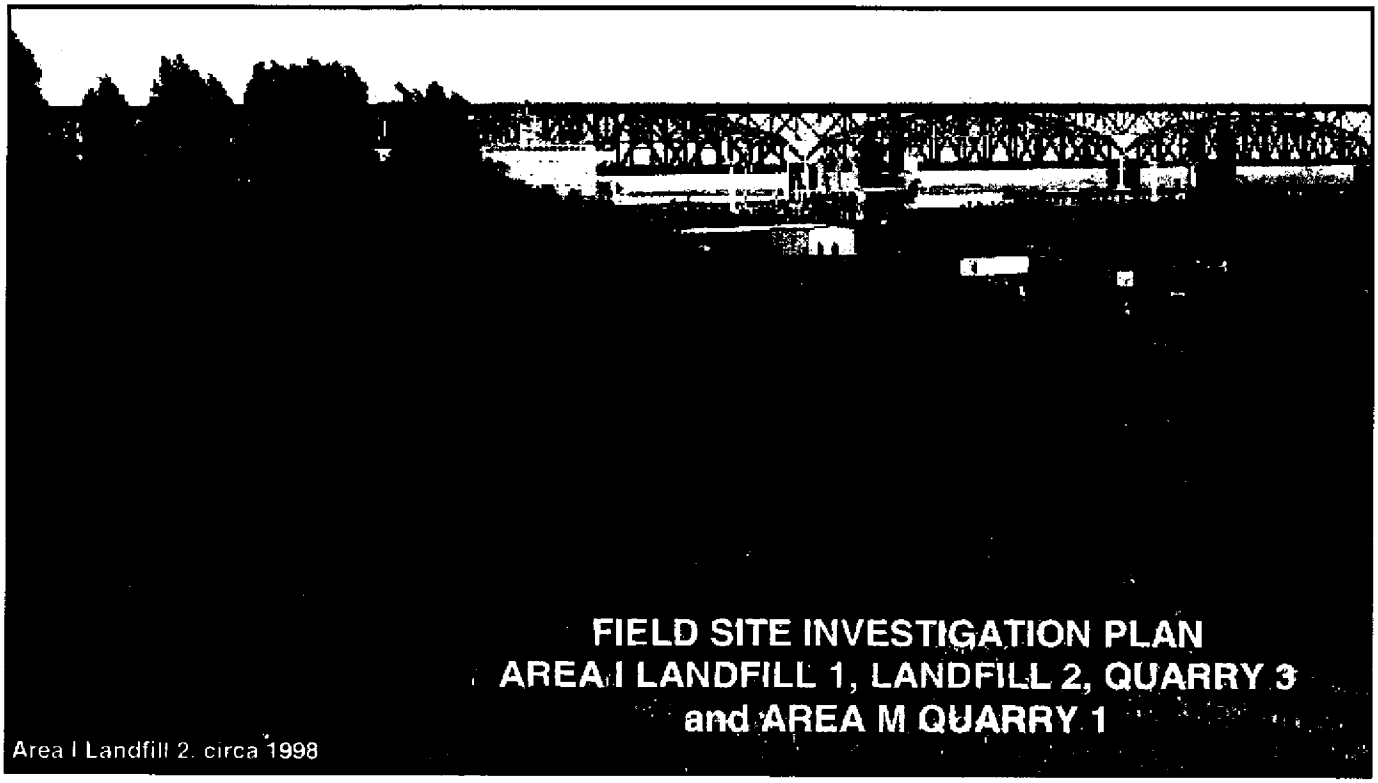


FIELD SITE INVESTIGATION PLAN
AREA I LANDFILL 1, LANDFILL 2, QUARRY 3 and AREA M QUARRY 1

Area I Landfill 2, circa 1998

for
Environmental Investigation at the Formerly Used Defense Site
at the Benicia Arsenal
Benicia, California

FUDS Site Number: J09CA075600

Prepared for:

DEPARTMENT OF DEFENSE
UNITED STATES ARMY ENGINEER DISTRICT, SACRAMENTO DISTRICT
CORPS OF ENGINEERS
1325 J Street
Sacramento, California 95814-2922

Prepared by:

FORSGREN ASSOCIATES/BROWN AND CALDWELL
2701 Prospect Park Dive
Rancho Cordova, California 95670-6025

January 2001

Contract Number:
DACW05-97-D-0035

Field Site Investigation Plan

for

Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Signatures of principal personnel responsible for development and execution of this Field Site Investigation Plan.

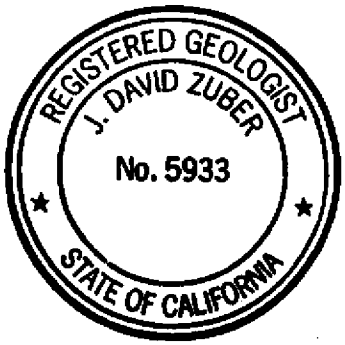
Approved:

David R. Jones, P.E.
Program Manager

Jay Lucas, R.G #4301
Quality Control Systems Manager

Patti DeLaO
Project Manager

David Zuber, R.G. #5933
Task Order Manager



DISTRIBUTION LIST
FIELD SITE INVESTIGATION PLAN
AREA I LANDFILL 1, LANDFILL 2, QUARRY 3 AND AREA M QUARRY 1

ADDRESS	NUMBER OF COPIES
Mr. Bruce Handel **U.S. ARMY CORPS OF ENGINEERS** 1325 J Street Sacramento, CA 95814-2922	5
Ms. Claudia Villacorta **CA REGIONAL WATER QUALITY CONTROL BOARD** 1515 Clay Street, Suite 1400 Oakland, CA 94612	1
Mr. David Price **CA DEPARTMENT OF TOXIC SUBSTANCES CONTROL, REGION I** 10151 Croydon Way, Suite 3 Sacramento, CA 95827	1
Mr. Michael Rees **SOLANO COUNTY DEPARTMENT OF ENVIRONMENTAL MANAGEMENT** 601 Texas Street Fairfield, CA 94533	1
Ms. Devita Cooper **BENICIA PUBLIC LIBRARY** 150 East L Street Benicia, CA 94510 (delivered by Ms. Parker of Parker Design)	1
Ms. Jackie Hebson **CAMEL BARN MUSEUM** 2060 Camel Road Benicia, CA 94510 (delivered by Ms. Parker of Parker Design)	1

DISTRIBUTION LIST (continued)
FIELD SITE INVESTIGATION PLAN
AREA I LANDFILL 1, LANDFILL 2, QUARRY 3 AND AREA M QUARRY 1

ADDRESS	NUMBER OF COPIES
Ms. Patti De La O, Project Manager	1
Mr. David Zuber, Task Manager	1
Ms. Linda Nuss, Project Chemist	1
Mr. Tom Kirk, Program Chemist	1
Ms. Anne Baptiste, Corporate Health and Safety Director	1
Ms. Wendy Linck, Site Safety Officer	3
Library	1
File	1
FORSGREN ASSOCIATES/BROWN AND CALDWELL 2701 Prospect Park Drive Rancho Cordova, CA 95670-6025	
Corporate Library **BROWN AND CALDWELL** 201 N. Civic Drive, Suite 115 Walnut Creek, CA 94596-3864	2
Ms. Mary Ann Parker **PARKER DESIGN** 350 Townsend Street, Suite 307 San Francisco, CA 94107	1
Ms. Heather Chin-Chu McLaughlin **CITY OF BENICIA** 50 East L Street Benicia, CA 94510	1
Library **FORSGREN ASSOCIATES, INC.** 370 East 500 South, Suite 200 Salt Lake City, UT 84111	1
Mr. George Spencer **USA ENVIRONMENTAL, INC.** 5802 Benjamin Center Drive, Suite 101 Tampa, FL 33634	1

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

BC	Brown and Caldwell
BCLA	BCL Associates
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylenes
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COPC	chemicals of potential concern
DoD	Department of Defense
DOT	Department of Transportation
DQCR	data quality control report
DQO	data quality objective
EE/CA	Engineering Evaluation/Cost Analysis
EMLL	electromagnetic line locating
FA/BC	Forsgren Associates/Brown and Caldwell
FSIP	field site investigation plan
FTL	field team leader
FTM	field team member
FUDS	Formerly Used Defense Site
GPR	ground penetrating radar
HLA	Harding Lawson and Associates
IDW	investigation derived waste
mg/kg	milligram per kilogram
MS/MSD	matrix spike/matrix spike duplicate
MRD	Missouri River Division
OE	ordnance and explosives
PAHs	polyaromatic hydrocarbons
PC	project chemist
PCB	polychlorinated biphenyl
PE	performance evaluation
PID	photoionization detector
PjM	project manager
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QCSM	quality control systems manager
QCSR	quality control summary report
RCRA	Resource Conservation Recovery Act
RRR	Records Research Report
RWQCB	Regional Water Quality Control Board
SOP	standard operating procedure
SSHP	site safety and health plan
SSO	site safety officer
STLC	soluble threshold limit concentration
SVOC	semivolatile organic compound
TAT	turn around time

LIST OF ACRONYMS (continued)

TC	terrain conductivity
TCE	trichloroethene
TDS	total dissolved solids
TIC	tentatively identified compound
TOM	task order manager
TPH	total petroleum hydrocarbon
TTLC	total threshold limit concentration
TWA	time weighted average
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compound
XRF	x-ray florescence

EXECUTIVE SUMMARY

This field site investigation plan (FSIP) for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 has been prepared for use in conducting Formerly Used Defense Site (FUDS) program investigation activities at the former Benicia Arsenal (Arsenal) in Benicia, California. This FSIP contains site specific information about the investigation and is to be used together with the Arsenal-Wide Investigation Workplan (Workplan) (Brown and Caldwell [BC], 1999a) and the Quality Assurance Project Plan (QAPP) (BC, 1999b). This FSIP details the site specific proposed sampling design, field and analytical methods, investigation derived waste (IDW), quality assurance/quality control (QA/QC) procedures and references. This document has been established to comply with both Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and Resource Conservation Recovery Act (RCRA) requirements, as appropriate, for hazardous and toxic waste cleanup actions, as well as the latest FUDS and United States Army Corps of Engineers (USACE) guidance documents, in order to promote consistency and comparability of all activities and to assure defensible data collection and production.

The Record Research Report (RRR) (Jacobs, 1999) named Landfill 1 and Landfill 2 as "landfills." However, it is unknown if these sites are "landfills" by regulatory definition and if "waste is discharged in or on land for disposal." As a result, one of the objectives of this FSIP is to determine if these sites are considered "landfills" according to applicable regulations (California Code of Regulations [CCR], Title 27, Division 2, Subdivision 1). For consistency, the names of these sites will remain the same for this document. However, if this investigation determines that these "landfills" do not contain refuse, then the name will be changed to reflect the use. The term "fillsite" will be considered if the materials disposed of meet the definition of inert wastes as per CCR, Title 27 regulations.

The goals of the activities described in this FSIP are to:

- assess if Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 contain refuse/fill materials
- assess the boundaries of Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1
- ascertain whether past Department of Defense (DoD) activities at Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 have resulted in groundwater contamination
- assess the subsurface stratigraphy in the vicinity of Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1
- assess the depth, flow direction, gradient and chemical quality of groundwater in the vicinity of Landfill 1 and Landfill 2
- assess the depth and chemical quality of groundwater in the vicinity of Area I Quarry 3 and Area M Quarry 1
- assess the nature of the fill or refuse material in the center of each site by trenching
- assess the chemical quality of surface soil samples at Landfill 2 and both quarries for risk analysis (note: Landfill 1 is paved, while the others are not)
- develop preliminary estimates of the volumes of material disposed of at each landfill/quarry

These goals will be achieved by investigation activities including geophysical surveys, trenching, static water level measuring points, soil and groundwater sampling, and soil and groundwater chemical analysis. Data collected during these activities will be used to assess if
1) no further action under FUDS is required;
2) further investigation is necessary; or
3) remedial action is necessary.

This FSIP was developed using the general rapid characterization approaches to investigate various use categories as outlined in Section 5 and Figure 5-5 of the Workplan for the Arsenal (BC, 1999a). Using relevant information found in the RRR (Jacobs, 1999) and site visits, we developed data quality objectives (DQOs), selected chemicals of potential concern (COPC) and prepared sample locations and analyte lists. This FSIP presents the results of this process and a summary of the proposed sampling and reporting activities.

If refuse is found, an evaluation of the compliance requirements in CCR, Title 27, Division 2, Subdivision 1 and CCR; CCR, Title 22, Division 4.5; and CCR, Title 23, Division 3, Chapter 15 will be included in the report for this investigation.

This investigation of potential contamination and potential refuse characterization at Landfill 1, Landfill 2 and Quarry 3 in Area I and Quarry 1 in Area M will be conducted according to procedures and requirements of the site specific site safety and health plan (SSHP) attached to this FSIP as Appendix A. Landfill 1, Landfill 2 and Quarry 3 are not classified in the Engineering Evaluation/Cost Analysis (EE/CA) for known UXO/OE disposal. The probability to encounter UXO/OE is considered low. Work will continue with qualified UXO personnel employing construction support. Quarry 1 in Area M is within a known UXO/OE area, Sector 5 in the EE/CA. As such, no field work will occur at this quarry until the removal action has been completed under the EE/CA. Upon completion of the removal action, field work will be conducted at Quarry I in Area M with appropriate UXO/OE construction support and consistent with methods and procedures used for Landfill 1, Landfill 2, and Quarry 3. UXO/OE Construction Support Procedures are attached to this FSIP as Appendix B.

Should UXO/OE material be encountered, Forsgren Associates/Brown and Caldwell's (FA/BC's) invasive investigation activities will stop, the work area will be evacuated, and the USACE Project Manager will be notified. USACE Project Manager will notify appropriate regulatory agencies. Subsequent identification, evaluation, handling and disposal of UXO/OE material will be conducted under the USACE Sacramento District.

SECTION 1.0
PROJECT ORGANIZATION

This section of the FSIP presents the specific personnel that will be responsible for the field site investigation at these sites. Staff includes Program Management team consisting of the Project Manager (PjM), the Task Order Manager (TOM), the Field Team Leader (FTL), the Site Safety Officer (SSO), the Quality Control Systems Manager (QCSM), the Project Chemist (PC), field team members (FTMs) and several subcontractors. Figure I7-1 presents the organization chart for this project and includes specific project responsibilities.

SECTION 2.0
PROBLEM DEFINITION AND BACKGROUND

Area I Landfill1, Landfill 2, Quarry 3 and Area M Quarry 1 in this FSIP were selected for investigation based on review of historical information for Area I and Area M landfills/quarries (Jacobs, 1999). The

review indicated these sites may have served as the repository for industrial wastes from the shop area, as well as other facilities at the Arsenal. Prior to use as possible waste repositories, Area I Quarry 3 and Area M Quarry 1 provided stone for the construction of several large structures on Arsenal grounds. Additionally, Quarry 1 may have been used as a dumpsite. Historical information is not specific about whether fill material was placed into the quarries.

These sites have been grouped and included in this FSIP because they involve similar investigation, analytical and reporting methods. In this investigation we will establish the extent of refuse and fill materials in the landfills and quarries; ascertain whether groundwater contamination resulting from past DoD activities may be present; and determine potential surface soil contamination at Landfill 2 and both quarries.

Data collected from these investigations will then be used to assess if no further action under FUDS is warranted, or if additional investigation or remedial action may be necessary.

2.1 Site Location and Description

The following summarizes the background and locations for each site included in this FSIP. Site locations of Landfill 1, Landfill 2 and Quarry 3 in Area I are shown on Figure I7-2. Area M Quarry 1 is shown on Figure I7-3.

Landfill 1. Landfill 1 is noted on the 1918 map included in "Benicia, Portrait of an Early California Town," page 106 (Jacobs, 1999). Identified on the map is a "dump" located slightly northeast of the former shop buildings (55, 56 and 57), at what appears to be the beginning of a swale leading northwest from the swamp area of the Carquinez Strait to the industrial area. The swamp area below the swale has since been filled. Building 71 was constructed over the filled area in 1920, with the southwest corner of the building coinciding with the western end of the landfill. Building 71 extended east beyond the eastern end of the landfill areas (Figure I7-2). Benicia Industries, Incorporated (BII), the current property owner, demolished Building 71 in the 1980s and is currently proposing construction of a new rice warehouse in the area of the former building and landfill. The site is currently paved and used for temporary storage of new vehicles (Photo Disk1_16). Available aerial photographs did not show the boundaries of the landfill, as a result the exact location and Area I extent of this landfill are not known, and boundaries referenced in this FSIP are approximate and based on the outline of the "dump" identified on the 1918 map.

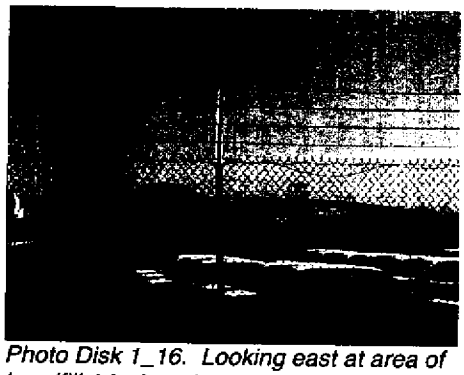


Photo Disk 1_16. Looking east at area of Landfill 1 in Area I.

Landfill 2. The Landfill 2 area was identified by USACE in its 1997 report as Area 9, situated southwest of Building 29, the Clocktower (Jacobs, 1999) (Figure I7-2). The Landfill 2 area is defined for this FSIP as the area bordered to the northeast and northwest by relatively steep escarpments, southeast and southwest by Adams Street and by Bayshore Road. Landfill 2 is currently fenced (Photo MVC-013F).

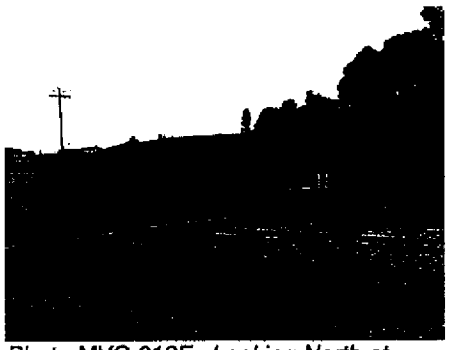


Photo MVC-013F. Looking North at Landfill 2 in Area I.

This landfill was identified by a former Arsenal employee, Mr. James Milburn, and was in use in the 1940s (Jacobs, 1999).

BII has owned the property since deactivation of the Arsenal in 1964. Currently, Landfill 2 consists of a large graded flat area that slopes gently to the southeast. Available aerial photographs did not show the exact location or boundaries of the landfill. As a result, the location and boundaries are shown on Figure I7-2 are approximate and based soley on the outline of the current graded area.

Quarry 3. Quarry 3 was located in the vicinity of Building 72, the former Arsenal Infirmary. The location of the quarry is expressed by a bowl-shaped indentation in the bluff along the northern side of former Building 72 (Figure I7-2 and Photo Quarry 3). The quarry is located within two assessor's parcels. Both parcels are located in a residential area of Benicia; one parcel is owned by Clock Tower Condominiums; the second parcel is owned by Mr. William Cambra.

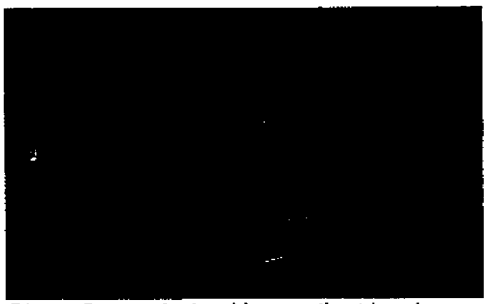


Photo Quarry 3. Looking north at bowl-shaped feature of Quarry 3 in Area I.

Quarry 1. Quarry 1 is located approximately 300 feet east of Building 9 (part of the Camel Barn Museum site) in the central portion of Area M (Figure I7-3). The location of the quarry is expressed by a bowl-shaped indentation in the bluff (Photo MVC-002F).

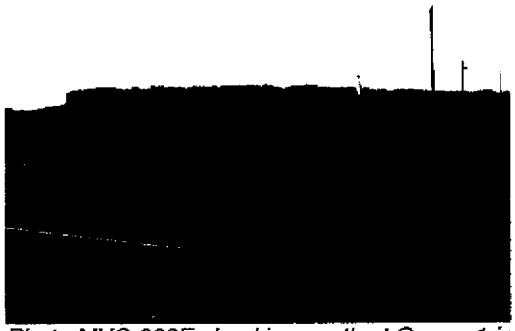


Photo MVC-002F. Looking south at Quarry 1 in Area M.

2.2 Site Geology and Hydrogeology

Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 are located in the western portion of the Arsenal. Topographically, the western portion of the Arsenal is a series of benches. Landfill 1 and Landfill 2 in Area I exist on a flat area extending to the Carquinez Strait. Quarry 3 is positioned on the sandstone hillside overlooking Landfill 1 and Landfill 2. Quarry 1 exists on a benched area of bedrock high in Area M, which overlooks Area I.

Bedrock in the area consists of southwesterly, steeply dipping beds of massive sandstone, siltstone and shale from the Martinez and Upper Chico Formations. These beds account for the rise in elevation. The Martinez Formation includes marine-derived sandstone interbedded with thin fossiliferous shale. Occasional thick beds of a well-cemented pebbly conglomerate occur throughout the formation (Dibblee, 1980). Soil covering these bedrock units is expected to vary in thickness from several inches to several feet.

Based on previous investigations in the area, alluvium and fill material overlay the Martinez Formation Bedrock in the low-lying flat areas. Alluvial material may range from just a few feet to more than 80 feet thick and is derived from bedrock formations of the surrounding hills. Low-lying areas to the south of Landfill 1 and Landfill 2 were previously marshland that filled in during development of the Arsenal. Water quality data indicate that the shallow groundwater is fresh to slightly saline. Preliminary information from investigations in the area of Landfill 1 indicates shallow groundwater within the alluvium is a few feet higher than the elevation of water in the Carquinez Strait. As a result, shallow groundwater near Landfill 1 is expected to be approximately 4 feet below ground surface (bgs). It is probable that depth to groundwater at Landfill 2 is similar. Depth to groundwater at Quarry 3 in Area I and Quarry 1 in Area M are anticipated to be significantly greater because both quarries are higher in elevation.

2.3 Site History and Historical Use

Table I7-1 summarizes background information for each of these sites. A description of uses associated with each feature that will be the focus of investigation activities is presented in Section 2 of the RRR Volume 1 on pages 2I-88 through 2I-91 and 2M-19 through 2M-20 (Jacobs, 1999).

2.4 Previous Investigations

Two previous investigations have been conducted at Area I Landfill 2. In 1987, a preliminary hazardous waste assessment was performed by BCL Associates (BCLA). The assessment included collecting soil samples and concluded that further investigation was required. In 1988, BII contracted Harding Lawson and Associates (HLA), to perform an independent field investigation of the former landfill area based on BCLA's data. This investigation consisted of digging seven test pits from 1.8 to 5 feet deep. Figure I7-4 identifies the test pit locations in the area of the former landfill. In addition, HLA collected soil samples that were analyzed for total and soluble lead only. Based on laboratory results it was determined that remediation was warranted, though lead concentrations above 1,000 milligrams per kilogram (mg/kg) were localized and not considered characteristic of the fill. Figure I7-4 presents the results for the HLA and BCLA investigations in the area of Landfill 2. The results are summarized in Table I7-2.

Fill was encountered to depths of 2 to 3 feet bgs during the HLA investigation in test pits 9 and 9C through 9F. The fill material was composed of asphalt. The total volume of fill encountered during the investigation was estimated at 270 cubic yards. The approximate surface area of the asphalt debris encountered is shown on Figure I7-4. No refuse material other than asphalt was identified in the HLA report. The extent of fill material in the southern, southeastern and northern parts of the landfill is unknown.

SECTION 3.0

PROJECT DESCRIPTION

This section outlines the plan for activities at Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1.

While previous investigation data are available at Landfill 2, the data do not indicate the exact location and extent of the refuse material. The HLA investigation noted several test pits where fill was encountered, but not refuse. These test pits were located within the northern portion of the landfill to focus on elevated lead concentrations from the BCLA investigation. Two of the three BCLA sample locations are within the approximate site boundaries, one in the northern portion and the other in the central portion. It is not known if fill was encountered in any of the BCLA sample locations. As a result, the extent of the

refuse/fill material is unknown in central and southern portion of the site. The approximate extent of the site drawn on Figure I7-4 is based on the extent of grading performed by BII. Because of this grading, the actual boundaries are not evident from the surface. Additionally, there is no information regarding the exact location and actual boundaries of Landfill 1 or the boundaries of Area M Quarry 3. Field work designed to obtain this information includes:

- A geophysical survey (using magnetic gradiometry, terrain conductivity, electromagnetic metal detection, ground penetrating radar, electromagnetic line locating) will be conducted to assess the location and limits of the landfill boundaries and the presence of anomalies that may indicate buried debris. Due to the lack of information on the location of disposal activities, the geophysical survey will include the entire area of Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 (Figures I7-3, I7-5, I7-6 and I7-7).

- A subsurface trenching investigation will be conducted to verify landfill/quarry boundaries identified by geophysical surveys. Where geophysics indicates the likely presence of refuse/fill, trenches will be excavated at the edge of refuse/fill to confirm boundaries. If the results from the geophysical surveys are inconclusive or do not indicate the presence of refuse or fill, trenches will be excavated near the center of potential refuse/fill areas to confirm the presence or absence of refuse/fill materials. If refuse/fill is encountered in these trenches, geophysical and trenching data will be re-evaluated and additional trenching locations selected to identify the boundary.

- Once the boundaries of each landfill or quarry have been confirmed through trenching, locations for three proposed temporary monitoring wells at Landfills 1 and 2 and the three proposed soil borings/in situ water sample locations at Quarries 1 and 3 will be evaluated and moved if necessary.

- Additional trenches will be dug at each site to examine the refuse/fill material. Where geophysics indicates the largest area of refuse/fill, one trench will be excavated to conduct a preliminary assessment on the nature and depth of the refuse/fill. If refuse/fill material is observed in the trench, soil samples will be collected from the native soil just below the refuse/fill bottom boundary.

- After the trenching has been completed, a preliminary estimate of the volume of the materials disposed in each landfill/quarry will be calculated using the geophysical boundaries and the boundaries confirmed by trenching.

3.1 Project Schedule

Field activities described in this FSIP will begin approximately three weeks after this document is finalized. Once field activities begin, the investigation will be conducted sequentially so that project personnel can refine the scope of work as new data are collected. Non-invasive activities will be conducted before invasive activities. The investigation will begin with the geophysical survey to better define targets and clear trenching locations. The initial invasive activity will be to excavate and determine landfill/quarry boundaries. After the completion of the trenching, surface soil samples will be collected at Landfill 2 and both quarries. The locations of these samples in this FSIP may change based on

the results of the geophysical survey and trenching.

SECTION 4.0

DATA QUALITY OBJECTIVES

The DQOs for this field investigation are presented in Table I7-3. The USACE Data Quality Objective Guidance worksheet (USACE Environmental Design Section Operating Procedure 4.5) was used to generate Table I7-3.

SECTION 5.0

SAMPLE PROCESS DESIGN

This section presents the rationale and design for data collection and sampling, sample types and matrices, and sampling frequencies to be conducted at these sites. The primary goal of the investigation is to assess if the landfills/fillsites exist at locations indicated by historical documentation. Additional goals included assessing the boundary of potential refuse in the landfills/quarries, characterize the refuse and determine if former DoD activities have resulted in soil or groundwater contamination.

The landfills and Quarry 3 have a low probability of finding UXO/OE. In addition, EE/CA removal action activities will be completed prior to beginning field activities at Quarry I in Area M. As such, anomalies will not be avoided at these sites and construction support will be provided during the trenching.

Geophysical surveys will be conducted at all sites. Sampling activities at Area I Landfill 1 and Landfill 2 will include trenching, groundwater sampling and static water level measuring point installations. Surface soil sampling will be conducted at Area I Landfill 2 and Quarry 3 and Area M Quarry 1 to evaluate the risk to human health and the environment. Landfill 1 is paved, therefore surface soil will not be evaluated at this time. Activities at the quarries will include trenching, surface soil sampling and groundwater sampling. Soil samples will be collected for potential impact to native soils beneath refuse/fill and for IDW characterization. These activities focus on historical and observed features that have the highest potential for contaminating groundwater and soil at these sites.

The rationale for each sampling method and location is summarized below. Trench and well locations are shown on Figures I7-3, I7-5, I7-6 and I7-7.

5.1 Geophysical Survey

A geophysical survey will be conducted at Area I Landfill 1, Landfill 2, Quarry 3, and Area M Quarry 1. The area of investigation for each area will be established so that it will extend beyond the suspected limits of each landfill and quarry. The purpose of the survey is to verify the general limits/boundaries of the disposal areas as well as to determine the approximate locations of buried miscellaneous debris that may be both metallic and non-metallic.

Prior to any geophysical survey activities, all surface metal and other miscellaneous debris will be removed to minimize interference and "false positives". Since the buried debris could be variable and include both ferrous and non-ferrous metal as well as non-metallic debris, four different geophysical methods are being proposed. A high resolution magnetic gradiometer (Geometrics G-858 cesium vapor gradiometer) will be operated along parallel traverses spaced 6 feet apart to detect localized magnetic variations due to buried ferrous metallic objects. The measurement interval along each traverse will be approximately 2 feet. In order to minimize diurnial effects, the magnetometer will be operated as a gradiometer, and therefore, vertical magnetic gradient measurements will be taken. For each measurement, the sensors will be oriented to the north.

An electromagnetic terrain conductivity meter (Geonics, EM-31) will be used to define localized conductivity variations that may be due to both ferrous metal objects and non-metallic debris. Traverses will be along the same traverses as established for the magnetic gradiometer is described above. The instrument will be operated so that both transmitting and receiving coils are at equal distances from the ground surface and oriented the same for all traverses. The EM-31 will be operated in a dual mode so that both in-phase and quadrature data will be recorded. The in-phase data is more sensitive to metal, whereas, the quadrature is sensitive to conductivity variations that may be caused by non-metallic debris.

A time domain electromagnetic metal detector (Geonics, EM-61) will be operated along traverses spaced 3 feet apart to detect shallow subsurface variations that may be due to both ferrous and non-ferrous metal. The same traverses that were spaced 6 feet apart for the magnetic gradiometer and electromagnetic conductivity meter will also be used for EM-61. To achieve 3-foot spacing, the EM-61 will also be operated along intermediate traverses spaced between the original traverses.

Following the magnetometer, EM-31, and EM-61 data acquisition, the data will be computer processed, to generate vertical magnetic gradient, terrain conductivity, in-phase, and time-domain conductivity contour maps for each area of investigation. The contour maps will be reviewed for localized magnetic and electromagnetic variations that may be caused by shallow subsurface sources. The locations of significant anomalies (variations) will be staked in the field for reference. Based on these results, ground penetrating radar and electromagnetic line locating methods will be used at proposed boring locations that are in close proximity to possible buried debris areas or areas where detectable utilities may exist. The information obtained using GPR and EMLL will be used to site borings away from potential utilities and other drilling obstructions. This work will include providing borehole clearance log sheets for each proposed boring location investigated. The logs will summarize the survey at each location as well as providing a scaled sketch showing the locations of potential subsurface obstructions in relation to the boring location. In the event that the locations of possible obstructions are unacceptable and may pose a risk, the boring location will be moved as necessary to a more appropriate location.

The geophysical contractor will submit a letter report to FA/BC summarizing the procedures and findings from each geophysical survey at the landfills and quarries. This geophysical report will be included in the Technical Memorandum prepared for this investigation. FA/BC and the geophysical contractor will review the report before the invasive activities begin. Trench locations will be finalized based on the recommendations from the geophysical contractor, to best complete the DQOs for each site.

5.2 Subsurface Investigation

Subsurface investigation activities will include excavating trenches, installing temporary monitoring wells, and collecting soil and groundwater samples. A SSHP for this portion of the investigation is included as Appendix A. Information from the trenches will be used to estimate the angles of slopes underlying the refuse and depths of landfills. Soil samples will be collected at each landfill/quarry.

Table I7-4 summarizes the substance of concern, and commonly associated chemical types identified through the RRR (Jacobs, 1999) and during site visits. Table I7-4 also indicates which analytical method will be used to assess if the chemical is present. Table I7-5 presents specific sampling and analysis activities that will evaluate the substances presented in Table

I7-4. Parameters for each location were selected using the rapid site characterization approach (see Workplan Chapter 5 [BC, 1999a]) along with site specific historical records and information collected during site visits. Additionally, Table I7-5 presents the purpose of each sampling location and sampling methods to be used at each location. The purpose of these activities is to assess the lateral extent of the landfills or quarries and to ascertain if soil and/or groundwater contamination may be present.

A brief description of each investigation activity is presented below.

Trenches. Based on the geophysical survey at each landfill and quarry, we will excavate approximately four to five trenches using a backhoe to evaluate fill boundaries at each landfill/quarry. The purpose of these trenches is to collect statigraphic data, determine the boundary of the landfill/quarry, and where landfill/quarry refuse or fill are encountered to visually document type of refuse/fill materials. In addition to the trenches along the boundaries of each landfill/quarry, one trench will be dug within each landfill/quarry based on geophysical evidence of refuse/fill. The purpose of these interior trenches is to determine stratigraphic data, vertical extent of the refuse/fill material and to document the type of refuse/fill material encountered. Because there is a low potential to encounter UXO/OE, UXO/OE construction support procedures as described in Appendix B will be implemented during trenching.

Trenches will typically be 15 feet long and advanced to 10 to 12 feet bgs unless refuse or groundwater is encountered (maximum depth will be 22 feet bgs due to equipment limitations). If refuse is encountered in the boundary trenches, the trenching will extend 1 to 2 feet into the refuse and then stop. The interior trench at each landfill/quarry will be dug into to refuse/fill until native soil is encountered. Soil samples will be collected from the native soil to determine potential impact from the refuse/fill materials. These samples will be collected from multiple locations in relatively fine-grained sediments, which are expected to retain soil moisture and contaminants better than the coarser grained sediments. Due to the typical heterogeneous nature of landfill content, samples of refuse/fill are not proposed for this investigation. If necessary, samples of refuse/fill may be collected during later phases to assist in assessment of potential remedial actions. Grab water samples will be collected, if groundwater is encountered.

Trenches may be shallower or deeper than originally planned based on the refuse encountered, the depth to groundwater, or data from field instrumentation. Excavation of trenches will be conducted according to UXO/OE construction support procedures and under the direction of USA Environmental. Excavated materials will be segregated and stockpiled adjacent to the excavation.

When complete, materials will be replaced in their original position. If refuse/fill material deemed to be potentially hazardous (as determined by visual inspection by the FTL) is encountered, trenching activities will immediately stop. Refuse/fill material deemed to be potentially hazardous will not be used as backfill. The potentially hazardous refuse/fill material will be placed in an over pack drum. The decision to continue trenching or move trenching locations will be approved by the FA/BC TOM and the USACE Project Manager. In addition, some clean, imported backfill may be required to achieve appropriate stability to backfill trenches where groundwater is encountered. When imported backfill is used, some excavated material will be contained and disposed as IDW (see Table I7-7).

Should UXO/OE materials be encountered during trenching, FA/BC investigation activities at that location will stop, the work area will be evacuated, and the USACE Project Manager will be notified. USACE Project Manager will notify appropriate regulatory agencies. Subsequent evaluation, handling, disposal or demolition of UXO/OE materials will be conducted by USACE Sacramento District.

Continuous Logging of Trench Materials. FA/BC will compile a continuous log, written and photographic, of the trench profiles from each trench location. The purpose of collecting this information is to document the subsurface stratigraphy, landfill/quarry refuse or fill, and soil types located at the landfill/quarry boundaries.

Surface Soil Sampling. Surface soil samples will be collected at Landfill 2 and both quarries. A minimum of 6 surface soil samples will be collected . Appendix D describes the procedures for determining the required sample size. Six samples will be evenly distributed throughout each quarry. The size of Landfill 2 is much larger than the quarries, so 12 samples will be collected from Landfill 2. Figures I7-3, I7-6 and I7-7 show the approximate locations of the surface soil samples at Landfill 2 and both quarries. These locations may change based on the actual boundaries determined from the geophysical surveys and trenching.

Soil Borings. Three soil borings advanced by hollow stem auger methods will be installed in areas outside each landfill. Two borings are proposed at each quarry. Because the quarries are located in bedrock and are less likely to contain leachable producing materials, wells are not necessary and in situ groundwater samples will be collected instead. These borings will be located near the perimeter and in the downgradient direction of each quarry. A continuous core will be obtained from each borehole in order to evaluate the subsurface stratigraphy and soil types. Soil borings to be converted into wells at Landfills 1 and 2 will typically be advanced to approximately 10 feet below the water table. One boring at each landfill/quarry that will be advanced to bedrock to obtain deeper stratigraphic data. Deep borings that are converted into shallow monitoring wells will be backfilled with bentonite slurry via tremmie to the total depth of the well. When groundwater is encountered in a borehole, grab samples will be collected for chemical analysis. Grab samples will be collected using a disposable bailer that is lowered into the borehole. A minimum of one set of field parameter measurements will be recorded and the appropriate sample containers will be filled.

Temporary Monitoring Wells. Temporary monitoring wells will be installed in each of the three soil borings outside the perimeter of each landfill based on geophysical and trenching results. The purpose of these wells is to obtain water level elevations and flow direction data and to provide temporary locations for groundwater chemistry sampling. These wells will be installed in 8-inch-diameter boreholes and constructed of 2-inch-diameter screen and blank casing. Screen intervals will be installed 10 feet below and 5 feet above the water table. Screen size and filter pack material will be determined based on soil materials encountered in the soil borings according to procedures referenced in Section 6 of this FSIP.

Once installed, each temporary monitoring well will be purged and sampled on a quarterly schedule for one year (4 events total). Each temporary well will be sampled for constituents indicated in table I7-5. In addition, a transducer will be placed in a downgradient well at each landfill to collect water level data for a period of 48 hours. This data will be used to determine if there are any significant influence on water levels from other sources (i.e., pumping wells, tidal effects).

5.3 Investigation Locations

The locations of proposed trenching activities for these sites are shown on Figures I7-3, I7-5, I7-6 and I7-7. Trench and temporary well locations for this investigation have been selected to address specific features identified during the RRR (Jacobs, 1999) or site visits. Specific sampling locations, the rationale, sampling method and the recommended analyses are presented in Table I7-5.

Landfill 1, Quarry 3 and Area M Quarry 1. Based on historical information, geophysical survey results and observed features, one trench will be dug on all four sides and within these sites to assess the presence of refuse/fill (Figures I7-3, I7-5 and I7-7). Three additional trenches will be excavated in the center of Landfill 1, Quarry 3 and Quarry 1 to visually assess the nature and depth of refuse/fill.

Landfill 2. Based on historical information, geophysical survey results and observed features, a total of five trenches (L002TR001 through L002TR005) will be dug along the northern, eastern and southern perimeters and within the landfill (L002TR006) to assess the presence of refuse/fill in Landfill 2 (Figure I7-6). Trenches along the western boundary of the landfill will not be dug since the HLA investigation indicated no refuse material in this portion of the landfill. One additional trench (L002TR006) will be excavated in the center of Landfill 2 to visually assess the nature and depth of refuse/fill.

Impacts from potential releases into groundwater will be assessed by installing three temporary monitoring wells at each landfill (Figures I7-5 and I7-6). The locations of these temporary wells have been selected based on site topography, historical and other pertinent information, and the anticipated direction of groundwater flow are shown on each figure referenced above. The locations on Figures I7-5 and I7-6 are planned locations for the wells. The well locations will be finalized based on geophysical results.

SECTION 6.0

SAMPLING METHOD REQUIREMENTS

Standard Operating Procedures (SOPs) to be implemented during this project are listed in Table I7-6. These SOPs are located in Appendix F of the QAPP (BC, 1999b). Requirements for sample containers, preservation methods and analytical holding times are included in the QAPP.

SECTION 7.0

ANALYTICAL METHODS SUMMARY

The chemical analyses to be conducted on each groundwater sample are presented in Table I7-5. A detailed description of each analytical method, practical quantitation limits (PQLs) and analyte lists are presented in the QAPP (BC, 1999b). In addition to analyte lists, tentatively identified compounds (TICs) will be reported for samples analyzed by United States Environmental Protection Agency (USEPA) Methods 8260B and 8270C (USEPA, Contract Laboratory Program National Functional Guidelines for Organic data Review [CLP organic], 1994a). QA/QC sampling protocols are described in the QAPP and in Section 9.1, Quality Control Samples.

Sample analysis will be completed on a 21-calendar day turn around time (TAT). Soil and groundwater analyses will be conducted in Torrance, California at EMAX Laboratory. A TAT of less than 21 calendar days is not anticipated for this project. Sample analytical results will be reported in electronic and hardcopy deliverables. Specifications for the laboratory reporting are included in the QAPP. Reporting for approximately 10 percent of the analytical data will be in Level IV - equivalent packages for full third-party validation. All

Level III and IV data review will be completed within 30 days of receipt of last laboratory data package for the field event. Upon completion of data validation, analytical results will be reported according to Section 5.4 of the Workplan (BC, 1999a).

SECTION 8.0

INVESTIGATION DERIVED WASTE

The purpose of this section is to describe the specific procedures used for proper collection, characterization, storage, containerization, transport and disposal of IDW. The Arsenal-Wide IDW Plan is described in detail in the Workplan, Section 4.5 (BC, 1999a).

The IDW generated as part of this FSIP will include soil from drilling, decontamination rinsate from drilling equipment and disposable protective clothing and ground covers.

Table I7-7 presents the anticipated quantities of IDW and anticipated number of containers required for each type of IDW. Soil and groundwater will be contained in the containers specified on Table I7-7.

The soil and groundwater containers will be staged at a temporary staging area at 940 Tyler Street (near Building 154 in Area I). This area is a secure site. Heavy equipment will be decontaminated in front of Building 57C, according to procedures described in the QAPP. Decontamination of sampling equipment during groundwater purging and drum sampling activities will be staged at the FA/BC Benicia Arsenal Field Office at 942 Tyler Street.

Excess disposable wastes derived from sampling, such as personal protective equipment (PPE), gloves and bailers, will be disposed of by BFI, which provides local garbage disposal service for the area.

Soil samples will be collected for the purpose of IDW characterization and identification of potential disposal areas. Additional analytical work may be required based on requirements of the disposal facility. Soil derived from drilling and sampling activity will be segregated, if possible, based on visual and instrument readings from a photoionization detector (PID) and by the potential contaminant. For example, wastes with potential solvent impacts will be segregated from potential fuel-only impacts. Table I7-8 presents the solid/liquid waste disposal facilities and transporters we propose to use for this investigation. The data presented in Table I7-8 are based on current information from each facility and transporter.

SECTION 9.0

QUALITY CONTROL

Field QC activities will include collecting and analyzing quality control samples, implementing the three-phase QC program, and validating and verifying analytical data. In accordance with the QAPP, field QC activities, including variances from this FSIP, will be documented in the data quality control report (DQCR) and summarized in field logbooks and the quality control summary report (QCSR). These activities are described in the QAPP and are summarized below.

9.1 Quality Control Samples

A variety of QC samples will be used to quantitatively assess the quality of data generated during the field investigation. These samples include matrix spike/matrix spike duplicate (MS/MSD) samples, field duplicates, split samples, trip blanks, equipment rinsate blanks, filter blanks, source water blanks and field ambient blanks. QA/QC sampling protocol is also described in the QAPP. QA/QC samples (sample duplicates, MS/MSD and QA split samples) will be collected at the frequencies required in the QAPP (BC, 1999b).

Table I7-9 lists the analytical methods, associated containers and QA/QC samples for each planned sample. Table I7-10 and I7-11 summarizes the total number of analyses and samples for primary and QA/QC samples for this FSIP. The list of analyses conducted for the previous Arsenal investigations is inclusive of all analytes planned for this investigation, except cyanide (USEPA Method 9012A) and pesticides (USEPA Method 8081A). No systematic performance problems were identified during the review of the previous investigation data, with the exception of the data for TPH-GRO (USEPA Method 8015B). The performance problem with this analysis was the consistently low MS/MSD recoveries that were not attributed to matrix effects. Since the planned laboratory is the same laboratory with the systematic problems, one performance evaluation (PE) sample for TPH-GRO will be included in this effort. In addition, since the laboratory has not previously performed pesticide and cyanide analyses for this project, PE samples for pesticides (one soil and one water) and cyanide (one water) will be submitted for this effort. The contract analytical laboratory procedures and services will be in accordance with the QAPP (BC, 1999b).

9.2 Three-Phase Quality Control Program

A three-phase QC program will include the preparatory phase, initial phase and follow-up phase activities.

9.2.1 Preparatory Phase - Laboratory. At least one week prior to beginning field work, the project team will conduct a laboratory kick-off meeting to review the items outlined in the QAPP and FSIP with the TOM, the PC and the contract laboratories (BC, 1999b). The results of this meeting will be documented in meeting minutes signed by meeting participants and distributed to the project team.

9.2.2 Preparatory Phase - Field. The TOM, FTL and PC will conduct a readiness review meeting approximately one week prior to beginning field work. The USACE Technical Leader will also be invited to this meeting. The purpose of this meeting will be to review and document preparation for the field investigation. All items discussed in the readiness review meeting must be completed prior to the start of fieldwork. The FTL will complete the checklist presented in Table I7-12 during the readiness review meeting to ensure that adequate documentation and equipment is available. This checklist may be modified, as necessary, during preparation activities.

9.2.3 Initial Phase - Laboratory. As a part of the previous field activities, USACE conducted a laboratory audit of EMAX Laboratory in May 1999 under the direction of the PC and again in June 1999 in conjunction with Jacobs Engineering. The audit results and laboratory responses to the audit findings are maintained in the project files. All issues from this audit have been resolved. Because analyses planned for this field effort were covered in the two previous audits, no audits are proposed for this phase of work. EMAX underwent USACE Missouri River Division (MRD) re-validation procedures in May 19-21, 2000 and is certified by the State of California for the required analyses.

If Level III review or Level IV validation indicates potential fraud, significant systematic errors, or laboratory contract compliance below 80%, corrective action (potentially including auditing the laboratory) could be initiated. The PC will work in conjunction with the USACE, Program Chemist and QA/QC Manager regarding determination of appropriate corrective action.

9.2.4 Initial Phase-Field. We will conduct field QC activities throughout this field investigation. To ensure that QC activities are in compliance with the QAPP and this

FSIP, we will evaluate field QC activities during the first week of the field effort through the initial phase inspection conducted by the QCSM. The initial phase inspection will be documented in a meeting and meeting minutes will be signed by meeting participants and attached to the DQCR. QC activities that will be evaluated during the initial phase inspection include those described in the QAPP (BC, 1999b).

9.2.5 Follow-up Phase. We will perform follow-up phase QC activities as needed throughout field and laboratory activities to resolve any deficiencies identified during the preparatory and initial inspections or deficiencies noted during field activities by the TOM, FTL, or PC.

We will conduct follow-up activities to assure continuing compliance with contract, QAPP and FSIP requirements until the completion of field and analytical activities (BC, 1999b). Final follow-up checks will be conducted and all deficiencies corrected prior to the start of additional fieldwork.

The QCSM will participate in the QC program as described in this FSIP and the QAPP (BC, 1999b). Additional phases and/or review of the subcontractors may be added during the execution of work, as deemed necessary, by the project staff and QCSM.

9.2.6 Data Validation. All laboratory data will be verified according to guidelines presented in the QAPP. Data generated for 100 percent of the field samples collected and analyzed for definitive methods will be validated. Ten percent of the data will be provided in USEPA Level IV equivalent data packages as described in the QAPP (BC, 1999b). The remaining 90 percent will be validated to equivalent USEPA Level III. Data will be independently validated to procedures consistent with those specified in "USEPA Contract Laboratory Program National Functional Guidelines for Organic/Inorganic Data Review" (USEPA, CLP Organic/Inorganic, 1994a, b), the appropriate USEPA reference methods and the QAPP (BC, 1999b). The PC shall provide data validation reports to USACE and the PjM within 21 days after receiving the analytical data from the laboratory.

SECTION 10.0

REFERENCES

Brown and Caldwell. 1999a. Arsenal-Wide Site Investigation Workplan for the Benicia Arsenal. Prepared for U.S. Army Corps of Engineers, Sacramento, California. February.

Brown and Caldwell. 1999b. Quality Assurance Project Plan for the Benicia Arsenal. Prepared for U.S. Army Corps of Engineers, Sacramento, California. February.

Brown and Caldwell. 1998. Benicia Arsenal General Site Safety and Health Plan. Prepared for U.S. Army Corps of Engineers, Sacramento, California. January.

Dibblee, T.W., Jr. 1980. Preliminary Geologic Maps of Benicia Quadrangle, Contra Costa and Solano Counties. USGS Open File Report. 80-400.

Harding Lawson Associates. 1988. Assessment of Lead Contamination, Building 49 Site, Benicia Industrial Park. Prepared for Benicia Industries, Benicia, California. May 12.

Jacobs Engineering. 1999. Records Research Report for the Benicia Arsenal. Prepared for U.S. Army Corps of Engineers, Sacramento, California. April.

SM. 1998. Standard Methods for the Examination of Water and Wastewater. 18th Edition.

U.S. Army Corps of Engineers. Environmental Design Section Operating Procedure 4.5 – Data Quality Objectives (also from Arsenal-Wide Conceptual Workplan, Appendix A).

United States Environmental Protection Agency. 1994a. Contract Laboratory Program National Functional Guidelines for Organic Data Review.

United States Environmental Protection Agency. 1994b. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.

United States Environmental Protection Agency. 1986. Test Methods for Evaluating Solid Waste (SW-846), Third Edition with Update I (7/92), Update II (9/94) Update IIA (8/93), Update IIB (1/95) and Update III (12/96).

United States Environmental Protection Agency. 1984. Compendium of Methods for the Determination of Toxic Compounds in Ambient Air.

United States Environmental Protection Agency. 1983. Methods for Chemical Analysis of Water and Waste.

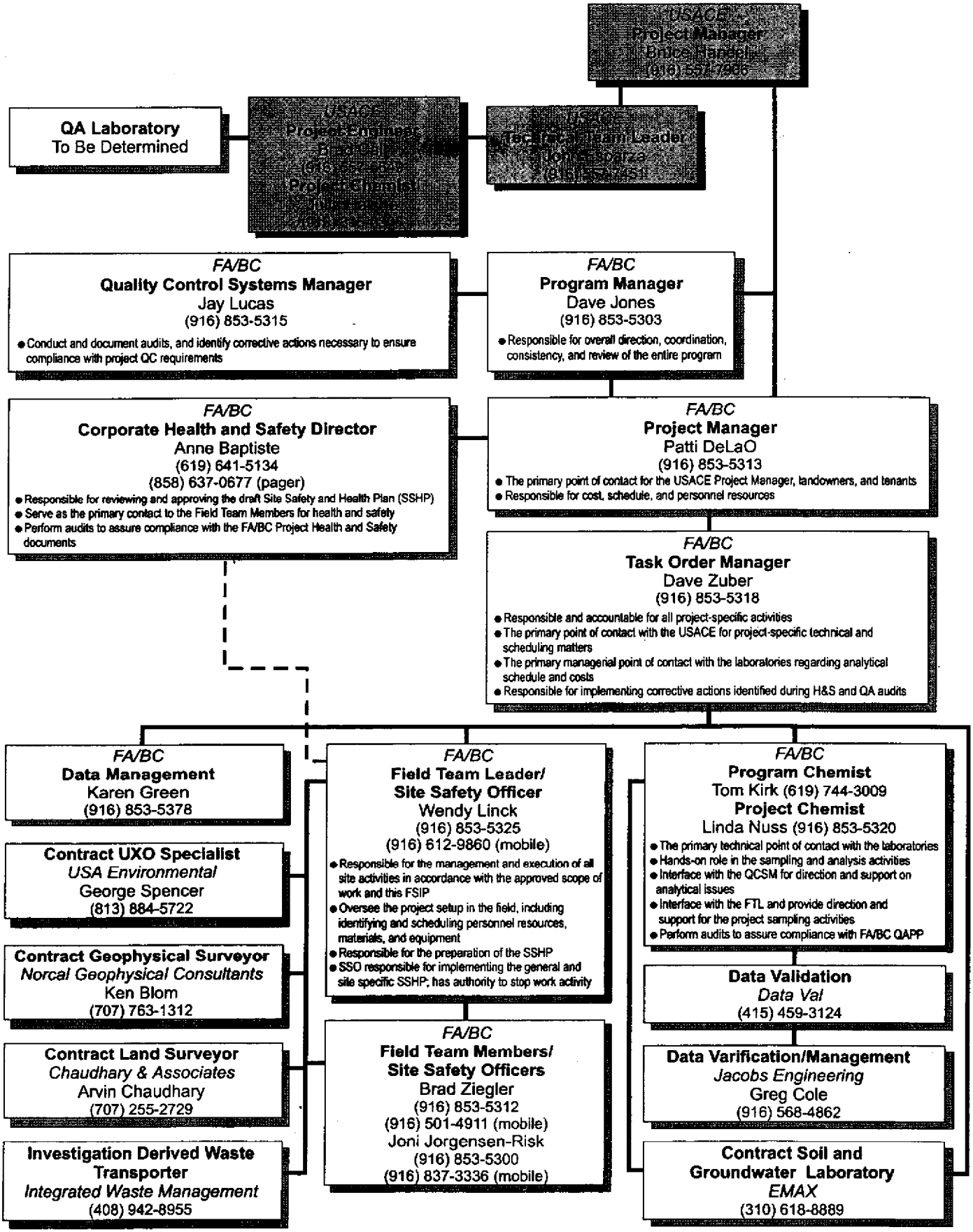
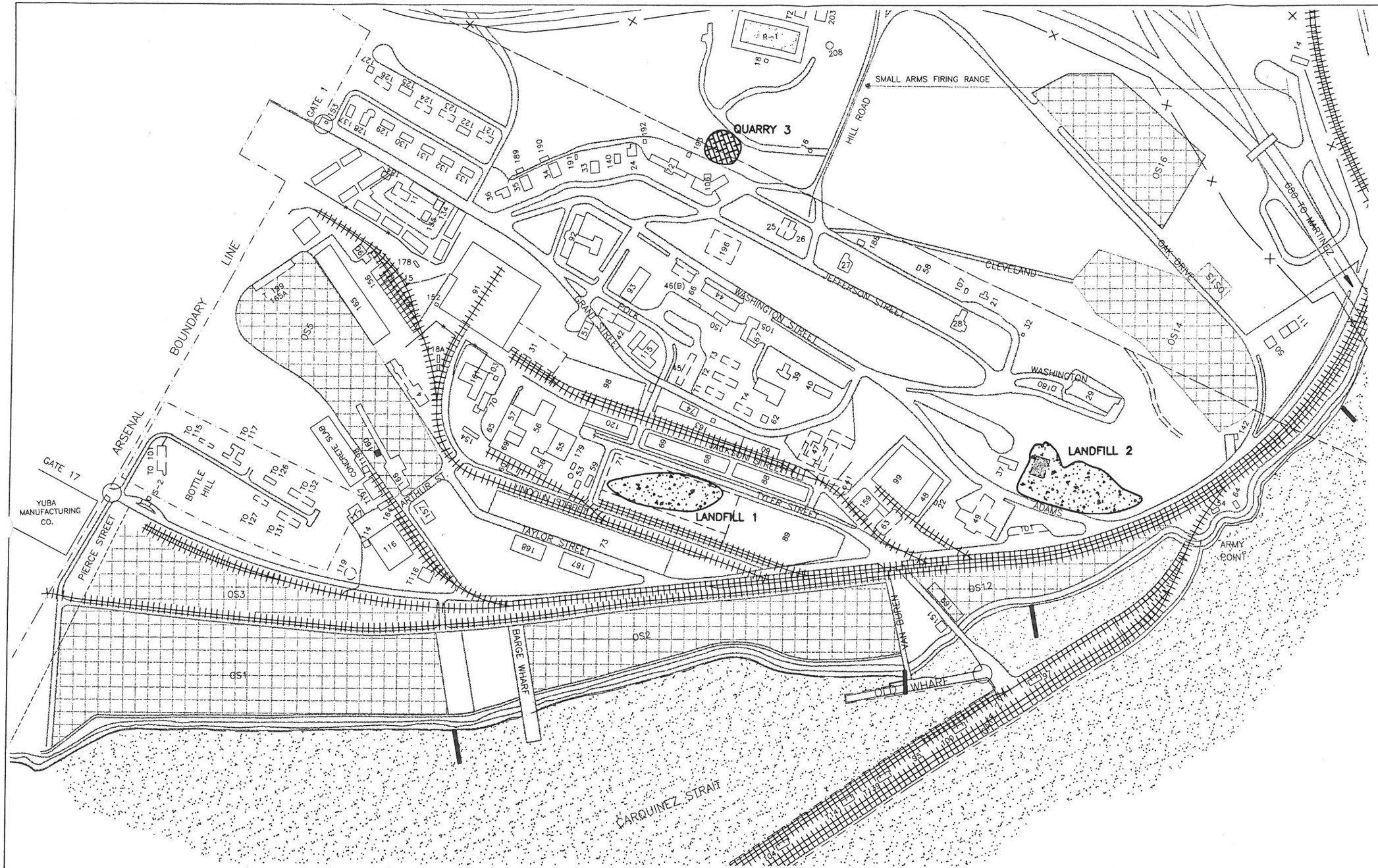


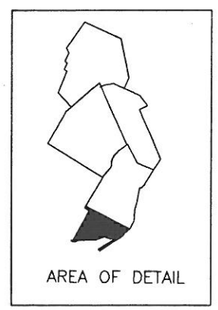
Figure I7-1
Organizational and Responsibility Chart
Field Site Investigation Plan
Benicia Arsenal

Landfill 1 (1877-pre 1945)

Landfill 2 (pre 1961)

Quarry 3 (1863-1964)





LEGEND

- 181 — Building Location
- Open Storage Areas
- Arsenal Boundary Line
- Area Boundary
- Railroad Tracks
- Landfill
- Water
- Quarry

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

100 0 100 200 300 400
Scale In Feet
(Approximate)

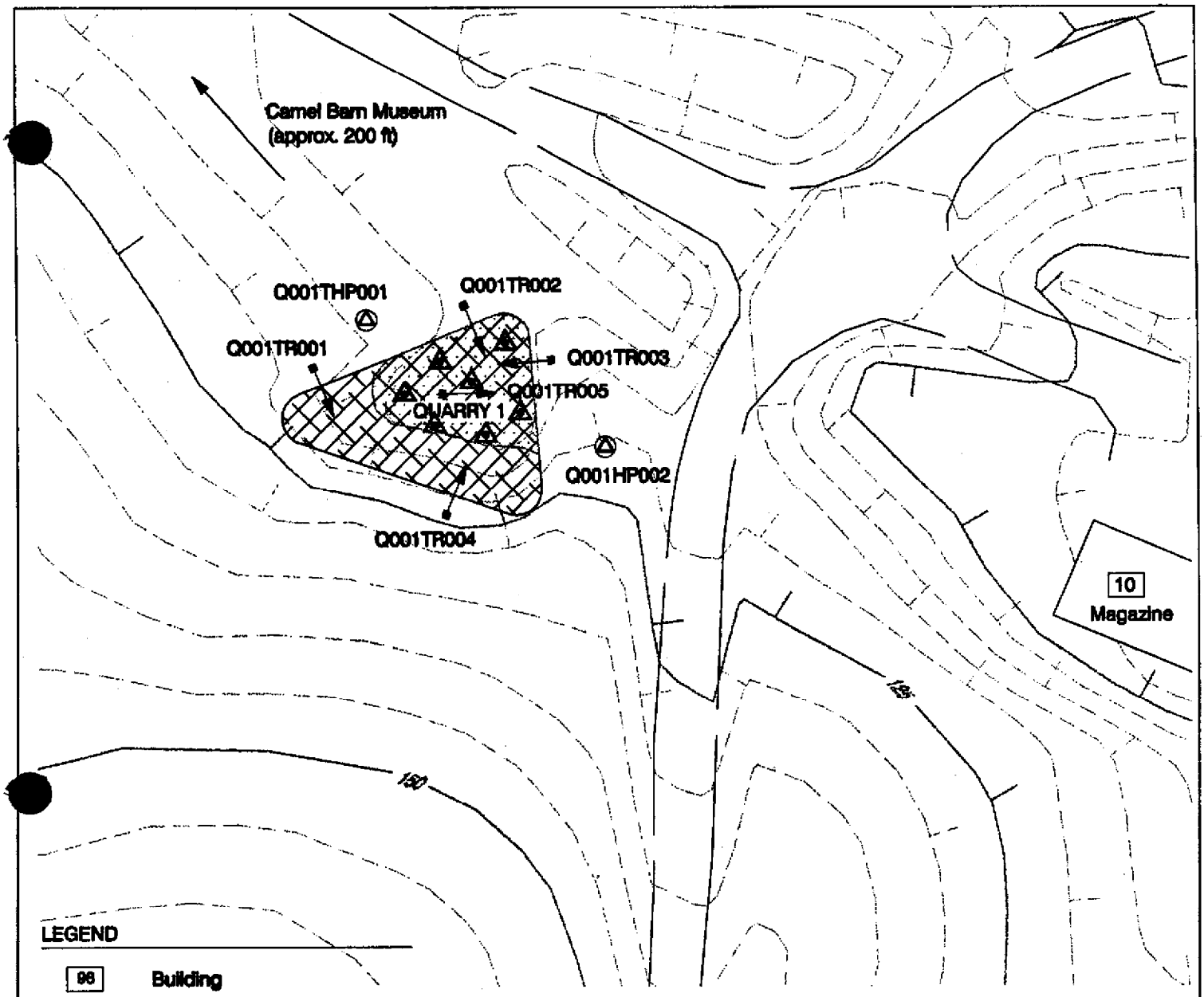
N

Figure I7-2
Location and Historic Uses Landfill1, Landfill 2, and Quarry 3

Area I - Field Site Investigation Plan
Benicia Arsenal

Forsgren Associates/Brown and Caldwell
12-6-00 grs P:\US Army Corps\Benicia Arsenal\FSIPs\areaI-Landfill2\Figures\past-use.dwg

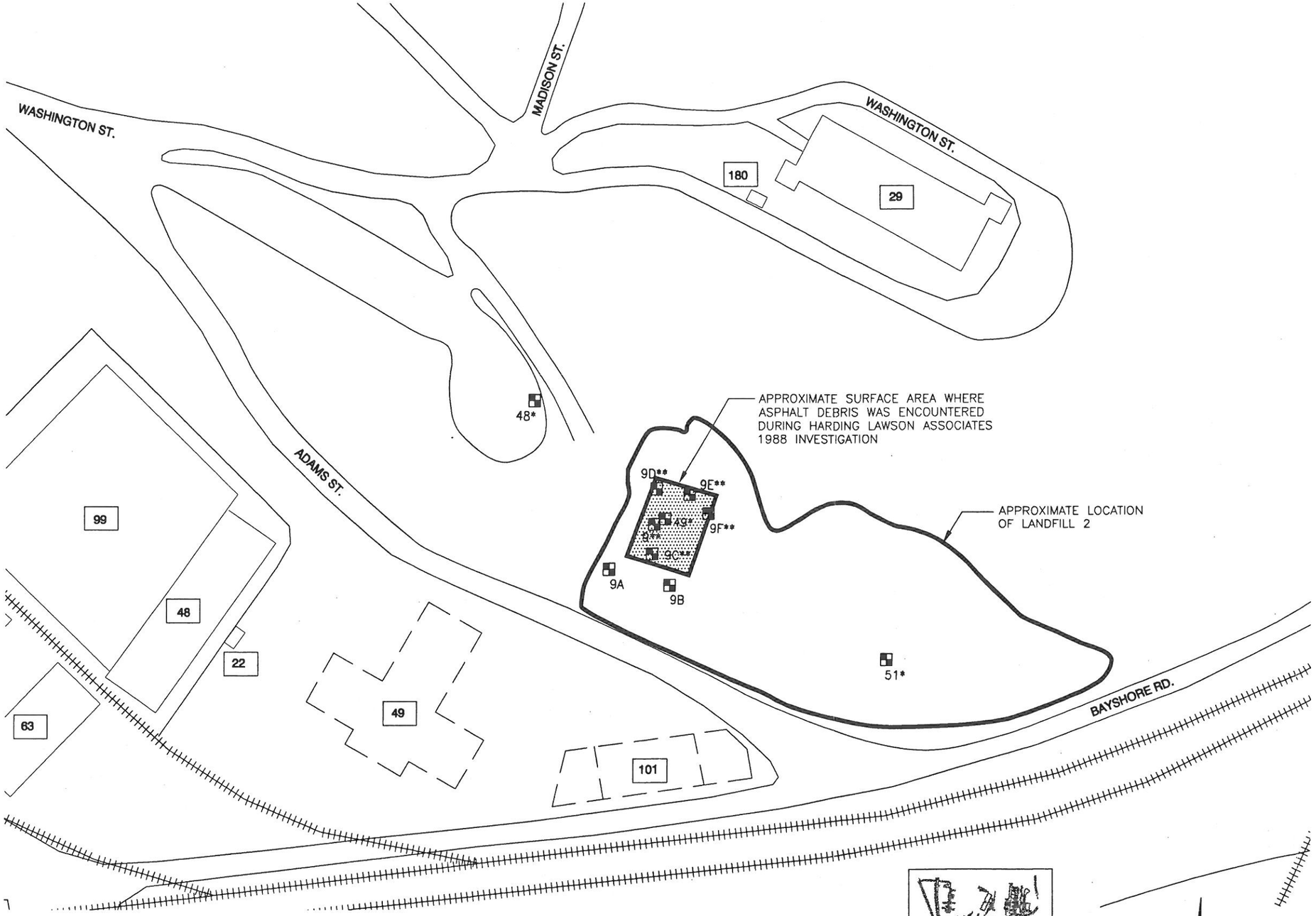
Final
January 2001



Note 1.
All site features referenced in Records Research Report (Jacobs Engineering, 999) documents or noted during site inspection are included on this figure.

Note 2.
The trench locations maybe modified based on the results from the Geophysical Surveys.

Figure I7-3
Proposed Trench and Groundwater Sample Location Map
Area M Quarry 1
Area I - Field Site Investigation Plan
Benicia Arsenal



LEGEND

29	Building Number
49	Former Building Location
	Railroad Tracks
48	Existing Test Pit Location and Number
*	Approximate Location
**	Fill Encountered in Test Pit
WET	Analyzed by the California Waste Extraction Test Method

9	Depth (ft bgs)	Method	Concentration
	0.0	7420	1,100 mg/kg
	1.0		1,500 mg/kg
	2.0		11 mg/kg

9A	Depth (ft bgs)	Method	Concentration
	0.0	7420	32 mg/kg

9B	Depth (ft bgs)	Method	Concentration
	0.0	7420	24 mg/kg

9C	Depth (ft bgs)	Method	Concentration
	0.5	7420	230 mg/kg
	1.5		8.2 mg/kg

9D	Depth (ft bgs)	Method	Concentration
	0.0	7420	460 mg/kg
	1.0		89 mg/kg

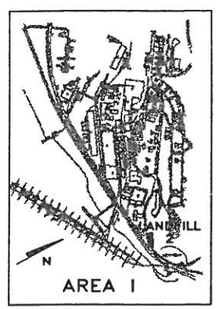
9E	Depth (ft bgs)	Method	Concentration
	0.0	7420	230 mg/kg
	1.0		6.2 mg/kg

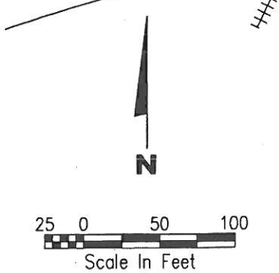
9F	Depth (ft bgs)	Method	Concentration
	0.0	7420	34 mg/kg
	1.0		130 mg/kg

48	Depth (ft bgs)	Method	Concentration
	0.0	WET	1.13 mg/L
	0.5		1.43 mg/L
	1.0		0.86 mg/L

49	Depth (ft bgs)	Method	Concentration
	0.0	WET	10.86 mg/L
	0.5		6.94 mg/L
	1.0		14.2 mg/L

51	Depth (ft bgs)	Method	Concentration
	0.0	WET	0.16 mg/L
	0.5		0.03 mg/L
	1.0		0.04 mg/L

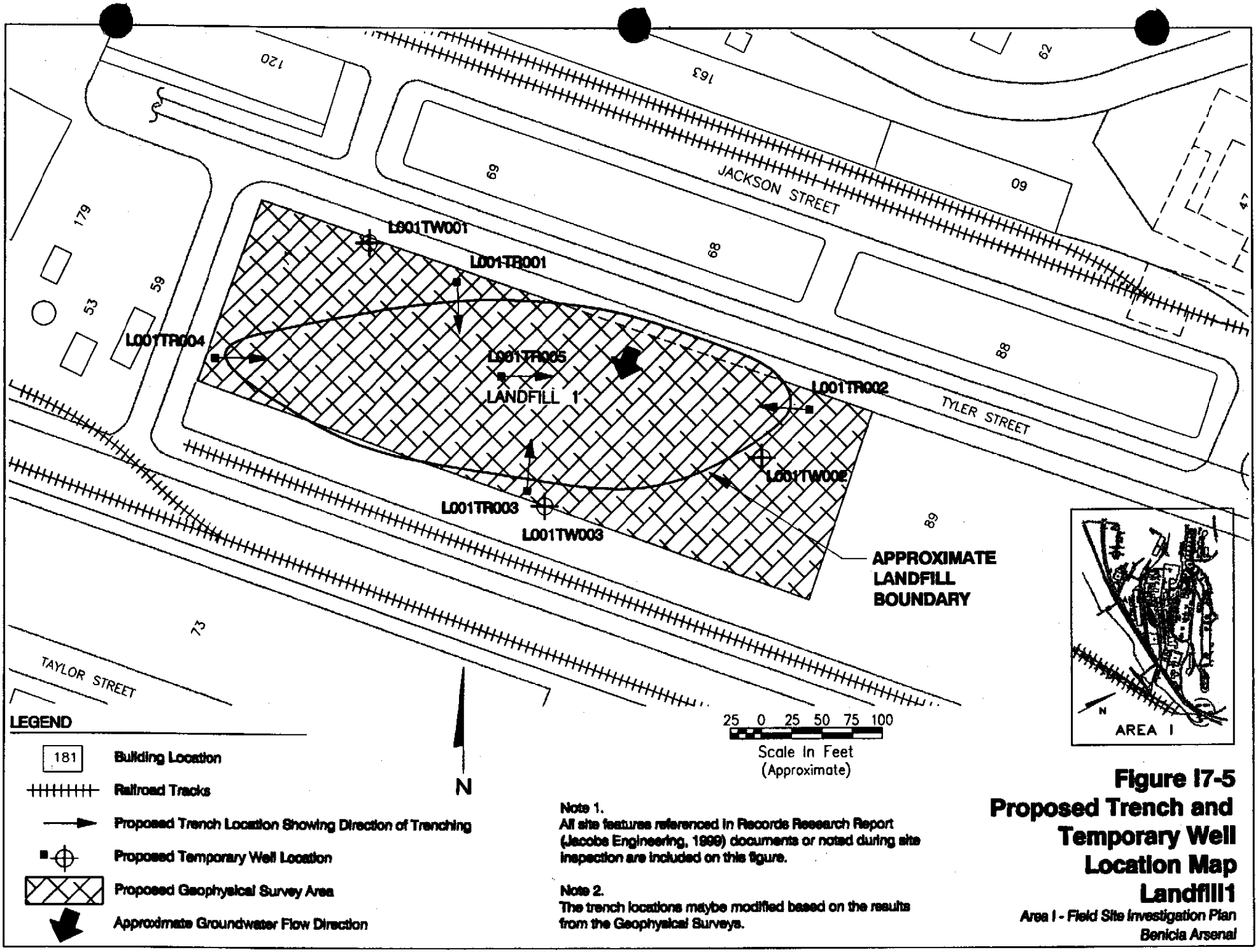




Note 1.
All site features referenced in Records Research Report (Jacobs Engineering 1999) documents or noted during site inspection are included on this figure.

Note 2.
Samples 9, 9A, 9B, 9C, 9D, 9E, and 9F were collected by Harding Lawson Associates (HLA) in March 1988. Samples 48, 49, and 51 were collected by BCL Associates in 1987. Only the samples within or adjacent to the approximate landfill boundary are shown.

Figure I7-4
Previously Collected Data
Lead Concentrations in Soil
Landfill 2
Area I - Field Site Investigation Plan
Benicia Arsenal



Note 1.
All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Note 2.
The trench locations maybe modified based on the results from the Geophysical Surveys.

Figure I7-5
Proposed Trench and Temporary Well Location Map Landfill1

Area I - Field Site Investigation Plan
Benicia Arsenal

WASHINGTON ST.

MADISON ST.

WASHINGTON ST.

180

29

APPROXIMATE SURFACE AREA WHERE ASPHALT DEBRIS WAS ENCOUNTERED DURING HARDING LAWSON ASSOCIATES 1988 INVESTIGATION

L002TW001

APPROXIMATE LOCATION OF LANDFILL 2

L002TR004

L002TR001

L002TR005

FORMER LUMBER SHED (PRE 1877–PRE 1945)

L002TR006

L002TR003

ADAMS ST.

99

48

22

63

49

101

L002TW002

IL002TR002

L002TW003

BAYSHORE RD.

142

54

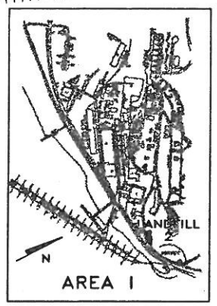
64

FORMER VELOCITY INSTRUMENT HOUSE (POST 1877–PRE 1932)
FORMER STOREHOUSE (PRE 1932–PRE 1945)

N

Note 1.
All site features referenced in Records Research Report (Jacobs Engineering 1999) documents or noted during site inspection are included on this figure.

Note 2.
The trench locations maybe modified based on the results from the Geophysical Surveys.



LEGEND

- 29 — Building Number
- 49 — Former Building Location
- Railroad Tracks
- Proposed Trench Location Showing Direction of Trenching
- Proposed Temporary Well Location
- Proposed Surface Soil Sample Location
- Proposed Geophysical Survey Area
- Approximate Groundwater Flow Direction

25 0 50 100
Scale In Feet

Figure I7-6
Proposed Trench and Temporary Well Location Map
Landfill 2
Area I - Field Site Investigation Plan
Benicia Arsenal

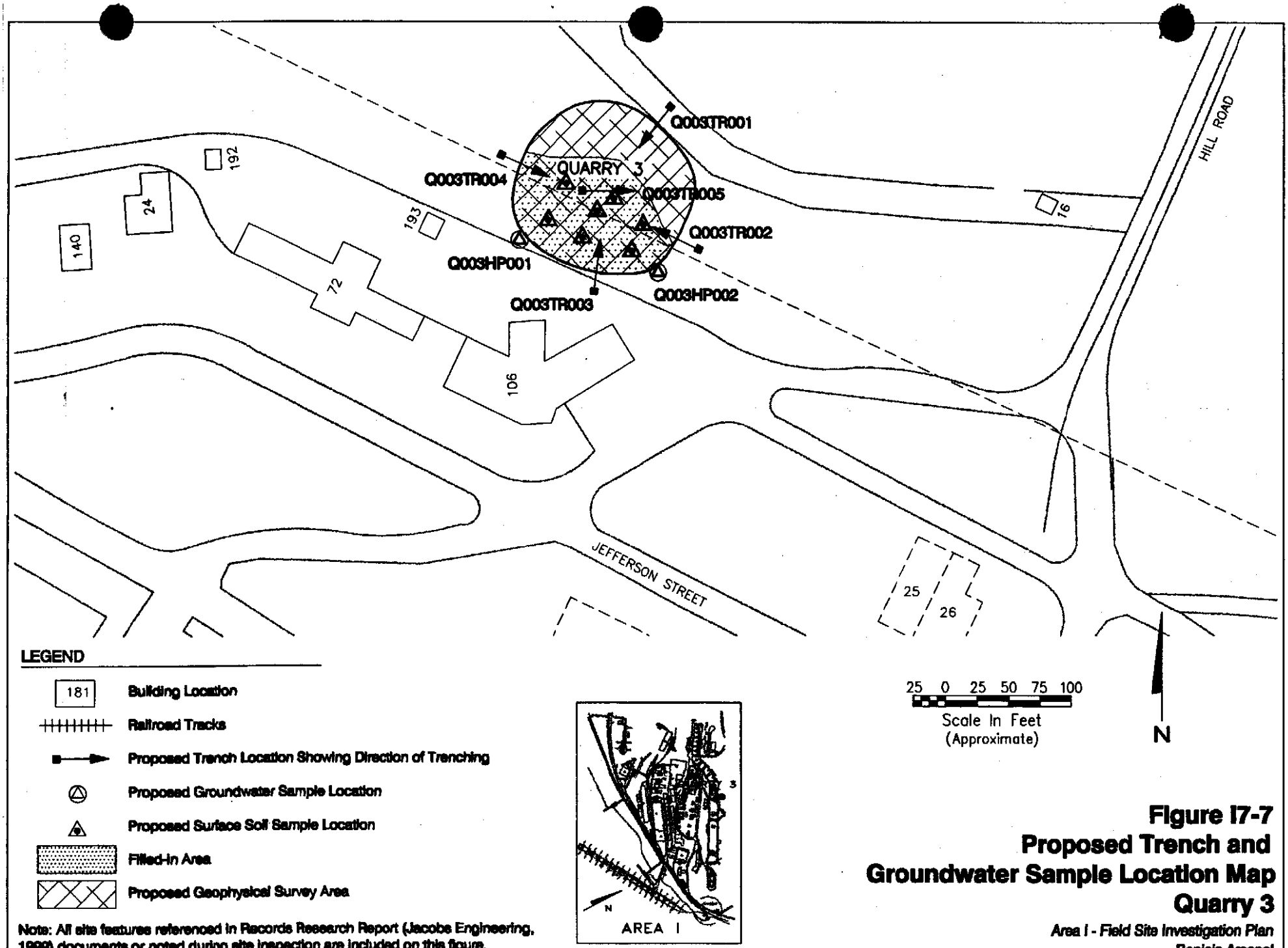


Figure I7-7
Proposed Trench and Groundwater Sample Location Map
Quarry 3

Area I - Field Site Investigation Plan
Benicia Arsenal

Table I7-1
Background Information for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Facility ID	Feature	Function	Materials handled	Evidence	Present status
Landfill 1	Area I landfill	Disposal of industrial wastes in the 1940s	Unknown potential for: acids, metal cleaning corrosives, petroleum, oils, lubricants, gasoline, foundry wastes, infectious wastes, and pesticides	Records Research Report	Benicia Industries Inc. has owned the property since deactivation of the Arsenal in 1964. The graded area of the former landfill is presently fenced.
Landfill 2	Area I landfill	Disposal of industrial wastes in the 1940s	Unknown potential for: acids, metal cleaning corrosives, petroleum, oils, lubricants, gasoline, foundry wastes, infectious wastes, and pesticides	Records Research Report	Benicia Industries Inc. has owned the property since deactivation of the Arsenal in 1964. The graded area of the former landfill is presently fenced.
Quarry 3	Area I quarry	Sandstone quarry used from the mid-1800s to the early 1900s	unknown	Records Research Report	The quarry is located in residential area.
Quarry 1	Area M quarry	Sandstone quarry used from the mid-1800s to the early 1900s	unknown	Records Research Report	First shown on a 1894 map, time period of usage is unknown. The original pit has been filled.

Table I7-2

Chemicals Identified at Landfill 2 to Date*

Medium	Chemicals reported	Concentration range
Soil	Lead (SW7420)	<0.5-1,500 mg/kg

*These results are based on a field investigation conducted in 1987 by BCL Associates and in January, 1988 by Harding Lawson Associates (12 May 1988).

Table I7-3
Data Quality Objectives
Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

State the Problem:

Confirm the boundaries in the Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 vicinity. Evaluate the extent of the refuse/fill in the Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1 vicinity and whether additional investigation may be necessary.

Identify the Decision:

Investigation-wide decisions:

- confirm the existence of each landfill/quarry at locations indicated in historical documentation and other pertinent information
- assess groundwater quality, elevation, flow direction, and gradient and evaluate if COPCs are present in groundwater at concentrations that exceed assessment criteria at Landfills 1 and 2
- assess the lateral extent of landfill/quarry refuse/fill by determining boundaries of the landfills/quarries using geophysical techniques
- confirm lateral extent of landfill/quarry refuse/fill by trenching
- assess groundwater quality and elevation and evaluate if COPCs are present in groundwater at concentrations that exceed assessment criteria at Quarries 1 and 3
- assess the surface soil quality and evaluate if COPCs are present in surface soils at concentrations that exceed risk assessment criteria at Landfill 2 and both quarries
- assess the extent and type of refuse/fill within each site
- if refuse is identified, assess if additional subsurface investigation may be necessary to determine the impact of the refuse/fill on soil, soil gas and groundwater
- develop a preliminary estimate of the volumes of the materials disposed in each landfill/quarry using results from the geophysical survey, and trenching
- evaluate the depth of fill and refuse in each landfill/quarry, as feasible, by sampling at multiple locations

Building or Feature-specific Decisions:

- None

Identify Inputs:

- results from HLA 1988 investigation including results of test pit excavations and results of soil sample analysis for lead
- review of aerial photos (if available) from 1932 to 1945
- results of facility drawings from the USACE, Solano County and Regional Water Quality Control Board (RWQCB) files
- geophysical results
- surface soil analytical results
- groundwater elevation data
- groundwater chemical analytical results
- survey data locating the lateral extent of landfill/quarry refuse/fill.

Table I7-3 (continued)
Data Quality Objectives
Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Physical Study Boundaries:

- The asphalt area at the southeast corner of Tyler Street and Polk Street, which corresponds to the former footprint of Building 71 (Landfill 1 in Area I).
- The graded area north of Bayshore Road and Adams Street, south of escarpments (Landfill 2 in Area I).
- The bowl-shaped escarpments of Quarry 3 in Area I and Quarry 1 in Area M.

Practical Study Boundaries:

- Trenches will be excavated to the practical depth of the equipment available (approximately 22 feet). If landfill refuse/fill is deeper, then drilling will be used in subsequent phases of field activities.
- Trenches will be excavated a maximum of 2 feet below refuse/fill material.
- Trench length will be variable but will extend until landfill/quarry refuse/fill is encountered to confirm boundary.
- Presence of permanent or semi-permanent cultural objects may limit the effect of some geophysical techniques.

Temporal Study Boundaries:

- Standard field and analytical methods are proposed to generate data useable for the duration of investigation and remediation.
- The results of field activities are not anticipated to be significantly affected by changing weather conditions.

General Site Decision Rules:

- If results from the geophysical survey indicate the landfill/quarry boundary is not in the vicinity of the proposed trench locations, then the shallow trenches will be moved based on the geophysical results.
- If the geophysical survey results from the areas suspected to contain refuse/fill are inconclusive or indicate that the refuse/fill is not present, then trenching locations will be modified to confirm the presence or absence of refuse/fill.
- If geophysical results do not identify a refuse/fill area, and if trenching cannot confirm the presence of refuse/fill, then no additional trenching will be attempted.
- If the geophysical survey results suggest the lateral boundaries of the landfill/quarry, then trenches will be dug to identify the extent of refuse/fill along the suspected boundaries. Trenching at Landfill 2 in Area I, will be along the southern, southeastern and northern boundaries because previous information indicates no refuse/fill at the western portion of the landfill.
- If trenches confirm the boundaries in these areas, then the results from this investigation will be documented by surveying the boundaries.
- If trenches do not confirm the boundaries then remaining trenches will be moved to confirm the presence or absence of refuse/fill.

Specify Tolerable Limits on Decision Errors:

- The analyses must provide definitive data. Accuracy, precision and completeness objectives set forth in the Arsenal-Wide QAPP will apply.
- Assessment criteria will be used as absolute values to compare point-by-point to analytical results. Results that exceed assessment criteria will be evaluated further[1].

Optimize Design for Study:

Based on site history and file review activities, collect surface soil and groundwater samples at pre-selected locations and depths. Sequence investigation activities so that scope of work can be modified as new information is collected.

[1] Although assessment criteria have not currently been developed for this site. Data generated will address conservative regulatory criteria (PRGs and MCLs) to assure compliance with DQOs.

Table I7-4

Summary of Commonly Used Substances

at Area I Landfill 1, Landfill 2, Quarry 3, Area M Quarry 1 and Analytical Rationale

Building	Substance of concern	Chemical types possibly associated with refuse	Laboratory water method	Laboratory soil method
Landfill 1	Refuse	GRO/DRO/RRO	3520C/3630C/8015B	--
Landfill 2		VOCs	5035/8260B	--
Quarry 3		PAHs	3520C/3630C/8310	3520/3630C/8310
Quarry 1		Metals (1)	3010A/6010B; 3020A/7000	3010A/6010B; 3020A/7000
		acids/bases	field measurement (pH)	--
		pesticides	3520C/8081A	3520C/8081A
		PCBs	3520C/8082	3520C/8082
		cyanide	9012A	--
		explosives	8330	8330

(1) metals to include: antimony (for soil), barium, beryllium, total chromium, cobalt, copper, manganese, molybodenum, nickel, silver, tin, vanadium, zinc by 6010B; cadmium and lead by 6010B ICP trace; antimony by 7041 (for water); arsenic by 7060A; selenium by 7740; thallium by 7841 and mercury by 7471A.

GRO = gasoline organic compounds
DRO = diesel range organic compounds
RRO = residual range organic compounds
PAHs = polyaromatic hydrocarbons
PCBs = polychlorinated biphenyls
VOCs = volatile organic compounds

Table I7-5

Sampling and Analysis Matrix

Field Specification for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Boring name	L001TR001-TR005		L001TW001 – TW003 (temporary wells)					
Attribute to investigate	Area I Landfill 1		Area I Landfill 1					
Boring location[1]	➢ Boundary trenches (L001TR001-TR004) ➢ Interior trench (L001TR005)		➢ L001TW001: upgradient of landfill ➢ L001TW002: downgradient of landfill ➢ L001TW003: downgradient of landfill					
Purpose	Assess concentrations of COPCs in subsurface native soil, groundwater, if encountered.		Quarterly assessment of concentrations of COPCs in groundwater from potential landfill release. L001TW003 to be advanced to bedrock. Four quarters total.					
Sampling method	Trench		Hollow stem auger					
COPC	Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives, fuels		VOCs, acids, fuels, metals, pesticides, PCBs, SVOCs, TDS, cations, anions, alkalinity, PAHs, cyanide					
Depth (ft-bgs)[1]	Native soil (just below refuse/fill)	GW	0	3	5	10	20	GW
TPH volatile 8015B	x	x						x
TPH extractable 8015B	x	x						x
VOCs 8260B	x	x						x
SVOCs 8270C	x	x						x
PAHs 8310	x	x						x
project metals list[2]	x	x						x
pesticides 8081A	x	x						x
PCBs 8082	x	x						x
pH 9045C		x						x
TDS E160.3/cations 6010B		x						x
anions E300.0		x						x
alkalinity E310.1		x						x
cyanide 9012A		x						x
explosives	x							

See notes on last page of Table I7-5.

Table I7-5

Sampling and Analysis Matrix

Field Specification for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Boring name	L002TR001-TR006		L002TW001 – TW003 (temporary wells)						L002SC001-L002SC012					
Attribute to investigate	Area I Landfill 2		Area I Landfill 2						Area I Landfill 2					
Boring location[1]	➢ Boundary trenches (L002TR001-TR005) ➢ Interior trench (L002T006)		➢ L002TW001: upgradient of landfill ➢ L002TW002: downgradient of landfill ➢ L002TW003: downgradient of landfill						➢ 12 evenly-spaced surface soil samples based on geophysical and trenching results					
Purpose	Assess concentrations of COPCs in subsurface native soil, groundwater, if encountered.		Quarterly assessment of concentrations of COPCs in groundwater from potential landfill release. L002TW003 to be advanced to bedrock. Four quarters total.						Assess concentrations in surface soil for risk					
Sampling method	Trench		Hollow stem auger						Scoop/trowel					
COPC	Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives, fuels		VOCs, acids, fuels, metals, pesticides, PCBs, SVOCs, TDS, cations, anions, alkalinity, PAHs, cyanide						Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives					
Depth (ft-bgs)[1]	Native soil (just below refuse/fill)	GW	0	3	5	10	20	GW	0	3	5	10	20	GW
TPH volatile 8015B	x	x						x						
TPH extractable 8015B	x	x						x						
VOCs 8260B	x	x						x	x					
SVOCs 8270C	x	x						x	x					
PAHs 8310	x	x						x	x					
project metals list[2]	x	x						x	x					
pesticides 8081A	x	x						x	x					
PCBs 8082	x	x						x	x					
pH 9045C		x						x						
TDS E160.3/cations 6010B		x						x						
anions E300.0		x						x						
alkalinity E310.1		x						x						
cyanide 9012A		x						x						
explosives	x								x					

See notes on last page of Table I7-5.

Table I7-5 (continued)

Sampling and Analysis Matrix

Field Specification for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Boring name	Q003HP001 – HP002						Q003SC001 – SC007						Q003TR001-Q003TR005	
Attribute to investigate	Area I Quarry 3						Area I Quarry 3						Area I Quarry 3	
Boring location[1]	➢ Q003HP001: downgradient of quarry ➢ Q003HP002: downgradient of quarry						➢ 7 evenly-spaced surface soil samples based on geophysical and trenching results						➢ Boundary trenches (Q003TR001-TR004) ➢ Interior trench (Q003TR005)	
Purpose	One time assessment of concentrations of COPCs in groundwater from potential quarry release. Q003HP002 to be advanced to bedrock.						Assess concentrations in surface soil for risk						Assess concentrations of COPCs in subsurface native soil, groundwater, if encountered.	
Sampling method	Hollow stem auger						Scoop/trowel						Trench	
COPC	VOCs, acids, fuels, metals, pesticides, PCBs, SVOCs, TDS, cations, anions, alkalinity, PAHs, cyanide						Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives						Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives, fuels	
Depth (ft-bgs)[1]	0	3	5	10	20	GW	0	3	5	10	20	GW	Native soil (just below refuse/fill)	GW
TPH volatile 8015B						x							x	x
TPH extractable 8015B						x							x	x
VOCs 8260B						x	x						x	x
SVOCs 8270C						x	x						x	x
PAHs 8310						x	x						x	x
project metals list[2]						x	x						x	x
pesticides 8081A						x	x						x	x
PCBs 8082						x	x							x
pH 9045C						x								x
TDS E160.3/cations 6010B						x								x
anions E300.0						x								x
alkalinity E310.1						x								x
cyanide 9012A						x								x
explosives							x						x	

See notes on last page of Table I7-5.

Table I7-5 (continued)

Sampling and Analysis Matrix

Field Specification for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Boring name	Q001HP001 – HP002						Q001SC001 – SC007						Q001TR001-Q001TR005	
Attribute to investigate	Area M Quarry 1						Area M Quarry 1						Area M Quarry 1	
Boring location[1]	➢ Q001HP001: downgradient of quarry ➢ Q001HP002: downgradient of quarry						➢ 7 evenly-spaced surface soil samples based on geophysical and trenching results						➢ Boundary trenches (Q001TR001-TR004) ➢ Interior trench (Q001TR005)	
Purpose	One time assessment of concentrations of COPCs in groundwater from potential quarry release. Q001HP002 to be advanced to bedrock.						Assess concentrations in surface soil for risk						Assess concentrations of COPCs in subsurface native soil, groundwater, if encountered.	
Sampling method	Hollow stem auger						Scoop/trowel						Trench	
COPC	VOCs, acids, fuels, metals, pesticides, PCBs, SVOCs, TDS, cations, anions, alkalinity, PAHs, cyanide						Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives						Metals, PAHs, pesticides, PCBs, VOCs, SVOCs, explosives, fuels	
Depth (ft-bgs)[1]	0	3	5	10	20	GW	0	3	5	10	20	GW	Native soil (just below refuse/fill)	GW
TPH volatile 8015B						x							x	x
TPH extractable 8015B						x							x	x
VOCs 8260B						x	x						x	x
SVOCs 8270C						x	x						x	x
PAHs 8310						x	x						x	x
project metals list[2]						x	x						x	x
pesticides 8081A						x	x						x	x
PCBs 8082						x	x						x	x
pH 9045C						x								x
TDS E160.3/cations 6010B						x								x
anions E300.0						x								x
alkalinity E310.1						x								x
cyanide 9012A						x								x
explosives							x						x	

See notes on last page of Table I7-5.

Table I7-5 (continued)

Sampling and Analysis Matrix

Field Specification for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

1. Sampling points, locations, depths and analytical methods to be determined in the field.
2. Project metals list consists of antimony (soil), barium, beryllium, total chromium, cobalt, copper, manganese, molybdenum, nickel, silver, tin, vanadium and zinc by 6010B, cadmium and lead by 6010B ICP trace, antimony by 7041 (water), arsenic by 7060A, selenium by 7740, thallium by 7841 and mercury by 7471A.

Notes:

- Field QC samples, including trip blanks, equipment rinsate blanks, filter blanks, source water blanks, splits and field duplicates, will be taken at the minimum frequency specified in the QAPP. See Table I7-9 for frequency and location of QC samples.
- Procedures to be used for proper collection, characterization, storage, containerization, transport and disposal of the Arsenal's IDW will be in accordance with the IDW Plan in the Arsenal-Wide Investigation Workplan.

anions = nitrite, chlorine, sulfate
cations = calcium, magnesium, sodium, potassium
IDW = investigation derived waste
GW = groundwater
PAHs = polyaromatic hydrocarbons
PCBs = polychlorinated biphenyls
SVOCs = semi-volatile organic compounds
TDS = total dissolved solids
VOCs = volatile organic compounds

Table I7-6
Applicable SOPs for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

SOP No.	SOP title	Applicable	Not applicable	Specific aspects of SOP to be implemented for this FSIP
1.0	Field Logbook	✓		All
2.0	Boring Log Development	✓		All
3.0	Field Classification and Description of Soils	✓		All
4.0	Sample Management	✓		All
5.0	Field Measurement of Organic Vapors	✓		1. A PID Model 580B OVM or equivalent will be used instead of a FID. 2. Direct reading colorimetric indicator tubes for benzene (fuel only sites) and TCE (VOC related sites) will be used to speciate contaminant exposures for assessment of PPE.
6.0	Utility Clearance	✓		All, except no lock-out/tag-out procedures necessary for this FSIP.
7.0	Collection of Soil Samples	✓		Soil samples will be collected from drums using scoop/trowels, thin-walled tubes and ring-lined samplers, as appropriate for IDW characterization. Surface soil samples will be collected using scoop/trowels.
8.0	XRF Soil Analysis		✓	
9.0	Packing and Shipping of Environmental Samples	✓		All
10.0	Sample Preservation and Analysis Methods	✓		Subcontracting laboratories will provide preserved sample containers. Preserved groundwater samples from previous investigations have been checked for proper pH. These results indicate that correct pH aliquots are provided in the sample containers. Therefore, only periodic pH checks will be conducted. Preservatives are available at the site and will be added, if necessary.
11.0	Sampling Equipment Decontamination	✓		All
12.0	Immunoassay		✓	
13.0	*In Situ* Groundwater Sampling	✓		Hydropunch® samples will be collected as part of the investigation at the quarries.
14.0	Borehole Abandonment	✓		
15.0	Well Development	✓		
16.0	Surface Water Sampling		✓	
17.0	Groundwater Purging and Sampling	✓		
18.0	Geophysical Testing	✓		For this investigation, ground penetrating radar, terrain conductivity and electromagnetic line locating methods will be used.
19.0	Soil Gas Sampling		✓	
20.0	Sludges and Sediments		✓	
21.0	Well and Piezometer Installation	✓		All
22.0	Field Measurement of pH	✓		A digital or analog pH tester will be used.
23.0	Field Measurement of Temperature	✓		All

Table I7-6
Applicable SOPs for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

SOP No.	SOP title	Applicable	Not applicable	Specific aspects of SOP to be implemented for this FSIP
24.0	Field Measurement of Specific Conductance	✓		All
25.0	Field Measurement of Water Levels	✓		All
26.0	Photographic/Video Documentation	✓		All
27.0	Drilling	✓		For this investigation, hollow stem auger drilling is planned.
28.0	Cone Penetrometer Drilling and Sampling Procedures		✓	
29.0	Trenching	✓		A subcontractor will provide a backhoe for trenching. Trenches will be backfilled with excavated material.
30.0	Methanol Preservation for Volatile Organic Compounds in Soils		✓	
31.0	Field Classification and Description of Rocks	✓		All
32.0	Field Sampling with EnCore™	✓		All

SOP = standard operating procedure
XRF = x-ray fluorescence

Table I7-7
Summary of Anticipated Investigation Derived Waste Volume
Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Boring name	Anticipated total depth	Matrix	IDW quantity		Number of 55-gallon drums		Notes
			Soil (cu ft)	Water (gallons)	Soil	Water	
L001TR001 through L001TR004 (Landfill 1 trenches)	15	Soil	45	--	6	--	A
L001TW001 through L001TW003 (Landfill 1 wells)	15 (60 total footage)	Water	11	99	1.5	2	B,C
L002TR001 through L002TR005 (Landfill 2 trenches)	15	Soil	45	--	6	--	A
L002TW001 through L002TW003 (Landfill 2 wells)	15 (60 total footage)	Water	11	99	1.5	2	B,C
Q003HP001 and Q003HP002 (Quarry 3 borings)	25 (50 total footage)	Water	9	--	1.25	--	B,C
Q001HP001 and Q001HP002 (Quarry 1 borings)	35 (70 total footage)	Water	13	--	1.75	--	B,C
Decontamination of soil and groundwater sampling equipment	--	Water	--		--	Minimal	
Totals (10 soil borings/wells)	360		134	198	18	4	

Notes:

A. Soil from the trenching will be backfilled and compacted in accordance with state or county mandated policies. Groundwater may be encountered in the trenches for Landfill 1 and Landfill 2, since groundwater is expected to be less than 10 feet bgs. If groundwater is encountered, soil backfilled below the groundwater table will not achieve proper stability. As a result, crushed aggregate will replace this soil. We have assumed that groundwater will be encountered in one trench at Landfill 1 and 2. We have assumed a 15 foot long by 3 foot wide trench with 1 feet of groundwater in trench (45 cubic feet). Therefore, approximately 45 cubic feet of soil will remain from each trench for disposal.

B. Assumed hollow stem auger drilling and one 55-gallon drum per 40 feet of hollow stem auger drilling.

C. Assumed 2-inch well, 3 gallons per casing volume, 10 casing volumes for development and 3 casing volumes for sampling per well (33 gallons per well).

Table I7-8

IDW Transport, Treatment and Disposal Information

Company	Location	Media	Level	Tests [a, b]
Transporters				
Integrated Waste Management (IWM)	San Jose	soil groundwater	all levels	
Nielson Construction	Napa	soil concrete asphalt	clean	
Landfills				
Kettleman Hills	Kettleman City	soil	TSDF Soil must meet organic treatment standards	- TTLC for SVOCs (8270C)[c] - TTLC for CAM 17 metals (6010B)[c] - TPH for all ranges of hydrocarbons - BTEX (8260B) - VOCs (8260B) - PCBs (8082) - Testing depends on desired waste classification (i.e., non-RCRA for direct landfill, RCRA for direct landfill, or RCRA for stabilization)
BFI Vasco Road Sanitary Landfill	Livermore	soil	low levels some TCE acceptable	- TPH for all ranges of hydrocarbons (8015B) - BTEX (8260B) - Lead (TTLC) (6010B) - CAM 17 metals (6010B) - LUFT 5 metals (6010B) - SVOCs (8270C) - Solvents (8260B) - 96-hour aquatic toxicity bioassay and/or RCI in some instances
B&J Landfill	Vacaville	soil	low levels petroleum hydrocarbons no TCE	- TTLC for CAM 17 metals[d]; and total analyses for TPH for all ranges of hydrocarbons[d] (8015M) - BTEX (8260B) - VOCs (8260B) - SVOCs (8270C) - PCBs[d] (8082)
Potrero Hills Landfill	Suisun City	soil	clean	- Visual inspection (no grass, weeds, large rocks, concrete or asphalt)
Bay Soil Remediation	Richmond	soil	low levels some chlorinated acceptable	Non-hazardous treatment facility. - TTLC for CAM17 (601B)[c] - TPH (8015) - BTEX (8260) - additional as required (i.e., wet tests)
Recylers				
Syar Industries, Incorporated	Vallejo	concrete asphalt		- Visual inspection

Table I7-8 (Continued)

IDW Transport, Treatment and Disposal Information

Company	Location	Media	Level	Tests [a, b]
Groundwater Treatment				
Seaport Environmental	Redwood City	groundwater	low levels	Tests for pH; flashpoint; total analyses for gasoline, diesel, oil (8015B), chlorinated solvents (8260B) and CAM 17 metals (6010B)
Safety Kleen	Sacramento	groundwater	California hazardous RCRA	Safety Kleen will conduct internal analysis of composite samples for each disposal event. Safety Kleen analysis will be based on site characterization data and could include: - TTLC for CAM metals (6010B) - VOCs (8260B) - SVOCs (8270C) - Pesticides (8081) - PCBs (8082) - BTEX (8260B) - Flashpoint
Soil Treatment				
Romic Environmental	San Jose	soil	California hazardous RCRA	Romic will conduct internal analysis of samples for the waste profile. The number of samples will be dependent on volume of waste. Romic analyses will be based on characterization data including: - TTLC for CAM metals (6010B) - VOCs (8260B) - SVOCs (8270C) - Pesticides (8081) - PCBs (8082) - BTEX (8260B) - Percent moisture

[a] Soil testing for waste profiting will be conducted using one 4-point composite sample per 150 cubic yards. Water testing will be conducted by one composite sample per disposal event.

[b] Specific testing required for disposal or treatment of any waste will depend on suspected contaminant source and characterization results from investigative activities.

[c] STLC and TCLP required if these values are too high.

[d] Additional testing required if these values exceed specified limits.

BTEX=	benzene, toluene, ethylbenzene, xylenes
CAM 17 metals =	antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc, mercury
LUFT 5 metals =	cadmium, chromium, lead, nickel, zinc
PCBs =	polychlorinated biphenyls
RCI =	reactivity, corrosivity and ignitability
RCRA =	Resource Conservation Recovery Act
STLC =	soluble threshold limit concentration
TCE =	trichloroethene
TTLC =	total threshold limit concentration
TPH =	total petroleum hydrocarbons
VOCs =	volatile organic compounds
SVOCs =	semi-volatile organic compounds

Table I7-9

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
LANDFILL 1 (L001TR001)											
L001TR001-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP	x			
L001TR001-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP	x			
LANDFILL 1 (L001TR002)											
L001TR002-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP		x		
L001TR002-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP		x		
LANDFILL 1 (L001TR003)											
L001TR003-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP			x	x
L001TR003-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP			x	x
LANDFILL 1 (L001TR004)											
L001TR004-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
L001TR004-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
LANDFILL 1 (L001TR005)											
L001TR005-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
L001TR005-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
LANDFILL 1 (L001TW001)**											
L001TW001-W01	10+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL			x	x
L001TW001-W01	10+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP			x	x

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
L001TW001-W01	10+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F			x	x
L001TW001-W01	10+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F			x	x
L001TW001-W01	10+	GW	9012A	cyanide	1 liter poly	1	NaOH				
LANDFILL 1 (L001TW002)**											
L001TW002-W01	10+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL	x			
L001TW002-W01	10+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP	x			
L001TW002-W01	10+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F	x			
L001TW002-W01	10+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F	x			
L001TW002-W01	10+	GW	9012A	cyanide	1 liter poly	1	NaOH				
LANDFILL 1 (L001TW003)**											
L001TW003-W01	10+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL		x		
L001TW003-W01	10+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP		x		
L001TW003-W01	10+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F		x		
L001TW003-W01	10+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
L001TW003-W01	10+	GW	9012A	cyanide	1 liter poly	1	NaOH		x		
LANDFILL 2 (L002TR001)											
L002TR001-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP	x			
L002TR001-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP	x			

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
LANDFILL 2 (L001TR002)											
L002TR002-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP		x		
L002TR002-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP		x		
LANDFILL 2 (L001TR003)											
L002TR003-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP			x	x
L002TR003-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP			x	x
LANDFILL 2 (L001TR004)											
L002TR004-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
L002TR004-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
LANDFILL 2 (L001TR005)											
L002TR005-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
L002TR005-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
LANDFILL 2 (L001TR006)											
L002TR006-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
L002TR006-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
LANDFILL 2 (L002TW001)											
L002TW001-W01	10+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
L002TW001-W01	10+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP				
L002TW001-W01	10+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F				
L002TW001-W01	10+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
L002TW001-W01	10+	GW	9012A	cyanide	1 liter poly	1	NaOH				
LANDFILL 2 (L002TW002)											
L002TW002-W01	10+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
L002TW002-W01	10+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP				
L002TW002-W01	10+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F				
L002TW002-W01	10+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
L002TW002-W01	10+	GW	9012A	cyanide	1 liter poly	1	NaOH				
LANDFILL 2 (L002TW003)											
L002TW003-W01	10+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
L002TW003-W01	10+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP				
L002TW003-W01	10+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F				
L002TW003-W01	10+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
L002TW003-W01	10+	GW	9012A	cyanide	1 liter poly	1	NaOH				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
LANDFILL 2 (L002SC001 – L002SC012)											
L002SC001-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP	x		x	x
L002SC001-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP	x		x	x
L002SC002-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP		x		
L002SC002-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP		x		
L002SC003-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC003-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC004-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC004-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC005-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC005-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC006-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC006-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC007-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC007-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
L002SC008-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP	x			
L002SC008-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP	x			
L002SC009-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC009-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC0010-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC0010-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC0011-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC0011-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
L002SC0012-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
L002SC0012-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
QUARRY 3 (Q003TR001)											
Q003TR001-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP	x			
Q003TR001-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP	x			

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
QUARRY 3 (Q003TR002)											
Q003TR002-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q003TR002-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
QUARRY 3 (Q003TR003)											
Q003TR003-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q003TR003-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
QUARRY 3 (Q003TR004)											
Q003TR004-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q003TR004-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
QUARRY 3 (Q003TR005)											
Q003TR005-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q003TR005-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
QUARRY 3 (Q003HP001)											
Q003HP001-W01	25+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL			x	x
Q003HP001-W01	25+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP			x	x
Q003HP001-W01	25+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F			x	x
Q003HP001-W01	25+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F			x	x
Q003HP001-W01	25+	GW	9012A	cyanide	1 liter poly	1	NaOH				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
QUARRY 3 (Q003HP002)											
Q003HP002-W01	25+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
Q003HP002-W01	25+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP				
Q003HP002-W01	25+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F				
Q003HP002-W01	25+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
Q003HP002-W01	25+	GW	9012A	cyanide	1 liter poly	1	NaOH				
QUARRY 3 (Q003SC001 – Q003SC008)											
Q003SC001-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP	x		x	x
Q003SC001-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP	x		x	x
Q003SC002-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP		x		
Q003SC002-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP		x		
Q003SC003-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q003SC003-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q003SC004-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q003SC004-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
Q003SC005-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q003SC005-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q003SC006-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q003SC006-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q003SC007-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q003SC007-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
AREA M QUARRY 1 (Q001TR001)											
Q001TR001-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q001TR001-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
AREA M QUARRY 1 (Q001TR002)											
Q001TR002-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q001TR002-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
AREA M QUARRY 1 (Q001TR003)											
Q001TR003-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q001TR003-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
AREA M QUARRY 1 (Q001TR004)											
Q001TR004-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q001TR004-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
AREA M QUARRY 1 (Q001TR005)											
Q001TR005-S01	(a)	Soil	5030B/8015, 5035/8260B	volatile TPH, VOCs	5 g Encore	6	NP				
Q001TR005-S02	(a)	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, extractable TPH, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
AREA M QUARRY 1 (Q001HP001)											
Q001HP001-W01	35+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
Q001HP001-W01	35+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP				
Q001HP001-W01	35+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F				
Q001HP001-W01	35+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
Q001HP001-W01	35+	GW	9012A	cyanide	1 liter poly	1	NaOH				
AREA M QUARRY 1 (Q001HP002)											
Q001HP002-W01	35+	GW	5030B/8015, 5035/8260B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
Q001HP002-W01	35+	GW	3520C/3630C/8015B, 3520C/8270C, 3520C/3630C/8310, 3520C/8081A, 3520C/8082	extractable TPH, SVOCs, PAHs, pesticides, PCBs	1 liter amber	10	NP				
Q001HP002-W01	35+	GW	3010A/6010B, 3020A/7041, 3020A7060A, 7471A, 3020A/7740, 3020A/7841	Project Metals List/Cations	1 liter poly	1	HNO_3/F				
Q001HP002-W01	35+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
Q001HP002-W01	35+	GW	9012A	cyanide	1 liter poly	1	NaOH				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
AREA M QUARRY 1 (Q001SC001 – Q001SC006)											
Q001SC001-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP		x		
Q001SC001-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP		x		
Q001SC002-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q001SC002-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q001SC003-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q001SC003-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q001SC004-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q001SC004-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q001SC005-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q001SC005-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				
Q001SC006-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q001SC006-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				

Table I7-9 (continued)

Analytical Method, Container and QA/QC Specification Matrix

Sample ID	Est. depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
Q001SC007-S01	0.5	Soil	5035/8260B	VOCs	5 g Encore	4	NP				
Q001SC007-S02	0.5	Soil	3050B/6010B, 3050B/7060A, 7471A, 3050B/7740, 3050B/7841, 3550B/3630C/8310, 8081A, 8082, 3550B/8270C, 8330	project metals list, PAHs, pesticides, PCBs, SVOCs, explosives	6-in long x 2-in-diameter stainless steel sleeve	1	NP				

Notes:

1. MS/MSD samples marked on this table are to be used only as a guide. Actual MS/MSD assignments will be coordinated with the laboratory on a daily basis and follow QAPP requirements:

GW = groundwater
HCL = hydrochloric acid
ml = milliliter
MS = matrix spike
MSD = matrix spike duplicate
NP = not preserved
PAHs = polyaromatic hydrocarbons
PCBs = polychlorinated biphenyls
QC = quality control
SVOCs = semi-volatile organic compounds
TDS = total dissolved solids
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

See Table I7-5 for project metals list
Cations include: calcium, magnesium, sodium, potassium
(a) To be collected in relatively fine-grained native soil beneath refuse/fill.
** Represents one quarter of samples. A total of four quarters are planned.

Table I7-10

Summary of Groundwater Analytical and QA/QC Specifications

	Matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
	Container	VOA	VOA	1 liter amber	1 liter amber	1 liter amber	1 liter amber	1 liter amber	1 liter poly	1 liter poly	1 liter poly	1 liter poly	1 liter poly
	Preservative	HCL	HCL	NP	NP	NP	NP	NP	HNO_3/F	NP/F	NP/F	NP/F	NaOH
	Lab	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX
Sample location	Sample type	VOCs (8260B)	TPH volatile (8260B)	TPH extractable (8015B)	SVOCs (8270C)	PAHs (8310)	Pesticides (8081A)	PCBs (8082)	PML/ cations*	TDS (160.3)	Anions (300.0)	ALK (310.1)	Cyanide (9012A)
L001TW001**	R	3	3	2	2	2	2	2	1	1	1	1	1
L001TW001**	TB	2											
L001TW001**	MS/MSD	3	3	2	2	2	2	2	1	1	1	1	1
L001TW002**	R	3	3	2	2	2	2	2	1	1	1	1	1
L001TW002**	D	3	3	2	2	2	2	2	1	1	1	1	1
L001TW003**	R	3	3	2	2	2	2	2	1	1	1	1	1
L001TW003**	S	3	3	2	2	2	2	2	1				1
L002TW001**	R	3	3	2	2	2	2	2	1	1	1	1	1
L002TW002**	R	3	3	2	2	2	2	2	1	1	1	1	1
L002TW003**	R	3	3	2	2	2	2	2	1	1	1	1	1
Q003HP001	R	3	3	2	2	2	2	2	1	1	1	1	1
Q003HP001	TB	2											
Q003HP001	MS/MSD	3	3	2	2	2	2	2	1	1	1	1	1
Q003HP002	R	3	3	2	2	2	2	2	1	1	1	1	1
Q001HP001	R	3	3	2	2	2	2	2	1	1	1	1	1
Q001HP002	R	3	3	2	2	2	2	2	1	1	1	1	1
Total Containers		46	42	28	28	28	28	28	14	14	13	13	14
Total equipment rinsate blank samples	EB	0	0	0	0	0	0	0	0	0	0	0	0
Total filter blank samples	LB	0	0	0	0	0	0	0	0	0	0	0	0
Total ambient blank samples	FB	0	0	0	0	0	0	0	0	0	0	0	0
Total trip blank samples	TB	2	0	0	0	0	0	0	0	0	0	0	0
Total normal samples	R	10	10	10	10	10	10	10	10	10	10	10	10
Total field duplicate samples	D	1	1	1	1	1	1	1	1	1	1	1	1

Table I7-10 (continued)

Summary of Groundwater Analytical and QA/QC Specifications

	Matrix	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW	GW
	Container	VOA	VOA	1 liter amber	1 liter amber	1 liter amber	1 liter amber	1 liter amber	1 liter poly	1 liter poly	1 liter poly	1 liter poly	1 liter poly
	Preservative	HCL	HCL	NP	NP	NP	NP	NP	HNO_3/F	NP/F	NP/F	NP/F	NaOH
	Lab	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX
Sample location	Sample type	VOCs (8260B)	TPH volatile (8260B)	TPH extractable (8015B)	SVOCs (8270C)	PAHs (8310)	Pesticides (8081A)	PCBs (8082)	PML/ cations*	TDS (160.3)	Anions (300.0)	ALK (310.1)	Cyanide (9012A)
Total lab QC samples	MS/MSD	2	2	2	2	2	2	2	2	2	2	2	2
Total split lab QA samples	S	1	1	1	1	1	1	1	1	0	0	0	1
Total analyses		16	14	14	14	14	14	14	14	13	13	13	14

Matrix: GW = groundwater

Preservative: NP = not preserved
HCL = hydrochloric acid
HNO_3 = nitric acid
NaOH = sodium hydroxide
F = filtered (0.45 micron)

Analyses: ALK = alkalinity
PAHs = polyaromatic hydrocarbons
PCBs = polychlorinated biphenyls
SVOCs = semi-volatile organic compounds
TDS = total dissolved solids
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

Sample Type: D = field duplicate sample
EB = equipment rinsate blank sample
FB = ambient blank sample
LB = filter blank sample
MS/MSD =matrix spike/matrix spike duplicate
R = normal sample
S = split sample
TB = trip blank sample
QA = quality assurance
QC = quality control

See Table I7-5 for project metals list (PML).
* cations include calcium, magnesium, sodium and potassium.
** Represents one quarter of samples. A total of four quarters are planned.

Table I7-11
Summary of Soil Analytical and QA/QC Specifications

	Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Container	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	5g Encore
	Preservative	NP	NP	NP	NP	NP	NP	NP
	Lab	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX
Sample location	Sample type	PML (various)	Extractable TPH (8015), PAHs (8310)	Pesticides (8081)	PCBs (8082)	SVOCs (8270)	Explosives (8330)	Volatile TPH (8015), VOCs (8260)
L001TR001	N	1	1	1	1	1	1	6
L001TR001	D	1	1	1	1	1	1	6
L001TR002	N	1	1	1	1	1	1	6
L001TR002	S	1	1	1	1	1	1	6
L001TR003	N	1	1	1	1	1	1	6
L001TR003	MS/MSD	1	1	1	1	1	1	14
L001TR004	N	1	1	1	1	1	1	6
L001TR005	N	1	1	1	1	1	1	6
L002TR001	N	1	1	1	1	1	1	6
L002TR001	D	1	1	1	1	1	1	6
L002TR002	N	1	1	1	1	1	1	6
L002TR002	S	1	1	1	1	1	1	6
L002TR003	N	1	1	1	1	1	1	6
L002TR003	MS/MSD	1	1	1	1	1	1	14
L002TR004	N	1	1	1	1	1	1	6
L002TR005	N	1	1	1	1	1	1	6
L002TR006	N	1	1	1	1	1	1	6
L002SC001	N	1	1	1	1	1	1	4 (VOCs only)
L002SC001	D	1	1	1	1	1	1	4 (VOCs only)
L002SC001	MS/MSD	1	1	1	1	1	1	8 (VOCs only)
L002SC002	N	1	1	1	1	1	1	4 (VOCs only)
L002SC002	S	1	1	1	1	1	1	4 (VOCs only)
L002SC003	N	1	1	1	1	1	1	4 (VOCs only)
L002SC004	N	1	1	1	1	1	1	4 (VOCs only)
L002SC005	N	1	1	1	1	1	1	4 (VOCs only)
L002SC006	N	1	1	1	1	1	1	4 (VOCs only)
L002SC007	N	1	1	1	1	1	1	4 (VOCs only)
L002SC008	N	1	1	1	1	1	1	4 (VOCs only)
L002SC008	D	1	1	1	1	1	1	4 (VOCs only)

Table I7-11
Summary of Soil Analytical and QA/QC Specifications

	Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Container	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	5g Encore
	Preservative	NP	NP	NP	NP	NP	NP	NP
	Lab	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX
Sample location	Sample type	PML (various)	Extractable TPH (8015), PAHs (8310)	Pesticides (8081)	PCBs (8082)	SVOCs (8270)	Explosives (8330)	Volatile TPH (8015), VOCs (8260)
L002SC009	N	1	1	1	1	1	1	4 (VOCs only)
L002SC0010	N	1	1	1	1	1	1	4 (VOCs only)
L002SC0011	N	1	1	1	1	1	1	4 (VOCs only)
L002SC0012	N	1	1	1	1	1	1	4 (VOCs only)
Q003TR001	N	1	1	1	1	1	1	6
Q003TR002	N	1	1	1	1	1	1	6
Q003TR003	N	1	1	1	1	1	1	6
Q003TR004	N	1	1	1	1	1	1	6
Q003TR005	N	1	1	1	1	1	1	6
Q003SC001	N	1	1	1	1	1	1	4 (VOCs only)
Q003SC001	D	1	1	1	1	1	1	4 (VOCs only)
Q003SC001	MS/MSD	1	1	1	1	1	1	8 (VOCs only)
Q003SC002	N	1	1	1	1	1	1	4 (VOCs only)
Q003SC002	S	1	1	1	1	1	1	4 (VOCs only)
Q003SC003	N	1	1	1	1	1	1	4 (VOCs only)
Q003SC004	N	1	1	1	1	1	1	4 (VOCs only)
Q003SC005	N	1	1	1	1	1	1	4 (VOCs only)
Q003SC006	N	1	1	1	1	1	1	4 (VOCs only)
Q003SC007	N	1	1	1	1	1	1	4 (VOCs only)
Q001TR001	N	1	1	1	1	1	1	6
Q001TR002	N	1	1	1	1	1	1	6
Q001TR003	N	1	1	1	1	1	1	6
Q001TR004	N	1	1	1	1	1	1	6
Q001TR005	N	1	1	1	1	1	1	6
Q001SC001	N	1	1	1	1	1	1	4 (VOCs only)
Q001SC001	S	1	1	1	1	1	1	4 (VOCs only)
Q001SC002	N	1	1	1	1	1	1	4 (VOCs only)
Q001SC003	N	1	1	1	1	1	1	4 (VOCs only)
Q001SC004	N	1	1	1	1	1	1	4 (VOCs only)

Table I7-11
Summary of Soil Analytical and QA/QC Specifications

	Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Container	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	5g Encore
	Preservative	NP	NP	NP	NP	NP	NP	NP
	Lab	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX
Sample location	Sample type	PML (various)	Extractable TPH (8015), PAHs (8310)	Pesticides (8081)	PCBs (8082)	SVOCs (8270)	Explosives (8330)	Volatile TPH (8015), VOCs (8260)
Q001SC005	N	1	1	1	1	1	1	4 (VOCs only)
Q001SC006	N	1	1	1	1	1	1	4 (VOCs only)
Q001SC007	N	1	1	1	1	1	1	4 (VOCs only)
Total containers				61				326
Total equipment rinsate blank samples	EB	2	2	2	2	2	2	0
Total filter blank samples	LB	0	0	0	0	0	0	0
Total ambient blank samples	FB	0	0	0	0	0	0	0
Total trip blank samples	TB	0	0	0	0	0	0	8
Total normal samples	R	47	47	47	47	47	47	47
Total field duplicate samples	D	5	5	5	5	5	5	5
Total lab QC samples	MS/MSD	4	4	4	4	4	4	4
Total split lab QA samples	S	5	5	5	5	5	5	5
Total analyses		61	61	61	61	61	61	69

Table I7-11
Summary of Soil Analytical and QA/QC Specifications

Sample location	Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil
	Container	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	Stainless steel sleeve	5g Encore
	Preservative	NP	NP	NP	NP	NP	NP	NP
	Lab	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX	EMAX
	Sample type	PML (various)	Extractable TPH (8015), PAHs (8310)	Pesticides (8081)	PCBs (8082)	SVOCs (8270)	Explosives (8330)	Volatile TPH (8015), VOCs (8260)

Matrix: Soil
Preservative: NP = not preserved

Sample Type:
D = field duplicate sample
EB = equipment rinsate blank sample
FB = ambient blank sample
LB = filter blank sample
MS/MSD =matrix spike/matrix spike duplicate

Analyses:
PAHs = polyaromatic hydrocarbons
PCBs = polychlorinated biphenyls
R = normal sample
S = split sample
TB = trip blank sample
QA = quality assurance
QC = quality control

See Table I7-5 for project metals list (PML).

Table I7-12

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Date of Readiness Review Meeting: _____ Date of Fieldwork: _____

Activity: Site Investigation

Location: Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

FSIP/SSHP Title: Field Site Investigation Plan – Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

1. Does FA/BC have Notice to Proceed on this task from USACE?

Yes NA Will Be When: _____

2. Have appropriate USACE personnel been notified of the Schedule of Activities?

Yes NA Will Be When: _____

3. Is the FSIP approved and final?

Yes NA Will Be When: _____

4. List the appropriate parcels requiring Rights of Entry and have they been signed?

Parcel Number: 080-140-140 Location: Area I Landfill 1

Yes NA Will Be When: _____

Parcel Number: 080-140-100 Location: Area I Landfill 2

Yes NA Will Be When: _____

Parcel Number: 080-222-030/094-671-220 Location: Area I Quarry 3

Yes NA Will Be When: _____

Parcel Number: 080-120-220 Location: Area M Quarry 1

Yes NA Will Be When: _____

Are Rights of Entry on file in field office?

Yes NA Will Be When: _____

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

5. Has the property owner been notified in writing of scope and schedule of activities?

   Yes NA Will Be When:_____

6. Subcontractor(s)

   A. Is *USA Environmental* under contract?

   Yes NA Will Be When:_____

   Is task order signed for this subcontractor?

   Yes NA Will Be When:_____

   B. Is *Nielson Construction* under contract?

   Yes NA Will Be When:_____

   Is task order signed for this subcontractor?

   Yes NA Will Be When:_____

   C. Is *Gregg Drilling* under contract?

   Yes NA Will Be When:_____

   Is task order signed for this subcontractor?

   Yes NA Will Be When:_____

7. Laboratory (stationary)

   Is *EMAX* under contract?

   Yes NA Will Be When:_____

   Is the analytical laboratory ready to receive samples?

   Yes NA Will Be When:_____

   Are all appropriate sample containers on-site?

   Yes NA Will Be When:_____

8. Laboratory (mobile) *Not Applicable*

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

9. Laboratory (QA)

   Has QA lab been selected? Name:_____

   Yes NA Will Be When:_____

   Is the QA laboratory ready to receive samples?

   Yes NA Will Be When:_____

10. Laboratory (specialized samples)

    Is _____under contract?

    Yes NA Will Be When:_____

    Is the analytical laboratory ready to receive samples?

    Yes NA Will Be When:_____

    Are all appropriate sample containers on-site?

    Yes NA Will Be When:_____

11. Trip blanks on site from *EMAX* (analytical laboratory name)?

    Yes NA Will Be When:_____

12. Is the courier set-up to pick up samples (if applicable)?

    Yes NA Will Be When:_____

13. Field Office

    Is field office equipment (e.g., refrigerator, phone) working properly?

    Yes NA Will Be When:_____

    Are field supplies (e.g., coolers, vermiculite, shipping labels, bubble wrap) on-site?

    Yes NA Will Be When:_____

    Are decon chemicals on-site with MSDS sheets on file in field office?

    Yes NA Will Be When:_____

    Are sample labels prepared?

    Yes NA Will Be When:_____

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

14. Documentation

Are field notebooks prepared?

Yes NA Will Be When:_____

Are sample documentation forms prepared and on-site?

Yes NA Will Be When:_____

Is database ready to receive sample information?

Yes NA Will Be When:_____

15. Personnel

Do appropriate FA/BC personnel have copies of QAPP, General SSHP, FSIP and site specific SSHP?

Yes NA Will Be When:_____

Have the QAPP and appropriate SOPs been reviewed?

Yes NA Will Be When:_____

Has the FSIP been reviewed?

Yes NA Will Be When:_____

Are all FA/BC personnel current on H&S training?

Yes NA Will Be When:_____

Are all subcontractor personnel current on H&S training (if applicable)?

Yes NA Will Be When:_____

Have subcontractors been briefed on QAPP requirements?

Yes NA Will Be When:_____

Is medical surveillance documentation for FA/BC personnel and subcontractors on file in field office?

Yes NA Will Be When:_____

Who is the competent person in charge _____*Dean Wall*_____

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

16. List the tenants that will be impacted from the field work.

Contact Name: _____

Business Name: Benicia Industries, Inc

Location: Vacant parking lot at Landfill 1

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When: _____

List any special ROE requirements.

_____

Contact Name: _____

Business Name: Benicia Industries, Inc

Location: Dirt lot at Landfill 2

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When: _____

List any special ROE requirements.

_____

Contact Name: CJM Association (Ms. Megan Marquez) and Mr. William Cambra

Business Name: NA

Location: Quarry 3

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When: _____

List any special ROE requirements.

_____

Contact Name: _____

Business Name: Benicia Industries, Inc

Location: Camel Barn Museum (Quarry 1)

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When:_____

List any special ROE requirements.

48 hour prior notice

17a. Does this site require UXO construction support (UXO potential moderate to high per EP 75-1-2)? **YES.**

17b. Does this site require UXO safety support (UXO potential is low per EP 75-1-2)? **YES.**

17c. Does the site require UXO clearance? **YES AT AREA M QUARRY.**

18. Have invasive locations been cleared for underground utilities?

Yes NA Will Be When:_____

19. Has FA/BC marked the sample locations?

Yes NA Will Be When:_____

20. Has USA been contacted with regard to underground utilities?

Yes NA Will Be When:_____

Date: _____

Ticket number(s): _____

Date Expires: _____

21. Has site walk for public utilities been scheduled?

Yes NA Will Be When:_____

Conducted?

Yes NA Will Be When:_____

22. Have utilities been marked by all providers?

Yes NA Will Be When:_____

If not, who? _____

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

23. List all required field equipment. Is equipment on site and in working condition?

Hand auger Drive sampler

PID

Calibration gas within date? PID calibrated?

Calibration log on-site?

pH/EC/temperature meter(s)

pH calibration fluids in date? EC calibration fluids in date?

Meter(s) calibrated? Calibration log on-site?

Other equipment (list)

Equipment: *Soil sampling equipment: sampler*

Equipment: *Encore sampling equipment and containers*

Equipment: *Water level indicator*

Equipment: *Subcontractor geophysical instruments*

Equipment: *Subcontractor backhoe and equipment*

Equipment: _____

Equipment: _____

24. List any specialty equipment necessary for this project. Is equipment on-site and in working condition?

Equipment: *Geophysical survey instruments to be provided by Norcal*

Yes NA Will Be When: _____

Equipment: *Backhoe and digging equipment to be provided by Nielson Construction*

Yes NA Will Be When: _____

25. Is PPE on-site and inspected?

Yes NA Will Be When: _____

Table I7-12 (Continued)

Readiness Review Checklist

for Area I Landfill 1, Landfill 2, Quarry 3 and Area M Quarry 1

26. Has project readiness meeting been held?

Yes NA Will Be When:_____

Attendees:

Printed Name	Signature	Date

SITE SAFETY AND HEALTH PLAN
AREA I LANDFILL 1, LANDFILL 2 AND QUARRY 3 AND AREA M QUARRY 1
BENICIA ARSENAL

Prepared by: _____ Date: 10/31/00
Ms. Wendy Linck
Site Safety Officer

Reviewed/Approved by: Anne Baptiste Date: 10-30-00
Ms. Anne Baptiste, CIH
Health and Safety Director

Reviewed/Approved by: _____ Date: 10/31/00
Ms. Wendy Linck
Site Safety Officer

Effective Dates: 10/31/00 to 10/31/01

FORSGREN ASSOCIATES/BROWN AND CALDWELL

SITE SAFETY AND HEALTH PLAN

Preface

This SSHP has been prepared for investigation activities to be conducted at Landfill 1, Landfill 2 and Quarry 3 in Area I, and Quarry 1 in Area M of the former Benicia Arsenal. This SSHP is supplemented by the FA/BC Health and Safety Program Manual and the Benicia Arsenal General SSHP (General SSHP) for the Arsenal FUDS, which will be referenced throughout this site specific SSHP. The FA/BC Health and Safety Program Manual will be referenced by using the appropriate 100 series number followed by the page number. For example, (203.5; p.2-13) represents the 200 series, Section 203.5, page 2-13.

This SSHP presents detailed procedures and limits to address potential chemical, physical and biological hazards at Landfill 1, Landfill 2 and Quarry 3 in Area I and Quarry 1 in Area M.

This investigation of potential contamination and potential waste characterization at Landfill 1, Landfill 2 and Quarry 3 in Area I and Quarry 1 in Area M will be conducted according to procedures and requirements of this site specific SSHP. The probability of encountering UXO is low. When determination is made that the probability of encountering is low, a minimum of a two-person UXO team will stand by in case the construction contractor encounters a suspected UXO.

Should UXO/OE material be encountered, FA/BC's invasive investigation activities will stop, the work area will be evacuated, and the USACE Project Manager will be notified. Subsequent identification, evaluation, handling and disposal of UXO/OE material will be conducted under the USACE Sacramento District.

PROJECT SUMMARY

The purpose of this investigation is to determine the location of landfill and quarry boundaries at Landfill 1, Landfill 2 and Quarry 3 in Area I and Quarry 1 in Area M. Area M Quarry 1 will be cleared in writing for UXO by a qualified UXO contractor prior to any investigation. A subsurface investigation will be conducted by trenching to determine the extent of the landfill and quarry boundaries. Further evaluation of subsurface lithology and groundwater chemistry will be conducted at three locations outside each landfill perimeter. Invasive activities will be limited to drilling outside of the landfill boundaries, and trenching near the landfill and quarry boundaries.

If FA/BC identifies potential UXO/OE material during drilling or trenching activities, the evaluation, removal, and/or disposal of the UXO/OE materials will be handled by USACE Sacramento District according to procedures as Attachment B. A detailed description of field activities is presented in the FSIP for Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1.

KEY PERSONNEL

The key personnel for this site specific SSHP are:

- Program Manager: Mr. Dave Jones
- Health and Safety Director: Ms. Anne Baptiste, Certified Industrial Hygienist
- Project Manager: Ms. Patti De La O

- Site Safety Officers: Ms. Wendy Linck and Mr. Paul Lopez

Descriptions of responsibilities for each key personnel and subcontractor are included in the General SSHP.

Project Contacts

A reference list of project contacts is located in the General SSHP.

HAZARD ANALYSIS

The site specific potential hazards to personnel working have been identified as chemical hazards, physical hazards, UXO, and biological hazards. Each potential hazard, the potential for exposure, and recommended control for all the sites are presented in Table A-1. Procedures of UXO/OE construction support are covered in Appendix B to the FSIP.

Chemical Hazards

Soil sampling will be conducted only at locations outside the perimeters of the landfills, thus minimizing exposure to workers.

Drilling and well installation in areas outside of the landfill perimeters, and trenching at landfill boundaries are the only invasive technique proposed for this project. However, trenching will be conducted only to confirm landfill and quarry boundaries, and excavation will be limited to at most 2 feet into any waste materials. The chemical related health hazards of this project would primarily be from petroleum, oils, and lubricants (specifically benzene, chlorobenzene, and total petroleum hydrocarbon [TPH]), polyaromatic hydrocarbons (PAHs), acids, and solvents (specifically trichloroethane [TCE]) that may be found in soil within the landfills or quarries. However, exposures to these chemical related health hazards are minimal, since possible direct exposure through soil sampling is not proposed for this investigation within landfill materials. Exposure to heavy metals (i.e., arsenic, chromium and lead), organochlorine pesticides, and dust may also occur. Engineering controls, such as wetting of soil during trenching and working up-wind of excavations, will be implemented to minimize dust and exposure to dust.

The primary routes for exposure from benzene, chlorobenzene, TCE, and solvents at this site may result from inhalation and skin contact. Worker exposures to metal dusts are commonly a result of inhalation. The primary route of work exposure to residual acids, PAHs, and organochlorine pesticides is skin contact. A more detailed discussion of each of the chemical compounds or groups is presented below. Potential chemical hazards, exposure limits and chemical characteristics for key chemicals that may be present at the site are listed in Table A-2.

Benzene. Benzene is regulated by OSHA as an occupational carcinogen and has been associated with leukemia. Acute health effects include irritation to the eyes, nose and respiratory system, headache, giddiness, nausea and anorexia. Benzene exposure can also lead to disturbances in gait, dermatitis and bone marrow depression.

The other BTEX compounds (toluene, ethylbenzene and xylenes) may cause irritation to the eyes, nose and respiratory system, and dermatitis. Acute exposure can lead to central nervous system effects including headache, dizziness, confusion and irritability. Exposure to toluene may also result in pupil dilatation, nervousness, reproductive toxicity and insomnia. Elevated concentrations of xylene isomers may lead to corneal damage, and gastrointestinal symptoms including abdominal pain, nausea and vomiting.

Table A-1
Potential Hazards and Recommended Controls for Area I Landfill 1, Landfill 2 and Quarry 3
Area M Quarry 1 Investigation Activities

Potential hazards	Recommended controls
Chemical exposure	The minimum level of proper PPE during activities is Level D. This level is considered adequate to protect individuals from exposure to petroleum hydrocarbon constituents. Air monitoring will be performed with an OVM, LEL meter, and H_2S meter to monitor the air quality in and around the work zone during invasive activities. Engineering controls, such as wetting of soil during trenching will be implemented to minimize dust.
Back injury	No sampling, using heavy equipment, or hand digging is anticipated for this project that would require excessive lifting. In general, high manual labor causes high stress forces on the back. Use proper lifting techniques, proper tools, vacuum bailers, two person rotations and adequate back support during all field tasks. Proper lifting techniques may also vary with task. Therefore, these techniques will also be addressed in the daily site safety briefings. Refer to the Ergonomics Program of the FA/BC Health and Safety Program Manual (103; p. 7-9).
Noise	Heavy equipment is anticipated for this project (i.e., backhoe and drilling rig), such that hearing protection may be necessary. A hearing conservation program will be implemented to determine exposure to workers for each piece of equipment that commonly requires hearing protection (backhoe and drilling rig). Noise exposure monitoring will be conducted initially by the SSO with assistance from the HSD to determine correct hearing protection for this type of equipment to be used for the rest of the project. Refer to the Noise/Hearing Conservation section in the FA/BC Health and Safety Program Manual (210; p. 44-45). In general, use hearing protection whenever the noise levels are such that conversation is impaired without raising the voice level.
Drum handling	Drum handling is not anticipated for this project. In general, drums may be used to store soil or water as a result of drilling or excavation operations. Utilize appropriate drum handling equipment (dollies, lift gates, etc.) and avoid manual lifting of filled or partially filled drums.
Migration of contamination	A work zone will be delineated before start of invasive work activities. An area within the work zone will be established for decontamination prior to exiting the site. The decontamination area must be away from the actual working area. Figures A-1, A-2, A-3 and A-4 are provided in this SSHP to show the area of the work zone for each site.
Exposure to potentially contaminated soil/water	Level D PPE is the minimum level required for this project. All personnel will don the appropriate level of PPE upon entering the work area and then use proper decontamination procedures before exiting the work zone. Workers will exit the work zone before eating.
Slips, trips and falls	The proper footwear for this project will include steel-toed boots upon entering the work zone. Wear proper footwear and anticipate footing hazards (i.e., steep slopes, potholes, and uneven surfaces).
Utilities/electrical	Have all utilities (underground and overhead) located and documented prior to the initiation drilling or excavation activities. Maintain a minimum distance of 20 feet clearance between any energized line of 37 kv or less, and any part of a drill rig, boom, or other piece of equipment at all times. If voltage is between 37 kv and 55 kv, then maintain a minimum distance of 27 feet. If voltage is between 55 kv and 100 kv, then maintain a minimum distance of 42 feet (8 CCR Division 1, Chapter 4, Subchapter 5, Group 2, Article 37, Section 2946.

Table A-1 (continued)
Potential Hazards and Recommended Controls for Area I Landfill 1, Landfill 2 and Quarry 3
Area M Quarry 1 Investigation Activities

Potential Hazards	Recommended Controls
Heavy equipment and backhoes	Drilling and excavating equipment may be necessary for this project. Personnel communication and wearing proper PPE during work activities is essential for the protection of workers at the site. See the Trenching, Drilling and Heavy Equipment SOPs for specifics. The competent person for trenching will be the on-site SSO.
Unexploded ordnance	There is a low potential for UXO at Landfill 1, Landfill 2 and Quarry 3 in Area I. For Quarry 1 in Area M, the area will be cleared in writing by a qualified UXO specialist prior to personnel entry.
Biological hazards	The project is in an area where animals, insects, or animal droppings may be present. Level D PPE will be donned for this project, unless conditions indicate an infestation of insects, mold, or animal droppings. Significant amounts of which would cause work stoppage. Be aware of spiders inside well boxes or insect swarms on buildings or in trees. The area around all the sites is open and these types of biological hazards are not anticipated.
Radiological hazards	Area I Landfill 2 was closed prior to 1945. As a result, there are no radiological hazards anticipated for this project.

Table A-2

Chemical Exposure Limits and Characteristics Controls for Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1

Constituent	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	PEL[d] 8-hour TWA	IDLH[e] level	Flammable range percent	Odor threshold, ppm	Notes[f]	Potential symptoms of exposure[g]
CHEMICALS									
Benzene	9.24	185	0.5 ppm	1 ppm	500 ppm	1.3-7.9	4.68	Ca, 65	irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Boric acid	13.5	NA	10 mg/m^3	NA	2,000 mg/m^3	(g)			nasal irritation, conjunctivitis, erythema
Chlorobenzene	9.07	179	10 ppm	75 ppm	1,000 ppm	1.3-9.6			irritation to skin, eyes, nose, drowsiness, incoherence
Ethylbenzene	8.76	111	100 ppm	100 ppm	800 ppm	1.0-6.7	0.25-200		irritation to eyes, muscle membranes, headache, dermatitis, narcosis, coma
Hydrochloric acid	NA	NA	NA	5 ppm	50 ppm	NC		C	inflammation of the nose, throat, laryngeal, coughing, burns throat, choking, burns eyes, skin, dermatitis
PAHs	NA	NA	50 mg/m^3	0.2 mg/m^3 (coal tar pitch)	500 ppm	0.9%-5.9%	NA		Irritation to eyes, skin, respiratory system. Carcinogen: lung, skin
Phosphoric acid	NA	NA	1 mg/m^3	1 mg/m^3	1,000 mg/m^3	NC			irritation to upper respiratory tract, irritation to eyes, skin, burns skin, burns eyes, dermatitis
Stoddard solvent	NA	approx 40	100 ppm	500 ppm	20,000 mg/m^3	unknown			irritation to eyes, nose, throat, dizziness, dermatitis
Toluene	8.82	126	50 ppm	200 ppm	500 ppm	1.2-7.1	0.17-40		fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lassitude, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis
Trichloroethene	9.5	54	50 ppm	25 ppm	1,000 ppm	8-10.5		Ca, 65	headache, vertigo, visual disturbance, tremors, somnolence, nausea, vomiting, irritation to eyes, dermatitis, cardiac arrhythmias, paresthesia

Table A-2 (continued)

Chemical Exposure Limits and Characteristics Controls for Area I Landfill 1, Landfill 2 and Quarry 3, and Area M Quarry 1

Constituent	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	PEL[d] 8-hour TWA	IDLH[e] level	Flammable range percent	Odor threshold, ppm	Notes[f]	Potential symptoms of exposure[g]
Xylene	8.56	111	100 ppm	100 ppm	900 ppm	1.0-7.0	0.05-200		dizziness, drowsiness, excitement, incoherence, staggered gait, irritation to eyes, nose, throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Methane	12.48	100	NA	NA	Not <19.5% O^2	5-15			
H_2S	10.46	NA	10	10	100	4-44	0.001-0.113 odor fatigue		
METALS									
Antimony	NA	NA	0.5 mg/m^3	0.5 mg/m^3	50 mg/m^3	NC			irritation to nose, throat, mouth, coughing, dizziness, headache, nausea, vomiting, diarrhea, stomach cramps, insomnia, anorexia, irritation to skin, unable to smell properly, cardiac abnormalities in antimony trichloride exposures
Arsenic	NA	NA	0.01 mg/m^3	0.01 mg/m^3	5 mg/m^3	NC		Ca, 65	ulceration of the nasal septum, dermatitis, gastrointestinal disturbance, peripheral neuropathy, respiratory irritation, hyper-pigmentation of the skin
Chromium III	(h)	NA	0.5 mg/m^3	0.5 mg/m^3	25 mg/m^3	NC		65	histologic fibrosis of the lungs, lung cancer, nexochrome, ulceration and perforation of the nasal septum
Copper	NA	NA	1 mg/m^3	1 mg/m^3	100 mg/m^3	NC			irritation to nasal and mucous membrane, pharynx, nasal perforation, irritation to eye, metallic taste, dermatitis
Lead	NA	NA	0.05 mg/m^3	0.05 mg/m^3	100 mg/m3	NC		65	weakness, lassitude, insomnia, facial pallor, pal eye, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, paralysis of the wrists and ankles, encephalopathy, nephropathy, irritation to eyes, hypotension

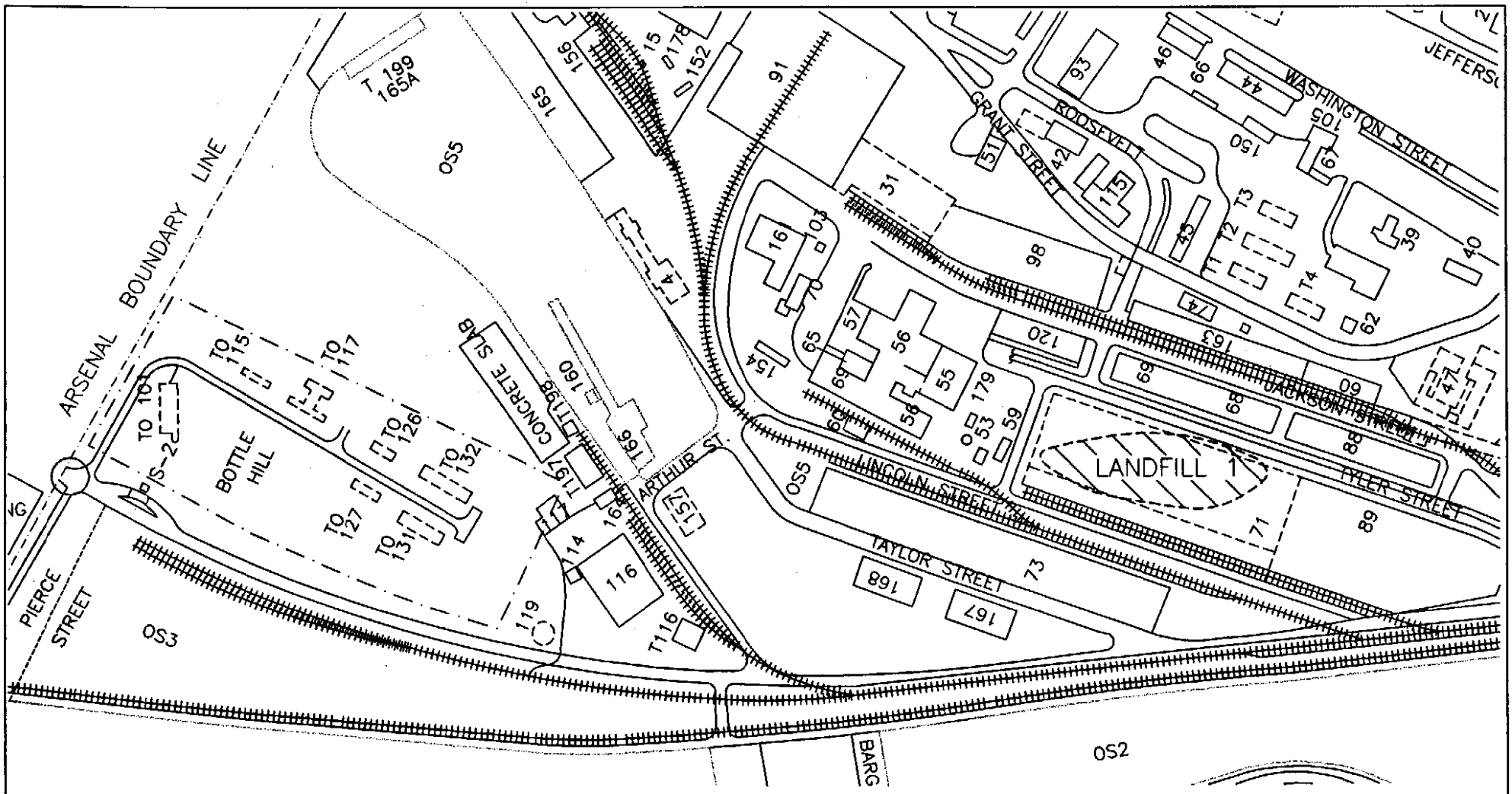
Table A-2 (continued)

Chemical Exposure Limits and Characteristics Controls for Area I Landfill 1, Landfill 2 and Quarry 3, and Area M Quarry 1

Constituent	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	PEL[d] 8-hour TWA	IDLH[e] level	Flammable range percent	Odor threshold, ppm	Notes[f]	Potential symptoms of exposure[g]
Nickel	NA	NA	1 mg/m^3	1 mg/m^3	10 mg/m^3	unknown combustible solid			headache, vertigo, nausea, vomiting, epigastric pain, substernal pain, coughing, hyperpnea, cyanosis, weakness, leukocytosis, pneumonitis, delirium, convulsions
Zinc Chloride	NA	NA		1 mg/m^3	50 mg/m^3	unknown			(as zinc chloride fumes) conjunctivitis, irritation to nose, throat, coughing, copious sputum, dyspnea, chest pain, pulmonary edema, bronchopneumonia, pulmonary fibrosis, corpulmonale, fever, cyanosis, tachypnea, burns to skin, irritation to eyes, skin
PESTICIDES									
Chlordane	NA	NA	0.5 mg/m^3	0.5 mg/m^3	100 mg/m^3	NC		Ca, S, 65	blurred vision, confusion, ataxia, delirium, coughing, abdominal pain, nausea, vomiting, diarrhea, irritability, tremor, convulsions, anuria
DDT	NA	NA	1 mg/m^3	1 mg/m^3	500 mg/m^3	unknown combustible solid		Ca, S, 65	paresthesia tongue, lips, face, tremor, apprehension, dizziness, confusion, malaise, headache, fatigue, convulsions, paresis hands, vomiting, irritation of eyes and skin
Dieldrin	NA	NA	0.25 mg/m^3	NA	50 mg/m^3	NC		Ca, 65	headache, dizziness, nausea, vomiting, malaise, sweating, myoclonic limb jerks, clonic, tonic convulsions, coma

[a] Ionization potential in electron-volts.
[b] Century Organic Vapor Analyzer relative response to the compound in percent with methane calibration.
[c] Threshold Limit Value as the airborne 8-hour TWA established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1999.
[d] Permissible Exposure as the airborne 8-hour TWA established by the OSHA.
[e] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.
[f] Hazard category; Ca-Carcinogen; C-Ceiling; S-Skin absorption; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.
[g] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of Poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merk Index, 1996.
[h] IP varies with chromium compound.

Notes:
NA = not applicable or not available
NC = noncombustible
NE = not established
NF = non-flammable
PAHs = polyaromatic hydrocarbons



LEGEND:

- Arsenal Boundary Line
- Area Boundary Line
- Road
- Railroad Tracks
- 40 — Building
- Proposed Work Zone

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

100 0 100 200 300
Scale In Feet
(Approximate)

N

Figure A-1
Work Zone Map
Landfill 1

Area I - Site Safety and Health Plan
Benicia Arsenal

WASHINGTON ST.

MADISON ST.

WASHINGTON ST.

180

29

142

APPROXIMATE SURFACE AREA WHERE ASPHALT DEBRIS WAS ENCOUNTERED DURING HARDING LAWSON ASSOCIATES 1988 INVESTIGATION

APPROXIMATE LOCATION OF LANDFILL 2

FORMER VELOCITY INSTRUMENT HOUSE (POST 1877–PRE 1932)
FORMER STOREHOUSE (PRE 1932–PRE 1945)

FORMER LUMBER SHED (PRE 1877–PRE 1945)

ADAMS ST.

99

48

22

63

49

101

BAYSHORE RD.

54

64

LEGEND

29	Building Number
49	Former Building Location
	Railroad Tracks
	Proposed Work Zone

AREA I

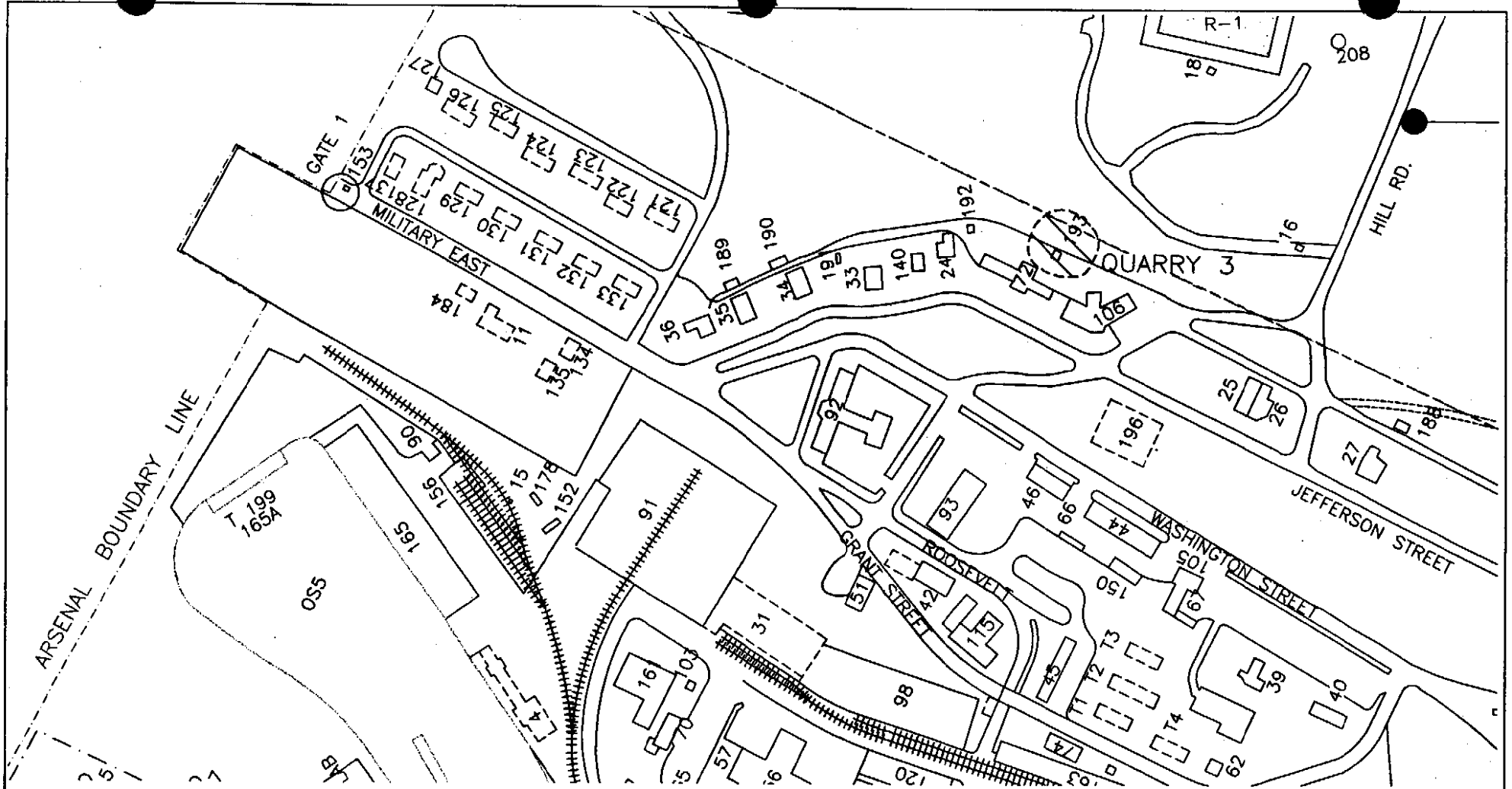
N

25 0 50 100

Scale In Feet
(Approximate)

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

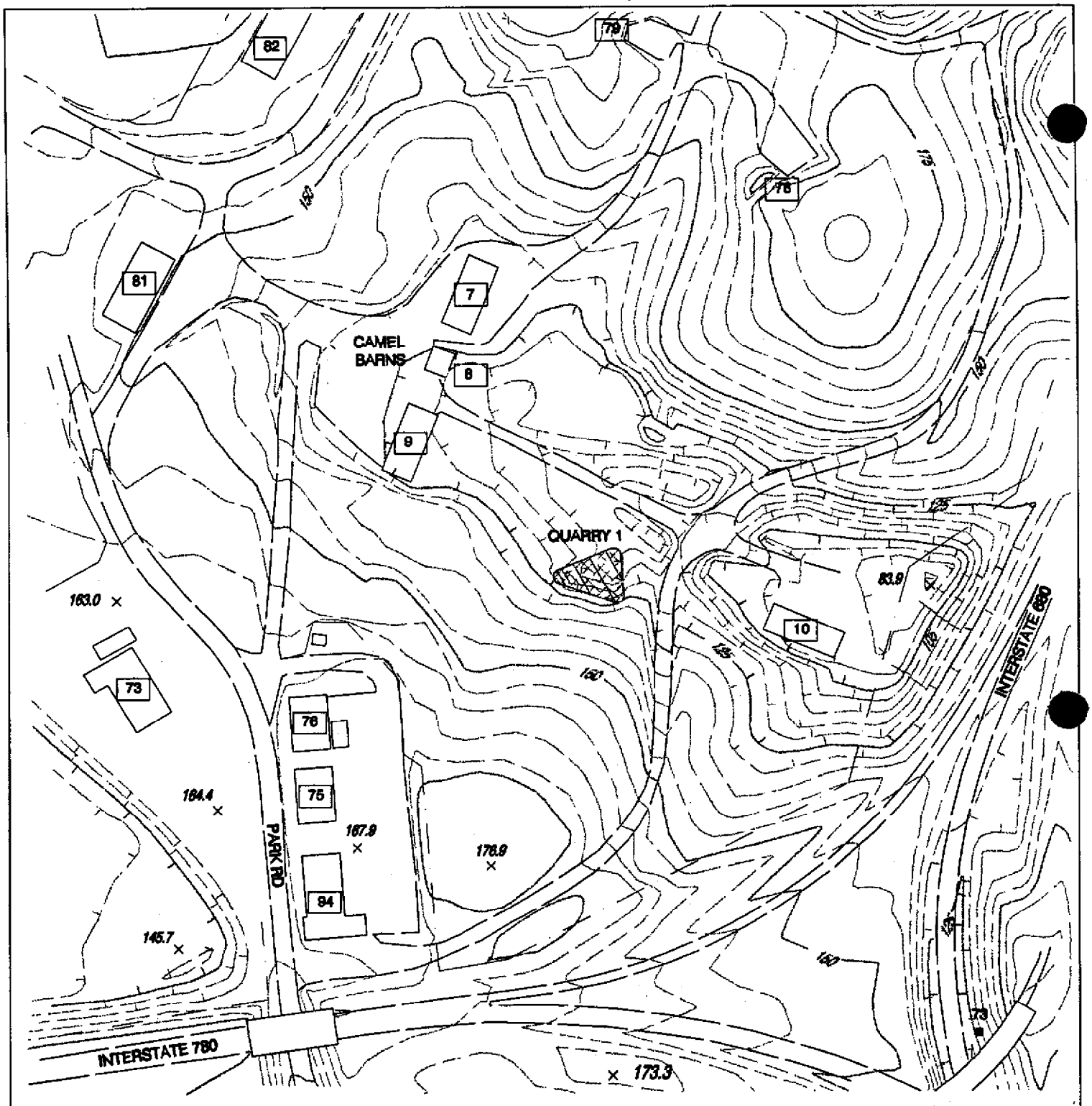
Figure A-2
Work Zone Map
Landfill 2
Area I - Site Safety and Health Plan
Benicia Arsenal



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Figure A-3
Work Zone Map
Quarry 3

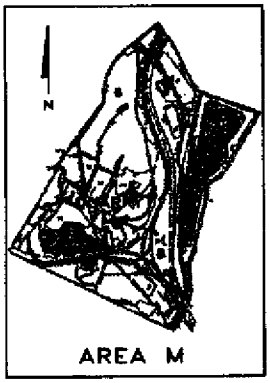
Area I - Site Safety and Health Plan
Benicia Arsenal



LEGEND

- 96 — Buildings
- Fence Line
- Railroad Tracks
- Proposed Work Zone

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.



50 0 50 100 150 200
Scale In Feet
(Approximate)

N

Figure A-4
Work Zone Map
Area M - Quarry 1
Area I - Site Safety and Health Plan
Benicia Arsenal

Total Petroleum Hydrocarbons. TPH refers to heavy hydrocarbons that may present a fire hazard in extreme circumstances, such as the presence of flame, excessive heat or strong oxidizers. An exposure limit for TPH has not been established due to the varied chemical composition. Presently, there are no known chronic health hazards associated with TPH.

Oils. Oils are not considered flammable, only combustible. Because of their low vapor pressure, they do not typically constitute an inhalation hazard unless working conditions include extremely hot temperatures or create excessive airborne oil-contaminated dust. These conditions are not anticipated.

Oxygenated Solvents. Oxygenated solvents are flammable liquids such as acetone and methyl ethyl ketone. In high concentrations, inhalation of these materials can cause anesthesia with dizziness being the usual symptom. They do not display serious chronic effects (acetone is found in the human body). These materials are very flammable. They cannot be readily detected by PID, but are easily detected by flame ionization detectors (FID). These materials have considerable odor and can be readily recognized by smell at levels well below those requiring protection.

PAHs. PAHs are common components of diesel fuel, fuel oil, and other oils and lubricants. Routes of entry include inhalation, ingestion, and skin contact. PAHs are not typically very volatile but many are carcinogens. Therefore, unless they are known to be in significant concentrations, such as when strong odors are evident or dust clouds are present, the primary method of protection is by avoiding skin contact and thorough decontamination.

Halocarbon Solvents. Halocarbon solvents are non-flammable liquids such as methylene chloride, TCE, tetrachloride, and chloroform. In high concentration, inhalation of these materials can cause acute liver and kidney damage. In lesser concentrations, they may cause acute effects such as dizziness or sleepiness related to their anaesthetic ability. The main chronic effect of these materials is their potential to cause liver disease. They are potential carcinogens as demonstrated by animal studies. Because of the potential of these materials to cause liver disease and cancer, exposure should be minimized. These materials are volatile and will evaporate if left in the open air. They can be detected by PIDs and/or FIDs.

Arsenic. Arsenic has toxic health effects, which include dermatitis, gastrointestinal upset, peripheral neuritis, irritation to the respiratory system, and discoloration of the skin. Arsenic is associated with skin cancer and lung cancer due to chronic exposure. Arsenic is an occupational carcinogen, and is regulated by OSHA through a comprehensive occupational health standard. The current PEL for arsenic is 0.01 milligrams per cubic meter (mg/m^3) as an 8-hour time weighted average (TWA) airborne dust concentration. The regulatory action level is 0.005 mg/m^3 TWA dust concentration. No employee may be exposed to any skin or eye contact with arsenic trichloride or to skin or eye contact likely to cause skin or eye irritation.

Chromium. Chromium has toxic health effects that can range from allergic skin reactions to mild, and eventually severe, respiratory system irritation. Chromium may exist in one of three valence states in compounds (+2, +3, or +6). Toxic health effects are primarily associated with Cr+6 (hexavalent chromium) exposure. It is a suspect carcinogen as Cr+6. Symptoms of acute exposure include coughing, wheezing, painful deep inhalation, and fever. Pulmonary edema may persist after other symptoms subside. Other effects include dermatitis, ulceration of the skin, conjunctivitis and asthma. Chronic

exposure may be associated with lung cancer. The current exposure limit for chromium as Cr+6 is 0.05 mg/m^3 as an 8-hour TWA airborne dust concentration.

Inorganic Lead. To present a health hazard, lead must be in such a form as to gain entrance into the body or tissue in measurable quantities. The primary mode of entry that is of concern is inhalation of lead dust, and secondary, is ingestion if poor personal hygiene is practiced. Lead is a cumulative poison. It is stored in the body and acts as a cellular poison to all organ systems before symptoms and disability is evident. Lead poisoning creates a red cell anemia and damages organs and tissues of the body such as kidneys, liver, blood vessels, nervous system and reproductive organs. Chemical and physical properties may vary depending upon the specific lead compound.

Lead is considered a carcinogen and reproductive toxin and has an airborne PEL of 0.05 mg/m^3. The blood lead action level for adults is equal to or less than 30 milligrams per deciliters (mg/dl) of blood. There is no safe level of lead exposure for children. Therefore, decontamination of adults and their clothing is a primary concern.

Particulates Not Otherwise Regulated. PNOC is a term given to a variety of dusts that may not cause fibrosis or systemic effects. At high concentrations, otherwise nontoxic particulates have been associated with the occasionally fatal condition know as alveolar proteinosis. High concentration of finely divided dusts and powders can also be explosive. At lower concentrations, the dust can inhibit the clearance of dust from the lung by decreasing the mobility of the alveolar macrophages. The airborne PEL is 10 mg/m^3 for PNOC total dust and 5.0 mg/m^3 for dust small enough to enter the lower respiratory tract.

Organochlorine Pesticides. Organochlorine pesticides are solids at ambient temperatures with no volatility or flammability problems. They are generally lipophilic, making them a potential hazard by means of skin absorption. In addition to skin exposure, inhalation/ingestion of contaminated dusts present a potential hazard. Health effects of organochlorine pesticide poisoning by ingestion, inhalation of dusts or by skin absorption can include liver and kidney damage and central nervous system effects. Symptoms of acute central nervous system toxicity include numbness, staggering gait, nausea, dizziness, headache, confusion, tremors and seizures. Symptoms of chronic toxicity include loss of weight, loss of appetite, mild anemia, muscle weakness, headache, dizziness, memory loss and convulsions. Any person who suspects he is suffering from organochlorine pesticide poisoning should seek medical attention. Skin protection and thorough decontamination are important to control exposure.

Chlorobenzene. Chlorobenzene is a flammable solvent used as a carrier in pesticide production. It has a faint, almond like odor. Chlorbenzene is a skin, eye and respiratory irritant which may be absorbed through the skin. It could potentially be ingested via inhalation/ingestion of contaminated dusts. It is toxic to the liver and kidneys and is a central nervous system depressant. Symptoms of acute or chronic exposures are headache dizziness, nausea and fatigue. Acute exposures can progress to sleepiness, coma and death. In the event of a respiratory exposure, the victim should be moved to fresh air immediately. Medical attention should be sought if ingestion is suspected.

Landfill Gases. Methane and carbon dioxide, may be encountered in soil gas or landfill gas as a by-product of landfill waste degradation. Exposure to methane gas can lead to asphyxiation. Methane gas is

explosive and flammable. When methane is present in the breathing zone, work zone, or in the atmosphere in the vicinity of the borehole or well head at 20 percent of the LEL or greater, field personnel will evacuate the area. A combination (4-channel) meter will be used that detects CO (parts per million [ppm]), H_2S (ppm), O_2 (%), and combustible gases (%LEL). The meter will be calibrated to methane gas and will be intrinsically safe.

Hydrogen Sulfide. Hydrogen Sulfide (H_2S) is highly toxic at low concentrations, and flammable. Furthermore it is heavier than air. At very low concentrations (2 parts per billion [ppb]) it produces a strong odor of rotten eggs, however, exposure for greater than 2 minutes may deaden sensitivity to smell. Symptoms of exposure can include: eye and respiratory system irritation, apnea, coma, convulsions, eye pain, lacrimation, photosensitivity, dizziness, headache, fatigue, irritability, insomnia and GI disturbance. OSHA construction industry standard is 10 ppm. This is also the maximum recommended exposure ceiling for 10 minutes.

Fire Safety. Fire is a potential hazard due to equipment malfunction or combustible gas levels. Before beginning any work activities, locate fire extinguishers and other emergency equipment. When work is conducted at the landfill, a fire extinguisher will be carried with the sampling vehicle. Do not block the path to this emergency equipment with work materials. Be familiar with the type of extinguishers and what kind of fire they are designated to put out. All job locations must have applicable fire extinguishers.

- Type A extinguishers put out ordinary combustibles such as paper, wood and some plastics.
- Type B extinguishers put out flammable liquids like oil and gasoline.
- Type C extinguishers put out electrical fires.
- Type ABC extinguishers put out all three types of fires.

In addition to potential fire hazard due to equipment malfunction, fire hazard during field operations is a potential for operating vehicles and equipment in and around dry grass, weeds, or other plant material. To reduce potential for vegetative fires, weeds, grass and dry brush will be cleared from work-areas prior to operating equipment. Vehicles will be operated on paved and dirt roads wherever possible. When off-road travel is necessary, areas with tall weeds or grasses will be avoided.

TRAINING REQUIREMENTS

There are no special training requirements anticipated for this site. General training requirements for all FA/BC staff working on site are described in the General SSHP. UXO personnel qualifications will be reviewed by FA/BC under direction of USACE, to assure they meet current USACE requirements.

PERSONAL PROTECTIVE EQUIPMENT

The minimum required level of personal protection for all the sites at all times is modified Level D. Level D includes safety boots/shoes, safety glasses, hard hat, and gloves for handling soil and debris. In addition to this protection, colored Tyvek© coveralls (preferably blue or brown) or equivalent will be worn at all times inside the work zone during trenching activities. These items are also listed on Table A-3, Field Equipment. Based on the environmental monitoring plan, if conditions warrant upgrade to Level C will be conducted to protect personnel. Descriptions of other levels of PPE are described in the FA/BC Health and Safety

Program Manual (301 and 302; p. 1-24) and the General SSHP.

ENVIRONMENTAL MONITORING PLAN

The following is the anticipated environmental monitoring plan necessary for Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1 field activities. Equipment anticipated for environmental monitoring is listed on Table A-3. Environmental monitoring will be in accordance with the Organic Vapor Response criteria outlined in Table A-4. Generally, only invasive activities will include monitoring of air quality in and around the work area and heat or cold stress.

MEDICAL SURVEILLANCE REQUIREMENTS

There are no special medical surveillance requirements anticipated for the Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1 field activities. The General SSHP describes the general medical surveillance requirements.

SITE CONTROL MEASURES

The approximate work zones are shown on site maps, which are included as Figures A-1 through A-4. The zone locations are subject to change based on work activities, site access, and wind direction. Equipment necessary for site control measures is listed on Table A-3. Further details regarding site control measures can be found in the FA/BC Health and Safety Program Manual (406; p.25-28).

DECONTAMINATION

Decontamination will take place within the work zones identified and shown on Figures A-1 through A-4. A sample decontamination set-up can be found in the FA/BC Health and Safety Program Manual (405; p.23). There are no special emergency decontamination procedures anticipated for this project. General decontamination equipment necessary for this project is listed on Table A-3.

EMERGENCY PROCEDURES

The nearest medical assistance center is **Kaiser Permanente Hospital** located at **975 Sereno Dr., Vallejo, CA.,** telephone number: **(707) 651-1000**. Directions from all sites to the nearest hospital are presented below and shown on the route to hospital map included in this document as Figure A-5.

*Directions from **Landfill 1** to I-780:*

- Turn left onto **Grant Street,** which becomes Military East.
- Continue northwest on **Military East** to East 5th Street.
- Right onto **East 5th Street** heading northeast.
- Left onto on-ramp to **I-780 West** towards Vallejo.

*Directions from **Landfill 2** to I-780:*

- Turn right onto **Adams Street** heading northwest.
- Right onto **Grant Street**, which becomes Military East.
- Continue northwest on **Military East** to East 5th Street.
- Right onto **East 5th Street** heading northeast.
- Left onto on-ramp to **I-780 West** towards Vallejo.

Table A-3
Anticipated Field Equipment for Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1

Equipment	Purpose and description
Personal Protective Equipment	
Nitrile disposable gloves	Prevents exposure to potentially contaminated soil or groundwater.
Tyvek© coveralls or equivalent	Prevents exposure to potentially contaminated soil or groundwater.
Respirators and cartridges	If necessary, half face or full face respirator will be used if the level of PPE is upgraded during work. Respiratory equipment must be in working condition and fit-tested for that person. A combination organic vapor/acid gas P100 particulate cartridge should be adequate protection for the contaminants expected at this site. The end of service for cartridge will be 12 hours based on toluene/chlorobenzene/trichloroethane and the respiratory manufacturers recommendations. If upgrade to Level C for unexpected chemicals is required, the HSD will be contacted to determine End of Service Life change out schedule for cartridges based on exposure conditions. All personnel wearing respiratory protection will be in compliance with fit-testing requirements as specified in the FA/BC Health and Safety Program Manual Section 302.
Steel-toed boots or shoes and a hard hat	Required PPE for Level D.
Gloves – leather or nitrile depending on conditions	Required PPE for Level D.
Environmental Monitoring Equipment	
Organic vapor monitor or equivalent	An OVM or equivalent is required to monitor air quality in and around the work zone. The OVM must be calibrated before and after each workday. A calibration data sheet will be maintained. A periodic response check will be performed during the workday to determine that it is responding to contaminants.
LEL/gas meter	For methane and H_2S detection.
Benzene detector tubes (0.5-10 ppm)	Detector tubes, benzene specific, is required to monitor air quality in the work zone.
Site Control Measures	
Traffic Cones, barricades and safety tape	All work areas will be delineated with traffic cones and/or safety tape to prevent people from entering the work zone. Barricades may also be used in higher traffic areas.
Dust control	Water will be used to minimize dust during trenching activities. Initially, dust monitoring will be conducted to determine if dust controls are effective. Upgrade to Level C PPE if dusts are greater than 3 mg/m3.
Decontamination Equipment	
Wash buckets and soap, plastic drop cloth, disposable towels, disposal containers.	Necessary for proper decontamination of small equipment and non-disposable PPE (i.e., work boots).

Table A-3 (continued)

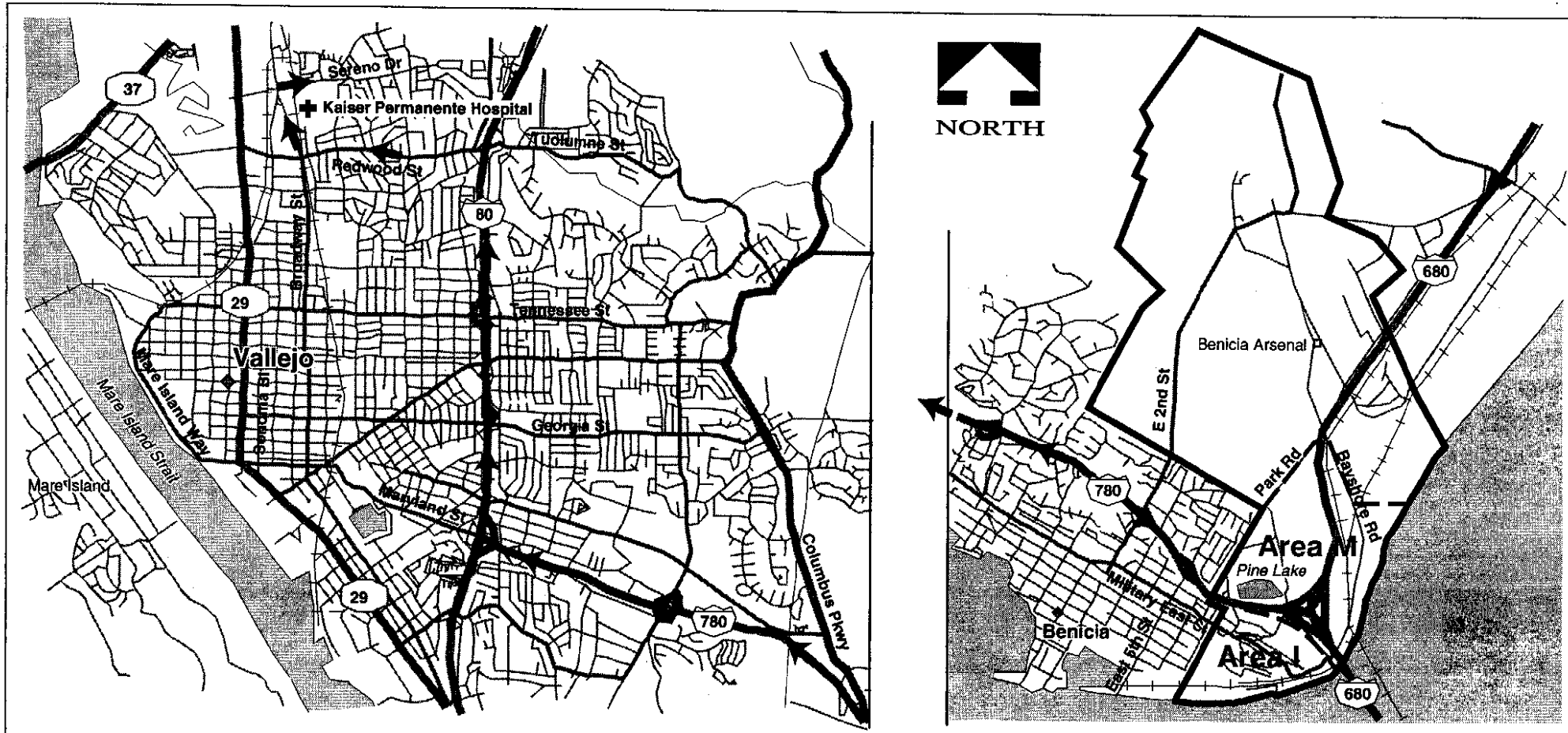
Anticipated Field Equipment for Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1

Equipment	Purpose and Description
Other Equipment	
Water level probe	There is a possibility during drilling that groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
Interface probe	There is a possibility during drilling that free-phase petroleum hydrocarbons in groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
pH/electrical conductance (EC) meter	If groundwater is encountered, physical properties (such as pH, EC, color, odor, and relative clarity) will be noted in the field logbook. This equipment will be calibrated before use and calibration notes will be logged in the field logbook.
Sampling containers (soil and water)	If necessary, appropriate containers for soil and groundwater samples will be required.
Sample labels, COC forms, zip-lock bags, cooler, ice (if necessary), custody seals	Necessary for any soil or groundwater sampling. Proper COC forms, labels, and custody seals will be completed for proper QC. Samples will be stored in a clean cooler (with ice, if necessary for specified analysis) for delivery to an analytical laboratory. If ice is used, all samples will be sealed around the end caps, lids, or caps to prevent water from invading the sample. Then the samples will be double-bagged and sealed for an additional protective barrier from melt water.
Hand auger or post hole digger	Prior to using power drilling equipment, a hand auger or hand operated post hole digger will be used to explore the upper 3 to 5 feet for underground utilities and other obstructions. In addition, the hand auger may be used for the collection of shallow subsurface soil samples.
Thermometer	Monitor air temperature when ambient temperature is above 70 degrees F. Thermometer should be placed in a shady area.
Illumination	All work activities will be conducted in daylight hours to provide adequate lighting for outside activities. Work activities will not be conducted indoors.
Potable water and sanitation	Drinking water and toilets are located at the site for use by all workers.

Table A-4
Organic Vapor Response Criteria for Petroleum Hydrocarbons that may Include Gasoline, Diesel and Fuel Oil

Organic vapor concentrations in breathing zone[a]	Sampling frequency	Action taken
0 less than 1 ppm	At a minimum of every 15 minutes, whenever active excavation or drilling is being conducted, upon initial approach to surface water and sediment sampling sites where contamination is anticipated.	Continue work with required minimum PPE for the field activity
1 ppm to 10 ppm for more than 2 minutes	Every 15 minutes until organic vapor concentration levels decrease less than 1 ppm.	Collect benzene detector tubes (DTs) at borehole: • If DTs reveal no detectable concentrations then, continue work with required minimum PPE for the field activity • If DTs reveal detectable concentrations greater than 1 ppm upgrade to Level C PPE • If DTs for benzene reveal detectable concentrations greater than 10 ppm, then stop work
10 to 100 ppm for more than 2 minutes	Every 15 minutes	Level C PPE required
100 ppm for more than 2 minutes with ½-face respirator (500 ppm with full-face respirator)	Every 10 minutes	• Stop work • Work crews position themselves upwind of site • Re-evaluate in 15 minutes • Contact HSD and PjM • Evacuate
Dust in breathing zone 0-3 mg/m^3 dust >3-15 mg/m^3 dust	 Every 15 minutes Every 15 minutes	 • Continue work • Upgrade to Level C, assume dust control procedures
>15 mg/m^3 dust	Every 15 minutes	• Stop work
H_2S >10 ppm >10% LEL	 Continuous continuous	 • Stop work • Stop work, evaluate the area

[a] OVA calibrated to methane (concentrations will be less if calibrated to isobutylene).



DIRECTIONS FROM ***LANDFILL 1***:
- TURN LEFT ONTO **GRANT STREET**, WHICH BECOMES MILITARY EAST.

DIRECTIONS FROM ***LANDFILL 2***:
- TURN RIGHT ONTO **ADAMS STREET** HEADING NORTHWEST.
- RIGHT ONTO **GRANT STREET**, WHICH BECOMES MILITARY EAST.

DIRECTIONS FROM ***QUARRY 1***:
- TURN LEFT ONTO **PARK ROAD** HEADING SOUTH.
- RIGHT ONTO **JEFFERSON STREET**.
- RIGHT ONTO **GRANT STREET**, WHICH BECOMES MILITARY EAST.

DIRECTIONS FROM ***QUARRY 3***:
- TURN RIGHT ONTO **JEFFERSON STREET**.
- RIGHT ONTO **GRANT STREET**, WHICH BECOMES MILITARY EAST.

CONTINUING LANDFILLS 1 AND 2, QUARRIES 1 AND 3 TO I-780:
- CONTINUE NORTHWEST ON **MILITARY EAST** TO EAST 5TH STREET.
- RIGHT ONTO **EAST 5TH STREET** HEADING NORTHEAST.
- LEFT ONTO ON-RAMP TO **I-780 WEST** TOWARDS VALLEJO.

DIRECTIONS FROM ***I-780 TO KAISER PERMANENTE HOSPITAL***:
- TRAVEL ON **I-780 WEST** FOR APPROXIMATELY 5.4 MILES.
- TAKE **I-80 EAST** TOWARDS SACRAMENTO FOR 2 MILES (HEADING NORTH).
- TAKE **REDWOOD STREET** EXIT.
- TRAVEL WEST ON **REDWOOD STREET** FOR 1 MILE.
- RIGHT ONTO **BROADWAY** HEADING NORTH FOR 0.4 MILES.
- RIGHT ONTO **SERENO DRIVE** HEADING EAST FOR 0.2 MILES.
- **HOSPITAL** IS LOCATED ON THE RIGHT AT **975 SERENO DRIVE**.

TOTAL TRAVEL TIME FROM THE PROJECT AREA TO KAISER PERMANENTE HOSPITAL IS APPROXIMATELY 20 MINUTES, AND THE TOTAL DISTANCE IS APPROXIMATELY 10 MILES.

Figure A-5
Route to Hospital
Area I Landfill 1, Landfill 2, and Quarry 3 and Area M Quarry 1
Area I - Site Safety and Health Plan
Benicia Arsenal

*Directions from **Quarry 1** to I-780:*

- Turn left onto **Park Road** heading south.
- Right onto **Jefferson Street**.
- Right onto **Grant Street**, which becomes Military East.
- Continue northwest on **Military East** to East 5th Street.
- Right onto **East 5th Street** heading northeast.
- Left onto on-ramp to **I-780 West** towards Vallejo.

*Directions from **Quarry 3** to I-780:*

- Turn right onto **Jefferson Street**.
- Right onto **Grant Street**, which becomes Military East.
- Continue northwest on **Military East** to East 5th Street.
- Right onto **East 5th Street** heading northeast.
- Left onto on-ramp to **I-780 West** towards Vallejo.

*Directions from **I-780** to **Kaiser Permanente Hospital**:*

- Travel on **I-780 West** for approximately 5.4 miles.
- Take **I-80 East** towards Sacramento for ≈ 2 miles (heading north).
- Take **Redwood Street** exit.
- Travel west on **Redwood Street** for ≈ 1 mile.
- Right onto **Broadway** heading north for ≈ 0.4 miles.
- Right onto **Sereno Drive** heading east for ≈ 0.2 miles.
- **Hospital** is located on the right at **975 Sereno Drive.**

Total travel time from the project area to Kaiser Permanente hospital is approximately 20 minutes, and the total distance is approximately 10 miles.

The nearest telephone is located in the work zone. If a cell phone is to be used for emergency purposes, it must be checked upon arrival to the site to verify that reception to the area is available. The emergency telephone numbers to be used to call for assistance are listed in the section on Key Personnel and Responsibilities in the FA/BC Health and Safety Program Manual (Forward; p. F-5). **In the event of a medical emergency cell phones must dial (707) 745-3411 or 3412 for the Benicia Police Department. FA/BC will post the number on or near each cell phone.**

DOCUMENTATION

Proper completion of standard Attachments A through E is required health and safety documentation for this site. Attachments A through E are located at the end of this SSHP. The procedures and frequency in which each Attachment must be completed is described in Table A-5.

REFERENCES

Brown and Caldwell. 1999. Benicia Arsenal General SSHP. Prepared for U.S. Army Corps of Engineers, Sacramento, California. January.

Forsgren Associates/Brown and Caldwell. 1998. Health and Safety Program Manual. Prepared for U.S. Army Corps of Engineers, Sacramento, California. August.

U.S. Army Corps of Engineers. 1996. Interim Guidance (EP 75-1-2). Generic Scope of Work for Ordnance Avoidance Operations. Draft. August.

Table A-5

Attachments A – E for Area I Landfill 1, Landfill 2 and Quarry 3 and Area M Quarry 1 Investigation Activities

Attachment	Procedures	Frequency
Attachment A – Site Safety & Health Plan Acknowledgement Form	Attachment A will be completed and signed by all contractors and subcontractors involved with the field effort. An emergency contact for each contractor and subcontractor will also be required on Attachment A.	Once, prior to the start of the field project
Attachment B – Site Safety & Health Plan Site Activity and Safety Briefing	A safety briefing will be held every day prior to start of work. Attachment B will be included with all other daily sheets (i.e., field notes, boring logs) submitted by the contractor at the end of the day.	Daily
Attachment C – Site Safety & Health Plan Safety Plan Implementation Checklist	Attachment C will be completed prior to the start of each field project and all items listed and their respective status will be reviewed every day of the field effort.	Once, prior to the start of the field project
Attachment D – Unsafe Conditions	Attachment D will be completed, if necessary, for every occurrence of an unsafe condition. If an Attachment D is completed for an unsafe condition, the PjM and the HSD will be notified immediately and all work at the job site will stop until the unsafe condition is corrected.	When necessary
Attachment E – Site Safety & Health Plan Safety Plan Environmental Monitoring Documentation	Attachment E is a sheet to record daily air monitoring data. This attachment will be included with all other daily sheets (i.e., field notes, boring logs) submitted by the contractor at the end of the day.	Daily during invasive activities

FA/BC	Attachment A—Site Safety and Health Plan Employee Acknowledgment

Employee Name

Project Name	Project Location	Project Number

Employee Statement of Acknowledgment

I hereby certify that I have read and that I understand the safety and health guidelines contained in FA/BC's Site Safety and Health Plan for the above-named project.

_____ _____

Employee Signature Date

In the Case of an Emergency, contact:

	Name	Relationship	Phone Number
1.			
2.			

Name of Site Safety Officer Receiving This Form

Signature of Site Safety Officer	Date

NOTE: Send completed form to Health and Safety Director.

FA/BC

Attachment B—Site Safety and Health Plan Site Activity and Safety Briefing

Name of Site Safety Officer	Signature of Site Safety Officer	
Project Name	Project Location	Project Number

Who attended the briefing?

Names of FA/BC Employees	**Names of Subcontractor(s) Employees**
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

What items were discussed?

- ☐ Site Safety and Health Plan
- ☐ Specific Accident/Incident
- ☐ Protective Equipment to be Used
- ☐ Emergency Hospital Route
- ☐ Other _____
- ☐ Hazardous Site Conditions/Activities
- ☐ Changes/Solutions to Specific Accident(s)
- ☐ Location of Emergency Telephone Number
- ☐ Work Schedule

Do any items require assistance from FA/BC Health and Safety staff? (If yes, describe the item and type of assistance required and contact the Health and Safety staff directly.)

☐ YES ☐ NO

_____

_____

_____

_____

NOTE: Place a copy of the completed form in the project file.

FA/BC Attachment C—Site Safety and Health Plan Safety Plan Implementation Checklist

Project Name	Project Location (city and state)	Date
Name of Site Safety Coordinator	Weather Conditions	Project Number

FA/BC Staff Present

Name	Office

Indicate the status of each of the following:

1. Is a copy of the Site Safety and Health Plan (SSHP) on site?	☐ YES	☐ NO	☐ N/A
2. Is the personal protective equipment required by the SSHP available and being used correctly?	☐ YES	☐ NO	☐ N/A
3. Have the work zones been delineated?	☐ YES	☐ NO	☐ N/A
4. Has a decontamination station been set up as required by the SSHP?	☐ YES	☐ NO	☐ N/A
5. Are the decontamination procedures being followed?	☐ YES	☐ NO	☐ N/A
6. Is access to the exclusion zone being controlled?	☐ YES	☐ NO	☐ N/A
7. Has the site activities briefing and tailgate safety meeting been provided?	☐ YES	☐ NO	☐ N/A
8. Is the list of emergency telephone numbers posted at the support zone?	☐ YES	☐ NO	☐ N/A
9. Are directions to nearest emergency medical assistance posted at support zone?	☐ YES	☐ NO	☐ N/A
10. Is emergency equipment available and functional, as required by the SSHP?	☐ YES	☐ NO	☐ N/A
11. Has the nearest toilet facility been identified or a portable facility been set up?	☐ YES	☐ NO	☐ N/A
12. Has an adequate supply of drinking water been provided?	☐ YES	☐ NO	☐ N/A
13. Has water for decontamination been provided?	☐ YES	☐ NO	☐ N/A
14. Have the instruments for environmental and exposure monitoring been calibrated and set up as required by the SSHP?	☐ YES	☐ NO	☐ N/A
15. Are the instruments being used properly and periodically checked during the shift for battery charge status?	☐ YES	☐ NO	☐ N/A
16. Have the trenches and excavations been clearly marked?	☐ YES	☐ NO	☐ N/A
17. Have trenches and excavations been shored or sloped as required by soil type and work activities?	☐ YES	☐ NO	☐ N/A
18. Are dust suppression measures being used?	☐ YES	☐ NO	☐ N/A
19. Is food and tobacco consumption being restricted to the support zone?	☐ YES	☐ NO	☐ N/A
20. Has a confined space been identified as part of this project?	☐ YES	☐ NO	☐ N/A
21. Are the confined space entry procedures being correctly implemented?	☐ YES	☐ NO	☐ N/A
22. Has the work/rest cycle for the shift been established?	☐ YES	☐ NO	☐ N/A
TIME ON (minutes): _____ TIME OFF (minutes): _____			
23. Has a shaded rest area been set up in the support zone?	☐ YES	☐ NO	☐ N/A

NOTE: Place completed form in project file.

SA/BC	**Attachment D** **Notice of Unsafe Conditions**

Contractor	Date
Project Name	Project Number

THIS NOTICE . . .

This notice is to advise you, the Prime Contractor on the above-named Contract, that this Representative of the Owner of the above-mentioned Project has observed (on the date shown above) an unsafe condition on the Project.

These conditions are listed as follows:

ITEM	CONDITION

By this Notice, the Owner or its Representatives shall not assume any responsibility under the GENERAL CONDITIONS or assume any liability for the existence or correction thereof, for the unsafe conditions, or any others that may have been unnoticed.

These conditions shall be remedied as soon as possible within a safe working period. If these corrections are not made, the Owner will be forced to remove all field staff from the job. No payment shall be made for any work installed after this date without first examination of work in accordance with the GENERAL CONDITIONS.

Signature of Owner's Representative	Title	Date
Received by (Signature of Contractor's Representative)	Title	Date

NOTE: Place a copy of completed form in project file.

EA/BC Attachment E—Site Safety and Health Plan Environmental Monitoring Documentation

Project Name	Project Number

Employee Name	Project Location

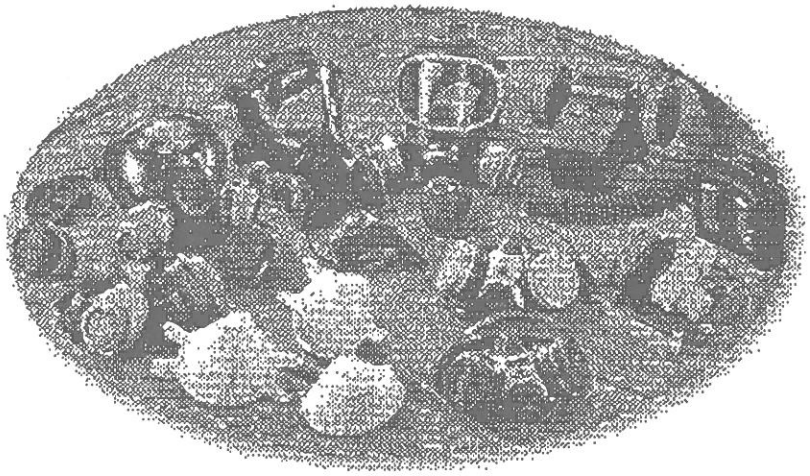
Equipment Used (check as appropriate)

	Calibrated	Date	Used	Dates(s)
OVA (Organic Vapor Analyzer)/FID	☐	_____	☐	_____
OVM (Organic Vapor Monitor)/PID	☐	_____	☐	_____
HNU	☐	_____	☐	_____
PTLV Sniffer	☐	_____	☐	_____
Photovac TIP	☐	_____	☐	_____
Combustible Gas Meter/Explosimeter	☐	_____	☐	_____
Other _____	☐	_____	☐	_____

Instrument	Date	Time	Readout Value	Area Monitored	Changes in PPE			User's Initials
					YES	NO	Type of PPE	

NOTE: Place completed form in project file.

MSA Cartridge Life Expectancy Calculator



MSA Cartridge Life Expectancy Results

Final Breakthrough Time Calculation

When using a Advantage200 Facepiece with a Adv. 200 GMC Cartridge under the following conditions:

Chemical Name:	Octane
Chemical PEL (ppm):	500 OSHA PEL
Temperature:	50 F
Relative Humidity:	40 %
Pressure:	760 Torr
Breathing Rate:	30 LPM
Use Concentration:	100 ppm
Breakthrough Concentration:	10 % OSHA PEL
The estimated Breakthrough Time at which cartridges need to be replaced is:	1753 **minutes**

"NaN" = Not A Number
For example, a result cannot be calculated if Use Concentration is less than Breakthrough Concentration.

Back to the Calculator

Combination cartridges should be replaced prior to the estimated breakthrough time if, the

APPENDIX B

UXO/OE CONSTRUCTION SUPPORT PROCEDURES

APPENDIX B

UXO/OE CONSTRUCTION SUPPORT PROCEDURES

B-1.0 GENERAL

This Plan describes site specific activities to perform construction support for potential UXO/OE during trenching at Landfill 1, Landfill 2, Quarry 3 in Area I and Quarry 1 in Area M. The purpose of this work is to provide UXO/OE construction support for these activities. The procedures described in this Plan will be used by USA Environmental, Inc. (USA) under subcontract to FA/BC.

USA will perform operations in accordance with the EP 75-1-2, FA/BC's Arsenal-Wide Investigation Workplan, SSHP (with input from USA covering UXO specific safety issues) and this Plan. All USA personnel will read and comply with these documents.

The activities described in this Plan will be performed in substantial compliance with CERCLA (Section 104) and the National Contingency Plan (Section 300.120 and 300.400 (e)). The provisions of 29 CFR 1910.120 shall apply to all actions taken at this site. Additionally, the Occupational Safety and Health Administration (OSHA) requires all employers performing on-site activities to develop and maintain an ongoing written Safety and Health Program in compliance with OSHA Standard 29 CFR 1910.120(b) and 29 CFR 1926.65 (b).

B-2.0 MOBILIZATION

USA will mobilize all personnel and equipment as required and upon receiving a written notice to proceed from FA/BC. Under this subcontract, UXO support involves providing construction support during:

- the excavation of 5 trenches at Landfill 1 in Area I to a clearance depth of 2 feet below the bottom of the refuse/fill.
- the excavation of 6 trenches at Landfill 2 in Area I to a clearance depth of 2 feet below the bottom of the refuse/fill.
- the excavation of 5 trenches at Quarry 3 in Area I.
- the excavation of 5 trenches at Quarry 1 in Area M.

The goal of mobilization is to ensure that the proper attention is dedicated to ensuring the UXO technicians are prepared and have the resources to perform all tasks described in this Plan. Actions performed during this phase include:

- identify/procure, package, ship, and inventory project equipment
- coordinate with FA/BC project personnel
- organize support facilities and test communications equipment
- procure any additional supplies and equipment required to perform the work and
- conduct site specific training.

B-2.1 Personnel

USA will deploy a SUXOS and a UXO Technician II to perform operations at the landfills and quarries. FA/BC personnel will coordinate with USACE.

B-2.2 Project Equipment

USA has thoroughly assessed the equipment requirements for this project. During mobilization, USA will:

- package and ship corporate equipment items
- coordinate with selected vendors for direct shipment of supplies and equipment
- coordinate with FA/BC for communications, administrative and other support and
- perform maintenance and quality checks of the equipment to ensure that it is operationally ready.

B-2.3 Site Specific Training

As part of the mobilization process, USA will perform site specific training for all personnel assigned to this project. The purpose of this training is to ensure that all personnel fully understand the procedures and methods USA will use to perform operations, their individual duties and responsibilities, and any and all safety and environmental practices/procedures associated with operations. All personnel will be trained as they arrive. A written record of this training and the signatures of personnel attending the training will be maintained. Training topics/issues and training responsibilities are as follows:

- UXO personnel qualifications will be reviewed by FA/BC under direction of USACE, to assure they meet current USACE requirements.

- The UXO Technician II will receive operational briefings and training on his duties and responsibilities. All personnel, to include FA/BC crews, will receive ordnance recognition and UXO safety precautions. This training will be performed by the SUXOS.

- All personnel will receive training on the individual equipment they will operate while on-site.

- All USA personnel will receive detailed training on this Plan prior to mobilization.

- All USA UXO personnel will complete HAZWOPER 40-hour (or 8-hour refresher) training as required.

All USA UXO personnel on site have completed a pre-placement or annual physical examination that complies with the requirements of 29 CFR 1910.120 and have been certified as fit to work by an Occupational Physician certified in Occupational Medicine by the American Board of Preventive Medicine, or who by necessary training and experience is board eligible. All USA personnel on-site are in the USA medical surveillance program. Documentation as to the medical qualifications of personnel are on file on site and be provided to the contracting officer. All personnel are screened for drugs in accordance with the USA Drug/Alcohol Abuse Program.

B-3.0 OPERATIONS

Upon completion of mobilization, USA will provide construction support during trenching under the direction of FA/BC. The following subparagraphs describe the general work practices that USA will follow during all operations, and the specific procedures and method's USA will use during this project.

B-3.1 General Site Practices

All UXO operational activities will be performed under the supervision and direction of qualified UXO personnel. Non-UXO qualified personnel will be prohibited from performing operations unless they are accompanied and supervised by a UXO Technician. Throughout operations, USA will strictly adhere to the following general practices. Detailed UXO safety precautions and procedures are in the site specific SSHP as Appendix A of this Plan.

B-3.1.1 Work Hours. Operations will be conducted during daylight hours only. In no case will UXO personnel work more than ten hours in any one day.

B-3.1.2 Site Access. USA, in conjunction with FA/BC and the current property owners will control access into operating areas and will limit access to only those personnel necessary to accomplish the specific operations or who have a specific purpose and authorization to be on the site. No hazardous operations will be conducted when unauthorized persons are in the vicinity.

B-3.1.3 Handling of UXO. UXO items will **NOT** be handled, even though qualified UXO personnel are on-site. Non-UXO site personnel will be emphatically instructed and closely supervised to ensure they do not handle any UXO. OE scrap will not be handled or touched until inspected by the SUXOS to insure there are no explosives or hazardous material remaining in the items.

B-3.1.3.1 Incident Reporting and Response Procedures. OE items found or located during construction support operations will be immediately reported and site investigation activities will cease. The UXO/OE contractor shall immediately secure the area and the area shall remain secure pending arrival of the 787th EOD company. Immediately contact USACE Project Manager (Bruce Handel) at (916) 557-7906 M-F 0800 to 1730, A. R. Smith at (916) 557- 6973, [pager number (831) 520-0602], and 787th EOD company will be contacted directly for response. Outside of the above duty hours, immediately contact USACE Huntsville (Greg Bayuga) at (877) 321-0923 (pager) and 787th EOD company will be contacted directly for response.

In the event the above contacts are not accessible, immediately contact the 787th Ordnance Company (EOD), Moffet Field, California at (650) 603-8301/02 (24 hours).

Local Police department and regulatory agencies will be contacted by the USACE Project Manager.

Subsequent identification, evaluation, handling and disposal of UXO/OE material will be conducted under the USACE Sacramento District.

--THIS POLICY WILL BE STRICTLY FOLLOWED—

B-3.1.4 Safety Briefing. USA will conduct daily tailgate safety briefings. In addition, the SUXOS may hold a safety stand-down at any time he notes any degradation of safety or a safety issue that warrants a review.

Daily Tailgate Briefing. Tailgate safety briefings will be conducted by FA/BC with the support of the SUXOS. A written record of this training and the signatures of personnel attending the briefing will be maintained. The briefing will focus on the specific hazards anticipated at each work site during that day's operations and the safety measures that will be used to eliminate or mitigate those hazards. It will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and the team's location changes within a site, or from site-to-site, any corresponding changes in ingress/egress routes and emergency evacuation routes will also be reviewed during this tailgate briefing.

Visitor Safety Briefing. Site visitors must receive a safety briefing prior to entering the operating area and must be escorted at all times by the SUXOS or the FA/BC Representative. All visitors entering must sign in with the FA/BC field representative.

B-3.1.5 Environmental Awareness. The promotion of environmental awareness will be ongoing as part of safety and operational briefs.

B-3.1.6 Safety and Environmental Violations. Safety violations or unsafe acts will be immediately reported to FA/BC and the SUXOS. Failure to comply with safety rules/regulations or failure to report violations may result in removal from area. Reckless interference with sensitive species or blatant disregard for environmental issues will likewise not be tolerated and may lead to removal from area.

B-3.1.7 Work Clothing and Field Sanitation. Work clothing will be appropriate for the conditions encountered. In most cases this will be Level D PPE.

- Short or long sleeve cotton coveralls or work clothing.
- Footwear will be sturdy work boots. UXO personnel will not wear steel toe safety boots when using magnetometers.
- Hand protection will consist of leather or canvas work gloves. Rubber inner or outer gloves may be required where increased protection is needed.
- Safety glasses with side shields, hearing protection, and hard hats will be available and worn when engaged in activities where their use is required.
- In no case will tennis/running shoes or abbreviated attire such as tank tops or shorts be permitted.

The team will be outfitted with field decontamination equipment which will consist of portable eye-wash kits, containers of wash water, paper towels and soap. Prior to commencing operations each day, these facilities will be in place and ready for use in the vicinity of the team's work area as needed. Good housekeeping and decontamination measures will be practiced. Existing field sanitation stations will be utilized by the work team.

B-3.1.8 Compliance with Plans and Procedures. USA will conduct operations in a systematic manner using proven operating methods and techniques. All activities will be conducted under the direction, supervision and observation of the SUXOS. All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted by on-site supervisory personnel in close liaison with the FA/BC representative. Any new course of action or desired change in procedures will be submitted with justification for approval as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality on the part of the UXO team.

B-3.1.9 Equipment Checks. All instruments and equipment that require maintenance and/or calibration will be checked prior to the start of each work day. If equipment field checks indicate that any piece of equipment is not operating correctly, and field repair cannot be made, the equipment will be tagged and removed from service and a request for replacement equipment will be placed immediately. Replacement equipment will meet the same specifications for accuracy and precision of the equipment removed from service.

USA will use the Schonstedt GA-52CX magnetometer for anomaly detection. The GA-52CX has the capabilities to detect a 81 mm mortar at a depth of one foot and a MK81 bomb at a depth of 6 feet. Prior to use the magnetometer will be checked and/or calibrated against a known metallic anomaly. The purpose of this test/calibration is to ensure that the instrument is operating properly and to appropriately adjust the sensitivity level of the instrument.

The USA SUXOS will establish a magnetometer check point by burying a 81 mm inert projectile at 1 foot and a 105 mm inert projectile (or similar mass metal objects) at a depth of 3 feet or equivalent. Magnetometers will be checked against these sources to ensure they are operational and capable of detecting ferrous objects at the depth specified in the Scope of Work. This test will be performed daily prior to placing the instrument into operation.

B-3.2 UXO Construction Support

USA will provide all personnel and equipment necessary to perform UXO/OE construction support at landfills and quarries. The approximate boundaries will be identified by geophysical survey and staked prior to trenching. USA will use non-intrusive techniques to locate ferrous objects on the surface and the subsurface. The probability of encountering UXO/OE is low. When a determination is made that the probability of encountering UXO is low, a minimum of a two-person UXO team will stand by in case the construction contractor encounters a suspected UXO.

B-3.2.1 Equipment. The equipment requirements for this activity include:

- Schonstedt magnetometers used to detect subsurface metallic anomalies;
- Forms and logbooks to record activities and anomaly identification.

B-3.2.2 Records. The SUXO will prepare and maintain a detailed accounting of activities performed at each location. The will include information pertaining to the following:

- The date and time construction support operations began.

- The date and time construction operations support were completed.
- The number of hours, by labor category, expended in performing avoidance operations.
- The location, number, type, and description of OE items encountered.

B-4.0 DEMOBILIZATION

During this phase, USA removes its operational capability from the area and reallocates its personnel and equipment to other projects. The SUXOS will closely monitor operational performance throughout the execution of this project. When a clear projection can be made of the actual completion date he will, with the approval of FA/BC's site representative, initiate actions to demobilize personnel and equipment.

B-5.0 REFERENCES

Brown and Caldwell. 1999. General Site Safety and Health Plan. Prepared for U.S. Army Corps of Engineers, Sacramento, California. January.

Earth Tech. 1999. Engineering Evaluation/Cost Analysis. Prepared for U.S. Army Corps of Engineers, Sacramento, California. June.

Forsgren Associates/Brown and Caldwell. 1998. Corporate Health and Safety Manual. Prepared for U.S. Army Corps of Engineers, Sacramento, California. August.

Forsgren Associates/Brown and Caldwell. 1999a. Arsenal-Wide Investigation Workplan. Prepared for U.S. Army Corps of Engineers, Sacramento, California. February.

Forsgren Associates/Brown and Caldwell. 1999b. Arsenal-Wide Quality Assurance Project Plan. Prepared for U.S. Army Corps of Engineers, Sacramento, California. February.

Jacobs Engineering. 1999. Record Research Report. Prepared for U.S. Army Corps of Engineers, Sacramento, California. April.

USACE. 1996. Interim Guidance (EP 75-1-2). Generic Scope of Work for Ordnance Avoidance Operations. Draft. August.

APPENDIX C

PROCEDURES USED TO DETERMINE REQUIRED SAMPLE SIZE

APPENDIX C

PROCEDURE USED TO DETERMINE REQUIRED SAMPLE SIZE FOR SOIL SAMPLES AT LANDFILLS

Surface soil samples will be collected at one landfill and two quarries ranging in size from 8,000 square feet to 80,000 square feet. The samples will be analyzed for metals, pesticides, PCBs and PAHs.

In general, sample size equations are specific to the statistical method that will be used to analyze the data. In this case, it is assumed that the primary use of the data will be to determine the 95th one-sided, upper confidence limit (95% UCL) on the mean for purposes of risk assessment. It is also assumed that the data will be independent and lognormally distributed. A smaller number of samples will be needed if the data are normally distributed.

The required sample size for estimating the mean of an independent population can be determined from the following equation[1]:

$$n = (Z_{1-\alpha/2}\eta / d_r)^2$$

In this equation, n is the required sample size, $Z_{1-\alpha/2}$ is the standard normal deviate that cuts off (100α/2)% of the upper tail of a standard normal distribution, η is the coefficient of variation (CV), and d_r is the relative error. The CV, which is also known as the relative standard deviation, is equal to the mean divided by the standard deviation. The relative error, d_r, is equal to the absolute value of the estimated mean minus the true mean divided by the true mean. The equation is designed to answer the question, "How large a sample must be taken to achieve a desired precision in estimating the mean of a population?" The smaller the confidence interval half-width, the more precise the estimate of the mean.

There are a number of ways to approach sample size determination, all of which involve pre-specification of desired parameters. For this estimation example, FA/BC has assumed a relative error of one and a CV of 1.5. A CV of 1.5 is used because many environmental data are skewed resulting in a CV greater than one. If d_r is pre-specified as one andη is assumed to be 1.5 then the appropriate Z statistic is 1.6449 and the required number of samples is six. The calculation was conducted assuming a 90% confidence interval. This means that 5% of the distribution lies above the upper confidence limit and 5% lies below the lower confidence limit because the calculation is two-sided. The location of the upper confidence limit is therefore equivalent the location of the 95%, one-sided upper confidence limit.

It is common practice to collect approximately 20% more samples that the number indicated by sample size estimates. In this case, the minimum required number of samples would be seven because 20% of six is approximately one.

[1] Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring.* Page 33. Van Nostrand Reinhold Company, New York, NY, 320 pp.

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

A Technical Team Meeting was held with DTSC, RWQCB, USACE and FA/BC for the Benicia Arsenal Project on 18 September 2000. During this meeting, DTSC provided comments to "Agency Comments and Responses for Area I Landfill 1, 2, Quarry 3 and Area M Quarry 1", submitted to DTSC and RWQCB on 28 August 2000. Formal written comments were not provided by DTSC or RWQCB. However, DTSC personnel (Dave Price) indicated that these verbal comments were the formal comments. DTSC's 18 September 2000 comments are considered back check comments. This table has been revised to include the back check comments and responses. This table contains the original comments and responses from DTSC and RWQCB. The back check comments/responses are highlighted in [redacted] to distinguish the original comments/responses from the back check comments/responses. This table reflects all comments and responses from DTSC and RWQCB pertaining to the subject document.

Comments from David Price, Department of Toxic Substances Control, dated 20 April 2000			
1.	General	A more inclusive chemical of potential concerns (COPCs) list should be considered for each sampling location. At a minimum, surface and subsurface soils metals should be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), TPHs (volatile and extractable), explosive residues and metals. It is possible that various military industrial activities at the Arsenal in the past century may have caused disposal seemingly unrelated to historical uses of the sites. Therefore, the most effective way to commence the investigation at the Landfill\Quarry sites is to include all the above mentioned COPCs, then to refine the COPCs for further investigation.	Concur. Analyte lists for surface and subsurface soil samples have been expanded as requested, except for TPH analyses for surface soil samples. Evaluating potential risk from TPH in surface soils has been addressed by including analysis of PAH and VOCs for each surface soil sample. Changes due to this comment/response are reflected in: • Table I7-5 Sampling and Analysis Matrix • Table I7-9 Analytical Method, Container and QA/QC Specification Matrix • Table I7-11 Summary of Soil Analytical and QA/QC Specifications

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

2.	General	If UXO\OE is encountered during the landfill\quarry investigations, the DTSC Project Manager should be contacted immediately as well as the USACE PM to ensure appropriate approvals as well as coordinating control measures to reduce the impact of detonation on the environment and surrounding land uses.	Concur. USACE PM will contact the appropriate regulatory agencies, if UXO/OE is encountered. This change has been made to Paragraph 7, Executive Summary and Paragraph 4, Trenches, Section 5.2 Subsurface Investigation. Landfill 1, Landfill 2 and Quarry 3 are not classified in the Engineering Evaluation/Cost Analysis (EE/CA) for known UXO/OE disposal. The probability to encounter UXO/OE is considered low. Work will continue with qualified UXO personnel employing construction support. If OE/UXO is found, EOD personnel from Moffett field will be deployed in accordance with the memorandum of understanding (MOU) between U.S. Army and USACE. Appropriate notifications will occur and will include the DTSC PM. Control measures and safety guidelines, pending arrival of EDD personnel, are included in Appendix C of the FSIP. Quarry 1 in Area M is within a known UXO/OE area, Sector 5 in the EE/CA. As such, no field work will occur at this quarry until the removal action has been completed under the EE/CA. Upon completion of the removal action, field work will be conducted at Quarry I in Area M with appropriate UXO/OE construction support and consistent with methods and procedures used for Landfill 1, Landfill 2, and Quarry 3.
3.	General	Since the COPCs contain VOCs, it is recommended that a soil gas survey be conducted to identify releases and assess the risks of ongoing impacts to the air and groundwater. [redacted] [redacted]	A soil gas survey is not planned until landfill or the landfills are located and confirmed by the geophysical and trenching activities planned in this FSIP. A soil gas survey may be included in a later phase of investigation, as appropriate. [redacted] [redacted]

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

4.	General	Please explain the rationale for the proposed number and locations of monitoring wells and grab samples at the landfill and quarry sites. Additional monitoring wells should be installed at Landfill 2 in the southcentral and southeastern boundaries and at Landfill 1 in the southwestern boundary and between proposed wells L001TW003 and L001TW002. Also, additional grab groundwater samples are warranted at both Area M Quarry 1 and Area I Quarry 3. We would like to work with the USACE to select additional groundwater sampling locations at these sites.	We disagree that additional monitoring wells are needed at this time. Three monitoring wells for each landfill are proposed in this FSIP as the minimum number of locations necessary to evaluate flow direction and gradient. However, proposed locations of wells L001TW002 and L001TW003 have been moved to the west to include the suggested location. It is important to note that all three proposed well locations may be modified based on the location of the landfill derived from geophysical and trenching results. These wells will be monitored and sampled for 4 quarters. Additional wells, as appropriate, may be added during another phase of investigation based on results of the monitoring. Additional sampling (i.e., wells or hydropunch), as appropriate, will be added during another phase of investigation based on the results of this investigation. Three grab samples at each quarry are planned in this FSIP to evaluate groundwater quality. Three samples were selected to provide minimum coverage around anticipated landfill boundaries. Sampling locations may be modified based on the results from the geophysical survey and trenching activities.
5.	Section 5.2, page 17-27	The FSIP states that interior trenches will be excavated within the landfills\quarries to determine the vertical extent of the refuse or fill and to document the type of material found. If possible, the USACE should attempt to collect a sample of the refuse\fill encountered (not just the surface soil). Also, the report states that soil samples may be collected from the native soil beneath the refuse\fill. In order to assess the vertical extent of the contamination, soil samples below any refuse\fill should be collected. If groundwater is encountered during excavation of the interior trenches, a grab groundwater sample should be collected.	Table I7-5, Table I7-9 and Table I7-11 have been revised to include subsurface soil samples from native soil just below the refuse/fill material, and grab water samples if water is encountered in a trench. These samples will be collected from [redacted] relatively fine-grained sediments, which are expected to retain soil moisture and contaminants better than the coarser grained sediments. Due to the typical heterogeneous nature of landfill content, samples of refuse/fill are not proposed for this investigation. If necessary, samples of refuse/fill may be collected during later phases to assist in assessment of potential remedial actions. *Note: Response to Comment is changed per Back Check Comment #10 (see highlighted text)*

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

6.	Section 5.2, page 17-27	Excavated materials are stated to be replaced in their original position. Waste removed from the trenches will need to be characterized properly and if hazardous, disposed of as hazardous waste.	The following will be added as paragraph 3 in Section 5.2, Trenches: "If refuse/fill material deemed to be potentially hazardous (as determined by visual inspection by the FTL) is encountered, trenching activities will immediately stop. Refuse/fill material deemed to be potentially hazardous will not be used as backfill. The potentially hazardous refuse/fill material will be placed in an over pack drum. The decision to continue trenching or move trenching locations will be approved by the FA/BC TOM and the USACE PM."
7.	Section 5.2, page 17-28	No monitoring wells are proposed for Area I Quarry 3 and Area M Quarry 1 because the quarries are located in bedrock and are less likely to contain leachable producing materials. Although this is unlikely, it may be possible that the bedrock in this area contains fractures that could act as preferential pathways. As such, if contaminants are detected in the grab groundwater samples, the installation of monitoring well may be required at the quarries. Monitoring wells may not be required at these sites if it can be shown that groundwater cannot be found in fractured rock.	Concur. Later phases of investigation will include monitoring wells, as appropriate, based on the findings from this investigation.
8.	Section 5.3, page 17-29	The FSIP states no trenches along the western boundary of Landfill 2 were proposed because the HLA investigation found no refuse in this area. However, during the HLA investigation, fill material was encountered in this area, but the extent was not determined. Since the goal of this investigation is to determine the extent of refuse or fill at these sites, additional trenching should be performed to determine the western boundary at Landfill 2.	Figure I7-6 has been revised to include a trench along the western boundary of Landfill 2. Trench locations shown on figures in this FSIP are proposed and likely will be moved based on the results from the geophysical survey. The primary purpose of the trenches is to best confirm the presence or extent of refuse or fill at each site.

Agency Comments and Responses (Inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

Comments from Mark Vest, Department of Toxic Substances Control, dated 7 April 2000			
1.	17-1	The FSIP discusses the possibility that these sites may be more appropriately called fillsites rather than landfills. The FSIP should be amended to indicate that the sites will be considered fillsites only if the materials disposed of meet the definition of inert wastes as per State Water Resources Control Board (SWRCB) definitions.	Corrected as noted. Executive Summary, paragraph 2 revised as follows: "However, if this investigation determines that these "landfills" do not contain refuse, then the name will be changed to reflect the use. The term "fillsite" will be considered if the materials disposed of meet the definition of inert wastes as per CCR, Title 27 regulations."
2.	Page I7-1	The FSIP references California Code of Regulations (CCR), Title 27 as applicable regulations. It should be noted in the FSIP that CCR, Title 22 regulations are likely to also be applicable in view of the reported disposal of industrial wastes and UXO in landfills at the Arsenal.	Corrected as noted. Executive Summary, paragraph 5 revised as follows: "If refuse is found, an evaluation of the compliance requirements in CCR, Title 27, Division 2, Subdivision 1; CCR, Title 22, Division 4.5; and CCR, Title 23, Division 3, Chapter 15 will be included in the report for this investigation."
3.	Pages I7-1 and I7-2	The FSIP identifies the goals of the investigation. The goals should be amended to include developing estimates of the volumes of material disposed of at the sites.	Corrected as noted. Executive Summary revised as follows: • develop preliminary estimates of the volumes of material disposed of at each landfill/quarry. Table I7-1, Data Quality Objectives has been revised to include this Investigation-wide decision: • develop a preliminary estimate of the volumes of the materials disposed in each landfill/quarry using results from the geophysical survey, and trenching. Section 3.0, bullet #5 has been added. • After the trenching has been completed, a preliminary estimate of the volume of the materials disposed in each landfill/quarry will be calculated using the geophysical boundaries and the boundaries confirmed by trenching.

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

4.	Page I7-2	The FSIP states *If refuse is found, an evaluation of the compliance requirements in CCR, Title 27, Division 2, Subdivision 1 and CCR, Title 23, Division 3, Chapter 15 will be included in the report for this investigation.* The FSIP should be amended to include evaluating the requirements of Title 22 if the presence of hazardous waste or hazardous waste constituents is assumed based on site history or confirmed by investigation activities.	Corrected as noted. See above Mark Vest Comment #2.
5.	Page I7-3 -	The FSIP discusses avoiding trenching into areas associated with anomalous geophysical readings which may indicate buried UXO. a. It should be noted in the FSIP that anomalous readings may indicate the presence of not only UXO, but of any number of other things including buried drums, vehicle bodies or frames, engine blocks, steel plate or other scrap metal. b. If identifying the sources of anomalies is intended, it is recommended to excavate overlying soil, identify and remove encountered metal objects and resurvey. c. The FSIP should be amended to specify that where anomalies are assumed to be UXO and are not excavated and identified, then it will be assumed that the landfills exhibiting such anomalies also contain hazardous wastes (UXO).	The landfills and Quarry 3 have a low probability of finding UXO/OE. In addition, EE/CA removal action activities will be completed prior to beginning field activities at Quarry I in Area M. As such, anomalies will not be avoided at these sites and construction support will be provided during the trenching. Based on this approach, the Executive Summary, Section 2.0, Section 3.0, and Section 5.2 (Trenches) have been revised. a. Corrected as noted. Page I7-3 revised as follows: "Geophysical surveys will be used to identify potential anomalous readings at the locations to be trenched. Anomalous geophysical readings may indicate the presence of UXO/OE related material. Anomalous geophysical readings may also indicate the presence of other metallic objects such as buried drums, vehicle bodies, engine blocks, scrap metal, etc." b. All excavation activities will be conducted with UXO/OE support. Anomalies may be identified during the excavation process at Landfill 1, Landfill 2, Quarry 3, and Quarry I in Area M (after removal action) but anomalies will not be avoided. Excavation will be coordinated with appropriate UXO/OE construction support. c. See above response to Dave Price Comment #2.

Agency Comments and Responses (Inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

6.	Page I7-12	The FSIP again mentions conducting a geophysical survey at the sites. When the FSIP first discusses geophysical methods it should identify the specific methods that are proposed.	Section 3.0, bullet #1 has been revised to include the specific methods to be used during the geophysical survey. • A geophysical survey (using magnetic gradiometry, terrain conductivity, electromagnetic metal detection, ground penetrating radar, electromagnetic line locating) will be conducted....."
7.	Pages I7-12 and I7-17	The FSIP discusses trenching to confirm the landfill boundaries that are tentatively identified by geophysical methods. To provide for estimating volumes of waste, the exploratory trenching should also be used to estimate the angles of slopes underlying the wastes and depths of landfills.	Concur. Section 5.2, paragraph 1 has been revised to include: "Information from the trenches will be used to estimate the angles of slopes underling the refuse and depths of landfills."

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

8.	Page I7-17	The FSIP proposes to construct three temporary monitoring wells at Landfills 1 and 2. However, at Quarries I and 3 the FSIP proposes to collect three in situ water samples from borings. a. The FSIP should explain what is meant by temporary monitoring wells. At the landfill sites, wells should be constructed and samples should be collected and analyzed for constituents of concern quarterly for one year. Also, ground water elevations should be determined and flow directions identified at least quarterly. Any tidal influence on ground water flow direction should be assessed. b. If wastes are present in the former quarry sites then ground water monitoring wells should be constructed and samples should be collected and analyzed for constituents of concern quarterly for one year. Also, ground water elevations should be determined and flow directions identified at least quarterly. [redacted]	a. The term "temporary" monitoring well is used per the USACE Right-Of-Entry agreements until data suggest permanent legal agreements should be entered into. A temporary monitoring well is expected to exist no more than 3 years. One year of quarterly data (water levels, flow directions, gradients and chemistry) will be collected at the landfills. b. Installation of groundwater monitoring wells at the quarries (if appropriate based on results of this investigation) will be conducted in another phase of investigation. [redacted]

9.	Page I7-17 -	The FSIP states *If refuse/fill material is observed in the trench, soil samples may be collected from the native soil just below the refuse/fill boundary. The decision to collect these soil samples will be approved by the FA/BC TOM and the USACE PM.* a. The FSIP should be amended to specify sampling beneath the fill at all of the landfills and quarries. The landfills and quarries may have received liquid wastes that may or may not have left obvious staining. Accordingly, samples should be collected from sediments underlying the trenches whether or not visual indications of wastes are identified. b. The samples should be collected from relatively fine-grained sediments which are expected to retain soil moisture and contaminants better than relatively clean sands.	a. Concur. See response to Dave Price Comment #5. b. Concur. See response to Dave Price Comment #5.

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

10.	Table I7-3	Data Quality Objectives - The DQOs should be amended to incorporate the following recommendations a. The investigation should provide for depth of fill and volume estimates b. The investigation should provide for sampling and analysis of sediments from beneath the fill at all of the landfills and quarries. These samples should be collected from multiple locations at each site c. The proposed practical study boundary that limits trenches to a maximum of 10 to 12 feet below ground surface should be amended because the approach proposed in the FSIP requires excavating through the wastes. Backhoes are commonly available with digging depths of 14 to 18 feet. Excavators can dig to 30 feet or more.	a. Concur. Table I7-3 Data Quality Objectives has been revised to include this Investigation-wide decision: • evaluate the depth of fill and refuse in each landfill/quarry, as feasible b. Concur. See response to [redacted] Comment #[redacted] c. Concur. The total depth of the landfill refuse will be measured. If the depth to the landfill refuse/fill is deeper than the proposed trenching equipment available, than drilling will be used in subsequent phases of field activities. The planned trenching equipment for this investigation will reach to a maximum depth of 22 feet. Bullets #1 and #2 of the Practical Study Boundaries have been revised: • Trenches will be excavated to the practical depth of the equipment available (approximately 22 feet). If landfill refuse/fill is deeper, then drilling will be used in subsequent phases of field activities. • Trenches will be excavated a maximum of 2 feet below refuse/fill material.

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

10.	Table I7-3	Data Quality Objectives - The DQOs should be amended to incorporate the following recommendations a. The investigation should provide for depth of fill and volume estimates b. The investigation should provide for sampling and analysis of sediments from beneath the fill at all of the landfills and quarries. These samples should be collected from multiple locations at each site c. The proposed practical study boundary that limits trenches to a maximum of 10 to 12 feet below ground surface should be amended because the approach proposed in the FSIP requires excavating through the wastes. Backhoes are commonly available with digging depths of 14 to 18 feet. Excavators can dig to 30 feet or more. [redacted]	a. Concur. Table I7-3 Data Quality Objectives has been revised to include this Investigation-wide decision: • evaluate the depth of fill and refuse in each landfill/quarry, as feasible b. Concur. See response to [redacted] Comment #[redacted] c. Concur. The total depth of the landfill refuse will be measured. If the depth to the landfill refuse/fill is deeper than the proposed trenching equipment available, than drilling will be used in subsequent phases of field activities. The planned trenching equipment for this investigation will reach to a maximum depth of 22 feet. Bullets #1 and #2 of the Practical Study Boundaries have been revised: • Trenches will be excavated to the practical depth of the equipment available (approximately 22 feet). If landfill refuse/fill is deeper, then drilling will be used in subsequent phases of field activities. • Trenches will be excavated a maximum of 2 feet below refuse/fill material. [redacted]

13.	Page I7-18 and I7-19	- Section 5.1, Geophysical Survey provides some information regarding the geophysical methods that are proposed for implementation. a. Site-specific geophysical work plans should be prepared as part of the FSIP. The work plans should specify instrumentation to be used, mode of operation (e.g., in-phase and quadrature readings for conductivity, total field magnetic intensity values and gradiometer/vertical magnetic field for magnetometer surveys), and orientation and spacing of transects (magnetic north-south is recommended for magnetometer transects). b. The work plans should also discuss reporting of geophysical data. Reports should include maps illustrating transects and stations, as well as contours of data with associated values posted legibly. In addition to interpretations, data should be provided in a tabular format on a computer disc. [redacted]	a. Site specific geophysical work plans are not planned, but the information requested will be added to this FSIP. Section 5.1 has been revised and expanded to include the information requested. b. Concur. The following paragraph has been added to the end of Section 5.1 Geophysical Survey: "The geophysical contractor will submit a letter report to FA/BC summarizing the procedures and findings from each geophysical survey at the landfills and quarries. [redacted]. FA/BC and the UXO contractor will review the report before the invasive activities begin. Trench locations will be finalized based on the recommendations from the geophysical contractor and the UXO contractor to best complete the data quality objectives for each site." [redacted]
14.	Page I7-21 -	The FSIP states *If UXO/OE-related material is suspected, the uncovering, evaluation and removal of these materials will be conducted by others under the direction of the USACE Sacramento District.* The above, along with discussions regarding moving wells/trenches away from mapped anomalies, is interpreted to say that geophysical anomalies which result in relocation of monitoring wells or trenches will be excavated and the source of the anomalies will be identified.	See response to Dave Price Comment #2.

Agency Comments and Responses (Inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

15.	Page I7-27 -	The FSIP discusses trenching and states that trenches at the margins of the landfills will be approximately 15 feet long and, if refuse is encountered, will extend 1 to 2 feet into the waste and stop. The margin trenches should be deep enough to provide an approximation of the slope of native materials underlying the waste.	Concur. See response to Mark Vest Comment #7.
16.	Page I7-27 -	The FSIP states *Soil samples may be collected from the native soil to determine potential impact from the refuse/fill material. Based on the type of refuse/fill encountered, a field decision will be made to collect soil samples with FA/BC TOM and USACE PM approval.* a. As discussed above, visual indicators cannot be relied on to demonstrate the extent or lack of contamination c. Due to the heterogeneous nature of waste disposal in landfills, soil samples should be collected and analyzed from multiple locations beneath the waste to assess whether waste constituents have leached from the fill. [redacted]	Paragraph 2 of Section 5.2 Subsurface Investigation, Trenches, has been revised to state: "Soil samples <u>will</u> be collected from the native soil to determine potential impact from the refuse/fill material." a. Comment noted. [redacted]

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

17.	Page I7-28	The FSIP states *Surface soil samples will be collected at Landfill 2 and both quarries.* The presence of asphalt paving on Landfill 1 does not eliminate future exposure potential. As discussed above, surface soil samples should be collected from Landfill 1.	See response to Mark Vest Comment #12.
18.	Page I7-28	The FSIP refers to Appendix D regarding the statistical basis for determining the required sample size. The analysis in Appendix D assumes the sample results will be normally distributed. Contaminant concentrations in environmental samples are often lognormally distributed. The FSIP should be amended to discuss this possibility and calculate required sample size assuming a lognormal distribution.	Concur. Appendix D has been revised to include a discussion of the possibility that the data may be lognormally distributed. Appendix D has also been revised to include a calculation of the required sample size assuming that the coefficient of variation is greater than one.
19.	Page I7-28 -	The FSIP states *Because the quarries are located in bedrock and are less likely to contain leachable producing materials, wells are not necessary and insitu groundwater samples will be collected instead.* a. The FSIP should be amended to specify the drilling method proposed to be used at these sites. b. If other than inert wastes are disposed of in the former quarries, or if there is no documentation of the types of wastes disposed, monitoring wells should be constructed and both water elevations and quality should be monitored and reported quarterly for at least one year. c. The FSIP should be amended to include well construction specifications for these wells.	a. Concur. The planned method of drilling will be hollow stem auger. This has been added to Table I7-6 as a "specific aspect" under SOP No. 27.0. b. Groundwater monitoring wells may be installed in a subsequent phase of work, based on the results of this investigation. See response to Mark Vest Comment #8. c. The construction procedures for temporary monitoring wells are described in SOP 21.0 of the QAPP (as indicated on Table I7-6). Construction specifics are stated in Paragraph 1 of Section 5.2 Subsurface Investigation, Temporary Monitoring Wells.

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

20.	Page I7-28 -	According to the FSIP, one boring at each landfill or quarry will be advanced to bedrock to obtain stratigraphic data. The FSIP should specify the method proposed to backfill the deep borings to depths appropriate for monitoring well construction.	Concur. The following sentence has been added to the end of Paragraph 1 of Section 5.2 Subsurface Investigation, Soil Borings: "Deep borings that are converted into shallow monitoring wells will be backfilled with bentonite slurry via tremmie to the total depth of the well."

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

21.	Page I7-29 -	The FSIP states *Impacts from potential releases into groundwater will be assessed by installing three temporary monitoring wells at each landfill (Figures I7-5 and I7-6). The locations of these temporary wells have been selected based on site topography and the anticipated direction of groundwater flow and are shown on each figure referenced above.* a. To assess potential releases from the landfills, two down gradient wells should be monitored quarterly for at least one year. b. It should be demonstrated that the wells are down gradient from a significant part of the unit being monitored, not down gradient from marginal areas of disposal. c. If historical information indicates that wastes were disposed in canyons or other drainage courses, monitoring wells should target those areas. According to the RRR, Landfill 1 appears to be located in such an area. d. As discussed above, ground water elevations should be determined and flow directions identified at least quarterly. Any tidal influence on ground water flow direction should be assessed. [redacted]	a. Concur. See response to Dave Price Comment #4. b. Locations of the wells will be finalized based on geophysics and trenching. Due to the lack of historical groundwater data, actual flow direction is not known. Sentence 1 of Paragraph 1 in Section 5.2 Subsurface Investigation, Temporary Monitoring Wells has been revised to : "Temporary monitoring wells will be installed in each of the three soil borings outside the perimeter of each landfill based on geophysical and trenching results." c. Noted. d. Concur. See response to Dave Price Comment #4. [redacted] c. [redacted]

Agency Comments and Responses (inclusive of Back Check Comments) for Area I Landfills 1 and 2, Quarry 3 and Area M Quarry 1
David Price, Mark Vest - Department of Toxic Substances Control (DTSC)
Claudia Villacorta - Regional Water Quality Control Board (RWQCB), San Francisco Bay Region

22.	Table I7-4	Summary of Commonly Used Substances and Table I7-5 Sampling and Analysis Matrix - The tables should be amended to incorporate the following recommendations. a. Samples should be collected and analyzed from sediments underlying wastes from multiple locations at each site. b. The surface samples should be analyzed for SVOCs in addition to the analyses proposed in the FSIP. c. The samples from beneath the base of the wastes should be analyzed for VOCs, SVOCs, and the analyses proposed for soil samples in the FSIP. d. Soil gas surveys should be completed to identify if VOCs are present in the shallow subsurface within and surrounding waste disposal areas. This information is most important at sites where nearby structures are present or may be constructed in the future. e. Soil samples for VOC analysis should be collected, handled, and analyzed in a manner consistent with the USEPA Region 9 interim policy for determining VOC concentrations in soil. A memorandum describing the policy is attached for ready reference.	a. See response to Mark Vest Comment #11 b. Concur. See response to Dave Price Comment #1 c. Concur. See response to Dave Price Comment #1 d. See response to Dave Price Comment #3 e. Concur. This procedure has been implemented for the Benicia Arsenal project.