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MCAS EL TORO
SSIC # 5090.3

PROPOSED PLAN for Final Soil and Groundwater Cleanup at Marine Corps Air Station El Toro

MCAS EL TORO

Draft—April 2000

Marines Propose Joint Treatment Facility for Groundwater Cleanup

The Marine Corps is requesting comments from the public on alternatives for cleanup (remediation) of contaminated ***groundwater*** at Installation Restoration Program ***Operable Unit*** (OU) 1 Site 18, the Regional Groundwater ***Plume*** and cleanup of soil and groundwater at OU-2A Site 24, the ***Volatile Organic Compound*** (VOC) Source Area, at Marine Corps Air Station (MCAS) El Toro (see map page 3). Soil cleanup at Site 24 was addressed previously in an interim ***Record of Decision*** (ROD) signed in September 1997. This Proposed Plan summarizes actions taken and proposes a final remedy for OU-1 and OU-2A.

This Proposed Plan notifies the public of opportunities to comment on several alternatives and presents the Marine Corps' preferred remedy that addresses Sites 18 and 24 and protects both public health and the environment. This Plan provides an overview of environmental investigation results, and summarizes the cleanup alternatives that underwent detailed evaluation. More detailed descriptions of the remedial investigation and cleanup alternatives are presented in the Draft Final Remedial Investigation Reports and the Draft Final Feasibility Study Reports, respectively. These reports are available for public review at the Heritage Park Regional Library in Irvine, and are part of the MCAS El Toro Installation Restoration Program Administrative Record file (see page 21).

Remedial investigations concluded that VOCs, primarily the industrial solvent ***trichloroethene*** (TCE), are present in groundwater at Site 18 and in soil and groundwater at Site 24. VOCs in the soil at Site 24 have migrated into the ***shallow groundwater unit*** beneath the site and then into the regional groundwater ***(principal aquifer)***. TCE is present in a groundwater plume that extends about 3 miles west of the Station to Culver Drive in Irvine. This groundwater is currently not used as a drinking water source. The source of contamination is believed to be TCE and other solvents that may have been used for degreasing parts, paint stripping, and other maintenance activities performed within the Site 24 boundary to support the Station's mission as an aviation center. TCE is no longer used at the Station.

The Marine Corps' remedial action objectives for the shallow groundwater unit and the principal aquifer are to: reduce concentrations of VOCs in groundwater to the more stringent of federal or state ***water quality standards;*** control VOC migration; and prevent ***domestic use*** of groundwater containing VOCs above ***cleanup goals*** until cleanup is achieved.

The preferred remedy, Alternatives 8A and 10B' combined, is to extract contaminated groundwater and treat it to remove VOCs until it complies with cleanup goals and water quality standards of the federal ***Comprehensive Environmental Response, Compensation, and Liability Act*** (CERCLA) (see page 13). VOC treatment to meet CERCLA standards would be conducted at a VOC treatment plant constructed at the planned Irvine Desalter Project (IDP) treatment plant. Groundwater will also be treated at the IDP to remove ***total dissolved solids*** (TDS) and ***nitrates*** in a non-CERCLA treatment program so the water is suitable for recycled water purposes such as irrigation and industrial use. Elevated levels of TDS and nitrates resulted from natural conditions and regional agricultural practices rather than MCAS El Toro operations (see page 5). Treatment to remove TDS and nitrates is not the Marine Corps' responsibility.

A final remedy will be selected after the public comment period has concluded and all comments have been reviewed and considered. The selection of the final remedy for groundwater cleanup of Sites 18 and 24 and final soil cleanup at Site 24 will be documented in a ROD.

Public Meeting Month/day, 2000 4:30-8:30 p.m.

Irvine City Hall, Conference and Training Center, One Civic Center Plaza, Harvard at Alton Parkway, Irvine

You are invited to attend a public meeting to discuss the information presented in this Proposed Plan regarding the groundwater cleanup at Installation Restoration Program Operable Unit 1 Site 18 and groundwater and soil cleanup at Operable Unit 2A Site 24 at MCAS El Toro. Marine Corps representatives will provide visual displays and information on the environmental investigations and the cleanup and closure alternatives evaluated. You will have the opportunity to ask questions and formally comment on the alternatives.

Public Comment Period TBD, 2000

We encourage you to comment on this Proposed Plan and site-related documents during the 30-day public comment period. You may submit written comments by mail **postmarked no later than month, day 2000** to: Mr. Dean Gould, Base Realignment and Closure (BRAC) Environmental Coordinator, Environmental Division, MCAS El Toro, P.O. Box 51718, Irvine, CA 92619-1718. Comments may also be sent to Mr. Gould by fax to [(949) 726-6586] or by e-mail [gouldda@efdsw.navfac.navy.mil]. Public comments received during this period, or in person at the public meeting, will be considered in the final cleanup and closure decision for these sites.

Environmental Investigation Overview

To effectively manage the cleanup effort at MCAS El Toro, the Marine Corps organized the Station's Installation Restoration Program (IRP) sites into Operable Units. Operable Units, or OUs, are areas where similar cleanup activities can be implemented. The MCAS El Toro IRP sites that are the focus of this Proposed Plan are: OU-1 Site 18, Regional Groundwater Plume; and OU-2A Site 24, Volatile Organic Compound (VOC) Source Area. An overview of the environmental investigation results pertaining to groundwater contamination at these two sites and soil contamination at Site 24 is presented below.

Site Background

MCAS El Toro was commissioned in 1943 as a Marine Corps pilot fleet operation training facility. In 1950, the Station was selected for development as a master jet station and permanent center for Marine Corps aviation on the West Coast. The Station's mission involved the operation and maintenance of military aircraft and ground-support vehicles and equipment. Much of the industrial activity (aircraft maintenance and refurbishment) took place in the southwestern quadrant of the Station where Site 24 is located.

The first indication of groundwater contamination at the Station occurred during routine water quality monitoring in 1985 when the Orange County Water District (OCWD) discovered the VOC trichloroethene (also called TCE) in groundwater at an irrigation well approximately 3,000 feet northwest of MCAS El Toro. A VOC is an organic, or carbon-containing, compound that evaporates easily at room temperatures. VOCs are commonly used as solvents for machinery and parts degreasing, paint stripping, and other industrial applications. Groundwater from the above-mentioned irrigation well is used for agricultural purposes. Drinking water wells located approximately three miles from the irrigation wells do not contain TCE. Subsequent investigations showed that the VOC contamination originated from Site 24.

Site Descriptions

OU-1 Site 18, Regional Groundwater Plume, is the area of groundwater contamination that extends from the source area (Site 24) beyond the western boundary of the Station and into the principal aquifer of the regional groundwater approximately three miles to the west beneath the City of Irvine. The overall regional groundwater study area is bound by Interstate 405, Harvard Avenue, and Trabuco Road. Figure 1 on page 3 shows the locations of Sites 18 and 24 and the concentrations of TCE in the shallow and principal aquifer.

OU-2A Site 24, the VOC Source Area, encompasses approximately 200 acres in the southwest quadrant of the Station. Two large aircraft hangers (Buildings 296 and 297) and several smaller buildings within the Site 24 boundary were used for aircraft and support vehicle maintenance and repair. Aircraft maintenance at Buildings 296 and 297 may have used industrial solvents containing TCE for degreasing parts, paint stripping, and aircraft washing. No records were kept that describe the precise origin, nature, and use of TCE at the site, or the circumstances or quantities of individual releases. Solvents containing TCE are no longer used at the Station.

On July 2, 1999, operational closure of all military activities at MCAS El Toro was completed. The Marine Corps' mission at the Station was incorporated into Marine Corp Air Station Miramar operations in San Diego, California

Previous Studies

After the discovery of TCE in the off-Station groundwater, the Marine Corps conducted several studies that were designed to determine the nature and extent of contamination and plan the best means of remediation.

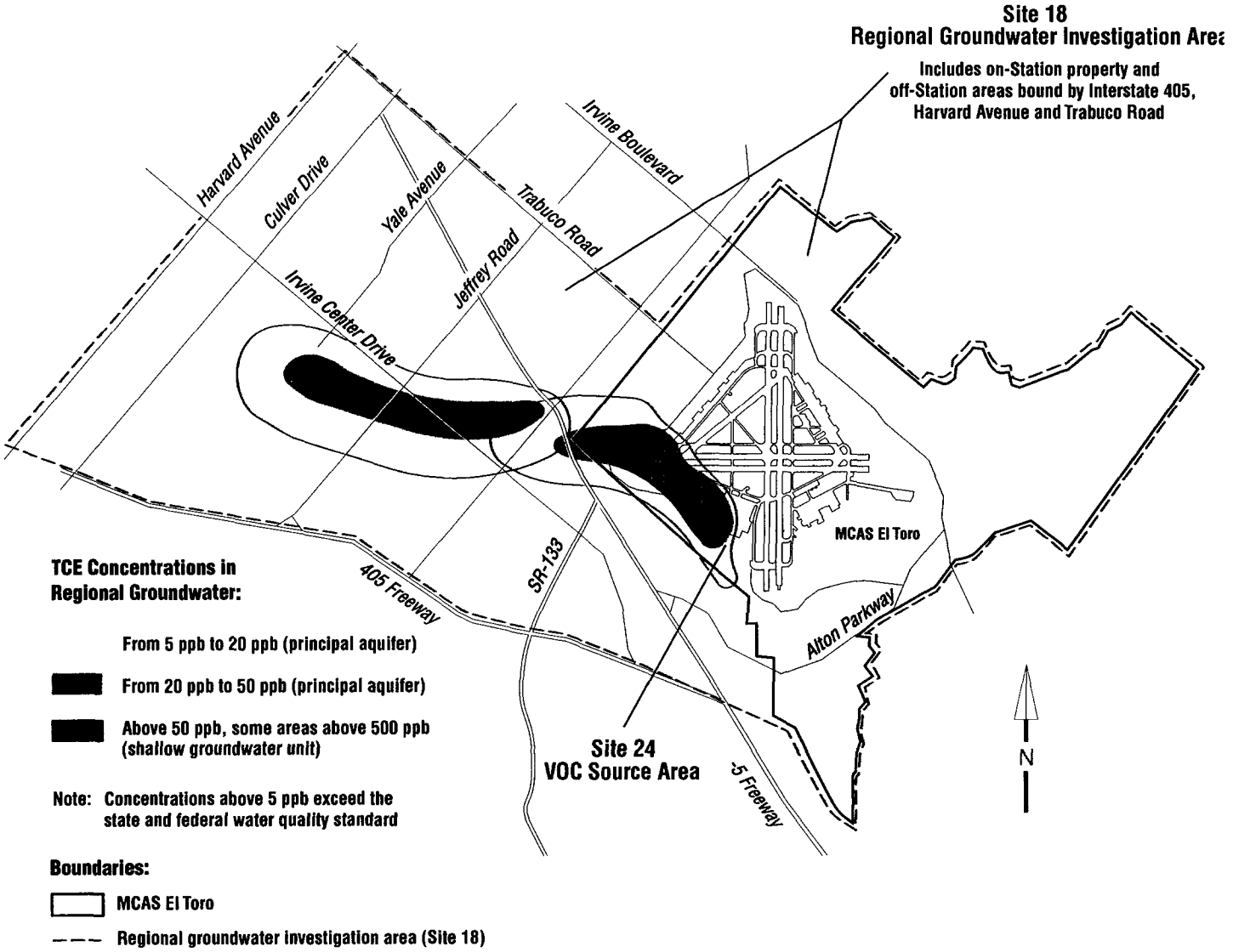
In 1987, the Marine Corps conducted a perimeter study to investigate whether VOCs were present near the Station boundary. Investigation results indicated that VOCs were present in the shallow groundwater unit near the Station's southwest boundary.

Remedial investigations (RI) of Sites 18 and 24 were conducted from 1992 to 1996. The objective was to further assess and characterize the nature and extent of chemical releases into the environment reported in previous studies and assess potential risks to human health and the environment. ***Feasibility studies*** (FS) were performed after the RI to evaluate potential cleanup alternatives for contaminated groundwater at Site 18 and for contaminated groundwater and soil at Site 24.

Remedial Investigation Focus

The RI applied a phased approach to conduct sampling of soil, soil gas, and groundwater to assess the types of contaminants present. The first phase concentrated on IRP sites within the Station to locate the VOC source, and on groundwater west of the Station boundary (OU-1 Site 18) to determine the extent of VOC contamination in groundwater. This early phase of the groundwater investigation tested soil and groundwater for a variety of chemicals (i.e., nitrates, dissolved minerals, and VOCs) and determined that only VOCs were attributed to past Station practices. The second phase of the RI concentrated on Site 24, the VOC Source Area, to further characterize and refine the extent of soil and groundwater contamination.

Figure 1 – Site Location Map



During the RI, groundwater samples were collected at different depths from newly constructed monitoring wells, pre-existing wells, and temporary well points in and around Sites 18 and 24. Analysis of groundwater samples provided information needed for determining where and to what extent VOCs are present in groundwater. For each sample, the measured concentration (or level) of the detected chemical was recorded and compared to federal and state ***water quality standards.*** The data were mapped as VOC plumes in the groundwater to assess potential risks to human health and the environment. Soil and gas samples were collected from near the surface to the water table at Site 24 to help locate the VOC sources of the regional groundwater plume. Detailed maps and lists of the chemicals and their detected levels are presented in the OU-1 and OU-2A RI/FS Reports. Information on the public availability of these reports is on page 21.

Definitions of Technical Terms

To assist readers in understanding technical terms, a glossary is included in the Proposed Plan. The first time a technical term is presented it appears in ***bold/italic*** typeface. Refer to the glossary on page 7 for definitions.

What the Remedial Investigation Found

VOCs in Soil and Groundwater Originate at Site 24

The RI concluded that VOC contamination, primarily TCE, is present in the soil and groundwater at Site 24. The Marine Corps estimates that approximately 1,500 pounds of TCE were initially present in ***soil gas*** beneath the area of Buildings 296 and 297. Other VOCs, including tetrachloroethene (PCE), carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), and Freon 113 were also found in the soil at Site 24 but at lower concentrations.

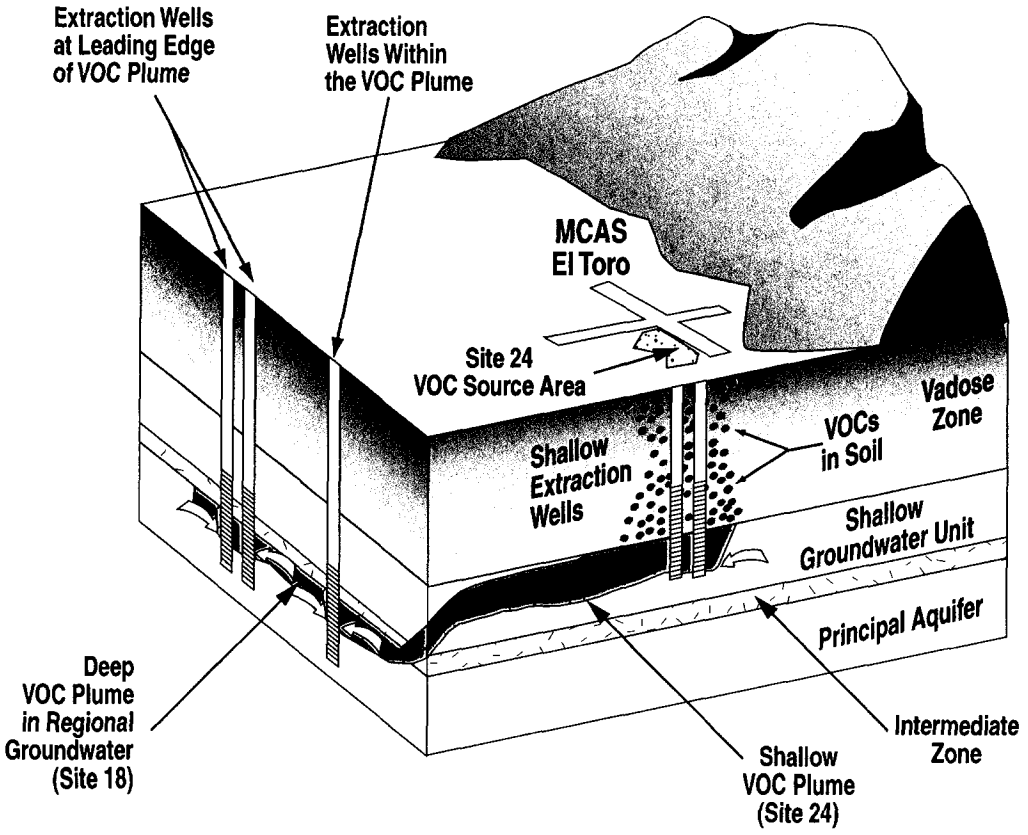
VOC-contaminated soil is not a risk to human health because most of the contamination is located far below the ground surface. However, the VOC-contaminated soil in the area beneath Buildings 296 and 297 has been determined to be an ongoing source of the low-level regional VOC groundwater contamination. VOCs, primarily TCE, have migrated from the soil at Site 24 into the shallow groundwater and then into the principal aquifer. In addition to TCE, other VOCs, including PCE, 1,1-DCE, and carbon tetrachloride, are present in the groundwater but at much lower concentrations. Figure 2 shows the link established between the VOC-contaminated soil and groundwater.

Extent of VOC Plume in Groundwater

Data evaluation focused on determining the extent of the VOC plume in both the shallower groundwater (80 to 110 feet below ground surface), and in the deeper groundwater (200 to 450 feet deep) that makes up the area's principal aquifer. Key findings are summarized below:

- The VOC groundwater plume extends from the VOC Source Area about 3 miles west of the Station.
- Within the Station boundaries, concentrations of TCE are generally limited to shallow groundwater, with the highest concentrations up to 4,850 parts per billion (ppb) beneath the area of Building 296 at Site 24. The deeper principal aquifer beneath Site 24 is not affected.
- Outside the Station boundaries, the water quality of the shallow groundwater in most cases is better than the federal and state water quality standard of 5 ppb of TCE. In the principal aquifer, TCE concentrations range from barely detectable to above the limit allowed for drinking water. The highest reported concentration of TCE in the principal aquifer was 61 ppb.
- TCE concentrations gradually decrease as the contamination moves farther away from the source area.

Figure 2 – Underground View of the VOC Plume



Irvine Desalter Project

The Irvine Desalter Project (IDP) is a proposed water supply development project initiated by the Orange County Water District and the Irvine Ranch Water District (OCWD/IRWD). Priorities of this project are to extract and treat groundwater to: (1) develop a local water supply drawing from the principal aquifer; (2) intercept, contain, and treat groundwater with high concentrations of total dissolved solids (TDS) and nitrates; (3) and accept and treat for VOC removal the groundwater that the Marine Corps must remediate.

OCWD is responsible for planning, right-of-way acquisition, design, and construction of project facilities, with full participation by the IRWD. Project facilities will be operated by the IRWD. The IDP project is being designed to meet all federal and state water quality standards.

The IDP was prompted by a regional groundwater study conducted in 1984 that identified the migration of inorganic constituents, mainly TDS and nitrates, from the Irvine area toward the main portion of the Orange County groundwater basin. The relatively poor groundwater quality of the Irvine area is mostly attributable to the geology of the area and to agricultural and irrigation practices and that have long been prevalent in the region. Later studies identified the presence of TCE in area groundwater. After the discovery of TCE in groundwater, the OCWD modified the IDP to treat VOCs in addition to TDS/nitrates.

Cleanup of VOC contamination is the responsibility of the Marine Corps and several potential remedial alternatives were developed and evaluated to achieve cleanup. Some of the alternatives for VOC contamination in groundwater relied on the IDP as the key component. The preferred remedy that is presented in this Proposed Plan assumes that the IDP would consist of two separate systems designed to treat groundwater from two sources in the principal aquifer and from the shallow groundwater unit at Site 24.

- Groundwater from Site 24 and areas inside the principal aquifer VOC plume (which is contaminated above drinking water standards) would be extracted, treated, and discharged for use as recycled water.
- Groundwater from areas outside the principal aquifer VOC plume (which already meets water quality standards) would be extracted, treated even further to remove trace amounts of VOCs, and to remove TDS and nitrates. Treated water would then be released for domestic purposes.
- Groundwater from both sources would be kept separate at all times.
- Only the VOC-related portion of the IDP that treats water from Site 24 and areas inside the principal aquifer VOC plume would be considered part of the CERCLA remedy.

Additional text to be provided—see cover letter.

Human Health Risk Assessments

As part of the remedial investigations, human health risk assessments were performed at OU-1 Site 18, Regional Groundwater Plume and OU-2A Site 24, VOC Source Area, to evaluate whether environmental cleanup or controls are necessary as a result of potential risks to human health from exposure to untreated groundwater. VOC-contaminated soil at Site 24 was also addressed. Results from the risk assessments indicate that if action is not taken to remediate groundwater and/or prevent exposure to untreated groundwater, potential risks to human health are present if untreated water is used for domestic purposes (i.e., drinking or bathing). Ecological risk assessments were not performed at either site because no wildlife is present at the highly industrialized Site 24 and groundwater is present too far below the surface of either site for plant and animal exposure. The human health risk assessment results are included below.

Subsequent to the RI, a risk assessment was also performed for chemicals in groundwater from the well that provides water for North Lake. This lake is used year round for recreational purposes. The risk assessment showed that the groundwater does not pose an unacceptable risk to human health.

Identifying Exposure Pathways

To assess potential human health risks, information on the types and amounts of chemicals present at each site was collected during the remedial investigations. Possible exposure

pathways, which show how people could come in contact with these chemicals, were then identified. The risk assessment hypothetically assumes people are living at a site for a period of 30 years.

To determine potential risks from exposure to untreated groundwater, the human health risk assessments assumed that untreated groundwater from Sites 18 and 24 would serve as a source of water for ***domestic use.*** To determine potential risks from exposure to soil, the risk assessment assumed that a resident would live at Site 24 for 30 years and be exposed to chemicals present up to 10 feet below the ground surface. The hypothetical assumptions are considered conservative because there is no current use of the groundwater for domestic purposes. Site 24 is also expected to continue to be used for industrial, not residential, purposes in the future.

Estimating Human Health Risks

Calculated risk levels are an indication of potential risks, and are not an absolute prediction that risk will occur at a certain level. Actual human exposures and risks are likely to be much less than those calculated for the risk assessments. The assumptions made during the risk assessment process are intended to lead to an overestimation of risk and provide a margin of safety to protect public health and the environment.

Risks to human health associated with exposure to and toxicity of chemicals were estimated for cancer-causing (carcinogenic) and noncancer-causing (noncarcinogenic) effects. For carcinogens, potential risk is expressed in terms of the probability of an individual contracting cancer (cancer risk). To estimate noncancer risks, a hazard index is applied. The probability of an individual contracting cancer is expressed as the number of additional cancer cases that would occur within a population, and is calculated assuming an individual has an extended exposure to the chemicals (30-year period). The term "additional cancer cases" refers to cancer cases that could occur, in addition to those cases that otherwise occur in a population not exposed to the chemicals in untreated groundwater.

To manage risks and protect human health from known or suspected carcinogens, the U.S. EPA has established generally allowable *exposure levels* at general concentration levels that represent an *excess* lifetime cancer risk to an individual of between 10^{-4} (1 additional case in a population of 10,000) and 10^{-6} (1 additional case in a population of 1,000,000). Risk estimates between 10^{-4} and 10^{-6} may call for remedial action and estimates greater than 10^{-4} usually call for remedial action. Various site specific factors such as exposures, types of contaminants, and potential future uses are factored into the determination and selection of a remedy that protects human health.

In addition, for groundwater actions, federal and state MCLs ***(maximum contaminant levels)*** and non-zero MCLGs ***(maximum contaminant level goals)*** for specific chemicals are generally used to gauge whether remedial action is warranted. MCLs are the maximum permissible level of a contaminant delivered to any user of a public water system. MCLs are enforceable standards. Under the federal Safe Drinking Water Act, MCLGs are non-enforceable concentrations of drinking water contaminants, set at the level at which no known or anticipated adverse effects on human health occur. MCLGs are usually the starting point for determining the regulated MCL.

Noncarcinogenic risks are expressed as a hazard index. The U.S. EPA considers a hazard index of less than 1 as protective of human health. A hazard index of 1 indicates that the exposure to the chemicals has limited potential for causing adverse health effects (e.g., respiratory distress). A site with a hazard index greater than 1 does not by itself require remedial action, but indicates the need to take into account the types of chemicals, historical activities, and potential toxic effects of the chemicals of concern.

Risk Assessment Results

Soil

Because VOC concentrations are very low in soil near the surface (where exposure occurs), the corresponding risk to human health is also very low. The risk assessment concluded that risk due to exposure to shallow soil at Site 24 is on the order of 10^{-8} (1 additional case in a population of 100,000,000). Although this level of risk does not require remedial action, VOCs in the soil contribute to groundwater contamination. Actions currently underway to remediate contaminated soil are presented on page 14.

Groundwater

The additional chance of a resident contracting cancer from exposure to untreated groundwater is greater than 10^{-4} at some locations in the shallow groundwater unit beneath Site 24. In the principal aquifer, VOC concentrations are much lower, and the corresponding risk levels due to VOCs are between 10^{-5} and 10^{-6}. Risk that was estimated from exposure to naturally occurring inorganic compounds (dissolved minerals) and manmade compounds such as nitrates (from fertilizers) in the principal aquifer was somewhat higher, on the order of 10^{-4} to 10^{-5}. Elevated concentrations of inorganic chemicals and nitrates that cause these risks are believed to be the result of the geology of the area and agricultural practices, not Marine Corps activities.

The human health risk assessments also indicated that there is a potential for noncancer risks associated with exposure to untreated groundwater. In the shallow groundwater unit, the hazard index exceeded 1 for both adult and child residents. Potential noncancer risks were due to TCE and carbon tetrachloride. Noncancer risks also exceeded a hazard index of 1 in several wells at Site 18 due to TCE, carbon tetrachloride, herbicides, inorganics, and nitrates. Only the risks due to VOCs are attributable to Station activities (past use of industrial solvents for aircraft maintenance).

Human health risks (cancer-causing and noncancer-causing) in the shallow groundwater unit were high enough to warrant remedial action. The VOCs in the principal aquifer exceed MCLs. Therefore, remedial action is being taken to bring the VOCs into compliance with the water quality standards.

Glossary of Terms

Air Stripping: A treatment technology that transforms VOCs in groundwater to gas for removal and treatment.

Aquifer: A particular zone or layer of rock or soil below the earth's surface through which groundwater moves in sufficient quantity to serve as a source of water.

Cleanup Goals: Chemical concentration levels that are the goals of the remedial action. Once the cleanup goals have been achieved, the remedy is considered protective of human health and the environment.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Commonly known as the Superfund. This law authorizes EPA to respond to past hazardous waste problems that may endanger public health and the environment. CERCLA was authorized and amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

Domestic Use: Use of water for drinking, cooking, and bathing.

Extraction Wells: Wells used to pump groundwater to the surface for treatment or for use.

Feasibility Study (FS): An analysis of cleanup or remedial alternatives to evaluate their effectiveness and to enable selection of a preferred alternative.

Federal Facility Agreement: A voluntary agreement entered into by the Navy, U.S. EPA, and Cal-EPA (Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board (RWQCB)) establishing an overall framework for how the investigation and cleanup of MCAS El Toro is to be conducted.

Groundwater: Underground water that fills pores in soil or openings in rocks.

Infiltration: Process by which dissolved chemical constituents are carried by water through the soil.

Intermediate Zone: A generally low permeability layer that separates that shallow groundwater unit from the principal aquifer at MCAS El Toro.

Maximum Contaminant Levels (MCLs): The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

Maximum Contaminant Level Goal: A non-enforceable concentration of a drinking-water contaminant, set at a level at which no known adverse effects on human health occur.

Monitored Natural Attenuation: Refers to the routine sampling and testing of groundwater to assess the cleanup effectiveness of natural attenuation processes.

Monitoring Well: Wells drilled at specific locations either on or near a hazardous waste site, for the purpose of determining direction of groundwater flow, types and concentrations of contaminants present, or vertical or horizontal extent of contamination.

Natural Attenuation: The process by which a compound is reduced in concentration over time, through adsorption, degradation, dilution, and/or transformation.

Nitrates: Compounds containing nitrogen which dissolve in water and may have harmful effects on humans and animals. Nitrates are commonly used in fertilizers.

Operable Unit (OU): Term for each of a number of separate activities undertaken as part of a Superfund site cleanup.

Plume: A three-dimensional zone within the groundwater aquifer containing contaminants that generally move in the direction of, and with, groundwater flow.

Principal Aquifer: The main (regional) water-bearing aquifer in the vicinity of MCAS El Toro.

Rebound: The tendency of soil gas concentrations to increase after SVE is turned off.

Record of Decision (ROD): A public document that explains what cleanup alternative will be used at a specific NPL site. The ROD is based on information and technical analysis generated during the remedial investigation/feasibility study and consideration of public comments and community concerns.

Remedial Action (RA): The actual construction or implementation phase that follows the remedial design of the selected cleanup alternative at a Superfund site.

Remedial Design (RD): The design of the selected cleanup alternative for a Superfund site.

Remedial Investigation (RI): One of the two major studies that must be completed before a decision can be made about how to clean up a Superfund site. (The FS is the second major study.) The RI is designed to determine the nature and extent of contamination at the site.

Shallow Groundwater Unit: The shallowest water-bearing zone beneath MCAS El Toro.

Soil Gas: Gas found in soil pore space. In contaminated areas, soil gas may include VOCs.

Soil Vapor Extraction (SVE): A process whereby contaminated soil gas is brought to the surface for treatment.

Trichloroethylene (TCE): A volatile organic compound that has been widely used as an industrial solvent. TCE is a colorless, odorless liquid that, when inhaled or injested in large amounts, can cause irritation of the nose, throat, and eyes, nausea, blurry vision, or dermatitis. EPA has classified TCE as a "probable human carcinogen."

Total Dissolved Solids (TDS): Used to reflect salinity of groundwater.

Vadose Zone: All soil from the ground surface to the water table. The vadose zone includes soil particles, soil moisture, and soil gas.

Volatile Organic Compound (VOC): An organic (carbon containing) compound that evaporates readily at room temperature. VOCs are commonly used in dry cleaning, metal plating, and machinery degreasing operations.

Water Quality Standards: State-adopted and EPA-approved ambient standards for water bodies. The standards cover the use of the water body and the water quality criteria which must be met to protect the designated use or uses.

Summary of Groundwater Remediation Alternatives

The Marine Corps' remedial action objectives for the shallow and principal aquifers are to:

- **reduce concentrations of VOCs in groundwater to the more stringent of federal or state water quality standards;**
- **control the migration of groundwater containing VOCs above cleanup levels; and**
- **prevent domestic use of groundwater containing VOCs above cleanup levels until cleanup is complete.**

These objectives shaped the development of several remedial alternatives that would prevent exposure to contaminated groundwater, minimize further migration of already-contaminated groundwater, and restore the groundwater at Sites 18 and 24 to a condition where it can safely be used for domestic purposes.

Federal and state cleanup levels are known as maximum contaminant levels, or MCLs. The MCLs represent water quality standards that are protective of human health. Table 1 shows the criteria and standards for the VOCs most commonly detected in groundwater at Sites 18 and 24.

Development of Alternatives

Remedial alternatives are developed and evaluated by performing a feasibility study. Separate feasibility studies were conducted for Site 18 and Site 24, however these studies were prepared in close coordination to ensure consistency of approach and ensure that the Marine Corps looked at a wide range of possible alternatives. Alternatives for Site 18 were developed and evaluated in the Draft Final Interim Action Feasibility Study Report issued in August 1996. Site 24 alternatives were presented in the Draft Final Phase II Feasibility Study issued in December 1997.

In 1999, a final alternative was developed for Site 18. This alternative is a refinement based on the other alternatives evaluated. A description and technical evaluation of the alternative was transmitted to the regulatory agencies by means of a letter dated December 1, 1999. A copy of this letter is available for review in the Administrative Record file or in the Information Repository (see page 21).

The first step in the feasibility study process was to identify and evaluate a wide range of potential technologies to accomplish the cleanup objective. This evaluation focused on technologies to contain the migration of contaminants in groundwater, treat the groundwater in place *(in situ* treatment), or treat the groundwater once it has been extracted to the surface *(ex situ* treatment). The Marine Corps also evaluated a variety of technologies to use or dispose of the extracted and treated groundwater. Each of these technologies was screened on the basis of its effectiveness, implementability, and cost, consistent with U.S. EPA and National Oil and Hazardous Substances Contingency Plan (NCP) guidance for feasibility studies. The most effective technologies were developed into remedial alternatives and subjected to further evaluation. Table 2 shows technologies evaluated for groundwater at Sites 18 and 24.

Computer modeling was used to evaluate the most effective remedial alternatives. Investigation results have demonstrated that there is a connection between the soil, which is the source of contamination, and the shallow groundwater unit and principal aquifer. Therefore, the modeling was used to simulate VOC ***infiltration*** through the soil and the movement of VOCs in groundwater over the next 20 to 40 years. By varying the location and number of wells, the model was used to compare the relative rate of contaminant removal, amount of migration of contaminants, and time to reach the state and federal cleanup standards.

Table 1
Criteria and Standards for VOCs Most Commonly Detected in Groundwater at MCAS El Toro

Chemical VOC	Concentration (parts per billion)		
	U.S. EPA Maximum Contaminant Level (MCL)	California Maximum Contaminant Level (MCL)	Maximum Reported Concentration
Benzene	5	1	730
Carbon tetrachloride	5	0.5	61
1,1-Dichloroethene	7	6	71
cis-1,2-Dichloroethene	70	6	14
trans-1,2-Dichloroethene	100	10	5.6
Tetrachloroethene (PCE)	5	5	58
Trichloroethene (TCE)	5	5	4,850

Sources:
Federal and state cleanup standards are established in 40 Code of Federal Regulations §141.61(a) and Title 22 California Code of Regulations §64444, respectively.

Note: The U.S. Marine Corps cleanup standard is the more stringent of the federal and state MCLs.
Maximum reported concentrations are through July 1999.

Groundwater Remedial Alternatives

The remedial alternatives developed in the feasibility studies consist of a No Action alternative and a variety of alternatives that actively treat contaminated areas.

The No Action alternative is used as a baseline against which the other alternatives are evaluated.

Table 2
Technologies Evaluated for OU-1 and OU-2A Feasibility Studies

Containment
Hydraulic Containment (wells)
Physical Barriers (slurry wall)
Removal of Contaminants
Groundwater Extraction (wells)
Vacuum-Enhanced Groundwater Extraction
In-Situ Treatment (performed in place)
Monitored Natural Attenuation
Treatment of Groundwater in Place (air sparging or bioremediation)
Ex-Situ Treatment (remove and treat above ground)
Physical Treatment of Extracted Groundwater (carbon adsorption, air stripping, steam stripping)
Chemical Treatment of Extracted Groundwater (oxidation)
Biological Treatment of Extracted Groundwater (bioremediation)
Air Emission Controls and Treatment (adsorption, catalytic conversion, thermal destruction)
Discharge/Use
Discharge to Publicly Owned Treatment Works
Discharge to Surface Waters
Reinjection of Treated Groundwater
Evaporation Ponds
Beneficial Use (domestic, irrigation, etc.)

Except for the No Action alternative, each of the remedial alternatives for groundwater at Sites 18 and 24 contains four components:

- extracting groundwater from the shallow groundwater unit and/or principal aquifer;
- treating the extracted groundwater for VOCs to meet water quality standards for disposal or use;
- disposing of or using the treated groundwater;
- preventing inadvertent use of contaminated groundwater until remediation is complete.

The alternatives differ in the estimated number and conceptual placement of groundwater extraction wells, treatment methodology, and the disposal options used. Common elements of each alternative are the use of institutional controls such as deed restrictions to protect extraction and monitoring equipment and prevent inadvertent use of contaminated groundwater until remediation is complete. Institutional controls also ensure that provisions exist for access by the Department of the Navy (DoN) and the regulatory agencies to conduct or oversee monitoring and maintenance activities. Soil vapor extraction (SVE) was accepted as the remedial alternative for soil at Site 24 in an interim ROD signed in September 1997. Therefore, SVE is an integral part of all remedies for that site. For information on remediation of VOC-contaminated soil underway at Site 24, see page 14.

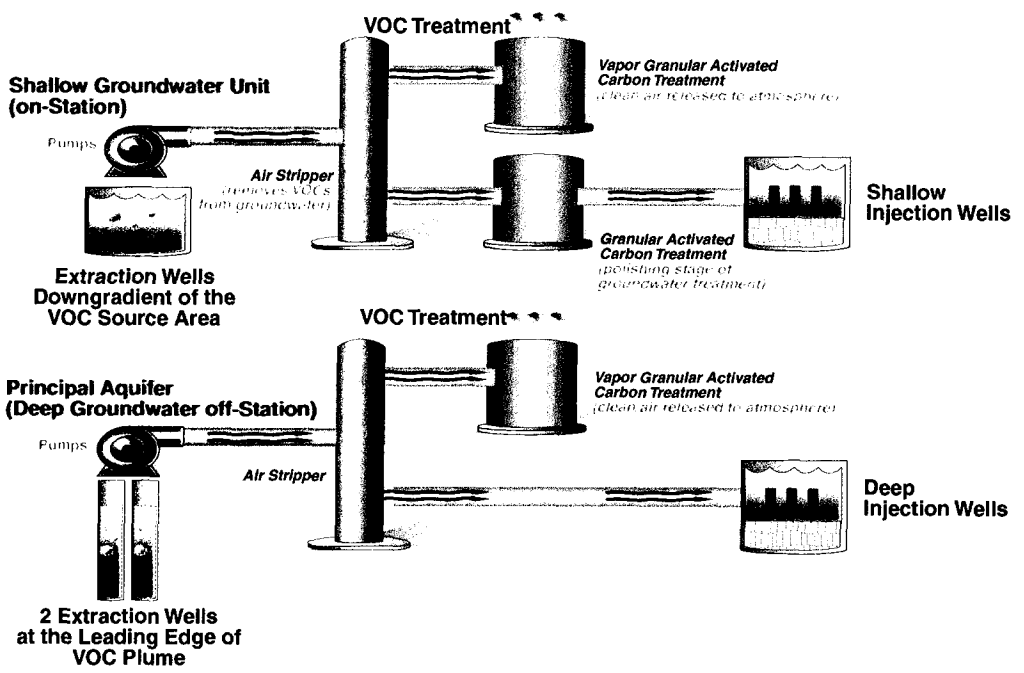
Site 18 Alternatives

Twelve alternatives were initially evaluated for Site 18. Nine alternatives were screened out based on effectiveness, implementability, and cost. In addition to the No Action alternative, two alternatives, 2A and 6A, were retained for detailed evaluation due to their effectiveness in terms of the mass of VOCs removed, time to remediate the groundwater, and cost.

When the BRAC Cleanup Team (BCT), composed of the U.S. EPA, Cal-EPA Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board (RWQCB), reviewed the Draft Interim Action Feasibility Study in 1995, concern was expressed over the high cost of groundwater extraction and treatment to reduce the low concentrations of TCE in the principal aquifer (Alternative 2A – $56.4 million and Alternative 6A – $40.3 million, see page 16). The BCT suggested that the Marine Corps evaluate lower-cost alternatives and a ***monitored natural attenuation*** approach for the principal aquifer. In response to agency comments, the Marine Corps developed three additional alternatives (7A, 7B, and 8). These alternatives incorporate some monitored natural attenuation in the principal aquifer combined with extra ***monitoring wells*** that are used to assess the progress of ***natural attenuation.***

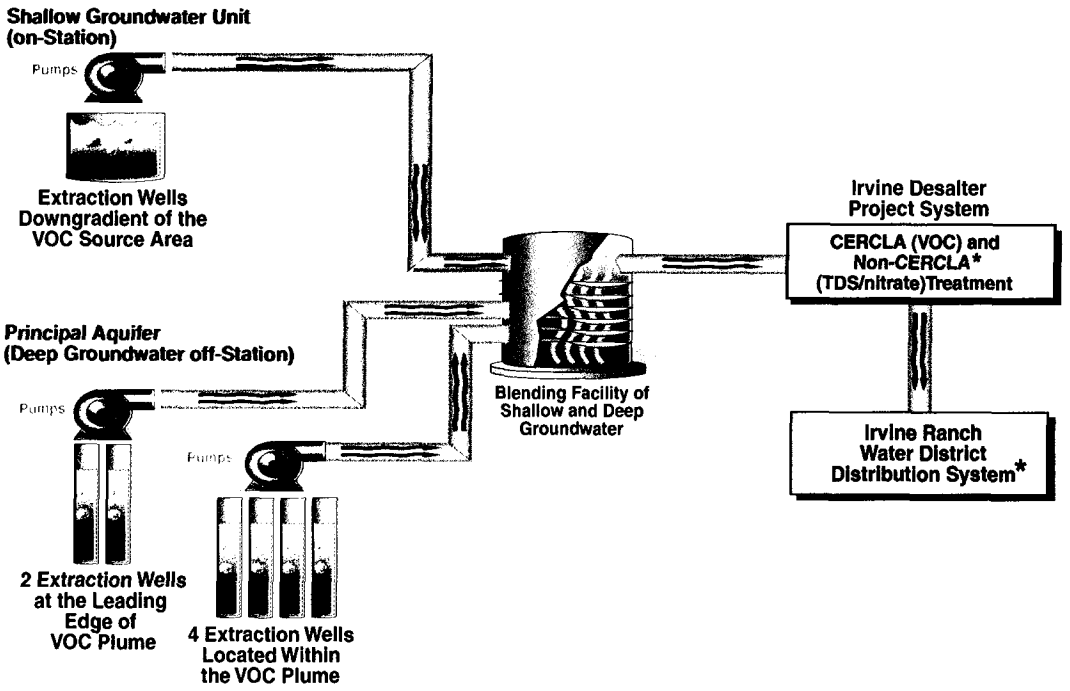
In 1999, an additional alternative, Alternative 8A, was developed. This alternative also incorporates some monitored natural attenuation in the principal aquifer and extra monitoring wells to assess the progress of natural attenuation. The technical adequacy of Alternative 8A was evaluated by means of computer modeling. Results were provided to the BCT in December 1999 in a technical memorandum titled Groundwater Modeling of Alternative 8A and are part of the Administrative Record file.

Alternatives 2A and 9 Conceptual Design



Operation of the SVE system at Site 24 is an integral part of Alternative 9.

Alternatives 6A and 10A Conceptual Design



** Associated with local water supply. TDS/nitrate treatment is not a component of the CERCLA remedial action requirements.*

Operation of the SVE system at Site 24 is an integral part of Alternative 10A.

Site 18 Alternatives

Alternative 2A – involves construction of separate groundwater extraction, treatment, and injection systems for the shallow groundwater unit and principal aquifer. Groundwater from each of these areas is conveyed (piped) to separate treatment facilities to remove VOCs and is then pumped (injected) back into the groundwater unit it came from. Cleanup time of the shallow groundwater unit is estimated to take 52 years, and the principal aquifer 43 years.

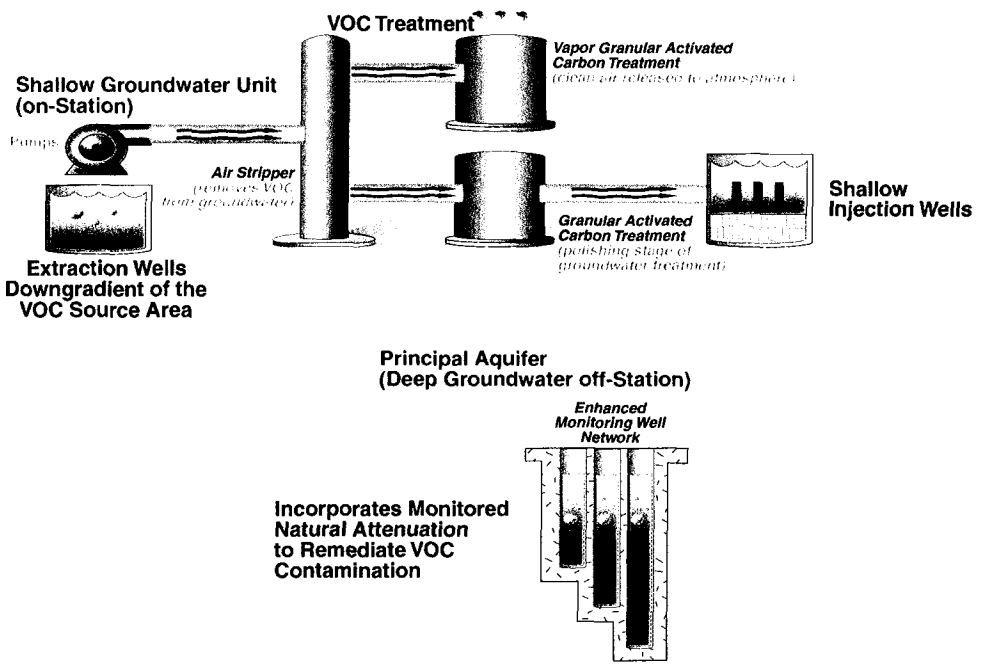
Alternative 6A – groundwater from the shallow groundwater unit and principal aquifer is extracted, blended (mixed), and conveyed to the IDP for removal of VOCs. Treated groundwater is distributed to the public for domestic purposes such as drinking and bathing. Cleanup time of the shallow groundwater unit is estimated to take 48 years, and the principal aquifer 49 years.

Alternative 7A – uses the same shallow groundwater extraction, treatment, and reinjection system as 2A and incorporates monitored natural attenuation to remediate VOC contamination in the principal aquifer. Shallow groundwater unit cleanup is estimated to take 52 years, and the principal aquifer 60 years.

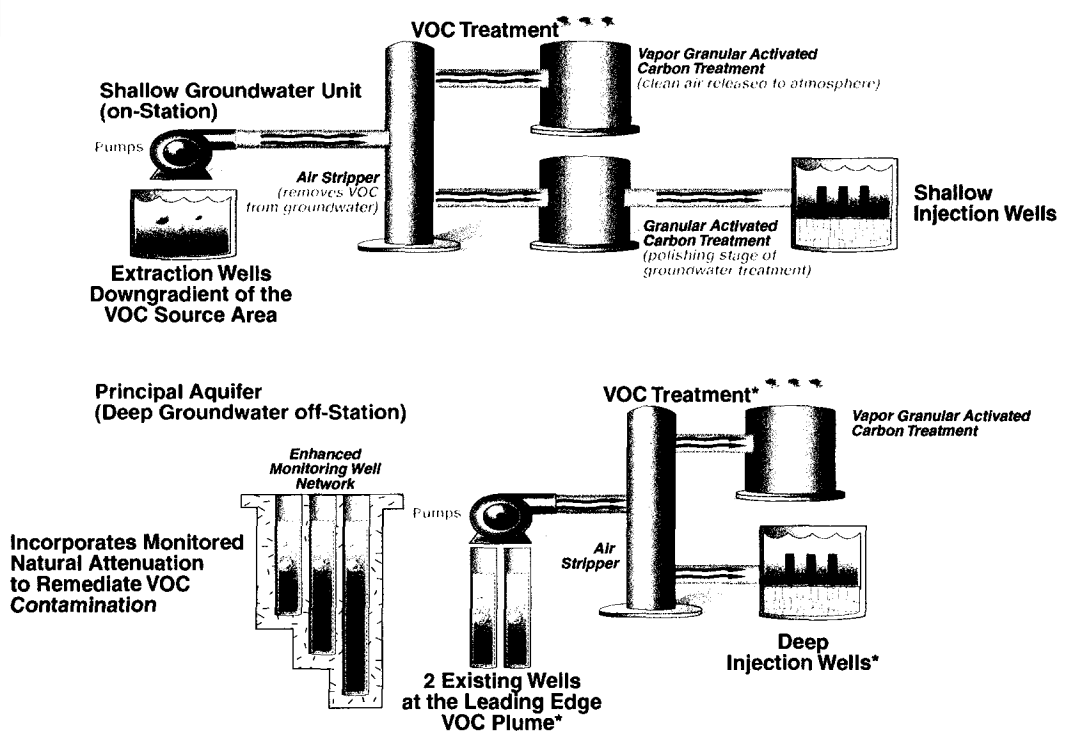
Alternative 7B – is identical to 7A except it is assumed that after 10 years the existing irrigation wells at the leading edge of the VOC plume are no longer used for agriculture due to reduced demand or because TDS concentrations are too high for irrigating crops. In Alternative 7B, the Marine Corps acquires the existing irrigation wells after 10 years, treats the extracted groundwater from these wells to remove VOCs, and injects the treated groundwater upgradient of the VOC plume in the principal aquifer. Cleanup time of the both the shallow groundwater unit and the principal aquifer is estimated to take 54 years.

Alternative 8 – extracts groundwater from wells downgradient in the shallow groundwater unit and from the existing wells located primarily within the VOC plume in the principal aquifer located off-Station. Water from both extraction well systems is blended and conveyed to the IDP for treatment and reuse for domestic purposes. Groundwater downgradient of the extraction wells is remediated using monitored natural attenuation. Shallow groundwater unit cleanup is estimated to take 59 years, and the principal aquifer 70 years.

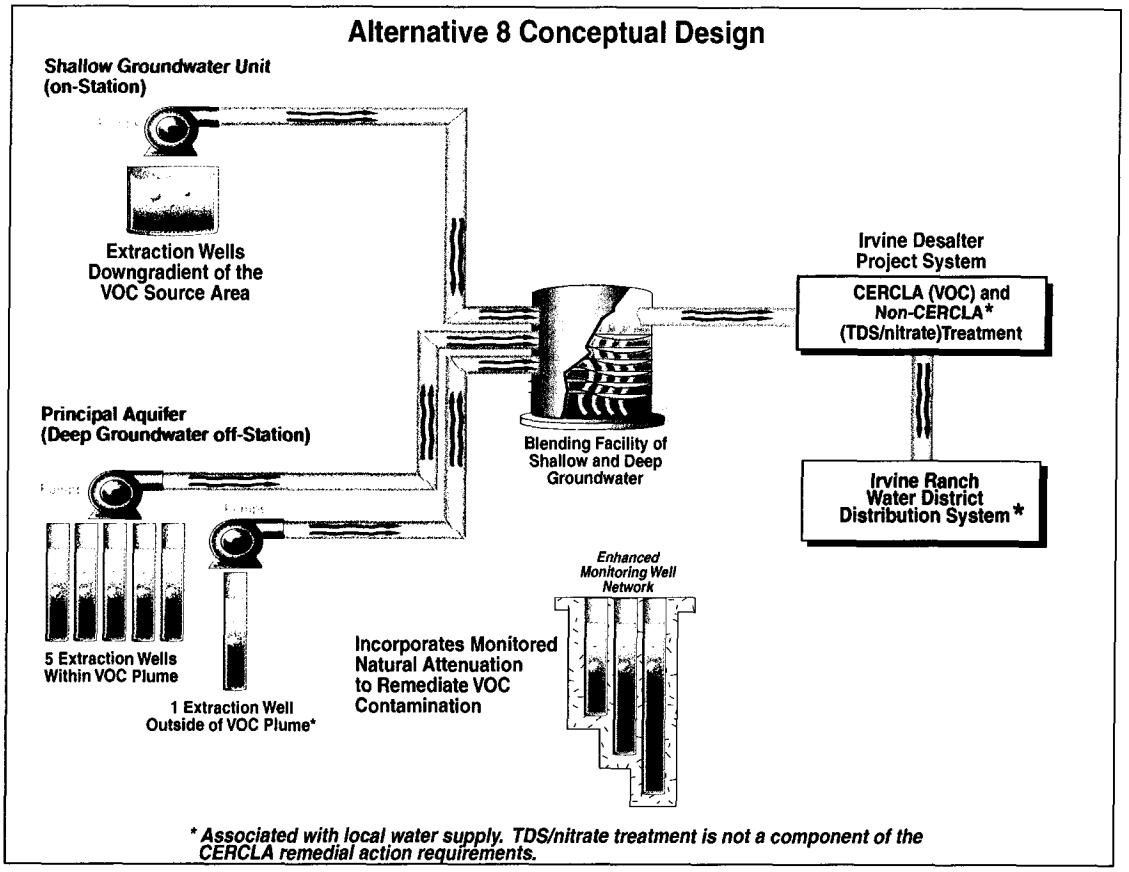
Alternative 7A Conceptual Design

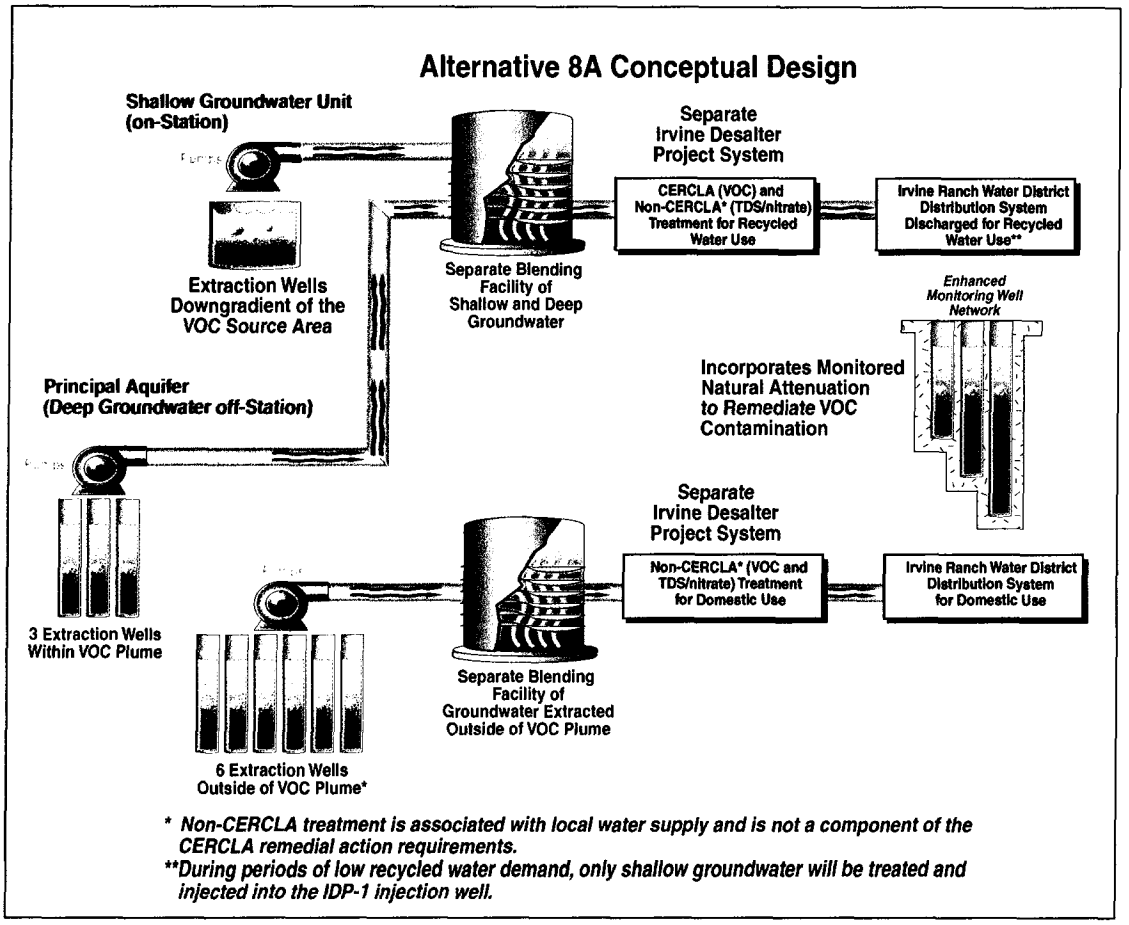


Alternative 7B Conceptual Design



** Component for groundwater extraction, VOC treatment and reinjection after first 10 years of monitored natural attenutation.*

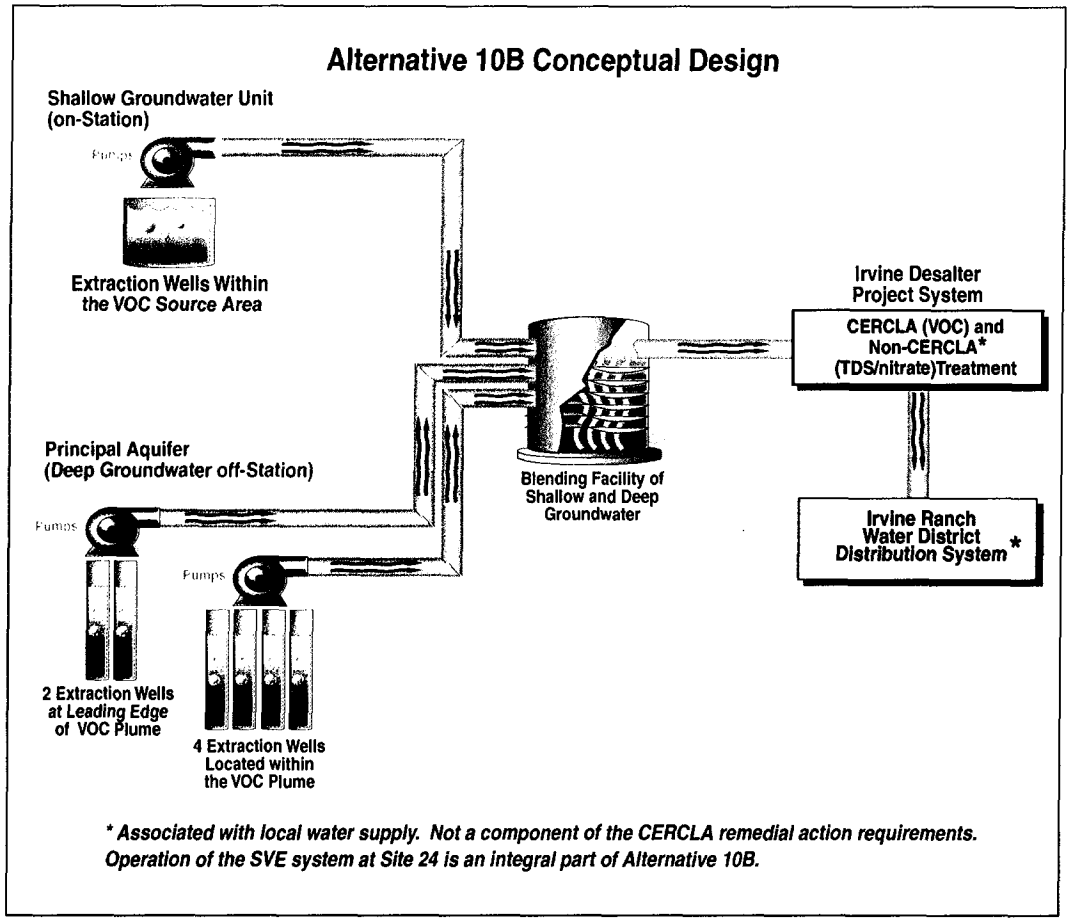


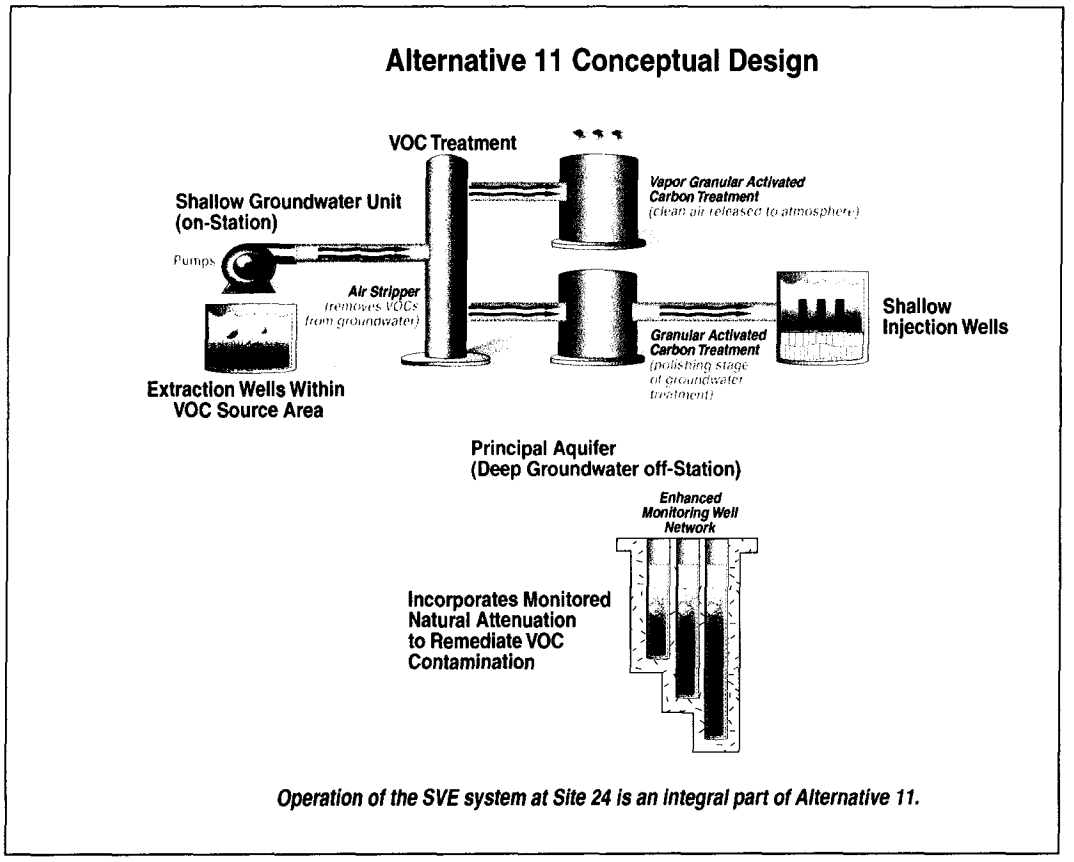


Alternative 8A – Contaminated groundwater from the shallow groundwater unit and from within the VOC plume in the principal aquifer is extracted, blended, and conveyed to the IDP for removal of VOCs during a portion of the year. Treated groundwater is used for non-domestic purposes such as irrigation and industrial water supply. During some times of the year it is assumed that water is not needed for irrigation or other purposes. During those time periods, groundwater will not be extracted from the principal aquifer. Groundwater will continue to be extracted from the shallow groundwater unit. The extracted water will be treated at the IDP and will be injected downgradient of the shallow groundwater unit VOC plume. Groundwater downgradient of the extraction wells in the principal aquifer is remediated using monitored natural attenuation. An enhanced monitoring well network will be used to demonstrate that VOC concentrations continue to lessen and that the leading edge of the VOC plume does not move from its current location. Cleanup of the principal aquifer is expected to take 70 years.

Site 24 Alternatives

In addition to the No Action alternative required by the NCP, four other alternatives (9, 10A, 10B, and 11) were developed for Site 24. All of these alternatives used computer modeling to simulate the removal of contaminants from the soil at Site 24 using soil vapor extraction technology.





Alternative 9 – is identical to the Site 18 Alternative 2A except for slightly different assumptions used in the computer modeling, including operation of the SVE system, which reduces cleanup time. See page 10 for the illustration of the conceptual design. Shallow groundwater unit cleanup is estimated to take 44 years, and the principal aquifer 25 years.

Alternative 10A – is identical to the Site 18 Alternative 6A except for slightly different assumptions used in the computer modeling, including operation of the SVE system. See page 10 for the conceptual design illustration. Cleanup time of the shallow groundwater unit is estimated to take more than 80 years, and the principal aquifer 30 years.

Alternative 10B – is similar to the Site 24 Alternative 10A (and Site 18 Alternative 6A) except that the extraction wells in the shallow groundwater unit are located within the areas with the highest VOC contamination. Groundwater is extracted from these wells in the shallow groundwater unit, blended with groundwater extracted from wells in the principal aquifer, and conveyed to the IDP for treatment of VOCs. Shallow groundwater unit cleanup is estimated to take 19 years, and the principal aquifer 34 years.

Alternative 11 – is similar to the Site 18 Alternative 7A except that the extraction wells in the shallow groundwater unit are located in the areas with the highest VOC concentrations. Groundwater in the principal aquifer is remediated using monitored natural attenuation. An enhanced monitoring well network would be used to assess the progress of natural attenuation. Shallow groundwater unit cleanup is estimated to take 38 years, and the principal aquifer 31 years.

Cleanup of VOC-Contaminated Soil at Site 24

In September 1997, the BRAC Cleanup Team signed an Interim Record of Decision (ROD) that documented the remedy selected to remove VOCs from soil and set interim ***cleanup goals.*** The final ROD will address both soil and groundwater remediation and document "final" cleanup goals and performance criteria. The final remedy consists of the construction, operation, and maintenance of a ***soil vapor extraction*** (SVE) system to remove VOCs, mainly the industrial solvent TCE, from the soil at Site 24. VOC-contaminated soil at Site 24 is not a risk to human health because VOC concentrations near the surface are very low. However, contaminated soil is an ongoing source of contamination to the groundwater. Cleanup goals were developed to help minimize or prevent groundwater contamination above the MCLs. Cleanup of soil was estimated to take 2 to 4 years to complete and would be conducted entirely on site without requiring excavation of contaminated soil.

SVE is a process that removes VOCs from the soil by using proven technology and equipment. VOCs are removed when a vacuum is applied to a network of underground extraction wells above the groundwater table, and contaminants, in the form of vapor or gas, are pulled to the surface. The extracted VOC vapors are passed through a granular activated carbon filter system. VOCs are trapped on the granular activated carbon filters and clean air is dispersed into the atmosphere. The activated carbon is then transported to an off-Station treatment facility for regeneration so it can be used again.

Pilot tests conducted at Site 24 removed approximately 870 pounds of TCE, demonstrating that SVE is effective, technically feasible for site conditions, and poses a minimum of risk to public health and the environment.

Soil Gas Concentrations and Cleanup Goals

VOC	Soil Gas Cleanup Goal*	Maximum Concentrations Reported at Site 24*
Trichloroethene (TCE)	27	6,120
Tetrachloroethene (PCE)	69	192
Carbon tetrachloride	61	31
1,1-Dichloroethene	563	447

*(micrograms per liter)

The Marine Corps is using the treatment equipment that successfully removed VOCs from soil at Norton Air Force Base in San Bernardino, California. Transfer and installation of that equipment was completed in 1998. In January 1999, the remedial design for the SVE system was completed and operational testing of the Central Treatment System remediation equipment commenced. The remedial action began in March 1999 with the use of portable SVE systems to extract from existing SVE wells. The Central Treatment System operations and installation of the initial phase of additional SVE wells and the associated vapor conveyance piping began in May 1999.

Significant progress in remediating the vadose zone soils has taken place and vapor concentrations at all the SVE wells were below the soil gas cleanup goals by the end of calendar year 1999. ***Rebound*** testing of existing SVE wells and the installation of supplemental SVE wells to confirm that soil gas cleanup goals have been achieved throughout the soil gas plume is expected to be completed by April 2000. A closure report documenting that soil gas cleanup goals have been attained is scheduled to be submitted to the BCT by the end of calendar year 2000.

Multi-Agency Environmental Team Concurs with Preferred Alternative

The Base Realignment and Closure (BRAC) Cleanup Team (BCT), composed of the Marine Corps/Navy, the U.S. EPA, and the Cal-EPA, was established when MCAS El Toro was designated for closure. The primary goals of the BCT are to protect human health and the environment, to expedite the environmental cleanup, and to coordinate the environmental investigations and cleanup at the Station.

The team completed its review of the Remedial Investigation and Feasibility Study reports for Sites 18 and 24. The team also reviewed the modeling results for OU-1 Alternative 8A and the evaluation of how this alternative meets the U.S. EPA evaluation criteria (see page 17). Based on these reviews and on continuing discussions held regarding the findings of the field investigations, the results of human health risk assessments, and the outcome of pilot tests and implementation of the Soil Vapor Extraction System at Site 24, the BCT agrees that the combination of Alternatives 8A and 10B' represents the optimal solution for remediation of Sites 18 and 24.

The Marine Corps' Preferred Remedy

The Marine Corps has proposed Alternative 8A for remediation of the principal aquifer at Site 18 and Alternative 10B' for remediation of the shallow groundwater unit at Site 24. Along with the preferred remedy for groundwater, soil vapor extraction will be used to remediate soil at Site 24. The Marine Corps' rationale for proposing these alternatives is presented on page 17.

Alternative 8A – consists of three extraction wells located within the VOC plume in the principal aquifer. These wells are assumed to have a combined seasonal extraction rate of 2,500 gallons per minute. The Marine Corps and regulatory agencies will establish the exact well locations and pumping rates during the remedial design phase. Cleanup time of the principal aquifer is estimated at 70 years.

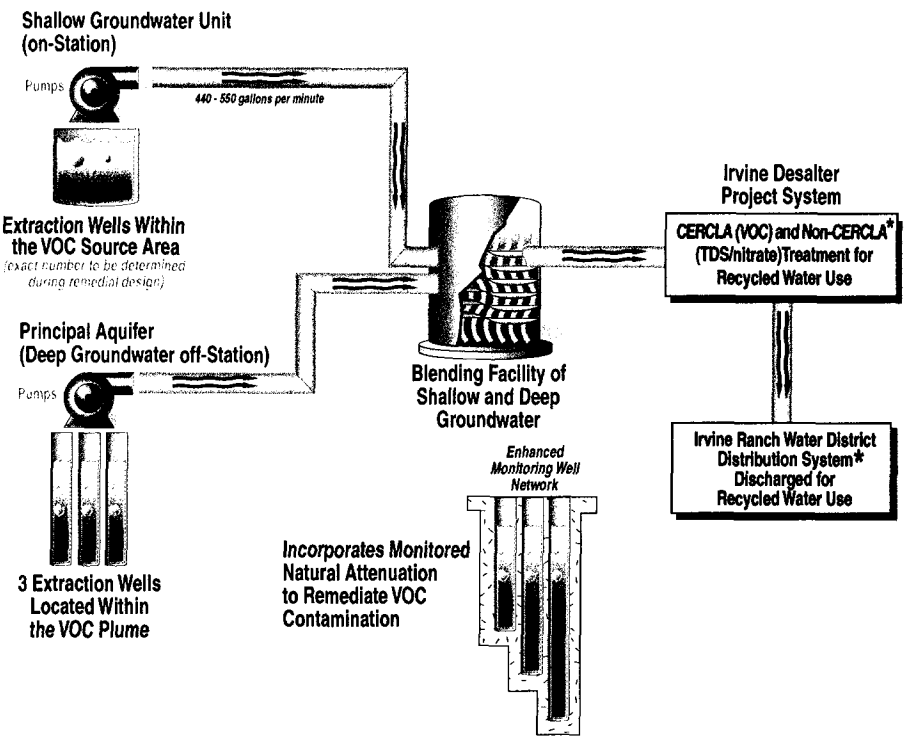
Alternative 10B' ***(pronounced Alternative 10B prime)*** – a variation of Alternative 10B that conceptually consists of multiple extraction wells located within the areas of highest VOC concentration in the shallow groundwater unit at Site 24. Alternative 10B' differs from Alternative 10B in that the minimum extraction flow rate is reduced from 800 gallons per minute to 440 to 550 gallons per minute. The Marine Corps and regulatory agencies will establish the actual number and location of the wells during the remedial design phase. Even though the total pumping rate is reduced, the time to remediate VOCs in the shallow groundwater unit to the MCLs is approximately the same as Alternative 10B. Shallow groundwater unit cleanup is estimated at 20 years.

Additional Measures – If the Marine Corps' preferred remedy is selected, the Record of Decision will include specific procedures designed to provide additional protection to the public beyond groundwater remediation and compliance with water quality standards. These procedures will provide for temporary and/or permanent shutdown of the IDP, subject to concurrence by the Marine Corps, U.S. EPA, and Cal-EPA, pending further study of the need for additional treatment in the unlikely event that additional contaminants are detected that might not be adequately treated by the IDP.

The ROD will also provide that the Marine Corps will conduct further evaluation of monitored natural attenuation for the principal aquifer if the IDP is permanently terminated for any reason. This is based upon currently available information indicating that natural attenuation may be an appropriate backup remedy in the event of IDP termination.

Additional text to be provided—see cover letter.

Preferred Remedy Conceptual Design Alternatives 8A and 10B' Combined



Associated with local water supply. TDS/nitrate treatment is not a component of the CERCLA remedial action requirements. Non-CERCLA wells in the principal aquifer are not shown because they are not part of the CERCLA remedy.

Operation of the SVE system at Site 24 is an integral part of the preferred remedy.

Additional text to be provided—see cover letter.

Groundwater Remedial Alternatives – Comparative Cost Estimate Summary											
Cost Category	*Estimated Cost in Millions $*										
	Site 18 Alternatives *40 years of estimated operation (shallow groundwater unit)* *40 years of estimated operation (principal aquifer)*						**Site 24 Alternatives** *20 years of estimated operation (shallow groundwater unit)* *40 years of estimated operation (principal aquifer)*				**Preferred Remedy Sites 18 & 24**
	Alt.2A	**Alt.6A**	**Alt.7A**	**Alt.7B**	**Alt.8**	**Alt. 8A**	**Alt.9**	**Alt.10A**	**Alt.10B'**	**Alt.11**	**Alternative 8A (principal aquifer)** **Alternative 10B' (shallow ground-water unit)**
Capital Costs	29.9	21.3[a]	18.0	25.9	17.1[a]	[a][b]	23.6	20.0	21.5	14.2	[b]
Includes design and construction of groundwater treatment and distribution systems that pertain to the VOC-related groundwater contamination.											
Operation, Maintenance and Monitoring Costs	26.5	19.0[a]	16.0	22.3	15.2[a]	[a][b]	18.1	26.2	26.1	9.6	[b]
Includes operating and maintaining groundwater treatment and distribution systems that pertain to the VOC-related groundwater contamination.											
Total – Present Worth Costs	56.4	40.3[a]	34.0	48.2	32.3[a]	[a][b]	41.7	46.2	47.6	23.8	[b]
Covers all costs to complete VOC portions of groundwater and treatment systems and includes a 20% contingency to cover cost increases that may result of unforeseen conditions. Total present worth costs for each alternative include cleanup of both the shallow groundwater unit and principal aquifer.											
Costs and additional text to be provided—see cover letter.											

Notes:
(a) **Explanatory footnote to be provided—see cover letter.**
(b) **Costs and additional text to be provided—see cover letter.**

Evaluation of the Preferred Remedy

Each alternative has undergone detailed evaluation and analysis, using evaluation criteria developed by the U.S. EPA. The nine criteria are categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. Generally, the modifying criteria are taken into account after public comment is received on the Proposed Plan and reviewed with the various State regulatory agencies to determine if the preferred alternatives remain as the most appropriate remedial action. The nine criteria are defined below and are accompanied by the key points from the evaluation of the preferred remedy. The preferred remedy is a combination of Alternative 8A for the principal aquifer and Alternative 10B' for the shallow groundwater unit. A chart that summarizes evaluation of the groundwater alternatives is shown on page 18. The locations of where to view the feasibility studies and other reports that provide a more detailed explanation of the evaluation of alternatives are found on page 21.

A. Threshold Criteria

1. Overall Protection of Human Health and the Environment – *assesses whether a cleanup remedy provides adequate public health protection and describes how health risks posed by the site will be eliminated, reduced, or controlled through treatment, engineering controls, or institutional and regulatory controls.*

- The preferred alternative provides short-term protection through institutional controls that prevent the use of contaminated groundwater and long-term protection by removing VOCs and remediating the aquifer to water quality standards for VOCs.
- Removing VOCs in soil will prevent or minimize further groundwater contamination and reduce the time to remediate groundwater.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) – *addresses whether a cleanup remedy will meet all federal, state, and local environmental statutes or requirements (see page 18).*

- VOC-contaminated water will be treated to meet water quality standards.
- Emission controls will be used to ensure compliance with air quality standards.

B. Primary Balancing Criteria

3. Long-Term Effectiveness and Permanence – *refers to the ability of a remedy to continue protecting human health and the environment over time after the cleanup action is completed.*

- Extraction and treatment of groundwater using ***air stripping*** is a proven, effective technique for removing VOCs and remediating groundwater (air forced through water releases VOCs).
- Requires some treatment of residual wastes (used carbon, filters), generally through regeneration or disposal.

4. Reduction of Toxicity, Mobility, and Volume – *refers to the degree to which a cleanup alternative uses treatment technologies to reduce: 1) harmful effects to human health and the environment (toxicity), 2) the contaminant's ability to move (mobility), and 3) the amount of contamination (volume).*

- Significantly reduces toxicity and volume through treatment.
- Shallow groundwater unit extraction wells placed within the TCE hot spot remove VOC mass more effectively than wells placed at the leading edge of the plume.
- Computer modeling indicates that the leading edge of the plume is not expected to move. This will be confirmed by groundwater monitoring.
- Removal and treatment of VOCs produces few by-products.

5. Short-Term Effectiveness – *assesses how well human health and the environment will be protected from impacts due to construction and implementation of a remedy. Also considers time to reach cleanup goals.*

- Does not present substantive risks to on-Station workers or the community; potential for some dust generation during well installation.
- Potential air emissions are easily controlled through activated carbon adsorption.
- Groundwater remediation may take up to 70 years.

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

- Technology is readily available.
- Successful pilot tests demonstrate feasibility of extracting and treating contaminated groundwater.
- Allows evaluation of monitored natural attenuation if the IDP fails due to unanticipated technical barriers.
- Treatment and reuse of groundwater is technically feasible.

7. Cost – *evaluates the estimated capital costs and present worth in today's dollars required for design and construction and long-term operation and maintenance costs of a remedy.*

- $32.9 million, includes capital costs, operation and maintenance costs, and monitoring costs (see chart on page 16).
- Saves the government money because the Marine Corps does not need to dispose of the treated groundwater.
- Treatment of VOCs at the IDP is less costly than on-Station treatment and disposal.
- If the IDP fails, allows for evaluation of monitored natural attenuation before a replacement treatment system is considered.

C. Modifying Criteria

8. State Acceptance – *reflects whether the State of California's environmental agencies agree with, oppose, or have no objection to or comment on the Marine Corps' preferred alternative.*

- The State of California concurs with Marine Corps' preferred remedy for groundwater.

9. Community Acceptance – *evaluates whether community concerns are addressed by the remedy and if the community has a preference for a remedy. Although public comment is an important part of the final decision, the Marine Corps is compelled by law to balance community concerns with the other criteria.*

- MCAS El Toro community-based Restoration Advisory Board has had the opportunity to review and comment on the OU-1 and OU-2A Remedial Investigation and Feasibility Study (RI/FS) Reports.
- Proposed Plan and Draft Final RI/FS Reports are currently available for public comment.
- Public comment on this Proposed Plan and the Draft Final RI/FS Reports will be reviewed and considered during the preparation of the Record of Decision.

Comparative Analysis of Remedial Alternatives*

U.S. EPA Criteria	No Action 1	Site 18 Alternatives 2A	6A	7A	7B	8	8A	Site 24 Alternatives 9	10A	10B	11	Preferred Remedy 8A/ 10B'
1 Overall Protection of Human Health and the Environment	X	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2 Compliance with Applicable or Relevant and Appropriate Requirements	N/A	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
3 Long-Term Effectiveness and Permanence	○	◕	●	◒	◒	●	●	●	◕	●	●	●
4 Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment	○	◕	●	◒	◒	●	●	●	◒	◕	●	●
5 Short-Term Effectiveness	○	●	●	◕	●	◒	◒	◕	◒	●	◕	◕
6 Implementability	●	◒	◕	◕	◕	◕	◕	◒	◕	◕	◕	◕
7 Cost	●	○	◒	◕	◒	◕	◕	◒	◒	◒	●	◕
8 State Acceptance – State concurs with the preferred remedy, performance criteria to be determined for all other alternatives												●
9 Community Acceptance – This criteria will be addressed in the Record of Decision.												

X – does not meet criteria ✔ – meets criteria N/A – not applicable

*Note: In this analysis, remedial alternatives for each site are only evaluated against each other. Thus, Site 18 Alternatives are not to be compared with Site 24 Alternatives.

Relative Performance in Satisfying Criteria

○ Least Acceptable Performance ◒ Fair Performance ◕ Moderate Performance ● Good Performance

Internet Connection

For access to information on MCAS El Toro (Restoration Advisory Board meeting minutes, proposed plans, and fact sheets), check out the *Southwest Division Naval Facilities Engineering Command Web Site* at:

www.efdsw.navfac.navy.mil/pages/envrnmtl.htm

Rationale for the Marine Corps' Preferred Remedy

The Marine Corps prefers Enhanced Alternative 8A and Alternative 10B' for remediation of groundwater at Sites 18 and 24 for several reasons, including cost-effectiveness, implementability, and anticipated community acceptance.

The preferred remedy is cost effective. The cost of combined Alternative 8A/10B' is lower than the cost of any other alternatives that actively remediate the principal aquifer. **Additional text to be provided—see cover letter.**

Finally, the Marine Corps anticipates a higher level of community acceptance for the preferred remedy because these alternatives restore and make beneficial use of scarce groundwater resources. Community acceptance will be evaluated following the public comment period (see page 19).

Status of Installation Restoration Program Activities

Remediation of contaminated groundwater associated with Installation Restoration Program (IRP) Operable Unit 1 Site 18 (off-Station regional groundwater) and Operable Unit 2A Site 24 (on-Station shallow groundwater) represents a key component of the comprehensive environmental investigation and cleanup program underway at MCAS El Toro. Designed to protect public health and the environment, the IRP provides a structure for the Marine Corps to identify, investigate, and implement remedies for contamination that resulted from past operations and waste disposal activities. This effort is being coordinated with the operational closure of the Station that took place in July 1999. The IRP process for Operable Unit 1 Site 18 and Operable Unit 2A Site 24, is shown below.

To effectively manage the overall cleanup effort, the Marine Corps organized the IRP sites into Operable Units or OUs.

- OU-1 (Site 18) addresses the VOC contamination in the regional groundwater that extends 3 miles west of the Station.
- OU-2A includes VOC-contaminated soil and groundwater at Site 24, the VOC Source Area; and Site 25, the Major Drainage Channels at the Station.
- OU-2B (Sites 2 and 17) and OU-2C (Sites 3 and 5) address inactive landfill sites that contain a variety of waste materials.
- OU-3 includes the remaining IRP sites at the Station.

In 1997, the Marine Corps issued Proposed Plans and established public comment periods for: the Site 24 VOC Source Area for soil cleanup using soil vapor extraction technology; and for the Marine Corps' recommendation for No Further Action for OU-3 Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and OU-2A Site 25. After consideration of public comments on the proposed alternatives, Records of Decision (RODs) formally documenting the remedial actions planned for these sites were finalized in September 1997.

In May 1998, the Marine Corps issued a Proposed Plan and established a public comment period for the OU-2B and OU-2C (landfill) sites. Completion of the ROD process for closure of landfills (Sites 2 and 17 and Sites 3 and 5) is anticipated to occur in 2000.

In May 1999, the Marine Corps issued a Proposed Plan for Sites 8, 11, and 12. Based on agency and public comments, only Site 11 was included in the ROD that was finalized in September 1999. Completion of the ROD process for Sites 8 and 12 is expected to occur in 2000.

What Happens After the Public Comment Period?

After the close of the 30-day public comment period (month, day, 2000) for the OU-1 and OU-2A Proposed Plan, the next steps in the Installation Restoration Program process are the Record of Decision/Responsiveness Summary and Remedial Design/Remedial Action.

The ROD formally documents the selection of a groundwater remedial alternative and also finalizes the selection of SVE for remediation of soil at Site 24. SVE was previously selected in an interim ROD that addressed only soil. The final ROD for Sites 18 and 24 will address groundwater at Site 18 and soil and groundwater at Site 24. Comments received in writing or verbally provided to the court reporter at the public meeting held on month/day, 2000 are documented and responded to in the Responsiveness Summary portion of the ROD. The Marine Corps will consider comments received from the public in the final selection of a remedial alternative.

Remedial design involves developing detailed designs and specifications for the selected remedy. Implementation of the preferred remedy would involve coordination of the Marine Corps, the regulatory agencies, and the Orange County Water District and Irvine Ranch Water District during the design phase. ***Remedial action*** refers to the construction, testing, and operation of the groundwater treatment system and requires similar cooperation between these agencies. If another alternative were selected, roles of the various agencies would be determined by the scope of that alternative.

MCAS El Toro Installation Restoration Program Process Groundwater Remediation – OU-1 and OU-2A

NPL Listing/ Federal Facilities Agreement Signed	Remedial Investigation (RI)	Feasibility Study (FS)	Proposed Plan/ Public Comment Period	Record of Decision (ROD)/ Responsiveness Summary	Remedial Design	Remedial Action
COMPLETED			WE ARE HERE	TO BE DONE		
The Station was placed on U.S. EPA's National Priorities List in Feb. 1990.	The RI identified the sources and areas of soil and groundwater contamination.	The FS identified remedial alternatives for soil and groundwater cleanup.	The public has the opportunity to comment on the preferred remedy and other proposed alternatives.	The selected remedial alternative and responses to public comments will be documented in the ROD.	Detailed specifications for the selected remedy will be developed.	A qualified contractor will begin the closure actions according to specifications.

Applicable or Relevant and Appropriate Requirements for Remediation of VOC Contamination at OU-1 and OU-2A

The federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) states that remedial actions at sites listed on the National Priorities List must meet federal or state (if more stringent) environmental standards, requirements, criteria, or limitations that are determined to be legal applicable or relevant and appropriate requirements (ARARs). MCAS El Toro was listed on the National Priorities List in 1990. The intent of meeting ARARs is to select and implement cleanup or remedial actions that are protective of human health and the environment in accordance with regulatory requirements. Requirements of potential ARARs are divided into three categories:

■ ***Chemical-specific*** *– are health- or risk-based numerical values for various environmental media, specified in federal or state statutes or regulations.*

■ ***Location-specific*** *– addresses regulations that may require actions to preserve or protect aspects of environmental or cultural resources that may be threatened by remedial actions to be undertaken at the site.*

■ ***Action-specific*** *– are regulations that apply to specific activities or technologies used to remediate a site, including design criteria and performance requirements.*

Potential ARARs that will be met by the preferred remedy (Alternatives 8A and 10B') for cleanup of VOC-contaminated groundwater at OU-1 (regional groundwater) and OU-2A (Site 24) at MCAS El Toro are listed below. Requirements with a ● symbol are potential ARARs for VOC-contaminated groundwater; those with a ▲ symbol are potential ARARs for both VOC-contaminated groundwater and soil at Site 24.

U.S. Environmental Protection Agency (U.S. EPA)

Substantive requirements of the following provisions of Title 40 of the Code of Federal Regulations pertaining to maximum contaminant levels (MCLs) and nonzero MCL goals for VOCs have been determined to be Federal ARARs:

- Sectiond 141.61;
- Section 141 Subpart F.

Substantive requirements of the following provisions of Title 22 of the California Code of Regulations (CCR) have been determined to be Federal ARARs:

▲ Hazardous waste treatment, storage, or disposal [Section 66261.24(a)];

▲ System construction within 100-year floodplain [Section 66264.18(b)];

▲ Onsite waste generation [Sections 66262.10(a) and 66262.11]; and

▲ Pretransport requirements for hazardous waste [Sections 66262.30, 66262.31, 66262.32, 66262.33 and 66262.34].

▲ Groundwater protection and **vadose zone** standards of MCLs for VOCs as determined under Section 66264.94 (except for 66264.94 (a)(2) and 66264.94 (b)); [Note: The Santa Ana Regional Water Quality Control Board (RWQCB) identified State Water Resources Control Board (SWRCB) Res. No. 92-49 as a groundwater and vadose zone protection standard. The Marine Corps does not agree with the RWQCB because SWRCB Res. No. 92-49 is no more stringent than Title 22 CCR Section 66264.94. However, because the standards are identical in these two regulations and the proposed remedy complies with the standards in both regulations, the RWQCB concurs with the proposed remedy while reserving its legal position.]

- While it is the Marine Corps' position that the designation of a point of compliance for the groundwater protection standard for VOCs at the downgradient edge of the VOC source area in Site 24 pursuant to Title 22 CCR 66264.95 would be appropriate and is supported by CERCLA, the NCP, and the Administrative Record for Sites 18 and 24, the Marine Corps agrees to comply with the groundwater protection standard throughout the VOC plume and does not intend to designate a point of compliance at this time, reserving its right to do so at a later time.

- The substantive requirements of Title 36 Code of Federal Regulations (CFR) Part 65; 40 CFR Section 6.301(3); and 16 USC Section 469 [National Archaeological and Historical Preservation Act] have been determined to be Federal ARARs. Further evaluations of compliance with these requirements will be conducted when exact locations of wells are identified during engineering design work.

▲ The substantive requirements of 40 CFR Part 6, Appendix A, excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); and 40 CFR Section 6.302 have been determined to be Federal ARARs [system construction within a floodplain].

The California EPA Department of Toxic Substances Control (DTSC)

The substantive requirements of the following provisions of Title 22 CCR have been determined to be State ARARs:

▲ Hazardous waste determinations [Sections 66261.22(a)(3) and (4), 66261.24(a)(2) to (a)(8), 66261.101, 66261.3(a)(2)(C), or 66261.3(a)(2)(F)]; and

▲ State MCL listings for organic chemicals [Section 64444].

The California Regional Water Quality Control Board–Santa Ana Region (RWQCB)

Substantive provisions of the following requirements have been determined to be State ARARs:

- Comprehensive Water Quality Control Plan (CWQCP) for the Santa Ana River Basin, 1995

- The substantive provisions of Water Code Section 13240 as implemented through the beneficial use designations and VOC water quality objectives in the CWQCP for the Santa Ana River Basin, 1995;

- State Water Resources Control Board (SWRCB) Resolution No. 88-63; and

- California Water Code, Division 7, Section 13241, (Porter-Cologne Water Quality Act);

- The Santa Ana RWQCB identified the substantive provisions of the "Statement of Policy with Respect to Maintaining High Quality Waters in California" (SWRCB Res. No. 68-16) as a State ARAR and interprets it as prohibiting further migration of the VOC contaminant plume in Site 18; the USEPA and the Marine Corps do not agree that SWRCB Res. No. 68-16 applies to further migration; however, the Santa Ana RWQCB concurs with the proposed remedy and agrees that the preferred remedy will comply with their interpretation of SWRCB Res. No. 68-16 because the MCL line of the VOC plume will not move.

South Coast Air Quality Management District (SCAQMD)

The substantive requirements of the following SCAQMD rules have been determined to be ARARs as discussed below:

▲ SCAQMD Rule 1303 [discharges to air] has been determined to be a Federal ARAR because the U.S. EPA approved this rule as a component of the State Implementation Plan (SIP) in accordance with 40 USC Section 7410 and portions of 40 CFR Section 52.220 [Clean Air Act]; and

▲ SCAQMD Rule 1401 [treatment requirements for discharges to air] is a State ARAR because it is not included in the SIP.

Reports and Documents Available for Review and Comment

The collection of reports and documents used by the Marine Corps in the selection of cleanup or environmental management alternatives is referred to as the Administrative Record (AR). A site-specific AR file has been compiled for Operable Unit 1 Site 18 and Operable Unit 2A Site 24 discussed in this Proposed Plan. Key documents include: the Phase I Remedial Investigation Draft Technical Memorandum (May 1993); Draft Final Operable Unit 1 Interim Remedial Investigation/Feasibility Study (RI/FS) Report, Nine Volumes (August 1996); Draft Final Phase II Remedial Investigation Report, Operable Unit 2A, Site 24, Four Volumes (March 1997); the Draft Final Phase II Feasibility Study Report, Operable Unit 2A, Site 24 (December 1997); the Groundwater Modeling of Alternative 8A (October 1999); and the Evaluation of Alternative 8A with Respect to Nine NCP Criteria (April 2000). Documents that pertain to groundwater remediation pilot tests include: Draft Final Groundwater Remediation Pilot Test Work Plan (July 1997) and Draft Groundwater Remediation Pilot Test Report (November 1998).

The RI/FS reports, other relevant documents that pertain to these sites, and a complete index of all MCAS El Toro documents are housed in the Information Repository at the Heritage Park Regional Library, 14361 Yale Avenue in Irvine, (949) 551-7151.

The complete collection of documents listed in the AR index is also available for review at MCAS El Toro. To schedule a time to review documents at the Station during the public comment period, contact Dean Gould at (949) 726-5398, 726-2840, or (619) 532-0784.

Where to Get More Information

Copies of Remedial Investigation and Feasibility Studies Reports, including the human health risk assessments and other key documents relating to environmental activities at MCAS El Toro, are available for public review at this Information Repository: **Heritage Park Regional Library, 14361 Yale Avenue, Irvine, California 92714; (949) 551-7151**. Current hours of operation: Monday – Thursday 10 a.m. to 9 p.m.; Friday – Saturday 10 a.m. to 5 p.m.; and Sunday 12 p.m. to 5 p.m.

The Marine Corps encourages community involvement in the decision-making process of the environmental restoration program at MCAS El Toro. If you have any questions or concerns about environmental activities at the Station, please feel free to contact any of the following project representatives:

Mr. Dean Gould
BRAC Environmental Coordinator
Base Realignment and Closure
MCAS El Toro
P.O. Box 51718
Irvine, CA 92619-1718
(949) 726-5398 or (619) 532-0784

Mr. Andrew Bain
Community Involvement Coordinator
Superfund Division
U.S. EPA
75 Hawthorne St. (SFD-3)
San Francisco, CA 94105
(800) 231-3075

Ms. Kim Foreman
Public Participation Specialist
California EPA
Department of Toxic Substances Control
5796 Corporate Ave.
Cypress, CA 90630
(714) 484-5324

MAILING LIST COUPON

If you would like to be on the mailing list to receive information about environmental restoration activities at MCAS El Toro, please complete the coupon below and mail to: Base Realignment and Closure, Attn: Dean Gould, Base Realignment and Closure Environmental Coordinator, MCAS El Toro, P.O. Box 51718, Irvine, CA 92619-1718.

❒ Add me to the MCAS El Toro Installation Restoration Program mailing list.

❒ Send me information on Restoration Advisory Board membership.

Name _____

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City _____ State _____ Zip Code _____

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Attn: Mr. Dean Gould
BRAC Environmental Coordinator
MCAS El Toro
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SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/225
March 31, 2000

United States Environmental Protection Agency, Region IX
Hazardous Waste Management Division (SFD 8-2)
ATTN: Mr. Glenn Kistner
75 Hawthorne Street
San Francisco, CA 94105-3901

Subj: DELIVERY OF THE DRAFT PROPOSED PLAN, IRP SITES 18 AND 24, MARINE CORPS AIR STATION, EL TORO

Dear Mr. Kistner:

In accordance with the terms of the Federal Facilities Agreement for Marine Corps Air Station El Toro, provided is the subject document. Comments from earlier versions have been received, and incorporated. The Base Closure Team (BCT) has recently been involved in discussion with the Department of Justice (DOJ) during which, it was agreed that the Draft Proposed Plan (third issuance) would be released to the BCT, without certain information. As a result of ongoing negotiations between the DOJ, Irvine Ranch Water District and the Orange County Water District, information related to the settlement agreement and associated costs has not been included. This information will be made available to the BCT as soon as the settlement process permits, for inclusion into the final document.

As a result of reviews of the previous drafts, the BCT was in agreement at our meeting on March 29, 2000, that 30 days would be adequate for the review of this document. As was also discussed at our meeting, while conducting your review, please focus on the actual content more so than the layout, as the layout will change when the settlement related information is included.

Please contact myself at (619) 532-0784 or Ms. Content Arnold at (619) 532-0790, should your have any questions.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/226
March 31, 2000

Mr. John Scandura
California Environmental Protection Agency
Department of Toxic Substances Control, Region 4
Chief Office of Military Facilities
Southern California Operations
5796 Corporate Avenue
Cypress, CA 90630

Subj: DELIVERY OF THE DRAFT PROPOSED PLAN, IRP SITES 18 AND 24, MARINE CORPS AIR STATION, EL TORO

Dear Mr. Scandura:

In accordance with the terms of the Federal Facilities Agreement for Marine Corps Air Station El Toro, provided is the subject document. Comments from earlier versions have been received, and incorporated. The Base Closure Team (BCT) has recently been involved in discussion with the Department of Justice (DOJ) during which, it was agreed that the Draft Proposed Plan (third issuance) would be released to the BCT, without certain information. As a result of ongoing negotiations between the DOJ, Irvine Ranch Water District and the Orange County Water District, information related to the settlement agreement and associated costs has not been included. This information will be made available to the BCT as soon as the settlement process permits, for inclusion into the final document.

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Please contact myself at (619) 532-0784 or Ms. Content Arnold at (619) 532-0790, should your have any questions.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/227
March 31, 2000

Ms. Patricia Hannon
California Regional Quality Control Board
Santa Anna Region
3737 Main Street, Suite 500
Riverside, CA 92501-3339

Subj: DELIVERY OF THE DRAFT PROPOSED PLAN, IRP SITES 18 AND 24, MARINE CORPS AIR STATION, EL TORO

Dear Ms. Hannon:

In accordance with the terms of the Federal Facilities Agreement for Marine Corps Air Station El Toro, provided is the subject document. Comments from earlier versions have been received, and incorporated. The Base Closure Team (BCT) has recently been involved in discussion with the Department of Justice (DOJ) during which, it was agreed that the Draft Proposed Plan (third issuance) would be released to the BCT, without certain information. As a result of ongoing negotiations between the DOJ, Irvine Ranch Water District and the Orange County Water District, information related to the settlement agreement and associated costs has not been included. This information will be made available to the BCT as soon as the settlement process permits, for inclusion into the final document.

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Please contact myself at (619) 532-0784 or Ms. Content Arnold at (619) 532-0790, should your have any questions.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

Copy to: (w/encl)
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Environment & Natural Resources Division
Environmental Defense Section
601 D Street NW
Room 8148
Washington, D.C. 20004

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720 Kennon Street SE
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620 Newport Center Drive, Suite 450
Newport Beach, CA 92660

Dr. Chuck Bennett
Restoration Advisory Board Subcommittee Chairman
224 Jacaranda Street
Fullerton, CA

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CLEAN II TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-92-D-4670 **Document Control No.:** CTO-0200/0057

File Code: 0214, 0216

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R.RS
1220 Pacific Highway
San Diego, CA. 92132-5190

DATE: March 31, 2000
CTO #: 200 (EL2)
LOCATION: MCAS El Toro

FROM: Thurman L. Heironimus, Project Manager

DESCRIPTION: Draft Proposed Plan for Groundwater Remediation at Operable Unit 1 Site 18 and Operable Unit 2A Site 24 – DTD April 2000

TYPE: ____ Contract Deliverable (Cost) X CTO Deliverable (Technical) ____ Other

VERSION: Draft REVISION #: 0

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CLEAN II TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-92-D-4670 **Document Control No.: CTO-0200/0057-1**

File Code: 0214, 0216

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R.RS
1220 Pacific Highway
San Diego, CA. 92132-5190

DATE: April 3, 2000
CTO #: 200 (EL2)
LOCATION: MCAS El Toro

FROM: Thurman L. Heironimus, Project Manager

DESCRIPTION: **(Transmittal Page Only)** - Draft Proposed Plan for Groundwater Remediation at Operable Unit 1 Site 18 and Operable Unit 2A Site 24 – DTD April 2000

TYPE: ____ Contract Deliverable (Cost) X CTO Deliverable (Technical) ____ Other

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