Removal Action Work Plan
Tourtelot Cleanup Project
Benicia, California

May 2000

Prepared by:

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LIMITATIONS

This Removal Action Work Plan (RAW) presented for the Tourtelot Cleanup Project (Project Site) in Benicia, CA, has been developed in accordance with principles and practices generally employed in the environmental consulting and remediation profession.

Remedial investigation methodologies designed to be employed on the Project Site are based upon the following: (1) data and literature provided by the Department of Defense (e.g., Archives Search Report [ASR]), Regulatory Agencies (e.g., Department of Toxic Substance Control [DTSC], California Environmental Quality Act [CEQA] Initial Study) and private sources including the : (2) documentation of prior clearances: (3) field investigations including geophysical mapping and ordnance and explosives (OE) sampling performed by SECOR International, Inc. and Earth Tech project teams: and (4) observations made and verbal information obtained during site visits. Information developed by other government agencies and independent contractors has been accepted as authentic and true as stated, unless otherwise noted.

The work to be performed shall attempt to determine the lateral and vertical extent of the non-OE contamination present within the Project Site at the North Valley Military Landfill. This RAW presents procedures to perform limited OE clearance and non-OE site characterization.

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April 25, 2000
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EXECUTIVE SUMMARY

This Removal Action Work Plan (RAW) has been prepared to address the methods and procedures to be employed to evaluate the aerial extent and depth of the North Valley Military Landfill and to assess whether the soil within and beneath the landfill is affected with non-ordnance and explosives (non-OE) materials. Two intersecting test trenches will be excavated through the landfill and into the soil beneath the landfill. Soil samples will be collected at the landfill bottom/natural soil interface and 2 feet below the interface at 25-foot intervals along each trench. Additionally, approximately four soil samples will be collected from the soil matrix within the landfill and at areas where field instruments or physical observations indicate that soil may be affected.

Soil samples from within the North Valley Military Landfill and beneath the landfill will be analyzed in the analytical laboratory. Specific tests will include substances of interest identified from the activities that occurred at the Ammunition Renovation/Primer Destruction Site and the Howitzer Test Facility. The soils will be tested for solvents, metals, petroleum hydrocarbons, and other substances. This RAW is designed to complete the non-OE characterization of the Tourtelot Cleanup Project Site.

The Tourtelot Cleanup Project site lies completely within the City of Benicia, Solano County, California, approximately 30 miles northeast of San Francisco. Consisting of approximately 220 acres, it is partially within the boundaries of the Former Benicia Arsenal. The site has rolling topography that includes an area referred to as the "Ridge," which separates the North Valley and the South Valley, both of which have areas of steep terrain. The Tourtelot Cleanup Project Site is bordered by the Southampton residential development to the west and south, industrial and commercial facilities to the east, and open space to the north and east. The elevation of the site varies from 75 feet above mean sea level (MSL) in the southern region to 250 feet above MSL in the northern region.

The North Valley Military Landfill, the Project Site that will be investigated under this RAW, is in the North Valley of the Tourtelot Cleanup Project Site. The landfill is bordered to the east by the Howitzer Test Facility and to the west by relatively undisturbed area. The landfill lies in the bottom of the North Valley in a relatively flat area. A soil stockpile lies directly to the west of the landfill. To the south and east of the site is a relatively steep hill leading up to the Ridge. Immediately to the north of the site is the valley floor, then a hill leading up to the area referred to as the TNT Strips. A small wetlands lies downgradient of the landfill at the extreme eastern end of the North Valley.

Two main activities occurred in the North Valley that may have contributed debris to the North Valley Military Landfill: activities at the Howitzer Test Facility, and activities at the Ammunition Renovation/Primer Destruction Site. The landfill is just east of the Howitzer Test Facility (Figure 2-3). The Records Research Report

(RRR) for the Benicia Arsenal indicated that there was a disposal area associated with the Howitzer Test Tunnels. During initial site preparation work performed by Granite Management, debris was cleaned out from around the test tunnels, and a landfill, now referred to as the North Valley Military Landfill, was encountered. The debris initially uncovered in the landfill was mainly wood crates, pallets, and packing material. Some inert ordnance was recovered from this area, including practice 155-millimeter (mm) howitzer rounds (gravel or plaster filled). Only a small portion of the landfill was removed at this time. The RRR and the Archive Search Reports (ASR) for the Benicia Arsenal did not indicate the presence of a landfill in the North Valley.

Data collected from a geophysical survey conducted over a portion of the North Valley Military Landfill indicate the presence of several anomalies within the landfill. However, because of the type of material expected in the landfill (wood debris), the magnetometer survey data (geophysical data) for the landfill would not necessarily define the aerial extent of the landfill. The Tourtelot Cleanup Project Site is currently fenced, and access is controlled.

Although ordnance and explosives (OE) is not expected to be found within the landfill, OE removal, handling and disposition procedures are included as a safety precaution.

Prior to the start of intrusive activities, a public withdrawal distance (PWD) around the trenching will be established and cleared of nonessential personnel. The default PWD is 1,701 feet, which is the maximum calculated flight distance of a metal fragment if there were an accidental detonation at the ground surface of the most probable munition without any engineering controls.

Two basic disposal alternatives may be considered in the event that an OE item or material is encountered at the Project Site.

1. Blow (detonate) in place (BIP) for OE and materials that are not safe to move.

2. When an OE item or material has been determined safe to move, it may be moved to a storage magazine.

Sandbag enclosures will be used as the engineering control designed to mitigate fragmentation and blast effects due to intentional detonations of items that are not safe to move. Engineering controls for disposal of safe-to-move items are not considered because all safe-to-move items will be stored in explosives magazines.

After the trench excavation and soil sampling are completed, the trenches will be backfilled with clean soil to the original ground surface.

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ACRONYMS/ABBREVIATIONS

AA	anti-aircraft
AP	anti-personnel
AR	Army Regulations
ARAR	Applicable or Relevant and Appropriate Requirement
ASR	Archives Search Report
ASTM	American Society of Testing and Materials
ATF	Alcohol, Tobacco, and Firearms
BATF	Bureau of Alcohol, Tobacco, and Firearms
bgs	below ground surface
BIP/PW	Blow in Place with Engineering Controls
BIP	blow in place
C.I.H.	Certified Industrial Hygienist
CAA	Clean Air Act
CAM	California Assessment Manual
CCBC	Consolidate in Controlled Blast Chamber
CCDA	Consolidate in Controlled Demolition Area
CCDA/PE	Consolidate in Controlled Demolition Area with Engineering Controls
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEHNC	U.S. Army Engineering and Support Center, Huntsville
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
C.I.H.	Certified Industrial Hygienist
COC	chain of custody
COFT	Consolidate for Off-Site Treatment
CWA	Clean Water Act
CWM	chemical warfare material
DA	Department of the Army
DOD	Department of Defense
DOT	Department of Transportation
DQO	Daily Quality Objective
DTSC	Department of Toxic Substances Control
EE/CA	Engineering Evaluation/Cost Analysis
EIR	Environmental Impact Report
EM	electromagnetic
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
EPP	Environmental Protection Plan

ESA	Endangered Species Act
FS	feasibility study
FTL	Field Team Leader
GIS	Geographic Information System
GPR	ground-penetrating radar
GPS	Global Positioning System
GTM	Geophysical Technical Manager
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	high explosive
HSC	Health and Safety Code
HSO	Health and Safety Officer
Hz	Hertz
IDW	investigation-derived waste
IR	infrared
LUFT	Leaking Underground Fuel Tank
MBTA	Migratory Bird Treaty Act
MDL	method detection limit
mg/kg	milligram per kilogram
mm	millimeter
MPM	Most Probable Munition
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
NAD27	North American Datum of 1927
NCP	National Contingency Plan
NCR	Nonconformance Report
NHPA	National Historic Preservation Plan
OAO	Ordnance Accountability Officer
OE	ordnance and explosives
OESM	Ordnance and Explosives Safety Manager
OSHA	Occupational Safety and Health Administration
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PE	Project Engineer
PETN	pentaerythritol tetranitrate
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
PPP	Public Participation Plan
PQL	practical quantitation limit
PR	purchase requisition
PRG	Preliminary Remediation Goal

PWA	Public Withdrawal Area
PWD	Public Withdrawal Distance
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCM	Quality Control Manager
QCP	Quality Control Plan
QDN	Quality Deficiency Notice
QES	Quanterra Environmental Services
RAW	Removal Action Work Plan
RCRA	Resource Conservation and Recovery Act
RDX	cyclonite
RI	remedial investigation
RRR	Records Research Report
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SIFSP	Soil Investigation Field Sampling Plan
SOW	Statement of Work
SSHP	Site-Specific Safety and Health Plan
SSO	Site Safety Officer
SUXOS	Senior Unexploded Ordnance and Explosives Supervisor
SVOC	semivolatile organic compound
TBC	to be considered
TM	Technical Manual
TEPH	total extractable petroleum hydrocarbon
TMF	total magnetic field
TNT	trinitrotoluene
U.S.C.	U.S. Code
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
VOC	volatile organic compound

1.0 INTRODUCTION

This Removal Action Work Plan (RAW) has been prepared to address the methods and procedures to be employed to locate and remove ordnance and explosives (OE), to the extent needed to collect soil samples from the North Valley Military Landfill (the "Project Site") within the Tourtelot Property in Benicia, California (Figure 1-1). This RAW is being prepared for the California Environmental Protection Agency (EPA), Department of Toxic Substances Control (DTSC), in response to the Imminent and/or Substantial Endangerment Determination and Remedial Action Order (Order) (Docket No. I/SE 98/99-011) and in accordance with the California Environmental Quality Act (CEQA) Initial Study. All work performed under this RAW will be consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S. Code [U.S.C.] 9601 et seq.), as amended, the National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] Part 300), as amended, and the California Health and Safety Code (HSC) Section 25356.1 et seq., as amended.

1.1 PROJECT OBJECTIVE

The objective of this RAW is non-OE characterization of the North Valley Military Landfill.

The specific objectives of this investigation are to characterize:

1. The lateral and vertical extent of the North Valley Military Landfill
2. Whether soil within and/or immediately below the North Valley Military Landfill is affected with non-OE materials.

1.2 PROJECT PURPOSE

The purpose of this action is non-OE characterization of the North Valley Military Landfill. The activities described in this RAW are part of the overall non-OE characterization of the Tourtelot Property as described in the Non-OE Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Earth Tech, 2000). The results of the non-OE investigation will be presented in an RI Report, which will also include a brief description of any OE encountered during the investigation with a detailed OE inventory provided as an appendix. This data will be considered along with data from other previous investigations in developing the Remedial Action Plan for the Project Site.

An Administrative Record list of documents used to support the need for the activities described in this RAW is presented in Appendix A. To comply with the CEQA, DTSC has prepared an Initial Study to determine the potential environmental effects from the activities described in this RAW. The Initial Study

resulted in a negative declaration of the expected environmental impacts from the investigation described in this RAW.

1.3 PROJECT ORGANIZATION

The organizational structure for this project is shown on Figure 1-2. This organizational structure provides the Project Coordinator with a dedicated project team, including project engineers, technical and administrative support staff, and subcontracting managers.

1.3.1 Department of Toxic Substances Control Oversight

It is the role of the DTSC to review and approve this RAW and all related documents necessary to complete the actions described herein. All notices, comments, approval, and other communication from DTSC will be through U.S. Army Corps of Engineers (USACE), Sacramento District, Granite Management Corporation, and the respondents' project coordinators.

1.3.2 Responsible Parties

This project organization is designed to provide a clear line of management responsibility and authority to facilitate delegation of authority to the management level responsible for completing the OE removal and non-OE characterization activities described in this RAW. The organization reflects strong technical and management leadership and provides a direct line of communication between Earth Tech managers and Granite's Project Coordinator, Peter Russell. Lines of communication from Earth Tech to the DTSC and the USACE, Sacramento District, are through Peter Russell. The Earth Tech lines of authority flow from the Project Engineer (PE) to the support staff.

It is the responsibility of all management personnel who may affect the quality of the data collected, studies, operations, or other quality-related functions to be aware of and implement the policies and practices set forth in this document.

Project Coordinator Responsibilities

The Project Coordinator's primary responsibility is for the overall coordination of the project with DTSC. Additional responsibilities include receiving all notices, comments, approvals, and other communication from DTSC. The Project Coordinator works closely with the PE and all other team members to ensure that project goals and objectives, including project schedule, are met. Lines of authority for the Project Coordinator flow directly from the respondents named in the Order. The Project Coordinator serves as the primary point of contact for the Project Engineer.

1.3.3 Earth Tech

The Project Engineer (PE) may delegate authority to appropriate personnel to assure activities are conducted in a compliant, cost-effective, and timely manner. However, responsibility for the project will remain with the PE. A summary of the responsibilities of project management personnel is provided below:

Project Engineer (PE). The PE, who is responsible for the overall direction, coordination, technical consistency, and review of the RAW, will monitor the performance of all project staff through the Project Manager (PM). The PE will have the authority to select or dismiss staff; select or terminate major subcontractors; approve or disapprove budgets and schedules; stop work; and communicate with Northgate Environmental Management, Inc., as necessary, to evaluate the progress on any task and ensure the early resolution of any problem. Communication with DTSC and the USACE, Sacramento District, will be coordinated with Northgate Environmental Management, Inc. The PE's specific responsibilities include:

- Final approval and review of project plans, all project deliverables, schedules, and manpower allocations for each task
- Designation of a PM
- Ensuring availability of key personnel assigned to the project for the duration of the project
- Overseeing coordination among management, field teams, and support personnel to ensure consistency of performance
- Communicating, as necessary, with Granite to evaluate the progress of the program and to facilitate the early resolution of any potential problems.

Project Manager (PM). The PM, who will report directly to the PE, will be fully responsible and accountable for all project activities, and will serve as the focal point and main channel of communication between Northgate Environmental Management, Inc., and the project team regarding technical and scheduling matters. The PM will establish and interpret project policies; monitor schedule; coordinate all reporting and other forms of communications; ensure necessary resources are made available; prepare plans; identify and resolve potential problems or conflicts; and provide for safe performance and quality of the work. Other duties, as appropriate, will include:

- Allocating work assignment and schedules to members of the project team, and orienting the staff to the objective of the RAW
- Evaluating the qualifications of project staff and critical subcontractor personnel, and identifying individuals who need additional training

- Assigning project field managers to direct specific field activities and providing them with the necessary resources
- Tracking the performance of the investigation
- Reviewing, approving, and consistently implementing the project planning documents (e.g., this RAW) and procedures, including approval of geophysical techniques, schedules, and manpower allocations
- Addressing specific tasks for compliance with federal, state, and local regulations/laws, and directives
- Providing overall technical, quality, and performance consistency throughout the investigation
- Identifying procurement needs (e.g., materials, services, subcontracts) and coordinating project procurements
- Identifying, documenting, and notifying the PE, the Geophysical Technical Manager (GTM), the Health and Safety Officer (HSO), the Ordnance and Explosives Safety Manager (OESM), and project staff of changes in project scope
- Reviewing sampling logs, laboratory reports, and final reports
- Interacting with regulatory or public agencies at the request of Northgate Environmental Management, Inc., and preparing progress reports
- Disseminating project-related information from Northgate Environmental Management, Inc.
- Preparing the RI Report and related presentations at progress meetings between the project team and Northgate Environmental Management, Inc.
- Reporting any significant conditions adverse to quality and obtaining concurrence by Northgate Environmental Management, Inc., on proposed resolutions
- Reviewing quality assurance audit reports and any resulting corrective action disposition.

Geophysical Technical Manager (GTM). The GTM will be responsible for oversight and direction of all geophysical activities for the investigation. The GTM will have a degree in geographics, geology, geological engineering, or a closely related field and a minimum of 5 years of directly related geophysical experience. The GTM will also have knowledge of various geophysical instrumentation detection capabilities and experience in the collection, analysis, and interpretation of

geophysical data as it pertains to ordnance and landfill detection. The GTM will be directly responsible to the PM.

The GTM is responsible for overall direction of geophysical operations. The GTM, or his/her designee, will interface with the client and regulatory agencies regarding the quality of the geophysical data collected. The GTM, or his/her designee, will track all quality assurance (QA)/quality control (QC) results of the geophysical survey on a spreadsheet that will tabulate survey area identified, coordinates, and date surveyed. A QA summary will be prepared and submitted to the client and PM. Other responsibilities for the GTM are outlined in Section 5.2.7 of the Ordnance and Explosives Characterization Plan.

Site Safety Officer (SSO). The SSO will be principally responsible for execution of all health and safety operations for field activities. The SSO will have knowledge of the Occupational Safety and Health Administration (OSHA) requirements and corporate health and safety requirements.

The SSO is responsible for the implementation of the Site-Specific Safety and Health Plan (SSHP) and will provide overall direction of the health and safety function for field activities. The SSO, or her/his designee, will administer health and safety functions of the project and will coordinate activities with the PM. In addition, the SSO will perform any necessary audits, surveillance, document reviews, and other health and safety functions as required to determine the continued effectiveness of the SSHP. Other responsibilities include, but not limited to:

- Coordinating the Program Certified Industrial Hygienist (C.I.H.) review of the SSHP and obtaining the C.I.H. certification of the SSHP
- Ensuring regulatory and operational compliance with OSHA requirements, the SSHP, and Earth Tech's corporate health and safety requirements
- Reviewing health and safety training and medical monitoring
- Working with the PM, the Field Team Leader (FTL), and the Senior Unexploded Ordnance and Explosives Supervisor (SUXOS), to ensure that all health and safety requirements outlined in the SSHP are implemented in the field
- Performing document reviews, and other health and safety functions as required, to determine the continued effectiveness of the SSHP
- Performing random health and safety assessments in the field, implementing corrective measures for site-specific health and safety deficiencies, and verifying resolution of any resulting corrective actions

- Monitoring the labeling, shipping, and control of hazardous or potentially hazardous samples and materials, and briefing all field personnel concerning health and safety requirements.

Ordnance and Explosives Safety Manager (OESM). The OESM will be principally responsible for oversight of all OE operations for field activities to be implemented by the SUXOS (see Chapter 6.0 for SUXOS responsibilities). The OESM will have knowledge of all requirements mandated by OSHA, USACE, U.S. EPA, Title 8 of the California Code of Regulations (CCR), and the Earth Tech Corporate Health and Safety Program. The OESM will be a United States citizen and a graduate of either the U.S. Army Bomb Disposal School or the U.S. Naval Explosive Ordnance Disposal School. The OESM will have at least 15 years of unexploded ordnance (UXO) experience, which may be a combination of active duty military explosive ordnance disposal (EOD) and contractor UXO experience, and include 10 years in supervisory positions. The OESM will be directly responsible to the PM.

The OESM, or his/her designee, will interface with the FTL, the SUXOS, and the SSO on OE safety functions of the project and will coordinate activities with the PM. In addition, they will, as necessary, perform audits, surveillance, document reviews, and other OE safety functions as required to determine the continued effectiveness of the SSHP. The OESM will, as necessary, audit compliance with the SSHP, and will perform OE safety reviews of selected project tasks. Other responsibilities will include, but not limited to:

- Performing and documenting regular and frequent OE site hazard inspections and observing employees at work

- Stopping work when necessary to prevent injury or illness associated with OE and to ensure human and environmental health and safety

- Investigating all injuries and illnesses resulting from OE-related incidents

- Performing random health and safety assessments in the field, implementing corrective measures for site-specific health and safety deficiencies, and verifying resolution of any resulting corrective actions

- Overseeing the SUXOS, who will be responsible for all OE operations to be implemented. The SUXOS will report directly to the PM.

Field Team Leader (FTL). The FTL reports to the PM and is responsible for project setup in the field, including identifying and scheduling personnel resources, materials, and equipment. The FTL is assigned to oversee and control all field activities, and is responsible for field cost tracking through administrators and project billing. The FTL will also conduct project control assessments and provide purchasing support for small purchases necessary to initiate the project. The FTL will provide site-level implementation of environmental protection, fire protection, occupational safety and health requirements, and permitting for this

project. The FTL has the organizational freedom and authority to implement changes to work practices; identify problems and proposed solutions; and if necessary, stop work activities that could pose a threat to personnel or the environment. The FTL will coordinate activities with the PM and other project personnel as appropriate. Duties of the FTL include, but are not limited to:

- Initiating field activities with the required resources, materials, and equipment
- Directing all field activities, supervising field staff and any subcontractors, and ensuring that field procedures described in this RAW are implemented
- Maintaining daily records of work performed, personnel on site, and any work stoppages or communications with other agencies pertaining to the project
- Managing equipment, preventive maintenance, decontamination, and calibration programs
- Using a correction tracking system in order to ensure correction of field work.

1.4 PROJECT PUBLIC PARTICIPATION SUPPORT

A Public Participation Plan (PPP) has been developed for the project in accordance with Section 5.8 of the Order. Project personnel will participate in public meetings to discuss project progress and activities in accordance with the PPP. Distribution of any data generated or reviewed for this RAW will be in strict compliance with the PPP.

Prior to initiation of any proposed activities, businesses and residents near the Project Site will be informed of the proposed project activities by direct mail. This notification will include information on a public information phone line that will be established and maintained to provide updated information on project activities, including information on planned or accidental detonations, if applicable. The phone line will also allow residents and business to express concerns or ask questions regarding project activities. All appropriate city, county, state, and federal officials will also be kept informed by direct mail and phone notification.

1.5 REMOVAL ACTION WORK PLAN ORGANIZATION

This RAW consists of the following:

Chapter 1.0 - Introduction. Discusses the purpose of the removal action and provides a detailed description of the project organization and objective of this RAW.

Chapter 2.0 - Site Characterization. Provides a geographic and physical description (including topography, geology, soils, hydrology and hydrogeology), as well as a detailed history of the Project Site. It also presents the Site Conceptual Model for the North Valley Military Landfill.

Chapter 3.0 - Removal Action Goals and Objectives. Describes the project goals and objectives. This chapter also assesses the Applicable or Relevant and Appropriate Requirements (ARARs) that may apply to activities described in this RAW.

Chapter 4.0 - Project Approach. Describes the activities that will be implemented during the non-OE investigation of the North Valley Military Landfill, including mobilization and surface preparation, geophysical investigation and mapping, OE subsurface clearance, and non-OE soil sampling.

Chapter 5.0 - Ordnance and Explosives Construction Support Plan. Outlines the activities associated with the geophysical mapping of the Project Site to be conducted by Earth Tech and its subcontractors, including the technology to be used to detect subsurface OE. The geophysical methods to be used during OE removal are also described.

Chapter 6.0 - Ordnance and Explosives Operations. Describes how OE will be investigated and safely handled by Earth Tech during site characterization activities and includes guidelines on storage and disposal of OE, if encountered.

Chapter 7.0 - Explosives Management/Siting Plan. Describes how explosives will be handled on the site.

Chapter 8.0 - Soil Investigation Field Sampling Plan. Describes the field sampling to be conducted for the non-OE characterization of the North Valley Military Landfill.

Chapter 9.0 - Environmental Protection Plan (EPP). Identifies any mitigation measures that must be taken while performing investigative work at the Project Site, so that impacts to environmental, biological and cultural resources are minimized.

Chapter 10.0 - Ordnance and Explosives Quality Control Plan (QCP). This chapter outlines the OE quality control plan. This plan provides QC measures as they relate to the clearance of OE for non-OE characterization of the Project Site.

Chapter 11.0 - Ordnance and Explosives Data Management Plan. Describes the activities associated with managing the geophysical data and any other OE data collected from the Project Site.

Appendix A - Administrative Record List. List the documents used to support the actions described in this RAW.

Appendix B - OE Safety and Health Program - OE Avoidance

Appendix C - Site Access Control Plan

Appendix D - Standard Operating Procedures, OE Operations - Demolition/ Disposal Operations. Provides procedures for demolition/disposal operations.

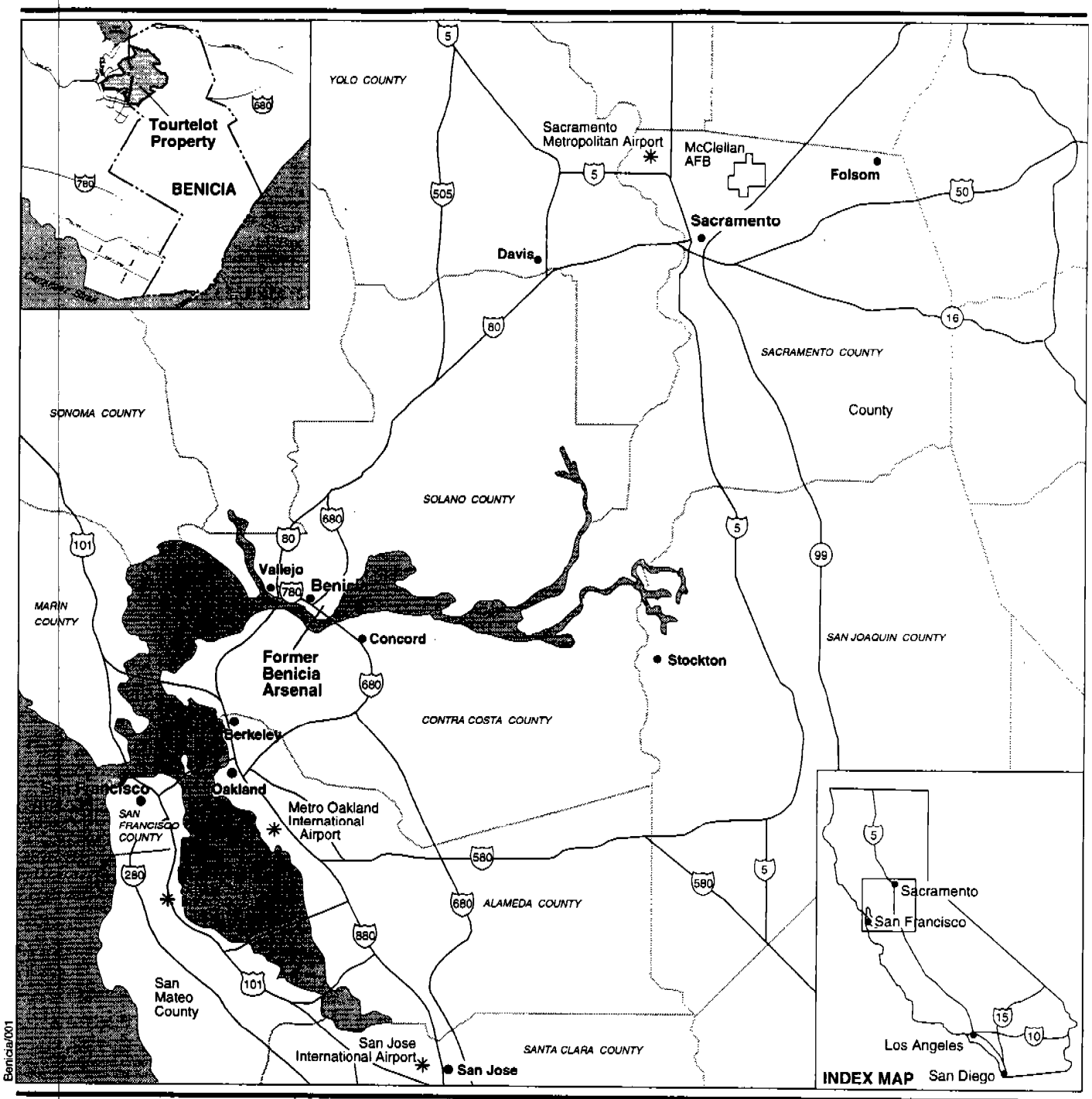
Appendix E - Earth Tech Forms. Contains all operational forms provided by Earth Tech.

Appendix F - Calculated Fragmentation Distances for Public Withdrawal Distance (PWD) Zones. Fragmentation distances precalculated for ordnance known to be at the Project Site. These distances will be used as PWDs for investigations/disposal.

Appendix G - Quality Assurance Project Plan

Appendix H - Standard Operating Procedures for PM_{10} Monitoring

Appendix I - Responses to Comments



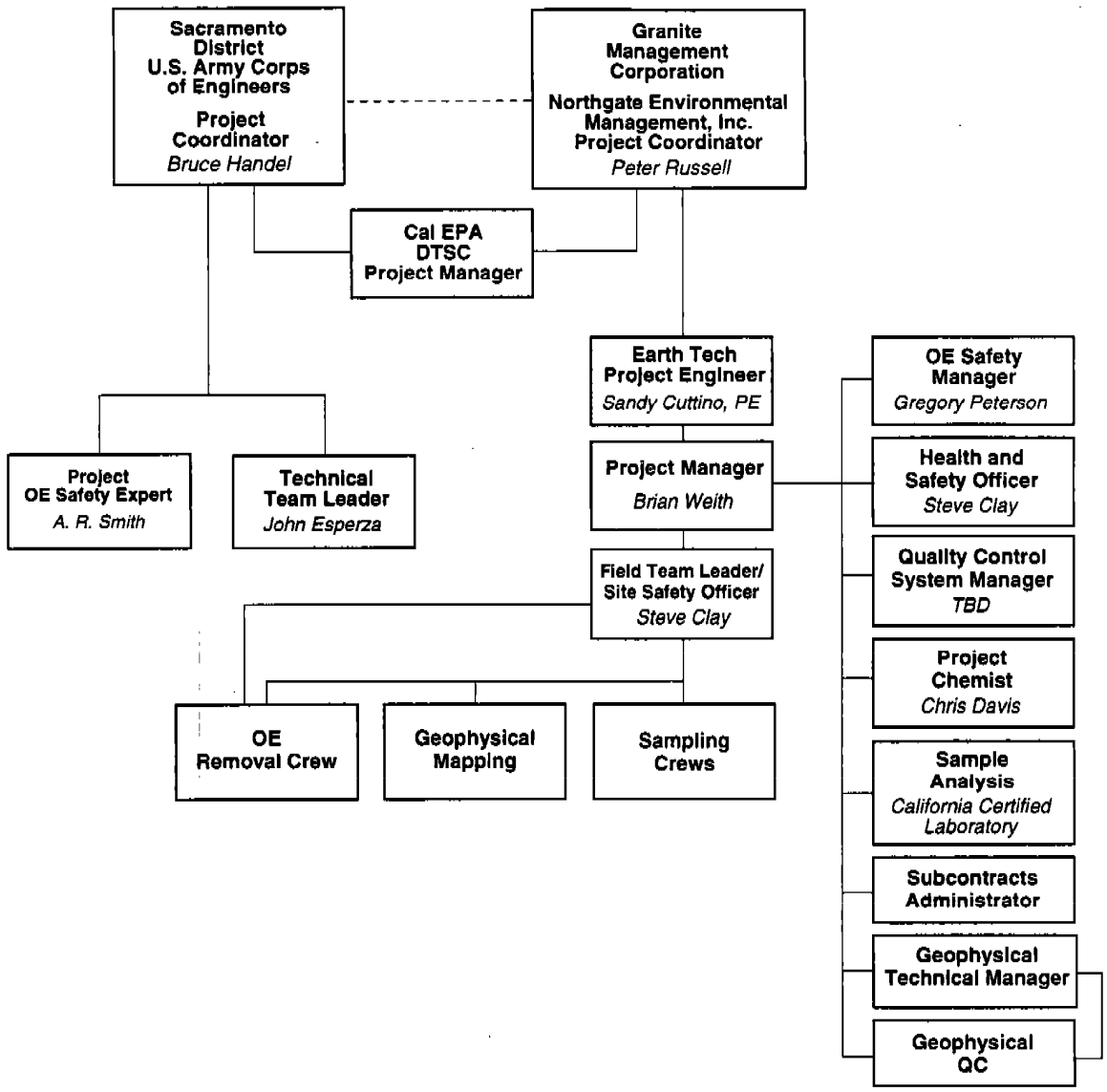
EXPLANATION

- ✳ Airports
- (99) California State Highway
- (101) U.S. Highway
- (280) Interstate Highway
- County Boundary

0 3.5 7 14 Miles

Regional Map

Figure 1-1



Benicia/068

EXPLANATION

CSP	=	Certified Safety Professional
DTSC	=	Department of Toxic Substances Control
EPA	=	Environmental Protection Agency
OE	=	Ordnance and Explosives
PE	=	Professional Engineer
TBD	=	To Be Determined

Project Organization Chart

Figure 1-2

2.0 SITE CHARACTERIZATION

2.1 PROJECT LOCATION AND SITE DESCRIPTION

The North Valley Military Landfill project site lies completely within the Tourtelot Cleanup Project Site. The Tourtelot Cleanup Project Site is within the City of Benicia, Solano County, California, approximately 30 miles northeast of San Francisco (see Figure 1-1). The Tourtelot Cleanup Project Site consists of approximately 220 acres, and it is partially within the boundaries of the Former Benicia Arsenal (Figure 2-1). The Tourtelot Cleanup Project site has rolling topography that includes areas referred to as the "Ridge," which separates the North Valley and the South Valley, both of which have areas of steep terrain (Figure 2-2). Both the South and North valleys contain wetlands areas, the one in the South Valley being considerably larger. The Tourtelot Cleanup Project Site is bordered by the Southampton residential development to the west and south, industrial and commercial facilities to the east, and open space to the north and east (see Figure 2-2). The elevation of the site varies from 75 feet above mean sea level (MSL) in the southern region to 250 feet above MSL in the northern region.

The North Valley Military Landfill is the Project Site that will be investigated under this RAW (see Figure 2-2). The North Valley Military Landfill is in the North Valley of the Tourtelot Cleanup Project Site. The landfill is bordered to the west by the Howitzer Test Facility and Soil Stockpile #3. The landfill lies in the bottom of the valley in a relatively flat area. To the south and east of the site is a relatively steep hill leading up to the Ridge. Immediately to the north of the site is the valley floor, then a hill leading up to the area referred to as the TNT Strips. A potential wetlands lies downgradient of the landfill at the extreme eastern end of the North Valley. The following sections provide a summary of the Project Site history and a detailed history summary for the area to be investigated.

2.2 HISTORY OF PROJECT SITE

Between 1849 and 1958, the U.S. Army acquired approximately 2,700 acres of land in Benicia and established the Benicia Arsenal for use as a depot for ordnance. In 1944, the Army leased a 200-acre piece of undeveloped ranchland known as the Tourtelot Property that was situated next to the Benicia Arsenal. Between 1945 and 1947, the Army began developing the Tourtelot Property for a number of different activities in both the North Valley and the South Valley (see Figure 2-2). In 1955 and 1960, the Army's leases for the Tourtelot Property terminated, and in January 1962, Department of Defense (DOD) declared the entire Benicia Arsenal excess.

Portions of the former arsenal were developed in the late 1960s. The Tourtelot Property remained under private ownership and was not developed. In 1971, portions of the Tourtelot Property were acquired from Mary Tourtelot by

developers, and the remaining 110-acre parcel was acquired from Mary Tourtelot in 1981 as part of the Southampton residential development. In 1989, the City of Benicia approved the Environmental Impact Report (EIR) for residential development of the land. In 1990, grading activities were conducted on the Tourtelot Property in support of off-site and on-site residential development. The activities included using the Ridge as a borrow site for soils, some of which were placed as fill during construction of the McAllister Drive Land Bridge, which crosses the South Valley and provides access to the Ridge from Rose Drive (see Figure 2-2). The sewer line along the south side of the South Valley was also installed at this time.

In mid-1996, during preliminary site preparation associated with development of the Tourtelot Property, concrete-filled howitzer shells were unearthed in the Howitzer Test Facility area. Granite retained military-trained explosives specialists and initiated preliminary site investigations for affected soils and OE. Part of the investigation included collection of geophysical data across the majority of the Project Site. Plate 1 depicts the results of the geophysical survey. In late fall 1996, live ordnance was first encountered and reported by Granite to local military personnel for handling. Granite provided its investigation data to the USACE for inclusion in its work. In 1998, the USACE began investigation of the Project Site as part of an arsenal investigation to characterize the area for OE/UXO.

The Project Site remains undeveloped. The Tourtelot Property is currently fenced, and access is controlled. Some adjoining land is also enclosed by fencing.

2.2.1 Department of Defense Activities at the Project Site

During the period when the Tourtelot Property was used by DOD, it accommodated various activities. Based on site inspection, data collected by the USACE for the Former Benicia Arsenal Engineering Evaluation/Cost Analysis (EE/CA) Report, data presented in the Records Research Report (Jacobs, 1999), review of historical aerial photographs, and review of geophysical data collected across the majority of the Tourtelot Cleanup Project Site, several potential areas of interest were identified on the Tourtelot Property. The hillside to the north of North Valley was used to dispose of trinitrotoluene (TNT). Approximately 6 acres in the North Valley were developed with roads and structures where the accuracy of locally manufactured howitzer gun barrels were checked, ordnance was inspected and renovated, and primers were destroyed in a "burn cage." The North Valley Military landfill was one of the sites identified in the North Valley. Section 1.2 of the Non-OE RI/FS Work Plan provides a complete history of each of these potential sites. The following subsection provides general information about activities that may have contributed debris to the North Valley Military Landfill.

2.2.1.1 North Valley Military Landfill.

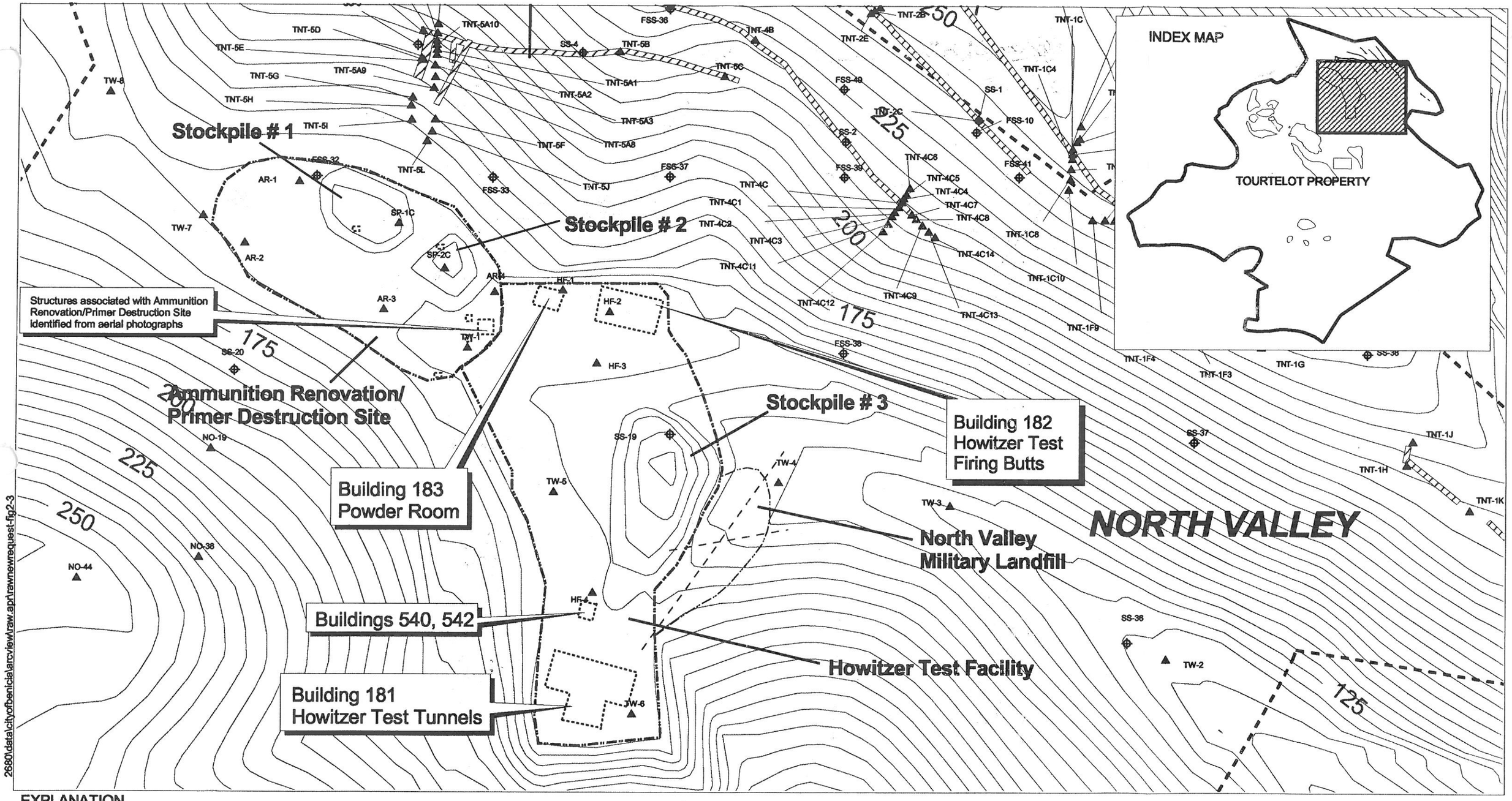
There were two main activities that occurred in the North Valley that may have contributed to debris in the North Valley Military Landfill: activities at the Howitzer Test Facility, and activities at the Ammunition Renovation/Primer Destruction Site.

The Records Research Report (RRR) indicated that there was a disposal area associated with the Howitzer Test Tunnels. It is believed that this disposal area was immediately adjacent to the tunnels and may have been the debris cleaned out from around the test tunnels during initial site preparation performed by Granite Management. This debris consisted of gravel and howitzer shells filled with pea gravel or plaster and inert OE scrap. This debris was screened for OE, and as much as possible was sorted into two soils stockpiles. One stockpile was relatively free of OE scrap, and the other stockpile had gravel and small fragments of OE scrap. The areas where the soils piles were placed were geophysically mapped and any identified anomalies removed. During the removal activities, a landfill, now referred to as the North Valley Military Landfill, was encountered to the east of the soil stockpiles (Figure 2-3). The debris initially uncovered in the landfill was mainly wood crates, pallets, and packing material. Some inert ordnance was recovered from this area, including practice 155-millimeter (mm) howitzer rounds (gravel or plaster filled). Only a small portion of the landfill was removed at this time. The debris encountered varied in depth up to 5 feet. The RRR and the Archive Search Reports (ASR) for the Benicia Arsenal did not indicate the presence of a landfill in the North Valley.

Data collected from a geophysical survey conducted over the majority of the Project Site indicate the presence of several anomalies within the landfill (Figure 2-4). However, because of the type of material expected in the landfill (wood debris), the magnetometer survey data (geophysical data) for the landfill would not be readily evident in the data. Therefore, the aerial extent of the landfill is not known from the available geophysical data. During the recent RI/FS investigation, OE avoidance activities associated with the installation of TW-4 (a temporary well) indicated the presence of some subsurface metallic material in the area. Review of historical aerial photographs (Section 2.3.5) indicates that the ground in the general vicinity of the suspected landfill appears disturbed. Based on review of the above data, the extent of the landfill has been estimated (see Figure 2-3).

Based on the activities that occurred at the Ammunition Renovation/Primer Destruction Site and the Howitzer Test Facility and from direction provided by DTSC, the following potential substances of interest may have affected the soils and groundwater (if present) near the North Valley Military Landfill:

- Solvents may be present from the cleaning and general maintenance activities associated with the facility
- Polyaromatic hydrocarbons (PAHs), dioxins, and furans from the burning of primers
- Diesel, motor oil, polychorinated biphenyls (PCBs), and total petroleum hydrocarbon from any vehicles parked at the facility or used for heating
- Kerosene from the Primer Destruction Facility used to fuel the oil burners



Previous Sample Locations
North Valley
Tourtelot Cleanup Project

Figure 2-3

Stockpile # 1

Stockpile # 2

TNT STRIP # 4

TNT STRIP # 2

TNT STRIP # 1

Structures associated with Ammunition Renovation/Primer Destruction Site identified from aerial photographs

Ammunition Renovation/ Primer Destruction Site

Building 183 Powder Room

Stockpile # 3

Building 182 Howitzer Test Firing Butts

NORTH VALLEY

North Valley Military Landfill

Buildings 540, 542

Howitzer Test Facility

Building 181 Howitzer Test Tunnels

225

200

175

250

125

INDEX MAP

TOURTELOT PROPERTY

EXPLANATION

- Areas of Interest
- Buildings
- Approximate Trench Locations
- Vertical Magnetic Gradient Data
- Property Boundary
- Area Geophysically Mapped

N

Scale: 1" = 100'

100 0 100 Feet

Vertical Magnetic Gradient Data
North Valley
Tourtelot Cleanup Project

Figure 2-4

- Metals from activities at the Howitzer Test Facility involving ammunition rounds
- Explosives from the primers either burned at the facility or mishandled during ammunition renovation activities
- Nitrogen from the black powder used as propellant for the howitzer rounds
- Chloropicrin from the possible presence of chemical warfare materials (CWMs)
- Pesticides from the soil laboratory
- Rocket fuel (perchlorates) associated with Nike Test Cell
- Pentachlorophenol from wood preservatives used on wood crates, pallets, and packing materials.

2.3 PROJECT SITE GEOLOGY

2.3.1 Geomorphic Setting

The Project Site and surrounding area lies within the Coast Ranges Geomorphic Province. The Coast Ranges are a series of north-to-south-oriented mountains extending from the southern limit of the Klamath Mountain block in Oregon to the northern boundary of Santa Barbara County. The Sulphur Springs Mountains begin at Benicia and stretch northwest, forming a ridge that defines the eastern flank of the Napa Valley. Lake Herman is situated along the northwestern boundary of the Project Site at the southern terminus of the Sulphur Springs Mountains. The nearby Carquinez Strait, south of the Project Site, is a submerged canyon cutting through the Coast Ranges formed by the ancestral flow of the Sacramento and San Joaquin River drainages. The strait is a narrow, deep channel cut simultaneously with the uplift and folding of the Coast Ranges. The Carquinez Strait connects the Sacramento and San Joaquin Rivers with the San Francisco Bay. The strait is tidally influenced, and there is a gradual change from seawater in the San Francisco Bay to the west to brackish water in the Sacramento delta to the east.

2.3.2 Regional Geologic Setting

The oldest geologic formation present in the Benicia area is the sedimentary rocks of the Upper Jurassic to Upper Cretaceous Great Valley Sequence. The Great Valley Sequence accumulated in a forearc basin between the Sierran arc and the Mesozoin subduction zone (Harden, 1998). Sediments of the Great Valley Sequence continued to be deposited in the forearc basin in early Cenozoic time. The Great Valley Sequence consists of sandstone, shale, and conglomerate, in a stratified thickness up to approximately 19,000 feet (U.S. Army Corps of Engineers, 1997). The older, lower formations of the Great Valley Sequence

consist of sandstone rich in volcanic rock fragments that eroded from the volcanoes of the Jurassic and early Cretaceous Sierran arc. The younger formations of the Great Valley Sequence consist of sandstones that are rich in feldspar and quartz eroded from the granitic pluton. Fossils and sedimentary features show the western side of the ancestral Great Valley to consist of deeper ocean sediments deposited by turbidity currents. The eastern side of the ancestral Great Valley consists of deltaic and shallow ocean water deposits. The structural basement in this area of the Coast Ranges is characterized by metasedimentary rocks of the Franciscan Formation. The major structural feature of the Benicia area is the Southampton fault, shown on Figure 2-5, and the Concord-Green Valley fault (approximately 2 miles east of the site). These faults are considered to be active. Other active faults in the region include the Calaveras-Franklin (6 miles southwest), the Hayward (12 miles west), the Rogers Creek (18 miles northwest), the Antioch (18 miles southeast), and the San Andreas (30 miles west). There are no known active faults crossing the site (Engeo, 1989).

2.3.3 Site Geology

The Great Valley Sequence (bedrock) underlies the entire Project Site. The bedrock at the site, as observed in several test pits throughout the Project Site (Plate 2), is weathered and fractured and consists mostly of claystone with various interbedded deposits of sandstone and siltstone. Bedding units generally strike to the northwest and dip to the south. However, bedding strike-and-dip near faults varies.

There are numerous faults mapped within Benicia, including four on or adjacent to the site. There is no evidence that these four faults are active or potentially active. Engeo located several exploratory trenches across these faults and observed bedrock faulting. However, none of the faults observed appeared fresh, contained preserved slickensides, or offset the uppermost soils.

Quaternary alluvium is present in the bottom of the North Valley. The total thickness of the alluvium in this valley is uncertain but may be as deep as 30 feet or more. Various amounts of colluvium blanket the slopes of the hills. The colluvium is generally a silty or sandy clay and ranges in thickness from a few feet to over 12 feet in thickness.

Shallow, seated slides are common throughout the Benicia area. Several slides were observed and mapped along the slopes of the North Valley by Engeo during their preliminary soils investigation. The location of any remaining slides and mitigated landslides are shown on Plate 2 (specific details shown on Figures 2-6, 2-7, 2-8, 2-9, 2-10, and 2-11). Minor amounts of stockpiled fill are also present in the North Valley.

The soils encountered in borings and test pits on the Tourtelot Cleanup Project Site were found to consist mostly of brown to dark brown silty and sandy clays. Depth

of soil deposition varies from a few feet on hillsides to in excess of 20 feet in the major swales.

2.3.4 Hydrology and Hydrogeology

There is a small area at the east end of the North Valley that remains wet seasonally and is recharged by springs on the hillside above. No other surface water is present in the North Valley. Surface water from the site flows down to the Sulphur Springs Creek Canal and generally runs from north to south through the industrial park in Benicia, and eventually exits into the Carquinez Strait near the Benicia-Martinez bridge.

The location, quality, and quantity of groundwater beneath the Project Site and surrounding area are not well known. In 1872, a well was drilled in the southern portion of the arsenal. Groundwater in this well was first encountered at a depth of 960 feet. The water in this well contained organic matter and was determined to be unfit for human consumption. The well was blocked off to a depth of 960 feet using cement, sand, and grain sacks (Cowell, 1963). Since this time, several monitoring wells have been installed at the Former Benicia Arsenal by private parties for the purposes of environmental investigation. The wells have indicated water-bearing strata at shallower depths.

In 1988/1989, during the process of conducting a soils exploration, Engeo drilled 22 borings and encountered groundwater in three of the borings. Two of the borings with groundwater were in the South Valley (see Plate 2). Two borings, B-17 and B-18, were situated in the bottom of the North Valley. Boring B-18 (see Plate 2) encountered groundwater at approximately 21 feet bgs (total depth of boring). Weathered bedrock was encountered at approximately 8 feet bgs in this boring. Boring B-17 was situated at the east end of the North Valley. The boring was advanced to approximately 25 feet bgs, with weathered bedrock encountered at approximately 8 feet bgs. Groundwater was not encountered in this boring. However, the alluvial/colluvial soils in the boring are reported as being wet. Two additional borings were placed in the North Valley by Engeo. These borings were approximately 20 to 25 feet above the valley floor, with no reports of encountered groundwater.

Shallow groundwater recharge at the Project Site is via precipitation. Once at the ground surface, precipitation will naturally take the flow path of least resistance. Given the topography and geologic conditions at the Project Site, the preferential flow path on the valley slopes is via surface runoff from the topographic highs (ridges) toward the topographic lows (valleys). Therefore, much of the precipitation flows via the surface toward, and accumulates in, the floor of the North Valley. Once the precipitation has flowed to the lowest point, preferential infiltration into the valley alluvium and underlying weathered bedrock zone will occur. Given the low permeability of the alluvium and weathered bedrock materials (typically clay to silty clay), groundwater flow within the alluvium and weathered bedrock is anticipated to be relatively slow. If groundwater movement within the alluvium/weathered bedrock is slow and sufficient water accumulates in the valley

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Scale: 1" = 150'

Summary of Ordnance Data

Removal Action Work Plan
Tourtelot Cleanup Project
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See City Attorney's Office for Full Size
707-746-4216

Scale: 1" = 250'

Plate 2

Geologic Map

Removal Action Work Plan
Tourtelot Cleanup Project

April 26, 2000

floors (via either subsurface runoff or subsurface groundwater migration), and downward infiltration beyond the weathered bedrock zone into the underlying competent bedrock is limited, wetlands will be created, as observed in the South Valley, and to a lesser extent, in the North Valley.

Currently, groundwater is being investigated and is not expected in the area at the depths proposed for trenching in the North Valley Military Landfill.

According to the Groundwater Basin Plan (Regional Water Quality Control Board, 1995), the shallow groundwater beneath the Project Site is considered a potential source of drinking water; however, it is not actually expected ever to be used for drinking water purposes because of the overall quality, which is considered brackish. The majority of drinking water for the City of Benicia is currently obtained from the Sacramento River via the North Bay Aqueduct. Approximately 10 percent of the City's water is obtained from Lake Herman.

2.3.5 Historical Aerial Photograph Analysis

Available historical aerial photographs were reviewed to identify areas of disturbance within the Project Site. A total of 39 photographs comprising 17 vintages or sets of photographs including stereoscopic pairs were reviewed with a stereoscope equipped with 10-power magnifying binoculars. The aerial photographs reviewed were taken between 1937 and 1997. These aerial photos are available for public review at the Benicia Library. The following sections present the results of this review.

2.3.5.1 North Valley (Howitzer Test Facility and Ammunition Renovation/Primer Destruction Site).

This area includes Buildings 181, 182, 183, 540, 542, and the North Valley Military Landfill, all of which become clearly visible in the 1947 aerial photograph, except for Building 181, which is first seen in the 1962 aerial photographs. The area south of Building 181, known as the Dynamite Burn Site, shows signs of ground scarring and contains numerous vehicle tracks.

In the 1947 aerial photo just east of the test firing tunnel is an area of discoloration suspected to be associated with the North Valley Military Landfill. The 1952 aerial photograph shows Buildings 182 and 183, and the roads leading to this area are clearly visible. In the 1952 aerial photograph, the area of discoloration just east of the Howitzer Facility Area, situated northeast of the test firing tunnel area, is larger than in the 1947 photograph. While the aerial photo coverage of this area is limited, a small portion of discolored soil is visible. Specific "activities" are not discernable. The 1960 aerial photograph shows extensive grading activity and discoloration of numerous pits in the vicinity of the Howitzer Test Facility and Ammunition Renovation Area/Primer Destruction Site as well as ground disturbance activities surrounding Buildings 540 and 542, and the North Valley Military Landfill. The top of the test firing tunnel has been covered with soil, possibly from the hillside to the southeast. No earth-moving equipment or notable

activities were noted. Minimal ground disturbance can be seen in the 1962 and 1973 aerial photographs. In the 1962 aerial photograph, the area shows signs of vegetation regrowth, and a faint outline of the discolored area is slightly visible. The 1983 aerial photograph indicates substantial grading noted within the Ammunition Renovation Area/Primer Destruction Site and the area of the North Valley Military Landfill. The 1988, 1989, and May 1990 aerial photographs indicate that there are no major changes to this area. In the September 1990 aerial photograph, grading activities have obscured visual evidence of several structures and features previously observed in this area. By 1991, the aerial photograph shows numerous roads and grading activities around the Howitzer Test Facility. The 1993, 1996, and 1997 aerial photographs show extensive grading to this area. By 1997, the Ammunition Renovation/Primer Destruction Site is totally gone.

2.4 CONCEPTUAL SITE MODEL

This section presents the Conceptual Site Model for the North Valley Military Landfill. This information, coupled with the results of past investigations, can be used to assess whether any additional information is necessary to adequately define the extent of contamination at the site.

Substances of interest have been detected during previous sampling events; potential substances of interest are those substances likely to be associated with the types of past activities being conducted at the North Valley Military Landfill as detailed in Section 2.2.

The groundwater conditions within the project area are currently being evaluated.

2.4.1 North Valley Military Landfill

The North Valley Military Landfill is situated near the center of the North Valley, where the natural topography has been graded to accommodate both the Howitzer Test Facility and the adjacent Ammunition Renovation/Primer Destruction Site (see Figure 2-3). The North Valley Military Landfill is closely associated with the Howitzer Test Facility and Ammunition Renovation/Primer Destruction Site, which suggests the substances to be investigated. Based on the limited information available, it is assumed that the majority of the debris in the landfill will be wood crates, pallets, and other packing material. Some inert OE items such as 155mm howitzer rounds could be expected. Based on historical photograph review, there were no deep, incised areas in the North Valley. Also, debris initially encountered as part of the site preparation activities was found at a relatively shallow depth (less than 5 feet). Therefore, it is likely that the total depth of material buried in the area should be relatively shallow (less than 5 feet bgs). Based on the geophysical data available and historical aerial photos, the landfill is approximately 125 feet wide (east-west) and 300 feet long (northeast-southwest). The underlying geology and hydrogeologic conditions would be identical to those of the Howitzer Test Facility.

The North Valley Military Landfill may be underlain by artificial fill (associated with test pads/tunnels of the Howitzer Test Facility), then a brown to dark brown clay that grades into a brown to brown-gray claystone that weathers to a silty clay (weathered bedrock zone). Beneath the weathered bedrock zone is more competent bedrock that consists predominantly of claystone.

Potential Substances of Interest

Based on previous preliminary, unvalidated sample results and/or at DTSC direction, the following compounds remain potential substances of interest associated with the North Valley Military Landfill: explosives (including nitroglycerin and pentaerythritol tetranitrate [PETN]), PAHs, as well as heavy fuels (diesel, kerosene, motor oil), volatile organic compounds (VOCs), nitrate/nitrite, organochlorine pesticides, perchlorates, dioxins, furans, pentachlorophenol, PCBs, total petroleum hydrocarbon, and chloropicrin.

Potential Pathways

The following potential transport pathways have been identified for North Valley Military Landfill:

- Precipitation infiltration into subsurface soils
- Precipitation runoff from the stockpiled soils.

With the exception of the VOCs, most of the potential substances of interest are very persistent in soils. Heavy fuels, PAHs, and metals all tend to be immobile. Explosives tend to be somewhat mobile (as discussed in Section 1.6.1 of the Non-OE RI/FS Work Plan) but relatively insoluble, while solvents are considered to be mostly readily soluble and highly mobile.

Activities at the North Valley Military Landfill may, therefore, have affected the subsurface soils. Since the North Valley generally slopes to the east, it is likely that the underlying bedrock, where groundwater (if present) would likely be encountered, would also slope to the east. Therefore, any affected groundwater would predominantly migrate to the east down the North Valley.

Potential Additional Investigations

Based on the North Valley Military Landfill Conceptual Site Model, additional information is needed to evaluate whether substances of interest occur in the subsurface soil/weathered bedrock and shallow groundwater as a result of the activities conducted at the Howitzer Test Facility.

2.5 DATA QUALITY OBJECTIVES

The primary function of field sampling and measurement is to generate data of quantity and quality sufficient to support project decision making. To achieve this goal, Data Quality Objectives (DQOs) have been developed for this project to

determine the type, quantity, and quality of project data that need to be collected. The DQO development process is described in the EPA guidance documents entitled *Guidance for the Data Quality Objectives Process* (EPA QA/G-4 Final, September 1994) and *Data Quality Objectives Process for Superfund: Interim Final Guidance* (EPA/540/G-93/071, September 1993). DQOs are qualitative and quantitative statements developed by data users to specify the quality and quantity of data from field and laboratory data generation activities required to support project decision making or regulatory actions, while minimizing data collection expenditures by defining data requirements and acceptable levels of decision errors during the planning stage of projects. The DQO process provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when and where to collect samples, the tolerable level of decision errors for the study, and how many samples to collect. The final product of the DQO process is a data collection design that meets the quantitative and qualitative needs of the study.

To evaluate the data using the DQO process, it is necessary to have first established decision quality criteria using the DQO process or its equivalent. DQOs for environmental assessment are included in the following section. DQOs for field record and analytical data QA/QC are included in the Non-OE RI/FS Quality Assurance Project Plan (QAPP).

The Seven-Step DQO Process

The following DQO process discussion is related to the non-OE characterization of the North Valley Military Landfill. DQOs, as they relate to the collection and evaluation of geophysical data to detect OE or OE scrap, are discussed in Chapter 5.0 of this RAW. Since the purpose of actions described in this RAW is the non-OE characterization of the subject site and the removal of OE only to facilitate non-OE sampling, DQOs for OE other than detection are not required.

The DQO process involves the following seven steps:

1. Problem Statement Summarize the problem that requires environmental data acquisition and identify the resources available to resolve the problem.

2. Decision Identification Identify the decision that requires acquisition of environmental data to address the problem. Identify the intended uses of the data projected to be acquired.

3. Identification of Decision Input Identify the information needed to support the decision and specify the inputs requiring environmental measurements.

4. Definition of Study Boundaries Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision.

5. Decision Rule Develop a logical statement that defines the conditions that would cause the decision-maker to choose among alternative actions.

6. Limits of Decision Error Specify the decision-maker's acceptable limits on decision errors, which are used to establish appropriate performance goals for limiting uncertainty in environmental data.

7. Optimization of the Data Collection Design Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy project DQOs.

Problem Statement. Previous investigations and site history suggest that substances from previous site activities may have affected the soil and groundwater at the North Valley Military Landfill. The presence or absence of these substances needs to be evaluated. If these substances are present, the lateral and vertical extent, concentration, toxicity, and treatment alternatives will need to be evaluated. The following substances at elevated concentrations may be present at the North Valley Military Landfill: TNT and PAHs, as wells as arsenic and iron, have been detected in areas adjacent to the landfill. Although not encountered to date in the area, OE is potentially present.

The previous investigations do not provide sufficient data to fully define the lateral and vertical extent of the elevated constituents at this site, nor do they provide sufficient data to determine if these substances have affected nearby groundwater and sediments.

Decision Identification. The goal is to determine the vertical and lateral extent of elevated constituents in soil at the North Valley Military Landfill at a confidence level of 95 percent. To achieve this goal, the acquisition of additional soil data is necessary at the site.

As noted in Section 2.3.4, groundwater is not present at shallow depths beneath the sites. The quality of the groundwater at the site is being evaluated under the Non-OE RI/FS site investigation. The results of the investigation, as well as the results from the investigation described in this RAW, will be presented in a single RI report.

For the non-OE RI/FS site investigation, data is being collected to determine site background levels for metals. If metals are present above background levels, they will be evaluated for future remediation.

Although not known to be associated with past Project Site uses, dioxins/furans have been detected at the Project Site. Additional sampling and evaluation will be proposed to determine background levels of dioxins/furans.

Identification of Decision Input. Decision-making inputs will include historical and chemical data collected at each site and action levels defined as the EPA

Region IX background metals concentrations or background dioxins/furans concentrations (to be determined).

Chemical data will include the results from the previous investigations and new data collections proposed in this Work Plan. The scope of the planned data acquisition is presented in Chapter 8.0, which provides the rationale for the proposed sampling and laboratory method of measurement for each matrix at the North Valley Military Landfill.

The action levels are based on residential land use regulatory thresholds or background concentrations to be determined. The background metals and dioxins/furans concentrations will be established using previous environmental investigation results from on-site and off-site locations (within the City of Benicia and within Solano County), and data collections proposed in this RAW.

Definition of Study Boundaries. This RAW addresses only the chemical concentrations and OE along transects to be trenched at the North Valley Military Landfill. Information regarding OE at the site is included in the *Engineering Evaluation/Cost Analysis, Former Benicia Arsenal, Benicia, California* (Earth Tech, 1999), and in the Administrative Draft OE Work Plan, submitted on December 15, 1999. Study boundaries have been defined by the review of available records (including historical aerial photos) to include potentially affected portions of adjoining properties. The lateral extent of the North Valley Military Landfill is based on review of historical records, photographs, geography of the valley, topography, and soil sampling data.

During previous investigations, soil samples were collected to a maximum depth of approximately 30 feet bgs. Soil contamination has been identified at shallow soil depths, generally at surface to approximately 2 feet bgs. Additional soil data will be collected to determine the lateral and vertical extent of contaminant of concern detections above the action levels at each site.

The sampling results will not vary with weather conditions because they will be reported on a dry weight basis. Certain features, such as seeps/springs and surface water, can be sampled only following precipitation events.

Decision Rule. The sampling data (validated to a confidence level of 95 percent) will be considered definitive for constituent extent determinations for each site. The decision rule for each site is, "If the constituent concentrations are greater than background for metals or dioxins/furans, then the site soil/groundwater/ surface water will be remediated."

Some analytical detection limits are recognized to be above the established decision thresholds. In these cases, if other data (e.g., previous detection, historical usage, known degradation byproducts of confirmed releases) suggest the presence of those analytes, the analyses will be performed using the best

available technology. If the practical quantitation limit (PQL) for such an analyte exceeds the established decision threshold, the method detection limit (MDL) will be used (see Section 3.2.4.2 of the Quality Assurance Project Plan [Appendix H] for definitions). If the MDL exceeds the established decision threshold, the default decision threshold will be the laboratory-reported MDL below which the analyte is assumed not to be present. If multiple laboratories are used, MDLs for each laboratory will be evaluated with regard to decision thresholds. Table 2-1 compares the PQLs (and MDLs where the PQLs exceed the action levels) and action levels for each contaminant of concern.

The traditional approach for establishing background concentrations is to compare analytical results for samples collected from background locations outside of the study areas. It is assumed at this time that background concentrations will be established for arsenic, iron, and dioxins/furans. The action levels for the other metals will be established based on background levels.

A statistical approach for estimating the background concentrations is proposed based primarily on EPA-suggested methods as described in *Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites* (U.S. Environmental Protection Agency, 1995). In this approach, the inorganic data collected at the Project Site, and surrounding sites where data meet the DQOs of this Work Plan, are pooled, and potentially affected data points are removed using historical use data; samples that tested positive for organic compounds are censored. The data is also statistically analyzed to exclude potentially contaminated data points, or outliers, and to establish upper tolerance levels to compare to data collected from the sites. The use of a pooled data set has two advantages:

- A far greater data set can be used for calculation of background concentrations
- Background samples are collected from the same geologic regimes as environmental samples.

The upper tolerance limits established will be used as a preliminary screening tool for the analysis of metals and dioxins/furans results at the Project Site.

Statistical procedures modified from those outlined by the U.S. EPA (1995) will be applied to the pooled sample results in order to establish background concentrations for metals and dioxins/furans as follows:

- Calculate proportion of nondetects
- Analyze data distribution
- Identify potentially affected sites

- Establish the 95th quantile on nonnormal distributed data and analytes with a large proportion of nondetects.

Limits of Decision Error. The tolerance for decision errors would be least when the chemical data erroneously indicate that the site contaminants do not exceed the action levels, resulting in a potential hazard to public health. This type of false positive error ("Type I") should be less than 5 percent and should approach 0 percent for each analyte.

The tolerance for decision errors would be somewhat higher when the chemical data erroneously indicate the site contaminants do exceed the action levels, resulting in unnecessary remediation expenditure. This type of false negative error ("Type II") should be less than 10 percent for each analyte.

Optimization of the Data Collection Design. A judgment-based sampling program has been developed for each site based on existing data collection results and the conceptual site models. In general, the selected additional data points target expected maximum concentration locations where no data exists, and additional upgradient, downgradient, and crossgradient locations for the determination of lateral and vertical extent.

Table 2-2 summarizes the proposed quantities of samples, the sample matrices, the contaminants of concern and measurement methods, and the rationale for the sampling program at each site.

The protocols and procedures described in the following chapters have been developed to provide representative soil, groundwater, and surface water sample collection and analysis consistent with the qualitative and quantitative needs of this study.

Table 2-1. Action Level Reference Guidance
(Page 1 of 8)

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations PRG	Reference Concentrations Background	Action Level
SOIL						
Metals						
Aluminum	SW6010B	mg/kg	40	76,000	TBD	Background
Antimony	SW6010B	mg/kg	3.0	31	TBD	Background
Arsenic	SW6010B	mg/kg	0.8 / 0.28	0.39	TBD	Background
Barium	SW6010B	mg/kg	1.0	5,400	TBD	Background
Beryllium	SW6010B	mg/kg	0.4	150	TBD	Background
Cadmium	SW6010B	mg/kg	1.0	9.0	TBD	Background
Calcium	SW6010B	mg/kg	200	--	TBD	TBD
Chromium, Total	SW6010B	mg/kg	2.0	210	TBD	Background
Cobalt	SW6010B	mg/kg	2.0	4,700	TBD	Background
Copper	SW6010B	mg/kg	3.0	2,900	TBD	Background
Iron	SW6010B	mg/kg	15	23,000	TBD	Background
Lead	SW6010B	mg/kg	0.6	400	TBD	Background
Magnesium	SW6010B	mg/kg	100	--	TBD	TBD
Manganese	SW6010B	mg/kg	1.0	1,800	TBD	Background
Mercury	SW7471A	mg/kg	0.1	23	TBD	Background
Molybdenum	SW6010B	mg/kg	4.0	390	TBD	Background
Nickel	SW6010B	mg/kg	4.0	150	TBD	Background
Potassium	SW6010B	mg/kg	200	--	TBD	TBD
Selenium	SW6010B	mg/kg	2.0	390	TBD	Background
Silver	SW6010B	mg/kg	2.0	390	TBD	Background
Sodium	SW6010B	mg/kg	200	--	TBD	TBD
Thallium	SW6010B	mg/kg	2.0	--	TBD	TBD
Vanadium	SW6010B	mg/kg	5.0	550	TBD	Background
Zinc	SW6010B	mg/kg	4.0	23,000	TBD	Background

Table 2-1. Action Level Reference Guidance
(Page 2 of 8)

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations PRG	Reference Concentrations Background	Action Level
PAHs						
Acenaphthene	SW8270	mg/kg	1	3,700	TBD	TBD
Acenaphthylene	SW8270	mg/kg	1	--	TBD	TBD
Anthracene	SW8270	mg/kg	1	22,000	TBD	TBD
Benzo(a)anthracene	SW8270	mg/kg	1 / [c]	0.62	TBD	TBD
Benzo(a)pyrene	SW8270	mg/kg	1 / [c]	0.062	TBD	TBD
Benzo(b)fluoranthene	SW8270	mg/kg	1 / [c]	0.62	TBD	TBD
Benzo(g,h,i)perylene	SW8270	mg/kg	1	--	TBD	TBD
Benzo(k)fluoranthene	SW8270	mg/kg	1 / [c]	0.61	TBD	TBD
Chrysene	SW8270	mg/kg	1	6.1	TBD	TBD
Dibenzo(a,h)anthracene	SW8270	mg/kg	1	0.062	TBD	TBD
Fluoranthene	SW8270	mg/kg	1	2,300	TBD	TBD
Fluorene	SW8270	mg/kg	1	2,600	TBD	TBD
Indeno(1,2,3-c,d)pyrene	SW8270	mg/kg	1 / [c]	0.62	TBD	TBD
Naphthalene	SW8270	mg/kg	1	56	TBD	TBD
Phenanthrene	SW8270	mg/kg	1	--	TBD	TBD
Pyrene	SW8270	mg/kg	1	2,300	TBD	TBD
Acenaphthene	SW8310	mg/kg	0.4	3,700	TBD	TBD
Acenaphthylene	SW8310	mg/kg	0.4	–	TBD	TBD
Anthracene	SW8310	mg/kg	0.14	22,000	TBD	TBD
Benzo(a)anthracene	SW8310	mg/kg	0.02	0.62	TBD	TBD
Benzo(a)pyrene	SW8310	mg/kg	0.02	0.062	TBD	TBD
Benzo(b)fluoranthene	SW8310	mg/kg	0.03	0.62	TBD	TBD
Benzo(g,h,i)perylene	SW8310	mg/kg	0.02	–	TBD	TBD
Benzo(k)fluoranthene	SW8310	mg/kg	0.02	0.61	TBD	TBD
Chrysene	SW8310	mg/kg	0.04	6.10	TBD	TBD
Dibenzo(a,h)anthracene	SW8310	mg/kg	0.04	0.062	TBD	TBD
Fluoranthene	SW8310	mg/kg	0.05	2,300	TBD	TBD
Fluorene	SW8310	mg/kg	0.04	2,600	TBD	TBD
Indeno(1,2,3-c,d)pyrene	SW8310	mg/kg	0.04	0.62	TBD	TBD
Naphthalene	SW8310	mg/kg	0.4	56	TBD	TBD
Phenanthrene	SW8310	mg/kg	0.12	–	TBD	TBD
Pyrene	SW8310	mg/kg	0.06	2,300	TBD	TBD

Table 2-1. Action Level Reference Guidance

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations		Action Level
				PRG	Background	
Dioxins/Furans						
Heptachlorinated dibenzo-p-dioxins, Total	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	SW8290	mg/kg	5.0e-06	--	TBD	TBD
Heptachlorinated dibenzofurans, Total	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,4,6,7,8-Heptachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,4,7,8,9-Heptachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
Hexachlorinated dibenzo-p-dioxins, Total	SW8290	mg/kg	5.0e-06	7.8e-05	TBD	TBD
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	SW8290	mg/kg	5.0e-06	--	TBD	TBD
Hexachlorinated dibenzofurans, Total	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,4,7,8-Hexachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,6,7,8-Hexachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,7,8,9-Hexachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
2,3,4,6,7,8-Hexachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
Octachlorodibenzo-p-dioxin	SW8290	mg/kg	1e-05	--	TBD	TBD
Octachlorodibenzofuran	SW8290	mg/kg	1e-05	--	TBD	TBD
Pentachlorinated dibenzo-p-dioxins, Total	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	SW8290	mg/kg	5.0e-06	--	TBD	TBD
Pentachlorinated dibenzofurans, Total	SW8290	mg/kg	5.0e-06	--	TBD	TBD
1,2,3,7,8-Pentachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
2,3,4,7,8-Pentachlorodibenzofuran	SW8290	mg/kg	5.0e-06	--	TBD	TBD
Tetrachlorinated dibenzo-p-dioxins, Total	SW8290	mg/kg	2.0e-06	--	TBD	TBD
2,3,7,8-Tetrachlorodibenzo-p-dioxin	SW8290	mg/kg	2.0e-06	3.9e-06	TBD	TBD
Tetrachlorinated dibenzofurans, Total	SW8290	mg/kg	2.0e-06	--	TBD	TBD
2,3,7,8-Tetrachlorodibenzofuran	SW8290	mg/kg	2.0e-06	--	TBD	TBD

Table 2-1. Action Level Reference Guidance
(Page 4 of 8)

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations PRG	Reference Concentrations Background	Action Level
Explosives						
2-Amino-4,6-dinitrotoluene	SW8330	mg/kg	0.4	--	TBD	Background
4-Amino-2,6-dinitrotoluene	SW8330	mg/kg	0.4	--	TBD	Background
1,3-Dinitrobenzene	SW8330	mg/kg	0.4	6.1	TBD	Background
2,4-Dinitrotoluene	SW8330	mg/kg	0.4	120	TBD	Background
2,6-Dinitrotoluene	SW8330	mg/kg	0.4	61	TBD	Background
Hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine	SW8330	mg/kg	0.4	--	TBD	Background
Nitrobenzene	SW8330	mg/kg	0.4	20	TBD	Background
Nitroglycerin	SW8330	mg/kg	0.5	35	TBD	Background
2-Nitrotoluene	SW8330	mg/kg	0.4	370	TBD	Background
3-Nitrotoluene	SW8330	mg/kg	0.4	370	TBD	Background
4-Nitrotoluene	SW8330	mg/kg	0.4	370	TBD	Background
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	Sw8330	mg/kg	0.4	3,100	TBD	Background
Pentaerythritol tetranitrate	SW8330	mg/kg	0.5 or 1.0[b]	--	TBD	Background
Tetryl	SW8330	mg/kg	0.4	610	TBD	Background
1,3,5-Trinitrobenzene	SW8330	mg/kg	0.4	1,800	TBD	Background
2,4,6-Trinitrotoluene	SW8330	mg/kg	0.4	16	TBD	Background
VOCs						
Acetone	SW8260	mg/kg	0.020	1600	TBD	TBD
Benzene	SW8260	mg/kg	0.005	0.67	TBD	TBD
Bromobenzene	SW8260	mg/kg	0.005	28	TBD	TBD
Bromochloromethane	SW8260	mg/kg	0.005	--	TBD	TBD
Bromodichloromethane	SW8260	mg/kg	0.005	1.0	TBD	TBD
Bromoform	SW8260	mg/kg	0.005	62	TBD	TBD
Bromomethane	SW8260	mg/kg	0.010	3.9	TBD	TBD
2-Butanone	SW8260	mg/kg	0.020	7,300	TBD	TBD
n-Butylbenzene	SW8260	mg/kg	0.005	140	TBD	TBD
sec-Butylbenzene	SW8260	mg/kg	0.005	110	TBD	TBD
tert-Butylbenzene	SW8260	mg/kg	0.005	130	TBD	TBD
Carbon Disulfide	SW8260	mg/kg	0.005	360	TBD	TBD
Carbon Tetrachloride	SW8260	mg/kg	0.005	0.24	TBD	TBD
Chlorobenzene	SW8260	mg/kg	0.005	150	TBD	TBD

Table 2-1. Action Level Reference Guidance
(Page 5 of 8)

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations		Action Level
				PRG	Background	
Chloroethane	SW8260	mg/kg	0.010	3.0	TBD	TBD
2-Chloroethyl vinyl ether	SW8260	mg/kg	0.005	--	TBD	TBD
Chloroform	SW8260	mg/kg	0.005	0.24	TBD	TBD
Chloromethane	SW8260	mg/kg	0.010	1.2	TBD	TBD
2-Chlorotoluene	SW8260	mg/kg	0.005	--	TBD	TBD
4-Chlorotoluene	SW8260	mg/kg	0.005	--	TBD	TBD
Dibromochloromethane	SW8260	mg/kg	0.005	1.1	TBD	TBD
1,2,-Dibromo-3-chloropropane	SW8260	mg/kg	0.010	0.062	TBD	TBD
1,2-Dibromoethane	SW8260	mg/kg	0.005	0.0069	TBD	TBD
Dibromomethane	SW8260	mg/kg	0.005	--	TBD	TBD
1,2-Dichlorobenzene	SW8260	mg/kg	0.005	370	TBD	TBD
1,3-Dichlorobenzene	SW8260	mg/kg	0.005	130	TBD	TBD
1,4-Dichlorobenzene	SW8260	mg/kg	0.005	3.4	TBD	TBD
Dichlorodifluoromethane	SW8260	mg/kg	0.010	94	TBD	TBD
1,1-Dichloroethane	SW8260	mg/kg	0.005	590	TBD	TBD
1,2-Dichloroethane	SW8260	mg/kg	0.005	0.35	TBD	TBD
1,1-Dichloroethene	SW8260	mg/kg	0.005	0.054	TBD	TBD
cis-1,2-Dichloroethene	SW8260	mg/kg	0.005	43	TBD	TBD
trans-1,2-Dichloroethene	SW8260	mg/kg	0.005	63	TBD	TBD
1,2-Dichloropropane	SW8260	mg/kg	0.005	0.35	TBD	TBD
1,3-Dichloropropane	SW8260	mg/kg	0.005	--	TBD	TBD
2,2-Dichloropropane	SW8260	mg/kg	0.005	--	TBD	TBD
1,1-Dichloropropene	SW8260	mg/kg	0.005	0.082	TBD	TBD
cis-1,3-Dichloropropene	SW8260	mg/kg	0.005	0.082	TBD	TBD
trans-1,3-Dichloropropene	SW8260	mg/kg	0.005	0.082	TBD	TBD
Ethylbenzene	SW8260	mg/kg	0.005	230	TBD	TBD
Hexachlorobutadiene	SW8260	mg/kg	0.005	6.2	TBD	TBD
2-Hexanone	SW8260	mg/kg	0.020	--	TBD	TBD
Isopropylbenzene	SW8260	mg/kg	0.005	160	TBD	TBD
p-Isopropyltoluene	SW8260	mg/kg	0.005	--	TBD	TBD
Methylene chloride	SW8260	mg/kg	0.020	8.9	TBD	TBD
4-Methyl-2-pentanone	SW8260	mg/kg	0.020	790	TBD	TBD
Methyl(tert)butylether	SW8260	mg/kg	0.005	--	TBD	TBD
Naphthalene	SW8260	mg/kg	0.010	56	TBD	TBD

Table 2-1. Action Level Reference Guidance
(Page 6 of 8)

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations PRG	Background	Action Level
n-Propylbenzene	SW8260	mg/kg	0.005	140	TBD	TBD
Styrene	SW8260	mg/kg	0.005	1700	TBD	TBD
1,1,1,2-Tetrachloroethane	SW8260	mg/kg	0.005	3.0	TBD	TBD
1,1,2,2-Tetrachloroethane	SW8260	mg/kg	0.005	0.38	TBD	TBD
Tetrachloroethene	SW8260	mg/kg	0.005	5.7	TBD	TBD
Toluene	SW8260	mg/kg	0.005	520	TBD	TBD
1,2,3-Trichlorobenzene	SW8260	mg/kg	0.005	--	TBD	TBD
1,2,4-Trichlorobenzene	SW8260	mg/kg	0.005	650	TBD	TBD
1,1,1-Trichloroethane	SW8260	mg/kg	0.005	770	TBD	TBD
1,1,2-Trichloroethane	SW8260	mg/kg	0.005	0.84	TBD	TBD
Trichloroethene	SW8260	mg/kg	0.005	2.8	TBD	TBD
Trichlorofluoromethane	SW8260	mg/kg	0.010	390	TBD	TBD
1,2,3-Trichloropropane	SW8260	mg/kg	0.005 / *	0.0014	TBD	TBD
1,1,2-Trichlorotrifluoroethane	SW8260	mg/kg	0.005	5,600	TBD	TBD
1,2,4-Trimethylbenzene	SW8260	mg/kg	0.005	5.7	TBD	TBD
1,3,5-Trimethylbenzene	SW8260	mg/kg	0.005	21	TBD	TBD
Vinyl Acetate	SW8260	mg/kg	0.010	430	TBD	TBD
Vinyl Chloride	SW8260	mg/kg	0.010	0.022	TBD	TBD
m & p-Xylene	SW8260	mg/kg	0.010	210	TBD	TBD
o-Xylene	SW8260	mg/kg	0.005	210	TBD	TBD
Inorganic						
Phosphorus	E365.2	mg/kg	2.0	--	TBD	Background
TEPH						
as Diesel	SW8015M	mg/kg	1.0	--	TBD	TBD
as Kerosene	SW8015M	mg/kg	1.0	--	TBD	TBD
as Motor Oil	SW8015M	mg/kg	1.0	--	TBD	TBD

Table 2-1. Action Level Reference Guidance
(Page 7 of 8)

Parameter	Method	Units	PQL/MDL[a]	Reference Concentrations		Action Level
				PRG	Background	
Common Anions						
Chloride	E300.0	mg/kg	5.0	--	TBD	TBD
Nitrate-N	E300.0	mg/kg	0.5	--	TBD	TBD
Nitrite-N	E300.0	mg/kg	0.5	--	TBD	TBD
Sulfate	E300.0	mg/kg	5.0	--	TBD	TBD
Perchlorate						
Perchlorate	E300.0-Mod	mg/kg	0.5	39	TBD	TBD
Chlorinated Pesticides						
Aldrin	SW8081A	mg/kg	1.7	0.029	TBD	TBD
alpha-BHC	SW8081A	mg/kg	1.7	--	TBD	TBD
beta-BHC	SW8081A	mg/kg	1.7	--	TBD	TBD
delta-BHC	SW8081A	mg/kg	1.7	--	TBD	TBD
gamma-BHC (Lindane)	SW8081A	mg/kg	1.7	--	TBD	TBD
alpha-Chlordane	SW8081A	mg/kg	1.7	--	TBD	TBD
gamma-Chlordane	SW8081A	mg/kg	1.7	--	TBD	TBD
4-4'-DDD	SW8081A	mg/kg	3.4	--	TBD	TBD
4-4'-DDE	SW8081A	mg/kg	3.4	--	TBD	TBD
4-4'-DDT	SW8081A	mg/kg	1.7	--	TBD	TBD
Dieldrin	SW8081A	mg/kg	3.4	0.033	TBD	TBD
Endosulfan I	SW8081A	mg/kg	1.7	--	TBD	TBD
Endosulfan II	SW8081A	mg/kg	3.4	--	TBD	TBD
Endosulfan sulfate	SW8081A	mg/kg	3.4	--	TBD	TBD
Endrin	SW8081A	mg/kg	3.4	18	TBD	TBD
Endrin aldehyde	SW8081A	mg/kg	3.4	--	TBD	TBD
Endrin ketone	SW8081A	mg/kg	3.4	--	TBD	TBD
Heptachlor	SW8081A	mg/kg	1.7	0.11	TBD	TBD
Heptachlor epoxide	SW8081A	mg/kg	1.7	--	TBD	TBD
Methoxychlor	SW8081A	mg/kg	35	310	TBD	TBD
Toxaphene	SW8081A	mg/kg	67	0.44	TBD	TBD

Table 2-1. Action Level Reference Guidance

Notes:
(a) MDL is indicated for use when PQL > action level. If MDL > action level, use laboratory reported MDL below which parameter is assumed not to be present.
(b) 1.0 PQL may be reported for some samples not associated with the TNT Strips.
(c) MDL will be provided for parameter upon final selection of laboratory.

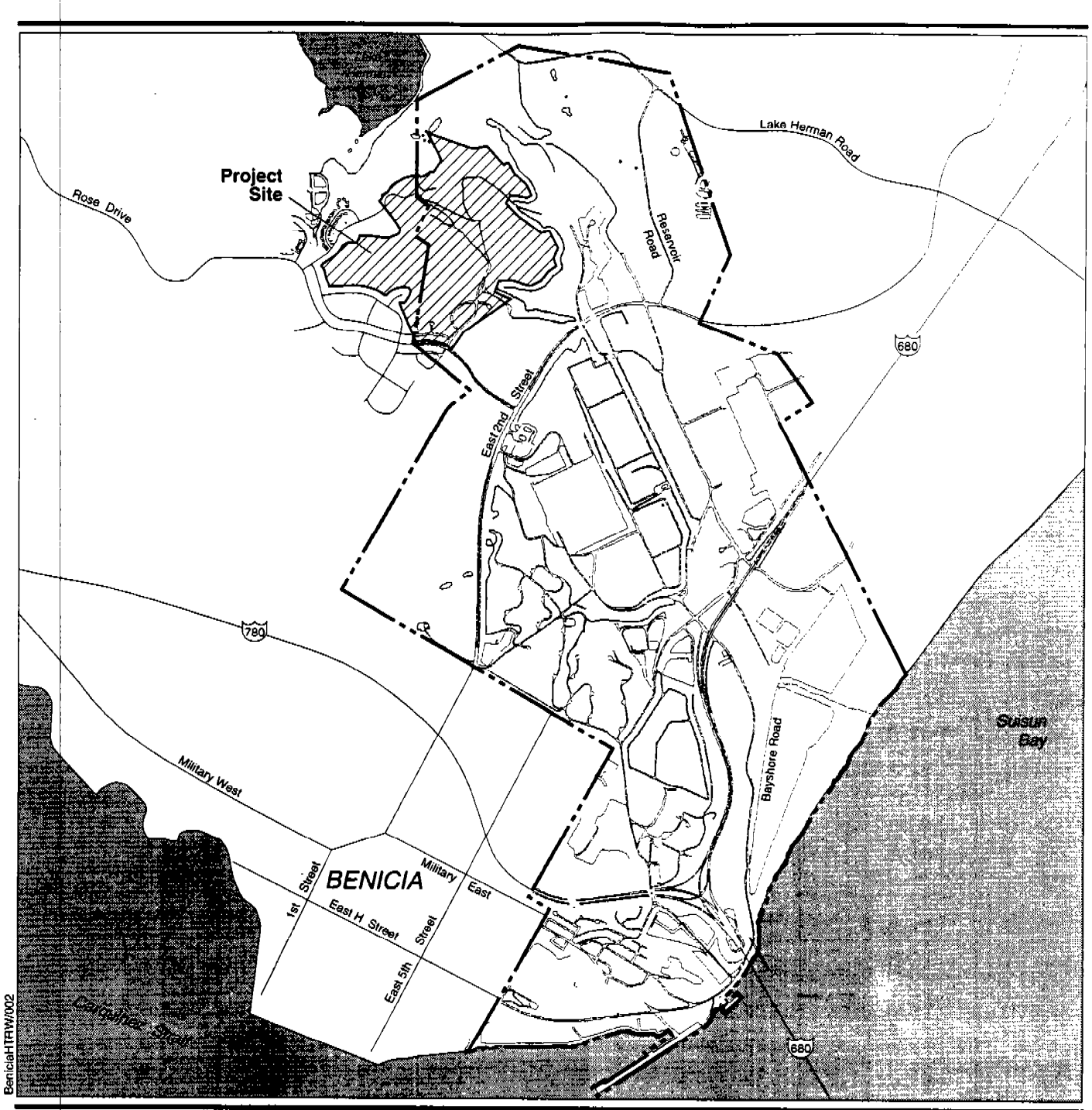
PQL = Practical quantitation limit. Uncorrected laboratory limit is shown; laboratory limit for each soil sample analysis is corrected for moisture.
MDL = Method detection limit. Uncorrected laboratory limit is shown; laboratory limit for each soil sample analysis is corrected for moisture.
PRG = Preliminary Remediation Goals established by United States Environmental Protection Agency (EPA) Region IX (October 1999). Bold PRGs are California Environmental Protection Agency (Cal-EPA) modified values.
-- = No established value (per EPA Region IX PRG table)
TBD = To be determined
mg/kg = Milligrams per kilogram, or parts per million
μg/L = Micrograms per liter, or parts per billion
N/A = Not applicable

California Assessment Manual (CAM) 17 Metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc.
EPA Method SW6010B for metals by inductively coupled plasma (ICP).
EPA Method SW7471A/SW7470A for mercury analysis by cold vapor atomic absorption.
EPA Method SW8081A for chlorinated pesticides.
EPA Method SW8270C for semi-volatile organic compounds (SVOCs).
EPA Method SW8260B for volatile organic compounds (VOCs).
EPA Method SW8310 for polynuclear aromatic hydrocarbons (PAHs).
EPA Method SW8290 for dioxins/furans.
EPA Method SW8330 for explosives.
EPA Method SW8260 for volatile organic compounds (VOCs).
EPA Method E.300.0 for common anions.
EPA Method E.300.0-Modified by California Department of Health Services (CADHS) for perchlorate.
EPA Method E365.2 for total phosphorus.
California Leaking Underground Fuel Tank (LUFT) Modified EPA Method SW8015M for total extractable petroleum hydrocarbons (TEPH).

Table 2-2. Data Collection Rationale

Matrix	Proposed Number and Type of Samples	Parameter and Method	Site-Specific Purpose
Soil	Two trenches across landfill, one northeast-southwest approximately 300 feet long, a second east-west approximately 150 feet long. Each trench will have samples collected at 25-foot intervals. One sample at landfill/soil interface and one at 2 feet below interface. Four additional samples from matrix of landfill. Additional sampling as required based on observations.	• Explosives EPA SW8330 • Nitroglycerin and PETN EPA SW8330 • PAHs EPA SW8310[a] • Metals EPA SW6010B, SW7470A, SW7471A • TEPH-D/MO/K EPA SW8015M • VOCs EPA SW8260B • Pesticides EPA SW8081A • Perchlorate CADHS E300.0-Mod • Nitrate/nitrite as nitrogen EPA 300.0 • Dioxins/Furans EPA SW8290 • Chloropicrin EPA SW8270C • PCBs EPA SW8082	• Determine if contaminants are present. • Delineate lateral and vertical extent of debris in landfill. • Confirm/deny transport of contaminants via infiltration into subsurface soils. • Estimate volume of soil/debris to be remediated based on action levels on Table 2-9 as decision rule criteria.
Previous Investigations:		• No soil samples collected at landfill to date • Landfill periphery encountered during previous investigations • Extent of landfill inferred from geophysical data and historical aerial photographs • Contaminants of interest assumed to be similar to other contaminants suspected for other sites in the North Valley	

Note: (a) EPA Method SW8270C for semi-volatile organic compounds (SVOCs) will be used for the determination of PAHs when severe interference is encountered during analysis of PAHs by SW8310.
EPA Method SW8260B for volatile organic compounds (VOCs).
EPA Method SW8330 for explosives.
EPA Method SW8310 for polyaromatic hydrocarbons (PAHs).
EPA Method SW6010B for metals by inductively coupled plasma (ICP).
EPA Method SW7470A/SW7471A for mercury analysis by cold vapor atomic absorption.
California Leaking Underground Fuel Tank (LUFT) Modified EPA Method SW8015M for total extractable petroleum hydrocarbons (TEPH) as diesel, kerosene and motor oil.
California Assessment Manual (CAM) 17 Metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium and zinc) plus aluminum, calcium, iron, manganese, potassium, and sodium.
Sample results will be reported on a dry weight basis.
All EPA Test Methods will be performed according to the preparation and cleanup methods specified in the QAPP (Appendix J).
See Chapter 10.0 for field sampling program details.
EPA Method 300.0 for nitrate/nitrite as nitrogen.
EPA Method SW8081A for pesticides.
EPA Method SW8082 for polychlorinated biphenyls (PCBs).
EPA Method SW8270C for chloropicrin.
EPA Method SW8290 for dioxins/furans.
California Department of Health Services E300.0 Modified for perchlorate.



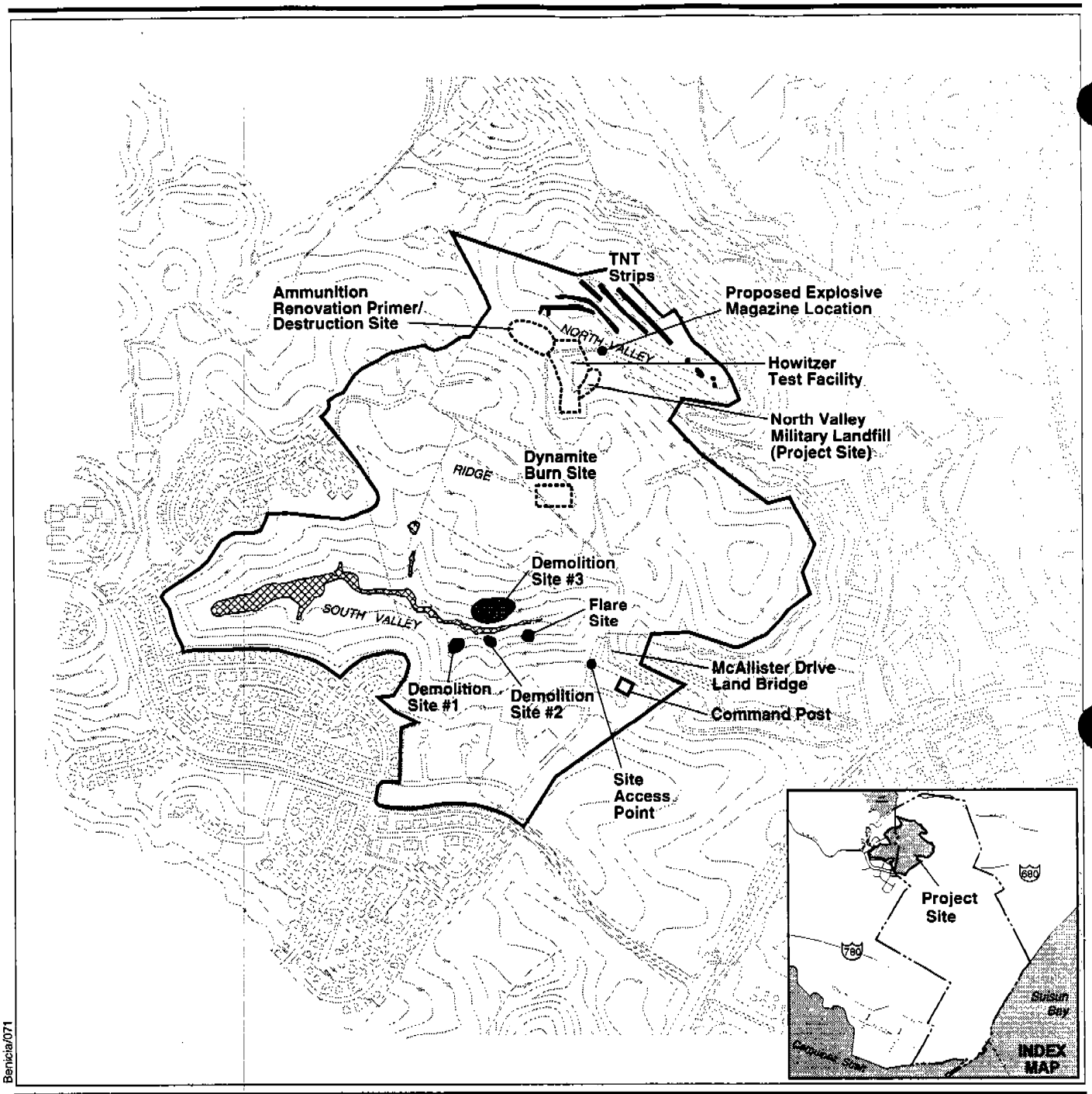
EXPLANATION

- 680 Interstate Highway
- Former Benicia Arsenal Boundary (estimated)
- Project Site

0 .125 .25 .5 Mile

Project Site Location Map

Figure 2-1



Benicia/071

EXPLANATION

Project Site Boundary

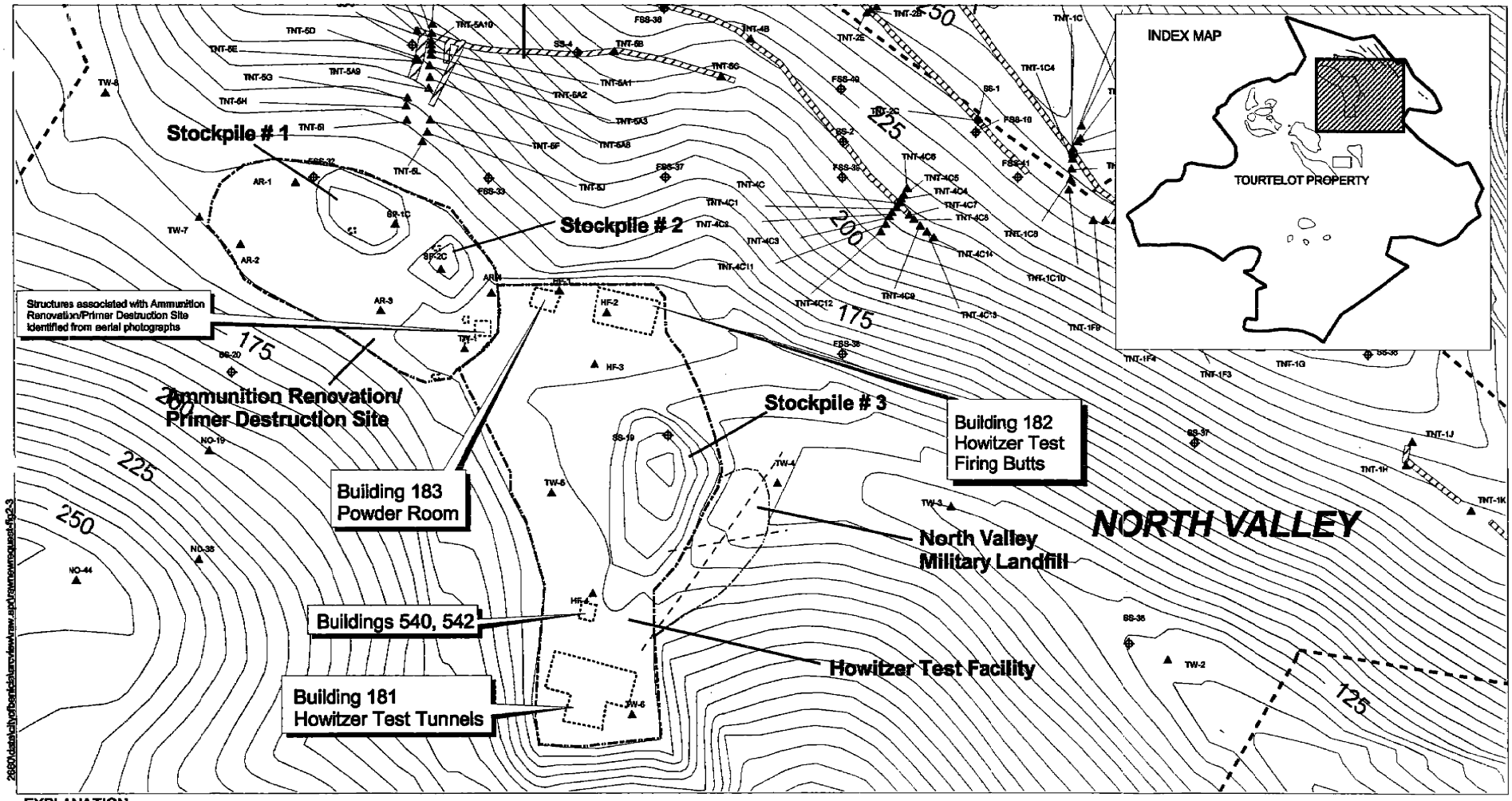
South Valley Wetlands

Project Site Map

0 250 500 1000 Feet

Note: Contour interval equals 25 feet.

Figure 2-2



EXPLANATION

- Secor Sample Location (sample depth data unknown)
- Earth Tech Samples
- Approximate Trench Locations
- Property Boundary
- Areas of Interest
- Buildings

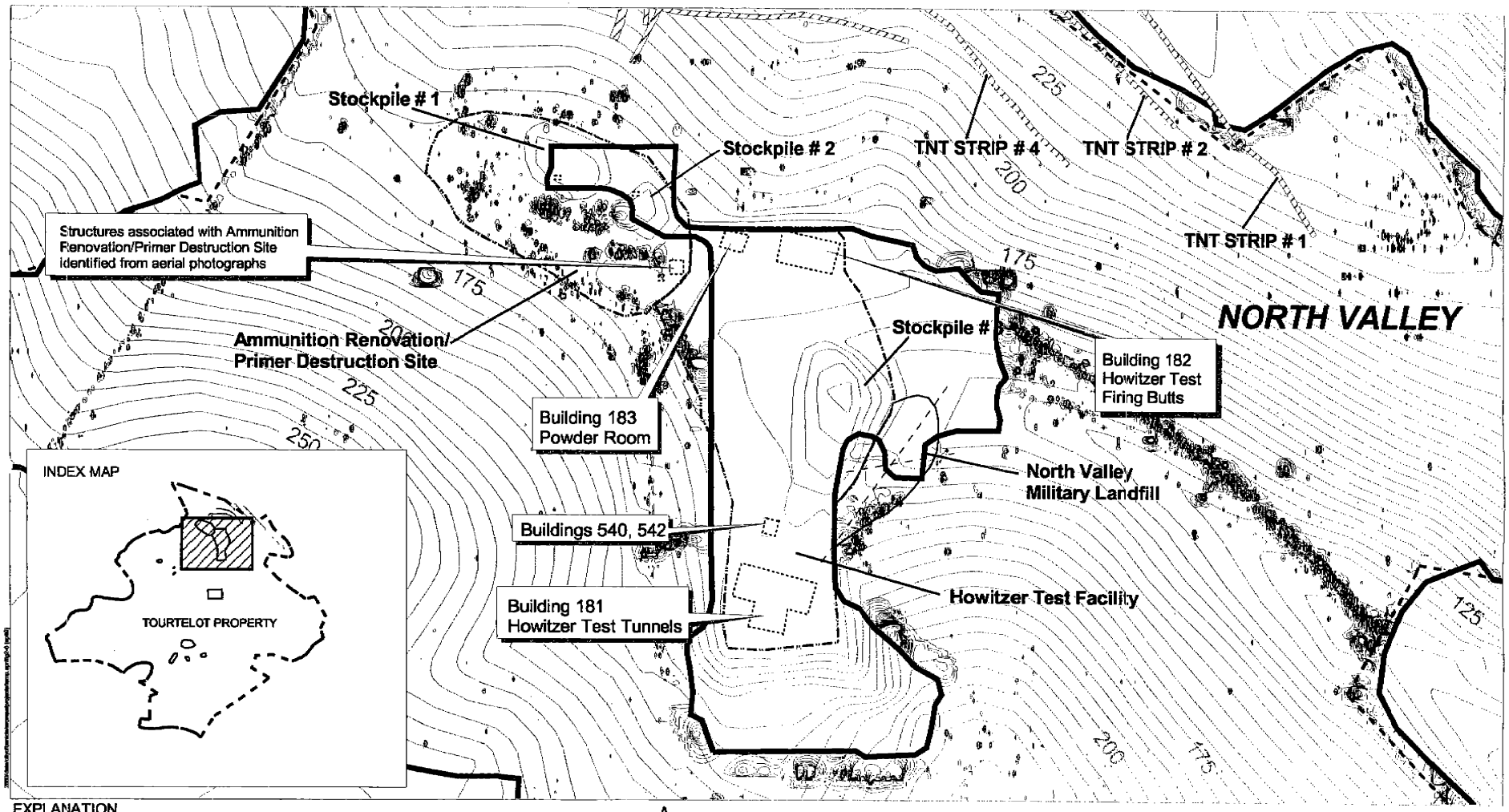
N

Scale: 1" = 100'

100 0 100 Feet

Previous Sample Locations
North Valley
Tourtelot Cleanup Project

Figure 2-3



EXPLANATION

- Areas of Interest
- Buildings
- Approximate Trench Locations
- Vertical Magnetic Gradient Data
- Property Boundary
- Area Geophysically Mapped

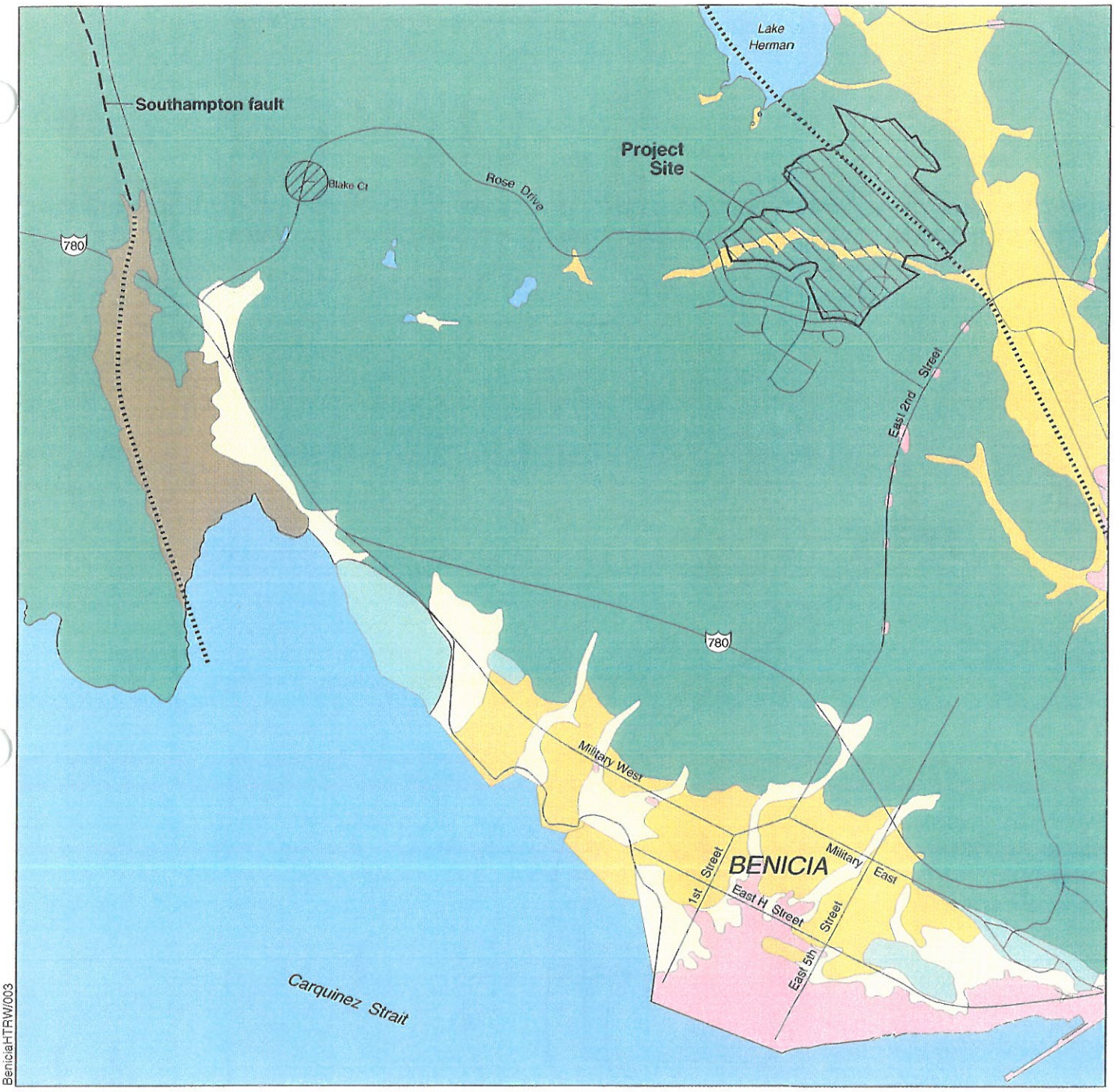
N

Scale: 1" = 100'

100 0 100 Feet

Vertical Magnetic Gradient Data
North Valley
Tourtelot Cleanup Project

Figure 2-4



BeniciaHTRW/003

EXPLANATION

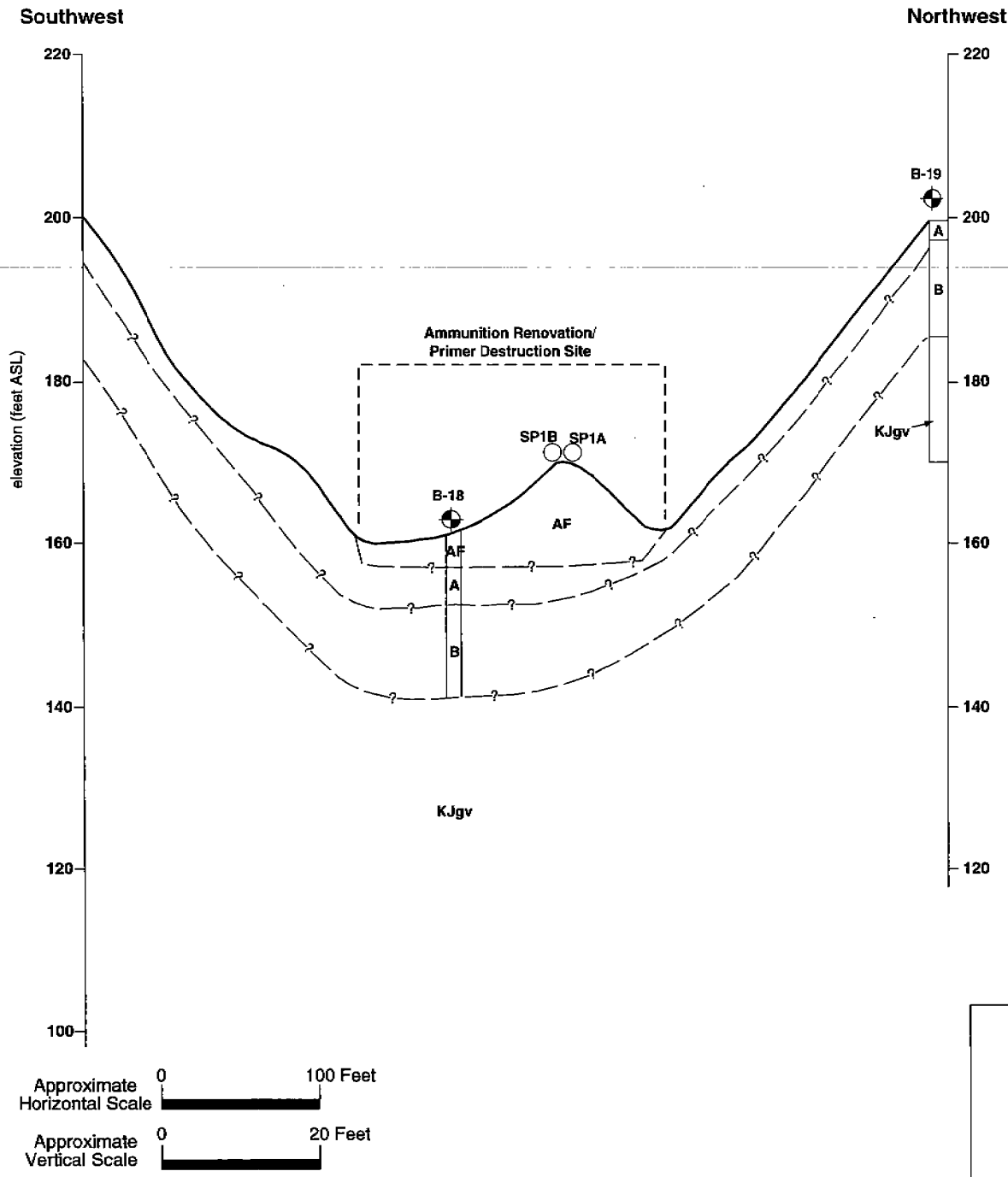
- Fault (approximate)
- Fault (concealed)
- Interstate Highway
- Sample collection area to determine local metals background range (Solano County Landfill Site)
- Project site
- Open Water
- Undivided sandstone and shale
- Alluvial fan and fluvial deposits (Holocene)
- Alluvial fan and fluvial deposits (Pleistocene)
- Artificial fill
- Bay mud
- Vine Hill Sandstone of Weaver

Regional Geology

0 .125 .25 .5 Mile

Source: U.S.G.S Open File Report 99-162

Figure 2-5



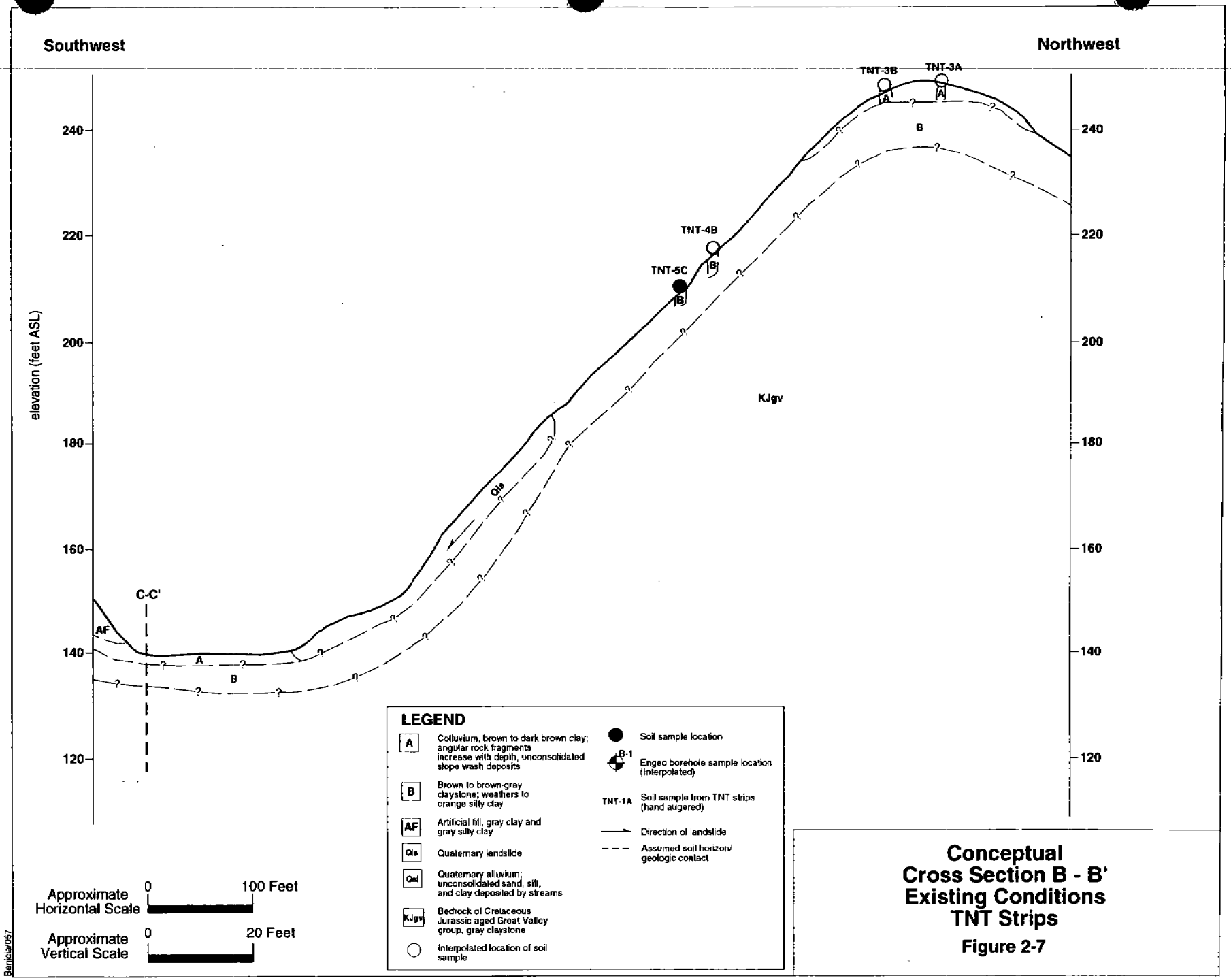
LEGEND

- **A** — Colluvium, brown to dark brown clay; angular rock fragments increase with depth, unconsolidated slope wash deposits
- **B** — Brown to brown-gray claystone; weathers to orange silty clay
- **AF** — Artificial fill, gray clay and gray silty clay
- **Qls** — Quaternary landslide
- **Qal** — Quaternary alluvium; unconsolidated sand, silt, and clay deposited by streams
- **KJgv** — Bedrock of Cretaceous Jurassic aged Great Valley group, gray claystone
- Interpolated location of soil sample
- B-1 — Engeo borehole sample location (Interpolated)
- SP1B — Soil sample from soil stock pile (grab samples)
- Direction of landslide
- Assumed soil horizon/ geologic contact

Conceptual Cross Section A - A' Existing Conditions Ammunition Renovation/ Primer Destruction Site

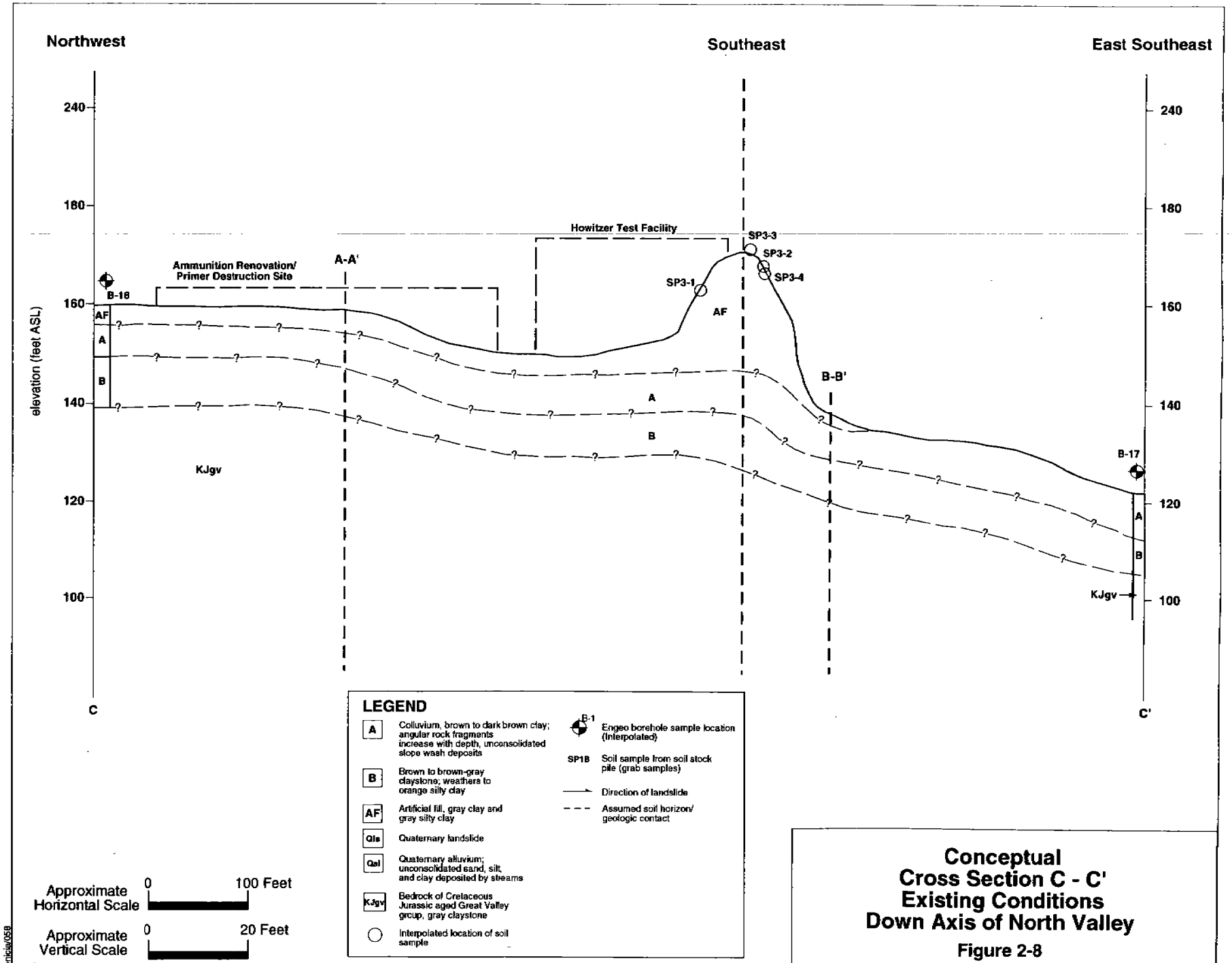
Figure 2-6

Benicia/056



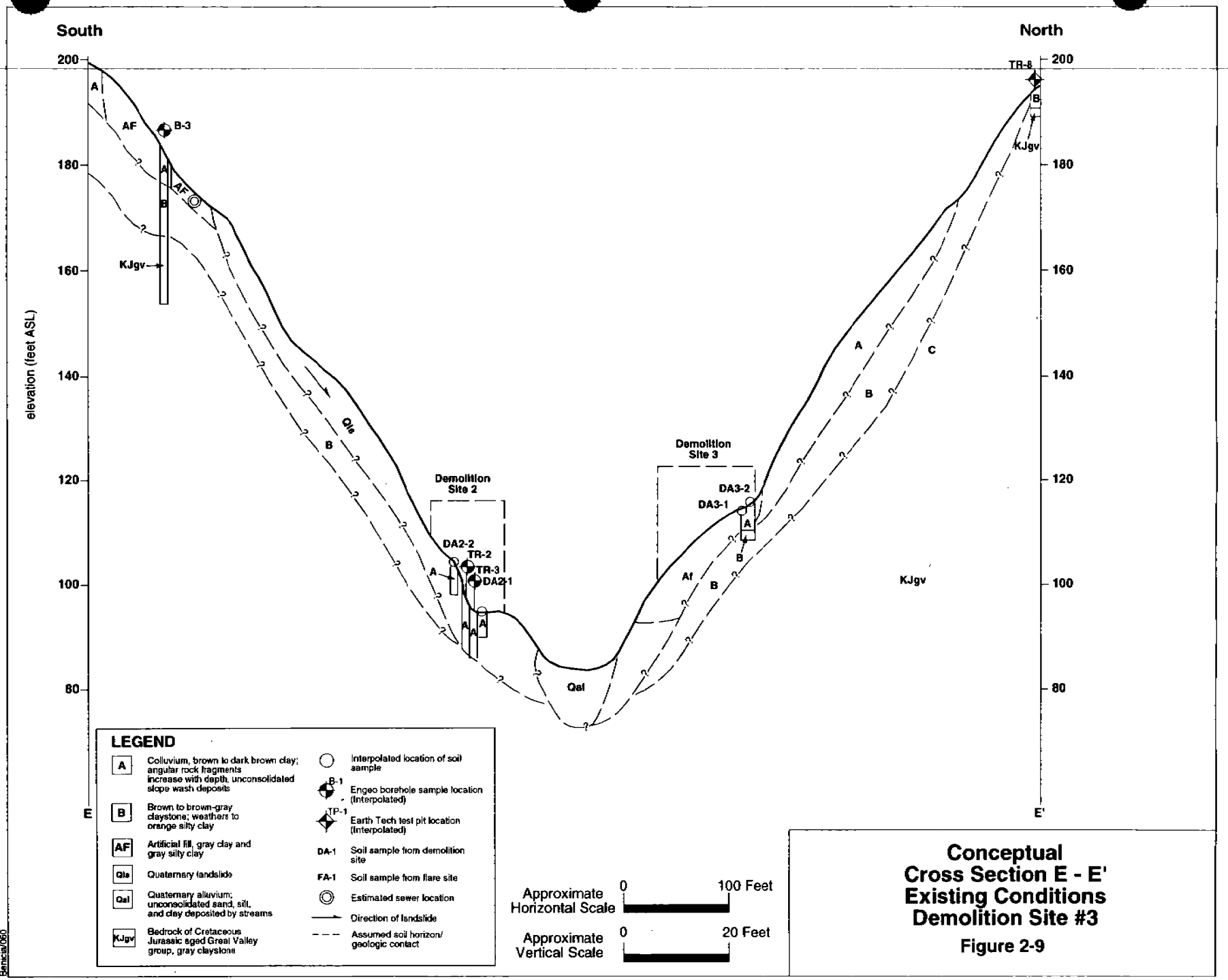
Conceptual Cross Section B - B' Existing Conditions TNT Strips

Figure 2-7



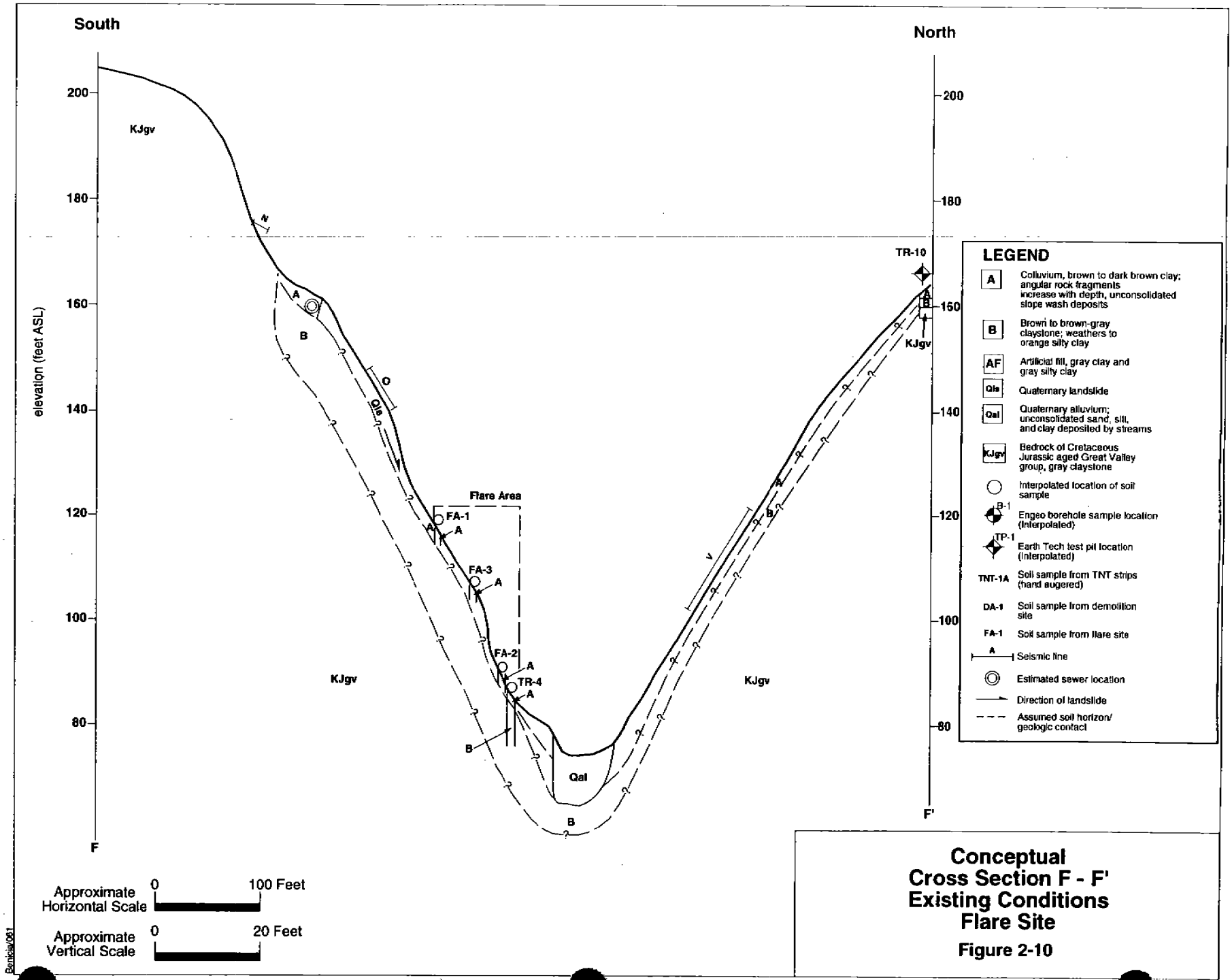
Conceptual Cross Section C - C' Existing Conditions Down Axis of North Valley

Figure 2-8



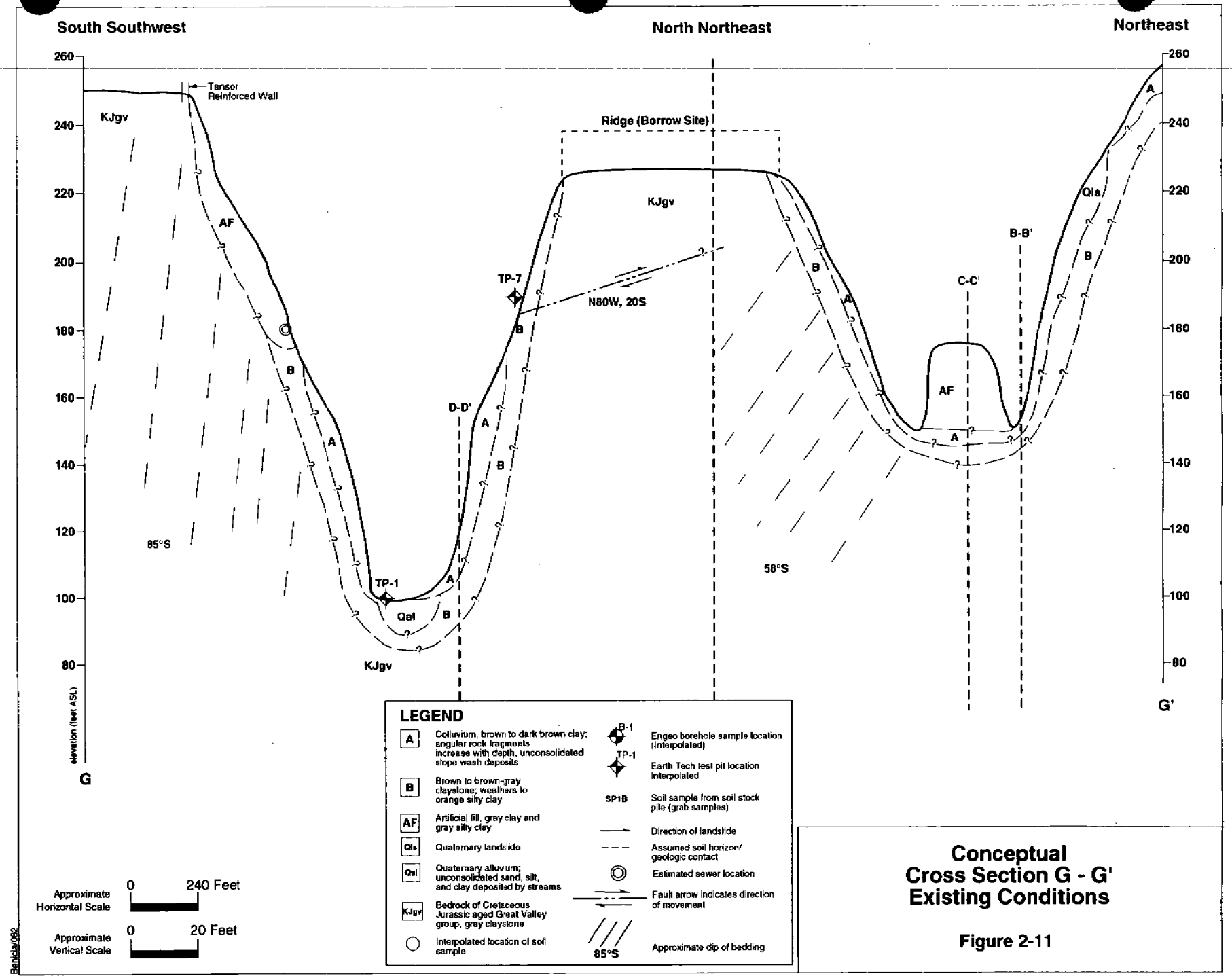
Conceptual Cross Section E - E' Existing Conditions Demolition Site #3

Figure 2-9



Conceptual Cross Section F - F' Existing Conditions Flare Site

Figure 2-10



Conceptual Cross Section G - G' Existing Conditions

Figure 2-11

3.0 REMOVAL ACTION GOALS AND OBJECTIVES

3.1 INTRODUCTION

RAW objectives concern non-OE characterization of the North Valley Landfill. Due to the uncertainty about what has been disposed of in the landfill, plans for limited OE clearance (removal) are needed to achieve these objectives. The removal of OE is for the protection of the workers (human health) who would be collecting soil samples for site characterization. Protection from potential exposure to chemicals will be accomplished through the use of personnel protective equipment.

3.2 AREAS, CHEMICALS, AND MEDIA OF INTEREST

OE and OE scrap may be present at the North Valley Military Landfill. OE presents a significant risk to human health if mishandled and if an accidental detonation should occur. The following chemicals may have affected soils and groundwater below the North Valley Military Landfill:

- Solvents may be present from the cleaning and general maintenance activities associated with the facility
- PAHs, dioxins, and furans from the burning of primers
- Diesel, motor oil, PCBs, and total petroleum hydrocarbons from any vehicles parked at the facility or used for heating
- Kerosene from the Primer Destruction Facility used to fuel the oil burners
- Metals from activities at the Howitzer Test Facility involving ammunition rounds
- Explosives from the primers either burned at the facility or mishandled during ammunition renovation activities
- Nitrogen from the black powder used as propellent for the howitzer rounds.
- Chloropicrin from the possible presence of chemical warfare materials
- Pesticides from the soil laboratory
- Rocket fuel (perchlorates) associated with Nike Test Cell
- Pentachlorophenol associated with wood preservatives used on wood crates, pallets, and packing materials.

3.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

All work for this project will be conducted consistent with, or in compliance with, the ARARs described in this section and identified in Table 3-1.

3.3.1 Assessment of ARARs

Section 111 of CERCLA requires that site cleanups comply with federal ARARs, or state ARARs in cases where these requirements are more stringent than federal requirements. ARARs are derived from both federal and state laws. Under CERCLA Section 111(d)(2), the federal ARARs for a remedial action could include requirements under any of the federal environmental laws (e.g., Clean Air Act [CAA], Clean Water Act (CWA), Safe Drinking Water Act [SDWA]). State ARARs include promulgated requirements under state environmental or facility siting laws that are more stringent than federal ARARs and that have been identified in a timely manner, according to 40 CFR Part 300.400(g)(4). A requirement may be either "applicable" or "relevant and appropriate."

3.3.1.1 Definition of ARARs.

"Applicable" requirements are defined as those cleanup or control standards, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state laws that specifically address a hazardous substance, pollutant, remedial action, location, or other circumstance at a CERCLA site (NCP, 40 CFR Part 300.5). Applicable requirements are identified on a site-specific basis by determining whether the jurisdictional prerequisites of a requirement fully address the circumstances at the site or the proposed remedial activity. All pertinent jurisdictional prerequisites that must be met for the requirement to be applicable are as follows:

- The party must be subject to the law
- The substances or activities must fall under the authority of the law
- The statute must require, limit, or prohibit types of substances or activities
- The time period in which the law is in effect must be defined.

A requirement is applicable if the specific terms (or jurisdictional prerequisites) of the statute or regulation directly address the circumstances at the site.

If not applicable, a requirement may be relevant and appropriate if circumstances at the site, based on best professional judgment, are sufficiently similar to the problems or situations regulated by the requirement. "Relevant and appropriate" refers to those cleanup standards, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not necessarily applicable, address problems or situations sufficiently similar

to those encountered at the CERCLA site, and whose use is well suited to the particular site (U.S. Environmental Protection Agency, 1993). The relevance and appropriateness of a requirement can be judged by comparing a number of factors including the characteristics of the remedial action, the items in question, or the physical circumstances of the site, with those addressed in the requirement. If there is sufficient similarity between the requirement and the circumstances at the site, determination of the requirement as relevant and appropriate may be made.

Determining whether a requirement is both relevant and appropriate is a two-step process. First, to determine relevance, a comparison is made between the remedial action, location, or chemicals covered by the requirement and related conditions at the site, release, or potential remedy. A requirement is relevant if it generally meets these conditions. Second, to determine whether the requirement is appropriate, the comparison is further refined by focusing on the nature of the substances, the characteristics of the site, the circumstances of the release, and the proposed remedial action. The requirement is appropriate if, based on such comparison, its use is well suited to the particular site. The facility must comply with requirements that are determined to be both relevant and appropriate.

In addition to ARARs, nonpromulgated advisories or guidance referred to as "to-be-considered" (TBC) materials may also apply to the conditions found at a site. Although not legally binding, TBCs may be used to determine cleanup levels when ARARs do not exist or when ARARs alone would not be sufficiently protective of human health and the environment. If a TBC is chosen as a cleanup requirement, it becomes a performance standard with which the chosen remedy must comply. The selection of TBCs as performance standards, however, is discretionary and not mandatory. TBCs are not expected to be used in this investigation.

There are certain circumstances under which ARARs may be waived. CERCLA Section 111(d) allows ARARs to be waived if remedial alternatives are selected that meet any of six conditions. However, the selected remedy must be protective even if an ARAR is waived. The conditions for a waiver are as follows:

- The removal action selected is only part of a total remedial action that will attain such level or standard of control when completed.
- Compliance with such requirement at that site will result in greater risk to human health and the environment (e.g., worker safety) than alternative options.
- Compliance is technically impracticable from an engineering perspective.
- Use of another method or approach for the removal action selected will result in a standard of performance that is equivalent to an applicable requirement.

- A state requirement has not been equitably applied in similar circumstances on other removal actions within the state.

- A fund-financed removal action does not provide a balance between available monies and the need for protection of public health and the environment at the sites where the need is more immediate.

3.3.1.2 Types of ARARs.

ARARs that govern actions at CERCLA sites fall into the following three broad categories, based on the chemical contaminants present, site characteristics, and remedial alternatives proposed for cleanup:

- ***Chemical-specific ARARs*** include those environmental laws and regulations that regulate the release to the environment of materials posing certain chemical or physical characteristics or containing specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limits for specific hazardous substances by media (see Preamble to Proposed NCP, 53 Federal Register 51437). Chemical-specific ARARs are triggered by the specific chemical contaminants found at a particular site. The U.S. EPA presently considers standards developed under the Resource Conservation and Recovery Act (RCRA), the SDWA, the CWA, and federal Ambient Water Quality Criteria for the protection of aquatic life as potential ARARs. A more stringent standard requirement, criterion, or limitation promulgated pursuant to a state environmental statute is also a potential ARAR.

- ***Location-specific ARARs*** govern activities in certain environmentally sensitive areas. These requirements are triggered by the particular location and the proposed activity at the site. An example of a location-specific ARAR is compliance with the Endangered Species Act (ESA), as amended, to avoid sensitive ecosystems or habitats. Location-specific ARARs also focus on wetland or floodplain protection areas or archaeologically significant areas.

- **Action-specific ARARs** are restrictions that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. Examples include the Federal Transportation Act requirements for transporting explosives and hazardous materials, and a state Air Quality Management Authority that sets limitations on fugitive dust generated during grading and excavation activities during removal actions.

3.3.1.3 Application of ARARs for the Proposed Actions.

In determining whether a requirement was pertinent to proposed actions at the Project Site, potential ARARs were initially screened for applicability. If determined not to be applicable, the requirement was then reviewed for both relevance and appropriateness. Requirements that are considered to be relevant and appropriate command the same importance as applicable requirements. Potential federal and state ARARs determined to be specific to the Project Site are listed in Table 3-1. The table lists the description of the regulation and the rationale for its selection as an ARAR.

3.4 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

All personnel scheduled to participate in geophysical mapping, OE removal, soil sampling, and on-site project management will be familiar with the content of this RAW. All assigned personnel will acknowledge that they have read and understood this document, including this chapter, by signing the signature page. If the possibility that a federal, state, or local regulation may be compromised exists, personnel will contact the Earth Tech PM, who will assess the situation and determine if a work stoppage or change in field investigations is warranted. Every attempt will be made to adhere to all regulations associated with this project.

Table 3-1 Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
California Designated Level Methodology for Waste Characterization and Cleanup Level Determination	Staff Report, California regional Water Quality Control Board	Proposes a methodology for determining cleanup levels in soil based upon impact on groundwater.	Chemical-specific	TBC	Can be used in determining cleanup levels in soil that are protective of groundwater quality.
Water Quality Objectives	Water Quality Control Plan, San Francisco Bay Basin	The Porter-Cologne Water Quality Act established authority of state and regional Water Quality Control Boards to regulate discharges into water of the state. The Basin Plan establishes limits and procedures to protect water quality. The objective of the plan is to protect the quality of surface and groundwater in the San Francisco Bay Area.	Chemical-specific	Applicable	Discharge standards for National Pollutant Discharge Elimination System (NPDES) permits and Waste Discharge Requirements (WDRs) may be applicable if discharge to surface water is proposed.
California Environmental Health Standards for the Management of Hazardous Waste[a]	Title 22, Sections 66261 and 66268.1, and 66261.23	Criteria for identifying RCRA hazardous wastes and hazardous wastes that are restricted from the landfill. Under this rule, UXO is considered a hazardous waste.	Chemical-specific	Applicable	Waste munitions, munition fragments, and soil contaminated with explosives could be considered hazardous if they contain a listed waste or exhibit hazardous waste characteristics (e.g., reactivity). If found to be hazardous, they could be restricted from landfill disposal.
California Endangered Species Act (CESA)	CESA Code 2080.2081	Protects endangered species from being exported or imported. Establishes authority permitting processes and mitigation requirements to protect endangered species.	Location-specific	Relevant and Appropriate	Disturbance to riparian, wetland habitats, or vegetation will require mitigation such as contouring the ground surface to pre-project elevation and replanting of native vegetation in appropriate ratios.

Table 3-1 Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
California Clean Air Act (CCAA)[b]	AB 2595	Establishes primary and secondary air quality standards necessary to protect human health, welfare, plant and animal life, buildings, materials, and visibility.	Location-specific	Relevant and Appropriate	Provisions of this Act should be followed.
Bay Area Air Quality Management District (BAAQMD) Air Quality Rules and Regulations	BAAQMD 5-401.14	Establishes the permitting requirements for the disposal of explosives through open burning.	Action-specific	Relevant and Appropriate	A variance permit is required as of January 1, 1997, to conduct combustion-related disposal within BAAQMD districts that produces PM pollution that is visible for more than 3 minutes.
California Health and Safety Code (HSC)	HSC, Division 20 Chapter 6.5, 6.8	Establishes regulations and incentives to ensure generators of hazardous wastes to employ safe handling practices, treatment, recycling, and destruction of hazardous waste prior to disposal. Also establishes a program for response authority for release, spills, disposal sites, and compensation for medical expenses resulting from injuries caused by exposure to releases of hazardous substances.	Action-specific	Applicable	Under Title 22, Section 66261.23, UXO is considered a hazardous waste. Provisions of this Act should be followed.

Table 3-1 Applicable or Relevant and Appropriate Requirements (ARARs), Tourtelot Cleanup Project, Benicia, California

Requirement	Citation	Description	Type	Applicable or Relevant and Appropriate	Comments
OE Waste Identification	Draft Department of the Army Memorandum	Adopts criterion of 10% explosive content as a measure of contaminated soil for secondary explosives.	Action-specific	TBC	Provisions of this Act should be followed.

Notes: (a) Title 22 is more stringent than the federal RCRA.
(b) CCAA is more stringent than the federal Clean Air Act.
AB = Assembly Bill
OE = ordnance and explosives
RCRA = Resource Conservation and Recovery Act
TBC = to be considered
UXO = unexploded ordnance

4.0 PROJECT APPROACH

4.1 DESCRIPTION OF REMOVAL ACTION WORK PLAN

The purpose of this project is to obtain soil samples from beneath the North Valley Military Landfill and to determine the approximate boundary and depth of the landfill. The actions described in this RAW will include the removal of OE along transects to be trenched as part of non-OE characterization of the North Valley Military Landfill. OE removal procedures are included as a safety precaution as it is not anticipated that OE will be present in the landfill. This approach was chosen because preliminary review of existing data and site reconnaissance indicate that anomaly density (i.e., subsurface metallic debris) would be too high to use OE avoidance techniques. Therefore, the sampling area would need to be cleared (all anomalies removed) to facilitate the collection of soil samples for non-OE characterization of the site.

Existing geophysical data will be reviewed to help determine the areal extent of the site. The site will be investigated by trenching across the area to determine the vertical and lateral extent of the site. OE and OE scrap will be removed from the trenches as described below. All trenching will be performed under the direct supervision of a qualified UXO technician (see Section 1.3.3 for qualification requirements). As trenching progresses, a qualified geologist will be visually inspecting the debris removed from the trench and observing the trench bottom. Once the landfill/natural soil interface is observed, soil samples will be collected at 25-foot intervals laterally along each trench at the interface and 2 feet vertically below the interface. A minimum of four samples will be collected from the soil matrix within the landfill; in addition, samples will be collected from other areas in the landfill that show evidence of the presence of chemicals using field screening techniques (e.g., photoionization detection [PID]).

At the North Valley Military Landfill, two trenches will be excavated through the approximate center of the landfill, one trench traversing generally from east to west and the other generally from northeast to southwest (Figure 4-1). The depth and length of the trenches will be determined in the field based on field observations. The depth of the trenches will be determined by the observed bottom of the landfill. The length of the trenches will be determined by the lateral extent of the landfill. Once trenching is complete, anomaly avoidance techniques will be employed to facilitate soil sampling. It is anticipated that the total depth of the trenches for this site will not exceed 6 or 7 feet bgs.

The following sections describe the activities associated with implementation of the RAW.

In order to facilitate the non-OE characterization of the soil beneath the landfill, the proposed trench locations will need to be cleared of OE. The clearance will consist of a multi-step approach including mobilization and surface preparation,

real-time geophysical investigation and mapping, establishment of the PWD, anomaly excavation, and OE disposal. The QA/QC steps will include: review of digitally collected geophysical data by a qualified geophysicist, inspection of anomaly excavations by a senior UXO technician, and following sampling and analytical procedures outlined in the QAPP included as Appendix G.

These tasks are summarized in the following subsections. Detailed procedures for the implementation of these tasks are the subject of the remaining chapters of this document. The proposed project schedule for completion of the OE removal and sample collection is shown in Figure 4-2.

4.1.1 Mobilization and Surface Preparation

Mobilization and surface preparation will include:

- Mobilization of OE clearance crew, geophysical investigation crew, soil investigation crews, support staff, and management personnel
- Clearance of vegetation
- Location and marking of trench locations
- Location and marking of PWD boundary from Project Site center
- Surface clearance of all metallic debris within the trench excavation area.

Mobilization of management personnel, support staff, geophysical investigation crews, and OE clearance crew will be based on task start dates. A command post will be established consisting of one temporary office trailer and one storage annex to be situated near the corner of Piercy and McAllister drives. The management staff will consist of a PM, SUXOS, the UXO Site Safety Officer (UXO/SSO), and Site Geophysicist. Roles and responsibilities of these personnel are described in Chapter 1.0.

In order to geophysically map the sites, the areas will be cleared of vegetation to a height of 6 inches or less by the OE clearance crew. The vegetation will be cleared by personnel using gas-powered weed cutters.

Following vegetation removal, the survey crew will identify the trench locations using corner stakes. OE avoidance techniques described in Appendix B will be followed for the placement of corner stakes.

The Project Site center must be established. The established Project Site work area will be used to determine the PWD boundary, which will be marked at all Project Site access points and further marked whenever the boundary is outside the fenced in, controlled area. The marking must be clearly visible to the public, and the area must be controlled by contractor personnel during active site operations.

Once vegetation removal is complete, the OE clearance crew will conduct a surface clearance to locate and dispose of OE, OE scrap, and metallic surface debris.

As previously mentioned, a low probability of encountering live OE is anticipated at the Project Site. However, in the event that a live OE item is discovered, the following procedures will be followed. OE encountered during project activities will be visually inspected in place to determine whether or not it is safe to move. The inspection will be directed by the SUXOS in conjunction with the UXOSSO. The determination that the item is OE or OE scrap is based on the experience, training, and knowledge that is required by federal agencies for the positions these personnel hold. If the item is determined to be OE versus OE scrap, a determination will be made as to whether the OE item is safe to move using the following criteria: (1) OE items that are armed or damaged will be considered not safe to move and will require in-place disposal by detonation (blow-in-place [BIP]); and (2) items whose status cannot be reliably evaluated due to deterioration, positioning, etc., may need to be considered not safe to move and may need to be detonated in place. Otherwise, OE items that are unfired and not damaged will be considered safe to move and will be temporarily stored in the vicinity of the Howitzer Test Facility in a Bureau of Alcohol, Tobacco, and Firearms (BATF) Type II explosive storage magazine. Items that are safe to move will be disposed of following the completion of Project activities.

If the item is not safe to move, the SUXOS will halt all fieldwork, the item will be secured by placing sandbags around and over it, and an observer will be posted until the item is properly disposed of. The California EPA, DTSC Site Mitigation Project Manager will be contacted immediately, and a subsequent approval to detonate the item in place will be obtained on a case-by-case basis. The item will be detonated in place by on-site OE personnel under the direct supervision of the SUXOS with DTSC authorization. The following procedures will be followed in the event an in-place detonation is required.

1. Granite will immediately stop work at the site and contact the DTSC Site Mitigation Project Manager.

2. Granite will provide the following information about the OE item to DTSC:

    a) A description of why the OE must be detonated in place and cannot be safely moved and stored in a magazine or bunker for later disposal.

    b) A comprehensive description of the OE that requires detonation in place and its condition.

    c) A description of the immediate environmental setting where the OE lies. Indicate whether the area, including the soils, around the OE has been cleared of OE.

d) The geographical area in which human health may be affected by the OE detonation. Provide the PWD and surrounding land uses.

e) The geographical area that may be affected by the OE detonation.

f) A list of other local and state agencies consulted and those to be notified of an OE detonation.

g) The procedure for public notification and evacuation, if required. Discuss the system to be used to inform the public of results of the detonation and respond to complaints, if any. Provide a comprehensive mailing list of all residents within the PWD and 1/4 mile from the PWD, if required.

h) A description of control measures and monitoring to reduce the impact of OE detonation on human health and the environment. [Note: the control measures and monitoring are already described/prescribed by DTSC in the Initial Study and bullet 6, below.]

i) A discussion of why alternatives to the proposed OE detonation are not feasible (e.g., disarming, defusing, charge removal). [Note: disarming, defusing, and/or charge removal are considered "render safe" procedures; by federal law, only active military personnel are allowed to perform this procedure.]

3. The DTSC Site Mitigation Project Manager will review the submitted information and, if appropriate, grant approval to detonate the OE item in place using proved and USACE-approved engineering controls. DTSC will coordinate with Granite and require control measures to reduce the impact of detonation on the environment and surrounding land uses to the degree reasonable. An appropriate CEQA document will be prepared for this subsequent discretionary action.

4. Appropriate local and state agencies will be informed of the detonation.

5. A DTSC staff member will be on site for the in-place detonation, if feasible.

6. Air and noise monitoring will be performed, as appropriate and feasible for the specific detonation, in order to characterize the detonation.

7. Trenching activities will be reassessed, including an evaluation of whether use of an EM 61 and a backhoe are still appropriate.

8. Prior to a BIP, the public information phone line will be updated to provide information to the public on when the BIP is planned. After the detonation, the public information phone line will be updated with information on the BIP.

BIP detonations, if required, will be conducted during normal business hours to minimize disturbance to residences. Unless absolutely necessary, detonations will not occur during days of low cloud cover or temperature inversions that could amplify noise associated with detonations and adversely affect local residences. BIP detonations will be carried out as soon as feasible with all required engineering controls in place.

4.1.2 Geophysical Investigation and Mapping

Geophysical investigation and mapping activities include:

- Geophysical data collection
- Pinpointing anomaly centers
- Marking of anomalies
- Reviewing digital data.

After the area has been surface cleared of OE, OE scrap, and metallic surface debris, the geophysical crew will begin collecting subsurface anomaly data from each trench traverse. Geophysical data will be collected using an EM61 pulled by a member of the geophysical investigation crew. The EM61 system locates anomalies by using electromagnetic (EM) energy (Figure 4-3). The EM61 produces both an audio tone that varies in pitch and volume in response to changing proximities to metallic objects and a digital visual display (via data logger screen). The operator will identify anomalies from the audio and digital output of the instrumentation.

Anomalies will be identified as the mapping progresses in contiguous passes over the footprint of the trenches. As the system is translated along the paths, the instrument operator will drop a marker at the approximate anomaly location. Digital data captured during the transect surveys will be recorded as a quality check record of the real-time mapping effectiveness. Once the initial geophysical anomaly locations have been identified, the operator will immediately return with a hand-held EM system and pinpoint the anomaly center. The resulting position will be marked and identified to the OE clearance personnel. The subsurface anomalies will be excavated, and any OE demilitarized/destroyed and disposed of, if necessary, in accordance with the requirements of this RAW.

The geophysical team will control instrument position along the corridor using a nonmetallic survey tape and an odometer triggered by the optical encoder attached to the axle of the EM61 wheel cart. The geophysical survey field team will consist of an operator and an assistant to aid in tracking control. The instrument operator will be trained and experienced in collection of geophysical data with the instrumentation used. This experience will include procedures for initializing data

loggers and identifying anomalies from the audio and digital output of the instrumentation. The survey team will maintain a daily log that details pertinent activities, survey results, and field conditions encountered in the performance of the real-time geophysical characterization.

An equipment field test will be conducted on the first field day after mobilization to the site to verify that the recommended methodology and approach meet the performance criteria established for the Project Site. Geophysical data will be monitored real-time and digitally captured into a file with coordinates recorded relative to the established southwest corner of the test plot and processed to produce profiles that identify the characteristics of the test plot.

The data will be collected in continuous traverses (no stopping and searching) along the designated paths. Just as will be performed over the trench footprint, markers will be dropped at suspected anomaly locations. Real-time target identification will be accomplished through immediately returning to pinpoint the anomaly center and then verified against post-data collection computer processing results. As the trenching will progress in individual lifts of 12 inches, only those target sources lying within the upper foot of the near-surface need be detected. Additionally, target blanks (where holes are excavated but no metallic object is placed in the hole) will be created. The ground surface for all targets will be restored to as near as practical the pre-excavation conditions. This effectively causes the entire test plot to be "blind" to the equipment operator.

4.1.3 Ordnance and Explosives Subsurface Clearance

OE subsurface clearance includes:

- Excavation and identification of geophysical anomalies
- Removal and disposal of anomalies.

The OE clearance crew will excavate and identify each anomaly marked with a colored pin flag. Each marked location will be excavated to uncover and identify the source of the anomaly. Once the anomaly is identified as OE, OE scrap, or metallic debris, it will be removed or disposed of as discussed under Mobilization and Surface Preparation (Section 4.1.1). If an OE item is encountered, and it is determined that it is not safe to move, the SUXOS will halt all fieldwork. The DTSC Site Mitigation Project Manager will be contacted immediately, and a subsequent approval to detonate the item in place will be obtained on a case-by-case basis, as previously discussed. A QC team consisting of the SSO and a geophysicist will verify that all anomaly sources have been removed from the trench corridors.

Once all anomalies are removed, trenching will proceed. Trenching will be accomplished using a backhoe operated by a heavy equipment operator under the direct supervision of the SUXOS or his designated representative (must meet USACE UXO III requirements) at all times. Safety procedures can be found in the SSHP. Trenching will progress in 12-inch lifts. After each lift is removed, the trench corridor will be remapped and anomalies excavated and removed. This

procedure will be repeated until either the bottom of the landfill is identified or until OE avoidance techniques can be employed for the safe collection of soil samples.

Strict safety protocols will be followed at all times during the excavation of all anomalies. Specific procedures are provided in Chapter 6.0, Ordnance and Explosives Operations. The safety procedures will include the enforcement of a PWD during the excavation of anomalies and disposal of OE. Before OE clearance work can be accomplished, the on-site manager will execute the requirements of the Site Access Control Plan (Appendix C) and Chapter 6.0.

A PWD of 1,701 feet will be established for the surrounding areas. There are no residences within the PWD. However, open-space areas owned by the City of Benicia, a portion of occupied business, storage yards for two businesses, and the backyards of three residences are within the PWD.

Pertinent data relating to the size, shape, and if possible, the type of ordnance item will be recorded for each anomaly investigated. Sandbag enclosures or other appropriate engineering controls will be used in order to reduce the PWD of any item detonated in place and to reduce noise associated with detonations. Detailed procedures for the disposal of OE items by detonation are presented in Chapter 6.0 and Appendix D of this RAW.

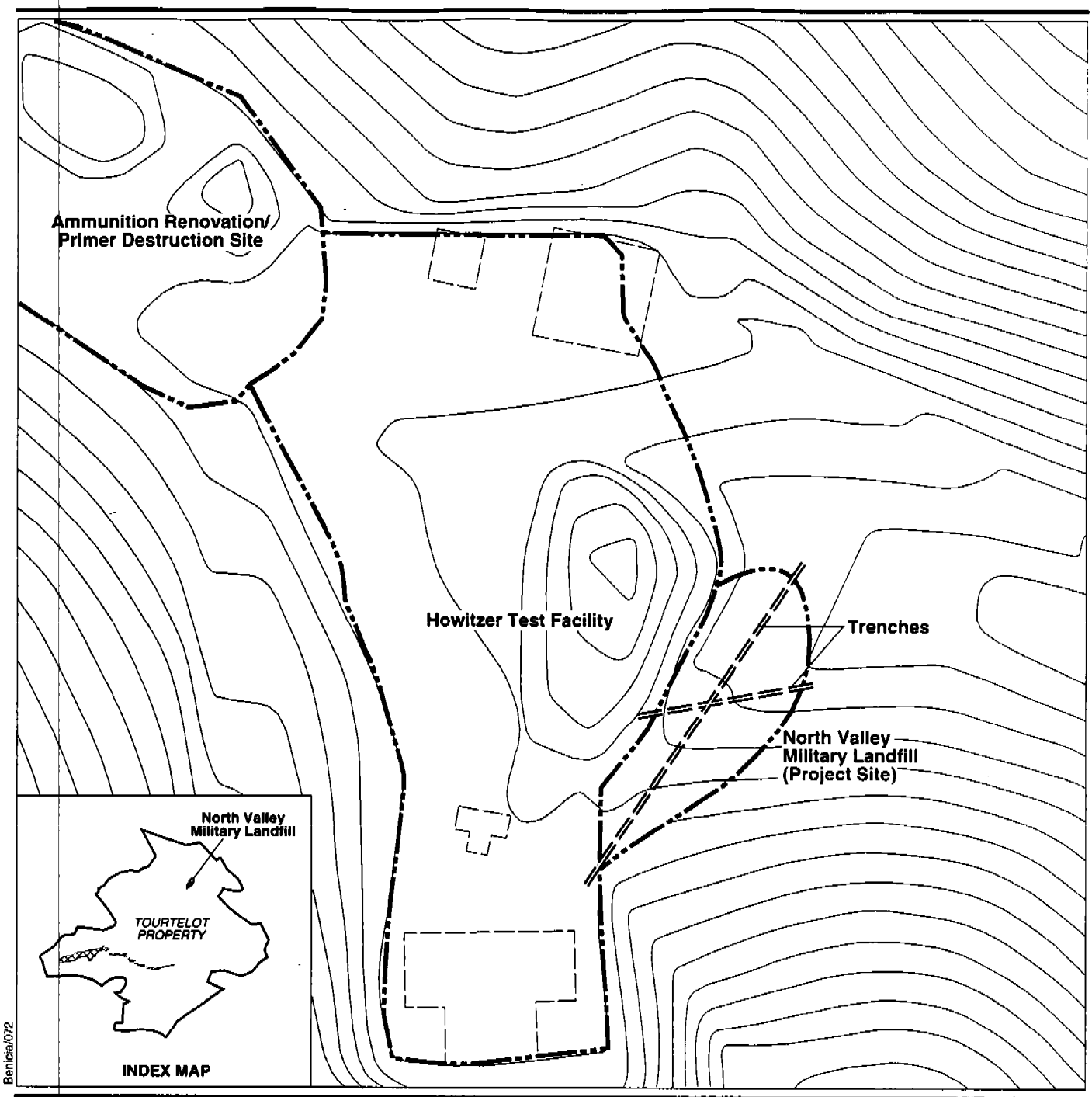
All disposal operations will be coordinated with the local authorities (e.g., city police) and DTSC. Detonations will be conducted during normal business hours to minimize disturbance to residences. Unless absolutely necessary, detonations will not occur during days of low cloud cover or temperature inversions, which could amplify noise associated with detonations and adversely affect local residences.

Explosives will be purchased from and delivered to the site by a local vendor and managed in accordance with the Explosives Management/Siting Plan (Chapter 7.0). Figure 4-4 shows the route that will be used by the local vendor to transport all explosives to and from the site.

4.1.4 Soil Investigation

All subsurface trenching activities will be conducted under the direct supervision of a qualified geologist and the site SUXOS. Earth Tech personnel will direct the excavation of the trenches to characterize the North Valley Military Landfill. The landfill will contain two trenches that intersect each other. The anticipated depth to the bottom of the landfill is approximately 4 to 5 feet. The trenches will be lithologically described and classified in accordance with the American Society for Testing and Materials (ASTM) D 2488 Description and Identification of Soils (Visual-Manual Procedures). Photographic sequences of each trench will be recorded.

Field sampling and analysis activities will be performed in accordance with the procedures described in Chapter 8.0. The material excavated from the trenches will be properly disposed of as described in Section 8.9.1.



EXPLANATION

Approximate trench locations

Proposed Trench Locations

0 30 60 120 Feet

Figure 4-1

Project Schedule

Tasks/Subtasks	WBS Number	FY 00				
		FEB	MAR	APR	MAY	JUN
Draft RAW Document Issued	1.00.22.01	▲				
Public/Agency Review/Comments				▲		
Final RAW Document Issued				▲		
Agency Approval of RAW Document					△	
Initiation of RAW Fieldwork					△	
Completion of RAW Fieldwork					△	
Draft RI Document Issued						△

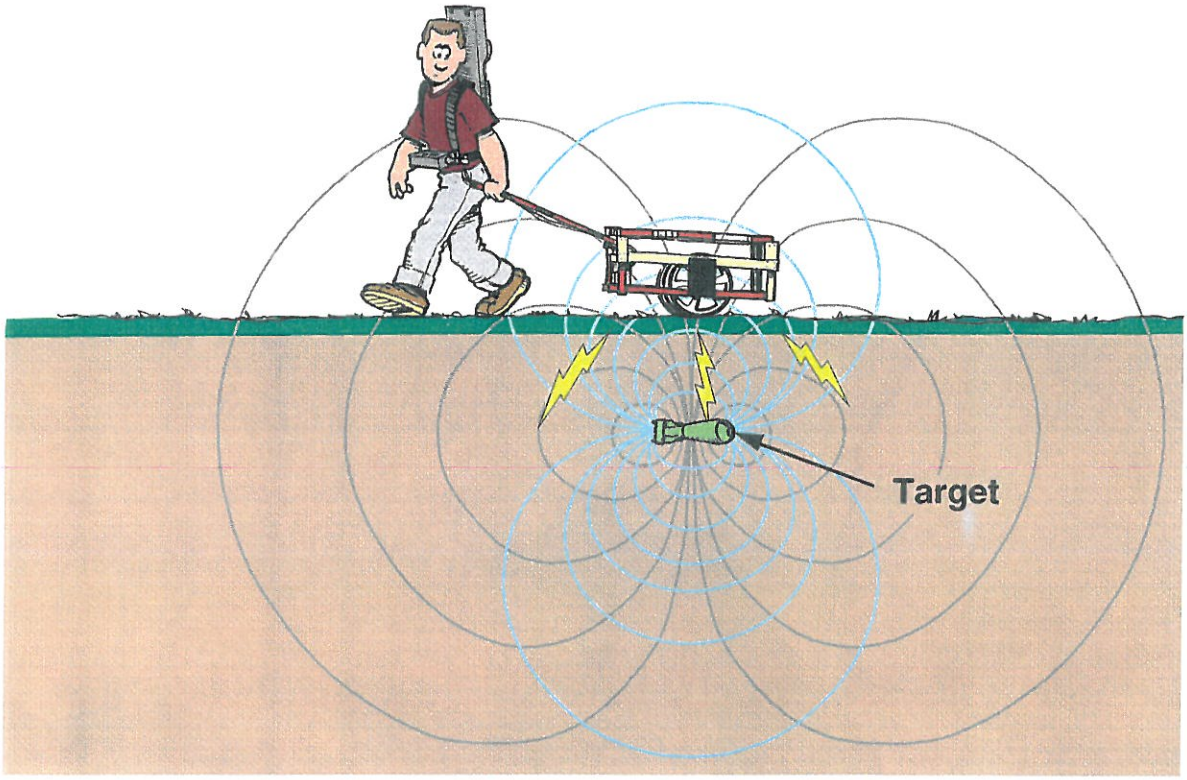
EXPLANATION

△ Schedule milestone (not completed) ◇ Schedule slip (not completed) ——— Subtask duration

▲ Schedule milestone (completed) ◆ Schedule slip (completed) — — — · Intermittent or uncertain

Figure 4-2

Benicia/091

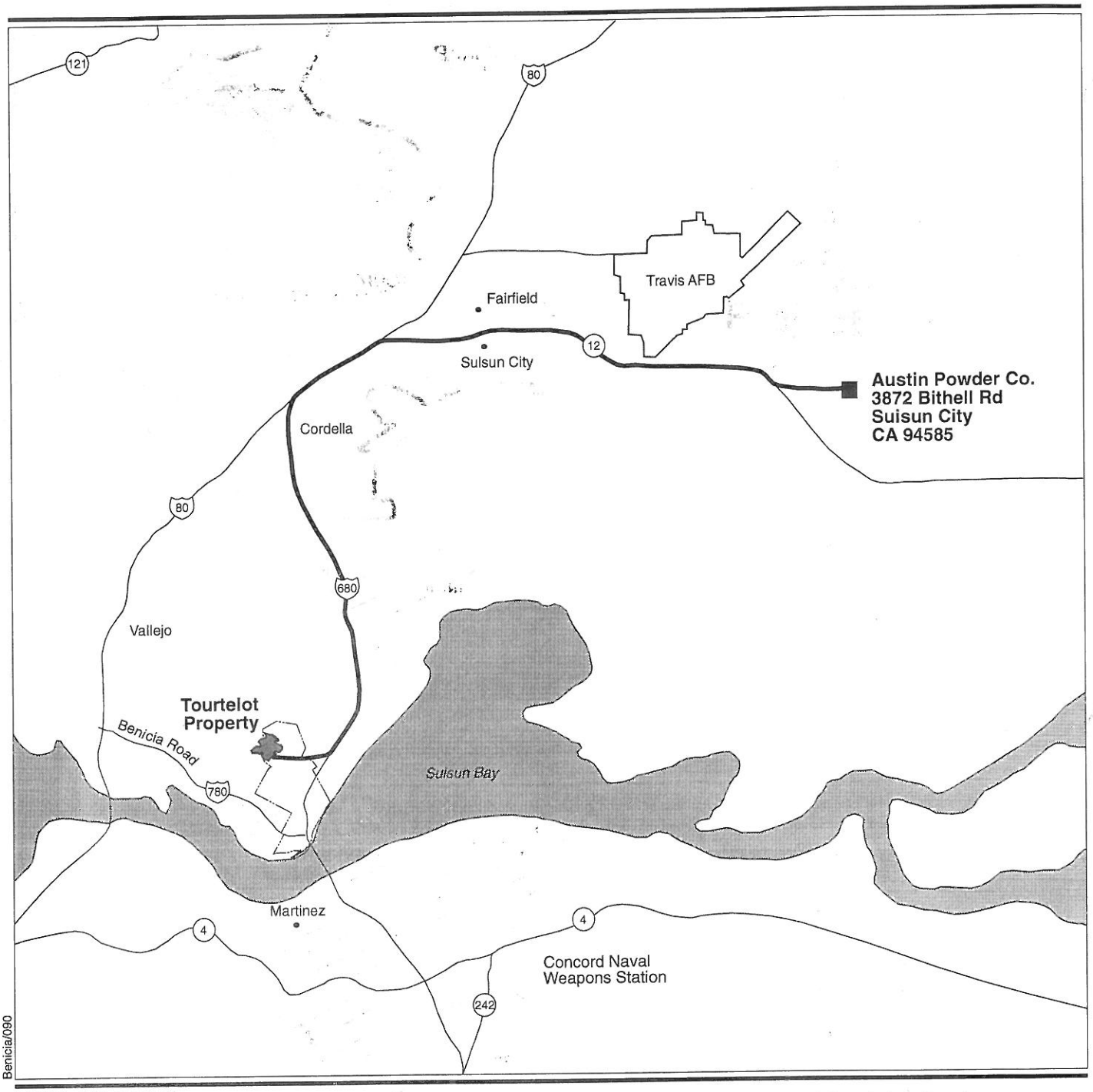


Electromagnetic methods rely on the ability of metal items to conduct electricity that is forced into the ground better than the surrounding soil and rock.

Benicia/069

Geophysical Mapping Using Electromagnetic Method - Personnel Towed

Figure 4-3



EXPLANATION

- Route for Explosives Transport
- (99) California State Highway
- (101) U.S. Highway
- (280) Interstate Highway

Not to Scale

Route for Explosives Transport

Figure 4-4

5.0 ORDNANCE AND EXPLOSIVES CONSTRUCTION SUPPORT PLAN

5.1 DESCRIPTION OF METHODOLOGY

To assure the safety of personnel engaged in trenching investigations, the corridors over the areas of interest will be geophysically mapped to provide OE clearance construction support using an EM system that detects both ferrous and nonferrous objects. Anomalies identified from this mapping will be explored by the OE clearance crew to assure all potential OE anomaly sources have been detected, mapped, and removed.

5.1.1 Geophysical Characterization

5.1.1.1 Objective.

The objective of this task is to provide construction support by geophysically mapping and removing potential OE-caused anomalies within the areas of interest in advance of exploratory trenching excavations. A corridor over the footprint of the planned trench will be geophysically mapped in realtime, and digital data will be simultaneously captured electronically using a man-towed EM61 metal detector.

Anomalies will be identified as the mapping progresses in contiguous passes over the footprint of the trenches. As the system is translated along the paths, the instrument operator will drop a marker at the approximate anomaly location. Digital data captured during the transect surveys will be recorded as a quality check record of the realtime mapping effectiveness. Once the initial geophysical anomaly locations have been identified, the operator will immediately return with a hand-held EM system and pinpoint the anomaly center. The resulting position will be marked and identified to the OE clearance personnel. The subsurface anomalies will be excavated and any OE demilitarized/destroyed and disposed of, if necessary, in accordance with the requirements of this RAW.

The geophysical team will control instrument position along the corridor using a nonmetallic survey tape and an odometer triggered by the optical encoder attached to the axle of the EM61 wheel cart. The geophysical survey field team will consist of an operator and an assistant to aid in tracking control. The instrument operator will be trained and experienced in collection of geophysical data with the instrumentation used. This experience will include procedures for initializing data loggers and identifying anomalies from the audio and digital output of the instrumentation. The survey team will maintain a daily log that details pertinent activities, survey results, and field conditions encountered in the performance of the realtime geophysical characterization.

The characterization will be conducted under the direction of a project geophysicist with at least 5 years of experience performing geophysical characterizations, including OE detection and mapping investigations.

The project geophysicist will monitor and review pre-mapping equipment field tests and daily data collection, daily logs and field maps, and compare excavation findings with mapped geophysical anomalies to identify any anomaly locations that require further investigation/exploration.

5.1.1.2 Methodology.

EM instrumentation has been proposed for this work because it has been consistently shown at the equipment test plot on the Tourtelot Property, at the Army's Jefferson Proving Ground evaluations, and at each geophysical prove-out conducted by Earth Tech, to have target detection capabilities equal to magnetometers for resolving large OE items in the near-surface and better capabilities for resolving small ordnance items (e.g., 20mm, 37mm, 40mm, grenades, fuzes) than cesium vapor magnetic gradiometers (and better depth detection than fluxgate gradiometers). Further, the EM response is less complex and more reliable in terms of actual targets located versus "noise-induced" or "false positive" responses from magnetometers.

EM systems operate by transmitting a radio wave into the ground. When the wave encounters an electrically conductive object, such as a piece of metal, it induces an alternating current through it. The object then radiates a secondary (induced) signal, and the corresponding voltage potential is detected by a receiver above the surface. Background response levels for the measurement system to be deployed derive primarily from the characteristics of near-surface soils. The wavelengths of background responses are relatively much longer than those of finite-dimensioned objects and can be readily distinguished from the short, spike-like character of metallic (OE-target) anomalies.

The combined geometry of dipole transmission and dipole response results in a drop-off of signal inversely proportional with increasing distance. This results in relative immunity to surrounding noise sources and very good target resolution. The instrumentation, although affected by soil conductivity, is configured such that anomaly responses caused by small, finitely bounded concentrations of conductive soils or minerals are not recorded in the data. Highly conductive objects (metal) retain electrical current longer than soil materials. The electrical potential measured at the receiver above ground is initially strong, then diminishes to nothing over time as the amplitude of the current decays. The time interval during which the measurements are taken is that which best shows the more persisting signal from highly conductive targets and misses the early faster-diminishing returns from soil.

5.1.1.3 Instrumentation.

The Geonics, Ltd. EM-61 will be deployed at the Project Site. The EM61 will be deployed as a single, vertical gradiometer system with a path width of 1 meter; sensor output is sampled as a voltage. EM data are sampled at 10 Hertz (Hz) and correlated with the navigation data. Survey speed will be constrained to ensure measurements are recorded at no more than 1-foot (0.3-meter) intervals along the survey lanes. The sensor measurements are mapped out separately for the upper and lower coils. All navigation and sensor data are electronically captured in the data loggers.

5.1.1.4 Geophysical Equipment Field Tests.

An equipment field test will be conducted on the first field day after mobilization to the site to verify that the recommended methodology and approach meet the performance criteria established for the Project Site. Geophysical data will be monitored realtime and digitally captured into a file with coordinates recorded relative to the established southwest corner of the test plot and processed to produce profiles that identify the characteristics of the test plot.

The data will be collected in continuous traverses (no stopping and searching) along the designated paths. Just as will be performed over the trench footprint, markers will be dropped at suspected anomaly locations. Realtime target identification will be accomplished through immediately returning to pinpoint the anomaly center and then verified against post-data collection computer processing results. As the trenching will progress in individual lifts of 12 inches, only those target sources lying within the upper foot of the near-surface need be detected. Additionally, target blanks (where holes are excavated but no metallic object is placed in the hole) will be created. The ground surface for all targets will be restored to as near as practical the pre-excavation conditions. This effectively causes the entire test plot to be "blind" to the equipment operator.

5.1.1.4.1 Equipment Test Plot Construction.

The test plot will be constructed after first performing a background survey over the area selected for the test plot to characterize the test environment. The smallest OE item of interest is a 37mm projectile. If the EM system can detect the smallest item of interest, it should be able to detect any larger OE items with the target depth range (i.e., less than 1 foot). Five certified inert 37mm projectile targets (or simulants of 37mm cannot be obtained) will be buried in the test plot. Target locations will be measured from corner stakes set to mark the test plot; measured locations will be accurate to ± 4 inches.

The plot will consist of one transect along a 50-foot corridor. The separation between targets and the depths of burial are detailed in the following subsections.

5.1.1.4.2 Test Bed Items.

If inert 37mm projectiles cannot be obtained, steel cylinders will be used to simulate buried OE that could be present at the site. Use of an equivalent cylinder is appropriate for use with EM systems because the EM response is a function of surface area and aspect ratio of the buried targets. The dimensions of the simulating cylinders will present a surface area equivalent to a 37mm projectile (22.6 in^2).

Five 37mm targets or simulants will be placed along 50-foot transect. Three of the targets will be oriented in 3 primary orthogonal directions such that the top of each target will be 1 foot bgs. The 2 other targets will be placed at depths of 3 inches and 9 inches bgs so that a depth response curve may be plotted.

Because it is necessary to establish a standard response for the instrumentation, a 3-inch-diameter carbon steel sphere will be included in the test bed.

5.1.1.4.3 Performance Criteria.

At a minimum, pass/fail detection performance criteria for the geophysical methodologies will meet the following criteria:

- Detect all targets buried at 12 inches bgs or less
- Horizontal Accuracy: 90 percent of all excavated items must lie within a 0.5-meter radius of their mapped surface location as identified during the realtime mapping tests.

A letter report describing the geophysical equipment, field test results, and survey methodology will be prepared. The letter report shall also document all activities performed to create the test plot.

5.1.1.5 Data Quality Objectives.

The fiducials and geophysical anomaly locations represented in the realtime field results and processed geophysical data will be compared to geophysically referenced spatial data (GIS base maps). The features of the referenced data that are reflected in the geophysical data should be locationally coincident to within 0.5 meter.

5.1.1.5.1 Instrument Precision.

To ensure that the geophysical responses to buried sources are properly considered for intrusive investigation, it is necessary that a threshold or other target-characteristic criteria be recognized in the geophysical instrument response. In order for these criteria to be effective, the instrumentation must produce like responses to similar target sources each time the same source and receiver geometry is encountered. Daily documentation of the standardization

responses within a set acceptance range will be required for each sensor system deployed.

5.1.1.5.2 Geophysical Reasonableness.

Given the existing geological environment and prior land use of the survey area, the recorded geophysical responses must reflect the physical properties of conductive materials in the near-surface. Data will be reviewed by an experienced geophysicist to assess usefulness of the data for detecting and resolving OE anomalies. Noise levels in the data will be analyzed to ensure that they are sufficiently low to allow adequate signal-to-noise differentiation of pertinent anomalies. At a minimum, signal-to-noise levels greater than 1.5:1 will be required for target discrimination.

5.1.1.5.3 Representativeness.

The character and response parameters of identified anomalies must be adequately accounted for by the anomaly source(s) identified. Identified anomalies will be reviewed to ensure that the anomaly is representative of that which would be expected for the particular source discovered during OE construction support activities.

5.1.1.6 Standardization.

Proper operation and function of the instruments used will be checked and documented in the field log each day by a standardization process prior to commencement of the day's geophysical surveys. Baseline responses over the equipment test plot and standardization acceptance ranges will be established for each mapping system deployed.

Standardization procedures and standard response (for each system) will be established before any geophysical mapping of the survey lanes is performed. This will be accomplished by establishing a target and a background reference geometry and determining the numerical difference between target-anomaly high and background response of each system. Multiple anomaly-versus-background measurements will be made to allow computation of a mean residual (anomaly response) and calculation of a standard deviation specific to the system.

Standardization of each system will be performed periodically each day to ensure proper operation and function of the system, including before and after each grid. Standardization will be accomplished using a portable source in a fixed, ground-level geometry with each receiver antenna. The portable source is used to eliminate the need to return to one location several times each day. The portable standard target will be a solid, 3-inch carbon steel sphere. The response to the portable target is such that any contributions from the environment are negligible.

Typical background responses are on the order of 1-5 millivolts; the response to the sphere will be an order of magnitude greater, will not be affected by orientation, and will not require exclusive "stand by" or down time by the geophysical teams while transitioning to/from a buried target. Standardization consists of comparing the residual anomaly to an acceptance range and recording the values in the daily logs. Acceptance range is specified at ± 10 percent of the standard response (calculated mean residual anomaly).

The standardization response and acceptance range shall be recorded in the field logbooks assigned to each antenna component receiver. If a system component does not respond within the acceptance range, the standardization measurements will be repeated. Three sequential failures will cause the system to be removed from service. Any failed component must be replaced/repaired and a new standard response (with a new standard deviation and acceptance range) calculated before being redeployed to the field.

5.2 CHARACTERIZATION OF THE SITE

5.2.1 Data Collection

Data will be collected using the standard instrument configuration (16-inch antenna stand-off height with a two-wheel, man-towed cart). A field logbook will be maintained that details pertinent activities, survey lane features, and field conditions encountered in the performance of the geophysical characterization. A field sketch map of mapped survey lanes will be made as or before the geophysical data collection progresses/commences. All activities related to geophysical data collection will be documented in the daily field logbook. Field maps will note date/time of the survey, area covered, and the location and description of noise sources that will affect interpretations.

A safety and work assignment briefing will be conducted prior to the beginning of each day's field activities. The safety briefing will address any known hazards of concern for the particular area being investigated. Attendees and briefing substance will be recorded in the field logbook. Elements of a survey day include:

- Morning pre-survey checks of instrument and batteries
- Safety and planning briefing
- Identification of traverse segment(s) to be mapped
- Equipment set-up
- Initialization of data logger(s) to record geophysical response
- Performance of instrument standardization
- Traverse of survey lanes to collect data; verification of complete investigation of all segments.

At the completion of the survey day, digital survey data will be delivered to the Earth Tech Site Manager on 3.5-inch, IBM-compatible microcomputer diskettes in ASCII format. The diskettes will be labeled with survey lane identifications and date.

5.2.2 Anomaly Identification

Anomaly discrimination is accomplished by identification of discrete response parameters distinct from background response levels. The EM61 produces both an audio tone that varies in pitch and volume in response to changing proximities to metallic objects and a digital visual display (via the data logger screen). Appropriate signal-to-noise ratios for target anomaly discrimination will be defined by the response parameters obtained at the equipment test plot.

The digital data processing and QA/QC will be performed using validated software to perform data quality checks, validate data, and make the required plots. Digital data will be corrected for navigation errors, instrument bias, and measurement drift. All corrections, edits, filtering, or normalization of the data used to identify potential OE anomaly locations will be fully documented in a data processing log.

Data resolution will be such that anomaly locations can be identified to within a 0.5-meter radius of the source location. Processing of digital data will include a symbol posting of centerline locations of the sensor array and production of color plots of the data mesh over the survey area. Anomaly symbols and identification numbers will be superimposed on these plots. An ASCII-format tabulation of the anomalies will also be generated. The table will include anomaly number, longitude and latitude (in California State Plane coordinates), anomaly amplitude, and other anomaly attributes (i.e., depth estimate).

5.2.3 Anomaly Reacquisition

The anomaly recovery team will refine the anomaly location using a hand-held EM metal detector and record the peak recovered anomaly value and relative background response in a field logbook. After the centroid of the anomaly is determined, the locations will be marked using a pin flag and paint.

OE teams will center their intrusive investigation at the centroid of identified anomaly locations. They will also provide a description, including recovery depth and item orientation, of the discovered anomaly source, and record (with sketch map) the offset distance and direction between actual source center and the marked anomaly centroid in their field logbooks.

5.2.4 Field Processing

All collected data, including field notes, maps, standardization documentation, and digital data, will be collected by the Earth Tech Site Manager before the close of each day's activities.

The digital geophysical data will be checked, edited for corrections, and processed into ASCII files. The data shall be presented in delineated fields as x, y, and z, where x and y are survey lane coordinates in easting and northing, and z is the instrument reading. Where multiple instrument values are recorded, the data will be presented as x, y, $z1...z_n$ in the same ASCII file.

Field processing will be limited to production of simple profiles of the data measured at the geophysical receivers. A visual inspection of data will be performed to identify any single-point anomalies, steps in response, or incoherent signal/excessive noise bandwidth. All such events will be noted and described in the field logbooks. This field processing will be performed by the site geophysicist and delivered to the PM's designee no later than 5 working days after data collection.

5.2.5 Review of Field Data

Field data will be reviewed to ensure that precise measurements of the geophysical response were obtained by verifying that instrument performance during standardization fell within the established ±10 percent acceptance range. Daily standardization field measurements and results are to be completely documented in the field logbooks. The field logbooks will be reviewed to ensure proper implementation of the quality controls.

The field logs will also be reviewed each day to verify that data were collected following a continuous progression along the survey lanes. If the survey progression was interrupted for a particular segment because of terrain or other considerations, the causes of the deviation and the actual mode of progression should be fully described in the field logbook notes.

The field review will ensure that the survey lane characterization was complete by verifying that the data volume for each receiver is comparable (±1 percent) and that the spatial data density is representative of the mapping effort described in the field logbook. Field notes will be compared to the downloaded digital file data to assure correspondence between lanes searched and lanes recorded.

5.2.6 Data Transfer

Copies of all digital and field data will be made and sent to the Earth Tech office in Colton, California (originals to stay in project files), via parcel delivery service each day. This daily deliverable will include:

- Field notes (including field maps)
- Standardization data
- Digital data.

Data tracking documentation will be completed and a copy included in the transmittal. Digital data will also be electronically transmitted to the Earth Tech office in Colton via Internet connection (or on magnetic or optical media if an Internet connection is not available).

5.2.7 Quality Assurance

QA processing of digital data will include production of representative profiles. The raw data from the data loggers will be used to create these plots; the data will not be filtered unless background noise levels are excessive (this will be determined during the first week of the field effort). The profile images will be used as a QA tool to compare visually discriminated locations with those anomalies identified by automated (digital) routines. QA will comprise the following activities:

- Review of daily field QA documentation (e.g., maps, field notes)
- Review of standardization results (instrument precision)
- Generation of profile plots (representativeness/ reasonableness)
- Comparison of field anomaly map, digital data image, and OE sampling results for each area investigated (representativeness).

Digital data will be archived to document the geophysical characterization, including thoroughness of the survey, detection efficiency, and locations of identified anomalies; provide a means of quantifying the confidence that can be applied to the OE cleanup report results; and preserve and document the extent, precision, accuracy, and quality of the geophysical characterization.

5.2.7.1 Quality Assurance Summary.

The QA/QC results of the geophysical survey will be tracked on a master spreadsheet that will tabulate survey area identification, coordinates, and date surveyed. A QA summary will be prepared and submitted to the client. The weekly summary will include:

- **Precision** - A mean deviation from the standard response will be calculated for each instrument used. This will be reported in a progressively updated table.
- **Accuracy** - Any discrepancies in positional or locational accuracy of the data noted during the field review will be described, including steps taken to correct or resolve any such QA issues.
- **Completeness** - The percentage of coverage of each investigated segment will be tabulated. Significant lack of coverage (> 2 percent missed) will be flagged and annotated with the steps (to be) taken to resolve the missed coverage. Unavoidable obstacles will have been mapped on the field sketches and should result in direct

correspondence with missing data. Data drop-outs or inexplicable data shortages, if not detected during the field review and scheduled for reacquisition, will be evaluated to identify the root problem and steps needed for resolution.

- **Representativeness** - A table will be developed and progressively updated that presents pertinent anomaly data (e.g., anomaly identity, amplitude, width, apparent source, depth to target). Any anomalies that are not adequately accounted for by the discovered source will be reinvestigated by the OE clearance crew.

- **Reasonableness** - Any variations or results not compatible with prior results or expectations will be reviewed with the geophysicist to determine causative features that may be present. These field contacts will be summarized and included in the QA summary report.

- **Detection performance** - A table will be prepared that presents:

  - Source description

  - Depth to source

  - Percentage of sources found within the prescribed distances from the identified anomaly location.

5.2.8 Deliverables

After completion of the field effort, Earth Tech will complete data QA/QC, copy and index all appropriate field data, and prepare the following:

- CD-ROM containing all "raw" digital format x, y, z files

- Profile/image plots of the digitally recorded data

- Daily field logs of geophysical characterization activities

- Standardization response documentation

- Field notes, including sketch map of surveyed area

- ASCII data (digital files) providing data logger files and/or downloaded raw data and edited/corrected data files giving California State Plane x, y coordinates

- Target anomaly listings.

These data will be available no later than 30 days after demobilization from the field has been completed.

5.3 ORDNANCE AND EXPLOSIVES SAMPLING

Data describing the anomaly sources discovered during the intrusive investigation process will be recorded and available at the conclusion of the field effort. Recorded data will include, where possible, size, estimated weight, orientation, depth bgs, and description of the item excavated. Chapter 6.0, Ordnance and Explosives Operations, provides a description of all activities to be conducted in the field.

6.0 ORDNANCE AND EXPLOSIVES OPERATIONS

6.1 PURPOSE

This chapter outlines the OE removal activities associated with the site investigation. OE is not anticipated to be encountered based on the site history presented in Chapter 2.0, Site Characterization. However, for planning purposes, it has been assumed that any OE encountered during this investigation would be similar to other OE items recovered from the Tourtelot Cleanup Project Site. Based on this assumption, the largest OE item of interest is that of a 75mm projectile. Therefore, the PWD to be used during OE investigation and excavation is a 75mm projectile. A 75mm projectile has a maximum fragmentation distance of 1,701 feet (assuming the item is on the ground surface) and the unintentional detonation PWD is equal to this distance. The PWD for intentional detonations is 200 feet based on the 75mm projectile and use of sandbag mitigation measures.

6.2 GENERAL

Earth Tech and subcontractor personnel (i.e., Project Team) will perform operations at the Project Site in accordance with the SSHP and this RAW. Additionally, all on-site personnel will sign an acknowledgment page verifying that they have read and understand the Tourtelot Cleanup Project SSHP.

The work under this contract will be performed consistent with CERCLA (Section 104) and the NCP (Sections 300.120 and 300.400[e]). The provisions of 29 CFR Part 1910.120 will apply to all actions taken at this site. Additionally, 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 Parts 1910.120(b) and 1926.65(b).

The following sections discuss procedures for the field activities during the OE removal action, including:

- Mobilization to the Project Area
- Vegetation removal
- Location and marking of search trenches
- Locate and mark PWD boundary (as described in Section 4.1.1)
- OE surface clearance
- Geophysical mapping
- Anomaly reacquisition
- OE investigation of anomalies
- OE and OE scrap disposal
- OE QC surveys
- Demobilization from the Project Site.

The methods to be used to conduct the geophysical mapping are discussed in detail in Chapter 5.0, Ordnance and Explosives Construction Support Plan.

6.3 MOBILIZATION

All necessary personnel and equipment will be mobilized, as required, upon receipt of written approval of this RAW by DTSC. The goal of the mobilization is to ensure that all project personnel are prepared and properly resourced to perform applicable field activities. Actions performed during mobilization include:

- Packaging, shipping, and inventorying required project equipment
- Coordinating upcoming field activities with key project personnel
- Coordinating with site personnel (e.g., security, safety)
- Setting up a site Command Post
- Organizing support facilities and test communications equipment
- Identifying and procuring any additional supplies and equipment required to perform the work
- Conducting site-specific training.

6.3.1 Personnel

Table 6-1 depicts the number of Project Team field personnel anticipated to be on site during implementation of a specific field activity.

6.3.2 Project Equipment

During mobilization, the project personnel will:

- Package and ship corporate equipment items to the Project Site
- Coordinate with selected vendors for direct shipment of supplies and equipment
- Coordinate with Earth Tech for communications and administrative and other support
- Coordinate with personnel/agencies to accommodate site-specific security requirements (e.g., vehicle inspections)
- Perform maintenance and quality checks of the equipment to ensure that it is operationally ready.

6.3.3 Site-Specific Training

As part of the mobilization process, Earth Tech will perform site-specific OE 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 that will be

used to perform operations at the Project Site, their individual duties and responsibilities, and all safety and environmental practices/procedures associated with operations. All personnel will be trained as they arrive, and they will not be allowed onto the Project Site until they have received site-specific training. Training topics/issues and responsibilities are as follows:

- The OE Specialists will receive operational briefings and training on their duties and responsibilities. All project personnel will receive ordnance recognition and OE safety precautions briefings. The SUXOS and SSO will perform this training.

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

All OE personnel will receive detailed training on this RAW and the Tourtelot Cleanup Project SSHP. All training activities will be documented utilizing appropriate forms (e.g., training, field logbooks).

Prior to mobilization, all project personnel will receive Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour/24-hour (or 8-hour refresher) training, as required. Additionally, all on-site personnel must be participating in a medical surveillance program and must have completed a pre-placement or annual physical examination that complies with the requirements of 29 CFR Part 1910.120. Project personnel must have been certified as fit to work by an Occupational Physician certified in Occupational Medicine by the American Board of Preventive Medicine, or one who, by necessary training and experience, is board-eligible. Documentation of the medical qualifications of personnel will be filed on site.

6.3.4 Field Office Management

The Command Post will be serviced with hard-wired communication (two telephone lines, one fax line), electricity, and trash pickup. In addition, furnishings will include office furniture, telephones, a fax machine, two-way radios, lighting, laptop computers, a printer, and a photocopier.

The Command Post will be kept in a neat and clean condition. Wall space will be made available for posting important health and safety information and mandatory employee notifications. For security reasons, keys to the Command Post will be under the strict control of the FTL and the SUXOS. However, doors to the Command Post will remain unlocked during hours of operation (typically 6:30 a.m. to 5:30 p.m., Monday through Thursday).

Over the course of field activities, the Command Post will be staffed with the FTL and the SSO, a Project Geophysicist, SUXOS, and appropriate staff members. Specific project management activities are detailed in Chapter 1.0, Introduction, including organizational and individual responsibilities and project communication and reporting requirements and deliverables. On-site personnel will also be responsible for maintaining a project field logbook that will contain an accurate

account of all activities conducted during the course of field operations. Section 11.2, Project Field Documentation, provides additional details regarding project logging requirements.

6.4 VEGETATION REMOVAL

In order to conduct geophysical mapping of the site, the Project Site will be cleared of vegetation to a height of 6 inches or less. The following procedures will be used to perform the vegetation removal:

- The vegetation will be cleared by personnel using gas-powered weed cutters (equipped with spark suppression systems)
- Brush clearing supervisors will ensure all team members are equipped with appropriate safety equipment (i.e., safety goggles, hearing protection, leather-palm work gloves) during vegetation removal activities

6.5 LOCATION AND MARKING OF REMOVAL AREAS

6.5.1 General

Location and marking tasks will entail using Total Station surveying equipment to locate and install semipermanent markers. The areas of concern enclosed by the stakes will become the planning and recording basis for OE surface clearance, geophysical mapping, and OE subsurface clearance operations to be performed.

6.5.2 Search Area Procedures

Once the vegetation has been removed, surveyors will install semipermanent markers (36-inch nonmetallic survey stakes) using OE avoidance techniques described in Appendix B.

OE personnel will be required to escort the surveyors during this task using OE avoidance (Appendix B). The escorts will visually check the surface (using a Schonstedt® magnetometer) along the paths the surveyors use to transit the property for OE and check the subsurface area (also using the Schonstedt® magnetometers) where the stakes will be driven for anomalies. Anomaly locations will be avoided by a safe distance (24 to 36 inches) during installation of survey stakes. OE encountered during visual sweeps will be marked and reported to the SUXOS and the PM for recording and disposal disposition.

The survey stakes will be painted with a biologically safe fluorescent orange paint to provide easy visual location, and the southwest corner stake for each trench will have a number assigned and will be marked for trench identification.

Once the trench locations are constructed, maps illustrating the locations will be developed. All field books, sketches, and computation sheets will be maintained in the project documentation files.

6.6 ORDNANCE AND EXPLOSIVES SURFACE CLEARANCE

6.6.1 General

Once the trenches have been established, an OE surface clearance will be conducted. OE clearance crews will use hand-held Schonstedt® magnetometers and visual search methods to clear the area of OE, OE scrap, and metallic debris that would be a hazard to the mapping crews and to sanitize the site of significant surface anomalies for the subsurface mapping. All OE scrap and metallic debris larger than 1 inch by 2 inches will be removed. All OE scrap and metallic debris will be placed outside the southwestern corner of each trench.

The OE clearance crew will remove all OE scrap and metallic materials from the southwest corner of the trench. The OE clearance crew will also remove all "safe to move" OE items that have been flagged and store them in an ATF Type II storage magazine for disposal at a later date. All OE items that are determined unsafe to move will be BIP. Prior to any item being BIP, the notification, coordination, and authorization procedures outlined in Chapter 4.0, paragraph 4.1.1, will be followed.

6.6.2 Quality Control

The SSO will perform a random sweep QC inspection over 25 percent of each trench. The 25-percent QC inspections will be conducted before unescorted personnel are allowed access to the trench. The trenches that fail the QC inspection will require another complete surface clearance if any of the following occurs:

- OE is found
- OE scrap or metallic debris greater than 1 inch by 2 inches is found.

The surface clearance will involve a systematic search (Figure 6-1) to clear each trench surface of OE, OE scrap, and metallic debris. OE and OE scrap encountered during the surface search will be reported to the SUXOS and recorded on the OE Surface Clearance Information Sheet (Appendix E). OE will be flagged for disposal operations. OE and OE scrap will be processed in accordance with the OE Process Flowchart (Figure 6-2). OE and OE scrap will be disposed of and recycled in accordance with the procedures delineated in Section 6.9.2.3, OE Identification and Disposal.

6.7 FENCE REMOVAL/INSTALLATION

No fence removal or installation will be required for the operations planned in this RAW.

6.8 GEOPHYSICAL MAPPING AND ANOMALY REACQUISITION

Geophysical mapping and anomaly reacquisition will be conducted by the geophysical personnel in accordance with the procedures identified in Chapter 5.0, Ordnance and Explosives Construction Support Plan.

6.9 OPERATIONS IN ORDNANCE AND EXPLOSIVES AREAS

Earth Tech will provide all personnel and equipment necessary to perform OE investigations and clearance over the areas of concern at the locations desired for field soil sampling. Geophysical anomalies will have been previously identified/flagged during the mapping phase. OE clearance crews will intrusively investigate all anomalies at the locations desired for field soil sampling as described in the following procedures (unless removal of surface metallic debris is verified by Earth Tech as accounting for the mapped geophysical anomaly).

6.9.1 Equipment

The equipment requirements for this activity include:

- Instrumentation (hand-held Schonstedt® magnetometers) used to assess proximity to subsurface metallic anomalies and/or OE during progress of excavation
- Miscellaneous common hand tools (e.g., screwdrivers, digging implements)
- Forms and logbooks to record activities
- Backhoe.

6.9.2 Ordnance and Explosives Investigation and Clearance

Prior to the start of intrusive activities, the SUXOS and SSO will verify that the area around the operating site is clear of all nonessential personnel. At a minimum, PWDs of 1,701 feet, or a lesser distance if determined appropriate by DTSC (for 75mm projectiles or smaller), will be established and maintained in the vicinity of the operating site in accordance with the Site Access Control Plan (Appendix C and Appendix F). The appropriate PWD is determined by the Most Probable Munition (MPM) to be encountered. The 75mm projectile is the largest OE item recovered during previous OE investigations at the Tourtelot Cleanup Project Site and will be used as the MPM unless a larger item is encountered during the clearance. The maximum fragment range shown under accidental/unintentional detonations has been calculated for the PWD by the USACE. Figure 6-3 depicts

See City Attorney's Office for Full Size
707-746-4216

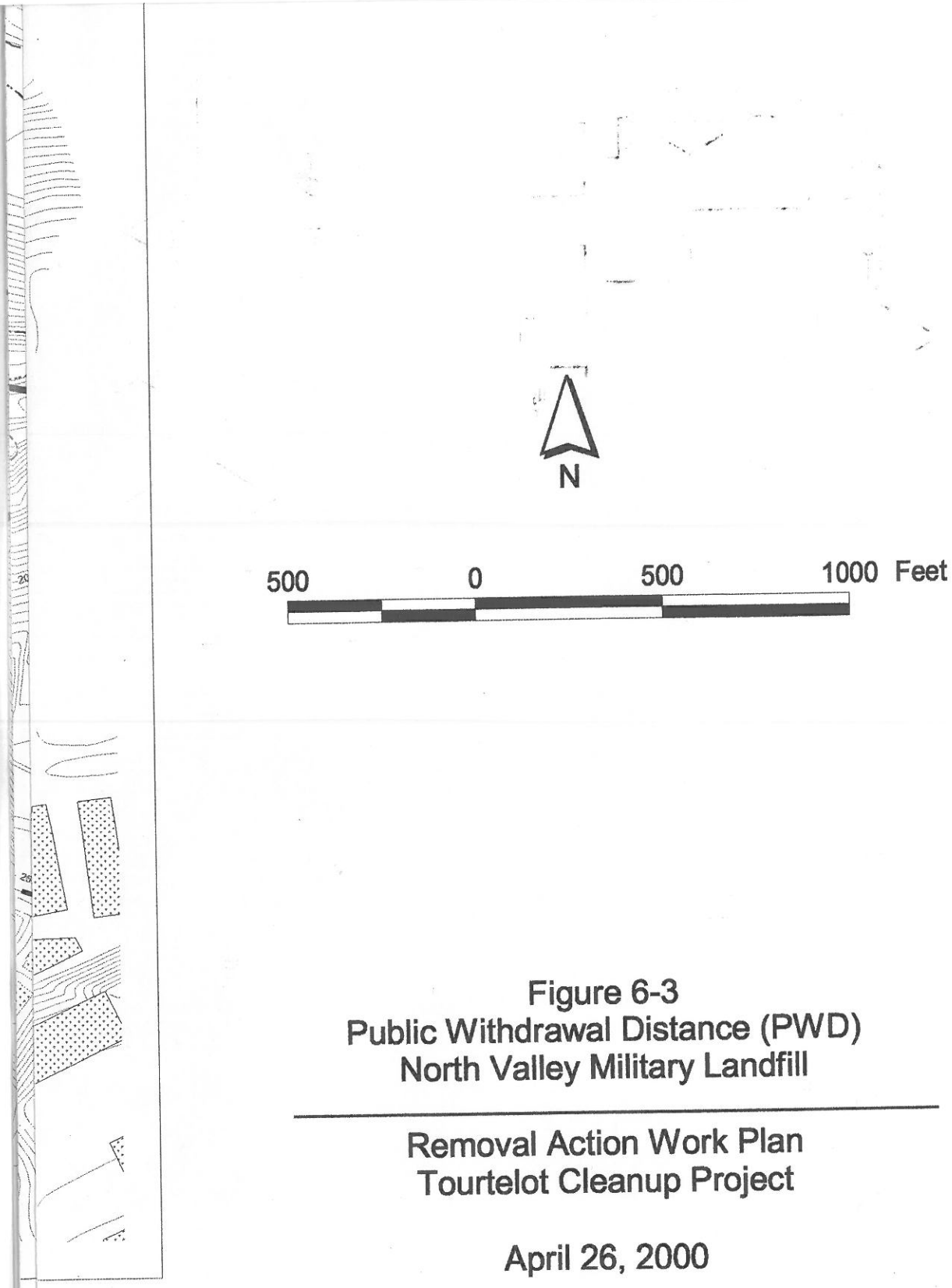


Figure 6-3
Public Withdrawal Distance (PWD)
North Valley Military Landfill

Removal Action Work Plan
Tourtelot Cleanup Project

April 26, 2000

the PWD for the North Valley Military Landfill. Excavation of anomalies will be performed in accordance with the procedures outlined in the following subsections. Subsurface OE and OE scrap will be processed in accordance with the OE Process Flowchart (see Figure 6-2). OE and OE scrap encountered during the subsurface search will be reported to the SUXOS and recorded on the OE Excavation Information Sheet (Appendix E).

6.9.2.1 Near-Surface Anomalies.

Near-surface anomaly sources are those that are partially exposed or are suspected to be within 1 foot of the surface and can be excavated using hand tools. These anomalies will be excavated by carefully removing the earth overburden using a hand shovel/trowel or other small digging implement. Throughout the excavation, the UXO Technicians will use a Schonstedt® magnetometer to check and verify the proximity of the anomaly.

6.9.2.2 Subsurface Anomalies.

Subsurface anomalies are those caused by sources that are more deeply buried or that may require excavation using heavy equipment (e.g., backhoe). For these excavations, the SUXOS will coordinate equipment requirements with the PM. Prior to the arrival of the heavy equipment, the SUXOS will ensure that a cleared entrance and egress path is available for the heavy equipment. Heavy equipment or manual digging tools will be used to excavate the earth overburden in 6-inch lifts. After each lift, the anomaly location will be redefined with a Schonstedt® magnetometer and the anomaly source exploratively sought using hand tools. This process will continue until the source of the anomaly has been uncovered and identified.

When UXO Technicians are checking backhoe excavations for suspected OE-source proximity, the backhoe bucket will be placed on the ground, away from the excavation, and the operator will keep his/her hands clear of the operating controls. The backhoe operator will resume excavation operations only after the UXO Technicians are clear of the excavation and outside of the bucket swing area.

6.9.2.3 Ordnance and Explosives Identification and Disposal.

When the OE clearance crew finds an OE item, they will identify the specific item and determine the disposal method in accordance with procedures detailed in Figure 6-2. Items determined to be safe to move will be moved to the OE magazine for storage. Items that are considered unsafe to move will be BIP using procedures in Section 4.1.1 with appropriate fragmentation mitigation methods (Appendix D) and with DTSC approval. All BIP and disposal operations will be followed by OE scrap recovery operations.

6.9.3 Ordnance and Explosives Quality Control Surveys

An QC Specialist will verify that all sources for the identified geophysical anomalies have been removed from each intrusive investigation site after the OE clearance. The QC Specialist will perform the clearance surveys using a hand-held EM61. QC survey data will be recorded in a field logbook and will include trench identity, anomaly identification number, and survey results. Logbook entries will be signed and dated by the SUXOS performing the survey. Anomalies discovered during a QC survey will be reported to the PM and SSO and will be reinvestigated.

6.9.4 Removal and Disposal of Scrap Metal

The SUXOS will establish temporary, nonhazardous OE scrap and metallic debris collection points adjacent to the southwest corner of each clearance trench stake. During operations, OE scrap items and metallic debris that are free of explosive contamination will be placed into steel drums at these collection points. The material at these temporary collection points will be transported to the pre-designated central scrap collection point upon completion of operations in that trench. As the material is being loaded, the SUXOS will perform a second inspection of the material to ensure that it is free of explosives and other hazardous materials. All inert/empty ordnance items will be stored in a secure area within the project area. The first inspection of the scrap will be by the OE clearance crew, the second by the SUXOS.

The SUXOS and SSO will perform a final inspection of the scrap at the central collection point and will certify it to be free of any explosive hazard. The SUXOS and SSO will sign and annotate a Release/Receipt Document with the following statement: "This document certifies and verifies that the OE scrap listed has been 100 percent inspected and, to the best of our knowledge and belief, are inert and/or free of explosives and related materials."

When certified free of explosive hazards and closed, each drum will be affixed with a tamper-proof seal at the close of each business day. The drummed, nonhazardous scrap will be stored on site.

6.9.5 Records

The SUXOS will prepare and submit, to the PM a daily detailed accounting of activities performed over each trench using the OE Excavation Information Sheet (Appendix E) for each trench anomaly to be intrusively investigated. In addition, the SUXOS will provide the PM with a daily summary of the following information:

- The date and time operations began
- The date and time operations were completed

- The number of hours, by labor category, expended in performing operations
- The type(s) and amounts of explosives used
- The number, type, and description of OE items encountered
- An estimated weight, in pounds, of the OE scrap and metallic debris removed from the site.

6.9.6 Ordnance and Explosives Demolition Operations

All OE determined safe to move will be stored on-site in an ATF Type II explosives storage magazine. If an OE item is determined not safe to move, proper authorization for BIP as outlined in Chapter 4.0, paragraph 4.1.1, will have to be obtained from DTSC. Upon authorization, the item will be BIP in accordance with standard demolition procedures outlined in Appendix D. The SUXOS has the option of utilizing electric or nonelectric firing procedures as outlined in Appendix D, as the particular situation dictates. The following paragraphs describe the procedures that will be used to dispose of OE or OE-related items at the Project Site.

6.9.6.1 Ordnance and Explosives Demolition Procedures.

UXO Technicians will dispose of OE materials that cannot be moved safely. Proper authorization will be obtained from the DTSC prior to any BIP as outlined in Chapter 4.0, paragraph 4.1.1. Disposal operations will begin after all nonessential personnel are out of the PWD for controlled disposal of the ordnance being detonated.

The SSO and SUXOS will be on site at all times during demolition operations. These operations will be performed under the direction and supervision of the SUXOS, who is charged with the responsibility of ensuring that procedures contained in this RAW and referenced documents are followed. The SSO will monitor compliance with the safety measures contained in the SSHP and associated documents. In the event of noncompliance, the SSO is authorized to stop or suspend operations. Disposal activities are inherently hazardous and require strict adherence to approved safety and operational procedures. Violations of procedures by site personnel may result in immediate removal from this project.

Prior to the start of demolition activities, the SSO will verify that the area around the operating site is clear of all nonessential personnel. The PWD will be established for intentional detonations and maintained in the vicinity of the disposal site. The minimum intentional detonation PWD is based on data obtained from "Use of Sandbags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions (HNC-ED-CS-S-98-7)." Personnel remaining

on site will be limited to those needed to safely and efficiently prepare the item(s) for destruction. Engineering controls for blast and fragment mitigation will be used for BIP.

6.9.6.2 Ordnance and Explosives Disposal Operations Team.

At a minimum, the OE disposal operations team will consist of the OE clearance crew, as well as the SUXOS and the SSO. However, at the point when the explosives for the disposal shot are being prepared and placed, the procedures in Section 6.9.6.5 will be observed.

6.9.6.3 Evacuation and Site Control.

Prior to initiation of demolition operations, all personnel will be evacuated to a distance outside the PWD for intentional detonations with use of sandbag mitigation. Prior to priming the demolition charges, all avenues of ingress will be physically blocked by project personnel. Radio communications will be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the SUXOS and SSO. A constant state of vigilance will be maintained by all personnel to detect any intrusion into the intentional detonation PWD.

6.9.6.4 Explosives Accountability.

Earth Tech will obtain and provide internal accountability for all explosives utilized for the disposal of OE discovered on site in accordance with procedures described in Chapter 7.0, Explosives Management/Siting Plan, and using applicable references listed in Appendix A, Administrative Record List. All unused explosives will be returned to the explosives supplier at the completion of each days operations.

6.9.6.5 Ordnance and Explosives Demolition Shots.

Prior to performing OE detonation, the SUXOS will set up a video camera at a distance of no less than 200 feet from the OE detonation location. The video camera will be set to record prior to detonation of the shot and will be stopped no less than 10 minutes after the shot. The camera will be protected with sandbags as necessary.

While preparing OE for detonation, the SUXOS and SSO will ensure that the number of personnel on site is kept to the minimum required to safely accomplish the disposal mission. Authority to initiate disposal operations will rest solely with the SUXOS. Prior to authorizing the detonation of explosive charges, the SUXOS is responsible for ensuring that all personnel have been evacuated from the intentional detonation PWD, all personnel have been accounted for, all pertinent parties have been notified of an impending demolition shot, and the area is secure. Prior to priming demolition shots, the SUXOS will direct all nonessential personnel to withdraw outside the intentional detonation PWD. Upon priming

demolition shots and prior to detonating demolition shots, all remaining personnel will withdraw outside the intentional detonation PWD.

Upon completion of demolition operations including appropriate wait periods, the OE clearance crew will visually inspect each demolition shot. Upon completion of this inspection, and assuming there are no residual hazards, the SUXOS will authorize the resumption of site operations. OE scrap collection will be performed following each successful detonation.

6.9.6.6 Fire Safety during Disposal Operations.

The SUXOS will notify the local fire department of the location and approximate times prior to detonation. The PM will notify the local Fire Department approximately 10 minutes before an intentional detonation.

6.9.7 Demolition Site Testing/Treatment

The sites used for the disposal of OE will be tested in accordance with this RAW. The sites used for BIP demolition of OE will be left unearthed and positively marked for follow-on testing, if required.

6.10 GENERAL ORDNANCE AND EXPLOSIVES FIELD PROCEDURES

The following subsections describe the general work practices OE personnel will follow during all field operations, as well as the specific procedures and methods OE personnel will use during this OE removal action.

6.10.1 General Site Practices

All OE operational activities at the site will be performed under the supervision and direction of qualified UXO technicians. Non-OE-qualified personnel will be prohibited from performing operations in an exclusion area unless they are accompanied and supervised by an UXO Technician. Throughout operations, the UXO technicians will strictly adhere to the OE safety precautions and procedures provided in the SSHP.

6.10.1.1 Work Hours.

Operations will be conducted during daylight hours only.

6.10.1.2 Site Access.

Earth Tech will control access into operating areas and will limit access to only those personnel necessary to accomplish the specific operations, or to those 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 of the investigation and clearance areas. A Site Access Control Plan has been developed and is attached as Appendix C.

6.10.1.3 Handling of Ordnance and Explosives.

If handling of OE items is required, this activity will be performed by qualified UXO technicians only. Non-OE site personnel will be instructed and closely supervised to ensure that they do not handle any OE. OE-related scrap will not be handled or touched until checked by an OE Specialist to assure the item is not explosive or does not have explosives residue.

6.10.1.4 Safety Training/Briefing.

All on-site Project Team personnel will routinely participate in two types of safety briefings: a daily general briefing and a daily tailgate safety briefing. In addition, the SUXOS may hold a safety stand-down at any time, when degradation of OE-related safety issue that warrants a review is noted.

Daily General Briefing. The daily general briefing will be conducted for all on-site Project Team personnel at the Command Post prior to beginning work. The briefing will cover general hazards for the project and any new safety issues or hazards that were identified after the last briefing. The PM will conduct the briefing, with input from the SUXOS and SSO personnel.

Daily Tailgate Briefing. The SUXOS and SSO will conduct tailgate safety briefings. Written records of these briefings and the signatures of personnel attending the briefings will be maintained. The briefings will focus on the specific hazards anticipated with 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 ongoing operations within the area whose proximity may have safety ramifications. As work progresses any corresponding changes in ingress/egress and emergency evacuation routes will also be reviewed during this tailgate briefing.

6.10.1.5 Visitor Safety Briefing.

Site visitors must receive a safety briefing prior to entering the operating area and must be escorted at all times by an UXO qualified individual. All visitors entering the project area must sign in at the Command Post.

6.10.1.6 Environmental Awareness.

Promotion of environmental awareness will be an ongoing part of daily general and tailgate safety briefings. An Initial Study has been completed by the DTSC and determined that there are no significant environmental effects expected with the activities described in the RAW provided the site mitigation measures discussed in the IS are followed. Site personnel will be briefed on the specifics of the RAW prior to the start of site investigative activities.

6.10.1.7 Safety and Environmental Violations.

Safety violations or unsafe acts will be reported immediately to the SUXOS and SSO. Failure of personnel to comply with safety rules/regulations or failure to report violations may result in immediate termination of employment. Reckless interference with sensitive species or blatant disregard for environmental issues will likewise not be tolerated and may lead to termination of employment and possible legal proceedings.

6.10.1.8 Work Clothing and Field Sanitation.

Work clothing will be appropriate for the conditions encountered. In most cases, this will be Modified Level D personal protective equipment (PPE), as follows:

- Short- or long-sleeve cotton coveralls or work clothing.
- Sturdy footwear (e.g., ankle-high work boots). OE personnel will not wear steel-toed safety boots when using geophysical equipment.
- Hand protection will consist of leather work gloves. Rubber inner or outer gloves may be required where increased protection is needed.
- Respiratory Protection, safety glasses, hearing protection, and hard hats will be available and worn during activities for which their use is required. Hard hats will not be worn during the excavation and demolition of OE items.

The team will be outfitted with field decontamination equipment, which will consist of portable eyewash kits, containers of wash water, paper towels, and soap. Prior to commencement of daily operations, 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. The work teams will utilize existing field sanitation stations.

6.10.1.9 Compliance with Plans and Procedures.

OE personnel will conduct operations at the site in a systematic manner using proven operating methods and techniques. All activities will be conducted under the direction, supervision, and observation of the SUXOS (or a UXO technician during the OE escort activities). 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 SSO and PM. Any new course of action or desired change in procedures will be submitted with justification for approval in accordance with Chapter 12.0, OE QCP. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality on the part of the OE team.

6.10.1.10 Chemical Warfare Material.

The ASR, Records Research Report and discussions with USACE have indicated that the identified fieldwork areas should not contain chemical warfare materiel (CWM). If site personnel identify any items potentially containing CWM, field operations will cease, the subject area will be marked accordingly, all personnel will exit the area upwind, and the local military END unit will be notified immediately. OE personnel will secure the area from access until relieved by local military END representatives. Fieldwork will not resume until it has been determined safe to do so.

6.10.1.11 Equipment Checks.

All instruments and equipment that require maintenance and/or calibration will be checked prior to the start of each workday. 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 as the equipment removed from service.

OE escorts (see Section 6.10.2) or SUXOS will use Schonstedt® magnetometers to ensure OE avoidance and anomaly-source investigation at the site. Instrumentation that will be used for either surface or subsurface OE detection will be tested daily at the Project Site to verify that the instrument performance meets or exceeds that necessary to ensure safe performance of the work. Instrument performance criteria include:

- Instrumentation to be used for avoidance of surface OE will be capable of detecting a hollow-steel cylinder (nominally equivalent to a 37mm HE projectile) at a depth of 8 inches bgs

- Instrumentation to be used to clear locations for intrusive activities that will penetrate no more than 12 inches into the ground, such as setting sampling location stakes, will be capable of detecting a hollow-steel cylinder (nominally equivalent to a 37mm HE projectile) at a depth of 12 inches bgs

- Instrumentation used to verify that all sources for the identified geophysical anomalies have been removed from each intrusive sampling location will provide detection performance equal to that of the selected geophysical instrument (see Chapter 5.0, Ordnance and Explosives Construction Support Plan), as verified at the field equipment test plot.

6.10.2 Ordnance and Explosives Escort

The PM will deploy UXO qualified personnel to escort non-OE-qualified personnel during performance of their duties within potential OE-contaminated areas.

Activities that may require an OE escort include, but are not limited to, trench staking, and biological and/or cultural resources surveys.

All OE encountered will be reported to the SSO and SUXOS, and all suspected OE surface anomalies will be marked and avoided. An SUXOS will be responsible for directing the actions of the OE Escort Team(s). Throughout these operations, the SUXOS will closely monitor performance to ensure that procedures are being performed with due diligence and attention to detail. OE personnel will perform OE avoidance support for the operations described in the following subsections.

6.10.2.1 Equipment.

The equipment requirements for this activity include:

- Approved hand-held geophysical equipment used to detect subsurface metallic anomalies
- Pin flags listed in Table 6-2 (pin flag colors listed may change if they conflict with the colors used to mark anomalous areas)
- Miscellaneous common hand tools (e.g., screwdrivers).

6.10.2.2 Access Routes to Locations.

Prior to the arrival of excavation and geophysical crews on site, the OE team will conduct a visual surface reconnaissance of the area. The reconnaissance will include locating a clear path for crews, vehicles, and equipment. At a minimum, the approach path will be twice the width of the widest vehicle, with the exception of established, commonly used site roads. The boundaries of the approach path will be clearly marked with white pin flags (see Table 6-2) to prevent personnel from straying into uncleared areas. If OE is encountered, the OE team will report the items to the PM and SUXOS.

6.10.2.3 Anomaly Reacquisition Support.

The reacquisition of geophysically mapped subsurface anomalies will be conducted in accordance with the procedures identified in Chapter 5.0, Ordnance and Explosives Construction Support.

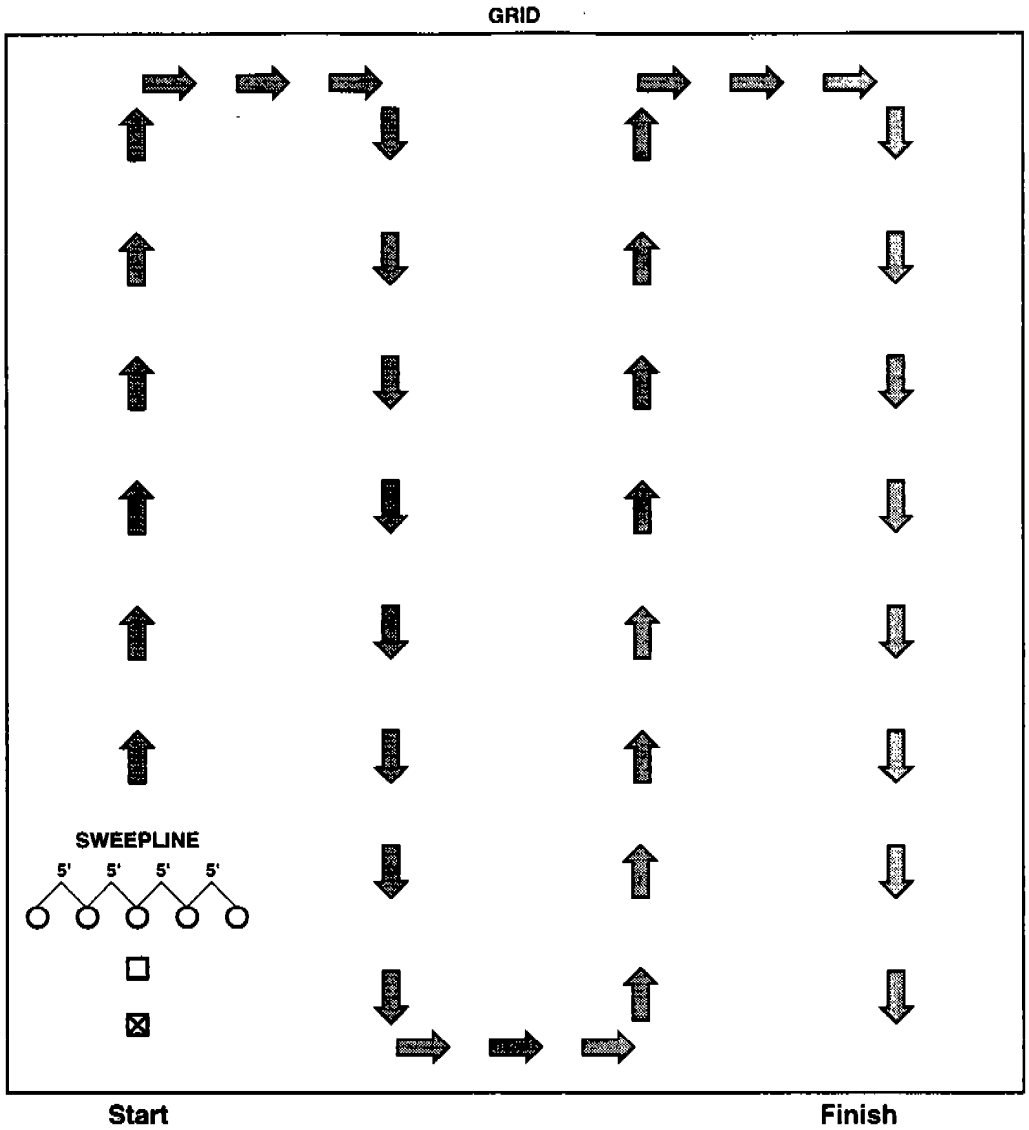
Anomaly reacquisition support will be provided by OE personnel, who will act as OE escorts during the reacquisition activities. The OE escorts will be responsible for the following:

- Assisting in the placement of pin flags or stakes for the purposes of anomaly location identification.
- Conducting visual surveys for surface OE items.
- Reporting any suspected OE encountered to the SSO and SUXOS.

After completion of all investigation/clearance activities, project personnel will remove all operational capability from the area. Demobilization is anticipated to take 2 working days and will be conducted under the direction of the PM and either the SSO or SUXOS.

Demobilization activities will include, but not be limited to:

- Removal of all personnel and equipment from the project area
- Close-out of files and records
- Clean up of the Command Post
- Return of all equipment furnished by others
- Notification of all appropriate points of contact and support organizations of departure
- Close-out of accounts with local vendor(s).



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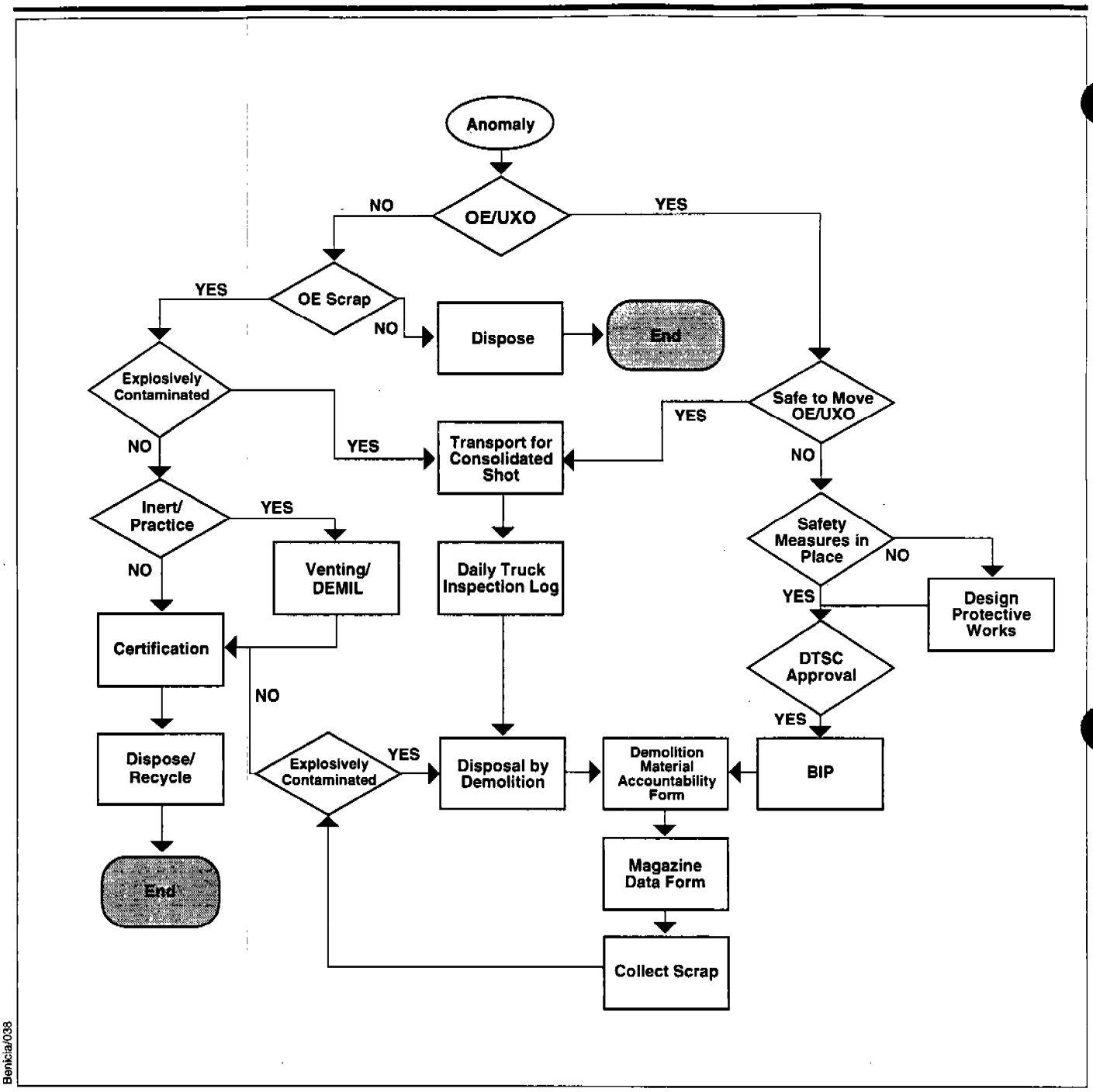
EXPLANATION

- ○ UXO Tech
- □ UXO Supervisor
- ⊠ Support Vehicle

OE Surface Clearance Walking Sweepline (Conceptual)

Figure 6-1



EXPLANATION

BIP	Blow in Place
OE	Ordnance and Explosives
UXO	Unexploded Ordnance
DEMIL	Demilitarization (to render unusable)

OE Process Flowchart

Figure 6-2

7.0 EXPLOSIVES MANAGEMENT/SITING PLAN

7.1 PURPOSE

The purpose of this plan is to describe the procedures applicable in the conduct of explosives management concerning the Tourtelot Cleanup Project RAW. These responsibilities include acquisition, license/permits, initial receipt, storage, emergency notification, explosives compatibility, transportation, and audit criteria.

7.2 SCOPE

This plan applies to all Project Team personnel, including contractor and subcontractor personnel, involved in the conduct of explosives management on the Project Site. This plan is not intended to contain all requirements needed to ensure compliance. Section 7.3 lists additional documents that can be consulted for information concerning compliance issues.

7.3 REFERENCES

The following documents were used in preparing this plan:

- Alcohol, Tobacco, and Firearms (ATF) P 5400.7, ATF-Explosives Law and Regulations
- Army Regulations (AR) 385-64, Ammunition and Explosives Safety Standards
- AR 190-11, Physical Security of Arms, Ammunition and Explosives
- U.S. Army Engineering and Support Center, Huntsville (CEHNC) Safety Concepts and Basic Considerations for OE
- Department of the Army (DA) PAM 385-64, Ammunition and Explosives Safety Standards
- DOD 6055.9-STD, Ammunition and Explosives Safety Standards
- DOD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives
- Department of Transportation (DOT), 49 CFR Parts 100 to 199, Transportation (applicable sections)
- OSHA, 29 CFR Part 1910, Occupational Safety and Health Standards
- OSHA, 29 CFR Part 1926, Construction Standards

- Technical Manual (TM) 9-1300-2-6, Ammunition and Explosives Standards
- TM 9-1300-200, Ammunition General
- TM 9-1300-206, Military Explosives.

7.4 RESPONSIBILITIES

The PM, in conjunction with the SUXOS, is responsible for the initial quantity and type of demolition material ordered. The SUXOS will be responsible for all subsequent requisitions for demolition materials.

7.5 ACQUISITION

The requisition of explosives will be in accordance with the references listed in Section 7.3. Explosives will be delivered by the vendor on an as-needed basis. Storage of explosives on site is not anticipated. All unused explosives will be returned to the vender.

7.6 LICENSE AND PERMITS

In order to purchase explosives, Earth Tech must have an Explosives Purchase/Receipt Authorization List for the receipt of explosives. This document must be on file and a copy provided to the explosives supplier prior to the purchase of explosives. A copy of all required licenses/permits and an authorization list for the Project Site will be maintained at the site Command Post (see Figure 2-2).

State Blaster's License/State or County Permits

A UXO qualified technician possessing a California State Blaster's License will be on site for all explosive disposal operations.

It will also be necessary to obtain a county permit to conduct explosive disposal operations. Permits will be obtained through the Solano County Fire Department prior to OE disposal operations.

7.7 INITIAL RECEIPT

Only those individuals named on the authorization list may sign for explosives received from the explosives vendor. In order to ensure that the quantity delivered is the same as the quantity listed on the delivery documents, two OE personnel will inventory the delivery prior to signing for any demolition materials.

Receipt Procedures

Explosives deliveries will be accompanied by the explosive supplier's bill of lading. The initial inventory will include reconciling the document with the actual delivery received.

Regardless of the outcome of the initial inventory, one copy of the bill of lading document will be attached to a copy of the purchase requisition (PR) and the purchase order. One copy of each of these three documents will be kept on file at the site Command Post, and one complete copy will be forwarded to the Earth Tech contracting office.

7.8 STORAGE

OE disposal operations will be conducted only as necessary for items that are not safe to move. All OE items that are safe to move will be stored for disposal during the OE point clearance activities. An RCRA temporary storage permit waiver for the storage of hazardous waste longer than 90 days will need to be granted by DTSC. Currently, the OE point clearance is scheduled to begin in fall/winter 2000/2001. This will require storage of OE items that can be safely transported (as discussed in Chapter 6.0) and stored in a secure magazine. Existing facilities are not sufficient for the storage of OE items. The PM will place on site two (2) BATF Type 2 magazines. Two magazines are required to allow for safe storage of incompatible items that may be encountered. The PM will assure compliance with local storage procedures. The project will:

- Use approved BATF Type 2 outdoor storage magazines
- The net explosive weight (NEW) for each magazine will not exceed 100 pounds
- Locate, install, and maintain the magazines to comply with the magazine criteria and quantity distance requirements established in ATF P5400.7 ATF-Explosives Laws and Regulations
- Ensure a lightning arrester system is installed and checked by an electrician for specification conformance.

Type 2 outdoor magazines will be used, which will consist of a box, trailer, semi-trailer or other mobile facility. It will be bullet-, fire-, weather-, and theft-resistant, and well ventilated. The ground around outdoor magazines must slope away for drainage, or other adequate drainage will be provided.

The exterior and doors are to be of not less than 1/4-inch steel and lined with at least 4 inches of hardwood. Magazines with top openings will have lids with water-resistant seals or which overlap the sides by at least 1 inch when closed.

Hinges and hasps will be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps will be installed so they cannot be removed when the doors are closed and locked.

Each door will be equipped with two padlocks fastened in separate hasps and staples. Padlocks must have at least five tumblers or five blades and a case-hardened shackle of at least 1/4-inch diameter. Padlocks will be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples.

7.8.1 Magazine Placard Requirements

BATF and DOD require that all magazines be appropriately posted for content hazard class and fire-fighting hazard, and an emergency notification list must be available. Magazines will be placarded in accordance with DOD 4145.26M and TM 9-1300-206. In most instances, this will require a Fire Division Class 1 for the recovered OE magazines.

7.8.2 Magazine Inspections/Inventory and Accountability Requirements

Magazines will be inspected weekly by the PM's designee when on-site conducting operations and by Granite security during periods when field activities are not being conducted. These inspections will be sufficient to determine whether there has been unauthorized entry or attempted entry into the magazines, or unauthorized removal of the magazine contents. Entries by Granite security or the PM's designee, as appropriate, will be annotated in daily logs to document these inspections. Personnel listed on the authorized access list (attached to the magazine) will be notified of unauthorized or attempted entry of the magazine for further investigation.

Inventory of magazine contents are required after completion of issue, transfer or receipt of explosives or a minimum of annually. Inventories will be annotated on the Explosive Accountability Record form (Appendix F).

7.8.3 Emergency Notification

An emergency notification list containing the name, telephone number, and local address of the individuals to be notified in the event of an emergency, will be posted on the outside, inside of the magazine door, and at the Command Post. These individuals should be the same individuals authorized to sign for explosives.

7.8.4 Explosives Compatibility

Explosives compatibility will be maintained in accordance with DOD 4145.26M and TM 9-1300-206. Table 7-1 lists the various storage compatibility groups; Table 7-2 is the compatibility chart.

Magazines will remain locked except when receipts, issues, and inventories are being conducted. The two locks on the magazines will require two different keys. One key will be kept by the SUXOS, and the second key by the FTL/SSO. This procedure ensures that access to the magazines cannot be made without obtaining the two keys and that no one individual can gain access to the magazines.

7.9 TRANSPORTATION REQUIREMENTS

Transportation of OE and explosives will comply with all federal, state, and local regulations. Permits are not required under CERCLA for on-site transportation of explosives or OE.

Transportation of explosives and OE on site will meet the following criteria:

- Vehicles will be inspected using Weekly Vehicle Inspection Checklists and will be properly placarded (Appendix E).
- Explosives will be transported in closed vehicles whenever possible. When using an open vehicle, explosives will be covered with a flame-resistant tarpaulin (except when loading/unloading).
- Vehicle engine will not be running during loading or unloading. Wheel chokes and brakes will be set when loading/unloading explosives.
- Beds of vehicles will have either a plastic bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed fittings.
- Vehicles transporting explosives will have a first aid kit, two 10-pound-rated fire extinguishers, and communications capabilities.
- Initiating explosives, such as detonators, will remain separated from other explosives at all times.
- Compatibility requirements will be observed.
- Operators transporting explosives will have a valid driver's license.
- Drivers will comply with posted speed limits but will not exceed a safe and reasonable speed for conditions. Vehicles transporting explosives off-road will not exceed 25 miles per hour.

Audit Criteria

The following items related to explosives acquisition, accountability, and transport will be audited to ensure compliance with this RAW:

- The Demolition Shot Record
- The Explosive Accountability Records
- The Site Daily Operational and Safety Logs
- The OE Operations Daily/Weekly Report
- The Safety Training Attendance Forms, for the initial site hazard training
- The Safety Training Attendance Forms, for the Daily Tailgate Safety Briefings
- The Daily Safety Inspection and Audit Log.

8.0 SOIL INVESTIGATION FIELD SAMPLING PLAN

This chapter presents the Soil Investigation Field Sampling Plan (SIFSP) for the proposed field investigation activities at the North Valley Military Landfill, where further delineation of the extent of contamination is warranted (see Figure 2-3). These areas can be effectively characterized through sample collection using trenching methods. The trenches will allow for more accurate field screening techniques and more useful soil sample location selection. This SIFSP, in conjunction with the QAPP (Appendix G), will be used to ensure that (1) all sample and field measurements are consistent with the project DQOs, as presented in Chapter 2.0; (2) samples are collected, identified, handled, preserved, packaged, and shipped in such a manner as to maintain their integrity and validity; and (3) field data are collected in such a manner as to ensure accuracy, precision, completeness, representativeness, and comparability, and provide an adequate database for achieving the DQOs.

8.1 TRENCHING METHODS

All subsurface trenching activities will be conducted under the direct supervision of a California state-registered geologist and an OE specialist. Earth Tech personnel will direct the excavation of two trenches to characterize the North Valley Military Landfill. The approximate locations of the trenches are shown in Figure 2-3. The landfill will contain two trenches that intersect each other. The anticipated depth to the bottom of the landfill is approximately 4 to 5 feet. Excavation will extend approximately 2 feet beyond the base of the landfill into native soil, with a total anticipated depth of about 6 or 7 feet bgs. The trenches will be benched or sloped as necessary for safety of project personnel required to work within them. The benching or sloping will be in accordance with 29 CFR Parts 1926.650, 651, and 652, Subpart P, Excavations. The minimum sloping will be 1-1/2 feet horizontal to 1 foot vertical. The trenches will be lithologically described and classified in accordance with the ASTM D 2488 *Description and Identification of Soils (Visual-Manual Procedures)*. Photographic sequences of each trench will be recorded. A backhoe will be used to excavate the trenches.

8.2 FIELD SAMPLING ACTIVITIES

All field sampling activities will be conducted under the direct supervision of an OE specialist. Sampling points will be situated at 25-foot intervals along the length of each trench. Soil samples for the North Valley Military Landfill will be collected from each sampling point at the base of the landfill (soil/debris interface) and 2 feet below the base. Four soil samples will also be collected from soil mixed with the contents of the landfill. Additional samples may be collected if indicated by field screening techniques (e.g., PID). The samples will be labeled according to the trench number (TR1 or TR2), the area in which the trench was excavated (LF), and the depth bgs from which it was collected. For instance, a sample collected at

4 feet bgs from the first sampling location in Trench 1 of the North Valley Military Landfill will be labeled LF1-TR1-S1-04.

The samples collected from TR1 and TR2 (Figure 8-1) in the North Valley Military Landfill will be delivered under chain of custody (COC) to the state-certified laboratory Quanterra, in West Sacramento, California, for analysis of:

- PAHs by EPA Method SW8310
- Dioxins/furans by EPA Method SW8290
- Chloropicrin by EPA Method SW8270CWM
- Pentachlorophenol by EPA Method SW8270C
- PCBs by EPA Method SW8082
- CAM 17 metals, plus aluminum, calcium, iron, manganese, magnesium, potassium, and sodium, by EPA Methods SW6010B, SW7470A, and SW7471A
- Explosives, including nitroglycerin and PETN, by EPA Method SW8330
- Nitrate/nitrite as nitrogen by EPA Method 300.0
- Organochlorine pesticides by EPA Method SW8081A
- TEPHs as diesel and motor oil by California LUFT Modified EPA Method SW8015
- TEPHs as kerosene by California LUFT Modified EPA Method SW8015
- VOCs by EPA Method SW8260B

and to the state-certified laboratory E.S. Babcock and Sons, in Riverside, California, for analysis of:

- Perchlorate by California Modified EPA Method 300.0.

Soil samples within 4 feet bgs will be collected using a hand-driven slide hammer with extensions. A 6-inch-long by 2.5-inch-diameter drive sampler will be attached to the slide hammer. The sampler will contain one 6-inch-long by 2-inch-diameter, certified, pre-cleaned, stainless steel liner. The drive sampler will not be allowed to drop onto the soil being sampled. A hand-driven slide hammer will be gently placed onto the soil being sampled. The sampler will be driven into the undisturbed formation with blows from the slide hammer. Blows will be applied until the sampler has advanced 6 inches, or until it is determined that no visible advancement is

being made. After the sampler is driven to the desired depth, it will be removed from the trench, opened, and the liner removed. The percent of recovery will be recorded on either the Test Boring Log or in the Daily Field Report (see Appendix E). Field Sampling Program numbers, locations, and analytical tests to be performed are in Table 8-1.

If, for any reason, the drive sampler cannot be advanced, surface scraping may be used to collect soil, sediment, or bedrock samples from the ground surface, and from select depths from the base of the trench. A thin layer of soil/sediment will be scraped using a stainless steel spoon. The samples will be placed directly into the above mentioned certified, pre-cleaned steel liners. Sloping of trenches will be performed in accordance with Section 8.1 criteria.

For safety reasons, soil samples below 4 feet bgs will be collected by taking a 6-inch lift from the desired sampling depth using the backhoe bucket. The backhoe bucket will be raised to the surface where a member of the sampling team will use a rubber mallet to drive a 6-inch-long by 2-inch-diameter, certified, pre-cleaned, stainless steel liner into the center of the soil being held by the bucket.

Soil samples collected for VOC analysis by EPA Method SW8260B will be sampled using the Encore™ sampling system according to EPA Method SW5035.

In the event that trenching reaches the water table and groundwater seeps into the trench, grab water samples will be collected in laboratory-supplied, pre-cleaned sample bottles containing the preservatives, if applicable. Grab water samples will be collected by holding the sample bottles at the desired depth within the water column in areas where water has collected. Grab water sample collection activities will be recorded on the Surface Water/Sediment Data Form.

8.3 FIELD QUALITY CONTROL

Trench soil samples collected from the North Valley Military Landfill will use the following unique numbering system:

LF-TR1-S1-00 and LF-TR2-S2-00

where:	LF	=	North Valley Military Landfill
	TR1	=	Trench 1, trended northeast to southwest
	TR2	=	Trench 2, trended east to west
	S#	=	Sample sequence, starting with S1 at the north end of TR1 or the east end of TR2
	00	=	The depth from which the sample was collected.

Each sample will be labeled according to the area in which the trench was excavated (DA1 or LF), the trench number (TR1 or TR2), the sequence in which the sample was collected along the length of the trench, and the depth bgs from which it was collected. For instance, a sample collected at 4 feet bgs from the first

sampling location in Trench 1 of the North Valley Military Landfill will be labeled LF-TR1-S1-04.

Field QC samples will be collected during the field investigation activities to assess the influence of sampling procedures, equipment, and handling on the reported results. The following types of QC samples will be collected.

8.3.1 Duplicate Samples

Field duplicates are samples collected separately at a particular location and time, in order to assess errors associated with sample heterogeneity, sampling methodology applicability, and sample handling techniques. Collocated duplicates are collected separately and placed directly into sample containers. Theoretically, each sample equally represents the medium at a given time and location. This is the required type of sample for volatiles analyses.

Since more information can be obtained from samples with detectable concentrations, efforts will be made to select duplicate samples from those areas anticipated to have the highest potential for contamination. Field duplicate samples will be collected for each analyte and will number 10 percent of the original sample number per field effort or field event, with a focus on critical sampling areas. The duplicate samples will be collected, labeled, packaged, and sealed in the same manner as the original field samples and submitted "blind" to the analytical laboratory. The duplicate samples will be analyzed for the same parameters as the original field samples.

Collected duplicates are defined as two samples collected independently at a single sampling location during a single act of sampling for analysis at one laboratory for each specified method. Field duplicate soil samples will generally be collected from two consecutive sample liners collected at one boring or sampling location during a single act of sampling. However, depending on the required sample volume, the soil stratigraphy being sampled, or other considerations, two separate aliquots of soil may be collected from a single liner and placed into two separate containers.

8.3.2 Equipment Blanks, Temperature Blanks, and Trip Blanks

8.3.2.1 Equipment Blanks.

Equipment blanks will be used to evaluate decontamination procedures for field sampling equipment. One set of equipment blanks will be collected each day of soil sampling.

Equipment blanks are samples of Type II reagent-grade or equivalent water that has been poured through the sampling equipment into the appropriate sample bottles and transported to the laboratory for analysis. Equipment blanks will be prepared immediately after the sampling device has been decontaminated, preferably between two sample collection points where target analyte detection is

Table 8-1. Field Sampling Programs - North Valley Military Landfill

			Chemical Analyses/EPA Test Methods													
			Explosives	Nitroglycerin PETN	Dioxins/ Furans	PCBs	TEPH-D/ MO	TEPH-K	Nitrate-N Nitrite-N	Pesticides	Chloropicrin	Pentachlorophenol	Perchlorate	Metals	PAHs	VOCs
Sample ID*	Sample Depth	Sample Matrix	SW8330	SW8330	SW8290	SW8082	LUFT Mod. SW8015	LUFT Mod. SW8015	E300.0	SW8081A	SW8270CWM	SW8270C	CA Mod. E300.0	SW6010B, SW7470A, SW7471A	SW8310	SW8260B
LF-TR1-LM1-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-LM2-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-LM2A-__	(1)	Soil Dup	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-LM1-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-LM2-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S1-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S2-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S3-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S4-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S5-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S6-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S7-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S8-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S9-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S10-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S11-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S12-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S13-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S13A-__	(2)	Soil Dup	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S1-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S2-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S3-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S4-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S5-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S6-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S7-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S7A-__	(2)	Soil Dup	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S1-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S2-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S3-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S4-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S5-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S5A-__	(3)	Soil Dup	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S6-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S7-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S8-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S9-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S10-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X

Table 8-1. Field Sampling Programs - North Valley Military Landfill

			Chemical Analyses/EPA Test Methods													
			Explosives	Nitroglycerin PETN	Dioxins/ Furans	PCBs	TEPH-D/ MO	TEPH-K	Nitrate-N Nitrite-N	Pesticides	Chloropicrin	Pentachlorophenol	Perchlorate	Metals	PAHs	VOCs
Sample ID*	Sample Depth	Sample Matrix	SW8330	SW8330	SW8290	SW8082	LUFT Mod. SW8015	LUFT Mod. SW8015	E300.0	SW8081A	SW8270CWM	SW8270C	CA Mod. E300.0	SW6010B, SW7470A, SW7471A	SW8310	SW8260B
LF-TR1-S11-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S12-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S13-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S1-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S2-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S3-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S4-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S5-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S5A-__	(3)	Soil Dup	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S6-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S7-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-GW-__	(4)	Water	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(1) Within the landfill/soil matrix
(2) Base of landfill
(3) Two feet below base of landfill
(4) Depth of groundwater if encountered
* Sample ID to be determined in the field when sample is collected

expected, rather than at the start or completion of the sampling day. Equipment blank samples will be collected, labeled, packaged, and sealed in the same manner as the original field samples and submitted "blind" to the analytical laboratory. Equipment blank samples will be analyzed for all analyses performed on associated samples.

Soil samples collected in certified, pre-cleaned, stainless steel liners driven directly into the sample medium without possible cross-contamination from other equipment will not require an equipment blank.

Equipment rinsate blank results will be routinely monitored to assess the effectiveness of decontamination procedures. If rinsate results are detected, field procedures will require revisions to address the source of contamination. If results are routinely nondetected, the frequency of equipment blank sampling may be reduced with permission of the regulators.

8.3.2.2 Temperature Blanks.

Temperature blanks will accompany each cooler shipment of soil samples sent to the laboratory for analysis by methods requiring sample preservation by cooling. A temperature blank is a sample bottle containing water. One temperature blank will accompany each cooler containing either water samples, soil samples, or water and soil samples.

8.3.2.3 Trip Blanks.

Trip blanks will accompany each cooler shipment of soil samples sent to the laboratory for analysis of VOCs (EPA Method SW8260B). A trip blank is a set of VOA vials containing Type II analyte-free water that is prepared in the laboratory, taken to the sampling site, and returned to the laboratory with samples submitted for analysis of VOCs. Trip blanks shall not be opened in the field. One trip blank will accompany each cooler containing soil samples to be analyzed for VOCs. The trip blank shall be analyzed by the same VOC analytical methods as the samples.

8.3.3 Field-Designated Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike (MS)/matrix spike duplicate (MSD) samples should be field-designated by the sampler for each shipment of samples. For every analytical batch of 20 or fewer soil samples within a sampling event from a major lithological type, the laboratory will prepare and analyze an MS/MSD pair from a project sample collected by Earth Tech. The sampler will designate one or more of the samples in each shipment by noting in the Remarks column on the COC Record that the sample(s) are for MS/MSD analysis. Samples designated for MS/MSD analysis should be typical of the matrix and should not be highly contaminated in order to minimize MS/MSD imprecision resulting from high levels of environmental contamination. In order to minimize the effects of soil heterogeneity, the laboratory will use a single or adjacent liners.

8.3.4 Field Audits

At least once in the course of this phase of field investigation for this project, the QC Systems Manager or designee will designate an Earth Tech field auditor not associated with the project team to be on site to perform an independent field QA audit to ascertain adherence to the field protocols and procedures set forth in this SIFSP, as specified in Section 3.3.2.3 of the QAPP (Appendix G). Additional follow-up audits may be required upon initiation of different phases that involve previously unaudited field activities, or to follow-up on corrective actions. Any deviations from the field protocols and procedures that could compromise the quality of the data obtained will be reported by the field geologist to the PM, who will decide what action to take. Any such deviations will be documented on an NCR (see Section 3.3.2.4, Figure 3.3-1 of the QAPP [Appendix G]) to include a description of the problem, how it was discovered, the corrective action, the follow-up and confirmation, and the appropriate signatures of those involved.

8.4 SAMPLING STORAGE, PRESERVATION, AND HOLDING TIMES

Sample bottles pre-cleaned and treated according to EPA specifications for the appropriate methods will be supplied by the analytical laboratory. Certified, pre-cleaned, stainless steel liners will be used for soil/sediment sample collection. Detailed requirements for sample containers and preservatives are presented in the QAPP (Appendix G).

8.5 SAMPLE HANDLING AND SHIPMENT

8.5.1 Sample Sealing

Each sample container will be sealed immediately after sample collection. In the case of soil liners, each end of the liner will be covered with Teflon™ sheeting and plastic end caps. This procedure will help the laboratory determine if any spillage occurred during shipment.

8.5.2 Sample Packaging and Shipment

U.S. DOT regulations will be followed for packaging and shipment. Samples will be properly packaged for shipment and submitted to the designated analytical laboratory for analysis, under strict COC protocol (see Section 2.18.2 of the November 16 RI/FS Work Plan). Soil samples contained in stainless steel liners will be sealed in self-sealing plastic bags.

Each cooler will be filled with the sealed and bubble-wrapped sample containers. Additional packaging will be used to prevent sample containers from moving or from making contact during shipment. Enough double-bagged ice or blue ice will be added to the coolers to maintain sample temperature at 4° ±2°C during shipment. A temperature blank will be placed in each cooler along with the samples.

8.5.3 Shipment by Commercial Carrier or Courier Service

If the sample coolers are to be shipped by a commercial carrier or courier service (other than the analytical laboratory), the COC Record (see Appendix E) accompanying the coolers to the analytical laboratory will be placed inside a sealed plastic bag and taped to the inside of the cooler lid. The coolers will then be secured and custody-sealed for shipment to the analytical laboratory. The custody seal will consist of a regular paper custody seal or filament tape wrapped around the cooler at least twice, with the tape end signed before the cooler is shipped. Wide, clear tape will be placed over paper custody seals to help ensure against accidental breakage. Custody seals will be used for all sample containers shipped by either a commercial carrier (i.e., Federal Express) or a courier service.

The coolers will be transported as environmental samples to the analytical laboratory as expeditiously as possible (e.g., via Federal Express overnight delivery service, if necessary). If the samples are sent by a commercial carrier, a bill of lading will be used. Receipts of the bills of lading will be retained as part of the permanent documentation. Commercial carriers/courier services are not required to sign-off on the COC Record as long as the form is sealed inside the sample cooler and the custody seals remain intact. A standard airbill will be necessary in order to ship environmental samples by a commercial carrier.

8.5.4 Shipment by Earth Tech or Analytical Laboratory

If the samples are delivered directly to the analytical laboratory by Earth Tech field personnel, or picked up from either the Project Site or Earth Tech's San Jose office by the analytical laboratory, the COC Record need not be secured inside the cooler lid. The COC Record will be handed directly to the analytical laboratory personnel after COC sign-off protocols have been completed. Custody seals will not be required for coolers delivered by Earth Tech or picked up by the analytical laboratory.

8.6 SURVEYING

Ten horizontal interval locations along each trench will be surveyed to a standard horizontal and vertical control by a surveyor licensed in the state of California. Elevations will be measured to the ground surface. All elevations will be surveyed to the nearest 0.01 foot and referenced to MSL. The horizontal locations will be surveyed to the nearest foot and referenced to the California State Plane Coordinate System. All surface expressions of the soil sampling collection locations will be surveyed by the same protocol as above.

8.7 FIELD TEST EQUIPMENT

Procedures for using health and safety field monitoring equipment (i.e., magnetometer, photoionization detector, and Mini-RAM) are presented in the SSHP. Field instruments will be calibrated prior to use, and the calibration

information will be recorded on either the Instrument Calibration Log or the Field Meter Instrument Calibration Log (see Appendix E). All field instruments will be maintained, calibrated or checked, and operated according to the manufacturers' specifications and guidelines. Test equipment, calibration frequencies, and field QC procedures are summarized in Tables 8-2, 8-3, and 8-4. The sensitivity of the field test equipment being used will be recorded on either the Instrument Calibration Log or the Field Meter Instrument Calibration Log.

8.8 DECONTAMINATION PROCEDURES

The purpose of decontamination procedures during soil sampling is to prevent foreign contamination of samples and cross-contamination between sampling locations. Before use, all sampling equipment including the slide hammer will be decontaminated by steam-cleaning, or alternatively by washing with a nonphosphate detergent such as Liquinox® or Alconox™ (or equivalent). Equipment washed with a nonphosphate detergent will be double rinsed using potable water and DI (or Type II reagent-grade) water. The decontamination procedure for sampling equipment will incorporate a detergent wash, potable water rinse, rinse with pesticide-grade methanol, rinse with DI water, and a final rinse with Type II reagent-grade water. As an alternative to use of reagent-grade water, analytical data may be collected to indicate that DI water to be used for the final rinse is free of the substances of interest for this project above the level of detection for the relevant analyses.

Sampling equipment that is not readily decontaminated will be discarded after each use. Discarded materials, including decontamination solutions, will be accumulated and stored in appropriate containers pending proper disposal (see Section 8.9). Decontamination procedures will be performed by all field personnel who have been in contact with contaminated or potentially contaminated materials. Procedures for decontamination of field personnel are presented in Section 10.1 of the SSHP.

8.8.1 Heavy equipment (i.e., backhoe)

The decontamination facility for heavy equipment will be situated adjacent to the trenches, just outside the North Valley Military Landfill. The decontamination facility will be constructed by first performing a surface clearance of the locations and removing all brush. The facility will be approximately 20 feet wide and 30 feet long. A sandbag berm will be placed at all sides of the location. The sandbags and bottom of the facility will be covered with 2 layers of high-density polyethylene sheeting (HDPE) or 5 layers of 10 mil polyethylene sheeting. This will form a water and debris containment for decontamination of the heavy equipment. A water pump will be placed into the HDPE containment to transfer decontamination effluent to polyethylene-lined drums placed outside the facility area. All effluent will be analyzed in accordance with the procedures outlined in Section 8.9.2.

The heavy equipment will be driven into the abovementioned facility prior to commencement of decontamination procedures. To decontaminate the heavy equipment once it is inside the facility, remove all loose soil and material with a brush; steam clean with high-pressure water or portable high-pressure steam spray all surfaces that were exposed to potentially contaminated soil and materials; and scrub the exposed surfaces with a brush and soap and water. Rinse all surfaces with clean water. Prior to driving the heavy equipment out of the facility, remove all water and debris from the facility. As the heavy equipment leaves the facility, a final rinse of the equipment will be performed so that all residual debris is removed from the equipment and remains within the facility.

8.9 INVESTIGATION-DERIVED WASTE

This section outlines the procedures to be used for proper collection, characterization, storage, containerization, and transport and disposal (if necessary) of investigation-derived waste (IDW). IDW is defined as waste generated during the field investigation activities that has the potential to be hazardous and thus requires special handling.

Proper collection and disposal characterization procedures for soil, decontamination rinsate, disposable protective clothing, and plastic ground covers are presented in the following sections.

8.9.1 Soil

The debris excavated from the North Valley Military Landfill will be placed in a roll-off container. Soil will be placed adjacent to the trench on nonpermeable material and covered. A berm will be constructed around the stockpile area to control the runoff. The analytical results for the soil samples collected from the trench will be used to determine appropriate disposal as described in Section 8.9.6. Additional sampling and analysis of the soil stockpiles and debris in the rolloff containers may also be necessary to satisfy the requirements of a licensed disposal facility. The soil stockpiles may be used as backfill for the trench after soil sample collection and trenching documentation are completed, if analyte concentrations in the soil are not elevated. Debris will be disposed of in an appropriate licensed facility. Hazardous soil and debris will be transported by a licensed hazardous waste hauler and disposed of at a licensed disposal facility.

8.9.2 Water

IDW water derived from decontamination rinsate will be placed in DOT-approved 55-gallon drums or other approved containers and appropriately labeled, as described in Section 8.9.4. IDW water samples will be collected from selected containers. If more than one container contains water from the same source, only one of the containers will be sampled. IDW water samples will be handled and shipped to the analytical laboratory in the same manner as the field samples. The analytical results will be used to determine appropriate disposal as described in Section 8.9.6. Additional sampling and analysis of the IDW water may also be

required in order to satisfy the requirements of a licensed disposal facility. If no substance of interest is detected in any of the samples collected from the IDW containers, the water may be discharged directly to the ground surface, on a portion of the Project Site that has not been affected by contaminants, in a manner to prevent surface ponding and runoff. Hazardous water will be transported by a licensed hazardous waste hauler and disposed of at a licensed disposal facility.

8.9.3 Disposable Protective Clothing and Ground Covers

Other wastes include disposable protective clothing, plastic ground covers, and nonreusable sampling equipment (e.g., disposable bailers) that have come in contact with media being sampled. These wastes will be collected, placed in a DOT-approved 55-gallon drum or other approved container, and labeled, pending appropriate disposal. These wastes will not be mixed with the IDW soil or water.

8.9.4 Waste Containers and Storage

IDW debris will be containerized in roll-off containers. Liquid wastes will be containerized in DOT-approved 17H 55-gallon drums with non-removable lids, or in a portable tank. All IDW containers will be inspected for physical integrity before filling.

8.9.5 Labeling of Containers

All IDW containers will be clearly labeled as follows, with a grease pencil:

- Matrix (i.e., soil, water, PPE)
- Date waste generated
- Where waste generated (i.e., site, boring/well locations)
- "Nonhazardous, Pending Analysis."

If the analytical results characterize the IDW container contents as hazardous, a hazardous waste label will be placed on the container and the IDW disposed of within 90 days of the date the waste was generated.

8.9.6 Waste Handling and Off-Site Disposal

Waste handling, including loading and transport, will be conducted by a licensed waste disposal contractor. No more than four trucks hauling soil will leave the site per hour. Whenever possible, waste characterized as hazardous will be disposed of in a manner by which a "Certification of Destruction" can be issued by the disposal facility. Granite will be identified as the waste generator. Hazardous and Nonhazardous Waste Manifests and Bills of Lading will be filled out and signed by Granite, or their designated agent. Proper documentation, such as EPA identification number and waste profile, will be obtained by Granite.

8.10 ANALYTICAL TEST METHODS

The analyses expected to be required for this project include the following: CAM 17 metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc), plus aluminum, calcium, iron, manganese, magnesium, potassium, and sodium, by EPA Methods SW6010B, SW7470A, and SW7471A; TEPH as diesel, kerosene, and motor oil (30 weight) by California LUFT modified EPA Method SW8015; VOCs by EPA Method SW8260B; PAHs by EPA Method SW8310; nitroaromatics and nitroamines, including PETN and nitroglycerin (explosives) by EPA Method SW8330; common anions (nitrate-N and nitrite-N) by EPA Method 300.0; perchlorate by California Department of Health Services Sanitation and Radiation Laboratories Branch modification of EPA Method 300.0 (CADHS 300.0-Mod); dioxins/furans by EPA Method SW8290, chloropicrin by EPA Method SW8270CWM, pentachlorophenol by EPA Method SW8270C; PCBs by EPA Method SW8082, and organochlorine pesticides by EPA Method SW8081A. In general, SVOCs by EPA Method SW8270C only will be used for the determination of PAHs when severe interference is encountered during analysis of PAHs by EPA Method SW8310. A brief description of the digestion and analytical methods to be used is presented in Section 3.2.4.2 of the QAPP (Appendix G).

8.11 GENERAL FIELD AND LABORATORY DOCUMENTATION

The following field data documentation will be used to record all field investigation activities at the Project Site. Measurements made and samples collected will be recorded in either the Daily Field Report or on an appropriate field activity form. Examples of field forms anticipated to be used during the field investigation activities are included in Appendix E. Other forms may be added or substituted, provided they contain all the relevant information required to adequately document the field investigation activities. All entries on field forms will be made in indelible ink, and no white-out will be allowed. If an incorrect entry is made on any field form, the information will be crossed out with a single strike mark, initialed, and date-marked. All equipment used to make measurements will be identified, along with the date of calibration. All field forms will be signed and dated by field personnel responsible for their completion.

8.11.1 Daily Field Reports

Daily Field Reports or log books will provide the means of recording investigation and data collection activities on a daily basis. As such, entries will be described in as much detail as possible so that persons going to the Project Site will be able to reconstruct a particular situation without reliance on memory. Daily Field Reports/log books will contain, but not be limited to, the following information (it is acceptable for some of this information to be recorded on other field activity forms to avoid duplication):

- Project name/site
- Date
- Weather conditions
- Field personnel performing investigation activities
- Subcontractors
- Work performed
- Location of work (i.e., trench location)
- Sampling performed, including specifics (e.g., number and type of samples collected, borings advanced)
- Field parameter measurements, including calibration checks
- Decontamination procedures
- IDW containment procedures (i.e., number of storage drums)
- Names and affiliation of visitors to the Project Site
- Problems encountered and corrective actions
- Other pertinent comments.

8.11.2 Chain-of-Custody Record

COC procedures provide an accurate written record tracing possession of individual samples from the time of field collection through to analytical laboratory analysis. A sample is considered in custody if it is:

- In a person's possession
- In a secure area after having been in a person's physical possession
- In a designated secure area restricted to authorized personnel.

The COC Record will be used to document the samples taken and the analyses requested. Information that field personnel will record on the COC Record (in indelible ink) includes the following:

- Project name/site
- Sampling location and/or well designation
- Name and signature of sampler(s)
- Dates and times of sample collection

- Sample designation (grab or composite)
- Matrix
- Container types and preservatives
- Number of sample containers
- Analyses to be performed
- Special instructions (i.e., short holding times)
- Signatures of individuals involved in custody (including, date and times of transfer)
- Airbill number, if appropriate.

Corrections may be made on the COC Record by drawing one line through the incorrect entry, entering the correction information, and initialing and dating the change.

If the samples are shipped by commercial carrier or courier service, the COC Record initiated in the field will be signed and dated, placed in a sealed plastic bag, and taped to the inside of the cooler lid. Signed airbills will serve as evidence of custody transfer between the field personnel and commercial carrier/courier service and the analytical laboratory. Copies of the COC Record and the airbill will be retained by the field personnel prior to shipment. Upon receipt of the cooler, analytical laboratory personnel will sign, date, and retain one copy of the COC Record and the airbill for their records, returning the completed COC Record and signed airbill to the PM's designee.

If the samples are either delivered directly to the analytical laboratory by field personnel or picked up from either the Project Site or Earth Tech's San Jose office by the analytical laboratory, the COC Record initiated in the field will be signed and dated as relinquished by the field personnel, and signed and dated as received by the analytical laboratory. Copies of the COC Record will be retained by the field personnel prior to relinquishment of the samples to the analytical laboratory.

Information that will be recorded on the COC Record, or another appropriate document (e.g., laboratory log book or Laboratory Information Management System), at the time of sample receipt by the analytical laboratory will include the following:

- Status of custody seals, if used
- Temperature of the temperature blank
- Identification number of broken sample containers, if any

- Description of discrepancies between the COC Record, sample labels, and requested analyses.

When the laboratory receives and logs in the contents of the shipping containers, the laboratory's sample control supervisor or the laboratory PM will fax the completed COC Records with a sample log-in summary and completed cooler receipt forms to the project chemist within 24-48 hours. The cooler receipt forms will be used by the laboratory for each cooler to verify sample condition, including proper sample containers, volumes, preservation, and any other pertinent information. Laboratory personnel will contact the project chemist regarding any discrepancies in the paperwork and sample preservation and will document nonconformance and corrective actions according to the analytical laboratory's standard operating procedures.

8.11.3 Geologic Logs

The on-site field geologist will prepare and maintain a geologic log for all trench excavations. Soil cuttings/samples will be classified in accordance with the ASTM D 2488 *Description and Identification of Soils (Visual-Manual Procedures).* Bedrock cutting/samples will be identified and recorded using the standard nomenclature in the *Classification of Rocks* (Colorado School of Mines, 1955). The geologic log will record, but not be limited to, the following information:

- Project name/site
- Date/time
- Weather conditions
- Field personnel performing investigation activities
- Drilling contractor
- Drilling and sampling method
- Reference elevation for all depth measurements
- Depth of each change of stratum
- Thickness of each stratum
- Soil or rock description
- Depth interval from which sample was collected
- Nominal boring diameter
- Location of any fractures, joints, faults, cavities, or weathered zone if cored

- Depth to first encountered groundwater.

Each geologic log will be reviewed and approved by a California state-registered geologist supervising the project.

8.11.4 Health and Safety Data Forms

Health and safety activities conducted during the field investigation activities will be documented on the appropriate health and safety forms presented in the SSHP.

8.11.5 Photographs

Photographs will be recorded in the Trench Photo Log. The log will record, but not be limited to, the following information:

- Project name/site
- Date/time taken
- Picture number, trench number, and horizontal interval
- Photographer
- Description (i.e., location, subject, names of any personnel included in the photograph).

8.12 FIELD DATA MANAGEMENT

General guidance for field data recording, validation, reporting, and assessment is presented in this section. General guidance for laboratory data management is included in the QAPP (see Appendix G).

8.12.1 Data Recording

Field data will be recorded either in the Daily Field Report or on the appropriate field activity forms (see Section 8.11). During anomaly investigations, the SUXOS will describe each anomaly source using the OE Excavation Information Sheet (Appendix E). During soil sampling, a unique field identification number will be assigned to each sample throughout the field investigation program, as indicated in Section 8.4. Sample COC documentation will be completed, as described in Section 8.11.2, to document chain of possession and track the samples throughout shipping, handling, and analysis. A corresponding laboratory identification number will be assigned and will be used to track each sample through the analytical process.

All field forms will be signed and dated by the person entering the data, using indelible ink and no white-out. All changes to documentation will be performed by striking out the incorrect data with a single line and initialing and dating the correction.

Field data will be validated through the review of the field documentation to identify inconsistencies or anomalous values. The PM, or designee, will be responsible for performing daily reviews of all field documentation for accuracy, legibility, and completeness, and for maintaining such information in the project file. Any inconsistencies discovered will be resolved immediately, if possible, by seeking clarification from personnel responsible for the data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this chapter and the QAPP (see Appendix G) to ensure that accurate and defensible data are obtained.

8.12.2 Data Reporting

Measurement data generated during the field investigation activities will be reported in tabular form to support data use and interpretation. The report formats will vary depending on the objectives of the field investigation. In general, data will be presented according to sampling location, analytical method, parameter, and/or matrix.

8.12.3 Data Assessment

Measurement data will be assessed and documented to quantitatively assess data quality, identify possible limitations on data use, and assess whether the site-specific DQOs have been met. The use of standard field, analytical, and QC procedures is designed to control the sampling processes in order to produce data of sufficient quality for the project needs. If a problem occurs in spite of these controls, the data assessment must identify the problem, determine which data are affected, state how use may be limited, and make recommendations for corrective actions as necessary. Corrective actions may include, but not be limited to, resampling at a particular location.

Table 8-1. Field Sampling Programs - North Valley Military Landfill

			Chemical Analyses/EPA Test Methods													
			Explosives	Nitroglycerin PETN	Dioxins/ Furans	PCBs	TEPH-D/ MO	TEPH-K	Nitrate-N Nitrite-N	Pesticides	Chloropicrin	Pentachlorophenol	Perchlorate	Metals	PAHs	VOCs
Sample ID[1]	Sample Depth	Sample Matrix	SW8330	SW8330	SW8290	SW8082	LUFT Mod. SW8015	LUFT Mod. SW8015	E300.0	SW8081A	SW8270CWM	SW8270C	CA Mod. E300.0	SW6010B, SW7470A, SW7471A	SW8310	SW8260B
LF-TR1-LM1-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-LM2-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-LM2A-__	(1)	Soil Dup	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-LM1-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-LM2-__	(1)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S1-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S2-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S3-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S4-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S5-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S6-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S7-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S8-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S9-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S10-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S11-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S12-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S13-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S13A-__	(2)	Soil Dup	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S1-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S2-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S3-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S4-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S5-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S6-__	(2)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S7-__	(2)	Soil	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S7A-__	(2)	Soil Dup	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S1-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S2-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S3-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S4-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S5-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S5A-__	(3)	Soil Dup	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S6-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S7-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S8-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S9-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S10-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X

Table 8-1. Field Sampling Programs - North Valley Military Landfill
Page 2 of 2

			Chemical Analyses/EPA Test Methods													
			Explosives	Nitroglycerin PETN	Dioxins/ Furans	PCBs	TEPH-D/ MO	TEPH-K	Nitrate-N Nitrite-N	Pesticides	Chloropicrin	Pentachlorophenol	Perchlorate	Metals	PAHs	VOCs
Sample ID*	Sample Depth	Sample Matrix	SW8330	SW8330	SW8290	SW8082	LUFT Mod. SW8015	LUFT Mod. SW8015	E300.0	SW8081A	SW8270CWM	SW8270C	CA Mod. E300.0	SW6010B, SW7470A, SW7471A	SW8310	SW8260B
LF-TR1-S11-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S12-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR1-S13-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S1-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S2-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S3-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S4-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S5-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S5A-__	(3)	Soil Dup	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S6-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-TR2-S7-__	(3)	Soil	X	X		X	X	X	X	X	X	X	X	X	X	X
LF-GW-__	(4)	Water	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(1) Within the landfill/soil matrix
(2) Base of landfill
(3) Two feet below base of landfill
(4) Depth of groundwater if encountered
* Sample ID to be determined in the field when sample is collected

Table 8-2. Typical Field Parameters and Measuring Equipment

Parameter	Equipment (or equivalent)
Water Conductivity	Cambridge Scientific Hydac pH/EC Meter
Water pH	Cambridge Scientific Hydac pH/EC Meter
Water Temperature	Thermometer (°C)
Water Turbidity	HF Scientific DRT-15C Turbidimeter, or LaMotte Chemical Model 2008 Turbidity Meter
Depth to Water	Electric Tape (Sounder)
Volume of Discharged Groundwater	Calibrated 5-gallon bucket or flow meter

EC = electrical conductivity

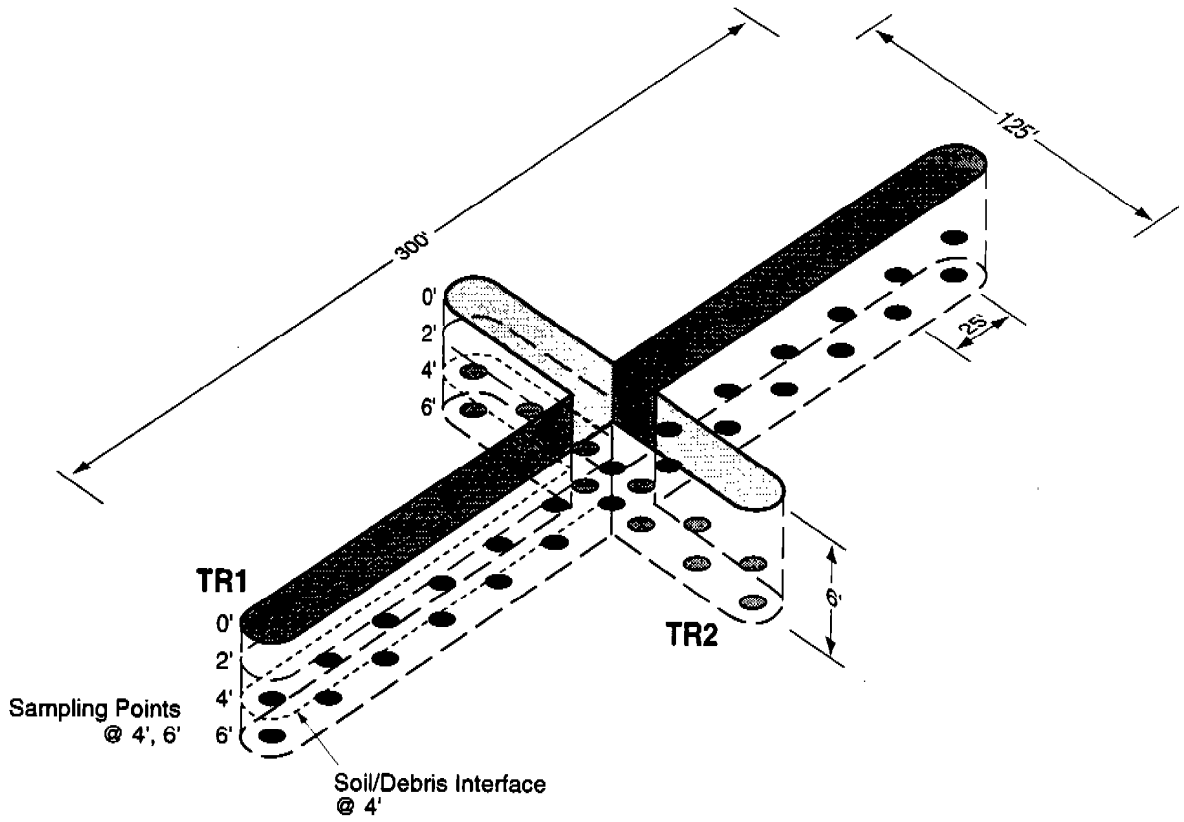
Table 8-3. Calibration Check Frequency For Field Test Equipment

Equipment	Calibration Frequency
pH/Conductivity Meter	Calibration check prior to use and at end of day.
Thermometer	No field calibration, annual calibration and certification required.
Turbidity Meter	Standardization check prior to use and at the end of each day.
Electric Tape	No field calibration
Container for Measuring Water Volume	Visual inspection before use

Table 8-4. Summary of Field Quality Control Procedures

Method	Parameter	QC Performed	Frequency[a]	Acceptance Criteria	Corrective Action
120.1	Conductance (aqueous)	Duplicate analysis	10%	RPD <5%	1) Obtain third value 2) Recalibrate
150.1	pH (aqueous)	Duplicate analysis	10%	±0.1 pH	1) Obtain third value 2) Recalibrate
170.1	Temperature (aqueous)	Duplicate analysis	10%	±1.0°C	1) Obtain third value 2) Use different thermometer
180.1	Turbidity (aqueous)	Duplicate analysis	10%	RPD <15%	1) Obtain third value 2) Recalibrate
ASTM D422	Grain size (soil)	Duplicate analysis	10%	RPD <10%	1) Obtain third value

Note: (a) Frequencies for duplicate samples and field blanks are computed based on the number of samples taken and the number of analyses specified in the FSP.



Benicia/074

EXPLANATION

TR1 Trench 1

TR2 Trench 2

TR1 Sampling Point

TR2 Sampling Point

North Valley Military Landfill Trench Sampling Locations

Figure 8-1

9.0 ENVIRONMENTAL PROTECTION PLAN

This EPP has been developed to protect sensitive receptors in the environment that may be affected by field activities conducted during the OE removal action and field sampling activities. The EPP provides a description of the resources that occur within the Project Site, describes the impacts that may occur as a result of geophysical mapping, OE removal activities, and field sampling activities, and outlines possible measures that can be used to lessen or mitigate the impacts.

9.1 ENVIRONMENTAL ISSUES AND CONCERNS

9.1.1 Air

The City of Benicia is in the Bay Area Air Quality Management District (BAAQMD) jurisdiction area, which encompasses the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB is designated as a nonattainment area for the ozone National Ambient Air Quality Standards (NAAQS) and as a nonattainment area for the ozone and particulate matter equal or less than 10 microns in diameter (PM_{10}) California Ambient Air Quality Standards (CAAQS). Ozone precursors are mostly generated by waste disposal, such as landfills. PM is mostly generated by miscellaneous processes such as unpaved road dust, fugitive windblown dust, and construction and demolition activities.

9.1.2 Noise

The noise environment near the Project Site consists of traffic noise from cars and trucks traveling on the main roadways, railway noise, and industrial noise from the various warehouses, trucking firms, and manufacturing facilities. Other sources of noise include helicopter and fixed-wing aircraft passing through the area, landscaping activities, playing children, and pets.

A residential community is adjacent to the south and west sides of the Tourtelot Property. The North Valley Military Landfill is approximately 1,700 feet from the nearest residence, and approximately 3,500 feet from the nearest school. There are no churches or hospitals in the immediate vicinity.

9.1.3 Surface and Groundwater

The North Valley Military Landfill is situated in the drainage of a small, ephemeral swale that originates entirely within the northern one-half of the Tourtelot Property and empties into Sulphur springs Creek within 2 miles of its outfall into Suisun Bay. An area containing potential wetlands is situated approximately 225 feet east and downslope of the Project Site in the bottom of the swale. There are no existing ponds, reservoirs, or other surface water adjacent to the Project Site.

There is no available validated information on the local aquifers and groundwater conditions in the project areas. Preliminary investigations at a monitoring well (MW-4) adjacent to the landfill indicate that groundwater is approximately 22 feet below ground surface.

9.1.4 Soil

Soils in the Project Site area consist of Dibble-Los Osos association (U.S. Department of Agriculture, 1977). The soils in this association are moderately deep and formed in materials weathered from sandstone. The soils are typified by a pale-brown loam or clay loam surface layer. The subsoil is generally a dark, yellowish-brown, heavy clay loam and light, olive-brown, light clay.

9.1.5 Biological Resources

The majority of the Project Site and the surrounding area is covered with nonnative annual grassland vegetation dominated by "weedy" introduced plant species such as slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), red brome (*Bromus madritensis* ssp. *rubens*), foxtail barley (*Hordeum jubatum*), wild radish (*Raphanus sativus*), fennel (*Foeniculum vulgare*), cheeseweed (*Malva parviflora*), and artichoke (*Cynara cardunculus*). Some native plant species are present and include California wild poppy (*Eschscholzia californica*), various lupines (*lupinus* sp.), blue dick (*Dichelostemma capitatum*), and coyote brush (*Baccharis pilularis*).

The grassland community present in the vicinity of the Project Site provides habitat for a variety of reptiles, birds, and mammals. Species observed included northwest fence lizard (*Sceloporus occidentalis*), Pacific gopher snake (*Pituophis melanoleucus catenifer*), lesser goldfinch (*Carduelis psaltria*), western meadowlark (*Sturnella neglecta*), ring-necked pheasant (*Phasianus colchicus*), California towhees (*Pipilo crissalis*), Botta's pocket gopher (*Thomomys bottae*), coyote (*Canis latrans*), and mule deer (*Odocoileus hemionus*). Several raptor species most likely use the area for foraging, and species observed included red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and northern harrier (*Circus cyaneus*).

The California Department of Fish and Game (CDFG) Natural Diversity Database and the U.S. Fish and Wildlife Service (USFWS) Rarefind Database of Threatened and Endangered Species were reviewed. There are no records of any unique, rare, or endangered plant or animal species in the vicinity of the Project Site.

9.1.6 Cultural and Paleontological Resources

The results of a records search by the Northwestern Information Center in July 1999 revealed that no prehistoric, historic, or Native American sites have been recorded on the Tourtelot Property. In August 1999, Basin Research Associates

(Busby, 1999) performed an archaeological survey of the Tourtelot Property and found no evidence of cultural resources.

The Benicia region does not generally display an abundance of fossil remains. Results of a literature search indicated that no paleontological resources have been identified within the vicinity of the Project Site.

9.2 AIR

9.2.1 Potential Impacts from Ordnance and Explosives Removal Activities and Field Sampling Activities

Air emissions associated with the proposed project will be limited to exhaust from heavy equipment (e.g., backhoe), emissions from an accidental detonation, and generation of fugitive dust from vehicles, vegetation clearance, and trenching activities. Vegetation clearing and trenching activities will occur in a limited area (approximately ½ acre) and will be short-term activities (10 days) that will not present the potential for ongoing dust generation. In addition, fieldwork is scheduled to take place in the spring rainy season, and excavated materials should already be damp, limiting dust emissions. If necessary, the excavated materials will be wetted to control dust.

9.2.2 Implementation of Air Quality Protection Measures

Because of the potential for an accidental or intentional detonation that could cause a significant impact to air quality, Earth Tech will perform ambient air sampling using PM_{10} monitors. The air monitoring will be performed at two PM_{10} monitoring stations downwind and one PM_{10} monitoring station upwind of the excavation site. A meteorological monitoring station will be placed at the excavation site to determine wind speed and direction, temperature, and relative humidity. The PM_{10} monitors will be operated continuously during the work day (approximately 9 hours per day). Samples will be analyzed for PM_{10} and the full suite of metals (listed in Chapter 8.0) only in the event of an accidental or intentional detonation. All samples will be sent to the laboratory for archiving provided no detonations occurred. The laboratory will archive each sample for a period of no fewer than 90 days. Appendix K contains the Ambient Air Quality Monitoring Plan.

Tarpaulins will be used to cover soils and debris being hauled off site to prevent fugitive dust and limit any volatile constituent emissions. Soil stockpiles will be covered with polyethylene sheeting or a tarp held in place with sandbags to prevent any dust from entering the air.

Because the landfill has not been in use for approximately 50 years, it is not anticipated that any volatile organic compounds (VOCs) remain in the soil. Air monitoring will be performed continuously during excavation activities. If VOCs or toxic air contaminants are detected, work will be halted, the trenches covered, and site conditions reevaluated prior to resumption of project activities.

9.3 NOISE

9.3.1 Potential Impacts from Ordnance and Explosives Removal Activities and Field Sampling Activities

The project includes three operations that could result in noise impacts:

- Brush and vegetation removal by gas-powered weed cutters for less than 1 day
- Trenching using a backhoe over a period of approximately 10 days
- Detonation of OE.

Noise levels from the listed activities are not expected to exceed the City of Benicia's Noise Level Performance Standards.

9.3.2 Implementation of Noise Control Measures

All construction equipment will be kept in good condition and will be equipped with high-quality mufflers and air intake silencers to reduce noise emissions. Hours of operation will be limited to daytime hours.

During a blow-in-place detonation, noise monitoring will be conducted at the Tourtelot Property line downwind of the Project Site and at the property line of the residences nearest to the Project Site (Kearny Street area).

9.4 SURFACE AND GROUNDWATER

9.4.1 Potential Impacts from Ordnance and Explosives Removal Activities and Field Sampling Activities

Because there is no surface water on the Project Site, no impacts to surface water quality will occur. The limited size of the Project Site and the nature of the proposed activities do not present the potential for depletion or degradation of groundwater, nor will they affect groundwater recharge. During project activities, there is no long-term requirement for water usage. Water will be brought on site for dust suppression only if required, and will not be used in a wasteful manner.

9.4.2 Implementation of Surface and Groundwater Protection Measures

A temporary sandbag berm will surround the Project Site to prevent surface water runoff and possible release of hazardous constituents to the potential wetlands and downslope drainage. Use of silt fences downslope of the excavation area will minimize any possible erosion of sediments into the potential wetlands.

The trenches are not expected to be more than 10 feet deep; consequently, they should not reach groundwater, which is expected to occur at depths greater than 20 feet in the North Valley. Should groundwater be encountered during project activities, trenching will not occur beyond that depth. Trenches will be covered at night and during heavy rains as necessary to minimize pooling of water in trenches and percolation to the groundwater. In addition, excavated landfill debris will be placed in 20-foot, sealed, roll-off containers to contain the debris. Soil stockpiles will be placed on a nonpermeable plastic sheeting to prevent leachate from entering the ground or running off.

9.5 SOIL

9.5.1 Potential Impacts from Ordnance and Explosives Removal Activities and Field Sampling Activities

The project will result in limited ground disturbance (approximately ½ acre) during excavation of trenches. Unstable earth conditions resulting from the excavation of the two trenches will not be significant because the depth of the trenches is not anticipated to exceed 10 feet and the sides of the trench will be sloped to prevent the collapse of the walls of the trench (Chapter 8.0).

9.5.2 Implementation of Soil Protection Measures

Trenching will not occur on very windy days. A meteorological monitoring station will be situated at the Project Site to provide wind speed and wind direction information. Trenches will be covered at night and during heavy rains as necessary using polyethylene sheeting or similar material. Soil stockpiles will be kept covered with polyethylene sheeting or a tarp held in place with sandbags.

Surface drainage at the Project Site will be controlled using sandbag berms to reduce the potential for erosion as a result of project activities.

9.6 BIOLOGICAL RESOURCES

9.6.1 Potential Impacts from Ordnance and Explosives Removal Activities and Field Sampling Activities

The project involves removing vegetation on the Project Site. Because of the small size of the Project Site (1/2 acre), the removal of vegetation will not significantly affect any habitat. The nonnative, annual grassland vegetation should regenerate on its own. The project will not result in the introduction of new plant species to the area or create a barrier to the normal replenishment of existing species; therefore, project activities will have little overall effect on plant communities.

The project will temporarily disrupt a minor area of animal habitat. Vegetation clearing or trenching activities could result in the loss of animal life or foraging, burrowing, or nesting habitat. The project will have no adverse effect on sensitive

species because there is no evidence of any unique, rare, threatened, or endangered species of plants or animals on the Project Site.

Indirect effects on wildlife could result from elevated noise levels during trench excavation activities or a detonation, which could startle animals and cause them to temporarily abandon the area.

9.6.2 Implementation of Biological Resources Protection Measures

Excavated landfill debris will be placed in sealed roll-off containers and will not present a hazard to wildlife.

Virtually all birds native to (or that migrate into or through) the United States are protected by the Migratory Bird Treaty Act (MBTA). OE removal activities and field sampling activities planned in this RAW could affect ground-nesting birds protected by the MBTA. Care will be taken to avoid nesting birds. Should a nest be discovered in the construction area, the USFWS will be consulted.

9.7 CULTURAL AND PALEONTOLOGICAL RESOURCES

9.7.1 Potential Impacts from Ordnance and Explosives Removal Activities and Field Sampling Activities

Results of a records search and previous surveys identified no significant cultural or paleontological resources on the Tourtelot Property. Because there is a low probability for significant prehistoric, historic, Native American, or paleontological resources to occur on the Tourtelot Property and the relatively small Project Site (½ acre), this project is not expected to have any significant effect on cultural or paleontological resources.

9.7.2 Implementation of Cultural and Paleontological Resources Protection Measures

Due to the low probability for cultural and paleontological resources, no protection measures are being implemented. However, if during the course of project activities, any of these types of resources is unexpectedly encountered, all work will stop in the immediate area and the California State Historic Preservation Officer will be consulted.

10.0 ORDNANCE AND EXPLOSIVES QUALITY CONTROL PLAN

10.1 INTRODUCTION

10.1.1 Policy Statement

It is the policy of Earth Tech to perform all field investigation activities in conformance with applicable standards of quality. The procedures specified in this OE QCP will be considered minimum acceptable standards for Earth Tech. Procedures less stringent than those specified herein shall not be adopted without prior written authorization from the cognizant Senior Vice President and the Corporate Quality Control Manager.

It is the personal responsibility of all company personnel involved in site investigation activities to understand and maintain the QCs applicable to their work.

This OE QCP has been developed to comply with appropriate industry and regulatory standards. It will be used as a management tool to ensure that related activities are conducted in a planned and controlled manner and that appropriate documentation exists to support each activity for which Earth Tech is responsible.

10.1.2 Scope

This plan includes a designated QC organization with the authority to enforce all provisions. The plan governs all operations, both on and off site, associated with OE removal. It covers submittals, three phases of control of field operations, field changes, equipment standardization and maintenance, audits, deficiencies and noncompliance, documentation, and records. The OE QCP is designed to follow the sequence of field operations.

10.2 SITE-SPECIFIC QUALITY CONTROL PLAN

This OE QCP is site-specific and was prepared for the OE removal action at this Project Site. Site-specific information includes, but is not limited to, project personnel, required control operations and equipment tests, specific equipment maintenance and standardization procedures, and regulatory documentation requirements.

10.3 QUALITY CONTROL ORGANIZATION

The responsible parties have selected a project team that will provide the specific technical and management capabilities and qualifications required to perform the removal action. The project organization will ensure that all project objectives are met in a timely and cost-effective manner. Chapter 1.0, Introduction, defines the personnel requirements, responsibilities, duties, and authorities for key personnel. It will be the responsibility of the QC specialist to perform his/her duties

independent of the cost, scheduling, and other performance constraints, which will be the responsibility of the PM. The QC specialist will be responsible for reviewing and updating the OE QCP as needed, and for verifying compliance with the plan. Compliance will be verified through audits of project activities by the QC Specialist, who has the authority to require corrective actions and to stop work, as needed, to ensure compliance with the OE QCP.

10.4 FIELD ACTIVITY CONTROL

Inspection and surveillance will be performed by Earth Tech to maintain control over field activities identified in this RAW.

The controls will ensure that qualified personnel and approved procedures and equipment are used, and that specified process parameters and environmental conditions are maintained.

10.4.1 Control Duties and Responsibilities

10.4.1.1 Field Team Leader.

The FTL will be responsible for implementation and documentation of all control activities. The FTL will be on site during field activities.

10.4.1.2 Quality Control Staff.

The QC specialist will be responsible for implementation of this OE QCP. The QC specialist will report to the FTL and OESM.

10.4.2 Phases of Control

Field investigation control will be performed in phases. The FTL will be responsible for the performance of the control phases as follows.

10.4.2.1 Readiness Review (preparatory phase).

This phase will be performed prior to beginning work and will include:

- A review of guidance documents
- A review to verify that all equipment has been tested, submitted, and approved
- A check to ensure that provisions have been made to provide required control inspection and testing
- An examination of the work area to verify that all required preliminary work has been completed

- A physical examination of required equipment and sample work to assure that they are on hand, conform to approved or submitted data, and are properly stored
- A review of the SSHP to verify safety requirements are met
- A discussion of procedures for performing the work including repetitive deficiencies, documentation of OE operation procedures, and standards for that phase of work
- A check to ensure that the RAW has been accepted by the DTSC
- A check to ensure that all required permits have been obtained and are posted at the job site, as necessary
- A check that all required health and safety equipment and supplies, field notebooks, data sheets, and other activity documentation record forms are available
- A review that all procurement documents (for materials, equipment, and subcontractors) are in order
- A check that all procedures and facilities for handling, holding, or disposing of OE and OE-related scrap are in place
- A review of all emergency procedures
- An assessment of weather conditions.

The readiness review will be documented on the preparatory-phase checklist and signed by the FTL and the QC specialist.

10.4.2.2 Initial Phase.

This phase will be accomplished at the beginning of a definable feature of work. The initial use of control will include:

- A verification of full contract compliance, including required control inspection and testing
- Establishment of level of workmanship and verification that it meets minimum acceptable workmanship standards
- Resolution of all differences
- Safety check to include compliance with and upgrading of the SSHP; review of the SSHP with each worker
- The initial phase will be repeated for each new crew to work on site, or whenever acceptable specified quality standards are not being met.

10.4.2.3 Daily Inspection (follow-up phase).

The QC specialist or designee will perform daily inspections/surveillances of job site activities. Appropriate technical assistance will be provided to perform the inspections/surveillances as necessary for the specific field activities being performed. The inspections/surveillances will include, but not be limited to, the following:

- Examination of the quality of workmanship
- Compliance with required submittals
- Verification that all required equipment calibration has been performed and that inspection and standardization results comply with this RAW
- Check for defective or damaged equipment
- Verification, inspection, and documentation of delivery and storage of material and equipment to the site
- Performance of follow-up checks and correction of all deficiencies prior to the start of additional features of work that may be affected by the deficient work; the project will not include field operations using nonconforming work methods
- Documentation of the daily inspections of field activities on the Daily QC Report Form (Appendix E).

10.4.2.4 Final Inspection.

Toward completion of all fieldwork or any definable features of the fieldwork, the FTL and the QC specialist will conduct a completion inspection of the work and develop a list of any items that do not conform to the RAW. Such a list will be included in the QC documentation and will include the estimated date by which the deficiencies will be corrected. The PM and the FTL will make a second completion inspection to ascertain that all deficiencies have been corrected and notify the DTSC of their findings. The completion inspection and any required deficiency corrections will be accomplished within the time specified for completion of the work.

10.4.3 Control Documentation

All inspection/surveillance documentation will be maintained in the project files and will include:

- Daily QC Report Forms
- All equipment standardization results and equipment maintenance results
- Preparatory-phase checklist
- QC-related meeting minutes
- All audit documentation and nonconformance and corrective action documents (Sections 10.7 and 10.8)
- Corrective Action acceptance documentation.

These documents will include the following information:

- Earth Tech/subcontractor personnel and their area of responsibility (trades)
- Weather conditions
- Work performed each day including location, description, and worker(s)
- Test and/or control activities performed with results and references to RAW requirements; deficiencies should be noted along with corrective action
- Quantity of materials received at the site with statement as to acceptability and storage
- Job safety evaluations stating what was checked, results, and instructions or corrective actions.

The Daily QC Report will be the primary document, with all other applicable reports and forms attached to it. The Daily QC Reports will be kept on site. All calendar days will be accounted for throughout the length of the field effort. Reports will be signed and dated by the QC specialist. The report from the QC specialist will include copies of reports prepared by all subordinate QC personnel.

10.5 PROJECT FIELD DOCUMENTATION

Field documentation comprises a permanent record of the field activities associated with the site activities. All activities at the site will be recorded in the site Project Logbook(s). Field logbooks will be used to record specific information and activities related to collection, reduction, and/or interpretation of data (geophysical surveying or OE removal) in the field or Project Site.

Project field documentation will be maintained in accordance with the Data Management Plan (Chapter 11.0).

10.6 FIELD CHANGE CONTROL

10.6.1 Scope

The purpose of this section is to ensure that a thorough review of field changes is performed by qualified personnel.

10.6.2 Responsibilities

10.6.2.1 General.

Any individual, including the PM, assigned to perform or supervise a task who recognizes the necessity for a field change is responsible for developing appropriate field changes and for completing and submitting the field change request for review and approval.

10.6.2.2 Project Manager.

The PM or a designated representative (e.g., FTL) is responsible for:

- Evaluating validity and acceptability of the field change request
- Evaluating and documenting the effect of the field change on overall effort and schedule
- Accepting, qualifying, or rejecting the field change
- Soliciting and obtaining approval of any changes from the Project Coordinator.

10.6.2.3 Field Team Leader.

The FTL is responsible for evaluating the changes to ensure that all QC requirements are met, that all changes to the RAW are properly reviewed and approved by the responsible personnel, and for keeping a log of the field change request forms.

10.6.3 Procedure

10.6.3.1 Recognition of Necessity for Field Changes.

During the course of field activities, the approved RAW, technical procedures, and design documents will be followed. This document has been developed to cover all contingencies that may be encountered during the field activities. In the unlikely event that a situation arises that has not been addressed in this RAW, the team performing the task will determine the best approach toward satisfactory completion of the task. The team will then inform the PM or FTL of the situation, and the following actions will occur:

- If warranted, stop affected activities until the PM or FTL evaluates the situation

- Through the project coordinator, submit field change request for approval by DTSC.

10.6.3.2 Instigation of Field Changes and Definition of Minor and Major Changes and Major Project Impact.

Field changes and major project impacts will be defined as follows:

- A Minor Change is defined as a field change that would not adversely affect the quality of the data or product, or the rationale for the field procedures. Examples of minor changes are as follows:

  - Changing the sequence of the field activities

  - Changing any of the administrative requirements relative to a remedial effort with the exception of those requirements mandated by federal or state regulations (e.g., chain-of-custody procedures).

- A Major Change can be defined as a field change that may adversely affect the quality of field activities, a major change in the scope of the activity, or something that will cause significant delays in the schedule. Examples of major changes are as follows:

  - Significantly changing the area to be geophysically surveyed

  - Significantly relocating a plant or animal population

  - Significantly changing the methods used to detect OE.

- A change with Major Project Impact is defined as a change that has a major impact on schedule and/or technical performance. Some changes defined as major changes may have major project impact.

Field changes will be documented by completing the Field Change Request Form (Appendix E), and describing the reasons for the change, the recommended disposition, cost impact, impact on previous work, and type of change (Minor, Major, Major Project Impact). The signed and dated form will be immediately provided to the PM and FTL for review.

Minor changes may be implemented prior to approval by the PM and the FTL.

10.6.3.3 Project Review and Approval of Field Changes.

All field change requests will be routed to the PM for review and approval.

The PM will:

- Appraise the changes in technical performance
- Appraise the effect of the change on project level of effort and schedule
- Check the appropriate box for acceptance or rejection of the field change
- Sign and date the form
- Provide form to Project Coordinator for interaction with DTSC.

The FTL will:

- Appraise conformance to the RAW specifications and the OE QCP
- Check the appropriate box for acceptance or rejection
- Sign and date the form
- Assist the PM in negotiation of changes
- Give the field change request a consecutive number from the project Field Change Request Log and log the request.

10.6.3.4 Final Disposition.

After completing the review and approval process, the Field Change Request Form will be forwarded by the PM to personnel responsible for the work and the FTL, with the following action requested:

- If approved, the personnel responsible for the work will implement the change
- The FTL will note final disposition of field change request (e.g., change incorporated and work completed, change rejected and work performed per original requirements) on the Field Change Request Form and the Field Change Request Log
- The FTL will verify that all changes to the Statement of Work (SOW) are marked on all copies in use in the field and on file
- The completed Field Change Request Form will be submitted to the project file.

If an implemented minor field change is not approved, it will be deemed a nonconforming condition and, as such, will be treated as directed by the procedures for Nonconformance/Corrective Action.

10.6.4 Records

Records pertaining to Field Change Control will include:

- Field Change Request Form
- Field Change Request Log.

10.7 AUDITS

10.7.1 Purpose

The purpose of this procedure is to establish methods of planning, conducting, and documenting a formal and comprehensive audit program to verify implementation of the OE QCP.

An audit is an examination and evaluation performed to determine whether applicable elements of the site-specific OE QCP have been performed, documented, and effectively implemented in accordance with specified requirements.

10.7.2 Scope

This procedure applies to all audits performed on activities affecting quality.

10.7.3 Responsibilities

The QC specialist is responsible for:

- Implementing and conducting an audit program of activities per the requirements of this procedure
- Reporting quality deficiencies to management
- Reviewing and evaluating audit reports to determine if quality deficiency trends are developing
- Evaluating the implementation and effectiveness of the OE QCP on a regular basis.

The PM is responsible for:

- Reviewing audit results
- Attending pre-audit and post-audit meetings, if possible
- Implementing corrective action in response to Quality Deficiency Notices (QDNs)

- Responding to QDNs within 30 days, or as stipulated in the audit report.

Consultants, outside laboratories, and/or subcontractors are responsible for:

- Reviewing audit reports, including any QDNs
- Implementing corrective action as required
- Replying to QDNs within 30 days of receipt, or as stipulated in the audit report.

10.7.4 Procedure

10.7.4.1 Objectives.

Audit objectives are as follows:

- To verify by evaluating objective evidence that the OE QCP is being implemented
- To assess the adequacy, effectiveness, and thoroughness of the OE QCP
- To verify conformance with approved procedures, work plans, and drawings and specifications
- To identify quality deficiencies
- To verify correction of previously identified quality deficiencies.

10.7.4.2 Scheduling Requirements.

The QC specialist may audit program- and project-related activities at least once per year. The QC specialist may perform audits of consultants, outside laboratories, and subcontractors. Requirements for audits shall depend upon the type and amount of work subcontracted.

Reauditing to verify implementation and satisfactory completion of recommended corrective actions will be performed as deemed necessary.

10.7.4.3 Scheduling of Audits.

The QC specialist will construct an annual tentative schedule of audits in a manner that provides effective coverage and coordination with ongoing program activities. The audit schedule will be periodically reviewed and revised, as necessary, to ensure that coverage is maintained.

10.7.4.4 Unscheduled Audits.

Unscheduled audits may be performed if the following occurs:

- Significant changes are made in functional areas of the OE QCP, such as significant reorganization or procedure revisions
- There is evidence of a serious breakdown in the implementation of the OE QCP
- A systematic, independent assessment of program effectiveness is necessary
- It is necessary to verify implementation of recommended corrective actions.

10.7.4.5 Implementation.

Individual audits will be performed by audit personnel in conformance with the following procedures:

Preparation

- Written Plan - An individual audit plan will be developed and documented. This plan will identify the audit purpose and scope, activities to be audited, applicable documents, and schedule of the audit. A checklist to verify conformance will be filled out for all audits.
- Notification - Involved organizations will be notified of a scheduled audit a reasonable time before it is to be performed (usually 2 to 4 weeks ahead of time). This notification may be in writing and should include the scope of the audit. Unannounced audits may be performed as required (Section 10.7.4.4).

Performance

- Pre-audit Discussion - A brief conference will be conducted at the site with cognizant organization/project management. The purpose of the conference will be to confirm the scope, present the audit plan, introduce auditors, meet counterparts, discuss audit sequence, and establish channels of communication.
- Audit
  - Checklists will be used to maintain depth and continuity of audits.
  - Objective evidence will be examined for compliance with applicable requirements.

- If a quality deficiency is found during an audit, the auditor will complete the QDN.

- Post-audit Conference - At the conclusion of the audit, a conference will be held with management of the audited organization/project. If a quality deficiency has been noted during the audit, responsible management will be advised of the quality deficiency in sufficient detail to ensure that the problem is clearly understood.

10.7.4.6 Report.

An audit report will be prepared and signed by the QC specialist and will include the following:

- Audit number
- Audit scope
- Audit date
- Auditor identification
- Controlling documents
- Personnel contacted
- Audit result summary, including an evaluation statement of elements audited
- Identification of any QDNs.

The report, with attached QDNs, will be distributed to responsible management. The audit report will be issued within 30 days (preferably within 2 weeks) of the audit.

The QC specialist will log the performed audits on the Audit Status Form (Appendix E), along with the number of QDNs, and track the responses or close the audit if no QDNs were issued.

10.7.4.7 Follow-Up.

By Audited Organization. The management of the audited organization will review the audit report and any QDNs. If a QDN has been issued, the management of the audited organization will determine and schedule appropriate corrective action, including action to prevent recurrence. The audited organization will describe the corrective action taken on the QDN and submit the notice to the auditor within the designated time frame, which should not be more than 30 days after audit report issuance.

By Auditor. The QC specialist will:

- Verify that the audited organization completes the appropriate sections of the QDN and submits the form within the designated time.
- Review the response and determine whether the response is satisfactory.
- Evaluate evidence of completion of corrective action to determine whether the action taken is satisfactory.
- Request an additional response if the response and/or corrective action is unsatisfactory.
- Close the QDN, if the response and/or corrective action is satisfactory. This will be noted on the Audit Status form.
- Complete the Audit Closure blocks.

10.7.4.8 General Requirements for Auditors.

Personnel selected for QC auditing assignments by the QC specialist shall have experience or training commensurate with the scope, complexity, or special nature of the activities to be audited. Personnel selected for QC auditing assignments will have, or be will given, appropriate training or orientation to develop their competence to perform required audits. The QC specialist will determine auditor qualifications and the type of additional audit training required of auditors.

Lead auditors will have the experience or training necessary to assure their competence in auditing skills, including:

- Knowledge and understanding of the standards and regulations applicable to field projects
- General structure of field investigation QC as a whole and applicable elements
- Auditing techniques of examining, questioning, evaluating, and reporting; methods of identifying and follow-up on corrective action items; and closing out quality deficiencies
- Audit planning in quality-related functions
- On-the-job training to include applicable elements of the audit program.

10.7.5 Records

Records pertaining to audits will include:

- Forms
- Audit Plans (notification and checklist)
- Audit Reports.

10.8 NONCONFORMANCE/CORRECTIVE ACTION

10.8.1 Purpose

The purpose of this section is to:

- Verify that conditions adverse to quality (nonconformances) are identified and reported to appropriate management levels
- Verify that nonconforming items (e.g., test data, analyses) are appropriately marked and/or segregated and not used until corrective action has been completed
- Verify that appropriate corrective actions or dispositions (accept, reject, repair, or rework) have been recommended, approved, and implemented
- Provide a system for the review and analysis of significant conditions adverse to quality (significant nonconformance) to determine their causes and trends, and to verify that corrective actions will preclude recurrence.

10.8.2 Scope

This procedure will be implemented whenever a condition adverse to quality is identified.

10.8.3 Responsibility

All Project Team personnel will be responsible for identifying and reporting nonconformance.

The PM is responsible for:

- Evaluating nonconformances to determine if the work should be stopped
- Proposing corrective action
- Implementing corrective action

- Evaluating nonconformance impact on prior work or on previously obtained data (if any), and notifying the Project Coordinator.

The QC specialist is responsible for reviewing nonconformances to determine if trends adverse to quality are developing, and proposing and implementing long-term corrective action to prevent recurrence of any identified material nonconformance and nonconformance trends.

10.8.4 Procedure

10.8.4.1 Identification and Reporting of Nonconformances.

A nonconformance exists if there is a deviation from or noncompliance with the OE QCP, approved procedures, RAW, or other project requirements. Nonconformances also include major errors in documented analysis, data or results, and deficiencies in documentation or any other aspect of the project that may materially affect quality. Personnel who identify a nonconformance will report the condition by:

- Completing Part A of the Nonconformance Report (NCR) (Appendix E)

- Requesting an NCR number from the FTL, who will enter the NCR on the log

- Distributing the NCR to the PM and QC specialist.

10.8.4.2 Evaluation of Nonconformance Report.

The FTL, PM, and QC specialist will review the NCR to determine if:

- Ongoing work should be stopped. (If work stoppage is required, work will be stopped per Section 10.8.4.5.)

- The nonconformance may constitute a condition materially adverse to quality, and in such a case, will determine the cause of the condition. Examples of conditions that may be materially adverse to quality are potentially material failures to implement the OE QCP, potentially material errors in data or analyses that had previously been approved, potentially material deviations from the approved Work Plans, and conditions that may materially affect the schedule of the work. Nonconformances that may constitute conditions materially adverse to quality will be reported to the PM per Section 10.8.4.6.

- The nonconformance has any impact on previously obtained data or potentially material reports. If there is an impact, the PM will note the potentially material impact in the Remarks section of the NCR and notify the Project Coordinator.

The evaluation will be documented by completing Part B of the NCR.

10.8.4.3 Recommendation of Corrective Action or Disposition.

Persons determining corrective action or disposition will have demonstrated competence, will have an adequate understanding of the requirement, and will have access to pertinent background information (e.g., the engineer responsible for the OE removal action). The FTL will recommend corrective action or disposition to resolve the nonconformance by completing Part C of the NCR.

In the case of a nonconformance, which is a condition materially adverse to quality, the corrective action will be such as to help preclude recurrence of the nonconformance.

The recommended corrective action or disposition will be reviewed and approved by the PM and FTL.

10.8.4.4 Corrective Action Implementation and Verification of Implementation.

The approved corrective action or disposition will be implemented by appropriate personnel. When completed, Part D of the NCR will be signed and dated by personnel performing the corrective action.

Corrective action or disposition implementation and NCR closeout will be reviewed and approved by the PM and FTL.

The identification, cause, and corrective action for a nonconformance, which is a condition materially adverse to quality, will be reported to the QC specialist.

The completed NCR will be given to the FTL for logging into the NCR Log and filing in the QC records.

10.8.4.5 Work Stoppage.

If it is determined that work will be stopped, it will be noted in Part B of the NCR; the conditions necessary for work to resume will be noted in the Remarks section of Part B of the NCR.

The supervisor will direct project personnel to stop all affected work. Work will not be restarted until the conditions required to restart work have been satisfied and written approval has been received from the FTL.

All work stoppages will be reported to the PM and Project Coordinator per Section 10.8.4.6.

10.8.4.6 Notification of Project Manager and Project Coordinator.

If client notification is required, the PM will submit a written report of the nonconformance to the Project Coordinator and will obtain concurrence from the Project Coordinator of the proposed corrective action or disposition.

10.8.4.7 Tracking of Nonconformance Reports.

The QC specialist will monitor nonconformance reports to determine if trends adverse to quality are developing. If such trends are developing (e.g., repetitive NCR related to a particular activity, organization), the QC specialist will issue a written report identifying the problem to the PM.

The PM will evaluate the identified problem, and propose and implement a written corrective action program to prevent recurrence of the nonconformance.

10.8.5 Records

Records pertaining to Nonconformance/Corrective Action will include:

- NCR
- NCR Log
- Documentation of Notification to the PM of Nonconformance
- Evaluation of NCR trends
- Corrective Action Report for NCR trends.

11.0 ORDNANCE AND EXPLOSIVES DATA MANAGEMENT PLAN

11.1 INTRODUCTION

11.1.1 Purpose

This plan describes how OE-related data and information will be collected, evaluated, and maintained. It also designates responsibility for data and records management, and details procedures and requirements for organizing, filing, storing, and controlling project data and records. This plan will be used to control, store, and maintain project files.

Data for this RAW will comprise information and materials gathered during pre-investigation site visits and planning activities; geophysical data, including field notes, digital field data, and processed analytical results; the results of the OE removal; and OE disposition documentation. Project records will also include documents or items that furnish evidence of the quality and completeness of the work. All data and records will be maintained and preserved in the project files for final delivery/disposition, as directed by Granite, the USACE, and DTSC.

11.1.2 Scope

Project data will be generated/gathered during historic records reviews/site visits; project design and planning; field activities; and data processing, interpretation, and analyses. Additional records will include results of reviews, inspection audits, and surveillances; qualifications of personnel; plans and procedures; and other documentation, such as project-specific correspondence; drawings, specifications, computer software and related documentation; procurement documents; peer review reports; operation and maintenance records; and nonconformance reports.

The requirements of this plan are not intended to cover miscellaneous or preliminary paperwork (work copies) generated during preparatory phases that may or may not be discarded (e.g., preliminary drawings and analyses, rough sketches, drafts).

11.2 PROJECT FIELD DOCUMENTATION

Field documentation comprises a permanent record of the field activities associated with the site investigation. All activities at the site will be recorded in the site project logbook. Field logbooks will be used to record specific information and activities related to collection, reduction, and/or interpretation of data (geophysical surveying or OE removal) in the field.

The following guidelines will be used to maintain field documentation:

- Entries will be completed in permanent (nonerasable and waterproof) black or dark blue ink.
- All entries will be legible.
- Corrections will be made by crossing out the entry to be revised with a single line, initialing, and dating the change.
- Serialized documents or data files will be preserved and maintained on site and referenced in the logbooks, as needed.
- Portions of any page that is not completely filled will have a single diagonal line drawn through the unused portion of the page. The individual lining out the unused portion of the page will sign and date the line.
- The FTL will sign and date each page of daily entries to the field logbooks.
- The logbooks will be periodically reviewed by the PM (or designee) to assure that the field effort is being properly and completely documented. This individual will sign and date the bottom of each page to signify his/her review and acceptance.

11.2.1 Project Logbook

The project logbook is the master field investigation document. Its primary purpose is to preserve, within one document, the actual field data or references to other field documents that contain a specific description of every activity and/or event that has occurred in the field on a given day. The project logbook will also contain administrative occurrences, site conditions, or activities that have affected the fieldwork for any given day or task.

11.2.2 Field Logbooks

Field personnel will use bound field logbooks with sequentially numbered pages for maintenance of field records. The front cover of the logbook will list project name, project task, book number, and start/end dates. The inside cover will replicate these data, in addition to listing the personnel performing the fieldwork, with their assigned responsibilities. Each field investigation team (geophysical OE removal or non-OE) will possess and maintain a field logbook series. These logbooks will be used to record the specific field information collected during the progress of the field investigation.

At a minimum, the following information will be recorded each day in the field logbook:

- Name and affiliation of the personnel performing work.
- Date, start time, and signature of individual providing entry.
- Significant weather conditions (i.e., conditions that could affect the interpretation of the collected data, or that could impact the progress of work).
- Notes of conversations with "visitors" to the work sites.
- Identification numbers of instruments used.
- Results of equipment standardization measurements.
- Documentation of OE removal action activities in each trench, including trench identification number, any abnormal procedures used, digital file names, narrative morphological description of each grid investigated (e.g., "Terrain slopes to northwest with approximately a 2-meter fall across the grid. Vegetation comprises knee-high grass and a few clusters of sagebrush. No significant terrain irregularities [washes, wadis, arroyos, gullies, or cliffs] were encountered. No cultural clutter or other interferences or obstacles present, except for fence near northern edge of grid").
- Summary of field activities, events impacting the progress of the work, and sampling results for each trench (e.g., number of anomalies in trench, any noted anomaly trends, unusual or especially interesting anomaly source descriptions, OE identity).

The field logbooks will also describe and discuss any problems encountered during the course of the daily activities and the resolution/status of the noted problem(s). Deviations from this RAW or other governing documents/procedures will be fully detailed and discussed by the SUXOS.

11.3 DATA COLLECTION AND EVALUATION AND RECORDS MAINTENANCE

11.3.1 Data Collection

Data will be collected for this project by Earth Tech and various subcontractors (e.g. geophysical, OE, or land surveyor). All data will be preserved and managed by Earth Tech in accordance with this RAW.

Historical data may comprise both digital electronic data and hardcopy (paper) materials. Digital data will be copied onto CD-ROM media; both the original source and CD will be maintained in project files located in Earth Tech's Colton, California, office. Hard-copy data will be photocopied and the originals stored in the Earth Tech office. Copies can be transmitted to the field site as needed.

Digital data will be maintained at Earth Tech's Colton office. Hard-copy maps and other documentation will be generated and transmitted to the field site.

Field data will consist of both digital and hard-copy originals. All original data will be maintained at the Command Post until the field activities are complete. Copies of field data will be made and transmitted to Earth Tech's Colton office via U.S. Postal Service. All data transfer will be accompanied by tracking control (i.e., chain-of-custody) documentation. These data will be preserved in the project files as detailed below. The data generated in the field will comprise mapping data, geophysical investigation measurements, OE removal data, and non-OE sampling data. Non-OE data will be collected, tracked, and reported as specified in Chapter 8.0 and the QAPP.

- Geophysical investigation measurements will include field notes, standardization results, sketch maps, and digital geophysical data. Digital copies of the geophysical data will be transferred from the field sites to the subcontractor's office for processing and interpretation.

- OE removal data will be generated and delivered to the SUXOS. These data will comprise field notes (bound notebooks) and hardcopy sampling forms.

The results of the analyses will be presented in both digital and hardcopy format. The geophysical subcontractor will transmit these data to the on-site Command Post and deliver copies to Earth Tech's Colton office.

Data analysis and interpretation of the removal results will be performed by Earth Tech. Data records will comprise digital and hardcopy output of field data and the OE removal results. Data transfers will be performed following appropriate tracking protocol and will be accompanied by tracking documentation. The analytical results will be transmitted to the Command Post with a copy of all material delivered to Earth Tech's Colton office for project file preservation. As before, all transfers will be documented and accompanied by tracking information.

11.3.2 Ordnance and Explosives Data Evaluation

Project data will be evaluated at several stages by Earth Tech and the various subcontractors. Historic records will be reviewed. Earth Tech will be responsible for maintaining, tracking, and compiling all data that will be used in the preparation of the Remediation Investigation (RI) report.

Field data will be evaluated by Earth Tech and the subcontractors. Earth Tech will independently review and evaluate all field data. It will be Earth Tech's responsibility to ensure that all data are properly and appropriately utilized for the OE RI report.

11.3.3 Records Maintenance

Each individual who handles a working document in the course of performing an assigned activity will protect the records against destruction, loss, or defacement. The PM will be responsible for:

- Developing the records file index system for the project.
- Assigning the file number from the records file index to the records generated by their activities.
- Assigning a file custodian to control the collection, storage, access, safety, maintenance, and retrievability of project files.
- Transmitting completed records to the file custodian.
- Preparing the records file index including location of files.
- Determining the acceptability of records for qualities of identification, legibility, reproducibility, and retrievability. If the records are not acceptable, return to sender for correction.
- Verifying that a file number from the records file index has been assigned to each record entered into the records file.
- Assuring that records are filed in the appropriate records file.
- Providing copies of records for reporting requirements and audits or upon request, approved by the PM.

Project staff/designated file custodian will:

- Prepare file indices including file section, title of file, and location
- Label project file folders as per the prescribed type of filing system
- Implement normal protective measures against environmental conditions, hazards, vandalism, or loss, or implement protective measures in conformance with the PM's directions
- Assist in file close-out.

Data and records users will:

- Ensure the integrity of the data and records
- Refrain from providing data and/or records to non-project-related personnel without the consent of the PM

- Contact the PM regarding any discrepancies identified in the data and/or records

- Assume responsibility for the return of all data and records utilized.

11.4 RECORDS MANAGEMENT

11.4.1 Use of Active Project Records

- Records will be stored in such a manner as to prevent any type of damage.

- Records will not be stored loosely on open surfaces such as tables or on tops of cabinets. Records will be firmly attached in binders or placed in folders or envelopes.

- Special processed records (e.g., radiographs, photographs, negatives, microfilm) that are light-, pressure-, or temperature-sensitive, will be packaged and stored as recommended by the manufacturer of these materials.

11.4.2 Collection of Records Not in Use

Project personnel will route all project records to the project files as the records are completed or for correspondence, as they are received or generated. Records are considered complete after they have been:

- Signed and dated by personnel performing the work, if required based on the type of records

- Signed and dated by personnel checking the work.

11.4.3 Guide to Types of Records to be Filed

The following types of records should be filed:

- Correspondence. Letters, e-mails, and memoranda of telephone conversations.

- Literature. References to or copies of information used for OE hazard descriptions in the RAW, previously available data on use of the area, published data used for the project, etc., should be filed.

- Site Characterization/Field Records. This is a broad category embracing field records including analytical data, computer analyses, or any other work that was done in the field useful for presentation in a report.

- Reports. Reviews of reports, as well as final reports, will be filed. Regulatory agency comments on the report will be filed as well.

Records will be placed in file folders marked with the project number and file content.

11.4.4 Revisions to Records

If revisions or changes to records are required, personnel making the revisions or changes will notify the file custodian of the record(s) being changed. The file custodian will copy the record prior to any changes being made, mark the copy "Superseded," and place it in the original file. The changes will be made to the original records. Changes will be made by crossing out the old entry with one line, adding the new information, and initialing and dating the change. Under no circumstances will the old entry be erased or otherwise removed. The revised record will be returned to the person responsible and placed in the original file. The copy marked "Superseded" will be disposed of upon return of the original to the file.

11.4.5 Records Storage and Retrieval

Original records entered into the project file will be kept in a file cabinet under the control of the PM. Personnel involved in project activities may find it necessary to periodically retrieve information from documents in the files. When project personnel require information from a file, the requester will make a request of the PM for a particular record or file folder. Only personnel assigned to the project will be authorized to request records.

No revisions will be made to the records except in accordance with Section 11.4.4.

11.5 RECORDS TRANSFER AND DISPOSITION

Prior to the transfer of records, the PM (or designee) will check the records against the records file index for compliance with QCP requirements. All records not requested as a part of turnover procedures will be maintained for a minimum of 5 years following completion of the project.

Records, the records file index, and records files will be prepared and transferred according to records turnover requirements for collecting and packaging records provided by the property owner.

APPENDIX A

ADMINISTRATIVE RECORD LIST

APPENDIX A ADMINISTRATIVE RECORD LIST

American Public Health Association, American Water Works Association, and the Water Environment Federation, 1992. Standard Methods for the Examination of Water and Wastewater, 18th ed., Washington, DC.

American Society for Testing and Materials, 1988. Annual Book of ASTM Standards: Vol. 4.08, Soil and Rock.

American Society for Testing and Materials, 1988. Annual Book of ASTM Standards: Vol. 11.01, Water.

American Society for Testing and Materials, 1990. Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers, ASTM Standard D5092-90, Volume D4.08 Soil and Rock.

AR 385-64, Ammunition and Explosives Safety.

AR 190-11, Physical Security of Arms, Ammunition and Explosives

ATF 5400.7, Alcohol, Tobacco and Firearms Explosives Laws and Regulations.

ASTMD-2488, Description and Identification of Soils.

Bissell and Karn, Inc., 1995. Grading Plans, Southampton Units D-1, D-2, D-3, D-4 and the Borrow Site, Benicia, California.

Brown and Caldwell, 1999. Final Arsenal-wide Investigation Work Plan, February.

Busby, C. I., 1999. Cultural Resources Inventory and Evaluation: Benicia Arsenal, Solano County, California, Letter Report, prepared by Basin Research Associates, October.

California Department of Health Services, California Code of Regulations, Title 22.

California Department of Water Resources, 1990. Water Well Standards: State of California, Bulletin 74-81.

California Regional Water Quality Control Board, 1995. Water Quality Control Plan, San Francisco Bay Basin (Region 2), June 21.

California State Parks, 1991. Benicia State Recreation Area General Plan, June.

CEHNC, Safety Concepts and Basic Considerations for OE.

Colorado School of Mines, 1955. Classification of Rocks.

Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S. Code Sections 9601-11050.

Cowell, J.W., 1963. History of Benicia Arsenal, Benicia, California.

DA PAM 385-64, Ammunition and Explosives Safety Standards.

Department of Defense 4145.26-M, Contractors Safety Manual for Ammunition and Explosives.

Department of Defense 6055.9-STD, Ammunition and Explosives Safety Standards.

Department of Defense Explosives Safety Board, 1998. Explosives Safety Submission for Removal of Ordnance and Explosives (OE) From Real Property, February.

Department of Transportation, 49 CFR Parts 100 to 199, Transportation.

DIA, 1945. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:20000, frames 16PS5M782-1:V:97 to 16PS5M782:V:102 and 16PS5M782-1:V:115, January 16.

DIA 1947a. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:27000, frames 812 to 815, October 19.

DIA, 1947b. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:27000, frames 827 and 828, December 1.

Earth Tech, 1999. Draft Engineering Evaluation/Cost Analysis (EE/CA) Report for the Former Benicia Arsenal, prepared for the U.S. Army Corps of Engineers, Huntsville Division, Ordnance and Explosives Design Center, June.

Earth Tech, 1999. Draft Final Non-Ordnance and Explosives Remedial Investigation/Feasibility Study Work Plan, Tourtelot Cleanup Project, Benicia, California, November.

Earth Tech, Inc., 1999a. Engineering Evaluation/Cost Analysis, Former Benicia Arsenal, Benicia, California, prepared for U.S. Army Corps of Engineers, Huntsville Division, Ordnance and Explosive Design Center, November.

Earth Tech, Inc., 1999b. Remedial Investigation (RI)/Feasibility Study (FS), Site-Specific Safety and Health Plan, November.

EIP Associates, 1989. Southampton Tourtelot Property General Plan Land Use Amendment and Rezoning Final Environmental Impact Report.

Endangered Species Act, 16 U.S. Code 1531-1543.

Engeo, Inc., 1989a. Geologic Study at Southampton for the Balance of Development East of Unit C-7, Southampton, Benicia, California.

Engeo, Inc., 1989b. Report to Southampton Company, Benicia, California, on the Balance of Development for Southampton, Benicia, California, January.

Engeo, Inc., 1990a. Report to Southampton Company, Benicia, California on the Preliminary Soils Exploration for Southampton Units D-1 Through D-7, Benicia, California, February.

Engeo, Inc., 1990b. First Progress Report on Testing and Observation Services During Rough Grading, Southampton Units D-1 through D-4, Benicia, California, June 13.

Engeo, Inc., 1990c. Second Progress Report on Testing and Observation Services During Rough Grading, Southampton Units D-1 through D-4, Benicia, California, November 20.

Engeo, Inc., 1991. Final Report on Testing and Observation Service During Mass Grading, Southampton Units D-1 through D-4, Benicia, California.

Geonex, 1962a. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:24000, frames Yol 1-56 to Yol 1-59, July 2.

Geonex, 1962b. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:24000, frames Sol 8-131 to Sol 8-133, July 22.

Geonex, 1973. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:24000, frames 3594-1-181 to 3594-1-185, 3594-1-188 to 3594-1-192, and 3594-1-238 to 3594-1-239, July 10.

Geonex, 1991. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:24000, frames 91000 2 6-1 to 91000 2 6-4, February 17.

Jacobs Engineering, 1999. Final Benicia Arsenal Records Research Report, April.

Jacobs Engineering, 1999. Records Research Report for the Benicia Arsenal, Final, April.

Migratory Bird Treaty Act, 16 U.S. Code 703.

National Contingency Plan, 40 Code of Federal Regulations Part 300.

National Historic Preservation Act, Public Law 93-91.

Norcal Geophysical Consultants, Inc., 1999. Seismic Refraction Survey Report, Tourtelot Property, Benicia, California.

Occupational Safety and Health Administration, 29 Code of Federal Regulations, Occupational Safety and Health Standards.

Pacific Aerial Surveys, 1989. Aerial photographs of Benicia Arsenal, Solano County California, scale 1:36000, frames AV 3601 4 19 and AV 3601 4 20, July 18.

Pacific Aerial Surveys, 1991. Aerial photographs of Benicia Arsenal, Solano County California, scale 1:12000, frames Sol AV 4070 24 48 and Sol AV 4070 24 49, June 21.

Pacific Aerial Surveys, 1993. Aerial photographs of Benicia Arsenal, Solano County California, scale 1:12000, frames Sol AV 4535 12 17 and Sol AV 4535 12 18, September 3.

Pacific Aerial Surveys, 1996. Aerial photographs of Benicia Arsenal, Solano County California, scale 1:24000, frames Solno AV 5140 33 30 and Solno AV 5140 33 31, April 26.

Pacific Aerial Surveys, 1997. Aerial photographs of Benicia Arsenal, Solano County California, scale 1:12000, frame Sol AV 5461 12 21, July 28.

Robert A. Karn and Associates, Inc., 1998. Grading Plan, Southampton, Units D-6 and D-7, Benicia, California.

Secor International, Inc., 1997. Storm Water Pollution Prevention Plan WDID No. 248S307744, Southampton Hills Development, Unit D-6 and D-7, Solano County, California.

State of California, 1989. Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup and Underground Storage Tank Closure, Leaking Underground Fuel Tank Task Force, October.

TM 9-1300-2-6, Ammunition and Explosives Standards

TM 9-1300-200, Ammunition General.

TM 9-1300-206, Military Explosives.

Unknown source, 1960. Aerial photographs of Benicia Arsenal, Solano County, California, scale unknown, frames 140 and 147, May 5.

Unknown source, 1983. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:14400, frames 83103-1 and 83103-2, May 12.

U.S. Army Corps of Engineers, St. Louis District, 1994a. Archives Search Report Findings, Benicia Arsenal, Benicia, Solano County, California, March.

U.S. Army Corps of Engineers, St. Louis District, 1994b. Archives Search Report Conclusions and Recommendations, Benicia Arsenal, Benicia, Solano County, California, March.

U.S. Department of Agriculture, 1937a. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:20000, frames ABO-57-38 to ABO-57-42, August 25.

U.S. Department of Agriculture, 1937b. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:20000, frames ABO-56-80 to ABO-56-83, August 25.

U.S. Department of Agriculture, 1952. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:20000, frames ABO-3K-135 to ABO-3K-144, August 3.

U.S. Army Corps of Engineers. Chemical Data Quality Management for Hazardous Waste Remedial Activities, ER 1110-1-263.

U.S. Army Corps of Engineers, 1994. Requirements for the Preparation of Sampling and Analysis Plan, EM 200-1-3, September.

U.S. Army Corps of Engineers, Sacramento District, 1997. Draft Environmental Assessment, Benicia Arsenal Site Investigation, Benicia, California, August.

U.S. Army Corps of Engineers, Sacramento District, 1999. Environmental Data Quality Management Program Specifications, Version 1.08, Draft Final

U.S. Army Corps of Engineers, St. Louis District, 1994a. Archives Search Report Findings, Benicia Arsenal, Benicia, Solano County, California, March.

U.S. Army Corps of Engineers, St. Louis District, 1994b. Archives Search Report Conclusions and Recommendations, Benicia Arsenal, Benicia, Solano County, California, March.

U.S. Department of Agriculture Soil Conservation Service, 1977. Soil Survey of Solano County, California, May.

U.S. Environmental Protection Agency, 40 Code of Federal Regulations, Protection of the Environment.

U.S. Environmental Protection Agency, 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, EPA 600-4-83-004.

U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.

U.S. Environmental Protection Agency, 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods, Second Edition, EPA-600/4-84-076.

U.S. Environmental Protection Agency, 1985. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. June 1985, Rev. Nov. 1985.

U.S. Environmental Protection Agency, 1986a. Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods, SW-846, Third Edition.

U.S. Environmental Protection Agency, 1986b. RCRA Ground Water Monitoring Technical Enforcement Guidance Document, Office of Solid Waste and Emergency Response, OSWER Directive 9950.1.

U.S. Environmental Protection Agency, 1987. A Compendium of Superfund Field Operations Methods, Office of Emergency and Remedial Response, EPA/540/P-87-001, OSWER Directive 9355.0-14, produced by U.S. Department of Commerce National Technical Information Service.

U.S. Environmental Protection Agency, 1988. User's Guide to Contract Laboratory Program, EPA/540/8-89/012, December 1988.

U.S. Environmental Protection Agency, 1990. Guidance Document, Laboratory Documentation Requirements for Data Validation. Document Control No. 9QA-07-90, Quality Assurance Management Section, US EPA Region IX, San Francisco, California, January.

U.S. Environmental Protection Agency, 1992. Final Update for Test Methods for Evolving Solid Waste: Physical/Chemical Methods, SW-846.

U.S. Environmental Protection Agency, 1993a. Data Quality Objectives Process for Superfund, EPA/540/G-93/071, September.

U.S. Environmental Protection Agency, 1993b. Guidance for Environmental Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process, EPA QA/G-2, July.

U.S. Environmental Protection Agency, 1994a. Guidance for the Data Quality Objectives Process, EPA QA/G-94, September.

U.S. Environmental Protection Agency, 1994b. National Functional Guidelines for Organic Data Review, EPA-540/R-94-012, February.

U.S. Environmental Protection Agency, 1994c. National Functional Guidelines for Inorganic Data Review, EPA-540R/R-94-013, February.

U.S. Environmental Protection Agency, 1994d. Update II for Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846.

U.S. Environmental Protection Agency, 1994e. EPA Requirements for Quality Assurance Project Plans, EPA QA/G-5, Final, August.

U.S. Environmental Protection Agency, 1995. Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites, prepared by R.P. Breckenridge and A.B. Crocket.

U.S. Environmental Protection Agency, 1996a. Guidance for Data Quality Assessment: Practical Methods for Data Analysis, EPA/QA G-9, July.

U.S. Environmental Protection Agency, 1996b. Update III for Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846.

U.S. Environmental Protection Agency, 1998. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, October.

WAC, 1988. Aerial photographs of Benicia Arsenal, Solano County, California, scale unknown, frames 88CA 29-44 and 88CA 29-45, September 12.

WAC, 1990a. Aerial photographs of Benicia Arsenal, Solano County, California, scale unknown, frames North Bay-90 6-23 and North Bay-90 6-24, May 13.

WAC, 1990b. Aerial photographs of Benicia Arsenal, Solano County, California, scale 1:1300, frames unknown, September.

Wetlands Research Associates, Inc., 1998. California Red-Legged Frog Field Survey Report, Southampton Hills Project, Benicia, California. Prepared for Pacific Bay Homes, August.

40 Code of Federal Regulations Part 136, Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, Appendix B to Pack 136, October 1984.

APPENDIX B

OE SAFETY AND HEALTH PROGRAM

OE SAFETY AND HEALTH PROGRAM
OE AVOIDANCE
RI/FS TOURTELOT CLEANUP PROJECT
BENICIA, CALIFORNIA

1.0 General

Ordnance and explosives avoidance escort services will be provided in support of the non-OE field sampling activity to be performed on the Project Site. The fieldwork is expected to commence in Spring 2000.

All work will be conducted in accordance with the Site Specific Safety and Health Plan. All personnel engaged in the work are required to read and understand all pertinent sections of this document prior to commencing any work at the Project Site. Because the work may be in areas contaminated with ordnance explosives (OE), all activities shall be conducted in full compliance with CEHNC, USACE, DA, DOD and the DTSC requirements regarding personnel, equipment and procedures.

The work will be performed in substantial compliance with CERCLA (Section 104) and the National Contingency Plan (Sections 300.120(c) 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). The program, including updates, shall be made available upon request.

2.0 Specific Requirements

This task will comprise providing OE technicians/escorts to:

- Visually sweep the sampling areas before personnel and equipment enter
- Escort the vegetation removal activities
- Sweep the specific path to field sampling locations and the specific sampling location prior to the ground being broken.

The OE technician/escort will lead all activities and personnel in areas of the field not previously surface cleared. The OE escort will visually and mechanically (with the aid of a Schonstedt magnetometer) inspect the path to be traversed by personnel and equipment before allowing personnel or equipment access. All personnel and equipment are required to follow the path designated by the OE escort. At a minimum, the path will be twice the width of the widest vehicle. The boundaries of the approach path will be clearly marked with white pin flags to prevent personnel from straying into uncleared areas. The OE escort will survey the proposed sampling locations or other areas in which limited intrusive activities are planned with a hand-held magnetometer. If an anomaly is detected, the planned intrusive location will be moved a safe distance away (24-36 inches), and the procedure will be repeated until an anomaly-free area has been found.

The OE escort will provide down hole anomaly detection during all drilling and boring operations. If an anomaly is detected, the drilling location will be moved a minimum of 36 inches from the anomaly location. When no anomaly is detected, the drilling may begin. Drilling will be performed in 1-foot increments. After each foot of drilling, the drill will be withdrawn, and the OE escort will perform down-hole magnetometer testing. Provided no anomalies are detected, the drilling may continue for another foot and the process will be repeated. Once the drilling exceeds 4 feet, OE detection will be discontinued. It is expected that the weight of the soil overburden will provide sufficient protection from injury at a depth below 4 feet. In the event that any OE item is encountered during drilling, the following procedures will be observed.

If OE is encountered, it will be marked with a pin flag for disposal at a later date. The PM and FTL/SSO will be notified of the OE encountered and the location. The pin flag will be placed a safe distance from the OE item (24-36 inches). During field operations, where the Contractor does not have OE disposition capabilities on site, the PM and FTL/SSO will contact Travis AFB EOD. Travis AFB EOD personnel will

determine the appropriate disposition method and dispose of the OE item. During field operations where the Contractor has on-site OE disposition capabilities, the OE clearance crew will determine the appropriate disposition method and dispose of the OE item. All field sampling personnel and equipment will be kept clear of the OE items.

A detailed accounting of all OE found shall be maintained by the PM. OE locations shall be identified using pin flags and paint. Pin flags will be constructed of non-conductive plastic or fiberglass. Conductive metal pin flags are prohibited.

3.0 Data Tracking

The progress of field activities will be recorded in bound field notebooks and maps (one for each OE Supervisor onsite) detailing activities and providing an accounting of all OE found during avoidance activities.

4.0 Schedule

The work is planned to begin in Spring 2000 and complete within 15 work days.

5.0 Personnel Qualifications

The Earth Tech shall submit resume(s) for personnel that will be onsite to perform the fieldwork (with alternates, as necessary). All OE personnel will be graduates of the U.S. Navy EOD Course, Indian Head, Maryland.

6.0 Assumptions

- Two (2) escorts will provide OE avoidance for field teams each day. A Senior OE Supervisor will be responsible for all OE-related work activities.
- Because this will be an OE avoidance-only activity, OE personnel are not limited to a 40-hour work-week. All other safety requirements will be met.

7.0 Equipment Requirements

Earth Tech is responsible for providing instrumentation and equipment. Earth Tech will maintain all equipment in good working order and provide routine and preventative maintenance. The OE avoidance will be performed with the aid of a Schonstedt Magnetometer.

8.0 Applicable Codes

All work shall be in accordance with the requirements of regulatory agencies and all federal regulations, including but not limited to:

- United States Environmental Protection Agency
- United States Occupational Safety and Health Administration Regulation 29 CFR 1910.120, and 8CCR 5192
- United States Fish and Wildlife
- United States Department of Transportation
- Department of Toxic Substance Control

- State Division of Wildlife
- State Department of Health and Welfare.

9.0 Records

Accurate records of all work shall be maintained in a daily field logbook or on daily field activities. The information to be recorded in the field logbook shall be consistent with the work described above.

10.0 Health and Safety

All activities at the site shall be in compliance with this SSHP, as approved by the DTSC for this task. The anticipated health and safety requirements for this project entail only standard practices required for modified Level D protection (as described by OSHA Hazardous Waste Operation regulations). Prior to commencement of Work at the Project Site, all field personnel shall be required to attend a project health and safety meeting and shall be required to sign a statement that they have received, read, and are familiar with the project SSHP, and agree to follow procedures outlined in the plan. Following the initial health and safety meeting, the field personnel shall attend daily health and safety meetings prior to the start of work each day.

Note: Soil containing TNT in excess of 10% is considered to be OE in accordance with ER-1110-1-8153. Personnel should avoid contact with soils in excess of 10% TNT. Spark, flame, and heat producing items and activities are not permitted in areas these areas.

Note: The PM or FTL/SSO will inform all personnel prior to entering the Project Site of the potential health effects associated with the use of the medication "Viagra" on a site with explosive constituents. Health hazards due to dermal absorption of explosives while taking Viagra can cause severe illness and death. All personnel have the right to upgrade their PPE to protect themselves from the increased risk posed by their health condition in combination with exposure to the site contaminants.

Note: Soil containing TNT in excess of 10% cannot be shipped. Laboratory analysis of soil in excess of 10% must be performed on site or performed after remediation activities to eliminate or reduce TNT content

11.0 Controls

OSHA requirements pertaining to construction/excavation equipment, materials handling, appliances, wiring and other construction aids shall be observed. OSHA requirements shall govern where mandatory; otherwise, compliance will be with the most stringent applicable requirements.

APPENDIX C

SITE ACCESS CONTROL PLAN

APPENDIX C
SITE ACCESS CONTROL PLAN

C.1 INTRODUCTION AND PURPOSE

Prior to ordnance and explosives (OE) clearance/demolition activities, a Public Withdrawal Distance (PWD) of 1701 feet will be established. As described in Chapter 6.0, Ordnance and Explosives Operations, this PWD is based on the fragmentation distance of the Most Probable Munition (MPM) which is a 75mm HE projectile. However, a PWD may be expanded if a munition with a farther/larger PWD is encountered. If the PWD is expanded, OE operations will cease until all new areas within the revised PWD are evaluated to determine if inhabited buildings or residences are affected which could lead to evacuation and relocation procedures. Preliminary site work, which includes surveying, laying search lanes, and non-intrusive detection of anomalies, does not require an exclusion zone. A PWD is a safety zone established around an OE work area and/or each OE team for the protection of other OE teams and non-project personnel from the potential hazards of OE clearance activities. During the time frame that OE intrusive operations are being accomplished, only the minimum essential OE project personnel are authorized within the PWD.

In some circumstances, the PWD will include areas that could be accessed by the public and accordingly will require the withdrawal of the public from the area prior to commencement of site operations. This Site Access and Control Plan addresses the procedures or safeguards that will be utilized to ensure that the public is not within the designated PWD each day prior to intrusive OE operations. The purpose of this plan is to ensure the safety and welfare of Benicia residents.

If the PWD is expanded, identification of buildings and residents that fall inside the new PWD will be determined by the Site Manager/Project manager in consultation with DTSC.

C.2 PWD ESTABLISHMENT AND CONTROL

The PWD will be established daily prior to commencement of intrusive OE operations. This will be accomplished visually by personnel involved in the OE operations by viewing the site from the ridge between the South and North Valley's to ensure that the fenced in portion of the PWD is clear of non-essential persons. Additionally, guards will be posted near the U.S. Metal's facility to the East of the site, on a ridge near Lake Herman to the Northwest of the site and inside of the residential area to the west of the site to verify that the PWD is clear of non-project personnel and remains clear throughout OE operations.

C.3 WITHDRAWAL AND RELOCATION

The withdrawal and relocation of residents within the PWD will only be required if the PWD is adjusted due to location of an OE that increases the PWD size. If the PWD is increased, withdrawal and relocation of residents will be coordinated and conducted

as outlined in the following subsections.

C.3.1 Notification of Homeowners and Supporting Agencies

The general schedule the Site/Project Manager will follow in regards to informing both the public and supporting agencies is as follows:

- The City of Benicia, the Benicia Fire Department, the Benicia Police Department, and Benicia residents will be briefed approximately 18 days prior to the withdrawal and relocation of residents regarding the designated PWD, the anticipated dates of withdrawal, the addresses falling within the PWD, and general withdrawal and relocation procedures.

- Notices of the dates and times of the required withdrawal and relocation information ("Withdrawal and Relocation Notice") will be distributed to each residence within the PWD approximately 10 days and again 72 hours in advance of the scheduled withdrawal and relocation. It is anticipated that residents will be required to withdraw from their homes from 8:30 a.m to 5:00 p.m. on the scheduled dates.

- If there are schedule or other changes between the 72-hour notification and the date on which the OE clearance activities are to be performed, residents will be notified of this change by 7:00 p.m. the night before the planned withdrawal. Similarly, if there are schedule or other changes necessitating an extension of the withdrawal period, residents will be notified by 7:00 p.m. the night before the withdrawal period was previously scheduled to terminate.

C.3.2 Relocation and Hospitality Services

Residents who are required to withdraw from their homes may temporarily relocate to the Hospitality Center during the day. The Hospitality Center will provide refreshments and the use of telephones and other amenities. Directions to the Hospitality Center and personnel to contact for additional information will be provided in the Withdrawal and Relocation Notice.

C.3.3 Transportation

Transportation will be provided between the PWD and the Hospitality Center for those without transportation or for those wishing to use the provided transportation. The Withdrawal and Relocation Notice will set forth neighborhood assembly points for pick-up and drop-off.

C.3.3.1 Entity Responsibilities.

<u>Site/Project Manager</u>

- Overall command and control of withdrawal and relocation of residents including briefing and notification requirements.

- Identification of PWD and providing information to the City of Benicia, the Benicia Fire Department,the Benicia Police Department, and DTSC regarding planned field activities, addresses within the PWD, and recommended road closures at least 72 hours prior to scheduled withdrawal.

The Benicia Police Department

- Provide traffic control and coordinate and maintain road closures during withdrawal hours.

- Provide overall security as needed.

- Verify that residents have vacated homes and report this information to the Site/Project Manager.

The Benicia Fire Department

- Provide support as necessary.

APPENDIX D

STANDARD OPERATING PROCEDURES, OE OPERATIONS - DEMOLITION/DISPOSAL OPERATIONS

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APPENDIX D
STANDARD OPERATING PROCEDURES
OE OPERATIONS - DEMOLITION/DISPOSAL OPERATIONS

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide the minimum procedures and safety and health requirements applicable to the conduct of demolition/disposal operations on sites contaminated with ordnance and explosives (OE).

2.0 SCOPE

This SOP applies to all site personnel, including contractor and subcontractor personnel, involved in the conduct of OE demolition/disposal operations on an OE contaminated site. This SOP is not intended to contain all of the requirements needed to ensure complete compliance, and should be used in conjunction with project plans and applicable federal, state and local regulations.

3.0 REGULATORY REFERENCES

Applicable sections and paragraphs in the documents listed below will be used as references for the conduct of OE demolition/disposal operations:

- OSHA General Industry Standards, 29 CFR 1910
- OSHA Construction Standards, 29 CFR 1926
- CEHNC Safety Concepts and Basic Considerations for Unexploded Ordnance
- USACE EM 385-1-1, Safety and Health Requirements Manual
- DOD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives
- DOD 4160.21-M, Defense Reutilization and Marketing Manual
- DOD 6055.9-STD, DOD Ammunition and Explosives Safety Standards
- AR 385-64, Ammunition and Explosive Safety
- AR 385-10, Army Safety Program
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- TM 9-1300-206, Ammunition and Explosive Standards
- TM 9-1300-200, Ammunition General
- TM 9-1300-214, Military Explosives
- TM 60A-1-1-31, EOD Disposal Procedures
- AR 190-11, Physical Security of Arms, Ammunition and Explosives
- ATF 5400.7, Alcohol Tobacco and Firearms Explosives Laws and Regulations
- Applicable sections of DOT, 49 CFR 100 to 199.

4.0 RESPONSIBILITIES

4.1 PROJECT MANAGER

The Project Manager (PM) shall be responsible for ensuring the availability of the resources needed to implement this SOP, and shall also ensure that this SOP is incorporated in plans, procedures and training for disposal of OE.

4.2 SENIOR OE SUPERVISOR

The Senior OE Supervisor (SUXOS) will be responsible for assuring that adequate safety measures and housekeeping are taken during all phases of site operation, to include demolition activities, and shall visit site demolition locations routinely to ensure that demolition operations are carried out in a safe, clean, efficient and economical manner.

4.3 DEMOLITION SUPERVISOR

Prior to initiation of demolition operations, the SUXOS shall designate an experienced and trained OE Supervisor to act as the Demolition Supervisor (DS). The demolition activities shall then be conducted under the direct control of the DS, who will have the responsibility of supervising all demolition operations within the area. The DS shall be responsible for training all on-site OE personnel regarding the nature of the materials handled, the hazards involved and the precautions necessary. The DS will also ensure that the Daily Operational Log and Demolition Shot Records are properly filled and accurately depict the demolition events and demolition material consumption for each day's operations. The DS shall be present during all demolition operations or designate a competent, qualified person to be in charge during any absences.

4.4 SITE SAFETY OFFICER

The Site Safety Officer (SSO) for the site is responsible for ensuring that all demolition operations are being conducted in a safe and healthful manner, and is required to be present during all OE demolition operations. The only exception to this rule is when the project site has multiple sites conducting various types of OE investigation and remediation operations being conducted concurrently with periods where there may be continuous demolition operations throughout the day. In that event, a demolition team SSO will be designated. This individual will report to the SSO and assume the SSO's responsibilities at the demolition range. In this situation, the SSO will conduct periodic safety audits of the demolition team and assist the demolition team SSO in the performance of their duties.

4.5 QUALITY CONTROL SPECIALIST

The Quality Control Specialist (QCS) is responsible for ensuring the completeness of disposal operations and for weekly inspection of the Daily Operational Log and Demolition Shot Records. The QCS, assisted by demolition team personnel, will inspect each disposal site and an area of up to 250 feet in radius after each disposal shot to ensure there are no kickouts, hazardous OE components or other hazardous items. In addition, the site will be checked with a magnetometer and large metal fragments four inches or greater,

and any hazardous debris will be removed. Any OE discovered during the QC check will be marked and disposed of that day. Extreme caution must be exercised when handling OE which has been exposed to the forces of detonation.

5.0 GENERAL OPERATIONAL AND SAFETY PROCEDURES

All personnel, including contractor and subcontractor personnel, involved in operations on OE contaminated sites shall be familiar with the potential safety and health hazards associated with the conduct of demolition/disposal operations, and with the work practices and control techniques used to reduce or eliminate these hazards. During demolition operations, general safety provisions listed below shall be followed by all demolition personnel. Non-compliance with the general safety provisions listed may result in discipline, to include termination of employment:

- All safety regulations applicable to demolition range activities shall be complied with.
- Demolition of any kind is prohibited without the express permission from the client.
- The use of sandbags for mitigation of fragmentation and blast effects due to intentional detonation of munitions will be conducted in accordance with Appendix D. The quantity of OE to be destroyed in a single shot will be kept to a minimum to reduce noise travel into residential areas.
- In the event of an electrical storm, or heavy snow or dust storms, immediate action will be taken to cease all disposal site operations and evacuate the area.
- In the event of a fire or unplanned explosion, if possible, put out the fire. If unable to do so, notify the fire department and evacuate the area. If injuries are involved, remove victims from danger, administer first aid and seek medical attention.
- The DS is responsible for reporting all injuries and accidents which occur during disposal operations to the SSO.
- Employees will not tamper with any safety devices or protective equipment.
- Methods of demolition shall be conducted in accordance with this procedure and approved changes thereto.
- Adequate first aid equipment shall be provided at all times.
- All personnel engaged in the destruction of OE shall wear under and outer garments made of natural fiber, close-weave clothes, such as cotton. Synthetic material such as nylon is not authorized unless treated with anti-static material.
- Care will be taken to minimize exposure to the smallest number of personnel, for the shortest time, to the least amount of hazard, consistent with safe and efficient operations.
- Work locations will be maintained in a neat and orderly condition.
- All hand tools shall be maintained in a good state of repair.

- Each heavy equipment and/or vehicle operator will have in their possession a valid state driver's license.

- Equipment and other lifting devices designed and used for lifting will have the load rating and date of next inspection marked on them. The load rating will not be exceeded and the equipment will not be used without a current inspection date.

- Leather or leather-palmed gloves will be worn when handling wooden boxes, munitions or OE.

- Lifting and carrying require care. Improper methods cause unnecessary strains. Observe the following preliminaries before attempting to lift or carry:

    - When lifting, keep your arms and back as straight as possible, bend your knees and lift with your leg muscles; and

    - Be sure you have good footing and hold, and lift with a smooth, even motion.

- Telephone and/or radio communication will be available and used during disposal operations.

- Motor vehicles and material handling equipment (MHE) used for transporting OEO or demolition materials must meet the following requirements:

    - Exhaust systems shall be kept in good mechanical repair at all times.

    - Lighting systems shall be an integral part of the vehicle.

    - One Class ABC rated, portable fire extinguisher shall, if possible, be mounted on the vehicle outside of the cab, on the driver's side, and one Class ABC fire extinguisher shall be mounted inside the cab.

    - Wheels of carriers must be chocked and brakes set during loading and unloading.

    - No demolition material or OE shall be loaded into or unloaded from, motor vehicles while their motors are running.

- Motor vehicles and MHE used to transport demolition material and OE shall be inspected prior to use to determine that:

    - Fire extinguishers are filled and in good working order.

    - Electrical wiring is in good condition and properly attached.

    - Fuel tank and piping are secure and not leaking.

    - Brakes, steering and safety equipment are in good condition.

    - The exhaust system is not exposed to accumulations of grease, oil, gasoline, or other fuels, and has ample clearance from fuel lines and other combustible materials.

- Employees are required to wear leather or rubber gloves when handling demolition materials. The type of glove worn is dependent on the type of demolition material.

- An observer will be stationed at a location where there is a good view of the air and surface approaches to the disposal site before material is detonated. It shall be the responsibility of the observer to warn the DS to suspend firing if any aircraft, vehicles or personnel are sighted approaching the disposal site.

- Two-way radios shall not be operated at the disposal site while the shot is primed or during the priming process. The charts shown in Tables D-1 and D-2, shall be used for determining the safe distances from transmitter antennas.

- Disposal operations will not be left unattended once explosives are on site and operations have begun.

- No disposal operations will be conducted if there is less than a 2,000 foot ceiling or if wind velocity is in excess of 20 mph.

- Disposal shots must be fired during daylight hours (i.e., between 30 minutes after sunrise and 30 minutes before sunset).

- No more than two persons shall ride in a truck transporting demolition material or OE, and no passengers are authorized to ride in the trailer/bed.

- Vehicles shall not be refueled when carrying demolition material or OE, and must be 100 feet from magazines or trailers containing such items before refueling.

- All explosive vehicles will be cleaned of visible explosive and other contamination before releasing the vehicles for other tasks.

- Prior to conducting any other task, personnel shall wash their face and hands after handling demolition material or OE.

- Disposal sites shall be spaced at least 50 feet apart, with no more than 10 sites prepared for a series of shots at any one time.

5.1 FIRE PREVENTION FOR DISPOSAL OPERATIONS

Due to the high fire potential season anticipated at the site, the following procedures will be adhered to on each disposal shot conducted at the Project Site:

- OE that is moved for disposal will be taken to a location that will provide the most protection from fires and provide the easiest access by fire fighting vehicles if required.

- For OE that cannot be moved, measures will be taken to carefully plan fire suppression accesses and procedures prior to detonating shots. All disposal and safety personnel will be fully briefed on fire suppression procedures.

- Immediately after the detonation, all safety personnel will report status of the disposal site.

- If fire or smoke in the vegetation surrounding the site is present, the demolition team will proceed immediately to the site with field fire suppression equipment and attempt to suppress any fires present.

- If a fire becomes uncontrollable, emergency notifications to local fire agencies will be made and all field workers will stand by to assist as necessary.

The fire prevention goals are to plan effectively for all potential fire suppression obstacles, ensure prevailing winds are not going to take potential smoke towards populated areas, ensure that adequate fire suppression equipment is on site, and keep vigilant communications with the local Fire Department during all disposal operations.

6.0 SPECIAL REQUIREMENTS FOR DEMOLITION ACTIVITIES

The following safety and operational requirements shall be followed during disposal site operations. Any deviations from this procedure shall be allowed only after receipt of written approval from the Earth Tech site manager and the client. Failure to adhere to the requirements and procedures listed in the paragraphs below could result in serious injury or death, therefore complete compliance with these requirements will be strictly enforced.

6.1 GENERAL REQUIREMENTS

The general disposal operations requirements listed below shall be followed at all times:

- Material awaiting destruction shall be stored at not less than intra-line distance, based on the largest quantity involved, from adjacent explosive materials and from explosives being destroyed. The material shall be protected against accidental ignition or explosion from fragments, grass fires, burning embers or detonating impulses originating in materials being destroyed.

- OE or bulk explosives to be destroyed by detonation should be detonated in a pit not less than three feet deep and covered with earth which protrudes not less than two feet above existing ground level. The components should be placed on their sides or in a position to expose the largest area to the influence of the demolition material. The demolition material should be placed in intimate contact with the item to be detonated and held in place by tape or earth packed over the demolition materials. The total quantity to be destroyed below ground at one time shall be kept at a minimum.

- Detonations will be counted to ensure detonation of all sites. After each series of detonations, a search shall be made of the surrounding area for OE. Items such as lumps of explosives or unfuzed ammunition, may be picked up and prepared for the next shot. Fuzed ammunition or items which may have internally damaged components will be detonated in place, if possible.

- Prevailing weather condition information will be obtained from the U.S. Weather Service and the data logged in the Demolition Shot Log before each shot or round of shots.

- All shots shall be dual primed.

- A minimum of 30 seconds will be maintained between each detonation.

- After each detonation and at the end of each day's operations, surface exposed scrap metal, casings, fragments, and related items shall be recovered from the disposal site and disposed of in accordance with OE scrap procedures, as well as all applicable environmental regulations. All collected scrap metal will be 100% inspected for absence of explosive materials by OE personnel and certified by the SUXOS.

- When operated in accordance with the conditions of this procedure the disposal site should not present a noise problem to the surrounding community. However, if a noise complaint is received, the name, address and phone number of the complainant should be recorded and reported to the SUXOS, who in turn, will report it to the Earth Tech site manager.

- Prior to and after each shot, the Demolition Shot Record is to be filled out by the DS with all applicable information.

6.2 ELECTRIC DETONATOR USE

The following requirements are necessary when using electric detonators and blasting circuits:

- Electric detonators and electric blasting circuits may be energized to dangerous levels from outside sources such as static electricity, induced electric currents and radio communication equipment. Safety precautions will be taken to reduce the possibility of a premature detonation of the electric detonator and explosive charges of which they form a part. Radios will not be operated while the site is primed or during the priming process.

- The shunt shall not be removed from the leg wires of the detonator until the continuity check of the detonator.

- When uncoiling or straightening the detonator leg wires, keep the explosive end of the detonator pointing away from the body and away from other personnel. When straightening the leg wires, do not hold the detonator itself, rather hold the detonator leg wires approximately one inch from the detonator body. Straighten the leg wires by hand, do not throw or wave the wires through the air to loosen them.

- Prior to use, the detonators shall be tested for continuity. To conduct the test, place the detonators in a pre-bored hole in the ground or place them in a sand bag, and walk facing away from the detonators and stretch the wires to their full length, or to 25 feet, whichever is less, being sure to not pull the detonators from the hole or sand bag. With the leg wires stretched to their full length, test the continuity of the detonators one at a time by un-shunting the leg wires and attaching them to the galvanometer and checking for continuity. After the test, re-shunt the wires by twisting the two ends together. Repeat this process for each detonator until all detonators have been tested. This process shall be accomplished at least 25 feet from any OE or demolition materials and out of the demolition range personnel and vehicle traffic flow pattern. In addition, all personnel on the demolition range shall be alerted prior to the test being conducted.

NOTE: When testing the detonator, prior to connecting the detonator to the firing circuit, the leg wires of the detonator must be shunted by twisting the bare ends of the wires together immediately after testing. The wires shall remain short circuited until time to connect them to the firing line.

- At the power source end of the blasting circuit, the ends of the wires shall be shorted or twisted together (shunted) at all times, except when actually testing the circuit or firing the charge. The connection between the detonator and the circuit firing wires must not be made unless the power end of the firing wires are shorted and grounded or the firing panel is off and locked.

- The firing line will be checked using pre-arranged hand signals or through the use of two-way radios if the demolition pit is not visible from the firing point. If radios are used, communication shall be accomplished a minimum of 25 feet from the demolition pit and detonators. The firing line will be checked for electrical continuity in both the open and closed positions, and will be closed/shunted prior to connecting the detonator leg wires.

- OE to be detonated/vented shall be placed in the demolition pit and the demolition material placed/attached in such a manner as to ensure the total detonation/venting of the OE. Once the OE and demolition material are in place and the shot has been tamped, the detonators will be connected to the demolition material. Prior to handling any detonators that are connected to the firing line, personnel shall ensure that they are grounded. The detonators will then be carried to the demolition pit with the end of the detonators pointed away from the individual. The detonators are then connected to the detonation cord, Non-EI, etc., ensuring that the detonator is not covered with tamping material to allow for ease of recovery/investigation in the event of a misfire.

- Prior to making connections to the blasting machine, the entire firing circuit shall be tested with a galvanometer for electrical continuity and ohmic resistance to ensure the blasting machine has the capacity to initiate the shot.

- The individual assigned to make the connections at the blasting machine or panel will not complete the circuit at the blasting machine or panel and will not give the signal for detonation until satisfied that all personnel in the vicinity have been evacuated to a safe distance. When in use, the blasting machine or its actuating device shall be in the blaster's possession at all times. When using the panel, the switch must be locked in the open position until ready to fire, and the single key must be in the blaster's possession.

- Prior to initiating a demolition shot(s), a warning will be given, the type and duration of such will be determined by the prevailing conditions at the demolition range. At a minimum, this should be an audible signal using a siren, air horn or megaphone which is sounded for a duration of one minute, five minutes prior to the shot and again one minute prior to the shot.

6.3 DETONATING CORD USE

The following procedures are required when using detonating cord (det cord):

- Det cord should be cut using approved crimpers and only the amount required should be removed from inventory.

- When cutting det cord, the task should be performed outside the magazine.

- For ease of inventory control, only remove det cord in one foot increments.

- Det cord should not be placed in clothing pockets or around the neck, arm or waist, and should be transported to the demolition location in either an approved "day box" or a cloth satchel, depending upon the magazine location and proximity to the demolition area.

- Det cord should be placed at least 25 feet away from detonators and demolition materials until ready for use. To ensure consistent safe handling, each classification of demolition material shall be separated by at least 25 feet until ready for use.

- When ready to "tie in" either the det cord to demolition materials, or det cord to detonator, the det cord will be connected to the demolition material and secured to the OE. The cord is then strung out of the hole and secured in place with soil, being sure to leave a one foot tail exposed outside the hole.

- Once the hole is filled, make a loop in the det cord that is large enough to accommodate the det cord detonator, place the detonator in the loop and secure it with tape. The explosive end of the detonator will face down the det cord toward the demolition material or parallel to the main line.

- In all cases, ensure there is sufficient det cord extending out of the hole to allow for ease of detonator attachment and detonator inspection/replacement should a misfire occur.

- If the det cord detonators are electric, they will be checked, tied in to the firing line and shunted prior to being taped to the loop. If the det cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place prior to taping the detonators to the det cord loop. If the det cord detonators are Non-EI, simply tape the detonators into the loop as described above.

- In the event that a time/safety fuse is used, and an igniter is not available and a field expedient initiation system is used (i.e., matches), do not split the safety fuse until the detonator is taped into the det cord loop.

6.4 TIME/SAFETY FUSE USE

The following procedures are required when using a time/safety fuse:

- Prior to each daily use, the burn rate for the time/safety fuse must be tested to ensure the accurate determination of the length of time/safety fuse needed to achieve the minimum burn time of five minutes needed to conduct demolition operations.

- To ensure both ends of the time/safety fuse are moisture free, use approved crimpers to cut six inches off the end of the time/safety fuse roll and place the six-inch piece in the time/safety fuse container.

- Take the six foot section out of the magazine and attach a fuse igniter.

- In a safe location, removed from demolition materials and OE, ignite the time/safety fuse, measure the burn time from the point of initiation to the "spit" at the end, and record the burn time in the DS's Log

- To measure the burn time, use a watch with a second hand or chronograph.

- To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.

- Whenever using time/safety fuse for demolition operations, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of five minutes.

6.5 PERFORATOR USE

The following procedures are required when using perforators:

- Only remove from inventory the number of perforators required to perform the task.
- Transport perforators in an approved "day box", cloth satchel or plastic container, depending upon magazine location and proximity to the demolition operations.
- Keep perforators stored at the demolition site at least 25 feet away from detonators and demolition materials until ready for use.
- When ready to use, place the det cord through the slot on the perforator and knot the det cord, ensuring the cord fits securely and has good continuity with the perforator.
- Once the det cord is secure, place the perforator in the desired location and secure it in place.
- Proceed from this point as described in Section 6.3.

6.6 USE OF TWO-COMPONENT EXPLOSIVES

The following procedures are required when using two-component explosives as demolition material:

- Only remove from inventory the amount of two-component required to perform the task.
- When transporting the solid and liquid, they need only be placed apart in the bed of a truck.
- Do not mix the solid and liquid components until certain that it will be used, since the resulting mixture is classified as a Class 1.1 explosive by Department of Transportation.
- When mixing the solid and liquids components, follow the manufacturer's instructions, while being sure to wear rubber gloves and goggles. Mix components in an area away from other demolition materials, the OE, and if possible, sheltered from the wind.
- Once the components have been mixed, it is essential that the lid to the solid bottle is put on securely as soon as possible after mixing to prevent evaporation of the liquid.
- Attach the det cord as recommended by the manufacturer, place the assembled unit in the desired location in the hole and secure the unit.
- Proceed from this point as described in Section 6.3.

7.0 METEOROLOGICAL CONDITIONS

In order to control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements shall apply to demolition operations:

- Demolition operations will not be conducted during electrical storms or thunderstorms.

- No demolition operations shall be conducted if the surface wind speed is greater than 10 miles per hour.

- Demolition operations will not be conducted during periods of visibility of less than one mile caused by, but not limited to, dense fog, blowing snow, rain, sand or dust storms.

- Demolition shall not be carried out on extremely cloudy days which are defined as: overcast (more than 80% cloud cover) with a ceiling of less than 2,000 feet.

- Demolition operations will not be conducted during any atmospheric inversion condition (low or high altitude).

- Demolition operations will not be conducted during periods of local air quality advisories.

- Demolition operations will not be initiated until 30 minutes after sunrise, and will be secured at least 30 minutes prior to sunset.

8.0 PRE-DEMOLITION/DISPOSAL PROCEDURES

8.1 PRE-DEMO/DISPOSAL OPERATIONAL BRIEFING

The DS will brief all personnel involved in range operations in the following areas:

- Type of OE being destroyed.
- Type, placement and quantity of demolition material being used.
- Use of sandbags for mitigation of fragmentation and blast effects.
- Method of initiation (electric, non-electric or Non-EI).
- Means of transporting and packaging OE.
- Route to the disposal site.
- Equipment being used (e.g., galvanometer, blasting machine, firing wire).
- Misfire procedures.
- Fire prevention procedures.
- Post shot clean up of site.

8.2 PRE-DEMO/DISPOSAL SAFETY BRIEFING

The SSO will conduct a safety briefing for all personnel involved in range operations in the following areas:

- Care and handling of explosive materials.

- Personal hygiene.

- Two man rule.

- Potential trip/fall hazards.

- Location of emergency shelter (if available).

- Parking area for vehicles (vehicles must be positioned for immediate departure, with the keys in the ignition).

- Location of emergency vehicle (keep engine running).
- Wind direction (to assess potential toxic fumes).
- Location of first aid kit and fire extinguishers.
- Route to nearest hospital or emergency aid station.
- Type of communications in event of an emergency.

8.3 TASK ASSIGNMENTS

Individuals with assigned tasks will report the completion of the task to the DS. The types of tasks which may be required are:

- Contact local Police, Fire personnel, and FAA as required.
- Contact hospital/emergency response personnel if applicable.
- Secure all access roads to the disposal site.
- Visually check PWD for any unauthorized personnel.
- Check firing wire for continuity and shunt.
- Prepare designated disposal sites as required.
- Check continuity of detonators.
- Check time/safety fuse and its burn rate.
- Designate a technician to maintain custody of blasting machine, fuse igniters or Non-EI initiator.
- Secure detonators in a safe location.
- Place OE in pit and place charge in desired location.

8.4 PREPARING EXPLOSIVE CHARGE FOR INITIATION

To prepare the explosive charge for initiation, the procedures listed below will be followed:

- Ensure firing wire is shunted.
- Connect detonator to the firing wire.
- Isolate or insulate all connections.
- Place demolition charge on OE.
- Prime the demolition charge.
- Depart to firing point (if using non electric firing system, obtain head count, pull igniters and depart to designated safe area).
- Insure all personnel are out of the PWD.
- Give one minute warning signal, using a bullhorn or siren, five minutes prior to detonation, and again at one minute prior to detonation.

- Yell **"fire in the hole"** three times (or an equivalent warning) and take cover.

- If using electric firing system, connect firing wires to blasting machine and initiate charge.

- Remove firing wires from blasting machine and shunt.

- Remain in designated safe area until DS announces **"All Clear."** This will occur after a post-shot waiting period of 5-minutes and the DS has inspected the site(s).

9.0 POST DEMOLITION/DISPOSAL PROCEDURES

Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so, and follow the below listed procedures:

- After the **"All Clear"** signal, check site for low orders, kick outs, and fires.
- Mag site and remove any large fragmentation.
- Back fill hole as necessary.
- Police up all equipment.
- Notify police, fire, etc. that the operation is complete.

10.0 MISFIRE PROCEDURES

A thorough check of all equipment, firing wire and detonators will prevent most misfires. However, if a misfire does occur, the procedures outlined below shall be followed.

10.1 ELECTRIC MISFIRES

To prevent electric misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire does occur, it must be cleared with extreme caution, and the responsible technician will investigate and correct the situation, using the steps outlined below:

- Check firing line connections to the blasting machine and make a second attempt to initiate charge.

- If unsuccessful, disconnect and connect to another blasting machine (if available) and attempt to initiate charge.

- If unsuccessful, commence a 30 minute wait period.

- After the maximum delay predicted for any part of the shot has passed, the designated technician will proceed to the site to inspect the firing system, and a safety observer must watch from a protected area.

- Disconnect and shunt the detonator wires, connect a new detonator to the firing circuit and prime the charge without disturbing the original detonator (replacement detonator must have been checked for continuity as outlined in Section 6.2, after disconnecting the defective detonator).

- Follow normal procedures for effecting initiation of the charge.

10.2 NON-ELECTRIC MISFIRES

Working on a non electric misfire is the most hazardous of all operations. Investigation and corrective action should be undertaken by the technician that placed the charge, using the following procedure:

- If charge fails to detonate at the determined time, initiate a 60 minute wait period plus the time of the safety fuse (i.e., 5 minute safety fuse plus 60 minutes for a total of 65 minute wait period).
- After the wait period has expired, a designated technician will proceed to the site to inspect the firing system. A safety observer must watch from a protected area.
- Prime the shot with a new non electric firing system and install a new fuse igniter.
- Follow normal procedures for initiation of the charge.

10.3 NON-EL MISFIRE

The use of a shock tube for blast initiation can present misfires which require the following actions:

- If charge fails to detonate, it could be the result of the shock tube not firing. Visually inspect the shock tube, if it is not discolored (i.e., slightly black), it has not fired.
- If it has not fired, cut a one foot piece off the end of the tube, re-insert the tube into the firing device and attempt to fire again.
- If the device still does not fire, wait 30 minutes and proceed to the site to replace the shock tube with a new tube.
- If the tube is slightly black, then a "Black Tube" misfire has occurred, and the shock tube will have to be replaced. When replacing the shock tube, be sure to remove the tube with the detonator in place. Without removing the detonator from the end of the tube, place the defective tube on the shot for disposal.

10.4 DETONATING CORD MISFIRE

Det cord will be used to tie in multiple demolition shots and to ensure that electric detonators are not buried. Since det cord initiation will be either electrical or non-electrical, the procedures presented in Sections 10.1, 10.2, or 10.3, as appropriate to the type of detonator used, will be used to clear a det cord misfire. In addition, the following will be conducted:

- If there is no problem with the initiating system, wait the prescribed amount of time and inspect the initiator to the cord connection to ensure it is properly connected. If it was a bad connection simply attach a new initiator and follow the appropriate procedures in Section 6.0.
- If the initiator detonated and the cord did not, inspect the cord to ensure it is det cord and not time fuse. Also, check to ensure there is PETN in the cord at the connection to the initiator.

- At this point, it may be necessary to uncover the det cord and replace it. If this is required, it must be accomplished carefully to ensure that the demolition charge and the OE item(s) are not disturbed.

10.5 PERFORATOR MISFIRE

The use of perforators is both cost effective and considerably safer than the use of C-4 and many other demolition materials. If the perforator is not initiated properly, it could malfunction. Since the perforator is covered with tamping material, det cord is used as the initiator. Therefore, in the event of a misfire, the procedures presented in Section 10.4 will be followed, along with the items presented below.

- If everything went but the perforator, one of four things has occurred:
  - Det cord grain size was insufficient to initiate the perforator
  - The det cord was dislodged from the perforator when placing tamping materials
  - The perforator was defective
  - The perforator was moved during the placement of tamping materials.

- Check to ensure the grain size of the det cord is sufficient, with 80 grain size or greater being the recommended size.

- If the det cord connection to the perforator was the problem, ensure that the next connection is secure (use duct tape if necessary).

- If it is evident that the perforator was moved, then ensure it is properly secured for the next shot.

- If cord size and connection are sufficient, replace the perforator, leaving the defective one on the shot

11.0 RECORD KEEPING REQUIREMENT

To document the demolition operations procedures and the completeness of the demolition of OE, the following record keeping requirements shall be met:

- Earth Tech will obtain and maintain all required permits.

- The DS will ensure the accurate completion of the logs, and the SUXOS will monitor the entries in the log for completeness, accuracy and compliance with meteorological conditions.

- The DS shall enter the appropriate data on the Demolition Shot Record to reflect the OE destroyed.

- The quantities of OE recovered must also be the quantities of OE destroyed or disposed of as scrap.

- Earth Tech will retain a permanent file of all Demolition Records, including permits, training records, inspector reports, waste manifests if applicable, and operating logs.

- Copies of ATF License and any state or local permits must be on hand.

12.0 SAFETY AND PPE REQUIREMENTS

The following safety measures and personal protective equipment shall be used in preventing or reducing exposure to the hazards associated with OE demolition/disposal operations. These requirements will be implemented unless superseded by site-specific requirements stated in the SSHP.

- Steel-toed safety boots will not be worn by personnel conducting demolition/disposal operations, unless a toe crush hazard exists, in which case personnel will wear boots with plastic or fiber toed safety toes;

- Unless a serious head, eye or face hazard exists, OE personnel will not be required to wear hard hats, safety glasses or face shields when conducting operations involving the handling of demolition explosives or OE; and

- In the event that a serious head, eye or face hazard does exist, OE personnel will wear the required PPE, but positive means shall be required to secure the PPE and prevent it from falling and causing an accidental detonation.

13.0 AUDIT CRITERIA

The following items related to demolition/disposal operations on an OE contaminated site will be audited to ensure compliance with these SOPs:

- The Demolition Shot Record
- The Site Daily Operational and Safety Logs
- The OE Operations Daily/Weekly Report
- The Safety Training Attendance Forms, for the initial site hazard training
- The Safety Training Attendance Forms, for the Daily Tailgate Safety Briefings
- The Daily Safety Inspection and Audit Log.

TABLE D-1
MINIMUM SAFE DISTANCE FROM TRANSMITTER ANTENNAS

Average or Peak Transmitter Power in Watts	Minimum Distance to Transmitter in Meters / Feet
0 - 5	7.5 / 25
6 - 30	30 / 98.4
31 - 50	50 / 164.1
51 - 100	110 / 360
101 - 250	160 / 525
251 - 500	230 / 755
501 - 1,000	305 / 1,000
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3,002
20,001 - 50,000	1,530 / 5,020
50,001 - 100,000	3,050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,001 - 6,400,000	24,400 / 80,056

Note: When the transmission is a pulsed or pulsed continuous wave type and its pulse width is less than 10 microseconds, the power column indicates average power. For all other transmissions, including those with pulse widths greater than 10 microseconds, the power column indicates peak power.

TABLE D-2
MINIMUM SAFE SEPARATION FORMULAS

Unknown (Worst Case)	Without Metal Pack		With Metal Pack	
	Frequency	Formula	Frequency	Formula
Use Table 120D-1-1	≤2.3 KHz	$D = 0.093 \times (PG)^{0.5}$	≤73 KHz	$D = 0.093 \times (PG)^{0.5}$
	2.3 KHz - 0.45 MHz	$D = 39.7 \times F \times (PG)^{0.5}$	73 KHz - 0.45 MHz	$D = 126 \times F \times (PG)^{0.5}$
	0.45 MHz - 400 MHz	$D = 18 \times (PG)^{0.5}$	0.45 MHz - 400 MHz	$D = 0.6 \times (PG)^{0.5}$
	400 MHz - 75 GHz	$D = (7137 / F) \times (PG)^{0.5}$	400 MHz - 2.4 GHz	$D = (226 / F) \times (PG)^{0.5}$
	>75 GHz	$D = 0.093 \times (PG)^{0.5}$	>2.4 GHz	$D = 0.093 \times (PG)^{0.5}$

Where :

D = Safe distance to the transmitter in feet (multiply feet by 0.305 to obtain meters)

P = Output power of the transmitter in watts

G = Numerical gain of transmitter antenna

F = Frequency in MHz (divide KHz by 1,000 to obtain MHz, and multiply GHz by 1,000 to obtain MHz)

To properly use this table, the following assumptions are made:

- The no-fire current of the EED is 10 mA.
- At least 10 dB below the no-fire current in EED is considered to be safe.
- The metal pack provides at least 30 dB of shielding.
- Non-metal packs provide no shielding.
- A 1 volt/meter field intensity is considered to be safe.
- At no time should personnel or munitions be exposed to more than 200 volts/meter.

APPENDIX E

EARTH TECH FORMS

Tourtelot Property Project Site
OE Sampling Excavation Information Sheet
(Must be completed for all targets)

Grid No.: _____ Completed By: _____ Date: _____

Time: _____

Anomaly ID No.: _____ OE Contractor: _____ Crew No.: _____

LOCATION

Northing: _____ Easting: _____

Field Sketch

N

EXCAVATION

Method:
- ☐ Hand
- ☐ Shovel
- ☐ Backhoe
- ☐ NONE (Surface Debris)

Notes _____

_____

Excavation Width: _____ inches

Excavation Depth: _____ inches

Depth to Top of Item: _____ inches

Estimated Scale: _____

ORIENTATION

Bearing: _____ degrees
☐ Measured ☐ Estimated

Estimated Inclination: _____ degrees
☐ Nose Up ☐ Nose Down ☐ No Nose

Distance from Flag: _____ inches
☐ Measured ☐ Estimated

Direction from Flag: _____

TARGET DESCRIPTION

Type/Model/DOD Nomenclature: _____

- ☐ Ordnance (OE)
  - ☐ Fuzed
  - ☐ Unfuzed
- ☐ Ordnance and Explosives (OE)
- ☐ OE Scrap
- ☐ Non-OE

Primary Composition:
- ☐ Ferrous
- ☐ Aluminum
- ☐ Brass
- ☐ Other _____

Condition (Mark all that apply):
- ☐ Intact
- ☐ Partial
- ☐ Rusted
- ☐ Dented
- ☐ Other _____

Diameter: _____ mm/inches
☐ Measured ☐ Estimated

Length: _____ inches
☐ Measured ☐ Estimated

Wall Thickness _____ inches
☐ Measured ☐ Estimated

Markings: _____

☐ Photo Taken (# _____)

Estimated Weight: _____ pounds/ounces

DISPOSAL

☐ Blown in Place ☐ Moved to Demo Area ☐ Date of Demo _____

Comments: _____

OE Contractor review by: _____ Title: _____ Date: _____

Earth Tech review by: _____ Title: _____ Date: _____

Site Safety Meetings
Tourtelot Property Project Site
Tailgate Safety Briefing Sign-in Log

Date: _____ **Time:** _____

Briefing Conducted By:	Signature:	Company Name:

This sign-in log documents the tailgate safety briefing conducted in accordance with 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response" as well as other applicable regulatory requirements. Personnel who perform work operations onsite are required to attend each safety briefing and acknowledge receipt of such briefings daily or as required.

TOPICS COVERED:

☐ General PPE usage	☐ Decontamination Procedures	☐ Emergency Procedures
☐ Respiratory Protection	☐ Smoking Eating and Drinking	☐ Existing Work Zones
☐ Hearing Conservation	☐ Slips, Trips, and Falls	☐ Lockout/Tagout
☐ Personal Hygiene	☐ Heat and Cold Stress	☐ Excavation/Confined Spaces
☐ Exposure Guidelines	☐ Site Control	☐ New Work Procedures

1.1 PERSONNEL SIGN-IN LIST

Printed Name	Signature	Company Name

Preparatory Phase Check List

Project Name _____ Project Number _____

Field Activity _____ Date of Activity _____ to _____

YES	NO	N/A	
____	____	____	Permits: _____
____	____	____	Applications: _____
____	____	____	Site visit performed
____	____	____	Work Plan completed, approved, distributed
____	____	____	Quality Control Plan completed, approved, distributed
____	____	____	Site-Specific Safety & Health Plan completed, approved, distributed
____	____	____	Procedure in place _____
			Personnel assigned
____	____	____	Project Manager _____
____	____	____	Site Safety Officer _____
____	____	____	Field Quality Control Manager _____
____	____	____	Other _____
			Training completed for
____	____	____	Field procedures
____	____	____	Quality control
____	____	____	Health and safety
			Equipment and supplies
____	____	____	Tested, approved
____	____	____	Calibrated
____	____	____	Field material properly stored
			Subcontractor(s): _____
____	____	____	Evaluation satisfactory
____	____	____	Procurement document/subcontract in place
____	____	____	Contaminated material holding and disposal procedures in place
____	____	____	Emergency procedures in place
____	____	____	Weather conditions accounted for
____	____	____	Review of nonconformances/audit findings completed

_____ Project Manager _____ Date _____ Quality Control Manager _____ Date

Preparatory Phase Check List

Project Name _____ Project Number _____

Field Activity _____ Date of Activity _____ to _____

YES	NO	N/A	
			List submittals required for the work: _____
_____	_____	_____	Contract specifications reviewed
_____	_____	_____	Contract drawings reviewed
_____	_____	_____	Test procedures ready
_____	_____	_____	Activity hazard analysis conducted
_____	_____	_____	Client notified
			List any items of mutual understanding developed during the preparatory phase:
			List any topics of concern (i.e., safety violations observed, areas of nonconformance, etc.):
			List persons in attendance:

_____ Project Manager _____ Date _____ Quality Control Manager _____ Date

EARTH TECH

Controlled Document Transmittal Record

To: _____

_____

_____

_____ Date _____

☐ QA program manual for

_____

☐ Calibration / service specification manual

☐ Procedure No. _____ Procedure name _____

☐ Work plan for project No. _____ Title _____

Revision No. _____ or revision date _____

Control No. _____

Instructions / remarks / variances

Please sign below and return to:

☐ I acknowledge receipt of the above document

☐ I acknowledge receipt of the revision to the above document and I have destroyed / marked the superceded version

☐ I am returning the document with this transmittal record

Signature _____ Date _____

Daily Quality Control Report
(Part I)

Report Number _____ Date _____

Contract Number _____

Name and Location of Project _____

Weather: (Clear) (P. Cloudy) (Cloudy) Temperature_____

Rainfall _____ Inches Minimum_____ Maximum_____

CONTRACTOR/SUBCONTRACTORS	AREA OF RESPONSIBILITY
a.	
b.	
c.	
d.	
e.	
f.	
g.	

1. Work performed today (Indicate location and description of work performed. Refer to work performed by prime and/or subcontractors by letter in table above).

2. Preparatory inspection for next item of work (Materials/shop drawings approved, required control testing arranged, all preliminary work has been accomplished as per plans and specifications).

Daily Quality Control Report
(Part II)

3. Initial inspection (Address quality of workmanship, assure control testing and materials being used in all work are in compliance with plans and specifications.

4. Follow-up inspection (Assure control testing performed as required and all work performed continues to be in compliance with plans and specifications).

5. Verbal instructions received (List any instructions given by government personnel on construction deficiencies, retesting required, etc., with action taken).

6. Remarks (Cover any conflicts in plans, specifications, instructions, or any delay to the job attributable to weather conditions).

Daily Quality Control Report
(Part III)

7. Results of safety inspection (Note safety violations and corrective action taken. Indicate phase of work where violations occurred).

8. Upcoming work (Indicate next major phase of work anticipated and approximate date of Preparatory Inspection meeting to cover this work).

9. Equipment data (Indicate items of construction equipment, other than hand tools, at the job site and whether or not used).

Earth Tech verification: The above report is complete and correct and all material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Earth Tech Approved/Authorized Representative

Daily Field Activity Report

Page _____ of _____

Date _____

Project Name _____ Weather _____

Project Number _____ Site Conditions _____

Visitors _____

Work Force		Remarks
Earth Tech		
Subcontractors		
Equipment		

Description of site activities

Materials delivered to the site _____

Safety _____

Areas of concern _____

Subcontractor work tickets reviewed _____ Approved _____ Attached _____

Prepared by _____ Date _____ Title _____

EARTH TECH

Daily Work Ticket

Date _____ Prepared by _____ Title _____

Project Name _____ Project No. _____ Contract No. _____

Approved by _____ Approved by _____

Site Manager Project Manager

EXPENSES				
	RATE	QUANTITY	COST	COMMENT
Subcontractor(s)				
Equipment		Sub Total		
Materials		Sub Total		
Labor		Sub Total		
		Sub Total		
		Grand Total		Cum. Total

DESCRIPTION OF ACTIVITIES

EARTH TECH

Field Change Request

Field Change No. _____

Page _____ of _____

Project Name _____

Contract Number _____ Project Number _____

Applicable Document _____ Date _____

DESCRIPTION

Minor Change ☐ Major Change ☐ Major Project Impact ☐

Requested by

REASON FOR CHANGE

RECOMMENDED DISPOSITION

IMPACT ON PRESENT AND COMPLETED WORK

Cost Impact

Accepted ☐ Rejected ☐ Signature _____ Date _____
Project Manager

Accepted ☐ Rejected ☐ Signature _____ Date _____
Project QC Manager

(For changes to engineering drawings and construction specifications)

Accepted ☐ Rejected ☐ Rework ☐ Signature _____ Date _____
Responsible Engineer

Remarks:

FINAL DISPOSITION

Signature _____ Date _____

EARTH TECH

Field Change Request Log

Project Name _____

Contract Number _____ Project Number _____

Field Change Request No.	Level of Change*	Activity	Date initiated	Final Disposition	Remarks

* Min C = Minor Change
Maj C = Major Change
MPI = Major Project Impact

EARTH TECH

Audit Schedule

Program / Project _____

Audit Subject	Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Prepared by _____ Date _____

Revised by _____ Date _____

EARTH TECH

Audit Check List

Audit Number _____

Audited Activity _____ Project Number _____

Controlling Document(s) _____

Auditor(s) _____ Date of Audit _____ Location _____

Person Contacted	Position	Date	Person Contacted	Position	Date

Item No.	Characteristic	Doc. No.	Para. No.	Verification	Conform (Yes/No)

Prepared by _____ Date _____

EARTH TECH

Audit Status

Program / Project ______________________________

Audit Number	Audit Subject	Date of Audit	Date of Audit Report	Quality Deficiency Notices				Audit Closed Date
				Number	Responses: Due	Responses: Received	Closed	

Quality Deficiency Notice

(Part I)

QDN Number _____

Project Name _____ Project Number _____

Activity _____ Location _____

Controlling Document:

Requirement

Description of Deficiency

Reported by _____ Date _____

Discussed with _____ Date _____

Response

This section to be completed by responsible organization and returned to the Earth Tech QC Manager or designated representative by _____ (Date).

Corrective Action (including action to prevent recurrence and root cause determination)

Scheduled Completion Date _____ Signed _____ Date _____

Quality Deficiency Notice

(Part II)

Evaluation of Response QDN Number _____

This section to be completed by the Quality Control Manager

First Response ☐ Satisfactory ☐ Unsatisfactory

Remarks

Evaluated by _____ Date _____

Second Response ☐ Satisfactory ☐ Unsatisfactory

Remarks

Evaluated by _____ Date _____

Third Response ☐ Satisfactory ☐ Unsatisfactory

Remarks

Evaluated by _____ Date _____

Corrective action verified ☐ Yes ☐ N/A

Remarks

Verified by _____ Date _____

Quality deficiency notice closed on _____ By _____

EARTH TECH

Nonconformance Report (NCR)

NCR No. _____

Project _____ Project Number _____

Activity _____ Location _____

Part A

Description of nonconformance

Nonconformance reported by _____ Date _____

Part B

Evaluation of nonconformance

Significant condition adverse to quality ☐ Yes ☐ No

Work stoppage required ☐ Yes ☐ No

Impacts previous data/reports ☐ Yes ☐ No

Remarks:

Evaluated by _____ Date _____ Title _____

Approved by _____ Date _____ _____ Date _____
Project Manager QC Manager

Part C

Recommended corrective action/disposition

Evaluated by _____ Date _____ Title _____

Approved by _____ Date _____ _____ Date _____
Project Manager QC Manager

Part D

Corrective action/disposition

Completed by _____ Date _____

Remarks:

Corrective action approved and NCR closed by:

_____ Date _____ _____ Date _____
Project Manager QC Manager

EARTH TECH

Nonconformance Report Log

NCR No.	Project/Activity	Date initiated (Part A)	Date NCR closed (Part D)	Remarks

EARTH TECH

DELIVERABLE REVIEW AND APPROVAL

FORM Q-1

Project Name:	
Project Number:	Certification Required:

Peer Review Assignments	
Reviewer: Date Comments Required: NTE _____ Hours Special Emphasis:	☐ Technical ☐ Editorial ☐ Statement of Work Compliance
Reviewer: Date Comments Required: NTE _____ Hours Special Emphasis:	☐ Technical ☐ Editorial ☐ Statement of Work Compliance
Reviewer: Date Comments Required: NTE _____ Hours Special Emphasis:	☐ Technical ☐ Editorial ☐ Statement of Work Compliance

PEER REVIEW SCHEDULE

Date	Event

Project Manager Signature:	Date:

EARTH TECH

DELIVERABLE REVIEW AND APPROVAL

Page ___ of ___

FORM Q-2

PEER REVIEW	
Document Title:	
Document Date:	Project Number:
Peer Reviewer's Name:	
Date Comments Required: NTE _____ Hours Special Emphasis:	
I have reviewed this document for: ☐ Technical Quality ☐ Conformance to Scope ☐ Editorial Quality	This review resulted in: ☐ No Comments ☐ Minor or Editorial Comments ☐ Significant Comments
☐ Document markup attached	☐ Supplemental comments attached
Signature:	Date Received: Date Completed:

RESPONSE TO PEER REVIEW COMMENTS	
Responses Prepared By:	
Peer review comments have been ☐ incorporated without exception ☐ incorporated with exception(s). Any exceptions must be explained in a written attachment.	
Signature:	Date:

MANAGEMENT APPROVAL	
Project Manager:	Date:
Office Manager:	Date:

NONCONFORMANCE REPORT

Page ___ of ___

FORM Q-3

Project Name:	
Project Number:	

	DESCRIPTION OF NONCONFORMANCE
	☐ Peer Review Plan (Form Q-1) ☐ Deliverable Review and Approval (Form Q-2) ☐ Peer Review Procedures
Description:	
Prepared By:	Date:

PROJECT MANAGER RESPONSE	
Project Manager Signature:	Date:

QC MANAGER APPROVAL	
QC Manager Signature:	Date:

Surface Clearance Information Sheet
(Must be completed for all targets)

Sector: _____ Completed By: _____ Date: _____

Time: _____

Grid No.: _____ UXO Contractor: _____ Crew No.: _____

TARGET DESCRIPTION

Type/Model/DOD Nomenclature:

_____

- ☐ Ordnance (UXO)
  - ☐ Fuzed
  - ☐ Unfuzed
- ☐ Ordnance and Explosives (OE)
- ☐ OE Scrap
- ☐ Non-OE

Primary Composition:
- ☐ Ferrous
- ☐ Aluminum
- ☐ Brass
- ☐ Other _____

Condition (Mark all that apply):
- ☐ Intact
- ☐ Partial
- ☐ Rusted
- ☐ Dented
- ☐ Other _____

Diameter: _____ mm/inches
☐ Measured ☐ Estimated

Length: _____ inches
☐ Measured ☐ Estimated

Markings: _____

Estimated Weight: _____ pounds/ounces

Wall Thickness _____ inches
☐ Measured ☐ Estimated

☐ Photo Taken (# _____)

DISPOSAL

☐ Blown in Place ☐ Moved to Demo Area ☐ Date of Demo _____

Comments:

_____

_____

_____

_____

UXO Contractor review by: _____ Title: _____ Date: _____

Earth Tech review by: _____ Title: _____ Date: _____

Daily Explosives Safety Vehicle Inspection Checklist

All vehicles owned, leased, rented, or otherwise provided for use by or to Earth Tech for the transportation of explosives will be inspected daily. Prior to bringing any vehicle within 100 feet of an explosives magazine or explosives, the vehicle must meet or exceed the minimum allowable use criteria listed below. Vehicles failing to meet or exceed the minimum use criteria shall not be used until criteria is met.

Description of planned transportation route:

_____

_____

_____

Pre-Loading Inspection:	**Yes**	**No**
Is the fire extinguisher filled, sealed, and in good working condition?		
Are the vehicle's chocks in the vehicle and serviceable?		
Is the electrical wiring in good condition, with no visible signs of wear?		
Are the fuel tank and piping secure and not leaking?		
Are the brakes, steering, lights, horn, and other standard equipment in good working condition?		
Does the vehicle's engine operate properly (run smoothly and is tuned to manufacturer's specifications)?		

Loading Inspection:	**Yes**	**No**
Is the loading area free of dry grass, spilled fuel and oil, or other combustibles that may come in contact with hot vehicle parts?		
Are the explosives planned for loading compatible with each other?		
Are the explosives in a covered cargo space?		
Are the explosives contained within a nonconductive or wood box?		
Is the explosives container appropriately tied down or blocked and braced?		
Is the vehicle appropriately placarded?		
Is the vehicle's engine off?		
Are the vehicle's wheels chocked and brakes set?		

Off-Loading Inspection:	**Yes**	**No**
Is the unloading area free of dry grass, spilled fuel and oil, or other combustibles that may come in contact with hot vehicle parts?		
Is the vehicle's engine off?		
Are the vehicle's wheels chocked and brakes set?		

APPENDIX F

CALCULATED FRAGMENTATION DISTANCES FOR PUBLIC WITHDRAWAL DISTANCE ZONES

SUBJECT: Public Withdrawal Distance (PWD)
SITE: Former Benicia Arsenal
MUNITION: 40 mm Mk2 Mod 0
REQUESTED BY: Bob Nore
PREPARED BY: Michelle Crull
DATE: 13 November 1998

This form shows calculated distances only. It does not constitute approval. Concurrence of CEHNC-OE-S is required to determine the applicable distance for a specific site.

In accordance with (IAW) OE Center of Expertise Interim Guidance Document 98-03, use of the range to no more than 1 hazardous fragment/600 sq ft as the PWD for accidental detonations requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S.

ACCIDENTAL DETONATIONS

Maximum Fragment Range = 1095 ft
Range to No More Than 1 Hazardous Fragment/600 sq ft = 200 ft
Range to 0.9 psi Overpressure = 30 ft

IAW OE Center of Expertise Interim Guidance Document 98-08, the PWD for intentional detonations may not be less than the default distance provided in DoD 6055.9-STD or the maximum fragment range or the K328 overpressure distance.

INTENTIONAL DETONATIONS

Maximum Fragment Range = 1095 ft
K328 Overpressure Range = 199 ft

The primary fragmentation characteristics used in the calculation of the values listed above were computed IAW CEHNC-ED-CS-S-98-1. The maximum fragment range was calculated using the maximum weight fragment and the initial velocity from these characteristics in the computer software TRAJ. The range to no more than 1 hazardous fragment/600 sq ft was calculated IAW CEHNC-ED-CS-S-98-2.

SIGNATURES:

Michelle Crull 11/13/98
Subject Matter Expert

CEHNC-ED-CS-S Branch Chief

SUBJECT: Public Withdrawal Distance (PWD)
SITE: Former Benicia Arsenal
MUNITION: 60 mm M49A3
REQUESTED BY: Bob Nore
PREPARED BY: Michelle Crull
DATE: 13 November 1998

This form shows calculated distances only. It does not constitute approval. Concurrence of CEHNC-OE-S is required to determine the applicable distance for a specific site.

In accordance with (IAW) OE Center of Expertise Interim Guidance Document 98-03, use of the range to no more than 1 hazardous fragment/600 sq ft as the PWD for accidental detonations requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S.

ACCIDENTAL DETONATIONS

Maximum Fragment Range = 1080 ft
Range to No More Than 1 Hazardous Fragment/600 sq ft = 200 ft
Range to 0.9 psi Overpressure = 41 ft

IAW OE Center of Expertise Interim Guidance Document 98-08, the PWD for intentional detonations may not be less than the default distance provided in DoD 6055.9-STD or the maximum fragment range or the K328 overpressure distance.

INTENTIONAL DETONATIONS

Maximum Fragment Range = 1080 ft
K328 Overpressure Range = 269 ft

The primary fragmentation characteristics used in the calculation of the values listed above were computed IAW CEHNC-ED-CS-S-98-1. The maximum fragment range was calculated using the maximum weight fragment and the initial velocity from these characteristics in the computer software TRAJ. The range to no more than 1 hazardous fragment/600 sq ft was calculated IAW CEHNC-ED-CS-S-98-2.

SIGNATURES:

Michelle Crull 11/13/98
Subject Matter Expert

CEHNC-ED-CS-S Branch Chief

Fragment Mitigation for Intentional Detonations
Site: Former Benicia Arsenal
Munition: 60 mm M49A3
Date: 16 November 1998

Requested by: Bob Nore
Calculated by: Michelle Crull, Phd, PE

For the purposes of this document, tamping refers to fragment mitigation using loose fill as opposed to fragment mitigation using sandbags. Tamping depths are calculated in accordance with HNC-ED-CS-S-97-7 Revision 1 dated January 1998. This document was approved by the DDESB "for deciding public and operational withdrawal distances during ordnance and explosives (OE) operations involving intentional detonations" on Nov. 3, 1998. Fragmentation characteristics are calculated in accordance with HNC-ED-CS-S-98-1 dated January 1998. This document was approved by the DDESB "for use in deciding Inhabited Building Distance (IBD) for primary fragments in site remediation activities" on April 6, 1998. Sandbag thicknesses and sandbag throw distances are calculated in accordance with HNC-ED-CS-S-98-7 dated August 1998.

FRAGMENT MITIGATION USING SANDBAGS

Required Sandbag Thickness* = 12 in
Sandbag Throw Distance = 25 ft
Withdrawal Distance = 200 ft

*Note: Sandbags must be placed such that there is a minimum standoff of 6 inches between the ordnance item and the nearest sandbags.

FRAGMENT MITIGATION USING TAMPING

Type of soil = Dry Sandy Clay

Depth of Burial (ft)	Fragment Throw Distance (ft)	Soil Ejecta Radius (ft)	Withdrawal Distance (ft)
1	654	114	654
1.5	361	119	361
2	114	0**	200

**Note: No soil ejecta because a camouflet is formed.

Michelle Crull 11/16/98
Subject Matter Expert Date

Allen C. Donnelly 11/16/98
Branch Chief Date

Fragment Mitigation for Intentional Detonations
Site: Former Benicia Arsenal
Munition: 40 mm Mk2 Mod 0
Date: 16 November 1998

Requested by: Bob Nore
Calculated by: Michelle Crull, Phd, PE

For the purposes of this document, tamping refers to fragment mitigation using loose fill as opposed to fragment mitigation using sandbags. Tamping depths are calculated in accordance with HNC-ED-CS-S-97-7 Revision 1 dated January 1998. This document was approved by the DDESB "for deciding public and operational withdrawal distances during ordnance and explosives (OE) operations involving intentional detonations" on Nov. 3, 1998. Fragmentation characteristics are calculated in accordance with HNC-ED-CS-S-98-1 dated January 1998. This document was approved by the DDESB "for use in deciding Inhabited Building Distance (IBD) for primary fragments in site remediation activities" on April 6, 1998. Sandbag thicknesses and sandbag throw distances are calculated in accordance with HNC-ED-CS-S-98-7 dated August 1998.

FRAGMENT MITIGATION USING SANDBAGS

Required Sandbag Thickness* = 12 in
Sandbag Throw Distance = 25 ft
Withdrawal Distance = 200 ft

*Note: Sandbags must be placed such that there is a minimum standoff of 6 inches between the ordnance item and the nearest sandbags.

FRAGMENT MITIGATION USING TAMPING

Type of soil = Dry Sandy Clay

Depth of Burial (ft)	Fragment Throw Distance (ft)	Soil Ejecta Radius (ft)	Withdrawal Distance (ft)
1	677	86	677
1.5	383	0**	383
2	28	0**	200

**Note: No soil ejecta because a camouflet is formed.

Michelle Crull 11/16/98 — Subject Matter Expert, Date
Rebecca Dalmalo 11/16/98 — Branch Chief, Date

Public Withdrawal Distance (PWD)
Benicia
75 mm M48

REQUESTED BY: Bob Nore
PREPARED BY: Michelle Crull, PhD, PE
DATE: 26 February 1999

This form shows calculated distances only. It does not constitute approval. Concurrence of CEHNC-OE-S is required to determine the applicable distance for a specific site.

In accordance with (IAW) OE Center of Expertise Interim Guidance Document 98-08, use of the range to no more than 1 hazardous fragment/600 sq ft as the PWD for accidental detonations requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S.

ACCIDENTAL DETONATIONS

Maximum Fragment Range = 1701 ft
Range to No More Than 1 Hazardous Fragment/600 sq ft = 234 ft
Range to 0.9 psi Overpressure = 60 ft

IAW OE Center of Expertise Interim Guidance Document 98-08, the PWD for intentional detonations may not be less than the default distance provided in DoD 6055.9-STD or the maximum fragment range or the K328 overpressure distance.

INTENTIONAL DETONATIONS

Maximum Fragment Range = 1701 ft
K328 Overpressure Range = 396 ft

The primary fragmentation characteristics used in the calculation of the values listed above were computed IAW CEHNC-ED-CS-S-98-1. The maximum fragment range was calculated using the maximum weight fragment and the initial velocity from these characteristics in the computer software TRAJ. The range to no more than 1 hazardous fragment/600 sq ft was calculated IAW CEHNC-ED-CS-S-98-2.

SANDBAG ENCLOSURE FOR INTENTIONAL DETONATIONS

Required Sandbag Thickness = 24 in. with 6" standoff between munition and sandbags
Sandbag Throw Distance = 125 ft
Minimum Exclusion Zone = 200 ft

Public Withdrawal Distance (PWD)
Benicia
75 mm M48

The required sandbag thickness and the sandbag throw distance were calculated IAW CEHNC-ED-CS-S-98-7. The minimum exclusion zone is based on the larger of the sandbag throw distance or 200 ft.

SIGNATURES:

Michelle Crull 2/26/99
Subject Matter Expert

William H. Rhoads 26 Feb 99
CEHNC-ED-CS-S Branch Chief

APPENDIX G

QUALITY ASSURANCE PROJECT PLAN

Addendum to the Quality Assurance Project Plan

This addendum modifies and adds the following methods and quality assurance/quality control (QA/QC) requirements to the referenced sections and tables of the Quality Assurance Project Plan, Section 3.0 of the *Non-Ordnance and Explosives Remedial Investigation (RI)/Feasibility (FS) Work Plan, Tourtelot Cleanup Project, Benicia, California* (February 15, 2000).

1.0 Add EPA Method SW8082

The analysis of polychlorinated biphenyls (PCBs) by EPA Method SW8082 is added as a referenced analytical method. Modifications to the QAPP Tables are presented in Section 7 of this addendum. The Sections of the QAPP referenced below will include the following additions and modifications:

3.2.4.2 Laboratory Analytical Procedures.

The analysis of polychlorinated biphenyls (PCBs) by EPA Method SW8082 will be added to the list of analyses expected to be required for this project.

Preparation Methods

Organic Analyses.

Extraction and Cleanup Procedures - EPA Method SW3510C or SW3520C will be used to prepare groundwater samples and EPA Method SW3550B will be used to prepare soil samples for analysis. Florisil column cleanup by EPA Method SW3620B, acid cleanup by EPA Method SW3665A, and sulphur cleanup by EPA Method SW3660B will be performed prior to the analysis of extracts for PCBs by EPA Method SW8082 as appropriate.

EPA Method SW3620B Florisil Cleanup. The analysis of extracts for PCBs by EPA Method SW8082 will be added to the methods specified for this cleanup method.

EPA Method SW3660B - Sulfur Cleanup. The sulfur cleanup is required when high levels of native sulfur are encountered in environmental samples for PCBs analysis by EPA Method SW8082. Samples are routinely screened for sulfur, and when determined to be present at interfering levels, one to three drops of mercury are added to 1.0 mL of sample extract, the sample agitated mechanically for up to two hours, and the extract pipetted off for analysis.

EPA Method SW3665A - Acid Cleanup. The acid cleanup method is suitable for the rigorous cleanup of sample extracts prior to the analysis for PCBs and is routinely used for samples undergoing analysis by EPA Method SW8082. The extract is solvent exchanged to hexane, then the hexane is sequentially treated with (1) concentrated sulfuric acid and (2) 5% aqueous potassium permanganate, with vortexing and hexane phase separation after each step. The hexane extract is reduced to the original volume and analyzed or stored for analysis.

Organic Analysis by Gas Chromatography (GC)

EPA Method SW8082 - PCBs. EPA Method SW8082 employs GC to determine PCBs at parts per billion (ppb) levels. Prior to the use of the methods, appropriate sample extraction techniques must be used. Both soil and groundwater samples can be analyzed by these methods. EPA Method SW3510C or SW3520C will be used to prepare groundwater samples and EPA Method SW3550B will be used to prepare soil samples for analysis. In both cases, the initial extraction

solvent is methylene chloride which is exchanged to hexane before analysis. A 1- to 2-l aliquot of the sample extract is injected into a gas chromatograph using the solvent flush technique, and target compounds are detected in the GC effluent gas stream by an electron capture detector (ECD).

If interferences prevent detection of the analyses, the extracts may undergo one or more cleanup procedures prior to reanalysis, including: Florisil column cleanup (SW3620B), acid cleanup (SW3665A), and sulfur cleanup (SW3660B) for PCBs procedures.

For the multicomponent analyses by SW8082, confirmation is based on pattern match criteria specified in the method.

2.0 Add EPA Method SW8315-Modified for Hydrazines

The analysis of speciated hydrazines (hydrazine, unsymmetrical dimethylhydrazine [UDMH], and monomethyl hydrazine [MMH]) by High Performance Liquid Chromatography (HPLC) according to the Truesdail Proprietary Modified EPA Method SW8315 will be added to the list of analyses expected to be required for this project. Modifications to the QAPP Tables are presented in Section 7 of this addendum. The sections of the QAPP referenced below will include the following additions and modifications:

3.1.1.2 Laboratory Project Personnel.

The following definitive level laboratory will be added for the special analytical service (SAS) analysis of speciated hydrazines.

Truesdail Laboratories
14201 Franklin Avenue
Tustin, CA 92780
(714) 730-6239 / FAX: (714) 730-6462

The responsibilities and authorities of key laboratory personnel are discussed in the following paragraphs.

SAS Laboratory Project Managers

The SAS laboratory PM will have ultimate responsibility for analytical performance, including adherence to contract requirements and QC requirements. This individual will serve as the primary laboratory contact person for the client and Earth Tech. This individual will process and record any change in the scope of work, monitor the progress and timeliness of the work, and review work orders and all laboratory reports. The analytical laboratory PM is responsible for ensuring that corrective action is taken to address problems identified by QC sample results or QA audit findings. Joe Bromblet has been identified as the project manager for Truesdail.

3.2.4.2 Laboratory Analytical Procedures.

The analysis of speciated hydrazines (hydrazine, unsymmetrical dimethylhydrazine [UDMH], and monomethyl hydrazine [MMH]) by High Performance Liquid Chromatography (HPLC) according to Truesdail Proprietary Modified EPA Method SW8315 will be added to the list of analyses expected to be required for this project.

Organic Analysis by High Performance Liquid Chromatography (HPLC)

Truesdail Laboratory Proprietary Method: Modified EPA Method SW8315 - Hydrazines in Water and Soil. This analysis will be performed by Truesdail Laboratories in Tustin, CA. No other laboratory is known to perform analysis of speciated hydrazines at or near the detection limits presented in Table 3.1-1. All appropriate QA/QC procedures specified in this QAPP addendum apply to this laboratory. This method can be used to quantify hydrazine, MMH, and UDMH in a variety of matrices, including sediment, soil, and water samples. Modification of EPA Method SW8315 is based on the analysis of a hydrazone derivative of the three hydrazines; MMH, UDMH, and hydrazine. The derivatization is performed in water samples directly. For soil samples, distilled water is used to extract the hydrazines. The pH is adjusted with dilute (6N) hydrochloric acid to less than 2 during the extraction of the soil samples, therefore the presence of calcium carbonate in the sample is a potential interferent. The soil extracts and the water samples are stored at pH <2. After derivatization of the hydrazines, the hydrazone products are extracted from the water with methylene chloride and exchanged into acetonitrile for analysis by HPLC. The analysis uses the EPA Method SW8315 HPLC procedure with a slight modification of the mobile phase. The detection limit is less than or equal to 5 µg/L (ppb) for the aqueous phase. For further reference, refer to Attachment A-1: Truesdail Laboratories Proprietary SOP for Speciated Hydrazines by Modified SW8315.

Due to lack of stability, MMH and UDMH commonly have extremely low spike recoveries in both soil and water samples. Hydrazine is more stable, and spike recoveries tend to be acceptable. Low matrix spike recoveries for this method will not be used to reject data or initiate corrective action, as these low recoveries will be interpreted as indicating that the species is not stable enough to survive in the matrix, and therefore is not stable enough to survive in the environment. However, such low recoveries will result in qualification of data as estimated and potentially biased low (UJ- or J-). In addition, the laboratory has found that the commercially available baked sand used for laboratory control sample (LCS) spikes has formaldahyde bound to the silica in the sand so strongly that it does not bake out. The formaldahyde is known to react with the hydrazines, causing low recoveries. The laboratory now washes the LCS sand with ketones and rebakes the sand, and better LCS recoveries have been reported. However, the problem may be encountered and is another indication of the extreme reactivity of hydrazines, demonstrating the difficulty of performing the analysis with acceptable QA/QC. Even in aqueous matrices, low recoveries may be encountered due to organic material or metals at reactive valences in the sample matrix. Performance evaluation (PE) samples will be analyzed for speciated hydrazines, however, low recoveries for MMH have been encountered in the past, and may be expected to be encountered again. These low recoveries are most likely due to impurities in the PE sample matrix, and again indicate the low possibility that this species could survive an extended period in the environment. Interference for the peaks of the low concentration calibration standards for MMH and UDMH is a known problem. The method has been modified to prevent this problem, however, if the problem occurs, the low level standard will not be used and the calibration curve starting with the second standard will be used for quantitation, the PQLs will be raised accordingly, and the linearity of the curve will be assessed without the low level standard. This may result in raised reporting limits for non-detected results.

3.0 Add Chloropicrin by EPA Method SW8270C Modified for Chemical Warfare Degradates

The analysis of chloropicrin by EPA Method SW8270C Modified for Chemical Warfare Degradates (SW8270CWM) is added as a referenced analytical method. Modifications to the QAPP Tables are presented in Section 7 of this addendum. The Sections of the QAPP referenced below will include the following additions and modifications:

3.2.4.2 Laboratory Analytical Procedures.

The analysis of chloropicrin by EPA Method SW8270C modified for Chemical Warfare Degradates (SW8270CWM) will be added to the list of analyses expected to be required for this

project.

Preparation Methods

Organic Analyses.

Extraction and Cleanup Procedures - EPA Method SW3510C or SW3520C will be used to prepare groundwater samples and EPA Method SW3550B will be used to prepare soil samples for analysis.

Organic Analyses by Gas Chromatography/Mass Spectrometry

EPA Method SW8270CWM - Chemical Warfare Degradates by GC/MS. Chloropicrin will be determined using EPA Method SW8270C modified for the analysis of chemical warfare degradates. Method SW8270CWM is a method for the analysis of organosulfur chemical agent degradates and nitralin-related compounds in environmental samples using GC/MS instrumentation. This method is modeled after USATHAMA LL03 and UL04 and is suitable for analysis of water and soil matrices. Prior to using this method, samples must be prepared for GC using appropriate sample preparation methods: generally sonication extraction (EPA Method SW3550B) for soil samples, and separatory funnel (EPA Method SW3510C) or continuous (EPA Method SW3520C) extraction for water samples. Calibration and QA/QC protocols for SW8270C are observed for this method for specified target compounds with the control limits specified in the QAPP Tables presented in Section 7 of this addendum.

4.0 Add Laboratory Sample Homogenization Method for SW8330 Requests for Specified Samples

The laboratory will homogenize samples received with request for analysis by EPA Method SW8330 specifying homogenization. This will be requested for specified samples due to the observed tendency for TNT to crystalize into clumps in soil matrices. The whole sample volume from the soil sample sleeve will be homogenized according to the Quanterra work instruction procedure described below before aliquots are taken for the analyses by all requested methods, including SW8330.

WORK INSTRUCTION PROCEDURE:
Procedure for Homogenizing Core Tube Soil Samples For Earth Tech, Inc, Benicia Tourtelot Project

No.: SAC-WI-0001	Revision No.: Original	Effective Date: March 2, 2000

Supersedes: None

1. PURPOSE:

1.1 To thoroughly homogenize soil samples received in core tubes.

2. MATERIALS:

2.1 Pre-cleaned one liter clear glass jars
2.2 Properly cleaned stainless steel spatulas
2.3 Hitachi FDS 100VA Cordless Drill
2.4 Special proprietary sample mixing drill bits

3. SAFETY:

All homogenizing must be performed in a laboratory fume hood using appropriate personal protective equipment.

Lumps of material that have a chemical appearance should be suspect. Explosives are generally a very finely ground grayish-white material. If the samples look suspect, STOP immediately and speak with your supervisor and/or project manager.

4. PROCEDURE:

4.1 Work in a clean properly ventilated hood.
4.2 Assemble the drill components as specified by the manufacturer. Use a separate properly cleaned drill bit for each sample.
4.3 Be sure drill is charged.
4.4 Retrieve samples from sample control and complete appropriate paperwork.
4.5 Procure pre-cleaned one liter glass jars from the warehouse. One container per core tube.
4.6 Label each jar with a corresponding sample ID, the lot specific ID and corresponding work order number.
4.7 Using a properly prepared stainless steel spatula (ie. solvent rinsed/baked), transfer the sample volume from the core tube into the glass jar. Use a separate spatula for each sample.
4.8 Place the drill bit in the jar and begin mixing.
4.9 Mix sample for approximately 30 to 45 seconds, depending on the matrix. Slowly move the drill bit from top to bottom repeatedly during mixing. Mix samples thoroughly to ensure homogeneity.
4.10 Replace glass jar lid and return sample to sample control.
4.11 Properly document sample container transfer in the comments section of internal chain of custody record.
4.12 Note in internal chain of custody record that the core tube is empty and then transfer it to hazardous waste for disposal or processing.

Appropriate sub-samples will then be taken for analyses requested on the COC. Soil sample aliquots (20 to 50 gram sub-samples) taken for SW8330 will be further homogenized according to Section 7.1.2.1 of SW8330 and the laboratory protocols for this method (dry, grind, and sieve, as appropriate within safety precautions).

Request for sample homogenization will be specified on the COC.

No further modifications to the QAPP are required for this procedure.

5.0 Variance for MDL Requirement for SW8330

The following variance to the requirements specified in the QAPP will be allowed: The requirement for Practical Quantitation Limits (PQLs) specified in Section ***3.2.4.2 Laboratory Analytical Procedures*** that "PQLs will be based on and must exceed laboratory-specific MDLs by a minimum factor of two" will not apply to mobile laboratory analyses by SW8330 as long as the MDLs are less than or equal to the PQLs. Non-detected results will be reported at the PQL, as specified in the QAPP, without qualification for this variance. The allowance for this variance will based on the ability of the laboratory to demonstrate sensitivity at the PQL through the analysis of daily PQL check standards within control limits of 75-125 percent recovery (%R). Note that the PQLs meet action limits proposed in the Work Plan for each target analyte by factors of 15 to 7750 (40 times factor for TNT). No further modifications to the QAPP are required for this variance.

6.0 Delete SW5030A as Possible Preparation Method for SW8260B Soils

The following reference to EPA Method SW5030A as a soil sample preparation method for SW8260B analysis was not intended to be left in the QAPP. The Section of the QAPP referenced below will include the following modification:

> ***3.2.4.2 Laboratory Analytical Procedures.***
>
> **Preparation Methods**
>
> **Organic Analyses.**
>
> **Extraction and Cleanup Procedures** - For water samples, EPA Method SW5030B will be used for purgeables and SW3510C or SW3520C will be used for nonpurgeables. For soil samples, EPA Method SW5035 will be used for purgeables and SW3540C or SW3550B will be used for nonpurgeables. ~~EPA Method SW5030A may be used for on-site laboratory soils analyses of purgeables as long as samples are analyzed within 48 hours, as specified for unpreserved samples in EPA Method SW5035.~~ In addition, ...

7.0 Modifications to the QAPP Tables

The modifications to the QAPP in Sections 1.0 through 4.0, above, require additions and modifications to the QAPP tables.

Note that the PQLs for organochlorine pesticides in soils listed in Table 3.1-1 have been corrected. The PQLs listed in the QAPP were incorrectly entered in µg/kg, whereas the header indicates PQLs in mg/kg. Therefore, the listed PQLs were presented as 1000 times too high. The corrected PQLs for pesticides in soils are presented below.

The tables in the QAPP referenced below will include the additions and modifications presented in the following QAPP Addendum Tables:

ADDENDUM TABLE 3.1-1. PRACTICAL QUANTITATION LIMITS FOR DEFINITIVE-LEVEL ANALYSES

(Page 1 of 1)

Parameter & Preparation Method	Method	Analyte	Water (µg/L)	Soil (mg/kg)
Chlorinated Pesticides	SW8081A	Aldrin	0.05	0.0017
SW3510C (Waters)		alpha-BHC	0.05	0.0017
SW3550B (Soils)		beta-BHC	0.05	0.0017
SW3620B (Extracts)		delta-BHC	0.05	0.0017
and SW3630C upon		gamma-BHC (Lindane)	0.05	0.0017
request (Extracts)		alpha-Chlordane	0.05	0.0017
		gamma-Chlordane	0.05	0.0017
		4,4'-DDD	0.1	0.0034
		4,4'-DDE	0.1	0.0034
		4,4'-DDT	0.1	0.0017
		Dieldrin	0.1	0.0034
		Endosulfan I	0.1	0.0017
		Endosulfan II	0.05	0.0034
		Endosulfan sulfate	0.1	0.0034
		Endrin	0.1	0.0034
		Endrin aldehyde	0.1	0.0034
		Endrin ketone	0.1	0.0034
		Heptachlor	0.05	0.0017
		Heptachlor epoxide	0.05	0.0017
		Methoxychlor	2	0.017
		Toxaphene	2	0.067
PCBs	SW8082	Aroclor 1016	1.0	0.033
SW3510C (Waters)		Aroclor 1221	2.0	0.067
SW3550B (Soils)		Aroclor 1232	1.0	0.033
SW3620B (Extracts)		Aroclor 1248	1.0	0.033
SW3660B (Extracts)		Aroclor 1254	1.0	0.033
SW3665A (Extracts)		Aroclor 1260	1.0	0.033
Chemical Warfare Degradates	SW8270C	Chloropicrin	5.0	1.0
Speciated Hydrazines	SW8315-Mod	Hydrazine	2	10
		Monomethyl Hydrazine (MMH)	5	50
		Unsymmetrical Dimethyl Hydrazine (UDMH)	5	50

The methods cited are from the following sources:

"SW " Methods = Test methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition (USEPA, , 1986, with updates)

All sample results will be reported down to the MDL (Refer to Section 3.2.4.2, last paragraph).

Addendum Table 3.1-2. Recommended Sample Container, Preservation, and Holding Times for Selected Analytical Test Methods

(Page 1 of 1)

			Volume Required		Preservation [b]		
Parameter	Aqueous Sample Container[a]	Field Filter[e]	Water (ml)*	Soil (g)	Water	Soil	Maximum Holding Times [c]**
PCBs (SW8082)	G, Teflon™ screw cap		1000	250	Cool 4°C	4°C	7 days (water) and 14 days (soil) until extraction, 40 days after extraction
Chloropicrin - Chemical Warfare Degradates (SW8270CWM)	G, Teflon™ screw cap, T		1000	250	Cool 4°C (0.008% $Na_2S_2O_3$[d])	4°C	7 days (water) and 14 days (soil) until extraction, 40 days after extraction
Speciated Hydrazines (SW8315-Mod)	G, Teflon™ lined septum, T		250	50	4°C, H_2SO_4 to pH<2	4°C	7 days until extraction, 3 days after extraction

NOTE: * Do not pre-wash bottle with samples.
** Extraction holding times are from date of sample collection; analysis times are from date of extraction.

REFERENCE: This table includes the requirements of the U.S. Environmental Protection Agency, as published in the Code of Federal Regulations, Volume 49, Number 209, 40CFR 136, dated October 26, 1984, page 43260.

(a) Polyethylene (P); glass (G); brass sleeves in the sample barrel, sometimes called California brass (T). Soil samples be collected in either glass jars or stainless steel liners with both ends sealed with Teflon™ paper and plastic caps.

(b) Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automatic sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting are completed.

(c) Samples should be analyzed as soon as possible after collection. The times listed are maximum times (in calendar days) that samples may be held before analysis and still be considered valid. Samples may be held for longer periods of time only if the monitoring laboratory has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period given in the table. The monitoring laboratory is obligated to hold the sample for a shorter period if knowledge exists to show this is necessary to maintain sample stability.

(d) Should only be used in the presence of residual chlorine.

ADDENDUM TABLE 3.2-1. SUMMARY OF FIELD AND LABORATORY QUALITY CONTROL PROCEDURES

Method	Parameter	QC Performed	Frequency	Acceptance Criteria	Corrective Action
SW8082 (GC/END)	Polychlorinated biphenyls (PCBs)	Method blank	1 per batch of 20 samples or less	<½ PQL[a] for all analyses	1) If concentration in associated sample is <PQL or >10X the contamination, note the blank contamination in the case narrative and report sample result. Otherwise: 2) Reanalyze blank once 3) Determine source of contamination (analyze a system blank) 3a) If source is instrument, perform maintenance, reanalyze blank and samples 3b) If source is preparation, reprep and reanalyze method blank and all samples (other than those in 1) associated with the contaminated blank.
		Surrogate spikes	Every sample, method blank, and standard	Refer to Table 3.2-4 Does not apply if more than 5X dilution	1) Check calculations, standards and system 2) If more than one surrogate is out, check instrument performance; if problem is found, correct and reanalyze sample, or proceed to 3. 3) If still unacceptable and within holding time or if positive results detected, re-extract and reanalyze sample, unless chromatogram indicates interference, in which case one reanalysis is acceptable. Report both sets of results. If beyond holding time, assess impact and qualify data. Discuss in case narrative.
		Matrix Spike/Matrix Spike Duplicate (MS/MSD) (must use project sample)	5% (one per SDG of 20 or fewer samples)	See Table 3.2-2 for accuracy (recovery) and precision (RPD) criteria.	1) Check calculations 2) Evaluate the System. (instrument) 3) Re-extract/reanalyze. If recoveries are still not within QC limits, flag data and note in the case narrative as attributable to matrix effects (if LCS recoveries are within QC limits).
		Laboratory Control Sample (LCS)	1 per preparation batch (maximum batch size of 20 samples)	See Table 3.2-3 for accuracy (recovery) criteria	1) Evaluate the system (instrument). See [b] 2) Recheck calculations 3) If LCS is high and associated sample results ND, note in (continued next page)

ADDENDUM TABLE 3.2-1. SUMMARY OF FIELD AND LABORATORY QUALITY CONTROL PROCEDURES

Method	Parameter	QC Performed	Frequency	Acceptance Criteria	Corrective Action
SW8082 (Cont.)					case narrative, report sample results 4) Reanalyze LCS if appropriate. 5a) If reanalysis acceptable, reanalyze associated samples (other than those in 3) 5b) If still out, reprep and reanalyze LCS and all associated samples (other than those in 3)
	Field QC:	Equipment Blank	Once per day per sampling team for reusable equipment	<½ PQL[(a)] for all analyses	No laboratory corrective action
		Unspiked Duplicate (aqueous) or Replicate (soil) Samples	10% (one per 10 samples)	≤30 RPD -Waters ≤40 RPD - Soils	No laboratory corrective action
SW8270-CWM	Chloropicrin - Chemical Warfare Degradates	Same as SW8270C Table 3.2-1 of QAPP			
Truesdail Modified SW8315	Hydrazines	Method blank	1 per batch of 20 samples or less	<½ PQL[(a)] for all analyses	1) If concentration in associated sample is <PQL or >10X the contamination, note the blank contamination in the case narrative and report sample result. Otherwise: 2) Reanalyze blank once 3) Determine source of contamination (analyze a system blank) 3a) If source is instrument, perform maintenance, reanalyze blank and samples 3b) If source is preparation, reprep and reanalyze method blank and all samples (other than those in 1) associated with the contaminated blank.
		Matrix Spike/Matrix Spike Duplicate (MS/MSD)	5% (one per SDG of 20 or fewer samples)	See Table 3.2-2 for accuracy (recovery) and precision (RPD) criteria.	1) Check calculations 2) Evaluate the System. (instrument) 3) Check LCS: If LCS recoveries are within QC limits, flag data and note in the case narrative as attributable to matrix (continued next page)

ADDENDUM TABLE 3.2-1. SUMMARY OF FIELD AND LABORATORY QUALITY CONTROL PROCEDURES

Method	Parameter	QC Performed	Frequency	Acceptance Criteria	Corrective Action
					effects. If LCS recoveries are not within QC limits, see below. Re-extract/reanalyze will not be required for this analysis (if LCS recoveries are within QC limits) due to the extreme lack of stability in environmental matrices.
		Laboratory Control Sample (LCS)	1 per preparation batch (maximum batch size of 20 samples)	See Table 3.2-3 for accuracy (recovery) criteria	1) Evaluate the system (instrument) and sand used for blank spike. See [b] 2) Recheck calculations 3) If LCS is high and associated sample results ND, note in case narrative, report sample results 4) Reanalyze LCS if appropriate. 5a) If reanalysis acceptable, reanalyze associated samples (other than those in 3) 5b) If still out, reprep and reanalyze LCS and all associated samples (other than those in 3)
Truesdail Modified SW8315 (Cont.)	Field QC:	Equipment Blank	Once per day per sampling team for reusable equipment	<½ PQL[a] for all analyses	No laboratory corrective action
		Unspiked Duplicate (aqueous) or Replicate (soil) Samples	10% (one per 10 samples)	≤30 RPD -Waters ≤40 RPD - Soils	No laboratory corrective action

Notes: (a) Practical Quantitation Limits (PQLs) listed in Table 3.1-1. Corrective action will be required at the PQL instead of ½ PQL for common laboratory contaminants for organic methods, for metals not on the CAM-17 metals list, and for inorganic analyses with PQLs not associated with DQOs (for example, chloride and sulfate).

(b) Laboratory batch control is based on preparation batches. Preparation batches use a Laboratory Control Sample (LCS) to determine batch acceptability.

The samples in the preparation batch will be considered out of control if any compound in the LCS is outside of the acceptance limits listed in Table 3.2-3. An out-of-control situation requires reanalysis and or re-preparation and reanalysis of the samples with appropriate quality control, or an assessment of the data if reanalysis is not possible. If any of the spiked analyses are not within control, the following corrective action will be performed:

1) If the out-of-control analyses of the LCS exceed the upper control limit and the sample results are ND, no further action is required.
2) If the out-of-control analyses of the LCS are below the lower control limit or exceed the upper control limit and the sample results for the out-of-control analyte are detected, the LCS shall be reanalyzed. If the reanalysis is acceptable, the method blank and all associated samples including QC samples shall be reanalyzed and reported.
3) If the reanalysis is not acceptable and the holding time has not expired, all associated samples shall be re-prepared with appropriate QC and reanalyzed. If the holding time is expired, all associated samples shall be re-prepared with appropriate QC and reanalyzed if the potential results will provide estimated data versus rejected data, or if the results can be used to confirm the original analytical results, and the program QA manager should be contacted. If the reanalyses cannot be used for these purposes, the decision not to re-prepare and reanalyze can only be made with the knowledge and consent of the program QA manager.

ADDENDUM TABLE 3.2-2. CONTROL LIMITS FOR MATRIX SPIKES, MATRIX SPIKE DUPLICATE, AND LABORATORY (MATRIX) DUPLICATES

(Page 1 of 1)

Analytical Method	Spiking Compounds *	Laboratory Control Limits: Percent Recovery, Water	Percent Recovery, Soil/Sediments	Relative Percent Difference, Water	Relative Percent Difference, Soil/Sediments
SW8082 (6)	Aroclor 1016	40-140	40-140	25	40
	Aroclor 1260	40-140	40-140	25	40
SW8270C Chemical Warfare Degradates	Chloropicrin	40-140	40-140	40	40
Modified SW8315	Hydrazine	0-125 (65-125) (7)	0-125 (65-125) (7)	25	35
	MMH	0-125 (65-125) (7)	0-125 (65-125) (7)	25	35
	UDMH	0-125 (65-125) (7)	0-125 (65-125) (7)	25	35

* Final spiking concentrations should be in the expected range of detectable concentrations for samples (mid range). Spiking concentrations should be consistent for the MS/MSD and LCS for each analyte.

(6) All surrogate or MS/MSD recoveries for samples undergoing silica gel or Florisil cleanup will have a lower control limit of 30% recovery.

(7) Re-extract/reanalyze will not be required for this analysis (if LCS recoveries are within QC limits) due to the extreme lack of hydrazines stability in environmental matrices. Control limits in parentheses will be used for validation criteria.

ADDENDUM TABLE 3.2-3. CONTROL LIMITS FOR LABORATORY CONTROL SAMPLES

(Page 1 of 1)

Analytical Method	Spiking Compounds *	Laboratory Control Limits: Percent Recovery, Water	Percent Recovery, Soil/Sediments	Relative Percent Difference, Water	Relative Percent Difference, Soil/Sediments
SW8082 (6)	Aroclor 1016	50-130	50-130	25	40
	Aroclor 1260	40-140	40-140	25	40
SW8270C Chemical Warfare Degradates	Chloropicrin	40-140	40-140	40	40
Modified SW8315	Hydrazine	65-125	65-125	25	35
	MMH	65-125	65-125	25	35
	UDMH	65-125	65-125	25	35

* Final spiking concentrations should be in the expected range of detectable concentrations for samples (mid range). Spiking concentrations should be consistent for the MS/MSD and LCS for each analyte.

(6) All surrogate or MS/MSD recoveries for samples undergoing silica gel or Florisil cleanup will have a lower control limit of 30% recovery.

ADDENDUM TABLE 3.2-4. CONTROL LIMITS FOR SURROGATE SPIKES

(Page 1 of 1)

Analytical Method	Anticipated Spiking Compounds (Surrogates)	Laboratory Control Limits Percent Recovery			
		Samples		Blanks and LCS	
		Water	Solids	Water	Solids
SW8082 (2)	2,4,5,6-Tetrachloro-m-xylene	40-140	40-140	40-140	40-140
	Decachlorobiphenyl	40-140	40-140	40-140	40-140
SW8270C Chemical Warfare Degradates	2-Fluorobiphenyl	17-111	40-140	17-111	40-140
	Nitrobenzene-d5	32-96	40-140	32-96	40-140

Notes: Surrogates are to be spiked into and used to control all standards, samples (including environmental samples, LCSs, and field QC samples) and blanks.
Surrogate control limits are to be established based on historical data. In the absence of sufficient historical data, control limits are estimated, and will be established once historical data is available.
(2) All surrogate or MS/MSD recoveries for samples undergoing silica gel or Florisil cleanup will have a lower control limit of 30% recovery.

ADDENDUM TABLE 3.2-5. SUMMARY OF CALIBRATION PROCEDURES

(Page 1 of 1)

Method	Parameter	Calibration	Frequency	Acceptance Criteria	Corrective Action
SW8082 (GC/END)	Polychlorinated biphenyls (PCBs)	Multpoint calibration (minimum five points)	Initially and as required	r ≥ 0.995 or average % RSD for RF ≤20% with maximum allowable 40%D	1) Evaluate system 2) Recalibrate
		Initial calibration verification check standard (ICV)	Daily, before sample analyses	±15% D of expected concentration, with maximum allowable 30%D, or corrective action is required	1) Evaluate system 2) Repeat calibration check 3) Recalibrate if still out 4) Reanalyze affected samples
		Continuing calibration verification standard (CCV).	Every 10 samples and end of analyses sequence		
SW8270-CWM (GC/MS)	Chloropicrin - Chemical Warfare Degradates	Check of instrument tuning criteria using DFTPP	Daily and every 12 hours	All relative ion abundances within criteria. Refer to Footnote [e]	1) Retune instrument 2) Repeat DFTPP analysis
		Multipoint calibration (minimum five points)	Initially and as required	% RSD ≤30% For ρ-chlorophenyl-methylsulfone, linear regression may be required (r ≥ 0.995).	1) Evaluate system 2) Recalibrate
		Continuing calibration check standard	Daily and every 12 hours	% Difference ≤ 30%	1) Evaluate system 2) Repeat calibration check 3) Recalibrate 4) Reanalyze affected samples
Truesdail Modified SW8315	Hydrazines	Multipoint calibration (minimum five points)	Initially and as required. Use RF with area closest to sample area.	r ≥ 0.995 or average % RSD for RF ≤ 20%[c] If interference at low level standard, raise detection limits and calibrate with 2nd standard as low level standard.	Recalibrate Repeat calibration
		Initial calibration verification (ICV)	Immediately after initial calibration	±20%	1) Reanalyze standard 2) Racalibrate 3) Reanalyze affected samples
		Continuing calibration verification (CCV)	At end of run (maximum 20 samples)	± 20%	

[c] If the average %RSD for all compounds >20% for GC or >15% for GC/MS, must use r or r^2 for all compounds. The use of r/ r^2 or % RSD is calibration specific. This acceptance criteria cannot be used interchangeably for a single calibration event.

[e] The acceptance criteria for DFTPP ion adundance are given below:

DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria	Mass	Ion Abundance Criteria
51	30% to 60% of mass 198	199	5% to 9% of mass 198
68	<2% of mass 69	275	10% to 30% of mass 198
69	(reference only)	365	>1% of mass 198
70	<2% of mass 69	441	Present but less than mass 443
127	40% to 60% of mass 198	442	>40% of mass 198
197	<1% of mass 198	443	17% to 23% of mass 442
198	Base peak, 100% relative abundance		