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ATLANTA FIELD OFFICE
BRAC ENVIRONMENTAL COORDINATOR
HAMILTON ARMY AIRFIELD
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NOVATO, CALIFORNIA 94949



January 6, 2004

DAIM-BO-A-HA

Subject: Forwarding the *Work Plan Miscellaneous Site Investigations* and the *Work Plan Addendum Concrete Lined Perimeter Drainage Ditch at Proposed Channel – Former Building 41*, Hamilton Army Airfield, Novato, CA.

Ms. Naomi Feger
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Dear Ms. Feger,

The Army is pleased to provide the *Work Plan Miscellaneous Site Investigations* and the *Work Plan Addendum Concrete Lined Perimeter Drainage Ditch at Proposed Channel – Former Building 41*, Hamilton Army Airfield, Novato, CA for your files.

The work plan and addendum incorporate RWQCB comments as submitted in the conditional approval letter dated December 14, 2003.

If you have any questions, please contact me at (415) 883-6386.

Sincerely,

Edward Keller, P.E.
BRAC Environmental Coordinator
Hamilton Army Airfield

Enclosure

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WORK PLAN
MISCELLANEOUS SITE
INVESTIGATIONS
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

Final



Prepared by:



**US Army Corps
of Engineers** ®

Sacramento District
Environmental Design Section

January 2004

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ACRONYMS

EDS	Environmental Design Section
FSP	Field Sampling Plan
HAAF	Hamilton Army Airfield
mg/kg	milligrams per kilogram
PAH	Polynuclear Aromatic Hydrocarbons
PDD	Perimeter Drainage Ditch
QAPP	Quality Assurance Project Plan
SFBRWQCB	San Francisco Bay Area Regional Water Quality Control Board
SSHP	Site Safety and Health Plan
Total DDTs	Sum of Dichlorodiphenyltrichloroethane, Dichlorodiphenyldichloroethane, and Dichlorodiphenyldichloroethylene (DDT + DDD + DDE)
USACE	U.S. Army Corps of Engineers
WP	Work Plan

Air Force Base and Army Airfield. The location of HAAF is shown in Figure 1-1.

1.4 SITE LOCATIONS

Figure 1-2 shows the locations of the miscellaneous sites within Hamilton Army Airfield.

1.5 SAMPLING STRATEGY ISSUES

1.5.1 Spoils Pile F for Total DDTs

The regulatory agency has requested the U.S. Army collect and analyze samples from the eastern edge of the excavation and the area just south of the over-excavation area of this Spoils Pile. The additional samples will be used to determine if the higher levels of DDT associated with this area have been removed.

1.5.2 South of the Runway DDT Hotspot

Sampling and analysis with field kits will be used to determine the extent of DDT in this area. Lab verification samples will be analyzed to verify the results of the field test kits.

1.5.3 Building 35 for Total DDTs

DDTs were found in the soil adjacent to excavation removal activities at Building 35.

1.5.4 Unlined Perimeter Drainage Ditch (PDD) for Total DDTs

Previous investigations show localized concentrations of DDT were identified at a concentration above 1 mg/kg. Investigate these areas to determine the extent of the contamination.

1.5.5 Revetments 6 and 7 for Mercury

Sampling and analysis will determine if mercury is present in either of the revetments.

1.5.6 Firing-In Target Butt (ASR # 19) for Selected Metals

Sampling and analysis will determine if unacceptable levels of metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) are in the soil or if ammunition

fragments are present. The results will be used to determine if further investigation of the site is required.

1.5.7 Skeet Range (ASR # 18) for Selected Metals and PAHs

Sampling and analysis will determine if unacceptable levels of metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) and PAHs from the clay pigeons are present in the soil, or if skeet and ammunition fragments are present. The results will determine if further investigation of the site is required.

1.5.8 Testing Range (ASR # 4) for Selected Metals

Sampling and analysis will determine if unacceptable levels of metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) are present at this site. Samples will be collected along the length of the Testing Range Area on the inboard side of the levee.

1.6 CHEMICALS OF CONCERN

The chemicals of concern for the miscellaneous investigation are Total DDTs [Dichlorodiphenyltrichloroethane (DDT), Dichlorodiphenyldichloroethylene (DDD) and Dichlorodiphenyldichloroethane (DDE) (Total DDT as the sum of DDT, DDD, and DDE)] at the Spoils Pile F, Total DDTs at the South of the Runway DDT Hotspot, Total DDTs at Building 35, Total DDTs at the Unlined PDD, mercury at Revetments 6 and 7, selected metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) at the Firing-In Target Butt, selected metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) and Polynuclear Aromatic Hydrocarbons (PAHs) at the Skeet Range, and selected metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) at the Testing Range.

2.0 PROJECT STAFFING AND SCHEDULE

2.1 PROJECT STAFFING

The Environmental Design Section (EDS), Sacramento District, USACE will perform this SCS, under the supervision of Rick Meagher, Section Chief. Key project contacts are:

<u>Person</u>	<u>Responsibility</u>
Kathy Siebenmann	Technical Lead, Chemist
Teresa Rodgers	Field Task Leader, Geologist
Donna Maxey	Industrial Hygienist

2.2 PROPOSED PROJECT SCHEDULE

The fieldwork for the Miscellaneous Soil Investigations is scheduled for the week of January 12, 2004. The investigation reports, as described in Section 3.0, will be submitted within 30 days following the receipt and validation of the analytical data.

3.0 REPORTING

The results and recommendations for Spoils Pile F and Revetments 6 and 7 will be reported as an addendum to the *Final Construction Report and Supplemental Construction Report for Building 41 Demolition and Soil Removal, Spoils Pile F Removal, and Revetments 6 and 7 Removal, Hamilton Army Airfield*, Shaw Environmental, Inc., May 2003.

The results and recommendations for the South of the Runway DDT Hotspot will be reported as an addendum to the *Results of the Area-Wide DDT Site Investigation, Hamilton Wetlands Restoration Project*, USACE, Draft, May 2003.

The results and recommendations for Building 35 will be reported as an addendum to the *1999 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Revision A, IT Corporation, April 2000.

The results and recommendations for the Unlined Perimeter Drainage Ditch will be reported as an addendum to the *1998 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Final, IT Corporation, April 2000.

The results and recommendations for the Firing-in Target Butt (ASR # 19), Skeet Range (ASR #18), and Testing Range (ASR # 4) will be submitted together as a separate report.

4.0 REFERENCES

- IT Corporation, *1998 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Final, April 2000.
- IT Corporation, *1999 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Revision A, April 2000.
- Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Public Comment Final, August 2003.
- Shaw Environmental, Inc., 2003, *Final Construction Report and Supplemental Construction Report for Building 41 Demolition and Soil Removal, Spoils Pile F Removal, and Revetments 6 and 7 Removal, Hamilton Army Airfield*, May 2003.
- USACE, *Results of the Area-Wide DDT Site Investigation, Hamilton Wetlands Restoration Project*, Draft, May 2003.
- U.S. Environmental Protection Agency (EPA), 1996, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition*, December 1996.
- U.S. Fish and Wildlife Service Biological Opinion and amending letter, August 2003 and September 2003.

APPENDIX A

DATA QUALITY OBJECTIVES

**DATA QUALITY OBJECTIVES
MISCELLANEOUS SITE
INVESTIGATIONS
HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA**

Final Submittal

Prepared by:



**US Army Corps
of Engineers ®**

Sacramento District
Environmental Design Section

January 2004

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**DATA QUALITY OBJECTIVES
MISCELLANEOUS SITE INVESTIGATIONS
HAMILTON ARMY AIRFIELD**

1.0 INTRODUCTION

To generate data that will meet the project objectives, it is necessary to define the decisions that will be made, identify the intended use of the data, and design a data collection program. Data Quality Objectives (DQOs) are an integrated set of thought processes, which define data quality requirements based on the intended use of the data. This includes any type of information utilized to form the sampling strategy or achieve the objective, not just analytical data. The DQO process will assist in determining the appropriate sampling design, detection and quantitation limits, analytical methods, and sample handling procedures.

This sampling effort is designed to investigate 8 sites at the former Hamilton Army Airfield (HAAF) inboard area – 3 sites identified in the Archives Search Report (ASR) for Hamilton Army Airfield (HAAF) (September 2001) that have not been previously investigated and 5 sites that have been previously investigated. Historical data from the previously investigated sites has been used to determine the sampling strategy.

2.0 DQO Steps

The seven steps of the DQO process are presented below for each site.

2.1 Spoils Pile F for Total DDTs

State the Problem: Soil excavation was accomplished at this site. It was determined that the confirmation sampling conducted did not provide adequate coverage of the eastern edge of the excavation and the area just south of the over-excavation area. The Army agreed to collect additional confirmation samples to determine if the soils contaminated with Total DDTs (defined as the sum of DDT, DDD, and DDE) has been adequately removed from the site.

Identify the Decision: Determine if any DDT contaminated soils that would require removal from the site remain.

Identify the Inputs to the Decision: 1) Previous results from *Final Construction Report and Supplemental Construction Report for Building 41 Demolition and Soil Removal, Spoils Pile F Removal, and Revetments 6 and 7 Removal, Hamilton Army Airfield*, Shaw Environmental, Inc., May 2003; 2) action goals from *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Final Final, August 2003; 3) the USFWS Biological Opinion and

amending letter, August 2003 and September 2003; and 4) data defining the concentrations of Total DDTs in soils at the Spoils Pile F area.

Define the Boundaries: The spatial boundary is the area near the highest historical concentration of Total DDTs and the limits of the Spoils Pile F excavation.

Develop Decision Rules: 1) If the Total DDTs concentration of the initial soil sample is greater than 0.024 mg/kg, samples will be collected in stepout locations both vertically and horizontally; 2) The area encompassing any Total DDTs contamination greater than 0.024 mg/kg up to stepout locations less than 0.024 mg/kg will be evaluated for excavation and disposal; 3) If the Total DDTs concentration of the initial soil sample is less than 0.024 mg/kg, no further sampling will occur and BRAC will not remove any additional soil from the Spoils Pile F area.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in evaluation of excavation of soil that does not pose a risk to future wetland species of the inboard area at Hamilton Army Airfield. Low bias or false negatives of analytical results would allow soil contaminated with Total DDTs to remain on site potentially impacting future wetland species.

Optimize the Sampling Design: Collect one surface sample approximately 25 feet south of the highest DDT hit from the pre-excavation samples (HBSF618) and three surface samples along the eastern edge of the excavation area. See Figure 2-1. These samples shall be sent to an off-site laboratory for analysis for Total DDTs. If results indicate residual DDTs above 0.024 mg/kg, then vertical and horizontal step-out samples will be collected and analyzed. The vertical step out shall be one foot and the horizontal step out shall be five feet.

2.2 South of the Runway DDT Hotspot

State the Problem: Samples collected by the USACE, San Francisco District, for the California Coastal Conservancy contained concentrations of Total DDTs above the ROD/RAP concentration for soil removal (1 mg/kg) up to 2 feet bgs at a sample location on the south runway (Sample Location HAA-2003-SO-36). See Figure 2-2.

Identify the Decision: Determine the extent of the Total DDTs contamination above the ROD/RAP removal action goal of 1 mg/kg.

Identify the Inputs to the Decision: 1) Previous results from *Results of the Area-Wide DDT Site Investigation, Hamilton Wetlands Restoration Project*, USACE, Final, May 2003; 2) action goals from the *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Final, August 2003; 3) the USFWS Biological Opinion and amending letter, August 2003 and September 2003; and 4) data defining the lateral and vertical extent of Total DDTs above the removal action goal surrounding the previous DDT hotspot.

Define the Boundaries: The spatial boundary is the area surrounding the previous Total DDTs hotspot extending to the runways and the previous sample locations HAA-2003-SO-35 and HAA-2003-SO-37.

Develop Decision Rules: 1) If the Total DDTs concentration of the initial soil samples is greater than 1 mg/kg, samples will be collected in stepout locations both vertically and horizontally; 2) The area encompassing any Total DDTs contamination greater than 1 mg/kg up to stepout locations less than 1 mg/kg will be excavated and taken off-site for disposal; 3) If the Total DDTs concentration of the initial soil samples is less than 1 mg/kg, step in samples may be

collected or no further sampling will occur and the extent of contamination will have been defined.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in excavation of soil that does not pose a risk to future wetland species of the inboard area at Hamilton Army Airfield or that could be mitigated by clean cover. Low bias or false negatives of analytical results would allow soil contaminated with Total DDTs to remain on site potentially impacting future wetland species.

Optimize the Sampling Design: Collect one sample approximately 3 feet bgs immediately adjacent to Sample HAA-2003-SO-36 and four surface samples 25 feet surrounding HAA-2003-SO-36. See Figure 2-2. Analyze the samples for Total DDTs with an immunoassay field test kit compared to the 1.0mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then soil samples from stepout locations both vertically (at 6-inch intervals) and horizontally (at 25-foot intervals) shall be collected and analyzed using the field test kits. Samples from the extent of the Total DDTs-contaminated soil (< 1 mg/kg) and at least one from within the DDT hotspot area shall be sent to an off-site laboratory for analysis for Total DDTs to verify the field testing results. Sample locations and selection of stepout locations may be adjusted based upon the topography of the area along with the probable accumulation of DDT runoff. Nonetheless, sampling will continue until the extent of Total DDTs above the 1 mg/kg action goal has been reached.

2.3 Building 35 for Total DDTs

State the Problem: Following the excavation east of Building 35, confirmation samples contained concentrations of Total DDTs above the ROD/RAP concentration for soil removal at one location under a discharge pipe. See Figure 2-3.

Identify the Decision: Determine the extent of any DDT contamination above the ROD/RAP and Biological Opinion action goals of 0.024 mg/kg and 1 mg/kg.

Identify the Inputs to the Decision: 1) Previous results from *1999 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, IT Corporation, April 2000; 2) action goals from *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Final, August 2003; 3) the USFWS Biological Opinion and amending letter, August 2003 and September 2003; and 4) data defining the extent of Total DDTs above the ROD/RAP action goals under the pipeline east of Building 35.

Define the Boundaries: The spatial boundary is the area under the pipeline (minimum depth 4 ½ feet) between Sample Number B35E-CS-001 and Sample Number B35E-CS-002 (the hotspot) east to the levee and the area surrounding the pipeline.

Develop Decision Rules: 1) If the Total DDTs concentration of the initial soil samples is greater than 1 mg/kg, samples will be collected in stepout locations both vertically and horizontally; 2) The area encompassing any Total DDTs contamination greater than 1 mg/kg up to stepout locations less than 1 mg/kg will be excavated and taken off-site for disposal; 3) If the Total DDTs concentration of the initial soil samples is less than 0.024 mg/kg, no further sampling will occur and the extent of contamination will have been defined.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in excavation of soil that does not pose a risk to future wetland species of the inboard

area at Hamilton Army Airfield or that could be mitigated by clean cover. Low bias or false negatives of analytical results would allow soil contaminated with Total DDTs to remain on site potentially impacting future wetland species.

Optimize the Sampling Design: Collect one sample at 5 feet bgs immediately adjacent to the previous sample B35E-CS-002 hotspot and three samples at 4 ½ feet bgs spaced 5 feet from and surrounding the hotspot, two along the pipeline and the third south of the pipeline. See Figure 2-3. Analyze the samples for Total DDTs with an immunoassay field test kit compared to the 1.0 mg/kg standard concentration. If the field test kit results are greater than 1.0 mg/kg, then soil samples from stepout locations both vertically and horizontally shall be collected and analyzed using the field test kits. Continue with stepout or stepin sampling until the extent of Total DDTs contamination above the 1 mg/kg action goal is met. Samples from the extent of the Total DDTs-contaminated soil (< 1 mg/kg) and at least one from within the high DDT concentration area shall be sent to an off-site laboratory for analysis for Total DDTs to verify the field testing results.

2.4 Unlined Perimeter Drainage Ditch for Total DDTs

State the Problem: Confirmation samples collected along the bottom and sides of the Perimeter Drainage Ditch (PDD) along the northwest corner of the panhandle contained concentrations of Total DDTs above the ROD/RAP concentration for soil removal. See Figure 2-4.

Identify the Decision: Determine the extent of the Total DDTs contamination above the ROD/RAP and Biological Opinion action goals of 0.024 and 1 mg/kg in the sediment of the PDD at the location of the DDT hotspots.

Identify the Inputs to the Decision: 1) Previous results from *1998 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Final, IT Corporation, April 2000; 2) action goals from the *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Final, August 2003; 3) the USFWS Biological Opinion and amending letter, August 2003 and September 2003; and 4) data defining the lateral and vertical extent of Total DDTs within the ditch surrounding the DDT hotspots.

Define the Boundaries: The spatial boundary is the area surrounding the previous Total DDTs hotspots within the ditch (bottom and sides) extending to the sample locations SS-PDUL-S35E and SS-PDUL-B35 to the southeast.

Develop Decision Rules: 1) If the Total DDTs concentration of the initial soil samples is greater than 1 mg/kg, samples will be collected in stepout locations both vertically and horizontally along the ditch; 2) The area encompassing any Total DDTs contamination greater than 1 mg/kg up to stepout locations less than 1 mg/kg will be excavated and taken off-site for disposal; 3) If the Total DDTs concentration of the initial soil samples is less than 1 mg/kg, stepin samples may be collected or no further sampling will occur and the extent of contamination will have been defined.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in excavation of sediment that does not pose a risk to future wetland species of the inboard area at Hamilton Army Airfield or that could be mitigated by clean cover. Low bias or false negatives of analytical results would allow soil contaminated with Total DDTs to remain on site potentially impacting future wetland species.

Optimize the Sampling Design: Collect a total of 15 samples at three locations – five samples at each location (floor sample approximately 1 foot below the floor of the ditch and centered on its midline; 2 surface samples halfway up the walls on either side of the ditch; 2 surface samples one foot from either edge of the ditch). The three locations are one at the curve of the ditch at the northwest corner of the panhandle and 2 other locations 100 feet on either side along the ditch from the initial sample location. See Figure 2-4. Analyze the samples for Total DDTs with an immunoassay field test kit compared to both the 0.2 mg/kg and 1.0mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then samples from stepout locations both vertically (6-inch intervals) and horizontally (50-foot intervals, 1-foot intervals laterally from the edge of the ditch) shall be collected and analyzed using the field test kits. If the field test kit results are less than 1.0 mg/kg, then samples from stepin locations horizontally (1/2 the sampling interval) shall be collected and analyzed using the field test kits. Samples from the extent of the Total DDTs-contaminated sediment (< 1 mg/kg) and at least one from within the high Total DDTs area shall be sent to an off-site laboratory for analysis for Total DDTs to verify field testing results. Continue with stepout or stepin sampling until the extent of Total DDTs contamination above the 1 mg/kg action goal is met.

2.5 Revetments 6 and 7 for Mercury

State the Problem: Mercury was detected above ROD/RAP action goals in samples for soil excavated from Revetments 6 and 7. See Figures 2-5a and 2-5b.

Identify the Decision: Determine if mercury concentrations exceed ROD/RAP action goals in the soil remaining on the site.

Identify the Inputs to the Decision: 1) Mercury concentrations in waste characterization data from *Final Construction Report and Supplemental Construction Report for Building 41 Demolition and Soil Removal, Spoils Pile F Removal, and Revetments 6 and 7 Removal, Hamilton Army Airfield*, Shaw Environmental, Inc., May 2003; 2) action goals from the *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Public Comment Final, May 2003; 3) mercury concentrations in soils remaining on site.

Define the Boundaries: The spatial boundary for each excavated area is illustrated in the document specified in 1) above. See Figure 2-5.

Develop Decision Rules: If the mercury concentration is greater than the inboard area Action Goal of 0.43 mg/kg, then further action to determine the source will be discussed.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in further action or discussion of the source of the mercury. Low bias or false negatives of analytical results would allow soil contaminated with mercury to remain on site without any mitigation (cover) potentially impacting future wetland species.

Optimize the Sampling Design: Composite samples will be collected from each excavated area of differing depth from both Revetments 6 and 7. See Figure 2-5a and 2-5b. Composites will include at least 4 discrete samples from the excavation.

2.6 Firing-in Target Butt (ASR #19) for Selected Metals

State the Problem: A Firing-in Target Butt (FITB) was identified on aerial photos from 1943 and 1946 and documented in the Archives Search Report. See Figure 2-6. The butt was removed in 1947; however, any residual contamination has not been investigated.

Identify the Decision: Determine whether residual contamination from the FITB exists.

Identify the Inputs to the Decision: 1) Historical information documented in *U.S. DoD BRAC Ordnance, Ammunition, and Explosives Archives Search Report, Conclusions and Recommendations, Hamilton Army Airfield*, Final, USACE, September 2001 and associated correspondence; 2) action goals from the *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Final, August 2003; 3) the USFWS Biological Opinion and amending letter, August 2003 and September 2003; 4) concentration of constituents indicative of the presence of residual contamination from ammunition used by DoD at the FITB; and 4) presence or absence of ammunition fragments.

Define the Boundaries: The spatial boundary is identified from aerial photos; features present in the aerial photos and currently known will be used to locate the site for sampling.

Develop Decision Rules: 1) If the concentration of antimony, arsenic, cadmium, chromium, copper, lead, nickel, or zinc is greater than the ROD/RAP or Biological Opinion action goals and ammunition or ammunition fragments are found, further investigation will be undertaken to identify the extent of contamination. 2) If the concentration of antimony, arsenic, cadmium, chromium, lead, nickel, or zinc is greater than the ROD/RAP and Biological Opinion action goals and no ammunition fragments are found, further action to verify that the source of the contamination is the FITB will be recommended. 3) If the concentrations of antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc are less than the ROD/RAP and Biological Opinion action goals, no further action will be taken.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in further investigation or discussion of the source of the lead. Action may include further sampling of soil surrounding the soil sample locations to determine extent of contamination of all associated constituents (and subsequent mitigation or excavation) and/or sampling in areas not impacted by the FITB to determine ambient concentrations of lead. Low bias or false negatives of analytical results would allow soil contaminated with constituents associated with ammunition to remain on site without any mitigation (cover) potentially impacting future wetland species.

Optimize the Sampling Design: Five soil samples will be collected immediately in front of and to the sides of the FITB and analyzed for antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc. Soil from four locations beneath the FITB will be collected and sieved to isolate any bullets or bullet fragments. See Figure 2-6.

2.7 Skeet Range for (ASR #18) Selected Metals and PAHs

State the Problem: A Skeet Range was identified on a 1941 aerial photo and documented in the Archives Search Report. See Figure 2-6. The Range was removed before 1946; however, any residual contamination has not been investigated.

Identify the Decision: Determine whether residual contamination from the Skeet Range exists.

Identify the Inputs to the Decision: 1) Historical information documented in *U.S. DoD BRAC Ordnance, Ammunition, and Explosives Archives Search Report, Conclusions and Recommendations, Hamilton Army Airfield*, Final, USACE, September 2001 and associated correspondence; 2) action goals from the *Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Final, August 2003; 3) the USFWS Biological Opinion and amending letter, August 2003 and September 2003; 4) concentration of constituents indicative of the presence of residual contamination from ammunition and clay pigeons (polynuclear aromatic hydrocarbons [PAHs]); and 5) presence or absence of ammunition or clay pigeon fragments.

Define the Boundaries: The boundary of the Skeet Range is hypothetical and was derived from aerial photos, knowledge of other similar sites, and the range of ammunition from shotguns used on such ranges.

Develop Decision Rules: 1) If the concentration of antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc or Total PAHs is greater than the ROD/RAP and Biological Opinion action goals and ammunition, ammunition fragments, or fragments of clay pigeons are found, further investigation will be undertaken to identify the extent of contamination. 2) If the concentration of antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc, or total PAHs is greater than the ROD/RAP and Biological Opinion action goals and no ammunition or clay pigeon fragments are found, further action to verify that the source of the contamination is the Skeet Range will be recommended. 3) If the concentrations of antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc, and PAHs are less than the ROD/RAP and Biological Opinion action goals, no further action will be taken.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in further investigation or discussion of the source of the lead and/or PAHs. Action may include further sampling of soil surrounding the soil sample locations to determine extent of contamination of all associated constituents (and subsequent mitigation or excavation) and/or sampling in areas not impacted by the Skeet Range to determine ambient concentrations of metals or PAHs. Low bias or false negatives of analytical results would allow soil contaminated with constituents associated with ammunition and skeet to remain on site without any mitigation (cover) potentially impacting future wetland species.

Optimize the Sampling Design: Five discrete samples will be collected at two distances from the firing line – two at 250 feet and three at 350 feet. These locations are based upon estimated distances of the range of ammunition from shotguns. See Figure 2-7. The samples will be analyzed for antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc and PAHs. Soil will also be collected from four locations within the range and sieved to isolate ammunition, ammunition fragments, and/or clay pigeon fragments.

2.8 Testing Area (ASR #4) for Selected Metals

State the Problem: A Testing Area was identified on an aerial photo from 1946 along the levee and documented in the Archives Search Report. See Figure 2-7. Any residual contamination from activities at the Testing Area has not been investigated.

Identify the Decision: Determine whether residual contamination from the Testing Area exists.

Identify the Inputs to the Decision: 1) Historical information documented in *U.S. DoD BRAC Ordnance, Ammunition, and Explosives Archives Search Report, Conclusions and Recommendations, Hamilton Army Airfield*, Final, USACE, September 2001 and associated correspondence; 2) action goals from the *Main Airfield Parcel Record of Decision/Remedial*

Action Plan, Hamilton Army Airfield, Final, August 2003; 3) the USFWS Biological Opinion and amending letter, August 2003 and September 2003; 4) concentration of constituents indicative of the presence of residual contamination from ammunition; and 5) presence or absence of ammunition or ammunition fragments.

Define the Boundaries: The spatial boundary is identified from aerial photo; features present in the aerial photo and currently known will be used to locate the site for sampling.

Develop Decision Rules: 1) If the concentration of antimony, arsenic, cadmium, chromium, copper, lead, nickel, or zinc is greater than the ROD/RAP and Biological Opinion action goals and ammunition or ammunition fragments are found, further investigation will be undertaken to identify the extent of contamination. 2) If the concentration of antimony, arsenic, cadmium, chromium, copper, lead, nickel, or zinc is greater than the ROD/RAP and Biological Opinion action goals and no ammunition fragments are found, further action to verify that the source of the contamination is the FITB will be recommended. 3) If the concentrations of antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc are less than the ROD/RAP and Biological Opinion action goals, no further action will be taken.

Specify the Consequences of Decision Errors: High bias or false positives of analytical results will result in further investigation or discussion of the source of the lead. Action may include further sampling of soil surrounding the soil sample locations to determine extent of contamination of all associated constituents (and subsequent mitigation or excavation) and/or sampling in areas not impacted by the Testing Area to determine ambient concentrations of lead. Low bias or false negatives of analytical results would allow soil contaminated with constituents associated with ammunition to remain on site without any mitigation (cover) potentially impacting future wetland species.

Optimize the Sampling Design: Five samples will be collected along the inboard side of the levee equally spaced the length of the Testing Area. See Figure 2-8. The soil samples will be collected from 0 to 6 inches bgs, between the toe and top of the levee, and analyzed for antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc based upon the assumption that the testing was for ammunition and the levee was used as a backstop. Soil from the five locations will also be collected and sieved to isolate any bullets or bullet fragments.

3.0 REFERENCES

IT Corporation, *1998 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Final, April 2000.

IT Corporation, *1999 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Revision A, April 2000.

Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield, Public Comment Final, August 2003.

Shaw Environmental, Inc., 2003, *Final Construction Report and Supplemental Construction Report for Building 41 Demolition and Soil Removal, Spoils Pile F Removal, and Revetments 6 and 7 Removal, Hamilton Army Airfield*, May 2003.

USACE, *Results of the Area-Wide DDT Site Investigation, Hamilton Wetlands Restoration Project*, Final, May 2003.

U.S. Environmental Protection Agency (EPA), 1996, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition*, December 1996.

U.S. Fish and Wildlife Service Biological Opinion and amending letter, August 2003 and September 2003.

APPENDIX B

FIELD SAMPLING PLAN

FIELD SAMPLING PLAN

MISCELLANEOUS SITE INVESTIGATIONS

HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

Final Submittal

Prepared by:



**US Army Corps
of Engineers ®**

Sacramento District
Environmental Design Section

January 2004

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ACRONYMS

ASR	Archive Search Report
COC	Chain of custody
DQOs	Data quality objectives
EDS	Environmental Design Section
FSP	Field sampling plan
GPS	Global Positioning System
HAAF	Hamilton Army Airfield
IDW	Investigation-derived waste
mg/kg	milligram/kilogram
QAPP	Quality assurance project plan
QC	Quality control
PAHs	Polynuclear aromatic hydrocarbons
SSHP	Site safety and health plan
Total DDTs	Sum of Dichlorodiphenyltrichloroethane, Dichlorodiphenyldichloroethane, and Dichlorodiphenyldichloroethylene (DDT + DDD + DDE)
USACE	U.S. Army Corps of Engineers
WP	Work Plan

FIELD SAMPLING PLAN

MISCELLANEOUS SITE INVESTIGATIONS

HAMILTON ARMY AIRFIELD

1. INTRODUCTION

1.1 SCOPE OF PROJECT

This Field Sampling Plan (FSP) describes the work to be performed in support of the investigation of soil at eight locations at Hamilton Army Airfield (HAAF). The Miscellaneous Site Investigations are designed to collect data that will be used to determine whether soil at the eight sites is contaminated, if soil can remain onsite or must be removed from a site because the concentrations of the chemicals of concern are too high, or if additional investigation is required.

The FSP outlines the methods of sampling and analysis of the eight areas. The US Army Corps of Engineers (USACE), Sacramento District is performing the Miscellaneous Site investigations.

1.2 SCOPE OF REPORT

This FSP presents the site investigations sampling and analysis programs, sampling objectives, sampling strategy and rationale, sampling locations, sample collection methods, and sample handling procedures. The FSP is designed to ensure that field procedures and documentation are standardized so that data collected are valid and defensible. All field personnel will become familiar with the FSP prior to conducting fieldwork.

The FSP will be implemented in conjunction with the Quality Assurance Project Plan (QAPP) and the Site Safety and Health Plan (SSHP).

1.3 SITE LOCATION

HAAF is located in Novato, CA. HAAF was a former Air Force Base and Army Airfield. The location of HAAF is shown in Figure 1-1.

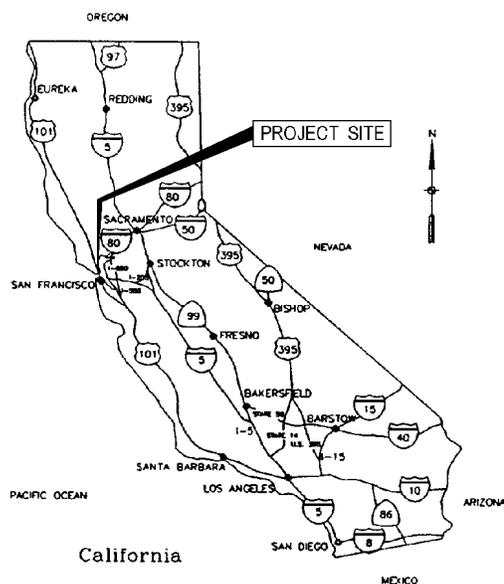


Figure 1-1: Project Location Map

1.4 MISCELLANEOUS INVESTIGATION SITES

The eight sites of the Miscellaneous Site Investigations are listed below and shown in Figure 1-2:

- Spoils Pile F;
- South of the Runway DDT Hotspot;
- Building 35;
- Unlined Perimeter Drainage Ditch
- Revetments 6 and 7;
- Firing-In Target Butt Near Revetment 1;
- Skeet Range;
- Testing Range.

1.5 PROJECT STAFFING

This study is being designed and implemented by the Environmental Design Section (EDS), Sacramento District, and USACE under the general supervision of Rick Meagher, Section Chief. The technical design team includes:

<u>Personnel</u>	<u>Responsibility</u>
Kathy Siebenmann	Technical Team Lead, Chemist
Teresa Rodgers	Field Task Leader, Geologist
Donna Maxey	Industrial Hygienist

Each team member provides an integral part in completing this Study, including preparation and implementation of the Design Quality Objectives, Work Plan (WP), performing fieldwork, and reporting.

2. SAMPLING

This section provides the sample locations, number of samples, analytical methods, and the rationale for the sampling and analytical program. Investigation and sampling techniques and procedures are discussed in Section 4.0. Overall, the investigative approach includes only soil sampling. All sampling locations will be identified using a Global Positioning System (GPS).

During the performance of fieldwork, sampling locations and depths stated in this FSP may be adjusted and additional samples added based on field observations or conditions.

Please refer to Figures 2-1 to 2-8 while reading the descriptions below.

2.1 SPOILS PILE F FOR TOTAL DDTs

Collect one surface sample south of the location of HBSFL618. Collect three surface samples along the eastern edge of the excavation area. (See Figure 2-1.) These samples shall be sent to an offsite laboratory for analysis for Total DDTs. If results indicate residual DDTs above 0.024 mg/kg, then vertical and horizontal stepout samples will be collected and analyzed. The vertical stepout shall be 1 foot and the horizontal stepout shall be five feet.

2.2 SOUTH OF THE RUNWAY DDT HOTSPOT

Collect one depth sample approximately 3 feet bgs immediately adjacent to Sample HAA-2003-SO-36 and four surface samples 25 feet away and surrounding HAA-2003-SO-36. (See Figure 2-2.) Analyze the samples for Total DDTs with an immunoassay field test kit and compare the results to both the 0.2mg/kg and 1.0mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then soil samples from stepout locations both vertically (at 6-inch intervals) and horizontally (at 25-foot intervals) shall be collected and analyzed using the field test kits. Verification samples from the extent of the Total DDTs-contaminated soil and at least one verification sample from within the DDT hotspot area shall be sent to an off-site laboratory for analysis for Total DDTs.

2.3 BUILDING 35 FOR TOTAL DDTs

Collect one sample at 5 feet bgs immediately adjacent to the previous sample B35E-CS-002 hotspot and three samples at 4.5 feet bgs spaced 5 feet from and surrounding the hotspot, two along the pipeline and the third south of the pipeline. (See Figure 2-3.) Analyze the sample for Total DDTs with an immunoassay field test kit and compare the results to both the 0.2 mg/kg

and 1.0 mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then soil samples from stepout locations both vertically (6-inch intervals) and horizontally along the pipeline (5-foot intervals) and south of the pipeline (5-foot intervals) shall be collected. Two verification samples from the extent of the Total DDTs-contaminated soil and at least one verification sample from within the high Total DDTs area shall be sent to an offsite laboratory for analysis for Total DDTs.

2.4 UNLINED PERIMETER DRAINAGE DITCH FOR TOTAL DDTs

Collect a total of fifteen samples – five samples at the curve of the ditch at the northwest corner of the panhandle (floor sample approximately 1 foot below the floor of the ditch and centered on its midline; 2 surface samples halfway up the walls on either side of the ditch; 2 bank samples will be collected 1 foot from the edge on either side of the ditch) and 2 other locations 100 feet on either side along the ditch from the initial sample location (for both, a floor sample will be collected approximately 1 foot below the floor of the ditch and centered on its midline; 2 surface samples will be collected halfway up the wall on either side of the ditch, and 2 bank samples will be collected 1 foot from the edge on either side of the ditch). See Figure 2-4. Analyze the samples for Total DDTs with an immunoassay field test kit and compare the results to both the 0.2 mg/kg and 1.0mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then sediment samples from stepout locations both vertically (6-inch intervals) and horizontally (50-foot intervals) shall be collected and analyzed using the field test kits. If the field test kit results are less than 1.0 mg/kg, then sediment samples from stepin locations horizontally (1/2 the sampling interval) shall be collected and analyzed using the field test kits. Samples from the extent of the Total DDTs-contaminated sediment (< 1 mg/kg) and at least one from within the high Total DDTs area shall be sent to an off-site laboratory for analysis for Total DDTs to verify field testing results.

2.5 REVETMENTS 6 AND 7 FOR MERCURY

Composite samples will be collected from each excavated area of differing depth from both Revetments 6 and 7 and analyzed for mercury. (See Figure 2-5a and 2-5b.) Composites will include at least 4 discrete samples from the excavation.

2.6 FIRING-IN TARGET BUTT (ASR # 19) FOR SELECTED METALS

Five soil samples will be collected immediately in front of and to the sides of the FITB and analyzed for selected metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc). Soil from four locations beneath the FITB will be collected and sifted to isolate any ammunition fragments. (See Figure 2-6 for locations.) (See Section 4.1 for sieving protocol.)

2.7 SKEET RANGE (ASR #18) FOR SELECTED METALS AND PAHS

Nine discrete samples will be collected at three distances from the firing line – one at 120 feet, two at 250 feet, three at 350 feet, and three at 500 feet. These locations are based upon estimated distances of the range of ammunition from shotguns. (See Figure 2-7.) The samples will be analyzed for metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) and PAHs. Soil will also be collected from four locations within the range and sifted to isolate ammunition, ammunition fragments, and/or clay pigeon fragments. (See Section 4.1 for sieving protocol.)

2.8 TESTING RANGE (ASR #4)

Five samples will be collected along the inboard side of the levee, and equally spaced along the length of the Testing Range Area. (See Figure 2-8.) The soil samples will be collected from 0 to 6 inches bgs, between the toe and top of the levee, and analyzed for metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc) based upon the assumption that ammunition was tested in this area, and that the levee was used as a backstop. Soil will also be collected from five locations within the range and sifted to isolate any ammunition fragments. (See Section 4.1 for sieving protocol.)

3. SOIL SAMPLING

Soil samples will be collected at each site as shown on the sample locations maps for each site. Sample locations may be adjusted based on site conditions and accessibility. Soil samples will be collected from the sample locations at the depths shown in Table 3-1. All sampling locations will be flagged, and the coordinates will be identified using GPS equipment (see Table 4-1).

During the performance of fieldwork, sampling locations and depths stated in this FSP may be adjusted, deleted, or additional samples added, based on field observations or conditions. Any changes will be documented in both the field logbook and final reports.

The analytes were selected based on the results of previous analytical results at HAAF and potential contaminants of concern based upon site history. Soil samples will be analyzed for the following analytes:

- Metals by Method SW6010B/SW7471A
- Pesticides by Method SW8081A (offsite laboratory)
- Pesticides by Method SW4042 (field laboratory)
- PAHs by Modified Method SW8270C.

TABLE 3-1: Summary of Proposed Analytical Parameters					
SAMPLE IDENTIFICATION				ANALYTE PROGRAM	
MISCELLANEOUS SITES	SAMPLE ID	SAMPLING DESIGN	CONTAINER TYPE/NUMBER	ANALYTE	METHOD
Spoils Pile F MS/MSD	HAAF-SPF-701 HAAF-SPF-702 HAAF-SPF-703 HAAF-SPF-704-MS/MSD	Collect one surface sample south of the location of HBSFL618. Collect three surface samples along the eastern edge of the excavation area. Send the samples to an offsite laboratory for analysis for Total DDTs.	4-oz clear wide mouth (CWM) jar /5	DDTs	Offsite lab; SW 8081A
South of the Runway DDT Hotspot	Characterization samples: HAAF-SRW-705-3FT HAAF-SRW-D-801-3FT HAAF-SRW-706 HAAF-SRW-707 HAAF-SRW-708 HAAF-SRW-709 Verification samples: HAAF-SRW-757-V HAAF-SRW-758-V HAAF-SRW-759-V	Collect one depth sample approximately 3 feet bgs immediately adjacent to Sample HAA-2003-SO-36 and four surface samples 25 feet away and surrounding HAA-2003-SO-36. Analyze the samples for Total DDTs with an immunoassay field test kit and compare the results to both the 0.2mg/kg and 1.0mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then soil samples from stepout locations both vertically (at 6-inch intervals) and horizontally (at 25-foot intervals) shall be collected and analyzed using the field test kits. Two verification samples from the excavated extent of the Total DDTs-contaminated soil and one verification sample from within the DDT hotspot area shall be sent to an offsite laboratory for analysis for Total DDTs.	4-oz clear wide mouth (CWM) jar /6 characterization samples; 3 verification samples	DDTs	(1) Characterization samples by Immunoassay field test kit; SW 4042 (2) Verification samples sent to offsite lab; SW 8081A
Building 35 for Total DDTs MS/MSD	Characterization samples: HAAF-B35-710-5FT HAAF-B35-711-4.5FT HAAF-B35-712-4.5FT HAAF-B35-713-4.5FT-MS/MSD Verification samples: HAAF-B35-760-V HAAF-B35-761-V HAAF-B35-762-V	Collect one depth sample at 5 feet bgs immediately adjacent to the previous sample B35E-CS-002 hotspot and three depth samples at 4.5 feet bgs spaced 5 feet from the hotspot. Two of these samples shall be placed along the pipeline and the third shall be perpendicular to the pipeline on the south side. Analyze the sample for Total DDTs with an immunoassay field test kit and compare the results to both the 0.2 mg/kg and 1.0 mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then soil samples from stepout locations both vertically (6-inch intervals) and horizontally (5-foot intervals) shall be collected.	4-oz clear wide mouth (CWM) jar /4 characterization samples; 3 verification samples	DDTs	(1) Characterization samples by Immunoassay field test kit; SW 4042 (2) Verification samples sent to offsite lab; SW 8081A

TABLE 3-1: Summary of Proposed Analytical Parameters					
SAMPLE IDENTIFICATION				ANALYTE PROGRAM	
MISCELLANEOUS SITES	SAMPLE ID	SAMPLING DESIGN	CONTAINER TYPE/NUMBER	ANALYTE	METHOD
		Two verification samples from the extent of the Total DDTs-contaminated soil and one verification sample from within the proposed excavation area shall be sent to an offsite laboratory for analysis for Total DDTs.			
Unlined Perimeter Drainage Ditch for Total DDTs	Characterization Samples: HAAF-UPDD-714-1FT HAAF-UPDD-715 HAAF-UPDD-716 HAAF-UPDD-773 HAAF-UPDD-774 HAAF-UPDD-717-1FT HAAF-UPDD-718 HAAF-UPDD-D-802 HAAF-UPDD-719 HAAF-UPDD-771 HAAF-UPDD-772 HAAF-UPDD-720-1FT HAAF-UPDD-721 HAAF-UPDD-722 HAAF-UPDD-775 HAAF-UPDD-776 Verification samples: HAAF-UPDD-763-V HAAF-UPDD-764-V HAAF-UPDD-765-V	Collect a total of fifteen samples – five samples at the curve of the ditch at the northwest corner of the panhandle (floor sample approx. 1 ft below the floor of the ditch and centered on its midline; 2 surface samples halfway up the walls on either side of the ditch, 2 surface samples on bank 1 ft from edge) and 2 other locations 100 ft on either side along the ditch from the initial sample location (for both, a floor sample will be collected approximately 1 ft below the floor of the ditch and centered on its midline; 2 surface samples will be collected halfway up the wall on either side of the ditch, surface samples on bank 1 ft from edge). Analyze the samples for Total DDTs with an immunoassay field test kit compared to both the 0.2 mg/kg and 1.0mg/kg standard concentrations. If the field test kit results are greater than 1.0 mg/kg, then sediment samples from stepout locations both vertically (6-inch intervals) and horizontally (50-foot intervals) shall be collected and analyzed using the field test kits. If the field test kit results are less than 1.0 mg/kg, then sediment samples from stepin locations horizontally (1/2 the sampling interval) shall be collected and analyzed using the field test kits. Verification samples from the extent of the Total DDTs-contaminated soil (above 1 mg/kg) and at least one verification sample from within the high Total DDTs area shall be sent to an offsite laboratory for analysis for Total DDTs.	4-oz clear wide mouth (CWM) jar /16 characterization samples; 3 verification samples	DDTs	(1) Characterization samples by Immunoassay field test kit; SW 846, Method 4042 (2) Verification samples sent to offsite lab; SW 8081A
Revetment 6 for Mercury	HAAF-REV6-723	Collect two 4-point composite surface samples (one composite each from the two shallower depths excavated previously [1 ft bgs, 2 ft	4-oz clear wide mouth (CWM) jar /4	Metals (mercury)	SW7471A

TABLE 3-1: Summary of Proposed Analytical Parameters					
SAMPLE IDENTIFICATION				ANALYTE PROGRAM	
MISCELLANEOUS SITES	SAMPLE ID	SAMPLING DESIGN	CONTAINER TYPE/NUMBER	ANALYTE	METHOD
	HAAF-REV6-724 HAAF-REV6-D-803 HAAF-REV6-725	bgs)) and one 10-point composite surface sample from the deepest excavation (up to 8 ft bgs).			
Revetment 7 for Mercury	HAAF-REV7-726 HAAF-REV7-727 HAAF-REV7-728	Collect three 4-point composite surface samples (one composite from each of the three depths excavated previously [1 ft bgs, 2 ft bgs, and 2.5 ft bgs]).	4-oz clear wide mouth (CWM) jar /3	Metals (mercury)	SW7471A
Firing-In Target Butt (ASR # 19)	HAAF-FITB-729 HAAF-FITB-730 HAAF-FITB-731 HAAF-FITB-732 HAAF-FITB-D-804 HAAF-FITB-733 HAAF-FITB-F-734 HAAF-FITB-F-735 HAAF-FITB-F-736 HAAF-FITB-F-737	Five discrete surface soil samples will be collected immediately in front of and to the sides of the FITB. Soil from four locations beneath the FITB will be collected and sifted to isolate any ammunition fragments.	4-oz clear wide mouth (CWM) jar /6 jars for soil analyses and 4 containers for samples to be sifted.	Metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc)	SW 6010B
Skeet Range (ASR #18) MS/MSD	HAAF-SR-738 HAAF-SR-739 HAAF-SR-740-MS/MSD HAAF-SR-741 HAAF-SR-742 HAAF-SR-766 HAAF-SR-768 HAAF-SR-769 HAAF-SR-770 HAAF-SR-F-743 HAAF-SR-F-744 HAAF-SR-F-745 HAAF-SR-F-746 HAAF-SR-F-767	Nine discrete surface samples will be collected at four distances from the firing line – one at 120 feet, two at 250 feet, three at 350 feet, and three at 500 feet. Soil will also be collected from five locations within the range and sifted to isolate ammunition and/or clay pigeon fragments.	4-oz clear wide mouth (CWM) jar /9 jars for soil analyses and 5 containers for samples to be sifted.	Metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc)	SW 6010B
				PAHs	SW 8270C (modified)

TABLE 3-1: Summary of Proposed Analytical Parameters					
SAMPLE IDENTIFICATION				ANALYTE PROGRAM	
MISCELLANEOUS SITES	SAMPLE ID	SAMPLING DESIGN	CONTAINER TYPE/NUMBER	ANALYTE	METHOD
Testing Range (ASR #4)	HAAF-TR-747	Five discrete surface samples will be collected along the inboard side of the levee, 12" – 18" into the levee and halfway between the toe and the top, and equally spaced along the length of the Testing Area.	4-oz clear wide mouth (CWM) jar /6 jars for soil analyses and 5 containers for samples to be sifted.	Metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc)	SW 6010B
	HAAF-TR-748				
	HAAF-TR-D-805				
	HAAF-TR-749				
	HAAF-TR-750				
	HAAF-TR-751	Soil will also be collected from five locations within the range and sifted to isolate ammunition fragments.			
	HAAF-TR-F-752				
	HAAF-TR-F-753				
	HAAF-TR-F-754				
	HAAF-TR-F-755				
HAAF-TR-F-756					
IDW-Water	HAAF-IDW-W-1	--	1-Liter amber glass bottle	DDTs	SW 8081A
				PAHs	SW 8702C (modified)
				Metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc)	SW 6010B

4. SAMPLING EQUIPMENT AND PROCEDURES

The field methods to be employed during the miscellaneous site investigation fieldwork performed under this FSP will be conducted in accordance with the SSHP and the QAPP, both prepared specifically for this investigation.

4.1 INVESTIGATIVE EQUIPMENT AND PROCEDURES

Sample locations will be identified with GPS equipment. Coordinates for the sample locations are listed in Table 4-1.

To collect soil samples for chemical analysis, a manual spade and scoop, stainless steel soil auger (hand or power-driven, as field conditions require), and/or pick and digging bar shall be used.

Samples at the surface (0-2 inches of undisturbed soil) will be collected at each location with the use of a manual spade and scoop. The spade and scoop will be used to remove any vegetative cover or debris.

Samples from the subsurface will be collected with the soil auger by insertion to the appropriate sample collection depth and withdrawal. Samples will be collected as close to the defined depth interval as possible (preferably within one inch) and the actual depth of the sample below the ground's surface will be recorded in the field logbook.

Composite soil samples (Revetments 6 and 7 for mercury) will consist of at least four discrete soil samples composited together. Each discrete soil sample to be used for making a composite sample shall be of approximately the same volume. The soil from the discrete samples shall be placed in a clean mixing bowl, thoroughly mixed for uniformity, and placed into a glass jar.

For samples to be collected at depth, individual soil core sections from each discrete depth horizon will be placed in a pre-cleaned stainless steel bowl, thoroughly mixed with a pre-cleaned stainless steel spoon, and placed into a glass jar.

Samples from the inboard side of the levee, Testing Range (ASR # 4), shall be collected at each of five locations. Samples will be collected between the toe and top, at a depth of 0" - 6" into the inboard levee side. Collection may be done with hand tools (soil auger, pick, digging bar, and/or stainless spoon) or backhoe, as required by field conditions. The soil shall be placed in a clean mixing bowl, thoroughly mixed for uniformity, and placed into a glass jar.

Samples to be sieved (ASRs # 4, # 18, and # 19) shall be handled in accordance with Standard Operating Procedure 1-1 (see Attachment A).

Samples collected for onsite or offsite laboratory analysis will be labeled as described in Section 5.1, sealed in Zip-loc™ bags, and placed in ice-filled coolers. Samples for onsite analysis will be delivered to the field chemist for processing as soon as possible after collection. Samples for offsite analysis will be sent to the laboratory daily via Federal Express under chain of custody, or hand-delivered.

MISCELLANEOUS SITES	SAMPLE ID	Easting	Northing
Site 1: Spoils Pile F	HAAF-SPF-701	1,426,396.69	573,079.71
	HAAF-SPF-702	1,426,426.63	573,138.64
	HAAF-SPF-703	1,426,456.78	573,195.35
	HAAF-SPF-704	1,426,407.52	573,142.81
Site 2: South of the Runway DDT Hotspot	HAAF-SRW-705-3FT	1421443.63	573715.49
	HAAF-SRW-D-801-3FT	1421443.63	573715.49
	HAAF-SRW-706	1421461.41	573730.18
	HAAF-SRW-707	1421461.41	573695.39
	HAAF-SRW-708	1421425.08	573696.94
	HAAF-SRW-709	1421425.08	573728.63
	HAAF-SRW-757-V	TBD	TBD
	HAAF-SRW-758-V	TBD	TBD
	HAAF-SRW-759-V	TBD	TBD
Site 3: Building 35 for Total DDTs	HAAF-B35-710-5FT	1,426,570.79	573,462.92
	HAAF-B35-711-4.5FT	1,426,574.05	573,461.39
	HAAF-B35-712-4.5FT	1,426,568.69	573,458.71
	HAAF-B35-713-4.5FT	1,426,565.05	573,465.79
	HAAF-SRW-760-V	TBD	TBD
	HAAF-SRW-761-V	TBD	TBD
	HAAF-SRW-762-V	TBD	TBD
Site 4: Unlined Perimeter Drainage Ditch for Total DDTs	HAAF-UPDD-714-1FT	1,418,561.29	578,169.69
	HAAF-UPDD-715	1,418,569.32	578,178.03
	HAAF-UPDD-716	1,418,563.22	578,159.74
	HAAF-UPDD-773	1,418,562.63	578,185.20
	HAAF-UPDD-774	1,418,556.13	578,151.02
	HAAF-UPDD-717-1FT	1,418,467.25	578,164.26
	HAAF-UPDD-718	1,418,473.06	578,172.49
	HAAF-UPDD-D-802	1,418,473.06	578,172.49

Table 4-1: Sample Location Coordinates			
MISCELLANEOUS SITES	SAMPLE ID	Easting	Northing
	HAAF-UPDD-719	1,418,474.03	578,155.79
	HAAF-UPDD-771	1,418,467.62	578,181.93
	HAAF-UPDD-772	1,418,467.62	578,147.10
	HAAF-UPDD-720-1FT	1,418,674.28	578,142.41
	HAAF-UPDD-721	1,418,671.71	578,153.96
	HAAF-UPDD-722	1,418,666.58	578,131.83
	HAAF-UPDD-775	1,418,678.23	578,161.11
	HAAF-UPDD-776	1,418,672.64	578,124.11
	HAAF-SRW-763-V	TBD	TBD
	HAAF-SRW-764-V	TBD	TBD
	HAAF-SRW-765-V	TBD	TBD
	Site 5a: Revetment 6 for Mercury	HAAF-REV6-723	1,425,899.16
HAAF-REV6-724		1,425,879.30	573,236.64
HAAF-REV6-D-803		1,425,879.30	573,236.64
HAAF-REV6-725		1,425,917.27	573,234.20
Site 5b: Revetment 7 for Mercury	HAAF-REV7-726	1,425,559.46	573,498.56
	HAAF-REV7-727	1,425,603.97	573,560.92
	HAAF-REV7-728	1,425,630.06	573,525.14
Site 6: Firing-In Target Butt (ASR # 19)	HAAF-FITB-729	1,424,902.18	572,118.86
	HAAF-FITB-730	1,424,846.58	572,063.29
	HAAF-FITB-731	1,424,856.17	572,007.71
	HAAF-FITB-732	1,424,831.24	571,944.47
	HAAF-FITB-D-804	1,424,831.24	571,944.47
	HAAF-FITB-733	1,424,848.50	571,864.94
	HAAF-FITB-F-734	1,424,897.38	572,060.41
	HAAF-FITB-F-735	1,424,908.89	572,021.13
	HAAF-FITB-F-736	1,424,902.18	571,972.26
	HAAF-FITB-F-737	1,424,880.13	571,938.72

MISCELLANEOUS SITES	SAMPLE ID	Easting	Northing
Site 7: Skeet Range (ASR #18)	HAAF-SR-738	1,424,370.01	570,346.52
	HAAF-SR-739	1,424,524.52	570,382.33
	HAAF-SR-740	1,424,680.16	570,345.40
	HAAF-SR-741	1,424,474.14	570,277.12
	HAAF-SR-742	1,424,588.35	570,273.77
	HAAF-SR-766	1,424,525.65	570,154.27
	HAAF-SR-768	1,424,325.35	570,490.05
	HAAF-SR-769	1,424,532.86	570,532.06
	HAAF-SR-770	1,424,731.62	570,486.55
	HAAF-SR-F-743	1,424,540.20	570,380.21
	HAAF-SR-F-744	1,424,387.92	570,298.39
	HAAF-SR-F-745	1,424,539.08	570,329.73
	HAAF-SR-F-746	1,424,664.49	570,296.15
	HAAF-SR-F-767	1,424,525.65	570,154.27
Site 8: Testing Range (ASR #4)	HAAF-TR-747	1,425,764.15	571,877.48
	HAAF-TR-748	1,425,829.83	572,007.89
	HAAF-TR-D-805	1,425,829.83	572,007.89
	HAAF-TR-749	1,425,900.56	572,157.98
	HAAF-TR-750	1,425,963.60	572,285.06
	HAAF-TR-751	1,426,020.67	572,398.32
	HAAF-TR-F-752	1,425,774.74	571,884.54
	HAAF-TR-F-753	1,425,842.10	572,014.03
	HAAF-TR-F-754	1,425,912.89	572,163.92
	HAAF-TR-F-755	1,425,976.39	572,291.36
	HAAF-TR-F-756	1,426,032.80	572,403.96

4.2 QUALITY CONTROL PROGRAM

The purpose of this section is to describe the field quality control (QC) samples that will be included in this project to support the data quality presented in the QAPP. The sampling methodologies, preservation techniques, and decontamination procedures described in this FSP have been selected to ensure appropriate data quality. The appropriateness of the field sampling protocol will be verified by inclusion of QC samples as described below. Specific QC duplicate samples are included in Table 3-1.

4.2.1 Field Duplicates (QC Samples)

QC duplicate samples collected in the field will provide precision information for the entire measurement system, including sample acquisition, homogeneity, handling, shipping, storage, preparation, and analysis. The field duplicates will be placed in a separate sample jar from the normal sample after homogenization of the sample in the mixing bowl. The identity of these samples will be held blind to the analysts and laboratory personnel until the data are in deliverable form. Duplicate analyses will be performed on approximately 10% of the total investigative samples for each method. QC sample locations are defined in this FSP; however, the locations may be adjusted based on information determined in the field. Odors or visual indicators may be used to assist in directing the location of QC samples to areas suspected to have the highest concentrations of the contaminants of interest. Duplicate samples will be analyzed by the laboratory for the same parameters as the primary sample (i.e., the sample that is being duplicated).

4.2.2 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

A Matrix Spike (MS) is an environmental sample to which known concentrations of analytes have been added. The MS is taken through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery. The MS is used to evaluate the effects of the sample matrix on the accuracy of the analysis.

A Matrix Spike Duplicate (MSD) is an environmental sample that is divided into two separate aliquots, each of which is spiked with known concentrations of analytes. The spiked aliquots are processed separately and the results compared to determine the effects of the matrix on the precision and accuracy of the analysis. Additional soil sample volumes will be collected for MS/MSD analyses in accordance with the QAPP. MSD sample locations are defined in this FSP; however, the locations may be adjusted based on information determined in the field.

4.2.3 Blanks

A small sample container of water will be labeled as a temperature blank. One temperature blank will be included in each cooler. The temperature blank will be packaged and handled in the same manner as the other samples to assure that its temperature is representative of the samples in that cooler. The laboratory will use a calibrated thermometer to directly measure the temperature of this sample. The temperature reading from the temperature blank will be used to determine whether samples were stored under the appropriate thermal conditions.

4.3 EQUIPMENT DECONTAMINATION PROCEDURES

During sampling activities, appropriate decontamination measures will be taken to minimize sample contamination from sampling equipment. The decontamination procedures for sampling equipment will incorporate the washing steps outlined in Sections 4.3.1 of this FSP.

All down-hole sampling equipment (excluding disposable equipment) used in the collection of samples will be decontaminated as described in the following paragraphs. Decontamination should be executed immediately prior to equipment use. Whenever this is not possible or practical, measures will be taken to assure that contamination of clean equipment will not occur. Clean disposable gloves will be worn while decontaminating sampling equipment and tools. Clean sampling equipment will not be placed on the ground or other contaminated surfaces prior to use. All non-disposable sampling equipment will be constructed of stainless steel and/or Teflon.

Detergent and reagent grade water rinses are the first steps in the decontamination process. Deionized water will be stored in plastic containers and applied via pump sprayers or decanted directly from the storage container. The waste decontamination fluids will be collected and handled in accordance with Section 6.0.

Decontamination will consist of the following steps:

- 1) Wash with non-phosphate detergent;
- 2) Rinse with potable water;
- 3) Rinse with analyte-free water (type II reagent grade water or equivalent);
- 4) Air dry;
- 5) Wrap equipment completely with aluminum foil (shiny side out) and place in a plastic bag to prevent contamination if equipment is to be stored or transported.

4.4 SAMPLING CONTAINERS AND PRESERVATION

For samples to be shipped offsite, the laboratory performing the analyses will supply sample containers for this project. For samples to be analyzed onsite, the appropriate sample containers will be supplied. A complete set of sampling containers will be prepared for each sample in advance of the sampling event. Containers will be labeled with the date, time, project name, sample number, samplers initials, parameters for analysis, and preservative. A total of 54 primary samples, 14 sieve samples, 3 MS/MSD samples, 5 QC samples, 9 verification samples, and 1 IDW sample (for water) shall be collected. Temperature blanks will be used for all coolers containing samples requiring preservation at $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

5. SAMPLING DOCUMENTATION AND HANDLING

5.1 SAMPLE NUMBERING SYSTEM

A unique identification number will be assigned to each sample. The number is typically an alphanumeric sequence or integer that serves as an acronym to identify the sample. Specific sample identification procedures will follow the strategy outlined below:

Primary Sample	HAAF - designator - XXX
Duplicate Sample	HAAF - designator - D - XXX or HAAF- designator - XXX - MS/MSD
Verification Sample	HAAF- designator – XXX - V
Investigation-derived Waste	HAAF- IDW - XXX

<u>Designator</u>	<u>Name</u>
SPF	Spoils Pile F
SRW	South of the Runway DDT Hotspot
REV6	Revetment 6
REV7	Revetment 7
FITB	Firing-in Target Butt
FITB-F	Ammunition Fragments (Firing-in Target Butt)
SR	Skeet Range
SR-F	Ammunition and Skeet Fragments (Skeet Range)
TR	Testing Range Area
TR-F	Ammunition Fragments (Testing Range)
B35	Building 35
UPDD	Unlined Perimeter Drainage Ditch

XXX is the sequential sample number, starting at 701. D indicates the sample is a field duplicate sample, while MS/MSD indicates a matrix spike duplicate. IDW is the designator for investigation-derived waste. The IDW sequential sample numbers shall start at 1.

5.2 SAMPLE LABELS

The identification number references information pertaining to a particular sample. It is recorded on the sample container, in the field logbook, and on the sample chain-of-custody form. Following sample collection, the sample label is completed in waterproof ink and secured to the sample container with clear tape.

Each sample collected at the site will be labeled with the following information:

- Sample identification number;
- Site name;
- Date and time of collection;
- Name of person collecting the sample;
- Analysis requested;
- Preservation;
- Any other information pertinent to the sample.

5.3 FIELD LOGBOOK

A field notebook bound with serially numbered pages will be used to record personnel on site, sample identification numbers, sampling date and time, and any significant observations or events during field activities. The project name, site location, sampling event, project leader, telephone number and address of contact office (should the book be misplaced or lost) will be listed in ink. The field notebook is intended to record events during sampling in sufficient detail to allow field personnel to reconstruct events that transpired during the project

The Sampling Team Leader, who will sign and date the notebook prior to initiation of fieldwork will maintain the field notebook. If it is necessary to transfer the logbook to alternative personnel during the course of fieldwork, the person relinquishing the logbook will sign and date the logbook at the time the logbook is transferred and the person receiving the logbook will do likewise. Crossing a line through the entry and entering the correct information will make corrections to erroneous data. The correction will be initialed and dated by the person making the entry. Unused portions of logbook pages will be crossed out, signed, and dated at the end of each workday. Logbook entries must be dated, legible, in ink, and contain accurate documentation. Language used will be objective, factual, and free of personal opinions.

Hypotheses for observed phenomena may be recorded, however, they must be clearly indicated as such and only relate to the subject observation.

The sample identification number, sample media, number of containers and laboratory analyses to be conducted are recorded with the sample identification number in the field log book and on the chain-of-custody.

The date and time of sample preparation and collection, and the personnel who conducted sampling are recorded with the sample identification number in the field logbook and on the chain-of-custody form. The names of visitors and other persons on site are also recorded in the field logbook. Sampling personnel will also record the ambient weather conditions and other conditions at the sampling location that may affect sample collection, the apparent representativeness of the sample, or sample analysis in the field log book.

5.4 SAMPLE PACKAGING AND SHIPPING

Samples will be transported as soon as possible after sample collection for immunoassay field test kit analysis or offsite laboratory analysis. The following procedures are to be used when packing and transporting samples to the offsite laboratory:

- Use rigid plastic coolers;
- Tape the cooler drain closed both inside and out;
- Wrap glass containers with cushioning material;
- Package samples in individual plastic bags and place in cooler;
- Place a temperature blank in the cooler;
- Package ice in double plastic bags and place bags around, among, and on top of the samples;
- Put paperwork (chain-of-custody record, etc.) in a waterproof plastic bag and tape it to the inside lid of the cooler;
- Tape the cooler lid shut with fiber-reinforced tape;
- Place two signed custody seals on cooler, one at the front right and one at the back left of cooler;
- Attach completed shipping label to the top of cooler and ship following the carrier's instructions.

Sample coolers are typically shipped by overnight express carrier to the laboratory. A copy of the bill of lading (air bill) is to be retained and becomes part of the sample custody documentation. The offsite laboratory will be notified in advance of all shipments, preferably by telephone on the day of shipment and by advanced scheduling.

5.5 CHAIN OF CUSTODY PROCEDURES

Custody of samples must be maintained and documented from the time of sample collection to completion of the analyses. Each sample will be considered to be in the sampler's custody, and the sampler will be personally responsible for the care and custody of the samples until they are delivered to the courier service for delivery to the laboratory. A sample is considered to be under a person's custody if:

- The sample is in the person's physical possession;
- The sample is in view of the person after that person has taken possession;
- The sample is secured by that person so that no one can tamper with the sample; or
- The sample is secured by that person in an area that is restricted to authorized personnel.

All samples will be accompanied to the offsite laboratory by a chain-of-custody (COC) form. The chain-of-custody form contains the following information:

- Project name;
- Sample numbers;
- Sample collection point;
- Date and time of collection of samples (these must match the date and time recorded on the sample label);
- Sample matrix description;
- Analyses requested for each sample;
- Preservation method;
- Number and type of containers used;
- Any special handling or analysis requirements;
- Signature of person collecting the samples;
- Signature of persons involved in the chain of possession; and

- Names and telephone numbers of the project point of contacts (POCs).

The chain-of-custody record forms will be filled out with ink. Prior to packaging samples for shipment, all samples should be double checked against the chain of custody form. When the samples are transferred from one party to another, the individuals will sign, date, and note the time on the form. A separate COC will accompany each delivery of samples to the laboratory. The chain-of-custody form will be included in the cooler used for preservation and transport of the samples. The sampling personnel will retain a copy of the form.

6. INVESTIGATION-DERIVED WASTE

Expected or potential sources of investigation-derived waste (IDW) for this project include rinse water from decontamination procedures. The waste decontamination fluids will be collected during the decontamination procedures. Rinse water shall be collected in separate buckets during decontamination. All containers shall be Department of Transportation (DOT) approved. Each container shall be labeled with a potential hazardous waste label indicating date sample was collected and Contaminated Waste Water. IDW in each container shall be characterized prior to disposal. If the characterization results indicate the materials in a container are hazardous, the container shall be labeled with a Hazardous Waste Label. USACE will dispose of the small amounts of IDW in accordance with all Federal, state, and local regulations.

Personal Protective Equipment (PPE), including nitrile gloves and tyvex overalls/booties, will be handled as non-hazardous waste.

The field report will document IDW disposal.

7. REFERENCES

- IT Corporation, *1998 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Final, April 2000.
- IT Corporation, *1999 Interim Removal Action Data Report, BRAC Property, Hamilton Army Airfield*, Revision A, April 2000.
- Main Airfield Parcel Record of Decision/Remedial Action Plan, Hamilton Army Airfield*, Public Comment Final, August 2003.
- Shaw Environmental, Inc., 2003, *Final Construction Report and Supplemental Construction Report for Building 41 Demolition and Soil Removal, Spoils Pile F Removal, and Revetments 6 and 7 Removal, Hamilton Army Airfield*, May 2003.
- USACE, *Results of the Area-Wide DDT Site Investigation, Hamilton Wetlands Restoration Project*, Draft, May 2003.
- U.S. Environmental Protection Agency (EPA), 1996, *Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition*, December 1996.
- U.S. Fish and Wildlife Service Biological Opinion and amending letter, August 2003 and September 2003.

ATTACHMENT A

STANDARD OPERATING PROCEDURE 1-1

FIELD SAMPLE COLLECTION: SIEVING

Standard Operating Procedure

(December 8, 2003)

Field Sample Collection: Sieving

Soil samples for sieving may be collected using a trowel, round-point shovel, or soil auger, and if necessary, sampling may be facilitated with a pick or digging bar. Sieve samples should be obtained in the following manner:

1. Place the soil from the desired sample depth in the clean, coarse sieve box. (standard 25-mm or 1" screen size).
2. Agitate the screen to facilitate the process. Collect sieved soil onto a clean piece of visqueen or into a stainless steel bowl. A plastic or wooden mallet may be used to break up dirt clods. Note: site conditions may require the screened sample be sieved through an intermediate screen size (e.g., standard 9.5-mm or 3/8") before being placed in the fine sieve box.
3. Place the coarsely sieved soil from the first box in the clean, finer sieve box (standard 14 – 1.4-mm screen size).
4. If sieving for bullets or pellets, and soil clumping prevents effective sieving, place the sieve within a 5-gallon bucket and either wash the soil through the sieve or soak the clumps prior to sieving. Containerized water will be managed as investigation-derived waste in accordance with the BRAC Miscellaneous Sampling Work Plan (December 2003).
5. Count the number and type of pellets, clay pigeon fragments, or bullets encounters and record the numbers on the field sampling log. After counting, return the fragments to the sampling location.
6. Mark the sample location using a pin flag, wooden stake, or equivalent.

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

**QUALITY ASSURANCE PROJECT PLAN
MISCELLANEOUS SITE INVESTIGATIONS
HAMILTON ARMY AIRFIELD**

NOVATO, CALIFORNIA

Final Submittal

Prepared by:



**US Army Corps
of Engineers ®**

Sacramento District
Environmental Design Section

January 2004

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Table C-2	Data Qualifier Convention for GC Analyses
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ATTACHMENT D

Immunoassay Test Instructions

LIST OF ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
bgs	below ground surface
BRAC	Base Realignment and Closure
CCB	Continuing Calibration Blank
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CDQAR	Chemical Data Quality Assessment Report
CESPK	Corps of Engineers, Sacramento District
CL	Control Limit
COC	Chain of Custody
CRWQCB	California Regional Water Quality Control Board
CVAA	Cold Vapor Atomic Absorption
cy	cubic yards
DL	Detection Limit
DoD	Department of Defense
DQO	Data Quality Objectives
DTSC	California Department of Toxic Substances Control
ECD	Electron Capture Detector
EDD	Electronic Data Deliverable
ELCD	Electrolytic Conductivity Detector
EPA	Environmental Protection Agency
FITB	Firing-in Target Butt
FSP	Field Sampling Plan
GC	Gas Chromatograph
HAAF	Hamilton Army Airfield
ICAL	Initial Calibration
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma (Spectroscopy)

ICS	Interference Check Standard
ICV	Initial Calibration Verification
IS	Internal Standard
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
MS	Matrix Spike
MSA	Method of Standard Addition
MSD	Matrix Spike Duplicate
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
NELAC	National Environmental Laboratory Accreditation Conference
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
P.E.	Professional Engineer
PM	Project Manager
PAHs	Polynuclear Aromatic Hydrocarbons
QL	Quantitation Limit
QA	Quality Assurance
QAC	Quality Assurance Chemist
QAPP	Quality Assurance Project Plan
QC	Quality Control
RF	Response Factor
RPD	Relative Percent Difference
RRF	Relative Response Factor
RSD	Relative Standard Deviation
RT	Retention Time
SD	Serial Dilution
SIM	Selective Ion Monitoring
SOPs	Standard Operating Procedures
SPCC	System Performance Check Compounds
Total DDTs	Sum of DDD, DDE, and DDT concentrations

USACE U.S. Army Corps of Engineers
USEPA U.S. Environmental Protection Agency
WP Work Plan

QUALITY ASSURANCE PROJECT PLAN MISCELLANEOUS SITE INVESTIGATIONS HAMILTON ARMY AIRFIELD

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents functions, procedures, and specific quality assurance (QA) and quality control (QC) activities designed to achieve the data quality goals for the various objectives of the sampling efforts at miscellaneous in-board sites described in the Data Quality Objectives (DQOs) at Hamilton Army Airfield. This project is conducted by the Environmental Design Section of the U.S. Army Corps of Engineers, Sacramento District (CESPK) on behalf of the Army Base Realignment and Closure (BRAC) environmental office. This QAPP is prepared in accordance with EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans (U.S. EPA, 2001). This document accompanies the Work Plan (WP), DQOs, and the Field Sampling Plan (FSP).

1.1 Site Location and Project Objectives

The site locations are illustrated in Figure 1-1 of the Work Plan. The objectives for the following sites included in this sampling effort are summarized below.

Spoils Pile F – Confirm full removal of Total DDT-contaminated soil
South of the Runway DDT hotspot – Determine extent of Total DDT hotspot
Building 35 – Determine extent of Total DDT contamination under discharge pipe
Unlined PDD – Determine extent of Total DDTs in the northwest corner of the PDD
Revetments 6&7 – Determine if mercury within these excavations exceeds action goals
Firing-in Target Butt (FITB) – Identify any residual contamination from Department of Defense (DoD) activities
Skeet Range - Identify any residual contamination from DoD activities
Testing Area – Identify any residual contamination from DoD activities

1.2 QAPP Objectives and Use

Standard procedures and specifications are established to ensure that all laboratories produce comparable data, and that data quality is consistently assessed and documented. The specific objectives of this QAPP are to:

- provide standardized references and quality specifications for all anticipated field sampling, analysis, and data review procedures required for the project sites;
- provide guidance and criteria for selected field and analytical procedures; and

- establish procedures for reviewing and documenting compliance with field and analytical procedures.

The fieldwork will include sediment and soil sample collection, field analysis, sample packaging, and shipping to offsite laboratory for analysis.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Corps of Engineers

The following Sacramento District, Corps of Engineers personnel have been assigned to accomplish the sampling design and execution required supporting this project. The USACE Project Manager is Ray Zimny. The project execution will be performed under the general supervision of Rick Meagher P.E., Chief of Environmental Design Section. The technical team consists of the following personnel:

Technical Team Leader/Chemist:	Kathy Siebenmann	(916) 557-7180
Sampling Team Leader/Geologist:	Teresa Rodgers	(916) 557-6624
Health & Safety Manager:	Donna Maxey	(916) 557-7437
USACE fax number:		(916) 557-7465

2.2 Project Management

2.2.1 Technical Team Leader

The Technical Team Leader will be responsible for reviewing the sampling plans and associated field activities, and ensuring that all sampling activities conform to the QAPP. The Project Leader will oversee quality assurance of field activities. Prior to the start of field activities, preparatory meetings will be held with the field crew. If field conditions require modifications to protocol outlined in the SAP or if questions arise, the Sampling Team Leader or field crew will contact the Technical Team Leader for direction. The Technical Team Leader will also be responsible for overseeing the project and subcontractors, directing field crews, and the compilation of data. The Technical Team Leader reports to the Section Chief.

2.2.2 Project Chemist

The Project Chemist will have a “hands on” role in management of project tasks associated with sampling and analysis. These tasks include:

- Coordination with the analytical laboratory to ensure readiness to implement project specific requirements,
- Review of analytical data as it becomes available to ensure conformance with quality standards, and

- Implementation of corrective actions in accordance with QAPP specifications when review of data uncovers deficiencies.

2.2.3 Sampling Team Leader

The Sampling Team Leader will be responsible for quality assurance of field activities and for executing all work elements related to the sampling program, including documenting field activities, maintaining field notes and photographs, maintaining a record of onsite personnel and visitors, and implementing the sampling plan. These tasks include instruction of field personnel in sampling and preservation requirements and general oversight of field personnel involved in sampling activities.

2.2.4 Health and Safety Manager

The certified industrial hygienist is responsible for the general health and safety plan development and training for field personnel. This individual is also responsible for ensuring that health and safety procedures are understood and followed by all field personnel, and for reporting and correcting any violations of policy or regulations.

2.2.5 Field Crew

Field crew personnel will be responsible for performance of project mobilization, demobilization, sample collection and oversight. Field personnel will report to the Sampling Team Leader. Field personnel will include members of the USACE Environmental Engineering Branch, Sacramento District.

3.0 QUALITY OBJECTIVES FOR ENVIRONMENTAL DATA

The term “data quality” refers to the level of uncertainty associated with a particular data set. Data quality associated with environmental measurement is a function of the sampling plan rationale and procedures used to collect the samples, as well as of the analytical methods and instrumentation used in making the measurements. Uncertainty cannot be entirely eliminated from environmental data. However, quality assurance programs effective in measuring uncertainty in data are employed to monitor and control excursions from the desired data quality objectives (DQOs). The DQO process and data needs are specified in Appendix A of the Work Plan. Sources of uncertainty that can be traced to the sampling component are poor sampling plan design, incorrect sample handling, faulty sample transportation, and inconsistent use of standard operating procedures. The most common sources of uncertainty that can be traced to the analytical component of the total measurement system are calibration and contamination.

The purpose of this QAPP is to ensure that the data collected are of known and documented quality and useful for the purposes for which they are intended. The procedures described are designed to obtain data quality indicators for each field procedure and analytical method. Data quality indicators include the PARCC parameters (i.e., Precision, Accuracy, Representativeness, Comparability, and Completeness). To ensure that quality data continues to be produced, systematic checks must show that test results and field procedures remain reproducible and that the analytical methodology is actually measuring the quantity of analytes in each sample.

A laboratory certified by the State of California and validated by the USACE or successfully audited by National Environmental Laboratory Accreditation Conference (NELAC) auditors will generate all laboratory chemical data. Laboratories must have an in-place program for data reduction, validation, and reporting as discussed in Section 7.0. The reliability and credibility of analytical laboratory results can be corroborated by the inclusion of a program of scheduled replicate analyses, analyses of standard or spiked samples, and analysis of split samples with QA laboratories for some projects. Regularly scheduled analyses of known duplicates, standards, and spiked samples are a routine aspect of data reduction, validation, and reporting procedures.

All data that will be collected for this project will be definitive data using EPA procedures and will be usable in identification, characterization, and engineering design. The data obtained will conform to the quality control requirements specified in the following text and the tables accompanying this document.

4.0 SAMPLE ACQUISITION, CUSTODY, MANAGEMENT, AND DECONTAMINATION

Sample acquisition, custody, management, and decontamination procedures are described in the Field Sampling Plan (FSP) (Appendix B).

The samples will be sent to a State of California and USACE certified or NELAC audited laboratory. The USACE certification includes in-depth audits to determine if quality assurance and quality control measures are in place and adequate. These audits are based upon many of the same elements as the NELAC audits. The address and point of contact will be listed below in the final QAPP pending selection of laboratory through the competitive bidding process.

Point of Contact: Jim Carter
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501
Phone: (310) 618-8889 #105
Fax: (310) 618-0818

5.0 ANALYTICAL METHODS AND CALIBRATION

This section contains brief descriptions of preparation and analytical methods that will be used to analyze soil samples collected for this project. These methods are listed in Table 5-1.

Table 5-1. Summary of Analytical Methods

Analytes	Preparatory	Analytical
Metals (antimony, arsenic, cadmium, chromium, copper, lead, nickel, zinc)	SW3050B	SW6010B
Mercury	Method	SW7471A
DDT, DDE, DDD	SW3550B, SW3630C	SW8081A
Polynuclear Aromatic Hydrocarbons (PAHs)	SW3550B	SW8270C Modified

If during the course of a project, it becomes necessary to apply a different quantitation limit because of changes in instrument capabilities, the Project Chemist will be notified and approval must first be obtained in instances where higher quantitation limits result. Methodology references contain specific QC criteria associated with the particular methods. These specific requirements include calibration and QC samples, and are described in detail within the methods. Daily performance tests and demonstrations of precision and accuracy are required. These calibration and QC samples are listed in Attachment A to this QAPP.

The laboratory methods identified in this document were published by the United States Environmental Protection Agency (U.S. EPA) in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846*, Third Edition (November 1986; Revision 1, July 1992; and Revision 2, November 1992, Update I, August 1993, Update II, September 1994, Update III, 1998). Preservation and holding times for these analytical procedures are presented in Table 5-2. Attachment A summarizes the calibration and the internal quality control procedures; Attachment B lists the quantitation limits and action goals that will be used for this project.

Table 5-2. Preservation and Holding Times

Method	Chemical Preservation	Holding Time	Temperature Preservation
SW8081A and SW4042	None	14 days before extraction, 40 days after extraction	Cool to 4°C
Modified SW8270C	None	14 days before extraction, 40 days after extraction	Cool to 4°C
SW6010B	None	40 days before digestion, 6 months after digestion	None
SW7471A	None	28 days to analysis	Cool to 4°C

5.1 Sample Preparation and Analytical Field Method

Total DDTs will be analyzed according to Method SW4042 in the field using an immunoassay field test kit to direct stepout sampling. A weighed portion of the soil sample is extracted with deionized water and filtered. An aliquot of the extract and an enzyme-DDT conjugate are added to immobilized DDT antibody. The enzyme-DDT conjugate competes with DDT present in the sample for binding to DDT antibody. The enzyme-DDT conjugate bound to the DDT antibody then catalyzes a colorless substrate to a colored product. The concentration range is indicated by comparing the color of the sample to the response produced by a reference reaction. The reference standard concentrations will include both 0.2 mg/kg and a 1 mg/kg of DDT. The manufacturer's instructions are included in Attachment D.

5.2 Sample Preparation and Analytical Methods - Organic

The following sections briefly summarize the sample preparation and analytical methods to be performed for the determination of organic analytes. Various cleanup methods may be used, depending upon the interferences encountered following extraction. Not all potential cleanup methods are included below. The Project Chemist should be advised of any alternative cleanup methods proposed by the laboratory.

5.2.1 Method SW3550B: Sonication Extraction

Method 3550B is a procedure for extracting nonvolatile and semivolatile organic compounds from solids such as soils, wastes, and sludges. The sonication process ensures intimate contact of the sample matrix with the extraction solvent. A weighted portion of the solid material is mixed with the anhydrous sodium sulfate, ground to form a free-flowing powder, and

then dispersed into the methylene chloride. The extract is separated from the sample by vacuum or gravity filtration, or centrifugation, and then dried with anhydrous sodium sulfate and concentrated to an appropriate volume for analysis.

5.2.2 Method SW3630C: Silica Gel Cleanup

Generally, solid-phase extraction cartridges filled with silica gel are used. Aliquots of sample extract are loaded onto the cartridges that are then eluted with suitable solvents, depending upon the analysis method. The collected fractions are analyzed by the appropriate method.

5.2.3 Method SW3640A: Gel-Permeation Cleanup

The extract is passed through a column containing a hydrophobic gel absorbent. The column is then flushed with clean organic solvents to separate the interferences from the analytes of interest by retention time.

5.2.4 Method SW8081A: Total DDTs

Method SW8081A is used to determine the concentration of DDD, DDE, and DDT on a gas chromatograph (GC). Prior to analysis, the sample is extracted into solution. An aliquot of solution is injected into an open-tubular capillary column, and detected by an electron capture detector (ECD) or electrolytic conductivity detector (ELCD). Any compounds identified tentatively in the primary analysis are confirmed on a second GC column.

5.2.5 Modified Method SW8270C: Polynuclear Aromatic Hydrocarbons by GC/MS Selective Ion Monitoring

Method SW8270C is used to quantify most neutral, acidic, and basic organic compounds that are soluble in methylene chloride. Such compounds include polynuclear aromatic hydrocarbons (PAHs). The concentrated extract is injected into a gas chromatograph for separation and detected by mass spectrometry. Mass spectrometry provides a characteristic ion pattern for fragmented target analytes, providing a high level of confidence in compound identification. Compounds are quantitated by comparing the response of a characteristic ion to the average response from a 5-point calibration. The internal standard technique is used for calibration. The instrument will be modified for selective ion monitoring (SIM) to reduce interferences and lower the quantitation and detection limits of PAHs for this project. Aliquot of the extract is injected into a GC/MS that is set up to detect only specific ions found in the PAH

analytes.

5.3 Sample Preparation and Analysis Methods - Inorganic

The following sections briefly summarize the sample preparation and analysis methods to be performed for the determination of inorganic analytes.

5.3.1 Method SW3050B: Acid Digestion of Sediments, Sludges, and Soils

This digestion procedure is used for the preparation of solid samples for analysis by inductively coupled plasma/atomic emission spectroscopy (ICP). A mixture of nitric acid, and the material to be analyzed is refluxed in a covered Griffin beaker or equivalent. This step is repeated with additional portions of nitric acid until the digestate is light in color or until its color has stabilized. Hydrogen peroxide is then added and the mixture warmed. The digestate is then cooled and brought to a low volume with water. If the digestate contains suspended solids, it must be centrifuged, filtered, or allowed to settle before analysis.

5.3.2 Method SW6010B: Inductively Coupled Plasma-Atomic Emission Spectrometry

ICP determines elements in solution. The sample requires digestion by Method SW3050B for soil prior to analysis.

The method provides a simultaneous or sequential multi-element determination of elements by ICP. Element-emitted light is measured by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific atomic line emission spectra are produced by radio frequency inductively coupled plasma. The spectra are dispersed and photo-multiplier tubes monitor the intensities of the lines. The spectra are the physical property of the element and the intensity is proportional to the concentration of the element in solution.

5.3.3 Method SW7471A: Cold Vapor Atomic Absorption Spectroscopy

Method SW7471A is based on the absorption of radiation at the 253.7 nm wavelength by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance is measured as a function of mercury concentration. Quantitation is accomplished by comparing the absorbance to a five-point calibration curve prepared from standards of known mercury concentration.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

6.1 Calibration Procedures and Frequency

All instruments and equipment used during sample analysis are operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations, as well as criteria set forth in the applicable analytical methods. Personnel properly trained in these procedures will operate, calibrate, and maintain the instruments. Laboratory capabilities will be demonstrated initially for instrument and reagent/standards performance as well as accuracy and precision of analytical methodology.

Calibration of instruments is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet established quantitation limits. Each instrument will be calibrated with standard solutions appropriate to the type of instrument and the linear range established for the analytical method presented in Section 5.0. The frequency of calibration and calibration verification and the concentration of calibration standards are determined by the manufacturer's guidelines and the analytical method. Calibration procedures for all instruments are summarized in the method-specific tables in Attachment A. All samples must be bracketed by passing calibration check samples for the majority of methods. Failure to bracket all samples with acceptable calibration checks may result in the reanalysis of affected samples.

6.1.1 Gas Chromatography

The field of chromatography involves a variety of instrumentation and detection systems. While calibration standards and acceptance criteria vary depending on the type of system and analytical methodology required for a specific analysis, the general principles of calibration apply uniformly. As outlined in EPA SW-846 procedures, each chromatographic system is calibrated prior to performance of analyses using five concentrations by external standard technique for all columns. The lowest calibration standard shall be within a factor of two relative to the QL, and the others corresponding to the expected range of concentrations or defining the working range of the detector. This is done on each chromatographic column and each instrument at the beginning of the contract period and each time a new column is installed. The results are used to determine a calibration curve and response factors for each analyte. Initial calibration consists of determining the working range, establishing limits of detection, and establishing retention time windows. The calibration is checked on a daily basis to ensure that

the system remains within specifications. Second column confirmation is required for single compound analytes.

Continuing calibration standards are analyzed to check the instrument response relative to the initial calibration curve at the beginning and end of each analytical run. Calibration checks are also performed for overall system performance and for retention time shifts, as specified in SW-846. Individual and standard mixes are analyzed to establish response factors and absolute retention time. The response factors and retention times are verified throughout the analytical run and at the end of the analytical sequence. Each analyte must be within its retention time window or the analyst shall take corrective action. For GC analyses conducted on this project, the response factor must agree with the factor determined during the initial 5-point calibration within 15% for quantitation analysis utilizing SW-846 methodology.

The instrumental detection limit, the linear range of the instrument, and interference effects must be established for each individual analyte on that particular instrument. The calibration is verified initially prior to sample analysis using an independent second source standard. Calibration verification standards are analyzed after every 10 samples using a midrange calibration check standard and must be within 15% of the expected value.

6.1.2 GC/MS analysis

Each day prior to analysis of samples, the instrument is tuned with bromofluorobenzene for volatile compounds and decafluorotriphenylphosphine for semivolatile compounds or other tuning criteria as specified by the method used. Mass spectral peaks must conform both in mass numbers and relative intensity to method-specified requirements before analyses can proceed.

The instrument is then calibrated for all target compounds. An initial calibration curve is produced to define the working range to establish criteria for identification. All GC/MS instruments are calibrated at five different concentrations for analytes of interest, using the procedures outlined in SW-846. Method system performance check compounds (SPCC's) must show a minimum mean response factor and method calibration check compounds (CCC) must show a relative standard deviation (RSD) less than the method specified standard for the initial calibration to be considered valid. On a daily basis, SPCC's must meet the same criteria relevant for the initial calibration and CCCs must show a minimum percent drift relative to the expected concentration of the CCC to be considered valid. This initial calibration is evaluated on a daily basis to ensure that the system is within calibration. If the daily standard does not meet the

established criteria, the system is recalibrated. These procedures will be modified for selective ion monitoring.

Following a successful tune, the initial five-point calibration is verified by a single mid-range concentration standard. The calibration is verified daily prior to sample analysis using an independent second source standard. This initial calibration can be utilized as long as the calibration verification remains valid.

6.1.3 Inductively Coupled Argon Plasma-Atomic Emission Spectrometry (ICPES) Metals

Plasma emission spectrophotometry, also termed inductively coupled argon plasma (ICP) spectrometry, is calibrated daily using either one standard solution and one blank or a four-point calibration (3 levels plus blank). For the single standard calibration, the calibration standard must be within the demonstrated linear range of the instrument. The instrumental detection limit, the linear range of the instrument, and interference effects must be established for each individual analyte on that particular instrument. The linear range is verified at the time of the analysis by analyzing the highest calibration standard as a sample, the results of which must be within $\pm 5\%$ of its true value. The calibration is verified initially prior to sample analysis using an independent second source standard at a concentration mid-range of the calibration. Continuing calibration checks are analyzed after every 10 samples using a mid-range calibration check standard and must be within $\pm 10\%$ of the expected value. Sensitivity is established at the lower calibration level by analyzing a low level standard at the QL (3 to 5 times the MDL). Calibration blanks are analyzed after all calibration check standards and no analytes may be detected above one-half the QL. An interelement check standard is analyzed at the beginning and end of each analytical run, to verify that interelement and background correction factors have remained constant. Results outside of the established criteria trigger reanalysis of samples.

6.1.4 Atomic Absorption Spectroscopy

The instrument must be calibrated and checked for contamination before each set of samples. An initial calibration (ICAL) consists of a minimum of a blank and three calibration standards. The least concentrated standard will be at a concentration corresponding to the QL. The remaining standards will define the working range of the instrument. A linear regression fit of the calibration data must yield a correlation coefficient must be at least 0.995. Failure to meet these criteria will require recalibration and possible preparation of a new set of standards. Prior to sample analysis, an initial calibration verification (ICV), consisting of a second source standard, and an initial calibration blank (ICB) will be analyzed to verify the quantitation and to detect any contamination. A continuing calibration verification (CCV) at a mid-curve

concentration and CCB will be analyzed every 10 samples and at the end of analytical sequence. If the CCV value varies from the predicted concentration by more than + 10% then the analysis must be stopped. The problem must be identified and corrected, and rerun the impacted samples. All samples must be bracketed by calibration standards that meet the stated criteria.

6.2 Standard and Reagent Preparation

A critical element in the generation of quality data is the purity and traceability of the standard solutions and reagents used in the analytical operations. The preparation and maintenance of standards and reagents will be performed per the specified analytical methods presented in Section 5.0. The laboratory shall continually monitor the quality of reagents and standard solutions through a series of well-documented standard operating procedures (SOPs). In general, SOPs for standards preparation should incorporate the following items:

- Documentation and labeling of date received, lot number, date opened, and expiration date;
- Documentation of traceability;
- Preparation, storage, and labeling of stock and working solutions; and
- Establishing and documenting expiration dates and disposal of unusable standards.

Primary reference standards and standard solutions used by the laboratory are to be obtained from the National Institute of Standards and Technology, or other reliable commercial sources to ensure the highest level of purity possible. All standards and standard solutions shall be catalogued to identify the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and all other pertinent information included in the specific SOP.

Standard solutions and reagents are validated prior to use. Validation procedures can range from a check for chromatographic purity to verification of the concentration of the standard using a standard prepared at a different time, concentration or source. Reagents are examined for purity by subjecting an aliquot or subsample to the analytical method in which it will be used; for example, every lot of dichloromethane (for organic extractables) is analyzed for undesirable contaminants prior to use in the laboratory. Stock and working standards are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change in concentration.

6.3 Field Quality Control Checks

Quality control checks in the field will include the collection of field duplicate and temperature blank samples. These QC checks are described in Section 4.2 of the FSP. In addition, the quality control checks associated with the immunoassay field analytical technique also include collection and analysis of duplicate samples, control samples, and reference standards.

6.4 Laboratory Quality Control Procedures

The Project Laboratories will have a QA/QC program that monitors data quality with internal QC checks. Internal QC checks are used to answer two questions:

- 1) Are laboratory operations in-control, (i.e., operating within acceptable QC guidelines), during data generation?
- 2) What effect does the sample matrix have on the data being generated?

Laboratory performance QC is based on the use of a standard control matrix to generate precision and accuracy data that are compared, on a daily basis, to control limits. This information, in conjunction with method blank data, is used to assess daily laboratory performance.

The second question is addressed with matrix-specific QC. Matrix-specific QC is based on the use of an actual environmental sample for precision and accuracy determinations and commonly relies on the analysis of matrix spikes, matrix spike duplicates, and surrogate standards. This information, supplemented with field blank results, is used to assess the effect of the matrix and field conditions on analytical data.

Laboratory performance QC will be provided as a standard part of every routine analysis. Matrix-specific QC frequency will be required per the tables in Attachment A. A brief summary of the required QC samples follows. The type and frequency of QC samples performed by the laboratory will be according to the specified analytical method.

6.4.1 Analytical Batch (Preparation Batch)

The analytical batch is defined as a set of samples that are extracted/analyzed concurrently or sequentially. The analytical batch will not exceed 20 samples. Significant gaps (greater than two hours) in the analytical sequence will result in the termination of the previous sequence and the initiation of a new analytical sequence. The analytical batch shall be analyzed sequentially on a single instrument. The practice of "holding a batch open" and performing a single set of batch QC samples for all analyses performed during that period is unacceptable.

The laboratory shall, at a minimum, analyze internal QC samples at the frequency specified in this QAPP for all analytical methods. These QC samples for each analytical batch shall include method blanks (MB) and laboratory control samples (LCS). Definitions for the QC samples described above are provided in Chapter 1, Update III to EPA SW-846. The matrix used for LCS analyses shall be reagent grade water for aqueous analyses and reagent sand for soil/sediment matrices.

Second column confirmation for all GC sample analyses involving identification of discrete peaks with detected concentrations will be required, as per the methods. Second column confirmation is not required for concentrations reported between the MDL and the QL.

6.4.2 Blanks

Two types of blanks routinely analyzed in the laboratory are method blanks and reagent blanks. Method blanks and reagent/solvent blanks are used to assess laboratory procedures as possible sources of sample contamination and can affect accuracy of the data.

Method or preparation blanks for all samples consist of deionized water or reagent sand that is subjected to the entire analytical procedure, including extraction, distillation, digestion, etc., as appropriate for the analytical method being utilized. One method blank will be analyzed for each analytical batch (minimum of one per day; one every 12 hours for GC/MS analyses). If the blank does not meet acceptance criteria, the source of contamination will be investigated and appropriate corrective action will be taken and documented. Investigation includes an evaluation of the data to determine the extent and effect of the contamination on the sample results. Corrective actions may include reanalysis of the blank and/or repreparation and reanalysis of the blank and all associated samples. No method blank may exhibit a detected concentration greater than the quantitation limit. However, exceptions may be made when the analyte is not detected in the related sample. Sample results are not corrected for blank contamination unless required by the analytical method.

Reagent/solvent blanks consist of individual reagents or solvents subjected to the entire analytical procedure as appropriate for the analytical method being utilized. The blanks are only used if contamination problems are indicated by the method blank or if a new lot of materials are being checked before use.

6.4.3 Laboratory Control Samples

Laboratory control samples (LCS) are used as a means of evaluating the efficiency of the analytical process. As discussed above, LCS is used to generate precision and accuracy data that are compared, on a daily basis, to control limits. Laboratory control samples are subjected to the

entire sample procedure, including extraction, digestion, etc., as appropriate for the analytical method utilized. They are generally introduced into an analytical batch (20 samples) immediately before extraction or analysis. LCS samples will be performed for both inorganic and organic laboratory methods.

6.4.4 Matrix Spikes and Matrix Spike Duplicates

A Matrix Spike (MS) is an environmental sample to which known concentrations of analytes have been added. The MS is taken through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis.

A Matrix Spike Duplicate (MSD) is a duplicate of the environmental sample described above, each of which is spiked with known concentrations of analytes. The two spiked samples are processed separately and the results compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results are expressed as relative percent difference (RPD) and percent recovery (%R).

6.4.5 Surrogate Recoveries and Standard Additions

Surrogates are organic compounds which are similar to the analytes of interest in chemical behavior, but which are not normally found in environmental samples. Surrogates are added to samples to monitor the effect of the matrix on the accuracy of the analysis for each sample. Results are reported in percent recovery. Laboratories routinely add surrogates to samples requiring GC or GC/MS analysis and report these surrogate recoveries to the client. The laboratory does not modify its operations based on surrogate recoveries in environmental samples. However, obvious problems with sample preparation and analysis (e.g. evaporation to dryness, leaking septum, etc.) which can lead to poor surrogate spike recoveries must be ruled out prior to attributing low surrogate recoveries to matrix effects.

Standard Additions is the practice of adding a series of known amounts of an analyte to an environmental sample. The fortified samples are then analyzed and the recovery of the analytes calculated. The practice of standard addition is generally used with metals analysis and wet chemistry to determine the effect of the sample matrix on the accuracy of the analyses.

6.4.6 Calibration Standard

A calibration standard is prepared in the laboratory by dissolving a known amount of a purchased pure compound or standard mix in an appropriate matrix. The final concentration calculated from the known quantities is the true value of the standard. The results obtained from

these standards are used to generate a standard curve and thereby quantify the compound in the environmental sample.

6.4.7 Reference Standard

A reference standard is prepared in the same manner as a calibration standard or may be obtained from National Institute of Standards and Testing (NIST). A reference standard is obtained from a source independent of the source of the calibration standard. The concentration of the known quantity is the “true” value of the standard. A reference standard is not carried through the same process used for the environmental samples, but is analyzed without digestion or extraction. A reference standard result is used to validate an existing concentration calibration standard file or calibration curve. The reference standard can provide information on the accuracy of the instrumental analytical method independent of various sample matrices.

6.5 Sensitivity

6.5.1 Method Detection Limit (MDL)

The method detection limit (MDL) is the lowest concentration at which a specific analyte in a matrix can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero. MDLs are experimentally determined for each target analyte of the method. Each individual instrument will maintain a current MDL study. MDLs are based on the results of seven spikes of clean matrix at the estimated MDL and are statistically calculated in accordance with the Title 40, Code of Federal Regulations Part 136 (40 CFR 136), Attachment B. The standard deviation of the seven replicates is determined and multiplied by 3.143 (i.e., the 99-percent confidence interval from the one-sided student t-test). The MDLs are updated annually and whenever significant instrument maintenance is performed (i.e., GC Column, AA lamp, etc.).

6.5.2 Quantitation Limit (QL)

The quantitation limit is defined by the lowest concentration in the multi-point initial calibration. The QL is the lowest level for quantitation decisions based on individual measurements for a given method and representative matrix. The QL for this project is based on a project-specific action level and the capability of the method and laboratory. Detected results above the MDL but below the QL, are qualified with a J flag due to the very low comparator values. The J flag will denote the sample results as below the QL and as qualitative, estimated concentrations. This increases the probability of false positive results at these low concentrations, especially for the sample matrix anticipated for this project. However, analyst

judgment will be used to determine if an apparent detected value should be reported or appears to be a false positive due to the sample matrix (e.g., from baseline “noise”).

If dilution to bring the reported concentration of a single compound of interest within the linear range of the calibration, results in non-detect values for all other analytes with detected concentrations in the initial sample analysis, the results of the original run and the dilution will be reported with appropriate notations in the narrative of the report. Matrix effects (i.e., highly contaminated samples requiring dilution for analysis, dilution to bring detected levels within the range of calibration, and matrix interference requiring elevation of detection limits) will be considered in assessing compliance with the requirements for sensitivity. Cleanup procedures will be used to minimize interferences and lower the QLs to those required. In addition, the sample aliquot will be increased from the standard mass to make up for the increased QLs when data is reported on a dry weight basis (these samples are expected to be at least 50% moisture). This increased aliquot size may also increase the matrix interferences, as they too will have increased in mass. The QLs required by this project are listed in the method-specific tables in Attachment B of this document.

6.6 Corrective Action

The Sampling Team Leader is responsible for initiating corrective action and for implementation of all corrective actions with respect to the field sampling operations. The laboratory QA Director in consultation with the Project Chemist is responsible for implementing corrective actions in the laboratory. It is their combined responsibility to see that all analytical and sampling procedures are followed as specified and that the data generated meet the acceptance criteria. The acceptance criteria for some of the QC samples (LCS, surrogate recoveries) will be those calculated by the laboratory as control limits. The number of samples used to develop the statistical control limits shall be all those analyzed within the previous six months or a minimum of 20 datapoints. The comparison control limits in Attachment A are to ensure that the laboratory can produce data with acceptable accuracy. If the laboratory statistical limits are consistently different from the comparison limits, a different laboratory shall be selected for that analytical method, or an alternate analytical or preparation method shall be selected that increases the accuracy of the laboratory. Corrective action procedures are summarized for each method in Attachment A.

Corrective actions for the laboratory may include, but are not limited to:

- Reanalyzing samples;
- Correcting laboratory procedures;

- Recalibrating instruments using freshly prepared standards;
- Replacing solvents or other reagents that give unacceptable blank values;
- Training laboratory personnel in correct sample preparation and analysis procedures; and
- Accepting data with an acknowledged and documented level of uncertainty.

Whenever corrective action is deemed necessary, the Laboratory Director will ensure that the following steps are taken:

- The problem is defined;
- The cause of the problem is investigated and determined;
- Appropriate corrective action is determined; and
- Corrective action is implemented and its effectiveness verified.

6.7 Documentation

All calibration information, instrument maintenance and repair are recorded by the laboratory on appropriate forms developed for SW-846 procedures. Out-of-control analyses are generally described on a QA/QC discrepancy form and submitted to the laboratory supervisor for corrective action. Copies are distributed to the laboratory QA coordinator and laboratory director for approval, and to the case file. The calibration information is filed with the raw data.

7.0 DATA REDUCTION, VERIFICATION AND REPORTING

7.1 Laboratory Activities

7.1.1 Data Reduction and Verification

All analytical data generated within the laboratories shall be reviewed prior to report generation to assure the validity of the reported data. The data verification process consists of data generation, reduction, and three levels of documented review. In each stage, the review process will be documented by the signature of the reviewer and the date reviewed.

The analyst who generates the analytical data will have the prime responsibility for the correctness and completeness of the data. All data will be generated and reduced following protocols specified in laboratory SOPs. Each analyst will review the quality of his or her work based on an established set of guidelines outlined in the SOPs. The analyst will review the data package to ensure that:

- The correct samples were analyzed and reported in appropriate units,
- Preservation and holding time requirements were met,
- Sample preparation information is correct and complete,
- Appropriate SOPs have been followed,
- Analytical results are correct and complete,
- QC samples are within established control limits,
- Blanks are within appropriate QC limits,
- Special sample preparation and analytical requirements have been met, and
- Documentation is complete (e.g., all anomalies in the preparation and analysis have been documented, anomaly forms are complete; holding times are documented, etc.).

The data reduction and validation steps shall be documented, signed and dated by the analyst. The analyst will then pass the data package to an independent reviewer, who will perform an independent review of the data package. This review is also to be conducted according to an established set of guidelines and to be structured to ensure that:

- Calibration data are scientifically sound, appropriate to the method, and completely documented,

- QC samples are within established guidelines,
- Qualitative identification of sample components is correct
- Quantitative results are correct,
- Documentation is complete and correct (e.g., anomalies in the preparation and analysis have been documented; anomaly forms are complete; holding times are documented, etc.), and
- The data are ready for incorporation into the final report; and the data package is complete and ready for data archive.

The review is to be structured so that all calibration data and QC sample results are reviewed and all of the analytical results from 10% of the samples are checked back to the bench sheet. If no problems are found with the data package, the review is complete. If any problems are found with the data package, an additional 10% of the samples will be checked to the bench sheet. This process will continue until no errors are found or until the data package has been reviewed in its entirety.

Data reviews shall be documented and the signature of the reviewer and the date of review recorded. The reviewed data are then approved for release and a final report is prepared. Before the report is released to the client, the data are reviewed for completeness and to ensure that the data satisfy the overall objectives of the project. The Laboratory Project Manager typically does this review.

Each step of this review process involves evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of the data is essential in ensuring that data of high quality are generated consistently.

7.1.2 Data Reporting

At the conclusion of all analytical work for this project, the primary laboratory will submit a comprehensive certificate of analysis. The final certificates of analysis will be submitted no later than 21 days after the last sample has been submitted to the laboratory for the project. All samples shall be reported in a legally defensible package and electronic data deliverable (EDD) format consistent with the USACE, Sacramento District Automated Data Review (ADR) format. The data package may be submitted in a read-only electronic file, compatible with Adobe

Acrobat reader.

The data package for organics analyses will consist of a case narrative, chain-of-custody documentation, cooler receipt form, summary of results for environmental samples, summary of QA/QC results, and the data. Legible copies of all data will be organized systematically on numbered pages. The data for compound identification and quantitation must be sufficient to support all results presented in other sections of the data package. This section of the data package will include legible copies of the data for environmental samples (arranged in increasing order of field ID), and instrument calibration, QA/QC analyses, sample extraction and cleanup logs, instrument analysis logs for each instrument used. Instrument analysis logs are particularly important because they provide the basic link between all sample analyses and QC information (calibration, matrix spike, etc.). Instrument analysis logs for all instruments used for sample data for each analysis will include measurement printouts and quantitation reports for each instrument used.

Raw data will be available for further inspection, if required, and maintained in the central job file. All records related to the analytical effort are maintained at the primary laboratory in secured filing cabinets (i.e., cost information, scheduling, and custody). All records are maintained for five years after the final report is issued. Types of records to be maintained for the project include the following:

- Chain-of-custody records, including: information on the sampler's name, date of sampling, type of sampling, location of sampling, location of sampling station, number and type of containers used, signature of sampler relinquishing samples to non-contract personnel (e.g., Federal Express agent) with the date and time of transfer noted, signature of primary laboratory sample custodian receiving samples with date and time noted
- Cooler receipt form documenting sample conditions upon arrival at the laboratory.
- Any discrepancy/deficiency report forms due to problems encountered during sampling, transportation, or analysis
- Sample destruction authorization forms containing information on the manner of final disposal of samples upon completion of analysis
- All laboratory notebooks including raw data readings, calibration details, QC checks, etc

- Data system printouts (chromatograms, mass spectra, ICP data files, etc.)
- Tabulation of analytical results with supporting quality control information

7.1.2.1 Case Narrative

The case narrative will be written and the laboratory director or his/her designee will authorize the release of data. Items to be included in the case narrative are the field sample ID with the corresponding laboratory ID, parameters analyzed in each sample and the methodology used (EPA method numbers or other citation), detailed description of all problems encountered and corrective actions taken, discussion of possible reasons for out-of-control QA/QC results, and observations regarding any occurrences which may affect sample integrity or data quality.

7.1.2.2 Chain-of-Custody Documentation

Legible copies of chain-of-custody forms for each sample will be maintained in the data package. Cooler log-in sheets will be associated with the corresponding chain-of-custody form. Any integral laboratory-tracking document will also be included.

7.1.2.3 Summary of Environmental Results

For each environmental sample analysis, this summary shall include field ID and corresponding laboratory ID, sample matrix, date of sample extraction (if applicable), date and time of analysis, identification of the instrument used for analysis, instrument specifications, weight or volume of the sample used for analysis/extraction, dilution or concentration factor used for the sample extract, method detection limit or sample quantitation limit, definitions of any data qualifiers used, and analytical results.

7.1.2.4 Summary of QA/QC Results

The following QA/QC results will be presented in summary form. Details specified in Section 7.1.2.3 also will be included for the summary of QA/QC results. Acceptance limits for all categories of QC criteria will be provided with the data.

7.1.2.4.1 Organic Analyses (General)

The summary of QA/QC results for organic analyses will include:

- Initial Calibration - The concentrations of the standards used for analysis and the date and time of analysis. The response factor, percent relative standard deviation (%RSD), and retention time for each analyte (as applicable, GC, HPLC and GC/MS)

analyses) will be included in initial calibration summaries. A statement should also be made about the samples or dates for which a single initial calibration applies.

- Daily Calibration and Mid-level Standard - The concentration of the calibration standard used for daily calibration and/or the mid-level calibration check will be reported. The response factor, percent difference, and retention time for each analyte will be reported (GC and GC/MS). Daily calibration information will be linked to sample analyses by summary.
- Method Blank Analyses - The concentrations of any analytes found in method blanks will be reported even if detected amounts are less than the QL. The environmental samples and QA/QC analyses associated with each method blank will be stated.
- Surrogate Standard Recovery - The name and concentration of each surrogate compound added will be detailed. The percent recovery of each surrogate compound in the samples, method blanks, matrix spike/matrix spike duplicates and other QA/QC analyses will be summarized with sample IDs such that the information can be linked to sample and QA/QC analyses.
- Precision and Accuracy - For matrix spike/matrix spike duplicate analyses, the sample results, spiked sample results, percent recovery, and RPD with the associated control limits will be detailed. For laboratory duplicate analyses, the RPD between duplicate analyses will be reported as applicable. For laboratory QC check and/or LCS analyses, the percent recovery and acceptable control limits for each analyte will be reported. All batch QC information will be linked to the corresponding sample groups.
- Compound Identification (GC, HPLC, GC/MS): The retention times and the concentrations of each analyte detected in environmental and QC/QC samples will be reported for both primary and confirmation analyses. Mass spectra will also be included for reported detections in samples and for detections identified in the quantitation report, but ruled out during analyst review.
- Method Detection Limit (MDL): The MDL study result sheet will have laboratory heading, instrument identification, analysis date, spike level, average recovery, standard deviation and calculated MDL for each analyte.

In addition, the summary of QA/QC results for organic analyses will include the following information relating specifically to the method used.

7.1.2.4.2 GC and GC/MS Analyses

This section of the data package will include legible copies of the data for environmental samples (arranged in increasing order of field ID, primary and confirmation analyses). The raw data for each analysis will include chromatograms (with target compound, internal standard, and surrogate compounds labeled by name) with a quantitation report and/or area printout. GC/MS analyses will also include the mass spectra or ion chromatograms for each reported analyte.

7.1.2.4.3 Inorganic Analyses

The summary of QA/QC results for the inorganic analyses will include:

- Initial Calibration: The source of the calibration standards, true value concentrations, found concentrations, the percent recovery for each element analyzed, and the date and time of analysis will be reported.
- Continuing Calibration Verification: The source of the calibration standard, true value concentrations, found concentrations, the percent recovery for each element analyzed, and the date and time of analysis will be reported.
- Method Blank Analyses: The concentrations of any analytes found in initial calibration, continuing calibration blank, and in the preparation blank will be reported. The date and time of analysis also will be reported.
- Precision and Accuracy - Matrix Spikes and Sample Duplicates: For matrix spike analyses, the sample results, spiked sample results, percent recovery, spiking solution used, and the control range for each element will be detailed. For post digestion spikes, the concentrations of the spiked sample, the sample result, the spiking solution added, and recovery and control limits will be detailed. For laboratory duplicates, the original concentration, duplicate concentration, relative percent difference, and control limits will be detailed. Date and time for all analyses will be recorded.
- Precision and Accuracy - Laboratory Control Samples: The source of the laboratory control sample, true value concentrations, found concentrations, percent recovery for each element analyzed, and the date and time of analysis will be reported.

- Method of Standard Additions (MSA): This summary must be included when MSA analyses are required for analysis by Graphite Furnace AA. The absorbance values and the corresponding concentration values, the final analyte concentrations, and correlation coefficients will be reported for all analyses. Date and time of analysis will be recorded for all analyses.
- Method Detection Limit (MDL): The MDL study result sheet will have laboratory heading, instrument identification, analysis date, spike level, average recovery, standard deviation and calculated MDL for each analyte.

7.2 Field Activities

7.2.1 Data Reduction

Since no field screening equipment will be used during this sampling event, data reduction is not applicable.

7.2.2 Data Integrity

Integrity of information and data on field activities shall be maintained by the Project Leader. Integrity of the field sample custody is accomplished by the field staff, according to the sample custody procedures discussed in Section 5.0. This information is generated in the field and recorded in the project field logbook and on the sample chain-of-custody form, shall be verified before sample shipping, and confirmed at the laboratory upon their receipt of the samples.

7.2.3 Quality Assurance of Field Data

Validation of information and data on field activities shall be conducted as a QC procedure by the Technical Team Leader. The Technical Team Leader shall review laboratory results and field data before use. Chain-of-custody forms shall be cross-checked to the laboratory results to assure conformity of sample identification numbers. This information is compared to results of duplicate and blank samples, and field conditions at the time of sample collection will be taken into account when qualifying the sample analytical results, if applicable. Many of these cross-checks may be handled electronically.

7.2.4 Data Storage

Field and laboratory data shall be stored in hard copy and electronic format (when applicable) as part of the project file. This information is retained in the project file until project completion and closeout. Upon project closeout, all records shall be archived for permanent storage.

8.0 PREVENTIVE MAINTENANCE

To minimize downtime and interruption of analytical work, preventive maintenance is routinely performed on each analytical instrument. Each laboratory shall have detailed SOPs on file that describe preventive maintenance procedures and schedules. All service and maintenance will be conducted by qualified laboratory staff or under service agreement with the manufacturer or their approved agent. All repairs, adjustments, and calibrations will be documented in a maintenance notebook or data sheet that will be maintained in a permanent file. The instrument notebook will clearly document the date, the problem description, corrective action taken, results of actions, and the name of the person performing the work. Table 8-1 lists common laboratory preventative maintenance parameters for laboratory instrumentation.

Table 8-1. Routine Laboratory Instrument Maintenance

Instrument	Operation	Frequency
Gas Chromatography	Change septum Change injection port liner Change column Bake detectors	Daily when used Daily when used As needed (when standard response decreases or sample carryover is noted, approximately monthly) As needed (when standard response decreases or sample carryover is noted , approximately monthly)
GC/MS	Clean source	As needed (show reduced sensitivity)
Atomic Absorption Spectrometer	Warm up instrument for 30 min. Digital readout values checked; check gas flows, cell alignment, wavelength, Photo multiplier voltage and lamp voltage Tygon tubing replaced Change contact rings Replace optical lens	Daily when used Daily when used Quarterly or as needed Daily, as needed or when used 6 months, or if deterioration is observed
Balances	Calibrate by manufacturer	Annually / verify monthly
Ovens/Refrigerators	Check temperature	Daily

9.0 ASSESSMENTS

9.1 Laboratory and Field Audits

All laboratories analyzing samples from the USACE are required to be USACE validated or to pass a National Environmental Laboratory Accreditation Committee (NELAC) audit. USACE validation is an evaluation of laboratory procedures or documentation and includes initial and periodic laboratory audits. The USACE laboratory on-site inspections or audits are performed by USACE chemists from the Center of Excellence in Omaha, Nebraska. The inspectors verify the following:

- The organization and personnel are qualified to perform assigned tasks,
- Adequate facilities and equipment are available,
- Complete documentation, included chain-of-custody of samples, is being implemented,
- Proper analytical methodology is being used without deviations, adequate analytical quality control (including reference samples, control charts, documented corrective actions, etc.) is being provided,
- Acceptable data handling and documentation techniques are being used,
- Adequate facilities and operations are installed to ensure laboratory health and safety, and
- Proper waste disposal procedures are implemented.

The on-site laboratory inspection helps to ensure that the laboratory is technically competent and that all the necessary quality control is being applied by the laboratory in order to deliver a quality product.

9.2 Laboratory Performance Evaluation Samples

At a minimum, the contract laboratory will participate in at least one performance evaluation program.

The performance evaluation (PE) samples are single blind (prepared by the laboratory from ambulated standards) and are often associated with the regular laboratory audits performed by the USACE and/or regulatory agencies. USACE, Center of Excellence, Omaha, Nebraska

reviews the results of the PE samples to determine if the laboratory should continue to receive USACE validation.

9.3 Quality Assurance Samples

QA samples are replicate samples submitted to a different laboratory, and subjected to the same environmental conditions and steps in the measurement process as the primary sample. They serve as an oversight function in assessing the analytical portion of the measurements system. QA samples will be collected once during the SI field effort for the groundwater samples.

9.4 Data Validation

The laboratory data will be validated using guidelines in Appendix C. The validation guidelines are based on EPA SW-846 methods and the EPA National Functional Guidelines for Organic and Inorganic Data Review. The Appendix C procedures shall supercede the procedures in these references. However, professional judgment shall be used when deciding if qualification of data is applicable. When professional judgment is applied that differs from the qualification scheme in Appendix C, the rationale shall be provided in the validation report. The data will be validated using an automated data review (ADR) software package prepared for the USACE. A chemist will review the data to ensure that the proper qualifiers have been added to the data.

9.5 Data Quality and Usability Assessment

The effectiveness of a QA program is measured by the quality of data generated by the laboratory. Data quality is judged in terms of its PARCC parameters. These terms are described as follows:

Precision

Precision is a measure of the reproducibility of analyses under a given set of conditions. Precision will be assessed by the RPD from replicate measurements of duplicate control samples, reference materials, or environmental samples.

Accuracy

Accuracy is a determination of how close the measurement is to the true value. Accuracy will be assessed by the percent recovery of spiked blank or environmental samples and by any external contamination evident from any associated field or laboratory blank results.

Representativeness

Representativeness is a qualitative parameter that reflects the extent to which a given sample is characteristic of a given population at a specific location or under a given environmental condition. Representativeness is best satisfied by making certain that sampling locations are selected properly, a sufficient number of samples are collected, and an appropriate sampling technique is employed. Variations at a sampling point will be evaluated based on the results of field duplicates. Some samples may require analysis of multiple phases to obtain representative results. Analytical data should represent the sample analyzed regardless of the heterogeneity of the original sample matrix. Sample representativeness will also be evaluated based on results from method blanks and trip blanks.

Completeness

Completeness will be evaluated qualitatively and quantitatively. The qualitative evaluation of completeness will be determined as a function of all events contributing to the sampling event including items such as correct handling of COC forms, incorporation of QC samples at the appropriate frequency, etc. The quantitative description of completeness is defined as the percentage of acceptable QC parameters that can be controlled. The goals for completeness are as follows: contract (95%), analytical (85%), technical (95%), and field sampling completeness (100%). Contract completeness is a measure of the results that meets contract requirements relative to the number of reported results expressed as a percentage. Analytical completeness is a measure of all unqualified results relative to the number of reported results expressed as a percentage. Qualified data due to detections below the QL will NOT count against analytical completeness. Technical completeness is a measure of the usable results relative to the number of reported results expressed as a percentage. Field sampling completeness is a measure of the number of samples collected relative to the number of samples planned expressed as a percentage.

Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. To ensure comparability, field procedures will be standardized and field operations will adhere to standard operating procedures. Laboratory data comparability will be assured by use of established and approved analytical methods, consistency in the basis of analysis (wet weight, volume, etc.), and consistency in reporting units ($\mu\text{g/L}$, mg/Kg , etc.). Analysis of standard reference materials will follow EPA or other standard

analytical methods, which utilize standard units of measurement, methods of analysis, and reporting format.

The Project Chemist will discuss the PARCC parameters of the project data and the impact on data usability in a Chemical Data Quality Assessment Report (CDQAR). The CDQAR will include an introduction, field procedures, number of samples collected and associated parameters, analytical methods used, frequency and compliance with criteria in this QAPP, impact of any non-compliant data, any systematic problems with the dataset, discussion of field duplicate results and impact on variability of the chemical concentration, and a brief conclusion regarding the usability of the data. This usability will relate directly to the objectives addressed in the Data Quality Objectives. The CDQAR will be presented as an appendix to the report.

10.0 REFERENCES

10.1 Environmental Protection Agency (EPA)

EPA 2001. *EPA Requirements for Quality Assurance Project Plans*, EPA QA/R-5, Final Interim Final, March.

EPA 2000a. *Guidance for Data Assessment*, USEPA QA/G-9, Final, July.

EPA 2000b. *Guidance on the Data Quality Objectives Process*, USEPA QA/G-4, Final, September.

EPA 1998. *Test Methods for Evaluating Solid Waste*, USEPA SW-846, Third Edition, (Update III), June.

National Functional Guidelines for Inorganics Data Review, USEPA Contract Laboratory Program, EPA 540/R-94/013.

National Functional Guidelines for Organic Data Review, USEPA Contract Laboratory Program, EPA 540/R-94/012.

10.2 U.S. Army Corps of Engineers (USACE)

Requirements for the Preparation of Sampling and Analysis Plans, Engineering Manual EM. 200-1-3, 1998.

Chemical Data Quality Management for Hazardous Waste Remedial Activities, Engineering Regulation 1110-1-263, October 1990.

ATTACHMENT A

CALIBRATION AND QUALITY CONTROL PROCEDURES

ACRONYMS AND ABBREVIATIONS

CCC	Calibration check compound
CCV	Continuing calibration verification standard
COD	Coefficient of determination
CV	Calibration verification standard
%D	Percent difference
GC	Gas chromatography
GC/MS	Gas chromatography/mass spectrometry
ICS	Interference check standard
ICV	Initial calibration verification standard
MDL	Method detection limit
MS/MSD	Matrix spike/matrix spike duplicate
LCS	Laboratory control sample
QC	Quality control
QL	Quantitation limit
r	Correlation coefficient
r ²	Coefficient of determination
RF	Response factor
RPD	Relative percent difference
RRF	Relative response factor
RSD	Relative standard deviation
SIM	Selective Ion Monitoring
SPCC	System performance check compound
USACE	United States Army Corps of Engineers

Table A-1
Summary of Calibration and Internal Quality Control Procedures for Method SW8081A (Total DDTs)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW8081A	DDD, DDE, DDT	Five-point initial calibration	Prior to sample analysis and when CCV fails	Option 1: RSD for each analyte $\leq 20\%$ Option 2: Grand mean RSD $\leq 20\%$, with no individual analyte RSD $>30\%$ Option 3: Linear regression – $r \geq 0.995$ Option 4: Non-linear regression COD $r^2 \geq 0.990$ (6 points for 2 nd order, 7 points for 3 rd order)	Correct problem then repeat initial calibration.
		Second source standard (not required if calibration verification below is prepared with a second source of the standard)	Following initial calibration	% Difference from expected value $\leq 15\%$ for all analytes OR grand mean $\leq 15\%$ with no individual response factor greater than 20%	Correct problem, rerun second source standard. If that fails, repeat initial calibration.
		DDT and endrin breakdown check	Daily prior to analysis of samples	Degradation $< 15\%$	Correct problem, then repeat breakdown check.
		Calibration verification	<u>ICV</u> : At the beginning of an analysis sequence <u>CCV</u> : After every 10 field samples and at the end of the analysis sequence	Response factor for all analytes within $\pm 15\%$ of initial calibration response factor OR grand mean within 15% with no individual response factor greater than 25%	<u>ICV</u> : Correct problem, rerun ICV. If that fails, repeat initial calibration <u>CCV</u> : Correct problem, then repeat CCV and reanalyze all samples since last successful CCV or ICV

Table A-1
Summary of Calibration and Internal Quality Control Procedures for Method SW8081A (Total DDTs)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW8081A	DDD, DDE, and DDT	Method Blank	1 per preparation batch	All analytes < ½ QL.	Investigate possible contamination source. Take appropriate corrective action. Reprepare and reanalyze all samples processed with a contaminated blank, unless analyte is not detected in associated samples or present at greater than 10x blank concentration.
		Laboratory Control Sample	1 per preparation batch	Comparison recovery limits 50-130% (soil)	Correct problem, then reprepare and reanalyze LCS and all samples in the associated preparatory batch for failed analytes.
		Matrix Spike and Matrix Spike Duplicate	1 MS/MSD per 20 project samples when identified on the Chain-of-Custody	Comparison recovery limits 50-130% (soil) and RPD <35% for soil samples	Evaluate for supportable matrix effect. If no interference is evident reprepare and reanalyze MS/MSD and all samples in the preparation batch once within the holding time. If still out report both sets of data.
		Surrogate spike	All field and quality control samples	Comparison recovery limits 50-130% (soil)	Evaluate for supportable matrix effect. If no interference is evident reprepare and reanalyze affected sample(s).
		Confirmation of positive results (second column or second detector)	All detected results at or above the QL must be confirmed.	Calibration and QC criteria same as for initial or primary column analysis. Results between primary and secondary column RPD ≤ 40%	None – report as detected result if criteria is met. Use professional judgment to determine whether primary or secondary column concentration should be reported. Report as not detected at QL if criteria is not met.
	Quantitation limit standard (lowest concentration on initial calibration curve)	Verify at least once for every matrix and field effort	QLs established shall not exceed those in the Appendix B tables.	QLs that exceed established criteria shall be submitted to USACE Project Chemist for approval prior to analysis of any project samples.	

Table A-2
Summary of Calibration and Internal Quality Control Procedures for Modified Method SW8270 (Polynuclear Aromatic Hydrocarbons by GC/MS Selective Ion Monitoring)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW8270 SIM	Polynuclear Aromatic Hydrocarbons	Instrument tune (decafluorotriphenyl-phosphine)	Prior to initial calibration and every 12 hours of analysis time	Ion abundance criteria as described in SW8270C	Retune instrument and verify. Rerun affected samples.
		Five-point calibration	When daily calibration verification fails or following major instrument maintenance or repair	1. <u>Average RRF for SPCCs</u> : ≥ 0.050 . 2. <u>%RSD for RRFs for CCCs</u> : $\leq 30\%$ 3. <u>One option below for ALL analytes</u> : Option 1: RSD for each analyte $\leq 15\%$ Option 2: Grand mean $\leq 15\%$ with no individual analyte RSD $> 30\%$ Option 3: linear regression, $r \geq 0.995$ Option 4: non-linear regression – COD $r^2 \geq 0.990$ (6 points 2 nd order, 7 points 3 rd order)	Correct problem then repeat initial calibration.
		Second source calibration verification	Once after each initial calibration	% Difference from expected value $\leq 25\%$ for all analytes.	Correct problem and verify second source standard. If that fails, then repeat initial calibration.

Table A-2
Summary of Calibration and Internal Quality Control Procedures for Modified Method SW8270 (Polynuclear Aromatic Hydrocarbons by GC/MS Selective Ion Monitoring)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW8270 SIM	Polynuclear Aromatic Hydrocarbons	Calibration verification	Daily, prior to sample analysis and every 12 hours of analysis time	1. Average RRF for SPCCs: ≥ 0.050 2. %Difference/drift for CCCs: $\leq 20\%D$ 3. Grand mean of concentration for all analytes within $\pm 20\%D$ of expected value, with no individual analytes (except CCCs) $> 25\%$.	Correct problem, rerun CV. If that fails, then repeat initial calibration.
		Calibration verification internal standards	With every CV	Retention time ± 30 seconds from retention time of midpoint standard in the initial calibration. Quantitation ion peak area within 2 times area of initial calibration midpoint standard	Inspect mass spectrometer and GC for malfunctions. Take appropriate corrective actions. Reanalyze samples analyzed while system was malfunctioning.
		Method Blank	1 per preparation batch	All analytes $< \frac{1}{2}$ QL. For common laboratory contaminants, all analytes $< QL$.	Investigate possible contamination source. Take appropriate corrective action. Reprepare and reanalyze all samples processed with a contaminated blank, unless analyte is not detected in associated samples or present at greater than 10x blank concentration.
		Laboratory Control Sample	1 per preparation batch	Comparison recovery limits - 50-120%	Correct problem, then reprepare and reanalyze LCS and all samples in the associated preparatory batch for failed analytes.

Table A-2
Summary of Calibration and Internal Quality Control Procedures for Modified Method SW8270 (Polynuclear Aromatic Hydrocarbons by GC/MS Selective Ion Monitoring)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW8270 SIM	Polynuclear Aromatic Hydrocarbons	Matrix Spike and Matrix Spike Duplicate	1 MS/MSD per 20 project samples when identified on the Chain-of-Custody	Comparison recovery limits 50-120% and RPD <35 %	Evaluate for supportable matrix effect. If no interference is evident reprepare and reanalyze MS/MSD and all affected samples once within the holding time. If still out report both sets of data.
		Surrogate spike	All field and quality control samples	Comparison recovery limits 50-120%	Evaluate for supportable matrix effect. If no interference is evident reprepare and reanalyze affected sample(s).
		Quantitation limit standard (lowest concentration on initial calibration curve)	Verify at least once for every matrix and field effort	QLs established shall not exceed those in the Appendix B tables.	QLs that exceed established criteria shall be submitted to USACE Project Chemist for approval prior to analysis of any project samples.

Table A-3
Summary of Calibration and Internal Quality Control Procedures for Method SW6010B (Selected Metals)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW6010B	Selected Metals	Initial calibration (minimum one high standard and a blank)	Daily prior to sample analysis	None unless run more standards; then $r > 0.995$	Correct problem and repeat initial calibration.
		Initial calibration verification standard (equivalent to second source standard)	Once after initial calibration, prior to sample analysis	% Difference from expected value $\leq 10\%$ for all analytes	Correct problem, rerun ICV (and all samples run since the ICV, if applicable). If that fails, repeat initial calibration.
		Continuing calibration verification	After every 10 field samples and at the end of the analysis sequence	% Difference from expected value $\leq 10\%$ for all analytes	Correct problem, then repeat CCV and reanalyze all samples since last successful CCV or ICV. If that fails repeat initial calibration.
		Low-level calibration check standard	At the beginning of the analysis sequence if one standard initial calibration used.	% Difference from expected value $\leq 30\%$ for all analytes	Correct problem, then reanalyze.
		Calibration blanks	<u>Initial calibration blank (ICB)</u> : At the beginning of an analysis sequence following the ICV. <u>Continuing calibration blank (CCB)</u> : After every 10 field samples and at end of sequence following the CCV.	All analytes $\leq \frac{1}{2}$ QL	<u>ICB</u> : Correct problem, rerun ICB (and all samples run since the ICB, if applicable). <u>CCB</u> : Correct problem, then repeat CCB and reanalyze all samples since last successful CCB or ICB.
		Method Blank	1 per preparation batch	All analytes $\leq \frac{1}{2}$ QL	Correct problem, then reprepare and reanalyze all samples in the preparation batch unless analyte is not detected in associated samples or present at greater than 10x blank concentration.

Table A-3
Summary of Calibration and Internal Quality Control Procedures for Method SW6010B (Selected Metals)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW6010B	Selected Metals	Interference check standard solutions (ICS)	At the beginning of the analytical sequence	% Difference from expected value $\leq 20\%$ for all analytes	Correct problem, then reanalyze ICS and associated samples.
		Laboratory control sample	1 per preparation batch	Comparison recovery limits 80-120%	Correct problem, then reprepare and reanalyze LCS and all samples in the associated preparatory batch for failed analytes.
		Matrix Spike (level of spike must be less than the mid-level standard of the calibration curve)	1 MS per 20 project samples when identified on the Chain-of-Custody	Comparison recovery limits 80-120%	Evaluate for supportable matrix effect. If no interference is evident reprepare and reanalyze MS/MSD and all affected samples once within the holding time. If still out report both sets of data.
		Matrix Duplicate or Matrix Spike Duplicate	1 duplicate per preparation batch or 1 MSD per 20 project samples when identified on the Chain-of-Custody	RPD < 25	Evaluate for supportable matrix effect. If no interference is evident reprepare and reanalyze MS/MSD and all affected samples once within the holding time. If still out report both sets of data.
		Serial Dilution (1:5 dilution)	Each preparation batch or when a new matrix is encountered and result is > 25 times the method detection limit (MDL)	Agreement between undiluted and diluted results $\pm 10\%$	Perform post digestion spike
		Post digestion spike	When serial dilution fails	All analytes recovered 75-125% of expected result	Perform method of standard addition for all samples with similar matrix
		Method of Standard Addition	As needed for samples with confirmed matrix effects	$r \geq 0.995$	Consider alternative sample preparation or analysis methods to reduce interference and discuss with USACE Project Chemist
Quantitation limit standard (lowest concentration on initial calibration curve)	Verify at least once for every matrix and field effort	QLs established shall not exceed those in the Appendix B tables.	QLs that exceed established criteria shall be submitted to USACE Project Chemist for approval prior to analysis of any project samples.		

Table A-4
Summary of Calibration and Internal Quality Control Procedures for Method SW7471A (Mercury)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW7471A	Mercury	Calibration (5 standards and blank)	Daily	$r > 0.995$	<ol style="list-style-type: none"> 1) Identify and repeat analysis for outlying points 2) Recalculate using valid points
		ICV/CCV	Daily: before sample analysis, every 10 samples, and at the end of the analytical sequence	ICV: % Recovery $\pm 10\%$ CCV: % Recovery $\pm 20\%$	<ol style="list-style-type: none"> 1) Reanalyze ICV/CCV 2) If still out, identify and correct problem 3) Recalibrate and reanalyze all samples since last valid CCV
		ICB/CCB	Beginning of sequence, every 10 samples, and at end of sequence	Analytes < MDL	<ol style="list-style-type: none"> 1) Reanalyze ICB/CCB 2) If still out, identify and correct problem 3) Recalibrate and reanalyze all samples since last valid CCB
		Method Blank (MB)	1 per sample preparation batch	Analytes < $\frac{1}{2}$ QL	<ol style="list-style-type: none"> 1) Investigate possible contamination source 2) Take appropriate corrective action 3) Repeat instrument blank analysis 4) Redigest and reanalyze all samples processed with a contaminated blank at no cost to USACE, unless analyte is not detected in associated samples or present at greater than 10x blank concentration. 5) Flag sample results associated with blank contamination
		LCS	1 per sample preparation batch	Comparison recovery limits 80-120%	<ol style="list-style-type: none"> 1) Reanalyze LCS. 2) If still out identify and correct problem. 3) Reprepare and reanalyze affected samples.
		Matrix Spike (MS) (level of spike must be less than the mid-level standard of the calibration curve)	1 per preparation batch	Comparison recovery limits 80-120%	<ol style="list-style-type: none"> 1) Evaluate for supportable matrix effect. 2) If no interference is evident re-extract and reanalyze MS once. 3) If still out report both sets of data.

Table A-4
Summary of Calibration and Internal Quality Control Procedures for Method SW7471A (Mercury)

Analytical Method	Applicable Parameter	Quality Control Check	Minimum Frequency	Acceptance Criteria	Corrective Action
SW7471A	Mercury	Matrix Duplicate (D) or Matrix Spike Duplicate (MSD) QL	1 per sample batch Low point on initial calibration curve.	RPD <20 QLs established shall not exceed those required by project; Refer to accompanying table.	1) Recalculate result; if still out: 2) Evaluate for supportable matrix effect. 3) If no interference is evident reanalyze affected sample(s) and narrate any outliers. QLs that exceed established criteria shall be submitted to USACE for approval prior to any project samples analyses

ATTACHMENT B

MAXIMUM QUANTITATION LIMITS

Table B-1
Maximum Quantitation Limits (QLs) and Action Goals for Metals by Method SW6010B
and Mercury by Method 7471A

Analyte	ROD/RAP Action Goals (mg/kg)	Soil QL (mg/Kg)	Soil MDL (mg/kg)
Antimony	None Established	10	1.7
Arsenic	16.7	5	0.4
Cadmium	1.2	0.50	0.1
Chromium	112	10	0.22
Copper	68.1	10	0.1
Lead	46.7	20	0.24
Mercury	0.43	0.1	0.033
Nickel	114	10	0.27
Zinc	158	10	0.19

Table B-2
Maximum Quantitation Limits (QLs) and Action Goals for Total DDTs by Method
SW8081A

Analyte	Action Goal (mg/kg)	Soil QL (mg/kg)	Soil MDLs (mg/kg)
4,4'-DDD	0.024 (Total DDTs-revised)	0.005	0.001
4,4'-DDE	0.024 (Total DDTs- revised)	0.005	0.001
4,4'-DDT	0.024 (Total DDTs- revised)	0.005	0.001

These detection limits were calculated using a clean matrix and may not be achievable with the samples collected for this project. By reporting down to the detection limit, there is an increased probability of low level false positives.

Total DDTs = DDT + DDD + DDE

Table B-3
Maximum Quantitation Limits (QL) and Action Goals for Polynuclear Aromatic Hydrocarbons (PAHs) by Method SW8270, Selective Ion Monitoring (SIM)

Analyte	ROD/RAP Action Goals (mg/kg)	Soil QL (mg/kg)	Soil MDLs (mg/kg)
Acenaphthene	Not applicable	0.01	0.0015
Acenaphthylene	Not applicable	0.03	0.0015
Anthracene	Not applicable	0.04	0.0015
Benzo(a)anthracene	Not applicable	0.03	0.0015
Benzo(b)fluoranthene	Not applicable	0.03	0.0015
Benzo(k)fluoranthene	Not applicable	0.03	0.0015
Benzo(g,h,i)perylene	Not applicable	0.03	0.0015
Benzo(a)pyrene	Not applicable	0.03	0.0015
Chrysene	Not applicable	0.03	0.0015
Dibenz(a,h)anthracene	Not applicable	0.03	0.0015
Fluoranthene	Not applicable	0.03	0.0015
Fluorene	Not applicable	0.01	0.0015
Indeno(1,2,3-cd)pyrene	Not applicable	0.03	0.0015
2-Methylnaphthalene	Not applicable	0.01	0.0015
Naphthalene	Not applicable	0.03	0.0015
Phenanthrene	Not applicable	0.03	0.0015
Pyrene	Not applicable	0.03	0.0015
Sum of PAHs	4.022	Sum of QLs = 0.46	Not applicable

These detection limits were calculated using a clean matrix and may not be achievable with the samples collected for this project. By reporting down to the detection limit, there is an increased probability of low level false positives.

ATTACHMENT C

VALIDATION QUALIFIER CONVENTIONS

Table C-1
Default Data Qualifier Convention for GC Analyses

Quality Control Item	Evaluation	Data Qualifier Flag		Sample(s) Qualified
		Detects	Nondetects	
Holding Times (Extraction/Analysis)	1) Holding time exceeded by 2 times or less	J-	UJ	Sample
	2) Holding time exceeded by greater than 2 times	J-	R	
Cooler Temperature	1) > 6 and ≤10 degrees Centigrade	J-	UJ	All samples shipped in the affected cooler
	2) >10 degrees Centigrade	J-	R	
	3) < 2 degrees Centigrade	No qual.	No qual.	
Initial Calibration	1) %RSD > 20%	J	UJ	All samples run on the same instrument under that initial calibration
	2) $r < 0.995$, $r^2 < 0.990$	J	UJ	
Initial and Continuing Calibration Verification (ICV and CCV) and Second Source Standard	1) % Difference > +20%	J+	No qual.	All samples bracketed by the ICV, CCV or under initial calibration associated with second source standard
	2) % Difference < -20% and ≥ -50%	J-	UJ	
	3) % Difference < -50%	J-	R	
Method Blank Contamination	1) Sample results for common lab contaminant less than or equal to 10 times the blank contamination	U	No qual.	All samples in the same preparation batch
	2) Sample results for other compounds less than or equal to 5 times the blank contamination	U	No qual.	
Surrogate Recovery	1) % Recovery < control limit (CL) but ≥ 10%	J-	UJ	Sample
	2) % Recovery <10%	J-	R	
	3) % Recovery > CL	J+	No qual.	
Matrix Spikes	1) % Recovery < CL but ≥ 10%	J-	UJ	Parent Sample
	2) % Recovery <10%	J-	R	
	3) % Recovery > CL	J+	No qual.	
	4) RPD > CL	J	UJ	
Laboratory Control Sample Recovery	1) % Recovery < CL but ≥ 10%	J-	UJ	All samples in the same preparation batch
	2) % Recovery <10%	J-	R	
	3) % Recovery > CL	J+	No qual.	
	4) RPD > CL	J	UJ	
Quantitation Limits	Quantitation limits not matching the project specified limits.	No qual.	No qual.	Sample (note in validation report)
	Results reported below the quantitation limit.	J	No qual.	Sample
Field Duplicates	RPD > 50 (soil)	No qual.	No qual.	Parent sample-review dataset for systematic occurrences

Table C-1
Default Data Qualifier Convention for GC Analyses

Quality Control Item	Evaluation	Data Qualifier Flag		Sample(s) Qualified
		Detects	Nondetects	
Equipment Blanks	1) Sample results for common lab contaminant less than or equal to 10 times the blank contamination 2) Sample results for other compounds less than or equal to 5 times the blank contamination	U	No qual.	All samples in the same sampling event
		U	No qual.	

Alternate qualifiers are acceptable on a case-by-case basis based upon validator professional judgment. All deviations from the above qualification scheme shall be documented in the validation report. Control limits are specified in Appendix A.

Table C-2
Default Data Qualifier Convention for GC/MS Analyses

Quality Control Item	Evaluation	Data Qualifier Flag		Sample(s) Qualified
		Detects	Nondetects	
Holding Times (Extraction/Analysis)	1) Holding time exceeded by 2 times or less	J-	UJ	Sample
	2) Holding time exceeded by greater than 2 times	J-	R	
Cooler Temperature	1) > 6°C and ≤10°C	J-	UJ	All samples shipped in the affected cooler
	2) >10°C	J-	R	
	3) < 2°C	No qual.	No qual.	
Instrument Tuning	1) Ion abundance criteria not met	JN	R	All samples associated with an initial calibration, if tune is associated to an initial calibration. All samples in same instrument batch, if tune is associated with calibration verification.
Initial Calibration	1) Average RRF < criteria in Appendix A tables	J	R	All samples associated with the initial calibration
	2) %RSD > 30%	J	UJ	
	3) r < 0.995	J	UJ	
Second Source Standard and Continuing Calibration Verification (CCV)	1) Average RRF < criteria in Appendix A tables	J	R	All samples associated with the second source standard and CCV
	2) % Difference > +25%	J+	No qual.	
	3) % Difference < -25% and ≥ -50%	J-	UJ	
	4) % Difference < -50%	J-	R	
Method Blank Contamination	1) Sample results for common lab contaminant less than or equal to 10 times the blank contamination	U	No qual.	All samples in the same preparation batch
	2) Sample results for other compounds less than or equal to 5 times the blank contamination	U	No qual.	
Surrogate Recovery	1) % Recovery < CL but ≥ 10%	J-	UJ	Sample
	2) % Recovery <10%	J-	R	
	3) % Recovery > CL Note: For semivolatile analysis, two or more surrogates in a fraction must be out of criteria for qualification unless recovery < 10%.	J+	No qual.	
Matrix Spike Recovery	1) % Recovery < CL but ≥ 10%	J-	UJ	Parent Sample
	2) % Recovery <10%	J-	R	
	3) % Recovery > CL	J+	No qual.	
	4) RPD > CL	J	UJ	

Table C-2
Default Data Qualifier Convention for GC/MS Analyses

Quality Control Item	Evaluation	Data Qualifier Flag		Sample(s) Qualified
		Detects	Nondetects	
Laboratory Control Sample Recovery	1) % Recovery < CL but ≥ 10%	J-	UJ	All samples in the same preparation batch
	2) % Recovery <10%	J-	R	
	3) % Recovery > CL	J+	No qual.	
	4) RPD > CL	J	UJ	
Quantitation Limits	Quantitation limits not matching the project specified limits.	No qual.	No qual.	Sample (note in validation report)
	Results reported below the quantitation limit.	J	No qual.	Sample
Field Duplicates	RPD >50 (soil)	No qual.	No qual.	Parent sample-review dataset for systematic occurrences
Equipment Blanks	1) Sample results for common lab contaminant less than or equal to 10 times the blank contamination	U	No qual.	All samples in the same sampling event
	2) Sample results for other compounds less than or equal to 5 times the blank contamination	U	No qual.	

Alternate qualifiers are acceptable on a case-by-case basis based upon validator professional judgment. All deviations from the above qualification scheme shall be documented in the validation report. Control limits are specified in Appendix A.

Table C-3
Default Data Qualifier Convention for Metals Analyses

Quality Control Item	Evaluation	Data Qualifier Flag		Sample(s) Qualified
		Detects	Nondetects	
Holding Times	1) Holding time exceeded by 2 times or less	J-	UJ	Sample
	2) Holding time exceeded by greater than 2 times	J-	R	
Initial Calibration	1) $r < 0.995$	J	UJ	All samples run on same instrument under the same calibration
Initial and Continuing Calibration Verification (ICV and CCV)	1) % Recovery $> 110\%$ but $\leq 125\%$	J+	No qual.	All samples bracketed by ICV or CCV
	2) % Recovery $> 125\%$	R	No qual.	
	3) % Recovery $< 90\%$ but $\geq 75\%$	J-	UJ	
	4) % Recovery $< 75\%$	J-	R	
Method Blank Contamination	Sample results less than or equal to 5 times the blank contamination	U	No qual.	All samples in the same preparation batch
Matrix Spike Recovery	1) % Recovery $< 80\%$ but $\geq 30\%$	J-	UJ	All samples from same site and similar matrix interference
	2) % Recovery $< 30\%$	J-	R	
	3) % Recovery $> 120\%$	J+	No qual.	
	4) RPD > 20	J	UJ	
Laboratory Control Sample Recovery	1) % Recovery $< 80\%$ but $\geq 50\%$	J-	UJ	All samples in the same preparation batch
	2) % Recovery $< 50\%$	J	R	
	3) % Recovery $> 120\%$	J+	No qual.	
	4) RPD > 20	J	UJ	
Quantitation Limits	Quantitation limits not matching the project specified limits	No qual.	No qual.	Sample (note in validation report)
	Reported result less than the quantitation limit.	J	No qual.	Sample
Field Duplicates	RPD > 50 (soil)	No qual.	No qual.	Parent sample-review dataset for systematic occurrences
Equipment Blanks	Sample results within 5 times blank contamination	U	No qual.	All samples in the same sampling event

Alternate qualifiers are acceptable on a case-by-case basis based upon validator professional judgment. All deviations from the above qualification scheme shall be documented in the validation report.

ATTACHMENT D
IMMUNOASSAY TEST INSTRUCTIONS

STRATEGIC DIAGNOSTICS INC.

EnviroGard® DDT in Soil Test Kit

73100

Intended Use

The EnviroGard DDT in Soil Test Kit is a qualitative or semi-quantitative field test for the detection of DDT and its metabolites DDD and DDE in soil. The EnviroGard DDT in Soil Test Kit allows rapid semi-quantitative screening for DDT at 0.2, 1.0, and 10.0 parts per million (ppm) in soils.

Test Principles

The EnviroGard DDT in Soil Test Kit is based on the use of polyclonal antibodies that bind either DDT or DDT-Enzyme Conjugate. These antibodies are immobilized to the walls of the test tubes. When DDT is present in the sample, it competes with the DDT-Enzyme Conjugate for a limited number of antibody binding sites.

Since there are the same number of antibody binding sites on every test tube and each test tube receives the same number of DDT-Enzyme Conjugate molecules, a sample that contains a low concentration of DDT allows the antibody to bind many DDT-Enzyme Conjugate molecules.

Therefore, a low concentration of DDT produces a dark blue solution. Conversely, a high concentration of DDT allows fewer DDT-Enzyme Conjugate molecules to be bound by the antibodies, resulting in a lighter blue solution.

NOTE: Color is inversely proportional to DDT concentration.

Darker color = Lower concentration

Lighter color = Higher concentration

Performance Characteristics

The EnviroGard DDT in Soil Test Kit will not differentiate between DDT, its metabolites, and other structurally similar compounds, but will detect their presence to differing degrees. The following table shows a number of compounds and the approximate concentration of each required to yield a positive result (Lower Limit of Detection or LLD), and the concentration required to inhibit one-half of the color developed by the Negative Control (IC50). Concentration is in parts per million (ppm) in soil.

Compound	LLD	IC50
<i>p,p'</i> -DDT (kit calibrator)	0.04	1.25
<i>p,p'</i> -DDD	0.01	0.3
<i>p,p'</i> -DDE	0.18	3.6
<i>o,p'</i> -DDT	4	93
<i>o,p'</i> -DDD	0.4	11
<i>o,p'</i> -DDE	3	93
DDA	0.002	0.04
Chloropropylate	0.007	0.08
Chlorobenzilate	0.03	0.35
Dicofol	0.14	2
Tetradifon	1.2	14
Thiobencarb	5	52
Tebuconazole	7	95
Neburon	17	284
Chloroxuron	24	216
Monolinuron	25	714
Diclofop	70	>1000

The following compounds have lower limits of detection > 100 ppm:

2,4-D	4-chlorophenoxyacetic acid
Chlorbromuron	Chlordane
Chlortoluron	Dicamba
Diffubenzuron	Diuron
Lindane	Linuron

MCPA acid

MCPB

Mecoprop

Precautions

- Treat DDT, solutions that contain DDT and potentially contaminated soil samples as hazardous materials.
- Where appropriate, use gloves, proper protective clothing, and methods to contain and handle hazardous material.
- Store all test kit components at 4°C to 8°C (39°F to 46°F) when not in use.
- Do not freeze test kit components or expose them to temperatures greater than 37°C (99°F).
- Allow all reagents to reach ambient temperature (18°C to 27°C or 64°F to 81°F) before beginning the test.
- Do not use test kit components after the expiration date.
- Do not use reagents or test tubes from one test kit with reagents or test tubes from a different test kit.
- Use approved methodologies to confirm any positive results.
- Do not dilute or adulterate test reagents or use samples not called for in the test procedure; this may give inaccurate results.
- Tightly recap the DDT calibrator vials to prevent evaporative loss.
- Distribution of DDT in soils may be highly variable. The use of a composite sampling technique may be appropriate. Development of a sampling plan that assures adequate sample number and distribution is the responsibility of the analyst.
- DDT is light sensitive. Store soil extracts at 2°C to 7°C, shielded from direct light.

Materials Provided

EnviroGard DDT in Soil Test Kit

This test kit contains the following items:

- 20 Antibody-Coated Test Tubes
- 1 vial of Assay Diluent
- 1 vial of Negative Control (methanol)
- 1 vial of 0.2 ppm DDT Calibrator in methanol
- 1 vial of 1.0 ppm DDT Calibrator in methanol
- 1 vial of 10.0 ppm DDT Calibrator in methanol
- 1 vial of DDT-Enzyme Conjugate
- 1 vial of Substrate
- 1 vial of Stop Solution
- 1 20-place Test Tube Rack
- 22 Pipette Tips, yellow (for the Gilson M-25 Microman® Positive Displacement Pipettor)

Materials Required but Not Provided

You will also need several other items, some of which are included in the EnviroGard Soil Field Lab.

- Methanol-ACS reagent grade Methanol is required for soil extraction, but is not included in the EnviroGard Soil Extraction Kit. You must order it separately.
 - EnviroGard Soil Extraction Bottle Kit
- Use this kit for the extraction of DDT in soil samples. This kit contains enough devices to process 14 samples:
- 14, 30 mL LDPE Bottles with screw caps (each bottle contains stainless steel mixing beads)
 - 14 filtration caps
 - 14 Millex® HV13 filters
 - 18 Wooden Spatulas
 - 1 Syringe with coupler
 - 1 Syringe coupler
 - 14 Screw Top Glass Vials, 4.0 mL
 - 14 Stoppers

- 18 Weigh Boats
- Gilson M-25 Microman Positive Displacement Pipettor
- Eppendorf™ Repeater® Pipettor and five Combitips® (3 x 12.5 mL, 1 x 5.0 mL, and 1 x 50 mL)
- Balance capable of accurately weighing 5 grams
- Differential Photometer or RPA-I Photometer
- Indelible marker for labeling test tubes
- Watch or timer
- Clean running water or a wash bottle containing tap or deionized water (500 mL)
- Calculator (optional)

Suggestions for Pipettor Use

- Practice using both pipettors (positive displacement and Repeater pipettor) with water and extra tips before you analyze your samples.
- Use a new tip each time you use the Repeater pipettor to avoid reagent cross-contamination. Label three 12.5 mL tips "Diluent", "Substrate" and "Stop," and one 5.0 mL tip "Conjugate".
- Draw the desired reagent volume into the Repeater pipettor and dispense one portion of the reagent back into the container to properly engage the ratchet mechanism. If you do not do this, the first volume delivered may be inaccurate.
- To add reagents using the Repeater pipettor, pipette down the side of the test tube just below the rim.
- To add samples and calibrators using the positive displacement pipettor, pipette down the side of the test tube just above the liquid level.
- The carryover volume of the positive displacement tips is minimal, but may affect results if you are going from a high to low DDT concentration. Use a new pipettor tip each time you pipette a new unknown.

Assay Procedure

Collect/Store the Sample

1. Collect soil in appropriately sized and labeled containers.
2. Take care to remove excess twigs, organic matter and rocks or pebbles from the sample. For best results, wet soils should be air-dried overnight and thoroughly mixed before testing.
3. Store soil samples at 4°C (39°F).

Prepare the Sample/Extract the Soil

1. Please follow the instructions from the EnviroGard Soil Extraction Bottle Kit to prepare the soil extract before the assay.
2. **5 ml of Methanol** will be used to extract DDT residue from a 5 gram soil sample. As per instructions, attach a **50 mL** Combitip to the Repeater pipettor and set the dial to **5**. Deliver once to add **5 mL** of **methanol** to the extraction vial, and cap tightly.

Perform the Test

NOTE: Allow all reagents and sample extracts to reach room temperature before you begin the test. Do not analyze more than 20 test tubes at a time.

1. The choice of calibrators to use in the test will depend on the selection of the analyst. The use of two calibrators may be appropriate if screening for a single level of DDT.

Remove the test tubes from the plastic bag and label them as follows*:

<u>Tube Label</u>	<u>Tube Contents</u>
NC	Negative Control
C1	0.2 ppm Calibrator
C2	1.0 ppm Calibrator
C3	10.0 ppm Calibrator
S1	sample 1
S2	sample 2
etc.	

You are not required to perform the assay in duplicate; however, doing so will increase the precision.

Place the test tubes in the test tube rack. Push down on each tube so that it is held firmly and does not fall out of the rack when shaken.

CAUTION: Do not "snap" the test tubes into the rack as this may result in a cracked tube.

2. Attach the **12.5 mL** Combitip labeled "Diluent" to the Repeater pipettor and adjust the dial to **2**. Add 500 microliters (µL) of Assay Diluent to each test tube.
3. Attach a clean pipette tip to the Microman pipettor and adjust the dial to "250". Add 25 µL of each calibrator (including Negative Control) to the corresponding test tube by placing the end of the pipette tip against the side of the tube (just above the level of the Assay Diluent) and dispensing the volume. Use a clean pipette tip each time.

CAUTION: Replace the caps on the calibrator vials immediately after use to minimize evaporation.

4. Using a clean tip for each sample, add 25 µL of each sample extract to the appropriately labeled test tube.
5. Attach the **5.0 mL** Combitip labeled "Conjugate" to the Repeater pipettor and adjust the dial to **1**. Add 100 µL of DDTenzyme Conjugate to each test tube.
6. Shake the test tube rack to mix for 10 to 15 seconds. Leave the test tubes undisturbed for 15 minutes.
7. Vigorously shake out the test tube contents into a sink or suitable container. Fill the test tubes to **overflowing** with cool tap or distilled water, then decant and vigorously shake out the remaining water. Repeat this wash step three more times, being certain to shake out as much water as possible on each wash. After the final wash, remove as much water as possible by tapping the inverted tubes on absorbent paper.
8. Attach the **12.5 mL** Combitip labeled "Substrate" to the Repeater pipettor and set the dial to **2**. Add 500 µL of Substrate to each test tube. Leave the test tubes undisturbed for 10 minutes.

NOTE: If a blue color does not develop in the Negative Control test tube within 10 minutes after adding the Substrate, the test is invalid and you must repeat it.

Interpret the Results

You can either interpret the results visually within 10 minutes after adding the Substrate to each test tube, or you can perform a more precise analysis with a photometer after you add the Stop Solution.

Visual Interpretation

After you add the Substrate, wait 10 minutes then mix the test tubes by shaking them for a few seconds until they are a uniform blue color. Compare the sample test tube to the calibrator test tubes against a white background. The test tube rack in the kit is well-suited for this purpose.

NOTE: The word DDT in the interpretation instructions below refers to "total DDT", i.e. the sum of p,p'-DDT, p,p'-DDD, and p,p'-DDE.

- If a sample test tube contains more color than the calibrator test tube, the sample contains DDT at a concentration lower than the calibrator.
- If a sample test tube contains less color than the calibrator test tube, the sample may contain DDT at a concentration greater than the calibrator.
- If the sample test tube contains color that is between the calibrator test tubes, the sample contains DDT at a concentration between the calibrator concentrations.
- If a sample test tube contains approximately the same amount of color as the calibrator test tube, the sample contains DDT at a concentration approximately equal to the calibrator.
- If the sample test tube contains less color than the 10 ppm Calibrator test tube, you may dilute a fraction of the soil extract in methanol (for example, 1:100) and perform the assay again. To determine the

concentration of the diluted extract multiply the result by the dilution factor. (Go to "Semi-Quantitative Interpretation" for further details.)

Photometric Interpretation

After you add the Substrate, wait 10 minutes then add the Stop Solution to each test tube.

WARNING: Stop solution is 1N Hydrochloric acid.

Attach the **12.5 mL** Combitip labeled "Stop" to the Repeater pipettor and set the dial to **2**. Add 500 μ L of Stop Solution to each test tube. This converts the blue color in the test tubes to yellow.

NOTE: After you add Stop Solution to the test tubes, results should be read within 30 minutes.

Differential Photometer

1. Place a water blank test tube containing 1.5 mL of deionized water, or equivalent in the left (reference) well.
2. Place the Negative Control test tube into the right (sample) well. Record the optical density (OD) of the Negative Control.
3. Remove the Negative Control test tube and replace it with the 0.2 ppm Calibrator test tube to reactivate the photometer. Record the result. Repeat this step to determine the OD for each of the remaining calibrators and for each sample.

Semi-quantitative Interpretation

Compare the OD of each sample to the OD of each calibrator:

NOTE: The word DDT in the interpretation instructions below refers to "total DDT", i.e. the sum of p,p'-DDT, p,p'-DDD, and p,p'-DDE.

- If a sample OD is equal to the OD of a calibrator, the sample contains DDT at a concentration approximately equal to the calibrator.
- If a sample OD is greater than a calibrator OD, the sample contains less DDT than the calibrator.
- If a sample OD is lower than a calibrator OD, the sample may contain more DDT than that calibrator.
- If an assay result indicates that a soil sample contains greater than 10 ppm total DDT, but you need more specific information, the soil extract may be diluted 1:100 in neat methanol, and assayed again. You must then multiply the results of the re-assay by 100 to determine the approximate sample concentration.

NOTE: If you know in advance that the "action level" of interest is greater than 10 ppm total DDT in soil, the assay may be modified to pinpoint that particular concentration. For example:

If you wish to categorize samples as less than or greater than 250 ppm, you should dilute all sample extracts 1:250 in neat methanol (e.g. 20 μ L extract plus 4.98 mL methanol) and compare the diluted extracts to the 1 ppm DDT kit calibrator. Due to the 250-fold dilution, the 1 ppm calibrator represents 250 ppm in the assay.

NOTE: If you are interested in action levels greater than 1000 ppm, please contact Technical Assistance for assistance.

Limitations of the Procedure

The EnviroGard DDT in Soil Test Kit is a qualitative/semi-quantitative screening test only. Actual quantitation of DDT by EnviroGard immunoassay is not possible due to the Test kit's cross-reactivity with DDT breakdown products and other similar compounds and to the variations in extraction efficiency inherent in the fast extraction protocol described in this product insert.

Soil sampling error may significantly affect testing reliability. The distribution of pesticides in different soils can be extremely heterogeneous. Soils should be dried and homogenized before analysis by any method. Split samples (i.e. for GC and immunoassay) should always derive from the same homogenate.

Ordering Information

Description	Catalog Number
EnviroGard DDT in Soil Test Kit	73100
EnviroGard Soil Extraction Bottle Kit	72010

Technical Assistance

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General Limited Warranty

Strategic Diagnostics Inc. warrants the products manufactured by it against defects in materials and workmanship when used in accordance with the applicable instructions for a period not to extend beyond a product's printed expiration date. **SDI MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED. THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

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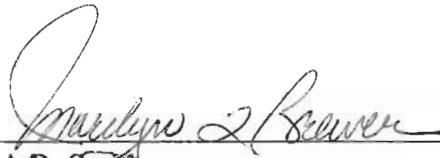
APPENDIX D

SITE SPECIFIC HEALTH AND SAFETY PLAN

SITE SAFETY AND HEALTH PLAN

**HAMILTON AIRFIELD
Novato, California**

Approved by:



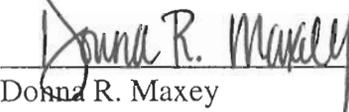
A.R. Smith

Chief, Safety and Occupational Health Office

Date:

1/8/04

Prepared by:

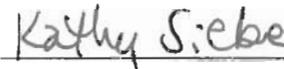


Donna R. Maxey

Project Safety and Health Officer

Date:

1/7/04



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Project Team Lead

Date:

1/8/03-04 145



U.S. Army Corps of Engineers
Sacramento District

JANUARY 2004

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PART I

1.0 INTRODUCTION

This Site Safety and Health Plan (SSHP) establishes the responsibilities, requirements, and procedures for the protection of U.S. Army Corps of Engineers (USACE) Sacramento District (SPK) field personnel during site activities involving preliminary non-intrusive activities (i.e., initial site visits, pre-work plan visits); contractor quality assurance audits; and sampling (soil). This SSHP is prepared for the sole use of SPK personnel.

1.1 Policy Statement

SPK's policy is to provide a safe and healthful work environment for field personnel. Field personnel will receive the appropriate training, equipment, medical, and other resources necessary to complete assigned tasks in a safe manner.

1.1.1 Safety / Health Responsibilities

SPK's Project Manager (PM), Project Safety and Health Officer (PSHO) and Site Safety and Health Officer (SSHO) will cooperatively implement the requirements of this SSHP / Accident Prevention Plan (APP).

1.2 Purpose

The purpose of this SSHP is to heighten awareness of the Hazards present, enhance the safety and health of SPK's site personnel performing field work at Hamilton Airfield Guidelines for emergency response. This SSHP is written to meet the safety and health requirements in EM 385-1-1 and ER 385-1-92 as well as OSHA AF requirements (29 CFR 1926.65 / 29 CFR 1910.120). The procedures and guidelines contained herein are based upon the best available information regarding the physical, chemical, biological, radiological, and safety hazards known, or suspected to be present at HAAF at the time of this SSHP's preparation. Specific requirements may be revised if new information is received or site conditions change. Any revisions to this plan will be made with the knowledge and concurrence of the PM, PSHO, and the Chief of the Safety and Occupational Health Office (SOH).

1.3 Supplemental SSHP

This SSHP supplements any contractor's SSHP when SPK personnel are auditing the contractor.

1.3.1 Contractor's SSHP

Contractors are responsible for their own SSHP and the safety and health of their employees. Contractor developed SSHP(s) are available to SPK personnel.

1.3.2 Multi-Employer Job Setting

Under OSHA AF, each employer is required to provide a safe and healthful working environment for its employees. SPK may be simultaneously working in conjunction with other contractors. In this situation, the activities of one employer could cause harm to the

employees of another employer. SPK and contractors will present the particular safety and health issues associated with each day's activities at the daily tailgate safety meeting.

1.4 Accident Prevention Plan

This SSHP also serves as the Accident Prevention Plan (APP) as required by EM 385-1-1 (Appendix A).

1.5 Compliance

SPK personnel will comply with this SSHP, any contractor prepared SSHP, applicable Federal, state, and local environmental laws, and occupational safety and health regulations.

1.6 Applicability

SPK site personnel are responsible for reading, understanding and abiding by this SSHP and documenting such understanding through signing the SSHP's Employee Acknowledgment Form.

1.7 Notification Requirements

The PM will be immediately notified of the following:

- a. Any required site evacuation, e.g., based on contractor air monitoring data.
- b. Any fatality or admission of one or more site personnel to the hospital. The PM will be responsible for notifying the employee's supervisor, the SOH and the client.
- c. Any site physical Hazard where continued site work could lead to possible death or permanent injury.

1.8 References

The SSHP and subsequent activities will comply with the following referenced documents, at a minimum:

- a. Title 29 Code of Federal Regulations (CFR) 29 CFR 1926.65 / 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*.
- b. USACE, *Safety and Health Requirements Manual*, EM 385-1-1.
- c. USACE, *Safety and Occupational Health Document Requirements for Hazardous, Toxic and Radioactive Waste (HTRW) Activities*, ER 385-1-92.
- d. NIOSH/OSHAAF/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Activities*.

1.9 SSHP Organization

This SSHP is comprised of two sections.

1.9.1 Section 1

This section addresses site specific safety and health issues. It includes a site description and contaminant characterization a safety and health risk/Hazard analysis for chemical, physical, biological, safety, and radiological Hazards; monitoring requirements and

action levels for upgrading or downgrading personal protective equipment (PPE) or evacuating the site; and emergency assistance information.

1.9.2 Section II

Section II (under development) includes general safety and health procedures common to SPK field efforts at any site. Section II describes the roles and responsibilities of field personnel with respect to safety and health, safety training requirements, medical surveillance program, descriptions of different levels of PPE, and standard safety procedures such as safety inspections, emergency response planning, Hazard communication, and spill containment. Information in this section will aid SPK employees when conducting contractor quality assurance audits.

1.9.3 SPK-OM-385-1-1

This SSHP will be utilized in conjunction with SPK's *Safety and Occupational Health Policy and Procedures Manual*, OM 385-1-1.

1.10 Activity Hazard Analysis (AHA)

Before activities begin, a safety and health tailgate meeting will be conducted by the SSHO and contractors to review the AHAs. This meeting will include a review of potential Hazards and control measures necessary to perform project activities safely as well as any contingency planning in the event of an emergency.

1.10.1 SPK Tasks

Work tasks include non-intrusive activities (i.e., initial site visits, pre-work plan visits); contractor quality assurance audits; and sampling (soil).

1.10.2 Contractor Tasks

The Contractor's work tasks are described in the contractor's SSHP(s).

2.0 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

The Hamilton Airfield is located in Novato, California. HAAF was a former Air Force Base and Army Field. Sampling will consist of numerous soil sampling in and around the base with varied laboratory analytical requirements. The investigations are designed to collect soil samples at three sites at HAAF is contaminated or the lateral and vertical extent of any contamination at five previously sampled sites. The eight sites are Spoils Pile F, South Runway DDT Hotspot, Revetments 6 and 7, Firing-In Target Butt Near Revetment 1, Skeet Range, Testing Range, Building 35, and Unlined Perimeter Ditch (UPDD).

2.1 Contaminant Characterization

A list of potential contaminants found or known to be present at HAAF is included as attachment Table 1 – Occupational Health Exposure and Toxicological Properties for Contaminants of Potential Concern. Compilation of this list is based on results of

previous studies or selecting the likely contaminants based on site history and prior site uses/activities.

3.0 HAZARD/RISK ANALYSIS

3.1 General

This SSHP identifies the chemical, physical, biological, radiological, safety, and OE/CWM Hazards may be encountered. The AHA identifies potential Hazards and control measures to be implemented to eliminate or reduce each Hazard to an acceptable level.

3.1.1 Tasks

- a. Non-intrusive visits.
- b. Soil sampling in soil stockpiles up to 2 feet deep.

3.2 Chemical Hazards

Known or suspected chemical Hazards exist at HAAF (see attached Table 1). These include potential exposure to a variety of metals such as lead, antimony, copper and zinc, explosive compounds, volatile and semi-volatile organic compounds, pesticides, PCBs, and dioxins. The chemicals are either known or suspected to exist at HAAF, with their respective exposure limits, are listed. The OSHA permissible exposure limit (PEL) and short-term exposure limit (STEL), the American Conference of Governmental Industrial Hygienist (ACGIH[®]) Threshold Limit values (TLV[®]), and the National Institute for Occupational Health and Safety (NIOSH) Immediately Dangerous to Life and Health (IDLH) concentrations are listed, if available, for each chemical. The actual exposure limit concentrations of these materials vary, depending upon the media in which the chemicals are present and site activities. Based on current information, it is suspected the surface and subsurface at HAAF may be contaminated with some or all of the compounds listed in the table. Actual contaminants encountered may not be limited to these. Personal exposures to these chemicals may be through inhalation, ingestion, skin and eye contact, skin absorption, or by a combination of these routes. Additionally, SPK will evaluate safety and health Hazards for Hazardous substances brought on site for the execution of site activities.

3.2.1 Chemicals of Potential Concern (COPC)

Table 1 – Occupational Health Exposure and Toxicological Properties of COC

COC	OSHA PEL	NIOSH REL	ACGIH TLV	IDLH
PAH	0.2 mg/m ³	0.1 mg/m ³ (10 hour exposure)	NA	80 mg/m ³

3.2.2 Chemical Information and Material safety Data Sheets (MSDS)

Prior to the commencement of work, all available information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on site will be made available to the affected employees. MSDSs will be available for Hazardous materials brought to the site by SPK and any contractor. It is not anticipated SPK will bring any Hazardous chemicals to the site in support of site activities.

3.2.3 Action Levels

Action levels are not required for SPK activities. SPK will comply with the contractor's actions levels for sites being audited.

3.3 Physical Hazards

Potential Hazards from physical agents include noise, heat and cold stress, solar radiation, weather, lifting, slipping, tripping, or falling,

3.4 Biological Hazards

Biological Hazards include insects, spiders, ticks and fleas, rattlesnakes, scorpions, rodents, and plants with thorns, spines and needles.

- a. Snakes and insects are found throughout HAAF. Possible cover and Habitat for these shall be minimized in the field operations area.
- b. Hantavirus exposure is also a potential Hazard. Potential risk factors for Hantavirus exposure include disturbing mice nests or areas with visible mouse droppings.

3.5 Radiological Hazards

There is no evidence of ionizing radiation sources or radioactive waste disposal at HAAF; therefore, no specific radiation screening is planned. In the event information is provided contradicts with this assumption, this SSHP will be amended to include appropriate screening and action levels for Halting or altering site work. SPK will not use nuclear sourced equipment (i.e., soil compaction nuclear density gauge, XRF).

3.6 Unexploded Ordnance

There is no evidence of UXO at the study site. If a suspect UXO is encountered, SPK employees will evacuate the site.

3.7 Safety Hazards

Safety Hazards from SPK and contractor site conditions and activities include excavation, slips, trips, and falls on same surface, electrical, equipment and machinery, weather, etc. SPK will ensure the controls implemented to address these safety Hazards comply with applicable sections of EM 385-1-1.

3.8 Hazard Analysis

This certifies SPK assessed the type, risk level, and severity of Hazards for the tasks and selected appropriate personal protective equipment in accordance with 29 CFR 1910.132

3.8.1 Heavy Equipment Operations

Prudent care will be exercised when moving about machinery of any kind. Personnel will be aware the use of certain protective equipment may limit dexterity and visibility, and may increase the difficulty in performing certain tasks.

3.8.2 Vehicle Traffic

Employees may be exposed to vehicle accident Hazards associated with the operation of vehicles during the project. Seat belts will be worn and basic speed laws followed.

3.8.3 Heavy Lifting

During manual lifting tasks, personnel will lift with the force of the load suspended on their legs and not their backs. They are to maintain a straight back and hold the object close to the body. Mechanical lifting devices or help from a fellow field team member will be sought when the object is too heavy for one person to lift.

3.8.4 Slip/Trip/Fall

All field members are to be vigilant in providing clear footing, identify obstructions, holes or other tripping Hazards, and maintaining an awareness of uneven terrain and slippery surfaces. Working at heights above six feet is not anticipated.

3.8.5 Noise

All field personnel will be required to wear hearing protective devices in areas where normal communication cannot be understood when field personnel are within three feet from one another and when working within 20 feet of heavy equipment.

3.9 Hazard Communication Program

SPK includes a Hazard communication program in SPK-OM-385-1-1.

4.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

The operational and safety and health responsibilities will be undertaken by qualified and competent safety and health professionals. Each person assigned specific safety and health responsibilities is identified.

4.1 SPK Chain of Command

Ms. Kathy Siebenmann is the Technical Team Lead, Ms. Donna Maxey is the Project Safety and Health Officer, Mr. A.R. Smith is the District Chief of Safety and Occupational Health, and the SSHO/Field Team Lead will be determined.

4.2 SPK Personnel Responsibility and Authority

SPK personnel are responsible for performing tasks in a safe and healthful manner, preventing unnecessary risk of Hazardous exposure to field personnel, other site personnel, the public, or the environment. Each individual is responsible for acknowledging and following applicable safe work rules and guidelines in this SSHP and the contractor's SSHP(s) and using best professional judgment in minimizing the potential for injury or adverse health associated with activities governed by this SSHP.

4.2.1 Project Manager

As the senior management representative, the PM is responsible for defining project objectives, allocating resources, determining the project delivery team, and evaluating project outcome. The PM will ensure the reporting, scheduling, and budgetary obligations are met.

4.2.2 Site Safety and Health Officer

Day-to-day safety and industrial hygiene support, including air monitoring, training, daily site safety inspections, will be provided by a designated SSHO who will report activities to the PSHO.

4.2.3 Field Personnel

All personnel will attend a project-specific briefing conducted by the PSHO or SSHO. This briefing is used to orient all site personnel to the nature of the site, the scope of work, the contents of the SSHP and any unique site conditions warrant explanation.

4.2.4 Project Safety and Health Officer

The PSHO is responsible for the development, technical assistance, and oversight of this SSHP. The PSHO shall ensure all health and safety program documents comply with Federal, state and local health and safety requirements. If necessary, the PSHO will modify the SSHP to adjust for on-site changes that affect safety and/or health. The PSHO will coordinate with the SSHO on all modification to the SSHP and will be available for consultation when required.

4.2.5 Chief, Safety and Occupational Health Office

The Chief, SOH is responsible for verifying that SPK personnel are current participants in the medical surveillance program, have current respiratory fit test (if applicable), complete safety and health training; and providing quality assurance for consistency with Corps policy and procedure. The SPK SOH may conduct a site safety audit. This audit will be to check for conformance with the SSHP. Findings will be written up and discussed with the PM, PSHO and SSHO to ensure that any deficiencies are corrected.

4.2.6 Other Key Safety and Health Personnel

- a. SPK will utilize the services of Dr. Lee Wugofski, MD, of the Division of Federal Occupational Health (DFOH) unit. Dr. Wugofski is certified in occupational medicine.
- b. SPK will utilize laboratories which are proficient to conduct personnel, area, and environmental analysis for organic and inorganic chemicals; fully equipped to analyze the required NIOSH, OSHA, and EPA analyses; and currently participating in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program and is certified by AIHA.

4.2.7 Key Personnel

Technical Team Leader	Kathy Siebenmann	(916) 557-7180
Chief SOH	Arthur R Smith	(916) 557-6973

Project Safety and Health Officer	Donna Maxey	(916) 557-7437
Site Safety and Health Officer	Kim Emerick	(916) 557-7319
Public Health Service (PHS)	Marion Conley, RN	(916) 930-2290
Occupational Physician (PHS)	Dr. Lee Wugfoski, MD	(415) 556-2975

4.2.8 *Site Visitors*

Visitors may be present at the project site during field activities. These individuals may include SPK staff, regulatory agency personnel, client personnel, and visitors. The SSHO will provide a brief overview of the field activities to the site visitors.

5.0 Training

5.1 General

All personnel who enter a Hazardous waste site must recognize and understand the potential Hazards to health and safety. It is the intent of this SSHP to provide every person a level of health and safety training consistent with their job function and responsibility. SPK on-site personnel have completed formal Hazardous waste operations (HAZWOPER) training and will complete an on-site briefing on this SSHP, the AHA, PPE, and Hazard communication. SPK personnel performing on-site activities will be familiar with the contents of this SSHP along with any contractor's SSHP(s), and sign the SSHP Employee Acknowledgment form.

5.1.1 *Additional Training*

In addition to the OSHA Hazardous waste operations and emergency response regulations, there are other ancillary safety and health regulations governing certain training aspects for these projects. These additional training requirements include:

- a. Respiratory Protection (29 CFR 1910.134).
- b. Hearing Conservation (29 CFR 1910.95).
- c. Hazard Communication (29 CFR 1910.1200 / 1926.59).
- d. Bloodborne Pathogens (29 CFR 1910.1030).

5.1.2 *Initial Training*

Field personnel Have completed 40 hours of off-site instruction, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor.

5.1.3 *Supervisory Training*

The Field Team Lead/SSHO Has completed 8 additional hours of specialized training on managing such operations.

5.1.4 *Refresher Training*

All site workers will complete 8 hours of off-site refresher training annually on the items covered in the 40-hour initial training program.

5.1.5 Site-Specific Training

Site-specific training covering site Hazards, procedures, and contents of the SSHP to all personnel, including those assigned only to the Support Zone who Have met the requirements of 29 CFR 1926.65. Training will be conducted prior to job start-up and as needed thereafter. The PSHO or SSHO will conduct initial site-specific training to ensure that employees have a thorough understanding of the SSHP, standard operating procedures (SOPs), and physical, safety, biological, radiological, and chemical Hazards of the site.

5.1.6 Daily Tailgate Safety Meetings

All personnel who enter the exclusion and contamination reduction zones will attend the daily tailgate safety meeting. This meeting, conducted by the SSHO and/or contractor, will cover specific health and safety issues, site activities, changes in site conditions, and will review topics covered in the initial health and safety meeting as they apply to daily activities.

5.1.7 Respiratory Protection

Respiratory protection training is included in the initial 40-hours and 8-hour update HAZWOPER training.

5.1.8 Hazard Communication

In accordance with the OSHA Hazard Communication standard (29 CFR 1910.1200 / 29 CFR 1926.59), copies of all material safety data sheets (MSDS), container labeling, and chemical health Hazards for Hazardous chemical materials brought onto any project site and used during site operations will be available. Site-specific training on the chemicals of concern will be provided. General Hazard communication training will be conducted during the HAZWOPER training.

5.1.9 Bloodborne Pathogens and CPR/First Aid

Selected employees have been trained in CPR and first aid for emergency use only. An introduction to the Bloodborne Pathogens standard will be provided during the CPR/First Aid Training.

5.1.10 Hearing Conservation

Hearing conservation is included in the initial 40-hour and 8-hour refresher HAZWOPER training classes.

5.1.11 Confined Space Entry

Confined space entry is not anticipated nor permitted without a revision to this SSHP. General awareness of confined space entry training is provided in the 40-hour initial and 8-hour refresher HAZWOPER training classes. Under no circumstance will employees not specifically trained in confined space safety be permitted to enter a confined space.

5.1.12 Excavation and Trenching

Excavating and trenching will not be conducted by contractors or SPK personnel.

5.1.13 Emergency Response Procedures

All employees will be made aware of the project emergency assistance network and the most probable route of evacuation in the event of an emergency.

5.1.14 Site-Specific Rules and Disciplinary Procedures

Prior to the initiation of field activities, employees will be instructed in specific safety rules. Employees will be instructed in the use of the “buddy” system; the buddy system will be used at all times when employees are within an exclusion or contamination reduction zone.

5.1.15 Documentation of Training

Documentation of training is the responsibility of SPK’s SOH.

5.1.16 First Aid / CPR

At least two SPK, or contractor persons trained in a minimum of both American Red Cross first-aid techniques and CPR will be on site whenever activities occur.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Personal Protective Equipment Program

SPK will develop a site-specific PPE program. This program will supplement SPK’s Protective Clothing and Equipment program, SPK OM 385-1-1, Appendix J. The program will address the elements of 29 CFR 1926.65(g)(5), 29 CFR 1910.132 (General Requirements) and 29 CFR 1910.134 (Respiratory Protection).

6.2 PPE Ensemble

SPK will specify minimum PPE ensembles (including respirators) necessary for each task/operation based on the Hazard/risk analysis, including potential heat stress and associated safety Hazards.

6.2.1 Site-Specific Personal Protective Equipment

Based on the Hazard assessment, including the review of the existing analytical data and related toxicological information, proposed activities, performance characteristics of the PPE relative to the requirements and limitations of the site, the task-specific conditions and durations, it is anticipated that Level D is the initial level of protection during SPK tasks. Personnel shall use the PPE ensemble as described in the contractor’s SSHP when conducting contractor audits.

6.2.2 Level D

Level D consists of the following:

- a. Long pants and sleeved shirts with collars.
 - b. Safety boots/shoes meeting the specifications of American National Standards Institute (ANSI) Z41.
 - c. Safety glasses (may be tinted for outdoors work). All approved eye protection must meet the specifications of ANSI Z87.1. The use of contact lenses is
-

discouraged during Level D operations, but not prohibited. Safety glasses will be used in addition to the contact lenses.

- d. Impervious gloves will be worn during all site activities that could result in direct contact with potentially contaminated soil or other items.
- e. Hearing protection (if required). The protective device must Have a noise reduction rating capable of providing the wearer with enough protection so as to reduce the received noise level to below 85 dBA.

Because of recent concerns of Hantavirus, which has resulted in several deaths in the Southwestern part of the United States, respirators may be worn by site personnel in Level D ensembles. For this reason, air purifying respirators (APR), Half-faced or full-faced, with either a dust filter or high efficiency particulate air (HEPA) filter (P100) will be made available. The dust filter will suffice, as the Hantavirus is typically transported via dust particles.

6.2.3 Level C

Level C protective equipment will be designated by SPK Personnel and may consist of the following:

- a. Chemical-resistant coveralls. This may include polyethylene coated Tyvek, or Saranex.
- b. Safety shoes with disposable boots covers or, Chemical-resistant steel toed boots, meeting the specifications of ANSI Z41.
- c. Chemical resistant gloves. This includes: disposable inner and outer gloves, such as polyvinyl alcohol and 4H or Silver Shield.
- d. Work gloves as necessary to prevent cuts, scrapes, and pinches.
- e. Half-faced or full-faced APR with HEPA (P100) cartridges, Safety glasses, goggles or face shield when wearing a Half-face APR, meeting the specifications of ANSI Z87.1. There is no longer an OSHA prohibition for the use of contact lenses with respiratory protective devices. Individuals who feel that the contact lens provides them superior vision and comfort may use them with respirators.
- f. Hardhat meeting the specifications of ANSI Z89.1.
- g. Cuffs sealed to boots or gloves with duct tape, or equivalent.
- h. Hearing protection as necessary depending on measured decibel readings in the field.
- i. Reflective traffic vests.

6.2.4 Level B and Level A

SPK personnel will not use Level B and Level A PPE.

6.2.5 Modification of PPE

Based on actual field conditions and on-site monitoring activities, modification in the PPE may be necessary. Modifications may include PPE upgrades to a higher degree of protection, downgrades, or substitutions such as use of engineering controls. The SSHO may modify the initial levels of PPE in response to additional site information, with the approval of the PSHO.

6.3 Fit-For-Duty

Site personnel will Have a current medical "fit-for-duty" clearance to use respiratory and other PPE.

6.4 Respirator Protective Program

All respiratory protective equipment will be National Institute for Occupational Safety and Health (NIOSH) approved. SPK maintains a written respiratory protective equipment program detailing selection, fit testing, use, cleaning, maintenance, and storage of respiratory protective equipment, as well as medical approval for individual use.

7.0 Medical Surveillance

7.1 General

Personnel performing on-site HTRW activities participate in an ongoing medical surveillance program meeting the requirements of 29 CFR 1926.65 and ANSI Z-88.2.

7.2 Medical Surveillance Coordinator

SPK's SOH has contracted the services of a Board-Certified Occupational Physician at DFOH to provide the bi-annual (more frequent on physicians recommendation) medical surveillance exams. The physician will review all medical examinations and will be available for medical consultation on an "as-needed" basis.

7.3 Medical Examinations

On-site SPK personnel have successfully completed a pre-placement or periodic/updated physical examination. The medical surveillance provided to the employee includes a judgment by the medical examiner of the ability of the employee to use negative-pressure respiratory equipment. Any employee found to have a medical condition that could directly or indirectly be aggravated by exposure to the COPC or by the use of respiratory equipment will not be employed for the project.

7.3.1 Contents of Medical Examination

SPK's SOH in consultation with the DFOH has established the minimum content of the medical examination based upon probable HTRW site conditions, potential occupational exposures and required protective equipment.

7.3.2 Injury or Illness

Any injury or illness (whether on or off the job) may require work restrictions after the employee returns to work. If the injury or illness required seeing a physician, either the attending physician or the physician giving the employment physical will be involved in the decision of when the employee will return to work, and if any work restrictions will apply.

7.3.3 Certification of Participation

The SOH will maintain the certification of employee participation in the medical surveillance program and the written opinion from the attending physician.

7.4 Medical Records

Personnel Medical records will be maintained by DFOH.

7.4.1 Project Specific Medical Monitoring

There are no HAAF specific medical monitoring elements.

7.5 Emergency Medical Assistance and First Aid

Prior to work start-up, an emergency medical assistance network will be established. The Fire Department, ambulance service, and clinic or hospital emergency room are identified. A vehicle will be available on-site during all work activities to transport injured personnel to the identified emergency medical facility. At least two field team members (SPK, HAAF or contractor) will be certified to render both CPR and First Aid. A first aid kit, including necessary protection against bloodborne pathogens, will be available. An adequate supply of fresh potable water for emergency eye wash purposes or a portable emergency eyewash, also will be available depending on the site hazards. A map and directions indicating the fastest route to the hospital emergency room will be posted.

8.0 RADIATION DOSIMETRY

Radiological hazards are not anticipated for this project.

9.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

9.1 General

Exposures to the COPCs above their PEL/TLV are not anticipated for these SPK outdoor tasks; there will be no direct-reading or integrated personal monitoring. If conditions are not as anticipated, work will stop until a monitoring program is established and monitoring equipment is obtained. Contractor may monitor intrusive activities that they conduct.

9.2 Dust Control

SPK activities will not require dust control.

9.3 Heat or Cold Stress Monitoring

Heat or cold stress will be monitored qualitatively. Personnel will not conduct strenuous activities that will require heat stress monitoring. Personnel will take breaks in air-conditioned vehicles.

10.0 HEAT / COLD STRESS MONITORING

10.1 General

Heat and cold stress will be monitored qualitatively.

10.2 Heat Stress

The stress of working in a hot environment can cause a variety of illnesses including heat exhaustion or heat stroke; the latter can be fatal. Use of personal protective equipment

can significantly increase heat stress. To reduce or prevent heat stress, SPK will implement scheduled rest periods and require controlled beverage consumption to replace body fluids and salts.

10.2.1 Monitoring for Heat Stress

Personnel are trained to recognize the symptoms of heat stress and the appropriate action to take upon recognition.

10.3 Cold Stress

During the winter months, cold stress may be an occupational stress. Frostbite and hypothermia are the primary concerns. Personnel will take breaks in a heated vehicle.

11.0 STANDARD OPERATING SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

SPK will develop and implement applicable and feasible engineering and work practice controls to reduce and maintain employee exposure at or below the OSHA PELs for the COPCs. SPK will develop and implement, as applicable, standard operating procedures (SOP), to include but not limited to:

- a. Site rules/prohibitions (buddy system, eating/drinking/smoking restrictions).
- b. Work permit requirements (e.g., radioactive work, excavation, hot work, confined space). Not applicable for SPK tasks.
- c. Material Handling procedures (soils, liquids, radioactive material). Not applicable for SPK tasks.
- d. Drum/container Handling procedures and precautions (opening, sampling, overpacking). Not applicable for SPK tasks.
- e. Confined space entry procedures. Not applicable
- f. Hot work, sources of ignition, fire protection/prevention. Not applicable.
- g. Electrical safety (ground-fault protection, overhead power line avoidance). Not applicable for SPK tasks.
- h. Excavation and trenching safety. Not applicable for SPK tasks.
- i. Guarding of machinery and equipment. Not applicable for SPK tasks.
- j. Lockout/Tagout. Not applicable for SPK tasks.
- k. Fall protection. Not applicable for SPK tasks.
- l. Hazard Communication.
- m. Illumination. Work will be conducted during daylight hours.
- n. Sanitation. Work breaks, eating, and drinking will be in the field vehicle or other suitable location outside the restricted area.
- o. Engineering controls.
- p. Process Safety Management. Not applicable.
- q. Signs and labels. Not applicable for SPK tasks.

11.1 Field Safety Requirements

The field safety requirements and procedures applicable to this project include safe work practices, work zones, site control, safety meetings, safety inspections, accident reporting and investigations, sanitation, and housekeeping.

11.2 Hearing Conservation

A hearing conservation program will be implemented at the site when noise exposures equal or exceed an 8-hour TWA of 85 A-weighted decibels (dBA). Audiometric testing is part of the medical surveillance program. Hearing protection will be worn by personnel working with or around heavy equipment.

11.3 Heavy Equipment Operations

Personnel will stay clear of contractor's operating equipment. Personnel will approach operating equipment only from the operator's angle of view and only after making eye contact with the operator. Personnel will wear reflective traffic vests.

11.4 Weather

SPK activities will be suspended during severe weather conditions.

11.5 Slips, Trips, Falls

These potential Hazards are likely due to slippery surfaces and uneven terrain. SPK personnel will watch where they walk.

11.6 Cuts and Scrapes

The potential for jagged-edged objects and general cuts and scrapes exist. SPK personnel will wear appropriate PPE.

11.7 Buried / Overhead Utilities

This is a contractor responsibility.

12.0 SITE CONTROL MEASURES

Currently there is no site control in progress for the HAAF site.

12.1 Work Zones

SPK tasks will be conducted in restricted areas; the 3-work zones will not be required. The contractors will establish work zones (Exclusion (EZ), Contamination Reduction (CRZ), and Support (SZ), including restricted and regulated areas) at HTRW sites based on the contamination characterization data and the hazard/risk analysis.

12.2 Authorized Personnel

Only authorized personnel will enter regulated areas associated with the field activities. The SSHO will establish the bounds of the regulated areas. The following measures will be taken to assure site security. All workers entering the regulated areas will be subject to the provisions of the SSHP. The SSHO will have the responsibility and authority to enforce this requirement.

12.3 Communication Systems

Two types of communications systems will be available for workers assigned to field projects. One system will ensure adequate communication between site personnel, and

the other will ensure the ability to contact personnel and emergency assistance off the site.

13.0 PERSONAL HYGIENE AND DECONTAMINATION

A formal decontamination station is not applicable for SPK activities. Decontamination will occur within the gravel firing range area. Wet-wipes will be used as an alternative procedure before eating and drinking.

14.0 EQUIPMENT DECONTAMINATION

Sampling equipment will be decontaminated between sampling locations. Disposable equipment will be containerized and removed from the area. No heavy equipment will be used by SPK personnel.

15.0 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

The following items, as appropriate, will be available for on-site use:

- a. First aid equipment and supplies.
- b. Emergency Eyewashes/showers (ANSI Z-358-1) (determined by SSHO)
- c. Fire Extinguishers (determined by SSHO)

Contractors may have additional emergency equipment at their job sites.

16.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

16.1 Local Fire / Police / Rescue

Local fire/police/rescue authorities having jurisdiction and nearby medical facilities that could be utilized for emergency treatment of injured personnel will be contacted to notify them of upcoming site activities and potential emergency situations, to ascertain their response capabilities, and to obtain a response commitment.

16.2 General

This section contains emergency response procedures specific to this project, including telephone numbers for the closest medical facilities capable of providing emergency service for hazardous waste site workers, a map showing the locations of these medical facilities. Additionally, telephone numbers for the Poison Control Center, local police, fire department (including emergency rescue squad), and SPK management contacts have been provided. The SSHO will be responsible for taking necessary action and contacting the appropriate emergency contacts and SPK personnel in case of emergency.

16.3 Spill and Discharge Control

Not applicable for SPK activities

16.4 Emergency Response Plan and Contingency Procedures

SPK personnel will be prepared to respond and act quickly in the event of an emergency. Pre-planning measures will include employee training, fire and explosion prevention and

protection, chemical spill and discharge prevention and protection, and safe work practices to avoid personal injury or exposure.

16.4.1 *Medical Emergency Response*

In the event of severe physical or chemical injury, emergency response personnel will be summoned for emergency medical treatment and ambulance service. The emergency medical responders will be utilized to provide care to severely injured personnel. Transportation routes and maps will be posted in each vehicle prior to the initiation of on-site activities.

16.4.2 *Emergency Response Contacts*

Field Team Leader/SSHO	Kim Emerick	(916) 557-7319
	On-Site Cell	(916) 261-9499
Project Safety and Health Officer	Donna Maxey	(916) 557-7437
Chief SHO	A.R. Smith	(916) 557-6973
Public Health Service (PHS)	Marion Conley, RN	(916) 930-2290
Occupational Physician (PHS)	Dr. Lee Wugfoski, MD	(415) 556-2975
SPK District 24 Hr Answering Service		(916) 452-1535
Novato Community Hospital		(415) 897-3111
180 Rowland Way		
Novato, CA 94945		
Poison Control Center		(800) 222-1222
Fire/Police Emergency		911

16.4.3 *Personal Exposure or Injury*

The SSHO will call for emergency assistance if needed. As soon as practical, the SSHO will contact the Section Supervisor. Staff assigned to this project will be briefed on procedures.

16.4.4 *Emergency Equipment*

The SSHO will have a cell phone at the site; the SSHO will determine if it functions at the individual sites. The SSHO will assure communication with HAAF security.

17.0 ACCIDENT PREVENTION

17.1 Daily Safety and Health Inspections

Daily safety and health inspections will be conducted by the SSHO to determine if site operations are in accordance with the approved SSHP, OSHA, and USACE requirements.

17.2 Accident or Incident

In the event of an accident or incident, the SSHO will immediately notify the Technical Team Lead and the employee's supervisor. Within three working days of any reportable accident/injury/illness, the employee and their supervisor will complete and submit to the SOH Office an Accident Report on ENG Form 3394, CA-1 and/or CA-2, and other applicable forms. The PM will complete and submit DA Form 285 for all Class A and B accidents.

17.3 Accident Investigations

All injuries, occupational illnesses, vehicle accidents, and incidents with potential for injury or loss will be investigated, appropriate corrective measures taken to prevent recurrence, and continually improve the safety and health of the work site.

18.0 **LOGS, REPORTS, AND RECORDKEEPING**

The following logs, reports, and records will be developed, retained, and submitted to the PM:

- a. Daily safety inspection logs (may be part of the Daily QC Reports).
- b. Employee/visitor register.
- c. Environmental and personal exposure monitoring/sampling results (contractor provided).

18.1 Recordkeeping

The PM will maintain reports generated by the Field Team Leader.

18.2 Accident Reporting and Investigation

All SPK personnel are required to report all near misses, injuries, illnesses, and accidents to their immediate supervisor. The supervisor will immediately arrange appropriate medical care as required. Once immediate medical care for the injured personnel has been accomplished, the supervisor will complete and submit the appropriate report forms required by the SOH Office and Human Resources. All near misses, injuries, illnesses, and accidents shall be investigated. The supervisor of the injured employee will investigate the conditions that led to the accident with the assistance of the Chief, SOH. They will document how the accident occurred and identify unsafe acts or conditions what occurred or existed at the time of the accident. Corrective actions will be determined and implemented to prevent recurrence of the accident, and responsibility for implementation of corrective actions will be assigned.

ACTIVITY HAZARD ANALYSIS

ACTIVITY: Site Visit/Sampling

Principal Steps	Potential Hazards	Recommended Controls
1. Non-intrusive visits	<u>Chemical Hazards:</u> See Tables 1 <u>Radiological Hazards:</u> None anticipated <u>Biological Hazards:</u> Rattlesnakes, insects,	<u>Chemical Hazards</u> 1. Level D PPE, upgrade to Level C as determined by SPK Personnel.
2. Soil Sampling	spiders, ticks, fleas	<u>Radiological Hazards:</u> None

	<p><u>Physical Hazards:</u></p> <ol style="list-style-type: none"> 1. Cuts, scrapes, and pinch points from Hand Augers 2. Slip/trip/fall on slippery surfaces and uneven terrain 3. Heat stress 4. Noise from heavy equipment 5. Struck by or against a piece of heavy equipment 6. Contact with overhead and underground utilities. 	<p><u>Biological Hazards:</u> Observe field conditions.</p> <p><u>Physical Hazards</u></p> <ol style="list-style-type: none"> 1. Watch where you step, be aware that sticks, rocks or other items can be concealed by leaves and grass, causing you to trip. 2. Only qualified and trained personnel will operate equipment. 3. Equipment must be inspected by a competent person and operated in accordance with the manufacturer's instructions. 4. Moving equipment must have properly functioning back-up alarms. 5. Equipment shall not run unattended. 6. Frequent breaks and replacement fluids to prevent heat stress.
Equipment to be Used	Inspection Requirements	Training Requirements
1. None	1. None	1. None

Table 1: See NIOSH Pocket Guide for Chemicals of Concern (Section 3.2.1)

EMPLOYEE ACKNOWLEDGMENT

The above project requires the following: that you be provided with and complete formal and site-specific training; that you be supplied with proper personal protective equipment including respirators; that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that the Corps of Engineers has met these obligations to you.

I Have Reviewed, Understand and Agree to Follow this Site Safety and Health in addition to the Contractor's SSHPs at HAAF.

Printed Name	Signature	Organization	Date

TRAINING ACKNOWLEDGMENT FORM

By signing this certificate, you are acknowledging that you have completed the following formal training:

SITE-SPECIFIC TRAINING: I have completed the SPK/contractor site-specific training
_____ Employee Initials

RESPIRATORY PROTECTION: I have been trained in accordance with SPK's Respiratory Protection Program, SPK OM 385-1-1. I have been trained in the proper work procedures and use and limitations of the respirator(s) I will potentially wear. I Have been trained in and will abide by the facial hair policy. SPK employees will evacuate the site if conditions require an upgrade to EPA/OSHA Level C PPE (which includes respiratory protection) if not trained, medically evaluated or provided a respirator.
_____ Employee Initials

MEDICAL EXAMINATION: I have had a medical examination within the [last twelve months] [two years] which was paid for by the Corps of Engineers. The examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. The Chief of SOH Office evaluated the medical certification provided by the physician. The physician determined that there:

- a. Were no limitations to performing the required work tasks;
_____ Employee Initials
- b. Were identified physical limitations to performing the required work tasks.
_____ Employee Initials

Employee's Signature _____ Date _____

Employee's Name _____
(Printed)

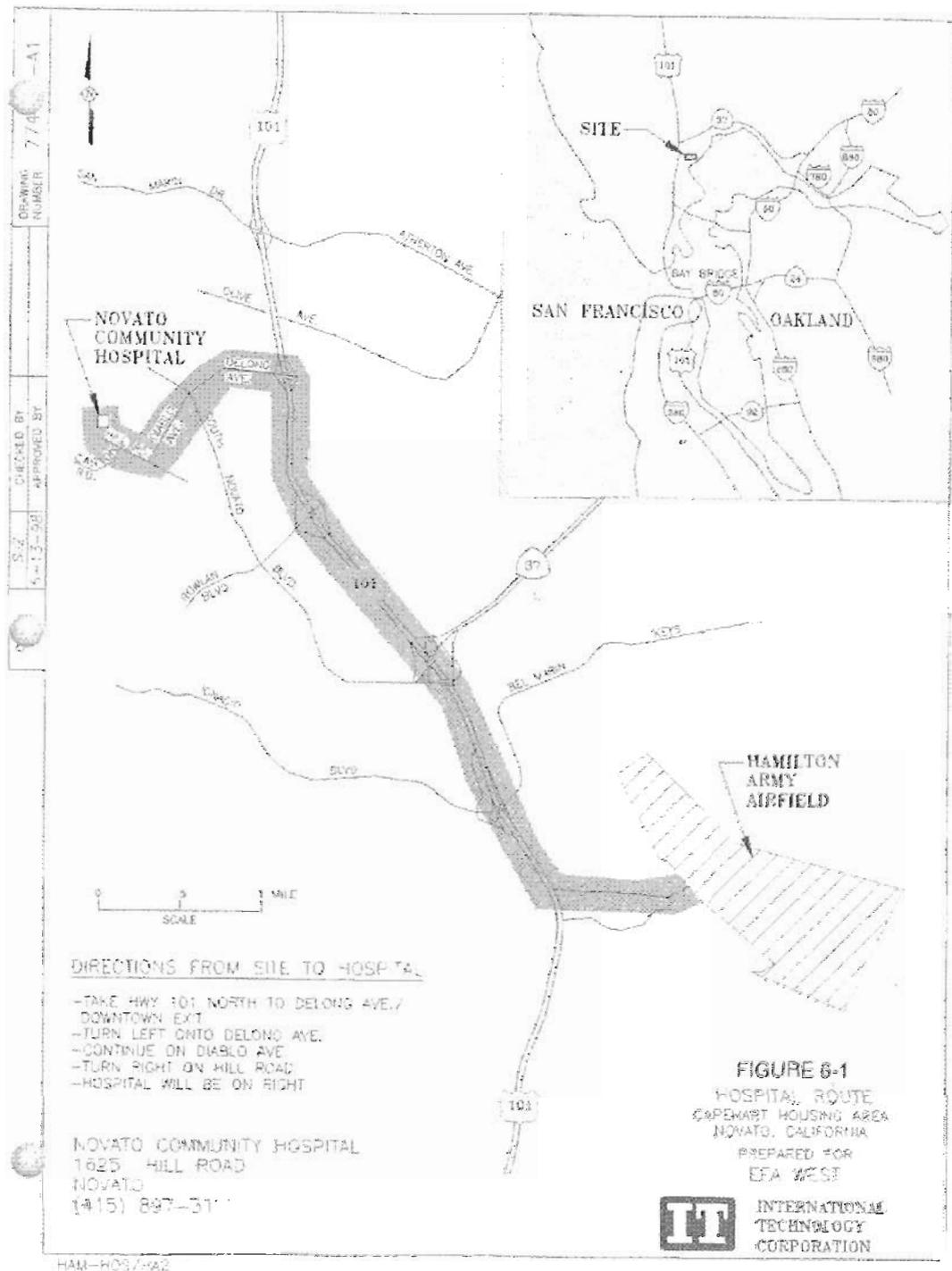


Figure 1. Site Location and Emergency Route to Novato Community Hospital.

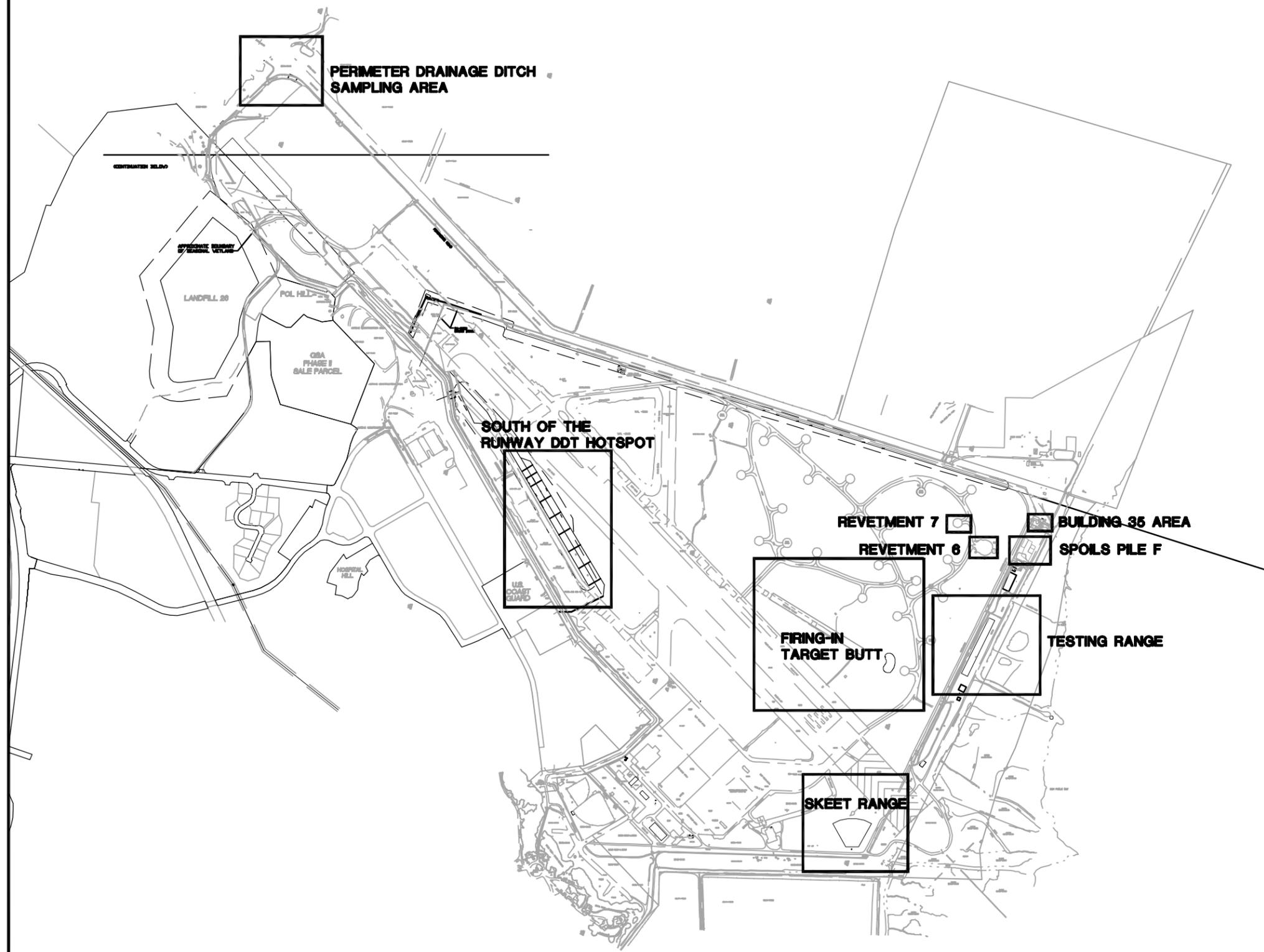
Novato Community Hospital (415) 897-3111
180 Rowland Way
Novato, CA 94945

FIGURES

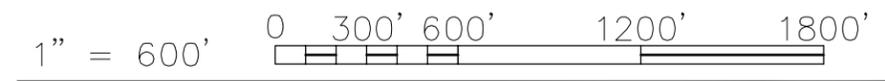
LEGEND



ASSOCIATED FIGURE BOUNDARY



GRAPHIC SCALE

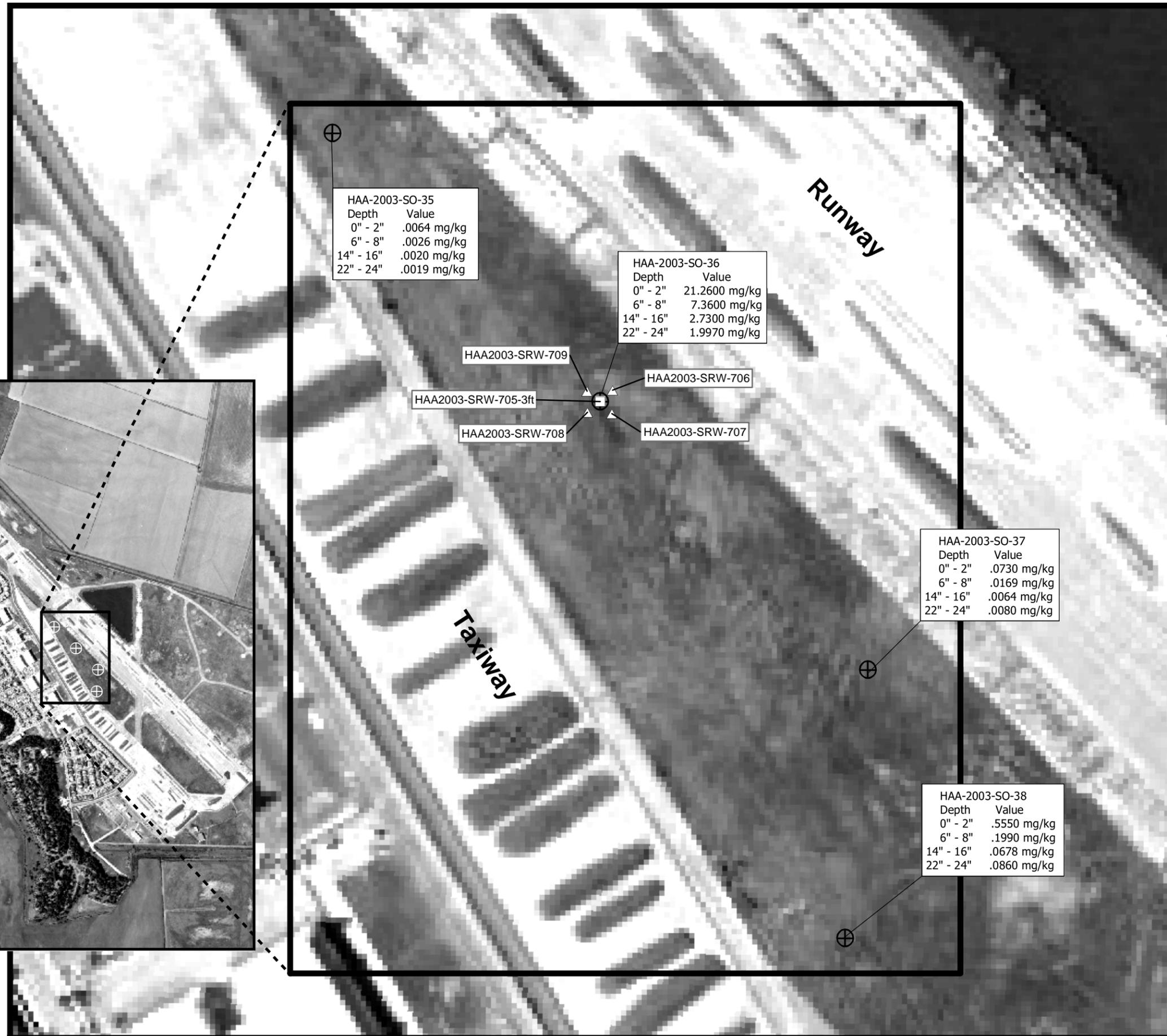
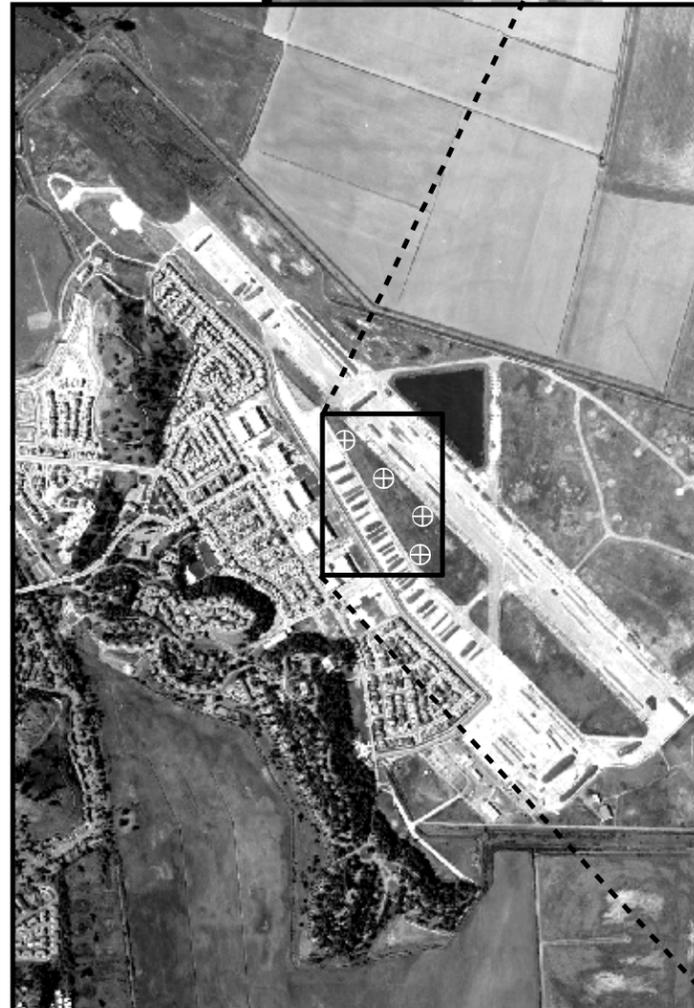


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FIGURE 1-2
MISCELLANEOUS SITES
LOCATION MAP

BRAC PROPERTY
HAMILTON ARMY AIRFIELD

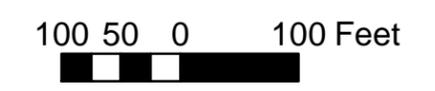
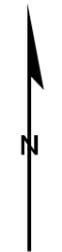
Area of Interest



Legend

- Proposed Stepdown Sample
- △ Proposed Stepout Samples
- ⊕ Historic Sampling Locations

Note: Stepout and stepdown locations may be adjusted based on the topography and the probable concentration of contaminants due to runoff.

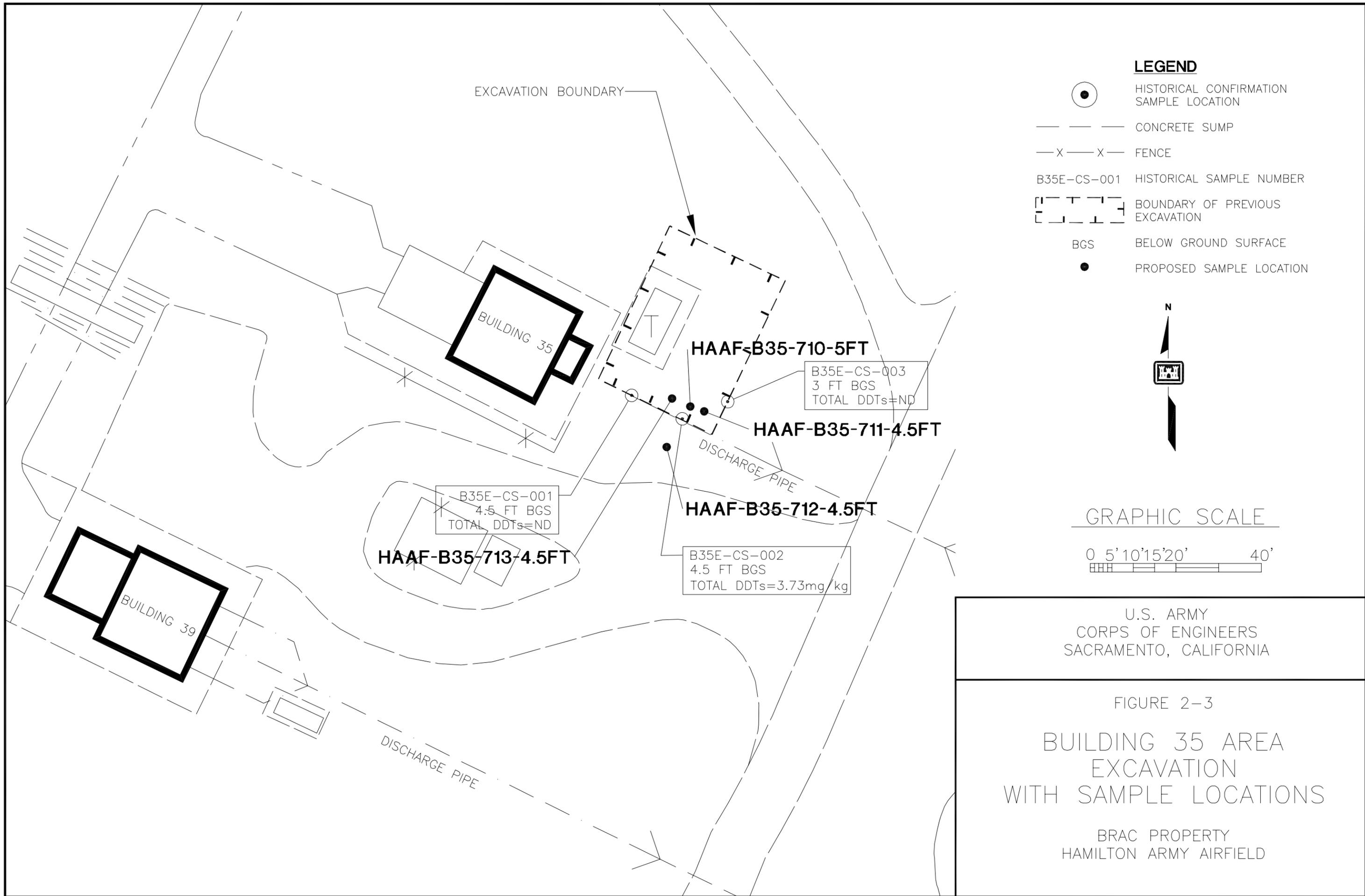


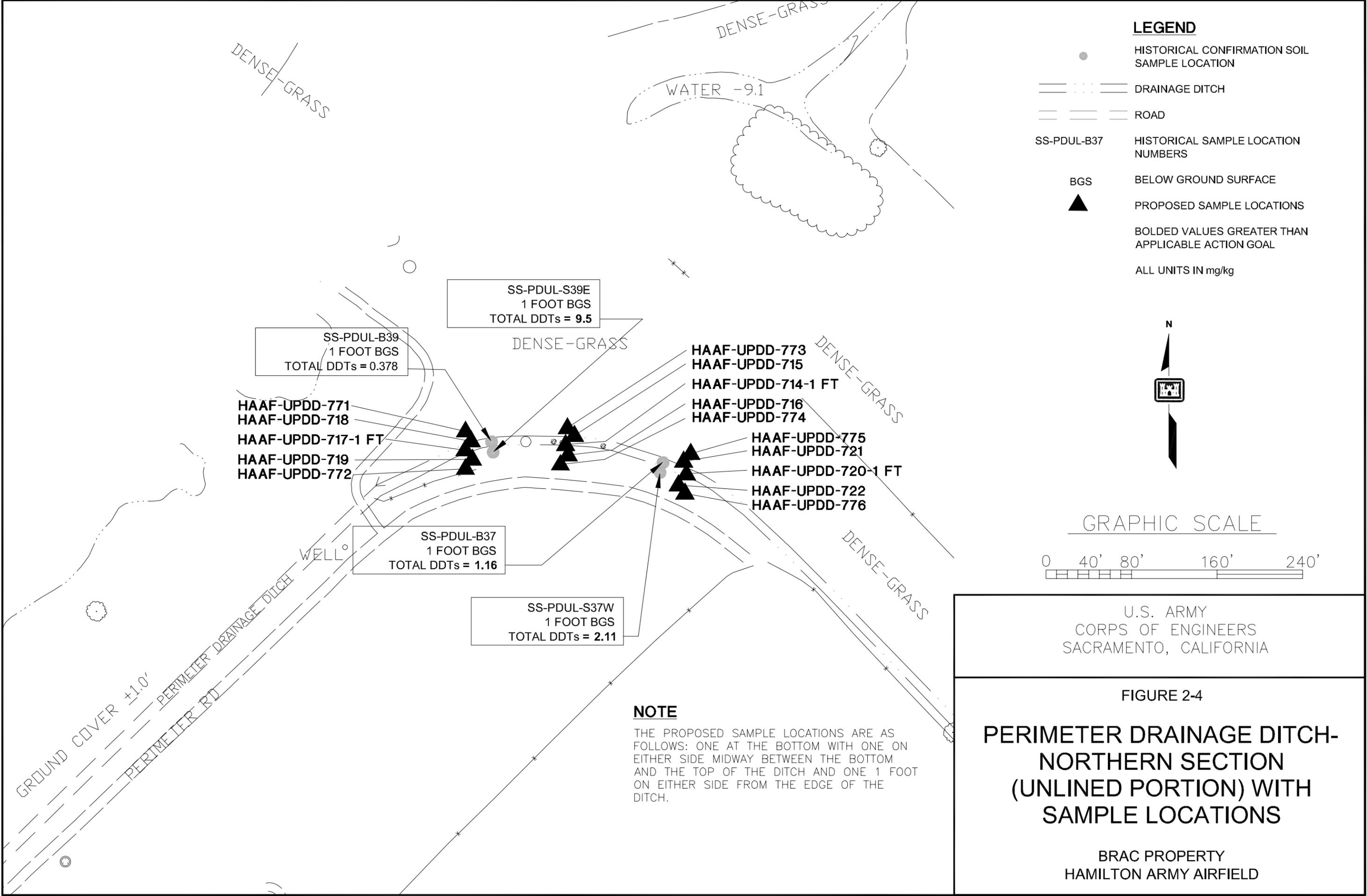
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Figure 2-2

SOUTH OF RUNWAY
DDT HOT SPOT WITH
SAMPLE LOCATIONS

BRAC PROPERTY
HAMILTON ARMY AIRFIELD





DENSE-GRASS

DENSE-GRASS

WATER -9.1

SS-PDUL-S39E
 1 FOOT BGS
 TOTAL DDTs = **9.5**

SS-PDUL-B39
 1 FOOT BGS
 TOTAL DDTs = 0.378

HAAF-UPDD-771
 HAAF-UPDD-718
 HAAF-UPDD-717-1 FT
 HAAF-UPDD-719
 HAAF-UPDD-772

HAAF-UPDD-773
 HAAF-UPDD-715
 HAAF-UPDD-714-1 FT
 HAAF-UPDD-716
 HAAF-UPDD-774

HAAF-UPDD-775
 HAAF-UPDD-721
 HAAF-UPDD-720-1 FT
 HAAF-UPDD-722
 HAAF-UPDD-776

SS-PDUL-B37
 1 FOOT BGS
 TOTAL DDTs = **1.16**

SS-PDUL-S37W
 1 FOOT BGS
 TOTAL DDTs = **2.11**

GROUND COVER ±1.0'
 PERIMETER DRAINAGE DITCH
 PERIMETER RD

WELL

DENSE-GRASS

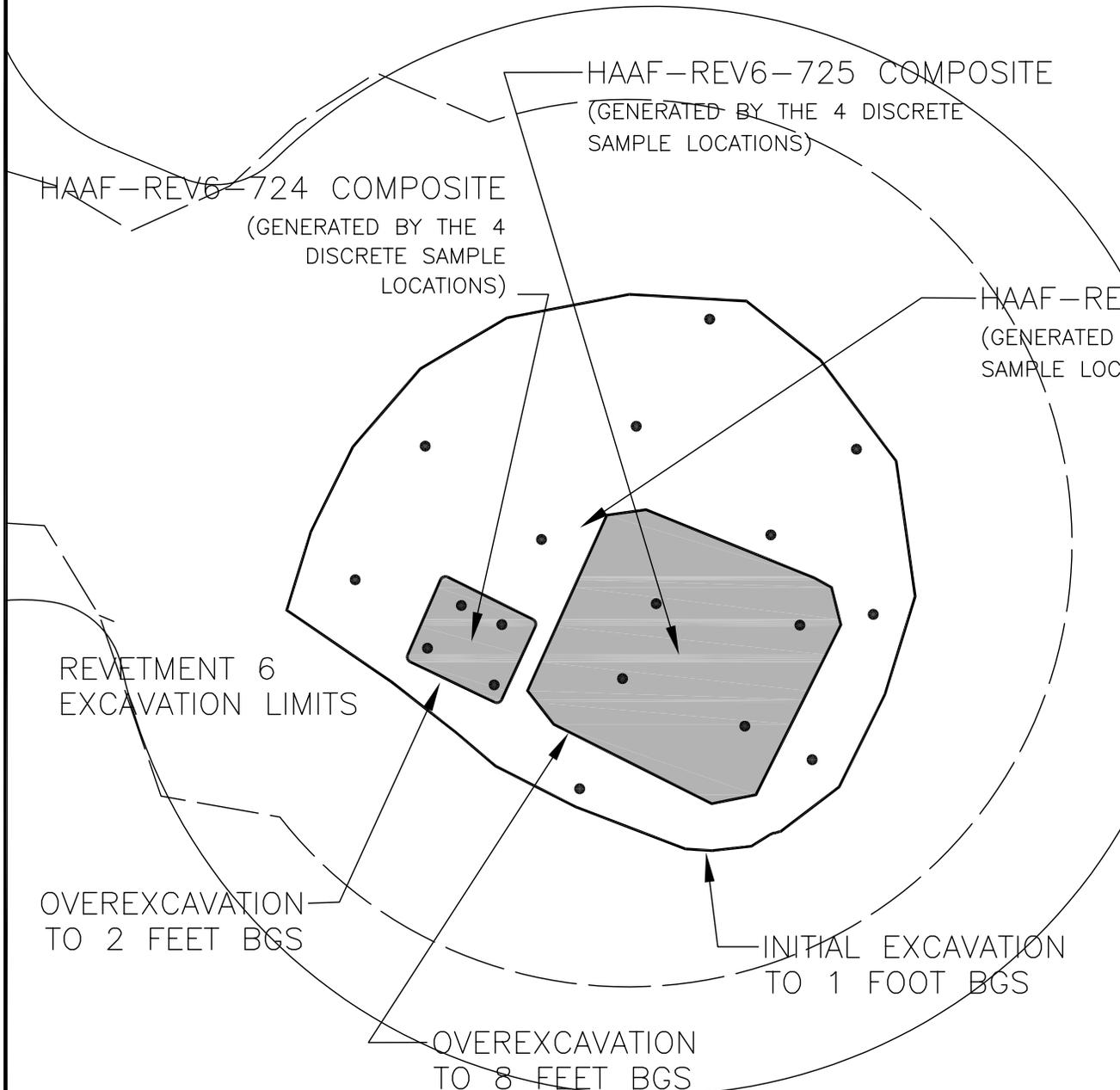
DENSE-GRASS

DENSE-GRASS

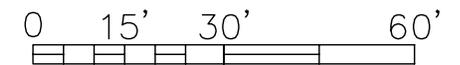
REVETMENT 6

LEGEND

-  EXCAVATION BOUNDARY
- BGS BELOW GROUND SURFACE
-  OVEREXCAVATION BOUNDARY
-  PROPOSED DISCRETE SAMPLE LOCATION (FOR COMPOSITING)
(LOCATIONS MAY BE MOVED DEPENDING UPON SITE CONDITIONS)



GRAPHIC SCALE



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FIGURE 2-5a

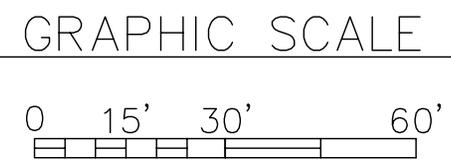
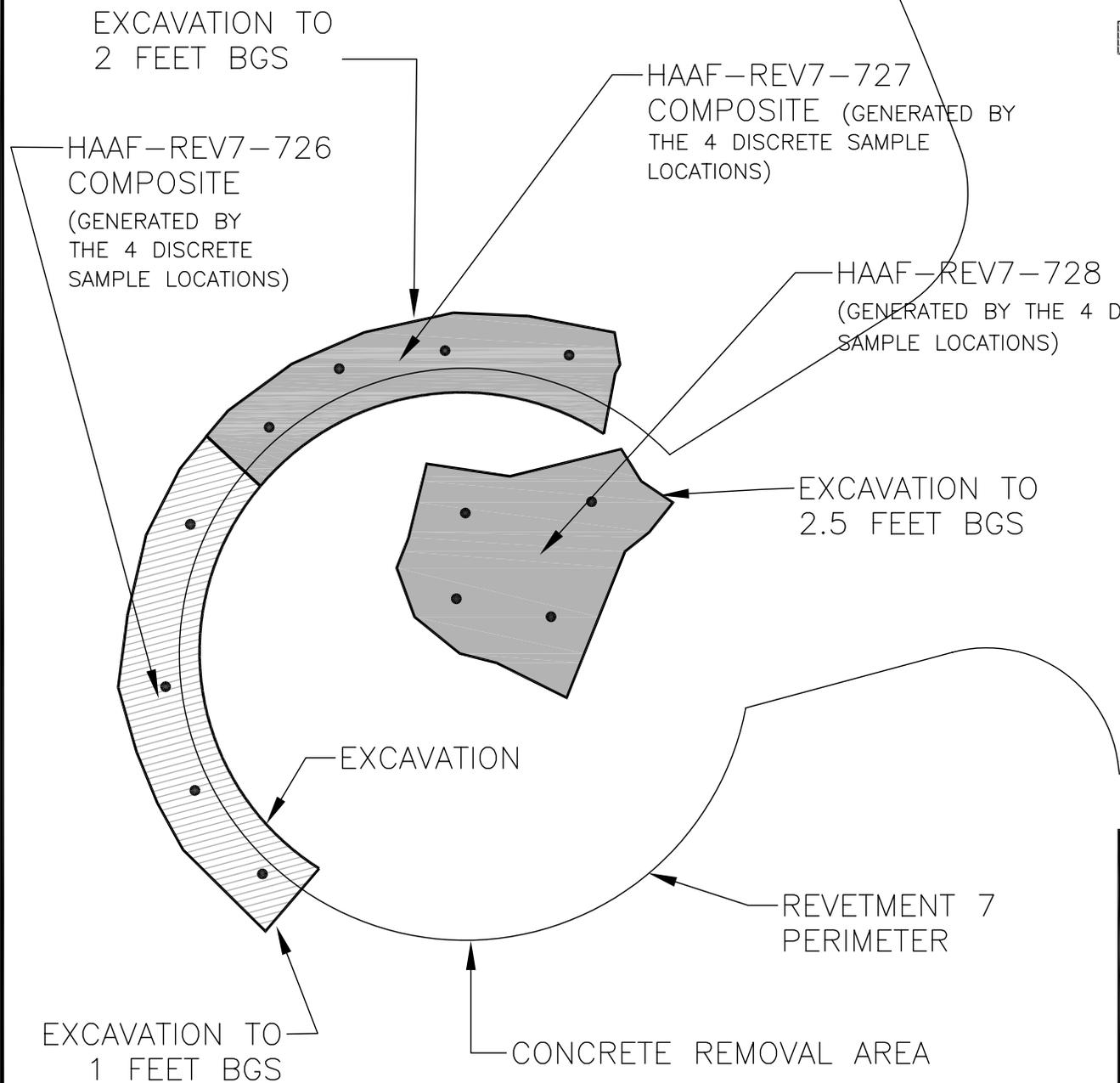
REVETMENT 6 EXCAVATION
WITH SAMPLE LOCATIONS

BRAC PROPERTY
HAMILTON ARMY AIRFIELD

REVETMENT 7

LEGEND

-  EXCAVATION BOUNDARY
-  BGS BELOW GROUND SURFACE
-  OVEREXCAVATION BOUNDARY
-  PROPOSED DISCRETE SAMPLE LOCATION (FOR COMPOSITING) (LOCATIONS MAY BE MOVED DEPENDING UPON SITE CONDITIONS)

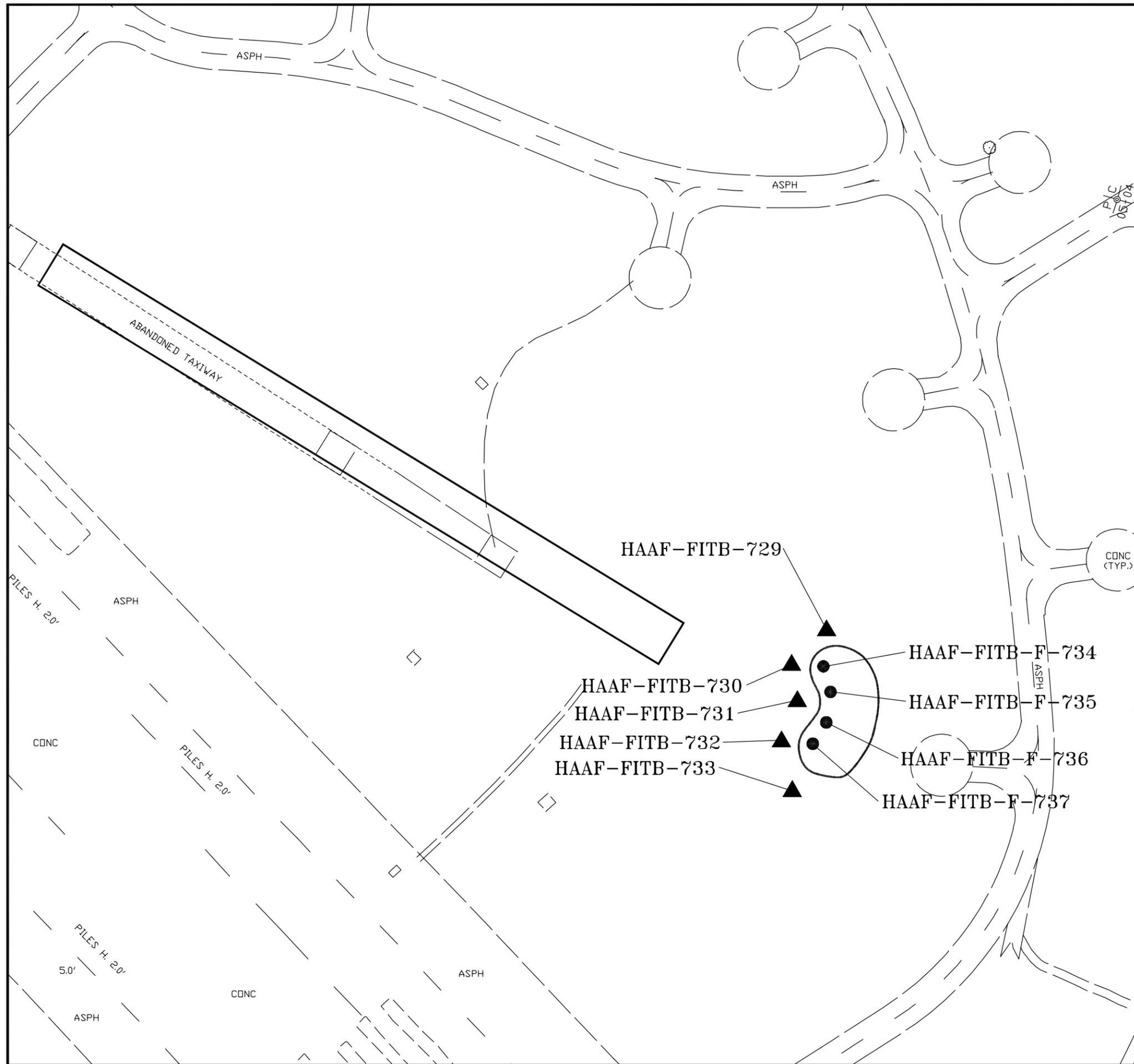


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FIGURE 2-5b

REVETMENT 7 EXCAVATION
WITH SAMPLE LOCATIONS

BRAC PROPERTY
HAMILTON ARMY AIRFIELD



LEGEND

-  FIRING-IN TARGET BUTT BOUNDARY
-  PROPOSED SAMPLE LOCATIONS
-  PROPOSED SOIL SIEVING SAMPLE LOCATIONS



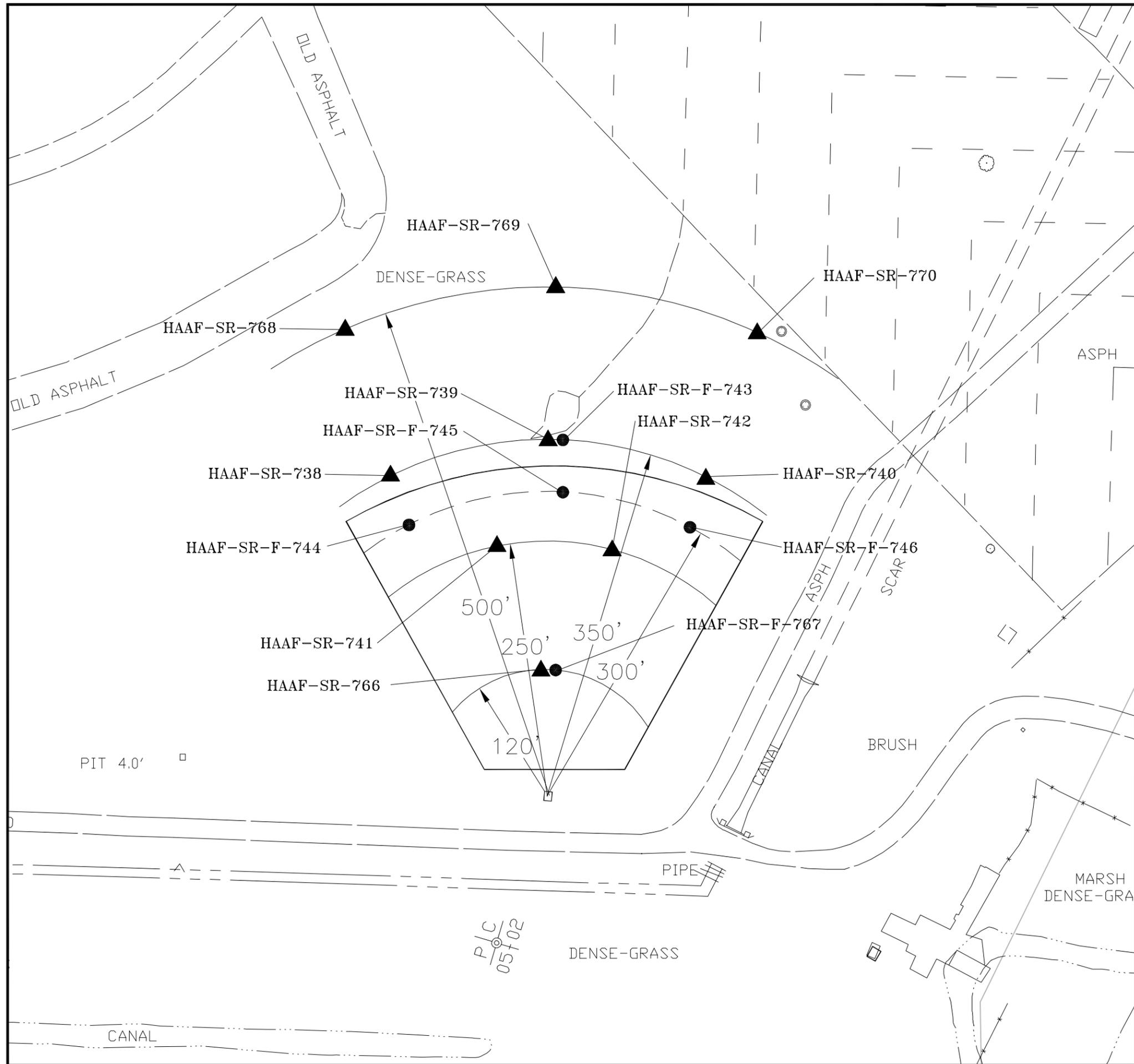
GRAPHIC SCALE



U.S. ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FIGURE 2-6
FIRING-IN TARGET BUTT
(ARCHIVE SEARCH REPORT
SITE #19) WITH
SAMPLE LOCATIONS

BRAC PROPERTY
HAMILTON ARMY AIRFIELD



- LEGEND**
-  SKEET RANGE BOUNDARY
 -  PROPOSED SAMPLE LOCATIONS
 -  PROPOSED SOIL SIEVING SAMPLE LOCATIONS



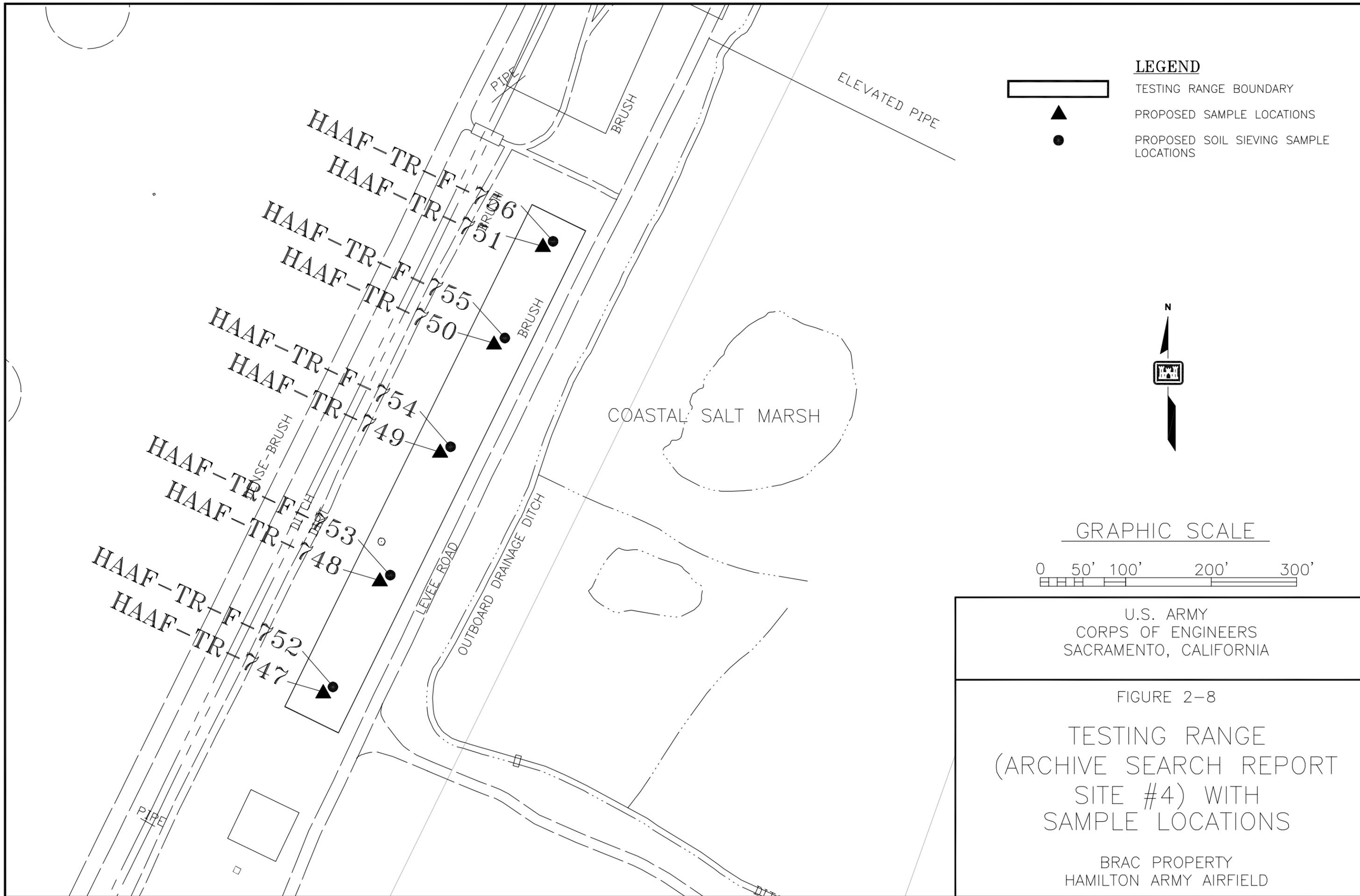
GRAPHIC SCALE



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FIGURE 2-7
SKEET RANGE
(ARCHIVE SEARCH REPORT
SITE #18) WITH
SAMPLE LOCATIONS

BRAC PROPERTY
HAMILTON ARMY AIRFIELD



HAAF-TR-F-756
HAAF-TR-F-751

HAAF-TR-F-755
HAAF-TR-F-750

HAAF-TR-F-754
HAAF-TR-F-749

HAAF-TR-F-753
HAAF-TR-F-748

HAAF-TR-F-752
HAAF-TR-F-747

COASTAL SALT MARSH

LEVEE ROAD

OUTBOARD DRAINAGE DITCH

PIPE

BRUSH

ELEVATED PIPE

N



U.S. ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FIGURE 2-8
TESTING RANGE
(ARCHIVE SEARCH REPORT
SITE #4) WITH
SAMPLE LOCATIONS

BRAC PROPERTY
HAMILTON ARMY AIRFIELD