412TH Test Wing
Edwards Air Force Base, California

Environmental Restoration Program

Site 29 Amendment to Operable Unit 2 Record of Decision

South Base

Final

July 2012

ENVIRONMENTAL RESTORATION PROGRAM

SITE 29
AMENDMENT TO
OPERABLE UNIT 2 RECORD OF DECISION
SOUTH BASE
EDWARDS AIR FORCE BASE
CALIFORNIA

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FINAL

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LIST OF ABBREVIATIONS AND ACRONYMS

>	greater than
%	percent
¶	*a linea* (off the line)
§	section
4,4'-DDD	dichlorodiphenyldichloroethane
4,4'-DDE	dichlorodiphenyldichloroethylene
4,4'-DDT	dichlorodiphenyltrichloroethane
412 TW/CEVR	412th Test Wing Civil Engineer Division Environmental Restoration
95 ABW/CETM	95th Air Base Wing, Civil Engineering Work Management Office Community Planning
95 ABW/CEVR	95th Air Base Wing, Environmental Restoration Branch
95 ABW/EMR	95th Air Base Wing, Environmental Restoration Division
ACM	asbestos-containing material
AECOM	AECOM Technical Services, Inc.
AF	Air Force
AFB	Air Force Base
AFCEE/ERD	U.S. Air Force Center for Environmental Excellence, Environmental Restoration Division
AFCEE/EXEW	Air Force Center for Engineering and the Environment, Environmental Programs Execution – West
AFCEE/ICE	Air Force Center for Engineering and the Environment/MAJCOM & Installation Support-CONUS (AFMC)
AFCEE/ISM	U.S. Air Force Center for Environmental Excellence, Installation Support, AFMC
AFFTC	Air Force Flight Test Center
AFFTC/EM	Air Force Flight Test Center, Environmental Management Directorate
AFFTC/EMR	Air Force Flight Test Center, Environmental Restoration Division
AFMC	Air Force Materiel Command
AM	Action Memorandum
ARARs	Applicable or Relevant and Appropriate Requirements
AVEK	Antelope Valley-East Kern Water Agency
bgs	below ground surface
BHC	benzene hexachloride (alpha, beta, gamma)
CA	California
CAI	closed, abandoned, or inactive
Cal/EPA	California Environmental Protection Agency
CalRecycle	California Department of Resources Recycling and Recovery
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDHS	California Department of Health Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued)*

CFR	Code of Federal Regulations
Ch.	Chapter
cm/sec	centimeters per second
CONUS	Continental United States
COPECs	Chemicals of Potential Ecological Concern
CSM	Conceptual Site Model
D	depth
Div.	Division
DTSC	Department of Toxic Substances Control
e.g.	*exempli gratia* (for example)
Earth Tech	Earth Tech, Inc.
ECOS-DoD	Environmental Council of States-Department of Defense)
EE/CA	Engineering Evaluation/Cost Analysis
EM	electromagnetic
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
et seq.	*et sequentes* (and the following)
FS	Feasibility Study
ft^2	square feet
ft	feet
ft bgs	feet below ground surface
GPR	ground penetrating radar
GPS	global positioning system
HERO	Office of Human and Ecological Risk
HHRA	Human Health Risk Assessment
i.e.	*id est* (that is)
ID	identification
IRA	Interim Removal Action
IRIS	Integrated Risk Information System
J.C. Palomar	J.C. Palomar Construction, Inc.
L	length
LDRs	Land Disposal Restrictions
LTM	long-term monitoring
LUCs	Land Use Controls
MCL	Maximum Contaminant Level
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MSL	mean sea level
N/A	not applicable
NCP	National Contingency Plan
No.	number
NP	not promulgated
OMB	Office of Management and Budget

LIST OF ABBREVIATIONS AND ACRONYMS *(Continued)*

OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
OU2	Operable Unit 2
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PERA	Predictive Ecological Risk Assessment
PRG	Preliminary Remediation Goal
QC	quality control
RA	Remedial Action
RACER™	Remedial Action Cost Engineering and Requirements
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
Rd	road
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SERA	Scoping Ecological Risk Assessment
STLC	soluble threshold limit concentration
SWAT	Solid Waste Assessment Test
SWRCB	State Water Resources Control Board
SVOCs	semivolatile organic compounds
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene
TTLC	total threshold limit concentration
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Society
UTS	universal treatment standard
UXO	unexploded ordnance
VOCs	volatile organic compounds
W	width
Water Board	California Regional Water Quality Control Board
yd^3	cubic yard

AUTHORIZING SIGNATURES AND SUPPORT AGENCY ACCEPTANCE OF REMEDY

Date 11 OCT 2012

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Date Sept 27, 2012

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The State of California, Department of Toxic Substances Control and the California Regional Water Quality Control Board, Lahontan Region had an opportunity to review and comment on this Record of Decision, and our concerns were addressed.

Date Oct. 16, 2012

ALLEN WOLFENDEN
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Date Oct. 25, 2012

PATRICIA Z. KOUYOUMDJIAN
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1.0 INTRODUCTION TO THE SITE AND STATEMENT OF PURPOSE

1.1 SITE NAME, LOCATION, AND DESCRIPTION

The site name is: Edwards Air Force Base (AFB) (Base), Kern, Los Angeles, and San Bernardino Counties, California (CA), United States Environmental Protection Agency (USEPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: CA1570024504.

To facilitate the administration of the Environmental Restoration Program (ERP) at Edwards AFB, the Base has been divided into ten Operable Units (OUs), which are used to group sites with similar site conditions and contaminants. This decision document addresses Site 29, South Base Abandoned Sanitary Landfill, which is located within South Base Operable Unit 2 (OU2).

Site 29 is located approximately 1.5 miles south of the western end of South Base Active Runway 06/24 and east of the former Sewage Treatment Facility (Building 190). The landfill is in an industrial area and surrounded by former and active evaporation ponds (Figure 1-1).

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision Amendment presents the revised selected remedy for Site 29, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by Superfund Amendments and Reauthorization Act (SARA) of 1986, and the CERCLA regulation the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA, 42 United States Code (USC) Section (§) 9617(c) and the NCP, 40 Code of Federal Regulations (CFR) § 300.435(c)(2)(ii) require the publication of an Amendment to the Record of Decision (ROD) if the differences in the remedial or enforcement action, settlement, or consent decree fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost.

This decision document is based on the Administrative Record File for Site 29 and will be made part of the Administrative Record File. The Administrative Record File is maintained at the 412th Test Wing Civil Engineer Division Environmental Restoration, 5 East Popson Avenue,

Edwards AFB, California 93524, and is available by appointment only, Monday through Friday, 8:00 a.m. to 4:30 p.m., by contacting Mr. Gary Hatch at (661) 277-4127.

The United States Air Force (USAF) as lead agency and the USEPA as support agency are selecting the remedy contained in this Record of Decision Amendment in concurrence with the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) and the California Regional Water Quality Control Board (Water Board), Lahontan Region as supporting agencies.

In March 2009, a document called the ROD was finalized for OU2, which contained a cleanup plan for Site 29 (Earth Tech, Inc. [Earth Tech 2009]). The plan included removal of surface waste, containing the buried waste in place, stormwater controls, implementing Land Use Controls (LUCs) to protect human health and the environment, and performing long-term monitoring and maintenance of the site. However, in 2010, geophysical and test pit data gathered during implementation of the 2008 and 2009 Remedial Actions (RAs) (documented in Section 2.8) indicates that the volume of buried waste is significantly less than originally projected and the risk of disturbing or removing the material is lower than previously thought because no hazardous materials were found in test pits. The Air Force re-evaluated remedy alternatives and concluded removing all the existing waste, not just the surface waste, would be more cost effective and more protective of human health and the environment.

1.3 SCOPE AND ROLE OF THE OPERABLE UNIT

Site 29, South Base Abandoned Sanitary Landfill, is considered part of OU2, the South Base Operable Unit. The proposed action for Site 29 is independent of any action being undertaken or proposed for other sites within OU2 or any other OU at Edwards AFB. Remedies for Sites 5/14, 76, and 86, which were also included in the OU2 ROD, are currently being implemented.

Interim Removal Action (IRA) alternatives for Site 29 were evaluated in an Engineering Evaluation/ Cost Analysis (EE/CA) (Earth Tech 1997) and Action Memorandum (AM) (Earth Tech 1998). Based on the results of this analysis, an eight-foot high chain-link fence was installed along the boundaries of the landfill to prevent unauthorized dumping and to limit site access.

2.0 SITE HISTORY, CHARACTERISTICS, CONTAMINATION, AND SELECTED REMEDY

2.1 SITE HISTORY

Site 29, South Base Abandoned Sanitary Landfill, is located near the southwestern shoreline of Rogers Dry Lake, near the former sewage treatment plant and inactive evaporation ponds (refer to Figure 2.7-1 of the OU2 ROD). The site covers approximately 38 acres and consists of two former landfills. The western portion of the site (west of County Road) encompasses approximately four acres, and the eastern portion of the site (east of County Road) encompasses approximately 34 acres (Figure 2-1). The older, Western Landfill area was active in the late 1930s. The newer, Eastern Landfill area was opened in the mid-1950s. Waste was deposited in the Eastern Landfill area until the 1970s.

Siting, design, operation, and recordkeeping practices were typical of the era. The waste was disposed in unlined trenches or pits and may have been covered each day by a layer of soil. Reportedly household and industrial wastes, construction rubble (mainly concrete and asphalt), and asbestos-containing materials were deposited at Site 29. There are anecdotal reports that the landfill may contain unexploded ordnance (UXO).

In 1985, construction rubble (mainly concrete and asphalt but also asbestos-containing material [ACM]) from the demolition of parts of South Base was placed over much of the ground surface of the Eastern Landfill. Only minimal surface debris was placed over the Western Landfill.

2.2 SITE TOPOGRAPHY AND SURFACE DRAINAGE

Site 29 is located in an area of little to no relief. The elevation at the site is approximately 2,280 feet above mean sea level (MSL). Surface drainage is limited to runoff during intense storm events and generally follows the slope of the site. Artificial drainage systems interrupt the pattern only slightly to divert surface runoff toward Rogers Dry Lake.

The inactive evaporation ponds in the area are usually dry; however, ephemeral ponds form after heavy rainfalls due to poor drainage. The terrain west and north of the site is poorly-drained stabilized dune

topography, with numerous small clay pans between the dunes that become shallow, ephemeral ponds after heavy rains.

2.3 SITE GEOLOGY

The geology at Site 29 consists of thick, unconsolidated sedimentary deposits comprised of silts, sands, clays, silty sands, clayey sands, gravels, and clayey gravels (refer to Figure 2.7-3 of the OU2 ROD). The sediments have been interpreted as eolian, playa, and lacustrine deposits (Dutcher and Worts 1963). Based on lithologic logs from Base water production wells in the area, the sediments are over 750 feet thick. Bedrock was not encountered while drilling any of the Base water wells near this site.

2.4 SITE HYDROGEOLOGY

Groundwater in monitoring wells at Site 29 is encountered at depths ranging from approximately 105 feet to 115 feet below ground surface (bgs) (Earth Tech 2007). Pumping at active Base production wells in the South Base Well Field approximately 0.8 miles to the southwest influences the groundwater flow direction at Site 29. A cone of depression with a steep hydraulic gradient has developed around the Base production wells; consequently, the groundwater flow direction in the area of Site 29 is toward the southwest (refer to Figure 2.7-2 of the OU2 ROD). Normal groundwater flow would be to the southeast.

2.5 ECOLOGICAL SETTING

Site 29 has been extensively disturbed and vegetation is sparse. The vegetation is 100 percent halophytic-phase saltbush scrub, while xerophytic-phase saltbush scrub and playa lakes are found within one kilometer of the site (United States Geological Survey [USGS] 2003). The Eastern Landfill area was covered with a combination of rubble piles and highly disturbed vegetation. Potential ecological receptors present at Site 29 include terrestrial plants, invertebrates, reptiles, small herbivorous mammals, granivorous and insectivorous birds, and raptorial avian species. The site was not revegetated after all surface debris was removed as part of a 2008 to 2009 RA (see Section 2.8); only sparse vegetation remains.

2.6 CURRENT AND FUTURE LAND AND RESOURCE USE

According to the *General Plan for Edwards AFB* (EAFB 2012), Site 29 is located in an area of the Base designated for "Miscellaneous Military Land" and "Other" uses, and the land use is categorized as Industrial. Future land use at Site 29 is expected to be similar to the existing land use.

The groundwater at Site 29 is within the cone of depression of the South Base Well Field, which, along with the Antelope Valley-East Kern Water Agency (AVEK) supplies drinking water to on Base facilities. AVEK, which also supplies drinking water to the surrounding communities of Lancaster, Palmdale, Rosamond, Mojave, California City, and Boron, gets its water from the California Aqueduct, not local wells. It is expected that the South Base Well Field will continue to be a source of drinking water supply to on Base facilities.

2.7 SUMMARY OF SITE INVESTIGATIONS

This section describes Remedial Investigations (RIs) conducted prior to implementation of the final remedy documented in the OU2 ROD. The results of the RIs are presented in Section 2.9.

2.7.1 REMEDIAL INVESTIGATIONS

This section presents a brief description of the RI activities conducted at Site 29. A more comprehensive discussion of the RI activities is presented in the South Base Feasibility Study (FS) (Earth Tech 2005a). The RI activities conducted to date include the following (presented in chronological order):

- In January 1990, three gas migration monitoring wells were installed in the eastern section of the landfill as part of an air Solid Waste Assessment Test (SWAT) to evaluate the potential for landfill gas migration (BSK & Associates 1990).
- In February 1992, a geophysical survey was conducted at Site 29 using magnetic and electromagnetic induction methods to delineate the boundaries of the two portions of the landfill.
- In May 1992, 40 soil gas points were installed around the perimeter of the landfill to evaluate possible contamination in soil and groundwater in or beneath the landfill.
- In July and August 1992, seven groundwater monitoring wells were installed around the perimeter of Site 29 in order to evaluate possible groundwater contamination from the

landfill. Soil samples were collected during the well installation. In September 1992, groundwater samples were collected from the monitoring wells, and two surface soil samples were collected at the southern perimeter of the landfill.

- In September 1993, groundwater samples were collected from the seven monitoring wells.
- In June 1994, three additional groundwater monitoring wells were installed at Site 29. Soil samples were collected during the installation of the wells. Groundwater samples were collected from the three newly installed monitoring wells in August and September 1994 and again in February 1995.
- In August 1996, 35 hand-augured boreholes were sampled to evaluate the potential risk due to contact with the surface soil. Soil samples were collected at the surface, one foot bgs, and two feet bgs or auger refusal.
- In June 1997, groundwater samples were collected from all 10 monitoring wells and rising head permeability tests were performed on four monitoring wells.
- In January 1998, groundwater samples were collected from all 10 monitoring wells.

Due to concerns over reports of the potential presence of UXO and access difficulty from surface debris/waste, no samples were collected from the waste within the landfill. In addition, due to the presence of the surface waste at the time of the RI, the areal extent and depth of subsurface waste could not be determined. Based on information existing prior to 2010, the total area of subsurface waste was estimated to be 25.2 acres based on review of historic aerial photographs and the conservative assumption that the footprint of the subsurface waste may be as large as the footprint of the surface debris piles. The volume of waste was estimated to be 490,000 cubic yards.

2.7.2 LONG-TERM GROUNDWATER MONITORING

Long-term groundwater monitoring at Site 29 began in January 1999, and occurred semiannually from 2000 through 2004 (Earth Tech 2002a, 2002b, 2003, 2004, and 2005b), and biennially in 2006 and 2008 (Earth Tech 2007 and AECOM Technical Services, Inc. [AECOM] 2009)). No volatile organic compounds (VOCs) other than acetone, a common laboratory contaminant, were detected in any of the groundwater monitoring wells sampled in 2008, and no metals were detected above background concentrations (AECOM 2009).

2.8 SUMMARY OF PREVIOUS REMOVAL AND REMEDIAL ACTIONS

Interim Removal Action (IRA) alternatives for Site 29 were evaluated in an EE/CA (Earth Tech 1997). Based on the results of this analysis, the recommended RAs included conducting groundwater monitoring to provide early warning of a chemical release to groundwater, and installing an eight-foot high chain-link fence along the boundaries of the landfill to prevent unauthorized dumping and to limit site access. Additionally, it was determined that ACM should be removed from the landfill surface for proper disposal.

Based on the recommendations in the EE/CA, the fence was installed in 1998, and the groundwater monitoring program was implemented in 1999. A total of 645 cubic yards of non-friable ACM and 15 cubic yards of friable ACM were removed from the site, and transported to the BDC Waste Management holding facility in Ventura, CA. Ambient air samples were collected from the perimeter of the work area during ACM removal. Analysis of the air samples indicated airborne fiber concentrations were below the Occupational Safety and Health Administration (OSHA) permissible exposure limit of 1.0 fiber per cubic centimeter (Earth Tech 1999).

To support the remedy proposed in the OU2 ROD, the Air Force conducted an RA to remove surface debris at Site 29. The RA was conducted in two phases. The first phase (pre-ROD) began September 16, 2008 and ended December 12, 2008; and the second phase (post-ROD) began October 13, 2009 and ended November 13, 2009. During the surface debris removal activities, concrete and asphalt debris were segregated, loaded into trucks, and transported to separate stockpile areas located west of Site 29. Metal, organic, and non-hazardous waste were segregated, loaded into dump trucks, and transported to the Edwards AFB Main Base Active Landfill for recycling and disposal. A total of 142,785 tons of concrete; 6,324 tons of asphalt; 688 tons of wood; 192 tons of metal; and 314 tons of other materials were removed from Site 29. Two trash cans filled with sodium bicarbonate (commonly used as an acid neutralizer) were encountered and taken to the Base Hazardous Waste Facility for identification and disposal. Several spent rocket casings (2.75-inch diameter) were found toward the southern end of the site. Work crews were moved out of the area, and the Base Command Post and the 95 ABW/CEVR OU2 Program Manager were notified. Base Explosive Ordnance Disposal (EOD) personnel went to the site to evaluate and make a determination of the potential Munitions and Explosives of Concern (MEC) items. After the items were evaluated as

non-hazardous, the casings were crushed (de-militarized) and sent to the Main Base Active Landfill for recycling as scrap metal. No ACM, hazardous waste, or stained soils were encountered during debris removal.

After surface debris removal was completed, the site was graded to smooth the uneven ground surface disturbed by the removal activities. The site was not revegetated after the RA; only sparse vegetation remains. A detailed description of the RA is provided in the Site 29 RA Report (AECOM 2010a).

2.9 NATURE AND EXTENT OF EXISTING CONTAMINATION

2.9.1 LANDFILL GAS AND SOIL VAPOR

Landfill gas is generated from the anaerobic decomposition of organic wastes, especially those which contain cellulose. No volatile organic gases or methane were detected in the landfill gas samples collected from three landfill gas probes located within the landfill boundary during the SWAT investigation that was performed in 1990. Low concentrations of solvents (trichloroethane [TCA], trichloroethene [TCE], and tetrachloroethene [PCE]), total volatile petroleum hydrocarbons, and aromatic hydrocarbons (benzene, toluene, ethylbenzene, and xylenes) were detected in the soil gas samples collected at the landfill perimeter in 1992. The source of the low concentrations of soil vapors may be volatilization of contaminants present in surface and subsurface soils or deteriorating containers of fuels or solvents. It should be noted, however, that no hazardous waste containers for products such as solvents, fuels, or other volatile contaminants of concern were found in the 57 test pits excavated to characterize waste cells and to explore geophysical anomalies near disturbed areas outside of cells (Section 3.2) so volatilization of contaminants in soils may be the more likely source.

2.9.2 SOIL

As described in the OU2 ROD, low concentrations of fuels, solvents, and pesticides were detected in surface and shallow soil samples collected at Site 29, but none were detected at concentrations exceeding Residential Preliminary Remediation Goals (PRGs) (USEPA 2000). Several metals were detected at concentrations exceeding the Residential PRGs and the background concentrations calculated for OU2. However, the overall risk from exposure to soils at Site 29 was evaluated to be acceptable

(Earth Tech 2008). For this ROD Amendment, Table 2.7-2 of the OU2 ROD was renamed Table 2-1 and updated to include comparisons of soil results at Site 29 to USEPA 2011 Regional Screening Levels (RSLs) yielding similar results.

Based on Total Designated Level methodology from the Regional Water Quality Control Board (RWQCB) – Central Valley Region, it was calculated that none of the contaminants detected in the soil samples collected at the abandoned landfill were at concentrations that could threaten the groundwater.

However, consistent with USEPA Office of Solid Waste and Emergency Response (OSWER) Presumptive Remedy guidance for municipal landfills (USEPA 1993) and the applicability of the guidance to military landfills (USEPA 1996), characterization of the landfill contents is only necessary or appropriate in limited cases. For this reason, and due to the presence of large quantities of surface debris that limited access to the subsurface with drilling equipment, soil sampling was limited to the upper two feet over the landfill surface (that is, soil cover materials) and no soil samples were collected within or below waste cells. Available information and field data indicated there was no need to investigate "hot spots". However, because sampling was limited, the presence of VOCs or other contaminants in the soils within the landfill boundary cannot be ruled out.

2.9.3 GROUNDWATER

In groundwater at Site 29, very low concentrations of organic compounds have been detected sporadically in the past, although there have not been any detections at concentrations above the Maximum Contaminant Levels (MCLs) (California Department of Health Services [CDHS] 2003) since May 2002. Trichloroethene (MCL of 5.0 μg/L) was detected at a maximum concentration of 7.2 μg/L in 1998 in a shallow discontinuous perched aquifer that is not a potential source of drinking water, however, this concentration declined to 4.2 μg/L in 2002. Metals have been detected in groundwater at concentrations above their MCLs and background concentrations for OU2, but only in the shallow discontinuous perched aquifer. The monitoring well (Monitoring Well 29-MW10) that was used to sample the shallow perched aquifer has been dry since 2006 (refer to Figure 2.7-5 of the OU2 ROD). No VOCs other than acetone, a common laboratory contaminant, were detected in any of the groundwater monitoring wells sampled in 2008, and no metals were detected above background concentrations (AECOM 2009).

2.10 DESCRIPTION OF PREVIOUSLY SELECTED REMEDY

Four alternatives were evaluated for Site 29 in the OU2 Proposed Plan (Earth Tech 2006) and ROD (Earth Tech 2009) to meet the Remedial Action Objectives (RAOs):

1. No Action. There is no cost associated with this alternative.

2. Land Use Controls, Stormwater Controls, and Long-term Monitoring. This alternative was estimated to cost $2.3 million over 30 years.

3. Removal of Recently Emplaced Surface Debris, Land Use Controls, Stormwater Controls, and Long-term Monitoring (Selected Alternative). This alternative was estimated to cost $4.4 million over 30 years.

4. Engineered Landfill Cover Constructed with On-Base Borrow Soil, Land Use Controls, and Long-term Monitoring. This alternative was estimated to cost $11 million over 30 years.

Alternative 3 was selected in the OU2 ROD as the plan which best addressed the Site 29 RAOs. This plan includes the following elements:

1. Using the existing landfill cover to contain the buried municipal waste;

2. Removing the surface debris that was deposited on the landfill cover in 1985;

3. Covering with soil any buried municipal waste in the landfill that may be exposed by the removal of the surface debris. The thickness of the soil cover shall be consistent with the existing landfill cover;

4. Regrading the landfill to fill in depressions that could cause significant ponding;

5. Applying soil stabilizer to the surface of the site after the debris has been removed, and allowing the site to naturally revegetate;

6. Enhancing the stormwater management system by installing additional stormwater drainage channels and improving existing drainage channels;

7. Using existing groundwater wells to perform groundwater monitoring at least biennially (i.e., every other year);

8. Using existing fences to provide access controls; and

9. Implementing and maintaining LUCs (signs, fences, and restrictions to site access) to prevent contact with the buried waste and prevent the unauthorized disposal of wastes.

3.0 BASIS FOR THE DOCUMENT

The following subsections describe the basis for the decision to revise the selected remedy.

3.1 PRE-DESIGN INVESTIGATION

After the OU2 ROD was finalized, and the surface waste was removed, the Air Force performed a Pre-design Investigation, which included a topographic land survey, geophysical survey, and test pit survey, to refine the nature and extent of subsurface waste remaining at the site so that a final grading plan for the site could be developed. The results of the investigation are documented in the Site 29 Subsurface Debris Investigation and Feasibility Study Addendum (FS Addendum) (AECOM 2010b) and are summarized below.

3.1.1 GEOPHYSICAL SURVEY

A geophysical survey of the Eastern Landfill was conducted from November 4 to November 20, 2009. Two complementary subsurface geophysical techniques, ground penetrating radar (GPR) and electromagnetic (EM) techniques, were used to detect subsurface metal and non-metal debris. The approximate penetration depths of the GPR and EM techniques are 5-feet and 13-feet, respectively. GPR was used to detect changes in the dielectric and conductive properties of the subsurface, which may be caused by non-native objects such as ceramics, concrete, and wood. The EM method was used to detect ferrous and non-ferrous metal objects buried at the site.

The data collected from the geophysical survey were interpreted to define five distinct potential subsurface debris areas throughout the Eastern Landfill area, as shown on Figure 3-1. These areas encompass approximately 33 percent of the Eastern Landfill area. The geophysical survey also indicated that small pieces of shallow metal debris are scattered throughout the site. A geophysical survey was not performed in the Western Landfill area because debris was visible throughout the area.

3.1.2 LAND SURVEY

After the surface debris was removed from the eastern portion of Site 29, a topographic land survey was performed to establish surface elevations, map physical site features, and establish horizontal and vertical control for the site. The topographic survey was performed in December 2009, under the

supervision of a registered land surveyor licensed in the State of California. The basis of bearing for the survey was established with a static global positioning system (GPS) survey tied to continuously operating reference stations, and based on the California State Plane Coordinate System, Zone 5, North American Datum 1983. Vertical control was established by tying into a benchmark located at the junction of Sage Street and Hospital Road. Elevation was referenced to the North American Vertical Datum 1988. Vertical and horizontal survey data were collected using a 50-foot grid, and at elevation break points throughout the site. These data were used to produce a site survey map showing contours at 0.5-foot intervals and other physical site features. Nine temporary benchmarks were set within the site boundary or near the site to establish horizontal and vertical control for future activities.

3.1.3 TEST PIT INVESTIGATION

A test pit investigation was conducted following the geophysical and land surveys to further define the composition, areal extent, and depth of the subsurface debris. The investigation was conducted between February 1 and February 5, 2010. The test pits were excavated with a backhoe to depths ranging from 4.5 to 12 feet. After each test pit was excavated and logged, it was backfilled with the subsurface materials removed from the pit, which were compacted during backfilling activities. No soil samples were collected.

Personnel working at the site received MEC awareness training prior to the test pit investigation. If suspected MEC was encountered during the investigation, activities would have been halted and the Base Program Manager for OU2 would have been notified. Based on the description of the suspected MEC, the Base Program Manager could have dispatched EOD personnel to the site if required.

Data collected from the geophysical survey were interpreted to designate the locations of the primary test pits in the Eastern Landfill, with an emphasis being placed on confirming the interpreted subsurface debris areas. In general, the primary test pits were located within the five subsurface debris areas identified in the Geophysical Survey Report (Figure 3-1). Some primary test pits were located outside of these five areas to investigate isolated geophysical anomalies. The four test pits located in the Western Landfill area were based on disturbed areas observed on historical aerial photographs. A total of 26 test pit locations were planned prior to mobilization based on anomalies (both metal and

non-metal) found during the geophysical survey. The northeast corner of each test pit location was surveyed with a handheld GPS instrument.

If subsurface debris was found, secondary test pits were excavated to delineate the area of subsurface debris. The locations of these secondary test pits were chosen based on field observations, including where, horizontally and vertically, the debris was encountered, as well as the thickness of the debris in the initial test pit. Primary and secondary test pit locations are shown on Figure 3-2.

Test pits were excavated to depths ranging from 4.5 feet to 12 feet bgs using a backhoe. If no subsurface debris was encountered, test pits were excavated to native clay or native dense, semi-cemented sand. If subsurface debris was encountered, the excavation was terminated after reaching native clay or sand, unless otherwise noted. Logging of test pits was conducted during excavation, recording soil lithology and debris dimensions and characteristics.

A total of 57 test pits were excavated at Site 29. Seven test pits were excavated in the Western Landfill area and 50 test pits were excavated in the Eastern Landfill area. Of the primary 26 test pits excavated, eight contained subsurface debris and required additional delineation with secondary test pits. Two test pits were terminated due to sloughing of the sidewalls at the bottom of the excavation, therefore the depth of waste in these test pits could not be directly determined.

3.2 NATURE AND EXTENT OF REMAINING SUBSURFACE DEBRIS AND CONTAMINATED SOILS

The five areas that potentially contained waste based on the geophysical survey were reduced to four areas based on the results of test pit excavations confirmed by areas of disturbance shown in historic aerial photographs. These areas are referred to as Area A, Area B, Area C, and Area D, and are shown on Figure 3-2.

Test pits excavated in the geophysical survey designated Areas #2 and #3, shown on Figure 3-1, uncovered no subsurface debris. The majority of Areas #2 and #3 consist of stabilized dune deposits with mature Joshua trees growing on them. In addition, no evidence of disposal trenches in Areas #2 and #3 was observed on the historical aerial photographs (AECOM 2010b). For these reasons,

Areas #2 and #3 are excluded from the areas thought to contain subsurface debris. Area #4 was divided into two, non-contiguous areas.

A summary of the investigation results from each test pit is presented in Table 3-1. The same general type of subsurface debris was encountered in both the Eastern and Western Landfill areas. The majority of the debris encountered consisted of glass bottles and scrap metal. Some test pits contained ceramics, charred paper, and charred and uncharred wood, in addition to the aforementioned items. According to the Base Archeologist, the subsurface debris in the Western Landfill contained glass bottles from as early as the mid-1940s, while the subsurface debris found in the Eastern Landfill contained glass bottles from as early as the mid-1950s. No hazardous waste or MEC was encountered. However, three empty 0.5 inch by 4.0 inch shell casings (munitions debris) and a concrete shape with metal lugs that may have been used as a practice bomb were encountered in the test pits.

A summary of the estimated total volumes of subsurface debris at Site 29 is presented in Table 3-2. Minimal stratification of soil and waste layers was observed during excavation of the test pits. In general, soil and waste were comingled throughout the depth of the waste layers. Based on visual observations made during the test pit investigation, the zones of subsurface debris consist of approximately 60 percent debris mixed with 40 percent soil.

The areal extent of the subsurface waste is now estimated to be only 3.8 acres. The maximum measurable depth that waste was encountered was 12 feet below ground surface. The maximum measurable thickness of the waste layer encountered was six feet. At two of 57 test pit locations, (Test Pits 29-TP08I and 29-TP21), the depth to the bottom of the waste could not be measured due to sloughing of the sidewalls at the bottom of the excavation, but the areas with undetermined depths are relatively small and the EM geophysical survey appears to support the overall test pit results of shallow burial depths. The estimated total volume of subsurface debris mixed with soil in the Western and Eastern Landfill areas is approximately 21,711 cubic yards (yd^3). This is substantially less than the original estimate of 490,000 yd^3. Because there was no recordkeeping for the landfill, the original estimates relied on interpretations of aerial photographs and assumptions that the footprint of the subsurface debris matched the footprint of the observed surface debris. This resulted in an overestimation of the buried waste present at the site.

In addition, a significant amount of soil and surface debris was removed from the central portion the Eastern Landfill during the surface debris RA activities conducted during 2008 and 2009. As shown on Figure 3-2, soil and debris (primarily concrete) were removed to a depth of approximately five feet below the existing ground surface near the perimeter fence adjacent to County Road because there was no delineation between what would have been surface debris and the shallow buried debris.

No soil samples were collected during the test pit sampling, therefore the quantity of contaminated soils at the site is not known. However, because no containers of hazardous waste were found during the investigation, the volume of contaminated soils is expected to be low. Nevertheless, because 100 percent of the refuse was not sampled, intact containers of hazardous substances could be present in the landfill. These containers could deteriorate, causing a future release of liquid or volatile waste.

3.3 SUMMARY OF SITE RISKS

The Air Force estimated risk to potential human receptors (people) and potential ecological receptors (plants and animals) based on data from the pre-ROD RI. Risk was calculated for residents, industrial workers, and construction workers. Each of these potential receptor types would use the site in different ways resulting in different types (paths) of exposure and durations of exposures to Contaminants of Concern. The findings of the Human Health and Ecological Risk Assessments for Site 29 are included in the OU2 ROD and are summarized below.

3.3.1 HUMAN HEALTH RISK

Human Health Risk Assessments (HHRAs) are conducted to evaluate the potential risk to human health to people living or working at a site, or in the area impacted by a site. Depending upon the nature and extent of the contamination, these people could potentially be exposed to the contaminants in the soil, groundwater, or air through ingestion, skin contact, or inhalation.

The calculated cancer risk estimates the probability that additional cases of cancer may develop within a population if the people are exposed to the contaminated soil or groundwater. For noncancer effects, a Hazard Index is calculated, which is a numerical expression that indicates whether the concentrations of chemicals are likely to result in specific toxic effects.

To manage the environmental risks, the USEPA has developed the following ranges: more than one additional cancer case for 10,000 people is considered unacceptable; one additional cancer case for 10,000 to one million people is considered to be in the risk management range. A Hazard Index less than 1 is considered acceptable.

For Site 29, all risk scenarios for cancer risks and noncancer hazards, including risks to future residents and industrial workers exposed to soils and future residents exposed to groundwater, were found to be either acceptable or within the risk management range (Table 3-3).

Although there are no current risk drivers requiring the waste to be excavated, it should be noted that these risk calculations are based on samples collected at the landfill surface (upper two feet), not within or below waste cells. Soil gas sampling indicated that there may be solvents (TCA, TCE, and PCE), total volatile petroleum hydrocarbons, and aromatic hydrocarbons (benzene, toluene, ethylbenzene, and xylenes) volatilizing off soils at the site, and groundwater results indicate that there may be a source of TCE present in the landfill although data indicate the source is relatively low-level and isolated. Although no asbestos containing materials were encountered during test pit excavation, due to their presence in the surface debris, the presence of these materials in the subsurface cannot be ruled out.

In addition, *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills* (USEPA 1996) states: "The waste most frequently deposited at these military landfills were municipal-type wastes; household, commercial (e.g., hospital wastes, grease, construction debris), and industrial (e.g., process wastes, solvents, paints) wastes." There is evidence that fuels and solvents were disposed at other landfills at Edwards AFB such as the Main Base Inactive Landfill (Site 3), which started accepting waste after the closure of Site 29. If containers of industrial waste are present in the waste cells at Site 29, and these containers degrade and release hazardous substances to the soil and groundwater in the future, the assessment of risk to human health and the environment could change.

Landfill gas is generated from the anaerobic decomposition of organic wastes, especially those which contain cellulose. Because the types of wastes that were encountered during test pit sampling (mostly metal, glass, and concrete) do not have the potential to generate landfill gas, and no landfill gas was detected at the site in the past, there is no current or future risk from explosive hazards from landfill gas. There may, however, be a future explosive risk from MEC. Although the munitions debris items

(spent rocket casings, spent shells, and concrete shapes) found at the site were non-hazardous, and no MEC was found, it is possible that munitions debris items were deposited in the landfill that do pose an explosive hazard.

3.3.2 ECOLOGICAL RISK

Ecological risk assessment is the process for evaluating how likely it is that the environment may be impacted as a result of exposure to one or more environmental stressors such as chemicals or changes in habitat. Ecological risk assessments are conducted using a phased approach.

A Scoping Ecological Risk Assessment (SERA) (USGS 2003) was conducted for Site 29 to select Chemicals of Potential Ecological Concern (COPECs) and determine whether complete or potentially complete exposure pathways exist between site-related contaminants and potential ecological receptors at the site. Based on the results of the SERA, a number of chemicals were found in site media at concentrations exceeding conservative screening benchmarks and were identified as COPECs. As a result, a limited Predictive Ecological Risk Assessment (PERA) was conducted for Site 29 to provide a more quantitative assessment of the exposure and effects of the COPECs in the environment on potential ecological receptors (Tetra Tech, Inc. [Tetra Tech] 2004).

The PERA used site-specific data from applicable media (e.g., soil, groundwater, and soil vapor) in plant and animal exposure models to quantify the potential risk to potential ecological receptor groups.

Potential risks to the following receptor groups at Site 29 were calculated in the PERA:

- Terrestrial plants.
- Terrestrial invertebrates.
- Reptiles (herbivorous, omnivorous).
- Birds (granivorous, invertivorous, carnivorous, and burrowing carnivorous birds and raptors).
- Mammals (burrowing herbivorous, omnivorous, and carnivorous).

The PERA concluded that there could be some potential risk to terrestrial plants, omnivorous reptiles, granivorous birds, invertivorous birds, carnivorous and burrowing carnivorous bird and raptors, and

burrowing herbivorous and omnivorous small mammals that live at or use the site. This conclusion was driven primarily by the detections of cadmium, lead, and zinc in nine to 12 percent of the soil samples collected at the landfill surface at concentrations that exceed the naturally occurring background concentrations. However, the contaminants are limited to small isolated areas, and it was concluded that there is no consistent and substantial risk to the plant and animal communities as a whole from the contaminants. In addition, the removal of all surface debris from the landfill as part of the recent RA also resulted in removal of the source of the surface contamination and resulted in considerable disturbance of surface soils, so past sampling results may overstate the current risk.

3.3.3 THREAT TO GROUNDWATER OR SURFACE WATER

TCE, a CERCLA hazardous substance, has been found in the past in the groundwater at this site at a maximum concentration of 7.2 μg/L in 1998. Because waste that may contain potential hazardous contaminants remains in unlined landfill cells at Site 29, there is a potential for future movement of contaminants from the landfill waste to groundwater. There is no surface water present in the vicinity of Site 29.

3.4 CHANGES TO THE CONCEPTUAL SITE MODEL

The Conceptual Site Model (CSM) for Site 29 is discussed in the OU2 ROD (Earth Tech 2009). The ROD concluded that the soil and groundwater present at Site 29 do not pose an unacceptable human health risk by either direct contact with soils, drinking or showering in the groundwater, or inhaling soil particles or volatile gases from soil or groundwater. However, as discussed in Section 3.3, the risk calculations were based on samples collected at the landfill surface (upper two feet), not within or below the waste cells; therefore the risk from soils at the site may be underestimated.

Because buried waste is present at the site, it is possible that containers of hazardous wastes such as waste oils, solvents, or pesticides could be present in the buried debris in areas not directly sampled by the test pits. If present, these hazardous wastes could be released if the containers holding them rust or otherwise decompose. Hazardous wastes could also be released to soils if metal objects degrade.

Although no explosively configured munitions debris was unearthed during test pit sampling, non-explosive munitions items were found, so the presence of MEC cannot be ruled out. MEC could create a physical hazard if unearthed.

The contents of the landfill could potentially leak. If the site drainage and soil covers are not well-maintained, stormwater may get into the waste and gradually wash contaminants down through the soil and possibly to groundwater. People could also be exposed to contaminants if they dig or drill into the waste without taking proper precautions. For this reason, there is a potential threat of a release of hazardous substances, and an RA is required under CERCLA to protect human health and animals.

No changes to the Exposure Pathways Retained for CERCLA Response are proposed as a result of the Pre-design Investigation. Pathways retained for CERCLA response are presented in Figure 3-3. Landfilled wastes are identified as a potential threat, albeit slight, to groundwater, and direct contact with landfilled wastes or potentially contaminated soils beneath such wastes could cause a threat to humans or animals. However, due to the limited extent and mostly inert nature of the waste, these threats are lower than previously evaluated. The risks associated with removing the observed waste types are manageable.

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES OR NEW ALTERNATIVES

Based on the small quantities of subsurface debris encountered at the site after completion of the surface debris RA and on the types of wastes observed in the test pits, the Air Force believes that it is both more protective of human health and the environment and more cost effective to remove all solid waste that could include potentially hazardous waste and CERCLA hazardous substances and clean-close Site 29. The extent of subsurface debris could not be accurately defined prior to the FS because of the large volume of construction and demolition debris on the landfill surface. This resulted in an overestimation of the volume of subsurface debris. Therefore, clean closure was not included in the original *Operable Unit 2 Feasibility Study* (Earth Tech 2005a).

4.1 CHANGES TO REMEDIAL ACTION OBJECTIVES

The existing RAOs listed in the OU2 ROD (Earth Tech 2009) were based on the CSM as understood at the time of ROD development and were to:

1. Protect human health and animals by preventing direct contact with landfill wastes or any associated contaminated soils, which could potentially contain physical or chemical hazards;

2. Protect groundwater by preventing contaminant migration from the buried waste to groundwater;

3. Protect groundwater by controlling surface water runoff and erosion that may allow the infiltration of stormwater into the landfill to a degree that would cause subsequent migration of landfill contaminants to groundwater; and

4. Protect human health by preventing human inhalation of a future release of VOCs that could potentially produce concentrations of contaminants in indoor air in future construction to levels exceeding those listed in Table 2.6-8 [of OU2 ROD].

RAO #3 was included in the ROD based on the presumptive remedy guidance (USEPA 1993) and the assumption that the presumptive remedy was highly applicable based on the potential footprint, volume, and nature of subsurface waste. This RAO is specific to closure in place remedies, because controlling runoff and erosion to prevent infiltration of water into landfill waste cells to mitigate migration to groundwater assumes contamination remains on site. It is effectively a subset objective to RAO #2,

which broadly protects groundwater by preventing migration of contaminants from the waste. The new remedy addresses the core issue underlying RAO #2 and RAO #3, protection of likely receptors from unacceptable exposures to future potential groundwater contamination, based on the latest understanding of nature and extent. For these reasons, RAO #3 will be deleted.

4.2 APPLICABILITY OF PRESUMPTIVE REMEDY TO SITE 29

Presumptive Remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and the USEPA's scientific and engineering evaluation of performance data on technology implementation. The USEPA has evaluated technologies that have been consistently selected at past sites using the remedy selection criteria set out in the NCP; reviewed currently available performance data on the application of these technologies; and has determined that a particular remedy, or set of remedies, is presumptively the most appropriate for addressing specific types of sites. Presumptive remedies are expected to be used at all appropriate sites.

As stated in the Presumptive Remedy for CERCLA Municipal Landfill Sites (USEPA 1993), "Consistent with the NCP, the EPA's expectation was that containment technologies generally would be appropriate for municipal landfill waste because the volume and heterogeneity of the waste generally make treatment impracticable."

In addition, the EPA's guidance document, *Application of the CERCLA Municipal Landfill Presumptive Remedy Guidance to Military Landfills* (USEPA 1996) lists six questions that should be addressed to evaluate if the presumptive remedy can apply to military landfills. An evaluation of these questions as they pertain to Site 29 is discussed below:

1. **What Information Should Be Collected?** The guidance indicates that information on the sources, types, and volumes of landfill wastes should be sufficient to determine whether source containment is the appropriate remedy for the landfill.

   Evaluation: The evaluation of historic records, aerial photographs, geophysical surveys, and test pit logs contained in this report provides sufficient information to determine if source containment is an appropriate remedy for Site 29.

2. **How May Land Reuse Plans Affect Remedy Selection?** The guidance indicates that for smaller landfills, (generally less than two acres), excavation could be considered as an option in addition to containment depending upon land reuse plans.

Evaluation: According to the Base General Plan there are no current plans to use the land at Site 29 for anything but its current purpose. However, although the acreage of the landfill (3.78 acres) is in excess of what the guidance indicates is suitable for excavation, the volume of the waste (21,711 cubic yards) is less than the 100,000 cubic yards deemed suitable for excavation (see Question 5, below).

3. **Do Landfill Contents Meet Municipal Landfill-Type Waste Definition?** To determine whether a specific military landfill is appropriate for application of the containment presumptive remedy, compare the characteristics of the wastes present in the landfill to typical municipal landfill wastes listed in the guidance.

   Evaluation: As indicated on Table 3-1, mostly glass bottles and scrap metal were found during excavation of test pits, which is not typical of municipal type waste.

4. **Are Military-Specific Wastes Present?** Military wastes (i.e., wastes specific to military bases), especially high-hazard military wastes (such as explosively configured munitions or chemical warfare materiel), may possess unique safety, risk, and toxicity characteristics.

   Evaluation: No dangerous wastes of a military nature, or other high-hazard wastes, were found at Site 29, suggesting a relatively low hazard to excavate the site. However, precautions would need to be taken, including the use of a UXO-qualified technician to assess the waste as it is excavated.

5. **Is Excavation of Contents Practical?** Although no set excavation volume limit exists, landfills with a content of more than 100,000 cubic yards (approximately two acres, 30 feet deep) would normally not be considered for excavation.

   Evaluation: Due to the estimated volume of waste (21,711 cubic yards), excavation is considered practical. Although the total lateral extent of waste is 3.8 acres, the waste deposits are relatively shallow and restoration of the four excavation areas is considered practical.

6. **Can the Presumptive Remedy Be Used?**

   Evaluation: The available information indicates that the presumptive remedy can be used at Site 29; however, clean closure is also practical.

The presumptive remedy was selected in the OU2 ROD for Site 29 ROD, but was subsequently ruled out after the 2008-2009 RA demonstrated that the volume and type of waste at Site 29 is suitable for removal for recycling, treatment, and disposal to achieve clean closure.

4.3 DESCRIPTION OF NEWLY SELECTED REMEDY

The Pre-design Investigation of the extent and character of the subsurface waste following surface waste removal indicated the footprint and volume of subsurface waste is much smaller than previously expected. Based on the results of the Pre-design Investigation, the Air Force re-evaluated remedial alternatives and determined a new remedial approach is warranted.

The Air Force believes that it is both more protective of human health and the environment, and more cost effective to remove all subsurface waste (removal of surface waste has already been completed) and clean close Site 29, returning the site to unlimited use approved for unrestricted exposure with No Further Action required.

Soil cleanup levels are provided in Table 4-1. With the exception of compounds identified in bold type, the cleanup levels are based on the Air Force's interpretation and application of the 23 April 2007 issue paper developed by DoD and the Environmental Council of States (ECOS), *Identification and Selection of Values/Criteria for CERCLA and Hazardous Waste Site Risk Assessments in the Absence of IRIS Values* (ECOS-DoD 2007), pertaining to the selection of toxicity values. The parties disagree on the correct interpretation and application of this ECOS-DoD issue paper. The State of California has developed more protective toxicity criteria for selected constituents shown in Table 4-1. Using the California criteria results in more protective cleanup levels than those proposed by the Air Force based on the above-referenced toxicity guidance memorandum.

To avoid a lengthy dispute and facilitate the timely implementation of a remedy that all parties believe is protective of human health and the environment, for those constituents where the Air Force and the State of California toxicity criteria differ, the Air Force, USEPA and Cal/EPA DTSC have agreed to cleanup levels at the mid-point (bolded levels in Table 4-1) between the preferred values of the Air Force and State of California. The Cal/EPA DTSC agreement is based on the site's particular attributes (remote location, and controlled human access, use, and exposure); and relies on the fact that the resulting, estimated cumulative risk is in the lower end of the risk management range. This is consistent with State of California policy for managing human health risk. The agreement of the parties to this compromise approach is site-specific and does not set a precedent for any other Air Force site.

Also, to account for background conditions, cleanup levels in Table 4-1 are no lower than calculated background concentrations.

The new proposed remedy would include removal of all waste, waste residues, and contaminated subsurface soils (if encountered) from Site 29. Procedures for waste removal would be specified in a new Site 29 RA Work Plan and would include the following:

1. **Removal of all non-inert waste, waste residues, and contaminated subsoils (if encountered).** Procedures for waste removal will be specified in the new Site 29 RA Work Plan and will include the following (addresses RAOs #s 1, 2, and 4)**:**

    a. All wastes will be excavated from the site. A UXO-qualified technician will inspect the wastes as they are excavated from the site for the presence of MEC. MEC, if encountered, will be disposed by Base EOD personnel. Materials suspected of containing asbestos will be segregated, tested for asbestos, and if found to contain asbestos, disposed at a licensed facility.

    b. Contaminated soils will be excavated and taken under manifest to a permitted off-site facility for treatment and disposal. The bottoms and sidewalls of excavations will be sampled to ensure that no soil contamination remains at the site at levels that pose a risk to groundwater or pose an unacceptable risk to human health or the environment. All samples will be analyzed for VOCs, semivolatile organic compounds (SVOCs), metals and other elements, polychlorinated biphenyls, and pesticides. In addition, samples collected from excavations where there is evidence of burning will be analyzed for dioxins/furans. Analytical results will be screened against the November 2011 USEPA residential RSLs (USEPA 2011) provided in Table 4-1, except in cases where the State of California has a recommended value under the Human and Ecological Risk Office (HERO) HHRA Note #3 (California DTSC 2011), where a mid-point value between the USEPA and Cal/EPA DTSC values will be used. Analytical results for metals or other elements will also be statistically evaluated against calculated background concentrations shown in Table 4-1. Excavation will continue until soil sample concentrations do not exceed the levels provided in Table 4-1, if practicable. If soil sample concentrations exceed the levels provided in Table 4-1 after all feasible soil excavations have been completed, a supplemental risk assessment will be conducted to evaluate whether LUCs are required at Site 29.

    c. Wastes commingled with soils will be segregated using a shaker screen. Soils will be stockpiled and sampled. Non-contaminated soils will be returned to the site. Contaminated subsurface soils will be taken to a permitted off-site facility for treatment. Recyclable waste will be taken to the Main Base Active Landfill Recycling Center.

    d. Non-recyclable waste will be taken to the Base Hazardous Waste Storage Facility. Base personnel will determine if this refuse may be disposed at the Main Base Active

Landfill. Any refuse that may not be disposed at the Main Base Active Landfill will be taken to a permitted off-site treatment and/or disposal facility.

e. A geophysical survey will be conducted at the end of excavation activities to confirm that buried waste has been removed from all areas of the site.

2. **Site restoration to return Site 29 to natural conditions.** Procedures for site restoration will be specified in the new Site 29 RA Work Plan and will include the following:

   a. The fence surrounding the site will be removed.

   b. Clean fill will be added as required and the site will be regraded to eliminate potholes and pitfalls and to restore the natural drainage of the area.

   c. All groundwater monitoring wells will be destroyed pursuant to California Department of Water Resources Bulletin 74-81, Water Well Standards: State of California, dated December 1981, and Bulletin 74-90, California Well Standards, dated June 1991.

   d. The site will be allowed to naturally revegetate.

4.4 COST OF NEWLY SELECTED REMEDY

The estimated present value cost of clean closure is $2.4 million (including the $0.9 million cost of the surface debris removal that has already been completed), and the cleanup would be completed in one year.

Remedial Action Cost Engineering and Requirements (RACER™) estimates were prepared to evaluate the cost of the previously selected remedy and clean closure (Appendix B). RACER™ Version 10.2 was used for both cost estimates to ensure consistency in unit rates for both alternatives. Both estimates assume that Remedial Design would be conducted in 2011, and field activities would be conducted in 2012. Both cost estimates assume zero escalation and a discount rate of 2.7 percent.

The cost estimate for the previously selected remedy was also revised to reflect current site conditions and current regulator guidance for preparing the estimates. The cost of enhancements to the existing cover were not included in the original cost estimate but are now included to fulfill the requirement in the OU2 ROD for the cover to be protective of groundwater quality. It was assumed that four acres would require improvement of the existing cover to ensure protection of groundwater quality. In

addition, at the request of the USEPA, long-term monitoring and maintenance costs for the landfill have been extended to 200 years versus the 30 years assumed in the OU2 ROD.

The estimated present value cost of the previously selected remedy is now $5.3 million, compared to the $3.3 million estimate contained in the OU2 ROD. This includes capital costs for the RA, and costs for LUCs and long-term monitoring. The estimated present value cost of clean closure is $2.4 million. This includes capital costs associated with waste removal, confirmation sampling, and site restoration. The cost of the previously selected remedy does not include the cost related to the loss of beneficial use of Site 29. A cost comparison of the previously selected remedy and clean closure is presented in Table 4-2. A detailed cost estimate is provided in Appendix G of the FS Addendum.

4.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Appendix A contains a summary of the Applicable or Relevant and Appropriate Requirements (ARARs) that would be required for clean closure. In particular, portions of California Code of Regulations (CCR) Title 27 addressing closure of closed, abandoned, or inactive (CAI) landfill sites were considered relevant and appropriate to the selected remedy. The following non-administrative portions of the following text from CCR Title 27 are considered relevant and appropriate to the clean closure of Site 29:

> *§20380. SWRCB - Applicability. (C15: §2550.0)*
>
> *(a) The regulations in this article apply to owners or operators of facilities that treat, store, or dispose of waste at waste management units. The owner or operator of a surface impoundment, waste pile, landfill, or land treatment unit that receives or has received waste (hereinafter referred to as "waste management units," or "Units") that is subject to the SWRCB-promulgated requirements of this division, pursuant to §§20080 and 20090 shall comply with the provisions of this article for purposes of detecting, characterizing, and responding to releases to ground water, surface water, or the unsaturated zone. Furthermore, §20400 of this article also applies to all determinations of alternative cleanup levels for unpermitted discharges to land of solid waste, pursuant to ¶III.G. of SWRCB Resolution No. 92-49 [§2550.4 of Title 23 of this code serves a similar function for unpermitted discharges to land of hazardous waste].*
>
> *(d) Apply Unless Clean-Closed — The regulations under this article apply during the Unit's active life and closure period. After closure of the Unit, the regulations in this article apply during the post closure maintenance period of the Unit and during any compliance period under §20410 of this article, unless:*

(1) the Unit has been in compliance with the water quality protection standard ("Water Standard" of §20390) for a period of three consecutive years; and

(2) Clean-Closure — all waste, waste residues, contaminated containment system components, contaminated subsoils, and all other contaminated materials are removed or decontaminated at closure, pursuant to: §21090(f), for landfills; §21400(b)(1), for surface impoundments; or §21410(a)(1), for waste piles.

§21090. SWRCB - Closure and Post-Closure Maintenance Requirements for Solid Waste Landfills.

(f) Optional Clean-Closure — Notwithstanding any other SWRCB-promulgated closure or post-closure maintenance requirement in this subdivision, a discharger proposing to clean-close a landfill shall submit a clean-closure plan meeting the requirements of this subsection. [Note: see also CIWMB's additional landfill clean-closure requirements under §21810.] The purpose of clean-closure is to render the landfill (including all surrounding environs contaminated by waste released from the landfill) no longer capable of posing a threat to water quality. The purpose of a clean-closure plan is to propose a series of actions, including an accurate estimate of the cost of each such action, that will meet the requirements of this paragraph. Upon the RWQCB's finding that the discharger has successfully completed clean-closure under this paragraph, the landfill shall no longer be subject to the SWRCB-promulgated requirements of this title. Nevertheless, if the RWQCB finds that the discharger's attempt to clean-close the landfill does not meet the requirements of this subsection, the discharger shall close the landfill and carry out post-closure maintenance in the same manner as though the discharger had not attempted clean-closure. For the purpose of this paragraph, the discharger shall have successfully clean-closed a landfill only if:

(1) all waste materials, contaminated components of the containment system, and affected geologic materials — including soils and rock beneath and surrounding the Unit, and ground water polluted by a release from the Unit — are either removed and discharged to an appropriate Unit or treated to the extent that the RWQCB finds they no longer pose a threat to water quality; and

(2) all remaining containment features are inspected for contamination and, if contaminated, discharged in accordance with ¶(f)(1).

4.6 CHANGES IN EXPECTED OUTCOMES

Based on the small quantities of subsurface debris encountered at the site during the test pit investigation, and the nature of the waste observed in the test pits, the Air Force believes that it is both more protective of human health and the environment and more cost effective to remove all subsurface debris and clean close Site 29 than to implement the original remedy which would required long-term

monitoring and maintenance of the landfill. In addition, clean closure would return Site 29 to unlimited use and unrestricted exposure.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis of alternatives for Site 29 is presented in Table 5-1. Because the volume of buried waste was assumed to be approximately 490,000 cubic yards and due to anecdotal reports that the waste could contain UXO, no clean closure alternatives were evaluated for Site 29 in the original Proposed Plan (Earth Tech 2006) and ROD for OU2. Therefore, to allow comparison with the selected alternative and meet the requirements of the NCP, which requires that the No Action alternative be considered, three alternatives are included in this evaluation: No Action; the remedy selected in the OU2 ROD; and clean closure. Note that because previous limited RAs were conducted at Site 29 (see Section 2.8), the "No Action" alternative should be considered to be a "No Further Action" alternative.

5.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Both the previously selected and clean closure alternatives for Site 29 would provide adequate overall protection of human health. The selected ROD remedy provides protection of human health through the use of LUCs and groundwater monitoring. LUCs would limit access to the site and reduce the physical hazards associated with buried debris. Groundwater monitoring would track the attenuation of contaminants from the landfill wastes. However, some biota would be exposed to contaminants present in the existing landfill cover.

Clean closure would eliminate the potential for future migration of contaminants to groundwater. It would also eliminate potential future hazards to human health or biota from contact with waste that is potentially hazardous. Contaminated soils, if encountered, would be removed.

The No Action alternative does not eliminate the potential for future exposure to contaminants, if they are present in landfill waste and migrate to groundwater. Existing LUCs may degrade in the future if not maintained.

5.2 COMPLIANCE WITH ARARS

Selected sections of CCR Title 27 have been identified as "relevant and appropriate" to the management of CERCLA landfill sites (Appendix A, Tables A-1 and A-2). The No Action alternative is not expected to comply with Title 27.

The previously selected remedy would be compliant with CCR Title 27 requirements for closure of landfill units that were CAI before November 27, 1984. Although a specific cover design was not specified in the OU2 ROD, Title 27, Section 20080(b) allows for consideration of alternatives to construction or prescriptive standards contained in SWQCB-promulgated regulations, provided that the specified alternative is consistent with performance goals addressed by the standard and affords equivalent protection against water quality impairment. It is estimated that areas of Site 29 that lack at least three feet of cover would require makeup soils to bring the landfill into compliance with Title 27.

The clean closure alternative is designed to be in full compliance with Title 27, Sections 20380 and 21810.

5.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

The No Action alternative would provide minimal long-term effectiveness because failure or destruction of the perimeter fence would permit access to the landfill and exposure of trespassers to hazardous wastes or explosively configured munitions potentially present within the landfill.

The previously selected remedy would provide Land Use Controls to protect human health, and LTM to confirm that no release to groundwater has occurred. The maintenance component included in this alternative would ensure that access controls, stormwater controls, and groundwater monitoring wells remain effective. However, this alternative does not offer a permanent solution, and Land Use Controls would have to be maintained as long as the waste remained at the site.

The clean closure alternative does offer a permanent solution. It eliminates physical and chemical risks to human health and animals once the remedy has been implemented by removing all debris and contaminated soils, if present, thereby allowing for unlimited use and unrestricted exposure.

5.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME OF CONTAMINANTS THROUGH TREATMENT

The No Action alternative does nothing to reduce the toxicity, mobility or volume of contaminants through treatment. If contaminants are present in landfill waste, the only reduction of toxicity that would occur is by natural processes. This is also true for the previously selected remedy; however, stormwater controls and enhancements to the cover would reduce the mobility of contaminants by creating physical barriers to stormwater infiltration (but not by treatment). The clean closure alternative would reduce the mobility of contaminants by removing all waste from the site.

Clean closure would also reduce the toxicity of contaminants in soils (if encountered) if the soils are taken to an off-site treatment facility for treatment and/or disposal. Because no hazardous wastes were found during the test pit investigation, it is not possible to precisely determine what wastes would hypothetically need to be treated, or to describe an appropriate treatment technology. However, it is the intent of this alternative to either destroy any hazardous wastes by treatment at an off-site facility that is permitted to take the type of waste that was uncovered, or recycle the waste. In addition, most of the non-hazardous waste (glass, metal) will be recycled, not disposed in an off-site landfill. Although the USEPA does not consider recycling treatment, it is a sustainable green form of remediation. Recycling of materials such as metals removes them from the landfill where they could potentially impact groundwater and uses them for a beneficial purpose.

5.5 SHORT-TERM EFFECTIVENESS

Although existing access controls (fencing and signs) installed under an Interim Remedial Action prevent direct contact with landfill wastes, these would not be maintained under the No Action alternative.

The previously selected remedy could expose construction workers to physical hazards during construction activities such as adding additional cover or constructing stormwater channels. The hazards associated with these activities are relatively minor and can be managed by following accepted health and safety protocols. Enlarging the borrow source pits to obtain the cover soils would result in the loss of desert habitat. Transporting soil from borrow pits to Site 29 would increase diesel fuel use and resulting air pollutants.

Clean closure could create a higher risk to site workers, base workers, and transport drivers due to the potential for hazardous wastes or UXO being unearthed during the clean closure excavations. Physical hazards may impact construction workers processing subsurface debris or contaminated soils. These risks could be mitigated by following accepted health and safety protocols, including the use of engineering controls such as blast shields on backhoes. As in the previously selected remedy, enlarging the borrow pits to obtain the cover soils would result in the loss of desert habitat, and transporting soil from borrow pits to Site 29 would increase diesel fuel use and resulting air pollutants.

Site improvements for both alternatives would take less than one year to complete.

5.6 IMPLEMENTABILITY

The two active alternatives can be technically implemented. There is no action to implement for the No Action alternative.

Implementation of the previously selected remedy would be affected by the availability of cover materials in on-Base borrow pits that meet design specifications. This alternative relies on the presence of an adequate on-site borrow source with suitable hydraulic conductivity (typically 10^{-4} centimeters per second [cm/sec]) for landfill cover construction. Conventional equipment can be used for landfill cover construction. Because the landfill and the surrounding area are USAF property, it is not expected that special permits, easements, or right-of-ways would be required for implementation of these alternatives. Installation of stormwater controls should also be relatively uncomplicated.

The implementation of the clean closure alternative would also use commercially available equipment and established procedures. Soil used to backfill excavated areas would not be required to meet rigid design specifications. Because the soils will be from non-contaminated borrow pit sources, no chemical testing of the soils would be required.

5.7 COST

The No Action alternative has no associated capital costs. The previously selected remedy has an upfront design and capital cost (present value cost) of $2.3 million for cover and stormwater improvements, and then annual maintenance and monitoring costs (present value cost) of $3.0 million over the next 200 years. Clean closure would have an upfront capital cost (present value cost) of

$2.4 million for work plans, removal of waste, and verification of the removal, but would incur no long-term monitoring or maintenance costs.

An evaluation of clean closure costs determined that the cost per cubic yard of subsurface debris is approximately $61. This calculation was made by dividing the total project cost (excluding costs for well destruction, fence removal, and reporting) by the estimated quantity of subsurface debris. The present value cost difference between clean closure and the previously selected remedy is approximately $2.9 million. Based on the results of the test pit investigation, review of historical aerial photographs, and previous investigations, it is unlikely that the cost of additional debris requiring removal during clean closure or other project uncertainties would exceed the cost of the previously selected remedy.

5.8 STATE ACCEPTANCE BY REGULATORY AGENCIES

The No Action alternative is not acceptable to the State agencies because it is not protective of human health and the environment. The previously selected remedy is acceptable to the regulatory agencies as being protective of human health and the environment and is in compliance with ARARs. The regulatory agencies will determine the acceptability of the clean closure alternative after completing their review of the draft ROD amendment.

5.9 COMMUNITY ACCEPTANCE BY THE PUBLIC

The OU2 Proposed Plan (Earth Tech 2006) and fact sheets were made available to the public during a public comment period and meetings were held to receive public input on the alternatives presented in the Proposed Plan. Because no comments were received for any alternatives in the Proposed Plan during the public comment period or meetings, it is assumed that the previously selected remedy is acceptable to the community. However, because clean closure was not part of the original Proposed Plan, this remedy had not been reviewed by or presented to the public. For this reason, a new Proposed Plan (AECOM 2010c) and a new public meeting were required. The revised Proposed Plan was prepared, the public comment period was held from 12 January 2011 through 28 February 2011, and public meetings were held on-Base and in Rosamond, CA, on 9 February 2011. Because no comments were received it is assumed that the new clean closure alternative is acceptable to the community.

5.10 SUMMARY

The analysis indicates that although the previously selected remedy and the clean closure alternative both meet threshold criteria for selection, the balancing criteria, particularly those evaluating long-term effectiveness and permanence and reduction of toxicity, mobility, or volume through treatment, clearly favor clean closure. This is because any contaminated soils that are encountered will be treated and/or disposed off-site and removal and recycling of metals and plastics removes them as a potential source of contamination to soil and groundwater. In addition, the estimated cost for clean closure is lower, especially if it is considered that costs for the previously selected remedy do not include the loss of beneficial use of the land at Site 29 due to the restrictions imposed by LUCs.

The No Action alternative does not eliminate the potential for future exposure to contaminants, if they are present in landfill waste and migrate to groundwater. Existing Land Use Controls may degrade in the future if not maintained.

Both of the active alternatives for Site 29 would provide adequate overall protection of human health. The previously selected remedy provides protection of human health through the use of LUCs and groundwater monitoring. LUCs would limit access to the site and reduce the physical hazards associated with buried debris. Groundwater monitoring would track the attenuation of contaminants from the landfill wastes. However, some animals could be exposed to contaminants present in the existing landfill cover.

Clean closure would eliminate the potential for future migration of contaminants to groundwater. It would also eliminate potential future hazards to human health or animals from contact with waste that is potentially hazardous. Contaminated soils, if encountered, would be removed. For these reasons, it would be more protective of human health and the environment than the previously selected remedy.

The clean closure alternative provides additional green remediation benefits because some of the waste would be recycled.

6.0 SUPPORT AGENCY COMMENTS

There are no outstanding support agency comments on this document.

7.0 STATUTORY DETERMINATIONS

The following sections discuss how the newly selected remedy of clean closure meets the statutory requirements.

Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by eliminating the potential for future migration of contaminants to groundwater and by eliminating potential future hazards to human health or animals from contact with waste that is potentially hazardous.

Compliance with ARARs

The selected remedy will comply with the technical requirements of all Federal and State ARARs identified for the RA (see Appendix A) as follows:

Chemical-Specific ARARs

- There are no chemical-specific ARARs associated with this remedy.

Location-Specific ARARs

Location-specific ARARs are restrictions on the concentrations of hazardous substances or on activities solely because they are in specific locations such as floodplains, wetlands, historic places, and sensitive ecosystems or habitats. Location-specific ARARs identified for the Site 29 RA include the following Federal requirements:

- Endangered Species Act of 1973, Section 7(c) (Table A-1, Item No. 1) (Relevant and Appropriate); and
- Migratory Bird Treaty Act (Table A-1, Item No. 2) (Applicable).

Location-specific ARARs identified for the Site 29 RA include the following State requirements listed as Relevant and Appropriate:

- California Endangered Species Act (Table A-1, Item No. 3);
- Wildlife Species/Habitats (Table A-1, Item No. 4);

- Fully Protected Bird Species (Table A-1, Item No. 5);
- Fully Protected Mammals (Table A-1, Item No. 6); and
- Fully Protected Amphibians and Reptiles (Table A-1, Item No. 7).

As stated in Air Force Instruction 32-7064, dated 17 September 2004, State-protected species will be protected when practicable and the appropriate State authority will be contacted if conflicts arise. The State may provide procedures for minimization of impacts and harm to species.

It is the Air Force's position that California Fish and Game Code Section 3503 is not an ARAR. However, based on a recent USAF bird survey at this site, California Department of Fish and Game (CDFG) believes that compliance with the MBTA (Item No. 4 in Table B-1) would effectuate substantive compliance with California Fish and Game Code Section 3503 for this Remedial Action because all of the birds listed in the survey are Migratory Birds as defined in the MBTA.

The selected alternative will comply with location-specific ARARs as annotated in Table A-1.

Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations that apply to particular remedial activities. Action-specific ARARs identified for the Site 29 Remedial Actions include the following requirements:

- Standards Applicable to Generators of Hazardous Waste (Table A-1, Item No. 8) – Although not identified during the RIs or surface debris removal, containerized hazardous waste may be present in the buried debris at Site 29. The selected RA will comply with standards applicable to the disposal of containerized hazardous waste, if encountered, during removal of subsurface debris;
- Definition of and Criteria for Identifying Hazardous Wastes (Table A-1, Item No. 9) – The criteria contained in this ARAR will be used to define if waste encountered during the removal of debris is hazardous;
- Hazardous Waste Land Disposal Restrictions (LDRs) (Table A-1, Item No. 10) - The criteria contained in this ARAR will be used to define if waste encountered during the removal of debris is subject to LDRs;
- Land Use Controls (Table A-1, Item No. 11) – After clean closure, this ARAR will no longer apply; and

- California Department of Resources Recycling and Recovery (CalRecycle) Requirements (Table A-1, Item No. 12; Table A-2) – The selected remedy will meet the technical requirements contained in CCR Title 27 for clean closure.

No waivers of ARARs are invoked by this remedy.

Cost Effectiveness

A cost-effective remedy under CERCLA is one whose "costs are proportional to its overall effectiveness" (NCP §300.430(f)(1)(ii)(D)). The "overall effectiveness" of a remedial alternative is determined by evaluating the following three of the five balancing criteria used in the detailed analysis of alternatives: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility and volume through treatment; and (3) short-term effectiveness. The selected remedy provides both short-term effectiveness and long-term effectiveness and permanence by removing all waste that could cause a risk to human health or the environment. The selected remedy has the potential to reduce the toxicity, mobility, and volume of wastes through off-site treatment of hazardous wastes if required. The selected remedy is also the lowest cost remedy that complies with ARARs.

Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy does, to the maximum extent practicable, incorporate permanent solutions through the removal and off-site treatment of all hazardous wastes at existing permitted waste treatment facilities. The selective remedy does not utilize alternative treatment technologies.

The selected remedy provides the best balance of tradeoffs among long-term effectiveness and permanence, short-term effectiveness, implementability, and cost. It is expected to be more permanent and effective over the long-term because all wastes that could pose a risk to human health or the environment will be removed, whereas the previously selected remedy achieves these goals only as long as LUCs are maintained. Both remedies are equally implementable; however, the currently selected remedy is lower in cost. The only balancing criteria favoring the previously selected remedy is short-term effectiveness, because there is a greater risk of a release of hazardous waste during waste excavation than installation of a landfill cover and drainage system, however, such a release could be readily mitigated.

Preference for Treatment as a Principal Element

Clean closure satisfies the statutory preference for treatment as a principal element of the remedy because contaminated soils, if encountered, will be treated off-site.

Five-Year Review Requirements

Five-year reviews will not be required because no waste is anticipated to be left in place above levels that will prevent unlimited use and unrestricted exposure and the action will be completed within five years of remedy initiation.

8.0 PUBLIC PARTICIPATION COMPLIANCE

The Air Force and the USEPA provided information regarding the cleanup of Site 29 to the public through public meetings, the Restoration Advisory Board, the Administrative Record File for Site 29, Information Repositories, the Environmental Restoration Division website (https://bsx.edwards.af.mil/environmental), the monthly publication Report to Stakeholders, and announcements published in the Antelope Valley Press, the Desert Eagle, and the Mojave Desert News. No comments were received.

The public was invited to review and comment upon the revised Proposed Plan (AECOM 2010c) for Site 29. The public comment period was from 12 January 2011 through 28 February 2011. Public meetings were held at Edwards AFB and off-Base at the Wanda Kirk Branch of the Kern County Library in Rosamond, California on 9 February 2011. No comments were received. These procedures thereby satisfied the requirements of 40 CFR § 300.435(c)(2)(ii).

9.0 REFERENCES

AECOM Technical Services, Inc. (AECOM). 2009. *Environmental Restoration Program, Site 29 2008 Biennial Groundwater Monitoring Report, South Base, Operable Unit 2, Edwards AFB, CA*. Prepared for 95 ABW/CEVR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Orange, CA. February.

———. 2010a. *Environmental Restoration Program, Site 29 Debris Removal Action Report, South Base, Operable Unit 2, Edwards AFB, CA*. Prepared for 95 ABW/CEVR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Orange, CA. February.

———. 2010b. *Environmental Restoration Program, Site 29 Subsurface Debris Investigation and Feasibility Study Addendum, South Base, Operable Unit 2, Edwards AFB, CA*. Prepared for 95 ABW/CEVR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Orange, CA. October.

———. 2010c. *CERCLA Proposed Plan (Revised) for Site 29, South Base Abandoned Sanitary Landfill, Operable Unit 2, Edwards AFB, CA*. January.

BSK & Associates. 1990. *Solid Waste Assessment Test - Air, Site 29 – South Base Landfill, Edwards Air Force Base, California*. Final Report. United States Air Force Contract No. FO 28059121-0005.

California Department of Health Services (CDHS). 2003. *Maximum Contaminant Levels and Regulation Dates for Drinking Water Contaminants. USEPA vs CDHS, September 2003*. From Internet site at State of California Department of Health Services Web page http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/EPAandDHS.pdf. Updated September 12, 2003.

California Department of Toxic Substances Control (DTSC). 2011. *Human Health Risk Assessment Note 3 - DTSC Recommended Methodology for Use of U.S. EPA Regional Screening Levels (RSLs) in Human Health Risk Assessment Process at Hazardous Waste Sites and Permitted Facilities*. California Department of Toxic Substances Control Internet Web page at http://www.dtsc.ca.gov/AssessingRisk/humanrisk2.cfm. Issue Date: May 20, 2011.

Dutcher, L.C. and G.F. Worts, Jr. 1963. *Geology, Hydrology, and Water Supply of Edwards Air Force Base, Kern County, California*. U.S. Geological Survey Open File Report 63-146. August.

Earth Tech, Inc. (Earth Tech). 1995. *Installation Restoration Program, Calculation of Upper Tolerance Limits for Background Metals in Soils Using Pooled Environmental Samples and Outlier Removal Techniques*, *South Base, Operable Unit No. 2*, *Edwards AFB, CA*. Prepared for AFFTC/EM, Edwards AFB, CA and AFCEE/ERD, Brooks AFB, TX. Long Beach, CA. September.

———. 1997. *Installation Restoration Program, Engineering Evaluation/Cost Analysis, Site 29, South Base, Operable Unit No. 2, Edwards AFB, CA*. Prepared for AFFTC/EM, Edwards AFB, CA and AFCEE/ERD, Brooks AFB, TX. Long Beach, CA. November.

———. 1998. *Installation Restoration Program, Action Memorandum for Site 29 South Base Abandoned Landfill, Operable Unit No. 2, Edwards AFB, CA*. Prepared for AFFTC/EM, Edwards AFB, CA and AFCEE/ERD, Brooks AFB, TX. Long Beach, CA. April.

———. 1999. *Interim Removal Action Report – Site 29, South Base Inactive Landfill, Operable Unit 2, Edwards AFB, CA*. Prepared for AFFTC/EM, Edwards AFB, CA and AFCEE/ERD, Brooks AFB, TX. Long Beach, CA. April.

———. 2002a. *Installation Restoration Program, Annual Groundwater Monitoring and Sampling Report for 2000, Site 29, South Base, Operable Unit No. 2, Edwards Air Force Base, California*. Prepared for AFFTC/EMR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Long Beach, CA. January.

———. 2002b. *Environmental Restoration Program, Annual Groundwater Monitoring and Sampling Report for 2001, Site 29, South Base Abandoned Landfill, Operable Unit No. 2, Edwards Air Force Base, California*. Prepared for AFFTC/EMR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Long Beach, CA. August.

———. 2003. *Environmental Restoration Program, Annual Groundwater Monitoring and Sampling Report for 2002, Site 29, South Base Abandoned Landfill, Operable Unit No. 2, Edwards Air Force Base, California*. Prepared for AFFTC/EMR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Long Beach, CA. April.

———. 2004. *Environmental Restoration Program, Annual Groundwater Monitoring and Sampling Report for 2003, Site 29, South Base Abandoned Landfill, Operable Unit No. 2, Edwards Air Force Base, California*. Prepared for 95 ABW/EMR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Long Beach, CA. September.

———. 2005a. *Environmental Restoration Program, South Base Feasibility Study, Operable Unit No. 2, Edwards Air Force Base, California*. Prepared for 95 ABW/EMR, Edwards AFB, CA and AFCEE/ISM, Brooks City-Base, TX. Long Beach, CA. August.

———. 2005b. *Environmental Restoration Program, Annual Groundwater Monitoring and Sampling Report for 2004, Site 29 South Base Abandoned Landfill, Operable Unit No. 2, Edwards Air Force Base, California*. Revised Final. Prepared for 95 ABW/CEVR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Long Beach, CA. August.

———. 2006. *Environmental Restoration Program, CERCLA Proposed Plan for Operable Unit 2, Edwards AFB, CA*. Prepared for 95 ABW/CEVR, Edwards AFB, CA and AFCEE/ISM, Brooks City-Base, TX. Long Beach, CA. August.

———. 2007. *Environmental Restoration Program, 2006 Annual Groundwater Monitoring Report, Operable Unit No. 2, South Base, Edwards Air Force Base, California.* Prepared for 95 ABW/CEVR, Edwards AFB, CA and Department of the Army, USACE, Sacramento District, Sacramento, CA. Long Beach, CA. June.

———. 2008. *Environmental Restoration Program, Addendum to the Human Health Risk Assessment, South Base Operable Unit 2, Edwards AFB, California.* Prepared for 95 ABW/EMR, Edwards AFB, California, and AFCEE/EXEW, Brooks City-Base, TX. Long Beach, CA. November.

———. 2009. *Environmental Restoration Program, Record of Decision, South Base, Operable Unit No. 2, Edwards Air Force Base, California.* Prepared for 95 ABW/CEVR, Edwards AFB, CA and AFCEE/ICE, Brooks City-Base, TX. Long Beach, CA. March.

Edwards AFB. 2012. *General Plan, Edwards Air Force Base, California, 2012*. Prepared by Asset Management Branch Community Planning 95 ABW/CEAO. April.

Environmental Council of States-Department of Defense (ECOS-DoD). 2007. *Identification and Selection of Values/Criteria for CERCLA and Hazardous Waste Site Risk Assessments in the Absence of IRIS Values*. Emerging Contaminants Task Group Risk Assessment Provisional Values Subgroup Issue Paper, ECOS-DoD Sustainability Work Group. Accessed at http://www.ecos.org/section/committees/cross_media/ecos_dod_sustainability_work_group. April.

United States Environmental Protection Agency (USEPA). 1980. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). (40 CFR 300 §300.430[e][2i]).

———. 1991. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decision*. OSWER Directive 9355.0-30. April.

———. 1993. *Presumptive Remedy for CERCLA Municipal Landfill Sites*. Office of Solid Waste and Emergency Response, Directive No. 9355.0-49FS, EPA 540-F-93-035, PB 93-963339. September.

———. 1996. *Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills*. Office of Solid Waste and Emergency Response, Directive No. 9355.0-67FS, EPA/540/F-96/020, PB96-963314. December.

———. 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. OSWER 9200.1-23P, EPA 540-R-98-031, PB98-963241. Washington, DC. July.

———. 2000. *Region IX Preliminary Remediation Goals (PRGs), U.S. Environmental Protection Agency Region IX*. October.

———. 2011. *Regional Screening Levels (Formerly PRGs)*. URL: http://www.epa.gov/region09/superfund/prg/index.html. November.

Tetra Tech. 2004. *Predictive Ecological Risk Assessment (PERA) for Sites 29, 69, 81, 84/87, 96, 102, 106, 107, 111, and 112 at Operable Unit 2, Edwards AFB*. (Final) Prepared for AFFTC/EMR, Edwards AFB, CA and the U.S. Army Corps of Engineers, Sacramento, CA. January.

United States Geological Survey. 2003. *Phase I Scoping Ecological Risk Assessment, OUs 1, 2 and 6, Edwards AFB*. (Final) Prepared by U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center, Davis, CA.

TABLES

2-1 Maximum Concentrations of Organic and Inorganic Constituents Detected in Soil Compared to Calculated Background Concentrations and 2011 RSLs – Site 29

3-1 Summary of Test Pit Logs – Site 29

3-2 Subsurface Debris Volume Estimates – Site 29

3-3 Summary of Human Health Risk Assessment Results – Site 29

4-1 Cleanup Standards for Contaminants of Potential Concern in Soil at Site 29

4-2 Comparative Costs of the Previously Selected Remedy and Clean Closure

5-1 Comparative Analysis of Alternatives – Site 29

TABLE 2-1. MAXIMUM CONCENTRATIONS OF ORGANIC AND INORGANIC CONSTITUENTS DETECTED IN SOIL COMPARED TO CALCULATED BACKGROUND CONCENTRATIONS AND 2011 RSLs - SITE 29

(Page 1 of 3)

Analyte	Maximum Concentration (mg/kg)	Location ID of Maximum Concentration	Sample Depth (ft bgs)	No. Detections/ Total No. Samples	Calculated Background Concentration [a] (mg/kg)	No. Samples Exceeding Background/ Total No. Samples	2011 Residential RSL [b] (mg/kg)	No. Samples Exceeding Residential RSL/Total No. Samples
Petroleum Hydrocarbons					-	-		
oil & grease	5,800	29-HB20	0	16/101	-	-	NP	-
unknown extractable hydrocarbons	39	29-SG02	0	1/9	-	-	NP	-
Volatile Organics					-	-		
acetone	0.31 (L)	29-HB02	0	41/111	-	-	61,000	0/111
ethylbenzene	0.010	29-HB28	2	1/111	-	-	5.4	0/111
methylene chloride	0.037 (J1)	29-MW03	40	10/111	-	-	11	0/111
n-propylbenzene	0.0055	29-HB28	2	1/97	-	-	240[c]	0/97
trichloroethene (TCE)	0.030	29-HB28	2	1/111	-	-	0.91	0/111
Semivolatile Organics					-	-		
benzo(g,h,i)perylene	0.53	29-HB18	2	1/79	-	-	NP	-
butyl benzyl phthalate	0.38 (J1)	29-MW01	75	1/79	-	-	260	0/79
Pesticides and PCBs					-	-		
alpha-chlordane	0.14	29-HB11	0	6/113	-	-	NP	-
gamma-chlordane	0.12 (K)	29-HB22	1	7/113	-	-	NP	-
4,4'-DDD	0.13 (K)	29-HB22	1	3/113	-	-	2	0/113
4,4'-DDE	0.49 (K)	29-HB22	1	4/113	-	-	1.4	0/113
4,4'-DDT	0.80 (K)	29-HB22	1	10/113	-	-	1.7	0/113
dieldrin	0.0045	29-MW06	90	1/113	-	-	0.03	0/113
endrin	0.0058	29-MW06	90	1/113	-	-	18	0/113

TABLE 2-1. MAXIMUM CONCENTRATIONS OF ORGANIC AND INORGANIC CONSTITUENTS DETECTED IN SOIL COMPARED TO CALCULATED BACKGROUND CONCENTRATIONS AND 2011 RSLs - SITE 29

Analyte	Maximum Concentration (mg/kg)	Location ID of Maximum Concentration	Sample Depth (ft bgs)	No. Detections/ Total No. Samples	Calculated Background Concentration [a] (mg/kg)	No. Samples Exceeding Background/ Total No. Samples	2011 Residential RSL [b] (mg/kg)	No. Samples Exceeding Residential RSL/Total No. Samples
Metals and Other Elements								
aluminum	48,100 G	29-HB02	0	103/103	35,900	2/103	77,000	0/103
arsenic	32.5	29-HB02	0	98/113	22.7	5/113	0.39	98/113
barium	394	29-HB06	2	112/113	301	1/113	15,000	0/113
beryllium	1.7 G	29-HB02	0	86/113	1.4	1/113	160	0/113
cadmium	18.6	29-HB27	2	5/113	0.5	5/113	1.7[c]	1/113
calcium	155,000	29-HB09	2	103/103	129,000	2/103	NP	-
chromium, total	41.2	29-HB27	2	113/113	39.1	1/113	NP	-
cobalt	20.2	29-HB27	2	111/113	18	1/113	23	0/113
copper	113	29-HB27	2	110/113	48.7	1/113	3,100	0/113
fluoride	5.33	29-SG02	0	2/2	-	-	3,100	0/2
iron	146,000	29-HB27	2	103/103	36,100	3/103	55,000	2/103
lead	784	29-HB27	2	113/113	28.2	14/113	80[c]	8/113
magnesium	34,100 G	29-HB02	0	103/103	30,900	1/103	NP	-
manganese	884 G	29-HB02	0	103/103	905	0/103	1,800	0/103
mercury	0.24	29-HB33	0	5/113	0.1	4/113	23	0/113
molybdenum	8.3	29-HB27	2	1/103	2	1/103	390	0/103
nickel	56.9	29-HB27	2	85/113	16.9	14/113	1,500	0/113
potassium	16,500 G	29-HB02	0	103/103	10,900	2/103	NP	-
selenium	1.1	29-HB25	2	2/113	0.5	2/113	390	0/113
silver	49.7	29-SG02	0	10/113	1	9/113	390	0/113
sodium	11,100	29-HB25	1	102/103	12,500	0/103	NP	-
vanadium	117 G	29-HB02	0	113/113	74.5	3/113	78[c]	3/113
zinc	341	29-HB27	2	113/113	107	10/113	23,000	0/113

TABLE 2-1. MAXIMUM CONCENTRATIONS OF ORGANIC AND INORGANIC CONSTITUENTS DETECTED IN SOIL COMPARED TO CALCULATED BACKGROUND CONCENTRATIONS AND 2011 RSLs - SITE 29

Notes:

Data for soil samples collected from July 1992 through October 1996.

[(a)] Background level calculated for OU2 (Earth Tech 1995).

[(b)] USEPA Regional Screening Levels for residential exposure (USEPA 2011 [November])

[(c)] California Human and Ecological Risk Office's Preliminary Remediation Goals for residential exposure in the HHRA Note #3. (DTSC 2011[May])

-	not applicable
4,4'-DDD	dichlorodiphenyldichloroethane
4,4'-DDE	dichlorodiphenyldichloroethylene
4,4'-DDT	dichlorodiphenyltrichloroethane
DTSC	Department of Toxic Substances Control
ft bgs	feet below ground surface
HHRA	Human Health Risk Assessment
ID	identification
mg/kg	milligrams per kilogram
No.	number
NP	not promulgated
PCBs	polychlorinated biphenyls
PRG	Preliminary Remediation Goal
RSL	Regional Screening Level
QC	Quality Control
USEPA	United States Environmental Protection Agency

Laboratory Data Qualifier:

G Elevated reporting limit. The reporting limit is elevated due to matrix interference.

Earth Tech Data Qualifiers:

(J1) Blank contamination: indicates possible high bias and/or false positives. Blank level multiplied by 5 is higher than sample results, except for contamination from methylene chloride, acetone, 2-butanone, and common phthalate esters where the multiplier is 10.

(K) Values may be biased high because one or more surrogates are out high. Non-detects are not qualified.

(L) Estimated value. Recoveries for one or more surrogates are below QC limits. Values may be biased low.

TABLE 3-1. SUMMARY OF TEST PIT LOGS – SITE 29
(Page 1 of 4)

Test Pit Number	Test Pit Dimensions	Type of Refuse Encountered	Depth to Top of Refuse (ft bgs)	Depth to Bottom of Refuse (ft bgs)
Western Landfill Area				
29-TP01	10-ft (L) x 2.5-ft (W) x 11.5-ft (D)	Glass bottles, scrap metal	4.0	10.0
29-TP01A	10-ft (L) x 2.5-ft (W) x 9-ft (D)	Glass bottles, scrap metal, ceramics, minimal amount of wood	3.0	7.0
29-TP02	9-ft (L) x 2.5-ft (W) x 12-ft (D)	Glass bottles, scrap metal	1.0	4.0
29-TP02A	2.5-ft (L) x 8-ft (W) x 11-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP03	7.5-ft (L) x 2.5-ft (W) x 10.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP03A	7-ft (L) x 2.5-ft (W) x 9-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP04	9-ft (L) x 2.5-ft (W) x 7-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
Eastern Landfill Area				
29-TP05	7-ft (L) x 2.5-ft (W) x 8-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP06	10-ft (L) x 5-ft (W) x 9.5-ft (D)	Concrete, glass bottles, scrap metal	2.0	6.5
29-TP06A	10-ft (L) x 2.5-ft (W) x 9.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP06B	9-ft (L) x 2.5-ft (W) x 9-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP07	10.5-ft (L) x 2.5-ft (W) x 11-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP08	10-ft (L) x 5-ft (W) x 11-ft (D)	Glass, scrap metal	2.0	4.0
29-TP08A	9-ft (L) x 5-ft (W) x 6-ft (D)	Ceramics, glass, scrap metal, some wood	2.5	3.0
29-TP08B	2.5-ft (L) x 17-ft (W) x 9-ft (D)	Glass, scrap metal	2.5	4.0
29-TP08C	2.5-ft (L) x 9-ft (W) x 9-ft (D)	Glass bottles, rubber tire, scrap metal	4.5	7.0
29-TP08D	2.5-ft (L) x 9-ft (W) x 7-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered

TABLE 3-1. SUMMARY OF TEST PIT LOGS – SITE 29
(Page 2 of 4)

Test Pit Number	Test Pit Dimensions	Type of Refuse Encountered	Depth to Top of Refuse (ft bgs)	Depth to Bottom of Refuse (ft bgs)
Eastern Landfill Area *(Continued)*				
29-TP08E	12-ft (L) x 5-ft (W) x 8-ft (D)	Charred paper, glass bottles, scrap metal	4.0	6.0
29-TP08F	10-ft (L) x 2.5-ft (W) x 9-ft (D)	Glass bottles, scrap metal, some wood	4.0	7.0
29-TP08G	13-ft (L) x 2.5-ft (W) x 10-ft (D)	Glass bottles, scrap metal, some wood	7.0	9.0
29-TP08H	10-ft (L) x 2.5-ft (W) x 9-ft (D)	Charred paper, glass bottles, scrap metal	3.0	4.0
29-TP08I	7-ft (L) x 2.5-ft (W) x 6-ft (D)	Bone (cattle), charred paper, glass bottles, scrap metal, wood	3.0	>6.0 (Not able to dig further – sides of trench sloughing in)
29-TP08J	9-ft (L) x 2.5-ft (W) x 9.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP08K	8-ft (L) x 2.5-ft (W) x 5-ft (D)	Bone (cattle), scrap metal, wood	1.5	2.5
29-TP09	8-ft (L) x 2.5-ft (W) x 7-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP10A	6-ft (L) x 2.5-ft (W) x 5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP11	8-ft (L) x 2.5-ft (W) x 4.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP12	2.5-ft (L) x 9-ft (W) x 7-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP13	2.5-ft (L) x 8-ft (W) x 8-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP14	9-ft (L) x 2.5-ft (W) x 10-ft (D)	Charred paper, glass bottles, scrap metal	6.0	9.5
29-TP14A	2.5-ft (L) x 10-ft (W) x 11-ft (D)	Glass bottles, scrap metal	4.5	10.8
29-TP14B	2.5-ft (L) x 9-ft (W) x 9.5-ft (D)	Charred paper, small charred metal pieces, glass bottles, scrap metal	4.0	6.0
29-TP14C	6-ft (L) x 2.5-ft (W) x 5.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered

TABLE 3-1. SUMMARY OF TEST PIT LOGS – SITE 29
(Page 3 of 4)

Test Pit Number	Test Pit Dimensions	Type of Refuse Encountered	Depth to Top of Refuse (ft bgs)	Depth to Bottom of Refuse (ft bgs)
Eastern Landfill Area *(Continued)*				
29-TP14D	2.5-ft (L) x 11-ft (W) x 12-ft (D)	Ash (charred wood), charred paper, glass bottles, scrap metal	6.0	12.0
29-TP14E	2.5-ft (L) x 28-ft (W) x 6-ft (D)	Glass bottles, scrap metal	2.0	3.0
29-TP14F	2.5-ft (L) x 7-ft (W) x 6-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP15	8-ft (L) x 2.5-ft (W) x 5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP16	8.5-ft (L) x 2.5-ft (W) x 5.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP17	9-ft (L) x 2.5-ft (W) x 8-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP18	8-ft (L) x 2.5-ft (W) x 10-ft (D)	Glass bottles	4.5	5.5
29-TP18A	8-ft (L) x 2.5-ft (W) x 10-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP19	9.5-ft (L) x 2.5-ft (W) x 6.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP20A	2.5-ft (L) x 6-ft (W) x 5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP21	11-ft (L) x 4.5-ft (W) x 9-ft (D)	Concrete, glass bottles, scrap metal	4.0	>9.0 (Not able to dig further – sides of trench sloughing in)
29-TP21A	10-ft (L) x 2.5-ft (W) x 10-ft (D)	Ash (charred wood), glass bottles, scrap metal	2.0	8.0
29-TP21B	8-ft (L) x 2.5-ft (W) x 9-ft (D)	Glass bottles, scrap metal	1.0	7.0
29-TP21C	15-ft (L) x 2.5-ft (W) x 9-ft (D)	Glass bottles, scrap metal	2.0	4.5
29-TP21D	8-ft (L) x 2.5-ft (W) x 6-ft (D)	Glass bottles, scrap metal	1.0	2.0
29-TP21E	7.5-ft (L) x 2.5-ft (W) x 8-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP21F	10-ft (L) x 2.5-ft (W) x 10-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered

TABLE 3-1. SUMMARY OF TEST PIT LOGS – SITE 29
(Page 4 of 4)

Test Pit Number	Test Pit Dimensions	Type of Refuse Encountered	Depth to Top of Refuse (ft bgs)	Depth to Bottom of Refuse (ft bgs)
Eastern Landfill Area *(Continued)*				
29-TP22	8-ft (L) x 2.5-ft (W) x 5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP23	8-ft (L) x 2.5-ft (W) x 5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP24	7-ft (L) x 6-ft (W) x 8.5-ft (D)	Glass bottles, scrap metal, large metal pieces, three 0.5-inch x 4.0-inch shell casings (empty)	3.0	8.5
29-TP24A	8-ft (L) x 2.5-ft (W) x 7-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP24B	8-ft (L) x 2.5-ft (W) x 7-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP25	8-ft (L) x 2.5-ft (W) x 6-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered
29-TP26	8.5-ft (L) x 2.5-ft (W) x 6.5-ft (D)	No refuse encountered	No refuse encountered	No refuse encountered

Notes:

>	greater than
bgs	below ground surface
D	depth
ft	feet
L	length (North-South direction)
W	width (East-West direction)

TABLE 3-2. SUBSURFACE DEBRIS VOLUME ESTIMATES – SITE 29

	Debris Area A	Debris Area B	Debris Area C	Debris Area D	TOTAL
Area (ft^2)	2,525	47,981	82,830	31,380	**164,716**
Volume (yd^3)					
Cover Soil Volume	527	9,516	10,825	4,319	**25,187**
Soil Volume	38	2,947	3,601	2,099	8,685
Debris Volume	56	4,421	5,401	3,148	13,026
Total Volume (Soil Mixed with Debris)	**94**	**7,368**	**9,002**	**5,247**	**21,711**

Notes:

Soil volume is assumed to be 40 percent of the calculated landfill volume.
Debris volume is assumed to be 60 percent of the calculated landfill volume.

ft^2 square foot
yd^3 cubic yard

TABLE 3-3. SUMMARY OF HUMAN HEALTH RISK ASSESSMENT RESULTS – SITE 29

Potential Exposure Scenario	Exposure Medium	Cancer Risk	Primary Risk Drivers[a]	Noncancer Hazard Index[b]	Primary Risk Drivers[a]
Residential (Hypothetical future)	Soil	$3x10^{-7}$	None	0.28	None
	Groundwater	$3x10^{-6}$	None	0.60	None
	Indoor Air (volatilization from soil)	$5x10^{-6}$	None	0.03	None
Industrial	Soil	$3x10^{-8}$	None	0.15	None
(Hypothetical future)	Groundwater	NA	NA	NA	NA
	Indoor Air (volatilization from soil)	$3x10^{-7}$	None	<0.01	None
Construction Worker	Soil	$5x10^{-10}$	None	0.06	None
	Groundwater	NA	NA	NA	NA
	Indoor Air	NA	NA	NA	NA

Notes:

[a] "None" indicates that there are no primary risk drivers as determined by the Human Health Risk Assessment. If the total cancer risk were greater than $1x10^{-4}$ or the Hazard Index is greater than 1, a constituent would be shown as a primary risk driver.

[b] A Hazard Index less than 1 is considered generally acceptable (USEPA 1991).

NA Not applicable; no exposure pathway identified.

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Volatile Organics				
acetone	6.10E+04	—	—	6.10E+04
acetonitrile	870	—	—	870
acrolein	0.15		—	0.15
acrylonitrile	0.24	0.055	—	0.148[f]
benzene	1.1	—	—	1.1
benzyl chloride	1.0	—	—	1.0
bromobenzene	300	—	—	300
bromochloromethane	160	—	—	160
bromodichloromethane	0.27	—	—	0.27
bromoform	62	—	—	62
bromomethane	7.3	—	—	7.3
n-butanol	6100	—	—	6100
2-butanone (MEK)	2.80E+04	—	—	2.80E+04
n-butylbenzene	3900	240	—	2070[f]
sec-butylbenzene	NP	220	—	220[e]
tert-butylbenzene	NP	390	—	390[e]
carbon disulfide	820	—	—	820
carbon tetrachloride	0.61	—	—	0.61
2-chloro-1,3-butadiene	9.40E-03	—	—	9.40E-03
chlorobenzene	290	—	—	290
chloroethane	1.50E+04	—	—	1.50E+04

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 2 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Volatile Organics (Continued)				
chloroform	0.29	—	—	0.29
chloromethane	120	—	—	120
3-chloropropene	0.68	—	—	0.68
2-chlorotoluene	1600	160	—	880[f]
4-chlorotoluene	1600	—	—	1600
cyclohexanone	3.10E+05	—	—	3.10E+05
dibromochloromethane	0.68	—	—	0.68
1,2-dibromo-3-chloropropane	5.40E-03	—	—	5.40E-03
dibromomethane	25	—	—	25
1,4-dichloro-2-butene, total	6.90E-03	—	—	6.90E-03
1,2-dichlorobenzene	1900	—	—	1900
1,3-dichlorobenzene	NP	530	—	530[e]
1,4-dichlorobenzene	2.4	—	—	2.4
dichlorodifluoromethane	94	—	—	94
1,1-dichloroethane	3.3	—	—	3.3
1,2-dichloroethane	0.43	—	—	0.43
1,1-dichloroethene	240	—	—	240
cis-1,2-dichloroethene	160	—	—	160
trans-1,2-dichloroethene	150	—	—	150
1,2-dichloroethene, total	700	—	—	700

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 3 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Volatile Organics (Continued)				
1,2-dichloropropane	0.94	—	—	0.94
1,3-dichloropropane	1600	—	—	1600
ethyl methacrylate	1500	140	—	820[f]
ethylbenzene	5.4	—	—	5.4
ethylene dibromide (EDB)	0.034	—	—	0.034
furfural	180	—	—	180
n-hexane	570	—	—	570
2-hexanone	210	—	—	210
isobutanol	2.30E+04	—	—	2.30E+04
isopropanol	9.90E+09	—	—	9.90E+09
isopropyl ether (DIPE)	2400	—	—	2400
isopropylbenzene	2100	—	—	2100
methyl acrylonitrile	3.2	—	—	3.2
methyl tert-butyl ether (MTBE)	43	—	—	43
4-methyl-2-pentanone (MIBK)	5300	—	—	5300
methylene chloride	11	—	—	11
n-propylbenzene	3400	240	—	1820[f]
styrene	6300	—	—	6300
1,1,1,2-tetrachloroethane	1.9	—	—	1.9
1,1,2,2-tetrachloroethane	0.56	—	—	0.56
tetrachloroethene (PCE)	0.55	—	—	0.55

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 4 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Volatile Organics (Continued)				
tetrahydrofuran	NP	9.4	—	9.4[e]
toluene	5000	—	—	5000
1,2,3-trichlorobenzene	49	—	—	49
1,2,4-trichlorobenzene	22	—	—	22
1,1,1-trichloroethane	8700	—	—	8700
1,1,2-trichloroethane	1.1	—	—	1.1
trichloroethene (TCE)	0.91	—	—	0.91
trichlorofluoromethane	790	—	—	790
1,2,3-trichloropropane	5.00E-03	—	—	5.00E-03
1,1,2-trichlorotrifluoroethane	4.30E+04	—	—	4.30E+04
1,2,4-trimethylbenzene	62	—	—	62
1,3,5-trimethylbenzene	780	21.3	—	401
vinyl acetate	970	—	—	970
vinyl chloride	0.06	—	—	0.06
o-xylene	690	—	—	690
xylenes, total	630	—	—	630
Semivolatile Organics				
acenaphthene	3400	—	—	3400
acetophenone	7800	—	—	7800
aniline	85	—	—	85
anthracene	1.70E+04	—	—	1.70E+04

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 5 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Semivolatile Organics (Continued)				
azobenzene	5.1	—	—	5.1
benzidine	5.00E-04	—	—	5.00E-04
benzo(a)anthracene	0.15	—	—	0.15
benzo(a)pyrene	1.50E-02	—	—	1.50E-02
benzo(b)fluoranthene	0.15	—	—	0.15
benzoic acid	2.40E+05	—	—	2.40E+05
benzo(k)fluoranthene	1.5	—	—	1.5
benzyl alcohol	6100	—	—	6100
bis(2-chloroethyl)ether	0.21	—	—	0.21
bis(2-ethylhexyl)phthalate	35	—	—	35
butyl benzyl phthalate	260	—	—	260
caprolactam	3.10E+04	—	—	3.10E+04
carbazole	NP	24	—	24[e]
4-chloroaniline	2.4	—	—	2.4
2-chloronaphthalene	6300	—	—	6300
2-chlorophenol	390	63	—	226.5[f]
2-chloroacetophenone	4.30E+04	3.30E-02	—	2.15E+04[f]
chrysene	15		—	15
dibenz(a,h)anthracene	1.50E-02	—	—	1.50E-02
dibenzofuran	78		—	78
3,3'-dichlorobenzidine	1.1	—	—	1.1

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 6 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Semivolatile Organics (Continued)				
2,4-dichlorophenol	180	—	—	180
diethyl phthalate	4.90E+04	—	—	4.90E+04
diisopropyl methylphosphonate	6300	—	—	6300
dimethyl phthalate	NP	1.0E+05	—	1.0E+05[e]
dimethylbenzenamine	160	—	—	160
2,4-dimethylphenol	1200	—	—	1200
di-n-butyl phthalate	6100	—	—	6100
4,6-dinitro-2-methylphenol	4.9	—	—	4.9
1,3-dinitrobenzene	6.1	—	—	6.1
1,4-dinitrobenzene	6.1	—	—	6.1
2,4-dinitrophenol	120	—	—	120
2,6-dinitrotoluene	61	—	—	61
di-n-octyl phthalate	NP	2400	—	2400[e]
dioctyl adipate	410	—	—	410
1,4-dioxane	4.9	—	—	4.9
diphenylamine	1500	—	—	1500
1,2-diphenylhydrazine	0.61	—	—	0.61
1,4-dithiane	610	—	—	610
fluoranthene	2300	—	—	2300
fluorene	2300	—	—	2300
hexachlorobenzene	0.3	—	—	0.3

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 7 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Semivolatile Organics (Continued)				
hexachlorobutadiene	6.2	—	—	6.2
hexachlorocyclopentadiene	370	—	—	370
hexachloroethane	12	—	—	12
indeno(1,2,3-cd)pyrene	0.15	—	—	0.15
isophorone	510	—	—	510
isopropyl methyl phosphonic acid	6100	—	—	6100
2-methylnaphthalene	310	—	—	310
2-methylphenol	3100	—	—	3100
4-methylphenol	310	—	—	310
naphthalene	3.6	—	—	3.6
2-nitroaniline	610	—	—	610
3-nitroaniline	NP	18	—	18[e]
4-nitroaniline	24	—	—	24
nitrobenzene	4.8	—	—	4.8
N-nitrosodibutylamine	8.70E-02	—	—	8.70E-02
N-nitrosodimethylamine (NDMA)	2.30E-03	—	—	2.30E-03
N-nitrosodiphenylamine	99	—	—	99
N-nitrosodipropylamine	6.90E-02	—	—	6.90E-02
pentachlorobenzene	49	—	—	49
pentachlorophenol	0.89	—	—	0.89
phenol	1.80E+04	—	—	1.80E+04

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 8 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Semivolatile Organics (Continued)				
pronamide	4600	—	—	4600
pyrene	1700	—	—	1700
pyridine	78	—	—	78
1,2,4,5-tetrachlorobenzene	18	—	—	18
2,3,4,6-tetrachlorophenol	1800	—	—	1800
2,4,5-trichlorophenol	6100	—	—	6100
2,4,6-trichlorophenol	44	6.9	—	25.45[f]
trimethyl phosphate	24	—	—	24
Pesticides and PCBs				
aldrin	2.90E-02	—	—	2.90E-02
Aroclor 1016	3.9	—	—	3.9
Aroclor 1221	0.14	—	—	0.14
Aroclor 1232	0.14	—	—	0.14
Aroclor 1242	0.22	—	—	0.22
Aroclor 1248	0.22	—	—	0.22
Aroclor 1254	0.22	—	—	0.22
Aroclor 1260	0.22	—	—	0.22
alpha-BHC	7.70E-02	—	—	7.70E-02
beta-BHC	0.27	—	—	0.27
gamma-BHC	0.52	—	—	0.52
4,4'-DDD	2.0	—	—	2.0

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 9 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Pesticides and PCBs (Continued)				
4,4'-DDE	1.4	—	—	1.4
4,4'-DDT	1.7	—	—	1.7
dieldrin	3.00E-02	—	—	3.00E-02
endrin	18	—	—	18
heptachlor	0.11	—	—	0.11
heptachlor epoxide	5.30E-02	—	—	5.30E-02
methoxychlor	310	—	—	310
toxaphene	0.44	—	—	0.44
Metals and Other Elements				
aluminum	7.70E+04	—	3.59E+04	7.70E+04
antimony	31	—	6.0	31
arsenic	0.39	—	22.7	22.7
barium	1.50E+04	—	301	1.50E+04
beryllium	160	1000	1.4	160
cadmium	70	1.7	0.5	35.85[f]
chromium, total	NP	—	39.1	39.1[g]
cobalt	23	—	18	23
copper	3100	—	48.7	3100
iron	5.50E+04	—	3.61E+04	5.50E+04
lead	400	80	28.2	240[f]

TABLE 4-1. CLEANUP STANDARDS FOR CONTAMINANTS OF POTENTIAL CONCERN IN SOIL AT SITE 29
(Page 10 of 10)

Contaminant of Potential Concern	USEPA 2011 RSLs[a] (mg/kg)	HERO HHRA Note #3 Screening Levels[b]	Calculated Background Concentration[c] (mg/kg)	Cleanup Standard[d] (mg/kg)
Metals and Other Elements (Continued)				
manganese	1800	—	905	1800
mercury	23	—	0.1	23
molybdenum	390	—	2.0	390
nickel	1500	—	16.9	1500
selenium	390	—	0.5	390
silver	390	—	1.0	390
vanadium	390	78	74.5	234[f]
zinc	2.30E+04	—	107	2.30E+04

Notes:

[a] USEPA Regional Screening Levels for residential exposure (USEPA 2011 [November]).
[b] California Human and Ecological Risk Office's Preliminary Remediation Goals for residential exposure in the HHRA Note #3. (DTSC 2011[May]).
[c] Source: Earth Tech, 1995n.
[d] The USEPA RSLs were used as the cleanup standard.
[e] The HERO PRGs were used as the cleanup standard, no USEPA RSL available.
[f] Midpoint between USEPA Regional Screening Levels and California HERO PRGs were used as the cleanup standard.
[g] The calculated metals background concentration was used as the cleanup standard.

—	not calculated/not available	HHRA	Human Health Risk Assessment
4,4'-DDD	dichlorodiphenyldichloroethane	mg/kg	milligrams per kilogram
4,4'-DDE	dichlorodiphenyldichloroethylene	NP	not promulgated
4,4'-DDT	dichlorodiphenyltrichloroethane	PRG	Preliminary Remediation Goal
BHC	benzene hexachloride (alpha, beta, gamma)	RSL	Regional Screening Level
HERO	Human and Ecological Risk Office	USEPA	United States Environmental Protection Agency

TABLE 4-2. COMPARATIVE COSTS OF THE PREVIOUSLY SELECTED REMEDY AND CLEAN-CLOSURE

Cost in 2010 Dollars	Previously Selected Remedy	Clean-Closure (Preferred Alternative)
Timeframe	200 Years*	2 Years
Capital	$2,284,000**	$2,488,000**
LUCs/LTM/Operations and Maintenance	$16,248,000	$0
Periodic Costs (Five Year Reviews and Closeout)	$260,000	$0
Cost (Current Dollars)	$18,792,000	$2,488,000
Present Value Cost	$5,299,000	$2,362,000

Notes:

* Although LUCs would need to be maintained until site conditions allow for unlimited use and unrestricted exposure, a timeframe of 200 years was used to enable the Air Force to compare costs between active alternatives. After 200 years, the increase in the present value discounted cost is negligible.

** Includes $877,000 cost to remove surface debris that has already been completed.

LTM Long-term Monitoring

LUCs Land Use Controls

Costs include estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent. The cost estimate for the previously selected remedy has been updated from the one presented in the OU2 Feasibility Study to delete escalation and incorporate the 2.7 percent real discount rate published in Office of Management and Budget (OMB) Circular A-94, Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analyses. A detailed cost analysis is provided in Appendix B.

TABLE 5-1. COMPARATIVE ANALYSIS OF ALTERNATIVES - SITE 29
(Page 1 of 2)

CERCLA Criteria [(a)]	NO ACTION	PREVIOUSLY SELECTED REMEDY	CLEAN-CLOSURE (PREFERRED ALTERNATIVE)
Threshold Criteria – Requirements that each alternative must meet to be eligible for selection.			
Overall Protection of Human Health and the Environment	**No.** Does not eliminate the potential for future exposure to contaminants, if they are present in landfill waste and migrate to groundwater. Existing Land Use Controls (signs and fences) may degrade in the future if not maintained.	**Yes.** Reduces the potential for future migration of contaminants to groundwater, if they are present in landfill waste. Reduces the potential for future hazards to human health or biota from contact with waste that is potentially hazardous through Land Use Controls.	**Yes.** Eliminates the potential for future migration of contaminants to groundwater. Eliminates potential future hazards to human health or biota from contact with waste that is potentially hazardous.
Compliance with ARARs	**Not applicable.** Alternative does not address ARARs for landfill containment.	**Yes.** Compliant with CCR Title 27 requirements for closure of landfill units that were closed, abandoned, or inactive (CAI) before November 27, 1984.	**Yes.** Compliant with CCR Title 27 requirements for clean-closure of landfill units.
Balancing Criteria – Used to weigh major tradeoffs among alternatives.			
Long-Term Effectiveness and Permanence	**Poor.** Lack of inspection and maintenance of the existing fence and cover may increase risk to human health posed by exposed waste and allow for unauthorized dumping.	**Good.** Land Use Controls will reduce physical and chemical risks to human health associated with site. Long-term monitoring will indicate if a release to groundwater has occurred.	**Better.** Permanent solution. Eliminates physical and chemical risks to human health and biota once the remedy has been implemented, by allowing for unlimited use and unrestricted exposure.
Reduction of Toxicity, Mobility, and Volume through Treatment	**Poor.** If contaminants are present in landfill waste, the only reduction of toxicity or volume that would occur is by natural processes.	**Fair.** The only reduction of toxicity or volume that would occur is by natural processes. Stormwater controls, site grading, and cover maintenance would reduce the mobility of contaminants by physical processes but not by treatment.	**Fair.** Removing wastes from the site would reduce the volume, toxicity, and mobility of wastes at the site by physical processes but not by treatment.
Short-Term Effectiveness	**Good.** Existing fencing and the digging permit process currently protects Base workers. There currently are no contaminants in the groundwater above regulatory limits.	**Better.** Physical hazards may impact construction workers processing surface debris or performing LTM. These risks could be mitigated by following accepted health and safety protocols.	**Good.** Physical hazards may impact construction workers processing subsurface debris. If hazardous materials and/or contaminated soils are present, there may be chemical hazards. There could also be risks from munitions or explosives constituents, if present. These risks could be mitigated by following accepted health and safety protocols.

TABLE 5-1. COMPARATIVE ANALYSIS OF ALTERNATIVES - SITE 29
(Page 2 of 2)

CERCLA Criteria [a]	NO ACTION	PREVIOUSLY SELECTED REMEDY	CLEAN-CLOSURE (PREFERRED ALTERNATIVE)
Balancing Criteria – Used to weigh major tradeoffs among alternatives. *(Continued)*			
Implementability	**Not applicable.** No activities proposed.	**Good.** This alternative can readily be implemented. Surface debris has already been removed. Assessment/amendment of the existing cover and construction of stormwater controls can be accomplished using locally available materials and standard engineering practice. Groundwater monitoring of existing wells and maintenance of LUCs is readily implementable as long as existing Base administrative infrastructure remains in place.	**Good.** This alternative can readily be implemented. Surface debris has already been removed. Hazardous wastes, if encountered, can be packaged and treated off site. Explosive ordnance, if encountered, can be demilitarized on site. Unlike the previously selected remedy, clean closure does not rely on the existence of Base administrative infrastructure for long term implementation of the remedy.
Cost			
Present Value Cost [b]	None	$5.3 million	$2.4 million
Modifying Criteria – Fully considered only after the public comment period for the proposed plan.			
Regulatory Agency Acceptance	**Not acceptable.**	**Acceptable.** Alternative selected in OU2 ROD.	**To be determined [c].**
Community Acceptance	No public comments specific to this alternative when presented in the original Site 29 Proposed Plan.	No public comments specific to this alternative when presented in the original Site 29 Proposed Plan.	No public comments were received during the public comment period for the Site 29 Proposed Plan (Revised).

Notes:

[a] Source: USEPA (1999).
[b] Present value cost in 2010 dollars (see Table 4-1).
[c] Regulatory agency acceptance of clean-closure will be determined after review of the draft document.

ARARs Applicable or Relevant and Appropriate Requirements
CAI closed, abandoned, or inactive
CCR California Code of Regulations
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
LTM long-term monitoring
ROD Record of Decision
USEPA United States Environmental Protection Agency

FIGURES

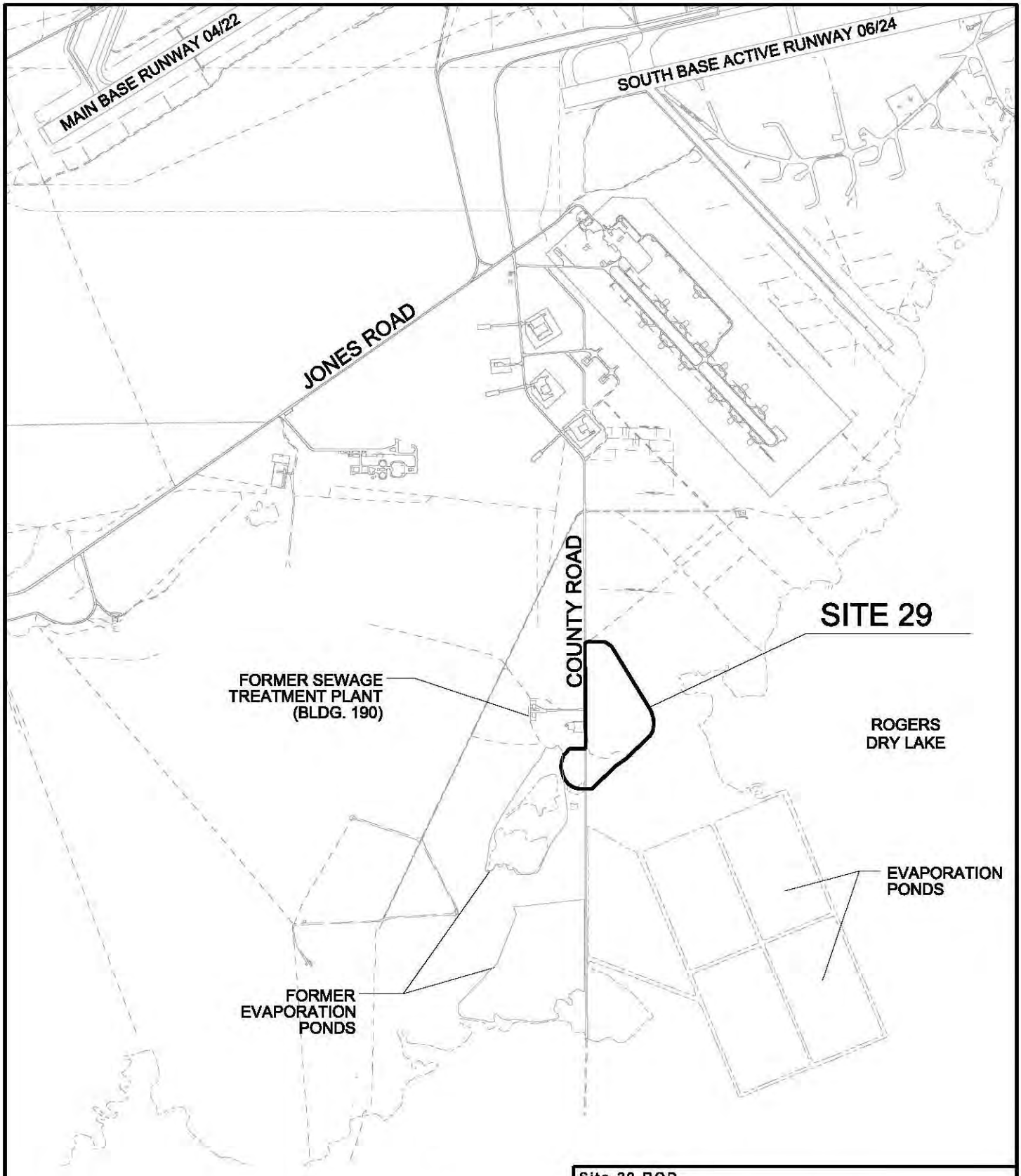
1-1 Reference Map – Site 29

2-1 Location Map – Site 29

3-1 Site 29 Subsurface Debris Areas Identified during Geophysical Survey February 2010

3-2 Site 29 Estimated Extent of Subsurface Debris

3-3 Pathways Retained for CERCLA Response – Site 29



Site 29 ROD

Reference Map Site 29

Date 07-12	South Base Edwards AFB	Figure 1-1
Project No. 60142113		

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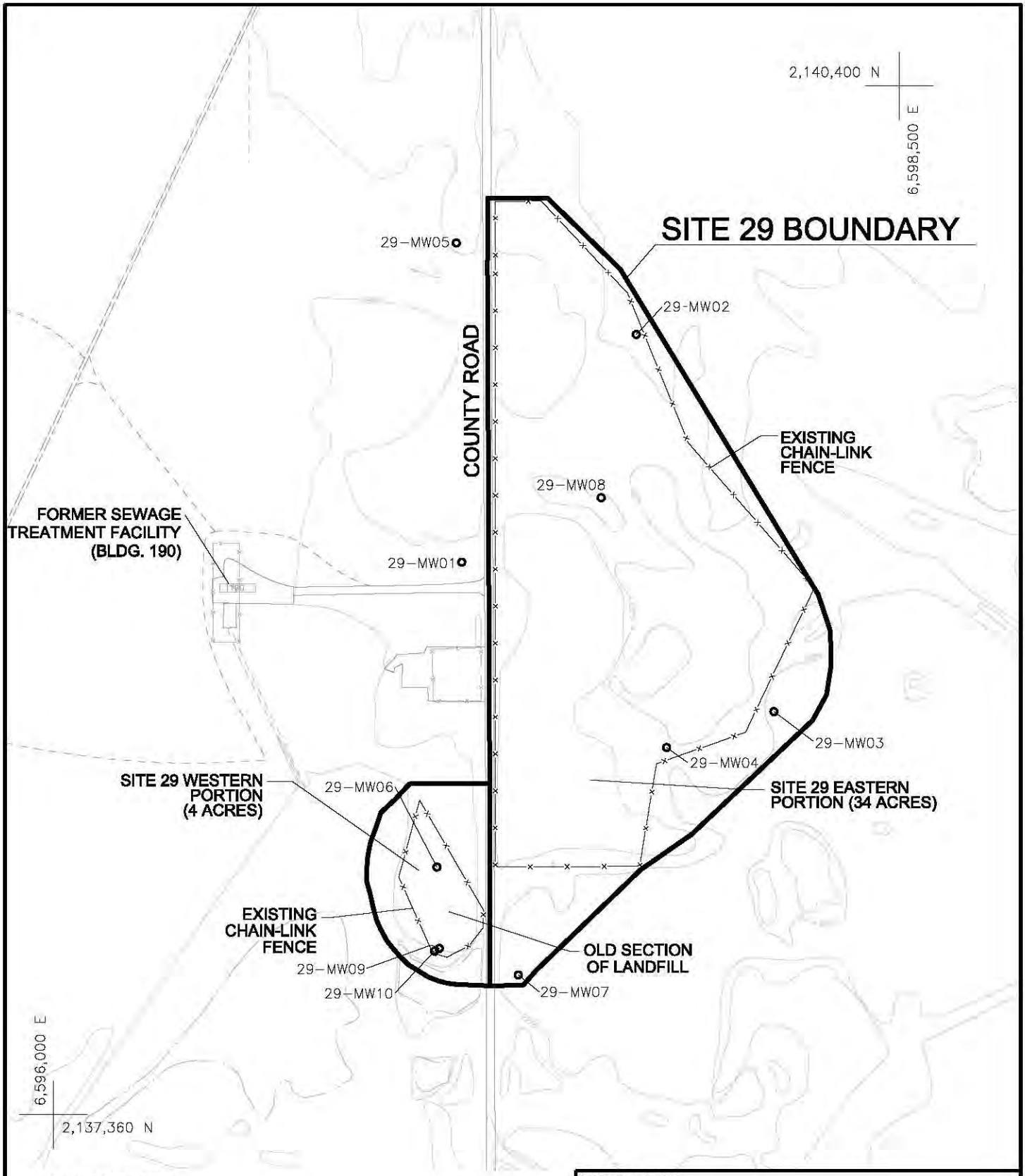

EXPLANATION

- EXISTING GROUNDWATER MONITORING WELL LOCATION

NORTH

0 200 400 FEET

SCALE: 1"= 400'

Site 29 ROD

Location Map Site 29

Date 07-12	South Base Edwards AFB	Figure 2-1
Project No. 60142113		

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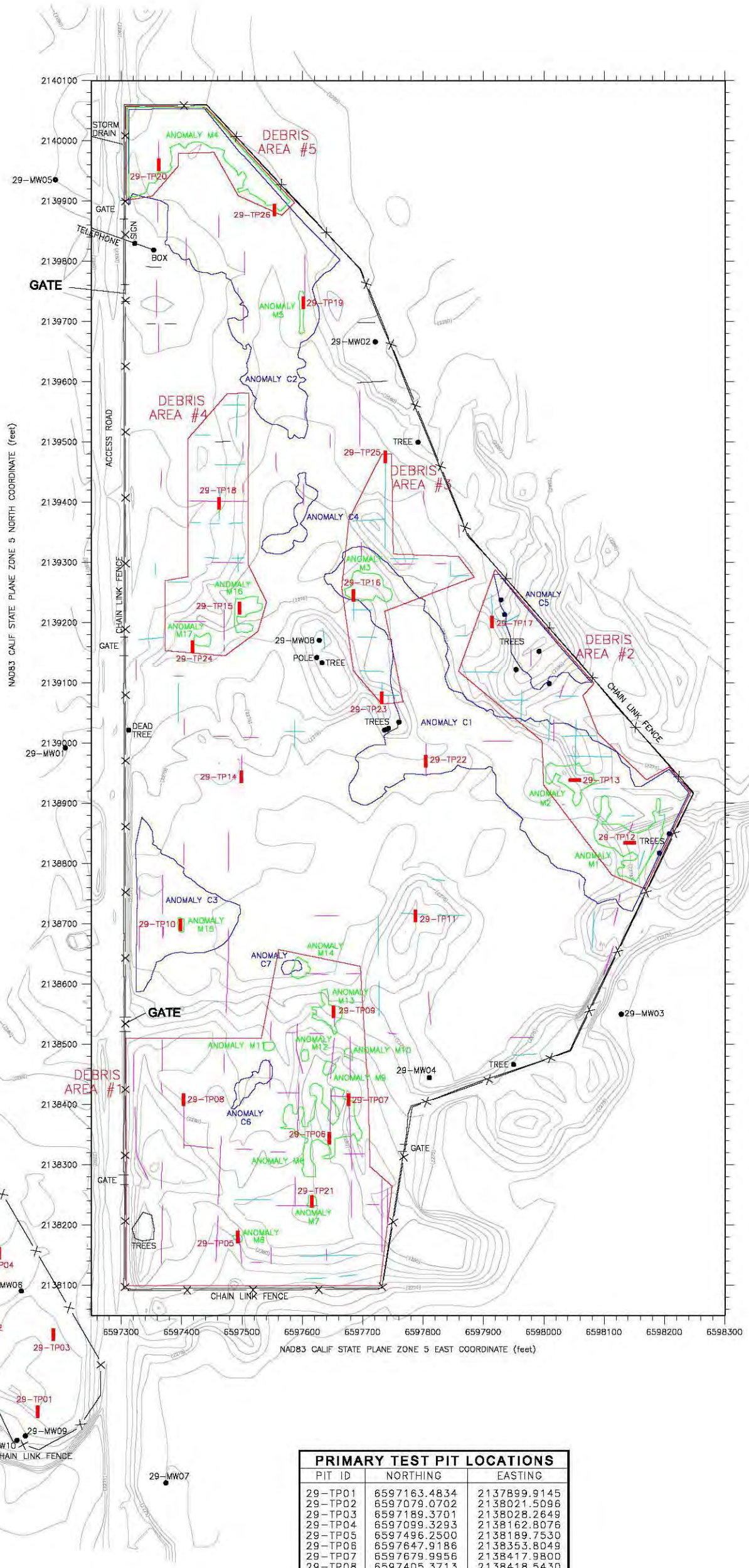

PRIMARY TEST PIT LOCATIONS		
PIT ID	NORTHING	EASTING
29-TP01	6597163.4834	2137899.9145
29-TP02	6597079.0702	2138021.5096
29-TP03	6597189.3701	2138028.2649
29-TP04	6597099.3293	2138162.8076
29-TP05	6597496.2500	2138189.7530
29-TP06	6597647.9186	2138353.8049
29-TP07	6597679.9956	2138417.9800
29-TP08	6597405.3713	2138418.5430
29-TP09	6597655.2344	2138564.3445
29-TP10	6597401.4320	2138707.8943
29-TP11	6597791.4211	2138723.6566
29-TP12	6598154.0592	2138836.8524
29-TP13	6598062.8929	2138940.9963
29-TP14	6597502.1651	2138954.4621
29-TP15	6597498.7886	2139234.2434
29-TP16	6597687.8742	2139255.6351
29-TP17	6597918.0409	2139211.1629
29-TP18	6597465.0233	2139408.1920
29-TP19	6597604.5865	2139740.8896
29-TP20	6597364.2901	2139970.5693
29-TP21	6597618.4086	2138249.0882
29-TP22	6597807.6028	2138980.6693
29-TP23	6597734.5854	2139084.9138
29-TP24	6597420.4224	2139169.8675
29-TP25	6597740.6802	2139484.6645
29-TP26	6597556.8352	2139895.5506

EXISTING WELL COORDINATES		
PIT ID	NORTHING	EASTING
29-MW02	6597722.0660	2139665.4820
29-MW04	6597811.6580	2138444.9350
29-MW06	6597133.8281	2138091.4597
29-MW08	6597628.5582	2139169.7152
29-MW09	6597146.0397	2137846.5299
29-MW10	6597131.6970	2137839.0550

EXPLANATION

- PROPOSED TEST PIT LOCATION
- EM-31 SOIL CONDUCTIVITY ANOMALIES (7) PRIMARILY RESPONDING TO SOIL TYPE/MOISTURE CONTENT CHANGES, NOT SUBSURFACE DEBRIS
- EM-31 METAL DETECTION ANOMALIES (17) REPRESENTING GROUPS OF SMALL DIMENSION, SHALLOW SUBSURFACE (0-10 FEET), METAL OBJECTS
- RADAR ANOMALIES (1590) REPRESENTING RANDOMLY DISTRIBUTED, SMALL DIMENSION, SHALLOW SUBSURFACE, METAL AND NON-METAL OBJECTS (NOT SHOWN)
- RADAR ANOMALY (105) GROUPS OF AT LEAST 5 SMALL DIMENSION (LESS THAN 0.5 FEET), SHALLOW SUBSURFACE (0-4 FEET) OBJECTS ALONG 5 FEET OF PROFILE
- RADAR ANOMALIES (55) REPRESENTING POSSIBLE BURIAL PITS CONTAINING MULTIPLE, SMALL DIMENSION SUBSURFACE OBJECTS
- INTERPRETED SIGNIFICANT SUBSURFACE DEBRIS AREAS ENCOMPASSING MOST OF THE EM METAL DETECTION ANOMALIES AND RADAR ANOMALY GROUPS AND PITS. THESE 5 AREAS RANGE FROM 0.48 TO 4.72 ACRES AND OCCUPY APPROXIMATELY 33% OF THE SEARCH AREA.

NORTH

0 100 200 FEET

SCALE: 1"=200'

Site 29 ROD

Site 29
Subsurface Debris Areas Identified during Geophysical Survey February 2010

Date 07-12	South Base Edwards AFB	Figure 3-1
Project No. 60142113		

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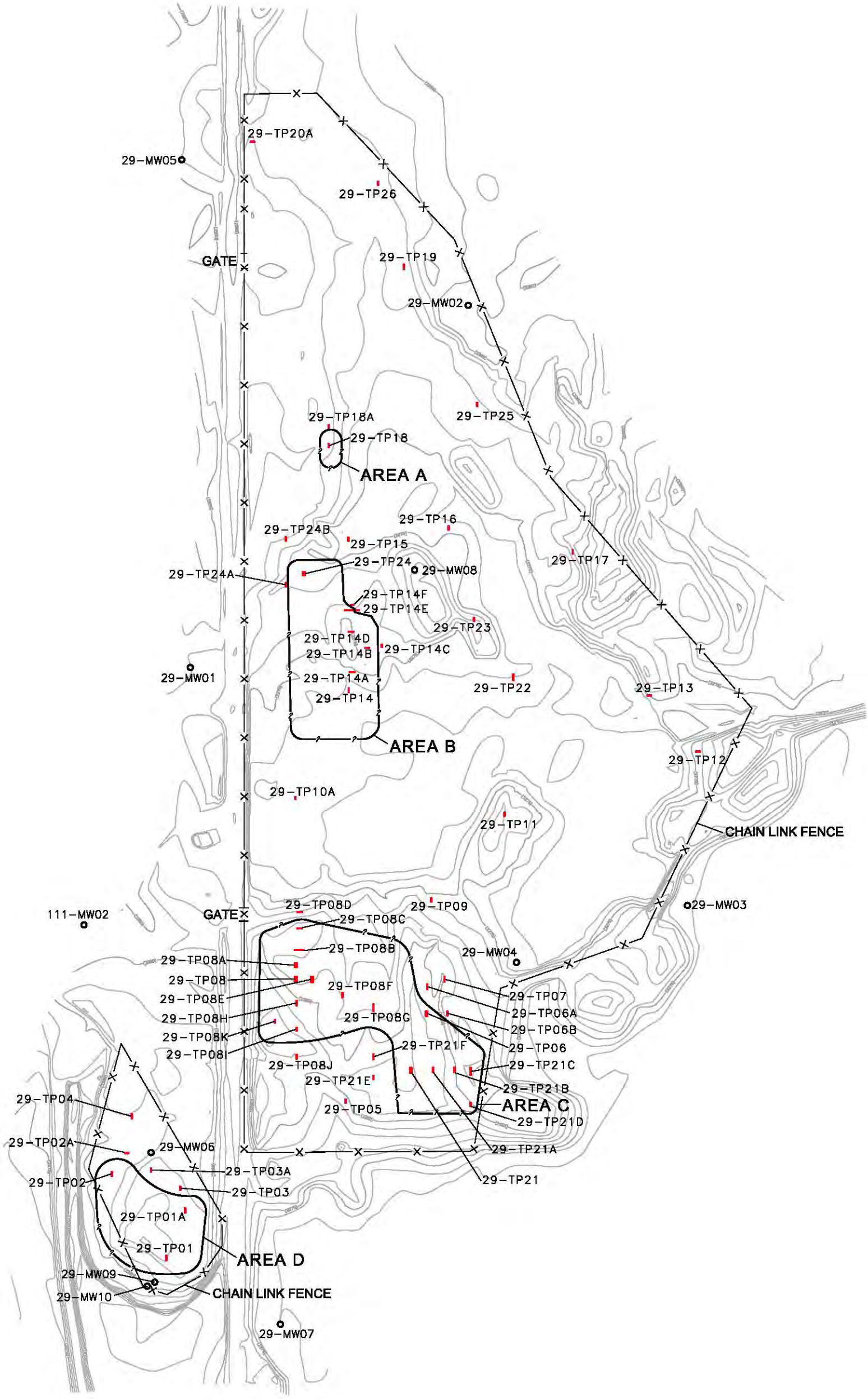

EXPLANATION

- TEST PIT LOCATION
- INTERPRETED AREAS OF SUBSURFACE DEBRIS (BASED ON TEST PIT EXCAVATIONS)
- EXISTING GROUNDWATER MONITORING WELL LOCATION

NOTE: SECONDARY TEST PIT LOCATIONS ARE LABELED WITH A LETTER DESIGNATION, E.G. 29-TP01A

NORTH

0 100 200 FEET

SCALE: 1"= 200'

Site 29 ROD

Site 29 Estimated Extent of Subsurface Debris

Date 7-12	South Base Edwards AFB	Figure 3-2
Project No. 60142113		

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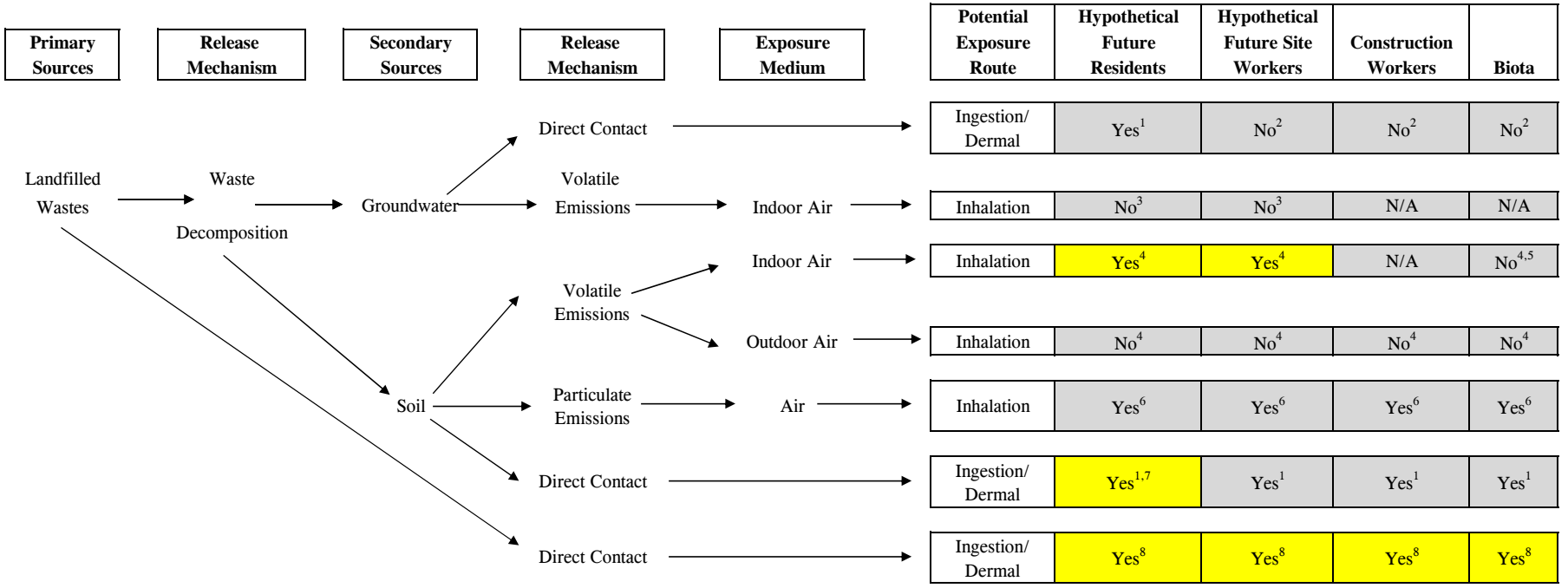
FIGURE 3-3. PATHWAYS RETAINED FOR CERCLA RESPONSE - SITE 29



Potential Exposure Route	Hypothetical Future Residents	Hypothetical Future Site Workers	Construction Workers	Biota
Ingestion/ Dermal	Yes[1]	No[2]	No[2]	No[2]
Inhalation	No[3]	No[3]	N/A	N/A
Inhalation	Yes[4]	Yes[4]	N/A	No[4,5]
Inhalation	No[4]	No[4]	No[4]	No[4]
Inhalation	Yes[6]	Yes[6]	Yes[6]	Yes[6]
Ingestion/ Dermal	Yes[1,7]	Yes[1]	Yes[1]	Yes[1]
Ingestion/ Dermal	Yes[8]	Yes[8]	Yes[8]	Yes[8]

Notes:

Yellow highlights indicate pathways retained for CERCLA response

Grey shading indicates pathways not retained either because the pathway does not exist, or risks were less than or within the risk management range, and action based on the risk calculations is not warranted.

[1] Pathway potentially complete, however cancer risks are less than 1 x 10^{-6} and the Hazard Index is less than 1, (see Table 3-3). No constituents in groundwater detected above primary MCLs. There is a future risk, albeit small, of a container of hazardous waste buried in the landfill leaking and contaminating underlying soils or groundwater. The risk is thought to be small because no evidence of hazardous waste disposal has been found in test pits.

[2] Depth to groundwater over 12 feet below ground surface; no complete pathway.

[3] Not specifically evaluated; however, volatile organic compounds only sporadically detected in groundwater (below MCLs since 2002) and groundwater depth is greater than 100 feet.

[4] Landfill gases (including methane) not detected in probes during Remedial Investigation; volatile organic compounds only sporadically detected in soil. There is a future risk, albeit small, of a container of hazardous waste buried in the landfill leaking and migrating as soil vapor to threaten indoor air in a hypothetical future building. The risk is thought to be small because because no evidence of hazardous waste disposal has been found in test pits.

[5] Risk for soil vapors accumulating in burrows likely to be low based on validation study (United States Air Force [USAF] 2002a).

[6] Pathway potentially complete; however, risk within acceptable limits (pathway included in PRGs for soil [see Table 3-3]).

[7] Soil samples not collected below waste cells; pathway cannot be ruled out.

[8] Not specifically evaluated; however, the presence of hazardous wastes cannot be ruled out, therefore, there may be risks from direct contact, albeit non-quantifiable.

MCLs	Maximum Contaminant Levels
N/A	Not applicable; receptor is not considered likely to be in contact with the exposure medium.
PRGs	Preliminary Remediation Goals

APPENDIX A

SUMMARY OF ARARS

TABLE A-1. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS – SITE 29

Item No.	Requirement	Citation	Federal or State Requirement	Description	ARAR Determination	Comments
Chemical-specific ARARs						
There are no chemical-specific ARARs associated with this remedy.						
Location-specific ARARs						
1	Endangered Species Act of 1973, Section 7 (c)	50 CFR Parts 200 and 402	Federal	Requires formal consultation with the USFWS if activities have the potential to alter the natural environment of listed endangered and threatened species.	Relevant and Appropriate	Endangered or threatened species and/or critical habitat are found at Edwards AFB. Site 29 is not considered to be critical habitat.
2	Migratory Bird Treaty Act	50 CFR Parts 10 and 20 (16 USC Section 703 et seq.)	Federal	Prohibits unlawful taking, possession, and sale of almost all species of native birds in the United States	Applicable	Edwards AFB has over 200 species of birds. Actions need to be taken during the Remedial Action to avoid take of birds protected under the Migratory Bird Treaty Act.
3	California Endangered Species Act	California Fish and Game Code, Div. 3, Ch. 1.5, Article 1, Sections 2050-2055; Article 3, Section 2080; 14 CCR, Div. 1, Subdivision 3, Ch. 6, Article 1, Sections 670.1, 670.5, and 783 et seq.	State	Establishes species, subspecies, and varieties of native California plants or animals as endangered, threatened, or rare. Prohibits the taking, importation, or sale of any species, or any part thereof, of an endangered species or a threatened species. Prohibits releases and/or actions that would have a deleterious effect on species or their habitat. Contains provisions concerning CDFG coordination and consultation with State and Federal agencies and with project applicants. 14 CCR Section 670.1 provides a listing of the plants of California to be declared endangered, threatened, or rare. 14 CCR Section 670.5 provides a listing of the animals of California to be declared endangered or threatened. 14 CCR Section 783 et seq. provides the implementation regulations for the California Endangered Species Act.	Relevant and Appropriate	Relevant and Appropriate if there are endangered or threatened species in the area that could be affected if actions are not taken to conserve the species, and where State law has a listing that is more stringent than the Federal Endangered Species Act and Migratory Bird Treaty Act. As stated in Air Force Instruction 32-7064, dated 17 Sept. 2004, State authority will be contacted if conflicts arise to determine if any conservation measures can be feasibly implemented to avoid or mitigate impacts.
4	Wildlife Species/Habitats	California Fish and Game Code, Div.3, Ch. 1, Section 2000; Div. 4, Part 2, Ch.1, Sections 3511 and 3513; and Div. 9, Ch.1, Section 12000 et seq. 14 CCR, Div. 1, Subdivision 2, Ch. 1, Section 250; Ch. 7, Section 507; Subdivision 3, Ch. 1, Section 650	State	Prohibits the taking of birds and mammals, except as otherwise provided in the Fish and Game Code and 14 CCR. Section 3511 provides that it is unlawful to take or possess any of the following fully protected birds: (a) American peregrine falcon; (b) Brown pelican; (c) California black rail; (d) California clapper rail; (e) California condor; (f) California least tern; (g) Golden eagle; (h) Greater sandhill crane; (i) Light-footed clapper rail; (j) Southern bald eagle; (k) Trumpeter swan; (l) White-tailed kite; (m) Yuma clapper rail.	Relevant and Appropriate	Relevant and Appropriate to the extent that such fully protected birds are located on or near Site 29. As stated in Air Force Instruction 32-7064, dated 17 Sept. 2004, State authority will be contacted if conflicts arise to determine if any conservation measures can be feasibly implemented to avoid or mitigate impacts.

Item No.	Requirement	Citation	Federal or State Requirement	Description	ARAR Determination	Comments
Location-specific ARARs *(Continued)*						
5	Fully Protected Birds	California Fish and Game Code, Div. 4, Part 2, Ch. 1, Section 3503.5	State	Section 3503.5 prohibits the take, possession, or destruction of any birds in the orders of Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto.	Relevant and Appropriate	Relevant and appropriate to the extent that birds-of-prey, or their nests and eggs, are located on or near Site 29. As stated in Air Force Instruction 32-7064, dated 17 Sept. 2004, State authority will be contacted if conflicts arise to determine if any conservation measures can be feasibly implemented to avoid or mitigate impacts.
6	Fully Protected Mammals	California Fish and Game Code, Div. 4, Part 3, Ch. 2, Section 4000 et seq.; Ch. 10, Section 4800 et seq. 14 CCR, Div. 1, Subdivision 2, Ch. 5, Section 460	State	Actions must be taken to assure that no fully protected mammals are taken or possessed at any time. Section 4000 et seq. provides that a fur-bearing mammal may be taken only with a trap, a firearm, bow and arrow, poison under a proper permit, or with the use of dogs. The Code identifies fur-bearing mammals as the following: pine marten, fisher, wolverine, mink, river otter, gray fox, cross fox, silver fox, red fox, kit fox, raccoon, beaver, badger, and muskrat. Section 4800 et seq. requires that action must be taken to avoid injuring, taking, possessing or transporting any mountain lion. Mountain lions are specially protected mammals in California. It is unlawful to take, injure, possess, transport, or sell any mountain lion or any part or product thereof. Violation of this section is a misdemeanor. 14 CCR Section 460 makes it unlawful to take fisher, martin, river otter, desert kit fox, and red fox.	Relevant and Appropriate	Relevant and appropriate if regulated mammals and/or their habitat are located on or near Site 29. As stated in Air Force Instruction 32-7064, dated 17 Sept. 2004, State authority will be contacted if conflicts arise to determine if any conservation measures can be feasibly implemented to avoid or mitigate impacts.

TABLE A-1. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS – SITE 29

Item No.	Requirement	Citation	Federal or State Requirement	Description	ARAR Determination	Comments
Location-specific ARARs *(Continued)*						
7	Fully Protected Amphibians and Reptiles	California Fish and Game Code, Div. 5, Ch. 1, Section 5000 et seq.	State	Section 5000 makes it unlawful to sell, purchase, harm, take, possess, or transport any tortoise or parts thereof, or to shoot any projectile at a tortoise. This does not apply to the taking of any tortoise when authorized by the department for education, scientific, or public zoological purposes.	Relevant and Appropriate	Numerous reptile species may be present at Site 29. Site 29 does not contain critical tortoise habitat; however, tortoises occur near Site 29. The Base INRMP details, or incorporates by reference, the management practices to be followed at sites with desert tortoise habitat.
		14 CCR, Div. 1, Subdivision 1, Ch. 5, Section 40.		14 CCR Section 40 makes it unlawful to capture, collect, intentionally kill or injure, possess, purchase, propagate, sell, transport, import, or export any native reptile or amphibian, or parts thereof unless under special permit from the department issued pursuant to 14 CCR Sections 650, 670.7, or 783 of these regulations, or as otherwise provided in the Fish and Game Code or these regulations.		As stated in Air Force Instruction 32-7064, dated 17 Sept. 2004, State authority will be contacted if conflicts arise to determine if any conservation measures can be feasibly implemented to avoid or mitigate impacts.
Action-specific ARARs						
8	Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262 49 CFR 171-177 and 49 USC 1801-1813	Federal	These regulations apply to generators of hazardous waste. Edwards AFB is a large quantity generator of hazardous waste (EPA ID CA1570024504) and already subject to these requirements.	Relevant and Appropriate if wastes are hazardous as defined by 22 CCR.	Relevant and Appropriate to waste generated during remedial actions if these wastes are hazardous. Substantive requirements are potentially ARARs if excavated soils or treatment residuals exceed RCRA or California[(a)] hazardous waste thresholds. Hazardous remediation waste may be stored on site in Corrective Action Temporary Units. These Corrective Action Temporary Units are not subject to the less than 90-day accumulation time requirement. Temporary units may operate for one year with an opportunity for a 1-year extension.
		22 CCR, Div. 4.5, Ch. 12, Articles 1-4, Sections 66262.10-.47	State	Establishes standards for generators of RCRA and California[(a)] hazardous wastes, including those for hazardous waste determination, accumulation, identification numbers, manifesting, pre-transport, and record keeping and reporting requirements.		Hazardous wastes may be encountered during subsurface debris removal.
		22 CCR, Div.4.5, Ch. 14, Article 9, Sections 88264.170 - .179		Establishes standards for the use and management of containers for the storage of hazardous waste.		
9	Definition of and Criteria for Identifying Hazardous Wastes	40 CFR 261.3 22 CCR, Div. 4.5, Ch. 11, Article 1, Sections 66261.2-.3; Article 3, Sections 66262.24 -.33; Article 5, Sections 66261.100-.101	Federal State	Defines wastes that are subject to regulation as a RCRA or California[(a)] hazardous waste. Excavated contaminated soil, extracted groundwater, and spent treatment residuals (e.g., granular activated carbon) must be classified using AF knowledge of the timing and nature of the release as well as waste toxicity characteristic testing. If, after good faith effort, the AF determines that the contaminated soil or groundwater contains a listed RCRA or California[(a)] hazardous waste or fails the Federal or State toxicity characteristic tests, then the excavated soil or extracted groundwater is considered hazardous based on EPA's "contained-in" policy and must be managed as hazardous remediation waste. Contaminated soils or groundwater that are treated in situ are not subject to the identification or classification requirements.	Applicable if wastes are hazardous as defined by 22 CCR.	The definitions of hazardous waste in Article 1 and toxicity characteristic criteria (i.e., TTLC and STLC levels) in Section 66261.24 are applicable for the characterization of soil cuttings from well installation, as well as purge water and spent carbon from groundwater monitoring and on site water treatment. Hazardous wastes may be encountered during surface debris removal at Site 29. No hazardous soil cuttings will be generated by the enhancement to the drainage system around Site 29. Hazardous wastes may be encountered during subsurface debris removal.

TABLE A-1. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS – SITE 29

Item No.	Requirement	Citation	Federal or State Requirement	Description	ARAR Determination	Comments
Action-specific ARARs *(Continued)*						
10	Hazardous Waste Land Disposal Restrictions (LDR)	22 CCR, Div. 4.5, Ch. 14 Article 15.5, Sections 66264.550-.553, including 66264.552.5 for California[a] hazardous wastes; Ch. 18, Section 66268	State	Identifies hazardous wastes that are restricted from land disposal without prior treatment to UTS. Hazardous remediation wastes that are managed off-site are subject to the LDR UTS specified in Section 66268 for wastewater (liquid) and non-wastewater (solid). Hazardous soils must be treated to 90% reduction in concentration capped at 10 times the UTS for principal hazardous constituents (90% capped at 10 x UTS). On-site treatment or disposal of hazardous remediation wastes are not strictly subject to the LDR treatment standards, but are subject to similar treatment standards specified in the Corrective Action Management Unit Amendment Rule codified in 40 CFR 264.550-.555 and 22 CCR 66264.550-.553.	Applicable if wastes are hazardous as defined by 22 CCR.	LDR applicable to off-site disposal of hazardous debris or soils for these remediation wastes are RCRA or California[a] hazardous waste, as determined through toxicity characteristic testing using TCLP and TTLC/STLC.
11	Land Use Controls	22 CCR, Div. 4.5, Ch. 39, Section 67391.1 California Civil Code, Div. 3, Part 1, Title 3, Section 1471(a) through (f)	State	Requires that if a remedy will result in hazardous substances remaining on a property at levels not suitable for unlimited use and unrestricted exposure, the limitations or controls are clearly set forth and defined in the response action decision document, and that the decision document include an implementation and enforcement plan. In the event of a property transfer, requires the State to enter into restrictive land use covenants with land-owners and their successors, with exceptions for Federal-to-Federal property transfers.	Relevant and Appropriate	Institutional controls will be required at Site 29 as long as the buried waste remains in place due to the potential that buried UXO is present in the landfill. Institutional controls will be required at Site 29 until soil vapor contaminants are assessed to be at levels to allow for unlimited use and unrestricted exposure. Although it is not contemplated that property at OU2 will be transferred, in the event that such property is transferred, the AF and the State have agreed to follow the procedure laid out in the Basewide Land Use Control Implementation Plan. EPA agrees that the substantive portions of the regulation referenced are ARARs. EPA specifically considers sections (a), (d), (e), and (f) of 22 CCR, Section 67391.1 to be ARARs for this ROD. DTSC's position is that all of the state regulation is an ARAR. After clean-closure, this ARAR will no longer apply.
12	California Department of Resources Recycling and Recovery (CalRecycle) Requirements for Non-hazardous Waste Management Units	27 CCR, Division 2, Subdivision 1, Chapter 1, Article 1; Chapter 3, Subchapter 2-5, Sections 20200 through 21420 Note: See also Table A-2 for detailed discussion	State	Requirements for non-hazardous waste management units. These regulations also replace those codified by SWRCB in Title 23, Division 3, Chapter 15 regarding cleanup of hazardous waste discharges, including remedial action groundwater monitoring requirements. Requirements include classification, design, siting, construction, operation, monitoring, and closure and post-closure care. Sets forth the performance standards and the minimum substantive requirements for proper closure, post-closure maintenance, and ultimate reuse of solid waste disposal sites to assure that public health and safety and the environment are protected from pollution due to the disposal of solid waste.	Applicable	Applicable for on-site facilities that manage non-hazardous remediation wastes. Portions of these regulations are more stringent than 40 CFR Part 258 for landfills without liner systems. Units that were closed, abandoned, or inactive (CAI) before November 27, 1984 (CAI Units) may not need to meet all of the Closure and Post-Closure Maintenance requirements of CCR, Title 27. 27 CCR §20380. SWRCB – Applicability and §21810 CalRecycle - Final Closure Plan Contents for Clean Closure (new) apply to sites for which clean-closure is proposed.

Notes:

[a] California hazardous waste (as used in this table) is the same as non-RCRA hazardous waste as defined in Section 66261.101 of CCR Title 22.

§	Section
%	percent
AF	Air Force
AFB	Air Force Base
ARARs	Applicable or Relevant and Appropriate Requirements
CAI	closed, abandoned, or inactive
CalRecycle	California Department of Resources Recycling and Recovery
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CFR	Code of Federal Regulations
Ch.	Chapter
Div.	Division
DTSC	Department of Toxic Substances Control
e.g.	*exempli gratia* (for example)
EPA	Environmental Protection Agency
et seq.	*et sequentes* (and the following)
i.e.	*id est*, that is
ID	identification
INRMP	Integrated Natural Resources Management Plan
LDR	land disposal restriction
No.	number
OU2	Operable Unit 2
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
STLC	soluble threshold limit concentration
SWRCB	State Water Resources Control Board
TCLP	toxic characteristic leaching procedure
TTLC	total threshold limit concentration
USC	United States Code
USFWS	United States Fish and Wildlife Service
UTS	universal treatment standard
UXO	unexploded ordnance

TABLE A-2. PORTIONS OF TITLE 27, CALIFORNIA CODE OF REGULATIONS APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS SPECIFIC TO SITE 29

Citation	Description	ARAR Determination	Comments
§20380 (d) Water monitoring	Specifies detection, evaluation, and corrective action program requirements. Part (d) of this section contains the requirements for clean-closed sites.	Applicable	Water monitoring is not required if site has been cleaned closed and has be compliance with Water Quality Standard for period of three years as stated "(d) Apply Unless Clean-Closed — The regulations under this article apply during the Unit's active life and closure period. After closure of the Unit, the regulations in this article apply during the post closure maintenance period of the Unit and during any compliance period under §20410 of this article, unless: (1) the Unit has been in compliance with the water quality protection standard ("Water Standard" of §20390) for a period of three consecutive years; and (2) Clean-Closure — all waste, waste residues, contaminated containment system components, contaminated subsoils, and all other contaminated materials are removed or decontaminated at closure, pursuant to: §21090(f), for landfills; §21400(b)(1), for surface impoundments; or §21410(a)(1), for waste piles."
§21090(f) Closure and Post-Closure Maintenance Requirements for Solid Waste Landfills	Contains the requirements for the clean-closure of solid waste landfills including the requirement for a detailed clean-closure plan and a verification report confirming that waste and residual contaminated soils have been removed.	Applicable	The clean-closure of Site 29 would be performed in compliance with this section. The discharger shall have successfully clean-closed a landfill only if: (1) all waste materials, contaminated components of the containment system, and affected geologic materials — including soils and rock beneath and surrounding the Unit, and ground water polluted by a release from the Unit — are either removed and discharged to an appropriate Unit or treated to the extent that the RWQCB finds they no longer pose a threat to water quality; and (2) all remaining containment features are inspected for contamination and, if contaminated, discharged in accordance with ¶(f)(1).

Notes:

¶ *a linea* (off the line)
§ Section
RWQCB Regional Water Quality Control Board

APPENDIX B

COST ESTIMATES

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 1 2011	Calendar Year 2 2012	Calendar Year 3 2013	Calendar Year 4 2014	Calendar Year 5 2015	Calendar Year 6 2016	Calendar Year 7 2017	Calendar Year 8 2018	Calendar Year 9 2019	Calendar Year 10 2020
Design	$102,170									
Stormwater and Access Controls		$212,408								
Concrete Debris Removal		$877,013								
Landfill Capping		$1,092,763								
Operations and Maintenance			$249,376	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring		$145,055	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$102,170	$2,327,238	$270,167	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.974	0.948	0.923	0.899	0.875	0.852	0.830	0.808	0.787	0.766
Present Value	$ 99,484	$ 2,206,479	$ 249,414	$ 63,008	$ 61,351	$ 59,739	$ 82,628	$ 56,639	$ 55,150	$ 53,700

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 11 2021	Calendar Year 12 2022	Calendar Year 13 2023	Calendar Year 14 2024	Calendar Year 15 2025	Calendar Year 16 2026	Calendar Year 17 2027	Calendar Year 18 2028	Calendar Year 19 2029	Calendar Year 20 2030
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.746	0.726	0.707	0.689	0.671	0.653	0.636	0.619	0.603	0.587
Present Value	$ 52,288	$ 72,323	$ 49,575	$ 48,272	$ 47,002	$ 45,767	$ 63,303	$ 43,392	$ 42,251	$ 41,140

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 21 2031	Calendar Year 22 2032	Calendar Year 23 2033	Calendar Year 24 2034	Calendar Year 25 2035	Calendar Year 26 2036	Calendar Year 27 2037	Calendar Year 28 2038	Calendar Year 29 2039	Calendar Year 30 2040
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.572	0.556	0.542	0.528	0.514	0.500	0.487	0.474	0.462	0.450
Present Value	$ 40,059	$ 109,382	$ 37,980	$ 36,982	$ 36,009	$ 35,063	$ 48,498	$ 33,243	$ 32,369	$ 31,518

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 31 2041	Calendar Year 32 2042	Calendar Year 33 2043	Calendar Year 34 2044	Calendar Year 35 2045	Calendar Year 36 2046	Calendar Year 37 2047	Calendar Year 38 2048	Calendar Year 39 2049	Calendar Year 40 2050
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out			$83,010							
Total	$70,093	$99,568	$153,104	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.438	0.426	0.415	0.404	0.394	0.383	0.373	0.363	0.354	0.344
Present Value	$ 30,690	$ 42,449	$ 63,557	$ 28,332	$ 27,587	$ 26,862	$ 37,155	$ 25,468	$ 24,799	$ 24,147

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 41 2051	Calendar Year 42 2052	Calendar Year 43 2053	Calendar Year 44 2054	Calendar Year 45 2055	Calendar Year 46 2056	Calendar Year 47 2057	Calendar Year 48 2058	Calendar Year 49 2059	Calendar Year 50 2060
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.335	0.327	0.318	0.310	0.302	0.294	0.286	0.278	0.271	0.264
Present Value	$ 23,512	$ 64,200	$ 22,292	$ 21,706	$ 21,135	$ 20,580	$ 28,465	$ 19,512	$ 18,999	$ 18,499

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 51 2061	Calendar Year 52 2062	Calendar Year 53 2063	Calendar Year 54 2064	Calendar Year 55 2065	Calendar Year 56 2066	Calendar Year 57 2067	Calendar Year 58 2068	Calendar Year 59 2069	Calendar Year 60 2070
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.257	0.250	0.244	0.237	0.231	0.225	0.219	0.213	0.208	0.202
Present Value	$ 18,013	$ 24,915	$ 17,078	$ 16,629	$ 16,192	$ 15,766	$ 21,808	$ 14,948	$ 14,555	$ 14,173

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 61 2071	Calendar Year 62 2072	Calendar Year 63 2073	Calendar Year 64 2074	Calendar Year 65 2075	Calendar Year 66 2076	Calendar Year 67 2077	Calendar Year 68 2078	Calendar Year 69 2079	Calendar Year 70 2080
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.197	0.192	0.187	0.182	0.177	0.172	0.168	0.163	0.159	0.155
Present Value	$ 13,800	$ 37,681	$ 13,084	$ 12,740	$ 12,405	$ 12,079	$ 16,707	$ 11,452	$ 11,151	$ 10,858

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 71 2081	Calendar Year 72 2082	Calendar Year 73 2083	Calendar Year 74 2084	Calendar Year 75 2085	Calendar Year 76 2086	Calendar Year 77 2087	Calendar Year 78 2088	Calendar Year 79 2089	Calendar Year 80 2090
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.151	0.147	0.143	0.139	0.136	0.132	0.129	0.125	0.122	0.119
Present Value	$ 10,572	$ 14,623	$ 10,024	$ 9,760	$ 9,504	$ 9,254	$ 12,800	$ 8,774	$ 8,543	$ 8,318

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 81 2091	Calendar Year 82 2092	Calendar Year 83 2093	Calendar Year 84 2094	Calendar Year 85 2095	Calendar Year 86 2096	Calendar Year 87 2097	Calendar Year 88 2098	Calendar Year 89 2099	Calendar Year 90 2100
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.116	0.113	0.110	0.107	0.104	0.101	0.098	0.096	0.093	0.091
Present Value	$ 8,100	$ 22,117	$ 7,679	$ 7,478	$ 7,281	$ 7,090	$ 9,806	$ 6,722	$ 6,545	$ 6,373

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 91 2101	Calendar Year 92 2102	Calendar Year 93 2103	Calendar Year 94 2104	Calendar Year 95 2105	Calendar Year 96 2106	Calendar Year 97 2107	Calendar Year 98 2108	Calendar Year 99 2109	Calendar Year 100 2110
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.089	0.086	0.084	0.082	0.080	0.077	0.075	0.073	0.072	0.070
Present Value	$ 6,205	$ 8,583	$ 5,883	$ 5,729	$ 5,578	$ 5,431	$ 7,513	$ 5,150	$ 5,014	$ 4,882

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 101 2111	Calendar Year 102 2112	Calendar Year 103 2113	Calendar Year 104 2114	Calendar Year 105 2115	Calendar Year 106 2116	Calendar Year 107 2117	Calendar Year 108 2118	Calendar Year 109 2119	Calendar Year 110 2120
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.068	0.066	0.064	0.063	0.061	0.059	0.058	0.056	0.055	0.053
Present Value	$ 4,754	$ 12,981	$ 4,507	$ 4,389	$ 4,273	$ 4,161	$ 5,756	$ 3,945	$ 3,841	$ 3,740

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 111 2121	Calendar Year 112 2122	Calendar Year 113 2123	Calendar Year 114 2124	Calendar Year 115 2125	Calendar Year 116 2126	Calendar Year 117 2127	Calendar Year 118 2128	Calendar Year 119 2129	Calendar Year 120 2130
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.052	0.051	0.049	0.048	0.047	0.045	0.044	0.043	0.042	0.041
Present Value	$ 3,642	$ 5,038	$ 3,453	$ 3,362	$ 3,274	$ 3,188	$ 4,409	$ 3,022	$ 2,943	$ 2,866

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 121 2131	Calendar Year 122 2132	Calendar Year 123 2133	Calendar Year 124 2134	Calendar Year 125 2135	Calendar Year 126 2136	Calendar Year 127 2137	Calendar Year 128 2138	Calendar Year 129 2139	Calendar Year 130 2140
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.040	0.039	0.038	0.037	0.036	0.035	0.034	0.033	0.032	0.031
Present Value	$ 2,790	$ 7,619	$ 2,646	$ 2,576	$ 2,508	$ 2,442	$ 3,378	$ 2,316	$ 2,255	$ 2,195

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 131 2141	Calendar Year 132 2142	Calendar Year 133 2143	Calendar Year 134 2144	Calendar Year 135 2145	Calendar Year 136 2146	Calendar Year 137 2147	Calendar Year 138 2148	Calendar Year 139 2149	Calendar Year 140 2150
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.030	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025	0.024
Present Value	$ 2,138	$ 2,957	$ 2,027	$ 1,974	$ 1,922	$ 1,871	$ 2,588	$ 1,774	$ 1,727	$ 1,682

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 141 2151	Calendar Year 142 2152	Calendar Year 143 2153	Calendar Year 144 2154	Calendar Year 145 2155	Calendar Year 146 2156	Calendar Year 147 2157	Calendar Year 148 2158	Calendar Year 149 2159	Calendar Year 150 2160
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.023	0.023	0.022	0.022	0.021	0.020	0.020	0.019	0.019	0.018
Present Value	$ 1,638	$ 4,472	$ 1,553	$ 1,512	$ 1,472	$ 1,433	$ 1,983	$ 1,359	$ 1,323	$ 1,289

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 151 2161	Calendar Year 152 2162	Calendar Year 153 2163	Calendar Year 154 2164	Calendar Year 155 2165	Calendar Year 156 2166	Calendar Year 157 2167	Calendar Year 158 2168	Calendar Year 159 2169	Calendar Year 160 2170
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.018	0.017	0.017	0.017	0.016	0.016	0.015	0.015	0.014	0.014
Present Value	$ 1,255	$ 1,735	$ 1,190	$ 1,158	$ 1,128	$ 1,098	$ 1,519	$ 1,041	$ 1,014	$ 987

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 161 2171	Calendar Year 162 2172	Calendar Year 163 2173	Calendar Year 164 2174	Calendar Year 165 2175	Calendar Year 166 2176	Calendar Year 167 2177	Calendar Year 168 2178	Calendar Year 169 2179	Calendar Year 170 2180
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.014	0.013	0.013	0.013	0.012	0.012	0.012	0.011	0.011	0.011
Present Value	$ 961	$ 2,625	$ 911	$ 887	$ 864	$ 841	$ 1,164	$ 798	$ 777	$ 756

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 171 2181	Calendar Year 172 2182	Calendar Year 173 2183	Calendar Year 174 2184	Calendar Year 175 2185	Calendar Year 176 2186	Calendar Year 177 2187	Calendar Year 178 2188	Calendar Year 179 2189	Calendar Year 180 2190
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.011	0.010	0.010	0.010	0.009	0.009	0.009	0.009	0.008	0.008
Present Value	$ 736	$ 1,019	$ 698	$ 680	$ 662	$ 645	$ 892	$ 611	$ 595	$ 579

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 181 2191	Calendar Year 182 2192	Calendar Year 183 2193	Calendar Year 184 2194	Calendar Year 185 2195	Calendar Year 186 2196	Calendar Year 187 2197	Calendar Year 188 2198	Calendar Year 189 2199	Calendar Year 190 2200
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$117,782	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$196,560	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.006
Present Value	$ 564	$ 1,541	$ 535	$ 521	$ 507	$ 494	$ 683	$ 468	$ 456	$ 444

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 191 2201	Calendar Year 192 2202	Calendar Year 193 2203	Calendar Year 194 2204	Calendar Year 195 2205	Calendar Year 196 2206	Calendar Year 197 2207	Calendar Year 198 2208	Calendar Year 199 2209	Calendar Year 200 2210
Design										
Stormwater and Access Controls										
Concrete Debris Removal										
Landfill Capping										
Operations and Maintenance	$49,303	$78,778	$49,303	$49,303	$49,303	$49,303	$78,778	$49,303	$49,303	$49,303
Long-term Monitoring	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791	$20,791
Site Close-out										
Total	$70,093	$99,568	$70,093	$70,093	$70,093	$70,093	$99,568	$70,093	$70,093	$70,093
Present Value Discount Factor	0.006	0.006	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005
Present Value	$ 432	$ 598	$ 410	$ 399	$ 389	$ 378	$ 523	$ 359	$ 349	$ 340

TABLE B-1: ESTIMATED COSTS OVER TIME FOR ALTERNATIVE 3 (SELECTED REMEDY) - SITE 29

Phase	Calendar Year 201 2211	Calendar Year 202 2212	Row Total
Design			$102,170
Stormwater and Access Controls			$212,408
Concrete Debris Removal			$877,013
Landfill Capping			$1,092,763
Operations and Maintenance	$49,303	$78,778	$11,239,578
Long-term Monitoring	$20,791	$29,872	$5,185,236
Site Close-out			$83,010
Total	$70,093	$108,650	$18,792,177
Present Value Discount Factor	0.005	0.005	
Present Value	$ 331	$ 500	$5,299,332

TABLE B-2: ESTIMATED COSTS OVER TIME FOR CLEAN CLOSURE - SITE 29

Phase	Calendar Year Year 1 2011	Calendar Year Year 2 2012	Row Total
Design Costs	$117,925		$117,925
Professional Labor Management		$11,943	$11,943
Excavate Clean Overburden		$64,129	$64,129
Excavate Waste		$140,156	$140,156
Segregate Waste - Shaker Screens		$57,536	$57,536
Load and Haul Segregated Waste		$139,316	$139,316
Backfill and Compaction		$92,727	$92,727
Load and Haul Clean Fill		$92,868	$92,868
Rough Grading		$14,564	$14,564
Soil Sampling		$595,275	$595,275
Well Abandonment		$17,088	$17,088
Demolition, Fencing		$23,867	$23,867
Reporting		$181,419	$181,419
Load and Haul Surface Debris		$877,013	$877,013
Off-site Transportation and Waste Disposal		$62,534	$62,534
Total	$117,925	$2,370,435	$2,488,360
Present Value Discount Factor	0.974	0.948	
Present Value	$ 114,825	$ 2,247,435	$ 2,362,260