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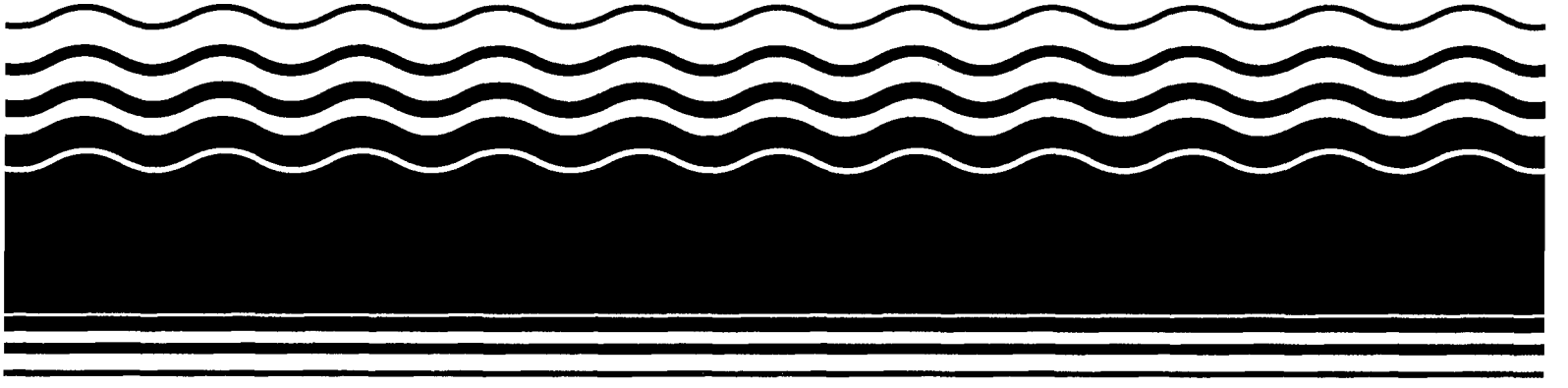

MARINE CORPS BASE
CAMP PENDLETON, CALIFORNIA

RECORD OF DECISION FOR
OPERABLE UNIT 1 - SITE 9 AND
GROUP A NO ACTION SITES
DRAFT FINAL

REVISION: 1

2 October 1995

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ACRONYMS/ABBREVIATIONS

AC/S,ES	Assistant Chief of Staff, Environmental Security (Formerly ENRMO)
ACU	Assault Craft Unit
ANOVA	Analysis of Variance
ARAR	Applicable of Relevant and Appropriate Requirement
atm-m^3/mol	Cubic Meters (Atmosphere) per Mole
ATSDR	Agency for Toxic Substances and Disease Control
AT&SF	Atchison, Topeka, and Santa Fe (Railway)
AvGas	Aviation Gasoline
BEIA	Biomedical and Environmental Information Analysis
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CRDL	Contract-Required Detection Limit
DCA	Dichloroethane
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethene
DPDO	Defense Property Disposal Office
DRMO	Defense Reutilization and Marketing Office
DTSC	Department of Toxic Substances Control
ENRMO	Environmental and Natural Resources Management Office (Currently ACS,ES)
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FS	Feasibility Study
HEAST	Health Effects Assessment Summary Table
HHRA	Human Health Risk Assessment
HI	Hazard Index

ABBREVIATIONS/ACRONYMS (continued)

HQ	Hazard Quotient
HRSD	Hazard Ranking System Database
HSDS	Hazardous Substances Data Bank
IAS	Initial Assessment Study
IDL	Instrument Detection Limit
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
LCAC	Landing Craft Air Cushion
LUFT	Leaking Underground Fuel Tank
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	Maximum Contaminant Level
MEK	Methyl Ethyl Ketone
mg/kg	Milligrams per Kilogram
mg/kg-day	Milligrams per Kilogram per Day
mg/l	Milligrams per Liter
MWR	Morale, Welfare,and Recreation
NCP	National Contingency Plan
NEESA	Naval Energy and Environmental Support Activity (Currently NFESC)
NFESC	Naval Facilities Engineering Services Center (Formerly NEESA)
NPL	National Priorities List
O&M	Operations and Maintenance
OU	Operable Unit
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
POL	Petroleum, Oil, and Lubricants
POTW	Publicly Owned Treatment Works
ppb	Parts per Billion
ppm	Parts per Million
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose

ABBREVIATIONS/ACRONYMS (continued)

RG	Remediation Goal
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
r-PRG	Risk-Based Preliminary Remediation Goal
RWQCB	California Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SF	Slope Factor
SI	Site Inspection
SMB	Santa Margarita Basin
SPLP	Synthetic Precipitation Leaching Procedure
STLC	Soluble Threshold Limit Concentration
SVE	Soil Vapor Extraction
SWDIV	Southwest Division Naval Facilities Engineering Command
SWRCB	California State Water Resources Control Board
TCA	Trichloroethane
TCE	Trichloroethene
TDS	Total Dissolved Solids
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
UV	Ultraviolet
VOC	Volatile Organic Compound
WET	Waste Extraction Test
µg/dl	Micrograms per Deciliter
µg/kg	Micrograms per Kilogram
µg/l	Micrograms per Liter

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1.0 DECLARATION

1.1 Site Name and Location

Marine Corps Base (MCB) Camp Pendleton, California, is located between San Diego and Los Angeles (Figure 1-1). The vast majority of the base is situated in San Diego County. A small portion of the northwest corner of the base is located in Orange County.

Installation Restoration Program sites at MCB Camp Pendleton were assigned to one of four groups (A, B, C, or D) according to potential impact to human health and the environment. Group A sites are believed to have the highest potential for such impact; Group D sites have the lowest. This Record of Decision (ROD) addresses soil and groundwater at Group A Sites 9 and 24 and soil at Group A Sites 4 and 4A. Site 9 is the only site included in Operable Unit (OU) 1 because it is the only site within Group A that was recommended for further evaluation via a feasibility study (FS). Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond, is located approximately 1 mile south of Las Flores Creek and 1/2 mile east of the Pacific Ocean, in the southwestern part of MCB Camp Pendleton. This ROD also includes the following sites, which were investigated with Site 9 during the remedial investigation (RI) of Group A sites and were recommended for no action:

- Sites 4 and 4A (soil) - Marine Corps Air Station (MCAS) Drainage Ditch and Concrete-Lined Surface Impoundment
- Site 24 (soil and groundwater) - 26 Area Morale, Welfare, and Recreation Maintenance (MWR) Facility

This ROD does not include groundwater at Sites 4 and 4A because data from the RI of Group A sites indicate that groundwater beneath Sites 4, 4A, and 6 may be potentially impacted by common sources. Therefore, evaluation of groundwater at Sites 4 and 4A has been deferred for inclusion in the Site 6 groundwater evaluation to be presented in the RI report for Group C sites.

1.2 Statement of Basis and Purpose

The purpose of this ROD is to set forth the remedial action for Site 9 groundwater, which is contaminated with the volatile organic compounds (VOCs) trichloroethene (TCE) and

tetrachloroethene (PCE). In addition, this ROD sets forth the basis for the no remedial action decision for soil at Sites 9, 4, 4A, and 24 and for groundwater beneath Site 24.

This ROD presents the selected remedial action for the MCB Camp Pendleton OU1, Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond. The remedial action was selected 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, to the extent practicable, the National Contingency Plan (NCP).

Soil at Sites 4, 4A, and 9 and soil and groundwater at Site 24 were determined to be in a protective state; that is, the media at these sites pose no current or potential threat to human health or the environment.

The above determinations are based on information presented in the remedial investigation/feasibility study (RI/FS) report dated 15 October 1993 and the Administrative Record for MCB Camp Pendleton and comply with Title 40, Code of Federal Regulations (CFR), Part 300. The U.S. Department of the Navy, the U.S. Environmental Protection Agency (EPA), and the State of California concur with the selected remedies for soil and groundwater at Sites 9 and 24 and soil at Sites 4 and 4A.

1.3 Assessment of Site 9

Constituents of concern identified in the soil at Site 9 are beryllium and petroleum hydrocarbons. Beryllium is also a naturally occurring metal, and investigations showed that, in Site 9 soils, naturally occurring background concentrations of this metal vary from 0.1 to 1.1 parts per million (ppm). The maximum concentration of beryllium detected in the soil at Site 9 was 1.9 ppm. Concentration of total petroleum hydrocarbons (TPH) in Site 9 soil vary from 0.5 to 6,700 ppm.

A health risk assessment was conducted to evaluate the current and potential risks posed by the chemicals in the soil and groundwater at Site 9. The results of the human health risk assessment (HHRA) indicated that beryllium in the soil is within the acceptable range of risks. Federal or State agencies have not published carcinogenic or noncarcinogenic risks associated with petroleum hydrocarbons. The leachability of petroleum hydrocarbon constituents from soil to groundwater was a concern. However,

subsequent tests performed to determine the leachability of site contaminants indicated that contaminants of concern, including beryllium and petroleum hydrocarbons, will not leach to and degrade the groundwater.

The RI also identified PCE and TCE in the groundwater at Site 9. Neither PCE nor TCE was detected in the soil at Site 9. Maximum concentrations of these compounds were 18 parts per billion (ppb) for PCE and 15 ppb for TCE. Although these concentrations exceed the State and Federal primary drinking water maximum contaminant levels (MCLs) of 5.0 ppb, the results of the HHRA indicated that risks due to these compounds in the groundwater at Site 9 are within the acceptable risk range.

Actual or threatened releases of hazardous substances from OU1, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

In accordance with the EPA's *Interim Final Guidance on Preparing Superfund Decision Documents* (EPA, 1989a), this section does not include a discussion of the no action sites.

1.4 Description of the Selected Remedy

RI sites at MCB Camp Pendleton were not preassigned to OUs. Instead, the parties to the Federal Facility Agreement (FFA) assigned sites to groups based on potential impact to health and the environment. Those sites determined to pose the highest threat were addressed first (i.e., Group A sites first). A listing of the RI sites is provided in Section 2.0. Based on the results of the RI of Group A sites, no action was determined to be necessary for soil at Sites 9, 4, and 4A and for soil and groundwater at Site 24 to achieve protection of human health and the environment. Removal actions are under way, or in the planning stages, for Sites 3, 5, and 6.

Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond, is the only site specified for OU1, which is the final remedial action for Site 9. Both soil and groundwater media are included in OU1. Results of the Site 9 baseline risk assessment indicate that the soil does not pose an unacceptable risk or hazard under the current military land use scenario. However, if the land were to be used for a residential setting in the future, beryllium could pose a potential human health risk. A residential use scenario was

evaluated for Site 9 as a conservative measure for the HHRA, even though future residential use is unlikely based on the MCB Camp Pendleton Masterplan. The maximum soil concentration of beryllium (1.9 ppm) in one surface soil sample within the Site 9 impoundment exceeded the background beryllium concentration (0.69 ppm). Based on exposure to the maximum beryllium concentration for 30 years, the incremental lifetime cancer risk (ILCR) for the baseline future residential use scenario is $2x10^{-5}$, which is within the acceptable risk range. However, the average soil concentration of beryllium within the Site 9 impoundment and the ILCR associated with the average soil concentration in a residential lot at Site 9 should be no greater than that associated with the background beryllium concentration at Site 9. Therefore, the MCB Camp Pendleton risk managers determined that the no action alternative is appropriate for soil.

For groundwater, the low levels of PCE and TCE present in the groundwater do not pose a significant risk to human health using either the maximum or average concentrations of these chemicals and the current military use scenario in the risk calculations. Using the more stringent hypothetical residential land use scenario, the human health risks due to these chemicals in groundwater are within the acceptable risk range of 10^{-4} to 10^{-6}. Although these compounds do not pose a significant health risk under the current use scenario, both compounds were detected in individual groundwater samples at concentrations slightly exceeding State and Federal MCLs and, thus, a remedial action is required for Site 9 groundwater. Natural attenuation with long-term monitoring is the selected groundwater remedy for the site. In addition, institutional controls will be implemented to prohibit the use of groundwater beneath and downgradient from Site 9. Long-term monitoring of Site 9 groundwater will be conducted to verify that contaminant concentrations are decreasing. If contaminant concentrations do not decrease within the expected time frame, the Navy will reevaluate remedial action options.

The following are the major components of the selected remedy:

- Amendment of the Masterplan to restrict future access to the groundwater in the immediate vicinity of Site 9 for the duration of the long-term monitoring or until the contaminants in the groundwater no longer exceed MCLs. In the unlikely event that Site 9 is converted to residential use, considerable regrading and import of clean fill, as well as notification requirements to inform interested parties of remaining site contaminants (beryllium and TPH) and their concentrations, would be required.

- Groundwater will be sampled and analyzed semiannually for 10 years to verify that dispersion and natural attenuation are occurring.

- An evaluation will be performed once every 5 years to assess the effectiveness and document the progress of the alternative.

- Compliance demonstration monitoring consisting of eight sampling events, evenly spaced throughout a 1-year period, will be conducted during the eighth year of groundwater monitoring to assess the effectiveness of the dispersion and natural attenuation of the low concentrations of PCE and TCE in the groundwater.

The no action remedy was selected for soil at Sites 4 and 4A and soil and groundwater at Site 24.

1.5 Statutory Determinations for OU1

This remedy for OU1 uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment was found to be impracticable for the principal threats presented by the site, this remedy does not satisfy the statutory preference for treatment as a principal element.

Because this remedy for OU1 will result in hazardous substances remaining on site at concentrations exceeding State and Federal MCLs, a review will be conducted within 5 years of the start of the remedial action to ensure that the remedy is continuing to provide adequate protection of human health and the environment.

The selected remedy for OU1 is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective.

1.6 Declaration Statement for Site 24 Soil and Groundwater and Sites 9, 4, and 4A Soil

No unacceptable health risks are present in soils at Sites 4, 4A, and 9 or in soil and groundwater at Site 24, as calculated for the risk assessment using a residential exposure scenario. Therefore, no further action is necessary at these sites to ensure protection of human health or the environment. Consequently, 5-year periodic reviews are not required for these sites.

FOR THE UNITED STATES MARINE CORPS, MARINE CORPS BASE CAMP PENDLETON:

12/4/95

C.W. Reinke
Major General, U.S. Marine Corps
Commanding

Date

FOR THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

12/7/95

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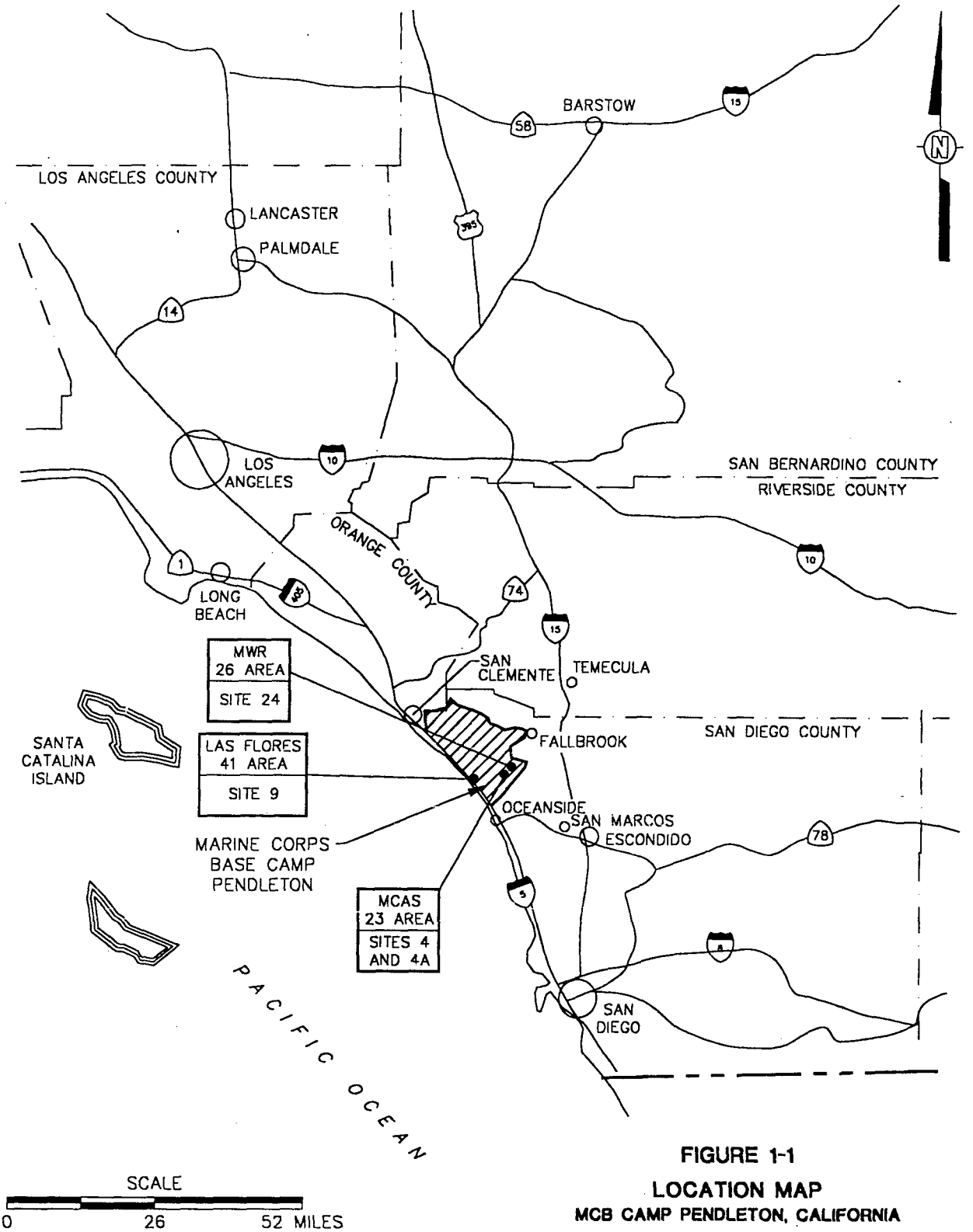

FIGURE 1-1

LOCATION MAP

MCB CAMP PENDLETON, CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT NO. N68711-89-D-9298

SOURCE:

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY, 1984, "INITIAL ASSESSMENT STUDY, MARINE CORPS BASE, CAMP PENDLETON, CALIFORNIA," NEESA 13-057, PREPARED BY SCS ENGINEERS, INC., SEPT.

IT INTERNATIONAL TECHNOLOGY CORPORATION

2.0 DECISION SUMMARY

2.1 Site Name, Location, and Description

MCB Camp Pendleton is the primary Marine Corps amphibious training center on the west coast. Located between the cities of Los Angeles and San Diego, California, MCB Camp Pendleton covers approximately 125,000 acres, almost entirely in San Diego County (Figure 1-1). Camp Talega, in the 64 Area near the northwestern border of the base, extends into Orange County. Surrounding communities include San Clemente to the northwest, Fallbrook to the east, and Oceanside to the south. The base is bordered to the west by the Pacific Ocean and encompasses 17 miles of coastal area; rolling hills and valleys stretch inland an average of 10 to 12 miles.

2.1.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

Site 9 is located within a designated maneuver area in the Las Flores 41 Area in the southwestern part of MCB Camp Pendleton (Figure 1-1). The site is southwest of Stuart Mesa Road and consists of an approximately 500- by 400-foot, engineered earthen impoundment (referred to as the waste stabilization pond) and adjacent areas, including a fenced grease disposal pit to the east of the waste stabilization pond (Figure 2-1). Mounds of dirt and dark stains are currently visible on the bottom of the waste stabilization pond. The land surrounding the site is covered with natural vegetation.

The 41 Area Stuart Mesa waste stabilization pond is located between two forks of a natural drainage arroyo on a relatively low-lying wave-cut terrace. An ephemeral stream trends north and east of the stabilization pond and drains southwestward toward the Pacific Ocean. Along the southeast edge of the main impoundment is a small low-lying area approximately 200 by 50 feet (Figure 2-1).

Site 9 is underlain by marine terrace deposits and is located outside the largest groundwater basin (Santa Margarita basin) on the base. The Santa Margarita basin provides the major source of drinking water consumed by MCB Camp Pendleton. Base water-supply wells (drinking water wells) are not currently located in the area hydrologically downgradient from Site 9. The site is located within 1/4 to 1/2 mile of Interstate 5 (hydrologically downgradient), which marks

the boundary of groundwater resources that are currently designated as having no beneficial uses according to the *Comprehensive Water Quality Control Plan for the San Diego Basin* (California State Water Resources Control Board [SWRCB], 1975).

2.1.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Impoundment

Site 4 is identified as the MCAS drainage ditch. The air station is located in the 23 Area of the base (Figure 1-1). In May 1990, Site 4 was expanded to include the concrete-lined surface impoundment, in response to the recommendation of the California Regional Water Quality Control Board (RWQCB). This impoundment is designated as Site 4A and is located between the MCAS drainage ditch and the MCAS, southwest of Building 2378.

The MCAS drainage ditch is located along Vandegrift Boulevard in the Chappo subbasin of the Santa Margarita basin. The ditch is approximately 5 feet deep, 20 feet wide, and is located between the MCAS flight-line operations and the former Atchison, Topeka, and Santa Fe (AT&SF) railway tracks.

2.1.3 Site 24 - 26 Area MWR Maintenance Facility

Site 24 is located within the floodplain of the Santa Margarita River. The MWR maintenance facility is situated on a flat area surrounded by low hills on three sides (Figure 1-1). The 26 Area is used primarily for warehouse and maintenance facilities.

2.2 Site History and Enforcement Activities

Construction of MCB Camp Pendleton started in March 1942, and the base was dedicated by President Franklin D. Roosevelt in September 1942. Although MCB Camp Pendleton has been an important training facility since its inception in 1942, it was not designated a permanent base until October 1944. The base currently supports more than 36,000 military personnel and employs approximately 4,600 civilians (Innis-Tennebaum Architects, Inc., 1990).

On 15 November 1989, MCB Camp Pendleton was added to the National Priorities List (NPL), primarily because an herbicide was detected in two base drinking water production wells. Site 9 is not located in the same basin as these production wells, and the herbicide has not been detected in these wells during subsequent monitoring events.

2.2.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

From 1963 to 1974 or 1975, the waste stabilization pond was operated as a sewage lagoon for oxidation and percolation of raw sewage generated in 41 Area. In 1975, a wet well and a lift station (Building 41300) were installed, and raw sewage was pumped into a treatment facility in 43 Area. The sewer line to the waste stabilization pond and the outfall pipe in the pond were left in place as an emergency backup system and reportedly have been used occasionally until very recently.

The waste stabilization pond, which contains water only briefly following heavy rainfall, has been used for stockpiling soils contaminated with petroleum hydrocarbons, primarily fuel and oil. A visual inspection of the area in 1988 indicated that waste oils and other liquids may have been placed at Site 9 in the past. The area immediately northeast of the waste stabilization pond has been used for disposal of wastes from mess hall grease traps, a practice that began after sewage treatment operations at Site 9 were discontinued.

Although MCB Camp Pendleton obtains its entire domestic and agricultural water supply from groundwater basins within its boundaries, no base water production (drinking water) wells are located within 1 mile of Site 9. No water production wells are located downgradient from Site 9, and the nearest upgradient water production wells are more than 1 mile to the northeast.

2.2.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment

The drainage ditch reportedly was used from the 1940s through the early 1980s for the disposal of liquid wastes generated by flight-line operations and also received contaminated runoff from spills and aircraft washing (Naval Energy and Environmental Support Activity [NEESA], 1984).

Hazardous substances reportedly placed in the drainage ditch include jet fuels, aviation gasoline (AvGas), kerosene, paints (including zinc chromate), paint strippers, toluene, methyl ethyl ketone (MEK), methyl isobutyl ketone, TCE, trichloroethane (TCA), nitrocellulose lacquers and thinners, aliphatic thinners, and isopropanol. An estimated 11,000 to 25,000 gallons reportedly was discharged in or adjacent to the ditch prior to 1982 (NEESA, 1984). Other liquid wastes, including oils, hydraulic fluids, battery electrolyte solutions, and aircraft washing wastewater, reportedly were also discharged into the ditch, but quantities of such materials could not be estimated. The on-site survey of the ditch conducted for the initial assessment study (IAS) revealed an oily sheen on the water at several locations and dead and discolored vegetation along the length of the ditch, possibly due to pest control measures (NEESA, 1984). No information is available on the quantities or specific types of wastes received by the Site 4A impoundment. Sites 4 and 4A were included in the RI of Group A sites conducted between February 1992 and April 1993. The results of the RI are presented in the draft final RI Report for Group A sites (Southwest Division Naval Facilities Engineering Command [SWDIV], 1993).

2.2.3 Site 24 - 26 Area MWR Maintenance Facility

The MWR maintenance facility provides maintenance services for approximately 200 buildings at MCB Camp Pendleton. Potential sources of contamination at this site are the welding shop, the paint shop, and a former hazardous waste storage area. Two base water production wells are located within 3/4 mile downgradient from Site 24.

Site 24 was not investigated during the IAS or the site inspection (SI). During a 1990 inspection, Environmental and Natural Resources Management Office (ENRMO) personnel collected surface soil samples in areas of visible soil contamination (ENRMO, 1990). Compounds detected in the soil samples included TPH, various heavy metals, benzene, and a number of semivolatile compounds. The site was included in the RI of Group A sites and the results are presented in the draft final RI report for Group A sites (SWDIV, 1993).

2.3 Highlights of Community Participation

The draft final FS report and the proposed plan for OU1, Site 9 - Stuart Mesa Waste Stabilization Pond, were released to the public in January 1995 (SWDIV, 1994a and 1994b). These two documents, as well as the draft final RI report for Group A sites (SWDIV, 1993), were made available to the public in the information repositories maintained at the base library and at the Oceanside Public Library. The public was also informed of the availability of these documents in the Administrative Record, which is maintained at the offices of the Assistant Chief of Staff, Environmental Security (AC/S, ES) at Camp Pendleton, as well as at the SWDIV offices in San Diego. The notice of availability for these two documents was published in the *Blade-Citizen* newspaper on 11 December 1994 and in the *South County News* on 29 December 1994. A public comment period was held from 12 December 1994 through 27 January 1995. In addition, a public meeting was held on 4 January 1995. Base, EPA, California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), San Diego RWQCB, and SWDIV representatives were available to answer questions about OU1 or the preferred alternative announced in the proposed plan. Neither base residents nor citizens of the neighboring communities attended the public meeting. A verbatim transcript of the public meeting is presented in Appendix A. In addition, no questions or comments were received from any source during the public comment period. Therefore, a responsiveness summary is not required and is not part of the Administrative Record. This ROD presents the selected remedial action for MCB Camp Pendleton OU1, Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision for this site is based on the Administrative Record.

The public was notified, via Fact Sheet No. 3 (March 1995), that soil at Sites 4 and 4A and soil and groundwater at Site 24 pose no threat to human health or the environment and that no action is contemplated at these sites. The proposed plan (SWDIV, 1995) for these sites was made available for public review from 10 June through 10 July 1995. A notice of availability of the proposed plan for public review was published in the *Blade-Citizen* newspaper on 8 June 1995, in the *Scout* (base) newspaper on 9 June 1995, and in the *San Clemente Sun Post* newspaper on 9 June 1995. A public meeting was held on 28 June 1995 to explain the proposed plan for Sites 4, 4A, and 24; answer questions; and receive comments. Only two interested persons, both base residents, attended this meeting. Neither person expressed any concerns regarding the proposed plan.

Therefore, a responsiveness summary is not required for these sites and is not part of the Administrative Record. A verbatim transcript of the 28 June 1995 public meeting is presented in Appendix A. The no action decision for soil at Sites 4 and 4A and for soil and groundwater at Site 24 is in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision for these sites is based on the Administrative Record.

2.4 Scope and Role of Operable Unit 1

As with many Superfund facilities, a large number of sites are to be investigated under CERCLA at MCB Camp Pendleton. Unlike most other Superfund facilities, RI/FS sites at Camp Pendleton were not preassigned to OUs. Instead, the parties to the FFA assigned sites to groups based on their potential impact to human health and the environment. Those sites that are determined to pose the highest threat are addressed first (e.g., Group A sites first). The sites are listed by group in Table 2-1. Based on the results of the RI of Group A sites, no action has been determined to be necessary for soil and groundwater at Sites 9 and 24 and for soil at Sites 4 and 4A to achieve protection of human health and the environment. Removal actions are under way or in the planning stages at Sites 3, 5, and 6. Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond, is the only site specified for OU1. Both the soil and groundwater media were addressed in the FS for OU1. The baseline risk assessment revealed that neither soil nor groundwater pose a threat to human health or the environment at the site. However, two chemicals, TCE and PCE, were detected in groundwater samples at concentrations exceeding Federal and State MCLs. The purpose of this response is to prevent current or future exposure to contaminated groundwater and to reduce concentrations of these chemicals in groundwater through dispersion and natural attenuation. This will be the final response action for Site 9.

2.5 Summary of Site Characteristics

This section provides an overview of the assessments conducted during the RI to characterize soil and groundwater at Sites 9 and 24 and soil at Sites 4 and 4A. The following information is presented:

- Suspected sources of contamination
- Quantities, types, and concentrations of hazardous substances
- Mobility, toxicity, and volume of contaminants

- Lateral and vertical extent of contamination
- Potential pathways for contaminant migration
- Current risks and potential routes of human and environmental exposure.

The suspected sources of contamination at each site are identified in Section 2.2. Summary tables presented in this section identify contaminants and associated concentrations (Tables 2-2 through 2-14). A general discussion of the factors that determine contaminant mobility is presented in Section 2.5.4, and the chemical parameters that affect environmental transport and persistence are listed for each contaminant in Table 2-15. The carcinogenicity of site contaminants is discussed in Section 2.6. The volume of contaminated soil at OU1 (Site 9) was determined during the FS. No attempt has been made to determine the volume of contamination at the other sites because they do not require remedial action. The lateral extent of contamination is depicted on the site maps, and the vertical extent of contamination is described in the text by noting the maximum depth at which contamination was detected.

Criteria Used for Generating Tables and Figures

Analytical data for each media at each site were summarized and compared against Federal and State standards (described in detail in the RI report), as appropriate. Tables 2-2 through 2-14 summarize contaminant concentrations, including background and maximum values, detected at each site. TPH, analyzed by modified EPA Method 8015, is reported as diesel or gasoline, depending on the calibration standard used. These concentrations are listed at the end of each table, as applicable.

2.5.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

This section presents brief summaries of analytical results from soil sampling, three quarters of groundwater sampling, and one quarter of surface-water sampling at Site 9.

2.5.1.1 Soils and Vadose Zone

Ranges of organic and metal concentrations detected in Site 9 soil samples (validated analytical results) are presented in Tables 2-4 and 2-5, respectively, along with preliminary remediation goals (PRGs) and background soil values, as appropriate. Soil samples were collected from 19 borings to characterize Site 9. Figure 2-1 shows soil sample locations, a summary of analytical results, and the

geologic cross-section location. Figure 2-2 presents a geologic cross-section showing the approximate vertical extent of soil contamination at Site 9. Analytical results are briefly summarized and evaluated below:

- The highest concentrations of TPH were detected at the north end of the former effluent lagoon. A TPH concentration of 6,700 milligrams per kilogram (mg/kg) was detected in soil boring 9B-17 at approximately 6 feet below surface. Below 6 feet, TPH concentrations were very low or nondetect.

- TPH was generally detected in shallow soils. The borings within the contour line shown in Figure 2-1 exhibit elevated concentrations of TPH at the surface. In addition, these borings exhibit concentrations of beryllium exceeding the PRG.

- Beryllium is a naturally occurring background metal in soil (Tables 2-2 and 2-3). A site-specific statistical evaluation was performed for beryllium concentrations in the soil at Site 9. Statistical results indicate that a beryllium concentration of 0.69 mg/kg (or less) is the 95 percent upper confidence limit (UCL) of the background distribution. Only one sample collected from 0 to 5 feet below ground surface (maximum depth for ecological risk assessment or HHRA) exceeded the 95 percent UCL of the background distribution for beryllium at Site 9: a sample collected at 1 foot below ground surface in boring 9B-14 with a beryllium concentration of 1.9 mg/kg.

2.5.1.2 Groundwater

Validated groundwater analytical results are summarized in Table 2-6 and illustrated in Figure 2-3. Groundwater analytical results for Site 9 are summarized as follows:

- PCE concentrations of 6.0, 10, and 4.0 micrograms per liter (µg/l) were detected in well 9W-07A during the first, second, and third rounds of groundwater sampling, respectively. The MCL for PCE is 5.0 µg/l. Well 9W-07A is the shallow well of a three-well cluster and is screened from 29 to 39 feet below grade.

- 1,2-Dichloroethane (1,2-DCA) was detected at a concentration of 2.0 µg/l in well MW-05 during the first round of groundwater sampling. The MCL for 1,2-DCA is 0.5 µg/l. Well MW-05 was dry during fourth quarter 1992 sampling (second round) and could not be accessed for sampling during the third round because of flooding. 1,2-DCA was not detected during the second quarter 1993 sampling. Figure 2-3 includes second quarter 1993 (Phase 2 RI) analytical results for this well and other wells in which MCLs were exceeded during at least one quarter of sampling and for which samples could not be collected during the three previous quarters.

- TCE concentrations of 11 and 15 µg/l were detected in well MW-04D during the first and second rounds of groundwater sampling, respectively. The MCL for TCE is 5.0 µg/l. Well MW-04D was not sampled during the third round of groundwater sampling because of flooding. TCE was detected at a concentration of 5.0 µg/l during second quarter 1993 sampling. Well MW-04D was installed during the previous SI and is screened from approximately 16 to 31 feet below grade.

- Antimony and nickel exceeded MCLs in upgradient and downgradient wells. Statistical evaluations (SWDIV, 1993) indicate that these concentrations are representative of background.

- Mercury was detected in wells 9W-07A and 9W-07B during third quarter 1992 sampling but was not detected in several subsequent sampling events (fourth quarter 1992 and first and second quarters 1993) and, thus, appears to be related to field or laboratory contamination. Consequently, mercury is not included in Figure 2-3.

- TPH (analyzed using EPA Method m8015 with a diesel standard) was detected at a maximum concentration of 470 µg/l in well 9W-07A during third quarter 1992 sampling. TPH was not detected in this well during subsequent rounds of sampling. An MCL has not been established for TPH and, thus, TPH is not plotted in Figure 2-3.

Groundwater analytical data indicate that an area of volatile organic contamination (TCE, PCE, and 1,2-DCA) is present downgradient from the former effluent lagoon at Site 9. This area is shown by a contour line in Figure 2-3. No contaminants were detected in the wells upgradient from the former effluent lagoon.

2.5.1.3 Surface Water and Sediments

Following January 1993 flooding, two surface-water samples were collected from the impoundment to supplement the ecological risk assessment. Contract Laboratory Program (CLP) metals analyses of these samples yielded the following maximum metals concentrations:

- Aluminum - 355 milligrams per liter (mg/l)
- Arsenic - 1.4B µg/l
- Barium - 28.2BE µg/l
- Copper - 25 µg/l
- Iron - 758 µg/l
- Manganese - 53.4 µg/l
- Nickel - 8.1B µg/l
- Vanadium - 3.0B µg/l
- Zinc - 9.2B µg/l.

These validated analytical results are compared with standards in Table 2-7. Antimony, beryllium, cadmium, cyanide, cobalt, chromium, mercury, selenium, and thallium were not detected in the surface-water samples.

2.5.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment

This section presents brief summaries of analytical results from soil and sediment sampling, surface-water sampling, and an evaluation of biota at Sites 4 and 4A.

Soil samples were collected from surface sediments (Site 4), hand-auger borings (Site 4), and angle borings (Site 4A). Ranges of organic and metal concentrations detected in Site 4 soil samples are listed in Tables 2-8 and 2-9, respectively, along with risk-based PRGs (r-PRGs) and background soil values, as appropriate. No contaminants were detected at concentrations exceeding r-PRGs in the soil samples collected at Sites 4 and 4A. Consequently, no map showing soil contamination was prepared. Figure 2-4 is a boring location map. Soil analytical data are presented in Appendices X and Z of the draft final RI report for Group A sites (SWDIV, 1993).

Surface-water samples collected from the MCAS drainage ditch showed generally low concentrations of potential contaminants. Validated surface-water analytical results are summarized in Table 2-10. Analyte concentrations were below State and Federal surface-water standards (SWRCB, 1992; EPA, 1992a).

Filamentous algae were collected from the Santa Margarita River as part of the second round of bioassay sampling in June/July 1993. Locations 6BADSM1 and 6BADSM2 are representative of downstream and upstream locations, respectively, from the entry of the combined drainage from Sites 4 and 6. As such, results from these sampling locations were used to evaluate possible contamination from the Site 4 drainage ditch. Location 6BADSM2 is approximately 100 feet upstream from the combined Site 4 and Site 6 drainage, and location 6BADSM1 is approximately 100 feet downstream. Aquatic sediment bioassay results for these locations are presented in Appendix U of the draft final RI report for Group A sites (SWDIV, 1993). Biota collected at the time of sampling was limited to filamentous algae. Analytical results for the field-

collected algae samples are presented in Table 2-11. Concentrations at these locations do not represent toxic levels of metals.

2.5.3 Site 24 - 26 Area MWR Maintenance Facility

This section presents brief summaries of analytical results from soil sampling and three rounds of groundwater sampling at Site 24.

2.5.3.1 Soils and Vadose Zone

Ranges of organic and metal concentrations detected in Site 24 soil samples are presented in Tables 2-12 and 2-13, respectively, along with r-PRGs and background soil values, as appropriate. Only two isolated soil samples at Site 24 contained constituent concentrations exceeding r-PRGs or a TPH concentration of 100 mg/kg, as shown in Figure 2-5. Soil analytical results are summarized below (EPA data qualifiers are explained in the tables):

- A gamma-BHC (Lindane) concentration of 3.0 micrograms per kilogram (µg/kg) and alpha- and gamma-chlordane concentrations of 6.7 and 3.6 µg/kg, respectively, were detected at a depth of 6 feet and an anomalous pyrene concentration of 44 µg/kg was detected at a depth of 20 feet in boring 24B-1, near the drum storage area. These concentrations are below the associated r-PRGs. No other constituents were detected in the three borings sampled around this location.

- Aroclor-1254, a polychlorinated biphenyl (PCB), was detected at a concentration of 480 µg/kg in the surface sample from boring 24B-4, adjacent to the paint shop. This concentration is below State and Federal cleanup levels. No PCBs were detected in seven deeper samples to a depth of 30 feet below surface at this boring.

- Maximum alpha- and gamma-chlordane concentrations of 7.5JX and 4.3JX µg/kg were detected at a depth of 1.5 feet in boring 24B-6, adjacent to the welding shop. These concentrations are below the r-PRGs. Chrysene and fluoranthene were also detected at concentrations below the r-PRGs in this sample but were not detected in deeper samples. No contaminants were detected in the deepest sample from this boring, at 15.8 feet. A lead concentration of 295N mg/kg in the surface sample from boring 24B-5 was the maximum for the site and is well below lead model action levels (Section 2.6).

- Maximum site concentrations of the following compounds were detected in boring 24B-8, located in a ditch into which two spills of heating fuel and hydraulic oil reportedly drained in 1990: 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'-dichlorodiphenyldichloroethene (4,4'-DDE),

4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), bis(2-ethylhexyl)-phthalate, fluoranthene, and pyrene. The maximum TPH concentration at this site was also detected in this boring.

- Beryllium was detected in borings throughout the site at concentrations exceeding the r-PRG but poses a cumulative ILCR of less than 10^{-6}.

- Metals concentrations reported for a sample collected from granitic bedrock at a depth of 24.8 feet in boring 24B-3 are 1.5 to 3.0 times those typically found in background samples collected from the alluvium. Observed concentrations in soils are consistent with the expected range of background concentrations for the metals of concern. The sample with the highest beryllium concentration (collected at 24.8 feet below surface in boring 24B-3) is a background sample.

Only minimal soil contamination was detected at known contaminant sources throughout Site 24, as shown in Figure 2-6. Soil constituents at Site 24 do not pose an unacceptable threat to human health or the environment (Section 2.6).

2.5.3.2 Groundwater

Groundwater analytical results are summarized in Table 2-14. Complete analytical data are presented in Appendix Y of the draft final RI report for Group A sites (SWDIV, 1993). Well locations are shown in Figure 2-5.

Potential groundwater contaminants at Site 24 do not pose an unacceptable threat to human health or the environment. Except for a one-time concentration of chromium, which is considered suspect, antimony, nickel, and selenium are the only compounds detected at Site 24 at concentrations exceeding MCLs.

Groundwater metals concentrations exceeding MCLs may be due to the influence of shallow granitic bedrock beneath the site or other sources (SWDIV, 1993). These metals are not considered site-related given the operational history of Site 24; the mobility of antimony, nickel, and selenium in the soil; and the results of the RI. In addition, nickel, antimony, and selenium exceed MCLs in upgradient and downgradient wells throughout the base; results of statistical evaluations of wells throughout the base show that the upgradient and downgradient populations of these metals are not significantly different at the 95 percent confidence limit; and several potential sources have been identified for these metals. The absence of other compounds at this site indicates that

antimony, nickel, and selenium concentrations are not related to the site and that groundwater has not been impacted by the site.

2.5.4 Contaminant Fate and Transport

The fate and transport of chemicals of concern (COCs) at MCB Camp Pendleton sites are important factors for risk assessment. The potential routes of migration in the environment and pathways of human exposure are determined by the physical and chemical properties of the chemicals released. These considerations are discussed in greater detail in Section 5.0 of the draft final RI Report for Group A sites (SWDIV, 1993). Table 2-15 lists pertinent chemical and physical parameters of chemicals detected at sites included in this ROD. This information is provided for reference for the site-specific discussions.

Several of the physiochemical properties commonly used to assess the mobility of a contaminant are listed in Table 2-15 for the contaminants detected in soils at Sites 4, 4A, 9, and 24. The Henry's law constant describes the partition of a chemical between water and air. Compounds that are highly soluble in water are more likely to be degraded by hydrolysis than by some other mechanism. Compounds with low water solubility (high Henry's law constant) are less likely to adsorb to soils and are more likely to evaporate and be dispersed in air. A Henry's law constant less than $1x10^{-7}$ cubic meters (atmosphere) per mole (atm-m^3/mol), the Henry's law constant for water, indicates that the compound is less volatile than water and will concentrate in water as it evaporates. Volatilization becomes an increasingly important migration mechanism for compounds with Henry's law constants less than $1x10^{-5}$ atm-m^3/mol. Compounds with intermediate values can be expected to volatilize slowly. Metals and other ions do not volatilize in the environment.

The octanol/water partition coefficient (K_{ow}) is defined as the ratio of a chemical's concentration in the octanol phase to its concentration in the aqueous phase of a two-phase octanol/water system. Values of K_{ow} for organic chemicals have been measured as low as 10^{-3} and as high as 10^{7}. For this reason, the log values of K_{ow} are frequently used. The values of K_{ow} represent the tendency of a chemical to partition between the organic phase and an aqueous phase. Chemicals with low values of log K_{ow} (<2) are considered relatively hydrophilic: they tend to

have high water solubilities, small soil/sediment adsorption coefficients, and small bioconcentration factors for aquatic life. Conversely, chemicals with values of log K_{ow} >2 to 4 are hydrophobic: they tend to have greater bioconcentration, more strongly adsorb to soil, and do not readily leach to groundwater. The partition of organic chemicals between water and soils is described by the soil partition (adsorption) coefficient, K_{oc}. As with K_{ow}, larger K_{oc} values (log K_{oc} >2 to 4) indicate greater bioconcentration and adsorption to soil and less leaching into water.

The distribution (or adsorption) coefficient (K_d) is the ratio of dissolved chemicals between water and the sorptive surfaces of soil. The ratio is the concentration in soil divided by the concentration dissolved in water. The effect of the adsorption to soil is retardation of these chemicals in relation to normal groundwater flow. This retardation is contingent on the minerals along the groundwater pathway and the chemistry of the groundwater. The greater the K_d, the greater the absorption or retardation.

The solubility column in Table 2-15 refers to the ability of a chemical to dissolve in water. Solubility is an important factor in the transport of chemicals in the environment. Chemicals that have high solubility dissolve easier in water and are less likely to adsorb onto soil or to evaporate. The higher solubility of a chemical could also increase its ability to leach into groundwater.

The half-life of a chemical is defined as the expected time for the concentration of the chemical to decrease by one-half when present in water or soil. Half-life ranges (high and low) for chemicals in surface water and soil are presented in days. Chemicals with longer half-lives are more persistent in environmental media.

2.5.4.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

The primary contaminants at Site 9 are beryllium in soil and TCE and PCE in groundwater. As a conservative assumption, contaminant concentrations in current and future land use scenarios are assumed to be the same.

Beryllium is the sole contributor to risk in soil above the target risk criterion of 10^{-6}. Although beryllium is present in both soil and groundwater, but statistical testing for background chemicals eliminated beryllium for groundwater. Because beryllium is found in both media, transport effects are assessed as being adequately described by the sampling data. Leachability testing was performed on soil samples collected in the areas of highest beryllium concentrations. The results indicate that beryllium is not leaching to groundwater. TCE and PCE were not detected in the soil but are present in groundwater at Site 9. Modeling of the Site 9 groundwater showed that dispersion and natural attenuation should reduce the levels of TCE and PCE below MCLs within 10 years.

2.5.4.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment

Although the results of the risk assessment indicated that soils at Sites 4 and 4A present no significant risks, a brief discussion of the fate and transport of the primary compounds detected at these sites is provided for information purposes.

The primary compounds detected at Sites 4 and 4A are organochlorine pesticides, including 4,4'-DDT and its degradation products. High log K_{ow} values (>3) indicate that these compounds are not likely to migrate in the soil. As a conservative measure for future land use scenarios, the concentrations in surface soil and the vadose zone are assumed to remain the same.

The primary contributors to risk at Sites 4 and 4A are 4,4'-DDT (log K_{ow} 6.19) and dieldrin (log K_{ow} 4.09) (Howard, 1991). Chemicals with log K_{ow} values above 3.0 are expected to have retarded movement in soil; as such, degradation processes should be predominant and impact on groundwater should not be significant. This is confirmed by groundwater monitoring results (i.e., pesticides were not detected in monitoring wells at Sites 4 and 4A).

2.5.4.3 Site 24 - 26 Area MWR Maintenance Facility

Although the results of the risk assessment indicated that soil and groundwater at Site 24 present no significant risks, a brief discussion of the fate and transport of the primary compounds detected at this site is provided for information purposes.

Primary contributors to risk in soil at Site 24 are as follows:

Chemical	log K_{ow}
bis(2-Ethylhexyl)phthalate	5.3
4-4'-DDE	5.69
4-4'-DDT	6.19
N-Nitrosodiphenylamine	2.79

Chemicals with log K_{ow} values above 3.0 are expected to have retarded movement in soil; as such, degradation processes should be predominant and impact on groundwater should not be significant. The greatest risk contributed by a single COC is $2x10^{-8}$ for 4,4'-DDT in soil.

With a log K_{ow} value of 2.79, N-nitrosodiphenylamine will have more tendency to move in soil than bis(2-ethylhexyl)phthalate, 4,4'-DDE, or 4,4'-DDT, but it still is not very mobile. It has an estimated half-life of 34 days in soil (Howard et al., 1991). N-Nitrosodiphenylamine was not detected in groundwater samples during the RI. Travel through the vadose zone of Site 24 to groundwater should require at least several half-lives and, therefore, the impact from N-nitrosodiphenylamine should be much less than the target risk criteria. The maximum cancer risk from this compound at the concentrations detected in site surface soil is $4x10^{-9}$.

Building 2662, the MWR maintenance facility, was built in 1944 and has been used for maintenance throughout its history. However, neither VOCs typically associated with maintenance facilities nor pesticides present in the soil were detected in groundwater samples during the RI. Numerical modeling was considered unnecessary because contamination was not detected in groundwater and is limited to the near-surface soil.

2.6 Summary of Site Risks

Baseline human health and ecological risk assessments for the Group A sites were conducted using data collected during the RI. All RI data have been validated and the quality is acceptable to support the recommendation of this ROD. The human health and ecological risk assessments are provided in their entirety in Sections 6.0 and 7.0,

respectively, of the draft final RI report for Group A sites (SWDIV, 1993). This summary addresses Group A Sites 9, 4, 4A, and 24.

2.6.1 Human Health Risks

The HHRA was conducted in accordance with the requirements of the NCP (EPA, 1990). The overall objective of the HHRA is to provide a conservative estimate of the ILCR and the potential noncarcinogenic health impact (hazard index [HI]) from chemical contaminants. Contaminants were evaluated for potential impact on human health for the no action alternative, which consists of the current site disposition with no remediation. The assessment was augmented with additional scenarios for future land uses.

The quantitative results were compared to target risk criteria. A reasonable maximum exposure (RME) ILCR of 10^{-6} is considered the "point of departure" above which risk management should be considered, according to 40 CFR 300.430(e)(2)(i)(A)(2). An ILCR above 10^{-4} generally requires remediation to achieve acceptable concentration goals representing risks below the point of departure of 10^{-6}. An HI greater than the target criterion of 1.0 is to be addressed by the risk managers and may require remediation.

Contaminant Identification

The environmental sampling data were collected according to knowledge-based, purposive sampling decision logic, with additional samples to provide data on areas of high, medium, and low contamination. The extent of contamination for each of the sites was based on the analyte concentration within a boring exceeding a risk-based criterion concentration referenced to either 10^{-6} ILCR or 1.0 HI. Background was determined empirically from the RI sampling and analytical data for geologically consistent areas (i.e., marine terrace for Site 9). The Student's t-test was used for soil and the analysis of variance (ANOVA) statistical procedure was used for groundwater to eliminate detected chemicals representing background.

Exposure Assessment

Exposure scenarios were developed based on current military land use and future military, residential, and commercial/industrial land uses. The RME

receptor was assumed to be located on the site for all exposure scenarios. Pathways related to surface soil were evaluated and summed in all cases. Vadose zone contaminants were evaluated for their potential to migrate in the soil. As expected, those with log K_{ow} values greater than 3.0 were generally not detected in groundwater, whereas those with log K_{ow} values below 3.0 were detected in both the vadose zone and groundwater. Fugitive dust was ruled out because of ground cover. Surface-water and sediment pathways may affect biota but do not present complete pathways for the HHRA at Sites 9, 4, 4A, and 24.

Toxicity Assessment

Toxicity values for the chemicals of potential concern (COPCs) were compiled from the Integrated Risk Information System (IRIS) (PA, 1992b), health effects assessment summary tables (HEAST) (EPA, 1992c), a Cal/EPA memorandum on criteria for carcinogens (Cal/EPA, 1992a), and the Superfund Health Risk Technical Support Center (EPA, 1994). Cross-route extrapolation was incorporated into the risk evaluations. If only oral toxicity values were available, they were used as inhalation toxicity values as well. Data gaps in toxicity values were identified in the uncertainty evaluation of the risk assessment.

Cancer slope factors (SFs) have been developed by the EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. SF values are multiplied by the estimated intake of a potential carcinogen to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The estimated intake is expressed in milligrams per kilograms per day (mg/kg-day), and SF values are expressed in $(mg/kg\text{-}day)^{-1}$. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Using this approach makes underestimation of the actual cancer risk highly unlikely. Cancer SF values are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by the EPA to indicate the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfD values (in mg/kg-day) are estimates of lifetime

daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfD values do not underestimate the potential for adverse noncarcinogenic effects.

Risk Characterization

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer SF. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1E-06). An excess lifetime cancer risk of $1x10^{-6}$ 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 the site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the RfD of the contaminant). The HI is calculated by adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed. The HI provides a useful reference point for gaging the potential significance within a single medium or across media.

Lead was evaluated separately using both the Federal (EPA, 1991) and State (Cal/EPA, 1992b) lead models. Evaluation of maximum soil concentrations and groundwater concentrations for lead using the Federal and DTSC blood lead models (SWDIV, 1993, Appendix S) indicated blood lead levels of less than 10 micrograms per deciliter (µg/dl) for 95 percent of children using the Federal model and for 99 percent of children using the State model, age range 0 to 6 years. This meets the target criteria for health protection specified by the EPA (1991).

Uncertainty

Uncertainty in risk characterization combines the uncertainties of both the toxicity assessment and the exposure assessment. The numerical uncertainty of the risk assessment may be as much as one order of magnitude (EPA, 1989b, p. 8-17). Contributors to the uncertainty of the risk assessment include the following:

- Toxicity value availability
- Future land use uncertainty
- Data evaluation involving laboratory contamination
- Summing of cancer risks (EPA, 1993)
- Use of absorption factors rather than chemical-specific values.

A more detailed uncertainty discussion is presented in Section 6.6.2 of the draft final RI report for Group A sites (SWDIV, 1993).

The results of the baseline HHRA for soil at Sites 9, 4, and 4A and soil and groundwater at Site 24 are summarized in the following sections. The complete baseline HHRA for Group A sites is presented in Section 6.0 of the draft final RI report for Group A sites (SWDIV, 1993).

2.6.1.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

Several additional rounds of groundwater sampling have been conducted since the completion of the baseline HHRA at Site 9. Groundwater data for this site have since been reevaluated and the results are as presented in the draft final FS for Site 9 (SWDIV, 1994a).

Subsequent to the completion of the baseline HHRA, additional groundwater monitoring wells (Phase 2 RI) were installed at Site 9 and four additional quarters of groundwater data were collected from all Site 9 wells (Phases 1 and 2). Groundwater data collected through the end of 1993 (five quarters) were reevaluated using ANOVA to assess the concentrations of arsenic in upgradient and downgradient wells to determine whether arsenic concentrations represent background rather than site-related contamination. The results showed that no significant difference exists between the upgradient and downgradient groups of data and that arsenic concentrations are not site related. The statistical calculations are provided in Appendix G of the draft final FS report (SWDIV,

1994a). The HHRA summary presented herein has been revised to reflect this information.

The COCs for soil and groundwater at Site 9 identified as a result of the HHRA are listed in Table 2-16, along with COC concentration ranges, frequency of detection, soil background data, MCLs, and representative concentrations.

Groundwater at Site 9 is not used for drinking water. No production (drinking water) wells are located downgradient from Site 9 and no plans have been made to install new production wells in this area. However, as a conservative measure, groundwater risks were summed with soil-related pathways for future land use because groundwater use is hypothesized for future scenarios.

Site 9 was initially evaluated in a screening risk assessment using maximum detected concentrations and a residential exposure scenario. The screening was conservative because default parameters were used for the pathway-specific critical receptor. Site 9 did not meet the target criteria in this screening and was evaluated further. Instead of maximum concentrations, representative concentrations of the COPCs were used (SWDIV, 1993, Table 6-3). These concentrations were assumed to remain the same over time. For current land use, the military exposure scenario was used based on a 25-year civil servant and a 3-year military person. For future land use, options were evaluated for military (same as current land use), residential, and commercial/industrial development. The most likely receptor was used for each case: adult and child for residential, and adult for commercial/industrial and military scenarios.

The baseline HHRA for Group A sites (SWDIV, 1993) presented arsenic as the main contributor to groundwater cancer risk and chronic health impact. After additional monitoring wells were installed and additional rounds of data were statistically evaluated, arsenic was shown to be within background. The other contributors to the groundwater cancer risk identified in the RI report were TCE, PCE, and chloroform. No other significant site-related groundwater contributors to chronic health impact were identified.

Beryllium was identified as the sole site-related contributor to the cancer risk for soil. No significant soil contributors to chronic health impact were identified for

the current military scenario. The chronic health impact for the future residential scenario resulted in an HI of 1.2. However, the main contributors target different organs, and the HI was below 1.0 for any one target organ.

The carcinogenic (cancer) risk and noncarcinogenic (chronic health impact) hazard for the main site-related contributors are summarized in Table 2-17. The RME concentration was used to calculate the risk for the current military civil servant scenario and the future residential scenario. The risk due to chloroform using RME concentrations was not significant; thus, the two remaining contributors were TCE and PCE. The sum of the cancer risk for groundwater and soil pathways resulted in $2x10^{-6}$ (2 in 1 million) for the military scenario and $2x10^{-5}$ (2 in 100,000) for the residential scenario. Beryllium exceeded soil background in only one sample (1.9 mg/kg detected; 0.69 mg/kg background) and was the main contributor to the summed site risk for the current military scenario. Site 9 is unlikely to be developed as a residential area according to the base Masterplan (Innis-Tennebaum Architects, Inc., 1990).

2.6.1.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment

Risk characterizations using maximum detected concentrations and RME scenarios for soil at Group A Sites 4 and 4A are summarized in this section. A conservative estimate of potential risk to human receptors due to COCs was calculated for soil. The risk characterization is based on a hypothetical residential exposure scenario and evaluated potential risks for critical human receptors.

No site-related carcinogens were identified at Site 4. The maximum concentration risk characterization for Site 4 resulted in an estimated HI of less than 0.1. For Site 4A, the estimated site-related ILCR values are $5x10^{-8}$ for exposure to surface soil via incidental ingestion and $2x10^{-7}$ for exposure via dermal absorption. The sum of both values is less than the target risk of 10^{-6}. The estimated HI for both exposure routes is less than 0.1.

The risk characterization using maximum concentrations indicated no potential cancer risk or adverse health impact exceeding target criteria for critical receptors

exposed to surface soil at the point of contamination via either direct ingestion or dermal absorption. Because there is no adverse health impact above target criteria based on the primary exposure pathways for residential receptors (the most conservative scenario), adverse impact above target criteria is not expected for either current or future human receptors.

2.6.1.3 Site 24 - 26 Area MWR Maintenance Facility

Risk characterizations using maximum detected concentrations and RME scenarios for Group A Site 24 are summarized in this section. A conservative estimate of potential risk to human receptors due to COCs was calculated for each media involved in a potentially complete exposure pathway. The risk characterizations were based on a hypothetical residential exposure scenario and evaluated potential risks for critical human receptors.

The maximum concentration risk characterization for Site 24 resulted in estimated site-related ILCR values of $6x10^{-8}$ for exposure to surface soil via incidental ingestion and $2x10^{-7}$ for exposure to surface soil via dermal absorption. No site-related carcinogens were identified for groundwater. All of the estimated site-related ILCR values are below the target level of 10^{-6}.

The HI for exposure to surface soil via both exposure routes was less than 0.1. The HI for exposure to groundwater was estimated to be 0.1, well below the target criterion of 1.0.

The risk characterization using maximum concentrations indicated that COCs in surface soil or groundwater pose no potential cancer risk or adverse health impact exceeding target criteria for the critical receptors. Although TPH was detected in soil, the toxic volatiles and semivolatiles usually associated with TPH were not. Because TPH was detected at low concentrations in soil and was not detected on a consistent basis in groundwater, adverse human health impact is not expected.

2.6.2 Environmental Risks

The results of the baseline ecological risk assessment for soil at Sites 9, 4, and 4A and soil and groundwater at Site 24 are summarized in the following sections. The complete baseline ecological risk assessment for Group A sites is presented in Section 7.0 of the draft final RI report for Group A sites (SWDIV, 1993).

2.6.2.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

Site 9 is surrounded by a large berm that generally prevents storm-water runoff except during prolonged periods of very heavy rainfall. Wind erosion is minimized because vegetation covers most of the site. Groundwater underlying this site does not discharge to surface water. Therefore, chemicals that leach into groundwater are effectively removed or isolated from environmental receptors.

Environmental receptors may be exposed to organic chemicals in soils via dermal contact or ingestion of soil. Exposure to chemicals in surface waters may result from ingestion of the water.

Results of the site characterization indicated adequate habitat within Site 9 for terrestrial plants, terrestrial animals (including raptors and various mammals), and soil invertebrates. The aquatic habitat in the area is minimal. No aquatic life was observed during the site characterization.

Inhalation exposure to the chemicals detected in Site 9 soils may be minimal because many of the chemicals are not volatile. Dermal absorption and toxicity were not addressed for this assessment.

Although some native plants are present, Site 9 contains few or no sensitive plant communities. Least Bell's vireo was the only special-status vertebrate species observed at Site 9 during surveys in August and September 1992.

Chemicals for which maximum concentrations at Site 9 exceed background and/or potential adverse effect levels are barium, cadmium, copper, lead, mercury, vanadium, zinc, and TPH-diesel. Results of toxicity and

bioaccumulation testing of plants and earthworms from the bioassays indicate potential toxic effects to animals and plants from surface soils (SWDIV, 1993). However, the minimal toxicity observed at the site cannot be ascribed to any particular contaminant on the basis of the test results.

Uncertainties and limitations are associated with the use of literature toxicity information, calculated and laboratory criteria rather than site-specific conditions, and other assumptions listed in Section 7.0 of the draft final RI report for Group A sites (SWDIV, 1993).

2.6.2.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment

Aquatic sediment toxicity testing indicates no apparent risk from contaminated sediment. Downstream sediments in the Santa Margarita River and sediments with metals concentrations similar to the Site 4 drainage were not toxic to aquatic plants and animals (SWDIV, 1993).

Based on the analyses of toxicity to aquatic and terrestrial organisms, concentrations of chemicals in soil, sediment, and surface water do not pose ecological risks to terrestrial or aquatic organisms. No special-status species were found on Sites 4 or 4A during surveys in August and September 1992.

Effects are not likely to occur given the conservative assumptions used in this assessment, lack of observable effects on plants in the field, and low probability of effects related to metals in the bioassays (with Site 3 soils and Site 6 soils and river sediments). In addition, none of the compounds detected in surface water exceed Federal or State standards. The concentrations of aluminum, barium, iron, and manganese in surface water exceed literature toxic effect levels and may be high enough to cause adverse effects to aquatic organisms. Available information from the literature and the results of the bioassays (particularly for the Santa Margarita River) do not indicate a need for remediation at Site 4 to protect ecological receptors.

2.6.2.3 Site 24 - 26 Area MWR Maintenance Facility

Semivolatile and volatile chemicals, as well as several chlorinated compounds, were detected in Site 24 soils. Copper, lead, and zinc were detected in Site 24 soil at levels that may cause effects in some sensitive plants or invertebrates. Although the bioaccumulative potential for the semivolatile and volatile chemicals may be low, chlorinated chemicals may potentially remain within the food chain at Site 24. Subsequent risk to higher trophic organisms may occur because of the presence of these chemicals. However, no effects on plants were observed in the small areas where these elevated concentrations occurred, and the disturbance caused by remediation would probably exceed the effects due to these elevated chemical concentrations. Thus, remediation is not suggested.

The only special-status vertebrate species observed on Site 24 was the orange-throated whiptail. However, the greater mastiff bat may also occur in the area. Up to 20 mammal, 20 to 25 bird, and 6 amphibian and reptile species probably are present in the site vicinity. Wildlife receptors are somewhat limited on the site proper owing to the general lack of favorable habitat.

2.6.3 Conclusions

The conclusions of the baseline risk assessments for soil at Sites 9, 4, and 4A and soil and groundwater at Site 24 are summarized in the following sections.

2.6.3.1 Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond

Site 9 is heavily vegetated, but is not located in an ecologically sensitive area. In addition, no endangered species inhabit the site. Consequently, at a 17 December 1993 meeting, Navy and MCB Camp Pendleton management, in consultation with the parties to the FFA, recommended that any remedial action at Site 9 be implemented to meet the human health (residential scenario) criteria of 10^{-6} ILCR rather than ecological goals (SWDIV, 1994c).

Beryllium concentrations detected in soil and PCE and TCE concentrations detected in groundwater do not pose an unacceptable risk under the current military scenario. Under a hypothetical future residential scenario beryllium in the

soil poses a cancer risk of $2x10^{-5}$, which is within the acceptable risk range. No other chemicals of concern exceed the point of departure for cancer risk of 10^{-6}. The noncancer HI is less than the acceptable 1.0 level for the current military scenario. Site 9 contaminants could pose a cummulative hazard under a hypothetical future residential scenario above 1.0, but the main contributors target different orgrans and the HI was below 1.0 for any one target organ. The cancer risk due to soil and groundwater contaminant at Site 9 is within the generally acceptable risk management range of 10^{-4} to 10^{-6} (40 CFR 300.430[e][2][i][A][2]). Therefore, no active remediation is required. However, because PCE and TCE have been detected in groundwater at concentrations exceeding MCLs, institutional controls and groundwater monitoring were selected as the remedial alternative (natural attenuation) for organic contaminants in groundwater. Contaminants in groundwater may exceed MCLs, which are based on risk values, but not present an unacceptable risk because mean and upper concentrations rather than maximum concentrations are used in risk calculations and MCLs are usually based on the lower end of the acceptable risk range (i.e., 10^{-6}).

Actual or threatened release of hazardous substances from this site, if not addressed by implementation of the response action selected in this ROD, may present an imminent and substantial danger to public health, welfare, and the environment.

2.6.3.2 Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment

The cancer risk for Sites 4 and 4A soil was below the NCP point of departure of 10^{-6}. The noncarcinogen health HI was less than the acceptable 1.0 level. The risk/hazard estimates were made using maximum concentrations under a hypothetical future residential scenario. The sites pose no significant risk to the environment. Soil at Sites 4 and 4A is protective of human health and the environment and, thus, no remediation is warranted. Groundwater at Sites 4 and 4A will be further evaluated along with Site 6, and the results will be presented in the RI report for Group C sites.

2.6.3.3 Site 24 - 26 Area MWR Maintenance Facility

The cancer risk at Site 24 was below the NCP point of departure of 10^{-6}. The noncarcinogen health HI was less than the acceptable 1.0 level. The risk/hazard estimates were made using maximum concentrations under a hypothetical future residential scenario. The site poses no significant risk to the environment. No endangered species were observed at Site 9, and the site generally lacks favorable habitat. Site 24 is already protective of human health and the environment and, thus, no remediation is warranted.

2.7 Description of Alternatives

This section summarizes the remedial alternatives. The description of alternatives is limited to the alternatives developed during the FS process for OU1 Site 9. Remedial alternatives were not developed for Sites 4 and 4A (soil) or Site 24 (soil and groundwater) because these sites were found to be in a protective state, and no action is warranted.

Under CERCLA, a process has been established to develop, screen, and evaluate appropriate remedial alternatives. A wide range of cleanup options was considered for remedial action at Site 9. Remedial alternatives were not developed for the other sites because Site 9 is the only one of these sites requiring remedial action. The alternatives for Site 9 satisfy the requirements of 40 CFR 300.430 (a)(1)(iii)(c), which specifies that alternatives be developed to include no action and institutional actions.

The initial process options considered during the preliminary screening process are presented in Tables 2-18 and 2-19. The process options were evaluated and retained or eliminated from further consideration on the basis of technical feasibility. Tables 2-18 and 2-19 also present the rationale for eliminating process options.

A secondary screening was then performed to evaluate the remaining process options on the basis of three criteria: implementability, effectiveness, and cost. The process options that remained after step one were subjected to a more detailed evaluation based on these three criteria. The results of this step are presented in Tables 2-20 and 2-21 for soil and groundwater, respectively. After this evaluation was completed, seven alternatives were developed for detailed analyses. Only the most feasible process

options for each technology type were retained for detailed analysis. Although seven alternatives do not represent every possible combination of soil and groundwater alternatives, professional judgment was used to combine the most feasible soil actions with the most feasible groundwater actions for the site conditions. The following sections summarize the seven alternatives. Detailed alternative descriptions, including cost estimates and breakdowns, are presented in the draft final FS report (SWDIV, 1994a).

2.7.1 Description of Soil Zones and Hot Spots

The soil component of each alternative was grouped into three types. Zone I soil contains beryllium concentrations exceeding the proposed remedial goal (RG). Zone II soil contains TPH-diesel concentrations exceeding 100 mg/kg (Option 1) or 1,000 mg/kg (Option 2). Volumes of soil with concentrations of metals that potentially exceed State or Federal hazardous waste leaching criteria are designated as hot spots. Figure 2-7 presents a graphic delineation of soil contamination, showing Zone I, Zone II, and hot spot soils.

Unlike the individual chemical constituents of petroleum hydrocarbons, cancer risk factors associated with TPH-diesel are not published by either State or Federal regulatory agencies. Guidance on recommended maximum concentrations of TPH-diesel in soil is based primarily on the protection of groundwater and on site-specific conditions. The overriding consideration is the leachability of hydrocarbons from contaminated soil to groundwater. According to the guidance provided in the *Leaking Underground Fuel Tank (LUFT) Field Manual* (SWRCB, 1989) and depending on a number of factors (e.g., depth to groundwater and annual precipitation), the concentrations of TPH-diesel that may be left in place at Site 9 varies from 100 to 1,000 ppm. For this reason, two options were developed for consideration by the risk managers in conjunction with the soil remediation alternatives, as follows:

- Option 1 - Remediate all soils containing TPH-diesel concentrations of 100 ppm or greater, a volume of approximately 21,000 cubic yards of soil
- Option 2 - Remediate soils containing TPH-diesel concentrations of 1,000 ppm or greater, a volume of approximately 6,480 cubic yards.

These options are evaluated for Alternatives 2 through 6 but not for Alternative 7 because the latter alternative was developed after further leachability testing showed that TPH is not leaching to groundwater.

Beryllium was detected at a concentration exceeding the proposed RG in only one sample. For evaluation purposes, beryllium-contaminated soil is assumed to extend 3 feet below ground surface within a 5-foot radius around this sample. The associated volume of soil is approximately 9 cubic yards. This soil is within the TPH-diesel plume and is referred to as Zone I.

Localized areas of lead- and cadmium-impacted soil, referred to as hot spots, were detected in borings 9B11, 9B16, and 9B17 and are also within the TPH-diesel soil plume. Soils in these areas would be considered potentially hazardous waste.

Lead and cadmium contamination is assumed to be limited to about the first 3 feet of soil. The volume of hot spot soil is estimated at 30 cubic yards. For purposes of the FS, the volume was estimated by assuming that the lead and cadmium hot spots extend 3 feet below ground surface within a 5-foot radius of borings 9B11, 9B16, and 9B17.

2.7.2 Alternative 1 - No Action

The no action alternative involves no institutional controls, containment, removal, or treatment. The no action alternative must be considered in order to comply with the provisions of the NCP.

Overall Protection of Human Health and the Environment

The no action alternative includes no treatment and no control of exposure pathways. Under this alternative, long-term risks would be the same as those calculated in the baseline risk assessment. The target risk criterion of 10^{-6} and HI criterion of 1.0 would be exceeded for the soil exposure pathway for the adult and child receptors in the future residential land use exposure scenario. No unacceptable site-related risks would result from the groundwater exposure pathway.

Compliance with ARARs

The only location-specific applicable or relevant and appropriate requirement (ARAR) applicable to Site 9 under the no action alternative is the Migratory Bird Treaty Act of 1972. Although migratory birds have been observed in the vicinity of Site 9 (SWDIV, 1993), they are not known to be affected by current site conditions; therefore, the no action alternative meets this ARAR.

TCE and PCE exceed the MCLs and, thus, groundwater ARARs (Appendix B of the draft final FS report [SWDIV, 1994a]). Although current conditions do not meet these groundwater criteria, contaminant concentrations only slightly exceed the criteria. Natural attenuation would likely reduce the concentrations to levels less than the proposed RGs and, thus, would ultimately meet groundwater ARARs. Because of uncertainties associated with the hydrogeologic regime and the contaminant source, it is difficult to model or otherwise evaluate the length of time required to reduce on-site groundwater contaminant concentrations to levels less than the proposed RGs. However, the proposed RGs would likely be met within 10 to 30 years. In accordance with NCP requirements (EPA, 1990, pp. 8732-8743), treatment may not be warranted because groundwater is unlikely to be used in the foreseeable future. However, action-specific ARARs require monitoring until compliance is achieved; therefore, the no action alternative does not comply with action-specific ARARs.

2.7.3 Alternative 2: Soil - Excavation and Off-Base Landfill for Hot Spots, Zone I, and Zone II; Groundwater - Institutional Controls

2.7.3.1 Alternative 2, Option 1

This alternative involves excavation and disposal of contaminated soil and institutional control of contaminated groundwater. Contaminated soil in hot spots, Zone I, and Zone II would be disposed of at a Class I landfill permitted under the Resource Conservation and Recovery Act (RCRA).

Soil containing beryllium (Zone I) and cadmium and lead (hot spots) would be excavated, segregated, transported to the disposal facility, and stabilized if necessary. Zone II soil containing TPH-diesel concentrations exceeding 100 mg/kg and heavy metal concentrations below soluble threshold limit

concentration (STLC) levels would be disposed of at the landfill. The schematics of the soil excavation operation are presented in Figure 2-8.

The institutional controls proposed for contaminated groundwater would involve amending the base Masterplan to restrict future access to the groundwater in the immediate vicinity of the site and groundwater monitoring to assess contaminant levels and potential migration. Water levels would be measured and groundwater samples would be collected from the existing site monitoring wells. If downgradient migration of the groundwater plume were to continue, the plume would discharge into the ocean after migrating about 3,900 feet. This alternative involves no treatment of the groundwater; instead, it relies on dispersion and natural attenuation over time.

Groundwater monitoring would continue for 10 years. The results of groundwater monitoring would be evaluated every 5 years to assess the need for any additional remedial activities. Groundwater monitoring would be conducted on a semiannual basis, and a compliance monitoring program consisting of eight sampling rounds would be conducted during the eighth year.

Overall Protection of Human Health and the Environment

Implementation of Alternative 2 would have no significant additional environmental or health impacts; it would reduce potential risks from soil and groundwater exposure pathways. The residual risk for soil would be the same as the risk level associated with background soils (i.e., background beryllium concentrations exceed the remedial action objective ([RAO] of 10^{-6}). Although groundwater contaminants would not be treated under this alternative, exposure pathways would be minimized through institutional controls.

Location- and action-specific ARARs would likely be attained during implementation of Alternative 2. Although groundwater would not be treated, groundwater modeling has shown that the low concentrations of organics present at the site would disperse and naturally attenuate to concentrations less than the proposed RGs before reaching the nearest receptors at the ocean.

Compliance with ARARs

Alternative 2 is expected to achieve location-specific ARARs. Actions would be coordinated with the U.S. Fish and Wildlife Service and the California Department of Fish and Game, as appropriate. Work plans for site operations would specify that migratory birds and endangered species not be harmed or injured. An on-site archaeologist would monitor excavation activities during remediation to comply with the National Archaeological and Historical Preservation Act.

ARARs for waste piles identified under Title 22 and Title 23, California Code of Regulations (CCR), would be addressed through implementation of work plans. Design and site operations would incorporate requirements, in accordance with the action-specific ARARs. Stockpiled contaminated soil would be placed on liners, and run-on and runoff would be controlled. Fugitive dust would be monitored and controlled through the use of suppressants.

TCE and PCE concentrations at the site exceed groundwater protection standards. Current conditions do not meet Federal action-specific groundwater ARARs because contaminant concentrations exceed MCLs, albeit only slightly. Despite uncertainties concerning the hydrogeologic regime and contaminant source, natural attenuation should reduce concentrations to below MCLs in less than 10 years. Under this alternative and in accordance with NCP requirements (EPA, 1990, pp. 8732-8734), groundwater contaminant concentrations would be monitored for 10 years and use restrictions would be implemented so that the groundwater is not used for drinking water.

Long-Term Effectiveness and Permanence

The long-term effectiveness of this alternative for soil would be significantly enhanced through the permanent removal of contaminated soil from the site, resulting in the adequate and reliable reduction of potential human health risks at the site. Institutional controls for groundwater would provide some reliability by reducing risks but would not eliminate risks or achieve significant long-term effectiveness.

The risk calculated for the hypothetical future land use residential scenario results in an ILCR of 2×10^{-5}. The ILCR resulting from background concentrations of beryllium remaining in the soil after completion of this remedial alternative

would be reduced by $4x10^{-6}$. This alternative would also reduce the health impact. The HI for the background beryllium soil concentration of 0.69 mg/kg is less than 0.1. The remaining concentrations of TPH-diesel in the soil would present no associated health impacts.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 2 does not entail on-site treatment of contaminated soil or groundwater. Soil contaminant mobility would be reduced by off-base chemical fixation and solidification of soil from Zone I and hot spots prior to disposal at a Class I landfill. This soil accounts for about 39 cubic yards, which is not significant compared with the total volume to be excavated under this alternative. Although the off-base treatment would significantly immobilize the contaminants in the soil, it would also increase the volume of the contaminated soil by 25 to 40 percent due to the addition of chemical reagents. Fixation and solidification are not irreversible; however, depending on the type of soil stabilization used, the contaminants could remain in stasis for thousands of years. Disposal of soil at a Class I landfill would not reduce either toxicity or volume.

The remaining 21,000 cubic yards of soil, designated as Zone II, are of concern because the TPH-diesel concentrations exceed the proposed RG of 100 mg/kg. Zone II soil would be transported and disposed of at an appropriately permitted landfill. Landfill disposal of soil does not reduce toxicity, mobility, or volume and is primarily a containment remedy. However, the contamination in Zone II is biodegradable, and the type and quantity of the remaining residuals would depend on the natural attenuation rate in the landfill.

Institutional controls for groundwater would not reduce toxicity, mobility, or volume of the contaminants. The contaminants at Site 9 would remain in the groundwater and move in the general direction of groundwater flow before discharging to the ocean. However, natural attenuation is expected to reduce PCE and TCE concentrations in on-site wells, and modeling indicates that contaminant concentrations would be below MCLs, and possibly nondetect, before the water reaches the ocean.

Cost

The total cost of Alternative 2, Option 1, is approximately $4.1 million. Cost assumptions and details are presented in Appendix E of the draft final FS report (SWDIV, 1994a).

2.7.3.2 Alternative 2, Option 2

Option 2 differs from Option 1 in that the volume of TPH-contaminated soil to be excavated and transported off base for disposal is limited to the area where TPH-diesel concentrations exceed 1,000 mg/kg. The criteria assessment for groundwater and soil in Zone I and hot spots is identical to Option 1 (Section 2.7.3.1), as are the ARARs; long-term effectiveness; and reduction of contaminant toxicity, mobility, or volume. Option 2 differs from Option 1 in short-term effectiveness, implementability, and cost.

Option 2 would involve handling a smaller volume of contaminated soil than in Option 1, resulting in short-term benefits. A smaller area of the site would be disturbed, and potential environmental impacts would be reduced in the short-term. Fewer trucks would be needed to transport the soil off site, with a concomitant lower potential for accidents. The time required to achieve site protection would be approximately 20 working days. The total cost of Alternative 2, Option 2, is approximately $1.5 million.

2.7.4 Alternative 3: Soil - Excavation and Off-Base Landfill for Zone I and Hot Spots, Biological Land Treatment for Zone II; Groundwater - Extraction, Ultraviolet/Chemical Oxidation, and Reinjection

2.7.4.1 Alternative 3, Option 1

Alternative 3 involves off-base disposal of contaminated soils from Zone I and the hot spots and on-site biological land treatment of contaminated soil from Zone II. Soils from Zone 1 and the hot spots (approximately 39 cubic yards) would be excavated, screened, segregated, and then transported by truck to a Class I landfill for disposal and stabilization, as required. The contaminated soil in Zone II (approximately 21,000 cubic yards of soil with TPH-diesel concentrations exceeding 100 mg/kg) would be transported to a biological land treatment facility

that would be constructed on site, as described in Section 4.1.1.5 of the draft final FS report (SWDIV, 1994a). The biological land treatment would achieve the remediation criteria of 100 mg/kg for TPH-diesel contamination.

Groundwater within the Site 9 channel deposits would be extracted and treated using an on-site pump-and-treat system and an ultraviolet (UV)/chemical oxidation system to destroy TCE and PCE and, thus, meet the proposed RGs. The treated groundwater would then be reinjected into the water-table aquifer on the upgradient edge of the plume to increase the hydraulic head and, in turn, increase the removal rate of the plume from the aquifer. The assumed locations of the extraction and reinjection wells and the schematics of the soil excavation operation are shown in Figure 2-9. Figure 2-10 presents a process flow diagram for the groundwater treatment system.

Overall Protection of Human Health and the Environment

The removal and treatment of groundwater and soil would reduce risks from soil and groundwater exposure pathways. Alternative 3 would likely attain ARARs; however, residual risk from background beryllium concentrations would still exceed the RAO of 10^{-6}.

Compliance with ARARs

Chemical-specific ARARs for groundwater would likely be achieved within 7 years as a result of implementing Alternative 3. Reduction of TCE and PCE concentrations in the groundwater would likely meet proposed RGs. These levels would be achieved at the point-of-compliance.

Location-specific ARARs would be attained through coordination with the U.S. Fish and Wildlife Service at the California Department of Fish and Game. Work plans for site operations would specify that migratory birds and endangered species not be disturbed, harmed, or injured during operations. Compliance with the National Archaeological and Historical Preservation Act would be attained by monitoring excavation activities.

Implementation of Alternative 3 would likely meet RCRA action-specific ARARs. Requirements for closure, container storage, and excavation would be incorporated into design specifications and site operations for Alternative 3. Land

treatment unit and stockpile design, construction, operation, and closure requirements would also be attained. The treatment process would adhere to requirements for underground injection of treated groundwater. Monitoring would be a component of this alternative. Implementation would adhere to provisions of the Clean Air Act. Low concentrations of volatiles would be emitted to the atmosphere and would be monitored during the equipment start-up phase to check that they are below harmful levels. If necessary, these off-gases could be treated with vapor-phase carbon.

Groundwater treatment is expected to meet State action-specific ARARs. State Title 23 requirements for land treatment units and stockpiles, including siting, design, construction, operation, closure, and monitoring, would be incorporated into the design and site operations.

Long-Term Effectiveness and Permanence

As with Alternative 2, Alternative 3 would include excavation of approximately 21,000 cubic yards of soil, including Zone I soil, and would reduce the beryllium levels in soil to the existing background concentration of 0.69 mg/kg. Therefore, the residual risk asscciated with the soil would be the same as for Alternative 2. The resulting noncancer health risk would be an HI of less than 0.1. Groundwater treatment is expected to reduce concentrations to below MCLs within a 7-year treatment period.

Reduction of Mobility, Toxicity, or Volume Through Treatment

Alternative 3 would satisfy the statutory preference for using treatment as a principal element to provide significant reductions in contaminant toxicity, mobility, or volume. Biological treatment of Zone II would reduce the TPH-diesel concentrations to 100 mg/kg by converting the hydrocarbons to carbon dioxide and water. Chemical fixation and stabilization of soil from Zone I and hot spots would reduce contaminant mobility prior to landfilling. Although contaminant immobilization would be attained, the addition of chemical reagents would increase soil volume by 25 to 40 percent. Landfill disposal would not reduce toxicity or volume.

Extraction and treatment of groundwater containing PCE and TCE would substantially reduce the toxicity and volume of these contaminants. Extraction

and reinjection of the groundwater through pumping would reduce the mobility of the contaminants. UV/chemical oxidation would effectively destroy PCE and TCE, transforming them into simpler, less toxic compounds. This treatment technology is considered irreversible.

Cost

The total cost of Alternative 3, Option 1, is approximately $2.4 million. Cost assumptions and details are presented in Appendix E of the draft final FS report (SWDIV, 1994a). The time required for completion of soil remediation activities would be approximately 28 weeks. Under this alternative, UV/chemical oxidation treatment of groundwater would continue for 7 years and monitoring would continue for 10 years.

2.7.4.2 Alternative 3, Option 2

Option 2 differs from Option 1 in the extent, volume, and TPH-diesel concentrations of the soil that would be excavated and treated. The remedial technologies employed to address the groundwater contamination and the soil contamination in Zone I and hot spots are identical for both options.

Option 2 would involve handling a smaller volume of contaminated soil than in Option 1. A smaller area of the site would be disturbed, and potential environmental impacts would be reduced in the short-term. The total cost of Alternative 3, Option 2, is approximately $1.4 million. The time required to achieve site protection would be approximately 2 months for soil.

2.7.5 Alternative 4: Soil - Excavation and Off-Base Landfill for Zone I, In Situ Bioremediation/Bioventing for Zone II; Groundwater - Extraction, Carbon Adsorption, and Reinjection

2.7.5.1 Alternative 4, Option 1

Alternative 4 differs from Alternative 3 in that the TCE and PCE in the extracted groundwater would be removed by adsorption onto a liquid-phase activated carbon bed instead of being destroyed in a UV/chemical oxidation system. Soil remediation would include excavation, screening, and transportation of Zone I

soil (containing beryllium) to a Class I landfill for disposal. The TPH-diesel contamination in Zone II would be remediated using in situ bioremediation/bioventing. The hot spots would not be excavated because they do not contain concentrations of contaminants exceeding the proposed RGs and, therefore, do not require remediation.

Because the depth of the soil contamination varies from 2 feet at the south end of the waste stabilization pond to 9 feet at the north end of the pond, a combination of in situ biological treatments would be used for the TPH-diesel contamination in Zone II. In the south end of Zone II, between borings 9B11 and 9B16, the top 2 to 3 feet of surface soil would be bioremediated by regular tilling, supplemented by irrigation, pH adjustment, and nutrient addition, as appropriate. Given the low concentrations of TPH-diesel in this area, remediation could be complete within a few months.

Bioventing would be used to remediate TPH-diesel contamination in the rest of Zone II. Depending on site conditions, bioventing could be performed using either wells or trenches for air injection or extraction. One configuration for placement of air injection trenches at Site 9 is shown in Figure 2-11.

Overall Protection of Human Health and the Environment

Implementation of Alternative 4, Option 1, would reduce risk due to soil and groundwater exposure pathways and provide for the overall protection of human health and the environment. Alternative 4 should attain ARARs and pose no significant additional impact to the environment or human health.

Compliance with ARARs

As with Alternative 3, chemical-specific ARARs for groundwater should be achieved within 7 years. The discussion of location-specific ARARs for Alternative 3 is equally applicable to Alternative 4 (Section 2.7.4.1).

Action-specific ARARs for Alternative 4 include groundwater treatment design and operation. These requirements would be incorporated into the design and site operations for this alternative. Requirements pertaining to underground injection of treated groundwater and air emissions are the same as those

discussed for Alternative 3 (Section 2.7.4.1) and would also be attained for Alternative 4.

Cost

The total cost of Alternative 4, Option 1, is approximately $1.3 million. Cost assumptions and details are presented in Appendix E of the draft final FS report (SWDIV, 1994a).

2.7.5.2 Alternative 4, Option 2

Option 2 differs from Option 1 in that the volume of soil requiring treatment is limited to approximately 6,480 cubic yards of soil containing TPH-diesel concentrations exceeding 1,000 mg/kg. The bioventing system would be designed to treat a smaller area than for Option 1. In addition, only the shallow areas of contamination around borings 9B16 and 9B11 would be remediated by in situ bioremediation because the shallow depth of contamination (1 to 3 feet) makes implementation of bioventing difficult.

The long-term effectiveness and overall protection would be about the same for both options because the area of high TPH-diesel contamination that presents the greatest potential for leaching into the groundwater would be equally remediated in both options. Because the area of the site that would be disturbed during implementation of Option 2 is smaller, potential environmental impacts would be reduced in the short-term. The total cost of Alternative 4, Option 2, is approximately $1.1 million.

2.7.6 Alternative 5: Soil - Excavation and Off-Base Landfill for Zone I, In Situ Bioremediation/Bioventing for Zone II; Groundwater - Institutional Controls

2.7.6.1 Alternative 5, Option 1

The soil remediation component of Alternative 5 is identical to that of Alternative 4 (Section 2.7.5.1), and the groundwater component is identical to that of Alternative 2 (Section 2.7.3.1). A schematic of the soil remediation is presented in Figure 2-12.

This alternative is intended to manage risks associated with soil and groundwater contamination by limiting access to the groundwater for beneficial use and by remediating Zone II soil via in situ treatment.

The total cost of Alternative 5, Option 1, is approximately $680,000. Cost assumptions and details are presented in Appendix E of the draft final FS report (SWDIV, 1994a). This alternative would require about 2 years or more for soil remediation, and groundwater monitoring would continue for 10 years.

2.7.6.2 Alternative 5, Option 2

The soil remediation component for Option 2 of this alternative is identical to that for Option 2 of Alternative 4, as described in Section 2.7.5.2. The groundwater component is the same as for Option 1 of Alternative 5 (Section 2.7.6.1).

The total cost of Alternative 5, Option 2, is approximately $523,000. The duration for completion of soil remediation is estimated at just over 1 year.

2.7.7 Alternative 6: Soil - Excavation and Off-Base Landfill for Zone I and Hot Spots, Biological Land Treatment for Zone II; Groundwater - Institutional Controls

2.7.7.1 Alternative 6, Option 1

The soil remediation component of Alternative 6 is identical to that of Alternative 3 (Section 2.7.4.1), and the groundwater component is identical to that of Alternative 2 (Section 2.7.3.1). A schematic of the soil excavation operation is shown in Figure 2-13.

The total cost of Alternative 6, Option 1, is approximately $1.8 million. Cost assumptions and details are presented in Appendix E of the draft final FS report (SWDIV, 1994a). Under Alternative 6, Option 1, soil remediation would require about 2 years or longer and groundwater monitoring would continue for 10 years.

2.7.7.2 Alternative 6, Option 2

The soil component of this alternative is identical to that described for Alternative 3, Option 2 (Section 2.7.4.2). The groundwater institutional controls are identical to those described for Alternative 2 (Section 2.7.3.1). The total cost of Alternative 6, Option 2, is approximately $816,000.

2.7.8 Alternative 7: Soil - No Action; Groundwater - Institutional Controls

Alternative 7 consists of no action for soil and institutional controls for groundwater. The soil component of the alternative involves no institutional controls, containment, removal, or treatment. The groundwater component involves risk management through an amendment of the base Masterplan to restrict future access to the groundwater in the immediate vicinity of the site and monitoring of contaminant concentrations and migration. Monitoring would consist of semiannual groundwater sampling for 10 years, with compliance monitoring consisting of eight sampling events during the eighth year. An alternative evaluation would be conducted once every 5 years to assess the effectiveness and document the progress of the alternative. Samples would be analyzed for TPH by modified EPA Method 8015 and for volatile organics by EPA Method 8240, using CLP protocol.

The no action soil alternative would include no treatment and no control of exposure pathways. Long-term risks would be the same as those calculated in the baseline risk assessment; that is, within the acceptable risk range. However, the target risk criterion of 10^{-6} and the HI of 1.0 would be exceeded for the soil exposure pathway for the adult and child in a residential land use exposure scenario. The sole contributor to surface soil risk is beryllium. Beryllium exceeded background in only one sample. The average concentration of beryllium in Site 9 soil presents risks within the background range. As previously discussed, the base Masterplan currently specifies that the Site 9 area is to be used for training, and no plans have been announced to use the area for any other purpose in the future.

Additional sampling and analysis using the waste extract test (WET) and synthetic precipitation leaching procedure (SPLP) analyses indicated that the

metals and TPH in the soils at the site are not likely to leach into groundwater. Analytical results were nondetect for all samples collected. Based on the results of these tests, TPH was excluded as a contaminant requiring action at Site 9.

Groundwater modeling indicates that the currently low concentrations of organics would be reduced to levels below the MCLs, and possibly to nondetect levels, by dispersion and natural attenuation before reaching the nearest receptors at the ocean. In spite of the uncertainties associated with using an uncalibrated model, computer modeling has shown that natural attenuation can be expected to reduce contaminant concentrations in site groundwater to below MCLs (Appendix B, Table B-1) within a 10-year period.

Location-specific ARARs applicable to other alternatives at Site 9 are not pertinent to Alternative 7, no action for soil.

TCE and PCE concentrations in site groundwater exceed groundwater protection standards. Under current conditions, action-specific groundwater criteria are not attained (Table B-4). However, contaminant concentrations exceed these criteria only slightly in two wells, and the concentrations likely would be reduced to levels below the MCLs through natural attenuation in less than 10 years. Concentrations would be monitored under this alternative and land use restrictions would be implemented.

The total cost of Alternative 7 is approximately $338,595. Cost assumptions and details are presented in Appendix E of the draft final FS report (SWDIV, 1994a).

2.8 Summary of Comparative Analysis of Alternatives

This section presents a comparative analysis of the evaluation of remedial action alternatives. The relative advantages and disadvantages are discussed with respect to the nine evaluation criteria required by the NCP and CERCLA Section 121. The comparative evaluation for Site 9 - Stuart Mesa Waste Stabilization Pond, is presented in the following sections and is summarized in Table 2-22. As previously discussed, Site 9 is the only site in OU1.

2.8.1 Overall Protection of Human Health and the Environment

Each of the alternatives would provide adequate protection of human health and the environment with the exception of Alternative 1 - No Action.

Alternative 2 would achieve protection by preventing exposure to soil via removal and disposal in an approved landfill. Potential groundwater exposure risks would be reduced through access restrictions and natural attenuation. Alternatives 3 and 4 would reduce risks from soil and groundwater through treatment. Alternatives 5 and 6 combine treatment of the soil with access restrictions and natural attenuation of the groundwater.

For Alternative 7, the calculated risk using the hypothetical residential scenario and RME concentrations is within the generally acceptable risk range of 10^{-4} to 10^{-6}. The target risk criterion of 10^{-6} would be exceeded for the soil exposure pathway for the adult/child receptor in the residential land use exposure scenario. However, land use for Site 9 is restricted to training purposes and future use of Site 9 is not likely to be residential. Beryllium is the sole contributor to risk in surface soil and exceeds background levels in only one sample. Using average concentrations, the calculated risk is within the background range. Leachability testing of the soil indicates that the metals and petroleum hydrocarbon constituents would not leach to groundwater. Combining these factors, Alternative 7 would provide for adequate overall protection of human health and the environment.

2.8.2 Compliance with ARARs

Alternatives 3 and 4 would meet ARARs. Alternatives 2, 5, 6, and 7 would meet location- and action-specific ARARs; chemical-specific ARARs would be attained over time through groundwater attenuation. Alternative 1 would not meet ARARs. The ARARs for the selected remedy, Alternative 7, are listed in Appendix B. ARARs for all remedial alternatives are presented in the draft final FS report (SWDIV, 1994a).

2.8.3 Long-Term Effectiveness and Permanence

Alternatives 3 and 4 would afford the highest degrees of long-term effectiveness and permanence because they involve treatment to reduce hazards posed by both soil and groundwater at Site 9. Alternatives 3 and 4 differ only in the technology used to treat the chlorinated hydrocarbons in groundwater. Transport of spent carbon off site would pose potential transportation risks for Alternative 4. Both UV/chemical oxidation (Alternative 3) and carbon adsorption (Alternative 4) can reduce TCE and PCE concentrations in groundwater to levels below proposed RGs. Alternatives 3 and 4 would require maintenance of the groundwater pump-and-treat system in addition to continued groundwater monitoring. Soil treatment, as part of both of these alternatives, would reduce contaminant concentrations to below proposed RGs.

Alternatives 5 and 6 employ the same soil technologies as Alternatives 3 and 4 but provide no active groundwater treatment. Bioventing in Alternatives 5 and 6 may potentially remove some contamination from groundwater through the subsurface movement of air, which in turn could enhance volatilization of contaminants. However, this impact is expected to be minimal because the effective bioventing zone would be a considerable distance from the groundwater plume. No incremental human health risks are attributable to groundwater contaminants; therefore, these four alternatives are comparable with respect to long-term effectiveness and permanence for the groundwater component.

Alternatives 2 and 7 are similar in that less than 1 percent of the soil is treated in Alternative 2 and none of the soil is treated in Alternative 7. Both alternatives rely on use restrictions to minimize exposures associated with the groundwater pathway. As with Alternatives 5 and 6, institutional controls would minimize potential risk from groundwater by removing the receptor even though no incremental human health risks are attributable to groundwater contaminants.

With the exception of the no action alternative, all of the alternatives involve long-term groundwater monitoring and maintenance requirements. Monitoring is assumed to continue for 10 years or until groundwater concentrations no longer exceed the proposed RGs. Reviews would be required every 5 years to verify whether goals have been met or further action is required.

2.8.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

Alternatives 3, 4, 5, and 6 use treatment to address the principal threats posed by soil and, thus, would satisfy the statutory preference for treatment as a principal element. For all four alternatives, TPH-diesel concentrations in soil from Zone II would be reduced, through biological treatment, to less than 100 mg/kg for Option 1 and less than 1,000 mg/kg for Option 2. For Alternatives 3 and 6, the mobility of contaminants in Zone I and the hot spots would be reduced through chemical fixation and stabilization. For Alternatives 4 and 5, the mobility of contaminants in Zone I soil would be reduced through chemical fixation and stabilization. The soil volume would be increased by approximately 25 to 40 percent.

Alternative 2 (Option 1 and Option 2) does not provide for on-site treatment of contaminated soil or groundwater. About 40 cubic yards of the soil excavated under this alternative is expected to require chemical fixation off base prior to disposal in a Class I landfill. Chemical fixation would reduce contaminant mobility but would also increase the volume of the soil. The remaining 21,000 cubic yards of soil would not be treated.

Although no treatment is proposed for the soil component in Alternative 7, the volume of soil is significantly smaller than for Alternatives 1 through 6 (approximately 9 cubic yards compared with 21,000 cubic yards). This difference is due to the change in the proposed RG evaluated for Alternative 7 compared with the other alternatives. Leachability testing results indicated that concentrations of diesel in the soil are not likely to leach. As a result, only soils with metals contamination that might pose a potential human health risk are addressed by Alternative 7, thus eliminating the large volume of soils containing only petroleum hydrocarbons.

In Alternatives 3 and 4, toxicity of contaminants in groundwater would be reduced through treatment. Alternative 3 uses UV/chemical oxidation and Alternative 4 uses carbon adsorption to treat PCE and TCE. Carbon adsorption can effectively remove PCE and TCE to levels below the proposed RGs.

No treatment of the groundwater is provided under Alternatives 2, 5, 6, and 7.

2.8.5 Short-Term Effectiveness

This criterion is not applicable to Alternatives 1 and 7 because these alternatives involve no actions that would disturb the site. The short-term effectiveness of Alternatives 4 and 5 is expected to be the greatest. Alternatives 4 and 5 would pose the least potential risk to workers, the community, and the environment. Because these alternatives incorporate in situ soil treatment technologies, only a small volume of soil would be excavated compared with the volume for the other alternatives, thus significantly reducing fugitive dust emissions. Also, because a smaller area would be disturbed under these alternatives, environmental impacts would be minimized.

Short-term protection is expected to be achieved under Alternative 2 in approximately 1 month through removal of soils and restrictions on groundwater use. Soil protection would be achieved in approximately 6 months for Alternatives 3 and 6 and in approximately 2 years for Alternatives 4 and 5. Groundwater protection would be achieved in approximately 7 years for Alternatives 3 and 4.

2.8.6 Implementability

This criterion is not applicable to Alternative 1. Because Alternative 7 includes only institutional controls for groundwater and no action for the soil, it is considered the easiest alternative to implement.

Alternative 2 ranks second under this criterion. Technologies included in this alternative include groundwater monitoring and excavation and disposal of soil in Zone I, Zone II, and hot spots. These are well-known technologies. If the planned operations require expansion, adequate area is available in the vicinity of Site 9 and would require minimal site preparation. Groundwater monitoring will track the effectiveness of the soil removal and any attenuation of contaminant concentrations in groundwater.

Alternatives 4 and 5 employ the same soil treatment technologies: excavation and off-base disposal of Zone I soils (as with Alternative 2) and bioventing of the Zone II soils. Because of the added treatment technologies, Alternatives 4 and 5

are slightly more complex and entail more operational requirements than Alternative 2. Off-base disposal for Zone I soils would be easily implemented. Although bioventing is fairly innovative, the process has been instituted at several sites and should be implementable at Site 9. Bioventing technology treatment levels are limited. These limitations would be evaluated by conducting a treatability study prior to implementation. If more stringent levels are required for Alternatives 4 and 5, the treatment process could easily be continued until the required levels are attained (provided that the levels are not beyond the capability of the technology). Adequate monitoring and proper maintenance would be required for the operation of the in situ bioremediation/bioventing systems.

Alternatives 3 and 6 are similar in complexity to Alternatives 4 and 5 with respect to soil treatment but include biological land treatment and require more excavation and the construction of an on-site landfarming facility. Monthly monitoring would be required to evaluate the progress of the system. This remedial technology is proven and reliable for treatment of TPH-diesel-contaminated soil.

Alternatives 3 and 4 also include treatment processes for the groundwater and, thus, entail more complex operations than those for Alternatives 2, 5, and 6. Alternatives 3 and 4 both include treatment for organics in the groundwater. The systems can be sized to handle larger volumes of water if necessary. Carbon adsorption is more established than UV/chemical oxidation, and UV/chemical oxidation requires greater maintenance. However, both technologies are readily obtainable as skid-mounted units. The effectiveness of these technologies would be evaluated by monitoring effluent streams and the groundwater. Additional hydrogeologic studies and treatability studies would be needed to help ensure the success of these alternatives.

2.8.7 Cost

With the exception of Alternative 1, Alternative 7 has the lowest capital, operations and maintenance (O&M), and present-worth costs, at $338,595. Alternative 5 has the second lowest cost, with total costs of $680,000 for Option 1 and $523,000 for Option 2. Alternative 4 has the third lowest cost, with total costs of $1.3 million for Option 1 and $1.1 million for Option 2. Alternative 5 does

not include groundwater treatment, thus resulting in lower O&M and groundwater present-worth costs than for Alternative 4. Alternative 6 has total costs of $1.8 million for Option 1 and $816,000 for Option 2. Alternative 3 has total costs of $2.4 million for Option 1 and $1.4 million for Option 2. The slightly higher cost for Alternative 3 is attributed to the treatment of PCE and TCE in groundwater. Alternative 2 has the highest capital and overall costs because it involves off-base landfill disposal, with total costs of $4.1 million for Option 1 and $1.5 million for Option 2.

2.8.8 State Acceptance

The State of California has reviewed and approved the OU1 FS and proposed plan and concurs with the preferred and selected option (Alternative 7) for Site 9.

2.8.9 Community Acceptance

No comments were received from the public during the public comment period for the OU1 proposed plan. In addition, a public meeting was held on 4 January 1995 for the purpose of presenting the preferred alternative to the public; no parties outside the project team attended the meeting. Therefore, it is assumed that base residents and members of the surrounding communities have no objection to the preferred alternative (Alternative 7) specified in the proposed plan.

2.9 Selected Remedy

The selected remedy for Sites 4, 4A, and 24 is no action. The selected remedy for OU1 - Site 9, Stuart Mesa Waste Stabilization Pond, is Alternative 7: Soil - No Action; Groundwater - Institutional Controls. The specific components of this alternative are presented in Section 2.7.8 and are further described in this section.

2.9.1 Major Components of the Selected Remedy

The major components of the selected remedy are described in this section.

2.9.1.1 Site 9 Soil

No action is the selected remedy for soil at Site 9. Soils at the site will be left in place as they presently exist. No containment, excavation, removal, or treatment will be performed. Institutional controls will be used in the unlikely event that Site 9 is used for residential purposes in the future.

2.9.1.2 Site 9 Groundwater

The groundwater component of the selected remedy involves risk management through an amendment to the base Masterplan restricting future access to groundwater in the immediate vicinity of the site and initiating monitoring of contaminant concentrations and migration. Monitoring will consist of semiannual groundwater sampling and analysis of 12 wells for 10 years, with compliance monitoring consisting of eight sampling events to be conducted during the eighth year, as required by 23 CCR 2250.10(g)(2). An alternative evaluation will be performed once every 5 years to assess the effectiveness and document the progress of the alternative, as required by CERCLA Section 121. Groundwater samples will be analyzed for TPH by modified EPA Method 8015 and for volatile organics by EPA Method 8240, using EPA CLP protocol. Results of the semiannual groundwater monitoring will be provided to the appropriate regulatory agencies by the Navy.

2.9.2 Estimated Cost of the Selected Remedy

Estimated capital costs for Alternative 7 are limited to $2,200, representing a dedicated groundwater sampling pump and miscellaneous support equipment. Net annual O&M costs are $32,970 per year, including analytical costs, maintenance, labor, and disposal of purged water. The eighth year compliance monitoring costs, estimated at $131,680, also include analytical costs, labor, and disposal. The 5-year alternative reevaluation costs are estimated at $5,200. Assuming an annual inflation rate of 5 percent and applying a discount rate of 10 percent, a cumulative total cost of $338,595 is estimated after 10 years of monitoring. A detailed cost analysis is provided in Table 2-23.

There are no costs associated with the no action remedy for Sites 4, 4A, and 24.

2.9.3 Basis for Remedy Selection

The no action remedy was selected for Sites 4, 4A, and 24 because these sites are currently in a protective state and pose no threat to human health or the environment.

The basis for the remedy selected for soil and groundwater at OU1 - Site 9 is described in the following sections.

2.9.3.1 Site 9 Soil

Using the future residential land use scenario, the human health risk due to beryllium in the soil results in an ILCR of $2x10^{-5}$, which is within the acceptable range of $1x10^{-6}$ to $1x10^{-4}$ as determined by the EPA. The future residential land use scenario represents the most conservative approach for a health risk assessment.

The probability that Site 9 will ever be used for anything other than training is extremely low. The base Masterplan restricts the use of this area of the base to training. In addition, beryllium exceeded area background concentrations in only one sample collected from a single boring at a depth of 1 foot at this site. This sample contained a beryllium concentration at 1.9 ppm. In the unlikely event that the impoundment is used for residential purposes at some time in the future, considerable grading and import of clean fill would be required. Site preparation would, in all probability, reduce the likelihood of dermal contact or ingestion of soil containing elevated levels of beryllium because beryllium-containing soil would be at depths estimated to be between 5 and 6 feet after site grading.

The primary concern for the TPH-diesel concentrations in soil at Site 9 is that these hydrocarbons, as well as beryllium in the soil, could leach to and degrade the quality of the groundwater. In addition, cadmium and lead were detected in the soil at concentrations below risk-based levels but greater than 10 times the STLC. To assess the leaching potential of these chemicals, soil samples were collected from the locations and depths containing maximum concentrations of beryllium and TPH-diesel and were submitted to the laboratory for analysis using the SPLP analysis (EPA Method 1312) for volatile organics and the WET

procedure for beryllium, cadmium, and lead. The test results showed that these compounds were not detected in the extract solution. Based on the results of these leachability tests, TPH-diesel, beryllium, cadmium, and lead are not expected to leach to or degrade the groundwater.

2.9.3.2 Site 9 Groundwater

As previously discussed, concentrations of PCE and TCE do not pose a significant risk to human health based on either the maximum or average concentrations and the current military use scenario. Although these compounds do not pose a significant health risk, both have been detected in individual samples at concentrations exceeding State and Federal MCLs. Several available treatment alternatives can effectively remove these constituents from groundwater. The difficulty lies not in successfully treating the groundwater but in pumping sufficient quantities of groundwater from the aquifer. The RI indicated that much of Site 9 is underlain by highly impermeable marine terrace deposits. Wells installed in these deposits could not be tested using conventional pumping techniques because they yielded extremely small quantities of groundwater. The implementability of any groundwater treatment alternatives involving groundwater extraction would necessarily be hampered by the low permeability of the marine terrace deposits and, consequently, the low yield of wells completed in these deposits. In addition, given the results of the RI, wells completed in these deposits would not likely be suitable as a source of municipal or domestic water supply. Wells completed in the marine terrace deposits do not produce sufficient water to support any form of residential structure.

Computer modeling suggests that the low concentrations of contaminants in Site 9 groundwater will not reach the ocean. The computer model used was not extensively calibrated to the hydrogeologic conditions at Site 9. As such, the results of the computer modeling performed for this site should not be considered definitive, but rather a best estimate based on available information. The computer modeling results suggest that an impact on marine receptors is highly unlikely. No users of groundwater are present downgradient from Site 9, between the site and the ocean, and the groundwater flow path is through the nonbeneficial zone, approximately 0.25 mile west of Site 9 (parallel to Interstate 5). Although PCE and TCE concentrations detected in groundwater

beneath the waste stabilization pond exceed MCLs, the groundwater fate and transport model indicates that contaminant concentrations will be reduced to below MCLs by dispersion and natural attenuation within 10 years. As indicated in the preamble to the NCP, the use of natural attenuation as a remediation technique is consistent with the EPA's groundwater protection policy for situations in which active restoration is not practical or warranted due to site conditions and groundwater is not likely to be used in the foreseeable future (EPA, 1990). Alternative 7 specifies that groundwater will be sampled and analyzed semiannually for 10 years to monitor dispersion and natural attenuation and whether that contaminant levels are decreasing, as expected, or increasing as a result of some unknown source.

The base Masterplan will be amended to restrict future access to groundwater, for any purpose, in the immediate vicinity of Site 9 during the long-term monitoring period and until contaminants in the groundwater at the site no longer exceed MCLs. As required by current regulations, a compliance monitoring program consisting of eight rounds of groundwater sampling will be conducted during the eighth year to assess the effectiveness of the dispersion and natural attenuation of the low concentrations of PCE and TCE in the groundwater. Compliance with ARARs will be achieved over time through natural groundwater attenuation. If concentrations of PCE and TCE are not being reduced by dispersion and natural attenuation within the expected time frame, the Marine Corps will reevaluate the situation and consider other treatment alternatives. Compliance with water-quality objectives and the need for further action will be reevaluated periodically during the groundwater monitoring period.

2.10 Statutory Determinations

This section discusses how the selected remedy for Site 9 meets statutory requirements of CERCLA Section 121. Under CERCLA Section 121, the selected remedy at a Superfund site must entail remedial actions that achieve adequate protection of human health and the environment. In addition, CERCLA Section 121 establishes several other statutory requirements and preferences specifying that, when complete, the selected remedial action must comply with ARARs established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy must also be cost-effective and must entail permanent solutions and alternative treatment

technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ, as their principal element, treatment technologies that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes.

2.10.1 Protection of Human Health and the Environment

The human health risk associated with Site 9 is within the NCP criteria range of $1x10^{-4}$ to $1x10^{-6}$ and the HI is less than 1.0. The results of the ecological risk assessment indicate no significant risk to the environment. The selected remedy was chosen because PCE and TCE concentrations exceed MCLs in two wells. The selected remedy will control the potential risk posed by the site by limiting access, restricting land use, and monitoring groundwater during natural attenuation.

2.10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all Federal and any more stringent State ARARs. No waivers are required. The ARARs for the selected remedy for Site 9 are discussed in Appendix B, along with any changes to ARAR determinations subsequent to the draft final FS for Site 9 (SWDIV, 1994a).

2.10.3 Cost-Effectiveness

The selected remedy was evaluated for cost-effectiveness in the context of the other six alternatives identified. The only alternative less expensive is the no action alternative, which would not comply with ARARs. Even though the selected remedy is not an active treatment, it must include monitoring to comply with ARARs. The selected remedy is the least expensive alternative that will comply with ARARs and be protective of human health and the environment.

2.10.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used for Site 9 in a cost-effective manner. Active treatment of soil and groundwater is not required because the risk associated with the site is within the NCP acceptable range of 10^{-4} to 10^{-6}, the HI is less than 1.0, and there is no significant risk to the environment. The practicality of implementing an active treatment for groundwater depends on the ability to pump sufficient quantities of groundwater. It was determined during the RI that Site 9 is underlain by highly impermeable marine terrace deposits that severely restrict the amount of groundwater that can be pumped from the formation, thereby limiting the effectiveness of and increasing the period of time associated with an active treatment system.

Computer modeling of the groundwater at Site 9 indicated that contaminant concentrations will be reduced to levels below MCLs within 10 years by dispersion and natural attenuation. Although the computer model was not extensively calibrated to site conditions, it represents the best estimate based on available site conditions. The combination of the low levels of contaminants present in the groundwater and the site conditions makes an active treatment system less desirable than dispersion and natural attenuation, which can achieve the same objectives in the same amount of time and at considerably lower cost. Table 2-24 presents a comparison of the costs and time estimates for completion for the different groundwater treatment alternatives identified. As indicated in the preamble to the NCP (EPA, 1990, p. 8734), the use of natural attenuation as a remediation technique is consistent with the EPA's groundwater protection policy for situations in which active restoration is not practical or warranted due to site conditions and groundwater is not likely to be used in the foreseeable future.

2.10.5 Preference for Treatment as a Principal Element

The requirement that treatment be a principal element of the remedy is not satisfied for the selected remedy for Site 9. Active remediation is not required given the results of the risk assessment. The selected remedy was chosen because the PCE and TCE concentrations in groundwater exceed MCLs. The

treatment alternatives identified require pumping of sufficient quantities of groundwater, which was determined to be impractical because of the impermeable marine terrace deposits underlying the site. Natural attenuation is consistent with the EPA's groundwater protection policy for situations in which active restoration is not practical and groundwater is not likely to be used in the foreseeable future.

TABLE 2-1
MCB CAMP PENDLETON RI/FS GROUPS

Group A - Sites with Limited Previous Investigation
- Site 3 - Pest Control Wash Rack
- Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment
- Site 5 - Firefighter Drill Field
- Site 6 - DPDO (DRMO) Scrap Yard and Building 2241
- Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
- Site 24 - 26 Area MWR Maintenance Facility

Group B - Landfills and Surface Impoundments
- Site 7 - Box Canyon Landfill
- Sites 8 and 8A - Las Pulgas Landfill and Las Flores Creek
- Site 14 - San Onofre Landfill
- Site 19 - 31 Area ACU-5 (LCAC) Surface Impoundments
- Site 20 - 43 Area Las Pulgas Vehicle Wash Rack
- Site 22 - 23 Area Unlined Surface Impoundment

Group C - Remaining Sites in the Santa Margarita Basin (SMB)
- Site 1 - Refuse Burning Grounds in SMB (2 locations)
- Site 2 - Grease Disposal Pits in SMB (2 locations)
- Site 10 - 26 Area Sewage Sludge Composting Yard
- Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch
- Site 17 - 22 Area Building 22187 Marsh and Ditch
- Site 27 - 22 Area Ditches Behind Building 22210
- Site 28 - 26 Area Trash Hauler's Maintenance Area
- Site 29 - 25 Area Skeet Range
- Site 30 - Firing Range Soil Fill in 31 Area
- Site 31 - Building 210801 Transformer (no sampling)
- Site 35 - Former Sewage Treatment Plant Facility in 25 Area
- Site 43 - SMB Groundwater Study
- Site 44 - SMB Surface Water and Sediment Study
- Site 45 - Santa Margarita Coastal Wetland Study

Group D - Remaining Sites outside the Santa Margarita Basin (SMB)
- Site 1 - Refuse Burning Grounds outside SMB (7 locations)
- Site 2 - Grease Disposal Pits outside SMB (4 locations)
- Site 18 - 13/16 Area Building 1687 Spill and Ditch
- Site 32 - Drum Storage Area and Drainage Between Buildings 41303 and 41366
- Site 33 - 52 Area Armory (Building 520452) and Drainage to Southeast
- Site 34 - Combat Engineers Maintenance Facility, Buildings 62580-62583
- Site 36 - Debris Pile Area Behind Ponds at Sewage Treatment Plant 11
- Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch
- Site 38 - 52 Area Sewer Line, Building 52188
- Site 39 - 41 Area Sewer Line, Buildings 41300 and 41346
- Site 40 - 13 Area Sewer Line, Building 13103
- Site 41 - 13 Area Sewer Line, Building 13128
- Site 42 - 13 Area Sewer Line, Building 13129
- Groundwater Study outside SMB
- Surface Water and Sediment Study outside SMB
- Coastal Wetland Study outside SMB.

ACU - Assault craft unit.
DPDO - Defense Property Disposal Office.
DRMO - Defense Reutilization and Marketing Office.
LCAC - Landing craft air cushion.
MCAS - Marine Corps Air Station.
MWR - Morale, Welfare, and Recreation.
POL - Petroleum, oil, and lubricants.
SMB - Santa Margarita basin.

TABLE 2-2
Range of Background Values from Validated Data
Santa Margarita Basin Alluvium

Analyte	Range of Background Values (mg/kg)	
	Minimum	Maximum
Aluminum	2,950	38,200
Antimony	ND<2.3	9.2BN
Arsenic	ND<0.16	12
Barium	8.4B	424
Beryllium	ND<0.09	1.2
Cadmium	ND<0.22	2.3
Calcium	1,750	44,800
Chromium	3.0	64
Cobalt	ND<1.7	16
Copper	ND<1.5	41
Iron	3,070	45,900
Lead	ND<0.7	45
Magnesium	865B	12,400
Manganese	16	1,060
Mercury	ND<0.02	0.08
Molybdenum	ND<0.10	3.3[a]
Nickel	ND<1.7	42
Potassium	351B	8,320
Selenium	ND<0.08	0.53B
Silver	ND<0.27	0.63B
Sodium	ND<112	5,590
Thaliium	ND<0.17	1.5B
Vanadium	5.3B	96
Zinc	ND<13	441

Background population is specific to lithology and geography. Background values are from all depths. Data base is presented in Appendix N of the draft final RI Report for Group A sites (SWDIV, 1993). Borings in this data base were selected based on the absence of site contaminants. Values have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Duplicate analysis exceeds control limits.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).
N - Spiked sample recovery not within control limits.

mg/kg - Milligrams per kilogram.
ND - Not detected.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.

TABLE 2-3
Range of Background Values from Validated Data
Marine Terrace Deposits

Analyte	Range of Background Values (mg/kg)	
	Minimum	Maximum
Aluminum	3,120	33,000
Arsenic	ND<1.3	4.9
Barium	ND<2.2	665
Beryllium	ND<0.10	1.1B
Cadmium	ND<1.20	4.7
Calcium	ND<139	15,400
Chromium	ND<3.2	71
Cobalt	ND<1.4	41
Copper	ND<2.6	87
Iron	2,680	37,900
Lead	ND<1.0	27
Magnesium	ND<335	12,300
Manganese	32	1,550
Mercury	ND<0.12	0.11
Molybdenum	ND<2.0	2.2B
Nickel	ND<4.5	50
Potassium	ND<441	6,940
Silver	ND<1.6	3.6
Sodium	ND<554	1,720
Thallium	ND<1.3	3.0B
Vanadium	7.8B	81
Zinc	ND<6.0	114

Background population is specific to lithology and geography. Background values are from all depths. Data base is presented in Appendix N of the draft final RI Report for Group A sites (SWDIV, 1993). Borings in this data base were selected based on the absence of site contaminants. Values have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).

mg/kg - Milligrams per kilogram.
ND - Not detected.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.

TABLE 2-4
Site 9 - Validated Organic Concentrations in Soil

Analyte	Range of Concentrations (µg/kg)		PRG (µg/kg)
	Minimum	Maximum	
Acetone	ND	110	27,000,000
2-Butanone	ND	16	13,500,000
4,4'-DDT	ND	34J	1,900
Diethylphthalate	ND	1,400J	216,000,000
Endosulfan sulfate	ND	30J	
Ethylbenzene	ND	190	27,000,000
bis(2-Ethylhexyl)phthalate	ND	240	46,000
Fluorene	ND	2,600J	10,800,000
Methylene chloride	ND	6	85,000
2-Methylnaphthalene	ND	22,000	
Naphthalene	ND	4,500	10,800,000
di-n-Octylphthalate	ND	210J	5,400,000
Phenanthrene	ND	5,700	
Toluene	ND	1,100	54,000,000
Total xylenes	ND	1,100	540,000,000
2,4,5-Trichlorophenol	ND	820	27,000,000
Diesel	ND	6,700,000	
Gasoline	ND	11,000	

Summary of validated soil analytical results from all depths for all organic compounds detected at Site 9. Validated analytical data are presented in Appendices X and Z of the draft final RI Report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

Contract Laboratory Program (CLP) qualifiers:

J - Estimated valued. Mass spectral data indicate the presence of a compound below the stated practical quantitation limit (PQL).

ND - Not detected.
PRG - Preliminary remediation goal, as calculated for the human health risk assessment.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.
µg/kg - Micrograms per kilogram.

TABLE 2-5
Site 9 - Validated Metals Concentrations in Soil[a]
(Sheet 1 of 2)

Analyte	Range of Concentrations (mg/kg)		Range of Background Values (mg/kg)[b]		PRG (mg/kg)
	Minimum	Maximum	Minimum	Maximum	
Aluminum	3,230	30,400	3,120	33,000	
Arsenic	ND	4.3	ND<1.3	4.9	0.36
Barium	ND	349	ND<2.2	665	18,900
Beryllium	ND	1.9	ND<0.10	1.1B	0.15
Cadmium	ND	13	ND<1.2	4.7	270
Calcium	ND	5,770	ND<139	15,400	
Cation exchange capacity[c]	1.4	2.6	NA	NA	
Chromium	ND	53	ND<3.2	71	1,350
Cobalt	ND	27	ND<1.4	41	1,160
Copper	ND	205	ND<2.6	87	
Electrical conductivity[d]	0.14	0.21	NA	NA	
Iron	3,430	37,900	2,680	37,900	
Lead	ND	207	ND<1	27	
Magnesium	1,000B	8,320	ND<335	12,300	
Manganese	31	721	32	1,550	27,000
Mercury	ND	1.3	ND<0.12	0.11	81
Molybdenum	ND	15	ND<2.0	2.2B	1,350
Nickel	ND	46	ND<4.5	50	5,400
pH[e]	7.4	7.6	NA	NA	
Potassium	ND	3,740	ND<441	6,940	
Selenium	ND	3.1B	ND	ND	1,350
Silver	ND	3.4	ND<1.6	3.6	1,350
Sodium	ND	630B	ND<554	1,720	
Total organic carbon	7,440	22,800	NA	NA	
Total phosphorus	392	663	NA	NA	
Vanadium	8.4B	125	7.8B	81	2,430
Zinc	ND	598	ND<6	114	54,000

TABLE 2-5
Site 9 - Validated Metals Concentrations in Soil[a]
(Sheet 2 of 2)

Summary of validated soil analytical results from all depths for all metals detected at Sites 4 ands 4A. Data base for background values is presented in Appendix N and validated analytical data are presented in Appendices X and Z of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Includes inorganics and general chemistry analytes.
[b]Range of background concentrations for the marine terrace deposits; validated analytical results.
[c]Cation exchange capacity units are milliequivalents per 100 grams (meq/100g).
[d]Electrical conductivity units are millimhos (mmhos).
[e]pH in units.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).

mg/kg - Milligrams per kilogram.
ND - Not detected.
PRG - Preliminary remediation goal, as calculated for the human health risk assessment.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.

TABLE 2-6
Site 9 - Comparison of Validated Groundwater Concentrations to MCLs
(Sheet 1 of 2)

Analyte	Range of Concentrations (µg/l)		Federal MCL (µg/l)	CA MCL (µg/l)
	Minimum	Maximum		
Alkalinity, bicarbonate	118	400		
Aluminum	ND	2,780		
Antimony	ND	19B[a]	6.0[b]	
Arsenic	ND	14	50	50
Barium	ND	292	1,000	1,000
Beryllium	ND	0.2B	4.0[b]	
Boron	ND	296		
2-Butanone	ND	5.0		
Cadmium	ND	13	5.0	10
Calcium	37,400	227,000		
Chloride	115,000	731,000		
Chromium	ND	76	100	50
Cobalt	ND	10B		
Copper	ND	6.5B		
Dalapon	ND	0.5	200	
1,2-Dichloroethane	ND	2.0	5.0	0.50
1,2-Dichloroethene	ND	5.0	70	6.0
Iron	ND	3,410		
Magnesium	32,200	154,000		
Manganese	ND	779		
Mercury[c]	ND	66	2.0	2.0
Molybdenum	ND	11B		
Nickel	ND	1,100[a]	100[b]	
Nitrate	ND	18,000	10,000 (as N)	45,000 (as NO_3)
pH[d]	5.40	7.8		
Potassium	ND	16,300		
Selenium	ND	2.6B	50	10
Silver	ND	6.1B		
Sodium	108,000	309,000		
Sulfate	76,000	372,000		
Tetrachloroethene	ND	10	5.0	5.0
Thallium	ND	1.1BW	2.0[b]	
Toluene	ND	0.9J	1,000	
Total dissolved solids	600,000	2,030,000		

TABLE 2-6
Site 9 - Comparison of Validated Groundwater Concentrations to MCLs
(Sheet 2 of 2)

Analyte	Range of Concentrations (µg/l)		Federal MCL (µg/l)	CA MCL (µg/l)
	Minimum	Maximum		
Trichloroethene	ND	15	5.0	5.0
Vanadium	ND	9.6B		
Zinc	ND	183		
Diesel	ND	470		

Summary of validated analytical results for compounds detected during third and fourth quarter 1992 and first quarter 1993 sampling. Validated analytical data are presented in Appendices W and Y of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Within background levels (Section 2.5.1.2).
[b]Promulgated MCL, but not in effect until January 1994.
[c]Maximum concentration detected during third quarter 1992, within a few days of detection of a mercury concentration of 15 µg/l in a field blank. Suspect contamination in the sample bottle. Mercury was not detected during the subsequent sampling rounds.
[d]pH in units.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).
J - Estimated value. Mass spectral data indicate the presence of a compound below the stated practical quantitation limit (PQL).
W - Postdigestion spike for graphite furnace atomic absorption analysis exceeds control limits, while sample absorption is less than 50 percent of spike absorption.

CA - California.
MCL - Maximum contaminant level.
ND - Not detected.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.
µg/l - Micrograms per liter.

TABLE 2-7
Site 9 - Comparison of Validated Surface-Water Concentrations to Standards

Analyte	Range of Concentrations (µg/l)		Aquatic Life Standards (µg/l)			
			California (SWRCB, 1992)		Federal (EPA, 1992a)	
	Minimum	Maximum	Acute	Chronic	Acute	Chronic
Aluminum	342	355	--	--	750	87
Arsenic	1.3B	1.4B	360	190	360	190
Barium	26BE	28BE	--	--	--	--
Calcium	9,090	9,680	--	--	--	--
Copper[a]	23B	25	8.4	6.0	8.4	6.0
Iron	638	758	--	--	--	1,000
Magnesium	5,300	5,460	--	--	--	--
Manganese	20	53	--	--	--	--
Nickel[a]	ND	8.1B	722	80	722	80
Potassium	3,780B	3,830B	--	--	--	--
Sodium	11,800	12,300	--	--	--	--
Vanadium	3.0B	3.0B	--	--	--	--
Zinc[a]	3.7B	9.2B	59.5	54	59.5	54

Summary of validated analytical results for compounds detected during third and fourth quarter 1992 and first quarter 1993 sampling. Validated analytical data are presented in Appendices W and Y of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Standards are hardness-dependent; standards developed using calculated hardness (as $CaCO_3$) value of 45 milligrams per liter for Site 9 surface water.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).
E - Reported value is estimated because of interference.

EPA - U.S. Environmental Protection Agency.
ND - Not detected.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.
SWRCB - California State Water Resources Control Board.
µg/l - Micrograms per liter.
-- No standard.

TABLE 2-8
Sites 4 and 4A - Validated Organic Concentrations in Soil

Analyte	Range of Concentrations (µg/kg)		Risk-Based PRG (µg/kg)
	Minimum	Maximum	
Acetone	ND	7.0J	27,000,000
di-n-Butylphthalate	ND	430J	27,000,000
4,4'-DDD	ND	100	2,700
4,4'-DDE	ND	170	1,900
4,4'-DDT	ND	75JX	1,900
Dieldrin	ND	5.6J	40
bis(2-Ethylhexyl) phthalate	ND	720J	46,000
Hexachloroethane	ND	750J	45,700
Toluene	ND	33	54,000,000
Trichloroethene	ND	6.0	58,000
Diesel	ND	68,000	
Gasoline	ND	3,700	

Summary of validated soil analytical results from all depths for all organic compounds detected at Sites 4 and 4A. Validated analytical data are presented in Appendices X and Z of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

Contract Laboratory Program (CLP) qualifiers:

J - Estimated valued. Mass spectral data indicate the presence of a compound below the stated practical quantitation limit (PQL).

JX - Value is less than the sample quantitation limit that would have been displayed for U.

ND - Not detected.

PRG - Preliminary remediation goal, as calculated for the human health risk assessment.

RI - Remedial investigation.

SWDIV - Southwest Division Naval Facilities Engineering Command.

µg/kg - Micrograms per kilogram.

TABLE 2-9
Sites 4 and 4A - Validated Metals Concentrations in Soil[a]
(Sheet 1 of 2)

Analyte	Range of Concentrations (mg/kg)		Range of Background Values[b] (mg/kg)		Risk-Based PRG (mg/kg)
	Minimum	Maximum	Minimum	Maximum	
Aluminum	5,940	29,400	2,950	38,200	
Antimony	ND	4.1BN	ND<2.3	9.2BN	108
Arsenic	ND	4.4B	ND<0.16	12	0.36
Barium	68	268	8.4B	424	18,900
Beryllium	ND	0.82B	ND<0.09	1.2	0.15
Cadmium	ND	1.7	ND<0.22	2.3	270
Calcium	2,090	16,400	1,750	44,800	
Chromium	8.3	33	3.0	64	1,350
Cobalt	ND	12B	ND<1.7	16	1,080
Copper	ND	32	ND<1.5	41	
Cyanide	ND	1.3	ND	ND	5,400
Iron	8,760[c]	32,200	3,070	45,900	
Lead	ND	41	ND<0.7	45	
Magnesium	2,630	10,400	865B	1,060	
Manganese	119N	576	16	576	27,000
Mercury	ND	0.12	ND<0.02	0.08	81
Nickel	ND	16	ND<1.7	42	5,400
Potassium	2,520	9,030	351B	8,320	
Silver	ND	2.0B	ND<0.27	0.63B	1,350
Sodium	ND	1,160	ND<112	5,590	
Thallium	ND	1.7B	ND<0.17	1.5B	21.6
Total organic carbon	485	7,610	NA	NA	
Vanadium	25	84	5.3B	96	2,430
Zinc	24E	138	ND<13	441	54,000

TABLE 2-9
Sites 4 and 4A - Validated Metals Concentrations in Soil[a]
(Sheet 2 of 2)

Summary of validated soil analytical results from all depths for all metals detected at Sites 4 and 4A. Data base for background values is presented in Appendix N and validated analytical data are presented in Appendices X and Z of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Includes inorganics and total organic carbon.
[b]Range of background concentrations for the Santa Margarita basin; validated analytical results.
[c]Duplicate analysis exceeds control limits.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).
E - Reported value is estimated because of interference.
N - Spiked sample recovery not within control limits.

mg/kg - Milligrams per kilogram.
NA - Not analyzed.
ND - Not detected.
PRG - Preliminary remediation goal, as calculated for the human health risk assessment.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.

TABLE 2-10
Site 4 - Comparison of Validated Surface-Water Concentrations to Standards
(Sheet 1 of 2)

Analyte	Range of Concentrations (µg/l)		Aquatic Life Standards (µg/l)			
			California (SWRCB, 1992)		Federal (EPA, 1992a)	
	Minimum	Maximum	Acute	Chronic	Acute	Chronic
Acetone	ND	5.0				
Alkalinity, bicarbonate	ND	664,000				
Alkalinity, carbonate	ND	80,000				
Alkalinity, total	ND	664,000				
Aluminum	ND	34,600			750	87
Arsenic	ND	34	360	190	360	190
Barium	ND	394				
Boron	ND	645				
di-n-Butylphthalate	ND	2.1				
Calcium	ND	129,000				
Chloride	ND	493,000			860,000	230,000
Chloromethane	ND	30				
Chromium[a]	ND	34	6,329	754	6,329	754
Copper[a]	ND	40	78	46	78	46
Diethylphthalate	ND	2.5				
Iron	ND	46,700				1,000
Lead[a]	ND	20	609	24	609	24
Magnesium	ND	59,300				
Manganese	ND	3,720				
4-Methylphenol	ND	790				
Molybdenum	ND	155				
Nitrogen, NO_2+NO_3	ND	5,890				
pH[b]	NA	8.2				
Potassium	ND	12,900				
Sodium	ND	494,000				
Sulfate	ND	297,000				
TDS	ND	1,820,000				
Toluene	ND	9			17,500[b]	
Vanadium	ND	115				
Zinc[a]	ND	140	446	404	446	404
Gasoline	ND	130				

TABLE 2-10
Site 4 - Comparison of Validated Surface-Water Concentrations to Standards
(Sheet 2 of 2)

Summary of validated analytical results for compounds detected during third and fourth quarter 1992 and first quarter 1993 sampling. Validated analytical data are presented in Appendices W and Y of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Standards are hardness-dependent; standards were developed using a calculated hardness (as $CaCO_3$) value of 485 milligrams per liter for Site 4 surface water.
[b]pH in units, not µg/l.

NA - Not analyzed.
ND - Not detected.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.
TDS - Total dissolved solids.
µg/l - Micrograms per liter.

TABLE 2-12
Site 24 - Validated Organic Concentrations in Soil

Analyte	Range of Concentrations (µg/kg)		Risk-Based PRG (µg/kg)
	Minimum	Maximum	
Acetone	ND	37	27,000,000
Aroclor-1254	ND	480	
Benzene	ND	3.0J	22,000
Benzoic acid	ND	110J	1,080,000,000
BHC (gamma) (Lindane)	ND	3.0	490
2-Butanone	ND	5.0J	13,500,000
Butylbenzylphthalate	ND	300J	54,000,000
di-n-Butylphthalate	ND	85J	27,000,000
Chlordane (alpha)	ND	7.5JX	490
Chlordane (gamma)	ND	4.3JX	490
Chloroform	ND	7.0J	105,000
Chloromethane	ND	4.0J	49,200
Chrysene	ND	77J	
4,4'-DDD	ND	200	2,700
4,4'-DDE	ND	72	1,900
4,4'-DDT	ND	140	1,900
Dieldrin	ND	2.2	40
Diethylphthalate	ND	59J	216,000,000
bis(2-Ethylhexyl) phthalate	ND	1,600J	46,000
Fluoranthene	ND	550J	10,800,000
Methylene Chloride	ND	538	85,000
n-Nitrosodiphenylamine	ND	97J	130,000
Nitrobenzene	ND	180J	135,000
Pyrene	ND	470J	8,100,000
Toluene	ND	350D	54,000,000
Diesel	ND	180,000	
Gasoline	ND	2,400	

Summary of validated soil analytical results from all depths for all organic compounds detected at Site 24. Validated analytical data are presented in Appendices X and Z of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

Contract Laboratory Program (CLP) qualifiers:
J - Estimated valued. Mass spectral data indicate the presence of a compound below the stated practical quantitation limit (PQL).
JX - Value is less than the sample quantitation limit that would have been displayed for U.
D - Identifies compound in an analysis that has been run at a dilution to bring the concentration of that compound within the linear range of the instrument. D qualifiers are only placed on samples that have been run initially with results above acceptable ranges.

ND - Not detected.
PRG - Preliminary remediation goal, as calculated for the human health risk assessment.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.
µg/kg - Micrograms per kilogram.

TABLE 2-11
Field-Collected Filamentous Algae
Santa Margarita River Sites
Tissue Contaminant Concentrations

Inorganics (mg/kg dry weight)	6BAS1 Downstream of Site 4 Drainage		6BAS2 Upstream of Site 4 Drainage	
Silver	0.37	B	0.36	U
Aluminum	398	*	170	*
Arsenic	0.72	B	0.74	B
Barium	125		32.6	B
Beryllium	0.1	U	0.1	U
Calcium	18,100	*	32,300	*
Cadmium	0.14	U	0.14	U
Cobalt	1	U	1	U
Chromium	0.56	U	0.56	U
Copper	2.1	B	1.1	B
Iron	676	*	225	*
Mercury	0.03	U	0.03	U
Potassium	1,340		1,220	
Magnesium	802	B	1,230	
Manganese	3,630		98.4	
Molybdenum	0.72	U	0.72	U
Sodium	388	B	392	B
Nickel	1.5	U	1.5	U
Lead	0.54	BWN	0.1	UWN
Antimony	2.5	U	2.5	U
Selenium	0.14	U	0.14	U
Thallium	0.14	U	0.14	U
Vanadium	4	B	2.1	B
Zinc	9.1	E	4.6	E

Contract Laboratory Program (CLP) qualifiers:
B - Reported value is greater than or equal to instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).
E - Reported value is estimated because of interference.
N - Spiked sample recovery not within control limits.
U - Value is less than the IDL or was not detected.
W - Postdigestion spike for graphite furnace atomic absorption is out of control limits, while sample absorption is less than 50 percent of spike absorption.
* - Duplicate analysis not within control limits.
mg/kg - Milligrams per kilogram.

TABLE 2-13
Site 24 - Validated Metals Concentrations in Soil[a]
(Sheet 1 of 2)

Analyte	Range of Concentrations (mg/kg)		Range of Background Values (mg/kg)[b]		Risk-Based PRG (mg/kg)
	Minimum	Maximum	Minimum	Maximum	
Aluminum	ND	19,500	2,950	38,200	
Antimony	ND	16N	ND<2.3	9.2BN	108
Arsenic	ND	3.0	ND<0.16	12	0.36
Barium	ND	105	8.4B	424	18,900
Beryllium	ND	0.69B	ND<0.09	1.2	0.15
Cadmium	ND	4.0	ND<0.22	2.3	270
Calcium	ND	8,210	1,750	44,800	
Chromium	ND	50	3.0	64	1,350
Cobalt	ND	10B	ND<1.7	16	1,080
Copper	1.8B	216	ND<1.5	41	
Iron	0.03B	26,900	3,070	45,900	
Lead	ND	295N[c]	ND<0.70	45	
Magnesium	0.01B	8,380	865B	12,400	
Manganese	ND	251	16	1,060	27,000
Mercury	ND	0.31	ND<0.02	0.08	81
Molybdenum	ND	0.82[c]	ND<0.1	3.3[c]	1,350
Nickel	ND	19	ND<1.7	42	5,400
Potassium	ND	6,500	351B	8,320	
Silver	ND	0.53B	ND<0.27	0.63B	1,350

TABLE 2-13
Site 24 - Validated Metals Concentrations in Soil[a]
(Sheet 2 of 2)

Analyte	Range of Concentrations (mg/kg)		Range of Background Values (mg/kg)[b]		Risk-Based PRG (mg/kg)
	Minimum	Maximum	Minimum	Maximum	
Sodium	ND	1,700E	ND<112	5,590	
Thallium	ND	0.49B	ND<0.17	1.5B	21.6
Total organic carbon	8,410	8,410	NA	NA	
Vanadium	ND	46	5.3B	96	2,430
Zinc	ND	254	ND<12.6	441	54,000

Summary of validated soil analytical results from all depths for all metals detected at Site 24. Data base for background values is presented in Appendix N and validated analytical data are presented in Appendices X and Z of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Includes inorganics and total organic carbon.
[b]Range of background concentrations for the Santa Margarita basin; validated analytical results.
[c]Duplicate analysis not within control limits.

Contract Laboratory Program (CLP) qualifiers:
B - Reported value greater than or equal to the instrument detection limit (IDL) but less than the contract-required detection limit (CRDL).
E - Reported value is estimated because of interference.
N - Spiked sample recovery not within control limits.

mg/kg - Milligrams per kilogram.
NA - Not analyzed.
ND - Not detected.
PRG - Preliminary remediation goal, as calculated for the human health risk assessment.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Engineering Command.

TABLE 2-14
Site 24 - Comparison of Validated Groundwater Concentrations to MCLs

Analyte	Range of Concentrations (µg/l)		EPA MCL (µg/l)	CA MCL (µg/l)
	Minimum	Maximum		
Alkalinity, bicarbonate	ND	475,000		
Alkalinity, total	ND	475,000		
Aluminum	ND	14,800		
Antimony	ND	49[a]	6.0[a]	
Arsenic	ND	9.5	50	50
Barium	ND	9.5	1,000	1,000
bis(2-Ethylhexyl)phthalate	ND	1.4	6.0[a]	4.0
Boron	ND	881		
Calcium	39,000	596,000		
Chloride	ND	2,243,000		
Chloromethane	ND	17	100	
Chromium[b]	ND	137	100	50
Copper	ND	13		
di-n-Butylphthalate	ND	3.0		
Iron	ND	13,000		
Lead	ND	3.5	50	50
Magnesium	4,290	120,000		
Manganese	28	501		
Molybdenum	ND	39		
Nickel	ND	633[a]	100[a]	
Nitrogen, NO_2+NO_3	ND	3,930	10,000 (as N)	45,000 (as NO_3)
Potassium	ND	17,300		
Total dissolved solids	646,000	4,740,000		
Selenium	ND	21	50	10
Sodium	156,000	667,000		
Sulfate	80,000	437,000		
Vanadium	ND	60		
Zinc	ND	696		
Diesel	ND	720		

Summary of validated analytical results for compounds detected during third and fourth quarter 1992 and first quarter 1993 sampling. Validated analytical results are presented in Appendices W and Y of the draft final RI report for Group A sites (SWDIV, 1993). Concentrations have been rounded off to whole numbers for values exceeding 10, to one decimal place for values less than 10, and to two decimal places for values less than 1.0.

[a]Considered to be within background range (Section 2.5.3.2).
[b]Promulgated MCL, but not in effect until January 1994.
[c]Only detected above the MCL in one well during the first quarter of sampling. Two subsequent quarters of sampling at this well showed concentrations considerably below the Federal or State MCL (approximately 10 times lower).

MCL - Maximum contaminant level.
ND - Not detected.
RI - Remedial investigation.
SWDIV - Southwest Division Naval Facilities Eningeering Command.
µg/l - Micrograms per liter.

TABLE 2-15
Pertinent Chemical and Physical Parameters of Chemicals Detected at Group A Sites
(Sheet 1 of 4)

Chemical	CAS No.	Mol Wt	Henry's Law Constant (atm-m^3/mol)	Log K_{ow}	K_{oc}[a]	K_d	Solubility (mg/l)	SW Half-Life Low (days)[b]	SW Half-Life High (days)[b]	Soil Half-Life Low (days)[b]	Soil Half-Life High (days)[b]
Acetone	67-64-1	58.09	3.67E-05[c]	0.24[c]	2.2	1.474	1,000,000 (miscible)[c]	1	7	1	7
Aluminum	7429-90-5	26.98					insoluble[d]				
Antimony	7440-36-0	121.75					insoluble[e]				
Aroclor-1254	11097-69-1	327	2.80-3.20E-04[f]	6.47[g]	1.0E+05-1.0E+09[h]		0.0027-0.91[f]	0.42[i]		15[i]	>50[i]
Arsenic	7440-38-2	74.92				200[j]	676[j]				
Barium	7440-39-3	137.34				60[j]	871[j]				
Benzene	71-43-2	78.11	5.43E-03[c]	2.13[c]	83	55.61	1791[c]	5	16	5	16
Benzoic acid	65-85-0	122.13	7.00E-08[k]	1.87[k]	54.4	36.448	2,700[k]	0.20[k]	3.6[k]		7[k]
Beryllium	7440-41-7	9.01				650[j]	426[j]				
gamma BHC	58-89-9	290.85	2.92E-06[c]	3.61[c]		7.3[c]					
Boron	7440-42-8	10.81				3[j]	19,300[j]				
2-Butanone	78-93-3	72.1	1.05E-05[c]	0.29[c]	4.5	3.015	239,000[c]	1	7	1	7
Butylbenzylphthalate	85-68-7	312.39	1.03E-06[k]	4.91[k]	17,000	11390	2.69[k]	1	7	1	7
di-n-Butylphthalate	84-74-2	278.38	5.30E-05[l]	4.72[k]	3,280	113,900	11.2[k]	1	14	2	23
Cadmium	7440-43-9	112.40				6.5[j]	469[j]				
alpha-Chlordane	5103-71-9	409.8	4.85E-05[m]	5.54[m]	3,090-43,651[m]		0.056[m]	<10[m]		2-3[m]	154[m]
beta-Chlordane	5103-74-2	409.8	8.31E-05[m]	5.54[m]	1,995,262[m]		0.056[m]	<10[m]		2-3[m]	210[m]
Chloroform	67-66-3	119.39	4.35E-03[c]	1.97[c]	31	20.77	7,950[c]	28	180	28	180
Chloromethane	74-87-3	50.49	2.40E-02[k]	0.91[k]	4.3	2.881	3,960,000	7	28	7	28

TABLE 2-15
Pertinent Chemical and Physical Parameters of Chemicals Detected at Group A Sites
(Sheet 2 of 4)

Chemical	CAS No.	Mol Wt	Henry's Law Constant ($atm\text{-}m^3/mol$)	Log K_{ow}	K_{oc}[a]	K_d	Solubility (mg/l)	SW Half-Life Low (days)[b]	SW Half-Life High (days)[b]	Soil Half-Life Low (days)[b]	Soil Half-Life High (days)[b]
Chromium (Total)	7440-47-3	52				850[j]	21.7[j]				
Chrysene	218-01-9	228.3	0.1064-218[l] ($Pa\cdot atm\text{-}m^3/mol$)	5.61[a]	200,000	134,000	0.002[a]	0.18	0.54	371	1,000
Cobalt	7440-48-4	58.93				45[j]	0.368[j]				
Copper	7440-50-8	63.54				35[j]	96.4[j]				
Cyanide	57-12-5	26.02					99.1[j]				
Dalapon	75-99-0	142.97	6.43E-08[h]	0.78[g]			502,000[n]	14	60	14	60
1,2-Dichloroethane	107-06-2	98.96	9.77E-04[c]	148[c]			8,524[c]	100	180	100	180
1,2-Dichloroethene (Total)	156-59-2(cis) 156-60-5(trans)	96.95	6.56E-03[a]	1.86[c] (cis), 2.06[c] (trans)	59	39.53	6,300[c]	0.125 (cis/trans)[c]			
4,4'-DDD	72-54-8	320	7.96E-06[a]	6.2[a]	770,000	515,900	0.09[j]	730	5,694	730	5,694
4,4'-DDE	72-55-9	318	6.80E-05[a]	7[a]	4,400,000	2,948,000	0.12[j]	0.63	6.1	730	5,694
4,4'-DDT	50-29-3	355	5.13E-04[a]	6.19[a]	243,000	162,810	0.025[j]	7	350	730	5,694
Dieldrin	60-57-1	380.93	5.80E-05[n]	4.32[n]	1,700	1,139	0.17[n]	175	1,080	175	1,080
Diethylphthalate	84-66-2	222.26	4.80E-07[k]	2.47[k]	142	95.14	1,080[k]	3	56	3	56
Endosulfan sulfate	1031-07-8	422.91	2.60E-05[o]	3.66[o]			0.117-0.22[o]				
Ethylbenzene	100-41-4	106.16	8.44E-03[k]	3.15[k]	1,100	737	161[k]	3	10	3	10
bis(2-Ethylhexyl)phthalate	117-81-7	390.54	1.10E-05[k]	5.11[k]	1.2	58,558	0.3[k]	5	23	5	23
Fluoranthene	206-44-0	202	6.46E-06[a]	4.9[a]	38,000	25,460	0.21[a]	0.88	2.6	140	440
Fluorene	86-73-7	166.23	6.42E-05[a]	4.2[a]	7,300	4,891	1.69[a]	32	60	32	60
Hexachloroethane	67-72-1	236.74	2.80E-03[c]	3.82[c]			50[c]	28	180	28	180
Iron	7439-89-6	55.85				25[j]	4.64[j]				

TABLE 2-15
Pertinent Chemical and Physical Parameters of Chemicals Detected at Group A Sites
(Sheet 3 of 4)

Chemical	CAS No.	Mol Wt	Henry's Law Constant (atm-m^3/mol)	Log K_{ow}	K_{oc}[a]	K_d	Solubility (mg/l)	SW Half-Life Low (days)[b]	SW Half-Life High (days)[b]	Soil Half-Life Low (days)[b]	Soil Half-Life High (days)[b]
Lead	7439-92-1	207.19				900[j]	93.6[j]				
Magnesium	7439-95-4	24.305									
Manganese	7439-96-5	54.94				65[j]	18,300[j]				
Mercury	7439-97-6	200.59				10[j]	5.60E-02[p]				
Methylene chloride	75-09-2	84.94	4.40E-02[a]	1.25[c]	8.8	5.896	1,300[c]	0.09	0.23	365	180
2-Methylnaphthalene	91-57-6	142.21	2.60E-04[l]	4.11	7,940	5319.8	25.4	2.25[l]	410[l]		
4-Methylphenol	106-44-5	108.13	9.60E-07[k]	1.94[k]	17	11.39	22,600[k]	0.04	0.67	0.04	0.67
Molybdenum	7439-98-7	95.94									
n-Nitrosodiphenylamine	86-30-6	198.24	6.60E-04[h]	2.57-3.13[h]	832-1,820[h]	0	40[h]	10	34	10	34
Naphthalene	91-20-3	128.16	4.83E-04[k]	3.3[k]	940	629.8	31.7[k]	0.5	20	16.6	48
Nickel	7440-02-0	58.71				150[j]	1,210[j]				
Nitrate	14797-55-8										
Nitrobenzene	98-95-3	123.12	2.44E-05[k]	1.79[g]	56.2-270[k]	6.87-176[l]	1,900[k]	13.41	197	13.41	197
di-n-Octylphthalate	117-84-0	390.57	1.41E-12[k]	9.2[k]			3[k]				
Phenanthrene	85-01-8	178	1.59E-04[a]	4.46[a]	14,000	9,380	1[a]	0.13	1.04	16	200
Potassium	7440-09-7	39.01									
Pyrene	129-00-0	202	5.04E-06[a]	4.88[a]	38,000	25,460	0.13[a]	0.03	0.09	210	1,900
Selenium	7782-49-2	78.96				300[j]	27,100[j]				
Silver	7440-22-4	107.87				45[j]	158[j]				
Sodium	7440-23-5	22.99									
Tetrachloroethene	127-18-4	165.82	1.49E-02[c]	3.40[c]			150.3[c]	180	360	180	360
Thallium	7440-28-0	204.37				1,500[j]	0.687[l]				

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TABLE 2-15
Pertinent Chemical and Physical Parameters of Chemicals Detected at Group A Sites
(Sheet 4 of 4)

Chemical	CAS No.	Mol Wt	Henry's Law Constant (atm-m^3/mol)	Log K_{ow}	K_{oc}[a]	K_d	Solubility (mg/l)	SW Half-Life Low (days)[b]	SW Half-Life High (days)[b]	Soil Half-Life Low (days)[b]	Soil Half-Life High (days)[b]
Toluene	108-88-3	92.13	5.94E-03[c]	2.73[c]	300	201	534.8[c]	4	22	4	22
Total xylenes	1330-20-7	106.17	7.04E-03[a]	3.26[a]	240	160.8	198[a]	7	28	7	28
Trichloroethene	79-01-6	131.4	1.03E-02[c]	2.42[c]	126	84.42	1,100[c]	180	365	180	365
2,4,5-TP	93-72-1	269.51	1.31E-08[n]	3.41[n]	5,250	3517.5	140[n]			12[n]	17[n]
Vanadium	7440-62-2	50.94				1,000[f]	4,480[j]				
Zinc	7440-66-6	65.37				40[f]	951[j]				

"Half-life" is defined as the expected time for the concentration of a chemical to decrease by one-half when present in water or soil.

[a]EPA, 1987.
[b]Howard et al., 1991.
[c]Howard et al., 1990.
[d]ATSDR, 1992a.
[e]EPA, 1992d.
[f]BEIA, 1989.
[g]Calculated using method from Lyman et al., 1991.
[h]ATSDR, 1992b.
[i]Mackay et al., 1992.
[j]HRSD, 1991.
[k]Howard, 1989.
[l]HSDB, 1992.
[m]ATSDR, 1993a.
[n]Howard, 1991.
[o]ATSDR, 1991.
[p]ATSDR, 1993b.
[q]Tinsley, 1979.

atm-m^3/mol - Cubic meters (atmosphere) per mole.
mg/l - Milligrams per liter.
mol wt - Molecular weight.
Pa-atm-m^3/mol - Vapor pressure x cubic meters (atmosphere) per mole.
SW - Surface water.

Table 2-16
Site 9 Chemicals of Concern[a] in Groundwater and Soil, Concentrations, Frequency of Detection, Soil Background, and Maximum Contaminant Levels

Soil Chemical of Concern	Frequency of Detection	Concentration Range Min - Max (mg/kg)	Background Range Min - Max (mg/kg)	Background Frequency of Detection	Background 95% UCL (mg/kg)	Average Concentration (mg/l)	RME Concentration[b] (mg/l)
Beryllium	7/7	0.15-1.9	<0.1-1.1	40/71	0.69	0.42	1.9[c]

Groundwater Chemical of Concern[d]	Frequency of Detection	Concentration[e] Range Min - Max (mg/l)	Maximum Contaminant Level[f] (mg/l)	Average Concentration (mg/l)	RME Concentration[b] (mg/l)
Trichloroethene	6/66	0.0007-0.015	0.005	0.0014	0.0022
Tetrachloroethene	14/66	0.004-0.018	0.005	0.0013	0.0019

[a]Chemicals of concern were evaluated in the risk assessment and determined to pose a risk. Data presented are from the RI for Site 9.
[b]The reasonable maximum concentration is the calculated 95 percent UCL. One-half the detection limit was used for nondetected values.
[c]The maximum detected concentration was used because the 95 percent UCL exceeded it.
[d]Tetrachloroethene exceeded its MCL in only one well, 9W-07A. Trichloroethene exceeded its MCL in only one well, MW-04D.
[e]The groundwater concentrations are from 5 rounds of groundwater monitoring from the third quarter of 1992 to the first quarter of 1994.
[f]The Federal and State MCLs are the same.

MCL - Maximum contaminant level.
mg/kg - Milligrams per kilogram.
mg/l - Milligrams per liter.
RI - Remedial investigation.
RME - Reasonable maximum exposure.
UCL - Upper confidence limit.

Table 2-17
Summary of Site 9 Groundwater Cancer Risk and Noncancer Hazard for the Reasonable Maximum Exposure to the Main Contributors

Exposure Scenario	Exposure Pathway	Route of Exposure	Chemical of Concern	Cancer			Noncancer		
				Chronic Daily Intake (mg/kg-day)	Slope Factor $(mg/kg\text{-}day)^{-1}$	Risk (CDI x SF)	Chronic Daily Intake (mg/kg-day)	Reference Dose (mg/kg-day)	Hazard Index (CDI/RfD)
Current									
Military Civil Servant	Soil	Ingestion and Dermal	Beryllium	2.6E-07	4.3E+00	1E-06	7.3E-07	5.0E-03	<1.0
	Pathway Total					1E-06			<1.0
	Total for Current Military Civil Servant					1E-06			<1.0
Future									
Adult Resident	Groundwater	Ingestion and Dermal	PCE TCE	3.0E-05 2.4E-05	5.2E-02 1.1E-02	1E-06 3E-07	6.8E-05 5.6E-05	1.0E-02 6.0E-03	<1.0 <1.0
		Route Total				1E-06			<1.0
	Groundwater	Inhalation	PCE TCE	9.6E-06 8.4E-06	2.0E-03 6.0E-03	2E-08 5E-08	2.3E-05 2.0E-05	1.0E-02 6.0E-03	<1.0 <1.0
		Route Total				7E-08			<1.0
	Pathway Total					2E-06			<1.0
Child Resident	Soil	Ingestion and Dermal	Beryllium	2.7E-06	4.3E+00	1E-05	3.2E-05	5.0E-03	<1.0
Adult Resident	Soil	Ingestion and Dermal	Beryllium	1.7E-06	4.3E+00	7E-06	4.9E-06	5.0E-03	<1.0
	Pathway Total					2E-05			<1.0
	Total for Future Resident Adult/Child					2E-05			<1.0

CDI - Chronic daily intake.
mg/kg-day - Milligrams per kilogram per day.
PCE - Tetrachloroethene.
RfD - Reference dose.
SF - Slope factor.
TCE - Trichloroethene.

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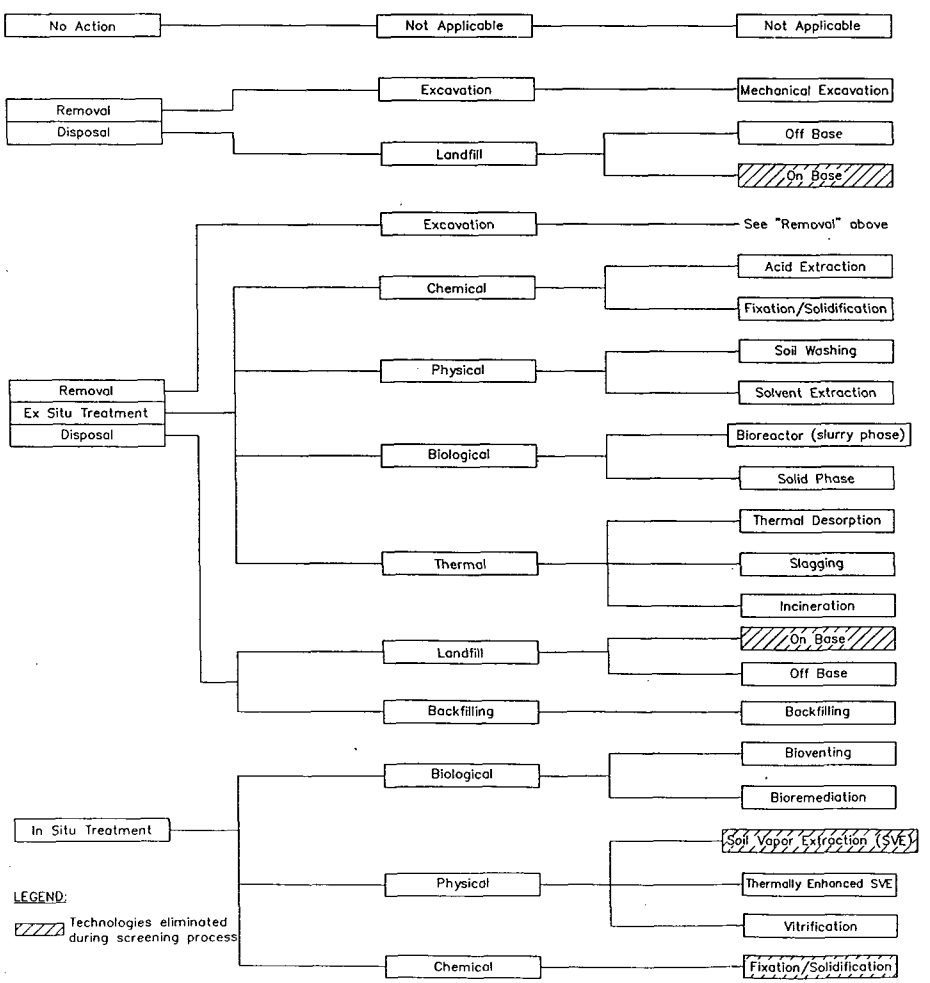
TABLE 2-18
INITIAL SCREENING OF TECHNOLOGIES FOR SOIL
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA



DESCRIPTION	SCREENING COMMENTS
No action is taken.	Consideration required by the National Contingency Plan
Contaminated soil is excavated by heavy equipment.	Potentially applicable
Contaminated soil is transported to an off-base landfill.	Potentially applicable
Contaminated soil is transported to an on-base landfill.	Not applicable
Metals are solubilized and removed from the soil.	Potentially applicable for metals
Reagents are added to the soil matrix to reduce the mobility of contaminants and improve waste handling.	Potentially applicable for metals
Contaminants that physically adhere to soil are removed by washing with water and reagents under mechanical action.	Potentially applicable
Organic contaminants are removed via a liquid-solid extraction process using a fluid solvent.	Potentially applicable for total petroleum hydrocarbons (TPH)
Excavated soil is mixed with water and nutrients to form a slurry, mechanically agitated, and dewatered.	Potentially applicable for TPH
Excavated soil is mixed with nutrients and contained; water is provided by a sprayer or a sprinkler system.	Potentially applicable for TPH
Organic contaminants are volatilized at high temperatures and removed from the gas phase in a controlled environment.	Potentially applicable for TPH
Contaminants are either volatilized and treated or liquified into a slag.	Potentially applicable
Contaminated soil is burned in air in a controlled environment to remove organic contaminants.	Potentially applicable for TPH
Treated soil is transported to an on-base landfill.	Not applicable
Treated soil is transported to an approved, engineered off-base disposal facility.	Potentially applicable
Treated soil is used as a backfill for the excavated area.	Potentially applicable
Indigenous microbial degradation of organics is enhanced by inducing a low air flow in subsurface soil.	Potentially applicable for TPH
Nutrients and an oxygen source (and possibly microbes) are injected into the soil via injection wells to enhance biodegradation. Indigenous microbes may be used.	Potentially applicable for TPH
Volatile organics are removed by inducing an air flow in subsurface soils and collecting the vapors through extraction wells.	Not applicable for metal constituents or TPH-diesel
Heat is used to enhance the volatilization of organic contaminants in a modified soil vapor extraction process.	Potentially applicable for TPH
Electrical power is used to melt contaminated soil to form a stable glass and crystalline structure.	Potentially applicable
Similar to the ex situ process option, except that soil is not excavated.	Not applicable because it requires a cap/cover, which does not meet remedial action objectives

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TABLE 2-19
INITIAL SCREENING OF TECHNOLOGIES FOR GROUNDWATER
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA
(SHEET 1 of 2)

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
No Action	Not Applicable	Not Applicable	No action is taken.	Consideration required by the National Contingency Plan
Institutional Actions	Access Restrictions	Use Restrictions	Use of groundwater in the area of influence is restricted by amending base masterplan.	Potentially applicable
	Alternate Water Supply	Off-Site Water Supply	New wells are installed in uncontaminated areas or existing water-supply systems are extended.	Not applicable
	Monitoring	Groundwater Monitoring	Ongoing monitoring of wells is conducted.	Potentially applicable
Containment	Vertical Barriers	Slurry Wall	Trenches around areas of contamination are filled with a soil (or cement) bentonite slurry.	Not applicable for the site conditions
		Grout Curtain	Grout is pressure injected in a regular pattern of drilled holes.	Not applicable for the site conditions
		Sheet Piling	Steel sheets are permanently driven into the ground to create a wall to retard the flow of the groundwater plume.	Not applicable for the site conditions
	Horizontal Barriers	Grout Injection	Grout is pressure injected at depth through closely spaced drilled holes to fill soil pores.	Not applicable for the site conditions
Removal Discharge	Extraction	Extraction Wells	Groundwater is extracted from a series of extraction wells.	Potentially applicable
		Extraction/Injection Wells	Uncontaminated water is injected via injection wells to hydraulically increase the flow to extraction wells.	Potentially applicable
	Subsurface Drains	Interceptor Trenches	Perforated pipes in trenches are backfilled with porous material to collect contaminated water.	Not applicable given the depth of groundwater
	On-Base Discharge	Surface Discharge	Extracted untreated water is discharged to a nearby stream.	Not applicable
		Treatment Plant	Extracted water is discharged to a wastewater treatment plant.	Not applicable
		Deep Well Injection	Extracted water is discharged to a deep well injection system.	Not applicable
	Off-Base Discharge	POTW	Extracted water is discharged to a publicly owned treatment works (POTW) facility for treatment.	Not applicable
		Surface Discharge	Extracted water is discharged to a stream or into the ocean.	Not applicable
In Situ Treatment	Biological	Bioremediation	Oxygen and nutrients are injected into groundwater to promote biodegradation of contaminants by indigenous microorganisms.	Not applicable to tetrachloroethene (PCE) because biodegradation of PCE is extremely slow
	Physical	Air Sparging	Air or nitrogen is injected into the groundwater plume to volatilize, collect, and treat volatile and semivolatile organic compounds.	Potentially applicable
		Permeable Treatment Bed	A buried bed of adsorbents is used to intercept a moving plume and remove contaminants from groundwater.	Potentially applicable
	Chemical	Chemical Treatment	Chemical reagents are used to destroy or render contaminants insoluble and immobile.	Not applicable

LEGEND:

Technologies eliminated during screening process.

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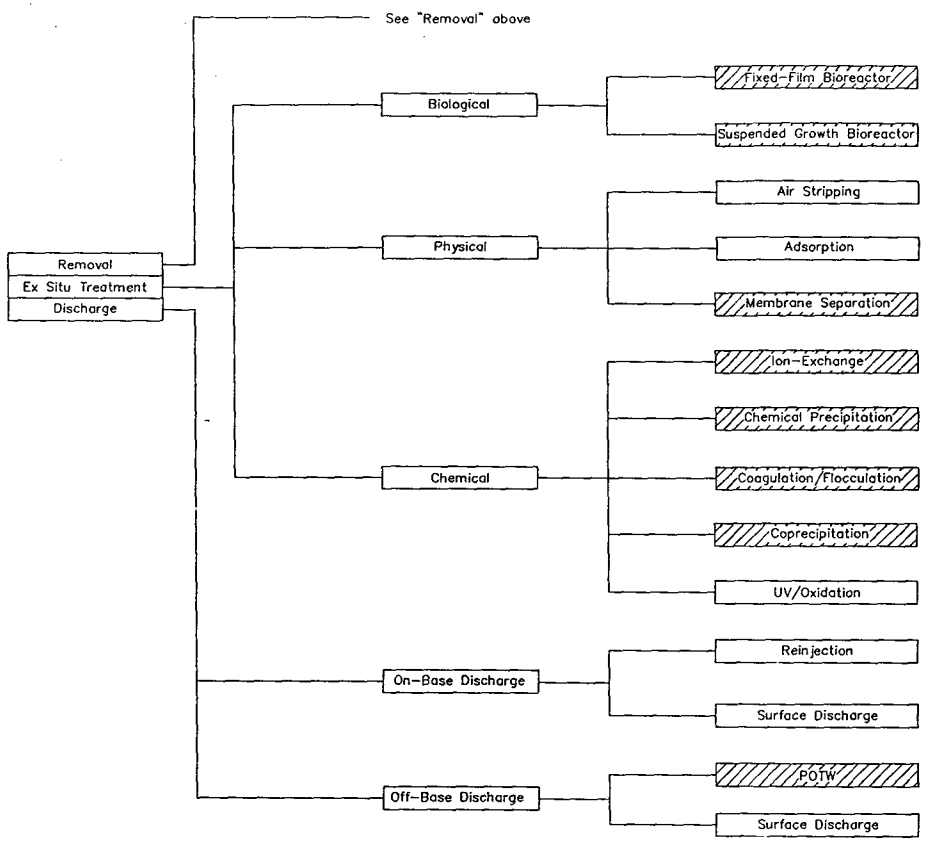
TABLE 2-19 (continued)
INITIAL SCREENING OF TECHNOLOGIES FOR GROUNDWATER
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA

(SHEET 2 of 2)



GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
See "Removal" above				
Removal, Ex Situ Treatment, Discharge	Biological	Fixed-Film Bioreactor	A mat of biomass attached to an inert support media is used to degrade organics in an aqueous waste.	Not applicable
		Suspended Growth Bioreactor	A suspension of bacteria in an aqueous waste is aerated to degrade the organics and create new bacteria.	Not applicable
	Physical	Air Stripping	Volatile contaminants are stripped off by contacting groundwater with air in a high interfacial area system.	Potentially applicable for organics
		Adsorption	Contaminants adhere to a solid-phase medium placed in contact with groundwater.	Potentially applicable for organics
		Membrane Separation	Small molecules pass through a porous membrane under elevated pressure; larger molecules are prevented from passing through membrane.	Not applicable
	Chemical	Ion-Exchange	Ions on a solid-phase medium selectively swap with ionic contaminants in the water, facilitating removal.	Not applicable for organics
		Chemical Precipitation	Contaminants are transformed into a less soluble state via chemical reaction, facilitating precipitation and eventual removal of contaminants.	Not applicable
		Coagulation/Flocculation	Reagents are added to neutralize surface charges of fine contaminant particles and to entrap them, facilitating precipitation.	Applicable only as a support technology
		Coprecipitation	Ionic contaminants are removed via adsorption onto or coagulation/enmeshment with another precipitating solid.	Not applicable for organics
		UV/Oxidation	Simultaneous application of a strong chemical oxydizer and an ultraviolet (UV) light source destroys certain organic contaminants in groundwater.	Potentially applicable for organics
	On-Base Discharge	Reinjection	Treated groundwater is reinjected into the same aquifer.	Potentially applicable
		Surface Discharge	Treated groundwater is discharged to a nearby stream.	Potentially applicable
	Off-Base Discharge	POTW	Treated groundwater is discharged to a POTW.	Not applicable
		Surface Discharge	Treated groundwater is discharged to a stream or the ocean.	Potentially applicable

LEGEND:

▨ Technologies eliminated during screening process.

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TABLE 2-20
EVALUATION OF PROCESS OPTIONS FOR CONTAMINATED SOIL
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA
(SHEET 1 of 2)

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST[a]
No Action	Not Applicable	Not Applicable	Potentially achieves remedial action objectives and proposed remediation goals (RGs).	Not applicable.	None
Removal Disposal	Excavation	Mechanical Excavation	High; effective and reliable in meeting proposed RGs. Dust emissions may pose a health risk to on-site personnel.	High; easy to implement; excavation equipment is standard and readily available.	Low
	Landfill	Off Base	High; effective and reliable in handling excavated soil. Transportation of soil may pose a potential health risk to the public.	High; uses conventional technology; sufficient capacity is available.	Moderate to high
Removal Ex Situ Treatment Disposal	Excavation	See "Removal" above			
	Chemical	Acid Extraction	Moderate; effective and reliable in meeting proposed RGs for metals but ineffective for total petroleum hydrocarbons (TPH). Potential exposure during implementation.	High; readily available; no permits are required.	Low to moderate
		Fixation/Solidification	Moderate; effective and reliable in meeting proposed RGs for metals and partially effective for TPH. Dust and chemicals used may pose health risks to on-site personnel. Process is subject to leaching.	High; readily implementable; uses commonly available technology.	Low to moderate
	Physical	Soil Washing	High; effective and reliable in meeting proposed RGs for metals and TPH. Soil clay content may impact the effectiveness of treatment.	High; readily implementable; mobile commercial units are available; no permits are required.	Moderate
		Solvent Extraction	Moderate; effective and reliable in meeting proposed RGs for TPH but ineffective for metals. Dust emissions and potential spills may pose health and environmental risks during implementation.	High; readily implementable; mobile commercial units are available; no permits are required.	Moderate
	Biological	Bioreactor (slurry phase)	Moderate; effective and reliable in meeting proposed RGs for TPH but ineffective for metals. Air emissions may pose a health or safety risk during implementation.	High; mobile bioreactors are commercially available; no permits are required.	Moderate to high
		Solid Phase	Moderate; effective and reliable in meeting proposed RGs for TPH but ineffective for metals. Air emissions may pose a health or safety risk during implementation.	High; uses conventional practices; adequate on-site area is available.	Low
	Thermal	Thermal Desorption	Moderate; effective and reliable in meeting proposed RGs for TPH but ineffective for metals. Air emissions may pose a health risk if an uncontrolled release occurs.	High; readily implementable; systems are commercially available; no permits are required.	Low to moderate
		Slagging	Moderate; potentially effective in meeting proposed RGs for TPH and metals. Air emissions may pose a health risk if an uncontrolled release occurs.	Moderate; equipment is commercially available.	High
		Incineration	Moderate; effective and reliable in meeting proposed RGs for TPH but ineffective for metals. Air emissions may pose a health risk if an uncontolled release occurs.	Low; not permitted in California.	High
	Landfill	Off Base	High; effective and reliable, dependent on continued maintenance; potential exposure during transportation.	High; uses conventional technology; capacity is available.	Moderate to high
	Backfill	Backfill	High; effective in handling estimated volume and meeting remedial objectives.	High; readily implementable; uses conventional earthmoving equipment.	Low

LEGEND:

- Selected as representative process option for incorporation into remedial action alternatives based on effectiveness, implementability, and cost.
- Process options that will not be incorporated into remedial action alternatives.

[a] Relative to other process options in the same technology type.

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TABLE 2-20
EVALUATION OF PROCESS OPTIONS FOR CONTAMINATED SOIL
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA
(SHEET 2 of 2)

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST[a]
In Situ Treatment	Physical	Vitrification	High; effective and reliable in meeting proposed PRGs for TPH and metals. The generation of high volumes of gases and vapors may pose health and safety risks during implementation.	Low; technology has recently been taken off the market for refinement.	High
		Thermally Enhanced Soil Vapor Extraction	Moderate; effective for removal of TPH from soil but poses potential risks to groundwater.	Moderate; readily implementable; risks associated with the higher mobility of contaminants must be addressed.	Moderate
	Biological	Bioventing	Moderate; effective for meeting proposed RGs for TPH but ineffective for metals. No significant risk to human health or the environment.	High; readily implementable; components and services are commercially available.	Low
		Bioremediation	Moderate; effective for meeting proposed RGs for TPH but ineffective for metals. May pose risk to groundwater.	Moderate; readily implementable (technically); risks associated with the introduction of nutrients, pH adjustment, and other factors must be addressed.	Moderate to high

LEGEND:

- Selected as representative process option for incorporation into remedial action alternatives based on effectiveness, implementability, and cost.
- Process options that will not be incorporated into remedial action alternatives.

[a] Relative to other process options in the same technology type.

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TABLE 2-21
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA

(SHEET 1 of 2)

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
No Action	Not Applicable	Not Applicable	Low; does not achieve remedial action objectives or proposed remediation goals (RGs).	Not applicable.	None
Institutional Actions	Access Restrictions	Use Restrictions	Moderate; although contamination is not reduced, the effectiveness of reducing risks depends on continued future implementation.	High; readily implementable.	None
	Monitoring	Groundwater Monitoring	Moderate; does not achieve proposed RGs. Method is reliable and proven.	High; additional wells can be easily installed; potentially acceptable to agencies because of low contaminant concentrations and absence of current receptors.	Low
Removal	Extraction	Extraction Wells	Moderate; effective and reliable for removal of contaminated groundwater.	High; readily implementable.	Low
		Reinjection Wells	High; effective and reliable for removal of contaminated groundwater.	High; readily implementable; water supply required for injection.	Moderate
Discharge	None retained from initial screening.				
In Situ Treatment	Physical	Air Sparging	Low; complex site hydrogeology would hinder the effectiveness of this option.	High; materials and equipment are readily available.	Moderate
		Permeable Treatment Bed	Moderate; effective and reliable in achieving proposed RGs, although groundwater brackishness may interfere with the effectiveness. Groundwater flow rates may render the technology ineffective. Performance is difficult to monitor.	Low; shoring may be required during excavation; slow rate of collection is controlled by groundwater movement; adsorbent material may require frequent replacement.	High

LEGEND:

Technologies eliminated during screening process.

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TABLE 2-21 (continued)
EVALUATION OF PROCESS OPTIONS FOR GROUNDWATER
GROUP A, SITE 9
MCB CAMP PENDLETON, CALIFORNIA
(SHEET 2 of 2)

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
Removal Ex Situ Treatment Discharge	See "Removal" above				
	Physical	Air Stripping	High; effective and reliable in achieving proposed RGs for volatile organic compounds. Air emissions may pose a health risk.	High; commercially available technology; skilled workers not required; air emissions approval required.	Low to moderate
		Adsorption	High; effective and reliable in achieving proposed RGs. Spent adsorbent may pose a health risk.	High; spent adsorbent will require regeneration or disposal; commonly used technology.	Moderate
	Chemical	UV/Chemical Oxidation	Moderate; proven effective for similar contaminants. Relatively new process. No health impact expected.	Moderate; materials and equipment are readily available; skilled workers are required; residuals require disposal.	High
	On-Base Discharge	Reinjection	High; minimal health risks. Does not address reduction of contaminants, but is used in conjunction with treatment.	High; readily implementable if cleanup goals are met through treatment.	Low
		Surface Discharge	High; meets remedial action objectives. Dependent on effectiveness of treatment process. No impact to human health or the environment.	High; associated equipment and methods well established; no construction problems expected; discharge permit is required.	Low
	Off-Base Discharge	Surface Discharge	High; meets remedial action objectives. No impact to human health or the environment.	High; associated equipment and methods well established; no construction problems expected; discharge permit is required.	Moderate

LEGEND:

////// Technologies eliminated during screening process.

TABLE 2-22
Summary of Comparative Analysis
MCB Camp Pendleton

Criteria	Alternatives						
	1	2	3	4	5	6	7
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	No	Yes[a]	Yes	Yes	Yes[a]	Yes[a]	Yes[a]
Long-Term Effectiveness and Permanence	NA	Low	High	High	Mod	Mod	Low
Reduction of Toxicity, Mobility, or Volume	No	Low	High	High	High	High	Low
Short-Term Effectiveness	NA	Mod	Mod	High	High	Mod	NA
Inplementability	NA	High	Mod	High	High	Mod	High
Cost ($ millions) Option 1 Option 2	 0 0	 4.1 1.5	 2.4 1.4	 1.3 1.1	 0.7 0.5	 1.8 0.8	 0.4

[a]ARARs achieved over time through natural groundwater attenuation.

Alternative 2: Soil - Excavation and Off-Base Landfill for Hot Spots, Zone I, and Zone II.
Groundwater - Institutional Controls (monitoring and use restrictions).

Alternative 3: Soil - Excavation and Off-Base Landfill for Zone I and Hot Spots; Biological Land Treatment for Zone II.
Groundwater - Extraction, Ultraviolet (UV)/Chemical Oxidation, and Reinjection.

Alternative 4: Soil - Excavation and Off-Base Landfill for Zone I; In Situ Bioremediation/Bioventing for Zone II.
Groundwater - Extraction, Carbon Adsorption, and Reinjection.

Alternative 5: Soil - Excavation and Off-Base Landfill for Zone I; In Situ Bioremediation/Bioventing for Zone II.
Groundwater - Institutional Controls.

Alternative 6: Soil - Excavation and Off-Base Landfill for Zone I and Hot Spots; Biological Land Treatment for Zone II.
Groundwater - Institutional Controls.

Alternative 7: Soil - No Action.
Groundwater - Institutional Controls.

ARARs - Applicable or relevant and appropriate requirements.
Mod - Moderate.
NA - Not applicable.

TABLE 2-23
Cost Analysis for Groundwater
Remedial Action - Alternative 7

1	2	3	4	5	6	7	8	9	10
Year	Treatment Unit Operation[a,b] ($)	Monitoring[a,c] ($)	Maintenance[a,d] ($)	Annual Operations and Maintenance (O&M) Cost[e] ($)	Inflation Rate at 5%[f]	Discount Rate at 10%[g]	Capital Cost[a] ($)	Present Worth of O&M Cost[h] ($)	Cumulative Total Cost[i] ($)
0	0	0	0	0	0.00	0.00	2,500	0	2,500
1	0	32,920	50	32,970	1.0500	0.9091	0	31,471	33,971
2	0	32,920	50	32,970	1.1025	0.8264	0	30,039	64,010
3	0	32,920	50	32,970	1.1576	0.7513	0	28,674	92,684
4	0	32,920	50	32,970	1.2155	0.6830	0	27,371	129,055
5	5,200	32,920	50	38,170	1.2763	0.6209	0	30,248	150,303
6	0	32,920	50	32,970	1.3401	0.5645	0	24,941	175,244
7	0	131,680	50	131,730	1.4071	0.5132	0	95,125	270,369
8	0	32,920	50	32,970	1.4774	0.4665	0	22,723	293,092
9	0	32,920	50	32,970	1.5513	0.4241	0	21,691	314,783
10	5,200	32,920	50	38,170	1.6289	0.3855	0	23,969	338,752
10	Salvage Value at 10 percent of Monitoring Equipment Capital ($2,500)				1.6289	0.3855	(157)[j]	0	338,595
Total	**10,400**	**427,960**	**500**	**438,860**			**2,343**	**336,252**	**338,595**

[a]Refer to Table H-2 of the draft final FS for Site 9 (SWDIV, 1994a).
[b]Cost of annual treatment includes system evaluation every 5 years.
[c]Annual estimated monitoring costs, including semiannual monitoring and seventh year compliance monitoring (eight times in 1 year).
[d]Annual estimated maintenance costs.
[e]Equal to column 2 + column 3 + column 4.
[f]Inflation factor = $(1 + \text{inflation rate}/100)^n$ where n = year.
[g]Discount rate factor = $1/([1 \text{ discount rate}/100]^n)$ where n = year.
[h]Present worth of O&M cost = column 5 x column 6 x column 7.
[i]Cumulative total cost for year $n = \sum_{i=0}^{n} (\text{column 8} + \text{column 9})_i$.
[j]Salvage value = Capital cost x column 6 x column 7 x 0.10.

TABLE 2-24
Cost and Schedule Comparison for Site 9
Groundwater Remedial Alternatives

Groundwater	Alternative 3 Extraction, Ultraviolet (UV)/Chemical Oxidation, and Reinjection	Alternative 4 Extraction, Carbon Adsorption, and Reinjection	Alternative 7 Institutional Controls
Cost for Treatment	$0.95 million	$0.94 million	$0.4 million
Time Estimate to Reach MCLs	10 years	10 years	10 years

The other alternatives are either no action or institutional controls for groundwater similar to Alternative 7.

MCLs - Maximum contaminant levels.

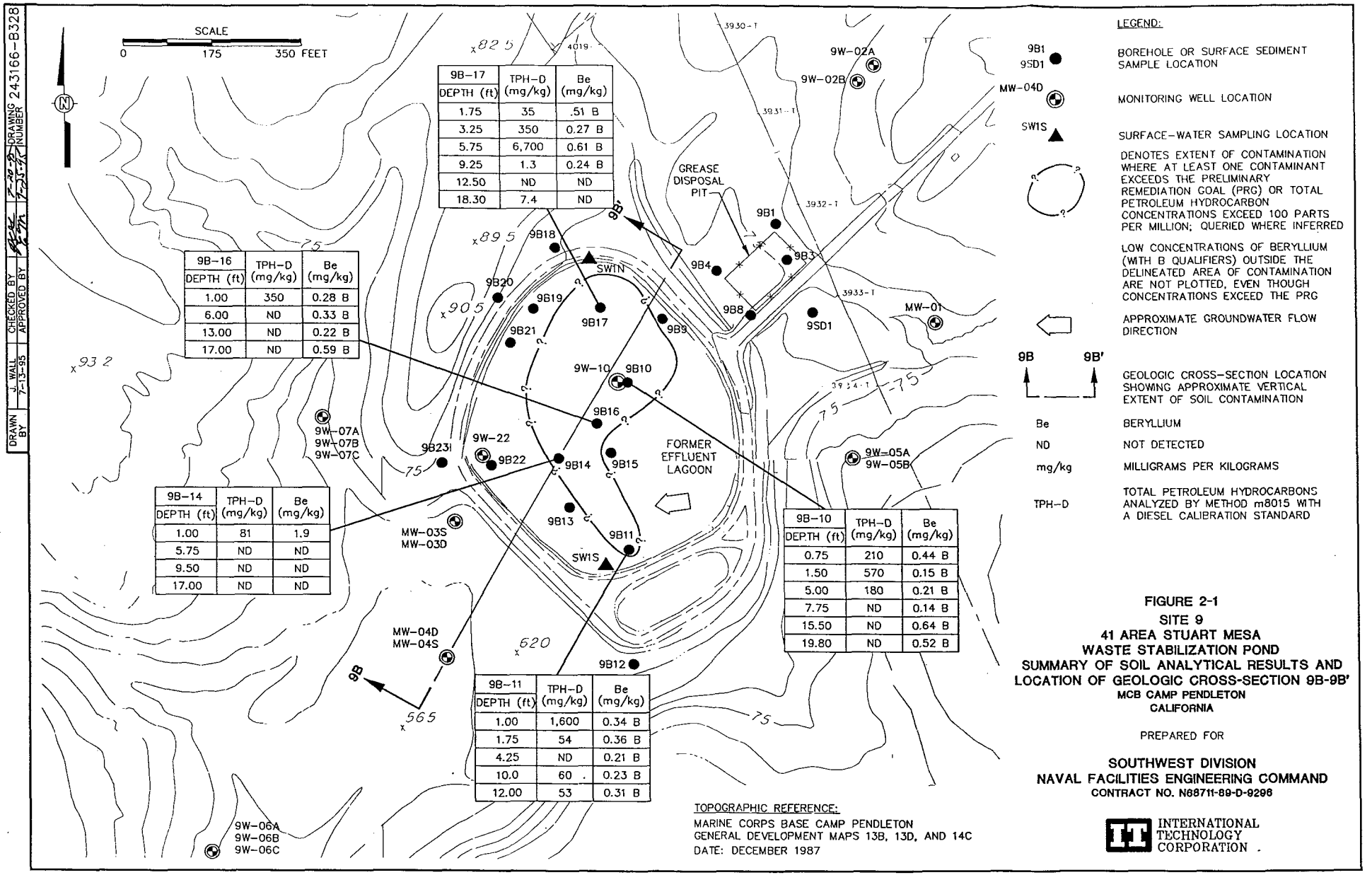

FIGURE 2-1
SITE 9
41 AREA STUART MESA
WASTE STABILIZATION POND
SUMMARY OF SOIL ANALYTICAL RESULTS AND LOCATION OF GEOLOGIC CROSS-SECTION 9B-9B'
MCB CAMP PENDLETON
CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT NO. N68711-89-D-9296

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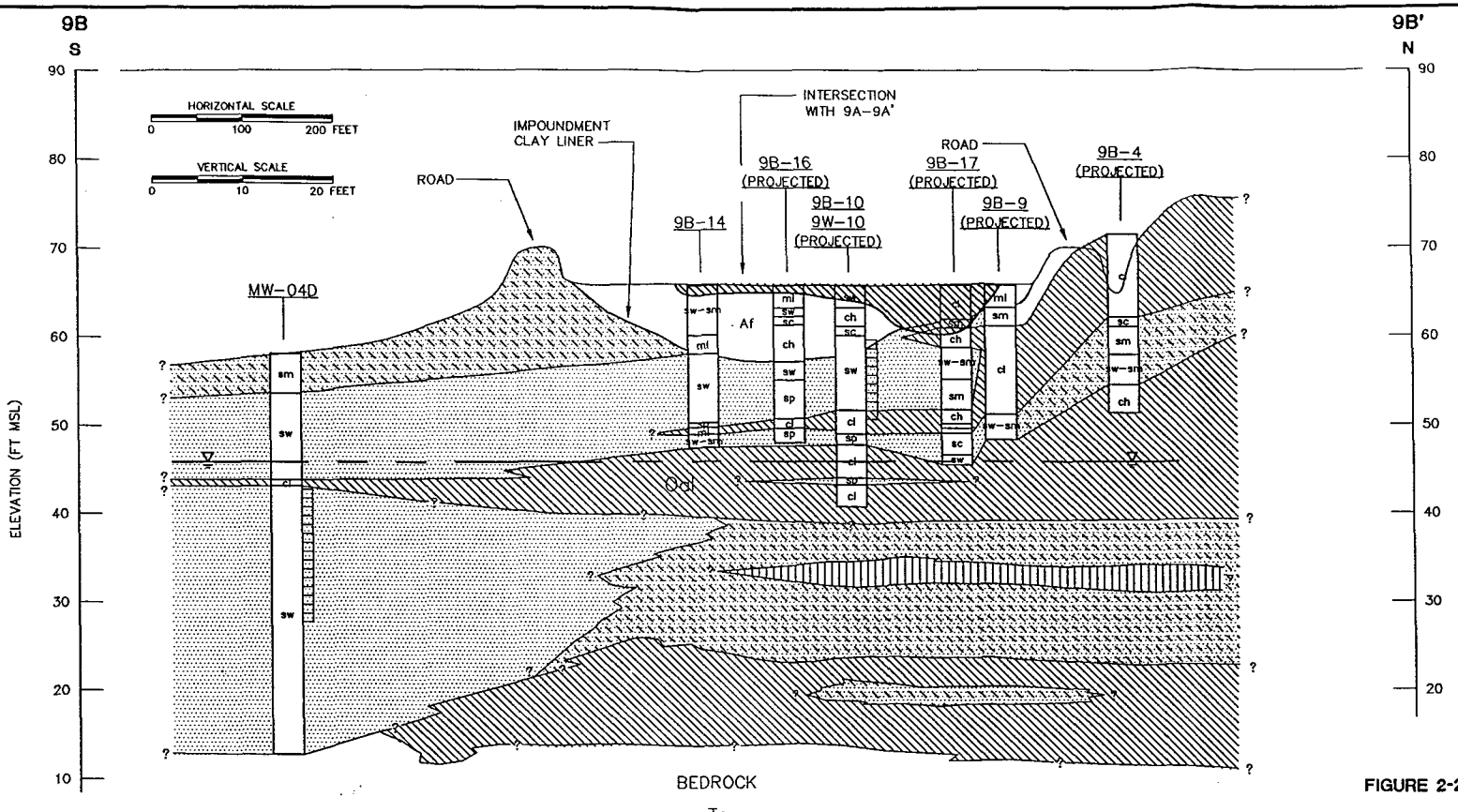

FIGURE 2-2

SITE 9 - 41 AREA STUART MESA
WASTE STABILIZATION POND
GEOLOGIC CROSS-SECTION 9B-9B'
SHOWING APPROXIMATE VERTICAL EXTENT OF SOIL CONTAMINATION
MCB CAMP PENDLETON
CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
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LEGEND:

- APPROXIMATE WATER TABLE
- B — SCREENED INTERVAL AND LETTER DESIGNATION FOR PARTICULAR WELL IN THAT CLUSTER
- SOIL CONTACT, QUERIED WHERE UNCERTAIN
- LITHOLOGIC CONTACT, QUERIED WHERE UNCERTAIN

LITHOLOGIC UNITS:

- Af — ARTIFICIAL FILL; BOUNDARIES DEFINED BY SURFACE IMPOUNDMENT; SOIL TYPES PRESENTED IN BORING LOGS

QUATERNARY ALLUVIUM (Qal):

- Qal — PREDOMINANTLY CLAY, HIGH AND LOW PLASTICITY
- Qal — PREDOMINANTLY SILT OR SILT WITH CLAY
- Qal — PREDOMINANTLY SAND, POORLY AND WELL GRADED
- Qal — PREDOMINANTLY SILTY SAND, SAND WITH SILT, AND CLAYEY SAND

BEDROCK UNIT:

- Tc — BEDROCK OF THE CAPISTRANO FORMATION; SILTSTONES AND CLAYSTONES
- SOIL EXHIBITING CONTAMINANT CONCENTRATIONS THAT MAY POSE A THREAT TO HUMAN HEALTH (i.e., EXCEEDING PRELIMINARY REMEDIATION GOALS FOR SOIL) OR CONCENTRATIONS OF TOTAL PETROLEUM HYDROCARBONS EXCEEDING 100 PARTS PER MILLION

NOTES:

1. LITHOLOGIES REPRESENT THE PREDOMINANT SOIL TYPE.
2. REFER TO FIGURE 2-1 FOR LOCATION OF GEOLOGIC CROSS-SECTION 9B-9B'.
3. WATER-LEVEL ELEVATIONS MEASURED ON 28 AUGUST 1992.
4. FT MSL DENOTES FEET ABOVE MEAN SEA LEVEL.

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APPROVED BY		
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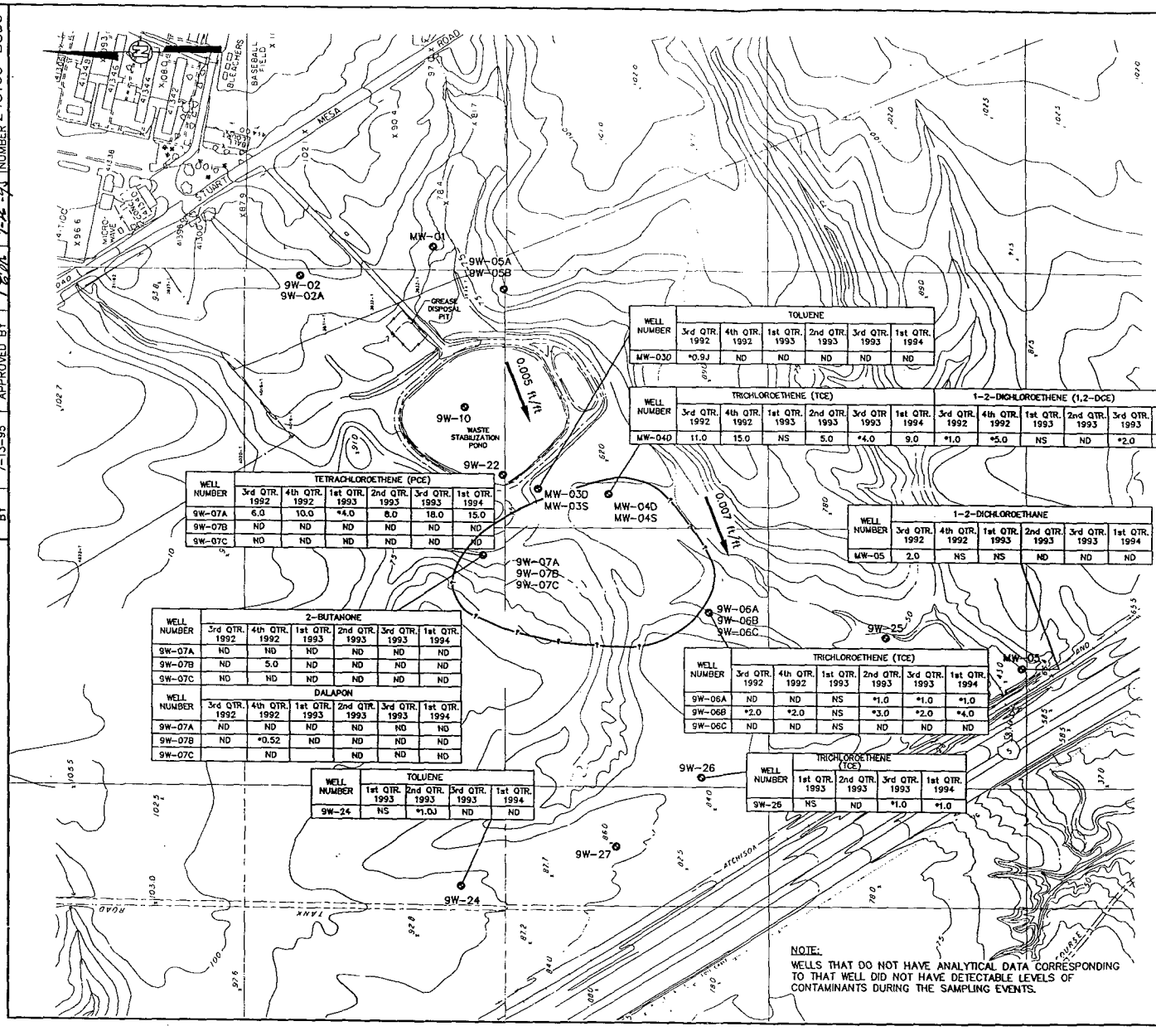

WELL NUMBER	TOLUENE					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
MW-03D	*0.9J	ND	ND	ND	ND	ND

WELL NUMBER	TRICHLOROETHENE (TCE)						1-2-DICHLOROETHENE (1,2-DCE)					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR 1993	1st QTR. 1994	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
MW-04D	11.0	15.0	NS	5.0	*4.0	9.0	*1.0	*5.0	NS	ND	*2.0	*2.0

WELL NUMBER	TETRACHLOROETHENE (PCE)					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
9W-07A	6.0	10.0	*4.0	8.0	18.0	15.0
9W-07B	ND	ND	ND	ND	ND	ND
9W-07C	ND	ND	ND	ND	ND	ND

WELL NUMBER	1-2-DICHLOROETHANE					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
MW-05	2.0	NS	NS	ND	ND	ND

WELL NUMBER	2-BUTANONE					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
9W-07A	ND	ND	ND	ND	ND	ND
9W-07B	ND	5.0	ND	ND	ND	ND
9W-07C	ND	ND	ND	ND	ND	ND

WELL NUMBER	DALAPON					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
9W-07A	ND	ND	ND	ND	ND	ND
9W-07B	ND	*0.52	ND	ND	ND	ND
9W-07C		ND		ND	ND	ND

WELL NUMBER	TRICHLOROETHENE (TCE)					
	3rd QTR. 1992	4th QTR. 1992	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
9W-06A	ND	ND	NS	*1.0	*1.0	*1.0
9W-06B	*2.0	*2.0	NS	*3.0	*2.0	*4.0
9W-06C	ND	ND	NS	ND	ND	ND

WELL NUMBER	TOLUENE			
	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
9W-24	NS	*1.0J	ND	ND

WELL NUMBER	TRICHLOROETHENE (TCE)			
	1st QTR. 1993	2nd QTR. 1993	3rd QTR. 1993	1st QTR. 1994
9W-26	NS	ND	*1.0	*1.0

NOTE:
WELLS THAT DO NOT HAVE ANALYTICAL DATA CORRESPONDING TO THAT WELL DID NOT HAVE DETECTABLE LEVELS OF CONTAMINANTS DURING THE SAMPLING EVENTS.

LEGEND:

- 9W-07A — MONITORING WELL LOCATION
- 0.005 ft/ft — APPROXIMATE GROUNDWATER FLOW DIRECTION AND GRADIENT IN SHALLOW (UNCONFINED) AQUIFER MEASURED 28 AUGUST 1992 (3rd Qtr. 1992)
- DENOTES EXTENT OF CONTAMINATION WHERE THE CONCENTRATION OF AT LEAST ONE CONTAMINANT EXCEEDS THE MAXIMUM CONTAMINANT LEVEL (MCL), QUERIED WHERE INFERRED
- • DENOTES CONCENTRATION BELOW MCL
- 3rd QTR. 1992 — DENOTES GROUNDWATER SAMPLES COLLECTED DURING THE 3rd QUARTER OF 1992 (FIRST SAMPLING ROUND, GROUP A WELLS)
- 4th QTR. 1992 — DENOTES GROUNDWATER SAMPLES COLLECTED DURING THE 4th QUARTER OF 1992 (SECOND SAMPLING ROUND, GROUP A WELLS)
- 1st QTR. 1993 — DENOTES GROUNDWATER SAMPLES COLLECTED DURING THE 1st QUARTER OF 1993 (THIRD SAMPLING ROUND, GROUP A WELLS) THIS WAS AN INCOMPLETE SAMPLING EVENT DUE TO FLOODING
- 2nd QTR. 1993 — DENOTES GROUNDWATER SAMPLES COLLECTED DURING THE 2nd QUARTER OF 1993 (FOURTH SAMPLING ROUND, GROUP A WELLS; FIRST SAMPLING ROUND, PHASE 2 GROUP A WELLS)
- 3rd QTR. 1993 — DENOTES GROUNDWATER SAMPLES COLLECTED DURING THE 3rd QUARTER OF 1993 (FIFTH SAMPLING ROUND, GROUP A WELLS; SECOND SAMPLING ROUND, PHASE 2 GROUP A WELLS)
- ANALYTE CONCENTRATIONS IN MICROGRAMS PER LITER (ug/l)
- NS — NOT SAMPLED
- ND — NOT DETECTED
- J — DATA VALIDATION QUALIFIER INDICATING AN ESTIMATED CONCENTRATION

SCALE
0 500 1000 FEET

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAPS 13B, 13D, 14A AND 14C
DATE: DECEMBER 1987

FIGURE 2-3
SITE 9 - 41 AREA STUART MESA WASTE STABILIZATION POND SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
MCB CAMP PENDLETON
CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT NO. N68711-89-D-9296

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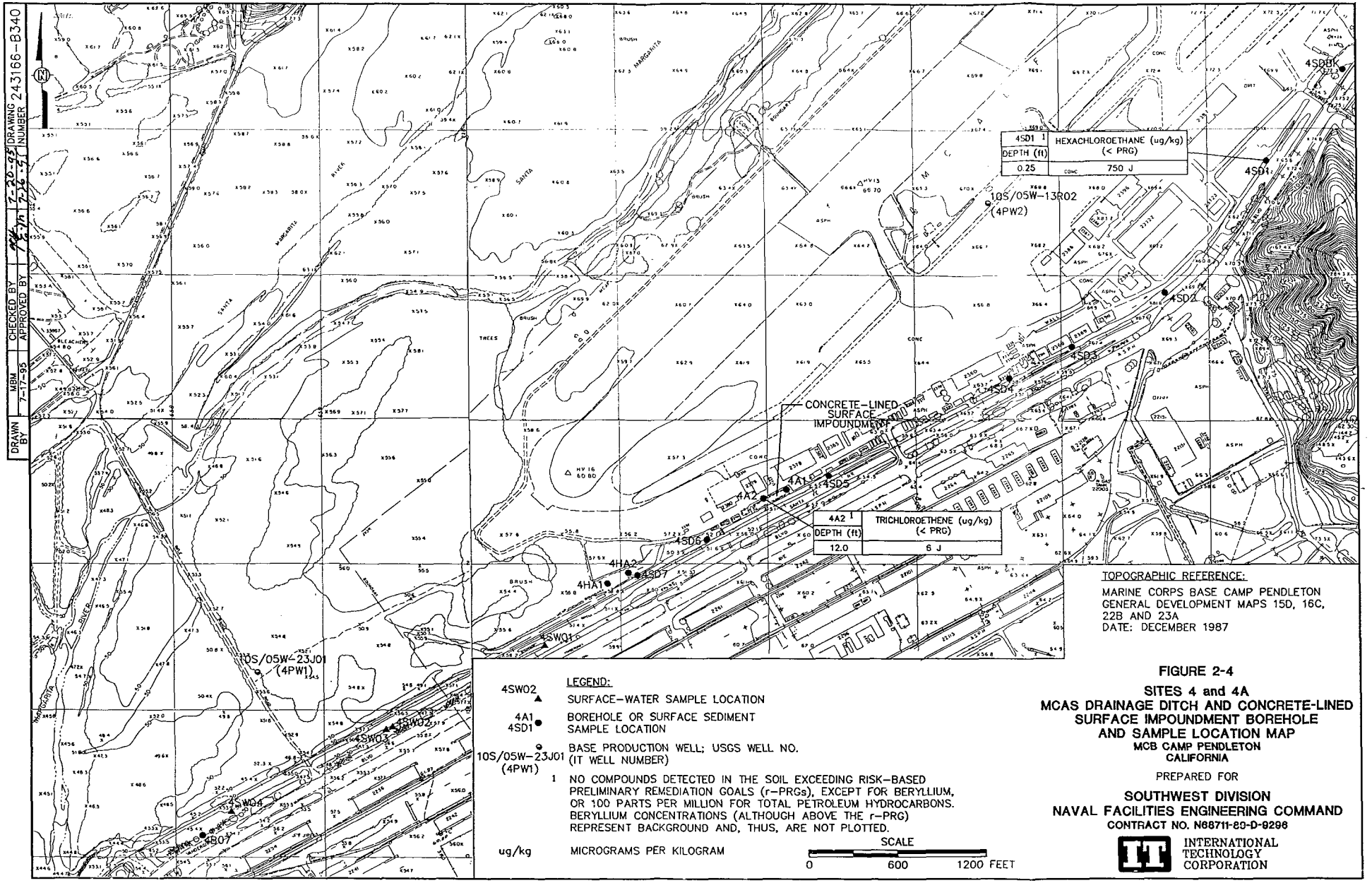

FIGURE 2-4

SITES 4 and 4A
MCAS DRAINAGE DITCH AND CONCRETE-LINED SURFACE IMPOUNDMENT BOREHOLE AND SAMPLE LOCATION MAP
MCB CAMP PENDLETON
CALIFORNIA

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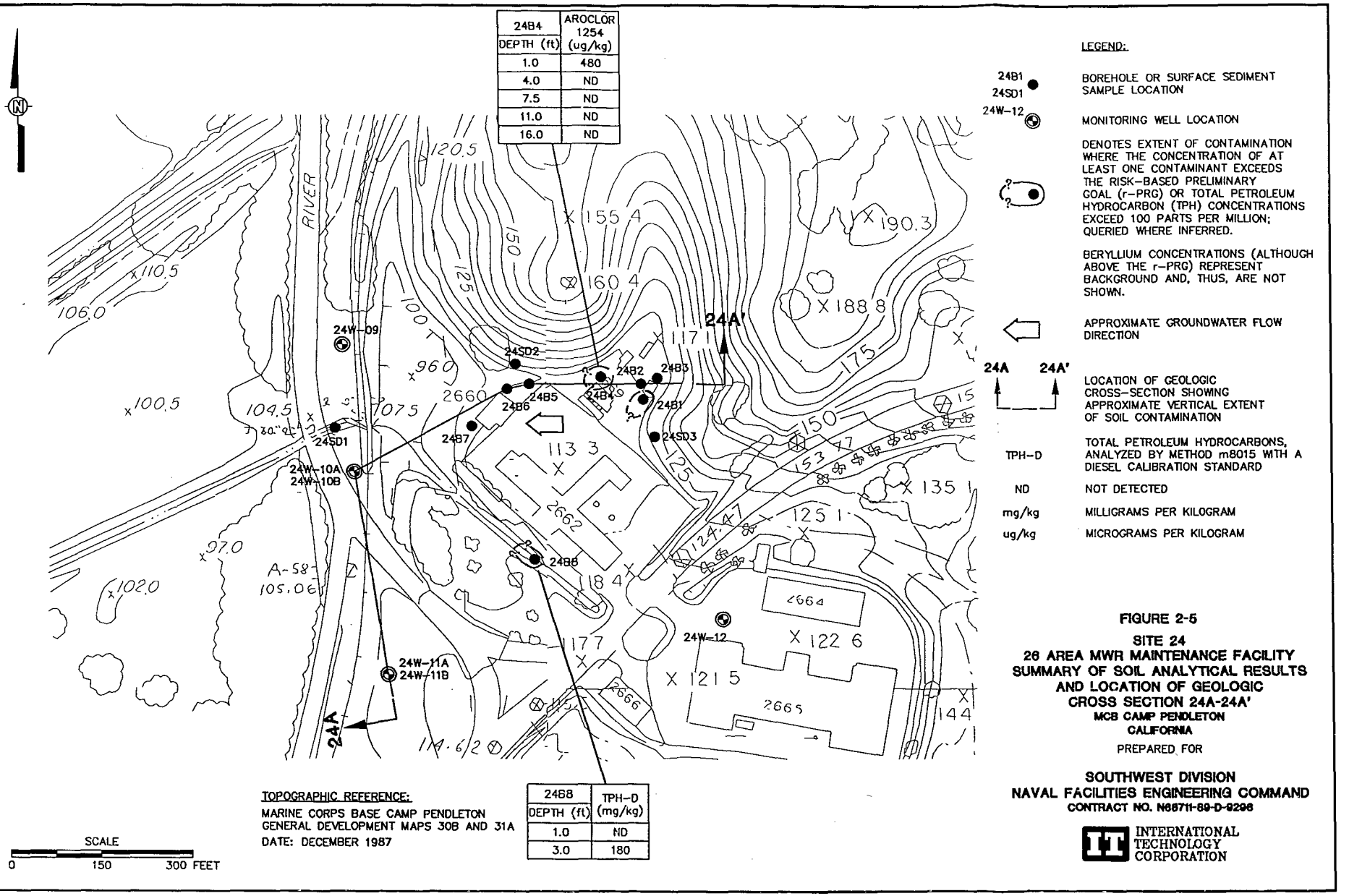

FIGURE 2-5

SITE 24
26 AREA MWR MAINTENANCE FACILITY
SUMMARY OF SOIL ANALYTICAL RESULTS AND LOCATION OF GEOLOGIC CROSS SECTION 24A-24A'
MCB CAMP PENDLETON
CALIFORNIA

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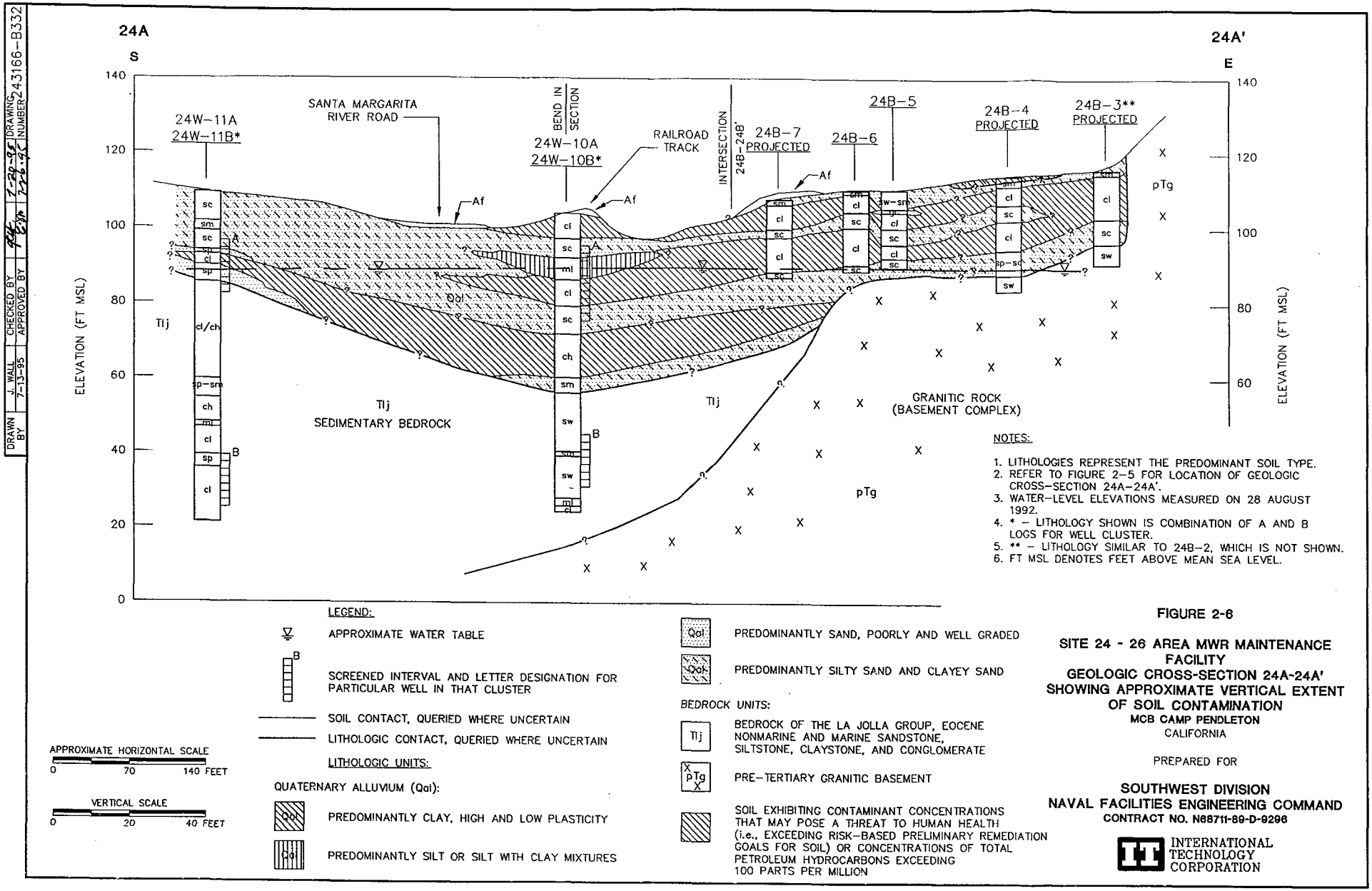

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APPROVED BY:
DRAWING NUMBER: 243166-B332

FIGURE 2-6

SITE 24 - 26 AREA MWR MAINTENANCE FACILITY
GEOLOGIC CROSS-SECTION 24A-24A' SHOWING APPROXIMATE VERTICAL EXTENT OF SOIL CONTAMINATION
MCB CAMP PENDLETON
CALIFORNIA

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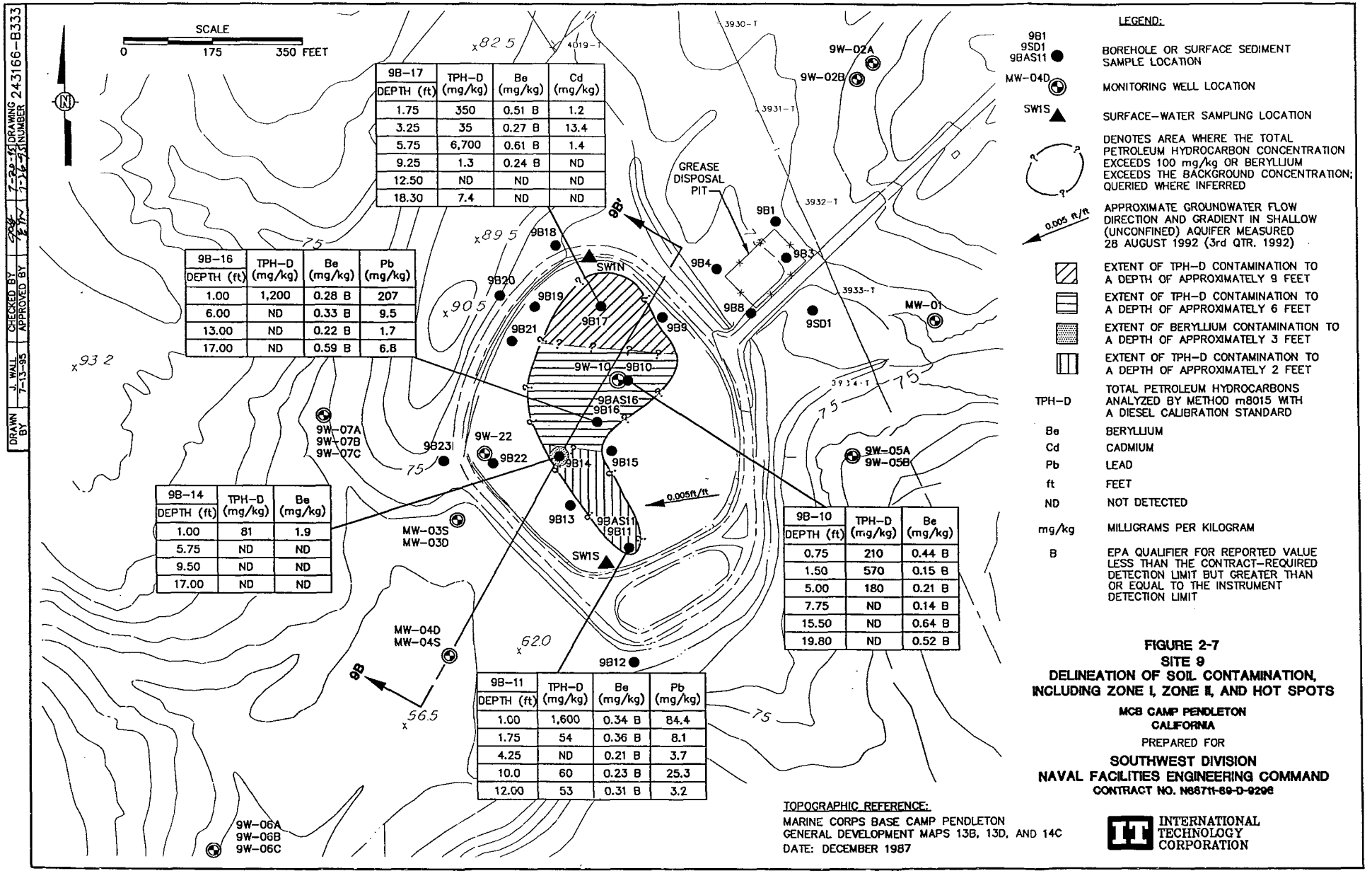

FIGURE 2-7
SITE 9
DELINEATION OF SOIL CONTAMINATION, INCLUDING ZONE I, ZONE II, AND HOT SPOTS

MCB CAMP PENDLETON
CALIFORNIA

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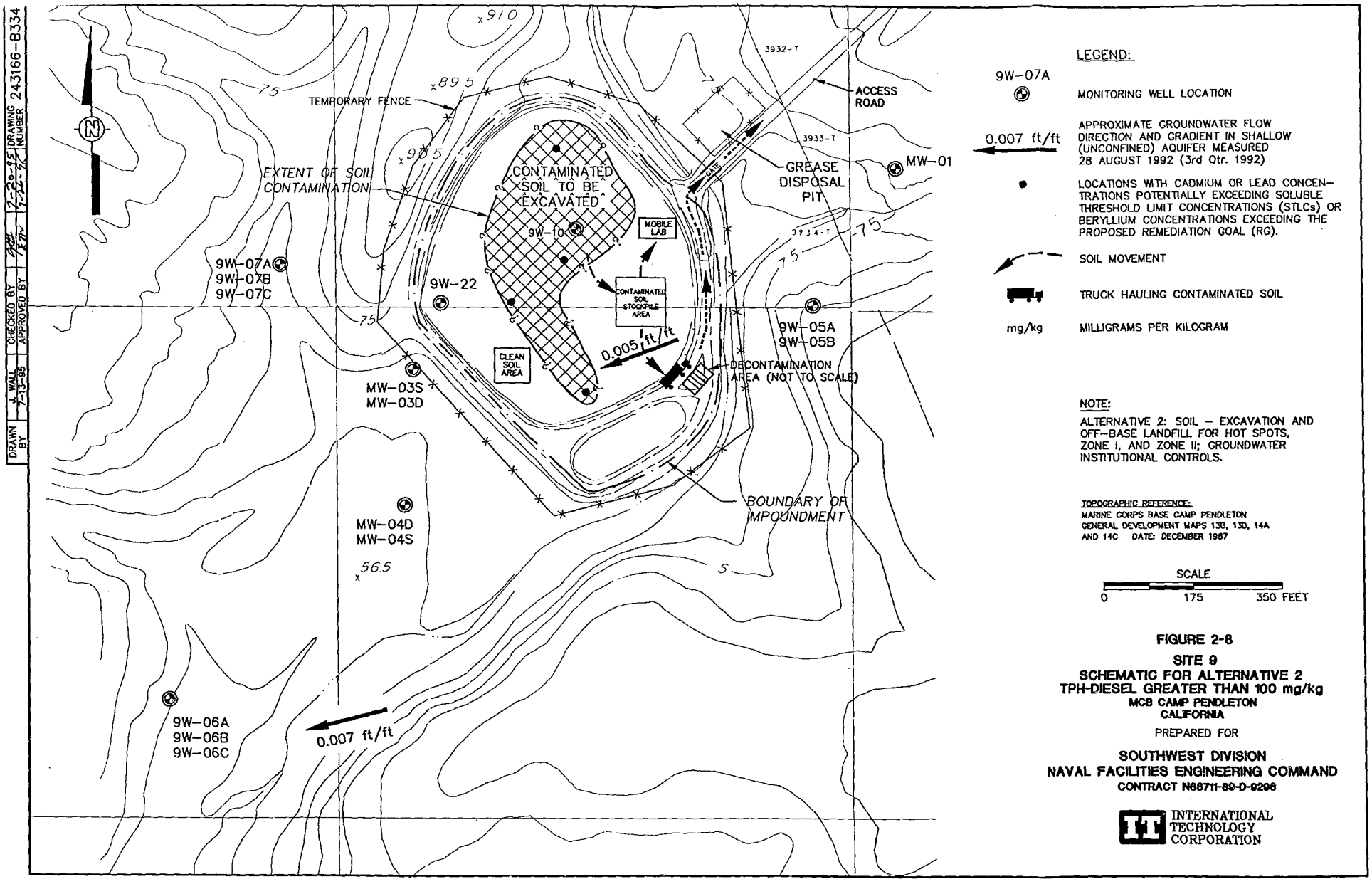

FIGURE 2-8

SITE 9
SCHEMATIC FOR ALTERNATIVE 2
TPH-DIESEL GREATER THAN 100 mg/kg
MCB CAMP PENDLETON
CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT N68711-89-D-9296

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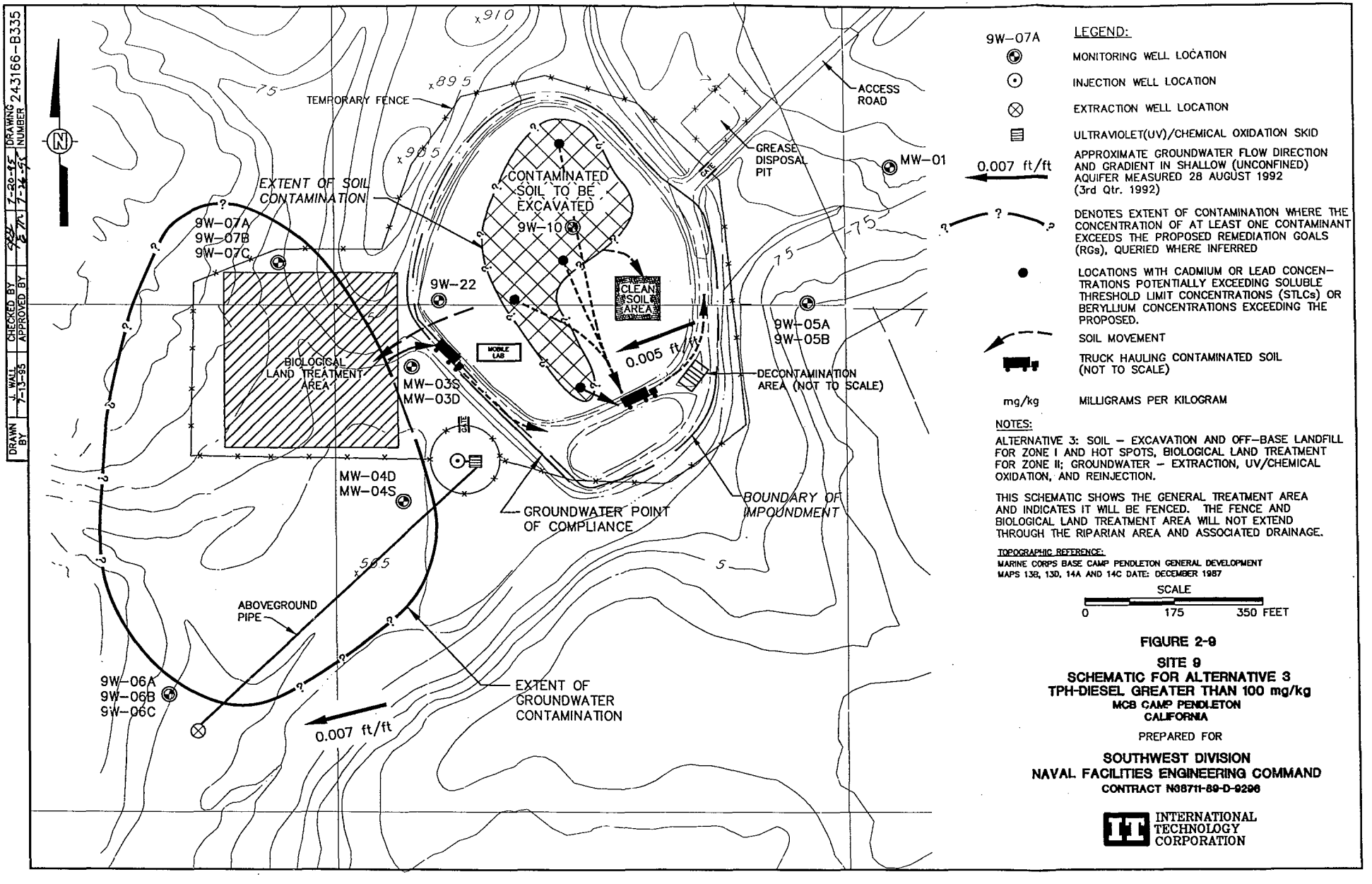

FIGURE 2-9

SITE 9
SCHEMATIC FOR ALTERNATIVE 3
TPH-DIESEL GREATER THAN 100 mg/kg
MCB CAMP PENDLETON
CALIFORNIA

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SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT N68711-89-D-9296

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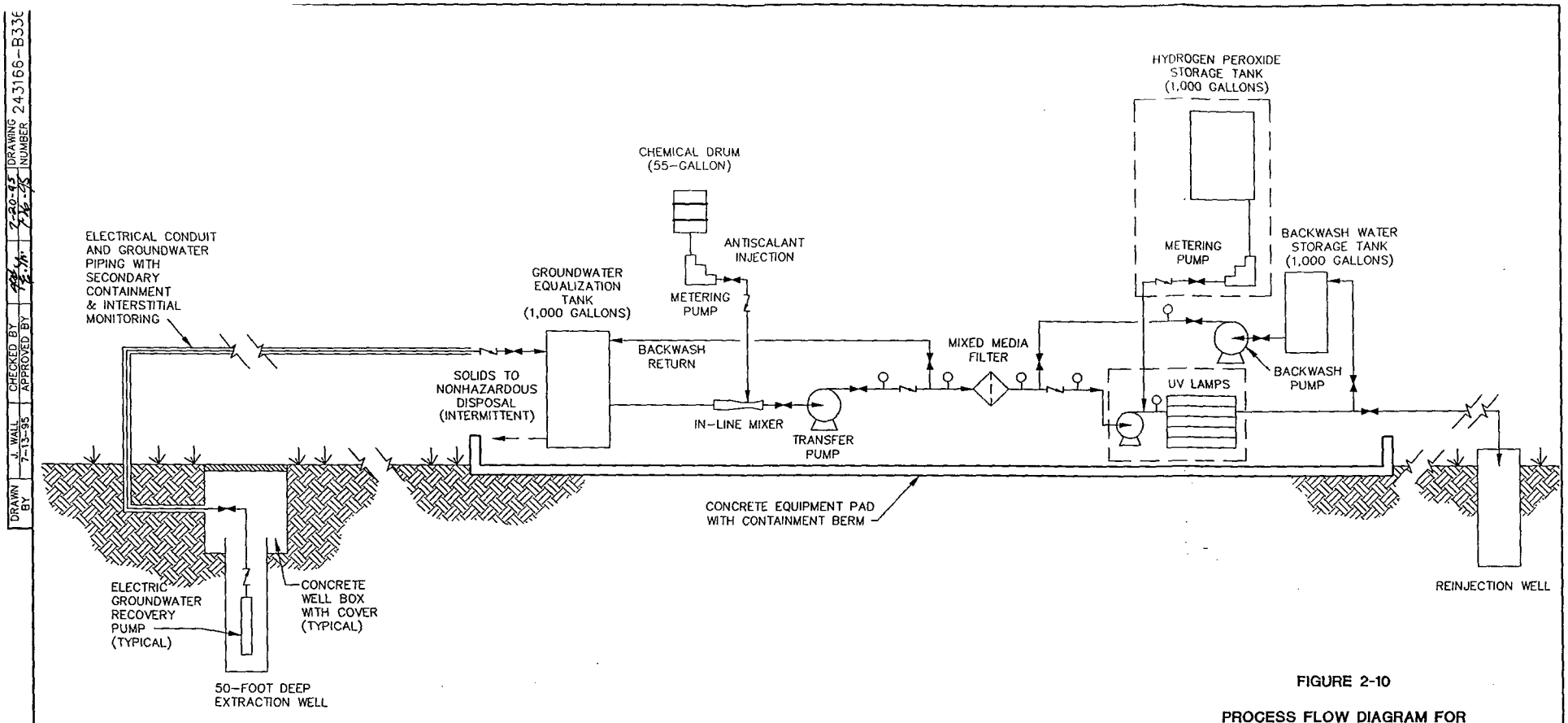

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APPROVED BY: 7-26-95
DRAWING NUMBER: 243166-B33E

NOTE:

ALTERNATIVE 3: SOIL - EXCAVATION AND OFF-BASE LANDFILL FOR ZONE I AND HOT SPOTS, BIOLOGICAL LAND TREATMENT FOR ZONE II; GROUNDWATER - EXTRACTION, ULTRAVIOLET (UV)/CHEMICAL OXIDATION, AND REINJECTION.

LEGEND

- CHECK VALVE
- CONTROL VALVE
- PRESSURE GAGE

FIGURE 2-10

PROCESS FLOW DIAGRAM FOR GROUNDWATER TREATMENT SYSTEM (ALTERNATIVE 3)
MCB CAMP PENDLETON
CALIFORNIA

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NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT NO. N68711-89-D-9296

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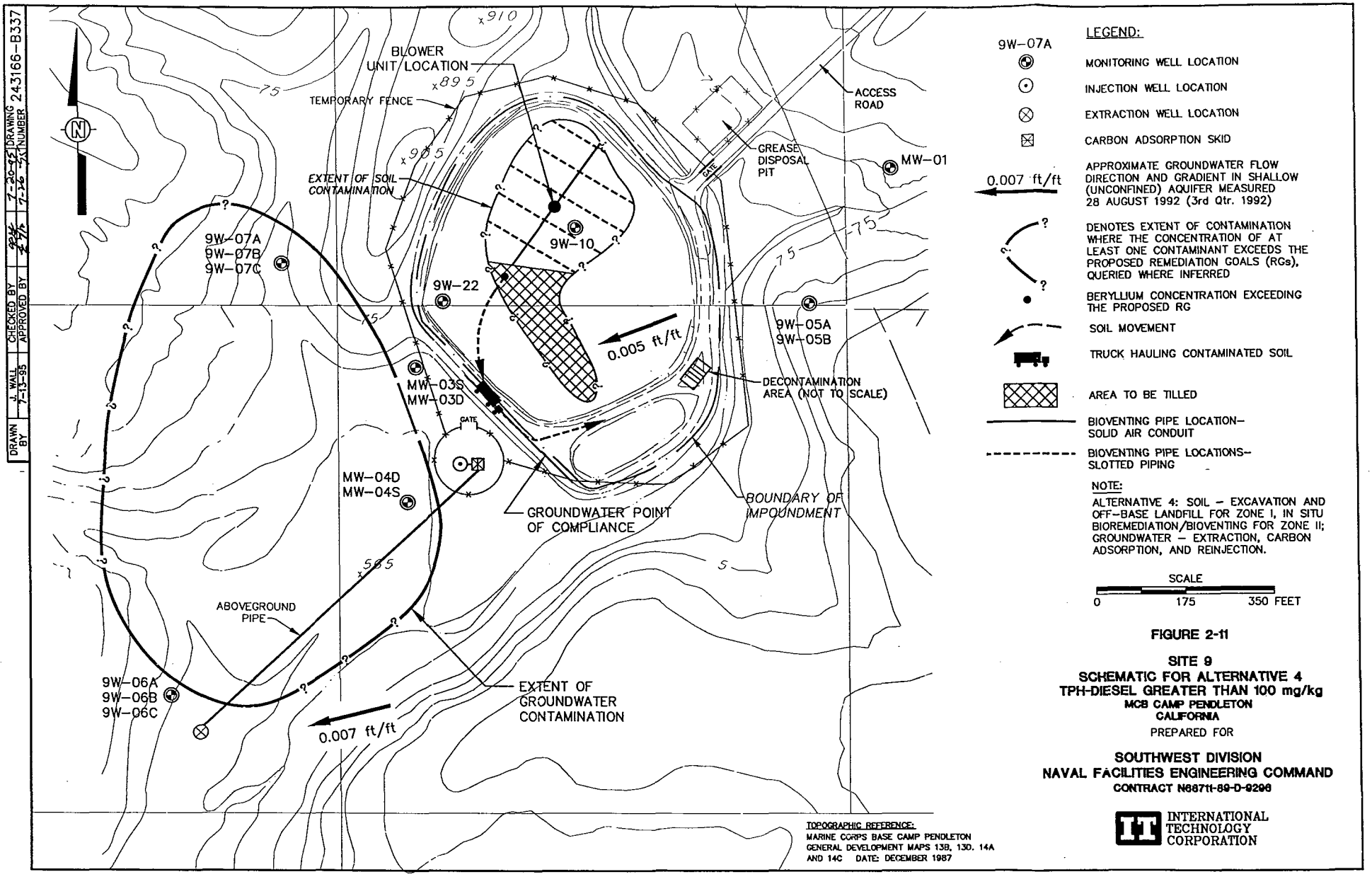

FIGURE 2-11

SITE 9
SCHEMATIC FOR ALTERNATIVE 4
TPH-DIESEL GREATER THAN 100 mg/kg
MCB CAMP PENDLETON
CALIFORNIA

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NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT N68711-89-D-9298

INTERNATIONAL TECHNOLOGY CORPORATION

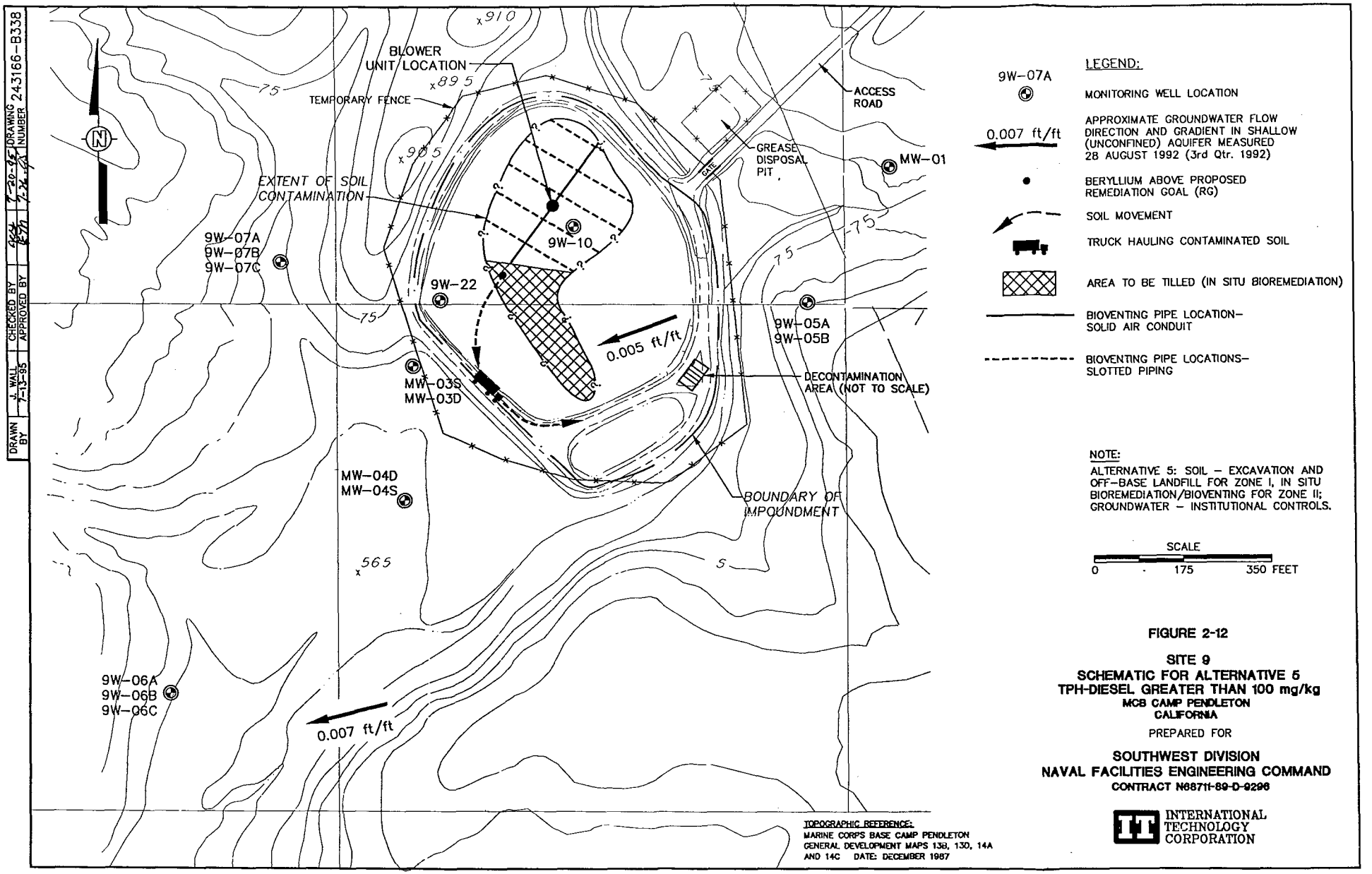

FIGURE 2-12

SITE 9
SCHEMATIC FOR ALTERNATIVE 5
TPH-DIESEL GREATER THAN 100 mg/kg
MCB CAMP PENDLETON
CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT N68711-89-D-9296

INTERNATIONAL TECHNOLOGY CORPORATION

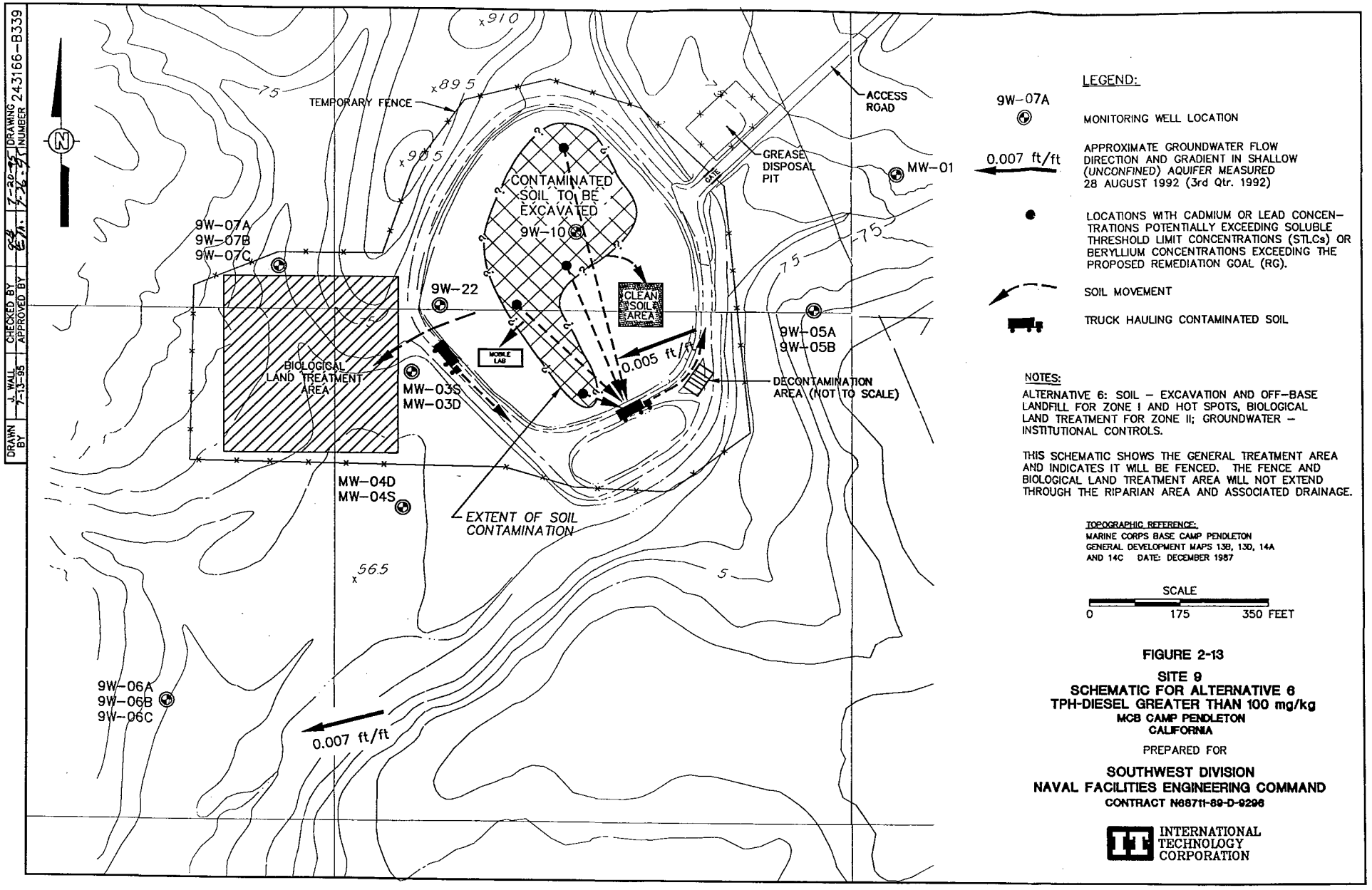

FIGURE 2-13

SITE 9
SCHEMATIC FOR ALTERNATIVE 6
TPH-DIESEL GREATER THAN 100 mg/kg
MCB CAMP PENDLETON
CALIFORNIA

PREPARED FOR

SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CONTRACT N68711-89-D-9298

INTERNATIONAL TECHNOLOGY CORPORATION

3.0 RESPONSIVENESS SUMMARY

As previously discussed in Section 2.3, documents leading to the decisions presented in this ROD were released to the public in January and March 1995. These documents were made available to the public in the information repositories maintained at the base library and at the Oceanside Public Library. The public was informed of the availability of these documents in the Administrative Record, which is maintained at the AC/S,ES offices at MCB Camp Pendleton and at the SWDIV offices in San Diego. Notices of availability were published in the local newspapers. Also published in the local newspapers were notices of the public meetings and public review and comment periods. Verbatim transcripts of the public meetings are presented in Appendix A. No questions or comments were received from any source during the public comment period. Therefore, a responsiveness summary is not required and is not part of the Administrative Record. This decision document presents the selected remedies for MCB Camp Pendleton OU1 - Site 9 - 41 Area Stuart Mesa Stabilization Pond, Site 24 - MWR Maintenance Facility, and Sites 4 and 4A - MCAS Ditch and Concrete-Lined Surface Impoundment (soil only), chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decisions for these sites are based on the Administrative Record.

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APPENDIX A

VERBATIM TRANSCRIPTS OF PUBLIC MEETINGS HELD 4 JANUARY AND 28 JUNE 1995 AT THE SENIOR CITIZENS CENTER OCEANSIDE, CALIFORNIA

CALIFORNIA DEPOSITION REPORTERS
A California Corporation

P.O. Box 108
Covina, California 91723

WHEN EVERY WORD COUNTS . . .

(800) 242-1996
(818) 915-1996

PUBLIC MEETING

Taken by	:	ED MINUGH
Commencing	:	7:15 p.m.
Location	:	455 Country Club Lane Oceanside, California 92054
Day, Date	:	Wednesday, January 4, 1995
Reported by	:	ELANA K. FITZGERALD, CSR No. 9651, RPR
Pursuant to	:	Oral agreement
Original to	:	ED MINUGH

COPY

EXHIBITS

EXHIBIT NO.	DESCRIPTION	MARKED FOR IDENTIFICATION
A	Public Meeting Attendance Record and Agenda, 11 pages	8
B	Overview of Superfund Program, 8 pages	8
C	MCB Camp Pendleton Installation Restoration Sites by Group, 1 page	8
D	Sign-in Sheet, 1 page	8

OCEANSIDE, CALIFORNIA, WEDNESDAY, JANUARY 4, 1995

7:15 P.M.

-oOo-

MR. NORQUIST: Good evening. Thank you brave souls for joining the Marine Corps Base Camp Pendleton in this public presentation of the remedial action plan for Site 9. As I look around, I see faces that I work with every day and faces that I have met over the last couple of weeks as part of the technical review committee and from southwest division and the contractor, IT Corporation. I do not recognize anyone from the public outside the base or outside the contractual regulatory agencies dealing with the installation restoration program or the technical review committee from Marine Corps Base Camp Pendleton. If that is not the case, I would like any individual outside that spectrum, anyone from the public, from the community, to identify themselves if you would.

(Pause in proceedings)

And for the record, there are no hands or no identification of any individuals outside of the Base Staff Regulatory Committee. Okay. That being the case, I'll discuss and hear some input from perhaps you regulatory agencies, USEPA, Ms. Sheryl Lauth, in the area of toxic control, Mr. Isaac Hirbawi and Mr. John Odermatt from the Regional Quality Control Board, San Diego County.

And what I would like to determine is the requirement for a public meeting when there is no public present. It's a consensus that the full requirement for a public meeting does not exist if the public is not present.

MR. ARMAS: Can I make a move that maybe we close the meeting whenever you feel, as you walk through, close the meeting and maybe wait till 7:30. Some of us -- so maybe if an individual was to walk in we could answer questions and from there maybe officially say we waited long enough.

Is that a consensus? Can I recommend that? Counsel, would you agree?

MR. SCHARFEN: I think that is a reasonable response in this situation. Good faith effort to make the information available to the public.

MR. NORQUIST: Our court recorder here is Elana Fitzgerald; is that correct?

THE REPORTER: (Nods head).

MR. NORQUIST: She will provide a transcript of what we have determined and we will adjourn these proceedings at this point and we will wait until 1930 at which time we'll see if anyone does show up from the public and we can go through one on one with them perhaps a presentation. If not, we will terminate the proceedings at that time.

MR. ARMAS: And for the record maybe could you very quickly go through the scope of what the meeting is for. The

specific scope as you probably have it there. So if you could add that on the record.

MR. NORQUIST: This meeting is convened to enable Marine Corps Base Camp Pendleton to meet its moral obligation and legal requirement to present its plan for remedial action for Site 9 aboard Marine Corps Base Camp Pendleton to the public and to allow public input and comment on that remedial action plan prior to implementation. The public not being present at this time for that input, we would adjourn for about 15 minutes or so to allow them to come on board and for us to present that to them.

MR. NORQUIST: Did you want anything further?

MR. ARMAS: I think that's good, Stan. Just make sure we go on the record as to what the scope is.

MR. NORQUIST: We certainly can skip some of these. Tonight's agenda, complete agenda, was to discuss the CERCLA process and Sheryl Lauth from USEPA was going to do that. The IR program, installation restoration, for Marine Corps Base Camp Pendleton was going to be presented by Ms. Jane Joy and then alternatives for remedial action as applied to Site 9 was to be presented by Robin Smith of International Technologies Corporation. After that, Jane Joy was going to review the alternative of the Marine Corps Base Camp Pendleton, had selected and go through the considerations that were involved in -- in arriving at that determination for that course of

remedial action and then after that we would open it up to the public for comment, receive those comments and then adjourn the meeting. We have published in the local media a notice of this meeting and provided opportunity for comments with the addresses and the time frame for those responses to be provided.

MR. SCHARFEN: I think we can attach our information sheet to the record.

MR. NORQUIST: Um-hum.

MR. SCHARFEN: Anything that we have that was available for the public we should attach to the record.

MR. NORQUIST: Major Scharfen recommended that we attach our proposed plan to the record which we will certainly do and publish that record.

Is there any other considerations that you feel we might address as a body?

MR. ARMAS: Just that we could have everybody that is here today sign the official record so that also could be attached to the minutes of the meeting as those present today that would be really good.

MR. NORQUIST: Just make sure that each of us here sign the roster before we leave.

Keith LeBouef, if you would have that up here at the table and let's make sure that we all sign it.

MR. UETZ: General Norquist, were any written notices received pursuant to the notice?

MR. NORQUIST: To date have any written comments been received? No?

MS. JOY: (Inaudible).

THE REPORTER: I couldn't hear that.

MR. NORQUIST: I'll repeat what she said. No comments have been received. The comment period is open until the 27th of January of '95.

Okay. This meeting stands adjourned and after about 10, 15 minutes you will hear me announce that we're dismissed unless we have someone else here.

(Recess)

MR. NORQUIST: Okay. If I can have your attention, please. The time is about 1933, that's 7:33 p.m. for some of you. Has anyone come in from the community? If so, identify yourself, please. No identification. No one has come in from the community.

For the record, let it be shown that at 1900 Marine Corps Base Camp Pendleton opened its public presentation on its plan, proposed plan for remedial action for Site 9 of the installation restoration program aboard Marine Corps Base Camp Pendleton. There was no public representation outside the base or immediate contractual or regulatory staff dealing with the Site 9 remedial action process and therefore the presentation was not presented and the meeting adjourned at 1934, 7:34 p.m. This meeting stands adjourned. I thank you very much.

(Exhibits A through D marked)

(The public meeting was concluded at 7:34 p.m.)

REPORTER'S CERTIFICATE

STATE OF CALIFORNIA)
) ss
COUNTY OF SAN DIEGO)

I, ELANA K. FITZGERALD, CSR No. 9651, a Certified Shorthand Reporter for the State of California do hereby certify:

That said public meeting was taken before me at the time and place therein stated and was thereafter transcribed into print under my direction and supervision, and I hereby certify the foregoing public meeting is a full, true and correct transcript of my shorthand notes so taken.

I further certify that I am not of counsel or attorney for either of the parties hereto or in any way interested in the event of this case and that I am not related to either of the parties thereto.

Witness my hand this 10th day of January, 1995

Elana K. Fitzgerald

ELANA K. FITZGERALD
CSR No. 9651, RPR

CERTIFIED COPY CERTIFICATE

I, Elana K. Fitzgerald, a Certified Shorthand Reporter, No. 9651, hereby certify that the attached public meeting is a correct copy of the original transcript of the public meeting, taken before me on January 4, 1995, as thereon stated.

I declare under penalty of perjury that the foregoing is true and correct.

Executed at San Diego, California, this 10th day of January, 1995.

Elana K. Fitzgerald

ELANA K. FITZGERALD
CSR No. 9651, RPR

PUBLIC MEETING ATTENDANCE RECORD

Date _____

Please Print Name _____

Mailing Address _____

Street, P. O. Box or Route & Box

_____

City, State, Zip Code

Name of Official, Organization, or Group you represent

_____

Check Appropriate Blocks	
☐ I want to make a statement	☐ I am a property owner in the project area
☐ I will hand in a written statement	
☐ I do not plan to make a statement	☐ I am a resident in the project area

A.1

MARINE CORPS BASE, CAMP PENDLETON
INSTALLATION RESTORATION PROGRAM
PROPOSED PLAN FOR SITE 9
PUBLIC MEETING

4 JANUARY 1995

AGENDA

7:00 PM	Welcoming Remarks and Introductions	LtCol Norquist Deputy, Environment Assistant Chief of Staff, Environmental Security
	The CERCLA Process	Ms. Sheryl Lauth Remedial Project Manager U.S. Environmental Protection Agency
	Status of the Camp Pendleton Installation Restoration Program	Ms. Jayne Joy Environmental Engineering Division Assistant Chief of Staff, Environmental Security
	Alternatives Evaluated for Site 9	Ms. Robin Smith Feasibility Study Manager IT Corporation
	Proposed Plan for Site 9	Ms. Jayne Joy
	Public Comments	
8:30 PM	Adjourn	

Marine Corps Base Camp Pendleton Superfund Site

Naval Facilities Engineering Command, Southwest Division

Camp Pendleton, California **November 1994**

NAVY PROPOSES PLAN FOR REMEDIAL ACTION AT OPERABLE UNIT 1

INTRODUCTION

The U.S. Department of the Navy (Navy), in cooperation with the U.S. Environmental Protection Agency (EPA), the California Regional Water Quality Control Board (RWQCB), and the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), is soliciting public comment on the results of environmental investigations and the proposed *remedial alternatives* for soil and groundwater at *operable unit 1 (OU1)* at the Marine Corps Base Camp Pendleton, California (MCB CamPen) Superfund site (Figure 1). OU1 consists of *unsaturated soil* and *groundwater* at the location known as Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond (Figure 2). The Navy is the lead federal agency for site activities, EPA is the lead regulatory agency, and RWQCB and DTSC are support agencies for proposed cleanup actions.

NOTE: Terms in italics are explained in the Glossary of Terms.

Section 117 of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)*, as amended by the *Superfund Amendments and Reauthorization Act of 1986 (SARA)*, requires that the public be advised of any proposed remedial actions, and afforded the opportunity to comment, either orally or in writing, on such plans. This *proposed plan* documents a proposed no action alternative for addressing chemicals detected in low concentrations in the

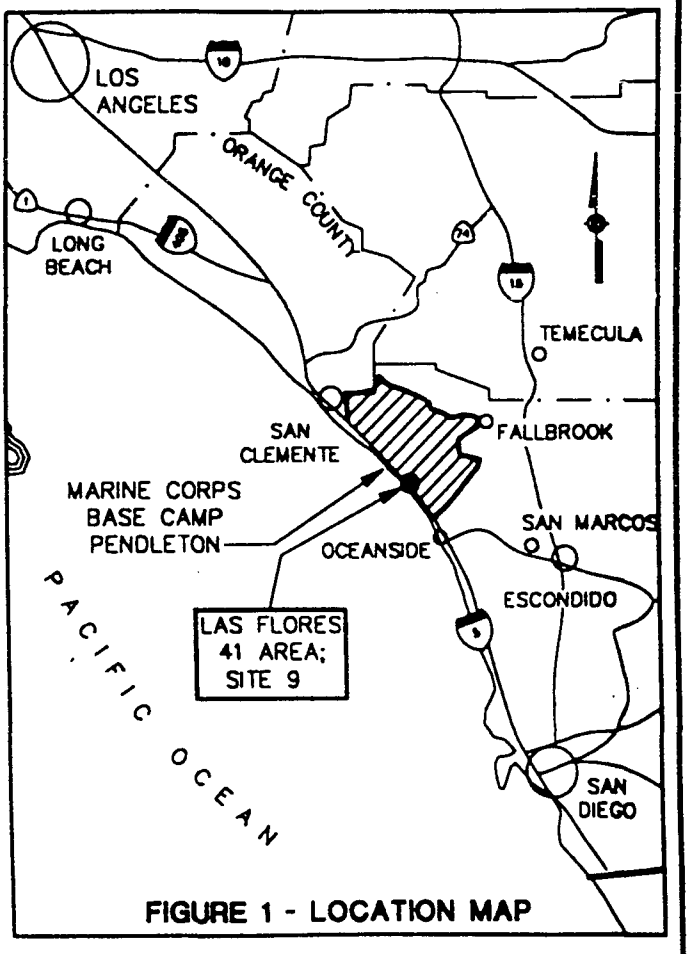


FIGURE 1 - LOCATION MAP

unsaturated soils at Site 9 (Figure 2), and proposes institutional controls, in the form of long-term monitoring (10 years) and restrictions on the use of *groundwater* in the vicinity of Site 9 for drinking water purposes, as the preferred alternative for dealing with low concentrations of chemicals detected in the groundwater at Site 9. The no action alternative for soil has been proposed because the *baseline risk assessment*, contained in the Draft Final Remedial Investigation Report for Group A

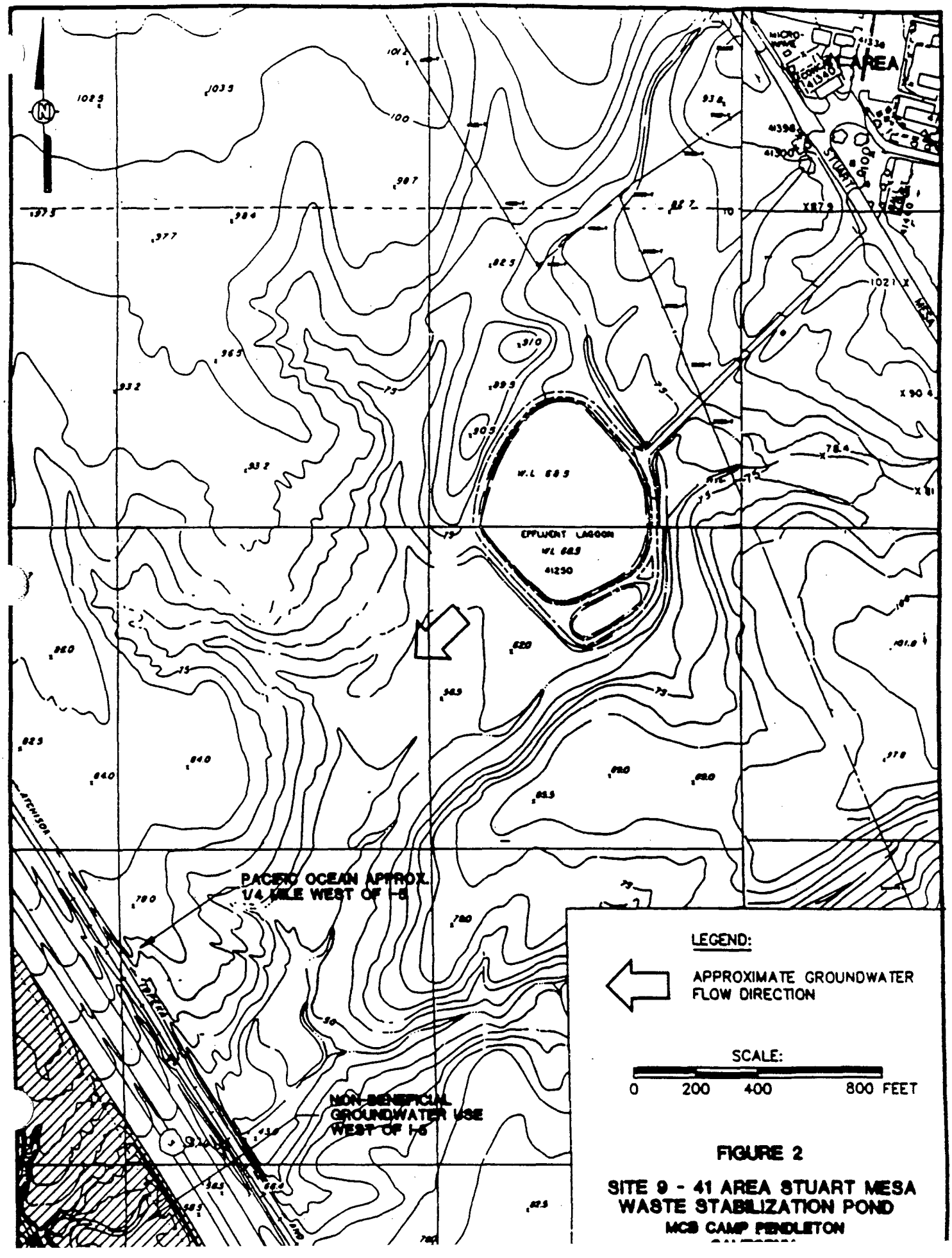


FIGURE 2

SITE 9 - 41 AREA STUART MESA
WASTE STABILIZATION POND
MCB CAMP PENDLETON

Sites (Navy, October 1993), concluded that based on current and future military land use scenarios, and hence *exposure pathways*, the chemical concentrations present in soil do not pose risks to human health which are appreciably greater than the risks associated with *background concentrations* of contaminants in the soil. Similarly, there are no threatened or endangered species or sensitive habitat areas at Site 9 that would be adversely affected by the low concentrations of chemicals in the soil.

The 1993 Remedial Investigation (RI) Report contains the results of environmental investigations and the baseline risk assessment conducted for soil and groundwater at Site 9. The 1994 *Feasibility Study* identifies and evaluates various remediation alternatives for Site 9. Both documents are part of the MCB Camp Pendleton *Administrative Record* and are available for public review at the Camp Pendleton Base Library and at the Oceanside Public Library. The public comment period on the Feasibility Study and this Proposed Plan is scheduled to begin **12 December 1994** and end **27 January 1995**. A public meeting will also be conducted during the public comment period. The Navy will consider all comments received from the public on the Feasibility Study and the Proposed Plan in making the final decision regarding the Site 9 - 41 Area Waste Stabilization Pond cleanup.

Facility Description

MCB Camp Pendleton is located between the cities of Los Angeles to the north and San Diego to the south (Figure 1). It is the Marine Corps' primary amphibious training center for the West Coast. Construction of MCB Camp Pendleton began in March 1942, and the base was dedicated in September 1942 by President Franklin D. Roosevelt. The base encompasses approximately 125,000 acres, most of which is in San Diego County. Surrounding communities include San Clemente to the northwest, Fallbrook to the east, and Oceanside to the south. The base is bordered to the west by the Pacific Ocean, which includes 17 miles of undisturbed coast. Since its inception, the primary mission of the base has been training. The base currently supports more than 36,000 military personnel and their dependents, and employs approximately 4,600 civilians.

Site Background

Site 9, also known as the 41 Area Stuart Mesa Waste Stabilization Pond, is located in an uninhabited area approximately one-quarter mile from Stuart Mesa road in the 41 Area and approximately one-quarter mile east of Interstate 5. The abandoned surface impoundment covers an area approximately 400 by 500 feet. The waste stabilization pond was operated as a sewage lagoon for oxidation and percolation of raw sewage generated in the 41 Area from 1963 until 1974 or 1975. In 1975, a wet well and lift station were installed in 41 Area to pump raw sewage to a treatment facility in 43 Area, and the use of the stabilization pond was discontinued. The waste stabilization pond, which contains water only briefly following heavy rainfall, has also been used for stockpiling of soils contaminated with petroleum hydrocarbons, primarily fuel and oil.

Scope and Role of Operable Unit 1

MCB Camp Pendleton and the Department of the Navy have been actively involved in the *Installation Restoration (IR) Program* process since 1980. The IR Program consists of the following phases:

- Preliminary Assessment/Site Inspection (PA/SI). The goal of the preliminary assessment is to review base activities and identify all sites that may require remediation. The site inspection is an on-site investigation to augment data collected during the preliminary assessment and to generate sampling and other field data required to evaluate whether additional investigation or action is appropriate.

- Remedial Investigation/Feasibility Study (RI/FS). The objective of the remedial investigation is to assess the nature and extent of contamination to a level of detail sufficient to support a risk assessment and feasibility study. During the feasibility study, the data compiled during the remedial investigation are used to develop and evaluate options for remedial action.

- Remedial Design/Remedial Action (RD/RA). The goal of the remedial design is to conduct technical analyses, following selection of a remedy for a site, as necessary to provide detailed plans and specifications for implementation of the remedial action. Remedial action is remediation of the site.

Forty-two sites have been identified for inclusion in the RI/FS phase, including regional groundwater, surface water, sediment, and wetland studies. The sites were divided into four manageable groups: Groups A, B, C, and D. Group A consists of six sites. The October 1993 Remedial Investigation Report for Group A Sites describes in considerable detail the site histories, physical characteristics of each site, a description of the remedial investigations conducted at each site, and the nature and extent of contamination at each of the Group A sites. The RI Report also includes the findings of the baseline human health and ecological risk assessments for the Group A sites, which include Site 9 - Stuart Mesa Waste Stabilization Pond. Expedited removal actions will be conducted at three of the Group A Sites (3, 5, and 6) in accordance with EPA guidelines.

Operable Unit 1 consists only of Site 9 - Stuart Mesa Waste Stabilization Pond. Both the soil and the groundwater beneath the waste stabilization pond have been contaminated with low levels of chemicals. The September 1994 Feasibility Study identified and evaluated several remedial alternatives for both the soil and the groundwater. The findings contained in the RI Report and the evaluations of the remedial alternatives contained in the Feasibility Study Report are the basis for determining the preferred alternative outlined in this Proposed Plan.

Summary of Site Risks

The RI identified beryllium and total petroleum hydrocarbons in the diesel fuel range (TPH-diesel) as soil contaminants that require evaluation for potential remedial action. The naturally-occurring background concentration for beryllium in soils located outside of the Waste Stabilization Pond (Site 9) is estimated to be in the range from <0.1 to 1.1 parts per million (ppm). In order to estimate the actual range of natural background soil concentrations for beryllium, the Navy collected and chemically analyzed 71 soil samples from the vicinity of Site 9. The maximum beryllium concentration observed at Site 9 was 1.9 ppm detected in a single soil sample located inside the Waste Stabilization Pond. The range in concentrations of total petroleum hydrocarbons for diesel fuel in soils from Site 9 was <0.5 (Non-Detectable) to 6,700 ppm.

As a means of estimating the human health risks caused by exposure to contaminants, EPA has established an acceptable range of risk levels, which are presented as *incremental lifetime cancer risks (ILCRs)* for carcinogens (cancer-causing chemicals) and *hazard indices* (HIs) for noncarcinogens (non-cancer-causing chemicals). EPA considers an ILCR range of $1x10^{-6}$ (one in a million) to $1x10^{-4}$ (one in ten thousand) an acceptable range for carcinogens. EPA considers an HI value of less than one for noncarcinogens to be protective of human health. The results of the human health risk assessment indicate that all current and future risks are within EPA's acceptable risk range. Therefore, the soil at Site 9 does not pose a risk to human health or the environment.

Unlike the individual chemical constituents of petroleum hydrocarbons, cancer risk factors associated with TPH-diesel (a mixture of chemicals) are not published by either State or Federal regulatory agencies. Guidance concerning recommended maximum concentrations of TPH-diesel in soil is based primarily on the protection of groundwater, and is based on site-specific conditions. The overriding consideration is the leachability of hydrocarbons from contaminated soil to the groundwater. According to the guidance provided in the California State Water Resources Control Board publication Leaking Underground Fuel Tank (LUFT) Field Manual, TPH-diesel concentrations of 1,000 ppm can be allowed to remain in place at Site 9. The LUFT Manual guidance was initially used in the absence of site-specific leachability studies.

Groundwater contaminants at Site 9 that require evaluation for potential remedial action are tetrachloroethene (PCE) and trichloroethene (TCE). The presence of these contaminants in groundwater did not result in an ILCR exceeding $1x10^{-6}$, regardless of whether the maximum or average concentration was used in the risk calculation, and based on a current military use scenario. The results of the human health risk assessment indicate that future risk, utilizing an improbable residential *land use scenario*, is within EPA's acceptable risk range. However, both chemicals have been, on occasion, detected in groundwater samples at concentrations exceeding the State and Federal maximum contaminant levels (MCL) of 5.0 parts per billion (ppb). PCE was detected in only one groundwater monitoring well at a maximum concentration of 18 ppb, while TCE was detected in a different well at a maximum concentration of 15 ppb. The range of contaminants observed in

groundwater during six separate sampling events are as follows:

Compound	State MCL (ppb)	Federal MCL (ppb)	Observed Range (ppb)	Maximum Observed (ppb)
Tetrachloroethene (PCE)	5	5	4-18	18
Trichloroethene (TCE)	5	5	1-15	15

Summary of Alternatives

Seven alternatives were identified as potential remedial alternatives for Site 9. Each alternative addressed both the soil and the groundwater media.

For purposes of evaluating the treatment alternatives, contaminated soil at Site 9 was grouped into three types. Zone 1 soil contains beryllium concentrations exceeding the proposed remediation goal (PRG) of 0.69 ppm, which is the background concentration for beryllium in soils at Site 9. Zone II soil contains TPH-diesel concentrations exceeding 100 ppm (Option 1) or 1,000 ppm (Option 2). Volumes of soil with concentrations of metals that potentially exceed State or Federal hazardous waste leaching criteria are designated as "hot spots."

The seven remedial alternatives which were evaluated in the Feasibility Study are:

- Alternative 1: No Action

- Alternative 2: **Soil** - Excavation and Off-Base Disposal (Landfill) for Hot Spots, Zone I, and Zone II
  Groundwater - Institutional Controls (groundwater monitoring for 10 years and land use restrictions so that the groundwater is not used for drinking water)

- Alternative 3: **Soil** - Excavation and Off-Base Disposal (Landfill) for Zone I and Hot Spots; Biological Land Treatment for Zone II
  Groundwater - Extraction, ultraviolet (*UV*)/Chemical Oxidation, and Reinjection, with groundwater monitoring

- Alternative 4: **Soil** - Excavation and Off-Base Disposal (Landfill) for Zone I; In Situ Bioremediation/Bioventing for Zone II
  Groundwater - Extraction, Carbon Adsorption, and Reinjection, with groundwater monitoring

- Alternative 5: **Soil** - Excavation and Off-Base Disposal (Landfill) for Zone I; In Situ Bioremediation/Bioventing for Zone II
  Groundwater - Institutional Controls (groundwater monitoring for 10 years and land use restrictions so that the groundwater is not used for drinking water)

- Alternative 6: **Soil** - Excavation and Off-Base Disposal (Landfill) for Zone I and Hot Spots; Biological Land Treatment for Zone II
  Groundwater - Institutional Controls (groundwater monitoring for 10 years and land use restrictions so that the groundwater is not used for drinking water)

- Alternative 7: **Soil** - No Action
  Groundwater - Institutional Controls (groundwater monitoring for 10 years and land use restrictions so that the groundwater is not used for drinking water)

The detailed analysis of alternatives provides the information necessary for decision-makers to select a site remedy. Each alternative was assessed in accordance with the EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, with consideration of the following:

- Overall protection of human health and the environment
- Compliance with *Applicable or Relevant and Appropriate Requirements (ARARs)*
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost.

Two other criteria, State acceptance and community acceptance, will be assessed after public comment on the FS and this Proposed Plan.

The alternative analysis, discussed in detail in the FS, is summarized as follows:

Criteria	Alternatives						
	1	2	3	4	5	6	7
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs (Note 1)	No	Yes[a]	Yes	Yes	Yes[a]	Yes[a]	Yes[a]
Long-Term Effectiveness and Permanence	NA	Low	High	High	Mod	Mod	Low
Reduction of Toxicity, Mobility, or Volume	No	Low	High	High	High	High	Low
Short-Term Effectiveness	NA	Mod	Mod	High	High	Mod	NA
Implementability	NA	High	Mod	High	High	Mod	High
Cost ($ millions)							
Option 1	0	4.1	2.4	1.3	0.7	1.8	0.4
Option 2	0	1.5	1.4	1.1	0.5	0.8	

Description of the Preferred Alternative

As previously mentioned, each of the seven remedial alternatives considered both the soil and groundwater media. Based on the detailed information provided in the RI Report and the FS Report, the Navy has identified Alternative 7 as the preferred alternative. The rationale for the selection of Alternative 7 is as follows:

Soil Media: No Action

The human health risk associated with the beryllium in the soil, utilizing the future residential land use scenario, is an ILCR of $2x10^{-5}$, which is within the acceptable range determined by the EPA of $1x10^{-6}$ to $1x10^{-4}$. The future residential land use scenario represents the most conservative approach when conducting human health risk assessments. The probability that Site 9 will ever be used for anything other than training is extremely low. In addition, beryllium was detected in only one boring in the Site 9 impoundment at levels that exceeded the area background concentrations of beryllium. The single sample found to contain 1.9 ppm of beryllium was from a depth of 1 foot below the surface at one specific location. In the unlikely event that the impoundment is utilized for residential purposes at some time in the future, considerable grading and import of clean fill would be required. Thus, site preparation would in all probability result in a lesser likelihood for dermal contact or ingestion of soil containing elevated levels of beryllium.

The primary concern for the TPH-diesel concentrations in soil at Site 9 is that these hydrocarbons as well as other metals present in the soil, could leach to the groundwater and degrade the quality of the shallow groundwater. In order to assess the potential for such leaching, soil samples were collected from the locations and depths containing maximum concentrations of beryllium and TPH-diesel and submitted to the laboratory for analysis using the *synthetic precipitation leaching procedure* (SPLP; U.S. EPA Method 1312) for volatile organics, and the *waste extraction test (WET)* for beryllium, cadmium, and lead. The test results showed that these compounds were not detected in the extract solution. Based on the results of these leachability tests, TPH-diesel, beryllium, cadmium, and lead are not expected to leach to, or degrade, the groundwater.

Groundwater: Institutional Controls and Long-Term Groundwater Monitoring

As previously mentioned, concentrations of tetrachloroethane (PCE) and trichloroethene (TCE) do not pose a significant risk to human health using either the maximum or average concentration of those chemicals, and utilizing the current military use scenario in the risk calculations. Although these compounds do not pose a significant health risk, both have been detected in individual samples at concentrations which exceed the State and Federal maximum contaminant levels (MCLs). As shown in the FS Report, there are several treatment alternatives which can effectively remove these constituents from groundwater. The difficulty does not lie in the ability to successfully treat the groundwater, but in the ability to pump sufficient quantities of groundwater from the *aquifer*.

It was determined during the remedial investigation that much of Site 9 is underlain by highly impermeable marine terrace deposits. Wells installed in these deposits could not be tested using conventional pumping techniques because these wells yielded extremely small quantities of groundwater. Based on the results of the RI, it is not likely that wells completed in these deposits would be considered suitable as a source of municipal or domestic water supply. In addition, implementability of any groundwater treatment alternatives which involve groundwater extraction will necessarily be hampered by the low *permeability* of the marine terrace deposits, and consequently the low yield of wells completed in these

Computer modeling suggests that the low concentrations of contaminants in Site 9 groundwater will not reach the ocean. The computer model used was not extensively calibrated to the hydrogeologic conditions at Site 9. For these reasons, results of computer modeling performed for this site should not be considered definitive, but a best estimate based upon available information. However, the computer modeling results suggest that an impact on marine receptors is not likely. There are no users of groundwater downgradient between Site 9 and the ocean, and the groundwater flow path is through the nonbeneficial zone which is located approximately one-quarter mile west of Site 9 (parallel to Interstate 5). Although levels of PCE and TCE above MCLs were detected in groundwater beneath the Waste Stabilization Pond, the groundwater fate and transport model indicates that concentrations of contaminants will be reduced to below maximum contaminant levels by dispersion and natural attenuation within 30 years. As indicated in the preamble to the National Oil and Hazardous Pollution Contingency Plan, the use of natural attenuation as a remediation technique is consistent with EPA's groundwater protection policy when active restoration is not practical or warranted due to site conditions, and groundwater is unlikely to be used in the foreseeable future. Alternative 7 specifies that groundwater will be sampled and analyzed semi-annually for 10 years to ensure that dispersion and natural attenuation is occurring, and that contaminant levels are not increasing as a result of some unknown source. During the long-term monitoring period, and until contaminants in the groundwater at the site are at or below Maximum Contamination Levels (MCLs), the base masterplan will be amended to restrict future access to the groundwater in the immediate vicinity of Site 9. As required by current regulations, a compliance monitoring program consisting of eight rounds of groundwater sampling will be conducted after 7 years to assess the effectiveness of the dispersion and natural attenuation of the low concentrations of PCE and TCE in the groundwater. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) will be achieved over time through natural groundwater attenuation. Compliance with water quality objectives and the need for further action will be re-evaluated periodically during the groundwater monitoring period.

Glossary of Terms

Remedial Alternative - One of several alternatives for remediating, or cleaning up, a site.

Operable Unit - Made up of one or more sites with similar characteristics that may require the same or similar methods of remediation.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) - Commonly referred to as the Superfund, authorized Federal action to respond to the release, or substantial threat of release, into the environment of hazardous substances, pollutants, or contaminants which may present an imminent or substantial danger to public health or welfare.

Superfund Amendments and Reauthorization Act of 1986 (SARA) - Reauthorized CERCLA and amended the authority and requirements of CERCLA and associated laws.

Proposed Plan - A document intended to facilitate public participation in the remedy selection process by identifying the preferred alternative for a remedial action at a site or operable unit and explaining the reasons for the preference.

Unsaturated Soil - Soil in which the space between grains is not filled with water.

Groundwater - Water beneath the ground surface found in between soil grains and cracks in rocks.

Baseline Risk Assessment - The process of defining the actual and potential risks of various types of pollution to human health and the environment. The "environment" in this context refers to all animals and plants, in addition to air, water, and soil, and how they may be affected by exposure to significantly higher levels of hazardous materials.

Exposure Pathways - Means by which humans or animals may be exposed to contaminants, including dermal exposure, ingestion, inhalation, food chain, etc.

Background Concentrations - Naturally occurring concentrations of certain compounds in soil and/or groundwater, including minerals, heavy metals, and organic compounds. Background concentrations are often determined statistically, and are expressed as mean (average) or reasonable maximum exposure (RME) levels.

Feasibility Study - An engineering evaluation of several alternatives which may be used to remediate a site. Criteria used to evaluate the alternatives include overall protection of human health and the environment, compliance with applicable or relevant and appropriate requirements, long-term effectiveness and relevance, reduction of toxicity, short-term effectiveness, implementability, and cost.

Administrative Record - A record of all information considered or relied upon in selecting a remedy. The record must be maintained "at or near" the facility at issue and must be available to the public.

Installation Restoration (IR) Program - Navy program to identify, assess, characterize, and clean up or control contamination from past hazardous waste disposal operations and hazardous material spills at Navy and Marine Corps activities.

Incremental Lifetime Cancer Risk (ILCR) - The risk of developing cancer, due to exposure to a contaminant, which is in addition to the cancer risk from all other sources during a lifetime.

Hazard Index (HI) - Potential for noncancer toxicity from exposure to site-related contamination. The HI is found by dividing the daily intake by the reference dose, or the estimate of the quantity of the contaminant which may be taken daily without significant risk of toxicity.

Land Use Scenario - Various purposes for which land may be used, such as residential, industrial, military, etc.

Applicable or Relevant and Appropriate Requirements (ARARs) - State and Federal laws and regulations which may be relevant or appropriate when remediating a site.

Aquifer - A layer of rock, sand, or gravel located beneath the ground surface capable of storing water within cracks and pore spaces, or between grains. When water contained within an aquifer is of sufficient quantity and quality, it can be used for drinking and other purposes. The water contained in an aquifer is called groundwater.

Synthetic Precipitation Leaching Procedure (SPLP) - A laboratory procedure wherein reagent water is used to extract volatiles and cyanides from soil samples. The extracted fluid is then analyzed by gas chromatogram. The procedure is designed to measure leachability of contaminants from soil.

Waste Extraction Test (WET) - A laboratory procedure designed to measure the leachability of compounds, particularly heavy metals, from soil. Citric acid is used as the extracting fluid.

Permeability - The rate at which groundwater may diffuse through soil.

FOR MORE INFORMATION

If you have any questions about Marine Corps Base Camp Pendleton OU1 please contact:

Ms. Jayne Joy
Division Head (IR)
Assistant Chief of Staff,
Environmental Security
Box 555008
MCB Camp Pendleton, CA
92055-5008
(619) 725-9752

Ms. Tracy Sahagun
IR Coordinator
Assistant Chief of Staff,
Environmental Security
Box 555008
MCB Camp Pendleton, CA
92055-5008
(619) 725-9741

Mr. Edward K. Dias
Remedial Project Manager
Southwest Division,
Naval Facilities Engineering
Command
1220 Pacific Highway
San Diego, CA 92132-5181
(619) 532-3575

COMMUNITY PARTICIPATION

The Navy invites the public to become involved in the process of selecting the final remedy. Comments from residents of MCB Camp Pendleton and the surrounding communities are valuable in helping the Navy select a final remedy for the site. Based on new information or public comments, the Navy may change the preferred alternative or choose another alternative.

There are two ways for you to provide your comments during the public comment period between 2 December 1994 and 27 January 1995. You may send written comments to GY Sgt Ruth Carver at the following address:

GY Sgt Ruth Carver
Joint Public Affairs Office
Marine Corps Base Camp Pendleton
Building 1160
Camp Pendleton, CA 92055-5001
(619) 725-5569

Alternatively, you may submit your comments to the Navy during the public meeting which will be held as follows:

Date: 4 January 1995
Place: Oceanside Senior Citizens Center
455 Country Club Lane
Oceanside, California
Time: 6:30 p.m.

A court reporter will be present at the meeting to record comments for a written record. The public meeting will be an information open house until 7:00 pm when the proposed plan will be presented and public comments taken.

After the public comment period is over, the Navy will review and consider the submitted comments before making a final decision on the remedial action alternative to be used at the site. Comments received from the public will be addressed in a Responsiveness Summary which will be included in the Administrative Record. The complete Administrative Record is available for review at the following locations:

Oceanside Public Library
300 North Hill Street
Oceanside, CA 92054
(619) 966-4690

Marine Corps Base Camp Pendleton
Base Library
Building 1122
Camp Pendleton, CA 92055-5001
(619) 725-5669

OVERVIEW OF

SUPERFUND PROGRAM

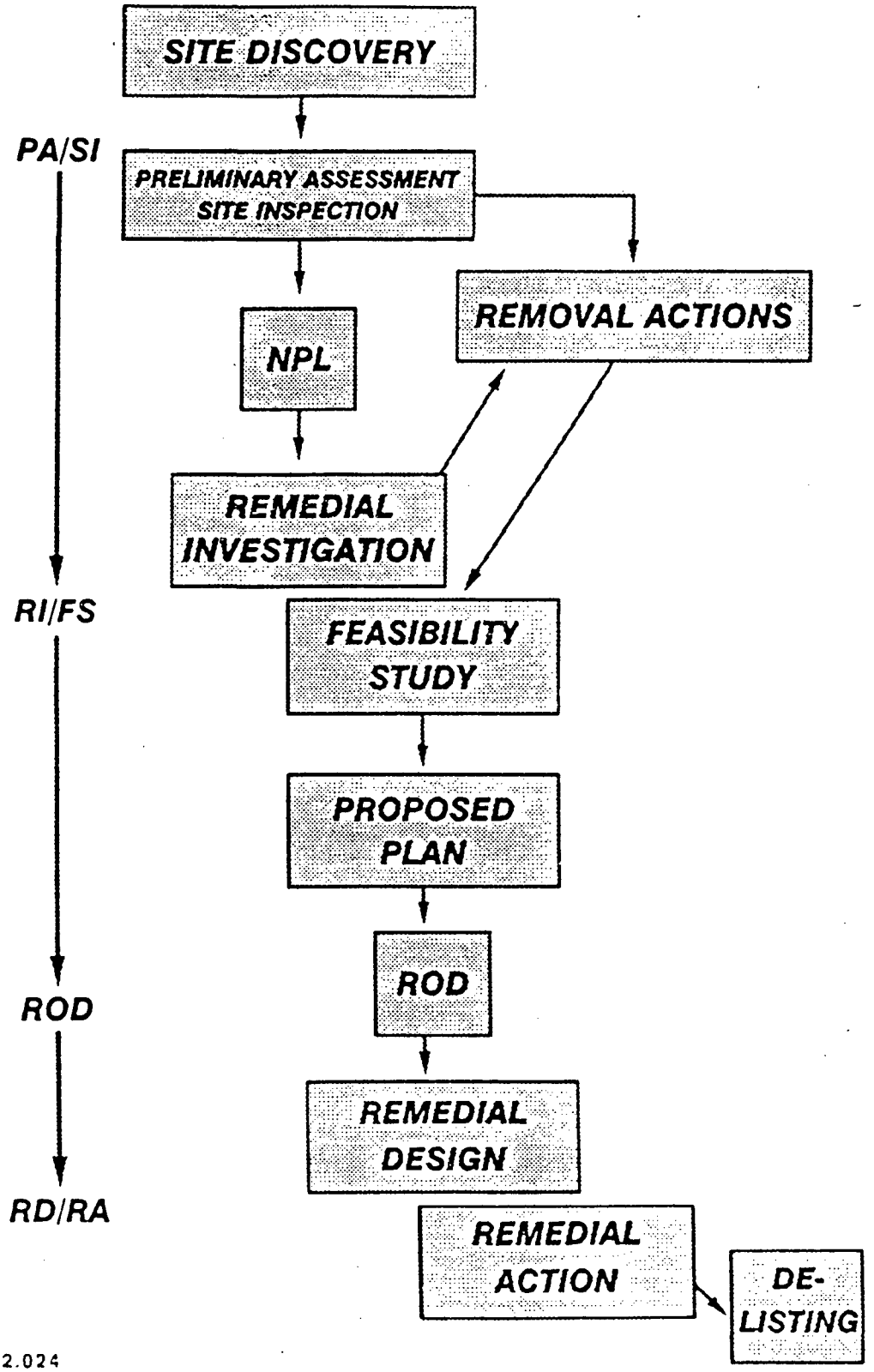
AS IT RELATES TO FEDERAL FACILITIES

D1082.013

EXHIBIT B
DEPO OF: PUBLIC HEARING
DATE: 1-4-95
ELANA K. FITZGERALD
8 PAGES

SUPERFUND PROGRAM AS IT RELATES TO FEDERAL FACILITIES

THE SUPERFUND PROCESS



D1082.024

AC/S, Environmental Security

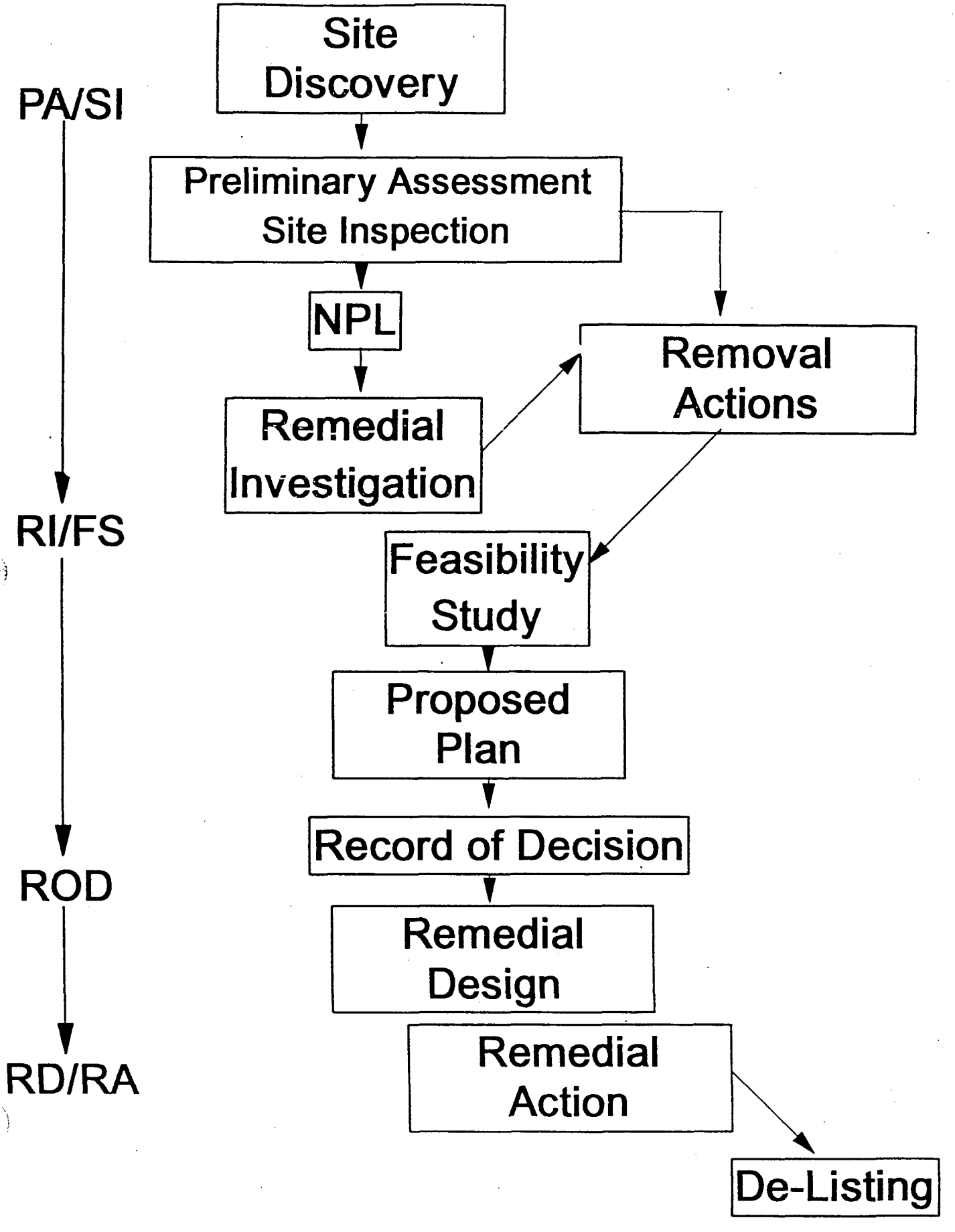
Installation Restoration Program

- Installation Restoration (IR) Program History
  - ► Placed on the National Priority List on 15 Nov 89
    - → EPA ranking score of 32.5
  - ► Federal Facilities Agreement
    - → Signed in October 1990
    - → Revised in October of 1992
    - → Placed the Sites into Groups
  - ► IR Program has 42 Sites, typical sites include
    - → Abandoned dumps/grease pits
    - → Pesticide handling areas
    - → Ditches associated with operations
    - → Landfills and surface impoundments

AC/S, Environmental Security
Installation Restoration Program

- Status of the Installation Restoration Program
  - Group "A" Completed Remedial Investigation and Feasibility Study:
    - One Site Feasibility Study/Proposed Plan
    - Three Sites Removal Actions
    - Three Sites No Further Action
  - Group "B" Completed the Remedial Investigation
  - Group "C" Completed the Field Investigation
  - Group "D" Begin Field Investigation in FY96

THE CERCLA PROCESS



Criteria	Alternatives						
	1	2	3	4	5	6	7
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	No	Yes[a]	Yes	Yes	Yes[a]	Yes[a]	Yes[a]
Long-Term Effectiveness and Permanence	NA	Low	High	High	Mod	Low	Low
Reduction of Toxicity, Mobility, or Volume	No	Low	High	High	High	High	Low
Short-Term Effectiveness	NA	Mod	Mod	High	High	Mod	NA
Implementability	NA	High	Mod	High	High	Mod	High
Cost ($ millions)							
Option 1 (100 ppm TPH)	0	4.1	2.4	1.3	0.7	1.8	0.4
Option 2 (1,000 ppm TPH)	0	1.5	1.4	1.1	0.5	0.8	

[a]ARARs achieved over time through natural groundwater attenuation.
NA - Not applicable.

AC/S, Environmental Security
Installation Restoration Program

- Proposed Plan for Site 9
  - ► Preferred Action Alternative No. 7
    - → Soil - No Action
    - → Groundwater - Institutional Controls & Restricted Use
  - ► The Pendleton Team, including regulatory agencies, has agreed on this alternative

AC/S, Environmental Security

Installation Restoration Program

- Rationale
  - Levels of Contamination
  - Soil
    - Background Concentration of Beryllium
    - Leaching Test Results
  - Groundwater
    - No Downgradient Drinking Water Wells
    - Fate and Transport
    - Low Well Yield

EXHIBIT C
DEPO OF: PUBLIC HEARING
DATE: 1-4-95
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1 PAGE

MCB CAMP PENDLETON INSTALLATION RESTORATION SITES BY GROUP

Group A (Sites with Limited Previous Investigation)

- Site 3 - Pest Control Wash Rack
- Sites 4 and 4A - MCAS Drainage Ditch and Concrete-Lined Surface Impoundment
- Site 5 - Firefighter Drill Field
- Site 6 - DPDO (DRMO) Scrap Yard and Building 2241
- Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
- Site 24 - 26 Area MWR Maintenance Facility

Group B (Landfills and Surface Impoundments)

- Site 7 - Box Canyon Landfill
- Sites 8 and 8A - Las Pulgas Landfill and Las Flores Creek
- Site 14 - San Onofre Landfill
- Site 19 - 31 Area ACU-5 (LCAC) Surface Impoundments
- Site 20 - 43 Area Las Pulgas Vehicle Wash Rack
- Site 22 - 23 Area Unlined Surface Impoundment

Group C (Remaining Sites in the Santa Margarita Basin (SMB))

- Site 1 - Refuse Burning Grounds in SMB (2 locations)
- Site 2 - Grease Disposal Pits in SMB (2 locations)
- Site 10 - 26 Area Sewage Sludge Composting Yard
- Site 16 - 22 Area Buildings 22151 and 22187 Ditch Confluence and Ditch
- Site 17 - 22 Area Building 22187 Marsh and Ditch
- Site 27 - 22 Area Ditches Behind Building 22210
- Site 28 - 26 Area Trash Hauler's Maintenance Area
- Site 29 - 25 Area Skeet Range
- Site 30 - Firing Range Soil Fill in 31 Area
- Site 31 - Building 210801 Transformer (no sampling)
- Site 35 - Former Sewage Treatment Plant Facility in 25 Area
- SMB Groundwater Study
- SMB Surface Water and Sediment Study
- Santa Margarita Coastal Wetland Study

Group D (Remaining Sites outside the SMB)

- Site 1 - Refuse Burning Grounds outside SMB (7 locations)
- Site 2 - Grease Disposal Pits outside SMB (4 locations)
- Site 18 - 13/16 Area Building 1687 Spill and Ditch
- Site 32 - Drum Storage Area and Drainage Between Buildings 41303 and 41366
- Site 33 - 52 Area Armory (Building 520452) and Drainage to Southeast
- Site 34 - Combat Engineers Maintenance Facility, Buildings 62580 - 62583
- Site 36 - Debris Pile Area Behind Ponds at Sewage Treatment Plant 11
- Site 37 - Pesticide- and POL-Handling Areas at San Clemente Ranch
- Site 38 - 52 Area Sewer Line, Building 52188
- Site 39 - 41 Area Sewer Line, Buildings 41300 and 41346
- Site 40 - 13 Area Sewer Line, Building 13103
- Site 41 - 13 Area Sewer Line, Building 13128
- Site 42 - 13 Area Sewer Line, Building 13129
- Groundwater Study outside SMB
- Surface Water and Sediment Study outside SMB
- Coastal Wetland Study outside SMB

EXHIBIT D
DEPO OF: PUBLIC HEARING
DATE: 1-4-95
ELANA K. FITZGERALD
1 PAGE

PUBLIC MEETING 4 JAN 95
REMEDIAL ACTION SITE 9
PROPOSED PLAN

	NAME
1	KEITH LEBOUEF
2	Capt D. S. Tump USMC
3	JOHN OWENS
4	John Gleason
5	Lloyd Cuma USMC
6	Major J. R. Scharfen, USMC Western Area Counsel Office
7	Sheryl Lauth USEPA
8	Edward K. Dim, SWDIV.
9	Larry R. Froebe, IT Corporation
10	CATHY ROTHWELL, SWDIV
11	ISAAC HIRBAWI, DTSC
12	John Odermatt, RWQCB
13	ED MINUGH, IT CORP
14	Harry Ohlendorf, CH2M Hill
15	Murphy, USMC
16	Robin Smith, IT Corp.
17	Liz Luecker, CH2M Hill
18	William Dougherty Hucs
19	CPL ALLEN CLARK
20	David Boyer USMC
21	Cpl Wade in Fairbanks
22	Cpl Stephanie N Conrad
23	LtCol S.W. Nugent Dep AC/S ES RICB Gen
24	[illegible]

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California
DEPOSITION REPORTERS

(800) 242-1996
FAX (818) 915-0197

REPORTER'S TRANSCRIPT OF PROCEEDINGS

455 COUNTRY CLUB LANE
OCEANSIDE, CALIFORNIA

WEDNESDAY, JUNE 28, 1995
6:30 p.m. - 7:13 p.m.

REPORTED BY:
ELANA K. SHIRLEY
C.S.R. NO. 9651

COPY

OCEANSIDE, CALIFORNIA, WEDNESDAY, JUNE 28, 1995

6:30 P.M.

-oOo-

LIEUTENANT COLONEL NORQUIST: Good evening. I'm Lieutenant Colonel Stan Norquist assigned to Marine Corps Base Camp Pendleton and the Assistant Chief of Staff of the Environmental Security Office. And on behalf of the Commanding General, Major General Reinke, of Camp Pendleton, I am pleased to welcome you to this public forum to -- open for public comment, the proposed plan for Sites 4, 4-A on Marine Corps Air Station and Site 24 located in Area 26 aboard the base.

A court reporter is here tonight recording the official transcript of the record of this meeting, and that transcript will be available post this meeting for all interested parties.

I would like to determine at this time if there are any present who are not military, not employed by Marine Corps Base Camp Pendleton, not contracted by the Marine Corps Base Camp Pendleton or not a regulator involved in the Technical Review Committee for Marine Corps Base Camp Pendleton.

Are there any members of the public present that do not fall into that category?

The record will show that there are no private citizens or representatives of the general public present

outside the employ of Marine Corps Base Camp Pendleton or the regulatory representatives to the Technical Review Committee for the Installation Restoration Program at Marine Corps Base Camp Pendleton.

What I would propose, then, is that we recess this meeting for a period of about 15 minutes to see if any of the public do arrive, and after 15 minutes, we'll reconvene the meeting. If no one does, then we will determine at that time if this satisfies the requirement for the public meeting and close the meeting at that time.

Any comments or suggestions? Let's recess this meeting then for 15 minutes.

(Recess)

LIEUTENANT COLONEL NORQUIST: Okay. Good evening. We'll reconvene now the public meeting for comment -- opportunity for public comment on Marine Corps Base Camp Pendleton's proposed plan for Installation Restoration 4 and 4-alpha at Marine Corps Air Station and Site 24 in the MWR Repair Facility or Maintenance Facility in the 26 area.

We do have some members of the public. We have two members of the public who have arrived. So we will provide the proposed plan as advertised.

So on behalf of the Commanding General Marine Corps Base Camp Pendleton, I would like to welcome you to this forum to provide opportunity for comment, fulfill the basis both legal

and moral obligation to the public, to provide that opportunity for comment on the proposed plan for remediation or addressal (sic) of those sites.

A court reporter is present and a transcript -- and we will provide a transcript for an official record, which will be available following -- in the weeks following this forum.

We would ask you to hold your questions until the formal presentation is complete, and many of the people who have been involved in the Technical Review Committee and in the investigation of the sites and in the oversight, the regulatory oversight of that process, are with us tonight. And I would like to take some time to introduce those key personnel right now.

First, I would like to introduce the Assistant Chief of Staff of Environmental Security for Marine Corps Base Camp Pendleton, Mr. Keith LeBouef. And then as I introduce the members of the Technical Review Committee who are here and the contracting agents who are here, I would ask you to just say a brief word on your involvement with the Committee and your oversight and what your role is.

Mr. Ed Dias is from the Southwest Division Department of the Navy. Mr. Dias.

MR. DIAS: Yeah, I am from Southwest Division in San Diego. I manage the contract for the Marine Corps Base. We have (inaudible) working on the IR Program, and -- and we try to

meet the deadlines in FTA. Okay. Thank you.

LIEUTENANT COLONEL NORQUIST: Thank you.

From the U.S. Environmental Protection Agency, we have Ms. Sheryl Lauth.

MS. LAUTH: Hi. I'm Sheryl Lauth, and I'm the project manager for the E.P.A. We're the lead regulatory agency that oversees the cleanup of Camp Pendleton.

LIEUTENANT COLONEL NORQUIST: From the San Diego Regional Water Quality Control Board, we have Mr. John Odermatt.

MR. ODERMATT: I'm with the Regional Water Quality Control Board, State of California agency, a support agency to the EPA, and providing regulatory oversight of the remedial investigations and cleanup of Camp Pendleton.

LIEUTENANT COLONEL NORQUIST: Representing International Technologies, which is the prime contractor in execution of the Investigation and Remedial Action Development Program, is Mr. Ed Minugh.

MR. MINUGH: Good evening. Yes, I'm Ed Minugh. I am the project manager from IT Corporation. Our -- we're a contractor to the Naval Facilities Engineering Command for the Environmental Engineering Services associated with the remedial investigation feasibility study here at Camp Pendleton.

LIEUTENANT COLONEL NORQUIST: The Assistant Chief of Staff of the Installation Restoration Program Manager is Mr. Keith LeBouef. Keith.

MR. LEBOUEF: I'm here at Camp Pendleton in Environmental Security. I control the -- well, I'm the manager of the Installation Restoration Program, and my name and number appears in a fact sheet that you may have. And if you have any questions, you can direct them to my number.

LIEUTENANT COLONEL NORQUIST: Just a few notes, by the way, of background. Marine Corps Base Camp Pendleton, the base was founded in 1942. It was contracted in 1942. It is a 126,000-acre facility, 17 miles of coast, separates San Diego from Los Angeles, and is a great, we think, divider from the problems of Los Angeles County and the northern counties and associated environmental issues infringement upon San Diego County.

So it is the home of the First Marine Expeditionary Force. That is the unit that consists of the First Marine Division, the First Four-Service Support Group and the Third Marine Aircraft Wing. Those are the primary major subordinate commands, and those are the units that were primarily involved in much of the deployment activity over the last several years to Somalia, to Saudi Arabia, Kuwait and many of those operations.

In addition to its national security admission -- and that is the primary purpose for Marine Corps Base Camp Pendleton's existence -- Marine Corps Base Camp Pendleton is proud of its record of and its ability to integrate the

environmental sensitivities and regulations of today into the mission and the accomplishment of the mission, the national security of Marine Corps Base Camp Pendleton. It is a host of numerous endangered species, some of which include the Least Bells Vireo, the California Least Turn, the Western Snowy Plover and others. And it is also the employer of 36,000 military and 4,600 -- approximately 4,600 civilian employees in the region. So it's a very diverse and extremely active dynamic base. It's alive and -- both with its mission and with its environment.

You are going to hear tonight some now on what our plan is to address sites that have been listed as requiring the attention of our Installation Restoration Program, and I will turn that over now to Mr. Keith LeBouef.

MR. LEBOUEF: Well, thank you Lieutenant Colonel.

I would like to welcome and encourage your participation in the ongoing cleanup effort aboard Camp Pendleton. Please hold all questions until the end of my presentation. At that time -- time has been arranged following the presentation to fully answer all questions. This presentation should take about 15 minutes.

I would like to, just for the record, state three weeks prior to this meeting, we published a public notice in the Scout. Two weeks prior, we published a half-a-page ad on the proposed plan. One week prior we had a short article placed in the Scout. Two weeks prior, we put a proposed plan in the Sun

Coast. And the Plan Committee, one week prior, we put -- placed a public notice in the Sun Coast, which is a paper in San Clemente. Also three weeks prior, in the Blade Citizen, the proposed plan was placed in the public section of the newspaper. One week prior to this meeting, a public notice referring to the Oceanside senior citizen facility, denoting what time the meeting was going to start. Also, these proposed plans were placed at both of our information repositories.

And now I would like to get into my presentation. Right now, I am here to provide information on the IR program. We refer to it as the Installation Restoration program. I want to completely discuss the investigations that have taken place at these three sites we refer to as Site 4, 4-A and 24, provide descriptions of these sites. We have slides showing different angles of the sites. Also, we have a site map with sampling and some of the investigation work that we have conducted at these sites.

Also, I would like to finish -- I mean furnish information on the proposed plan. This plan is a proposed plan. It's the proposed action we have -- we recommend for these sites. And a lot of effort and a lot of analysis has gone into this plan to get where we are today.

We also encourage the public participation and involvement in this program. It's a long -- several years' of work needs to be done and we have several opportunities that the

public can get involved. And I will be stating them towards the end of the presentation, how the public can get involved.

The main reason we are here is to answer all questions and especially listen to any concerns that anyone may have.

The Installation Restoration program was established to allow the base to comply with new environmental laws addressing past hazardous waste handling practices. In 1980, the Comprehensive Environmental Response Compensation and Liability Act was enacted. It was amended in 1986 by SARA, Superfund Amendment Reauthorization Act.

Okay. In 1990, October of that year, the Federal Facilities Agreement was signed by regulatory agencies and the Assistant Secretary of the Navy. This agreement outlined the roles, responsibilities and schedules to clean up the base.

Many agencies and community representatives play a major role in the IR program. We have a Technical Review Committee, which is composed of Fish and Wildlife, the City of Oceanside, also community representatives. We have a few base residents on this committee that review all of the documents we make available to the public. And this Technical Review Committee meets on a quarterly basis. And we also -- any member, we send documentation to them to comment on any of the findings or the results of our studies.

It is broken down into three sites. We refer to

them as Site 4, Site 4-A, Site 24, but they're actually -- a drainage ditch at Site 4. You can see in Figure 1 of the fact sheet that you may have picked up -- I will go ahead and show you the map here. Pretty hard to read on the overhead here, but -- basically, here's the main gate, Vandegrift is the main thoroughfare through the base. Site 4 is right near the Air Station, and Site 4-A -- 4 and 4-A are adjacent to each other. And then Site 24 is up there by Lake O'Neill. Site 24 is the Morale, Welfare and Recreation Maintenance Facility. The slide depicts the concrete impoundment. That's at the Air Station. What you have is a blowup of that concrete impoundment here. This line here is the main boulevard, Vandegrift, back there (indicating). This is the Air Station and Santa Margarita River flows nearby. This ditch -- which in the slide is the grassy area to the left of the impoundment, this ditch (indicating), that's just a small section of it. It runs the length of almost the Air Station down and empties into the Santa Margarita River. This Site 4, which is the ditch, is these arrows (indicating). The flow of the ditch during rain season goes that way (indicating), and those marks in red are -- or kind of a maroon-type color, are the sample sites where samples were taken. Some sites were -- two samples were taken and noted by times two. Three samples were taken here (indicating). Also, the triangles denote surface water samples that were taken.

The 22 area is across the boulevard and it's more

of an industrial site. Then you have a row of aircraft hangars on the other side of this ditch (indicating) that a lot of the runoff from aircraft maintenance is suspected in, over the years, of flowing into this ditch. That's why we decide -- that's why it was placed on a list to investigate it.

Also, this concrete impoundment, the concern was whenever a fire suppression system floods the hangars, the discharge may flow into this impoundment. And the concern was if there was cracks in the concrete, there may be some possibility solvents that were washed out of the hangars into the impoundment and leaked into the ground soil. It's kind of a unique angle. Borings were taken underneath the concrete itself and sampled.

At the very end of the presentation I will mention the results.

Oh, also, groundwater at Site 4 -- the groundwater is being further investigated with other sites in the area and is not included in this proposed plan.

Okay. Site 24. Here we have some more shots of -- this is the opposite direction. You can see the ditch over on the right-hand side. It is kind of -- it was the dry season. This photo was taken several years ago. We have recently gone out there just three or four days ago and it's pretty lush with green vegetation. The right side of it is where they are installing that channel, along Vandegrift, and that's why the

dirt is disturbed like that. This is the -- what the concrete impoundment looks like now. Several years ago they have gone back in and put a liner on it to keep it from leaking. It allows them to have more control over the discharges that are discharged into that impoundment. And half of it is dry just because of the dry weather we have been having.

Okay. And now we'll go to Site 24. Site 24 is the MWR Maintenance Facility. On the map it is located at Building 2662. This road right here (indicating) is Vandegrift. This building supports 20 other buildings on base, taking care of their maintenance, from broken windows to painting the exteriors, interiors, and also working on appliances that may have gone -- broke down. This facility is made up of a welding shop, which is located in the far right in the picture over there (indicating) and a paint shop is in the foreground left (indicating). And that's a picture of the welding shop. The area on the slide to the right where the little shed is in the fenced-in area is a former hazardous storage area, where they stored barrels of solvents, paints, and maybe some cleaners. And we were real concerned about that area. So several samples in that location were taken. Soil borings, sub-surface soil, surface soil and sediment samples were taken. Also, no groundwater was found. It is pretty elevated terrain there.

And the effort that was put forth was substantial. Site 4 and 4-A, I combined since they are so close to each

other. Four soil borings, eight soil borings were taken at Site 24, a total of 12, which are basically holes that are altered into the ground and at different levels in depth. Samples -- soil samples were taken. We have taken 55 of those. Then there was surface soil and sediment samples that were taken, 33 of those. Surface water samples were taken, a total of 10. There was no water -- surface water found at the facility, the maintenance facility.

That's a paint shop. Another shot of it. Okay.

Monitoring wells were drilled at three different depths: One was shallow, then medium and deep. Sixteen wells were put in at Site 4, six wells were put in at Site 24, and a total of 81 groundwater samples were collected.

I will just reemphasize, groundwater at Site 4 and 4-A is being further evaluated with other sites in the area and is not included in this proposed plan. Okay.

The data that was analyzed from the samples that were taken were placed in a remedial investigation report, and it was published in October of 1993. Within this report, there was a human health and ecological risk assessment. It takes the results of the samples of the concentrations of chemicals and breaks that down into a human health risk and an ecological risk. How dangerous is it? Then the conclusions. The conclusions were that conditions at these three sites are already protected of human health and the environment. With

this information, the proposed plan was prepared, and in that proposed plan we are recommending no remedial action for the soil at Site 4 and 4-A and the soil and groundwater at Site 24.

These investigations can be found at information repositories at the base library and also at the downtown Oceanside library, where there are several reports and statistics on what contain -- what was contained in the samples, what was found, if anything, and it explains kind of a process that has taken place to determine the contaminants. Also, the Marine Corps encourages public participation in the decision-making process. We print fact sheets periodically, almost quarterly, that we can mail out. If you would like to get out -- on our mailing list, just make sure you sign in, and you may be receiving several of these in the mail.

Also, the proposed plans are published in the papers, are available at the repositories. And we also have an administrative record which is kept in the Environmental Security Office. If the public would like to come in and take a look at the administrative record, they are welcome to do so.

Also, if they live in San Diego, it's available at Southwest Division. Ed Dias can help you out there if you would like to take a look at that. The final decision has not been made on these three sites. The public comment period goes through July 10th, and any public comment that is made, we will receive and consider. We will review it and consider it.

So let's see. At this time, that concludes my presentation, but I would just like to say a couple of administrative things.

There is a court reporter present. So if you have any questions, please state your name just so it goes on the record, and we can document that -- that questions have taken place.

I would also like to introduce the remedial program managers -- that we did before -- very quickly. We have Ed Diaz, John Odermatt from the Regional Water Quality Control Board, Sheryl Lauth from Environment -- Environmental Protection Agency. She flew down from San Francisco. Jayne Joy is our Environmental Engineering Division head, she may be able to answer some questions too. We also have quality -- our water quality person here if there are water quality issues. And we also have Mr. Ed Minugh from the IT Corporation that actually physically went out -- well, not physically, but his company physically went out, took samples at these sites and is very familiar with the sites.

So right now, if there are any questions, please, the floor's open. All right.

Let the record show there's no questions at this time.

Now, at the very end of tonight's discussion, there is a formal comment period. If there is any comments that you

would like to make to the team that has investigated these sites, please do so at this time. We will stay here until it's completed. If -- if you don't have a set comment -- if you don't have a formal comment right at this time, you can -- we have comment sheets that you can -- that you can write the comments down and send them in by July 10th of this -- of next month, and they will be considered. Please postmark them before -- or by July 10th, and we will receive it and consider those. This is the address where those comments can be sent to: Joint Public Affairs Office. If you have any questions on the IR program, you can call that number and either they will refer you to my phone or we'll have someone return the phone call.

GUNNERY SERGEANT RUTH CARVER: Excuse me, please. That number is incorrect, but in the publication you did here pre-1995, the phone number is correct.

MR. LEBOUEF: Okay.

GUNNERY SERGEANT RUTH CARVER: The phone number is correct here. That number is incorrect.

MR. LEBOUEF: Okay. So on the back page of your proposed plan, right towards the top of the page, that phone number is correct. It's 725-5569. Or also, you can -- in the fact sheet, there's a list of names, addresses and numbers of the TRC numbers. Any one of those individuals can assist you on any information that you desire.

Well, thank you for attending and we'll close the

meeting at this time.

(The meeting was adjourned at 7:13 p.m.)

REPORTER'S CERTIFICATE

STATE OF CALIFORNIA)
) ss.
COUNTY OF SAN DIEGO)

I, ELANA K. SHIRLEY, Certified Shorthand Reporter No. 9651, in and for the State of California, do hereby certify:

That the foregoing transcript of proceedings was taken before me on June 28, 1995, at the place set forth, and was taken down by me in shorthand, and thereafter transcribed into typewriting under my direction and supervision; and I hereby certify that the foregoing transcript of proceedings is a true and correct transcript of my shorthand notes so taken.

I further certify that I am not of counsel or attorney of the parties hereto or in any way interested in the event of this case and that I am not related to either of the parties thereto.

Witness my hand this 10th day of July, 1995.

Elana K. Shirley

ELANA K. SHIRLEY
CSR No. 9651, RPR

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) FOR SITE 9

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APPENDIX B

1.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) states that remedial actions at CERCLA sites must attain (or the decision document must justify the waiver of) any Federal or more stringent State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate (referred to as applicable or relevant and appropriate requirements [ARARs]).

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address the situation at a CERCLA site. If the requirement is not legally applicable, it is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, although not applicable, address problems or situations sufficiently similar to the circumstances of the proposed response action and are well-suited to the conditions of the site (U.S. Environmental Protection Agency [EPA], 1988). The criteria for determining relevance and appropriateness are listed in Title 40, Code of Federal Regulations (CFR), Section 300.400(g)(2).

In order to qualify as a State ARAR under CERCLA and the National Contingency Plan (NCP), a State requirement must be all of the following:

- A State law
- An environmental or facility siting law
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than the Federal requirement
- Identified in a timely manner
- Consistently applied.

In order to constitute an ARAR, a requirement must be substantive. Therefore, only substantive provisions of requirements identified as ARARs in this analysis will be considered ARARs. The ARARs for the selected remedy are summarized in the following sections and attached tables. The complete ARAR analysis for the seven

remedial alternatives considered for Site 9 is presented in Appendix B of the draft final feasibility study (FS) report for Site 9 (Southwest Division Naval Facilities Engineering Command [SWDIV], 1994).

2.0 SELECTED REMEDY - ALTERNATIVE 7 - ARARS

The selected remedy, Alternative 7, consists of no action for soil. The remedial investigation (RI) indicated that soil concentrations were below hazardous waste toxicity characteristic levels established under the Resource Conservation and Recovery Act (RCRA). Leachability testing indicated that the soil contaminants would not migrate to groundwater. The risk assessment identified no unacceptable threat to human health or the environment. No ARARs were identified for leaving the soil in place.

The selected remedy involves no treatment for the groundwater because the results of the risk assessment indicated no threat to human health or the environment. However, because tetrachloroethene (PCE) and trichloroethene (TCE) were detected at concentrations exceeding maximum contaminant levels (MCLs), the selected remedy will be achieved through institutional controls restricting access and monitoring during natural attenuation.

In the draft final FS report, the Department of the Navy addressed the issue of whether cleanup to background was technologically or economically feasible. The DON concluded that, because of the absorption of constituents to low-permeability marine terrace deposits and low extraction well yields in those deposits, achieving background levels of constituents is not technologically feasible within a reasonable time frame, consistent with the requirements of 22 CCR 66264.94, 23 CCR 2550.4, and California State Water Resources Control Board (SWRCB) Resolution Nos. 68-16 and 92-49. Federal MCLs were identified as the controlling cleanup level/concentration limits, as indicated in Section 3.4.3.5 and Appendix A of the draft final FS report (SWDIV, 1994). Federal MCLs were deemed to be adequately protective of human health and the environment. The Federal Facility Agreement (FFA) signatories agreed on and approved this conclusion in the draft final FS report. The Department of the Navy hereby adopts this determination for this Record of Decision (ROD).

The Department of the Navy has determined that, under 22 CCR 66264.94 and the Safe Drinking Water Act, the Federal MCLs are Federal ARARs for groundwater remediation cleanup levels in this case. 22 CCR 66264.94 is considered "relevant and appropriate" for this remedial action and is a Federal ARAR because it was approved by the EPA in its 23 July 1992 authorization of the State of California's RCRA program and is federally

enforceable (see 57 *Federal Register* [FR] 32727, 23 July 1992, and 55 FR 8742, 8 March 1990).

The Department of the Navy recognizes that the key substantive requirements of 22 CCR 66264.94 (as well as the identical requirements of 23 CCR 2550.4 and Section III.G of SWRCB Resolution No. 92-49) require cleanup to background levels of constituents unless such restoration proves to be technologically or economically infeasible and an alternative cleanup level of constituents will not pose a substantial present or potential hazard to human health or the environment. In addition, the Department of the Navy recognizes that these provisions are more stringent than the corresponding provisions of 40 CFR 264.94 and, although they are Federally enforceable via the RCRA program authorization, they are independently based on State law to the extent that they are more stringent than the Federal regulations.

The Department of the Navy and the State of California have not agreed whether State Water Resources Control Board Resolution Nos. 92-49 and 68-16 are ARARs for the remedial action at Site 9. Therefore, this Record of Decision documents each of the parties positions on the resolutions, but does not attempt to resolve the issue.

The Department of the Navy asserts that Title 22 CCR Section 66264.94 is a Federal ARAR. The State of California disagrees. This regulation is a part of the state's authorized hazardous waste control program. It is the state's position that it is a State ARAR and not a federal ARAR. See 55 Fed. Reg. 8765, March 8, 1990, and U.S. v. State of Colorado, 990 F.2d 1565, (1993).

The Department of the Navy has determined that SWRCB Resolution Nos. 68-16 and 92-49 and 22 CCR 2550.4 do not constitute ARARs for this remedial action because they are State requirements and are not more stringent than the Federal ARAR provisions of 22 CCR 66264.94. The NCP set forth in 40 CFR 300.400(g) provides that only State standards more stringent than Federal standards may be ARARs (see also Section 121(d)(2)(A)(ii) of CERCLA).

The provisions of 22 CCR 66264.94 and 23 CCR 2550.4 that address groundwater concentration limits are identical. Therefore, 23 CCR 2550.4 is not more stringent than 22 CCR 66264.94 and its provisions are not State ARARs. SWRCB Resolution No. 92-49 was promulgated by the SWRCB as policies and procedures to be followed by

Regional Water Boards for oversight of investigations and cleanup and abatement decisions. It is, therefore, not of general applicability and is not an "applicable" ARAR. However, it was evaluated as a potential "relevant and appropriate" State ARAR. Section III.G of SWRCB Resolution No. 92-49 provides in relevant part that regional boards shall ". . . , in approving any alternative cleanup levels less stringent than background, apply Section 2550.4. . ." Because this resolution incorporates and relies upon the provisions of 23 CCR 2550.4, which are not more stringent than 22 CCR 66264.94, SWRCB Resolution No. 92-49 is also not more stringent and, hence, its provisions are not State ARARs.

In the draft final FS report, the Department of the Navy indicated that SWRCB Resolution No. 68-16 was a potential ARAR governing further migration of the groundwater plume. Upon further consideration, the Department of the Navy has determined that further migration of already contaminated groundwater is not a discharge governed by the language in SWRCB Resolution No. 68-16. More specifically, the language of SWRCB Resolution No. 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 have already been degraded. However, the Department of the Navy has applied the principles of SWRCB Resolution No. 68-16 through its interpretation of 22 CCR 66264.94 in a manner consistent with SWRCB Resolution No. 92-49.

The remaining substantive provisions of 22 CCR 66264.92, 66264.93, and 66264.94 were reviewed and determined to be "relevant and appropriate" Federal ARARs. The corresponding provisions of Title 23, Chapter 15, were also evaluated and deemed to be no more stringent than the referenced sections of Title 22 CCR and, therefore, are not State ARARs with one exception: The substantive provisions of 23 CCR 2550.10(g)(2) were determined to be more stringent and, therefore, are State ARARs. Section 2550.10(g)(2) requires eight evenly spaced sampling events during a 1-year period to demonstrate compliance.

The selected remedy includes groundwater monitoring to satisfy the ARARs during natural attenuation of the contamination to MCLs. The selected remedy does not include excavation, soil storage, transportation, or disposal. Location-specific ARARs identified for other remedial alternatives that included these activities are not ARARs for the selected remedy.

State of California's Position Regarding Resolution Nos. 68-16 and 92-49 of the State Water Resources Control Board (SWRCB)

The State of California disagrees with the Department of the Navy's assertion that SWRCB Resolution Nos. 68-16 and 92-49 are not ARARs and believes that both resolutions are applicable requirements for the remedial action. Both resolutions require compliance with more than 22 CCR 66264.94. Resolution No. 92-49 requires compliance with 23 CCR 2550.4, but sections III.F. and III.G. also have additional requirements that must be met. Resolution No. 68-16 requires, among other things, that any change in existing high quality of water (including changes caused by the migration of polluted groundwater) not unreasonably affect the beneficial uses of the water. In addition, although not material under the circumstances covered by this ROD, both resolutions apply to nonhazardous wastes as well as hazardous wastes, resulting in a broader range of potential applicability than 22 CCR 66264.94. To the extent that Resolution Nos. 92-49 and 68-16 include provisions that are the same as 22 CCR 66264.94, the State believes that it is appropriate for the Department of the Navy to defer to the State's interpretation of 22 CCR 66264.94. However, for the reasons that follow, the State has decided to exercise its discretion not to invoke dispute resolution for this Record of Decision.

1. The State believes that natural attenuation is the best remedy for this site.

2. The groundwater plume is migrating toward an area that has no designated beneficial uses, according to the RWQCB's Water Quality Control Plan (Basin Plan), and is already within several hundred feet of that area.

3. The Navy will ensure that any polluted groundwater will not be used.

4. It is not technically feasible to pump groundwater at the site due to the absorption of constituents to low permeability marine terrace deposits and low extraction yields in those deposits.

5. The Navy has determined that the in-situ cleanup levels for the groundwater should be at Maximum Contaminant Levels (MCLs). The State believes that Resolution No. 92-49 requires that the cleanup levels be set at the lowest levels technically and economically achievable, not to exceed water quality objectives. For these constituents, the water quality objectives are MCLs. The Navy has not demonstrated that MCLs are the lowest levels that are achievable through natural attenuation, and, in fact, the Navy's reliance on natural attenuation suggests that the levels of pollutants in groundwater will be reduced to levels below MCLs in the course of time. Nonetheless, the State has determined that the groundwater plume will migrate to the area that has no designated beneficial uses before it attains MCLs. Once the plume reaches the area that has no designated beneficial uses, there will be no further benefit in achieving additional reductions

in the levels of the pollutants. Therefore, the remedial action will comply with Resolution 92-49.

6. The natural attenuation remedy selected for this site does not include containment of the plume. DON has projected that the plume will migrate downgradient towards the "non beneficial use area" west of Highway I-5. It is anticipated that water quality will be degraded in currently unaffected areas along the path of migration. However, the modelling that was done to project the migration of the plume focused upon the velocity of migration without any consideration of the rate of attenuation affecting the concentration of pollutants in the plume during the migration. Therefore, it cannot be determined with any certainty whether or not the concentration of pollutants in the migrating plume will exceed applicable water quality objectives or MCLs during the course of the migration. Under these circumstances the State cannot determine whether or not the proposed remedial alternative will comply with SWRCB Resolution No. 68-16, which would not condone degradation in excess of water quality objectives. Nonetheless, the State recognizes the technical impracticability of containing the plume (e.g., low well yield), the fact that the plume is within several hundred feet of the area with no designated beneficial uses and is migrating in that direction, and the Navy's assurance that any groundwater that becomes polluted will not be used. Based upon these particular factual circumstances, the State has determined that, based upon principles set forth in Resolution No. 68-16, it would be in the best interests of the people of the State to approve the proposed remedial action (including the anticipated transient degradation associated with the migration of the plume), and that the State should exercise its discretion to refrain from taking any enforcement action based upon Resolution No. 68-16 for transient water quality degradation associated with the proposed remedial action in this case.

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3.0 SUMMARY OF ARARS FOR THE REMEDIAL ALTERNATIVES CONSIDERED FOR SITE 9

No ARARs were identified for soil cleanup levels because the soil does not exhibit the characteristics of a regulated waste. Action-specific ARARs for soil remediation were evaluated for CERCLA actions such as excavation, storage of soil in waste piles, on-site land treatment, and in situ bioremediation/bioventing. RCRA requirements generally were determined to be relevant and appropriate for proposed RCRA-type soil and groundwater remedial activities (e.g., treatment or storage). Title 23, Chapter 15, requirements for discharges of waste to land that are more stringent than or supplemental to RCRA ARARs were determined to be applicable.

Groundwater at Site 9 is contaminated with chlorinated solvents. Under Federal and State RCRA requirements, groundwater withdrawn from the aquifer is considered nonhazardous based on results of the RI. However, RCRA groundwater protection standards and MCLs have been determined to be relevant and appropriate and are the controlling ARARs for the proposed CERCLA actions at the site. The proposed actions are limited to institutional controls and monitoring or treatment and reinjection into the source aquifer.

Numerical limits for groundwater are presented and the controlling numerical values associated with Federal or State ARARs for each chemical of concern are identified in Table B-1.

Surface water is seasonal on site. Potential ARARs for surface-water discharge from rainfall runoff were identified. No numerical values were provided because surface water at Site 9 is not impacted and remediation of surface water is not proposed.

Air Pollution Control District (APCD) rules governing emissions to air were identified for on-site actions such as excavation, storage, and treatment of soil and groundwater. Rules addressing emissions involving fugitive dust, particulate matter, and treatment unit activities are the controlling ARARs.

Location-specific ARARs were identified for Federal and State endangered species and migratory birds because regulated species were observed on or near the site during the RI (SWDIV, 1993). Requirements for protection of archaeological and historic resources were also identified even though initial surveys did not indicate the presence of such

resources at Site 9. The location-specific ARARs were identified for remedial alternatives that include excavation, storage, or disposal of soil on site.

The ARARs for Site 9 remedial Alternative 7 are detailed in Tables B-1 through B-5. The ARARs for Site 9 remedial Alternatives 1 through 6 are detailed in Appendix B of the draft final FS for Site 9 (SWDIV, 1994).

4.0 REFERENCES

California State Water Resources Control Board, 1975, *Comprehensive Water Quality Control Plan for the San Diego Basin*, California Water Quality Control Board, San Diego Region, July.

EPA, see U.S. Environmental Protection Agency.

Southwest Division Naval Facilities Engineering Command, 1993, "Draft Final RI Report for Group A Sites, Remedial Investigation/Feasibility Study, Marine Corps Base Camp Pendleton, California," prepared by Jacobs Engineering Group Inc., 15 October.

Southwest Division Naval Facilities Engineering Command, 1994, "Draft Final Feasibility Study for Group A Sites, Site 9 - Operable Unit 1, Remedial Investigation/Feasibility Study, Marine Corps Base Camp Pendleton, California," prepared by Jacobs Engineering Group Inc., 21 September.

SWDIV, see Southwest Division Naval Facilities Engineering Command.

SWRCB, see California State Water Resources Control Board.

U.S Environmental Protection Agency, 1988, *CERCLA Compliance With Other Laws Manual, Draft Guidance*, EPA/540/G-89/006, Office of Emergency and Remedial Response, Washington, DC, August.

U.S Environmental Protection Agency, 1992, *Drinking Water Regulations and Health Advisories*, Office of Water, November.

TABLE B-1
Numerical Values of Chemical-Specific ARARs for Groundwater
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton

Chemicals	California Primary MCL[a] (µg/l)	Federal MCL[b] (µg/l)	Federal MCLG[b] (µg/l)	Controlling ARAR[c] (µg/l)
Tetrachloroethene (PCE)	5	5	0	5[d]
Trichloroethene (TCE)	5	5	0	5[d]

Organic constituents detected once but not confirmed in repeated (two or more quarterly rounds) subsequent sampling are considered questionable and are not included in this table.

[a]22 CCR 64444.5.
[b]40 CFR Parts 141 and 143 and U.S. Environmental Protection Agency, 1992, *Drinking Water Regulations and Health Advisories*, Office of Water, November.
[c]The controlling ARAR determination was not based on stringency alone (Appendix B, Section 2.2.1, draft final FS report [SWDIV, 1994]); the MCLs were determined to be the controlling ARAR under the RCRA groundwater protection standard (22 CCR 66264.94); remediation to background levels was determined to be technologically infeasible (Section 3.4.3.5 of the draft final FS report [SWDIV, 1994]).
[d]The Federal MCL under the Safe Drinking Water Act, 42 USC 300(f), and 22 CCR 66264.94 is the controlling ARAR.

ARARs - Applicable or relevent and appropriate requirements.
CCR - California Code of Regulations.
FS - Feasibility study.
MCB - Marine Corps Base.
CFR - Code of Federal Regulations.
MCL - Maximum contaminant level.
MCLG - Maximum contaminant level goal.
RCRA - Resource Conservation and Recovery Act.
SWDIV - Southwest Division Naval Facilities Engineering Command.
USC - United States Code.
µg/l - Micrograms per liter.

TABLE B-2
Federal Chemical-Specific ARARs[a]
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 1 of 2)

Requirement	Prerequisite	Citation	ARAR Determination	Comments
GROUNDWATER				
Safe Drinking Water Act (SDWA), 42 USC 300(f)[b]				
Maximum contaminant level goals (MCLGs) pertain to known or anticipated adverse health effects (also known as recommended maximum contaminant levels [MCLs]).	Public water system.	Public Law No. 99-339; 100 Statute 642 (1986); 40 CFR 141, Subpart F	Not ARARs	MCLGs that have nonzero values are relevant and appropriate for groundwater determined to be a current or potential source of drinking water (40 CFR 300.430[e][2][i][B] through [D]). Groundwater in the vicinity of Site 9 has been designated for municipal/domestic use (potential drinking water) by the Regional Water Quality Control Board (RWQCB), San Diego Region (California State Water Resources Control Board [SWRCB], 1975). However, nonzero MCLGs do not exist for the groundwater chemicals of concern at Site 9.
National primary drinking water standards are health-based standards for public water systems (MCLs).	Public water system.	40 CFR 141.11 - 141.16, excluding 141.11(d)(3); 40 CFR 141.60 -141.63	Not applicable Relevant and appropriate	The National Contingency Plan (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. The San Diego RWQCB has designated groundwater for municipal/domestic use (potential drinking water) in the vicinity of Site 9 (SWRCB, 1975).

TABLE B-2
Potential Federal Chemical-Specific ARARs[a] by Media
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 2 of 2)

[a]Chemical-specific concentrations used for remedial action alternative evaluation may not be listed as ARARs in this table but may be based on other factors. Such factors may include the following:

- Human health risk-based concentrations (risk-based preliminary remediation goals; 40 CFR 300.430[e][2][i][A][1] and [2]).
- Ecological risk-based concentrations (40 CFR 300.430[e][2][i][G]).
- Practical quantitation limits of contaminants (40 CFR 300.430[e][2][i][A][3]).

[b]Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs follow each general heading.

ARARs - Applicable or relevant and appropriate requirements.
CFR - Code of Federal Regulations.
MCB - Marine Corps Base.
MCLs - Maximum contaminant levels.
MCLGs - Maximum contaminant level goals.
NCP - National Contingency Plan.
RWQCB - California Regional Water Quality Control Board.
SWRCB - California State Water Resources Control Board.
SDWA - Safe Drinking Water Act.
USC - United States Code.

References:

California State Water Resources Control Board, 1975, *Comprehensive Water Quality Control Plan for the San Diego Basin*, California Regional Water Quality Control Board, San Diego Region, July.

TABLE B-3
State Chemical-Specific ARARs[a]
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 1 of 2)

Requirement	Prerequisite	Citation	ARAR Determination	Comments
GROUNDWATER, SURFACE WATER, or SOIL				
California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC)				
State maximum contaminant levels (MCLs).	Drinking water.	22 CCR 64444.5	Relevant and appropriate	For groundwater cleanup and groundwater monitoring.
State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB)				
Incorporated into all Regional Board basin plans. Designates all groundwater and surface waters of the State as drinking water except where the total dissolved solids (TDS) concentration is greater than 3,000 parts per million (ppm), the well yield is less than 200 gallons per day (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 consumption using either best management practices or best economically achievable treatment practices.	Groundwater or surface water of the State.	SWRCB Resolution No. 88-63 (Sources of Drinking Water Policy)	Applicable	Substantive provisions are ARARs; see Appendix B, Section 2.2.1.2, of the draft final feasibility study for Site 9 (SWDIV, 1994).

TABLE B-3
State Chemical-Specific ARARs[a]
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 2 of 2)

[a]Chemical-specific concentrations used for remedial action alternative evaluation may not be listed as ARARs in this table but may be based on other factors. Such factors may include the following:

- Human health risk-based concentrations (risk-based preliminary risk goals; 40 CFR 300.430[e][2][i][A][1] and [2]).
- Ecological risk-based concentrations (40 CFR 300.430[e][2][i][G]).
- Practical quantitation limits of contaminants (40 CFR 300.430[e][2][i][A][3]).

ARARs - Applicable or relevant and appropriate requirements.
Cal/EPA - California Environmental Protection Agency.
CCR - California Code of Regulations.
CFR - Code of Federal Regulations.
DTSC - Department of Toxic Substances Control.
gpd - Gallons per day.
MCB - Marine Corps Base.
MCL - Maximum contaminant level.
ppm - Parts per million.
RWQCB - California Regional Water Quality Control Board.
SWDIV - Southwest Division Naval Facilities Engineering Command.
SWRCB - California State Water Resources Control Board.
TDS - Total dissolved solids.

TABLE B-4
Federal Action-Specific ARARs
for Remedial Alternative 7
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 1 of 3)

Remedial Alternative 7 - No action for soil; groundwater monitoring and institutional controls.				
Action	**Requirement**	**Prerequisite**	**Citation**	**Comments**
Resource Conservation and Recovery Act (RCRA), 42 USC 6901 et seq.*				
Container storage	Containers of RCRA hazardous waste must be maintained in good condition, compatible with hazardous waste to be stored, and closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small-quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal, or storage elsewhere in a container.	22 CCR 66264.171, 66264.172, and 66264.173	Extracted groundwater may be temporarily stored in containers on site.
	Inspect container storage areas weekly for deterioration.		22 CCR 66264.174	Extracted groundwater may be temporarily stored in containers on site.
	Place containers on a sloped, crack-free base and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.		22 CCR 66264.175(a) and (b)	Extracted groundwater may be temporarily stored in containers on site.
	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		22 CCR 66264.177	Extracted groundwater may be temporarily stored in containers on site.
	At closure, remove all hazardous waste and residues from the containment system and decontaminate or remove all containers and liners.		22 CCR 66264.178	Extracted groundwater may be temporarily stored in containers on site.
On-site waste generation	Person who generates waste shall determine if the waste is a hazardous waste.	Generator of hazardous waste in California.	22 CCR 66262.10(a) and 66262.11	Applicable to alternatives that will generate waste. Not an ARAR for no action.

TABLE B-4
Federal Action-Specific ARARs
for Remedial Alternative 7
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 2 of 3)

Remedial Alternative 7 - No action for soil; groundwater monitoring and institutional controls.				
Action	**Requirement**	**Prerequisite**	**Citation**	**Comments**
Groundwater monitoring and response	Groundwater protection standards: Owners/operators of RCRA treatment, storage, or disposal facilities must comply with conditions in this section designed to ensure that hazardous constituents entering the groundwater from a regulated unit do not exceed the concentration limits for contaminants of concern, set forth under Section 66264.93, in the uppermost aquifer underlying the waste management area beyond the point of compliance.	Uppermost aquifer underlying a waste management unit beyond the point of compliance; RCRA hazardous waste, treatment, storage, or disposal.	22 CCR 66264.94(a)(1) and (3), (c), (d), and (e)	Relevant and appropriate for groundwater at Site 9 because of similarities to RCRA-type actions proposed.
	Owners/operators of RCRA surface impoundment, waste pile, land treatment unit, or landfill shall conduct a monitoring and response program for each regulated unit.	Surface impoundment, waste pile, land treatment unit, or landfill for which constituents in or derived from waste in the unit may pose a threat to human health or the environment.	22 CCR 66264.91(a) and (c), except as it cross-references permit requirements	Relevant and appropriate for groundwater at Site 9 because of similarities to RCRA-type actions proposed and RCRA-type contamination.
	Establish a water-quality protection standard consisting of constituents of concern under Section 66264.293, concentration limits under Section 66264.294, and the point of compliance under Section 66264.295.	Regulated unit.	22 CCR 66264.92, except as it cross-references permit requirements	Relevant and appropriate for groundwater at Site 9 because of similarities to RCRA-type actions proposed and RCRA-type contamination.
Clean Air Act (CAA), 40 USC 7401 et seq.*				
Discharge to air	Provisions of State implementation plan (SIP) approved by the U.S. Environmental Protection Agency (EPA) under Section 110 of CAA.	Major sources of air pollutants.	40 USC 7410; portions of 40 CFR 52.220 applicable to San Diego County Air Pollution Control District (APCD)	Specific pertinent rules are listed below.
	No person shall discharge into the atmosphere, from any single source of emissions, any air contaminant darker than number 1 on the Ringelmann chart for more than 3 minutes in any 60-minute period.	Discharge of any air contaminant other than uncombined water vapor.	APCD Rule 50(d)(1)	Diesel generator emissions are expected for groundwater monitoring.

TABLE B-4
Federal Action-Specific ARARs
for Remedial Alternative 7
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 3 of 3)

Remedial Alternative 7 - No action for soil; groundwater monitoring and institutional controls.				
Action	**Requirement**	**Prerequisite**	**Citation**	**Comments**
Discharge of particulate matter	Particulate matter from any source may not be discharged to the atmosphere in excess of 0.1 grain per dry standard cubic foot (0.231 gram per dry standard cubic meter) of gas (except stationary internal combustion engines, sulfur recovery plants, burning of carbon-containing material, or sources of fumes and dust under Rule 54).	Discharge of particulate matter into atmosphere.	APCD Rule 52	Diesel generator emissions are expected for groundwater monitoring.

[a]Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs follow each general heading.

APCD - Air Pollution Control District (San Diego County).
ARARs - Applicable or relevant and appropriate requirements.
CAA - Clean Air Act.
CCR - California Code of Regulations.
CFR - Code of Federal Regulations.
EPA - U.S. Environmental Protection Agency.
MCB - Marine Corps Base.
RCRA - Resource Conservation and Recovery Act.
SIP - State implementation plan.
USC - United States Code.

TABLE B-5
State Action-Specific ARARs
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 1 of 2)

Remedial Alternative 7 - No action for soil; groundwater monitoring and institutional controls.		
Requirement	**Citation**	**Comments**
State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB)[a]		
Authorizes the State and Regional Water Boards to establish, in water-quality control plans, beneficial uses and numerical and narrative standards to protect both surface water and groundwater quality. Authorizes Regional Water Boards to issue permits for discharges to land, surface water, or groundwater that could affect water quality, including National Pollutant Discharge Elimination System (NPDES) permits, and to take enforcement action to protect water quality.	California Water Code, Division 7, Sections 13241, 13269, 13243, 13263(a), and 13360 (Porter-Cologne Water Quality Control Act)	See Appendix B, Section 2.2.1.2, of the draft final feasibility study (FS) report for Site 9 (SWDIV, 1994).
	Other provisions of Porter-Cologne Water Quality Control Act	Not ARARs; see Appendix B, Section 2.2.1.2, of the draft final FS report for Site 9 (SWDIV, 1994).
Describes the water basins in the San Diego region, establishes beneficial uses of groundwater and surface waters, establishes water-quality objectives, including narrative and numerical standards, establishes implementation plans to meet water-quality objectives and protect beneficial uses, and incorporates Statewide water-quality control plans and policies.	Comprehensive Water Quality Control Plan for the San Diego Basin (Water Code §13240)	Substantive provisions are ARARs; see Appendix B, Section 2.2.1.2, of the draft final FS report for Site 9 (SWDIV, 1994).
Incorporated into all Regional Board basin plans. Requires that, unless certain findings are made, waters of the State be maintained at a quality that is better than needed to protect all beneficial uses. Discharges to high-quality waters must be treated using best practicable treatment or control necessary to prevent pollution or nuisance and to maintain the highest quality water. Requires cleanup to background water quality or to lowest concentrations technically and economically feasible to achieve. Beneficial uses must, at least, be protected.	SWRCB Resolution No. 68-16, Policy with Respect to Maintaining High Quality of Waters in California (Water Code §13140)	Disagreement between DON/USEPA and State regarding status as ARAR; see Section 2.0 of this appendix.
Establishes policies and procedures for the oversight of investigations and cleanup and abatement activities resulting from discharges of waste that affect or threaten water quality. Requires cleanup of all waste discharged and restoration of affected water to background conditions. Requires actions for cleanup and abatement to conform to Resolution No. 68-16 and applicable provisions of Title 23, Division 3, Chapter 15, as feasible.	SWRCB Resolution No. 92-49, Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code §13304 (Water Code §13307)	Disagreement between DON/USEPA and State regarding status as ARAR (see Section 2.0 of this appendix): however, all parties agree that the selected remedy will comply.

TABLE B-5
State Action-Specific ARARs
Site 9 - 41 Area Stuart Mesa Waste Stabilization Pond
MCB Camp Pendleton
(Sheet 2 of 2)

Remedial Alternative 7 - No action for soil; groundwater monitoring and institutional controls.		
Requirement	**Citation**	**Comments**
Compliance demonstration must include eight evenly distributed sampling events for each monitoring point for 1 year.	23 CCR 2250.10(g)(2)	Applicable for groundwater monitoring and response because it is more stringent than Federal ARARs.
Establishes numerical water-quality objectives for the protection of human health and freshwater aquatic life for a large number of toxic pollutants. Also establishes narrative objectives and toxicity objectives. Provides a program of implementation and specifies proposals to adopt numerical standards for water bodies that are predominantly reclaimed water and agricultural drainage.	Water Code Section 13170; Clean Water Act Section 303(c)(1) (Water Quality Control Plan for Inland Surface Waters of California)	Applicable to seasonal surface water, except as invalidated by judicial determinations; see Appendix B, Section 2.2.2.2, of the draft final FS report for Site 9 (SWDIV, 1994).

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs follow each general heading.

ARARs - Applicable or relevant and appropriate requirements.
CCR - California Code of Regulations.
FS - Feasibility study.
MCB - Marine Corps Base.
NPDES - National Pollutant Discharge Elimination System.
RWQCB - California Regional Water Quality Control Board.
SWDIV - Southwest Division Naval Facilities Engineering Command.
SWRCB - California State Water Resources Control Board.