West/Annexes/Basewide Operable Unit

Travis Air Force Base

Groundwater Interim Record of Decision for the WABOU

Final

60th Air Mobility Wing

Travis Air Force Base, California

24 June 1999

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Acronyms List

AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AMC	Air Mobility Command
AMW	Air Mobility Wing
ARARs	Applicable or Relevant and Appropriate Requirements
BAAQMD	Bay Area Air Quality Management District
Base	Air Force Base
bgs	below ground surface
CAL-EPA/DTSC	California Environmental Protection Agency/Department of Toxic Substances Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFGC	California Fish and Game Code
COC	chemical of concern
COEC	chemical of ecological concern
COPC	chemical of potential concern
CRP	Community Relations Plan
DAA	Detailed Analysis of Alternatives
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
DPE	Dual-Phase Extraction
EIOU	East Industrial Operable Unit
FFA	Federal Facility Agreement
fpm	feet per minute
FS	Feasibility Study
gpm	gallons per minute
GSAP	Groundwater Sampling and Analysis Program

HHRA	Human Health Risk Assessment
HI	Hazard Index
HWCL	California Hazardous Waste Control Law
IROD	Interim Record of Decision
IRP	Installation Restoration Program
ISA	Initial Screening of Alternatives
LGAC	liquid-phase granular activated carbon
µg/L	micrograms per liter
MAP	Management Action Plan
MCL	maximum contaminant level
MNA	Monitored Natural Attenuation
msl	mean sea level
NAAP	Natural Attenuation Assessment Plan
NCP	National Contingency Plan
NEWIOU	North/East/West Industrial Operable Unit
NOU	North Operable Unit
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
O&M	operations and maintenance
OU	operable unit
P2 MAP	Pollution Prevention Management Action Plan
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCG	Preliminary Cleanup Goal
PCWQCA	Porter-Cologne Water Quality Control Act
POCOS	Petroleum-only Contaminated Sites
PP	Proposed Plan
ppb	parts per billion
ppt	parts per trillion

PRG	Preliminary Remediation Goal
RA	remedial action
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RD/RA	remedial design/remedial action
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act of 1986
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SIP	State Implementation Plan
SWRCB	State Water Resources Control Board
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene
TPH-d	total petroleum hydrocarbons-diesel
TPH-g	total petroleum hydrocarbons-gasoline
U.S. EPA	U.S. Environmental Protection Agency
UST	underground storage tank
VGAC	vapor-phase granular activated carbon
VOC	volatile organic compound
WABOU	West/Annexes/Basewide Operable Unit
WIOU	West Industrial Operable Unit

PART I

Declaration

Site Name and Location

Department of the Air Force
Travis Air Force Base
Fairfield, California 94535-5000

Statement of Basis and Purpose

This Interim Record of Decision (IROD) presents the interim groundwater remedial actions in the West/Annexes/Basewide Operable Unit (WABOU) at the Travis Air Force Base (AFB) Superfund site in Solano County, California. The Air Force will develop a separate WABOU Soil Record of Decision (ROD) to present the soil remedial actions in the WABOU. The Air Force selected the interim groundwater remedial actions in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) 42 USC § 9601 *et seq.*, and with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300 (National Contingency Plan [NCP]). The Administrative Record contains the documents used in the selection of the interim groundwater remedial actions. The Administrative Record is available for review at Travis AFB. The Travis AFB information repository also includes copies of these documents for public review and is found in the Vacaville Public Library.

The U.S. Environmental Protection Agency (U.S. EPA), Region IX, concurs with the selected interim groundwater remedies. The State of California, through the California Environmental Protection Agency's Department of Toxic Substances Control (Cal-EPA/DTSC) and the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), concurs with the selected interim groundwater remedies.

Assessment of the Site

As a result of past industrial activities, releases of volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and pesticides have contaminated the groundwater at four WABOU sites at Travis AFB. These sites are Building 755, Landfill 3, Building 905, and Building 916. Actual or threatened releases of hazardous substances from these sites, if not addressed by implementing the response actions selected in this Groundwater IROD, may present a potential threat to public health, welfare, or the environment.

Rationale for Interim Groundwater ROD

The Air Force has developed interim remedial actions to address groundwater contamination in the WABOU. The Air Force has prepared this groundwater IROD rather

than a final groundwater ROD in order to allow groundwater remediation to begin quickly to reduce contamination and risk. The groundwater IROD establishes an interim period to evaluate the effectiveness of the interim groundwater remedial actions and to monitor the status of each contaminant plume. The Air Force will use this data to establish final cleanup levels and select technically and economically feasible long-term actions in the final groundwater ROD. The Air Force will publish a public notice, hold a public comment period, and address the public's comments before the regulatory agencies finalize and approve the groundwater ROD. The Air Force will publish a separate Soil ROD to describe the soil remedial actions in the WABOU.

Description of the Selected Interim Remedies

The Air Force considered six potential interim remedial alternatives to address contaminated groundwater in the WABOU. Table 1 presents the potential interim groundwater remedial alternatives.

TABLE 1

Potential Interim Groundwater Remedial Alternatives

Remedial Alternative	Description
G1 - No Action	This serves as a starting point for comparing the other alternatives. No groundwater treatment takes place.
G2- Monitored Natural Attenuation	Monitored Natural Attenuation (MNA) is a groundwater treatment strategy that relies on naturally occurring processes to prevent the spread of contamination. A major part of this strategy is the destruction of contaminants into harmless byproducts by subsurface microorganisms. Groundwater monitoring is used to verify the effectiveness of this strategy.
G3 - Containment/ Treatment/Discharge	This alternative is designed to prevent the migration of the groundwater contamination. Groundwater is pumped from a series of extraction wells that are built near the leading edge of the contaminant plume. The resulting hydraulic barrier removes the contaminated groundwater before it can move past the extraction wells. The removed groundwater is treated using activated carbon and is either discharged to Union Creek or used for irrigation.
G4 - Extraction/ Treatment/Discharge	This alternative uses the extraction wells as described in alternative G3. It also places additional extraction wells in the more highly contaminated part of the plume in order to actively treat the whole plume. The removed groundwater is treated and is either discharged to Union Creek or used for irrigation.
G5 - Source Area and Groundwater Extraction/ Treatment/ Monitored Natural Attenuation	This alternative applies only to Building 755 and is divided into three parts. The first part uses a vacuum-enhanced groundwater technology, known as Dual-Phase Extraction (DPE). A DPE system uses a vacuum to draw contaminated groundwater into an extraction well and at the same time lower the local water table. Exposed pools of solvents would then evaporate, and the vacuum removes the contaminated vapors. The water and vapors are cleansed in a treatment plant. This is designed to remove the source of contamination at this site. The second part uses extraction wells in the center of the plume to remove highly contaminated groundwater. The third part uses MNA to treat the portion of the plume with lower contaminant concentrations. MNA is described in alternative G2.
G6 - Source Area Extraction/ Treatment/ Monitored Natural Attenuation	This alternative also applies only to Building 755 and is divided into three pechnology to treat the portion of the plume with lower contaminant concentrations. MNA is described in alternative G2.

The Air Force has selected interim remedial alternatives for the four WABOU sites with groundwater contamination. Table 2 presents the selected interim groundwater remedial alternatives.

TABLE 2
Selected Interim Groundwater Remedial Actions

Site Name (Site Designation)	Selected Alternative
Building 755 (DP039)	G5 - Source Area and Groundwater Extraction/ Treatment/ Monitored Natural Attenuation, and G3 - Containment/Treatment/Discharge
Landfill 3 (LF008)	G4 - Extraction/Treatment/Discharge
Building 905 (SS041)	G3 - Containment/Treatment/Discharge
Building 916 (SD043)	G3 - Containment/Treatment/Discharge

The Air Force selected the interim remedies as the most appropriate strategies for containing, monitoring, and treating contaminated groundwater in the WABOU. These remedies address the potential risks to human health and the environment that could result from exposure to groundwater by human (e.g., workers and residents) and ecological (e.g., aquatic) receptors.

Previously the Air Force created a North/East/West Industrial Operable Unit (NEWIOU) Groundwater Remedial Design/Remedial Action (RD/RA) Plan to describe the overall rationale for treatment and discharge of extracted groundwater for all NEWIOU groundwater sites. It also included the NEWIOU RD/RA schedule and a decision matrix for selecting the treatment technologies at each NEWIOU site. The Air Force will add an addendum to this plan to include a detailed description of the treatment and discharge of extracted groundwater for the WABOU sites. The addendum will also include the WABOU RD/RA schedule. The Air Force will provide an opportunity for public participation during the Remedial Design phase.

Previously the Air Force created a Natural Attenuation Assessment Plan (NAAP) to provide the methodology used to evaluate the potential use of Monitored Natural Attenuation (MNA) at NEWIOU sites. The Air Force will add an addendum to the NAAP to include a description of the approach to be used for the evaluation of the MNA component of Alternative G5 at Building 755.

In addition to the addendum to the NEWIOU Groundwater RD/RA Plan, the Air Force will perform a pre-design investigation, as necessary, and then prepare a site-specific RD/RA work plan for each WABOU groundwater site. The purpose of the pre-design investigation is to fill existing data gaps so that the Air Force can successfully implement the remedial action at a site. Examples of data gaps may include the distribution of groundwater contamination in subsurface strata, hydrogeologic conditions that affect remedial action performance, and unusual groundwater analytical results that may indicate the presence of additional groundwater contamination sources. The site-specific RD/RA work plan will present the results of the site-specific pre-design investigation, the preliminary design information including the potential placement of extraction and monitoring wells, groundwater monitoring protocols and frequency, and procedures to determine whether plume migration is occurring. After regulatory approval of the site-specific RD/RA work

plan, the Air Force will submit the RD design package that includes drawings, specifications, and a design report. The site-specific RD/RA work plan and the RD design package are primary documents and are described in the final NEWIOU Interim Groundwater RD/RA Plan. If a contingency action is necessary to control migration, the Air Force will request funding and implement a contingency action as soon as funding becomes available.

No potential for contaminated groundwater to migrate along storm and sanitary sewer lines is indicated by a comparison of the highest measured level of the local water table with the location and depth of the local sanitary and storm sewer lines in the WABOU. However, if future data collection suggests that contaminated groundwater has migrated to an area where interaction with preferential pathways is likely, the Air Force will investigate the potential interaction during the Remedial Design (RD). If the RD investigation reveals an interaction between groundwater and a preferential pathway, then an appropriate remedial action will be proposed for the site and documented in an amendment to this Groundwater IROD

The Air Force will implement interim groundwater remedial actions as described in this WABOU Groundwater IROD. The Air Force will monitor all sites and will measure the change in contaminant concentrations. The Air Force will utilize the monitoring results to evaluate the potential for using the MNA component of Alternative G5 at Building 755. The Air Force and regulatory agencies will periodically review the analytical and performance data from these actions to verify their effectiveness and the need for additional action(s). The Air Force and regulatory agencies will hold a formal program review after the IROD is signed and after sufficient analytical and performance data has been collected. The purpose of the program review will be to determine the final basewide remedial actions and cleanup levels that are technically and economically feasible for each groundwater site at Travis AFB.

Travis AFB will eventually replace this interim ROD with a final ROD as soon as sufficient data has been collected to support the selection of a final remedy. The sites described in the final NEWIOU Groundwater IROD and the WABOU groundwater sites may be addressed in one basewide groundwater ROD if the Travis AFB Cleanup Team decides that this approach is appropriate.

Declaration

These interim groundwater remedial actions are protective of human health and the environment, are compliant with Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) directly associated with these actions, and are cost-effective. These actions utilize permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable given the limited scope of the action. These actions do not constitute the final groundwater remedies for the Travis AFB WABOU sites. The Air Force and the regulatory agencies will address the statutory preference for remedies that reduce toxicity, mobility, or volume as a principal element at the time of the final basewide groundwater ROD. The Air Force will base subsequent actions on the knowledge and experience gained during the interim actions. Any future actions will fully address the principal threats posed by contaminated groundwater in the WABOU at Travis AFB.

Lead and Support Agency Acceptance
of the Interim Groundwater Record of Decision for
the WABOU, Travis Air Force Base

This signature sheet documents the agreement between the United States Air Force, the United States Environmental Protection Agency and the State of California, by the California Environmental Protection Agency, Department of Toxic Substances Control, and the San Francisco Bay Regional Water Quality Control Board on the Interim Groundwater Record of Decision for the WABOU at Travis Air Force Base. The respective parties may sign this sheet in counterparts.

_____ _____

Daniel D. Opalski — Date
Chief
Federal Facilities Cleanup Branch
U.S. Environmental Protection Agency, Region IX

_____ _____

Anthony J. Landis, P.E. — Date
California Environmental Protection Agency
Department of Toxic Substances Control
Chief of Operations
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Richard K. McMurtry — Date
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PART II

Decision Summary

The Decision Summary includes the findings, evaluations, decision-making process, and selected remedial actions for the West/Annexes/Basewide Operable Unit (WABOU) Groundwater Interim Record of Decision (IROD). Section 1.0 describes the physical and ecological setting of Travis Air Force Base (AFB). Section 2.0 provides an overview of non-Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and CERCLA environmental programs at Travis AFB. Section 3.0 summarizes the nature and extent of groundwater contamination as presented in the WABOU Remedial Investigation (RI). Section 4.0 presents the remedial alternatives that were considered and the comparison of the alternatives to the criteria set forth in the National Contingency Plan (NCP) as presented in the WABOU Feasibility Study (FS). Section 5.0 identifies the selected interim groundwater remedies and the rationale for their selection. Section 6.0 presents the applicable or relevant and appropriate requirements (ARARs) and performance standards for the interim actions. Section 7.0 is the list of references.

1.0 Travis AFB Description

Travis AFB is located midway between San Francisco and Sacramento, California, about 3 miles east of downtown Fairfield in Solano County. The Base occupies 5,025 acres. In addition, the Base maintains ownership of or administrative control over 11 annexes at offbase locations. Approximately 17,000 military and civilian personnel are present daily on the Base (Weston, 1993). Maps of the regional location of Travis AFB and annexes are presented on Figure 1-1.

Travis AFB is currently part of the Air Mobility Command (AMC) and is host to the 60th Air Mobility Wing (AMW). The AMW operates C-5 Galaxy cargo aircraft and KC-10 Extender refueling aircraft. The primary missions of Travis AFB since its establishment have been strategic reconnaissance and airlift of freight and troops.

1.1 Physical Description

Topography at Travis AFB is characterized by a gently sloping to nearly flat ground surface with variations in topographic relief of up to 50 feet. Elevations at Travis AFB range from over 100 feet above mean sea level (msl) near the northern boundary to less than 20 feet above msl near the south gate. The ground surface generally slopes to the south or southeast at about 30 feet per mile. Areas surrounding Travis AFB have a varied topography.

Within the WABOU, the ground surface elevation ranges from more than 100 feet above msl in the northwest to less than 30 feet above msl in the southern area.

The Travis AFB area climate is characterized as Mediterranean, with wet winters and dry summers. The Base is located near the Carquinez Straits, which is the major break in the Coast Range. Travis AFB usually experiences mild temperatures because of its proximity to

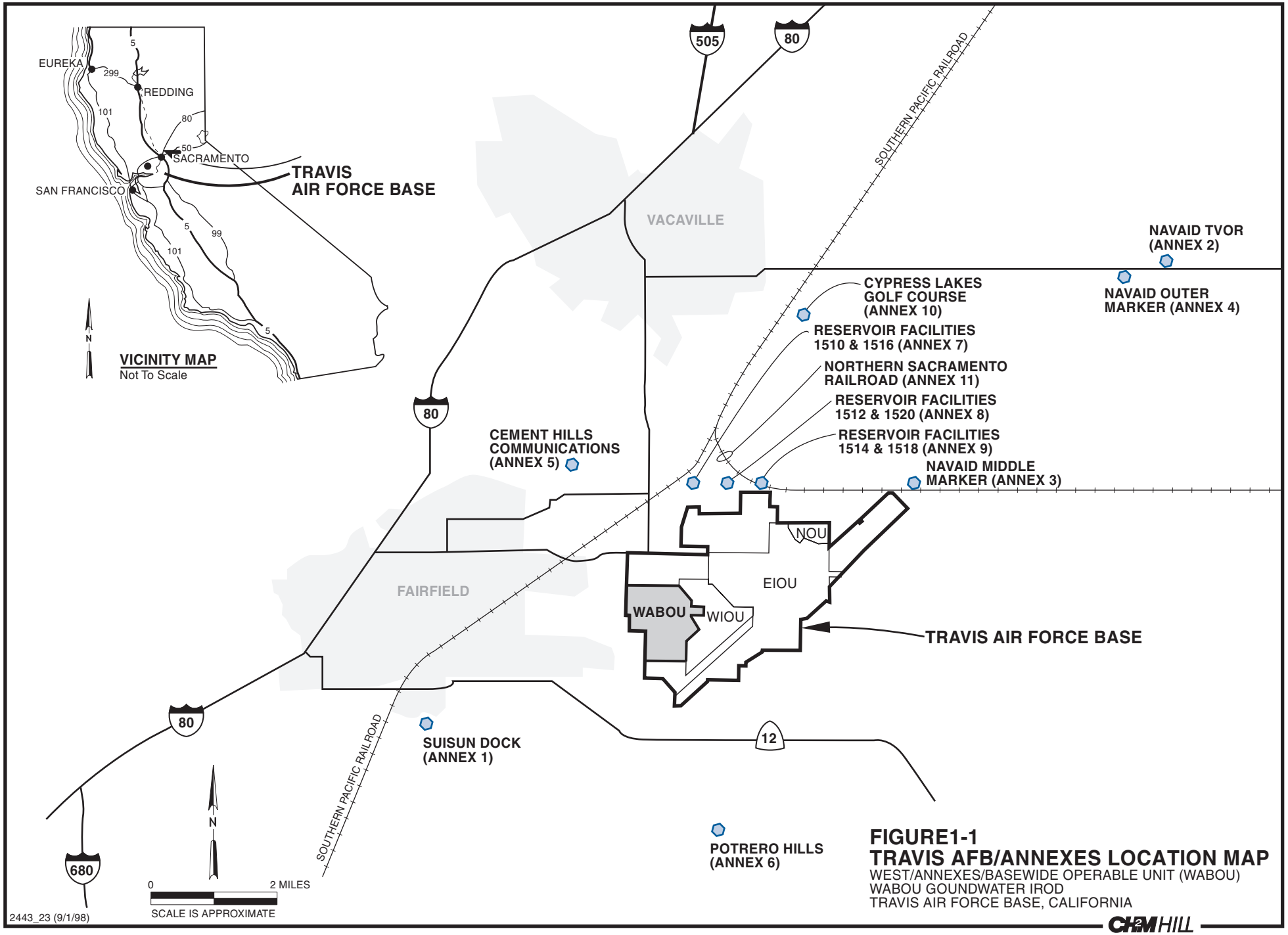

FIGURE1-1
TRAVIS AFB/ANNEXES LOCATION MAP
WEST/ANNEXES/BASEWIDE OPERABLE UNIT (WABOU)
WABOU GOUNDWATER IROD
TRAVIS AIR FORCE BASE, CALIFORNIA

CH2MHILL

the Carquinez Straits and the coast. The mean annual temperature is 60° F. The lowest temperatures occur in January, with a mean of 46° F. The highest temperatures occur in July and August, with a mean of 72° F. Monthly mean relative humidity typically ranges from a low of 50 percent during June to a high of 77 percent during January. The mean annual relative humidity is 60.5 percent.

Travis AFB averages 17.5 inches of rain annually. Approximately 84 percent of the annual precipitation occurs during the winter season of November through March. January is the wettest month, averaging 3.7 inches of precipitation; July is the driest month averaging 0.02 inch of precipitation.

Evapotranspiration ranges from about 50 to 75 inches per year. However, because most precipitation occurs in the winter, and most evaporation takes place in the summer, this apparent "net annual negative precipitation" has little impact on water infiltration through the soil column or on groundwater recharge.

Travis AFB experiences sea breezes during the summer because of its proximity to the Carquinez Straits. The average annual wind speed is 8 knots, with a winter average of 5 to 6 knots and a summer average of 12 knots. The predominant wind directions are from the southwest and west-southwest.

1.2 Land Use

Travis AFB occupies 5,025 acres of land near the center of Solano County, California, and is located approximately 3 miles east of downtown Fairfield and 8 miles south of downtown Vacaville (see Figure 1-1). Solano County's population in 1990 was 340,421 (U.S. Department of Commerce/U.S. Bureau of the Census; 1990). This population was estimated to have grown to 373,923 by 1994 (State of California, Department of Finance, 1994). During the 1980s, the population of Solano County increased nearly 45 percent (U.S. Department of Commerce/U.S. Bureau of the Census, 1990). However, the rate of growth has declined since 1990. The projected population growth between 1990 and 2000 is 47.4 percent for the City of Fairfield and 33.6 percent for Solano County overall (Association of Bay Area Governments, 1990).

According to the Travis AFB Office of Public Affairs, currently 7,750 active military personnel and 3,323 reservists are employed at Travis AFB. Approximately 5,613 people live in 3,466 onbase housing units. There are 3,006 civilians employed at Travis AFB. Approximately 17,000 people are onbase on a daily basis.

The land use areas of Travis AFB are grouped into eight functional categories:

- **Mission**—Uses are closely associated with the airfield and include facilities such as maintenance hangars and docks, avionics facilities, and other maintenance facilities. Aircraft operations facilities include control towers, Base operations, flight simulators, and other instructional facilities.

- **Administrative**—Uses include personnel, headquarters, legal, and other support functions.

- **Community**—Uses include both commercial and service activities. Examples of commercial uses include the Base Exchange, dining halls, service station, and clubs; service uses include the schools, chapel, library, and the family support center.

- **Housing**—Uses include both accompanied housing for families and unaccompanied housing for singles, temporary personnel, and visitors.

- **Base Support/Industrial**—Uses are for the storage of supplies and maintenance of Base facilities and utility systems.

- **Medical**—Uses include facilities for medical support, including the David Grant Medical Center.

- **Outdoor Recreation**—Uses include ball fields, golf course, equestrian center, swimming pools, and other recreational activities.

- **Open Space**—These areas are used as buffers between Base facilities and to preserve environmentally sensitive areas.

The lands surrounding Travis AFB on the northeast and east are primarily used for ranching and grazing. Areas to the south are a combination of agricultural and marshland. A few commercial/light industrial areas are present to the north of the Base. The area west of Travis AFB is predominantly residential.

Land use within the WABOU consists of open grasslands, light industrial support areas, administrative areas, personnel training areas, ammunition storage, and service/storage areas. Land use at and surrounding the annexes component of the WABOU is varied.

1.3 Ecology

Travis AFB has a variety of terrestrial and aquatic/wetland habitats and wildlife that are typical of the region. The information used in identifying biological resources was taken from field studies and reports produced by Biosystems (1993a, 1993b, 1994), CH2M HILL (1995, 1996), Jacobs Engineering Group (JEG) (1994a, 1994b), Radian (1994), and Weston (1995a, 1995b).

1.3.1 Terrestrial Habitats

The terrestrial habitats at Travis AFB and adjacent areas consist of herbaceous-dominated habitats (annual grassland, pasture, and early ruderal habitat) and urban habitat (industrial areas, lawns, and ornamental plants) according to the California Department of Fish and Game (CDFG) classification system (Mayer and Laudenslayer, 1988). Aquatic/wetland habitats at Travis AFB include riverine (Union Creek) and riparian habitat, lacustrine (Duck Pond), and herbaceous-dominated wetlands marshes, and vernal pools.

In general, annual grassland habitat is dominated by non-native plant species such as slender wild oat (*Avena fatua*), fescues (*Festuca)*, soft chess (*Bromus hordeaceus*), field bindweed (*Convolvulus arvensis*), and yellow star-thistle (*Centaurea solstitialis*). Some native plants, such as bunchgrass (*F. viridula)* and johnny-tuck (*Triphysaria eriantha*) may also be found, usually associated with undisturbed areas.

Mowed/disced grassland is generally composed of soft chess, Italian ryegrass (*Lolium multiflorum*), and wild oats. Pasture grassland can contain varying frequencies of filaree (*Erodium* sp.), ripgut brome (*Bromus diandrus*), soft chess, Italian ryegrass, and yellow star-thistle. Ruderal grasslands, on the other hand, contain higher numbers of perennial species and, in some areas, woody species such as coyote brush (*Baccharis pilularis*), eucalyptus (*Eucalyptus* sp.), Peruvian pepper-tree (*Schinus molle*), and black locust (*Robinia pseudoacacia*).

The urban habitat onbase contains maintained lawns as well as trees and shrubs such as eucalyptus, Fremont cottonwood (*Populus fremontii*), arroyo willow (*Salix lasiolepis*), and coyote brush. Most isolated stands of shrubs or trees are located within or near urban areas, permanent water sources, or near artificial surface mounds (for example, rail lines, blast protection, and building/road foundations.

1.3.2 Aquatic/Wetland Habitats

Herbaceous wetland vegetation is found along the permanent (natural or artificial) drainages onbase and can also occur seasonally within vernal pools, swales, and ditches. Native species include salt grass (*Distichlis spicata*); non-native species include meadow fescue (*Festuca elatior*), sickle grass (*Parapholis incurva*), and cattails (*Typha* sp.). Vernally inundated areas support seasonal vegetation such as non-native Mediterranean barley (*Hordeum murinum* ssp. *leporinum*) and brass buttons (*Cotula coronopifolia*) and native plants such as downingia (*Downingia* sp.) and toad rush (*Juncus bufonius*).

Vernal pools are shallow depressions or small, shallow pools that fill with water during the winter rainy season, then dry out during the spring and become completely dry during the summer. The vernal pools at Travis AFB contain indicator species such as goldfields (*Lasthenia fremontii*), coyote thistle (*Eryngium vaseyi*), dwarf woolly-heads (*Psilocarphus brevissimum*), water pygmy-weed (*Crassula aquatica*); and one or more species of downingia and popcornflower (*Plagiobothrys* sp.).

Although a few willows and coyote brush can be found along Union Creek, the dominant plant species found in the riparian zone of Union Creek are mainly herbaceous and consist of beardless wild rye (*Leymus triticoides*), broad-leaved pepperwort (*Lepidium latifolium*), Harding grass (*Phalaris aquatica*), and saltgrass. Hydrophytes such as cattails and rushes are also common.

1.3.3 Wildlife

Terrestrial vertebrates associated with non-native annual grasslands are commonly found onbase. Typical avian species include ring-necked pheasant (*Phasianus colchicus*), American kestrel (*Falco sparvarius*), American robin (*Turdus migratorius*), and the western meadowlark (*Sturnella neglecta*). Reptiles observed, or potentially occurring, at the Base include the western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleucus*), and California red-sided garter snake (*Thamnophis sirtalis* ssp. *infernalis*). Common mammals identified include deer mouse (*Peromyscus maniculatus*), California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), black-tailed hare (*Lepus californicus*), and red fox (*Vulpes vulpes*).

Permanent wetlands and seasonally wet areas support aquatic invertebrates, fish, amphibians, reptiles, birds, and mammals. Some aquatic invertebrate species observed in herbaceous wetlands and vernal pools at Travis AFB include vernal pool fairy shrimp

(*Branchinecta lynchi*), damselflies, crayfish, and aquatic snails. Amphibian species identified include bullfrog (*Rana catesbeiana*), Pacific tree frog (*Hyla regilla*), and California tiger salamander (*Ambystoma californiense tigrinum*). Aquatic birds observed on or near the Base include mallard (*Anas platyrhynchos*), great egret (*Casmerodiuis albus*), and great blue heron (*Ardea herodias*).

Because wildlife use riverine and riparian habitat somewhat similarly, these habitats are discussed together. Many aquatic invertebrates and amphibians are the same as those discussed above in herbaceous wetlands and vernal pools. These include damselflies, cray-fish, aquatic snail, bullfrog, Pacific tree frog, and California tiger salamander. Fish species include mosquitofish (*Gambusia affinis*), fathead minnow (*Pimephales promelas*), threespine stickleback (*Gasterosteus aculeatus*), and bluegill (*Lepomis macrochirus*). Riverine/riparian habitats are also used extensively by birds and terrestrial mammals for forage, shelter, and as a source of water. These include red-winged blackbird (*Agelaius phoenicus*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethicus*), and beaver (*Castor canadensis*).

Habitats that support special-status species are considered sensitive habitats. Aquatic/ wetland areas that are considered sensitive include vernal pools, swales, and ditches that can support special-status plants and animals. Urban environments, scattered throughout the Base, can also support special-status species. For example, burrowing owls (*Speotyto cunicularia*) may use man-made culverts, perches, and bare earth areas that contain burrows provided by ground squirrels. Loggerhead shrikes (*Lanius ludovicianus*) may nest on antenna wires and forage in grasslands. Both owls and shrikes are typical species of the grassland habitats onbase. Also, vernal pool fairy shrimp have been found in artificially created depressions that seasonally fill with water.

1.4 Geology and Hydrogeology

This section provides a discussion of the regional geologic setting in the vicinity of Travis AFB, as well as specific geologic conditions in the WABOU. This information is presented to provide a context for discussions on the potential migration of contaminants through the soil column and in groundwater.

1.4.1 Geology

Travis AFB is located on the western edge of the Sacramento Valley segment of the Great Valley Geomorphic Province. This province is a sediment-filled synclinal basin with a northwest-to-southeast-oriented axis. The Coast Range Geomorphic Province, which consists of folded and uplifted bedrock mountains, lies just to the west of Travis AFB (Thomasson et al., 1960; Olmsted and Davis, 1961).

The WABOU is located on the western flank of the truncated anticline that traverses Travis AFB in a northwesterly to southeasterly direction. The axis of the anticline runs through the EIOU in the vicinity of Facility 363, about 2 miles east of the WABOU boundary. Early Eocene Epoch Domengine Sandstone, which is the oldest sedimentary unit exposed at the Base, is exposed along the axis of the anticline.

Bedrock units that outcrop in the vicinity of Travis AFB include (from oldest to youngest) the Domengine Sandstone, the Nortonville Shale, the Markley Sandstone, the Neroly Sandstone, and the Tehama Formation, as shown on Figure 1-2. Bedrock at the

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LEGEND

- *Qal*-YOUNGER ALLUVIUM
- Qbm-BAY MUD
- *Qoal*-OLDER ALLUVIUM
- Tpth-TEHAMA FORMATION
- *Ten*-NORTONVILLE SHALE
- *Ted*-DOMENGINE SANDSTONE
- *Tpu*-UNNAMED FORMATION
- *Kfo*-FORBES FORMATION
- *Kg*-GUINDA FORMATION
- *Tem*-MARKLEY SANDSTONE

0 1500 3000 FEET

SCALE IS APPROXIMATE

FIGURE 1-2
GEOLOGIC MAP OF
TRAVIS AFB AND VICINITY
WEST/ANNEXES/BASEWIDE OPERABLE UNIT (WABOU)
WABOU GROUNDWATER IROD
TRAVIS AIR FORCE BASE, CALIFORNIA

2443_807 (9/1/98)

CH2MHILL

North/East/West Industrial Operable Unit (NEWIOU) has been defined as consisting of consolidated to semi-consolidated sedimentary rock. It has been distinguished from the overlying unconsolidated sediment by such criteria as fissility, cementation, bedding, blow counts, color, texture, and gradation into competent rock (Weston, 1995a). Because of its lower permeability relative to the unconsolidated alluvium that overlies it, the bedrock may form a boundary for groundwater flow and therefore influence the migration of contaminants in groundwater. Table 1-1 is a stratigraphic column that summarizes the lithology and age of the geologic units in the area.

TABLE 1-1
Stratigraphic Column of Geologic Units at Travis AFB

Million Years Ago	Era	Period	Epoch	Geologic Unit	Lithologic Description	Possible Range of Thickness
1.8	Cenozoic	Quaternary	Pleistocene and Recent	Younger Alluvium	Interbedded clays, silts, sands and gravels, continental	0-70 feet
				Older Alluvium	Interbedded clays, silts, sands, and gravel, continental	0-100 feet
				Bay Mud	Interbedded clays, silts, sands and gravel, continental	
5			Pliocene	Tehama Formation	Interbedded gravels, sands, silts and clays, partially consolidated, occasional volcaniclastic sediments; continental	
					Unconformity	
27.5		Tertiary	Miocene	Neroly Sandstone (San Pablo Group)	Interbedded sandstone, siltstone, and shale, distinctive bluish color; marine	0-60 feet
					Unconformity	
38			Oligocene			
55			Eocene	Markley Sandstone	Massive micaceous, arkosic sandstone, interbeds of siltstone and shale, marine	0-60 feet
				Nortonville Shale	Predominantly dark gray marine shale and siltstone, minor sandstone, coal and glauconitic sandstone unit	80 feet
				Domengine Sandstone	Coarse-grained sandstone, minior siltstone and shale interbeds, gray to brown, marine (in outcrop only as mapped by Sims et al., 1973).	50 feet
			Paleocene	Unnamed Formation (?)	Interbedded shale, siltstone, and thinly laminated friable sandstone, marine (as mapped by Sims et al., 1973)	

Source: Sims et al., 1973.

The Tehama Formation consists of poorly sorted deposits of clay, silt, clayey silt, sandy silt and clay, and silty sand, containing generally thin lenses of gravel and sand. In areas of outcrop, it consists chiefly of siltstone, sandstone, and conglomerate. The Tehama Formation

is widespread in the northern, northwestern, and western Sacramento Valley, and averages about 2,000 feet in thickness (Page, 1986). However, the thickness of the formation beneath the WABOU is unknown.

Travis AFB is located on the northeastern margin of the Fairfield-Suisun Basin astride the Vaca Fault. Travis AFB lies on alluvial fans that extend from the Vaca Mountains to the Suisun Marsh. These fans were deposited by the Ulatis, Union, Alamo, Laurel, and Suisun Creeks. Most of the alluvial material was deposited prior to the last period of glaciation during the Pleistocene Epoch, and is referred to as Older Alluvium. The parent rocks for the alluvium at Travis AFB include metasediments, serpentinites, ultramafic rocks, and the Sonoma Volcanics (Olmsted and Davis, 1961; Wagner and Bortugno, 1982). The drainages cut through the alluvial fans during the last glaciation, in response to the global lowering of the sea level. As the sea level has risen during the last 15,000 years, the drainages have filled again with alluvium. This material is referred to as Younger Alluvium. At Travis AFB, the overall thickness of the alluvium ranges from 0 to approximately 70 feet, but is generally less than 50 feet. West of Travis AFB, the thickness of the alluvium increases to over 200 feet (Thomasson et al., 1960). Some topographic relief in the form of very low ridges is provided by outcrops of sedimentary rocks characterized as bedrock in the Travis AFB area.

The younger and older deposits are distinguished at the surface by the difference in maturity of their soil profiles. The portion of the alluvium near the ground surface has been altered, or weathered over time by physical, chemical, and biological actions. The Younger Alluvium generally has an immature soil profile; the Older Alluvium generally has a well-developed, mature soil profile. Most of the sediment encountered at Travis AFB consists of Older Alluvium. The Younger Alluvium overlies the Older Alluvium and is found only in the northeastern portion of the Base.

Soil develops within geologic material exposed at the Earth's surface as the material is altered through physical, chemical, and biological processes. The nature of a soil is in part a function of climate, surface slope, time of exposure at the surface, and the type of original (parent) material. Soils in the vicinity of Travis AFB are primarily silt and clay loams that exhibit low permeabilities and poor drainage characteristics.

The majority of the Base, including the WABOU, is covered with soils derived from Pleistocene Epoch Older Alluvium designated as the Antioch-San Ysidro Complex. This complex comprises about 45 to 50 percent Antioch soil series and 35 to 45 percent San Ysidro soil series, with the remaining percentage composed of the Solano soil series and Pescadero soil series. The soils are old and are characterized by a well-developed soil profile.

1.4.2 Hydrogeology

Travis AFB is located along the eastern edge of the Fairfield-Suisun Hydrogeologic Basin. The Fairfield-Suisun Basin is a hydrogeologically distinct structural depression adjacent to the Sacramento Valley segment of the Central Valley Province. The basin is bordered to the north by the Vaca Mountains and to the east by the ridge that runs along the eastern portion of the North Operable Unit (NOU) and East Industrial Operable Unit (EIOU). The basin slopes south toward the Suisun Marsh; consequently, groundwater and surface water at Travis AFB tend to flow south to Suisun Marsh (California Department of Water Resources, 1994).

The primary water-bearing deposits in the region surrounding Travis AFB are the coarse-grained sediments (sand and gravel) within the Older Alluvium and Younger Alluvium. The bedrock units generally do not yield groundwater of usable quantity or quality in the Fairfield-Suisun Basin (Thomasson et al., 1960).

1.4.3 Groundwater Gradient and Flow

The groundwater gradient describes the differences in hydraulic potential that result in groundwater flow. The direction of the regional groundwater gradient is generally toward the south or southeast. Groundwater recharge occurs from the direct infiltration of rainfall on the valley surface and from the infiltration of runoff through local stream and creek beds. Natural groundwater discharge occurs at the marshlands located near the Potrero Hills, south of Travis AFB (Thomasson et al., 1960).

The general direction of groundwater flow at Travis AFB is toward the south, similar to the regional gradient. However, local variations (groundwater mounds and depressions) exist within the boundaries of Travis AFB. Changes in the groundwater gradient are normally related to the presence of lower permeability consolidated materials ("bedrock") in the subsurface, and the distribution of alluvium with relatively higher permeability. Groundwater typically flows away from the bedrock ridges, and toward the subbasins that contain thicker sequences of alluvial materials. Therefore, the bedrock ridges bordering the subbasins correspond with potentiometric highs in the groundwater elevation map.

The maximum horizontal hydraulic gradient in the shallow groundwater at Travis AFB outside of the WABOU is approximately 0.02 foot/foot at the groundwater mound near the old Base hospital. The minimum horizontal gradient in the upper portion of the aquifer is approximately 0.002 foot/foot near the southern border of Travis AFB. The average magnitude of the groundwater gradient in the shallow groundwater is approximately 0.005 foot/foot. The horizontal hydraulic gradients in the deeper zones of the alluvial aquifer range from approximately 0.003 to 0.01 foot/foot (Radian, 1996a).

Groundwater flows in a generally southerly direction in the WABOU, as shown on Figure 1-3. Variations in this flow regime are most pronounced in the north-central portion of the WABOU, in the vicinity of the topographic high point where the Tehama Formation outcrops. Groundwater flows radially away from the topographic high point in this area, and then curves back to the south. A subsurface ridge of the Tehama Formation that extends south from the outcrop also affects the groundwater flow direction (Figure 1-3). Groundwater flowlines appear to curve away from this ridge in the vicinity of sites such as Building 755. The groundwater gradient in the WABOU ranges from about 0.005 foot/foot near the mound to about 0.06 foot/foot at the southern end of the WABOU.

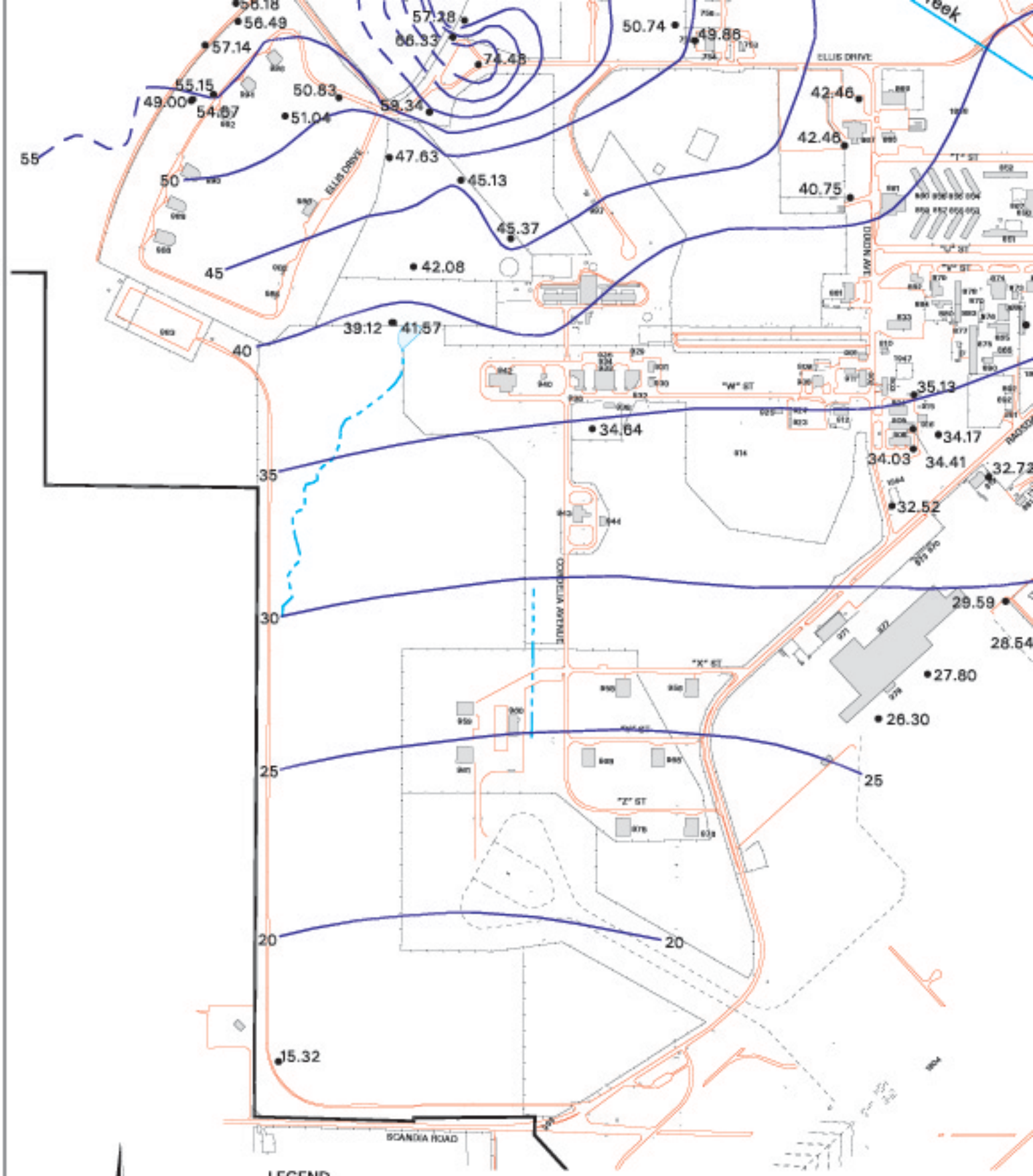

FIGURE 1-3
GROUNDWATE
July 9, 1996
WEST/ANNEXES/BAS
WABOU GROUNDWA
TRAVIS AIR FORCE B

Landfill 3 is located on a bedrock ridge near a groundwater divide. Groundwater here recharges the adjacent basins, and the vertical gradient is downward, ranging from about 0.2 foot/foot to about 0.35 foot/foot. Annual fluctations in the piezometric surface averaged about 2 to 5 feet. Water levels reached their low point just prior to the rainy season in late 1994, at the end of a multi-year drought. After 1994, the groundwater levels rose in the wells 5 to 6 feet during the wetter years of 1995 and 1996.

As previously mentioned, the Older Alluvium is the source of most of the groundwater supply in the Fairfield-Suisun Basin. The consolidated bedrock units that underlie the Older Alluvium do not yield groundwater of usable quantity or quality. The Older Alluvium reaches a maximum thickness of only about 200 feet (Thomasson et al., 1960). Investigations at Travis AFB indicate that the maximum thickness of the Older Alluvium at the Base is only about 70 feet (Radian, 1996b).

The Older Alluvium is extremely heterogeneous, and no discrete aquifer units were observed during the WABOU RI that could be correlated from site to site. In addition, a consistent vertical gradient up or down does not appear to be present in the WABOU. The Older Alluvium, therefore, should be regarded as a single hydrogeologic unit. In this regard, "shallow" and "deep" groundwater have little meaning in the WABOU. Groundwater is found under water table or semi-confined conditions, and flows in a predominantly horizontal direction.

Groundwater will flow preferentially through sediments with relatively higher permeability, such as silty sands and sands.

1.4.4 Aquifer Tests

The hydrogeologic parameters of hydraulic conductivity and porosity are needed to calculate groundwater flow velocities. To estimate the hydrogeologic parameters of the alluvial deposits and bedrock, aquifer slug tests and aquifer pumping tests have been conducted at Travis AFB between 1988 and 1996. Table 1-2 summarizes the values of hydraulic conductivity that have been calculated from these tests. The results of these aquifer tests indicate the horizontal hydraulic conductivity (K) of the alluvium beneath Travis AFB ranges from about 0.0001 foot per minute (fpm) to about 0.08 fpm, with an average of about 0.02 fpm. Vertical hydraulic conductivities calculated from aquifer pumping test data collected at MW245 and MW214 within the EIOU ranged from 1.21×10^{-4} fpm to 2.29×10^{-3} fpm (Radian, 1996a).

The wide range of hydraulic conductivities calculated from pump tests conducted at Travis AFB reflects the natural variability in permeability of the geologic units that are present. The lower range of hydraulic conductivities calculated for the vertical direction relative to the horizontal direction indicates that groundwater will flow more easily in the horizontal direction than in the vertical direction. Even in the presence of a vertical gradient, if the ratio of horizontal to vertical hydraulic conductivity is approximately 100 or more, groundwater flow will essentially be horizontal (Freeze and Cherry, 1979).

TABLE 1-2
Summary of Hydraulic Conductivity Values Derived from Aquifer Tests Conducted at Travis AFB

		Hydraulic Conductivity (K fpm)		
Geologic Unit	Number of Tests[a]	Minimum	Maximum	Mean
Younger Alluvium	9	0.0005	0.079	0.020
Older Alluvium	30	0.0001	0.074	0.027
(vertical K)	(2)	(0.000121)	(0.00229)	(0.0012)
Sandstone Bedrock	2	0.0025	0.021	0.0088
Shale or Siltstone Bedrock	4	0.0006	0.0415	0.020

[a]Identity of wells provided in Radian (1996b).

This fact is reinforced in the vicinity of Travis AFB by the fact that the regional discharge points for groundwater in the Fairfield-Suisun Basin are nearby Union Creek or Suisun Marsh. Therefore, dissolved contaminants that reach the water table will tend to migrate horizontally, with little opportunity for vertical migration before discharging. Dissolved contaminants in groundwater will also tend to migrate preferentially in geologic layers of higher permeability.

Based on the mean hydraulic conductivity in the Older Alluvium (Table 1-2), with an average groundwater gradient of 0.005 foot/foot and an assumed average effective porosity of 0.20, the average linear velocity of groundwater flow within the Older Alluvium is about 350 feet per year. Using the maximum value of hydraulic conductivity, the groundwater flow velocity in the Older Alluvium ranges up to about 970 feet per year. The average groundwater velocity calculated in the EIOU from pump tests performed in a variety of geologic settings was 110 feet per year (Weston, 1995b).

1.4.5 Groundwater Use

Intensive extraction of groundwater generally occurs only to the west of Travis AFB and Fairfield where the alluvium is thicker and contains a greater abundance of coarse-grained sediment. Groundwater wells in the area of Travis AFB are limited to domestic, stock-watering, and irrigation wells with typical screened depths of within 100 feet of ground surface (Weston, 1995b). Domestic wells, several of which are downgradient from Travis AFB, are used typically for households and gardens (Weston, 1995b). Based on the large distance (more than 4,500 feet) between the contaminated groundwater in the WABOU and the nearest domestic well, and the local groundwater flow velocity, it is highly unlikely that the downgradient domestic wells will ever be impacted by the contaminated groundwater. The groundwater cleanup actions of the four WABOU sites protect these offbase wells. However, if the contaminated groundwater from these sites reached an offbase domestic well, an alternative water supply would be provided.

No onbase wells are used for potable water production. However, several wells located 4 miles north of Travis AFB, at the Cypress Lakes Golf Course (Annex 10), produce 400 to 500 million gallons of water per year. This well water is mixed with surface water purchased from the City of Vallejo to supply potable water to Travis AFB. The Fairfield public water supply field is located approximately 3 miles west of Travis AFB. The large production

wells at the golf course and in Fairfield tend to be deeper than the nearby domestic wells, ranging up to 1,000 feet in depth.

1.5 Surface Water

Travis AFB is located in the northeastern portion of the Fairfield-Suisun Hydrologic Basin. Within the basin, water generally flows south to southeast toward Suisun Marsh, an 85,000-acre tidal marsh that is the largest contiguous estuarine marsh, as well as the largest wetland, in the continental United States. Suisun Marsh drains into Grizzly and Suisun bays. Water from these bays flows through the Carquinez Straits to San Pablo Bay and San Francisco Bay, and ultimately discharges into the Pacific Ocean near the City of San Francisco.

Union Creek is the primary surface water pathway for runoff at Travis AFB. The head-waters of Union Creek are located approximately 1 mile north of the Base, near the Vaca Mountains, where the creek is an intermittent stream. Union Creek splits into two branches north of the Base, with the main (eastern) branch being impounded into a recreational pond designated as the Duck Pond. At the exit from the Duck Pond, the creek is routed through a storm sewer to the southeastern Base boundary, where it empties into open creek channel.

The West Branch of Union Creek flows south and enters the northwestern border of Travis AFB east of the David Grant Medical Center in an excavated channel. This channel flows south to the northeast corner of the WABOU. The channel forms the boundary between the WIOU and the WABOU and parallels Ragsdale Street for about 4,000 feet, shown on Figure 1-3. Flow in the channel is then directed to a culvert under the runway and discharges to the main channel of Union Creek at Outfall II. From Outfall II, Union Creek flows southwest and discharges into Hill Slough, a wetland located 1.6 miles from the Base boundary. Surface water from Hill Slough flows into Suisun Marsh.

Local drainage patterns have been substantially altered within the Base by the rerouting of Union Creek, the construction of the aircraft runway and apron, the installation of storm sewers and ditches, and general development (e.g., the Base Exchange, industrial shops, maintenance yards, roads, housing, and other facilities). Surface water is collected in a network of underground pipes, culverts, and open drainage ditches. The surface water collection system divides the Base into eight independent drainage areas. The eastern portion of the Base is served by one of the drainage systems that collects runoff from along the runway and the inactive sewage treatment plant area and directs it to Denverton Creek and Denverton Slough. Denverton Creek is an intermittent stream in the vicinity of the Base. The northwestern portion of the WABOU drains to the west toward the McCoy Creek drainage area. McCoy Creek is also an intermittent stream in the vicinity of the Base. With the exception of these drainages, the remaining six drainage areas at the Base empty into Union Creek.

Travis AFB has limited topographic relief, and the clayey soils prevent rapid drainage. This swale topography leads to the formation of vernal pools. The annual cycle of vernal pools includes standing water during the winter and spring and desiccation during the summer and fall. During the time that the vernal pools contain water, biotic communities develop over relatively restricted areas. In the larger areas, grasslands form; in more confined, deeper areas, wetlands form. The vernal wetlands are concentrated along the western, southern, and southeastern boundaries of the Base. All of the surface water bodies on and in

the vicinity of the Base empty into the Suisun Marsh. No springs have been recorded within the confines of Travis AFB.

Surface water pathways, as defined in this WABOU Groundwater IROD, include Union Creek, drainage channels, the storm and sanitary sewer system, and the backfill material surrounding underground sewer lines. These pathways are a potential means for groundwater to interact with surface water. Based on the locations and depths of the sewer lines in the WABOU and the groundwater level measurements in the vicinity of the four WABOU sites, there is no interaction between surface water and contaminated groundwater in the WABOU.

2.0 Overview of Travis AFB Environmental Programs

The Travis AFB Environmental Management Office is divided into three branches: Compliance, Restoration, and Pollution Prevention. This section describes each branch and the programs that are designed to comply with current federal and state environmental regulations.

2.1 Compliance Branch

Travis AFB maintains several active environmental compliance programs that are described below.

2.1.1 Air Force Regulations

The Air Force has developed a parallel set of environmental regulations to the federal environmental regulations. These Air Force regulations are designed to ensure that federal requirements are implemented in an appropriate manner at Air Force installations. Air Force instruction AFI 32-7005 sets up an Environmental Protection Committee to oversee management of all environmental programs at each installation. The Air Force environmental compliance regulations that parallel the federal environmental regulations are divided into the following subject areas:

- Air Quality Compliance
- Water Quality Compliance
- Solid and Hazardous Waste Compliance
- Storage Tank Compliance
- Environmental Impact Analysis Process
- Integrated Natural Resource Management
- Cultural Resource Management

2.1.2 Management Action Plan and Base General Plan

The Travis AFB Management Action Plan (MAP) summarizes the current status of the Travis AFB environmental compliance, restoration, and pollution prevention programs, and presents a comprehensive strategy for implementing response actions necessary to protect human health and the environment. Travis AFB produced the most recent version of the MAP in January 1997. Travis AFB environmental staff and Air Force headquarters use the MAP to direct and monitor environmental response actions and to schedule activities needed to resolve technical, administrative, and operational issues.

The Travis AFB General Plan (the Plan), also known as the Base Comprehensive Plan, a companion document to the MAP, provides an organized, systematic, and comprehensive approach to current and future planning and development. The Base General Plan is a tool that addresses a multitude of installation requirements and assists in the long-range growth of the Base, including natural resources, environmental protection, land use, airfield operation, utilities, transportation, and architectural compatibility. Of particular importance is its role in environmental protection. The Plan addresses proper hazardous waste management and recognizes CERCLA-related activities through proper land use at Travis AFB.

Section 5.6 addresses the implementation of land use restrictions to the Plan based on CERCLA-related activities.

2.1.3 Resource Conservation and Recovery Act and Hazardous Waste Management Program

Travis AFB operates as a generator and facility for hazardous waste management under the Resource Conservation and Recovery Act (RCRA) and State of California hazardous waste management programs. Travis AFB received a Part B hazardous waste facility storage permit from the California Department of Toxic Substances Control Division (DTSC) and the U.S. Environmental Protection Agency (U.S. EPA) on 5 March 1993.

2.1.4 Petroleum-only Contaminated Sites Program

The Travis AFB Petroleum-only Contaminated Sites (POCOS) program is designed to manage on base petroleum-related contamination sites. Travis AFB and the regulatory agencies agreed to remove the POCOS from the Travis AFB CERCLA program because the law excludes petroleum as a CERCLA contaminant. The Air Force will address petroleum contamination under CERCLA if it is commingled with CERCLA contaminants.

POCOS are typically associated with surface and sub-surface releases from fuel spills, piping leaks, oil-water separators, or underground storage tanks (USTs). The POCOS program includes the removal of leaking USTs and the remediation of petroleum-only contaminated soil and groundwater. An example of a POCOS that was removed from the CERCLA program by the regulatory agencies and the Air Force is the North/South Gas Station site. The San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) is the lead oversight agency for this program.

2.1.5 Stormwater Discharge Permit

Travis AFB monitors stormwater outfalls in compliance with its California National Pollution Discharge Elimination System (NPDES) permit. The ongoing monitoring program was developed in 1992. The Air Force conducts surface water sampling and reporting according to the permit requirements. The SFBRWQCB is the lead oversight agency for stormwater discharges.

2.2 Restoration Branch

The Restoration Branch manages the Travis AFB Installation Restoration Program (IRP) which was initiated in 1983 to investigate the nature and extent of reported hazardous waste releases to the surrounding environment (Engineering-Science, 1983). On the basis of the evaluation of IRP data by the U.S. EPA, Travis AFB was placed on the National Priorities List (NPL) on November 21, 1989 (54 Federal Register 48187).

The Air Force, U.S. EPA, DTSC, and SFBRWQCB negotiated and signed a Federal Facility Agreement (FFA) in September 1990. The FFA is a legally binding document that establishes the framework and schedules for the environmental cleanup at Travis AFB. This document also requires Air Force compliance with the NCP, CERCLA, RCRA guidance and policy, and state laws and regulations.

2.2.1 CERCLA Process

CERCLA was passed in 1980 and amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986. This law established a program to remediate sites contaminated with hazardous constituents to protect public health and the environment. CERCLA established a series of steps to investigate site contamination and design and implement appropriate remedial actions at these sites. The major steps are described below.

2.2.1.1 CERCLA Steps

Remedial Investigation (RI)— The RI is used to collect data to characterize site conditions, to determine the nature of the waste, and to assess risk to human health and the environment. The WABOU RI used a phased and sequenced approach to minimize collection of unnecessary data and maximize data quality. Initial data collection efforts provided a basic understanding of site characteristics. As this basic understanding was achieved, subsequent data collection efforts focused on filling identified data gaps in the conceptual site model and gathering the information necessary to support evaluations of remedial alternatives. The results and conclusions of this investigation were published in the *West/Annexes/-Basewide Operable Unit Remedial Investigation Report (Volumes 1-4), 60th Air Mobility Wing, Travis Air Force Base, California* (CH2M HILL, 1997).

Feasibility Study (FS)— The FS is divided into three general phases: development of alternatives, screening of alternatives and detailed analysis of alternatives. In the first phase the technology types and process options available to implement the general response actions for contaminated soil and groundwater were defined. A technology implementability screening was conducted which provided the basis for the selection of representative process options for soil and groundwater remediation. In the second phase the remedial alternatives were assembled using the representative process options and the site-specific conditions in the WABOU. In the last phase the alternatives were evaluated against seven of the nine CERCLA criteria. The WABOU FS provided a comparative analysis of alternatives to identify the advantages and disadvantages of each alternative to assist the decision-making process. The results of this study were published in the *West/Annexes/Basewide Operable Unit Feasibility Study, 60th Air Mobility Wing, Travis Air Force Base, California* (CH2M HILL, 1998).

Proposed Plan (PP)— The PP presents to the public the preferred alternative for each site and the rationale for the preferences. The WABOU Groundwater PP (Travis AFB, 1998) gave the public an opportunity to comment on the preferred groundwater alternatives during a 30-day public comment period (April 8, 1998 to May 8, 1998). It was published and mailed to all community members on the Travis AFB Community Relations list just prior to the start of the public comment period. The Air Force formally presented the preferred groundwater alternatives to the public at the April 23, 1998 public meeting. The Air Force also published a WABOU Soil PP to present to the public the preferred alternatives for the WABOU soil sites. A separate 30-day public comment period (July 8, 1998 to August 8, 1998) and public meeting (July 23, 1998) were held to promote public participation in the decision-making process.

Record of Decision (ROD)— The ROD presents the selected alternative and final cleanup levels at each site. It summarizes all CERCLA activities at each site and documents that the Air Force and the regulatory agencies are in agreement as to how the cleanup is to take place. Travis AFB and the regulatory agencies have agreed to use an IROD to quickly start

the groundwater cleanup actions. This IROD will not specify final cleanup levels and/or the final selected alternative. It will allow Travis AFB to conduct the actions needed to reduce groundwater contamination and associated potential risk as well as gather the data needed to select the final groundwater actions to close out each site. Travis AFB anticipates that a basewide groundwater ROD will be used to document the final actions for all groundwater sites in both the NEWIOU and the WABOU. A WABOU Soil ROD will be written to document the selected alternatives and the final soil cleanup levels at the WABOU soil sites.

Remedial Design (RD)—The RD specifies the engineering design of the treatment system used to implement the selected alternative at each site. The approach used to implement the groundwater action at each WABOU groundwater site is similar to that found in the final NEWIOU Groundwater Remedial Design/Remedial Action Plan and the Final Natural Attenuation Assessment Plan. Therefore, the Air Force will add an addendum to these two documents to describe the development of the remedial designs for the WABOU groundwater sites. The Air Force will prepare a site-specific RD/RA work plan for each WABOU groundwater site.

Remedial Action (RA)—The RA is the construction and operation of the selected alternatives specified in the ROD and designed in the RD. The Air Force will submit a schedule for the RD/RA activities to the regulatory agencies 21 days after the WABOU Groundwater IROD is signed. The Air Force will also submit a RD/RA schedule to the regulatory agencies 21 days after the WABOU Soil ROD is signed.

2.2.2 Operable Units

Initially, Travis AFB was treated as a single entity with one associated comprehensive cleanup schedule. In May 1993, the FFA was amended and the Base was divided into the four Operable Units (OUs) listed below to facilitate the overall cleanup program:

- East Industrial Operable Unit (EIOU)
- West Industrial Operable Unit (WIOU)
- North Operable Unit (NOU)
- West/Annexes/Basewide Operable Unit (WABOU)

Operable unit boundaries are shown in Figure 1-1. In October 1995, the first three OUs were combined into the North, East, West Industrial Operable Unit.

The WABOU has three main components:

- The western portion of the installation. All four groundwater sites are located within the western portion of the Base.

- The annexes or noncontiguous parcels of property that are under the jurisdiction of the Travis installation commander. The boundaries of each annex are defined in the official records of the Travis AFB Real Property Office.

- Other sites within the installation not being addressed by the other three OUs. These sites were included to ensure that all portions of the Base had been addressed. This is the "Basewide" component of the WABOU.

2.2.3 Removal Actions

In April 1993 a RCRA corrective action was conducted to close the acid neutralization sump at Building 755. This sump was identified in the WABOU RI report as the most probable source of the trichloroethene (TCE)-contaminated groundwater that is migrating from the site. Pacifica Services, Inc. accomplished the sump removal. The cobblestones were decontaminated prior to disposal, and the residual liquids and solids at the bottom of the sump were sampled and analyzed for hazardous characteristics. All hazardous waste was contained, transported and disposed in accordance with federal, state and local environmental regulations. The concrete sump and associated piping were demolished and removed from the site. Soil samples were analyzed for hazardous constituents. A plastic liner was placed into the excavation. The excavation was lined with a plastic membrane and backfilled with clean soil.

Travis AFB has initiated several groundwater removal actions in the NEWIOU which are described in the *Travis Air Force Base Groundwater Interim Record of Decision for the NEWIOU* (Radian, 1997).

2.2.4 Treatability and Pilot Studies

To date no groundwater treatability or pilot studies have been conducted in the WABOU. However, Building 755 may be the focus of three Air Force Center for Environmental Excellence (AFCEE) funded treatability studies that would test the ability of innovative technologies to treat volatile organic compound (VOC)-contaminated groundwater in a faster or cost-effective manner. The three technologies that are being considered for testing at Building 755 are Dual-Phase Extraction, Reactive Wall or Barrier, and Phytoremediation. The regulatory agencies will receive briefings on these studies as more details become available and will be able to review all treatability study work plans and reports.

Travis AFB has conducted several groundwater treatability and pilot studies in the NEWIOU which are described in the *Travis Air Force Base Groundwater Interim Record of Decision for the NEWIOU* (Radian, 1997).

2.2.5 Risk Assessment

A human health risk assessment and an ecological risk assessment were conducted in the WABOU RI. The results of these assessments are summarized in Section 3.0. In addition, the potential ecological risks to plants and animals were quantified on a basewide perspective and were presented in the *Final Comprehensive Basewide Ecological Risk Assessment - Tier 2: Screening Assessment* (CH2M HILL, 1996).

2.2.6 Community Participation

Travis AFB has had a community relations program since 1990. This program is designed to inform the public and involve the community in the environmental decision-making process.

The highlights of the community relations activities taken by Travis AFB are presented below:

- **Federal Facilities Agreement (FFA).** The Air Force, U.S. EPA, California Department of Health Services (now Department of Toxic Substances Control), and SFBRWQCB have

negotiated an interagency agreement, which includes requirements for community relations activities based on provisions in federal (and where applicable, state) statutes, regulations, and guidelines.

- **Restoration Advisory Board (RAB).** In 1994, Travis AFB established a RAB comprised of representatives of the community and the regulatory agencies. Through its quarterly meetings and its focus groups, the RAB has provided valuable input about community concerns regarding the Restoration Program. The Technical Document Review focus group has reviewed and commented on the draft version of every major report. The Relative Risk focus group has provided input on the project prioritization, and the Community Relations focus group is working to reach out to all community members. The RAB replaced the Technical Review Committee, which met periodically to review program progress.

- **Administrative Record/Information Repository.** The Air Force established an Administrative Record to support Air Force decisions related to the Travis AFB IRP. In addition, the Air Force established a public information repository for the relevant portion of the Administrative Record at the Vacaville Public Library. Copies of RI reports, FS reports, Proposed Plans and decision documents for both OUs are available for public review.

- **Community Relations Plan (CRP).** The Air Force implemented the first Travis AFB CRP in 1991. The Air Force revised the CRP in 1998. The Travis AFB Remedial Project Manager (RPM) is currently implementing the CRP.

- **Mailing List.** A mailing list of all interested parties in the community is maintained by Travis AFB and updated regularly. The mailing list currently totals more than 1,300 names.

- **Fact Sheets and Newsletters.** The Air Force has been publishing fact sheets describing activities and milestones in the restoration program occasionally since 1993. Since 1995 the Air Force has published and mailed quarterly newsletters to everyone on the mailing list. The newsletters contain information about public participation, issues of potential concern to the public, and program updates. The RAB co-chairs also write columns in each newsletter.

- **Proposed Plans.** The Air Force has mailed copies of NEWIOU and WABOU Groundwater Proposed Plans to all parties on the Travis AFB mailing list, government officials, representatives of interested community groups, and members of the media. Copies are available at three Solano County libraries for public review.

- **Public Meetings.** The Air Force held a 30-day public comment period for the WABOU Groundwater Proposed Plan (April 8, 1998 –May 8, 1998). The Air Force held a public meeting on the evening of April 23, 1998 to present the proposed remedial alternatives for WABOU groundwater sites. At this meeting, representatives from the Air Force, Cal-EPA/DTSC, and U.S. EPA were present to answer questions about the groundwater contamination. Questions and comments from the public and responses are included in Part III, the Responsiveness Summary.

2.2.7 Remedial Design/Remedial Action

The RD/RA will include the design and implementation of all actions specified in the Groundwater IROD. The regulatory agencies will be involved in the approval and oversight of the design and construction of the interim remedial actions. Experience gained through implementation of the interim remedial actions will allow for technically and economically feasible long-term remedial options in the final ROD for groundwater at Travis AFB.

The Air Force will submit the RD/RA schedule for implementing the IROD 21 days after signing the IROD in accordance with the FFA. The regulatory agencies will review and approve the RD/RA schedule, as well as all reports and actions specified in the RD/RA schedule. Section 5.4 presents the elements that will be included in the RD/RA schedule.

2.3 Pollution Prevention Branch

Travis AFB has an active Pollution Prevention Program that strives to reduce the generation of wastes through a hierarchy of actions. The actions range from the most preferred choice of source reduction, to recycling, treatment, and finally disposal as a last resort. The Pollution Prevention MAP (P2 MAP) defines the framework to accomplish these actions. The P2 MAP analyzes all processes that generate hazardous waste streams and performs opportunity assessments of potential pollution prevention options to reduce the volume and/or toxicity of generated wastes. This program includes minimizing wastes generated by sampling activities in the IRP.