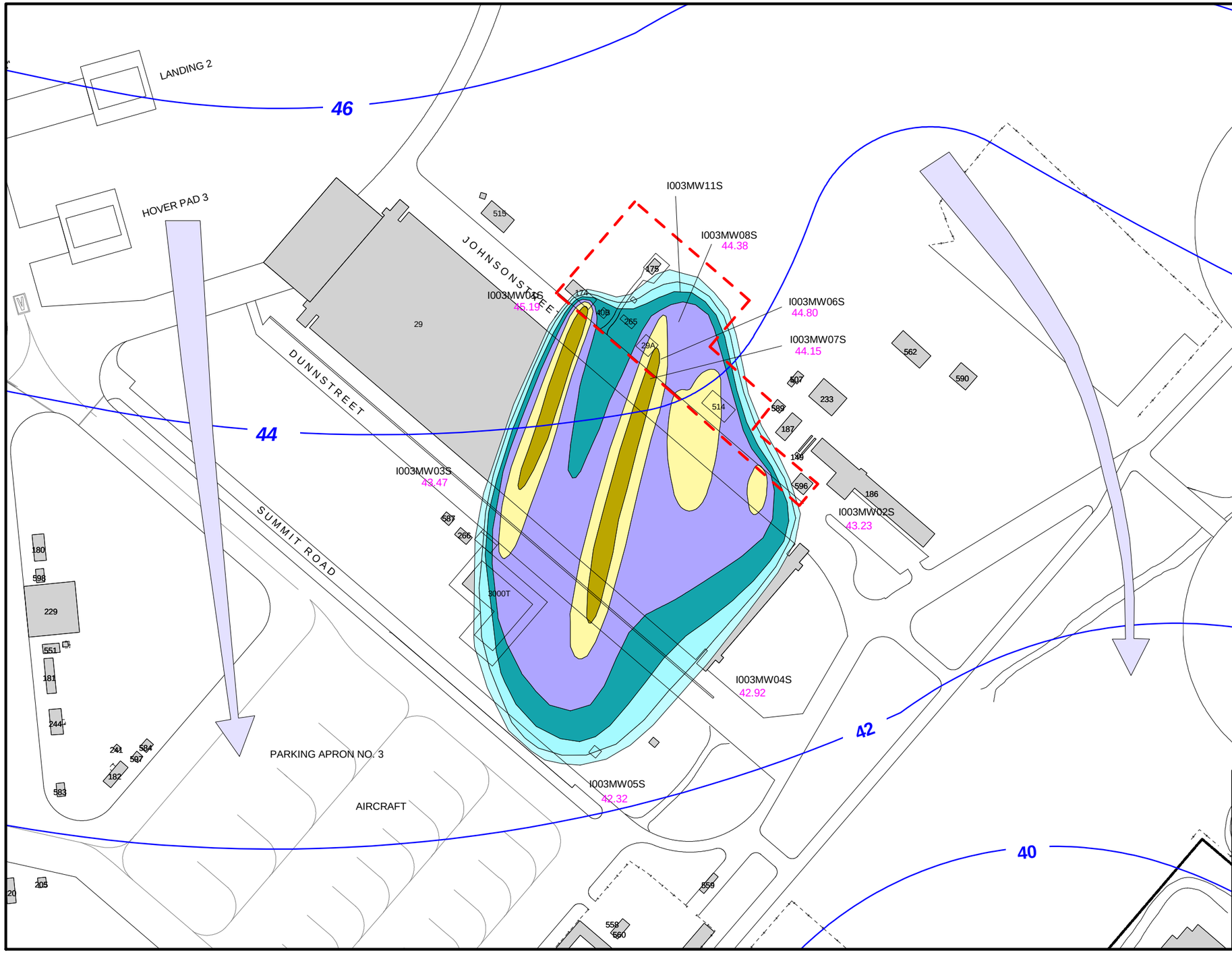
Acronyms/Abbreviations:
IRP – Installation Restoration Program
RFA – Resource Conservation and Recovery Act facility assessment
RI – remedial investigation

5.2.2.5 GROUNDWATER MONITORING

Interim basewide groundwater monitoring has been conducted at Former MCAS Tustin since the RI was completed in 1996. The following VOCs were reported in groundwater samples at concentrations exceeding applicable MCLs during 2001.

- TCE was reported in groundwater samples from six of eight wells in the first WBZ at concentrations up to 2,300 μg/L, and from two of five wells in the second WBZ at concentrations up to 780 μg/L.
- 1,1-DCE was reported in groundwater samples from seven of eight wells in the first WBZ at concentrations up to 8.1 μg/L, and in three of six wells in the second WBZ at concentrations up to 0.56 μg/L.
- cis-1,2-DCE was reported in groundwater samples from six of eight wells in the first WBZ at concentrations up to 29 μg/L, and in one of six wells in the second WBZ at concentrations up to 13 μg/L.
- Vinyl chloride (VC) was reported in groundwater samples from three of eight wells in the first WBZ at concentrations up to 3 μg/L, and in one of six wells in the second WBZ at concentrations up to 0.47 J μg/L (estimated).

Based on 2001 groundwater monitoring data, the lateral extent of VOCs reported in groundwater at concentrations exceeding 5 μg/L in the first WBZ was estimated to be approximately 800 feet in a north-south direction and approximately 450 feet in an east-west direction (Figure 5-9) (BEI 2003a). The maximum reported VOC concentration within this plume was 2,300 μg/L TCE in well I003MW06S.



LEGEND

- I001MW01S — WELL INSTALLED IN 1ST PERMEABLE WATER-BEARING ZONE (SHALLOW)
- 45.19 — GROUNDWATER ELEVATION LEVEL IN FT MSL FOR JUNE 2000
- 40 — 1ST WATER-BEARING ZONE EQUIPOTENTIAL LINE FOR JUNE 2000
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- FORMER MCAS TUSTIN BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE

TCE CONCENTRATION IN GROUNDWATER:

- 5 to 10 µg/L
- 10 to 20 µg/L
- 20 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- 2000 to 5000 µg/L
- > 5000 µg/L

N

SOURCES:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL IN NOVEMBER 1997 TO UPDATE BASE MAP

200 0 200 Feet

Record of Decision/Remedial Action Plan

Figure 5-5

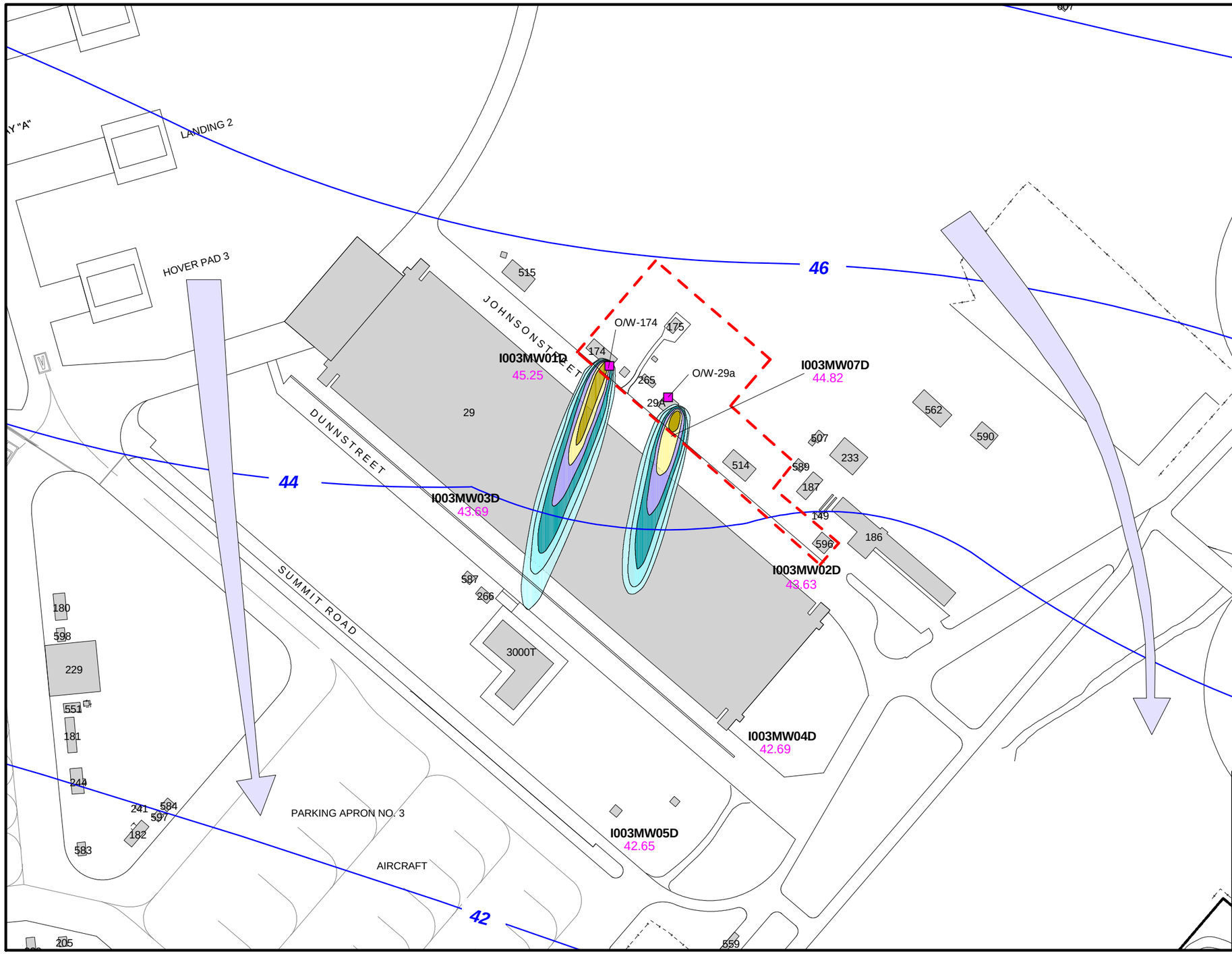
IRP-3 TCE Plumes in Groundwater in the First WBZ, Based on RI Data

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035L8864
Job No.: 23818-035
Rev No.: D



LEGEND

- I001MW01D — WELL INSTALLED IN 2nd PERMEABLE WATER-BEARING ZONE (SHALLOW)
- 45.25 — GROUNDWATER ELEVATION LEVEL IN FT MSL FOR JUNE 2000
- 40 — 2nd WATER-BEARING ZONE EQUIPOTENTIAL LINE FOR JUNE 2000
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- FORMER MCAS TUSTIN BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE
- FORMER LOCATIONS OF O/W-174 AND O/W-29a

TCE CONCENTRATION IN GROUNDWATER:

- 5 to 10 µg/L
- 10 to 20 µg/L
- 20 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- 2000 to 5000 µg/L
- > 5000 µg/L

N

SOURCES:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL IN NOVEMBER 1997 TO UPDATE BASE MAP

200 0 200 Feet

Record of Decision/Remedial Action Plan

Figure 5-6

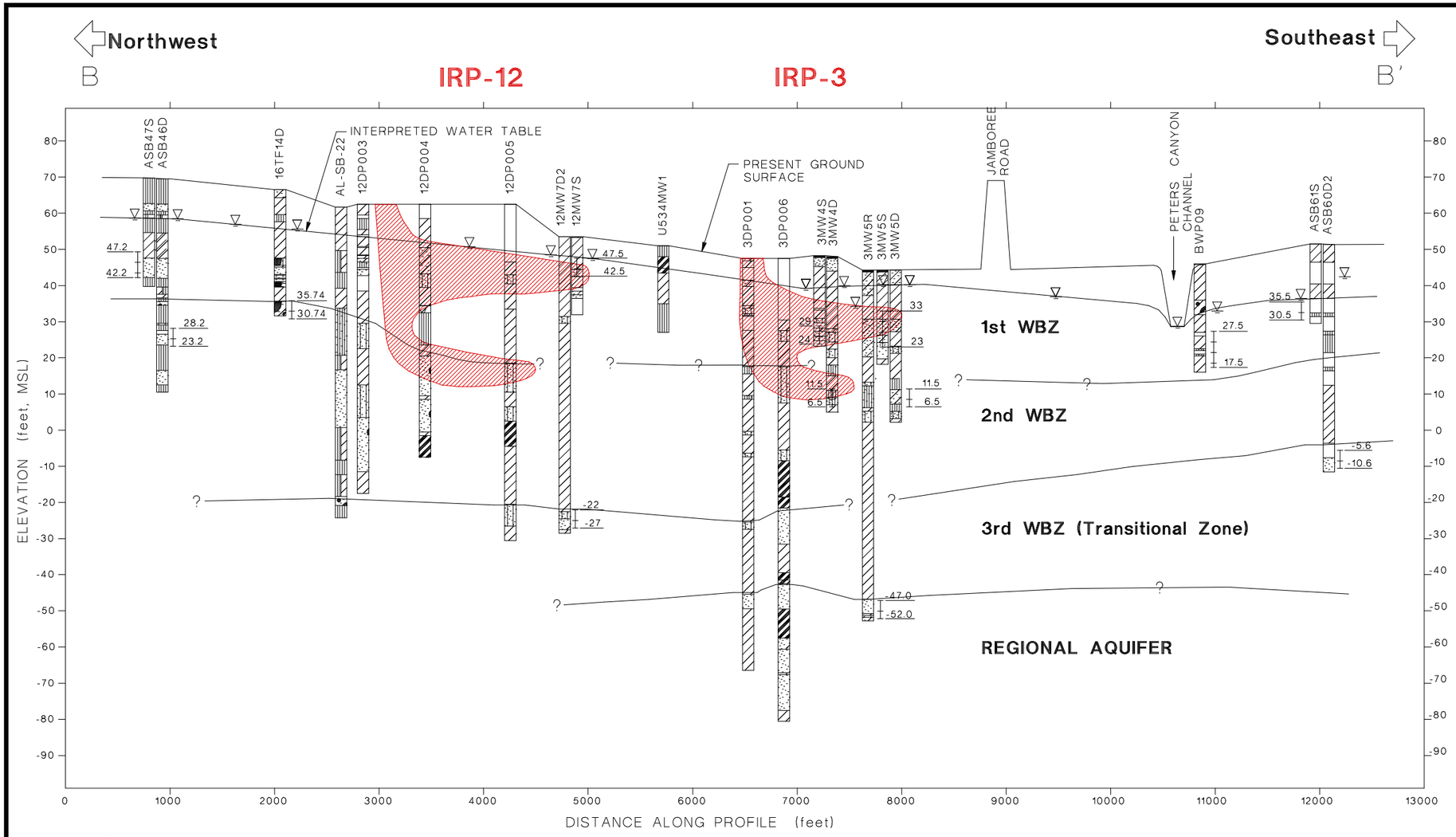
IRP-3 TCE Plumes in Groundwater in the Second WBZ, Based on RI Data

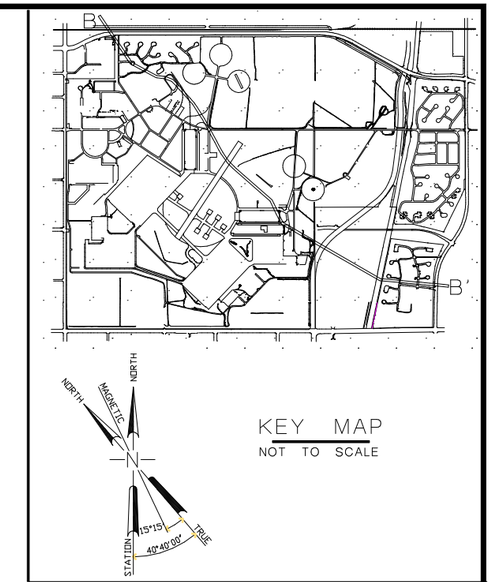
Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035L8865
Job No.: 23818-035
Rev No.: F





LEGEND

- WATER LEVEL IN WELLS SCREENED IN THE 1st WATER-BEARING ZONE.
- WATER LEVEL IN WELLS SCREENED IN THE 2nd WATER-BEARING ZONE.
- 27.5 / 17.5 — SCREEN INTERVAL (VALUES INDICATE TOP & BOTTOM OF SCREEN ELEVATIONS)
- WBZ - WATER-BEARING ZONE
- VOC PLUME

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL TO REFLECT CURRENT CONDITIONS, JULY 1995.

NOTES:

1. "1MW", "3MW", "12MW", "BMW", "BWP", "2WP" and "13WP" series wells were completed recently by Bechtel; Locations and elevations of those wells were surveyed.
2. "3DP", "12DP" and "16DP" borings were completed recently by Bechtel; Locations and elevations of those borings are approximated based on topographic maps.
3. "ASB" and "AL-SB" series wells/borings were completed by Argonne National Lab (ANL); Locations and elevations of those wells/borings were surveyed.
4. Water levels for wells measured in January 1996.
5. "1BC", "16TF", "U172MW", "A194MW" and "U534MW" wells were completed by previous Navy contractors. Locations and elevations were surveyed during the Remedial Investigation.

Explanation

GRAVEL (GP), poorly graded	GRAVELLY SAND (SW/GW)	SILTY SAND to SANDY SILT (SM-ML)	SANDY CLAY (CL)	FILL
GRAVEL (GW), well graded	SAND (SW/SP)	SANDY SILT (ML)	CLAY (CL), low to medium plasticity	ASPHALT
SANDY GRAVEL (GW)	SAND to SILTY SAND (SP-SM)	SILT (ML), low to medium plasticity	CLAY (CH), high plasticity	NO RECOVERY
SILTY GRAVEL (GM)	SILTY SAND (SM)	SILT (MH), high plasticity	ORGANIC CLAY (OH)	CALICHE
CLAYEY GRAVEL (GC)	CLAYEY SAND (SC)	ORGANIC SILT (OL)	WOOD, PEAT (Pt)	

Record of Decision/Remedial Action Plan

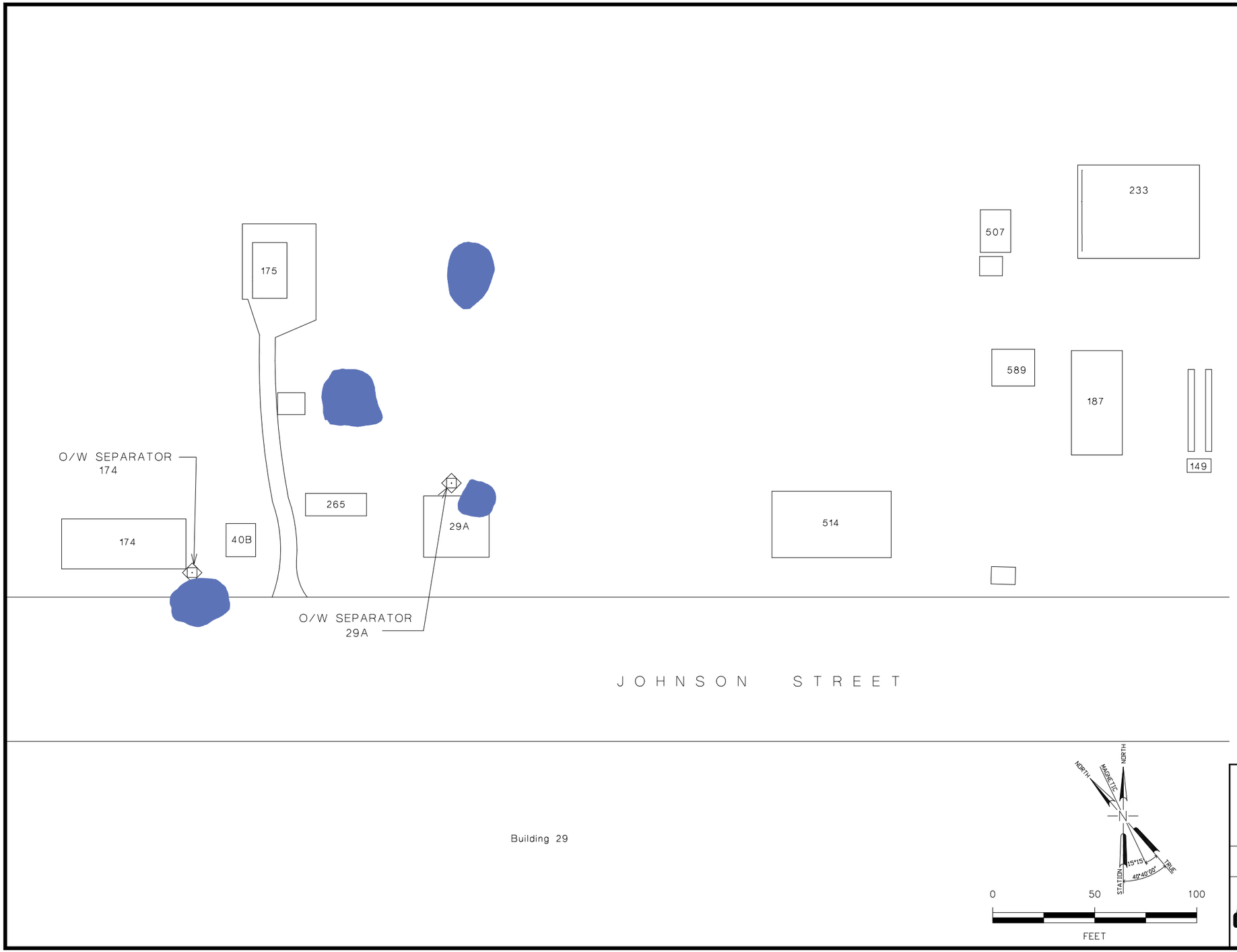
Figure 5-7

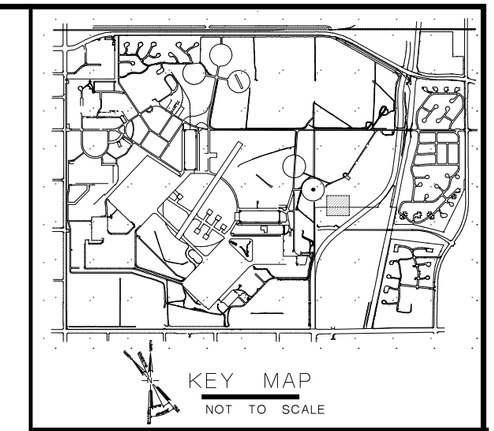
Vertical Extent of VOC Plumes in Groundwater at IRP-3 and IRP-12, Based on RI Data

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/26/04
File No: 035X8885
Job No: 23818-035
Rev No: C





LEGEND

> 400 ug/kg TCE AT 1 TO 13 FEET BGS

OIL/WATER SEPARATOR

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL TO REFLECT CONDITIONS AS OF NOVEMBER 1997.

Record of Decision/Remedial Action Plan

Figure 5-8

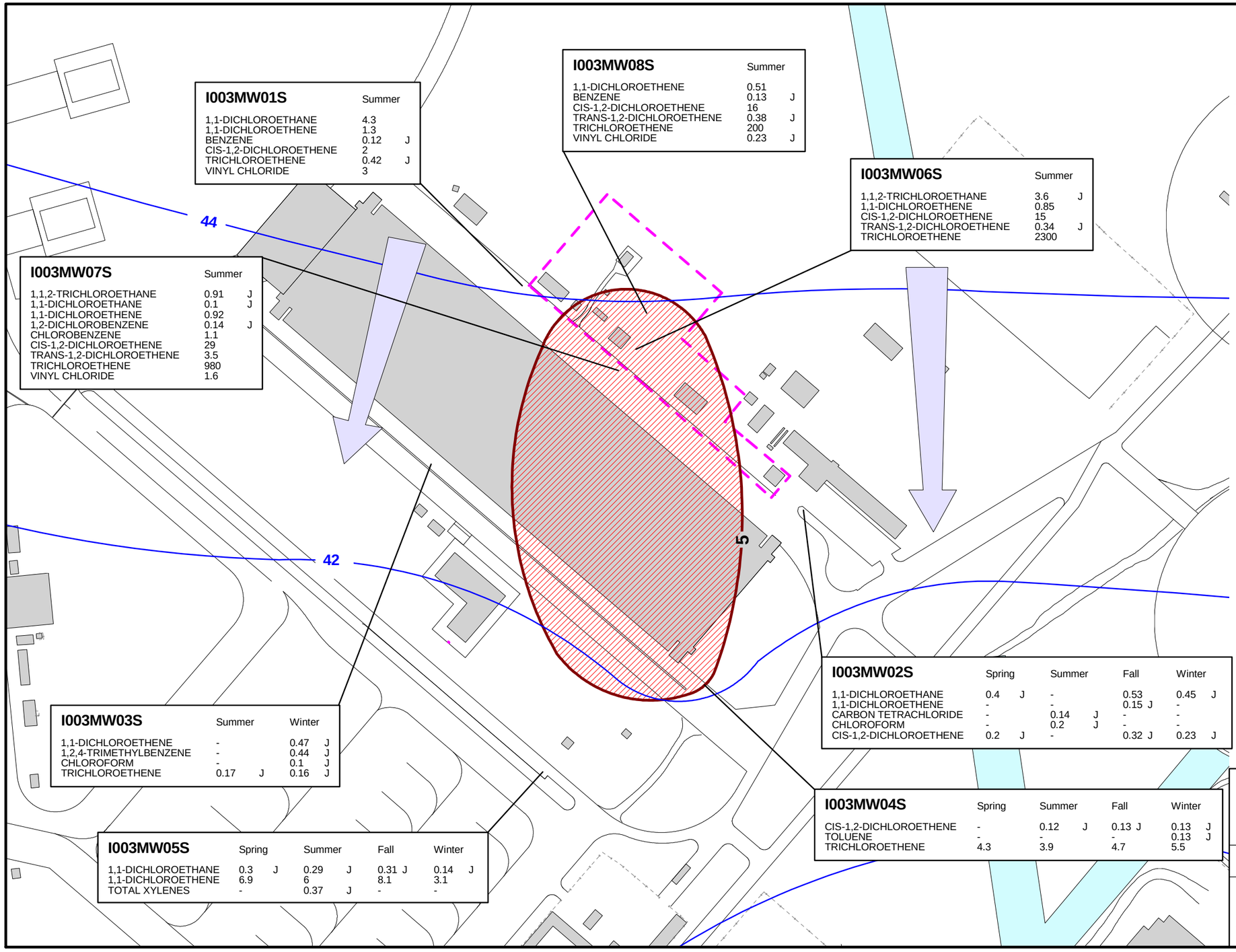
Extent of TCE Soil Contamination >400 ug/kg at IRP-3

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No: 035L8921
Job No: 23818-035
Rev No: C



I003MW01S Summer

1,1-DICHLOROETHANE	4.3	
1,1-DICHLOROETHENE	1.3	
BENZENE	0.12	J
CIS-1,2-DICHLOROETHENE	2	
TRICHLOROETHENE	0.42	J
VINYL CHLORIDE	3	

I003MW08S Summer

1,1-DICHLOROETHENE	0.51	
BENZENE	0.13	J
CIS-1,2-DICHLOROETHENE	16	
TRANS-1,2-DICHLOROETHENE	0.38	J
TRICHLOROETHENE	200	
VINYL CHLORIDE	0.23	J

I003MW06S Summer

1,1,2-TRICHLOROETHANE	3.6	J
1,1-DICHLOROETHENE	0.85	
CIS-1,2-DICHLOROETHENE	15	
TRANS-1,2-DICHLOROETHENE	0.34	J
TRICHLOROETHENE	2300	

I003MW07S Summer

1,1,2-TRICHLOROETHANE	0.91	J
1,1-DICHLOROETHANE	0.1	J
1,1-DICHLOROETHENE	0.92	
1,2-DICHLOROBENZENE	0.14	J
CHLOROBENZENE	1.1	
CIS-1,2-DICHLOROETHENE	29	
TRANS-1,2-DICHLOROETHENE	3.5	
TRICHLOROETHENE	980	
VINYL CHLORIDE	1.6	

I003MW03S

	Summer		Winter	
1,1-DICHLOROETHENE	-		0.47	J
1,2,4-TRIMETHYLBENZENE	-		0.44	J
CHLOROFORM	-		0.1	J
TRICHLOROETHENE	0.17	J	0.16	J

I003MW02S

	Spring		Summer		Fall		Winter	
1,1-DICHLOROETHANE	0.4	J	-		0.53		0.45	J
1,1-DICHLOROETHENE	-		-		0.15	J	-	
CARBON TETRACHLORIDE	-		0.14	J	-		-	
CHLOROFORM	-		0.2	J	-		-	
CIS-1,2-DICHLOROETHENE	0.2	J	-		0.32	J	0.23	J

I003MW04S

	Spring		Summer		Fall		Winter	
CIS-1,2-DICHLOROETHENE	-		0.12	J	0.13	J	0.13	J
TOLUENE	-		-		-		0.13	J
TRICHLOROETHENE	4.3		3.9		4.7		5.5	

I003MW05S

	Spring		Summer		Fall		Winter	
1,1-DICHLOROETHANE	0.3	J	0.29	J	0.31	J	0.14	J
1,1-DICHLOROETHENE	6.9		6		8.1		3.1	
TOTAL XYLENES	-		0.37	J	-		-	

LEGEND

- I003MW05S — WELL INSTALLED IN 1st PERMEABLE WATER-BEARING ZONE (WBZ) (SHALLOW)
- 42 — 1st WBZ WATER-LEVEL ELEVATION CONTOUR FOR DECEMBER 2001, IN FEET ABOVE MEAN SEA LEVEL
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE
- APPROXIMATE EXTENT OF TRICHLOROETHENE CONTAMINANTS IN GROUNDWATER AT CONCENTRATIONS GREATER THAN 5 MICROGRAMS PER LITER (µg/L)

MONITORING WELL ID

MONITORING ROUND

I003MW03S

	Summer		Winter	
1,1-DICHLOROETHENE	-		0.47	J
1,2,4-TRIMETHYLBENZENE	-		0.44	J
CHLOROFORM	-		0.1	J
TRICHLOROETHENE	0.17	J	0.16	J

ANALYTE

CONCENTRATION IN (µg/L)

REVIEW QUALIFIER

NOTES:

J - ESTIMATED VALUE
- - NOT REPORTED

N

200 0 200 Feet

Record of Decision/Remedial Action Plan

Figure 5-9

IRP-3 Groundwater Monitoring Results for the First WBZ in 2001

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035A8866
Job No.: 23818-035
Rev No.: C

The lateral extent of VOCs reported in groundwater at concentrations exceeding 5 μg/L in the second WBZ was estimated to be approximately 650 feet in a north-south direction and approximately 450 feet in an east-west direction (Figure 5-10). The estimated extent of this plume based on 2001 data is generally consistent with the estimated extent of the plume based on data obtained during the RI and subsequent monitoring rounds (BNI 2002).

5.3 IRP-12, DRUM STORAGE AREA NO. 2

IRP-12 occupies approximately 3.5 acres north of Building 28 in the northwestern portion of Former MCAS Tustin, along Copeland Street (Figures 1-2 and 5-11). IRP-12 includes two major buildings (Buildings 90 and 20B) and several former drum storage areas once used to manage hazardous wastes, including assorted unidentified solvents, motor oil, and hydraulic fluids. IRP-12 is also the site of former UST-90 as well as eight AOCs (ST-21A, ST-21B, ST-21C, ST-21D, ST-21E, ST-21F, STD-1, and MDA-07) investigated during the RFA.

5.3.1 Site History

The area identified as IRP-12 has been used primarily for materials storage and warehouse functions (BNI 1997a). Building 90, built in 1953 and renovated in 1989, has always been a warehouse. Building 20B was built in 1943 and has been used exclusively for storage (BNI 1996e). The following three subareas within IRP-12 were reportedly used for drum storage from the mid-1960s until 1975 and experienced leaks or releases as summarized below.

- Approximately 880 gallons of assorted organic liquids, including solvents, motor oil, and hydraulic fluids, leaked from drums within an approximately 250-square-foot area west of the northern corner of Building 90.
- Approximately 1,000 gallons of motor oil and hydraulic fluids leaked from storage containers within a 20,000-square-foot area northeast of Building 90.
- An estimated 660 to 800 gallons of motor oil and hydraulic fluids was released in a 500-square-foot area southeast of Building 20B.

A 500-gallon UST (UST-90), removed in 1993, was formerly located between Building 90 and Copeland Street. It was installed in 1953 and stored No. 2 fuel oil (similar to diesel fuel) for heating Building 90. Petroleum contamination was discovered both around the tank excavation zone and upgradient near Building 90 (BNI 2000b). The DON plans to remove the contaminated soils associated with former UST-90 under a separate petroleum corrective action program (BNI 1997a).

The AOCs associated with IRP-12 are shown on Figure 5-11. ST-21A and ST-21B are inactive hazardous waste storage units that formerly held materials such as mercury, jet fuel, other distilled petroleum products, and cleaning compounds. ST-21C, ST-21D, ST-21E, and ST-21F were used to store recyclable wastes such as oil, jet fuel, and batteries. STD-1 (Building 248) was used to store hazardous wastes. MDA-07 was used as a washpad for planes and blimps.

Since 1993, the area encompassed by IRP-12 has shown little surface staining or signs of stressed vegetation. The drum storage areas are vacant, except for abandoned building foundations within the fenced compound east of Building 90. Pavement covers the area north of Building 90 and a large portion of the area south of Building 20B (BNI 1997a).

5.3.2 Site Investigations

The following subsections serve as a summary of previous investigations related to IRP-12.

5.3.2.1 INITIAL ASSESSMENT STUDY

IRP-12 was recommended for a confirmation study based on the results of the IAS completed under the NACIP Program in 1985 in which IRP-12 was first identified as a potentially contaminated area (Brown and Caldwell 1985).

5.3.2.2 SITE INSPECTION

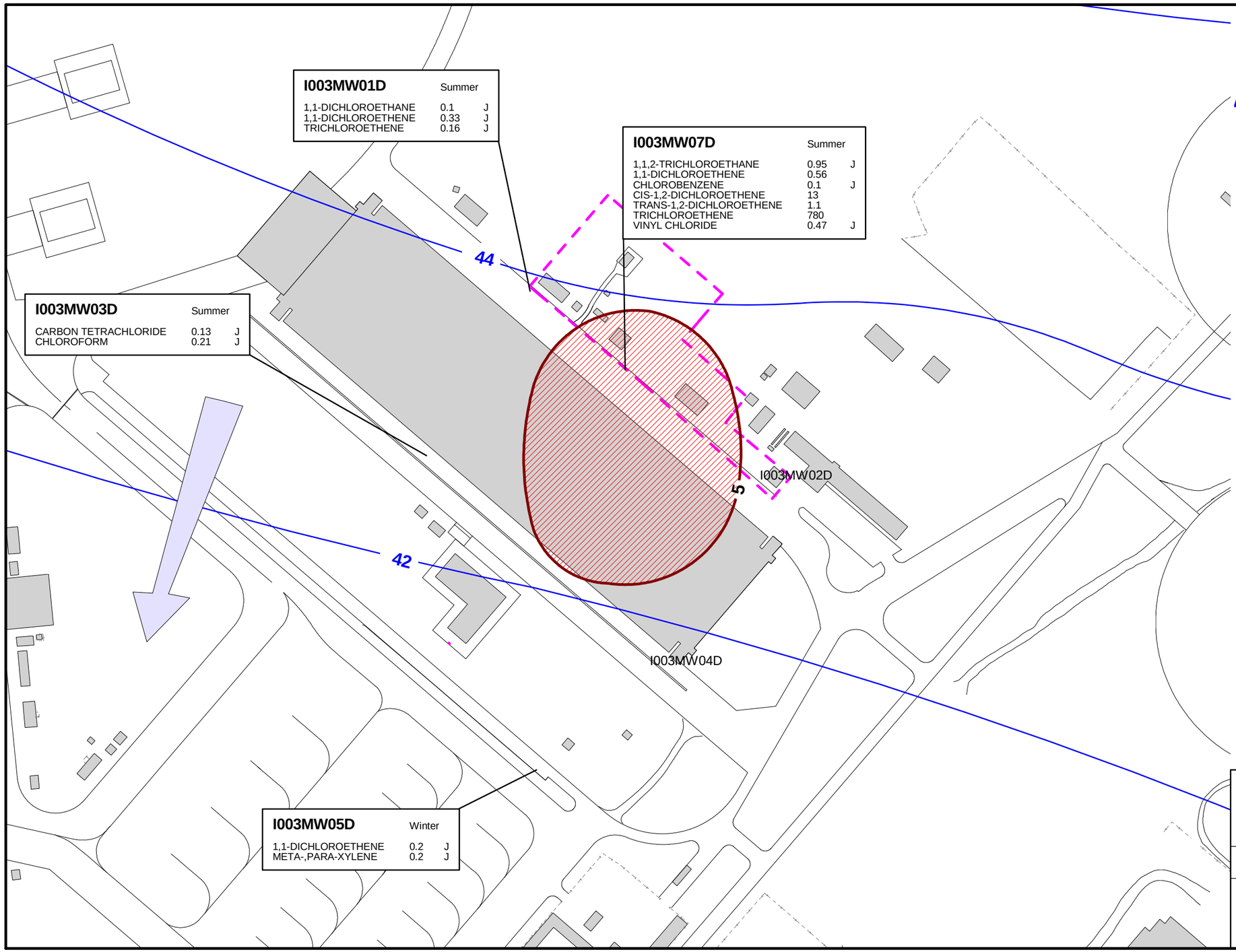
The initial subsurface investigation at IRP-12 was conducted during the 1991 SI (JEG 1993). This assessment included a soil gas survey and collection of shallow soil and groundwater samples.

Results from the SI indicated limited surficial soil contamination was present, primarily TPH at reported concentrations ranging to 730 mg/kg in an area just north of Building 90, in drainage ditch sediments east of Building 90, and in the area south of Building 20B (BNI 1997a). Pesticides reported in soil included dichlorodiphenyltrichloroethane, dichlorodiphenyldichloroethene, and dichlorodiphenyldichloroethane. Other organic compounds reported in soils included methylene chloride, acetone, and bis(2-ethylhexyl)phthalate at maximum concentrations of 68, 39, and 600 μg/kg, respectively. Heavy metals (arsenic, chromium, copper, lead, mercury, nickel, and zinc) were reported in shallow soil samples at concentrations near expected background values (BNI 1997a).

Selenium was reported in all groundwater samples collected during the SI at concentrations from 80 to 380 μg/L (BNI 1997a). TCE was reported in only one groundwater sample at a concentration of 1,000 μg/L.

5.3.2.3 REMEDIAL INVESTIGATION

In 1995, an RI was performed to confirm the findings of the SI and to determine the nature and extent of soil and groundwater contamination at IRP-12 (BNI 1997a). The major contaminants identified during the RI included TCE in soil and groundwater and TPH in soil. The presence of TCE in soil and groundwater was attributed to surface disposal of solvents as well as spills and leakage from solvent storage containers situated on the ground surface. It is believed that these releases occurred before the early 1980s.



LEGEND

- I001MW05D — WELL INSTALLED IN 2nd PERMEABLE WATER-BEARING ZONE (WBZ) (DEEP)
- 42 — 2nd (WBZ) WATER-LEVEL ELEVATION CONTOUR FOR DECEMBER 2001, IN FEET ABOVE MEAN SEA LEVEL
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE
- APPROXIMATE EXTENT OF TRICHLOROETHENE CONTAMINANTS IN GROUNDWATER AT CONCENTRATIONS GREATER THAN 5 MICROGRAMS PER LITER (µg/L)

MONITORING WELL ID

MONITORING ROUND

I003MW05D Winter

1,1-DICHLOROETHENE 0.2 J
META-,PARA-XYLENE 0.2 J

ANALYTE

REVIEW QUALIFIER

CONCENTRATION IN (µg/L)

NOTE:

J - ESTIMATED VALUE

N

200 0 200 Feet

Record of Decision/Remedial Action Plan

Figure 5-10

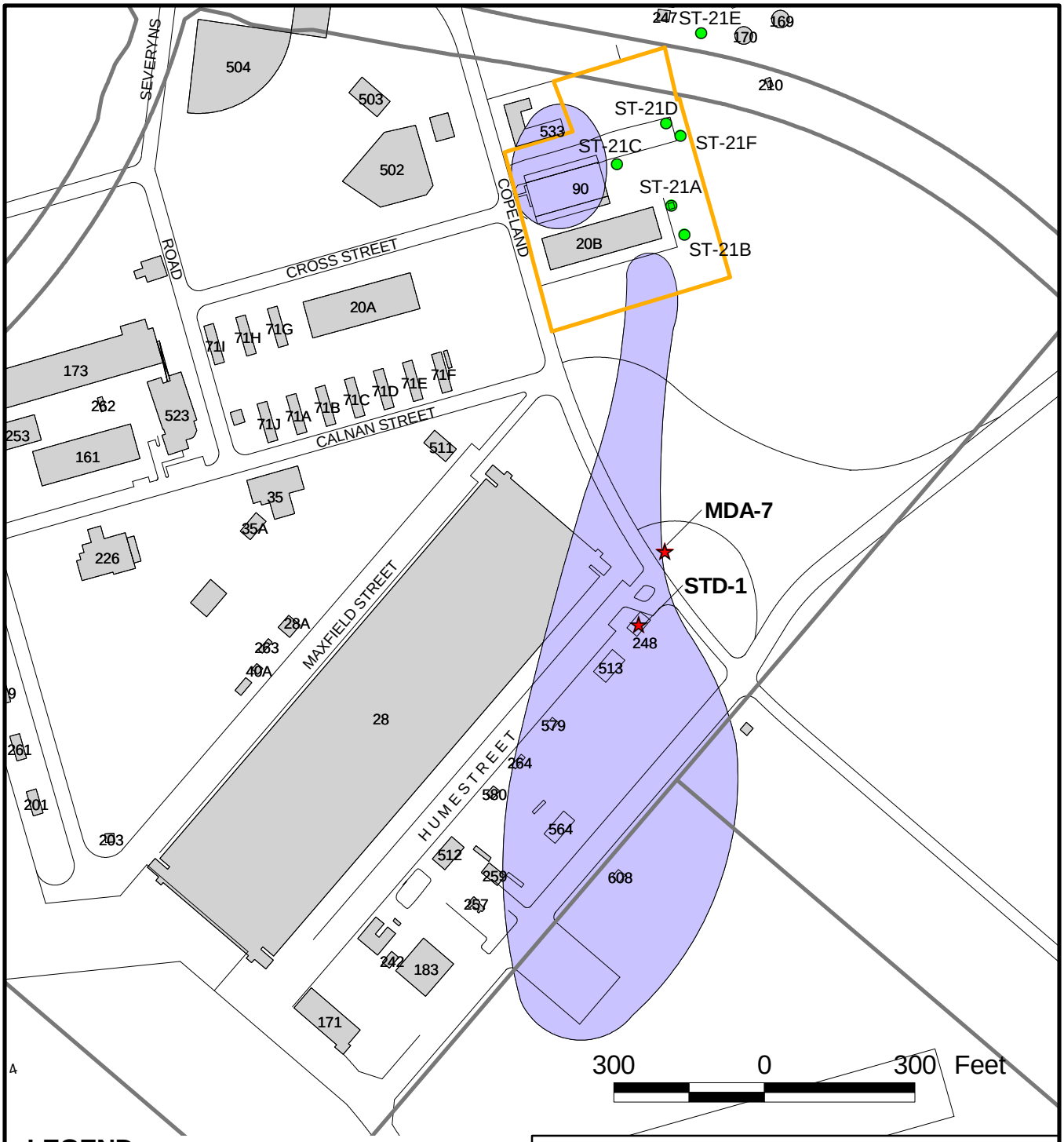
IRP-3 Groundwater Monitoring Results for the Second WBZ in 2001

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035A8867
Job No.: 23818-035
Rev No.: D



LEGEND

- LOCATION OF AREA OF CONCERN (AOC)
- AOC INCORPORATED INTO RISK ASSESSMENT
- IRP-12 CONTAMINANT PLUMES
- IRP-12 BOUNDARY
- FUTURE ROAD
- ROAD
- BUILDING

N

Record of Decision/Remedial Action Plan

Figure 5-11

IRP-12 and Nearby AOCs

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035L8862
Job No.: 23818-035
Rev No.: C

TCE contamination was not linked to either former UST-90 or to any of the AOCs. Former UST-90, however, was shown to be the principal source of the TPH-contaminated soil discussed above (BNI 1997a).

Soil Contamination

TCE, the most frequently reported VOC in soil samples, was reported in shallow vadose-zone soils (generally above 7 feet bgs) and in deeper saturated zone soils to a depth of approximately 24 feet bgs (BNI 1997a, 1998a). The maximum areal extent of TCE and the highest concentrations were generally reported in soil samples from 12 feet bgs. Common TCE degradation products, including 1,1-DCA, 1,1-DCE, 1,2-DCE, 1,2-DCA, and VC, were not reported in soil samples collected during the RI or during post-RI soil sampling programs.

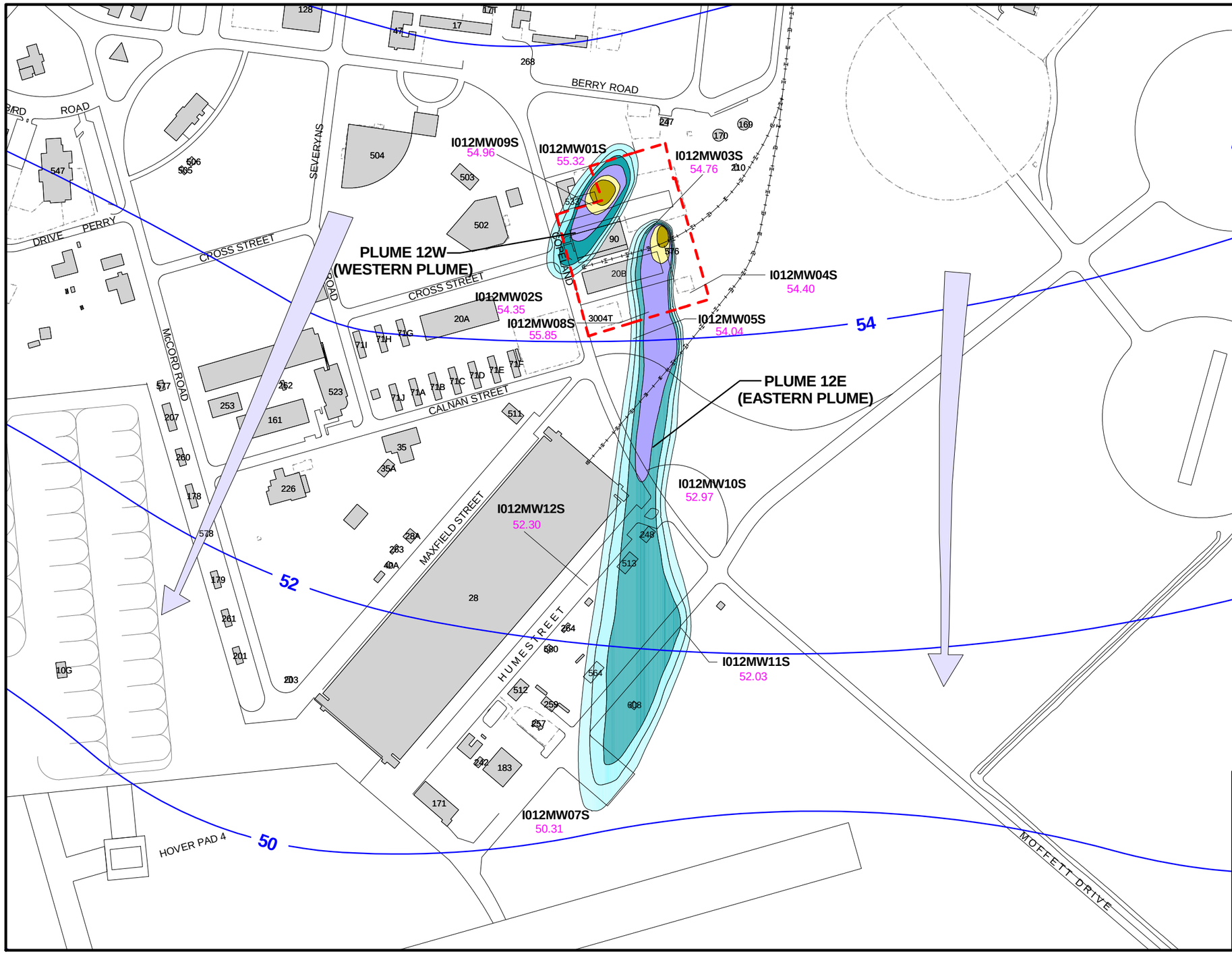
Concentrations of TCE reported in soil were significantly less in unsaturated vadose-zone soil samples (2 to 3 feet bgs) than in saturated zone samples (7 to 12 feet bgs) (BNI 1997a). TCE was reported in shallow vadose-zone soils at concentrations up to 200 μg/kg, and in soil samples collected at and below the water table at concentrations up to 6,629 μg/kg. TCE was reported in deeper saturated soil samples (17 to 24 feet bgs) at concentrations up to 346 μg/kg. TCE was not reported in soil samples collected between 25 and 90 feet bgs.

Other VOCs that have been used as industrial solvents (chloroform, acetone, methyl chloride, and chlorofluorocarbons [CFCs]) were reported in soils at trace concentrations. TPH was reported in approximately 10 percent of the soil samples analyzed during the RI at concentrations between 11 and 722 mg/kg. Constituents indicative of petroleum, notably aromatic hydrocarbons, aliphatic hydrocarbons, and PAHs, were reported infrequently and at trace concentrations. The occurrence of TPH and related hydrocarbons at IRP-12 was generally restricted to the top 2 feet of soil. Two plasticizers, bis(2-ethylhexyl)phthalate and butyl benzyl phthalate, were reported in the upper 1 foot of soil. PCBs were not reported in soil at IRP-12 (BNI 1997a).

Site-related metal contamination was also found generally in the upper portion of the vadose zone. Lead, selenium, and zinc were reported at 1 to 2 feet bgs. The presence of elevated concentrations of TPH in these surficial soils, together with reported releases of used motor oil, suggests that these metals are related to waste oil. Mercury was reported in six soil samples at concentrations slightly above background levels. Because of the reported storage of wastes containing mercury, the RI Report concluded that this metal was also probably a site-related contaminant in IRP-12 soil (BNI 1997a).

Groundwater

Based on data collected during the RI, VOCs (principally TCE) were reported in groundwater plumes in the first and second WBZs to a maximum depth of approximately 50 feet bgs (Figures 5-7, 5-12, and 5-13) (BNI 1997a, 1998b). Two groundwater plumes were identified at IRP-12; the western plume (Plume 12W) occurs only in the first WBZ, and the eastern plume (Plume 12E) occurs in both the first and second WBZs.



LEGEND

- 1012MW03S — WELL INSTALLED IN 1st PERMEABLE WATER-BEARING ZONE (SHALLOW)
- 54.76 — GROUNDWATER ELEVATION LEVEL IN FT MSL FOR JUNE 2000
- 40 — 1st WATER-BEARING ZONE EQUIPOTENTIAL LINE FOR JUNE 2000
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE

TCE CONCENTRATION IN GROUNDWATER:

- 5 to 10 µg/L
- 10 to 20 µg/L
- 20 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- 2000 to 5000 µg/L
- > 5000 µg/L

N

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL IN NOVEMBER 1997 TO UPDATE BASE MAP

300 0 300 Feet

Record of Decision/Remedial Action Plan

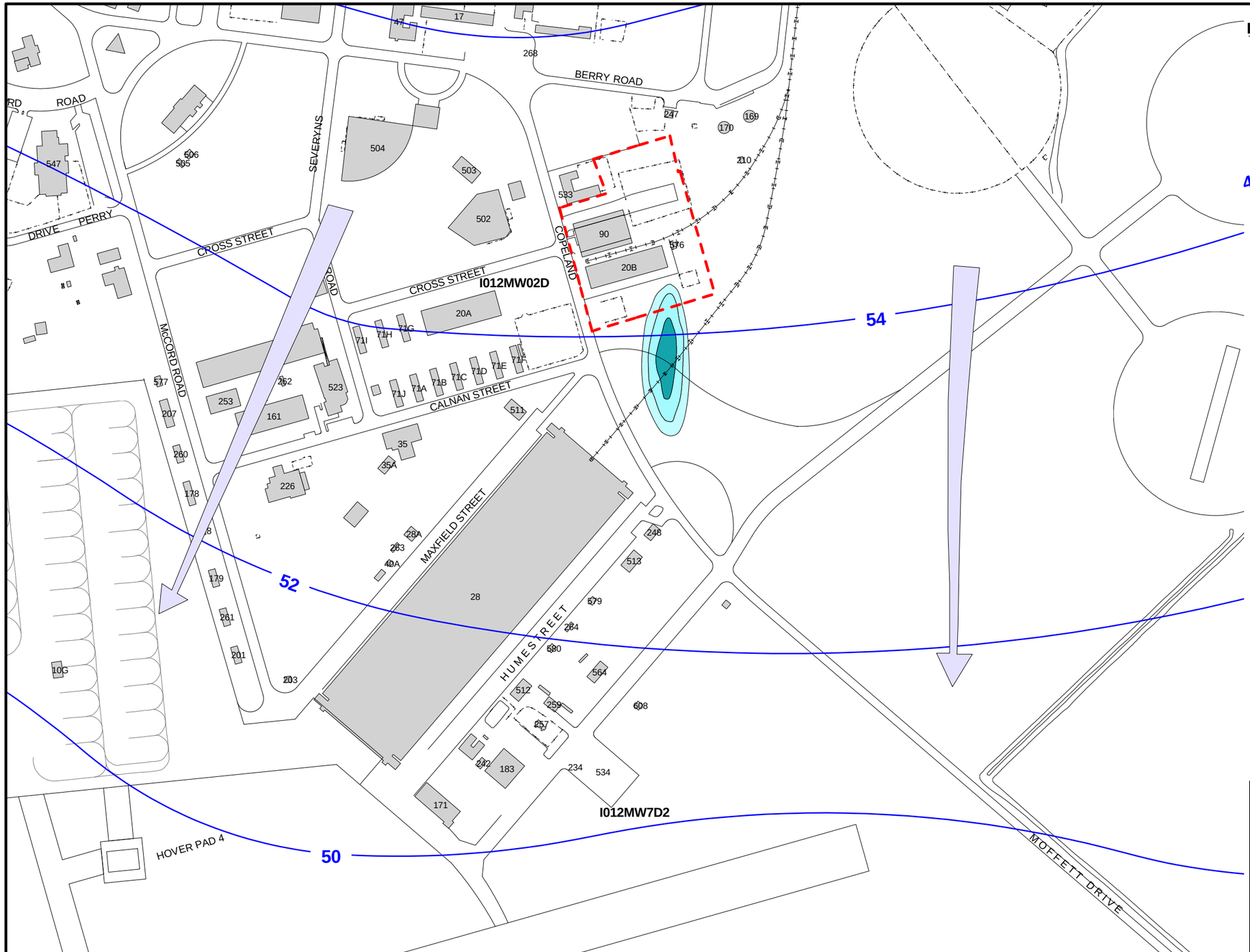
Figure 5-12

IRP-12 TCE Plumes in Groundwater in the First WBZ, Based on RI Data

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/26/04
File No.: 035A8868
Job No.: 23818-035
Rev No.: D



LEGEND

- 1012MW02D — WELL INSTALLED IN 2nd PERMEABLE WATER-BEARING ZONE (SHALLOW)
- 54.37 — GROUNDWATER ELEVATION LEVEL IN FT MSL FOR JUNE 2000
- 1012MW7D2 — WELL INSTALLED IN 3rd PERMEABLE WATER-BEARING ZONE (2nd WBZ IS ABSENT AT IO12MW7D2)
- 40 — 2nd WATER-BEARING ZONE EQUIPOTENTIAL LINE FOR JUNE 2000
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE

TCE CONCENTRATION IN GROUNDWATER:

- 5 to 10 µg/L
- 10 to 20 µg/L
- 20 to 100 µg/L
- 100 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- 2000 to 5000 µg/L
- > 5000 µg/L

N

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL IN NOVEMBER 1997 TO UPDATE BASE MAP

300 0 300 Feet

Record of Decision/Remedial Action Plan

Figure 5-13

IRP-12 TCE Plumes in Groundwater in the Second WBZ, Based on RI Data

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035A8869
Job No.: 23818-035
Rev No.: D

Plume 12W appears to originate in the TCE source areas located north-northeast of Building 533 and extends laterally approximately 450 feet in a south-southwest and north-northeast direction, following the predominant shallow groundwater flow direction in this area (Figure 5-12) (BNI 1997a, 1998b). The maximum width of Plume 12W is about 150 feet in a west-northwest and east-southeast direction. The downgradient extent of this plume appears to be located near Copeland Street across from the southwestern end of Building 90. During the RI, a maximum TCE concentration of 3,900 μg/L was reported in a grab water sample bailed from 21 feet bgs in a soil boring at the "core" of the plume. More recently, monitoring wells completed within this plume have shown maximum reported TCE concentrations of 350 to 460 μg/L.

Plume 12E appears to originate in TCE source areas located to the east and northeast of Building 20B and extends laterally approximately 1,800 feet in a north-south direction, with a maximum estimated width of approximately 400 feet (Figure 5-12) (BNI 1997a). Although Plume 12E covers a greater area than Plume 12W, reported TCE concentrations are substantially less. TCE was reported at a maximum concentration of 1,051 μg/L in groundwater samples from the source area of Plume 12E. During 1997, the maximum TCE concentration measured in this plume was in the range of 80 to 90 μg/L in a monitoring well located approximately 250 feet downgradient from the source area (BNI 1998b). A single plume lies directly under the footprint of Plume 12E, extending approximately 650 feet from the IRP-12 source area. This plume is 100 feet at its widest point. A maximum of 58 μg/L TCE was reported in the second WBZ at a depth of approximately 38 feet bgs, or 24 feet below MSL (BNI 1997a). TCE was not reported in any groundwater samples collected below approximately 43 feet bgs at IRP-12.

Other VOCs reported in groundwater samples from one or both of the plumes include 1,2-DCA, 1,2-DCE, and 1,1,2-trichloroethane (TCA). Two CFCs, 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113) and 1,2-dichloro-1,1,2-trifluoroethane (Freon 123a), were reported at concentrations up to 900 μg/L. The distribution of the CFCs appears to coincide with Plume 12E, suggesting that these solvents were released with TCE (BNI 1997a).

Three heavy metals, including cadmium, chromium, and hexavalent chromium, were reported in groundwater samples at concentrations up to 5, 32, and 3 μg/L, respectively. The maximum reported concentration of each metal occurred in the first WBZ at approximately 25 feet bgs. Cadmium is a constituent of waste oils and paint pigment. Chromium (measured as either total or hexavalent chromium) can be found in waste oils, residuals from paint-stripping and metal-polishing operations, and chemicals used for industrial cleaning. The occurrence of cadmium and chromium in IRP-12 groundwater at depths coincident with TCE contamination suggests that both metals are related to waste releases from the drum storage areas (BNI 1997a).

Based on data obtained during the RI, TCE, 1,2-DCE, and 1,1,2-TCA were identified as COPCs for groundwater at IRP-12 (Table 5-2) (BNI 1997a). In identifying these compounds as COPCs, it was assumed that background concentrations of chlorinated

Table 5-2
Primary Chemicals of Potential Concern in IRP-12 Groundwater

Contaminant	Detection Frequency[a]	Concentration Range[b] (micrograms per liter)
IRP-12		
trichloroethene	24/65	7–3,900
1,2-dichloroethene	9/65	4–8
1,1,2-trichloroethane	2/65	4–6

Notes:
[a] number of samples in which the contaminant was reported above detection level/total number of groundwater samples collected during the RI and RFA (BNI 1997a,b)
[b] range of concentrations for samples with detectable levels of the contaminant

Acronyms/Abbreviations:
IRP – Installation Restoration Program
RFA – Resource Conservation and Recovery Act facility assessment
RI – remedial investigation

VOCs in groundwater at Former MCAS Tustin were below the detection limits of available U.S. EPA analytical methods.

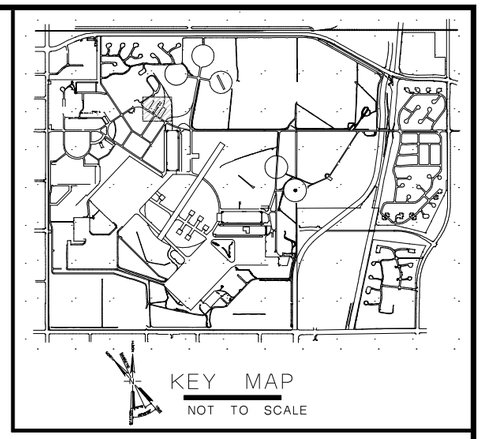
5.3.2.4 POST-RI SOIL SAMPLING AND FEASIBILITY STUDY

A post-RI field program was performed in 1997 that verified the estimated distribution of TCE in soil, interpreted from data collected during the RI. No additional TCE source areas were identified (BNI 1998a).

An FS was conducted for OU-1B that included developing and evaluating remedial action alternatives for groundwater (BNI 2002). Computer modeling performed during this FS indicated that TCE remaining in soil at concentrations exceeding 400 µg/kg within the vadose zone and in the upper confining layers of the first WBZ would act as a continuing source of contamination to groundwater resulting in concentrations of TCE exceeding the MCL. Based on soil sampling results obtained during the RI and post-RI soil sampling programs, one area with TCE concentrations in soil exceeding 400 µg/kg was identified at IRP-12 (Figure 5-14).

5.3.2.5 GROUNDWATER MONITORING

The lateral extent of VOCs (primarily TCE and 1,2-DCA) in groundwater in the first and second WBZs was estimated based on data collected during 2001 under the basewide groundwater monitoring program at Former MCAS Tustin (Figure 5-15) (BEI 2003a). The following VOCs were reported in groundwater samples at concentrations exceeding applicable MCLs during 2001.



LEGEND

THE EXTENT OF TCE CONTAMINATION > 400 ug/kg AT 2 TO 13 FEET BGS

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL TO REFLECT CONDITIONS AS OF NOVEMBER 1997.

Record of Decision/Remedial Action Plan

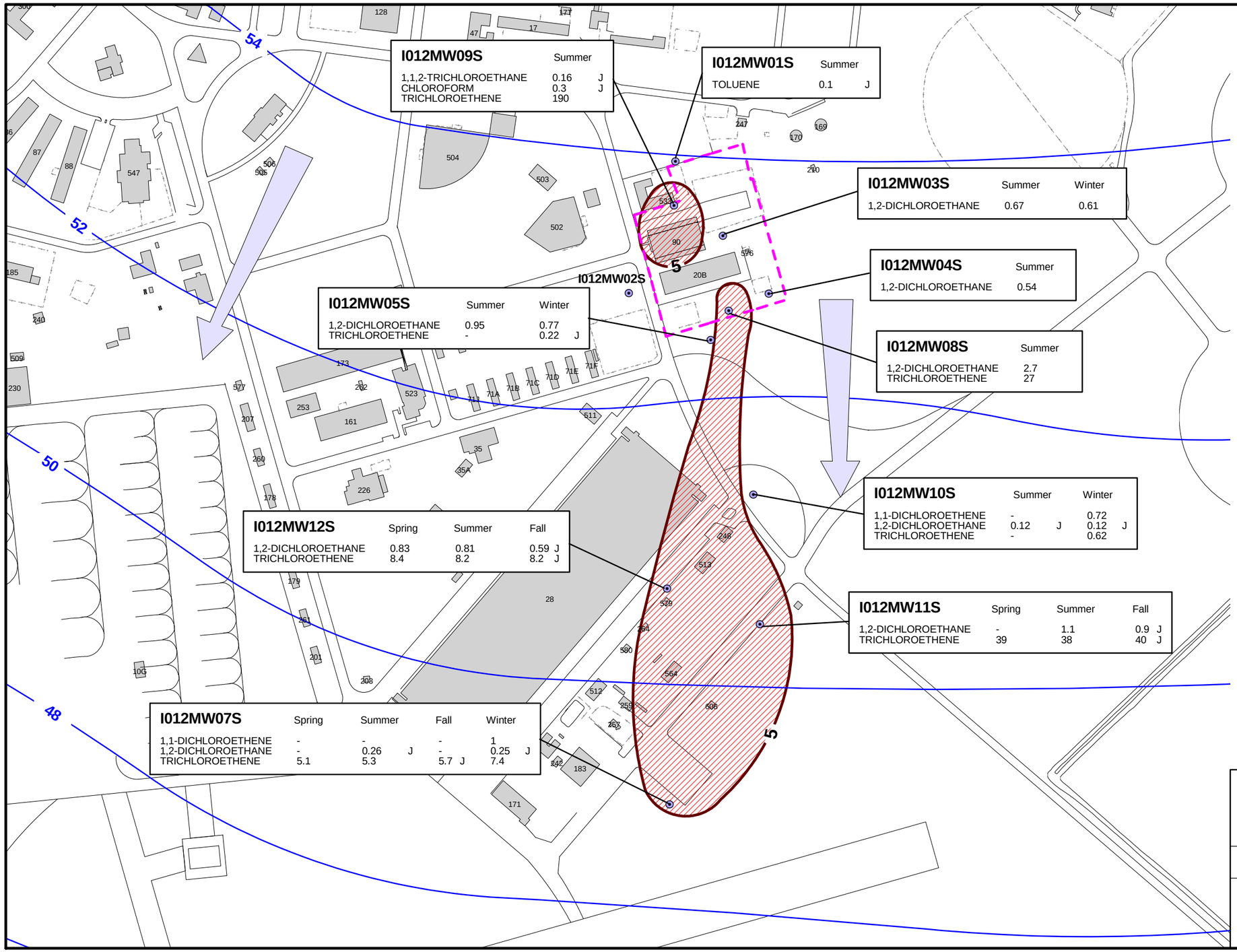
Figure 5-14

Extent of TCE Soil Contamination > 400 ug/kg at IRP-12

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/26/04
File No: 035L8922
Job No: 23818-035
Rev No: C



LEGEND

- I012MW09S — WELL INSTALLED IN 1st PERMEABLE WATER-BEARING ZONE (WBZ) (SHALLOW)
- 48 — 1st WBZ WATER-LEVEL ELEVATION CONTOUR FOR DECEMBER 2001, IN FEET ABOVE MEAN SEA LEVEL
- GENERALIZED GROUNDWATER FLOW DIRECTION (DIRECTION OF GROUNDWATER FLOW IS PERPENDICULAR TO WATER LEVEL CONTOURS)
- APPROXIMATE IRP SITE BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- FENCE
- APPROXIMATE AREAL EXTENT OF TRICHLOROETHENE IN GROUNDWATER AT CONCENTRATIONS GREATER THAN 5 MICROGRAMS PER LITER (µg/L)

MONITORING WELL ID — MONITORING ROUND

I012MW05S	SUMMER	WINTER
1,2-DICHLOROETHANE	0.95 J	0.77

ANALYTE — REVIEW QUALIFIER — CONCENTRATION IN µg/L

NOTES:

J - ESTIMATED VALUE

- - NOT REPORTED

ISOCONCENTRATION LINE DEPICTED USING MOST RECENT QUARTERLY DATA

N

300 0 300 Feet

Record of Decision/Remedial Action Plan

Figure 5-15

IRP-12 Groundwater Monitoring Results for the First WBZ in 2001

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035A8870
Job No.: 23818-035
Rev No.: C

- TCE was reported in groundwater samples from 7 of 11 wells in the first WBZ at concentrations ranging to 190 μg/L. TCE was reported at an estimated concentration of 0.12 μg/L in one groundwater sample from the second WBZ. TCE was not reported in any groundwater samples collected from the third WBZ.
- 1,2-DCA was reported in groundwater samples from 8 of 11 wells in the first WBZ at concentrations ranging to 2.7 μg/L. The VOC 1,2-DCA was not reported in any groundwater samples collected from the second or third WBZs.

Other VOCs reported in groundwater during 2001 monitoring included chloroform, 1,1-DCE, toluene, and 1,1,2-TCA.

Based on data collected during 2001 monitoring, the lateral extent of VOCs in Plume 12W in the first WBZ is approximately 250 feet in a north-south direction, and approximately 200 feet in an east-west direction (Figure 5-15). TCE was reported at a maximum concentration of 190 μg/L in a groundwater sample from the northern portion of the plume.

Based on data collected during 2001 monitoring, the lateral extent of VOCs in Plume 12E in the first WBZ is approximately 1,550 feet in a north-south direction and approximately 450 feet in an east-west direction (Figure 5-15). TCE was reported at a maximum concentration of 40 μg/L in this plume.

5.4 EXPOSURE PATHWAYS

Exposure pathways for COPCs in soil at IRP-3 and IRP-12 include ingestion, inhalation, and dermal contact (Figure 5-16). Exposure pathways were identified based on site-specific information, physical properties of COPCs, and human receptors corresponding to future land use planned by the city of Tustin (BNI 1997a). (Section 6 summarizes current and future land and resource uses, and Section 7 summarizes risks associated with routes of exposure.)

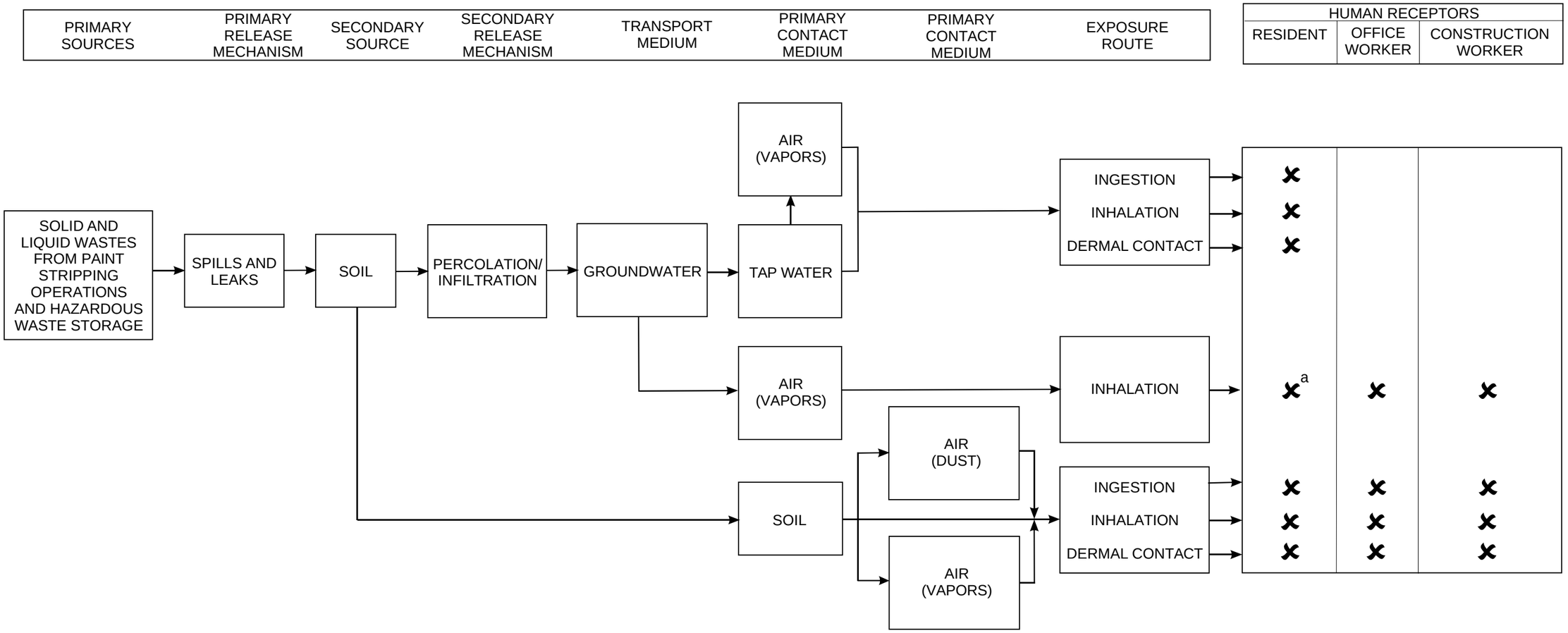
In the subsurface, VOCs are typically reported at low concentrations in the vadose zone. Maximum VOC concentrations were reported in soil samples collected from below the top of the water table beginning at approximately 12 feet bgs in a relatively thick, low permeability, silty clay layer known as the “upper confining layer of the first WBZ.” Reported concentrations of VOCs typically diminish from this upper confining layer above the first WBZ upward toward the vadose zone and the ground surface, and downward with depth in the saturated zone toward the bottom of the sand layer in the second WBZ. Direct exposure to chemicals in the subsurface, therefore, would not occur unless excavation activities exposed contaminated soils at the surface.

VOC contamination originating at or near the surface at Former MCAS Tustin entered groundwater through the vadose zone in dissolved form. Extensive groundwater plumes containing TCE have been shown to originate at IRP-3 and IRP-12 (BNI 1997a,b). All VOC contamination associated with OU-1B is confined to the first and second WBZs (BNI 1997b, 1998b). There is no indication that VOCs from Former MCAS Tustin have impacted the third WBZ or the deeper regional aquifer (BNI 1997a). Currently, there is

no complete exposure pathway to contaminated groundwater at either site; groundwater from the first and second WBZs is not being used for any purpose. However, groundwater remains a potential future route of exposure because it could in theory be used for irrigation or domestic purposes.

5.5 MASS OF TCE

The estimated total mass of TCE in groundwater is approximately 52 pounds, approximately 39.7 and 12.5 pounds at IRP-3 and IRP-12, respectively (Table 5-3). These estimates were based on data collected during the RI (BNI 1997a) and on groundwater modeling conducted during the FS (BNI 2002). It is estimated that much of the TCE mass remaining in the subsurface is contained within the upper confining layer of the first WBZ, although dissolved VOCs have also migrated vertically downward into the sand layer of the first WBZ as well as into the second WBZ.



a DOMESTIC VAPOR PHASE CONCENTRATIONS ARE CONSIDERABLY HIGHER THAN THOSE TRANSFERRED VIA GROUNDWATER.

Record of Decision/Remedial Action Plan

Figure 5-16

Potential Routes of Exposure
IRP-3 and IRP-12

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/26/04
File No: 035C8886
Job No: 23818-035
Rev No: C

Table 5-3
Estimated Plume Dimensions,
Maximum Reported TCE Concentrations, and Estimated TCE Mass in Groundwater

IRP No.	WBZ	Area (square feet)	Maximum Reported TCE Concentration (μg/L)*	Estimated TCE Mass (pounds)
3	First	457,000	1,742	36.7
	Second	125,000	1,000	3.0
			Subtotal IRP-3	**39.7**
12	First	450,000	3,900	12.2
	Second	42,000	39	0.3
			Subtotal IRP-12	**12.5**
			Total for IRP-3 and IRP-12	**52**

Note:
* maximum contaminant concentrations in the sand layers of the first and second WBZs, from data obtained during the remedial investigation (BNI 1997a)

Acronyms/Abbreviations:
IRP – Installation Restoration Program
μg/L – micrograms per liter
TCE – trichloroethene
WBZ – water-bearing zone

This page left blank intentionally

Section 6
CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

This section discusses the current and reasonably anticipated future land uses and current and potential groundwater and surface water uses at Former MCAS Tustin. The site and resource uses help determine realistic exposure scenarios in the baseline risk assessment.

6.1 LAND USES

The Former MCAS Tustin property was determined to be excess to the long-term needs of the USMC. It was therefore decided to transfer the property to other federal agencies and/or nonfederal interests for redevelopment and reuse.

In November 1993, the DON organized the BCT to manage and coordinate facilitywide cleanup and closure activities in order to expedite land transfer at Former MCAS Tustin. DTSC is the lead regulatory agency overseeing environmental restoration at the station. U.S. EPA and the RWQCB Santa Ana Region are also participating members of the BCT.

The city of Tustin has been recognized by the U.S. Department of Defense as the LRA responsible for reuse planning at Former MCAS Tustin. In September 1998, the LRA prepared an SP errata updating the 1996 SP, which designates the preferred reuse and transfer mechanism for each parcel at the station. The SP was approved by the U.S. Department of Housing and Urban Development (HUD) on 24 March 1998. The MCAS Tustin SP was adopted by the Tustin City Council on 03 February 2003.

The LRA and the USMC prepared a joint federal Environmental Impact Statement (EIS) and state Environmental Impact Report (EIR) to address potential environmental issues associated with the planned reuse of Former MCAS Tustin. The EIS/EIR was developed in accordance with the National Environmental Policy Act and the California Environmental Quality Act. The final EIS/EIR was issued in December 1999 (DON 1999).

As noted in the BRAC Cleanup Plan (SWDIV 1998), the SP is the cornerstone of the environmental restoration strategy at Former MCAS Tustin. Figure 6-1 shows Carve-Out Area 5, which surrounds IRP-12 and Carve-Out Area 6, which surrounds IRP-3, including the VOC groundwater plumes. Portions of this area are, or will be, leased while cleanup activities are taking place. Reuse designations at Former MCAS Tustin include commercial and residential areas, schools and child-care facilities, parks, and recreational facilities

The city's reuse plan for Former MCAS Tustin was the basis for the human-health risk assessment (HHRA) completed to support the RI (BNI 1997b). Future land use was also a key consideration throughout this ROD/RAP in the development and analysis of OU-1B remedial alternatives. For areas designated as "community core," it was assumed that remediation would have to be adequate to support residential redevelopment, generally considered the most sensitive reuse option.

On 02 July 1999, Former MCAS Tustin was closed, and the USMC's mission at the station was incorporated into MCAS Miramar operations in San Diego, California. Access to the station is currently controlled by security services. Services are maintained as necessary to provide support for caretaker, lessee, and environmental cleanup operations. Most of the buildings are unoccupied.

Parcel No. 16 has been affected by VOC-impacted groundwater at IRP-3. The future land use for this parcel is listed in the SP as "community core." Parcel No. 12, which has been designated for commercial businesses, is located immediately hydraulically downgradient from the current boundary of the plume in the first WBZ at IRP-3. The proposed future land use in and around IRP-3 also includes roadways and underground utilities.

IRP-12 is located in an area identified in the city of Tustin's redevelopment plan (SP) as Parcel No. 18, which has been designated as a future urban regional park. Plume 12E extends from the IRP-12 source areas onto Parcel No. 16, which is listed for redevelopment as "community core," and onto the western corner of Parcel No. 17, listed for redevelopment as "public schools." In addition, the northern extent of Plume 12W lies within the corridor of the proposed Valencia North Loop Road.

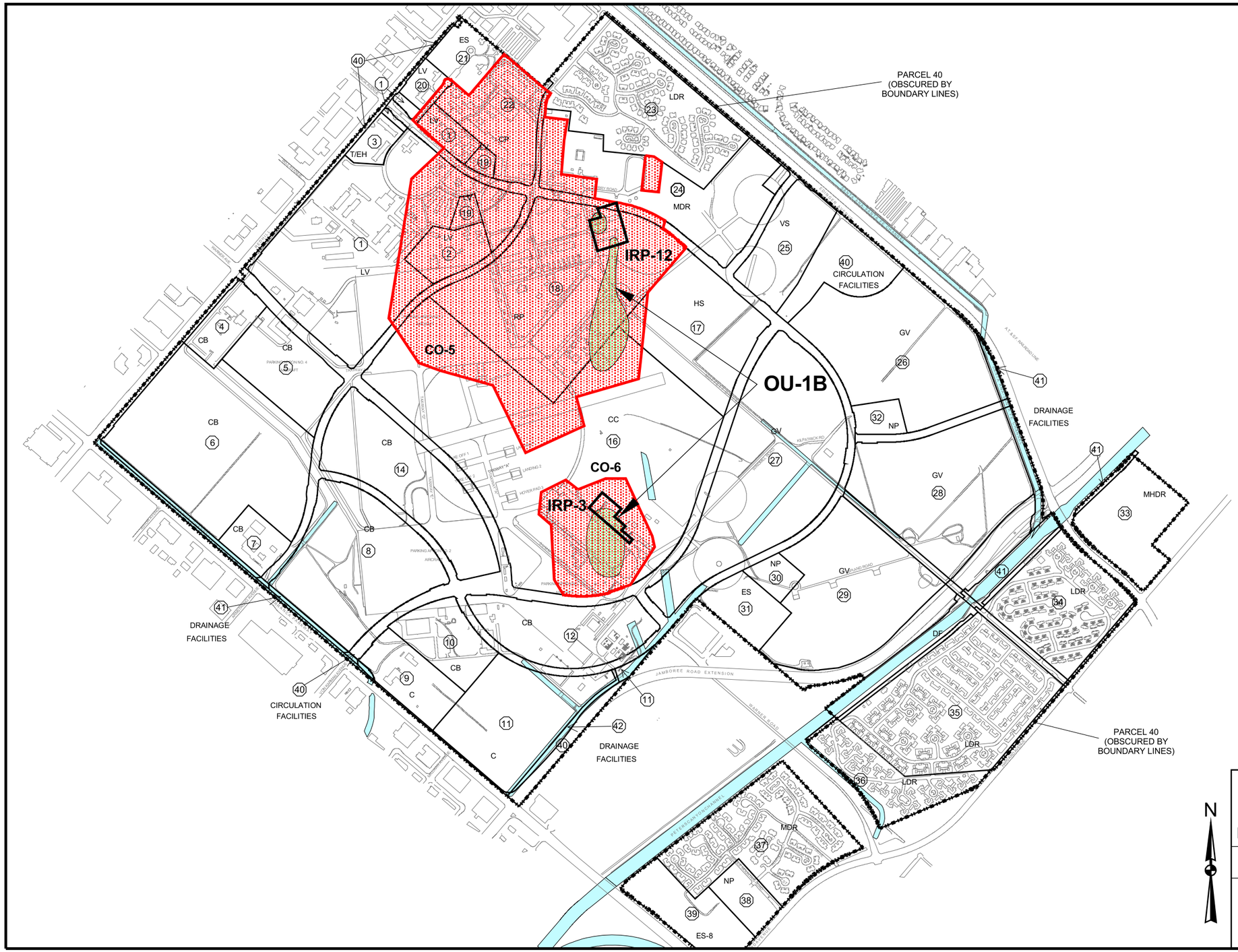
On 20 September 1997, HUD conditionally approved the SP as submitted. In addition to HUD concurrence, approval of the document from the Secretary of the Navy was required, along with prior completion of an EIS/EIR designed to evaluate the environmental impacts associated with the closure and reuse of MCAS Tustin. On 31 December 1997, the DON posted in the *Federal Register* (Fed. Reg.) formal determination of surplus for the disposal and reuse of MCAS Tustin. The LRA and the USMC finalized a joint EIS/EIR in December 1999 (DON 1999).

6.2 GROUNDWATER USES

Former MCAS Tustin is located within the Irvine Forebay Pressure subbasin, which has been designated by RWQCB as a public water supply source (RWQCB 1995). The deep regional aquifer beneath the station is currently a source of municipal drinking water. At present, shallower zones are not used for drinking water because of their generally low yield and poor quality (i.e., the shallow groundwater is saline to brackish). As noted in Section 5, the highest concentrations of salt and TDS occur in the first WBZ. The maximum TDS concentration reported in groundwater from the first WBZ was 23,000 mg/L. Groundwater containing TDS concentrations of this magnitude is generally not used for public drinking water (RWQCB 1995).

6.3 SURFACE WATER USES

Several man-made surface water channels at Former MCAS Tustin normally contain water year-round. The channels redirect surface water runoff from Former MCAS Tustin and discharge into San Diego Creek, and ultimately downstream to Newport Bay.



LEGEND

- FORMER MCAS TUSTIN BOUNDARY
- ROAD
- BUILDING OR STRUCTURE
- DRAINAGE DITCH
- REUSE PARCEL BOUNDARY
- FINDING OF SUITABILITY TO LEASE (FOSL) FOR CARVE-OUT (CO) AREAS 5 AND 6
- IR SITE BOUNDARY
- EXTENT OF GROUNDWATER CONTAMINATION FOR OU-1B

SYMBOL	LAND USE
1	PARCEL NUMBER
40	CIRCULATION FACILITIES
41	DRAINAGE FACILITIES
C	COMMERCIAL
CB	COMMERCIAL BUSINESS
CC	COMMUNITY CORE
CP	COMMUNITY PARK
	EASEMENTS/ROADS
ES	ELEMENTARY SCHOOL (K-6)
ES-8	ELEMENTARY SCHOOL (K-8)
GV	GOLF VILLAGE
HS	HIGH SCHOOL
LDR	LOW DENSITY RESIDENTIAL
LV	LEARNING VILLAGE
MDR	MEDIUM DENSITY RESIDENTIAL
MHDR	MEDIUM HIGH DENSITY RESIDENTIAL
NP	NEIGHBORHOOD PARK
RP	URBAN REGIONAL PARK
T/EH	TRANSITIONAL/EMERGENCY HOUSING
VS	VILLAGE SERVICES

1200 0 1200 Feet

N

Record of Decision/Remedial Action Plan

Figure 6-1

Proposed Future Land Use at Former MCAS Tustin

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/26/04
File No.: 035L12371
Job No.: 23818-035
Rev No.: A

Several sections of the on-site drainage ditches and portions of Peters Canyon Channel and Santa Ana-Santa Fe Channel were designated as potential wetland by the U.S. Fish and Wildlife Service (USDA 1992). The USACE designated two drainage areas as jurisdictional wetlands (Durham 1996) (see Figure 5-2). In 1999, a wetlands determination was completed to verify the extent and quality of wetland habitat and to provide sufficiently detailed and accurate jurisdictional delineations to support permitting and mitigation planning. As a result of this determination, eight areas were identified as jurisdictional waters of the United States. Within those jurisdictional waters, a smaller area was determined to be vegetated wetland/seasonal wetland (BNI 2000c).

No sensitive habitats have been identified at Former MCAS Tustin. However, approximately 5 miles southwest of the station is the upper Newport Bay Ecological Reserve, into which Peters Canyon Channel flows. The reserve was established in 1975 to preserve and enhance this saltwater marsh ecosystem. Eight species classified by the state of California as either rare or endangered are dependent on the upper Newport Bay Ecological Reserve. A series of marshy wildlife refuges (approximately 300 acres at UCI) is located approximately 5 miles south of Former MCAS Tustin.

This page left blank intentionally

Section 7
SUMMARY OF SITE RISKS

Baseline risk assessments provide evaluations of the potential threat to human health and the environment in the absence of any remedial action. They form the basis for determining whether remedial action is necessary and the justification for performing remedial actions (U.S. EPA 1988a). A previous risk assessment conducted during the RI evaluated risks from exposure to soil and groundwater at IRP-3 and IRP-12 for current conditions under residential and industrial scenarios. This baseline risk assessment was revised during the FS to address cumulative risks at IRP-3 sitewide and at two AOCs (TOW-X3 and TOW-X4) within IRP-3; and at IRP-12 sitewide and at two AOCs (STD-1 and MDA-07) within IRP-12 under residential, industrial, and construction worker scenarios.

A quantitative estimate of future risk was also performed based on concentrations of contaminants that were predicted to remain at the sites 30 years after implementation of proposed remedial Alternative 7, hydraulic containment with hot spot removal. The methodology and the results of the risk assessments are summarized in this section. A complete discussion of the risk assessments performed for IRP-3 and IRP-12 is presented in Appendix F of the OU-1B FS Report.

Habitat surveys were performed for the OU-1B sites, and it was concluded that no suitable wildlife habitats exist at OU-1B. Therefore, no ecological risk assessments were performed for the sites or their associated AOCs.

7.1 BASELINE HUMAN-HEALTH RISK ASSESSMENT

During the FS, an HHRA was performed to evaluate the cumulative risk from exposure to soil and groundwater at IRP-3 and IRP-12 under current conditions for residential, industrial, and construction scenarios and under future conditions (after remedial action objectives [RAOs] are achieved) for residential scenario. Results from the residential HHRA under current conditions assist the DON in determining whether remedial action is necessary for groundwater and soil at the site. Results from the residential HHRA under future conditions estimate risks to residents from residual contamination remaining after the RAOs have been achieved. Calculated risks include the cumulative risk of soil and groundwater contamination at the site. The evaluation of risks under these scenarios is the focus of this ROD/RAP.

7.2 CHEMICALS OF POTENTIAL CONCERN

This section presents an overview of the data evaluation process used to select the COPCs that subsequently were evaluated in the risk assessments for IRP-3 and IRP-12. Tables 7-1 through 7-4 summarize the COPCs selected for the OU-1B sites and their associated AOCs.

Table 7-1
Chemicals of Potential Concern at Former MCAS Tustin IRP-3

CAS Number	Analyte	Soil (0–2 feet bgs)	Soil (0–10 feet bgs)[a]	Groundwater[b]
67-64-1	acetone	√	√	√
83-32-9	acenaphthene		√	
120-12-7	anthracene	√	√	
7440-36-0	antimony	√	√	
11097-69-1	Aroclor 1254	√	√	
7440-39-3	barium	√	√	
71-43-2	benzene		√	
65-85-0	benzoic acid			√
56-55-3	benz(a)anthracene		√	
50-32-8	benzo(a)pyrene	√	√	
205-99-2	benzo(b)fluoranthene	√	√	
191-24-2	benzo(g,h,i)perylene	√	√	
207-08-9	benzo(k)fluoranthene	√	√	
319-85-7	BHC, beta			√
117-81-7	bis(2-ethylhexyl)phthalate		√	√
7440-43-9	cadmium	√	√	√
75-15-0	carbon disulfide		√	
108-90-7	chlorobenzene			√
67-66-3	chloroform			√
7440-47-3	chromium, total	√	√	
18540-29-9	chromium, hexavalent			√
218-01-9	chrysene	√	√	
7440-48-4	cobalt	√	√	
7440-50-8	copper	√	√	
53-70-3	dibenz(a,h)anthracene	√	√	
75-71-8	dichlorodifluoromethane			√
75-34-3	1,1-dichloroethane			√
156-59-2	cis-1,2-dichloroethylene		√	√
540-59-0	1,2-dichloroethylene (mixture)	√		
156-60-5	trans-1,2-dichloroethene			√
75-35-4	1,1-dichloroethene			√
84-66-2	diethyl phthalate			√
100-41-4	ethylbenzene		√	
206-44-0	fluoranthene	√	√	

(table continues)

Table 7-1 (continued)

CAS Number	Analyte	Soil (0–2 feet bgs)	Soil (0–10 feet bgs)[a]	Groundwater[b]
86-73-7	fluorene	√	√	
193-39-5	indeno(1,2,3-cd)pyrene	√	√	
7439-92-1	lead	√	√	
7439-96-5	manganese		√	√
78-93-3	methyl ethyl ketone (2-butanone)		√	√
75-09-2	methylene chloride		√	√
7439-98-7	molybdenum			√
91-20-3	naphthalene		√	
7440-02-0	nickel	√	√	
85-01-8	phenanthrene	√	√	
129-00-0	pyrene	√	√	
7440-22-4	silver and compounds	√	√	√
79-34-5	1,1,2,2-tetrachloroethane			√
127-18-4	tetrachloroethene		√	
7440-28-0	thallium			√
108-88-3	toluene	√	√	
71-55-6	1,1,1-trichloroethane		√	√
79-00-5	1,1,2-trichloroethane			√
79-01-6	trichloroethene	√	√	√
75-69-4	trichlorofluoromethane			√
75-01-4	vinyl chloride			√
1330-20-7	xylenes (total)		√	
7440-66-6	zinc	√	√	

Notes:
[a] this data set was used for air modeling
[b] groundwater data are used for IRP-3, TOW-X3, and TOW-X4

Acronyms/Abbreviations:
bgs – below ground surface
BHC – benzene hexachloride
CAS – Chemical Abstracts Service
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station

Table 7-2
Chemicals of Potential Concern at Former MCAS Tustin IRP-3 TOW-X3 and TOW-X4[a]

CAS Number	Chemical	TOW-X3 Soil (0–2 feet bgs)	TOW-X3 Soil (0–10 feet bgs)[b]	TOW-X4 Soil (0–2 feet bgs)	TOW-X4 Soil (0–10 feet bgs)[b]
67-64-1	acetone		√		
117-81-7	bis(2-ethylhexyl)phthalate		√		
7440-43-9	cadmium			√	√
156-59-2	cis-1,2-dichloroethene		√		√
540-59-0	1,2-dichloroethene (mixture)	√			
7439-92-1	lead			√	√
75-09-2	methylene chloride		√		
85-01-8	phenanthrene			√	√
127-18-4	tetrachloroethene		√		√
71-55-6	1,1,1-trichloroethane		√		
79-01-6	trichloroethene	√	√		√

Notes:
[a] TOW-X3 and TOW-X4 are located within IRP-3
[b] this data set was used for air modeling

Acronyms/Abbreviations:
bgs – below ground surface
CAS – Chemical Abstracts Service
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station

Table 7-3
Chemicals of Potential Concern at Former MCAS Tustin IRP-12

CAS Number	Analyte	Soil (0–2 feet bgs)	Soil (0–10 feet bgs)[a]	Groundwater[b]
67-64-1	acetone	√	√	√
7440-36-0	antimony and compounds	√	√	√
7440-38-2	arsenic		√	
7440-39-3	barium		√	
75-27-4	bromodichloromethane			√
67-66-3	chloroform			√
74-87-3	chloromethane			√
18540-29-9	chromium, hexavalent			√
218-01-9	chrysene		√	
7440-48-4	cobalt		√	
7440-50-8	copper and compounds			√
50-29-3	4,4′-DDT			√
124-48-1	dibromochloromethane			√
106-46-7	1,4-dichlorobenzene			√
75-34-3	1,1-dichloroethane			√
107-06-2	1,2-dichloroethane			√
540-59-0	1,2-dichloroethene (mixture)			√
75-35-4	1,1-dichloroethene			√
84-74-2	dibutyl phthalate	√	√	
100-41-4	ethylbenzene	√	√	
206-44-0	fluoranthene		√	
591-78-6	2-hexanone			√
7439-92-1	lead	√	√	√
7439-96-5	manganese		√	
7439-97-6	mercury	√	√	
78-93-3	methyl ethyl ketone (2-butanone)	√	√	√
75-09-2	methylene chloride		√	√
7440-02-0	nickel and compounds		√	√
85-01-8	phenanthrene	√	√	
129-00-0	pyrene		√	
7782-49-2	selenium	√	√	√
7440-22-4	silver and compounds			√
127-18-4	tetrachloroethene			√
7440-28-0	thallium	√	√	

(table continues)

Table 7-3 (continued)

CAS Number	Analyte	Soil (0–2 feet bgs)	Soil (0–10 feet bgs)[a]	Groundwater[b]
108-88-3	toluene	√	√	
79-00-5	1,1,2-trichloroethane			√
79-01-6	trichloroethene	√	√	√
75-69-4	trichlorofluoromethane			√
7440-62-2	vanadium			√
7440-66-6	zinc	√	√	

Notes:
[a] this data set was used for air modeling
[b] groundwater data are used for IRP-12, STD-1, and MDA-07

Acronyms/Abbreviations:
bgs – below ground surface
CAS – Chemical Abstracts Service
DDT – dichlorodiphenyltrichloroethane
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station

7.2.1 Soil Data and Chemicals of Potential Concern

The risk assessments for IRP-3 and IRP-12 were performed on an IRP-sitewide basis and on an AOC basis. The data sets used to assess risks from exposure to soil at the sites include data from soil samples collected from within the IRP boundaries during the RI (BNI 1997a) and from within the boundaries of the four AOCs (TOW-X3 and TOW-X4 at IRP-3; STD-1 and MDA-07 at IRP-12) during the RI and/or during AOC investigations (OHM 1995, 2000a, 2001). Analytical results obtained from soil samples that were subsequently excavated were excluded from the data sets.

With the exception of STD-1, the selection of COPCs for soil was based on data from samples collected at depths from 0 foot to 10 feet bgs for nonvolatile chemicals and at depths from the surface to the water table (0 foot to 15 feet bgs) for volatile chemicals. Selection of COPCs for STD-1 was based on data from soil samples collected from 0 foot to 2 feet bgs, the maximum depth of investigation.

Reported concentrations of metals in soil samples were compared with background concentrations to identify possible site-related analytes as COPCs. Maximum reported concentrations of metals in on-site soil were compared to the 99th percentile of the background data. If the maximum reported concentration of a metal was less than the background concentration, then the metal was eliminated from consideration as a COPC. Background concentrations of metals in soil at Former MCAS Tustin were established on the basis of statistical results obtained from approximately 650 to 900 soil samples (BNI 1996f). Inorganic nutrients (calcium, magnesium, potassium, and sodium), which are known to be required human trace elements, were excluded as COPCs.

Table 7-4
Chemicals of Potential Concern at Former MCAS Tustin IRP-12 STD-1 and MDA-07[a]

CAS Number	Analyte	STD-1 Soil (0–2 feet bgs)[b,c]	MDA-07 Soil (0–2 feet bgs)	MDA-07 Soil (0–10 feet bgs)[c]
67-64-1	acetone		√	√
7440-38-2	arsenic			√
84-74-2	dibutyl phthalate	√		
7439-92-1	lead	√		
7439-97-6	mercury	√		
78-93-3	methyl ethyl ketone (2-butanone)		√	√
7440-28-0	thallium	√		
108-88-3	toluene		√	√
79-01-6	trichloroethene		√	√

Notes:
[a] STD-1 and MDA-07 are located within IRP-12
[b] based on the 0-to-2-foot-bgs soil samples, the maximum depth of soil collection
[c] this data set was used for air modeling

Acronyms/Abbreviations:
bgs – below ground surface
CAS – Chemical Abstracts Service
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station

7.2.2 Groundwater Data and Chemicals of Potential Concern

Selection of COPCs for groundwater at IRP-3 and IRP-12 was based primarily on data from groundwater samples collected from monitoring wells installed in the first and second WBZs during the RI (BNI 1997a) and subsequent groundwater monitoring events.

Groundwater samples collected from HydroPunch® borings were also used in the selection of COPCs. HydroPunch groundwater samples generally are more turbid than samples collected from monitoring wells, which are constructed with filter packs and are developed to reduce turbidity. Inorganic chemicals were excluded from the HydroPunch data set on the basis of the high turbidity associated with suspended material in these samples. All results for metals from unfiltered groundwater samples collected from monitoring wells were included in the groundwater data set. All organic chemicals from both sample types were classified as COPCs.

Concentrations of metals in groundwater from each IRP site were statistically compared to their respective background concentrations to identify which analytes would be considered site-related COPCs. In particular, the RI (BNI 1997a) and FS evaluated concentrations of arsenic in groundwater at OU-1B and demonstrated that they did not vary significantly in samples collected from the first, second, or third WBZ, or from

samples collected from other areas within the regional aquifer. On this basis, arsenic was eliminated as a COPC at OU-1B.

7.3 EXPOSURE ASSESSMENT

Human-health risks at IRP-3 and IRP-12 were evaluated under three scenarios: residential, industrial, and construction worker. Groundwater in the shallow aquifer at Former MCAS Tustin is not currently used for domestic purposes, and it is unlikely that this groundwater would be used for such purposes in the future due to its naturally occurring high concentrations of TDS and nitrates. Nonetheless, it was assumed that a hypothetical resident could be exposed to soil and groundwater through the following exposure pathways:

- ingestion of impacted soil
- dermal contact with impacted soil
- inhalation of particulates that have been released from impacted soil
- inhalation of chemical vapors released from groundwater during household water use that accumulate in buildings
- ingestion of groundwater
- dermal contact with groundwater

Industrial and construction workers' exposure to soil and groundwater COPCs is as follows:

- ingestion of impacted soil
- dermal contact with impacted soil
- inhalation of particulates that have been released from soil
- inhalation of chemical vapors released from soil and groundwater

Hypothetical industrial and construction workers are assumed to be exposed to soil and to chemical vapors released from soil and groundwater that accumulate in buildings (industrial worker) or are released to the atmosphere (construction worker). It is assumed that the industrial and construction workers will not drink or come into dermal contact with contaminated groundwater. U.S. EPA guidance states that potential remedial actions should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future land-use conditions. The RME is defined as the "highest exposure that is reasonably expected to occur at a site" (U.S. EPA 1989). The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possibilities.

To achieve this conservative exposure case approach, the exposure point concentration (EPC) was assumed to be either the 95 percent upper confidence limit (UCL) of the average reported concentration of a chemical or the maximum reported concentration. Maximum reported concentrations were used instead of the 95 percent UCL when the 95 percent UCL of a chemical exceeded its highest reported concentration or when a low

number of samples or a low frequency of detection rendered the use of the statistically derived 95 percent UCL inapplicable. It was also assumed that soil and groundwater contaminant concentrations remained constant for the duration of the exposure period.

7.3.1 Exposure Point Concentrations for COPCs in Soil

Hypothetical residents and construction workers were assumed to be exposed to nonvolatile COPCs in soil at depths from 0 foot to 10 feet bgs. The hypothetical industrial worker was assumed to be exposed to nonvolatile COPCs in surface soil (0 foot to 2 feet bgs) only. Since VOCs could migrate to the surface and enter the atmosphere from any depth, EPCs for soil VOCs were derived from concentrations in soil samples collected from the surface to the water table (approximately 15 feet bgs). At STD-1, all hypothetical receptors were evaluated on the basis of volatile and nonvolatile organic compound concentrations in soil samples from 0 foot to 2 feet bgs because this was the maximum depth of investigation.

7.3.2 Exposure Point Concentrations for COPCs in Groundwater

Shallow groundwater data from the first and second WBZs at IRP-3 and IRP-12 were evaluated to select EPCs for COPCs used in the baseline human-health risk assessment (HHRA) under residential, industrial, and construction worker scenarios. Groundwater data were collected on an IRP, sitewide basis. Therefore, in the assessment of risks, the same EPCs for COPCs in groundwater were used for the IRP sitewide and AOC-specific assessments.

7.3.3 Exposure Point Concentrations for COPCs in Air

EPCs were calculated for potential sources of airborne chemicals, which were considered to be 1) contaminated soil from which chemical vapors and particles could be released and 2) contaminated groundwater from which chemical vapors could be released. Particulate concentrations used in the risk assessment were based on data recorded for the South Coast Basin from 1988 to 1996. Vapor concentrations were estimated using an air model (Johnson and Ettinger) (U.S. EPA 1998). Details of these estimations are provided in Appendix F of the OU-1B FS Report (BNI 2002).

7.3.4 Exposure Point Concentrations for Future Conditions

Human-health risks were calculated for IRP-3 and IRP-12 under current conditions and under future conditions (i.e., after 30 years, when remediation of groundwater is assumed to be complete). EPCs for VOCs in groundwater were developed by multiplying the current-day concentration by a factor (a 90 percent reduction) that reflected the overall concentration decline within the plume at the completion of remediation. The factor was based on the reduction in the concentration of TCE predicted by groundwater modeling performed during the FS. TCE is considered to be a conservative cleanup indicator relative to other VOC risk drivers because it has a lower aqueous solubility and a greater tendency to adsorb to soil than other VOCs. Because groundwater cleanup was intended for VOCs, concentrations of other contaminants (e.g., semivolatile organic compounds,

pesticides, and metals) were assumed to be the same as the concentrations used to evaluate current conditions in the baseline risk assessment. For soils, no reduction in concentrations of COPCs was assumed. However, soil samples associated with areas to be evaluated as part of the hot spot removal were eliminated from the future conditions soil data set.

7.3.5 Exposure Assumptions

Exposure assumptions describe the rate of contact that the receptors could have with the soil, water, or air. U.S. EPA guidelines on upper-bound exposure assumptions are designed to address conservatively the behavior or activity patterns of more than 90 to 95 percent of the receptor populations. The intent is to estimate an RME.

The exposure assumptions for a hypothetical resident, industrial worker, and construction worker follow.

Resident

- For soil oral exposure, 100 milligrams per day was assumed for an adult weighing 70 kilograms and 200 milligrams per day for a child (age 1 to 6 years) weighing 15 kilograms, 350 days per year.
- For soil dermal exposure, more than 30 percent of the resident's skin was assumed to be in contact with soil for 100 days per year for an adult and 350 days per year for a child.
- Inhalation of dust and vapors was assumed to occur 24 hours per day, 350 days per year for an adult and child.
- Exposure to vapors was assumed to occur exclusively indoors for an adult and child.
- For groundwater consumption, 2 liters of water per day was assumed for an adult weighing 70 kilograms and 1 liter of water per day for a child (age 1 to 6 years) weighing 15 kilograms, 350 days per year.
- For groundwater dermal exposure during showering, whole-body exposure (7,000 square centimeters for a child and 19,000 square centimeters for an adult) was assumed to occur for 0.25 hour per day, 350 days per year.
- Adult exposure to carcinogens was assumed for a total of 30 years, 6 years as a child and 24 years as an adult. (Child exposure was assumed to be 6 years.)

Industrial Worker

- Work is performed 8 hours per day, 250 days per year.
- Work is performed for 25 years.
- For soil dermal exposure, approximately 20 percent of the worker's skin (3,300 square centimeters) is in contact with soil.

- Inhalation of dust and vapors was assumed to occur 8 hours per day, 250 days per year.
- Exposure to vapors was assumed to occur exclusively indoors.

Construction Worker

- Work is performed 8 hours per day, 250 days per year.
- Work is performed for 1 year.
- For soil dermal exposure, approximately 20 percent of the worker's skin (3,300 square centimeters) is in contact with soil.
- Inhalation of dust and vapors was assumed to occur 8 hours per day, 250 days per year.
- Exposure to vapors was assumed to occur exclusively outdoors.

7.4 TOXICITY ASSESSMENT

The toxicity assessment categorized the COPCs by their carcinogenic and noncarcinogenic effects. The potential for carcinogenic effects was evaluated by estimating excess lifetime cancer risk. Noncarcinogenic risk was assessed by comparing the estimated daily intake of a chemical to the estimated safe level of daily exposure (reference dose [RfD]). The toxicity values used in the risk assessment were obtained from the 2000 table of PRGs published by U.S. EPA Region 9 (U.S. EPA 2000) and were confirmed by a review of the U.S. EPA Integrated Risk Information System database (U.S. EPA 2001) and the U.S. EPA Health Effects Assessment Summary Tables (U.S. EPA 1997). Toxicity values for cadmium, hexavalent chromium, and 1,2-dibromo-3-chloropropane were obtained from the 1994 updated table of cancer potency factors developed by Cal/EPA, Office of Environmental Health Hazard Assessment (Cal/EPA 1994).

Slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the risk assessment were extrapolated from oral values.

7.5 RISK CHARACTERIZATION

Cancer and noncancer risks were quantified separately. Excess lifetime cancer risks are presented as probabilities generally expressed in scientific notation (e.g., 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site. Guidelines for managing cancer risks are promulgated in the NCP (40 *Code of Federal Regulations* [C.F.R.] 300.430[e][2][I][A][2]). According to these regulations, an excess cancer risk of 1×10^{-6} is acceptable, and excess cancer risks ranging from 1×10^{-6} to 1×10^{-4} are considered generally acceptable. Cancer risks greater than 1×10^{-4} require further evaluation and may indicate a need for remedial action.

Noncarcinogenic effects from a single contaminant in a single medium are expressed as a hazard quotient (HQ). The sum of the HQs for all contaminants within a medium or across all media is expressed as the hazard index (HI). An HI less than 1 is generally considered to represent an acceptable noncarcinogenic risk. An HI equal to or greater than 1 indicates that a lifetime of exposure to the chemical(s) may have the potential for causing adverse health effects (e.g., respiratory distress, kidney failure) and should be evaluated further.

Results for human-health risks evaluated for current and future conditions at IRP-3 and IRP-12 are summarized in Tables 7-5 and 7-6 and are discussed in subsections below. Estimates for cancer risks using both U.S. EPA and Cal/EPA cancer slope factors are presented in the tables. The most conservative estimate is discussed in Section 7.5.1.

7.5.1 Estimated Risk Under Current Conditions

Estimates of the total cancer and noncancer risks to a resident are presented in Tables 7-5 and 7-6. The residential scenario is considered the most conservative of the three scenarios evaluated (residential, industrial, and construction worker) because it results in the highest estimate of risk. Current conditions at IRP-3 sitewide, TOW-X3, and TOW-X4 are presented in Table 7-5. Under the residential scenario, cancer risks exceed the generally acceptable risk range established by U.S. EPA (1×10^{-6} to 1×10^{-4}) and the noncancer risks exceed the noncancer threshold value or HI of 1. Total risks estimated for industrial and construction worker scenarios do not exceed cancer or noncancer threshold values.

For the residential scenario, the total cancer risk at IRP-3 sitewide, TOW-X3, and TOW-X4 are estimated at 1.5×10^{-4}, 1.5×10^{-4}, and 1.6×10^{-4}, respectively. The cancer risks are primarily associated with exposure to 1,1-DCE and hexavalent chromium in groundwater. The noncancer HIs estimated for the resident child at IRP-3 sitewide, TOW-X3, and TOW-X4 are 8.4, 6.0, and 6.4, respectively. The HIs at these three areas are principally related to thallium and chloroform in groundwater. At IRP-3 sitewide, manganese in soil was identified as an additional contributor to the HI.

Estimates of the total cancer and noncancer risks evaluated under the residential scenario for current conditions at IRP-12 sitewide, STD-1, and MDA-07 are also presented in Table 7-5. Estimates of total cancer risk under the residential scenario in these three areas exceed 1×10^{-4}. Cancer risks for a construction worker at IRP-12 sitewide and at MDA-07 are quantified within the generally acceptable risk range of 1×10^{-6} to 1×10^{-4}. Estimates of the total noncancer risks in the three areas for the residential scenarios and the construction worker at STD-1 exceed the HI threshold value of 1. Total risks estimated for the industrial worker scenario do not exceed cancer or noncancer threshold values.

Table 7-5
Summary of Lifetime Cancer Risk and Hazard Index
for Current Conditions Under a Residential Scenario

Exposure Route	Cancer Risk U.S. EPA[a,b]	Cancer Risk Cal/EPA[a,b]	Hazard Index[c]
IRP-3 Sitewide			
Soil total	1.8E-07	4.7E-07	2.3
Groundwater total	1.3E-04	1.5E-04	6.0
Total	**1.3E-04**	**1.5E-04**	**8.4**
IRP-3, TOW-X3			
Soil total	5.3E-08	1.6E-07	0.0052
Groundwater total	1.3E-04	1.5E-04	6.0
Total	**1.3E-04**	**1.5E-04**	**6.0**
IRP-3, TOW-X4			
Soil total	1.7E-06	2.0E-06	0.42
Groundwater total	1.3E-04	1.5E-04	6.0
Total	**1.3E-04**	**1.6E-04**	**6.4**
IRP-12 Sitewide			
Soil total	2.6E-05	2.6E-05	2.3
Groundwater total	1.1E-04	1.6E-04	26
Total	**1.4E-04**	**1.9E-04**	**29**
IRP-12, STD-1			
Soil total	NC[d]	NC	15
Groundwater total	1.1E-04	1.6E-04	26
Total	**1.1E-04**	**1.6E-04**	**42**
IRP-12, MDA-07			
Soil total	3.5E-05	3.5E-05	0.62
Groundwater total	1.1E-04	1.6E-04	26
Total	**1.5E-04**	**2.0E-04**	**27**

Notes:
[a] risk was calculated using U.S. EPA or Cal/EPA toxicity values
[b] the risk is higher for the resident adult; therefore, only the resident adult risk results are shown
[c] the index is higher for the resident child; therefore, only the resident child index is shown
[d] no carcinogen was identified

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
IRP – Installation Restoration Program
U.S. EPA – United States Environmental Protection Agency

Table 7-6
Summary of Lifetime Cancer Risk and Hazard Index for Future Conditions Under a Residential Scenario

Exposure Route	Cancer Risk U.S. EPA[a,b]	Cancer Risk Cal/EPA[a,b]	Hazard Index[c]
IRP-3 Sitewide			
Soil total	1.7E-07	4.8E-07	3.0
Groundwater total	1.5E-05	4.0E-05	4.5
Total	**1.5E-05**	**4.0E-05**	**7.5**
IRP-3, TOW-X3			
Soil total	4.3E-08	1.5E-07	0.005
Groundwater total	1.5E-05	4.0E-05	4.5
Total	**1.5E-05**	**4.0E-05**	**4.6**
IRP-3, TOW-X4			
Soil total	2.7E-07	3.3E-07	0.033
Groundwater total	1.5E-05	4.0E-05	4.5
Total	**1.5E-05**	**4.0E-05**	**4.6**
IRP-12 Sitewide			
Soil total	2.6E-05	2.6E-05	2.3
Groundwater total	1.1E-05	6.2E-05	7.6
Total	**3.7E-05**	**8.9E-05**	**9.9**
IRP-12, STD-1			
Soil total	NC[d]	NC	15
Groundwater total	1.1E-05	6.2E-05	7.6
Total	**1.1E-05**	**6.2E-05**	**23**
IRP-12, MDA-07			
Soil total	3.5E-05	3.5E-05	0.62
Groundwater total	1.1E-05	6.2E-05	7.6
Total	**4.6E-05**	**9.8E-05**	**8.2**

Notes:
[a] risk was calculated using U.S. EPA or Cal/EPA toxicity values
[b] the risk is higher for the resident adult; therefore, only the resident adult risk results are shown
[c] the index is higher for the resident child; therefore, only the resident child index is shown
[d] no carcinogen was identified

Acronyms/Abbreviations:
Cal/EPA – California Environmental Protection Agency
IRP – Installation Restoration Program
U.S. EPA – United States Environmental Protection Agency

For the residential scenario, the total cancer risks at IRP-12 sitewide, STD-1, and MDA-07 are estimated at 1.9×10^{-4}, 1.6×10^{-4}, and 2.0×10^{-4}, respectively. The cancer risks are primarily associated with exposure to hexavalent chromium, 1,2-DCA, chloroform, and 1,1,2-TCA in groundwater and arsenic in soil at IRP-12 sitewide and at MDA-07. For the construction worker scenario, total cancer risks at IRP-12 sitewide and at MDA-07 are estimated at 1.1×10^{-6} and 1.4×10^{-6}, respectively, and are primarily caused by arsenic in soil.

The noncancer HIs estimated for the resident child at IRP-12 sitewide, STD-1, and MDA-07 are 29, 42, and 27, respectively. The HIs for these three areas are principally related to chloroform, selenium, antimony, and 1,2-DCA in groundwater and manganese in soil at IRP-12 sitewide and thallium in soil at STD-1. The HI for the construction worker at STD-1 is estimated at 5.6 and is primarily due to thallium in soil.

7.5.2 Estimated Risk Under Future Conditions

Estimates of the future total cancer and noncancer risks under the residential scenario for IRP-3 sitewide, TOW-X3, and TOW-X4 are presented in Table 7-6. These risks were evaluated for future conditions (after 30 years, when cleanup of VOCs in groundwater is estimated to be complete under Alternative 7). Because groundwater cleanup was intended for VOCs, the risks due to other contaminants are assumed to remain the same as under current conditions. No reduction in concentrations is assumed for the soil medium. However, soil samples associated with areas to be excavated as a part of hot spot removal (projected for IRP-3 sitewide, TOW-X3, TOW-X4, and IRP-12 sitewide) were eliminated from the future conditions soil data set.

Total future cancer and noncancer risks under the industrial and construction worker scenarios were not evaluated because the current risks generally do not exceed 1×10^{-6} and 1, respectively. In addition, the anticipated decline in concentrations associated with remedial action would further reduce the risk from the current-day estimates presented in the FS Report (BNI 2002).

The total future cancer risk under the residential scenario at IRP-3 sitewide, TOW-X3, and TOW-X4 is estimated at 4.0×10^{-5}, which is within the NCP's generally acceptable risk range of 1×10^{-6} to 1×10^{-4}. These values represent an 88.5 percent reduction in risks for U.S. EPA-derived risks and 73 percent for Cal/EPA-derived risks. The principal cancer risk drivers are hexavalent chromium and 1,1-DCE in groundwater. The reduction in future risk from the current estimated risk is related principally to the reduction in 1,1-DCE in groundwater. The HIs for future conditions under the residential scenario at IRP-3 sitewide, TOW-X3, and TOW-X4 are 7.5, 4.6, and 4.6, respectively. At IRP-3 sitewide, the HI is associated with thallium in groundwater and manganese in soil; at TOW-X3 and TOW-4, the HI is primarily associated with exposure to thallium in groundwater.

The total future cancer risks under the residential exposure scenario at IRP-12 sitewide, STD-1, and MDA-07 are estimated within the NCP's generally acceptable range of 1×10^{-6} to 1×10^{-4}. The future residential cancer risk at IRP-12 sitewide, STD-1, and

MDA-07 is estimated at 8.9×10^{-5}, 6.2×10^{-5}, and 9.8×10^{-5}, respectively. This represents an approximate 74 to 90 percent reduction in risks for U.S. EPA-derived risks and 51 to 61 percent reduction in Cal/EPA-derived risks. The largest reduction in risk is achieved at STD-1. Groundwater VOCs including 1,2-DCA, chloroform, 1,1,2-TCA, and hexavalent chromium are identified as the primary contributors to the future cancer risk. At IRP-12 sitewide and MDA-07, the cancer risk associated with soil exposure is attributable to arsenic. The HIs for IRP-12 sitewide, STD-1, and MDA-07 are 9.9, 23, and 8.2, respectively. At IRP-12 sitewide, STD-1, and MDA-07, the HI is associated with selenium, antimony, and chloroform in groundwater. Manganese in soil at IRP-12 sitewide and thallium in soil at STD-1 provide an additional contribution to the HI.

7.6 RECOMMENDATIONS AND BASIS FOR RISK MANAGEMENT DECISION

Based upon the results of the baseline HHRA, the DON and BCT have determined that remedial action is required to reduce the concentration of contaminants in groundwater at OU-1B. Remedial action is not required to reduce risks from soil (soil with elevated concentrations of VOCs is recommended for removal to prevent future impact to groundwater), even though the cancer and/or noncancer risks exceed regulatory guidance thresholds at several locations. The rationale for this decision is discussed in the following paragraphs.

The HI for soil at IRP-3 sitewide and IRP-12 sitewide is 2.3 (Table 7-5). This represents the risk to a resident child and is primarily due to manganese. This exceedance is considered acceptable for the following reasons.

- Manganese is a naturally occurring metal, and there is no documentation or historical information indicating that manganese was used in operations that occurred at IRP-3 or IRP-12 sitewide.
- The inhalation RfDs used to evaluate risk due to manganese are estimated only for an adult receptor. Use of an adult RfD overestimates the resultant hazard to a child.

The excess cancer risk for soil exposure at TOW-X4 is 2×10^{-6}. The primary contributor to this risk is TCE that was assumed to be released from soil into a building and inhaled. This small exceedance is considered to be acceptable because the maximum concentration was used as the EPC (the 95 percent UCL exceeded its highest measured concentration). The assumption of long-term contact with the maximum concentration is conservative, and the use of maximum concentrations in the risk assessment results in uncertainty.

The excess cancer risks for soil exposure at IRP-12 sitewide and MDA-07 are 2.6×10^{-5} and 3.5×10^{-5}, respectively. The primary contributor to these risks is arsenic.

The HI for soil at STD-1 is 15. This represents the risk to a resident child and is primarily due to thallium. This exceedance is considered acceptable for the following reasons.

- Detection limits for thallium in soil at STD-1 were elevated, ranging from 58 to 63 mg/kg. This was probably due to the analytical method used (U.S. EPA Method 6010), which relies on an inductively coupled plasma atomic absorption spectrophotometer. All thallium results were reported at or just above laboratory detection limits and could be influenced by interferences from other metals present in the sample (e.g., aluminum). Much lower detection limits, and hence more reliable results, are achievable by U.S. EPA Method 7841, which uses a graphite furnace atomic absorption spectrophotometer.
- During an investigation at STD-1 (OHM 1995), six soil samples were collected outside the boundaries of this AOC. All thallium results were comparable to concentrations reported in the on-site samples collected.

7.7 EVALUATION OF FUTURE RISKS

Remediation of the OU-1B groundwater plumes will be considered complete when remediation goals, represented by state and federal drinking water standards, are achieved throughout the plume (see Section 8). At this time, the risk due to soil and groundwater will still exceed 1×10^{-6} at several locations at IRP-3 and IRP-12. Section 7.5 evaluated the risks due to soil. This section provides the rationale for why the future risks due to groundwater at OU-1B are acceptable.

Following remediation, cancer risks in groundwater at IRP-3 sitewide, TOW-X3, and TOW-X4 are estimated to be 4×10^{-5}. Principal cancer risk drivers are related to 1,1-DCE and hexavalent chromium in groundwater. It should be noted that carcinogenic risk estimates that include 1,1-DCE and hexavalent chromium are currently considered too high. As discussed in the FS Report, these projected risk estimates should not be taken as absolute indicators of risk because of inherent uncertainties associated with assumptions used in the analysis. Sources of uncertainty include:

- the assumption that groundwater VOCs degrade at the same rate as TCE,
- the use of a model to quantify future TCE concentrations, and
- the assumption that all other COPCs remain unchanged throughout groundwater cleanup.

Noncancer risks in groundwater at IRP-3 sitewide, TOW-X3, and TOW-X4 are estimated to be 4.5. This HI is associated primarily with exposure to thallium in groundwater. Thallium was retained as a COPC in groundwater during the IRP-3 risk assessment on the basis of a statistical comparison of on-site concentrations to background concentrations, following recommended risk assessment guidance (U.S. EPA 1989). However, the total noncancer risk at IRP-3 under current and future conditions is believed to be overly conservative due to the thallium contribution. The following reasons indicate why thallium in groundwater is not a site-related release.

- Thallium is a naturally occurring metal in both soil and groundwater. It is not a common environmental contaminant, and its use would primarily be limited to application of rodent pesticides.
- There is no documentation or historical information indicating thallium was used at IRP-3 sitewide, TOW-X3, or TOW-X4, or that pesticides containing thallium were applied at these locations.
- If concentrations of thallium in groundwater were due to a site-related release (i.e., not naturally occurring), then it would be expected that elevated thallium concentrations would be present in soil at IRP-3 sitewide and at the AOCs.
- Thallium was not reported in soil at IRP-3 sitewide; however, it was retained as a groundwater COPC in the risk assessment, based solely on statistical evaluation of on-site and background groundwater data.
- Thallium was infrequently reported in the IRP-3 groundwater data (9 of 56 sampling data points, or 16 percent).
- Concentrations of thallium (0.0073 mg/L) reported in background monitoring wells located at perimeter areas of Former MCAS Tustin are similar to the thallium groundwater EPC (0.0032 mg/L) used in the risk assessment.

Following remediation, cancer risks in groundwater at IRP-12 sitewide, STD-1, and MDA-07 are estimated to be 6.2×10^{-5}. The primary contributor to the groundwater cancer risk is hexavalent chromium (in over 52 percent of the state cancer risk). This risk value is considered overly conservative based on the following information presented in the OU-1/OU-2 RI Report (BNI 1997a, Section 4.2.3.2).

- Concentrations of hexavalent chromium reported in the RI groundwater data (seven samples, with one sampling result discounted due to elevated turbidity) were either not reported above the instrument detection limit (IDL) (three results) or essentially at the IDL (four results). The analytical method (U.S. EPA Method 7196) for hexavalent chromium is highly sensitive to matrix interferences (e.g., presence of iron in groundwater), and values reported close to the IDL are difficult to resolve due to variation in the instrument signal-to-noise ratio. Because of these factors, the analytical method for hexavalent chromium is subject to high false positive rates and most, if not all, of the RI groundwater results for hexavalent chromium at IRP-12 and IRP-3 (BNI 1997a) are likely false positives.
- Other results reported in the RI groundwater data (BNI 1997a, Table 4.2-8) cast further suspicion on the analytical results for hexavalent chromium, not only at IRP-12 but also at IRP-3. For instance, regular and field duplicate samples collected from IRP-12 well 12MW08S have poor reproducibility in terms of the reported total chromium and hexavalent chromium sample concentrations. Additionally, in several cases hexavalent chromium was reported in samples where no total chromium was reported above detection limits.

- Although considered a potential COPC in the RI, there is no documentation or historical information that chromium-containing materials, such as cleaning solutions or paints containing chromate, were potentially involved in a site-related release at IRP-12. Concentrations of total chromium reported in soil at these sites (31.6 mg/kg at IRP-12) are within background's 99th percentile (39.2 mg/kg) (BNI 1996b). Total chromium concentrations reported in groundwater at IRP-12 (0.0052 to 0.0455 mg/L) are similar to those reported in background monitoring wells (99th percentile of 0.0106 mg/L) located at perimeter areas of Former MCAS Tustin (BNI 1996b). If a site-related release involving chromium were to have impacted groundwater, it would be expected that elevated chromium levels would also be present in soil at IRP-12 sitewide and/or STD-1 and MDA-07.

The noncancer risk at IRP-12 sitewide, STD-1, and MDA-07 for current and future conditions is also believed to be overestimated due to inclusion of selenium and antimony, two metals that occur naturally in both soil and groundwater. The risks due to these metals are considered to be overstated for the following reasons.

- Antimony was reported infrequently in the IRP-12 groundwater data (8 of 55 samples [less than 15 percent]). This is consistent with infrequent occurrence in the background data (20 percent). Selenium was reported above detection limits in both IRP-12 and background groundwater samples with similar frequency (93 and 90 percent, respectively).
- Selenium and antimony both occur naturally in soil and groundwater. The OU-1/OU-2 RI Report (BNI 1997a, Volume V, page V-7) notes that background concentrations of selenium were randomly distributed in Former MCAS Tustin groundwater due to local geochemical conditions (i.e., oxidation-reduction conditions) and were not attributable to station activities, including IRP-12.
- Selenium is used in the manufacturing of electronics (semiconductors), photovoltaic cells, glass-making, photographic toner, and as a steel additive. Antimony is used in semiconductors and metal alloys; as a hardening agent for lead products; and in enamel paints, glass, and pottery (minor use). There is no documentation or historical information that either of these metals, or products that could have potentially contained them, were involved in a site-related release at IRP-12 sitewide and/or STD-1 and MDA-07.
- Selenium and antimony were retained as groundwater COPCs in the risk assessment, based solely on statistical evaluation of on-site and background data. Similar to hexavalent chromium, if a site-related release involving selenium and/or antimony were to have impacted groundwater, it would be expected that elevated levels of these metals would also be present in soil at IRP-12 sitewide and/or STD-1 and MDA-07.

Finally, chloroform contributes to cancer and, in particular, noncancer risk estimates at IRP-12 under future conditions. Although chloroform could have been used as a cleaning solvent and/or as a component of cleaning solvents used and subsequently released at the site, it was infrequently reported in the on-site groundwater data (17 of 221 samples [less than 8 percent]). Also, chloroform was not reported above detection limits in soil

samples collected from IRP-12 sitewide, STD-1, and MDA-07. Chloroform is not a primary contaminant in terms of occurrence in the overall groundwater plume at IRP-12. There is some question as to whether it is a site-related groundwater contaminant or a sampling or laboratory analytical artifact.

Section 8
DESCRIPTION OF ALTERNATIVES

This section describes the remedial alternatives selected for detailed analysis in the OU-1B FS Report. The alternatives are based on the RI, baseline HHRA, and a review of applicable or relevant and appropriate requirements (ARARs). The following overall RAOs were developed for OU-1B to focus the FS Report and define the scope of potential groundwater remediation activities.

- Reduce the concentration of VOCs in groundwater to levels consistent with site remediation goals, or until the plumes have stabilized, and prevent or limit VOC migration beyond the current OU-1B plume boundaries.
- Protect human health by preventing extraction of VOC-impacted shallow groundwater for domestic use until site remediation goals are achieved.
- Protect potential ecological receptors in Peters Canyon Channel and Barranca Channel by preventing the off-station migration of groundwater containing VOCs at concentrations exceeding site remediation goals.
- Implement appropriate remedial actions as necessary to facilitate transfer and reuse of those portions of the Former MCAS Tustin property actually or potentially affected by the OU-1B plumes.

While VOC-affected soil is of concern as continuing sources of groundwater contamination, the risk assessment completed for the RI showed that soil at IRP-3 and IRP-12 does not present unacceptable risk to human health even if future land use at the station includes redevelopment as residential areas and/or parks (BNI 1997a). These are the most sensitive uses for the Former MCAS Tustin property projected in the SP. Therefore, remediation of contaminated soil to health-based criteria was not an RAO of the FS, but was included to further enhance contaminant mass removal, lessen the time needed to achieve remediation goals or stabilize the plumes, and remove a potential continuing source of TCE to groundwater resulting in concentrations exceeding the MCL.

8.1 CHEMICALS OF CONCERN AND REMEDIATION GOALS

Table 8-1 lists the groundwater chemicals of concern (COCs) at OU-1B. The COCs include TCE and related halogenated compounds (1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE, and 1,1,2-TCA). For each of these VOCs, Table 8-1 presents the reporting frequency and concentration range for groundwater samples collected during the RI at the two IRP sites (BNI 1997a). In identifying these compounds as COCs, it was assumed that they might also exist in groundwater at OU-1B at concentrations below the detection limits of available U.S. EPA analytical methods.

The RFA and RI Reports also identified three metals (cadmium, chromium, and molybdenum) along with three additional VOCs (acetone, chloroform, and methyl ethyl ketone) as COPCs in OU-1B groundwater (BNI 1997a,b). These COPCs were reported above background concentrations at a frequency of at least 5 percent in samples collected at one or more of the IRP sites. However, the HHRA determined that none of these

Table 8-1
Chemicals of Concern in OU-1B Groundwater
(reported in micrograms per liter)

Chemical	Reporting Frequency[a]	Concentration Range[b]
IRP-3		
trichloroethene	19/52	3–1,742
1,2-dichloroethene	11/52	6–290
1,1-dichloroethane	3/52	6–12
1,1-dichloroethene	2/52	11–110
IRP-12		
trichloroethene	24/65	7–3,900
1,2-dichloroethane	9/65	4–8
1,1,2-trichloroethane	2/65	4–6

Notes:
[a] number of samples in which the contaminant was reported/total number of groundwater samples collected during the RI and RFA (BNI 1997a,b)
[b] range of concentrations for samples with reported concentrations of the chemical

Acronyms/Abbreviations:
IRP – Installation Restoration Program
OU – operable unit
RFA – Resource Conservation and Recovery Act facility assessment
RI – remedial investigation

constituents contributed significantly to the health-risk estimates for groundwater at IRP-3 or IRP-12 (BNI 1997a). Accordingly, these COPCs were not identified as groundwater COCs in the FS Report (BNI 2002).

Numerical remediation goals for OU-1B groundwater were developed in the FS Report based on an analysis of ARARs. Table 8-2 lists target concentrations for TCE and related halogenated organic compounds that are COCs at OU-1B. The values listed in Table 8-2 are federal MCLs or nonzero maximum contaminant level goals (MCLGs) promulgated by U.S. EPA or California MCLs established by the Department of Health Services, whichever is lowest for a given constituent. These groundwater remediation goals were developed as the concentrations necessary to achieve the first RAO for OU-1B. The RAO can also be achieved by demonstrating that the plumes have stabilized and will not migrate beyond the current OU-1B boundaries. Permanent shutdown of the hydraulic containment system is subject to DTSC, RWQCB, and U.S. EPA approval.

The feasibility of cleaning up to background was evaluated in the OU-1B FS Report. The FS Report noted that past U.S. EPA efforts to restore VOC-affected aquifers to background levels using groundwater extraction have generally not been successful (U.S. EPA 1996a). When extraction systems are installed, experience at full-scale remediation sites has often shown that contaminant concentrations in the groundwater

Table 8-2
Remediation Goals for OU-1B Groundwater
(reported in micrograms per liter)

Chemical	Remediation Goal	Basis
1,1-dichloroethane	5	California MCL[a]
1,2-dichloroethane	0.5	California MCL[a]
1,1-dichloroethene	6	California MCL[a]
1,2-dichloroethene	6 (cis isomer) 10 (trans isomer)	California MCL[a]
trichloroethene	5	Federal MCL[b]
1,1,2-trichloroethane	3	Federal MCLG[c]

Notes:
[a] Cal. Code Regs. tit. 22, § 64444
[b] 40 C.F.R. § 141.61
[c] 40 C.F.R. § 141.50

Acronyms/Abbreviations:
Cal. Code of Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
MCL – maximum contaminant level
MCLG – MCL goal
OU – operable unit
§ – section
tit. – title

decline rapidly during the initial period of operation. However, a potentially significant fraction of the contaminant mass remains adsorbed to or otherwise entrained within the aquifer matrix. The essentially immobile material remains an active, albeit low-level, contaminant source that is slowly released to groundwater via diffusion, desorption, or dissolution over an extended period of time. This leads to a leveling-off of contaminant concentrations, in many cases above remediation goals, and makes complete removal of contamination to background levels virtually impossible.

Similarly at Former MCAS Tustin, TCE concentrations in extracted groundwater would be expected to decline rapidly during the first several years of remediation and then be maintained at an asymptotic level for a long period of time. Removal of all traces of TCE (or other VOC compounds) would require permanent operation of the extraction system, resulting in significant (unreasonable) long-term costs with negligible benefit. Because attaining background levels (i.e., VOC concentrations below the detection limit) is not considered technologically feasible, restoration of the shallow aquifer at Former MCAS Tustin to pristine conditions was not included as an RAO, nor was background considered a potential remediation goal for VOCs in OU-1B groundwater. Other concentration limits determined to be protective of human health and the environment (i.e., MCLs and non-zero MCLGs), as provided for in *California Code of Regulations* (Cal. Code Regs.) title (tit.) 22, § 66264.94(c), will be used to satisfy RCRA groundwater protection requirements.

Table 5-3 lists the areal dimensions of the OU-1B plumes, maximum reported concentrations, and total estimated mass of TCE at the two IRP sites. These estimates were developed from data in the RI Report (BNI 1997a) and the results of groundwater modeling presented in Appendix B of the FS Report.

8.2 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Remedial alternatives were developed to meet the RAOs in accordance with CERCLA, as amended by SARA, 42 *United States Code* (U.S.C.) § 9602 et seq., and the NCP. The development of remedial alternatives was also guided by prior U.S. EPA experience at VOC-contaminated sites. Documents considered in the development of remedial alternatives for soil and groundwater include the following.

- **Contaminants and Remedial Options at Solvent-Contaminated Sites** (U.S. EPA 1994a) identifies response actions and remedial technologies commonly used and demonstrated to be effective for remediation of soils and groundwater with contaminants similar to those at IRP-3 and IRP-12.
- **Remediation Technologies Screening Matrix and Reference Guide** (U.S. EPA 1994b) provides a comprehensive listing of remedial technologies for VOC-contaminated soil and groundwater. This U.S. EPA reference effectively serves as a preliminary screening step to determine the technical implementability of various technologies for possible use at OU-1B.
- **Presumptive Response Strategy and *Ex Situ* Treatment Technologies for Contaminated Groundwater at CERCLA Sites** (U.S. EPA 1996a) states that groundwater extraction, source removal, and natural attenuation, alone or in combination, constitute the presumptive remedy for contaminated groundwater at sites where dense nonaqueous-phase liquids are not a concern. The presumptive technologies listed for *ex situ* treatment of VOCs in extracted groundwater include air stripping, granular activated carbon (GAC) adsorption, chemical oxidation, and aerobic biological treatment.
- **Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites With VOCs in Soils** (U.S. EPA 1993, 1996b) identifies soil vapor extraction (SVE), thermal desorption, and incineration as presumptive remedies for VOCs in soils.
- **Presumptive Remedy: Supplemental Bulletin Multiphase Extraction (MPE) Technology for VOCs in Soil and Groundwater** (U.S. EPA 1997) defines vacuum-enhanced extraction (VEE) (also known as MPE) as another presumptive technology for remediation of VOCs in soil and groundwater. MPE combines key components of conventional groundwater extraction and SVE. It is described by U.S. EPA as particularly applicable to sites such as Former MCAS Tustin with significant concentrations of VOCs adsorbed to low-permeability soils below the water table.

Presumptive remedies are preferred technologies for common categories of sites. These technologies are accepted by U.S. EPA based on historical patterns of remedial action selection and on evaluation of performance data on technology implementation; use of these technologies expedites site investigation and selection of remediation alternatives.

The use of the U.S. EPA presumptive remedy guidance resulted in development of the following nine comprehensive remedial alternatives:

- Alternative 1 – no action
- Alternative 2 – monitored natural attenuation
- Alternative 3 – hydraulic containment
- Alternative 4 – aggressive groundwater extraction with off-site soil disposal
- Alternative 4A – aggressive groundwater extraction with on-site soil treatment
- Alternative 5 – permeable reaction wall
- Alternative 6 – vacuum-enhanced extraction with off-site soil disposal
- Alternative 6A – vacuum-enhanced extraction with on-site soil treatment
- Alternative 7 – hydraulic containment with hot spot removal

Alternatives 4A and 6A are variations of Alternatives 4 and 6, respectively, that were developed to provide an option of on-site soil treatment and disposal rather than off-site soil disposal at a landfill.

Numerical remediation goals discussed in Section 8.1 and listed in Table 8-2 were used in the FS to compare the effectiveness of the remedial alternatives in decreasing contaminant concentrations to achieve the RAOs. However, achieving numerical remediation goals or demonstrating plume stability within its current boundaries can be used as a criterion for success in achieving the first RAO for OU-1B.

8.2.1 Alternative 1: No Action

Alternative 1 is required by CERCLA to provide a basis for developing and evaluating the other remedial alternatives. Under Alternative 1, no remedial measures or land-use controls (LUCs) would be implemented. Without remedial action, the impacted area on the Former MCAS Tustin property would expand significantly over time. The TCE plume originating at IRP-3 would eventually pass the station boundary at Jamboree Road and extend under an off-station industrial park. VOC-contaminated groundwater would be expected to begin impacting Peters Canyon Channel and Barranca Channel in about 40 years. Maximum TCE concentrations at approximately 80 μg/L would be discharged to the drainage channels in about 70 years. Eventually, the VOC concentration would decrease to groundwater remediation goals (MCLs/MCLGs presented in Table 8-2) because of natural attenuation in the aquifer. However, without any remedial action, the time required to meet these goals is expected to be more than 100 years.

8.2.2 Alternative 2: Monitored Natural Attenuation

Monitored natural attenuation (Alternative 2) would not entail engineered response actions to collect, treat, or contain the contaminant plumes at and downgradient from IRP-3 and IRP-12. However, Alternative 2 would include monitoring and institutional controls. Monitoring would be used to track VOC migration and support future evaluations of the protectiveness of natural attenuation processes.

Alternative 2 is based on the following assumptions.

- Naturally occurring processes in the subsurface at Former MCAS Tustin will reduce contaminant concentrations—and risk—as the OU-1B plumes continue to migrate through the shallow aquifer.
- Contaminant migration in the subsurface is primarily horizontal, toward Peters Canyon Channel. VOC contamination in the shallow aquifer does not threaten the deeper, regional aquifer used for potable water supply.
- Contaminant migration in the shallow aquifer can be readily tracked, and its impacts are reliably predicted.

The natural attenuation mechanisms that appear active at IRP-3 and IRP-12 include adsorption, dispersion, volatilization, diffusion, and dilution. Biodegradation is probably negligible given the recalcitrant nature of chlorinated VOCs under the prevailing aerobic conditions in the shallow aquifer underlying Former MCAS Tustin. Modeling conducted for the RI indicated that natural attenuation would eventually result in potentially significant reductions in VOC concentrations within the OU-1B plumes, even with no biodegradation assumed (BNI 1997a). However, the plumes would not disappear quickly, and groundwater would remain above remediation goals (Table 8-2) for more than 100 years.

Institutional controls in the form of land-use restrictions would be used to restrict potential human exposure to contaminated shallow groundwater as long as VOC concentrations remain above health-based remediation goals; to protect the remedial action; and to allow the DON, DTSC, and their authorized agents, employees, contractors, and subcontractors access to the premises to maintain the remedial action. These land-use restrictions would be implemented through two different legal mechanisms: 1) covenant agreements with the DTSC and 2) deed restrictions. A detailed discussion of the institutional controls and the methods of implementation can be found in Sections 10.4 and 10.5 of this ROD/RAP. A performance monitoring program with periodic progress reviews would be an integral component of this alternative.

VOC contamination is not expected to reach the station boundaries for approximately 15 years. Potential off-station impacts resulting from Alternative 2 would be determined by the types of land use in the areas affected by the VOC plumes. After passing under the station boundary at Jamboree Road, the combined plumes originating at IRP-3 and IRP-12 would migrate beneath an industrial park and eventually discharge to Peters Canyon Channel. Current land uses within the industrial park include light industry and commercial establishments. Assuming the same land use over the next

30 years in this area, human exposure to VOC-contaminated groundwater is unlikely in the industrial park, which is within the service area of an existing high-quality municipal water supply system.

A final consideration for off-station migration involves potential ecological impacts that could result from the eventual discharge of VOCs originating on the Former MCAS Tustin property to Peters Canyon Channel. Because the discharges of VOC-impacted groundwater to surface water are not expected to begin for almost 40 years, it is difficult to predict potential impacts to ecological resources in the drainage channels or in downstream areas. Monitoring and periodic reviews under Alternative 2 would be used to more accurately evaluate the significance of the future discharges, and contingency measures would be implemented to mitigate expected environmental impacts.

8.2.3 Alternative 3: Hydraulic Containment

Hydraulic containment would use a combination of engineering and administrative controls to limit further migration of the OU-1B groundwater plumes and prevent human exposure to VOC-contaminated groundwater. One extraction well would be placed along the downgradient margin of each plume identified in the first and second WBZs. The capture zones created by these wells would create a hydraulic barrier to effectively restrict further downgradient migration of VOCs within the shallow aquifer. Extracted groundwater would be treated at an aboveground facility located at each site and then discharged to Peters Canyon Channel.

Given the limited transmissivities associated with the upper two WBZs, only one or two wells would be needed to contain each of the identified plumes, and extraction rates of 1 to 3 gallons per minute (gpm) from each well would be adequate to create an effective hydraulic barrier. This would result in extraction of a limited volume of water (total extraction rate of 7.5 gpm), which would simplify treatment requirements as well as long-term operation and maintenance (O&M) activities. Since the areal and vertical distribution of contamination has been well defined, it would be easy to verify containment of the plumes and the performance of this alternative.

Institutional controls in the form of land-use restrictions would be implemented as a part of Alternative 3. Institutional controls in the form of land-use restrictions would be used to restrict potential human exposure to contaminated shallow groundwater as long as VOC concentrations remain above health-based remediation goals; to protect the remedial action; and to allow the DON, DTSC, and their authorized agents, employees, contractors, and subcontractors access to the premises to maintain the remedial action. These land-use restrictions would be implemented through two different legal mechanisms: 1) covenant agreements with the DTSC and 2) deed restrictions. A detailed discussion of the institutional controls and the methods of implementation is in Sections 10.4 and 10.5 of this ROD/RAP. A performance monitoring program with periodic progress reviews would also be an integral component of this alternative.

8.2.4 Alternatives 4/4A: Aggressive Groundwater Extraction With Off-Site Soil Disposal/On-Site Soil Treatment

Alternatives 4 and 4A include excavating VOC-contaminated soil and installing a network of groundwater extraction and injection wells to contain the OU-1B plumes, reduce VOC concentrations, and restore the shallow aquifer to beneficial uses as quickly as possible. Alternatives 4 and 4A differ only in the disposition of the excavated source-area soil. All other components of these two alternatives are identical.

Source removal would entail excavation of TCE-contaminated soil at concentrations greater than 100 μg/kg within the upper confining layer of the first WBZ at IRP-3 and IRP-12. The purpose of the removal would be to accelerate the rate of cleanup in the underlying permeable sand layers and maximize the overall efficiency of the remedial action. Removal of soil exceeding this criterion represents an optimum balance between the volume of excavated material that must be managed and reductions in long-term VOC loadings to groundwater.

Groundwater would be extracted using 15 wells located throughout the entire area of affected groundwater at and downgradient from IRP-3 and IRP-12. The total groundwater extraction rate would be 44 gpm. Groundwater extraction would continue until contaminant levels in the sand layers of the first two WBZs reached asymptotic levels. Extraction for longer periods of time would not result in significant additional contaminant reduction. After the extraction systems are shut down, natural attenuation processes would continue to reduce VOCs to site remediation goals.

Treated groundwater would be discharged through 15 injection wells into the first and second WBZs of the shallow aquifer. Injection of treated groundwater upgradient of the contaminant plumes would enhance flushing of VOCs to the extraction wells (thus reducing the time required for aquifer restoration) while diverting clean (upgradient) groundwater around the areas of contamination. The injection wells would be located in areas of the shallow aquifer where background levels of TDS and other inorganic constituents are not markedly different from the treated groundwater.

Institutional controls in the form of land-use restrictions would be implemented as a part of Alternatives 4/4A. Institutional controls in the form of land-use restrictions would be used to restrict potential human exposure to contaminated shallow groundwater as long as VOC concentrations remain above health-based remediation goals; to protect the remedial action; and to allow the DON, DTSC, and their authorized agents, employees, contractors, and subcontractors access to the premises to maintain the remedial action. These land-use restrictions would be implemented through two different legal mechanisms: 1) covenant agreements with the DTSC and 2) deed restrictions. A detailed discussion of the institutional controls and the methods of implementation is in Sections 10.4 and 10.5 of this ROD/RAP. A performance monitoring program with periodic progress reviews would also be an integral component of this alternative.

8.2.5 Alternative 5: Permeable Reaction Wall

Alternative 5 consists of permeable reaction walls installed within the shallow aquifer to remediate the VOC plumes downgradient from IRP-3 and IRP-12. The walls are assumed to be used in a funnel-and-gate configuration, with slurry walls directing (funneling) the contaminated groundwater through permeable sections of reactive iron. The slurry walls and permeable reaction walls would be configured such that all upgradient groundwater within the plumes would eventually pass through the iron via natural groundwater flow. The permeable reaction walls would extend vertically to effectively intercept VOC-affected groundwater in both the first and second WBZs. Low levels of existing VOC contamination downgradient from the walls would be remediated by natural attenuation processes, including dilution, dispersion, and adsorption.

Permeable reaction walls represent an innovative technology that would require a pilot test before full-scale implementation. However, studies reported in the literature have shown that TCE and other chlorinated VOCs can be completely degraded to nonchlorinated, nontoxic reaction products as groundwater flows through an *in situ* bed of reactive iron. This was confirmed in bench tests using groundwater samples collected from the OU-1B plumes (BNI 1998a). Long-term success of the permeable reaction wall would be evaluated using groundwater monitoring results after the remedy is in place.

Institutional controls in the form of land-use restrictions would be implemented as a part of Alternative 5. Institutional controls in the form of land-use restrictions would be used to restrict potential human exposure to contaminated shallow groundwater as long as VOC concentrations remain above health-based remediation goals; to protect the remedial action; and to allow the DON, DTSC, and their authorized agents, employees, contractors, and subcontractors access to the premises to maintain the remedial action. These land-use restrictions would be implemented through two different legal mechanisms: 1) covenant agreements with the DTSC and 2) deed restrictions. A detailed discussion of the institutional controls and the methods of implementation is in Sections 10.4 and 10.5 of this ROD/RAP. A performance monitoring program with periodic progress reviews would also be an integral component of this alternative.

8.2.6 Alternatives 6/6A: Vacuum-Enhanced Extraction With Off-Site Soil Disposal/On-Site Soil Treatment

Alternatives 6 and 6A are refinements of Alternatives 4 and 4A. They include source removal plus groundwater extraction to contain the OU-1B plumes while attempting to shorten the time required to remediate VOC-affected groundwater. Soil removal under Alternatives 6 and 6A is identical to that described in Section 8.2.4 for Alternatives 4 and 4A, respectively. Alternatives 6 and 6A differ only in the disposition of the excavated source area soil. All other components of these two alternatives are identical.

Alternatives 6 and 6A would impose a high vacuum (approximately 0.3 to 0.4 atmosphere) on the groundwater extraction wells completed in the first WBZ. The purpose of the VEE system would be to increase the groundwater extraction rate and, thus, the rate of VOC removal from the sand layer of the first WBZ. Additional contaminants would be removed with soil vapor captured by the vacuum system as the groundwater table is lowered in the vicinity of the VEE wells and VOCs are stripped from newly exposed soil. Conventional groundwater extraction wells would be installed to remove dissolved contaminants from the second WBZ. Modeling results presented in the FS Report suggest that six VEE wells and four conventional groundwater extraction wells would be required and that the optimal total groundwater extraction rate from the first two WBZs would be 80 gpm.

The extracted groundwater would be treated by GAC to remove organic contaminants at an aboveground treatment facility constructed at each site. Treated groundwater would be discharged in a manner identical to Alternative 3. Groundwater extraction would continue until contaminant concentrations in the sand layers of the first two WBZs reach asymptotic levels. Based on the modeling results presented in the FS Report, extraction is expected to continue for 10 years at IRP-3 and IRP-12. Extraction for a longer period of time would not result in significant additional contaminant reduction. After the extraction systems are shut down, natural processes (dilution, dispersion, and adsorption) would continue to reduce VOCs to site remediation goals (Table 8-2).

The modeling results presented in the FS Report also predicted that VEE wells at the two IRP sites could remove a combined total of 1.3 standard cubic feet per minute of soil gas. In contrast, the VEE pilot test conducted at IRP-3 found that vapor flow in these wells is unlikely because residual moisture in the upper clay layer in the first WBZ acts as an effective barrier to air circulation from the surface (BNI 1999a). Nevertheless, because extraction of soil gas is theoretically possible with a VEE system, provisions to handle VOC-containing vapors would be included in the design of the treatment facility to be constructed near IRP-3.

Institutional controls in the form of land-use restrictions would be implemented as a part of Alternatives 6/6A. Institutional controls in the form of land-use restrictions would be used to restrict potential human exposure to contaminated shallow groundwater as long as VOC concentrations remain above health-based remediation goals; to protect the remedial action; and to allow the DON, DTSC, and their authorized agents, employees, contractors, and subcontractors access to the premises to maintain the remedial action. These land-use restrictions would be implemented through two different legal mechanisms: 1) covenant agreements with the DTSC and 2) deed restrictions. A detailed discussion of the institutional controls and the methods of implementation can be found in Sections 10.4 and 10.5 of this ROD/RAP. A performance monitoring program with periodic progress reviews would also be an integral part of this alternative.

8.2.7 Alternative 7: Hydraulic Containment With Hot Spot Removal

Alternative 7 is an enhancement or optimization of Alternative 3 that combines hydraulic containment with soil and groundwater hot spot removal. Hot spot soils (soils with TCE concentrations greater than 400 μg/kg within the vadose zone and upper confining layer of the first WBZ) would be excavated. Soils with TCE concentrations exceeding 100 μg/kg would be treated on-site using a thermal desorption unit (TDU). Treated soil would be used as excavation backfill. Hot spot groundwater and soil removal optimizes hydraulic containment by reducing the time required to attain the remediation goals established for the sites. Treated water from the treatment system would be discharged to a city of Tustin storm drain, ultimately discharging into Peters Canyon Channel.

For purposes of the FS, it was assumed that groundwater extraction under Alternative 7 would use the identical extraction well configuration as for hydraulic containment under Alternative 3 (i.e., four hydraulic containment wells placed at the downgradient margins of the plumes in the first and second WBZs) plus five additional hot spot groundwater extraction wells placed in the areas of highest VOC concentrations in groundwater. The purpose of the more aggressive hot spot groundwater extraction under Alternative 7 is to reduce the highest contaminant concentrations in groundwater, thereby reducing the time required for remediation. Groundwater extraction using the additional hot spot wells would continue until contaminant levels in groundwater extracted from the hot spot wells reached asymptotic levels. Based on the modeling results, groundwater extraction using the hot spot wells is expected to continue for 10 years at IRP-3 and IRP-12 (BEI 2003c).

The total groundwater extraction rate from the nine wells extracting groundwater from the first two WBZs would be 23.5 gpm for years 0 to 10 and 7.5 gpm for years 10 to 30. Extraction for longer periods of time would not result in significant additional contaminant reduction. After the extraction systems are shut down, natural processes would continue to reduce VOCs to remediation goals.

Institutional controls in the form of land-use restrictions would be used to prevent human exposure to contaminated shallow groundwater as long as VOC concentrations remain above health-based remediation goals; to protect the remedial action; and to allow the DON, DTSC, and their authorized agents, employees, contractors, and subcontractors access to the premises to maintain the remedial action. These land-use restrictions would be implemented through two different legal mechanisms: 1) covenant agreements with the DTSC and 2) deed restrictions. A discussion of the institutional controls and methods of implementation is in Sections 10.4 and 10.5 of this ROD/RAP. As with Alternatives 3 and 4/4A, Alternative 7 has the advantage of limiting the areas where deed restrictions would be required, since the extent of VOC-affected groundwater would not expand significantly beyond current plume boundaries.

A performance monitoring program with periodic progress reviews would be an integral component of Alternative 7. The specifics of the monitoring program, including the sampling frequency, number of samples, and locations and specifications for any new monitoring wells (e.g., depths, screened intervals, construction materials), would be determined during the remedial design/remedial action phase and documented in the

OMP for OU-1B. Additionally, disposal options for treated groundwater would be reevaluated in the remedial design and would consider factors such as local hydrogeology, substantive regulations, regulatory/public input, and current discharge limits. The disposal options to be reevaluated include, but are not limited to, surface discharge, unit treatment processes, infiltration, sewer discharge, or other beneficial uses such as irrigation.

Section 9
SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes results from the comparative analysis conducted to evaluate the relative advantages and disadvantages of each remedial alternative in relation to the nine evaluation criteria outlined in CERCLA Section 121(b), as amended. A complete discussion of the evaluation of the alternatives for IRP-3 and IRP-12 is found in the OU-1B FS Report (BNI 2002).

CERCLA evaluation criteria are based on requirements promulgated in the NCP. As stated in the NCP (40 C.F.R. § 300.430[f]), evaluation criteria are arranged in the following hierarchical manner: threshold criteria, primary balancing criteria, and modifying criteria. Threshold criteria must be satisfied in order for an alternative to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs among alternatives. Generally, modifying criteria are taken into account after public comments are received on the Proposed Plan.

Threshold Criteria:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Primary Balancing Criteria:

- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Short-Term Effectiveness
- Implementability
- Cost

Modifying Criteria:

- State Acceptance
- Community Acceptance

Table 9-1 summarizes the comparative analysis of the OU-1B alternatives. Computer-based groundwater modeling supported the analysis by assessing the effect of each alternative on VOC contamination. The modeling was used primarily to evaluate long-term effectiveness; short-term effectiveness (i.e., time to achieve remediation goals); and reduction of toxicity, mobility, or volume of contaminants. Modeling for IRP-3 and IRP-12 was performed using Vadose Zone Leaching Model, Modular Three-Dimensional Finite-Difference Groundwater Flow Model, and MT3D computer codes with supporting information taken primarily from the RI Report, the 1997 Annual Groundwater Monitoring Report, and the Final 1999 Annual Groundwater Monitoring Report.

Table 9-1
Summary of Comparative Analysis of OU-1B Remedial Alternatives

Criterion	Alternative 1 No Action	Alternative 2 Monitored Natural Attenuation	Alternative 3 Hydraulic Containment	Alternatives 4/4A Aggressive Groundwater Extraction	Alternative 5 Permeable Reaction Wall	Alternatives 6/6A Vacuum-Enhanced Extraction	Alternative 7 Hydraulic Containment With Hot Spot Removal
Overall protection of human health and the environment	Not protective	Not protective	Protective	Protective	Protective	Protective	Protective
Compliance with ARARs	Not applicable	Complies	Complies	Complies	Complies	Complies	Complies
Long-term effectiveness and permanence	○	○	◑	◕	◔	◑	●
Reduction of toxicity, mobility, or volume through treatment	○	○	◑	◕	◑	◕	◕
Short-term effectiveness	○	◑	◕	◑	◑	◑	●
Implementability	●	●	◕	◕	○	◑	◕
Cost	●	●	◕	◑	○	◑	◑

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
OU – operable unit

Relative Performance in Satisfying NCP Criteria

○ ◔ ◑ ◕ ●

Least → **Best**

9.1 THRESHOLD CRITERIA

Threshold criteria include overall protection of human health and the environment and compliance with ARARs. An alternative must meet both threshold criteria to be eligible for selection.

9.1.1 Overall Protection of Human Health and the Environment

Assesses whether a cleanup remedy provides adequate public health protection and describes how health risks posed by the site will be eliminated, reduced, or controlled through treatment, engineering controls, or institutional and regulatory controls.

Alternatives 3, 4/4A, 5, 6/6A, and 7 are protective of human health and the environment. These alternatives would satisfy OU-1B RAOs because they would:

- prevent human exposure to VOCs in shallow groundwater through institutional controls (deed restrictions and permits required for new water supply wells);
- contain the OU-1B plumes within existing boundaries;
- prevent the off-station migration of contaminated groundwater and eliminate the potential for future VOC discharges to Peters Canyon Channel and Barranca Channel;
- substantially reduce TCE mass and maximum concentrations over 30 years, thereby reducing potential risk to human health and the environment;
- provide a permanent solution to existing groundwater contamination;
- comply with all identified ARARs and eventually achieve site remediation goals throughout the areas currently affected by the OU-1B plumes;
- track and verify the progress of groundwater remediation through a systematic program of long-term monitoring and periodic site reviews; and
- limit the area covered by deed restrictions to between approximately 44 acres (for Alternatives 3, 4 and 4A, 6 and 6A, and 7) and 105 acres (for Alternative 5) and restrict the construction of new water supply wells; in all cases, the required deed restrictions should be compatible with redevelopment of the Former MCAS Tustin property.

In addition to these benefits, hydraulic containment (Alternative 3), aggressive groundwater extraction (Alternatives 4/4A), VEE (Alternatives 6/6A), and hydraulic containment with hot spot removal (Alternative 7) alternatives would permanently remove VOC-affected soils from the source areas at the two OU-1B IRP sites.

Alternative 5 (permeable reaction wall) would provide many of the same advantages as those listed above for Alternatives 3, 4/4A, 6/6A, and 7. However, the long-term performance of this alternative was considered uncertain because the hardness in shallow groundwater would increase the potential for chemical precipitates to foul the reactive iron. In addition, deep iron-wall installations required to remediate the plumes in the second WBZ at IRP-12 may be difficult to construct. Finally, the deed restrictions

required by Alternative 5 would constrain redevelopment of those parcels overlying the permeable reaction walls.

Alternative 2 (monitored natural attenuation) was not considered protective of human health and the environment. Alternative 2 would prevent human exposure to VOCs in shallow groundwater through institutional controls. However, contaminant mass would not be reduced in the subsurface. Monitored natural attenuation would allow significant expansion of the OU-1B plumes on the MCAS Tustin property and would not prevent plume migration to off-property areas, which would result in the eventual discharge of VOCs to Peters Canyon Channel and Barranca Channel. For these reasons, Alternative 2 is considered to be not protective of human health and the environment. Continued migration of VOC-affected groundwater could also have a negative effect on site redevelopment. The deficiencies identified for Alternative 2 could be mitigated somewhat by long-term monitoring and periodic reviews, which would track plume movement and provide a basis for additional remedial actions.

Alternative 1 would have the same drawbacks noted above for Alternative 2 without the benefits of either deed restrictions or long-term monitoring. Although there is no current human exposure to VOCs in shallow groundwater at MCAS Tustin, redevelopment of the property may change this situation over time. Alternative 1 would not provide the engineering or additional institutional controls included with the other alternatives to mitigate future risks. Therefore, overall protection of human health and the environment was considered unacceptable under Alternative 1.

9.1.2 Compliance With Applicable or Relevant and Appropriate Requirements

Addresses whether a cleanup remedy will meet all federal, state, and local environmental statutes or requirements.

Alternative 3 (hydraulic containment), Alternatives 4 and 4A (aggressive groundwater extraction with off-site soil disposal and aggressive groundwater extraction with on-site soil treatment, respectively), Alternative 5 (permeable reaction wall), Alternatives 6 and 6A (VEE with off-site soil disposal and VEE with on-site soil treatment, respectively), and Alternative 7 (hydraulic containment with hot spot removal) would comply with all chemical-, location-, and action-specific ARARs identified for OU-1B. Alternatives 4/4A, 6/6A, and 7 would be designed to contain the plumes and restore the shallow aquifer to site remediation goals to the extent practicable. The hydraulic containment and permeable reaction wall alternatives would be designed to control migration of contaminated groundwater. While not intended as aquifer-restoration alternatives, both Alternatives 3 and 5 would offer potentially significant reductions in contaminant mass and would attain site remediation goals within the existing boundaries of the OU-1B plumes, but in a time frame generally greater than 100 years.

Alternative 2 (monitored natural attenuation) would eventually satisfy the chemical-specific ARARs for the shallow aquifer system, which are driven by RWQCB's classification of the underlying Irvine Pressure Subbasin (regional aquifer) as a potential source of drinking water supply. However, compliance with state action-specific ARARs would be problematic for Alternative 2, particularly for those requirements related to maintenance of beneficial uses and water quality objectives (WQOs) in the shallow aquifer.

ARARs are not triggered by Alternative 1 (no action).

9.2 PRIMARY BALANCING CRITERIA

Primary balancing criteria include long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost. These are used to weigh trade-offs among alternatives and identify the most favorable.

9.2.1 Long-Term Effectiveness and Permanence

Refers to the ability of a remedy to continue protecting human health and the environment over time after the cleanup action is completed.

For each alternative, long-term effectiveness and permanence were evaluated on the basis of model-based predictions of groundwater quality. The modeling results presented in the FS Report suggest that several alternatives could achieve site remediation goals given sufficient time. However, the shallow aquifer system underlying Former MCAS Tustin is heterogeneous, with potentially significant quantities of contamination adsorbed to low-permeability clay layers. These adsorbed VOCs are difficult to remediate and may serve as a continuing source of contamination to the more transmissive sand and gravel layers. It is difficult to model the long-term effect that VOCs released from the clay layers could have on water quality in the first and second WBZs. Thus, complete aquifer restoration by groundwater extraction or *in situ* treatment may not be technically practicable within a reasonable time, despite model predictions indicating otherwise.

With this qualification, Alternative 7 (hydraulic containment with hot spot removal) was determined to provide the best overall performance among the remedial options evaluated during the FS. Alternative 7 would also use proven and reliable technology to remove and treat contaminated soil and groundwater. Continued operation of the containment wells in Alternative 7 beyond 15 years causes residual VOC concentrations to be less than those in Alternative 4 during later years (Figures 9-1 through 9-4).

Alternatives 4 and 4A (aggressive groundwater extraction with off-site soil disposal and aggressive groundwater extraction with on-site soil treatment, respectively) were the next best options in terms of long-term effectiveness. They would generally achieve the lowest residual VOC concentrations after 20 years of remediation. Other advantages of

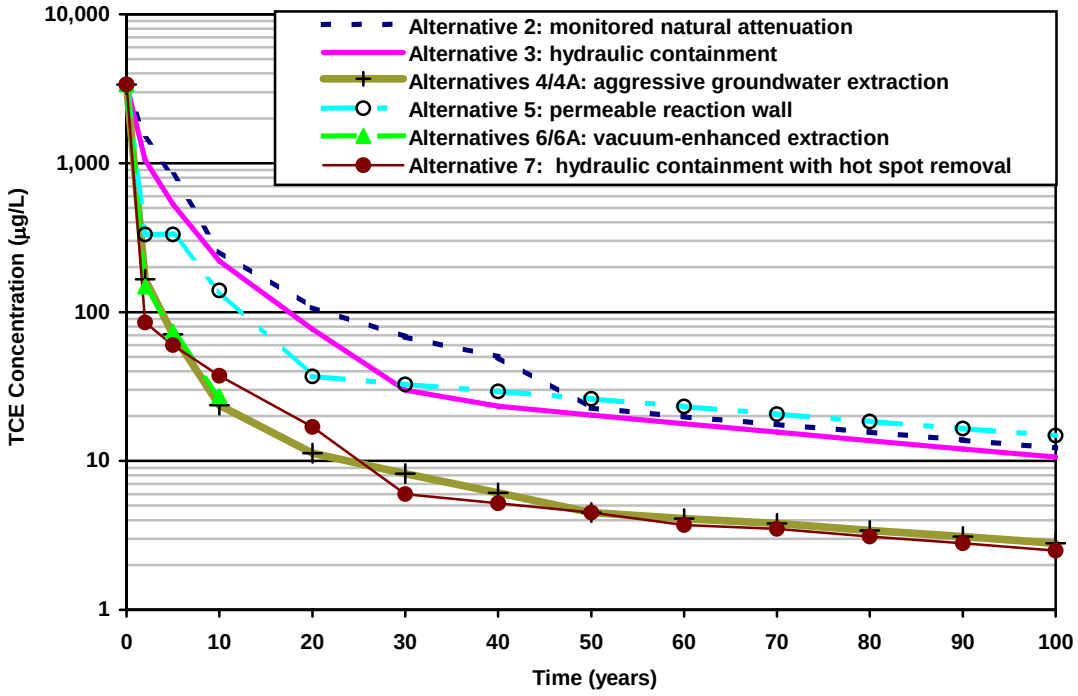


Figure 9-1
Maximum TCE Concentrations in First WBZ at IRP-12

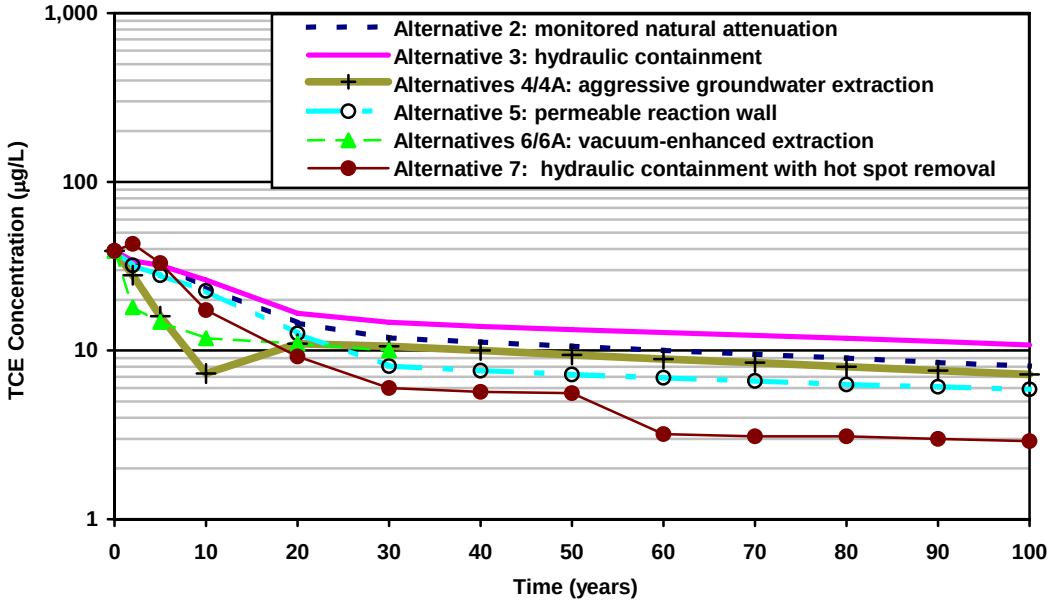


Figure 9-2
Maximum TCE Concentrations in Second WBZ at IRP-12

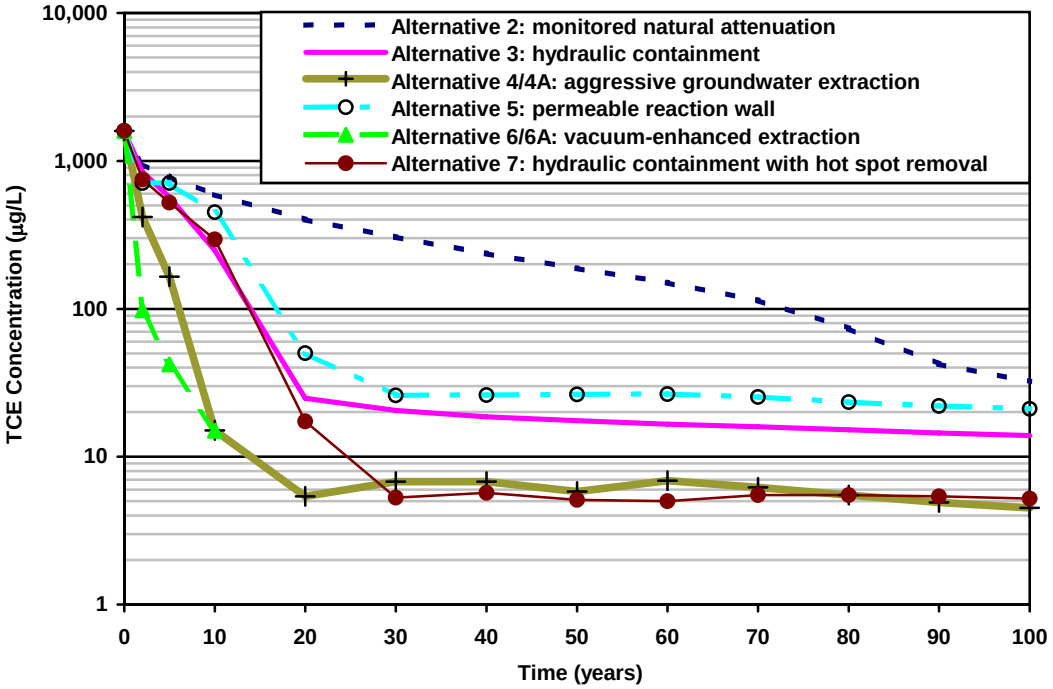


Figure 9-3
Maximum TCE Concentrations in First WBZ at IRP-3

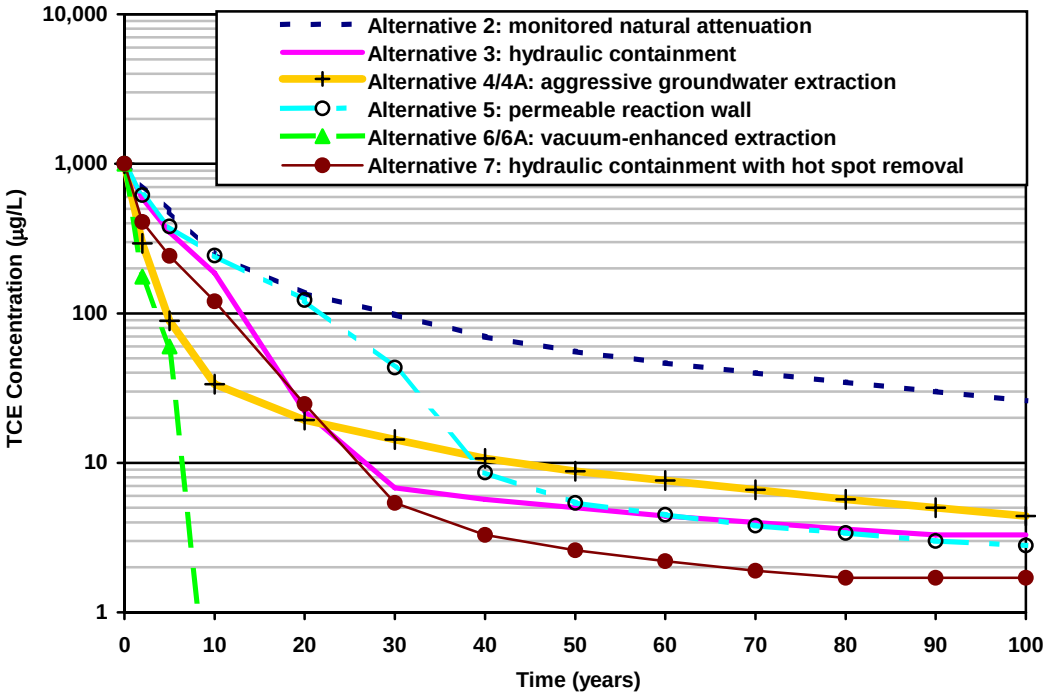


Figure 9-4
Maximum TCE Concentrations in Second WBZ at IRP-3

Alternatives 4 and 4A include their use of proven and reliable technology, prevention of significant plume migration beyond existing boundaries, and elimination of future contaminant discharges to Peters Canyon Channel and Barranca Channel. Although heterogeneities in the shallow aquifer system may ultimately preclude complete aquifer restoration, Alternatives 4 and 4A would at least contain the OU-1B plumes and prevent human exposure to VOCs through institutional controls.

Alternatives 6 and 6A (VEE with off-site soil disposal and VEE with on-site soil treatment, respectively) were rated slightly less effective than aggressive groundwater extraction in the long term. While these options would have many of the same advantages as Alternatives 4 and 4A, a recent field test at IRP-3 suggests that model-based predictions of high groundwater-extraction rates for a VEE system may not be realized in practice (BNI 1999a).

Alternative 3 (hydraulic containment) was also rated less favorably than Alternatives 4/4A and 7 with respect to long-term effectiveness and permanence. The major advantages of hydraulic containment are that it would prevent human exposure to VOCs (through institutional controls) and further migration of contaminated groundwater (through extraction at the downgradient plume margins). The major disadvantage of this option is that it could potentially require continued O&M of the groundwater extraction-and-treatment system for many decades beyond the 30-year period considered in the FS.

The long-term effectiveness and permanence of Alternative 5 (permeable reaction wall) were considered lower than those of Alternatives 4/4A and 7. Permeable reaction walls employ innovative technology, and the performance of this option over several decades is uncertain. Alternative 5 would significantly reduce maximum TCE concentrations and, therefore, risk at the two OU-1B IRP sites. However, residual contaminant concentrations after 30 years would generally be greater than they would be under several other alternatives, primarily because Alternative 5 would rely on natural groundwater flow to transport VOCs to the reactive iron wall.

Alternative 1 (no action) and Alternative 2 (monitored natural attenuation) were the least attractive options from the standpoint of long-term effectiveness and permanence because they would allow significant expansion of the contaminated plume and would potentially allow human (Alternative 1) and ecological (Alternatives 1 and 2) exposure to contaminated groundwater.

9.2.2 Reduction of Toxicity, Mobility, or Volume

This criterion assesses the degree to which the alternatives employ recycling or treatment that reduce 1) harmful effects to human health and the environment (toxicity), 2) the contaminant's ability to move (mobility), and 3) the amount of contamination (volume), including how treatment is used to address the primary threats posed by the site.

Based on initial modeling results, Alternatives 6 and 6A (VEE with off-site soil disposal and VEE with on-site soil treatment, respectively) were predicted to achieve the greatest reduction (more than 85 percent of TCE) in contaminant mass over the 30-year period considered in the FS (see Figures 9-5 and 9-6). However, the predictions assume that high groundwater-extraction rates can be attained with VEE, and pilot-scale test results showed that VEE rates were only marginally higher than standard pumping. Thus, the contaminant-mass reductions actually achievable with Alternatives 6 and 6A are likely equivalent to those with Alternatives 4 and 4A.

Alternative 7 removes VOC mass using hot spot extraction wells, containment wells, and soil excavation. Over 30 years, this alternative removes more than 75 percent of the TCE mass and is the second most effective alternative.

Alternatives 4 and 4A (aggressive groundwater extraction with off-site soil disposal and aggressive groundwater extraction with on-site soil treatment, respectively) were rated slightly less effective than Alternatives 6/6A and 7 at reducing contaminant toxicity, mobility, or volume through treatment. Over 30 years, this option would reduce the mass of TCE by approximately 75 percent through a combination of groundwater extraction and treatment along with soil excavation and either landfill disposal (Alternative 4) or on-site thermal treatment and disposal (Alternative 4A).

Predicted VOC removals were lower for Alternative 3 (hydraulic containment) and Alternative 5 (permeable reaction wall), which would reduce the VOC mass by approximately 48 and 55 percent, respectively. Alternative 3 would control VOC mobility through plume containment; the toxicity and volume of contaminated groundwater would gradually be reduced through extraction at the downgradient plume margins and treatment of the extracted water. Alternative 5 would reduce contaminant toxicity, mobility, and volume through *in situ* reductive dehalogenation of VOCs as the OU-1B plumes pass through sections of reactive iron.

Alternative 1 (no action) and Alternative 2 (monitored natural attenuation) would result in no reduction in contaminant toxicity, mobility, or volume other than that attributable to dilution, dispersion, and adsorption in the subsurface. Maximum VOC concentrations would decrease significantly over 30 years (Figures 9-1 through 9-4). However, there would be no decrease in the mass of TCE, since chlorinated VOC biodegradation is assumed to be negligible under the prevailing aerobic conditions of the shallow aquifer. The OU-1B plumes would continue to migrate into areas currently unaffected by VOCs, increasing the overall volume of contaminated groundwater over time.

9.2.3 Short-Term Effectiveness

The short-term effectiveness criterion assesses how well human health and the environment will be protected from impacts due to construction and implementation of a remedy. It also considers time required to reach remediation goals (Table 8-2).

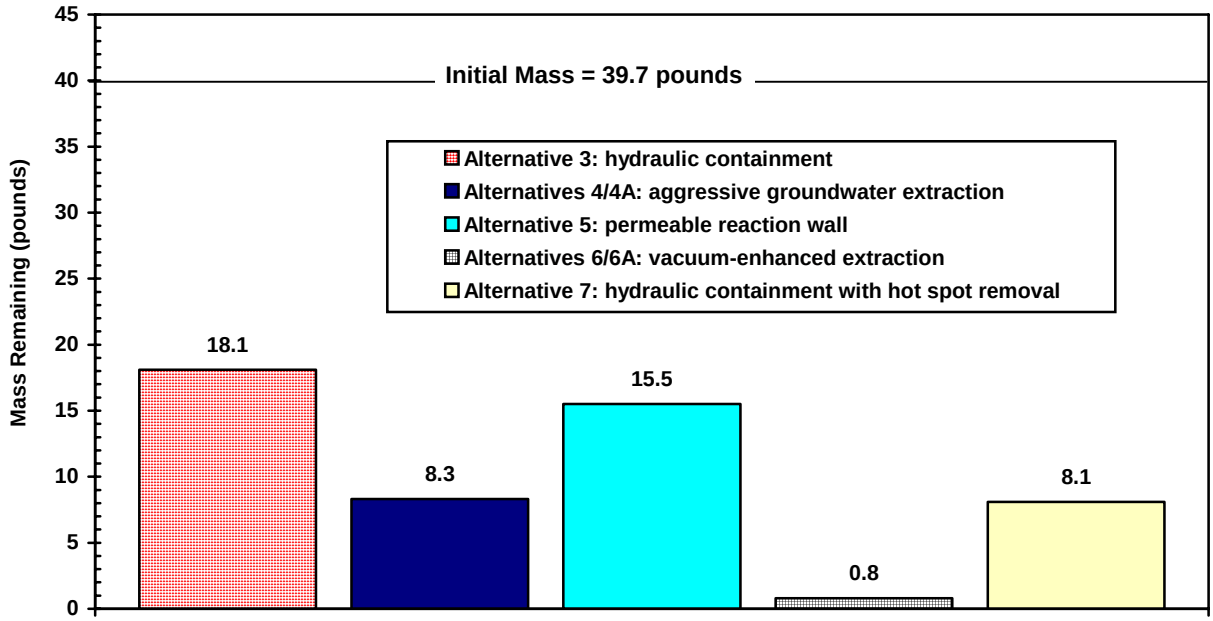


Figure 9-5
Residual TCE Mass at IRP-3 After 30 Years

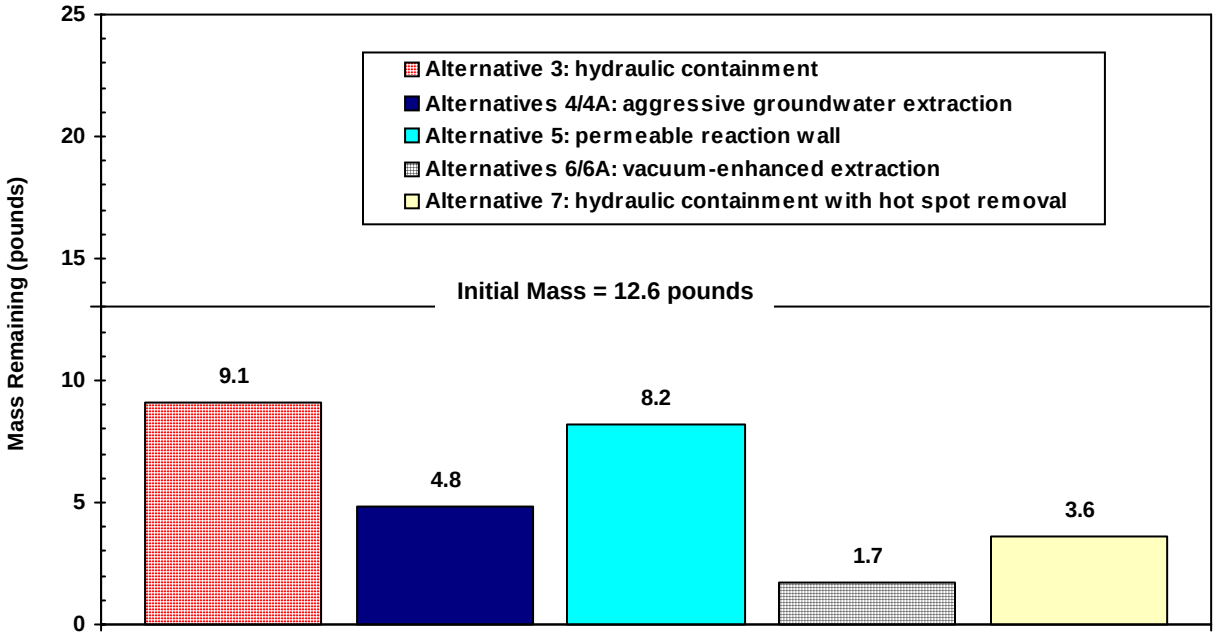


Figure 9-6
Residual TCE Mass at IRP-12 After 30 Years

Considering all the factors listed in the U.S. EPA RI/FS guidance (U.S. EPA 1988b), Alternative 7 (hydraulic containment with hot spot removal) was rated the most effective option in the short term. This alternative would involve limited-scale remedial activities and would be unlikely to have adverse short-term impacts on workers or the surrounding community. The combination of institutional and engineering controls comprising Alternative 7 would effectively limit further migration of the OU-1B plumes and reduce potential human exposure to VOC-affected groundwater. This option is relatively more effective in achieving remediation goals in Table 8-2 (in approximately 30 years) than hydraulic containment alone.

Alternative 1 (no action) was determined to be the least effective option in the short term. The OU-1B plumes would continue to expand in the downgradient direction, and VOC concentrations in the first and second WBZs would remain above site remediation goals for more than 100 years.

Alternative 2 (monitored natural attenuation) would present few risks during field implementation. Deed restrictions and the long-term groundwater monitoring program could be in place within a year after this ROD/RAP is finalized. However, Alternative 2 would not prevent further migration of the OU-1B plumes, and remediation goals would not be achieved for more than 100 years. Consequently, monitored natural attenuation was considered to be among the least effective alternatives in the short term primarily because of the length of time required to mitigate the major threats associated with OU-1B.

Alternative 3 effectively prevents plume migration but does not reach remediation goals for more than 100 years in most cases. Requiring no soil excavation, Alternative 3 presents fewer risks to workers and the surrounding community than does Alternative 7. Deed restrictions would effectively prevent exposure to contaminated groundwater until remediation goals are met.

Alternatives 4 and 4A (aggressive groundwater extraction with off-site soil disposal and aggressive groundwater extraction with on-site soil treatment, respectively), Alternative 5 (permeable reaction wall), and Alternatives 6 and 6A (VEE with off-site soil disposal and VEE with on-site soil treatment, respectively) were all rated less effective than Alternative 7 with respect to short-term effectiveness. The major components of these alternatives could be in place 9 months (Alternatives 4, 4A, 6, and 6A) to 3 years (Alternative 5) after mobilization for field construction. Once implemented, these alternatives would prevent or significantly reduce migration of the OU-1B plumes and control human exposure to VOCs in shallow groundwater. Assuming that restoration of the shallow aquifer at Former MCAS Tustin is technically feasible, the time required to attain site remediation goals was estimated to generally range from 45 to 90 years for Alternatives 4/4A and 6/6A and generally more than 100 years for Alternative 5. In addition, these alternatives would all entail relatively large-scale excavation of contaminated soil.

9.2.4 Implementability

Refers to the technical feasibility (how difficult the remedy is to construct and operate) and the administrative feasibility (coordination with other agencies) of a remedy. Factors such as availability of materials and services needed are considered.

Alternatives 1 and 2 are the most readily implemented because they entail no action (Alternative 1) or couple institutional controls with minimal construction (Alternative 2). The next best alternatives with regard to implementability are Alternative 3 (hydraulic containment), Alternatives 4 and 4A (aggressive groundwater extraction with off-site soil disposal and aggressive groundwater extraction with on-site soil treatment, respectively), and Alternative 7 (hydraulic containment with hot spot removal). Hydraulic containment, hot spot removal, and aggressive groundwater extraction would employ reliable, widely available technologies and would be installed using conventional equipment and construction methods. In addition, Alternatives 3, 4/4A, and 7 would not raise unusually complex or difficult administrative issues.

For technical reasons, Alternatives 6 and 6A (VEE with off-site soil disposal and VEE with on-site soil treatment, respectively) were considered less implementable than Alternatives 3, 4/4A, and 7. The benefits of using VEE to enhance groundwater capture in the first WBZ are uncertain, based on the results of pilot-scale testing (BNI 1999a). Otherwise, Alternatives 6 and 6A would use proven and reliable technologies and construction methods. The VEE options were also determined to be administratively implementable.

Alternative 5 (permeable reaction wall) has the lowest rating for implementability because of both technical and administrative issues. There are few full-scale applications of this innovative technology at sites as large as OU-1B. The hardness of the shallow groundwater at OU-1B could possibly cause chemical precipitation on the surface of the reactive iron, adversely affecting long-term performance. In addition, it is uncertain whether permeable reaction walls could be constructed to remediate the deep contamination associated with the plumes in the second WBZ at IRP-12. The deed restrictions required by Alternative 5 would constrain redevelopment on those parcels overlying the permeable reaction walls. In addition, only one process vendor markets the technology, further reducing the administrative implementability of this option.

9.2.5 Cost

This criterion evaluates the alternatives in terms of estimated capital costs and present worth in today's dollars required for design and construction and long-term O&M costs of a remedy.

Table 9-2 presents the net present cost estimates developed for the nine OU-1B remedial alternatives. These alternatives were grouped into three relatively low-cost options (under $3.5 million), five midrange cost options (approximately $4.5 to $7.8 million), and one high-cost option (approximately $11 million).

Table 9-2
Summary of Cost Estimates for OU-1B Remedial Alternatives
(dollars in millions)

Alternative	Total Capital Cost	Total O&M Cost[a]	Total Cost	Net Present Value[b]
Alternative 1 no action	0	0	0	0
Alternative 2 monitored natural attenuation	1.3	4.5	5.8	2.1
Alternative 3 hydraulic containment	2.5	5.7	8.1	3.5
Alternative 4 aggressive groundwater extraction with off-site soil disposal	4.6	5.2	9.8	7.5
Alternative 4A aggressive groundwater extraction with on-site soil treatment	3.7	4.2	7.9	5.8
Alternative 5 permeable reaction wall	1.9	15.7	17.6	11.5
Alternative 6[c] VEE with off-site soil disposal	2.7	7.6	10.3	7.8
Alternative 6A[c] VEE with on-site soil treatment	1.9	6.3	8.2	5.9
Alternative 7 hydraulic containment with hot spot removal	0.9	8.6	9.5	4.5

Notes:
[a] including other indirect costs, escalation, and contingency during assumed 30-year project duration
[b] in 1998 dollars
[c] cost of Alternatives 6 and 6A may increase by up to $0.5 million if additional VEE wells are required; actual extraction rates in the first WBZ could be as low as 5 gpm per well, as obtained in a recent VEE field test (BNI 1999a), rather than the 12 gpm per well estimated by the model presented in Appendix B of the FS Report

Acronyms/Abbreviations:
gpm – gallons per minute
O&M – operation and maintenance
OU – operable unit
VEE – vacuum-enhanced extraction
WBZ – water-bearing zone

Among the low-cost options, the least expensive was Alternative 1 (no action), which has no associated cost. At a net present cost of $2.1 million, Alternative 2 (monitored natural attenuation) was the next most attractive option from a cost standpoint. Alternative 3 (hydraulic containment) was somewhat more expensive with a net present cost of $3.5 million.

Net present costs for the midrange options, including Alternative 7 (hydraulic containment with hot spot removal), Alternatives 4 and 4A (aggressive groundwater extraction), and Alternatives 6 and 6A (VEE), are estimated to range from $4.5 to $7.8 million. The estimated net present cost of Alternative 6 could increase by $0.5 million to approximately $8.3 million if additional VEE wells are required to contain the OU-1B plumes and obtain the desired groundwater-extraction rates in the first WBZ. A similar increase would also apply to Alternative 6A. Given the accuracy of the cost-estimation procedures used in the FS (-30 to +50 percent), the $0.1 to $0.3 million cost difference between Alternatives 4 and 6 and Alternatives 4A and 6A is not significant. For purposes of this comparative analysis, the costs of aggressive groundwater extraction and VEE should be considered equivalent.

The most expensive remedial option was Alternative 5 (permeable reaction wall) at a net present cost of $11.5 million. The high cost of this alternative resulted from several factors: the installation of the deep and relatively thick reactive iron walls, the transportation and off-site disposal of contaminated soils removed during the initial construction, the assumed need to replace the reactive iron after 15 years, and the licensing fee paid to the process vendor.

9.3 MODIFYING CRITERIA

Modifying criteria include state and community acceptance. State acceptance is taken into account during development of the proposed plan and ROD/RAP. Public acceptance is considered through comments received during the public comment period.

9.3.1 State Acceptance

This criterion reflects whether the state of California's environmental agencies agree with, oppose, or have no objection to or comment on the DON's preferred alternative.

DTSC and RWQCB have reviewed the OU-1/OU-2 RI, the OU-1B FS, and the OU-1B Proposed Plan and concur with the selected remedy for groundwater remediation at IRP-3 and IRP-12.

9.3.2 Community Acceptance

This criterion evaluates whether community concerns are addressed by the remedy and if the community has a preference for a remedy. Although public comment is an important part of the final decision, the DON is compelled by law to balance community concerns with other criteria.

The Proposed Plan has been presented to the community and discussed at a public meeting. The responsiveness summary portion of this ROD/RAP addresses the public's comments and concerns about the selected remedy.

This page left blank intentionally

Section 10
SELECTED REMEDY

The remedy the DON has selected for OU-1B is Alternative 7: hydraulic containment with hot spot removal (with the off-site disposal component of Alternative 4 replacing the on-site treatment component of Alternative 7). This selection is based on the RI and FS Reports for OU-1B, the administrative record for these sites, and an evaluation of comments submitted by interested parties during the public comment period for OU-1A and OU-1B.

This section presents the conceptual design for hydraulic containment with hot spot removal. Design details and other specifications will be evaluated and established during the remedial design phase of the project. These specifics include exact number and placement of extraction and monitoring wells, extraction well pumping rates, performance monitoring, and other related design components, including disposal or reuse of clean, treated groundwater.

10.1 SOIL HOT SPOT EXCAVATION

The excavation and disposal of contaminated soil under the selected remedy consist of components from Alternative 7 (hot spot soil removal) and Alternative 4 (off-site soil disposal). According to the conceptual designs for Alternatives 4 and 7, soil with elevated concentrations of TCE would be removed from the vadose zone and upper confining layer of the first WBZ at IRP-3 and IRP-12 and disposed of off-site (Figures 10-1 and 10-2). The on-site component for treatment of hot spot soils using a TDU under Alternative 7 was determined to be infeasible based on several factors (see Section 12). Therefore, the hot spot soil removal component of Alternative 7 was combined with the off-site disposal component of Alternative 4. Specific details on soil excavation and disposal will be provided in the remedial design.

The rationale for removing these hot spot soils is to eliminate potential sources of low-level VOC contamination to groundwater in the first WBZ. The soils targeted for excavation will be those portions of the vadose zone and upper confining layer of the first WBZ with TCE at concentrations exceeding 400 μg/kg. This value was chosen because at this concentration, the soil will act as a continuing source of contamination to groundwater, resulting in concentrations of TCE exceeding the MCL. These targeted soils generally occur at depths of approximately 3 to 15 feet bgs. Using this 400 μg/kg criterion in the conceptual model in the FS for evaluation purposes, approximately 6,300 cubic yards of soil will be excavated from a total of five areas at IRP-3 and IRP-12 (Figures 10-1 to 10-3).

Soil will be excavated to the interface with groundwater (anticipated to be approximately 15 feet bgs) to ensure contaminated soil with the potential to impact groundwater is removed. Soil samples will be collected from the sidewalls of the excavation to guide the excavation and document residual TCE contamination. Excavated soil contaminated with TCE at concentrations greater than 100 μg/kg will be transported to a permitted off-site disposal facility. Clean fill consisting of sand or gravel will be obtained from an off-site commercial source, combined with clean excavated soil, and used to backfill the excavated area.

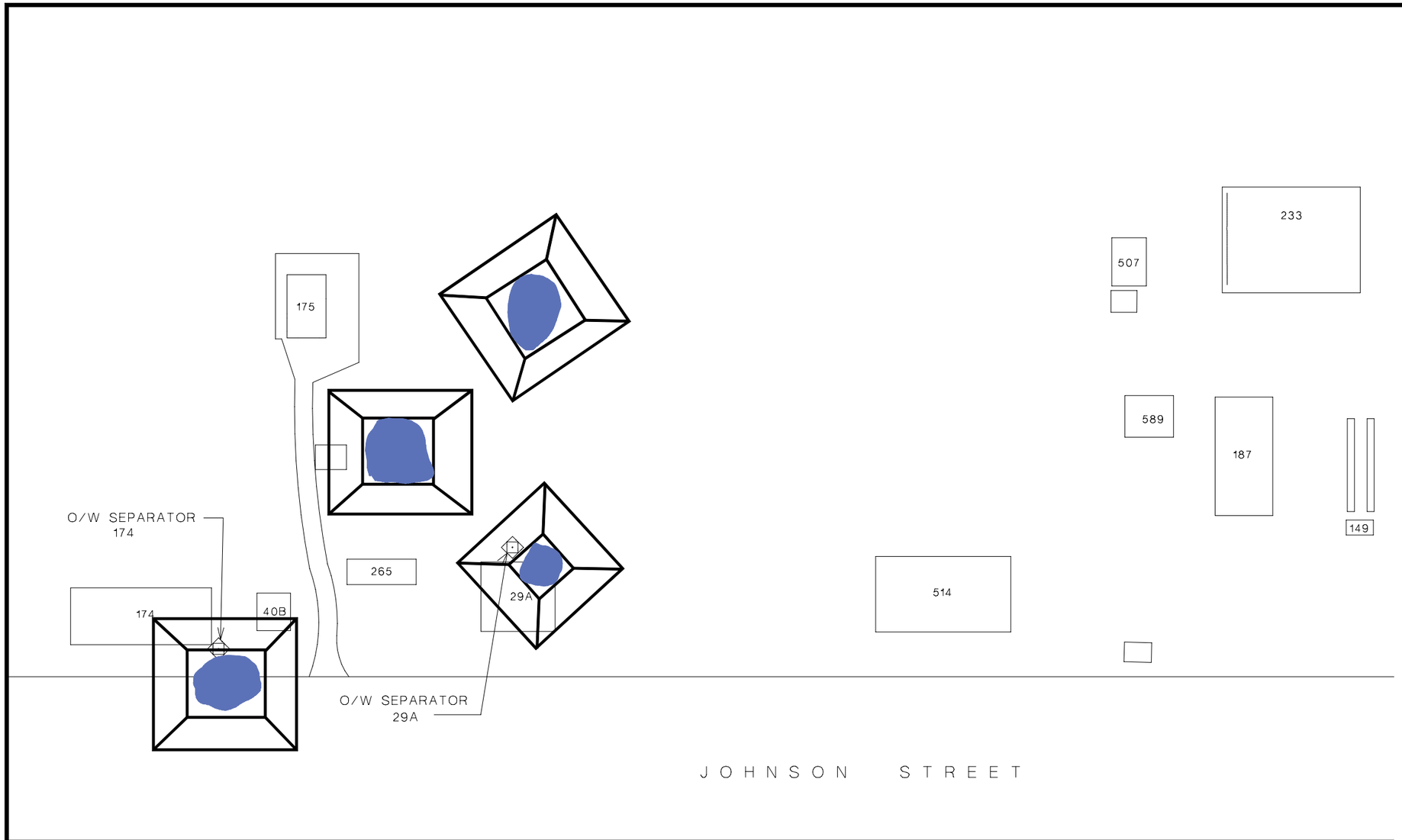
A number of existing structures at Former MCAS Tustin are located over areas that are anticipated to be excavated under Alternative 7. These structures, including Buildings 29A, 40B, and 174 at IRP-3, may have to be removed before excavation activities begin at this site. It should be noted that the excavation areas and building demolition proposed under Alternative 7 are conceptual in nature. The actual areas to be excavated and the need to demolish any affected structures will be determined based on additional data collected during the remedial design. Building 29A is located in an historic district as a contributing structure (City of Tustin 1998). The DON will coordinate with the Advisory Council on Historic Preservation and the State Historic Preservation Office to minimize impacts to this building.

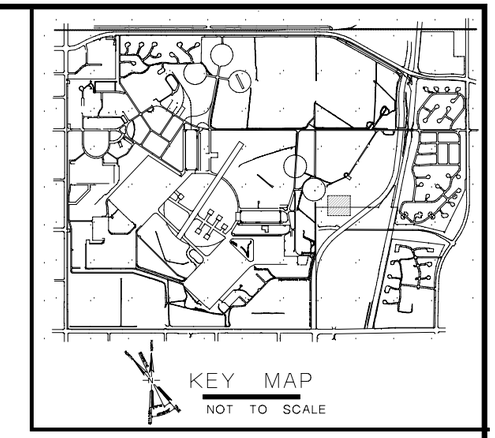
10.2 GROUNDWATER EXTRACTION

The conceptual design used for evaluation purposes in the FS includes nine groundwater extraction wells: five hot spot extraction wells and four hydraulic containment wells. Figure 10-4 depicts proposed locations for the nine wells. Five wells will be installed at IRP-3, including one containment well and three hot spot extraction wells in the first WBZ and one containment well in the second WBZ. Four wells will be installed at IRP-12, including one containment well and two hot spot wells in the first WBZ and one containment well in the second WBZ. The hot spot extraction wells will be located near the highest VOC concentrations in the contaminant plume and will operate for approximately 6 years. Hydraulic containment wells will operate for 30 years. The conceptual design was prepared using a groundwater model that incorporated site-specific hydrogeologic conditions encountered at IRP-3 and IRP-12 and an iterative approach to optimize hydraulic containment by varying the number, placement, and pumping rates of hot spot extraction and hydraulic containment wells. The exact number, placement, and pumping rates of all wells will be determined during the remedial design phase.

Operation of the hydraulic containment and hot spot extraction wells will create cones of depression that will capture contamination from the leading margins and from the central portions of the plumes, preventing further horizontal or vertical migration of VOCs in the upper two WBZs. Table 10-1 summarizes the proposed completion depths, pumping rates, and durations for the extraction wells. The actual extraction well locations, pumping rates, and completion depths will be determined during remedial design.

Extracted groundwater will be conveyed to an equalization tank at each site. The equalization tank will be used to prevent flow surges caused by cyclic operation of pumps in individual extraction wells. From the equalization tank, the extracted groundwater will be pumped through a cartridge filtration system followed by two-stage GAC adsorption. GAC is a proven and reliable method for removing VOCs from groundwater. It has been identified by U.S. EPA as a presumptive *ex situ* treatment for groundwater contaminated with VOCs (U.S. EPA 1996b). Treatability studies would not be needed to design and install this technology at Former MCAS Tustin. Figures 10-5 and 10-6 show the predicted distribution of TCE over time at in the first and second WBZs, respectively, at IRP-3 and IRP-12.





LEGEND

> 400 ug/kg TCE AT 1 TO 13 FEET BGS

EXCAVATION LIMIT

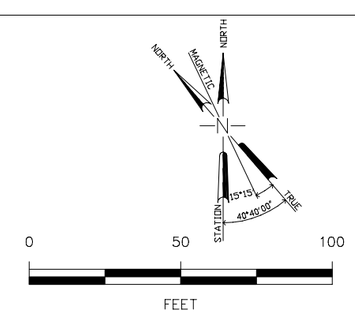
OIL/WATER SEPARATOR

NOTES:

AREAS OF EXCAVATION INCLUDE ALL TCE CONTAMINATION > 400 ug/kg. EXCAVATION AREAS ARE APPROXIMATE ASSUMING 1:1 CUT SLOPE TO A DEPTH OF 15 FEET BGS, EXCEPT THE EXCAVATION NEXT TO THE O/W SEPARATOR IS A VERTICAL CUT TO 15 FEET BGS.

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL TO REFLECT CONDITIONS AS OF NOVEMBER 1997.



Record of Decision/Remedial Action Plan

Figure 10-1

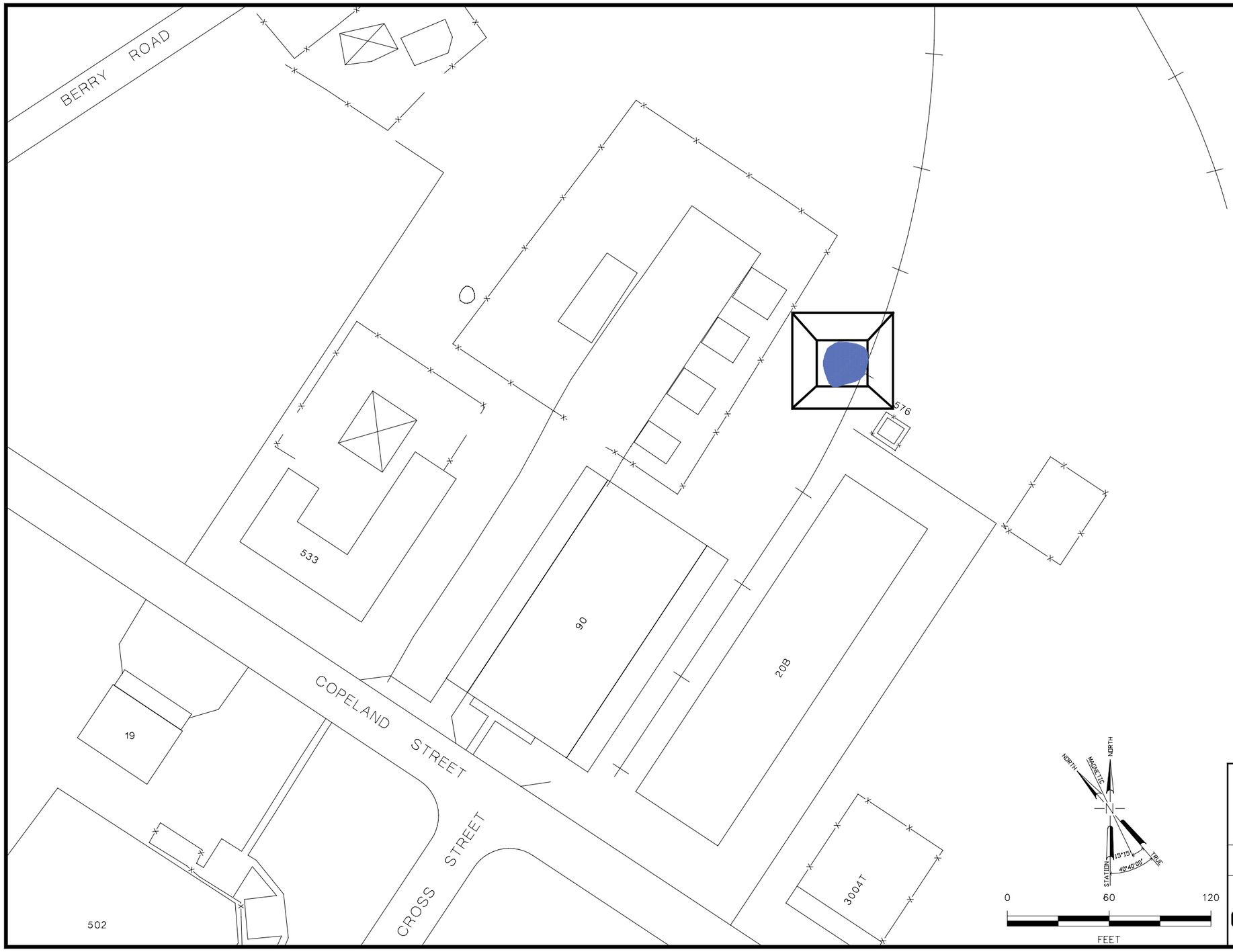
Alternative 7: Extent of TCE Soil Contamination >400 ug/kg and Excavation Areas at IRP-3

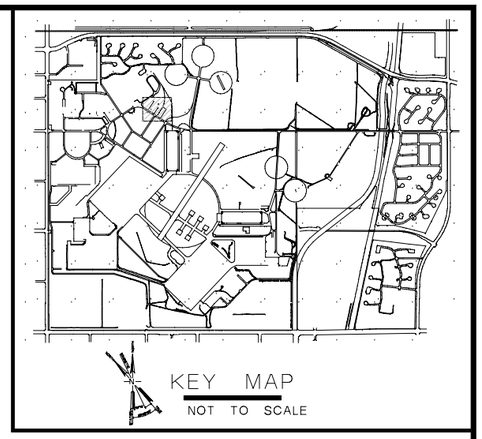
Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/25/04
File No: 035L8884
Job No: 23818-035
Rev No: C





LEGEND

THE EXTENT OF TCE CONTAMINATION > 400 ug/kg AT 2 TO 13 FEET BGS

EXCAVATION LIMIT

NOTES:

AREA OF EXCAVATION INCLUDES ALL TCE CONTAMINATION > 400 ug/kg.
EXCAVATION AREAS ARE APPROXIMATE ASSUMING 1:1 CUT SLOPE TO A DEPTH OF 15 FEET BGS

SOURCE:

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL TO REFLECT CONDITIONS AS OF NOVEMBER 1997.

Record of Decision/Remedial Action Plan

Figure 10-2

Alternative 7: Extent of TCE Soil Contamination > 400 ug/kg and Excavation Area at IRP-12

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/25/04
File No: 035L8883
Job No: 23818-035
Rev No: C

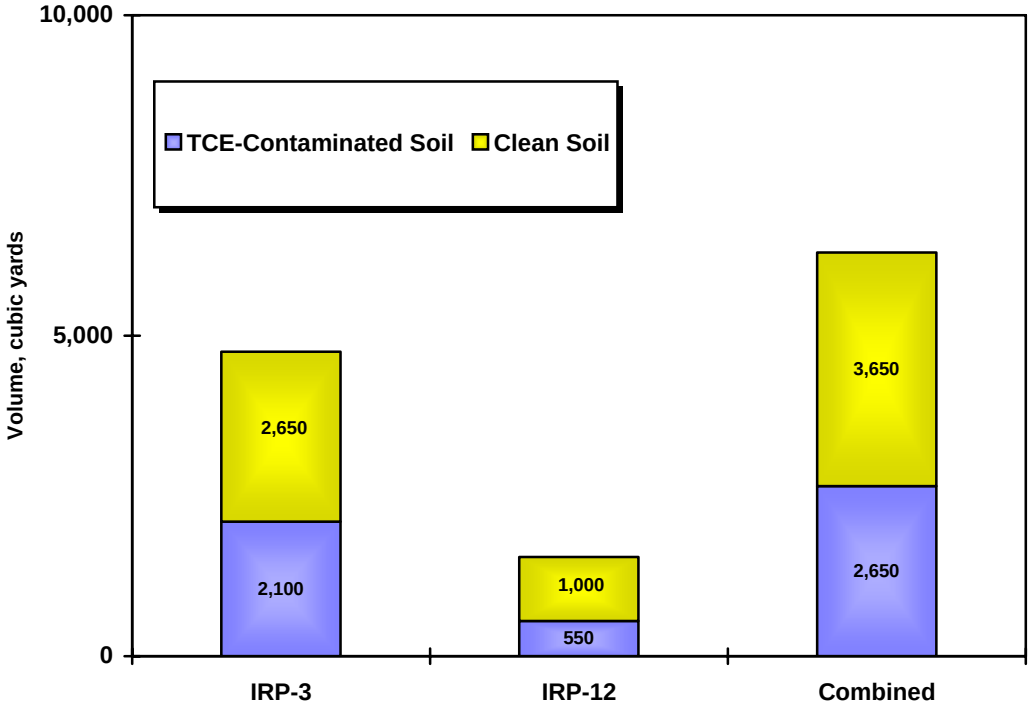


Figure 10-3
Volume of Soil to Be Excavated Under Alternative 7

Thirty years of operation would produce approximately 13,700 pounds of spent GAC. Regeneration or disposal of the spent carbon will be the responsibility of the GAC supplier under a long-term service contract. It is assumed that the spent GAC will be taken off-site for regeneration, which is the typical practice on groundwater remediation projects. Before it is shipped from the Former MCAS Tustin sites, the spent GAC will be tested to determine its waste classification. Characterization, packaging, and transport of this material will be in accordance with Department of Transportation, U.S. EPA, and DTSC requirements.

Disposal options for groundwater were evaluated in the FS for their effectiveness, implementability, and cost. Based on this initial evaluation, discharge to the storm drain was considered to be the most appropriate disposal option and is the selected disposal option in this ROD/RAP. However, other disposal options evaluated in the FS will be reevaluated during the remedial design phase in order to consider additional factors such as local hydrogeology, substantive regulations, regulatory/public input, and current discharge limits. The disposal options to be reevaluated include, but are not limited to, surface discharge, unit treatment processes, infiltration, sewer discharge, or other beneficial uses such as irrigation. If discharge to the storm drain is selected in the remedial design as the most appropriate disposal option, then treated water from the treatment system will be discharged (using single-walled piping) into a city of Tustin storm drain ultimately emptying into Peters Canyon Channel. The discharge will comply

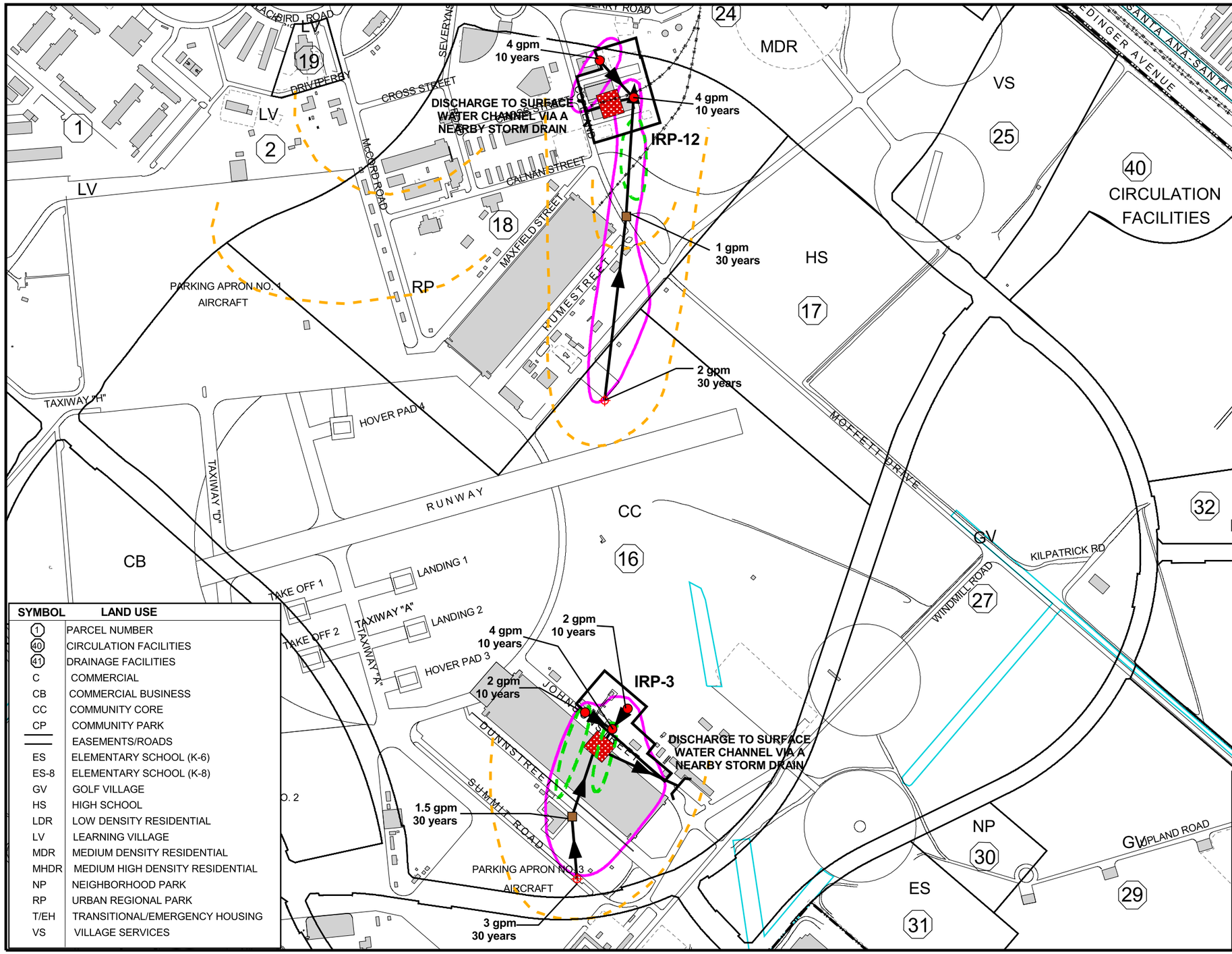
with substantive ARARs for surface water discharges. For potential storm drain discharges, the DON has reviewed the need to obtain a National Pollutant Discharge Elimination System (NPDES) permit and has determined that such a permit will not be necessary. The groundwater treatment system associated with the selected remedy will be operated entirely on-site as defined under CERCLA and the NCP. After being discharged into a city of Tustin storm drain emptying into Peters Canyon Channel, the treated groundwater will ultimately discharge into waters of the United States at an off-site location. The U.S. EPA has consistently maintained that the migration of treated water beyond site boundaries (after the response action has treated the water so that it complies with ARARs) is consistent with the on-site permit exclusion in Section 121(e) of CERCLA and does not constitute an "off-site" response action that requires an NPDES permit (see *In the Matter of the Former Weldon Spring Ordnance Works*, Weldon Spring, Missouri, Federal Facility Docket No. VII-90-F-0033, 01 November 1995).

Although not required to obtain an NPDES permit, the DON will assure that the discharge of treated groundwater complies with all ARARs as provided by Section 121 of CERCLA and the NCP, including the beneficial uses and WQOs of the RWQCB. The DON plans to evaluate compliance with these ARARs by regularly monitoring the influent and effluent of the treatment system. Details of the monitoring will be developed during the remedial design/remedial action phase. The groundwater treatment subcontractor will be responsible for documentation of the on-site treatment activities. This documentation will consist of a summary report detailing quantities removed, treated, and discharged; discharge flow rates; the number and types of samples collected; and the results of analyses.

10.3 PERFORMANCE MONITORING

Performance monitoring will be used to optimize operation of the extraction system, track mass removal, verify containment of the OU-1B plumes, and demonstrate successful treatment of the extracted groundwater before discharge. Monitoring will include water-level measurements as well as the collection and analysis of samples from wells placed within the plume areas. Process streams within the treatment plant will also be tested. A summary of the anticipated performance monitoring for the selected alternative is presented in Table 10-2.

On the basis of modeling used in the FS Report, groundwater monitoring is anticipated to be performed using four existing and two new groundwater monitoring wells. The actual number of monitoring wells to be sampled and the locations and specifications (depths, screened intervals, and well construction materials) for new monitoring wells will be determined during remedial design and documented in the OMP. This plan will also provide details on sampling procedures, target analytes, analytical methods, field and laboratory quality assurance/quality control, and reporting requirements. Well locations and surface-completion methods will consider accessibility along with the need to minimize impacts on redevelopment of the Former MCAS Tustin property. Groundwater monitoring will continue until the shutdown criteria presented in Section 10.7 are met.



SYMBOL	LAND USE
1	PARCEL NUMBER
40	CIRCULATION FACILITIES
41	DRAINAGE FACILITIES
C	COMMERCIAL
CB	COMMERCIAL BUSINESS
CC	COMMUNITY CORE
CP	COMMUNITY PARK
	EASEMENTS/ROADS
ES	ELEMENTARY SCHOOL (K-6)
ES-8	ELEMENTARY SCHOOL (K-8)
GV	GOLF VILLAGE
HS	HIGH SCHOOL
LDR	LOW DENSITY RESIDENTIAL
LV	LEARNING VILLAGE
MDR	MEDIUM DENSITY RESIDENTIAL
MHDR	MEDIUM HIGH DENSITY RESIDENTIAL
NP	NEIGHBORHOOD PARK
RP	URBAN REGIONAL PARK
T/EH	TRANSITIONAL/EMERGENCY HOUSING
VS	VILLAGE SERVICES

LEGEND

- HYDRAULIC CONTAINMENT WELL IN THE FIRST WATER-BEARING ZONE
- HYDRAULIC CONTAINMENT WELL IN THE SECOND WATER-BEARING ZONE
- HOT SPOT EXTRACTION WELL IN THE FIRST WATER-BEARING ZONE. WELLS WILL OPERATE FOR A PERIOD OF APPROXIMATELY 10 YEARS
- FORMER MCAS TUSTIN BOUNDARY
- EXISTING ROAD OR PAVED AREA
- SURFACE CHANNELS
- GROUNDWATER PLUME IN THE FIRST WATER-BEARING ZONE
- GROUNDWATER PLUME IN THE SECOND WATER-BEARING ZONE
- TREATMENT SYSTEM
- PIPING (INDICATING DIRECTION)
- PREDICTED CAPTURE ZONE OF EXTRACTION WELLS
- OUTFALL (DISCHARGE) TO CITY OF TUSTIN STORM DRAIN
- BUILDING OR STRUCTURE
- RAILROAD
- FENCE
- IRP SITE

SOURCE:
BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL TO REFLECT CURRENT CONDITIONS, NOVEMBER 1997

N

550 0 550 Feet

Record of Decision/Remedial Action Plan

Figure 10-4

Alternative 7: Hydraulic Containment with Hot Spot Source Removal Site Layout

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/25/04
File No.: 035Q8872
Job No.: 23818-035
Rev No.: D

Table 10-1
Extraction Well Details for Hydraulic Containment With Hot Spot Removal

Site	WBZ	No. of Wells	Completion Depth (feet bgs)[a]	Pumping Rate Hot Spot Wells (gpm)	Pumping Rate Containment Wells (gpm)	Combined Pumping Rate (gpm)
IRP-3	First	One	15–21	—[b]	3	—
	First	Three	15–21	8[c]	—	—
	Second	One	41–51	—	1.5	—
Subtotal		**Five**	**—**	**8**[d]	**4.5**	**12.5/4.5**[e]
IRP-12	First	One	15–21	—	2	—
	First	Two	15–21	4	—	—
	Second	One	41–51	—	1	—
Subtotal		**Four**	**—**	**8**[d]	**3**	**11/3**[f]
Total		**Nine**	**—**	**16**	**7.5**	**23.5/7.5**[g]

Notes:
[a] completion depths shown are estimated; actual depths will vary depending on conditions encountered at each location
[b] dash indicates not applicable
[c] combined extraction rate of three hot spot wells, including two wells at 2 gpm and one well at 4 gpm
[d] wells will operate for approximately 10 years after implementation of remedial alternative
[e] combined pumping rate for IRP-3 will be 12.5 gpm for years 0 to 10 and 4.5 gpm for years 10 to 30 of the remedial alternative
[f] combined pumping rate for IRP-12 will be 11 gpm for years 0 to 10 and 3 gpm for years 10 to 30 of the remedial alternative
[g] total combined pumping rate for all wells will be 23.5 gpm for years 0 to 10 and 7.5 gpm for years 10 to 30 of the remedial alternative

Acronyms/Abbreviations:
bgs – below ground surface
gpm – gallons per minute
IRP – Installation Restoration Program
WBZ – water-bearing zone

10.4 INSTITUTIONAL CONTROLS

Institutional controls are nonengineering mechanisms to implement land-use restrictions that will be used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances and to maintain the integrity of the remedial action until remediation is complete and remediation goals have been achieved (Table 8-2). Land-use restrictions are necessary to assure the protectiveness of and prevent damage to or interference with the remedial action. Monitoring and inspections will be conducted to assure that the land-use restrictions are being followed.

The following are land-use control (LUC) objectives to be achieved through land-use restrictions for these IRP sites.

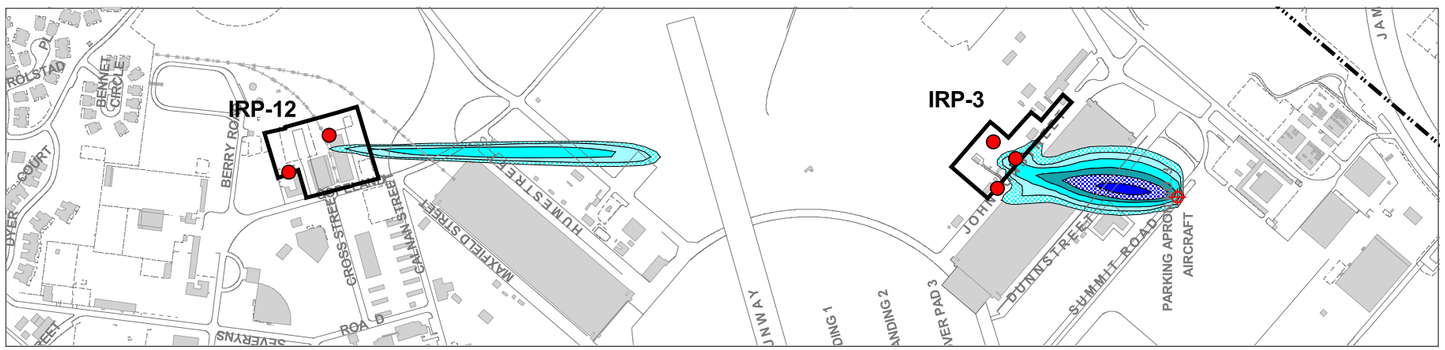
- Prohibit the installation of new groundwater wells of any type and prevent exposure to VOC-contaminated groundwater without prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB until remediation objectives have been achieved.
- Prohibit the installation of any well that has the potential to affect plume migration.
- Prohibit the alteration, disturbance, or removal of groundwater extraction and monitoring wells and associated piping and equipment (e.g., treatment system) without prior review and written approval from the DON, DTSC, U.S. EPA, and RWQCB.

The DON shall address institutional control implementation and maintenance actions, including periodic inspections, in the Remedial Design Package to be developed and submitted to the FFSRA signatories for review pursuant to the FFSRA. The Remedial Design Package is the CERCLA equivalent to the RCRA Corrective Measures Implementation Plans and Specifications listed in Section 10.3 of the FFSRA. The Remedial Design Package shall include a LUC remedial design section to describe more specific LUC implementation and enforcement actions including:

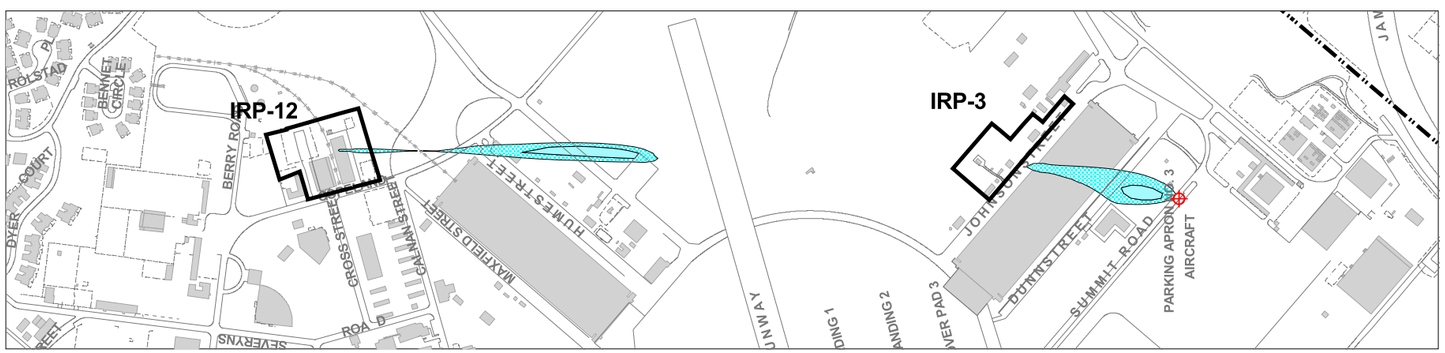
- requirements for a CERCLA 5-year remedy review;
- frequency and requirements for periodic monitoring or visual inspections;
- reporting results from monitoring and inspections;
- notification procedures to the regulatory agencies for planned property conveyance, corrective action required, and/or response to actions inconsistent with LUCs for the remedy;
- consultation with U.S. EPA, DTSC, RWQCB, and other government agencies regarding wording for land-use restrictions and parties to be provided copies of the language of the deed, once executed;
- identification of responsibilities for the DON, U.S. EPA, DTSC, RWQCB, other government agencies, and the new property owner for implementation, monitoring, reporting, and enforcement of LUCs;

ALTERNATIVE 7: HYDRAULIC CONTAINMENT WITH HOT SPOT REMOVAL

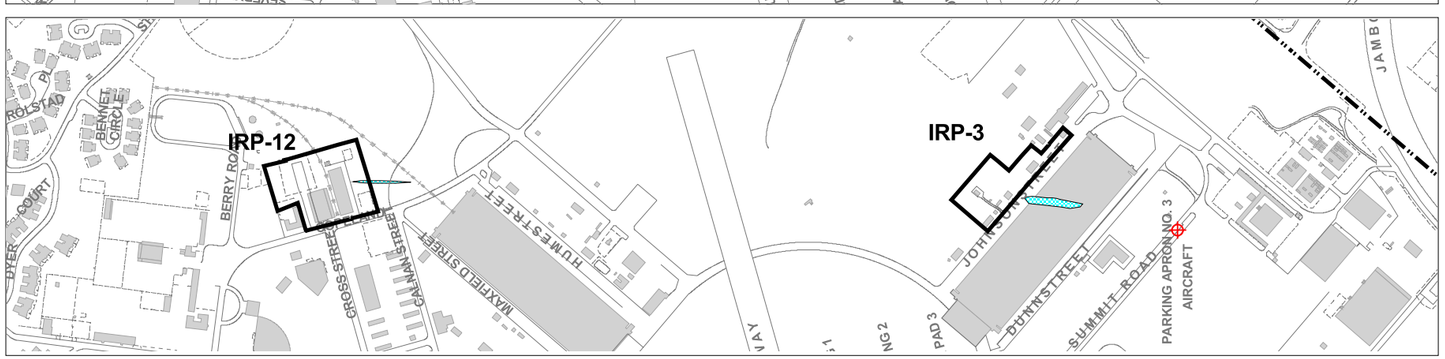
CURRENT CONDITIONS



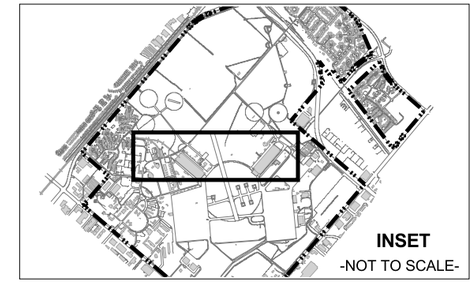
AFTER 10 YEARS



AFTER 20 YEARS



AFTER 30 YEARS



LEGEND

- HOT SPOT EXTRACTION WELL IN THE 1ST WBZ
- HYDRAULIC CONTAINMENT WELL IN THE 1ST WBZ
- FORMER MCAS TUSTIN BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- RAILROAD
- FENCE
- IRP SITE BOUNDARY

TCE CONCENTRATION IN GROUNDWATER:

- 5 to 10 µg/L
- 10 to 20 µg/L
- 20 to 50 µg/L
- 50 to 100 µg/L
- 100 to 200 µg/L
- 200 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- 2000 to 5000 µg/L
- > 5000 µg/L

N

750 0 750 Feet

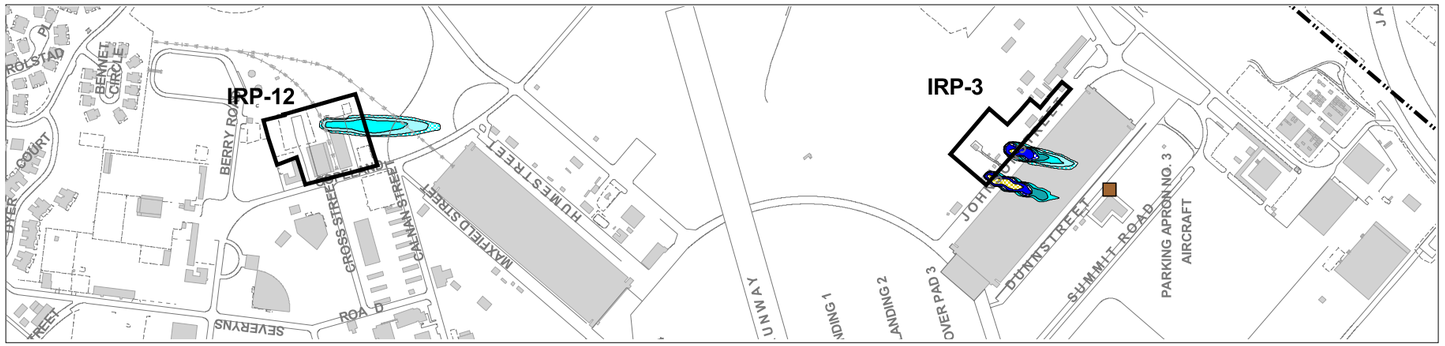
Record of Decision/Remedial Action Plan
Figure 10-5
Alternative 7: Hydraulic Containment With Hot Spot Source Removal, Simulated TCE Concentrations in the First WBZ at IRP-3 and IRP-12

Former MCAS Tustin, California

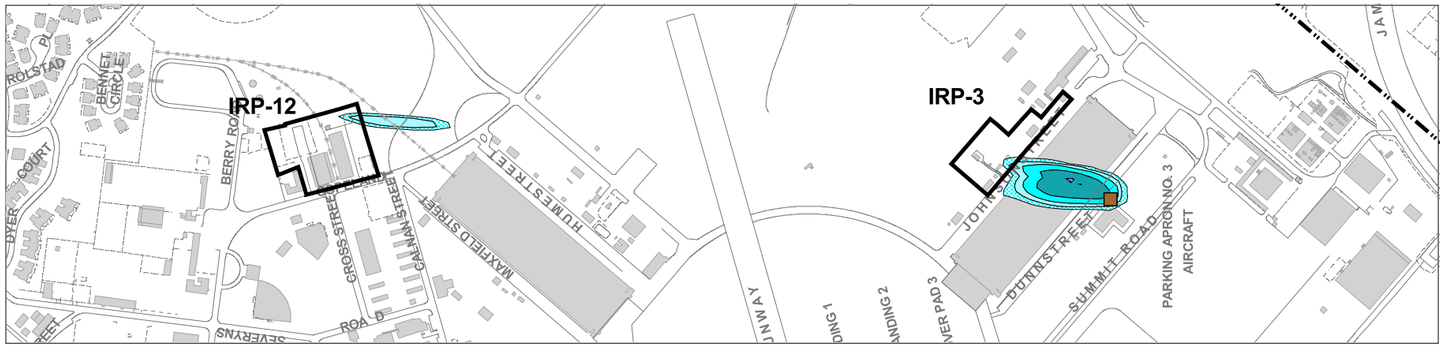
Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/25/04
File No.: 035A8873
Job No.: 23818-035
Rev No.: D

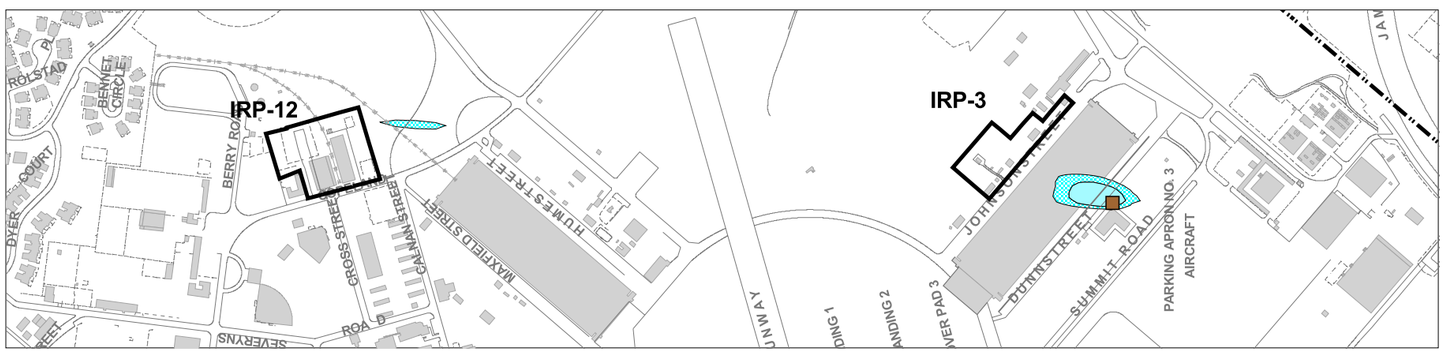
ALTERNATIVE 7: HYDRAULIC CONTAINMENT WITH HOT SPOT REMOVAL



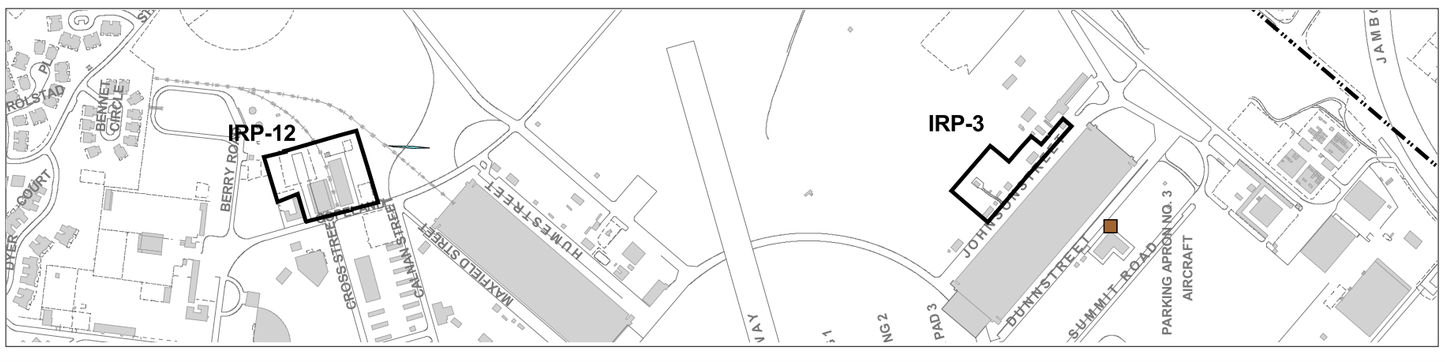
CURRENT CONDITIONS



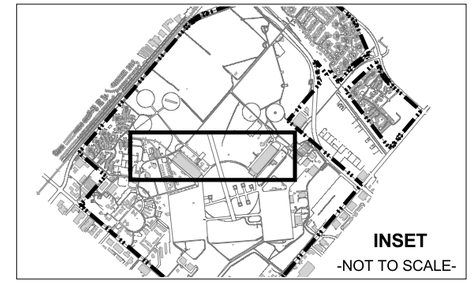
AFTER 10 YEARS



AFTER 20 YEARS



AFTER 30 YEARS



LEGEND

- EXTRACTION WELL IN THE 2ND WBZ
- FORMER MCAS TUSTIN BOUNDARY
- EXISTING ROAD OR PAVED AREA
- BUILDING OR STRUCTURE
- RAILROAD
- FENCE
- IRP SITE BOUNDARY

TCE CONCENTRATION IN GROUNDWATER:

- 5 to 10 µg/L
- 10 to 20 µg/L
- 20 to 50 µg/L
- 50 to 100 µg/L
- 100 to 200 µg/L
- 200 to 500 µg/L
- 500 to 1000 µg/L
- 1000 to 2000 µg/L
- 2000 to 5000 µg/L
- > 5000 µg/L

N

750 0 750 Feet

Record of Decision/Remedial Action Plan
Figure 10-6
Alternative 7: Hydraulic Containment With Hot Spot Source Removal, Simulated TCE Concentrations in the Second WBZ at IRP-3 and IRP-12

Former MCAS Tustin, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 1/25/04
File No.: 035A8874
Job No.: 23818-035
Rev No.: F

Table 10-2
Performance Monitoring for Hydraulic Containment With Hot Spot Removal

Type of Monitoring Data	Monitoring Locations	Purpose/Use of Data
Water levels	Monitoring wells throughout and around the VOC plumes	Prepare potentiometric surface maps and hydrographs. Determine horizontal and vertical hydraulic gradients. Confirm capture zones (containment of plumes).
VOC concentrations in the shallow aquifer	Monitoring wells throughout and around the VOC plumes	Delineate areal and vertical extent of contamination. Confirm containment of plumes.
VOC concentrations in extracted groundwater	Extraction wells and equalization tank effluent	Estimate cumulative mass of VOCs removed from aquifer. Characterize extracted groundwater from individual wells and combined treatment plant influent with respect to RCRA and non-RCRA hazardous waste criteria.
General water quality parameters as well as VOC, SVOC, and metal concentrations in treatment plant effluent	Effluent lines from GAC vessels	Assess performance of treatment system. Demonstrate compliance with discharge requirements.
Flow rates	Extraction wells and various points in treatment system	Confirm that extraction and treatment systems are operating to specifications.
Other operational parameters (e.g., waterline pressures)	Various locations	Use as needed to assess proper operation or incipient failure of pumps and filters.

Acronyms/Abbreviations:
GAC – granular activated carbon
RCRA – Resource Conservation and Recovery Act
SVOC – semivolatile organic compound
VOC – volatile organic compound

- providing a list of LUCs with the expected duration; and
- providing maps identifying where LUCs are to be implemented.

The DON shall be responsible for implementing, inspecting, reporting, and enforcing the LUC objectives described in this ROD/RAP in accordance with the approved Remedial Design Package. Although the DON may later transfer some of these responsibilities to another party by contract, property transfer agreement, or other means, the DON shall retain ultimate responsibility for remedy integrity. Should any of the LUC objectives fail, the DON shall ensure that appropriate actions are taken to reestablish the protectiveness of the remedy and may initiate legal action to either compel action by a third party(ies) and/or recover the DON's costs for mitigating any discovered LUC violation(s). The LUC shall be maintained until the concentrations of hazardous substances in groundwater have been reduced to levels that allow for unlimited exposure and unrestricted use.

The DON and DTSC shall enter into a Covenant to Restrict Use of Property as provided in the Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control and attached covenant models (10 March 2000) prior to transfer of property impacted by remaining groundwater contamination at OU-1B. The Covenant to Restrict Use of Property shall conform to the models attached to this Memorandum of Agreement and incorporate land-use restrictions identified in the final Remedial Design Report. The Covenant to Restrict Use of Property shall address the real property containing the OU-1B groundwater plumes and associated buffer zone. It shall be executed by DTSC and the Navy and shall be recorded in the county where the land is located. It shall run with the land and continue in perpetuity unless modified or terminated in accordance with applicable law.

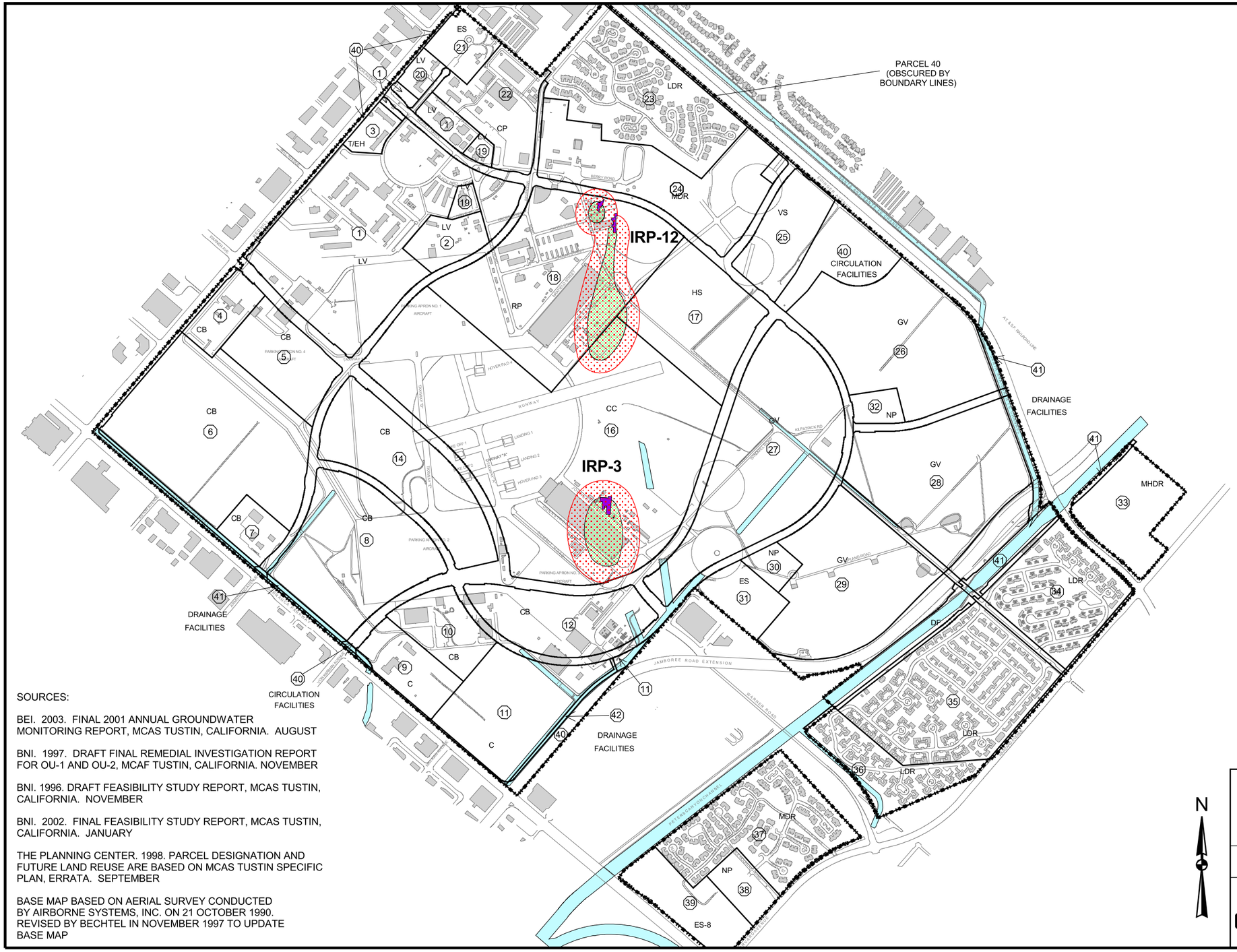
The area requiring institutional controls at OU-1B is shown on Figure 10-7.

10.5 PERIODIC REVIEWS

As required by CERCLA Section 121(c), the DON will document in a summary report at least every 5 years 1) whether the remedy is expected to remain protective, 2) any deficiencies identified during the review, and 3) recommended specific actions to correct any deficiencies (DON 2001). If necessary, the 5-year review report will include descriptions of follow-on actions needed to achieve, or to continue to assure, protectiveness along with a timetable for these actions.

10.6 OPERATION AND MAINTENANCE PLAN

An OMP will be developed during the remedial design phase. This plan will establish the exact number and location of monitoring wells. It will also outline sampling and analysis methods, periods and sampling frequency for each well, and major decision points to be made during monitoring (e.g., adding or removing wells, or changing sampling frequency or analytical parameters). The criteria for assessing the effectiveness of the remedial action and for shutoff will be developed during the remedial design phase and will be incorporated into the OMP.



LEGEND

- FORMER MCAS TUSTIN BOUNDARY
- ROAD OR PAVED AREA
- RAILROAD
- BUILDING OR STRUCTURE
- DRAINAGE DITCH
- FORMER MCAS TUSTIN REUSE PARCEL BOUNDARY
- EXTENT OF TCE GROUNDWATER CONTAMINATION
- LOCATION OF KNOWN OR POTENTIAL SOIL CONTAMINATION
- AREA OF INSTITUTIONAL CONTROLS (INCLUDING GROUNDWATER EXTRACTION)

NOTE:

TCE PLUMES ARE BASED ON WINTER 2001 GROUNDWATER DATA

SYMBOL	LAND USE
1	PARCEL NUMBER
40	CIRCULATION FACILITIES
41	DRAINAGE FACILITIES
C	COMMERCIAL
CB	COMMERCIAL BUSINESS
CC	COMMUNITY CORE
CP	COMMUNITY PARK
	EASEMENTS/ROADS
ES	ELEMENTARY SCHOOL (K-6)
ES-8	ELEMENTARY SCHOOL (K-8)
GV	GOLF VILLAGE
HS	HIGH SCHOOL
LDR	LOW DENSITY RESIDENTIAL
LV	LEARNING VILLAGE
MDR	MEDIUM DENSITY RESIDENTIAL
MHDR	MEDIUM HIGH DENSITY RESIDENTIAL
NP	NEIGHBORHOOD PARK
RP	URBAN REGIONAL PARK
T/EH	TRANSITIONAL/EMERGENCY HOUSING
VS	VILLAGE SERVICES

1200 0 1200 Feet

N

SOURCES:

BEI. 2003. FINAL 2001 ANNUAL GROUNDWATER MONITORING REPORT, MCAS TUSTIN, CALIFORNIA. AUGUST

BNI. 1997. DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU-1 AND OU-2, MCAF TUSTIN, CALIFORNIA. NOVEMBER

BNI. 1996. DRAFT FEASIBILITY STUDY REPORT, MCAS TUSTIN, CALIFORNIA. NOVEMBER

BNI. 2002. FINAL FEASIBILITY STUDY REPORT, MCAS TUSTIN, CALIFORNIA. JANUARY

THE PLANNING CENTER. 1998. PARCEL DESIGNATION AND FUTURE LAND REUSE ARE BASED ON MCAS TUSTIN SPECIFIC PLAN, ERRATA. SEPTEMBER

BASE MAP BASED ON AERIAL SURVEY CONDUCTED BY AIRBORNE SYSTEMS, INC. ON 21 OCTOBER 1990. REVISED BY BECHTEL IN NOVEMBER 1997 TO UPDATE BASE MAP

Record of Decision/Remedial Action Plan

Figure 10-7

Approximate Extent of Contaminated Soil and Groundwater Within Scope of OU-1B Feasibility Study

Former MCAS Tustin, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 3/26/04
File No.: 035L12372
Job No.: 23818-035
Rev No.: A

10.7 EXTRACTION WELL SHUTDOWN CRITERIA

RAOs for OU-1B include reducing concentrations of VOCs in groundwater to levels consistent with remediation goals, or until the plumes have stabilized, and preventing VOC migration beyond the current OU-1B plume boundaries. As a part of the selected remedy, the DON will operate hot spot groundwater extraction wells and hydraulic containment wells to meet these RAOs. The DON will evaluate groundwater monitoring and system performance data to 1) optimize the performance of the hot spot wells in reducing VOC contaminant mass in the central portion of the plumes and to determine when they may be shut down; and 2) optimize and verify the performance of the hydraulic containment wells in containing VOCs within their present boundaries and determine when they may be shut down (i.e., when the VOC plumes are stable or shrinking without active remediation). Groundwater monitoring and system performance data will be evaluated by the DON and reported to DTSC, RWQCB, and U.S. EPA.

10.7.1 Hot Spot Extraction Wells

For evaluation of hot spot extraction wells, if monitoring data indicate that these wells are no longer efficiently removing VOC mass (i.e., if an asymptotic condition is reached based on concentration versus time trend analysis) or if remediation goals have been achieved at the wells, they can be temporarily shut down and groundwater will be monitored for rebound in VOC concentrations. An “asymptotic condition” is defined as the point where the quantity of VOC mass removed over time has been reduced to a level at which continued reduction of VOCs is considered no longer technologically and/or economically feasible. After hot spot extraction wells are shut down, monitoring will continue for up to 2 years, and the data will be evaluated and reported to DTSC, RWQCB, and U.S. EPA. If monitoring data indicate a significant rebound in VOC concentrations in the hot spot portions of the plumes, the hot spot extraction wells will be restarted. Once asymptotic conditions for VOC mass removal are reached, the hot spot wells will be permanently shut down, subject to DTSC, RWQCB, and U.S. EPA concurrence.

10.7.2 Hydraulic Containment Wells

For evaluation of the hydraulic containment system, the DON can propose a temporary shutdown of the system if monitoring data indicate that either of the following conditions has been met:

1. VOC concentrations in groundwater within (throughout) the present OU-1B plume boundaries reach remediation goals (Table 8-2)
2. boundaries of the VOC plumes have stabilized (or are shrinking) and VOCs will not migrate beyond their present boundaries at concentrations exceeding remediation goals (this would require groundwater modeling)

Temporary shutdown will be subject to DTSC, RWQCB, and U.S. EPA concurrence. The groundwater monitoring program will continue for up to 2 years. If it is

demonstrated in this period that VOCs in groundwater meet the remediation goals (Table 8-2), the parties agree that system operation will be shut down permanently.

If, during temporary shutdown of the hydraulic containment system, data from monitoring wells within the boundaries of the plumes indicate that VOC concentrations are rebounding to levels exceeding the remediation goals, the containment system will be restarted. The DON can then attempt to demonstrate through groundwater modeling that remaining VOCs exceeding remediation goals would reach the current OU-1B plume boundaries at concentrations equal to or less than the remediation goals. Groundwater modeling will be subject to DTSC, RWQCB, and U.S. EPA concurrence. If the boundaries of the plume are demonstrated to be stable or shrinking without active remediation, the DON can then propose a permanent shutdown of the hydraulic containment system, subject to DTSC, RWQCB, and U.S. EPA concurrence. Groundwater monitoring at OU-1B would continue to confirm that VOCs are approaching remediation goals and that the remedy is still effective. If monitoring and/or modeling data indicate that the plumes would not remain within their present boundaries, the system will be restarted and operated as needed.

If the first or second condition stated above could not be achieved, the DON will demonstrate that VOCs in groundwater have been removed to the extent technically and economically feasible by analyzing:

- whether the total mass removal is approaching asymptotic levels after temporary shutdown periods and appropriate system optimization,
- the additional cost of continuing to operate the system at concentrations approaching asymptotic mass levels, and
- whether discontinuing the system will significantly prolong the time to achieve remediation goals for groundwater.

The signatories to this ROD/RAP will jointly make the decision that the hydraulic containment system may be shut off permanently. Groundwater monitoring will continue until all portions of the plume achieve remediation goals or until monitoring and modeling demonstrate the existing plumes are stable (or shrinking) and will not migrate beyond their present boundaries.

10.8 RATIONALE FOR REMEDY SELECTION

The selected alternative provides the best balance with respect to the NCP evaluation criteria. Based on the information available at this time, the selected alternative offers:

- a high level of performance when assessed against the following NCP evaluation criteria: short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume; implementability; compliance with ARARs; and overall protection of human health and the environment; and
- a cost-effective means of accomplishing the RAOs for the sites.

Table 10-3 summarizes the cost estimate for the selected alternative, including capital and O&M costs assumed to extend for 30 years. The assumed 30-year time frame does not necessarily reflect the duration of the O&M activities at the site; the discontinuation or extension of O&M activities will be determined based on the results of sampling designed to evaluate the effectiveness of remediation.

Another advantage of the selected remedy is its compatibility with current and future land use. The use of containment wells will inhibit migration of contaminated groundwater and minimize the area over which the institutional controls must be enforced. Impact on the existing infrastructure at IRP-3 and IRP-12 will also be minimized to the extent practicable provided that remedial action efforts are not compromised.

Some modifications to the selected remedy (e.g., locations and number of wells, pumping rates) may be necessary as a result of the remedial design and construction process. Detailed design specifications, performance evaluations, and schedule will be determined during the remedial design phase.

Table 10-3
Summary of Cost Estimate[a] for Alternative 7

Description	Capital Cost	O&M COSTS Annual	O&M COSTS 5th Year	Total Cost[b]
Engineering Studies				
Predesign study, remedial design, long-term monitoring plan (2,750 hours @ $80/hour)	$220,000			$220,000
Removal of Source Materials				
Soil excavation and off-site disposal[c]	$342,000			$342,000
IRP-3 (4,750 yd^3) and IRP-12 (1,550 yd^3), including backfill				
Groundwater extraction				
IRP-3 and IRP-12 (30 years)				
Installation of extraction wells				
IRP-3 (five wells), IRP-12 (four wells)	$108,000			$108,000
Five wells (10 years O&M)		$4,330		$43,000
Four wells (30 years O&M)		$4,833		$145,000
Piping				
IRP-3 (1,250 feet) and IRP-12 (2,050 feet)	$47,000			$47,000
Treatment system, IRP-3				
Equalization tank, prefilter, GAC units, pumps and control systems, water knock-out, two water vapor separator pumps	$62,000			$62,000
10 years of O&M		$8,100		$81,000
20 years of O&M		$7,238		$145,000
Monitoring Activities (30 Years)				
Installation of four monitoring wells	$22,000			$22,000
Building demolition	$45,000			$45,000
Electrical distribution	$59,000			$59,000
Performance monitoring				
Groundwater quality and water levels				$581,000
Treatment system influent/effluent				$226,000
Annual monitoring report[d]		$10,000		$230,000
5-year review			$26,000	$156,000
Subtotal	**$907,000**			**$2,512,000**

(table continues)

Table 10-3 (continued)

Description	Capital Cost	O&M COSTS Annual	O&M COSTS 5th Year	Total Cost
Indirect costs				$2,974,000
Contingency[e]				$1,098,000
Escalation				$2,896,000
Total Cost				**$9,480,000**
Net Present Value of Alternative 7 (2001 $s)				***$4,454,000***

Notes:

[a] see Appendix D of the FS (BEI 2003b) for cost estimate details; sums may not agree due to rounding

[b] total costs reflect hot spot groundwater extraction for 10 years and hydraulic containment for 30 years; monitoring activities (annual and 5-year) continue for assumed 30-year project duration

[c] costs for soil excavation and off-site disposal are comparable to costs for soil excavation and on-site thermal treatment and reuse; based on a reevaluation of the soil disposal component of the preferred remedy presented in the Proposed Plan, on-site thermal treatment was determined to be infeasible and was replaced by off-site disposal as discussed in Section 12 of this ROD/RAP

[d] cost not incurred every 5th year

[e] contingency and other indirect costs not incurred on studies, plans, and reports

Acronyms/Abbreviations:

GAC – granular activated carbon
IRP – Installation Restoration Program
O&M – operation and maintenance
yd^3 – cubic yard

This page left blank intentionally

Section 11
STATUTORY DETERMINATIONS

Under CERCLA, the DON's primary responsibility is to undertake remedial actions that achieve adequate protection of human health and the environment. Section 121 of CERCLA establishes several additional statutory requirements and preferences specifying that, when complete, the selected remedial action must comply with ARARs established under federal and state laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and use permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that, as their principal element, permanently and significantly reduce the volume, toxicity, or mobility of hazardous waste. The following sections discuss how the selected remedy meets these statutory requirements and preferences. Complete discussions are found in the OU-1B FS Report (BNI 2002).

11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

RAOs for OU-1B are concerned with limiting future contaminant migration and exposures to contaminated media and restoring the beneficial use of the groundwater. The selected remedy protects human health and the environment by preventing use of contaminated groundwater for domestic purposes until remediation is complete. Although groundwater is currently not used for potable purposes, contaminated groundwater is a potential future threat to human health if it is used for domestic purposes. Remediation of soil and groundwater will eliminate this threat over time; in the interim, hydraulic containment will limit VOC migration beyond the current OU-1B plume boundaries, and institutional controls will prevent inadvertent exposure to VOCs at concentrations above remediation goals by controlling new well drilling and prohibiting the domestic use of untreated groundwater. Land-use restrictions will also be used during remediation to prevent disturbance of extraction and monitoring wells and equipment for treatment of soil and groundwater.

There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

11.2 COMPLIANCE WITH ARARS

The selected remedy will comply with the substantive provisions of all ARARs. Section 121(e) of CERCLA, U.S.C. § 9621(e), states that no federal, state, or local permit is required for remedial actions conducted entirely on-site. Therefore, actions conducted entirely on-site must meet only the substantive, not the administrative, requirements of the ARARs. Any action conducted off-site is subject to the full requirements of federal, state, and local regulations. The chemical-, location-, and action-specific ARARs for the selected remedy for OU-1B are listed in Tables 11-1, 11-2, and 11-3, respectively, and discussed below.

Table 11-1
Chemical-Specific ARARs for Selected Remedy

Action/Requirement	Citation	ARAR[a] Determination	Comments
FEDERAL			
Safe Drinking Water Act, 42 U.S.C. § 300[b]			
National primary drinking water standards are health-based standards for public water systems (MCLs).	40 C.F.R. § 141.61(a)	Relevant and appropriate	The NCP defines MCLs as relevant and appropriate for groundwater determined to be a current or potential source of drinking water, in cases where MCLGs are not ARARs. MCLs are relevant and appropriate for Class II aquifers such as the Irvine Forebay Pressure subbasin. The Santa Ana RWQCB has designated the Irvine Forebay Pressure subbasin for municipal/domestic use (potential drinking water) in addition to other uses. These designations also apply to the shallow groundwater system at Former MCAS Tustin. Only the primary standards for organic chemicals (40 C.F.R. § 141.61[a]), specifically VOCs, are ARARs for this action. MCLs for inorganics specified in 40 C.F.R. § 141.11 and 40 C.F.R. § 141.62 are not identified as ARARs because these are not the result of activities that occurred at Former MCAS Tustin or at IRP-3 or IRP-12.
Resource Conservation and Recovery Act[b]			
Definition of RCRA-characteristic hazardous waste.	Cal. Code Regs. tit. 22, § 66261.100(a)(1), 66261.21, 66261.22(a)(1), 66261.23, and 66261.24(a)(1)	Applicable	VOC-affected soil and groundwater, which may be generated by excavation, during well construction or monitoring, or groundwater extraction at IRP-3 and IRP-12, are not RCRA-listed hazardous wastes and are unlikely to be RCRA-characteristic hazardous wastes. However, soil and groundwater will still be tested for hazardous waste characteristics at the point of generation. In addition, there is the potential for some of the spent carbon to exceed TCLP limits for TCE, making it a characteristic hazardous waste.

(table continues)

Table 11-1 (continued)

Action/Requirement	Citation	ARAR[a] Determination	Comments
Resource Conservation and Recovery Act[b] (continued)			
Groundwater protection standards: owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section designed to assure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for COCs set forth under § 66264.94 in the uppermost aquifer underlying the waste management area.	Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e)	Relevant and appropriate	This is not applicable because IRP-3 and IRP-12 are not TSD facilities. No RCRA-listed hazardous wastes were reported disposed at OU-1B or at IRP-3 or IRP-12, and groundwater contamination did not result from release of RCRA-regulated waste. However, it is relevant and appropriate because the waste soil and groundwater proposed to be generated are similar in composition to hazardous waste, and constituents in soil may have been released or have the potential to be released to groundwater.
Clean Water Act of 1977, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)			
Federal ambient water quality standards.	40 C.F.R. § 131.36 (NTR) and 40 C.F.R. § 131.38 (CTR)	Applicable	Federal water quality standards are applicable for the proposed discharge of treated groundwater to surface water.
STATE			
Department of Toxic Substances Control			
Definition of "non-RCRA hazardous waste."	Cal. Code Regs. tit. 22, § 66261.22 (a)(3) and (4), 66261.24(a)(2) to (a)(8), 66261.101(a)(1) and (a)(2), 66261.3(a)(2)(C), or 66261.3(a)(2)(F)	Applicable	Using the state definition for hazardous waste, groundwater extracted from OU-1B wells, soil removed during well construction, and spent carbon residuals are determined not to be listed non-RCRA hazardous waste but will be tested to determine whether they meet the criteria for characteristic non-RCRA hazardous waste. If the waste is found to be a characteristic non-RCRA hazardous waste, generator requirements are applicable.
State and Regional Water Quality Control Board			
Authorizes SWRCB and RWQCB to establish, in water quality control plans, beneficial uses and numerical and narrative standards to protect both surface and groundwater quality.	Cal. Water Code, div. 7, §§ 13241, 13243, 13263(a), 13269, and 13360 (Porter-Cologne Water Quality Act)	Applicable	The DON accepts the substantive provisions of §§ 13241, 13243, 13263(a), 13269, and 13360 of the Porter-Cologne Water Quality Act enabling legislation, as implemented through the beneficial uses, WQOs, waste discharge requirements, and promulgated policies of the Basin Plan for the Santa Ana Region as ARARs.

(table continues)

Table 11-1 (continued)

Action/Requirement	Citation	ARAR[a] Determination	Comments
State and Regional Water Quality Control Board (continued)			
Describes water basins in the Santa Ana region; establishes beneficial uses of ground and surface waters; establishes WQOs, including narrative and numerical standards; establishes implementation plans to meet WQOs and protect beneficial uses; and incorporates statewide water quality control plans and policies.	Comprehensive Water Quality Control Plan for the Santa Ana Basin 1995	Applicable	Substantive provisions of Chapters 2 through 4 are applicable. The beneficial uses for the Irvine Forebay Pressure subbasin designated in the WQCP are municipal/domestic use (potential drinking water), agricultural supply, industrial service supply, and industrial process supply. These uses also apply to the shallow groundwater system at Former MCAS Tustin. The WQOs and waste discharge requirements are applicable for groundwater cleanup and discharge to surface water.
Incorporated into all regional board basin plans. Designates all ground and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water-conveyance facility, or the water cannot reasonably be treated for domestic use by either best management practices or best economically achievable treatment practices.	SWRCB Res. No. 88-63 (Sources of Drinking Water Policy)	Applicable	Substantive provisions are ARARs. The WQCP currently identifies the Irvine Forebay Pressure subbasin and the overlying shallow groundwater at Former MCAS Tustin as a source of drinking water.
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be	Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Applicable	This is not an ARAR for determining groundwater cleanup standards, although it is applicable for discharges to surface water, including discharges of treated groundwater in remedial actions (see action-specific ARARs Section 11.2.3.2).

(table continues)

Table 11-1 (continued)

Action/Requirement	Citation	ARAR[a] Determination	Comments
State and Regional Water Quality Control Board (continued)			
maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.			
Substantive provisions of the ISWP provide the method for calculating effluent limitations and determining whether they are required.	Policy for implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Phase 1 of the ISWP and the Enclosed Bays and Estuaries Plan [2000])	Applicable	Substantive provisions are applicable for the proposed discharge to surface water. This policy implements the federal NTR and CTR criteria for TCE.

Notes:

[a] where MCLs were not available, chemical-specific concentrations used to establish remediation goals may be based upon the following:

- human-health risk-based concentrations (40 C.F.R. § 300.430[e][2][I][A][1] and [2])
- ecological risk-based concentrations (40 C.F.R. § 300.430 [e][2][I][G])
- practical quantitation limits of contaminants (40 C.F.R. § 300.430[e][2][I][A][3]);

many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

(table continues)

Table 11-1 (continued)

Notes: (continued)

[b] statutes and policies and their citations are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statute or policy as a potential ARAR; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:

ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
Cal. Water Code – California Water Code
C.F.R. – *Code of Federal Regulations*
ch. – chapter
COC – chemical of concern
CTR – California Toxics Rule
div. – division
DON – Department of the Navy
gpd – gallons per day
IRP – Installation Restoration Program
ISWP – Inland Surface Waters Plan
MCAS – Marine Corps Air Station
MCL – maximum contaminant level
MCLG – maximum contaminant level goal
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
NPDES – National Pollution Discharge Elimination System
NTR – National Toxics Rule
OU – operable unit
ppm – parts per million
RCRA – Resource Conservation and Recovery Act
Res. – resolution
RWQCB – (California) Regional Water Quality Control Board
§ – section
SWRCB – (California) State Water Resources Control Board
TCE – trichloroethene
TCLP – toxicity characteristic leaching procedure
TDS – total dissolved solids
tit. – title
TSD – treatment, storage, and disposal
U.S.C. – *United States Code*
VOC – volatile organic compound
WQCP – water quality control plan
WQO – water quality objective

Table 11-2
Location-Specific ARARs for Selected Remedy

Location/Requirement	Citation	ARAR Determination	Comments
FEDERAL			
Archaeological and Historical Preservation Act*			
Construction within area where action may cause irreparable harm, loss, or destruction of significant artifacts requires data recovery and preservation.	Substantive requirements of 36 C.F.R. § 65, 40 C.F.R. § 6.301(c), 16 U.S.C. § 469–469c-1	Relevant and appropriate	Extensive surveys at Former MCAS Tustin indicate that the OU-1B plumes do not underlie any culturally sensitive areas. SHPO and USACE have recommended no further assessment work for prehistoric or archaeological resources. Fossils have been identified at Former MCAS Tustin, but no impacts are expected from OU-1B remedial actions because construction grading is not planned as part of the remedial action. If fossils are identified during limited trenching, a PRMP could be implemented.
Archaeological Resources Protection Act of 1979, as Amended*			
Prohibits unauthorized excavation, removal, damage, alternation, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Pub. L. No. 96-95 16 U.S.C. § 470aa–470mm	Applicable	Substantive provisions are considered applicable. Permits themselves are considered administrative in nature and are not required for on-site CERCLA actions. See comment under Archaeological and Historical Preservation Act.

Note:
* statutes and policies and their citations are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statute or policy as a potential ARAR; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R. – *Code of Federal Regulations*
DON – Department of the Navy
MCAS – Marine Corps Air Station
OU – operable unit
PRMP – Paleontological Resources Management Plan
Pub. L. No. – Public Law number
§ – section
SHPO – State Historic Preservation Office
USACE – United States Army Corps of Engineers
U.S.C. – *United States Code*

Table 11-3
Action-Specific ARARs for Selected Remedy

Action/Requirement	Citation	ARAR Determination	Comments
FEDERAL			
Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq.*			
Person who generates waste shall determine whether it is a hazardous waste.	Cal. Code Regs. tit. 22, §§ 66262.10(a), 66262.11, and 66264.13(a) and (b)	Applicable	Applicable for any operation generating waste, including extracted groundwater, soil cuttings from well installation, trench spoils, excavated soils, and treatment residuals such as spent GAC. The determination of whether materials are RCRA hazardous will be made when the wastes are generated.
On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads, or inside buildings, and is labeled and dated, etc.	Cal. Code Regs. tit. 22, § 66262.34	Applicable	Applicable for any operation where hazardous waste is generated and transported. The determination of whether waste is hazardous will be made at the time of generation.
Requires that owners/ operators of a RCRA surface impoundment, waste pile, land-treatment unit, or landfill conduct a monitoring and response program for each regulated unit.	Cal. Code Regs. tit. 22, § 66264.91 (a) and (c), except as it cross-references permit requirements	Relevant and appropriate	Relevant and appropriate for IRP-3 and IRP-12. Not applicable because these sites are not regulated units. Table 8-1 identifies chemicals of concern at OU-1B.
Requires that a groundwater monitoring system be established and provides requirements the system must meet.	Cal. Code Regs. tit. 22, § 66264.97 (b) and (e)(1)–(5)	Relevant and appropriate	Relevant and appropriate for IRP-3 and IRP-12. Not applicable because these sites are not regulated units. A groundwater monitoring plan will be developed during the remedial design phase.
Requires that the owner or operator of a regulated unit develop a detection monitoring program that will provide reliable indication of a release.	Cal. Code Regs. tit. 22, § 66264.98	Relevant and appropriate	Relevant and appropriate for IRP-3 and IRP-12. Not applicable because these sites are not regulated units. A groundwater monitoring plan will be developed during the remedial design phase.
Provides requirements for a corrective action program for a regulated unit.	Cal. Code Regs. tit. 22, § 66264.100 (a) and (b)	Relevant and appropriate	Relevant and appropriate for IRP-3 and IRP-12. Not applicable because these sites are not regulated units. A groundwater monitoring plan will be developed during the remedial design phase.

(table continues)

Table 11-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq.* (continued)			
In order to prevent release of hazardous waste or hazardous constituents to the environment, tank systems, including piping at ancillary equipment, shall have secondary containment (e.g., double-walled piping), meeting the requirements of Cal. Code Regs. tit. 22, § 66264.193 (b) and (c).	Cal. Code Regs. tit. 22, § 66264.193 (a), (b), (c), and (f)	Applicable	Applicable in the event that groundwater from extraction-well locations near the center of the OU-1B plumes exceeds the TCLP limits for TCE. The DON would comply with these requirements by using double-walled conveyance piping to transport untreated groundwater exceeding TCLP limits from the wellhead to the entrance point of the treatment system.
STATE			
Clean Air Act*			
Standard for approving permits. Equipment, the use of which may cause the issuance of air contaminants or the use of which may eliminate, reduce, or control the issuance of air contaminants, is so designed, controlled, or equipped with such air pollution control equipment that it may be expected to operate without emitting air contaminants.	SCAQMD Rule 212 (approved into SIP 04 February 1996)	Relevant and appropriate	CERCLA actions are exempt from local permit requirements. Substantive provisions are relevant and appropriate for the groundwater-treatment alternatives using vacuum-enhanced groundwater extraction.
Dust or fumes, including lead or lead compounds, may not be discharged to the atmosphere in amounts that exceed standards during any 1-hour period.	SCAQMD Rules 403 (approved into SIP 17 February 2000) and 405 (approved 02 September 1998)	Applicable	Fugitive dust emissions are expected from excavation and waste soil handling. Measures will be taken to control dust emissions.
Particulate matter from any source may not be discharged to the atmosphere in excess of 0.1 grain per cubic foot (0.230 milligrams per cubic meter) of particulate matter in gas calculated as dry gas at standard conditions.	SCAQMD Rule 404 (approved into SIP 02 September 1998)	Applicable	Fugitive dust emissions are expected from excavation and waste soil handling. Measures will be taken to control dust emissions.

(table continues)

Table 11-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
California Civil Code			
Provides conditions under which land-use restrictions will apply to successive owners of land.	Cal. Civ. Code § 1471	Relevant and appropriate	Generally, Cal. Civ. Code § 1471 allows an owner of land to make a covenant to restrict the use of land for the benefit of a covenantee. The covenant runs with the land to bind successive owners, and the restrictions must be reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in section 25260 of the California Health and Safety Code. Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land . . . where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed and Covenant to Restrict Use of Property at the time of transfer.
California Health and Safety Code			
Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Cal. Health & Safety Code § 25202.5	Relevant and appropriate	The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . "
Provides a streamlined process to be used to enter into an agreement to restrict specific use of property.	Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C)	Relevant and appropriate	Generally, Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provides the authority for the Department of Toxic Substances Control to enter into voluntary agreements with land owners to restrict the use of property. The agreements

(table continues)

Table 11-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
California Health and Safety Code (continued)			
			run with the land restricting present and future uses of the land. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property…" and (2) "…the agreement is irrevocable, and shall be recorded by the owner, …as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health and Safety Code 25355.5(a)(1)(C) provisions are "relevant and appropriate": "…execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land."
Provides processes and criteria for obtaining written variances from a land-use restriction and for removal of the land-use restrictions.	Cal. Health & Safety Code §§ 25233(c) and 25234	Relevant and appropriate	Cal. Health & Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "…the waste no longer creates a significant existing or potential hazard to present or future public health or safety."
Requirements for land-use covenants	Cal. Code Regs. tit. 22, § 67391.1	Relevant and appropriate	Cal. Code Regs. tit. 22 § 67391.1 provides for a land-use covenant to be executed and recorded when remedial actions are taken and hazardous substances will remain at the property at concentrations that are unsuitable for unrestricted use of the land. The

(table continues)

Table 11-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
California Health and Safety Code (continued)			
			substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON.
South Coast Air Quality Management District			
No person shall discharge into the atmosphere from any single source of emissions any air contaminant for more than 3 minutes in any 60-minute period that is as dark as or darker than number 1 on the Ringelmann chart.	SCAQMD Rule 401(b)(1)(A)	Applicable	Fugitive dust emissions are expected from excavation and waste soil handling. Dust-suppression measures will be taken to control dust emissions.
State and Regional Water Quality Control Board			
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to	Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Applicable	The DON acknowledges that SWRCB Res. 68-16 is an action-specific state ARAR for discharge of treated groundwater by storm drain to surface water of Peters Canyon Channel at Former MCAS Tustin. The selected alternative will comply with SWRCB Res. 68-16 by meeting the substantive provisions of NPDES Permit No. CAG918001. Compliance with the substantive provisions of this permit will assure that discharge of treated groundwater will not change or increase the concentrations of chemicals already allowed to be discharged to city of Tustin storm drains. Therefore, the selected alternative will not degrade the existing quality of the receiving downstream surface water bodies and will comply with the antidegradation provisions of SWRCB Res. 68-16.

(table continues)

Table 11-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
State and Regional Water Quality Control Board (continued)			
discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.			

Note:
* statutes and policies and their citations are provided as headings to identify general categories of potential ARARs; specific potential ARARs are addressed in the table below each general heading

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Civ. Code – *California Civil Code*
Cal. Code Regs. – *California Code of Regulations*
Cal. Health & Safety Code – *California Health and Safety Code*
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
DON – Department of the Navy
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
GAC – granular activated carbon
IRP – Installation Restoration Program
MCAS – Marine Corps Air Station
NPDES – National Pollutant Discharge Elimination System
OU – operable unit
RCRA – Resource Conservation and Recovery Act
Res. – resolution
§ – section
SCAQMD – South Coast Air Quality Management District
SIP – site implementation plan
SWRCB – State Water Resources Control Board
TCE – trichloroethene
TCLP – toxicity characteristic leaching procedure
tit. – title
U.S.C. – *United States Code*

11.2.1 Chemical-Specific ARARs

Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. If a chemical has more than one remediation goal, the most stringent level has been identified as an ARAR for this remedial action. The selected remedial action can be implemented to comply with chemical-specific ARARs.

Chemical-specific ARARs have been identified for groundwater, soil, and surface water. Groundwater is a medium of concern at IRP-3 and IRP-12; although shallow groundwater is not a potential source of drinking water, it contributes to the underlying aquifer, which is designated for beneficial use. Soil is not a direct threat to human health or the environment, but some soil hot spots have contaminant levels that could threaten groundwater. Surface water is not a medium of concern. However, chemical-specific ARARs have been identified for this medium because the selected remedy includes on-site discharge of treated groundwater that ultimately enters Peters Canyon Channel.

The substantive provisions of the following requirements were identified as the most stringent of the potential federal and state groundwater ARARs for remedial actions at IRP-3 and IRP-12:

- water quality control plan (WQCP) for the Santa Ana Region, 1995 (specifying WQOs, beneficial use, waste discharge limitations)
- federal MCLs listed in the Safe Drinking Water Act (SDWA)
- RCRA groundwater protection standards in Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e)

The most stringent of these are the RCRA groundwater protection standards and Cal. Code Regs. tit. 22, § 66264.94 requirements to restore affected groundwater to background conditions, if possible, or else attain the best water quality that is technically and economically feasible. These requirements also address the soil threat to groundwater at § 66264.94(d)(1).

The DON has determined that the substantive provisions of Cal. Code Regs. tit. 22, § 66264.94(a)(1), (a)(3), (c), (d), and (e) constitute relevant and appropriate federal ARARs for groundwater. These provisions are considered a federal ARAR because this requirement was approved by U.S. EPA in its 23 July 1992 authorization of the state of California's RCRA program and is federally enforceable. The state of California disagrees with the DON; this regulation is a part of the state's authorized hazardous waste control program, so the state contends that the regulation is a state ARAR and not a federal ARAR. See 55 Fed. Reg. 8765 (08 March 1990), and *United States v. State of Colorado*, 990 F.2d 1565 (1993).

In addition to ARARs for groundwater, the substantive provisions of the following requirements were identified as the most stringent chemical-specific ARARs for discharge of treated groundwater to Peters Canyon Channel:

- WQCP for the Santa Ana Region, 1995 (specifying WQOs, beneficial use, waste discharge limitations)
- Federal Water Quality Standards at 40 C.F.R. §§ 131.36 and 131.38 (referred to as the "National Toxics Rule" [NTR] and the "California Toxics Rule" [CTR], respectively)
- Inland Surface Waters Plan (ISWP)

Discussions of chemical-specific ARARs for groundwater and surface water follow.

11.2.1.1 GROUNDWATER CLASSIFICATION

Under the SDWA and RCRA, a significant issue in identifying ARARs for groundwater is whether the groundwater can be classified as a source of drinking water. The U.S. EPA groundwater policy set forth in the NCP preamble uses the protocols in the U.S. EPA Guidelines for Groundwater Classification under the U.S. EPA Groundwater Protection Strategy (NCP, 55 Fed. Reg. 8752–8756). Under this policy, groundwater is classified in one of three categories (Class I, II, or III) based on ecological importance, its ability to be replaced, and vulnerability. Class I is irreplaceable groundwater currently used by a substantial population or groundwater that supports a vital habitat. Class II consists of groundwater currently used or that might be used as a source of drinking water in the future. Class III is groundwater that cannot be used for drinking water because of its unacceptable quality (e.g., high salinity or widespread naturally occurring contamination) or insufficient quantity. The U.S. EPA guidelines define Class III as groundwater with TDS concentrations over 10,000 mg/L. The aquifer underlying Former MCAS Tustin is classified as a Class II aquifer and is designated by RWQCB as a potential source of drinking water, along with other beneficial uses such as agricultural and industrial.

11.2.1.2 SAFE DRINKING WATER ACT

MCLs under the SDWA are potential relevant and appropriate requirements for aquifers with Class I and II characteristics and, therefore, are potential federal ARARs. The point of compliance for MCLs under the SDWA is at the tap. For CERCLA remedies, however, U.S. EPA indicates that MCLs should be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when the waste is left in place (55 Fed. Reg. 8753). In accordance with the RAOs, it is the DON's intent to restore potential beneficial uses of the shallow aquifer underlying Former MCAS Tustin with regard to VOCs. The DON does not intend to establish a point of compliance for this remedial action.

The primary federal MCL for TCE that is an ARAR for the remedial action at OU-1B is set forth in 40 C.F.R. § 141.61(a) (Maximum Contaminant Levels for Organic Chemicals). MCLs for inorganics are not ARARs for OU-1B because there is no

evidence that exceedances for these chemicals are caused by site-related activities. The primary state MCL for TCE set forth in Cal. Code Regs. tit. 22, § 64444 is not an ARAR for OU-1B because it is the same as, not more stringent than, the federal MCL.

11.2.1.3 RCRA GROUNDWATER PROTECTION STANDARDS

Cal. Code Regs. tit. 22, § 66264.94 states that concentration limits for RCRA groundwater protection standards are set for RCRA-regulated units. These regulations provide that compounds must not exceed their background levels in groundwater or some higher concentration limit set as part of the corrective action program. A limit greater than background may be approved if the owner can demonstrate that it is not technologically or economically feasible to achieve the background value and that the constituent at levels below the concentration limit will not pose a hazard to human health or the environment. A concentration limit greater than background must never exceed other applicable statutes or standards such as MCLs established under the federal SDWA (Cal. Code Regs. tit. 22, § 66264.94[e]).

RCRA groundwater protection standards are applicable only for regulated units managing hazardous wastes. These standards are not applicable to IRP-3 and IRP-12 because these sites do not contain a RCRA waste management unit and the VOC-affected groundwater and soil to be addressed by this remedial action are not RCRA-listed hazardous wastes. However, these standards are considered relevant and appropriate because they address circumstances and contaminants similar to those encountered in the plumes at and downgradient of IRP-3 and IRP-12. Accordingly, the DON has determined that the RCRA groundwater protection standards are ARARs for this remedial action.

A discussion of the technical and economic infeasibility of remediating groundwater to background is presented in the OU-1B FS Report. This document was reviewed and accepted by U.S. EPA, DTSC, and RWQCB. Therefore, as provided for in Cal. Code Regs. tit. 22, § 66264.94, a concentration limit for TCE based on MCLs and MCLGs is considered a remediation goal for IRP-3 and IRP-12.

11.2.1.4 WATER QUALITY CONTROL PLAN (SURFACE WATER)

The DON accepts as state ARARs for surface water the substantive provisions in Chapters 2 through 4 of the WQCP for the Santa Ana River Basin (RWQCB 1995), including beneficial uses, WQOs, and waste discharge requirements. The beneficial uses for Peters Canyon Channel include intermittent recreation, warm freshwater habitat, and wildlife habitat. There are no numerical WQOs specific to this surface water body.

11.2.1.5 NATIONAL TOXICS RULE AND CALIFORNIA TOXICS RULE

On 22 December 1992, U.S. EPA promulgated federal water quality standards under the authority of the federal Clean Water Act (CWA) Section 303(c)(4)(B), 33 U.S.C., Chapter (ch.) 26, § 1313, in order to establish water-quality standards required by the CWA where the state of California and other states had failed to do so (57 Fed. Reg. 60848 [1992]). These standards have been amended over the years in the Fed. Reg. including the amendments of the NTR (60 Fed. Reg. 22228 [1995]). The water quality

standards, as amended, are codified at 40 C.F.R. § 131.36. The water quality standards contained in 40 C.F.R. § 131.36(a) are applicable federal ARARs for discharge to surface water at Former MCAS Tustin.

On 18 May 2000, U.S. EPA promulgated a rule to fill a gap in California's water quality standards that was created in 1994 when a state court overturned the state's WQCPs that contained water quality criteria for priority toxic pollutants. The rule, commonly called the CTR, is codified at 40 C.F.R. § 131.38 and is applicable in the state of California for inland surface waters and enclosed bays and estuaries for all purposes and programs under the CWA. They are also applicable requirements for groundwater that discharges to surface water. The DON will use NPDES Permit No. CAG918001, as discussed in Section 11.2.1.7, to comply with NTR and CTR requirements.

11.2.1.6 INLAND SURFACE WATERS PLAN

The 2000 California State Water Resources Control Board (SWRCB) Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California has substantive provisions that have guidance for implementing the federal CTR requirements. The substantive requirements for determining whether an effluent limitation is required and the methodology for calculating the effluent limitation found in Sections 1.3 and 1.4 of the ISWP are applicable state ARARs for the proposed discharge of treated groundwater to Peters Canyon Channel. The DON will use NPDES Permit No. CAG918001, as discussed in the following Section 11.2.1.7, to comply with the substantive requirements of the ISWP.

11.2.1.7 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

RWQCB has indicated that it intends to issue an NPDES permit if the selected OU-1B remedial action includes surface water discharge.

The DON has determined that Section 121(e)(1) of CERCLA and the corresponding provision in the NCP (40 C.F.R. § 300.400[e][1]) apply to the discharge of treated groundwater resulting from the remediation of OU-1B and that an NPDES permit is, therefore, not required for that discharge. The DON intends to construct and operate the groundwater treatment system entirely on-site. The treated groundwater will be discharged to a nearby storm drain, which will transport the treated water and ultimately discharge it into waters of the United States at an off-site location. The U.S. EPA has consistently maintained that the off-site migration of extracted water that has been treated under the response action so that it complies with ARARs is consistent with the on-site permit exclusion in Section 121(e) of CERCLA and, therefore, does not constitute an off-site response action that requires an NPDES permit. (See *In the Matter of the Former Weldon Ordnance Works*, Weldon Springs, Missouri, Federal Facility Docket No. VII-90-F-0033, 01 November 1995.) The DON agrees with this interpretation of CERCLA and the NCP.

Legal counsel from the DON and RWQCB have communicated regarding RWQCB's requirements for regulation of discharges to surface waters under the NPDES and have "agreed to disagree" on this matter. The DON and RWQCB positions are documented

in correspondence dated 27 December 2000 (DON 2000) and 26 January 2001 (RWQCB 2001). Although the subject of this correspondence is a site at MCAS El Toro, the respective positions of both parties are the same for Former MCAS Tustin OU-1B.

On 01 October 1996, RWQCB Santa Ana Region originally adopted NPDES Permit No. CAG918001, General Groundwater Cleanup Permit, and most recently (2002) renewed the permit under Order No. R8-2002-0007. This permit applies to discharges of extracted and treated groundwater resulting from the cleanup of groundwater contaminated with petroleum hydrocarbons, solvents, and/or petroleum hydrocarbons mixed with lead and/or solvents. The DON will use the general permit to determine the substantive requirements and comply with federal and state ARARs identified for the discharge of groundwater proposed at OU-1B. The procedural and administrative provisions for obtaining permit coverage and fees are not ARARs.

If the RWQCB issues a site-specific NPDES permit for the surface discharge associated with the selected OU-1B, it would not be an ARAR for this action because it would not be considered of general applicability. However, by complying with the substantive provisions of the general permit, the DON will most likely comply with the permit that RWQCB issues for the site. Consistent with this agree-to-disagree compromise, the DON continues to maintain that any surface water discharge related to OU-1B remedial action is exempt from such permit requirements, but the DON agrees to use the substantive requirements of NPDES Permit No. CAG918001, General Groundwater Cleanup Permit, to assure compliance with the substantive provisions of the CWA, CTR, WQCP, and other federal and state ARARs identified for the discharge of treated groundwater to surface water.

11.2.1.8 STATE WATER RESOURCES CONTROL BOARD RESOLUTIONS 92-49 AND 68-16

The DON's Position Regarding SWRCB Resolutions 92-49 and 68-16

The DON and the state of California have not agreed whether SWRCB Resolution (Res.) 92-49 and Res. 68-16 are ARARs for the remedial action at IRP-3 and IRP-12. Therefore, this ROD/RAP documents each party's position but does not attempt to resolve the issue.

The DON recognizes that the key substantive requirements of Cal. Code Regs. tit. 22, § 66264.94 (and the identical requirements of Cal. Code Regs. tit. 23, § 2550.4 and Section III.G of SWRCB Res. 92-49) require cleanup to background levels unless such restoration proves to be technologically or economically infeasible and an alternative remediation goal will not pose a substantial present or potential hazard to human health or the environment. In addition, the DON recognizes that these provisions are more stringent than the corresponding provisions of 40 C.F.R. § 264.94, and although they are federally enforceable under RCRA, they are also independently based on state law to the extent that they are more stringent than the federal regulations.

The DON has also determined that SWRCB Res. 68-16 is not a chemical-specific ARAR for determining remedial action goals, but is an action-specific ARAR for regulating

discharged treated groundwater. The DON has determined that further migration of already contaminated groundwater is not a discharge governed by the language in Res. 68-16. More specifically, the language of SWRCB Res. 68-16 indicates that it is prospective in intent, applying to new discharges in order to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

The DON's position is that SWRCB Res. 68-16 and Res. 92-49 and Cal. Code Regs. tit. 23, § 2550.4 do not constitute chemical-specific ARARs for groundwater for this remedial action because they are state requirements and are not more stringent than the federal ARAR provisions of Cal. Code Regs. tit. 22, § 66264.94. The NCP set forth in 40 C.F.R. § 300.400(g) provides that only state standards more stringent than federal standards may be ARARs (see also CERCLA Section 121[d][2][A][ii] [42 U.S.C. § 9621(d)(2)(A)(ii)]).

The substantive technical standard in the equivalent state requirements (i.e., Cal. Code Regs. tit. 23, Division [div.] 3, ch. 15 and SWRCB Res. 92-49 and Res. 68-16) is identical to the substantive technical standard in Cal. Code Regs. tit. 22, § 66264.94. This section of Cal. Code Regs. tit. 22 will likely be applied in a manner consistent with equivalent provisions of other regulations, including SWRCB Res. 92-49 and Res. 68-16.

The DON acknowledges that SWRCB Res. 68-16 is a state ARAR for discharge of treated groundwater by storm drain to surface water of Peters Canyon Channel at Former MCAS Tustin. SWRCB Res. 68-16 is discussed in this context in Section 11.2.3.2. The selected alternative will comply with SWRCB Res. 68-16 by meeting the substantive provisions of NPDES Permit No. CAG918001. Compliance with the substantive portions of the permit would assure that discharge of treated groundwater would not change or increase the concentrations of chemicals already allowed to be discharged to city of Tustin storm drains. Therefore, the selected alternative would not degrade the existing quality of the receiving downstream surface water bodies, and it will comply with the antidegradation provisions of SWRCB Res. 68-16.

State of California's Position Regarding SWRCB Resolutions 68-16 and 92-49

The state does not agree with the DON determination that SWRCB Res. 92-49 and Res. 68-16 and certain provisions of Cal. Code Regs. tit. 23, div. 3, ch. 15 are not ARARs for groundwater for this response action. SWRCB has interpreted the term "discharges" in the *California Water Code* to include the movement of waste from soils to groundwater and from contaminated to uncontaminated water (SWRCB 1994). However, the state agrees that the proposed action would comply with SWRCB Res. 92-49 and Res. 68-16, and compliance with Cal. Code Regs. tit. 22 provisions should result in compliance with Cal. Code Regs. tit. 23 provisions. The state does not intend to dispute the ROD/RAP but reserves its rights if implementation of the Cal. Code Regs. tit. 22 provisions is not as stringent as state implementation of Cal. Code Regs. tit. 23 provisions. Because the Cal. Code Regs. tit. 22 regulation is part of the state's authorized hazardous waste control program, it is also the state's position that Cal. Code Regs.

tit. 22, § 66264.94 is a state ARAR and not a federal ARAR (*United States v. State of Colorado*, 990 F.2d 1565 [1993]).

Conclusion

Whereas the DON and the state of California have not agreed on whether SWRCB Res. 92-49 and Res. 68-16 and Cal. Code Regs. tit. 23, § 2550.4 are ARARs for this response action, this ROD/RAP documents each party's position on the resolutions but does not attempt to resolve the issue.

11.2.1.9 REMEDIATION GOALS

Remediation goals for groundwater are set at health-based levels, reflecting current and potential use and exposure. COCs in groundwater at OU-1B are VOCs, several of which exceed federal or state MCLs. The remediation goals for these chemicals are based on federal and state MCLs and MCLGs. Table 8-2 shows the remediation goals for COCs in groundwater. The DON believes that the remediation goals for COCs in groundwater satisfy the intent of the NCP preamble and that U.S. EPA National Ambient Water Quality Criteria need not be considered ARARs for this groundwater remedial action.

The shallow groundwater at Former MCAS Tustin contains elevated TDS, nitrate, sulfate, and selenium, all of which result from sources unrelated to USMC operations. Cleanup of this groundwater to below background conditions is not required by SWRCB under the Porter-Cologne Act. Therefore, the success of Alternative 7 would not be measured by reductions in TDS or other inorganic constituents that are not site-related contaminants.

11.2.2 Location-Specific ARARs

Location-specific ARARs are restrictions on the concentrations of hazardous substances or on activities solely because they are in specific locations such as floodplains, wetlands, historic places, and sensitive ecosystems or habitats. The selected remedial action will be implemented to comply with location-specific ARARs.

The substantive provisions of the following requirements were identified as the most stringent of the potential federal and state location-specific ARARs for the remedial actions at IRP-3 and IRP-12:

- 40 C.F.R § 6.302(c) (Executive Order Number 11990, Protection of Wetlands)
- 40 C.F.R. § 6.301(a) (Historic Sites, Buildings, and Antiquities Act of 1935 [16 U.S.C. §§ 461–167])
- 40 C.F.R § 6.301(b) (National Historic Preservation Act [NHPA] of 1966, as Amended [16 U.S.C. § 470–470x-6])
- 40 C.F.R. § 6.301(c) (Archaeological and Historic Preservation Act [16 U.S.C. § 469–469c-1])

Jurisdictional wetlands exist in the vicinity of IRP-3, specifically 0.28 acre in the drainage ditch identified as IRP-5 North (USACE 1996). Other drainage ditches, not

classified as wetlands, are present near IRP-12. Title 40 C.F.R. § 6.302(c) requires that actions within a wetlands be implemented to minimize the destruction, loss, or degradation of wetlands. The DON will take appropriate action during the remedial design and remedial action phase to minimize impact on wetlands and will consider the location of the wetlands in siting the containment, extraction, and monitoring wells and their associated piping and equipment.

Information on historical and cultural resources that could be impacted by the OU-1B remedial action was derived from a historical resources survey for Former MCAS Tustin conducted by Thirtieth Street Architects, Inc. (1993) as well as a literature and records search conducted by John Minch and Associates (1993a,b,c). Both of these studies were further evaluated in the Former MCAS Tustin Environmental Setting Report (Cotton/Beland Associates, Inc. 1994).

NHPA requires that potential impacts to federally funded properties included in or eligible for the National Register be identified and mitigated. The two timber-framed blimp hangars at Former MCAS Tustin (Buildings 28 and 29) were nominated and entered into the National Register because they are associated with World War II and are among the largest wood-supported structures in the world.

In December 1999, the DON, State Historic Preservation Office (SHPO), Federal Advisory Council on Historic Preservation, and city of Tustin signed a Memorandum of Agreement (MOA) (Advisory Council on Historic Preservation 1999). This MOA stated, "A substantive effort must be made to determine whether there is an economically viable adaptive use of the Hangar 28 Complex and the Hangar 29 Complex." This is to be accomplished through a comprehensive marketing effort carried out in accordance with the guidelines established in Appendix C of the MOA. The MOA also provided mitigative measures in the event that it is not possible to achieve an economically viable adaptive use of the hangar complexes.

The blimp hangars are in locations that could be impacted by the OU-1B remedial action. Therefore, the selected remedial alternative would have to be designed and constructed to minimize impacts to these structures. Coordination with SHPO would also be required.

The Archaeological and Historic Preservation Act of 1974 requires that potential impacts to federally funded projects involving significant scientific, prehistoric, historic, or archaeological data be identified and mitigated. Former MCAS Tustin was the focus of numerous prehistoric archaeological assessments dating from 1972 through the early 1990s. As a result, the open spaces within Former MCAS Tustin have been thoroughly examined for prehistoric resources (Cotton/Beland/Associates, Inc. 1994). These investigations culminated in the discovery of a single prehistoric archaeological site that was destroyed in 1971 during construction of two large concrete water tanks. The SHPO and the Los Angeles office of the USACE have both recommended no further assessment work in conjunction with prehistoric archaeological resources in any of the open-space areas within the station (John Minch and Associates 1993a,b).

Paleontological resources were also evaluated, and it was determined with the finding that potentially significant fossil deposits could be encountered during construction and

grading activities at Former MCAS Tustin (John Minch and Associates 1993c). The resources most likely to be encountered include invertebrate and vertebrate fossils in Pleistocene and recent sediments between the land surface and a depth of approximately 280 feet bgs. In a study by John Minch and Associates (1993c), a recommendation was made for the preparation of a paleontological resources management plan (PRMP) detailing methodologies to be used for surveillance of construction grading activities as well as actions to be taken in the event that fossils are discovered. This study stated that construction-related impacts to potential paleontological resources at the former station can be effectively mitigated if the recommendations of the PRMP are implemented in compliance with the Archaeological and Historic Preservation Act of 1974. Based on this finding, the Archaeological and Historic Preservation Act of 1974 constitutes a federal location-specific ARAR for this remedial action at OU-1B.

The Archaeological Resources Protection Act of 1979, as amended, prohibits excavation of archaeological site resources located on public lands unless such action is conducted pursuant to a permit. Remedial actions conducted under CERCLA entirely "on-site" are not required to obtain permits for said actions. However, conducting the limited excavation and/or site alteration that may be necessary in accordance with the substantive requirements of a dig permit appropriate to the purpose would assure these remedial activities are in compliance with the Archaeological and Historic Preservation Act of 1974. The Archaeological Resources Protection Act of 1979, therefore, also constitutes a federal location-specific ARAR for remedial action at OU-1B.

11.2.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities and apply to particular remediation activities. The selected remedy, Alternative 7 from the FS, includes groundwater containment and hot spot removal of soil and groundwater. Excavated soil will be loaded into trucks for off-site disposal (with prior treatment, as necessary) at a state-certified treatment, storage, and disposal (TSD) facility. Imported clean fill will be used to fill the excavation. Extracted groundwater will be treated at an aboveground facility located near IRP-3 and IRP-12 and then discharged to an on-site city of Tustin storm drain. Actions associated with the selected remedy that trigger ARARs at OU-1B include installation of extraction and monitoring wells; soil excavation; groundwater monitoring, extraction, and treatment by carbon filtration; and discharge of groundwater to surface water. Federal and state action-specific ARARs for these activities are discussed in the following subsections.

11.2.3.1 FEDERAL

Federal laws that give rise to potential ARARs for actions to be undertaken as part of the selected alternative include RCRA requirements for monitoring, characterizing, managing, storing, treating, and disposing of hazardous waste. These regulations are discussed below.

RCRA

RCRA requirements for monitoring, identification/characterization, management, storage, treatment, and disposal of hazardous wastes (soil cuttings, water generated in the course of installing monitoring and extraction wells, extracted groundwater, and spent carbon) are federal action-specific ARARs identified for the selected alternative. Portions of the RCRA groundwater protection standards contained in Cal. Code Regs. tit. 22 are considered relevant and appropriate for the groundwater potentially impacted by the releases from OU-1B because the hazardous chemicals being addressed by this alternative are similar or identical to those found in RCRA hazardous wastes.

Based on a review of historical site information, manifests, storage records, and interviews with past employees, the DON has determined that soil, groundwater, and spent carbon at the OU-1B sites would not be classified as RCRA-listed hazardous wastes. However, testing would still be required to classify these materials with respect to the RCRA hazardous waste characteristics. This determination would be made at the time the waste is generated. Because GAC filters will be transported off-site as they become spent, no on-site storage is proposed, and GAC filters would not be addressed by ARARs, which are for on-site CERCLA activities. If spent GAC is shown by testing to be RCRA-characteristic hazardous waste, then all applicable requirements will be complied with for off-site transportation and disposal. Soil cuttings, trench spoils, groundwater, and excavated soil are not expected to be RCRA-characteristic hazardous waste based on data collected during the RI. However, if testing at the time of generation indicates a hazardous waste, then the appropriate RCRA requirements in Table 11-3 for storage, treatment, and disposal would be ARARs.

Based on RI data and the modeling results presented in the FS Report, the DON expects that the groundwater to be extracted under Alternative 7 would be well below the RCRA-characteristic level (500 μg/L for TCE) for classification as D040 hazardous waste, with the exception of groundwater extracted from plume hot spots at IRP-3 and IRP-12. Further characterization of groundwater extracted from the shallow groundwater unit will be performed during the remedial design phase as well as during start-up of the treatment system. The purpose of this testing would be to confirm the DON's expectations regarding groundwater characteristics and to satisfy federal RCRA waste-classification requirements. If extracted groundwater is found to be RCRA characteristic waste, substantive RCRA requirements would apply from the individual wellheads where TCE concentrations exceed 500 μg/L to the point at which the water no longer exhibits the characteristics of RCRA hazardous waste. The RCRA requirements will be met by using double-contained conveyance piping from the wellhead with TCE concentrations exceeding 500 μg/L to the entrance point of the treatment system.

A groundwater monitoring program will be developed during the remedial design phase. Substantive provisions of the following requirements are relevant and appropriate to the development and implementation of the monitoring program:

- groundwater monitoring and response (Cal. Code Regs. tit. 22, § 66264.91[a] and [c], except as it cross-references permit requirements)

- requirements for monitoring groundwater and surface water (Cal. Code Regs. tit. 22, § 66264.97[e])
- detection monitoring (Cal. Code Regs. tit. 22, § 66264.98)
- corrective-action program (Cal. Code Regs. tit. 22, § 66264.100[a] and [b])

These regulations are not applicable because the sites are not RCRA-regulated units.

The DON plans to excavate soil within the vadose zone and upper confining layer of the first WBZ with TCE at concentrations greater than approximately 400 µg/kg. Groundwater modeling results indicate that soils left in place with TCE at concentrations exceeding 400 µg/kg would result in a continuing source of contamination to groundwater at concentrations exceeding the remediation goals established for these chemicals. Soils with these contaminant concentrations are not subject to land disposal restrictions; therefore, treatment prior to disposal will not be required. Excavated soil will be loaded into trucks for off-site disposal at a state-certified TSD facility selected based on the waste characterization results. CERCLA ARARs do not pertain to off-site actions such as disposal (after treatment, if necessary); however, these actions are subject to applicable state regulatory program requirements. Because these state requirements are not CERCLA ARARs for on-site actions, they are not documented in this ROD/RAP, but will be identified and discussed in the work plan for the remedial design phase. The work plan will also state how the excavated waste will be contained, labeled, and transported for off-site disposal and which state-permitted TSD facility will be used. Only imported, clean fill will be used to backfill the excavated area.

Waste soil and spent GAC are not anticipated to be classified as RCRA hazardous wastes or stored for a significant period of time after generation. However, RCRA requirements for storage of hazardous waste for 90 days or less would be relevant and appropriate to the temporary accumulation of these wastes. In the unlikely event that storage of these wastes exceeds 90 days, the requirements of Cal. Code Regs. § 66264.34(d) and (e) and 66264.35 would become relevant and appropriate.

Clean Air Act

Desorbed and potentially carcinogenic VOCs may be emitted to the atmosphere under Alternative 7 after groundwater treatment by vapor-phase GAC. Requirements that have been incorporated into the State Implementation Plan and are therefore considered to be federal ARARs for this action include substantive requirements of South Coast Air Quality Management District (SCAQMD) Rule 212, and for fugitive dust, Rules 403 and 404. Rules 403 and 404 regulate releases of dust and particulate matter that could occur during grading or excavation of soil. The DON will comply with these regulations by employing standard dust suppression measures such as wetting the soil during excavation and loading for off-site disposal.

11.2.3.2 STATE

State laws that give rise to potential ARARs for actions to be undertaken as part of the selected alternative include state requirements for characterizing non-RCRA hazardous

waste; the WQCP waste-discharge requirements; SWRCB Res. 68-16 requirements for treated groundwater that is being discharged to surface water; and *California Civil Code* (Cal. Civ. Code) and Cal. Health & Safety Code requirements for implementing institutional controls. These regulations are discussed below.

RCRA

Waste streams generated in the course of implementing the selected alternative would be characterized with respect to state criteria for identification of non-RCRA hazardous waste. Materials that would be tested under this requirement are the soil cuttings and development water from installation of monitoring and extraction wells, trench spoils from construction of conveyance pipelines, extracted and treated groundwater, excavated soil from potential source removal, and spent GAC. Although not anticipated based on existing sample results, any waste exhibiting a characteristic of non-RCRA hazardous waste would be managed in accordance with the appropriate requirements of Cal. Code Regs. tit. 22, § 66264 already identified as federal ARARs in Section 11.2.3.1.

Water Quality Control Plan

Performance goals for treatment of extracted groundwater will be based on reducing TCE and 1,2,3-TCP to levels allowable for discharge to surface water. The proposed discharge would comply with the substantive provisions of the waste-discharge requirements and surface WQOs applicable to a city of Tustin storm drain, as established in the WQCP. These elements of the WQCP constitute state chemical-specific ARARs for Alternative 7 and were discussed previously in Section 11.2.1.

NPDES Permit

The discharge of treated water to surface water would need to comply with the ARARs identified in Section 11.2.1, Chemical-Specific ARARs. RWQCB intends to issue an NPDES permit if the selected OU-1B remedial action includes surface water discharge. The DON and RWQCB have "agreed to disagree" concerning the applicability of the permit exclusion of CERCLA Section 121(e). Consistent with this agree-to-disagree compromise, the DON continues to maintain that any surface water discharge related to OU-1B remedial action is exempt from such permit requirements, but the DON agrees to comply with the substantive requirements of the existing general permit as a means of assuring compliance with the substantive provisions of the WQCP and other state ARARs as provided by Section 121(d) of CERCLA.

State Water Resource Control Board Resolution 68-16

As stated in Section 11.2.1.8 and Table 11-1, the DON acknowledges that SWRCB Res. 68-16 is a state ARAR for discharge of treated groundwater by storm drain to surface water of Peters Canyon Channel at Former MCAS Tustin. The selected alternative will comply with SWRCB Res. 68-16 by meeting the substantive provisions of NPDES Permit No. CAG918001. Compliance with the substantive portions of the permit will assure that discharge of treated groundwater will not change or increase the concentrations of chemicals already allowed to be discharged to city of Tustin storm

drains. Therefore, the selected alternative will not degrade the existing quality of the receiving downstream surface water bodies, and it will comply with the antidegradation provisions of SWRCB Res. 68-16.

South Coast Air Quality Management District Regulations

The state requirement regulating dust generated during excavation consists of the substantive provisions of SCAQMD Rule 401. Rule 401 regulates releases of dust and particulate matter that could occur during grading or excavation of soil. The DON will comply with this rule by employing standard dust suppression measures.

California Civil Code Section 1471; California Health and Safety Code Sections 25202.5, 25222.1, 25233(c), 25234, 25355.5; and Cal. Code Regs. Tit. 22 Section 67391.1.

State statutes that have been accepted by the DON as ARARs for implementing institutional controls and entering into a Covenant to Restrict Use of Property with DTSC include substantive provisions of the Cal. Civ. Code § 1471 and the Cal. Health & Safety Code §§ 25202.5, 25222.1, 25233(c), 25234, and 25355.5. DTSC promulgated a regulation on 19 April 2003 regarding "Requirements for Land-Use Covenants" at Cal. Code Regs. tit. 22, § 67391.1. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the DON.

The substantive provisions of Cal. Civ. Code § 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in § 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the Covenant to Restrict Use of Property and run with the land.

The substantive provision of Cal. Health & Safety Code § 25202.5 is the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . ." This substantive provision will be implemented by incorporation of restrictive environmental covenants in the Covenant to Restrict Use of Property at the time of transfer for purposes of protecting present and future public health and safety.

Cal. Health & Safety Code §§ 25222.1 and Cal. Health & Safety Code 25355.5(a)(1)(C) provide the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of property. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property,..." and (2) "…the agreement is irrevocable, and shall be recorded by the owner, …as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and

appropriate": "…execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land."

The DON will comply with the substantive requirements of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) by incorporating CERCLA use restrictions into the DON's deed of conveyance in the form of restrictive covenants under the authority of Cal. Civ. Code § 1471. The substantive provisions of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) may be interpreted in a manner that is consistent with the substantive provisions of Cal. Civ. Code § 1471. The covenants shall be recorded with the deed and run with the land.

Cal. Health & Safety Code § 25233(c) sets forth "relevant and appropriate" substantive criteria for granting variances from prohibited uses based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "…the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

In addition to being implemented through the Covenant to Restrict Use of Property between the DON and DTSC, the appropriate and relevant portions of Cal. Health & Safety Code §§ 25202.5, 25222.1, 25233(c), 25234, and 25355.5(a)(1)(C) and Cal. Civ. Code § 1471 shall also be implemented through the deed between the DON and the transferee.

U.S. EPA does not agree with the DON and DTSC that the sections of the Cal. Civ. Code and Cal. Health & Safety Code cited above are ARARs because they fail to meet the criteria for ARARs pursuant to U.S. EPA guidance (i.e., they are administrative, not substantive, requirements that establish a discretionary way to implement land-use restrictions). However, U.S. EPA agrees that the substantive provisions of the recently promulgated regulation (Cal. Code Regs. tit. 22, § 67391.1) providing for the execution of a land-use covenant between the DON and DTSC is a "relevant and appropriate" state ARAR. DTSC's position is that all of the state statutes and regulations referenced in this section are ARARs.

11.3 COST-EFFECTIVENESS

The selected remedy has been determined to provide overall effectiveness proportional to its costs; it is therefore considered cost-effective. The estimated net present-worth cost for this remedial action is approximately $4.5 million. Capital and O&M costs include costs associated with excavation and treatment of contaminated soil and with construction and operation of the shallow groundwater containment and extraction wells and conveyance pipelines. Technologies included in Alternative 7 are readily implementable and have been widely used and demonstrated to be effective. The cost of the selected alternative, although higher than the cost of the no action alternative, represents a low-cost, effective, permanent solution for soil and groundwater remediation.

11.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE

The DON and the state of California have determined that the selected remedy represents the maximum extent practicable to which permanent solutions and alternative treatment technologies can be used cost-effectively at OU-1B. This alternative is protective of human health and the environment and complies with the ARARs for both sites. VOC contaminants within groundwater will be extracted and permanently destroyed or removed from the site areas. Although some residual contamination may remain in groundwater, the concentration should not be high enough to present a risk to human health. The selected alternative is readily implementable using standard equipment and methods. Remediation of groundwater is expected to take several decades. In the meantime, the DON will protect human health through land-use restrictions prohibiting use of untreated groundwater for domestic purposes.

The most decisive factors in the selection of Alternative 7 are that this alternative will permanently reduce the toxicity and volume of VOC contaminants and will assist in restoration of the groundwater to its designated beneficial uses.

11.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

CERCLA Section 121(b) identifies a statutory preference for alternatives that use treatment to reduce the toxicity, mobility, or volume of contamination. The selected alternative complies with this requirement to the extent practicable.

Section 12
DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for OU-1B, released for public comment in April 2002, identified Alternative 7, hydraulic containment with hot spot removal, as the preferred alternative for remediation of groundwater at IRP-3 and IRP-12. A component of the preferred alternative included on-site thermal treatment and reuse of excavated soil. Since the Proposed Plan was released, the feasibility of this soil disposal component of the preferred alternative was reevaluated based on new information and was found to be infeasible. The selected remedy presented in this ROD/RAP (Section 10) includes the off-site soil disposal component from Alternative 4 as a feasible replacement for the original on-site thermal treatment and reuse component.

The evaluation of on-site thermal treatment and reuse of soil in the FS assumed permits for this activity would be readily available, existing utilities could be used, and an existing on-site TDU would not require extensive pretesting. The recently conducted reevaluation of the soil disposal component considered the technical feasibility of permitting an on-site TDU, the current availability of utilities, and pretreatment requirements. The following conditions exist at the site that were not known during the FS or have changed since the FS.

- Permitting: Discussions with SCAQMD indicated that permitting an on-site TDU for VOCs could be prolonged based on difficulties in demonstrating the TDU would operate as designed and in assuring that no off-gassing of hazardous substances would occur. The DON's experience prior to the Proposed Plan included on-site treatment of soils that were not impacted by VOCs.
- Utilities: The DON previously owned utilities at Former MCAS Tustin, but these utilities were transferred to the city of Tustin in 2002. Since the transfer, natural gas lines previously used for an on-site TDU have been shut down by the city of Tustin. An alternate source of natural gas would therefore be required. Electrical and water utility systems were likewise transferred to the city of Tustin in 2002, and both these systems have been restricted in some capacity by the city of Tustin. Therefore, use of electricity and water would also need to be coordinated and contracted with the city of Tustin to support another on-site TDU.
- Pretreatment requirements: Prior to mobilizing an on-site TDU, pilot tests would be required to assist in the design of the full-scale system. The pilot tests would need to evaluate soil conditions, optimal temperature ranges, and additional treatment requirements. These tests would be necessary to address uncertainties about the treatment of soil and whether such an operation could be permitted.

Existing conditions at the sites and additional permitting requirements contribute to determining that the on-site thermal treatment and reuse component is infeasible as the soil disposal component of the preferred alternative. Therefore, on-site thermal treatment and reuse have been replaced with off-site disposal as the soil disposal component of the selected remedy.

Off-site soil disposal was evaluated in the FS as a component in the screening process for remedial technologies. Off-site soil disposal was retained for further consideration and was included in two of nine alternatives evaluated in the FS (Alternatives 4 and 6). The detailed analysis of the nine remedial alternatives in the FS indicated Alternative 7 would be the preferred alternative. However, components of the other alternatives, including the off-site disposal

component, were determined to be feasible for use in the selected remedy since they had all been fully evaluated in the FS and presented in the Proposed Plan.

The new information obtained for the on-site thermal treatment component rendered it infeasible, and another soil disposal component was required for the preferred alternative. In accordance with U.S. EPA guidance on the preparation of RODs, significant changes to the preferred alternative after release of the Proposed Plan and prior to signing of this ROD/RAP require documentation of and rationale for the changes. The change in the soil disposal component of the preferred alternative for OU-1B is reasonable because the off-site soil disposal component was fully evaluated in the FS, found to be feasible, and presented previously in the Proposed Plan under two alternatives.

The DON prepared a Fact Sheet that included a discussion of the proposed change to the soil disposal component for OU-1B. The Fact Sheet was issued to the public on 17 February 2004, and a 30-day public comment period was established to address any comments the DON received on the change. The change in the soil disposal component was also discussed at the RAB meeting on 24 February 2004. Oral and written comments from the public have been incorporated into the Responsiveness Summary for OU-1B. Based on the comments received and on discussions with the regulatory agencies, the change in the soil disposal component of the preferred alternative was incorporated into the selected remedy as presented in Section 10.

Section 13
REFERENCES

Advisory Council on Historic Preservation. 1999. Letter from Lee Keatings, Program Analyst, to Melanie Ault, Department of the Navy. Memorandum of Agreement for the Disposal and Reuse of the Marine Corps Air Station Tustin, Orange County, California. 16 December.

ANL. *See* Argonne National Laboratory.

Argonne National Laboratory. 1994. Draft Report: Geology, Hydrogeology, and Site History at the Marine Corps Air Station Tustin, California. Applied Geosciences and Environmental Management Section, Environmental Research Division. August.

———. 1995. Final Report: Phase II Investigations for Expedited Site Characterization for Marine Corps Air Station Tustin, California. Applied Geosciences and Environmental Management Section, Environmental Research Division. October.

Bechtel Environmental, Inc. 2002. Final Updated Community Relations Plan, Former Marine Corps Air Station Tustin, California. December.

———. 2003a. Final 2001 Annual Groundwater Monitoring Report, Marine Corps Air Station Tustin, California. August

———. 2003b. Final Feasibility Study Report for Operable Unit 1A, Former Marine Corps Air Station Tustin, California. August.

———. 2003c. Final Operation and Maintenance Plan, Operable Unit 3, Marine Corps Air Station Tustin, Orange County, California. May.

Bechtel National, Inc. 1996a. Draft Final Expanded Site Inspection Report, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. October.

———. 1996b. Draft Remedial Investigation Report for Operable Unit 3, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. July.

———. 1996c. Draft Feasibility Report for Operable Unit 3, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. July.

———. 1996d. Revised Draft Engineering Evaluation/Cost Analysis for IRP-2 (Oil Disposal Area) and IRP-9 (Hangar No. 1 Line Shacks), Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. October.

———. 1996e. Draft RCRA Facility Assessment Visual Site Inspection Report for Three Potential AOCs, MCAS Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. February.

———. 1996f. Draft Final Background Concentrations of Metals Issue Paper, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. October.

———. 1997a. Draft Final Remedial Investigation Report for Operable Units 1 and 2, Marine Corps Air Facility Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. November.

———. 1997b. Draft Final RCRA Facility Assessment Report, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. April.

———. 1998a. Draft Technical Memorandum: TCE-in-Soil Confirmation Sampling, Pilot-Scale Extraction Test, Bench-Scale Column Test, and Model Sensitivity Analysis, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. March.

———. 1998b. Final 1997 Annual Groundwater Monitoring Report, Marine Corps Air Facility Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. August.

———. 1999a. Draft Technical Memorandum: Pilot-Scale Vacuum-Enhanced Extraction Test, Marine Corps Air Facility Tustin, California. February.

———. 1999b. Revised Draft Feasibility Study Report, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. March.

———. 2000a. Final 1999 Annual Groundwater Monitoring Report, Marine Corps Air Facility Tustin, California. November.

———. 2000b. Final Site Management Plan, Marine Corps Air Facility Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. February.

———. 2000c. Draft Final Basewide Environmental Baseline Survey, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. May.

———. 2001a. Final Amended Site Management Plan, 2001 Update, Marine Corps Air Station Tustin, California. Prepared for Southwest Division Naval Facilities Engineering Command. October.

———. 2001b. Final 2000 Annual Groundwater Monitoring Report, Marine Corps Air Station Tustin, California. December.

———. 2002. Final Feasibility Study Report, OU-1B, Marine Corps Air Station Tustin, California. January.

BEI. *See* Bechtel Environmental, Inc.

BNI. *See* Bechtel National, Inc.

Brown and Caldwell. *See* Brown and Caldwell Consulting Engineers.

Brown and Caldwell Consulting Engineers. 1985. Initial Assessment Study of Marine Corps Air Station, Tustin, California. NEESA 13-075. Prepared for Naval Energy and Environmental Support Activity. September.

Cal/EPA. *See* California Environmental Protection Agency.

California Environmental Protection Agency. 1994. Office of Environmental Health Hazard Assessment. http://www.oehha.ca.gov/risk/chemicaldb/index.asp.

California Regional Water Quality Control Board, Santa Ana Region. 1995. Water Quality Control Plan, Santa Ana River Basin (8).

———. 2001. Letter from John Broderick, Regional Water Quality Control Board Santa Ana Region, to Dean Gould, BRAC Environmental Coordinator, MCAS El Toro. Proposal to Discharge Treated Groundwater from Former Marine Corps Air Station El Toro, IRP Site 16, to Bee Canyon Wash. 26 January.

California State Water Resources Control Board. 1994. Application of State Water Board Resolution No. 68-16 to Cleanup of Contaminated Groundwater. February.

City of Tustin. 1998. Draft MCAS Tustin Specific Plan/Reuse Plan, Errata. September.

Cotton/Beland/Associates, Inc. 1994. Environmental Setting Report EIS/EIR: Specific Plan/Reuse Plan and Base Disposal; for the Marine Corps Air Station (MCAS) Tustin. 731.00. Prepared in association with Howard Needles Tammen & Bergendoff for the United States Marine Corps and the city of Tustin. January.

DON. *See* United States Department of the Navy.

Durham, M. 1996. United States Army Corps of Engineers. Letter to United States Marine Corps BRAC Environmental Coordinator. 29 January.

IT. *See* The IT Group.

Jacobs Engineering Group Inc. 1992. Marine Corps Air Station (MCAS) Tustin, California, Facility Assessment Revised Preliminary Review/Draft Visual Site Inspection Report. Prepared for Southwest Division Naval Facilities Engineering Command. March.

———. 1993. Marine Corps Air Station Tustin, California, Final Site Inspection Report. Prepared for Southwest Division Naval Facilities Engineering Command. 12 March.

James M. Montgomery. 1988a. MCAS El Toro and Tustin Site Inspection Plan of Action.

———. 1988b. MCAS Tustin Fuel Farm Area Remedial Investigation. Prepared for Western Division Naval Facilities Engineering Command. July.

JEG. *See* Jacobs Engineering Group Inc.

JMM. *See* James M. Montgomery.

John Minch and Associates. 1993a. Environmental Setting for Archaeological and Paleontological Resources. 20 January.

———. 1993b. An Extended Literature and Records Search Addressing Prehistoric Archaeological Resources Located Within the Boundaries of the U.S. Marine Corps Air Station (MCAS) Tustin, Orange County, California. 22 July.

———. 1993c. Findings of a Literature Review of Paleontological Resources at the Marine Corps Air Station Tustin, Orange County, California. 22 July.

Marine Corps Air Station Tustin Base Realignment and Closure Cleanup Team. 1997. Meeting minutes. 24 July.

MCAS Tustin BCT. *See* Marine Corps Air Station Tustin Base Realignment and Closure Cleanup Team.

OHM. *See* OHM Remediation Services Corp.

OHM Remediation Services Corp. 1995. Final Closure Certification Report, RCRA Clean Closure Building 248, Tustin, California. October.

———. 1997. Site Assessment/Closure Report, Former IRP-16B, Marine Corps Air Station (MCAS) Tustin, California. 10 September.

———. 1998. Draft Closure Report Soil Removal Action at Site IRP-2 (Oil Disposal Area), Marine Corps Air Facility Tustin, California. 27 April.

———. 2000a. Draft Final Closure Report: Soil Removal Action at Sites IRP-9A (Hangar No. 1 Line Shacks, Sub-areas 1 and 2) and IRP-9B (Apron No. 1 Sub-areas 1 and 3), MCAF Tustin, California. 18 May.

———. 2000b. Draft No Further Action Report, Volume I, for Temporary Storage Units ST-18B, ST-19, ST-20A, ST-20B, ST-48, ST-49, ST-50, ST-81, ST-86, and ST-87. Marine Corps Air Facility Tustin, California. 01 May.

———. 2001. Final Memorandum, Remedial Activities for Site TOW-X4 at Marine Corps Air Station Tustin, California. 22 June.

RWQCB. *See* California Regional Water Quality Control Board, Santa Ana Region.

Southwest Division Naval Facilities Engineering Command. 1998. Base Realignment and Closure Cleanup Plan (BCP), Marine Corps Air Facility, Tustin, California. March.

SWDIV. *See* Southwest Division Naval Facilities Engineering Command.

SWRCB. *See* California State Water Resources Control Board.

The IT Group. 2000. Final Memorandum to DeAnna Dunbar, MCAF Tustin RPM, from Marcus Smith, IT PM. Subject: Remedial Activities for Site TOW-X3 at MCAF Tustin, California, Delivery Order No. 103, Document Control No. SW9003. 14 November.

Thirtieth Street Architects, Inc. 1993. MCAS Tustin Historic Resources Survey. 12 October.

United States Army Corps of Engineers. 1996. Safety and Health Requirements Manual EM 385-1-1. September.

United States Department of Agriculture. 1992. Natural Resource Management Plan: Marine Corps Air Station Tustin, California. Soil Conservation Service, Davis, California. January.

United States Department of the Navy. 1999. Final Environmental Impact Statement (EIS)/Environmental Impact Report (EIR), Disposal and Reuse of MCAS Tustin, California. In conjunction with the city of Tustin.

———. 2000. Letter from Dean Gould, Base Realignment and Closure Environmental Coordinator, to John Broderick, California Regional Water Quality Control Board, Discharge Permitting at IRP Site 16, Marine Corps Air Station El Toro. 27 December.

———. 2001. Policy for Conducting Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Statutory Five-Year Reviews. November.

United States Environmental Protection Agency. 1988a. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites. EPA/540/G-88/033. December.

———. 1988b. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01. EPA/540/G-89/004. Office of Emergency and Remedial Response. Interim Final. October.

———. 1989. Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A). December.

———. 1993. Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils. EPA 540-F-93-048. OSWER Directive 9355.0-48FS. September.

———. 1994a. Contaminants and Remedial Options at Solvent-Contaminated Sites. EPA 600/R-94/203. November.

———. 1994b. Remediation Technologies Screening Matrix and Reference Guide. EPA 542/B-94/013. NTIS PB95-104782. October.

———. 1996a. Presumptive Response Strategy and *Ex-Situ* Treatment Technologies for Contaminated Ground Water at CERCLA Sites. EPA 540-R-96-023. OSWER 9283.1-12. Final Guidance. October.

———. 1996b. User's Guide to the VOCs in Soils Presumptive Remedy. EPA 540/F-96/008. OSWER Directive 9355.0-63FS. July.

———. 1997. Presumptive Remedy: Supplemental Bulletin Multi-Phase Extraction (MPE) Technology for VOCs in Soil and Groundwater. EPA 540-F-97-004. OSWER Directive 9355.0-68FS. April.

———. 1998. Software Implementation of Johnson and Ettinger Model. Version 1.2. September.

———. 2000. Preliminary Remediation Goals. http://www.epa.gov/region09/waste/sfund/prg/.

———. 2001. Integrated Risk Information System. http://www.epa.gov/iris/subst/index.html.

USACE. *See* United States Army Corps of Engineers.

USDA. *See* United States Department of Agriculture.

U.S. EPA. *See* United States Environmental Protection Agency.

This page left blank intentionally

RESPONSIVENESS SUMMARY

RESPONSES TO COMMENTS
RECEIVED DURING THE PUBLIC COMMENT PERIOD

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Comments Received During Public Meeting Held on 23 April 2002

Comments by: ***Don Zweifel, RAB Member***

Number	Comments	Responses
1	Keith, my name's Don Zweifel. I must tell—you know, there are a lot of assumptions being made here. And, of course, as you know, the word "assume"—you know what is the definition of the work "assume": It makes an ass out of you and an ass out of me. And I'm not trying to be facetious, ladies and gentlemen. We do have some definite concerns. For instance, why do we give such short shrift to the permeable membrane having to do with Fe, the iron particulate wall? I honestly think—I've seen some studies on it. And I'm sure some of you have, also. It's a remarkable process. It's *in situ*, of course, in the ground. And eleven and a half million is a bit on the high side. I have a feeling that you didn't give it full play. I think that the—let's look at it for a second. As far as short-term effectiveness is concerned, I—that's not what—that's not the way I—well, the studies that I've seen indicate the obverse. I mean, you know, I don't see it that way from the studies I've seen. Maybe someone in this room will agree with me, perhaps. Now, there was a Ph.D. that I—from the El Toro RAB, but he was going to be a member. I don't know if some of our old-time members would remember him. He was a firm proponent of the permeable iron membrane, the wall itself. He says it's a marvelous idea. I think it has to do with ionization. Perhaps, a factor is something to do with the covalent. Is it something—anything to do with that, or is that something else? Or is that not relevant at all? I'm getting into a realm where I'm not familiar with the technical ramifications of the membrane, the iron membrane. But I have a feeling—I can't remember what he told me. But I did remember one thing. He says hey, it's really worthwhile to look into.	**Response:** The Navy thanks Mr. Zweifel for his contributions to the Restoration Advisory Board for Former MCAS Tustin and agrees that the permeable iron wall represents an innovative technology that could perform very effectively in some applications. The permeable reaction wall was considered seriously for IRP-3 and IRP-12. This technology survived the initial screening in the Feasibility Study (FS) process and was thoroughly evaluated as a remedial action alternative (Alternative 5). Unfortunately, the wall was found to be inappropriate for this particular site for several reasons. The permeable reaction wall would use reactive iron material placed in "curtains" installed at downgradient locations in positions perpendicular to groundwater flow such that groundwater would naturally pass through them and contamination would be removed. Because this alternative requires natural groundwater flow to transport VOC contamination through the walls, it would require a much longer time to achieve the cleanup goals in the shallow aquifer. In particular, significant contamination would remain after 30 years in upgradient portions of the sand layers in the first WBZ. This alternative was also determined to be the most expensive and least implementable because of the potential for fouling due to the elevated TDS concentrations in the shallow aquifer at MCAS Tustin. It was also rated low in implementability because there is only one experienced process vendor available to market this technology.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Comments Received During Public Meeting Held on 23 April 2002

Comments by: Don Zweifel, RAB Member

Number	Comments	Responses
	And I think you did say, if I remember—and I was listening to you. You said the track record of the permeable iron membrane is really unknown. Well, in actuality, it is known; but it's not known to you, or it's not known to the people at Bechtel, or IT Corp, or whoever did this survey. Maybe we should give the permeable iron membrane another look, perhaps. And the CERCLA process is great. We're not a CERCLA site. Whereas El Toro is, we're not. Right? Even though we came up with the HRA, the hazardous ranking assessment, was almost—this is before you came on board. Ladies and gentlemen, we came within two points, maybe three points of having our HRA, hazardous ranking assessment—risk assessment of being a CERCLA site, maybe two or three points maybe. Someone can correct me there, but I'm fairly sure. Dr. Temeshy, maybe you know. So what I'm saying is I do have a case that we look into—the CERCLA process is wonderful. I'm so glad you use the nine criteria. I'm very happy about that. That's something on a positive note. However, the trouble with that is when you assume, there's too many assumptions. And that's the only thing I wanted to say. Thank you very much.	

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Comments Received During Public Meeting Held on 23 April 2002

Comments by: ***Stephen Melvin***

Number	Comments	Responses
1	My first comment is it is unclear, from the documentation provided here and in the handouts we've received, whether or not the site will be completely unusable for the duration of the cleanup. It does state it will be thirty years. Now, that may have been covered in previous documentation or previous meetings. I apologize if it has. But it's unclear, from the documentation that's presented here today.	**Response:** The property containing IRP-3 and IRP-12 will be usable during the duration of the cleanup. There will be some use restrictions placed on the property containing the sites to make sure that the remedy remains effective. The restrictions will be designed to accomplish the following objectives. • Prevent the use of VOC-contaminated groundwater for domestic purposes until cleanup objectives have been achieved (no new groundwater wells will be allowed without prior written approval from the DON and DTSC); • Protect groundwater extraction and monitoring wells and associated piping and equipment (altering, disturbing, or removing wells or equipment associated with remediation of the sites will not be allowed); and • Assure access to the site by the DON and regulatory agencies to assure that construction, operation and maintenance, and monitoring of the final remedy and any future investigations or response actions are implemented as necessary. There will not be any restrictions on the type of land use (e.g., residential, industrial, recreational) that can take place at the sites. The DON currently plans to lease the areas containing the OU-1B sites to the City of Tustin. The property may be used for any purposes consistent with the (lease) restrictions stated above.
2	And the second question—or, comment I have, on the five-year review process, it appears that the process—the cleanup will be reviewed to make sure that it's still on track. I would like to make a recommendation that it also be reviewed every so often to find out if there have been new technologies put into place, which might help reduce the cost and the time factor and get the same bang for our buck. Thank you.	**Response:** As part of the long term groundwater monitoring program that will be implemented at the site, the effectiveness of the remedy will be evaluated annually and during the 5-year review process. The DON is continually evaluating new technologies that have potential applications at sites under remediation.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Comments Received During Public Meeting Held on 23 April 2002

Comments by: ***Berkelee Maughan, Tustin Resident***

Number	Comments	Responses
1	I've attended these meetings off and on, some in the beginning and the middle, and now towards the end here. And as a resident, I'm very concerned about the success rate. I've been impressed about your approach and how you've gone after the—identified the problems, and the alternatives, and so forth. But what I would like to see the Navy do is—you know, this is not the first base closure. You can do some research and look at the problems that various base closures have had. And there's some commonalities. And I think the Navy ought to review the methods that were used at these various closures to look at the success rate, because—and before you adopt your final measure or your plan to clean things up, the pollution. Because if they're not successful, then it becomes a contingent liability and a future liability. And if this is turned over to the city of Tustin, and then they sell some of it off to developers, then they get in there and start mixing the soil up. And the soil is so easily contaminated, it contaminates other soil, and also groundwater, and so forth. This thing could really snowball. And, you know, in the newspapers, they say, you know, that the Navy's going to clean everything up. But are they going to hold the city of Tustin harmless if something goes wrong with these remedial measures, and then the developer sues the City, and so forth? And then, it ends up the taxpayers have got a real problem on their hands. So I'd like to see the problems that we have at this base, compared to like problems at other bases, the measures, the remedial measures they use to clean it up, and how successful they were before you adopt your final remedial measures. Thank you.	**Response:** The Navy appreciates your attendance and input to these Restoration Advisory Board meetings for Former MCAS Tustin. This comment suggests that the Navy should look at the commonalities between bases to determine the most successful strategy for cleanup of IRP-3 and IRP-12. Please be assured that this is the approach that was taken during the feasibility study (FS) process. As discussed in Section 3.2 of the OU-1B FS Report and in Section 8.3 of the Record of Decision, the development of remedial alternatives was guided by prior U.S. EPA experience at VOC-contaminated sites throughout the United States. Documents considered in the development of remedial alternatives for soil and groundwater included the following: • **Contaminants and Remedial Options at Solvent-Contaminated Sites** identifies response actions and remedial technologies commonly used and demonstrated to be effective for remediation of soils and groundwater with contaminants similar to those at IRP-3 and IRP-12. • **Remediation Technologies Screening Matrix and Reference Guide** provides a comprehensive listing of remedial technologies for VOC-contaminated soil and groundwater. This U.S. EPA reference effectively serves as a preliminary screening step to determine the technical implementability of various technologies for possible use at OU-1B.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Comments Received During Public Meeting Held on 23 April 2002

Comments by: ***Berkelee Maughan, Tustin Resident***

Number	Comments	Responses
1 (cont'd)		• **Presumptive Response Strategy and *Ex Situ* Treatment Technologies for Contaminated Groundwater at CERCLA Sites** states that groundwater extraction, source removal, and natural attenuation, alone or in combination, constitute the presumptive remedy for contaminated groundwater at sites where DNAPLs are not a concern. The presumptive technologies listed for *ex situ* treatment of VOCs in extracted groundwater include air stripping, granular activated carbon (GAC) adsorption, chemical oxidation, and aerobic biological treatment. • **Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils** identifies soil vapor extraction (SVE), thermal desorption, and incineration as presumptive remedies for VOCs in soils. • **Presumptive Remedy: Supplemental Bulletin Multiphase Extraction (MPE) Technology for VOCs in Soil and Groundwater** defines VEE (also known as MPE) as another presumptive technology for remediation of VOCs in soil and groundwater. MPE combines key components of conventional groundwater extraction and SVE. It is described by U.S. EPA as particularly applicable to sites such as MCAS Tustin with significant concentrations of VOCs adsorbed to low-permeability soils below the water table.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Comments Received During Public Meeting Held on 23 April 2002

Comments by: ***Berkelee Maughan, Tustin Resident***

Number	Comments	Responses
1 (cont'd)		Use of the presumptive remedy guidance to select alternatives to evaluate was designed to make sure that proven remedies that work best at sites similar to IRP-3 and IRP-12 are selected. The selected remedy will be implemented by the Navy which, as you note, has extensive experience in implementing similar remedies at many other sites. With regard to your concern about something going wrong with the remedy, the Navy has a policy that addresses Responsibility for Additional Environmental Cleanup after Transfer of Real Property (known as the "come back policy"). The policy states that if a determination is made in the future that the selected remedy is no longer protective of human health and the environment because the remedy failed to perform as expected, the DON is obligated to return to perform additional cleanup.

RESPONSES TO LETTERS
RECEIVED DURING THE PUBLIC COMMENT PERIOD

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: ***Melinda Bowman, Planning & Development Services Department, County of Orange, Letter Dated April 16, 2002***

Number	Comments	Responses
1	In general, the County is concerned about discharges into Peters Canyon Wash and any associated impacts on water quality in the Newport Bay/San Diego Creek watershed. Comments specific to this concern are attached (see comments from Chris Crompton, County of Orange).	**Response:**. The selected remedy, Alternative 7 (Hydraulic Containment with Hot Spot Removal), is specifically designed and intended to contain the VOC plumes within their current boundaries at IRP-3 and IRP-12, and to prevent further contaminant migration toward Peters Canyon Channel. Once the groundwater is extracted and cleaned up, it would be discharged from the treatment systems into surface waters in Peters Canyon Channel that eventually reaches San Diego Creek and Newport Bay. The Navy will use discharge standards applicable to the surface water body that the water is being discharged into to make sure that the water in San Diego Creek and Newport Bay is not degraded.
2	The County is also concerned about the potential impact of the Preferred Remedy (Alternative 7) for IRP-12 on the future regional park (Parcel 18). Specifically, the described soil hot spot excavation and thermal treatment may affect the planned reuse of buildings to be utilized for archeological/paleontological storage (Building Numbers 20B, 90, and 533 in Parcel 18). Of further concern is the impact of hot spot extraction and containment wells and the groundwater treatment facilities that may be located on the balance of the regional park parcel. If the Department of the Navy plans to undertake any excavations or locate any wells or treatment facilities on Parcel 18, coordination with the County on siting these facilities away from park activity centers will be important to help ensure the economic viability of the hanger and functionality of other associated park uses. To this end, the County requests to be consulted during the remedial design phase as the detailed designs are developed for the IRP-12 portion of OU 1B.	**Response**: The remedial action alternatives (including Alternative 7) developed in the OU-1B Feasibility Study (FS) are conceptual in nature. The actual areas to be excavated and need to demolish any affected structures at IRP-12 will be determined based on additional data collected during the remedial design phase of the project. Currently, soil excavation boundaries and excavation activities proposed for the one hot spot soil removal area are not expected to impact existing structures at IRP-12 including Buildings 20B, 90, 533, or 576. (According to the Finding of Suitability to Lease for Carve-Out Areas 5, 6, 7, 8, 9, 10, and 11, Building 576 is scheduled for demolition. Building 533 is scheduled to be retained for educational/recreational uses. The use of Buildings 20B and 90 is to be determined.) In addition, under Alternative 7, contaminated soil would be transported off-site to a permitted disposal facility. The Navy will consult with the county of Orange during the remedial design phase of this project with regard to minimizing impacts to future land use from remedial activities to be conducted within Parcel 18 at Former MCAS Tustin.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: ***Chris Crompton, Manager, Environmental Resources Manager, Public Facilities & Resources Department, County of Orange, Memo to Melinda Bowman Dated March 27, 2002***

Number	Comments	Responses
1	The report needs to address whether the Navy will be responsible for overseeing all remedial activities associated with OU 1B.	**Response**: The Navy [in conjunction with California Department of Toxic Substances Control (DTSC)] will retain responsibility for the oversight of remedial activities until the remedial action objectives for the site are achieved. In addition, if a determination is made in the future that the selected remedy is no longer protective of human health and the environment because the remedy failed to perform as expected, the DON is obligated to return to perform such additional cleanup as would be generally required by regulatory agencies. (Please see the comments made during the public meeting on this same issue.)
2	It should clearly be stated which party will assume ownership of the recommended extraction and containment wells. What impact will long-term installation of wells have on County park property?	**Response:** The Navy will retain ownership of the hydraulic containment and hot spot extraction wells recommended in the selected remedy until the time they are abandoned at the conclusion of the remedy, after the remedial action objectives are achieved. Land-use restrictions will be used to protect groundwater extraction and monitoring wells and associated piping and equipment (altering, disturbing, or removing wells or equipment associated with remediation of the sites will not be allowed). As long as the wells and equipment are protected, the impact of the wells on the use of the property is anticipated to be minimal. The Navy will work with the county of Orange and future transferees to mitigate/minimize potential impacts to land-use to the extent practicable.
3	Treated effluent from the extraction wells will be discharged into Peters Canyon Wash which enters Upper Newport Bay via San Diego Creek. Permits for this activity must be secured from the Regional Water Quality Control Board and County of Orange.	**Response:** The selected alternative would extract contaminated groundwater from the shallow aquifer, treat the groundwater, and discharge the clean treated groundwater to an on-site storm drain. The cleanup levels for the treated groundwater will be based on requirements of the California Water Code, the Water Quality Control Plan for the Santa Ana River Basin (Basin Plan), and will comply with substantive requirements of the general NPDES permit issued by the Regional Water Quality Control Board.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: ***Chris Crompton, Manager, Environmental Resources Manager, Public Facilities & Resources Department, County of Orange, Memo to Melinda Bowman Dated March 27, 2002***

Number	Comments	Responses
3 (cont'd)		As discussed in the FS and the ROD, the Navy is not required to obtain a permit for this action. CERCLA 121(e)(1), 42 U.S.C. § 9621(e)(1), states that "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where the remedial action is selected and carried out in compliance with this section." The term on-site is defined as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 C.F.R. § 300.5). The DON intends to construct and operate the groundwater treatment system entirely on-site. The treated groundwater will be discharged to a nearby storm drain, which will transport the treated water and ultimately discharge it into waters of the United States at an off-site location. The U.S. EPA has consistently maintained that the off-site migration of extracted water that has been treated under the response action so that it complies with applicable or relevant and appropriate regulations (ARARs) is consistent with the on-site permit exclusion in Section 121(e) of CERCLA and, therefore, does not constitute an off-site response action that requires an NPDES permit. (See "In the Matter of the Former Weldon Ordnance Works, Weldon Springs, Missouri," Federal Facility Docket No. VII-90-F-0033, 01 November 1995.) The DON agrees with this interpretation of CERCLA and the NCP. Legal counsel from the DON and RWQCB Santa Ana Region have communicated regarding RWQCB's requirements for regulation of discharges to surface waters under the NPDES and have "agreed to disagree" on this matter. Their respective positions are documented in Appendix A, Section A4.9.2 of the FS, and in Section 11.2.1.8 of the ROD.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: ***Chris Crompton, Manager, Environmental Resources Manager, Public Facilities & Resources Department, County of Orange, Memo to Melinda Bowman Dated March 27, 2002***

Number	Comments	Responses
4	The Newport Bay/San Diego Creek watershed has Total Maximum Daily Loads (TMDLs) for sediment, nutrients, and fecal coliform. The toxics TMDL is anticipated by late April 2002. Will the discharge from the groundwater into Peters Canyon Wash contain any chemical constituents which will exacerbate TMDL conditions?	**Response:** The Navy will continue to work with RWQCB to meet substantive existing requirements for TMDLs and new requirements as these are developed.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: Roy L. Herndon, District Hydrogeologst, Orange County Water District, Letter Dated April 12, 2002

Number	Comments	Responses
1	Orange County Water District (OCWD) staff has reviewed the subject document and supports the decision to pursue Alternative 7, Hydraulic Containment and Hot Spot Removal as the preferred remedy for OU 1B, which includes IRP Sites 3 and 12. In addition to soil treatment, Alternative 7 includes extraction and containment of contaminated groundwater from the first and second water bearing zones (WBZs). According to your conceptual hydrogeologic model of OU 1B, the upper two WBZs are hydraulically interconnected, while the underlying third WBZ is hydraulically separated from the upper two zones by a clay/clayey silt layer that underlies most of the base. While the third WBZ may be largely isolated from the overlying WBZs, MTBE and 1,2,3-TCP have been detected in monitoring wells screened in the third WBZ, indicating that vertical hydraulic connection does exist locally. The third WBZ is described as a transition zone between the shallow aquifer system and the underlying regional aquifer. Most groundwater production in the area surrounding MCAS Tustin is from the regional aquifer. Our primary comment regards the need for adequate vertical data control on the groundwater monitoring system that is included in the proposed remedy. Because the regional aquifer supplies approximately 75 percent of the total water demand of the surrounding cities of Tustin, Santa Ana, and Irvine, the proposed remedy needs to provide a data collection program that demonstrates the long-term effectiveness of the proposed extraction and hydraulic containment system in preventing the downward migration of contaminated groundwater into the third WBZ or the regional aquifer. This can best be accomplished by constructing "sentinel" monitoring wells screened in the third WBZ. We respectfully request that the final remedial action plan acknowledge the need for and include proposed locations of these monitoring in the third WBZ adjacent to and downgradient of the current groundwater plume. These monitoring wells should be monitored regularly along with other wells to demonstrate the effectiveness of the remedy at hydraulically containing the VOCs.	**Response:** The Navy thanks OCWD for their thoughtful review of the Proposed Plan, and support for the selected remedy at OU-1B, Hydraulic Containment With Hot Spot Removal. The following statement has been placed in Section 10.3 of the OU-1B ROD: "Groundwater monitoring is anticipated to be performed using six existing and four new groundwater monitoring wells. The actual number of monitoring wells to be sampled and the locations and specifications (depth, screened interval, and well construction materials) for new monitoring wells (including the potential need for monitoring well[s] in the third WBZ) would be determined during remedial design and documented in the long-term monitoring plan."

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: Dana Ogden, Program Manager, City of Tustin, Letter Dated March 28, 2002

Number	Comments	Responses
1	Thank you for providing the City of Tustin with a copy of the above referenced document [the Proposed Plan/Draft Remedial Action Plan for OU-1B, MCAS Tustin). The Proposed Plan/Draft Remedial Action Plan provides the Navy's preferred cleanup remedy for treatment of two Installation Restoration Program (IRP) sites (IRP-3 and IRP-12) at the former Marine Corps Air Station (MCAS) Tustin. Our comments are as follows: Page 7, first paragraph – Military operation of the property over the past 50 years has resulted in soil and groundwater at the sites being contaminated with volatile organic compounds (VOCs). It is noted that there is a risk to the public associated with this contamination from "indoor inhalation of VOC vapors." Yet, the Proposed Plan does not identify how the implementation of the proposed Alternative 7 would reduce this risk. It is noted that the Final Feasibility Study (FS) for OU-1B also does not provide a proposed solution to this issue. We request that the issue be fully analyzed and resolved to the satisfaction of the Department of Toxic Substances Control (DTSC) prior to Navy approval of the Proposed Plan/Remedial Action Plan for OU-1B.	**Response:** The risk to a resident at IRP-3 and IRP-12 from indoor inhalation of VOC vapors (from tapwater during showering, washing dishes) will be eliminated by using institutional controls to prevent the use of contaminated groundwater. The risk to an industrial worker from vapor intrusion through building foundations was evaluated and found to be acceptable. DTSC has reviewed the FS and has concurred that the vapor intrusion risk is acceptable and that the proposed institutional controls are an adequate means of protecting human health from risks due to groundwater until cleanup goals have been reached.
2	Page 15, Institutional Controls – The Proposed Plan includes a general explanation of the term "Institutional Controls" but the document does not include a graphic representation of the area proposed to be impacted by Institutional Controls nor does it list the specific Institutional Controls being proposed by the Marine Corps/Navy for the Operable Unit. Please provide a clear description of both of these items prior to Navy approval of the Proposed Plan/Remedial Action Plan for OU-1B.	**Response:** The FS report and Record of Decision/Remedial Action Plan contain figures that illustrate the area over which the institutional controls will be applied. These documents also contain a detailed description of the Institutional Controls that will be applied to IRP-3 and IRP-12. The institutional controls were summarized on Page 9 of the Proposed Plan. They were not discussed in detail in the Proposed Plan because the Proposed Plan is intended to be a summary-level document that presents information in a format that is readily understandable to local residents and other interested parties. Additional information is provided in the more lengthy FS Report, at the Public Meeting, and in the Record of Decision/Remedial Action Plan.

RESPONSIVENESS SUMMARY FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B		
Letters Received During Public Comment Period		
Comments by: Dana Ogden, Program Manager,. City of Tustin, Letter Dated March 28, 2002		
Number	**Comments**	**Responses**
3	The DTSC should concur that "naturally occurring" hazardous materials (e.g., arsenic) are actually occurring at background levels for the region and that these contaminants have not been introduced to the site by the military.	**Response:** The assessment that arsenic and other non-VOC materials are present at background levels was made in the FS. The DTSC has reviewed this document and has concurred with its findings.

RESPONSIVENESS SUMMARY
FORMER MARINE CORPS AIR STATION – TUSTIN, CALIFORNIA
PROPOSED PLAN/DRAFT REMEDIAL ACTION PLAN FOR OPERABLE UNIT (OU) 1B

Letters Received During Public Comment Period

Comments by: Jennifer M. Winn, City of Irvine Community Development Department, Letter Dated May 2, 2002

Number	Comments	Responses
1	The City of Irvine has reviewed the notice and letter sent by the State Department of Toxic Substances Control pertaining to the above referenced project. The information has been routed to the City's Public Works staff for review. The document indicates that groundwater extracted during the proposed cleanup process would be discharged into a storm drain that flows to Peters Canyon Channel and ultimately into Upper Newport Bay. The City is concerned about any pollutant that might reach Upper Newport Bay. As a stakeholder in the environmental quality of the region, the City is cooperating with the County and other jurisdictions to reduce such pollutants. In response to our inquiry, you have indicated that the Santa Ana Regional Water Quality Control Board has reviewed the remediation plan. Based on this statement, the City of Irvine has no additional comments. Thank you for the opportunity to review the project.	**Response:** The selected alternative would extract contaminated groundwater from the shallow aquifer, treat the groundwater, and discharge the clean treated groundwater to an on-site storm drain that eventually discharges to Peters Canyon Channel. The Navy will use discharge standards for the treated water that are applicable to the surface water body that the water is being discharged into to make sure that the water in San Diego Creek and Newport Bay is not degraded. Also, as you point out, all technical documents related to IRP-3 and IRP-12, including the FS, Record of Decision and remedial design documents are reviewed by the Santa Ana Regional Water Quality Control Board. The Board shares the City of Irvine's concern about degradation of water quality and reviews each document to make sure that this issue is addressed satisfactorily.