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FIELD INVESTIGATION WORK PLAN (FINAL)

SUPPLEMENTARY SOIL INVESTIGATION FOR ENGINEERING EVALUATION/COST ANALYSIS SITE 7C FORMER LOCATION OF BUILDING 547

NAVAL AIR STATION, ALAMEDA
ALAMEDA, CALIFORNIA
May 22, 1996

Prepared By:

Moju Environmental Technologies, Inc.
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Oakland, CA 94607

ENGINEERING SERVICES FOR VARIOUS ENVIRONMENTAL ENGINEERING PROJECTS AT NAVAL AIR STATION ALAMEDA, CALIFORNIA

Contract No. N62474-94-D-7535

Contract Task Order 0001

Navy Remedial Project Manager: George Kikugawa

Moju Project Manager: Akali Igbene

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1.0 PROJECT DESCRIPTION

Moju Environmental Technologies (Moju) was awarded Work Delivery Order (WDO) No. 0001 from the Department of the Navy, Western Division, Naval Facilities Engineering Command, under Engineering Services for Various Environmental Engineering Projects at Naval Air Station, Alameda, California Contract No. N62474-94-D-7535. The Navy statement of work (SOW) dated February 16, 1995 (revised April 25, 1995), directs Moju to perform the following activities in support of the interim removal action (IRA) Engineering Evaluation/Cost Analysis (EE/CA) for Installation Restoration (IR) Site 7C at Naval Air Station (NAS) Alameda, California: (1) prepare a quality assurance project plan, a health and safety plan, and a field investigation work plan, (2) collect and analyze soil samples, (3) develop and evaluate potential disposal and/or treatment alternatives, and prepare an engineering evaluation and cost analysis report, (4) prepare a public notice, action memorandum, implementation work plan, detailed cost estimate, and provide coordination and support for the site, (5) address investigation-derived waste (IDW) management and disposal, and (6) attend project meetings and provide project management.

Based on historical data for Site 7C, contaminants are present at the site and the contaminants are at high enough concentration that unrestricted future site usage is not possible based on current regulatory standards. The primary goal of the proposed field investigation described in this workplan is to provide supplemental data necessary to implement a removal action that will mitigate potential environmental impacts of the identified contaminants in soil. It is expected that during the implementation of the removal action, verification sampling of residual contamination will be conducted. The residual concentrations of contaminants after the removal action will be considered in a Site Risk Assessment conducted to assess potential future site uses and final site restoration. The investigation and remediation of groundwater is not within the scope of this project.

This Field Investigation Work Plan describes the approach, protocols, and procedures for conducting field soil sampling and analyses to better define the vertical and lateral extent of the petroleum hydrocarbons; fuel constituents benzene, toluene, ethylbenzene, and xylenes (BTEX); semi-volatile organic compounds (SVOC); and lead in soils at Site 7C. This Field Investigation Work Plan describes a sampling program to provide additional information for the evaluation, selection, and implementation of removal actions at this site.

1.1 Site Physical Description

Site 7C is a two-acre area located within the northeast corner of the Naval Air Station Alameda (NAS Alameda) which occupies the western end of Alameda Island in Alameda County, California. NAS Alameda is bounded by the Oakland Inner Harbor to the north, by San Francisco Bay to the west and south, and by the City of Alameda to the east. The NAS Alameda complex occupies about 2,635 acres, of which about 1,525 acres are useable land and about 1,110 acres are shoreline and marine waters. Figure 1 shows the regional location of NAS Alameda.

Site 7C is generally flat, with asphalt paving over much of the area and some vegetation on the southern end. Structures that formerly existed at the site have been dismantled and removed except for the foundations. Former structures include a car wash facility, a fueling island with overhead canopy, and a third smaller structure located next to the fueling island which probably housed electrical control equipment for the fuel island.

There are trees growing along the northern fence line, and a lawn with some landscaping along the eastern fence line. The site was previously surrounded by chain link fences, but the only remaining fences are along the north and east boundaries of the site. Subsurface utility lines cross under the site at several locations, and overhead power lines oriented in an east-west direction are present near the middle of the site.

1.2 Site History

Site 7C was a fuel station from 1971 to 1988. Building 547, an on-base annex service station, previously occupied the site. The service station was located between Eleventh and Main Streets. The two-acre site, shown on Figure 2, contained three 12,000-gallon fiberglass underground storage tanks (USTs). Earlier site reports indicated that one 10,000-gallon stainless steel waste oil tank and one 5,000-gallon underground stainless steel waste oil tank were suspected to be present at the site (PRC/Montgomery Watson, 1993). However, the Environmental Base Survey does not indicate the presence of the waste oil tanks. A geophysical survey conducted by PRC in 1994 did not locate any subsurface waste oil tanks.

The three 12,000-gallon USTs, reportedly installed in 1971, were located in the northwest corner of the property. In 1980, one of the tanks was reportedly punctured by a tank measuring rod dropped into the tank. The punctured tank was reported to have been drained and repaired between 1980 and 1987 (Canonie, 1990). The 1987 tank test survey by Environmental Resources Management revealed that feed lines to the same tank were leaking. The lines were subsequently removed and replaced. Following a failed precision tightness test in a 1988 tank testing survey, the fuel was removed from the tank. The three USTs were excavated and removed in 1995. The small building located next to the fuel island was dismantled at an unknown date. The fueling island, car wash, and fences along the southern and western borders of the site, were dismantled in the summer of 1995.

1.3 Current Operations

Site 7C area is currently not being used. Soil stockpiles derived from UST removal activities were removed from the site in the summer of 1995.

1.4 Site Geology And Hydrogeology

The site is underlain by hydraulic fill to depths ranging from 7 feet to 12.5 feet below ground surface (bgs). The fill consists of intermixed sandy clay, silty sand, clayey sand and sand. The sand is generally fine-grained. The fill is underlain to the depths explored (about 15 feet) by native materials described as silty sand of the Merritt Sand formation (PRC/Montgomery Watson, 1993).

Groundwater was encountered between about 5.5 and 7 feet bgs during the 1990 field investigation by Canonie. Groundwater has been reported to flow to the southeast with an estimated gradient of 0.008 foot/foot.

2.0 RESULTS OF PREVIOUS INVESTIGATIONS

Previous investigations performed at Site 7C include: (1) a tank testing survey performed in 1987 by Environmental Resources Management, (2) a tank testing survey conducted in 1988, (3) a remedial investigation (RI) conducted by Canonie in 1990, (4) and a follow-up investigation conducted by PRC/Montgomery Watson in 1994, and (5) tank and piping excavation in early 1995.

2.1 Summary of Previous Investigation Data and Existing Site Information

Two previous field investigations were performed at the site. Canonie performed a soil gas survey, soil drilling and soil sampling, construction of monitoring wells, and groundwater sampling. PRC/Montgomery Watson performed a similar, follow-up investigation but did not collect soil vapor samples. During these investigations, samples of soil vapor, soil, and groundwater were collected and selected samples analyzed. During the 1995 excavation of three USTs and removal of associated piping, backfill and contaminated soil were stockpiled on the site. Soil sampling and analysis of the UST excavation base, sidewalls, and piping trenches were also performed.

In preparation of this document, Moju conducted a document review, including the data reported by Canonie and PRC, and the NAS Alameda Public Works utility maps. The site plan with a detailed subsurface utilities plan is shown in Figure 3.

Review of the previous data indicates that the primary chemicals detected at elevated concentrations are benzene, toluene, ethylbenzene, and xylene (BTEX), gasoline range hydrocarbons, polyaromatic hydrocarbons (PAHs) typically present in gasoline (naphthalene and methylnapthalene), and heavier petroleum hydrocarbons reported as JP-5 jet fuel and diesel (see Table 1). There are also localized areas where motor oil range hydrocarbons and lead were reported at concentrations of concern.

BTEX compounds were found in soil above 1,000 parts per million (ppm) with associated gasoline range hydrocarbons above 10,000 ppm (up to 66,900 ppm) in soil at a depth of about 5 feet, just above the water table reported at the time the samples were collected. Heavier fuel hydrocarbons are also encountered in this approximate depth range but at a concentration less than 5,000 ppm. Motor oil range hydrocarbons appear to be present primarily as isolated hot-spots at or near the surface at concentrations above 1,000 ppm. Motor oil was reportedly identified in some near surface samples. Most of the sample locations where motor oil was identified were located outside the site boundaries. In most cases these areas are asphalt-paved or may have been previously paved.

A total of 110 samples were analyzed for lead. Of theses samples, only one sample was found to have a significantly high lead concentration, 9,890 ppm. The sample with the high lead concentration is identified as a near surface sample. Based on the low reported incidence for lead, it is assumed that a localized area may have high lead concentrations in soil or that sample contamination may have occurred.

At one location, naphthalene (a PAH) was reported at a concentration above 100 ppm and 2-methylnapthalene was reported at a lower concentration. Naphthalene and 2-methylnapthalene are components of gasoline.

The soil gas survey data indicate that BTEX vapor is widely distributed across the western part of the site. The source areas appear to be the former location of the USTs and service island, with the vapor apparently migrating in a southerly direction (see Figure 4). These data suggest that the highest concentrations of petroleum products and vapor are along the alignment of the subsurface utilities where the permeable backfill (typically placed around underground utilities) may have contributed substantially to the migration of BTEX and petroleum products.

2.2 Summary of Site Conditions

Based on the available site data, it appears that fuel leaked from either the USTs and/or related piping possibly until 1988 when the tanks were emptied. Leaked fuel probably migrated downward rapidly to the top of the groundwater table and then migrated at the top of the water table (inferred to be at a depth of about 5 feet) laterally primarily in the direction of the groundwater gradient (generally southward). Permeable utility line backfills, present in the areas where fuel probably leaked, are likely to have contributed to the migration of petroleum free products and petroleum vapor transmission. The likely maximum extent of the petroleum product plume is the extent of the BTEX vapor plume, delineated by Canonie in 1990, as petroleum vapor is the media that migrates the fastest in soil and BTEX compounds are the most mobile of the fuel product compounds.

Analyses of soil samples previously collected indicated the primary zone of contamination by gasoline and heavier fuel products was probably from 4 to 5 feet bgs, in a zone just above the groundwater table.

Subsurface utility lines, previously not reported as being present, cross the site in the direction of groundwater migration adjacent to the former location of the USTs and under the fuel island. Permeable backfill is usually placed as backfill around subsurface utilities. Based on the vapor plume delineated by Canonie, it is likely that the utility line backfill acts as a conduit for petroleum vapor migration. The utility line backfills may also be acting as conduits for migration of petroleum product in the liquid phase.

3.0 DATA QUALITY OBJECTIVE (DQO) AND QUALITY ASSURANCE/QUALITY CONTROL

3.1 Data Quality Objectives (DQOs)

Data Quality Objectives (DQOs) are qualitative and quantitative statements that are derived from the outputs of the DQO process that:

(1) clarify the study objective;
(2) define the most appropriate type of data to collect;
(3) determine the most appropriate conditions from which to collect the data; and
(4) specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to suggest the decisions.

Three DQOs have been developed for this site by defining the boundary for the investigation and partitioning this boundary into sub-areas, by identifying the action level which triggers an activity associated with the decision rule, and by specifying the acceptable uncertainty in the resulting data.

Data Quality Objective (DQO) - Total Petroleum Hydrocarbons (TPH)

Problem: Petroleum hydrocarbon has leaked or spilled from underground supply pipes in the area of a former fuel station, and this area is proposed for future unrestricted use as industrial, commercial or residential development.

Decision: Will the area require a removal action or remediation prior to conversion to unrestricted use?

Inputs: The information needed to support the decision includes a determination of current residual levels of contaminants with potential environmental or human health risks. This data will then be utilized in a Risk Assessment to determine what clean-up levels are appropriate for the site.

Boundaries:

The site is bordered by fences on the north (undeveloped) and east (Main Street) sides of the site and by Eleventh Street and K Avenue on the west and south sides. This investigation will focus on two sub-areas - an approximately 20,000-square-foot area with elevated benzene concentrations; and an approximately 6,000-square-foot area, mostly within the first sub-area, with total petroleum hydrocarbon (TPH) concentrations exceeding 100 ppm.

The objectives of the sampling plan are fourfold:

1. To confirm that contamination exists within the suspected plume boundaries.

2. To determine the concentration of contamination within the suspected plume boundaries.
3. To redefine the limits of the plume.
4. To assess whether soil vapor extraction (SVE) is an appropriate remediation technology and, if so, how best to implement it.

Decision Rule:
If BTEX, volatile petroleum compounds, and heavier (non-volatile) petroleum compounds are found to be present in soil at elevated concentrations, then a Risk Assessment (RA) will be conducted to assess the potential effects on human health and the environment and to determine final clean-up levels for removal or remediation of the soil. An interim removal action will be conducted if high concentrations of contaminants are identified from the investigation. Removal Action will be conducted based on the recommendations of a site specific Engineering Evaluation/Cost Analysis (EE/CA).

Limits On Decision Errors:
Decision errors will affect proposed future usage of the site. There are potential environmental impacts that could occur during remediation and potential health effects to future users of the site if the site is not remediated appropriately. The contamination identified is 3 to 5 feet bgs. Contaminants appear to have migrated and spread along the top of the groundwater table, perhaps preferentially along utility trenches, and into exposed capillary fringe areas due to rising and falling water table elevations. The proposed investigation targets the previously defined boundaries and the area within the boundaries identified previously as being potentially contaminated. The number, spacing, and depths of sampling locations and the types of chemical analyses proposed are sufficient to assure that if a problem exists the problem will be identified. Additionally, the types of contaminants present at the site, the concentrations of the contaminants, and the boundaries of the contamination will also probably be well defined. The appropriateness of proposed remediation technologies will also be evaluated.

Data Quality Objective (DQO) - Motor Oil

Problem: Motor oil was reported in some samples previously collected from the site and adjacent to the site. It is of concern that motor oil is present in site soils or alternatively that samples may have been contaminated by asphaltic paving products which may have caused a false positive analytical result for the presence of motor oil. If motor oil is present at elevated concentrations, remediation of site soils would be required by regulatory agencies and the proposed unrestricted use for industrial, or commercial, or residential development would be encumbered.

Decision: Is motor oil is present in site soils and, if so, are the concentrations high enough to require a removal action or remediation prior to conversion to unrestricted use?

Inputs: The information needed to support the decision includes an assessment of site soil conditions to determine if motor oil is present, and if so, does it pose a threat to groundwater quality.

Boundaries:

The geographic area of the field investigation includes the area along K Street on the south side of the site.

The objectives of the sampling plan are threefold:

1. To confirm whether motor oil contamination exists near the site boundaries or whether a false positive result due to the inclusion of asphalt pavement in samples is the source of reported motor oil.
2. If motor oil is present, to determine its concentration within the suspect areas.
3. To assess whether remediation is necessary.

Decision Rule:
If motor oil is found to be present in soil at elevated concentrations, then a RA will be conducted to assess the potential effects on human health and the environment and to determine final clean-up levels for removal or remediation of the soil. An interim removal action will be conducted if high concentrations of motor oil are identified from the investigation. Removal Action will be conducted based on the recommendations of a site specific Engineering Evaluation/Cost Analysis (EE/CA).

Limits On Decision Errors:
Decision errors will have little or no affect on proposed future usage of the site. Motor oil is primarily an environmental contaminant for aquatic life forms. Potential environmental impacts are also minimal as the concentration of motor oil previously reported may be a false positive result, and if not a false positive the concentrations are not so high as to cause significant environmental impact. The possibility of samples being contaminated by asphaltic paving products will be assessed by doing two types of analyses for each sample. The analyses will be for total recoverable petroleum hydrocarbons (TRPH) analysis (using EPA Method 418.1) and motor oil analysis (using EPA Method 8015 Modified). If the results for the TRPH analysis is substantially greater than the motor oil result for a sample, it will be assumed that asphaltic paving materials are the source of the petroleum compounds reported.

Data Quality Objective (DQO) - Lead

Problem: Of the 110 samples analyzed for the presence of lead, lead was reported to have been detected in only one sample at a concentration above EPA Region IX preliminary remediation goals (PRGs). The sample, with a concentration of 9,890 ppm lead, was collected from the southeastern corner of the site. Based on the low reported incidence for lead, it is assumed that a localized area may have high lead concentrations in soil or that sample contamination occurred. A determination as to which scenario is correct needs to be made. If lead is present at elevated concentrations, remediation of site soils would be required before the proposed unrestricted use for industrial, or commercial, or residential development could be accomplished.

Decision: Is lead present at the site at elevated concentrations. If so, how extensive is the area that will require a removal action or remediation prior to conversion to unrestricted use?

Inputs: The information needed to support the decision includes an assessment of site soil conditions to determine if lead is present at elevated concentrations. In order to make this decision, nine additional soil samples will be collected and analyzed, from a 30-foot by 30-foot area subdivided into nine 10 foot by 10 foot grids that surround and include the location where lead was previously identified.

Boundaries:
The geographic area of the field investigation is the location of Boring MW547-5, located in the southeast corner of Site 7C.

The objectives of the sampling plan are threefold:

1. To confirm if lead contamination exists in the vicinity of MW547-5.
2. To determine the concentration of lead, within the suspect area, if it is present.
3. To assess whether remediation is necessary.

Decision Rule:
After completion of the site specific RA, if the concentration of lead in near surface soil samples exceeds the clean-up level determined by the RA, further investigation to assess the vertical and lateral extent of lead in soil may be needed to conduct a cost effective removal action. An interim removal action will be conducted if high concentrations of lead are identified from the investigation. Removal Action will be conducted based on the recommendations of a site specific Engineering Evaluation/Cost Analysis (EE/CA).

Limits On Decision Errors:
Decision errors will have little or no affect on proposed future usage of the site as a large number of samples, 110, have already been analyzed for the presence of lead and lead was not found to be present at high concentrations. Only one sample had a concentration of lead high enough to be of concern. This elevated single sample result may be false positive or may indicate a localized problem. To confirm whether lead is present at elevated concentration in the localized area, a high density of samples, nine samples will be collected from a 30 foot by 30 foot area and analyzed. If lead is identified at concentrations above 400 ppm, and the limits of lead contamination are not defined, further investigation is recommended.

3.2 Quality Assurance/Quality Control Sampling

The types of QA/QC samples to be collected during the field investigation activities include: (a) field duplicates, (b) laboratory matrix spike/matrix spike duplicates (MS/MSD), (c) sample duplicates (DUP), and (d) trip blanks.

Field Duplicates Field duplicate samples will be collected for all samples except ambient air samples. Field duplicates are separate samples collected vertically adjacent to the original sample in separate container using the same field sampling procedure and equipment. The field duplicate samples to be collected during field work at the site are shown in Table 4.

Matrix Spikes, Matrix Spike Duplicates, and Sample Duplicates MS, MSD, and DUP samples as specified in Table 2 will be prepared, preserved and transported in accordance with the protocols and procedures detailed in Sections 9.1.4 and 9.2.2 of the approved Quality Assurance Project Plan (QAPP).

Trip Blanks Trip blanks will be prepared to determine whether contamination has been introduced through sampling containers or as a result of exposure during shipment. An NFESC approved analytical laboratory will prepare trip blanks in the laboratory by filling 40-milliliter (mL) VOC vials with organic-free, distilled, deionized water containing preservative. The trip blanks will be labeled with their preparation dates. The trip blanks will be shipped with sampling equipment and bottles, and will be handled in the same way as regular samples.

4.0 INVESTIGATION RATIONALE, OBJECTIVES, AND PROPOSED SAMPLING METHODS AND SAMPLING LOCATIONS

The primary objectives of the field investigation are to delineate the lateral and vertical extent of the petroleum product soil plume needing remediation and to provide information needed to determine appropriate remediation methods and develop a preliminary design of the selected remediation system(s). Secondary objectives are to assess whether previously reported data indicating the possible presence of motor oil and the metal lead in surface or near surface soil reflects site conditions or reflects anomalous and/or localized conditions or erroneous data. The scope of the field investigation is based on Moju's interpretation of data reported from previous investigations (by others) and data gathered by Moju.

Based on the available data, it appears that fuel leaked from the site USTs and/or related piping, possibly continuing until 1988 (when the USTs were emptied). Leaked fuel probably migrated downward rapidly to the top of the groundwater table (inferred to be at a depth of about 5 feet) and then laterally primarily in the direction of the groundwater gradient (generally southward). Permeable utility line backfills, present in the area where fuel leaked, may have contributed to the migration of free product or may only be a conduit for petroleum vapor transmission. The likely maximum extent of the petroleum plume is the extent of the BTEX vapor plume, delineated by Canonie in 1990, as petroleum vapor is the media that migrates the fastest in soil and BTEX compounds are the most mobile of the fuel product compounds.

Analyses of previously collected soil samples for gasoline range petroleum products,was done for only the three boring completed within the area of this proposed investigation. Of the samples analyzed from these three borings, samples collected at about 5 feet bgs (approximately groundwater table) had detectable concentrations of gasoline in excess of 10,000 ppm and up to 66,900 ppm. From these same three borings, but at 2.5 feet bgs, gasoline was detected at concentrations of 26 ppm or less in the soil samples. Samples from the four other soil borings completed within the proposed limits of this investigation were analyzed to characterize heavier (non-volatile) petroleum products. Samples were collected at both 5 feet bgs and 6 feet bgs, but only samples collected at 6 feet bgs were analyzed. One of these samples had a concentration of 10,800 ppm TRPH. Analysis of samples from other depths, ranging from 4.5 to 1 foot bgs, identified TRPH ranging from 200 ppm to non-detectable, typically increasing in concentration with proximity to the water table.

The analytical data for samples collected from soil borings previously completed within the limits of the proposed investigation indicates that a significant problem related to gasoline contamination may exist and that fairly high concentrations of heavier petroleum products may also be present. However, the density and location of borings previously completed and the limited number of analyses conducted for gasoline range compounds does not provide sufficient information to delineate the lateral or vertical extent of the soil plume.

Subsurface utility lines cross the site in the groundwater flow direction, passing immediately adjacent to the former location of the USTs and under the fuel island. Permeable backfill is usually placed as backfill around such subsurface utilities. Based on the vapor plume delineated by Canonie, it appears likely that the utility line backfill has acted as a conduit for petroleum vapor migration. The utility line backfill may also be acting as a conduit for petroleum product migration in the liquid phase. Goals of the proposed investigation are to assess whether the backfill is a conduit for petroleum product migration and whether it is the primary reservoir for petroleum contaminants, and, if so, how far the petroleum has migrated from the backfill and at what concentrations.

A total of 110 samples were analyzed for lead. Of theses samples, only one sample was found to have a significantly high concentration (9,890 ppm). Based on the low reported incidence for lead, it is assumed that a localized area may have high lead concentrations in soil or that sample contamination occurred. To determine which scenario is correct, nine additional soil samples will be collected from a 30- by 30-foot area subdivided into 10- by 10-foot grids that surround and include the location were lead was previously identified. The sample with the previously reported high lead concentration was a near surface sample, and the additional samples will also be near surface samples. The newly collected samples will be analyzed for lead.

Motor oil was reportedly identified in some near surface samples. Most of the sample locations where motor oil was identified were located outside the perimeter of the site. In most cases these areas are asphalt paved or may have been previously paved. To determine whether the previously reported motor oil data may indicate conditions present at the site or alternatively was caused by asphalt contamination, new near surface samples will be collected at eight locations, mostly near the site southern perimeter. The samples will be analyzed for total TPH and for motor oil range hydrocarbons. If total TPH greatly exceeds motor oil concentrations, it will be assumed asphalt pavement is the source of the petroleum.

Gasoline and heavier hydrocarbons will be differentiated at this investigative stage because it is likely that the most cost-effective remediation method for the longer-chain, less volatile hydrocarbons will be different than the remediation method for the more volatile, BTEX components. For example, a typical remediation method for gasoline and BTEX hydrocarbons is vapor extraction. After these volatile compounds are extracted, the heavier hydrocarbons may be remediated by in-situ bioventing or by excavation and surface farming to accelerate bio-remediation.

Napthalene and 2-methylnapthalene, detected in a soil samples from one location, are not target compounds of this investigation because they will not affect the selection of a remediation method. Their distribution is expected to be constrained within the gasoline plume but to be less extensive due to their lower mobility. In addition, their detected concentrations are relatively low.

4.1 Sampling Objectives

Based on site conditions described above, the objectives of this supplementary field investigation, which are summarized on Table 3, are to:

- Confirm the lateral extent of the petroleum product plume in soil, which is presently assumed to be the limits of thepreviously defined vapor plume.
- Obtain additional data to complete the definition of the vertical and lateral distribution of fuel hydrocarbon at concentrations.
- Locate the source area(s) of the petroleum products.
- Assess underground utility line backfill as conduits for petroleum product migration.
- Verify whether lead is a contaminant of concern in near surface soils
- Verify motor oil is a contaminant of concern in near surface soils
- Collect stratigraphic and permeability data, including subsurface utility line for site soils
- Assess the potential effectiveness of vapor extraction for remediating site soils.

4.2 Sampling Locations

Sampling at Site 7C is proposed at 35 locations (12 soil borings, 6 trenches, and 17 surface and sub-pavement samples) as shown in Figure 5. A total of 142 sample analyses may be performed as summarized in Table 2. Table 4 presents the sampling and analyses matrix showing the proposed sampling depths and analytical methods. Soil vapor extraction tests will be conducted at two locations, as shown in Figure 6. One set of extraction test wells will assess vapor extraction from utility line backfill and the other set vapor extraction from finer grained fill soils.

A background sampling program to provide a basis for evaluating naturally-occurring levels of organic and inorganic soil constituents in the vicinity of NAS Alameda was conducted by others in 1992. Data from the background studies are documented in the PRC/JMM report titled "Data Summary Report, Background and Tidal Influence Studies and Addition Work at Sites 4 and 5, NAS Alameda, Vol. 1, August 4, 1992". Background soil samples will therefore not be collected during this investigation.

The locations of the new soil borings proposed are identified as MJ1 through MJ12. The location of the new soil trenches proposed are identified as T1 through T6. Vapor extraction test wells for the fine grained fill soils are identified as VT1a , VT1b, and VT1c. Vapor extraction test wells for the utility line backfills are identified as VT2a, VT2b, and VT2c.

Nine soil borings are located to verify the limits of the TPH/BTEX plume in soil, with three soil borings and six trenches located to assess the vertical and lateral TPH/BTEX concentrations within the soil plume. The six trenches are located near subsurface utilities to assess the distribution of TPH/BTEX in the vicinity of the subsurface utility lines.

A total of 53 subsurface soil samples will be collected from 12 soil borings, including 7 duplicate samples, at depths of 2.5 feet, 5 feet, 6.5 feet.

To assess the motor oil contamination, sub-pavement soil samples will be collected from eight locations on the site. At locations where the surfaces are asphalt-paved, the samples will be collected at approximately 3 inches below the asphalt base and the sandy fill. These locations are identified as S1 through S8 on Figure 5.

To assess the distribution of lead in the vicinity of the area where lead was previously detected, surface soil samples will be collected from nine 10- by 10-foot grids located at and adjacent to the location where the sample with a high lead concentration was collected. These locations are identified as S9 through S17 .

Table 2 identifies the number and distribution of soil samples to be collected at the various depths.

4.3 Sampling Procedures

All soil samples collected during the investigation, except for trench samples, will be "undisturbed." Trench samples will be grab samples collected from the backhoe bucket. Soil samples will be collected from soil borings 2.5 feet bgs, 5.0 feet bgs, and 6.5 feet bgs. Soil sampling from soil borings will be conducted in accordance with procedures specified in section 4.0 of the approved field investigation QAPP.

Surface samples will be collected at 0 to 3 inches bgs. Surface soil samples will be collected by repetitively driving a 6-inch-long by 2-inch-diameter brass liner into the upper 3 inches of the soil. In areas that are asphalt-paved, sub-pavement samples of sandy fill will be collected below asphaltic materials by cutting through the asphalt surface and excavating base materials with a hand trowel prior to driving 6-inch-long by 2-inch-diameter brass liners into the soil.

All soil borings will be drilled with 8-inch hollow-stem flight augers. Soil samples will be collected in 2-inch-diameter by 6-inch-long brass liners using a 2-inch-diameter modified California split-spoon sampler driven by a Standard Penetration Test hammer.

A field portable Photo-Ionization Detector (PID) will be used to screen soil samples for ionizable volatile petroleum compounds benzene, toluene, and many of the hydrocarbon compounds in gasoline. The PID will also be used to monitor the concentration of these compounds in the ambient air within and along the boundaries of the site during the field investigation in conformance with the Project Health and Safety Plan. Field observations and soil boring log information will be recorded on Moju Field Logbook and Boring Logs as specified in section 4 of the approved field investigation QAPP.

4.4 Trench Investigation

Trenches will be excavated at six locations to characterize site subsurface soil type and relative permeability and to collect samples for laboratory sieve and laboratory chemical analyses. Trenches will be excavated using a backhoe and by hand-digging as needed. Four of the trenches will be excavated as pairs of two; one trench on either side of the utility lines. Proposed trench locations are shown in Figure 6. These locations are identified as T1 through T6.

Trenches will typically be 5 feet in length and depth. At two locations the length of the trenches will be extended to 10 feet to assess lateral migration of petroleum products from the utility line backfills. The trenches will be excavated at right angles to the longitudinal axis of utility lines. One soil sample will be collected at each end of the trenches, from the bottom of the trenches. Detailed descriptions of the protocols and procedures for the trench work are contained in Appendix E (FP-4) of the approved field investigation QAPP.

Samples of utility line backfill will be visually classified. Backfill samples will be submitted for sieve analysis to assess grain size distribution. Sieves to be used will include standard ASTM method D422-63 with sieve sizes 3 inches to #200. The grain size distribution determined from the test will be correlated to relative permeability via correlations published by the Department of the Navy, NAVFAC DM-7. Additionally, samples of utility line backfill at one end of the trenches, and fine grained fill from the other end of the trenches, will be subject to quantitative chemical analysis to assess the concentration of BTEX and gasoline range hydrocarbons and thus the extent of migration of petroleum products through backfill and laterally, away from the backfill, into finer grained fill soils.

Soil excavated from trenches will be stockpiled on a plastic membrane, with soil from each trench stockpiled separately. Trenches will be backfilled with clean soil excavated from sparsely vegetated areas at the eastern side of the asphalt-paved portion of the site. The excavator backhoe bucket will be used to compact clean soil into the trench.

4.5 Vapor Extraction Test

Vapor extraction tests will be conducted at two locations. One group of three test wells will be constructed in subsurface utility backfill, and the other group will be constructed about 40 feet away from utility backfill, as at the location shown in Figure 6. One well in each group will serve as an extraction well and the other two wells will be observation wells.

Test wells will be constructed by driving 6-foot-long, 3/4-inch-diameter schedule 40 steel pipes, 5 feet into the ground, with either the push from a drill rig or by hand driving with a slide hammer. The bottom two feet of each well point will be perforated to allow the entrance of soil vapor. A vacuum pump capable of extracting 20 to 30 cubic feet of soil vapor per minute will be attached to the extraction wells.

Soil vapor will be extracted for a period of 3 hours. Every 30 minutes, during the tests, vapor samples will be collected in Tedlar bags and a PID will be used to monitor the concentrations of ionizable petroleum compounds present in the bag sample. Rate of flow of extracted soil vapor will be measured at the extraction wells and induced vacuum will be measured at the observation wells. One sample of extracted vapor will be collected for each test and submitted for laboratory analysis. The samples will be collected at the end of each test. Samples will be analyzed for TPH and BTEX.

Detailed description of the protocols and procedures for driving well points and collecting vapor samples are contained in Appendix F (FP-10-5) of the approved field investigation QAPP.

5.0 PROJECT ORGANIZATION

The Moju Team organization for this project is as shown in Figure 7. The Task Manager has responsibility for overall control of the task and is assisted by qualified technical sub-Task leaders and staff. The Task Manager and sub-Task Leaders are all appropriately licensed professionals with extensive experience conducting field investigations. Field implementation personnel, typically not licensed, also have extensive implementation and educational experience and work under the direct supervision of the licensed sub-Team Leaders. Specialty contractors, conducting work at the site, are also licensed by the State of California to conduct specific tasks such as installation of soil borings and surveying.

6.0 SAMPLE HANDLING AND ANALYSIS

This section discusses the sample integrity requirements during the field investigation. Sample preservation and holding times, and handling and shipment, are also discussed in the field investigation QAPP Section 4.0 Table 1.

6.1 Sample Handling Procedures

Details on equipment calibration, chain-of-custody procedures, and field documentation are included in Section 5.1.4 of the QAPP. Records of equipment maintenance, calibration and repairs shall be maintained for all equipment to be used on-site.

The methods and procedures used for handling all field samples will be such as to assure the integrity of samples submitted to the laboratory for analyses. All sample bottles and liners will be obtained from NFESC-approved laboratory. The bottles will be tightly capped to prevent leakage.

As soon as a sample is collected in a sample bottle or liner, the bottle or liner will be tightly capped and properly labelled. The sample will then be placed in a cooler containing ice or blue ice for transport to the laboratory. Sample description including the sample identification number, matrix, date and time of collection, type of analysis required, and name of person collecting sample will be properly documented in a Chain-of-Custody (COC) record. The COC procedures and protocols are documented in Section 5.1.4 of the QAPP.

A field log will be used to record daily field activities. Moju field personnel will record all information pertinent to the sampling and measurement program in a consecutively numbered field logbook. Each page will be dated and signed by the person making the entries. Logbooks are accountable field documents and serve as a chronological representation of the sampling and measurement program. The field geologist is responsible for making sure that a copy of the field log is sent to the project file as soon as each sampling round is completed. Field log entries will be prepared in accordance with Section 5.1.4 of the QAPP.

The coolers will be kept in a secured location on the site until transported to the laboratory. The coolers containing samples for analyses will be delivered to the laboratory together with the Chain-of-Custody within 12 hours of sampling. The Chain-of-Custody will be rigorously maintained to provide traceability of the samples from original source to their final disposal.

6.2 Sample Designation

Each sample container will be labeled with a unique sample identification number. The label will also identify the sampling location, date, time of collection, and analyses to be performed. The following numbering system will be used for this field investigation:

A7C-MJ01-5-DUP or A7C-MJ01-5-R or A7C-S01-0-R

where:

A7C = Site Identification Number (Alameda Site 7C)
MJ01 or S01 = sample location (see Figure 5)
0 or 5 = sample depth (feet)
DUP = sample duplicate
R = regular sample

6.3 Sample Analysis

Soil samples collected from the site will be analyzed according the sample analysis plan outlined in Tables 2, 3, and 4. Soil samples collected from the soil borings at depths of 2.5 feet, 5 feet and 6.5 feet bgs will be analyzed for TPH-gasoline and the BTEX compounds using Modified EPA Method 8015 with GC/FID and PID, and heavy petroleum hydrocarbon fractions including JP-5 using EPA Method 8015 Modified. Surface soil samples collected from the site will be analyzed for motor oil using EPA Method 8015 Modified. Additionally, surface soil samples collected from the vicinity of the reported localized lead-contaminated area will be analyzed for lead using EPA Method 6010. All laboratory analyses will be conducted by a laboratory approved by the NFESC for the methods of analyses specified herein.

7.0 SAMPLING EQUIPMENT DECONTAMINATION AND PROCEDURES

7.1 Equipment Decontamination

The purpose of decontamination and cleaning procedures during drilling and sampling tasks is to prevent foreign contamination of the samples and cross-contamination between borings. All sampling and drilling equipment will be decontaminated by steam cleaning or alternatively by washing with a detergent such as Liquinox or its equivalent. A tap water rinse and a double deionized water rinse will follow the washing with the detergent. Cleaned equipment will be allowed to air-dry away from the sampling area to reduce cross-contamination. The following item-specific decontamination procedures will be observed:

Drill Rig	-	Steam clean before drilling each day.
Auger Flights and Tools	-	Steam clean before drilling each hole.
Samplers and Hand Auger	-	Steam clean or detergent wash between each use.
Mixing Bowl and Utensils	-	Steam clean or detergent wash between each use.
Sampling Equipment	-	Steam clean or wash with detergent between borings.

Decontamination fluids will be containerized in 55-gallon drums. The following Section 8.2 further addresses the disposal of investigation-derived decontamination fluids. Sample containers will normally not require decontamination at the site since they are sent precleaned from the Navy certified analytical laboratory. An area for decontamination activities will be organized before drilling activities begin.

7.2 Investigation-Derived Waste (IDW) Management And Disposal

The Moju Team will plan, coordinate and assist the Navy in the proper disposal of all IDW generated during the field effort within 90 days in accordance with federal, state, and local regulation. IDW will consist of residual soils from the field screening samples, decontamination water, and personal protective equipment (PPE) which will be collected in separate 55-gallon drums. Results of the chemical analyses performed on the decontamination water sample will be submitted to the Navy Public Works Center to obtain approval for discharging the decontamination water to the Building 5 industrial waste water treatment plant. A composite soil sample will be collected from the residual soil drum and will be submitted along with the final confirmation soil sampling results to a Class I facility for waste profiling. Residual soils and PPE will be disposed of in a Class I or III landfill.

7.3 Field Notes And Logbooks

Moju field personnel will record all information pertinent to the sampling and measurement program in a consecutively numbered field logbook. Each page will be dated and signed by the person making the entries. Logbooks are accountable field documents and serve as a chronological representation of the sampling and measurement program. The following details will be included in the logbook to provide as follows:

- Purpose of sampling (program support and contract number)
- Name and address of facility and site where sampling and measurements are performed

The chronology of sampling and process measurements will be included as follows:

- Description of site conditions
- Description of sampling methodology

- Number and volume of samples collected
- Date and time of collection

8.0 HEALTH AND SAFETY PLAN

A project-specific Health and Safety Plan (HASP) has been prepared for Site 7C. The approved field investigation site-specific plan for Site 7C will identify a work zone covering the investigation. The work zone will be established as an exclusion zone where active investigation work is taking place. This area will be of a size to allow mechanical equipment to easily move and operate.

Volatile hydrocarbons are anticipated to be present at the site and as such present a potential fire or explosion hazard. Other hazards expected at the site may include excessive noise and dust exposure during drilling and CPT operations. There are also physical hazards associated with working around or near drilling and moving equipment, or handling heavy equipment.

The equipment operating crew on-site shall follow appropriate safety regulations to protect the safety of people working around equipment in conformance with the HASP. Equipment and machinery to be used on-site shall be in good condition and shall be operated by qualified employees according to the manufacturer's instructions.

Air monitoring using a portable field PID instrument will be performed within and along the boundaries of the exclusion zone. Vapor monitoring, site control, communication, necessary personnel protective equipment and emergency response will be maintained strictly in accordance with the protocols and procedures contained in the Health and Safety Plan.

9.0 REFERENCES

Canonie, 1990c. Sampling Plan, Remedial Investigation/Feasibility Study (RI/FS), Navy Air Station (NAS) Alameda, California, Vol. 1. Prepared for NAVY-WESTDIV, February, 12 1990.

PRC/Montgomery Watson, 1993c. Data Summary Report, RI/FS Phases 1 and 2A, NAS Alameda, Final. Prepared for Navy-WESTDIV, August, 1993.

USEPA Office of Emergency and Remedial Responce, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Final. October 1988 (EPA 540/G-89/060)

PRC/JMM, 1992. Draft Final, Data Summary Report, Background and Tidal Influence Studies and Addition Work at Sites 4 and 5, NAS Alameda, Vol. 1, August4, 1992.

USEPA Document. Method for Chemical Analysis of Water and Waste. (EPA 600/4-79-020).

Date: 5/22/96

TABLE 1: SITE-7C, NAVAL AIR STATION, ALAMEDA
HISTORICAL DETECTED CHEMICAL SUMMARY

Results for VOCs, TPH(Gasoline) Detected in Soil Samples - SITE 7C

SAMPLE ID	Sample Depth (ft)	Chemical	# Of Hits	Highest Conc. (ppm)	PRG (ppm)	# of Hits > PRG	Comment
MW547-3	4.0	Methylene Chloride	42/81	54	11	1/81	Lab Contaminant GW - 1 ppb
B547-8	8.5	Acetone	26/81	0.69	2000	0/81	Lab Contaminant
MW547-3	4.0	1,2-Dichloroethene	2/81	0.014	59	0/81	
B547-7	11.5	2-Butanone (MEK)	6/81	0.019	8700	0/81	Lab Contaminant
B547-8	11.5	Trichloroethene	5/81	0.011	7.1	0/81	
B7C-12-5.0	**5.0**	**Benzene***	**11/81**	**3.3**	**1.4**	**1/81**	
MW547-3	4.0	4-Methyl-2-pentanone	1/81	72	5200	0/81	
B7C-14-5.0	**5.0**	**Toluene**	**49/81**	**840**	**1900**	**0/81**	
B7C-14-5.0	**5.0**	**Ethyl Benezene**	**18/81**	**570**	**2900**	**0/81**	
B7C-14-5.0	**5.0**	**Xylenes (total)**	**21/81**	**2600**	**980**	**1/81**	
B547-8	5.5	Ethylene Dibromide	2/25	0.0024	0.005	0/81	
B7C-14-5.0	**5.0**	**TPPH (Gasoline)**	**9/30**	**66900**	**N/A**	**-**	

Results for TRPH & TEPH Detected in Soil Samples - SITE 7C

SAMPLE ID	Sample Depth (ft)	Chemical	# Of Hits	Highest Conc. (ppm)	PRG (ppm)	# of Hits > PRG	Comment
B547-7	**6.0**	**TRPH**	**21/64**	**10800**	**N/A**	**-**	
B7C-14-5.0	**5.0**	**TEPH (JP5)**	**3/30**	**4590**	**N/A**	**-**	
M7C-07-0	**0.0**	**TEPH (Motor Oil)**	**15/30**	**3000**	**N/A**	**-**	

Results for SVOCs Detected in Soil Samples - SITE 7C

Sample ID.	Sample Depth (ft)	Chemical	# Of Hits	Highest Conc. (ppm)	PRG (ppm)	# of Hits > PRG	Comment
B547-7	5.5	Phenol	2/93	0.3	3900	0/93	
B7C-14-5.0	5.0	2-Chlorophenol	1/93	3.1	330	0/93	
B7C-14-5.1	5.0	4-Chloro-3-methylphenol	1/93	5.7	N/A	-	
B7C-14-5.0	5.0	Pentachlorophenol	1/93	9	2.5	1/93	
B7C-14-5.0	**5.0**	**Naphthalene**	**17/93**	**110**	**800**	**0/93**	GW - 0.7 ppb
B7C-14-5.0	**5.0**	**2-Methylnaphthalene**	**18/93**	**110**	**N/A**	**-**	GW - 0.9 ppb
B7C-14-5.0	5.0	Acenaphpthene	7/93	3.2	360	0/93	
B547-7	5.5	Fluorene	4/93	0.13	300	0/93	
B7C-14-5.0	5.0	Phenanthrene	14/93	2.7	N/A	-	
B547-7	5.5	Anthracene	5/93	0.096	19.0	0/93	
B547-8	11.5	Di-n-butylphthalate	20/93	6.3	6500	0/93	
B7C-14-5.0	5.0	Fluoranthene	16/93	1.4	2600	0/93	
B7C-14-5.0	5.0	Pyrene	18/93	4.9	2000	0/93	
B7C-08-0.0	0.0	Benzo(a)anthracene	9/93	0.35	0.61	0/93	
B7C-06-0.0	0.0	Chrysene	12/93	0.51	24/6.1**	0/93	
MW547-2	13.0	bis-(2-Ethylhexyl)phthalate	31/93	3.6	32	0/93	Lab Contaminant GW - 0.6 ppb
B7C-08-0.0	0.0	Benzo(b)fluoranthene	11/93	0.52	0.61	0/93	
MW547-5	5.5	Benzo(k)fluoranthene	4/93	0.12	6.10	0/93	
B7C-08-0.0	0.0	Benzo(a)pyrene	6/93	0.40	0.061	4/93	
B7C-08-0.0	0.0	Indeno(1,2,3-cd)pyrene	6/93	0.42	0.61	0/93	
B7C-08-0.0	0.0	Benzo-(g,h,i)perylene	5/93	0.39	N/A	0/93	

*: **Benzene** Chemicals of Concern for Site 7C
**: 24/6.1, Residential: EPA/Cal State

TABLE 1: SITE-7C, NAVAL AIR STATION, ALAMEDA
HISTORICAL DETECTED CHEMICAL SUMMARY
(2 of 2)

Results for Pesticides Detected in Soil Samples
- SITE 7C

Sample ID.	Sample Depth (ft)	Chemical	# Of Hits	Highest Conc. (ppm)	PRG (ppm)	# of Hits > PRG	Comment
MW547-5	1.0	4,4'-DDD	2/63	0.009	1.9	0/63	
MW547-5	1.0	4,4'-DDE	4/63	0.230	1.3	0/63	
MW547-5	1.0	4,4'-DDT	3/63	0.530	1.3	0/63	
MW547-3	6.0	Methoxychlor	2/63	0.020	330	0/63	
MW547-5	1.0	alpha-Chlordane	2/63	0.027	0.34	0/63	
MW547-5	1.0	gamma-Chlordane	2/63	0.022	0.34	0/63	

*: Values for Total DDT.

Results for Metals Detected in Soil Samples
- SITE 7C

Sample ID.	Sample Depth (ft)	Chemical	# Of Hits	Highest Conc. (ppm)	PRG (ppm)	# of Hits > PRG	Comment
MW547-1	1.0	Aluminum	93/93	26800	77000	0/93	
M7C-07-2.5	2.5	Arsenic	45/93	34.3	31	1/93	GW - 0.021 ppm + Background <100ppm in CA
M7C-09-0.0	0.0	Barium	93/93	376	5300	0/93	
M7C-06-0.0	0.0	Beryllium	51/93	1.9	0.14	0/93	
M7C-13-0.0	0.0	Cadmium	44/93	4.3	38/9 Cal	0/93	
MW547-1	1.0	Calcium	93/93	15500	N/A	-	
B547-7	9.5	Chromium	93/93	67.5	210	0/93	
MW547-3	6.0	Cobalt	62/93	17	N/A	0/93	
MW547-1	1.0	Copper	93/93	86.2	2800	0/93	
MW547-3	6.0	Iron	93/93	29600	N/A	-	
MW547-5	1.0	Lead	50/93	9890	400/130*	1/93	GW - 1.5 ppb EPA 15 ppb
MW547-2	10.5	Magnesium	93/93	42400	N/A	-	
MW547-3	9.0	Manganese	93/93	734	380	5/93	Essential Element
MW547-3	6.0	Nickel	90/93	89	1500/150 Cal	0/93	
M7C-09-2.5	2.5	Potassium	90/93	3220	N/A	-	
MW547-2	10.5	Selenium	8/93	5.7	380	0/93	
MW547-5	1.0	Silver	2/93	1.2	380	0/93	
MW547-1	1.0	Sodium	67/93	1810	N/A	-	
MW547-2	7.0	Titanium	63/63	704	47000	0/93	
MW547-1	1.0	Vanadium	93/93	62.3	540	0/93	
B547-7	12.0	Zinc	93/93	3880	23000	0/93	

+: Shacklettle & Boernger 1984
*: 400/130, Residential: EPA/Cal State

TABLE 2

NAVAL AIR STATION, ALAMEDA
SITE-7C FIELD INVESTIGATION
SUMMARY OF SAMPLE ANALYSIS PLAN

ANALYTE	ANALYTICAL METHOD	NUMBER OF SAMPLES FOR ANALYSIS								Total No. of Samples
		Field Samples				Total Field Samples	QC Samples		Total QC Samples	
		0' bgs	2.5' bgs	5.0' bgs	6.5' bgs		Field	Lab		
TPH(g) w/BTXE	EPA 8015M/8020	-	16	20	10	46	7	8	15	**61**
Diesel, Motor Oil & JP-fuel	EPA 8015M	8	16	20	10	54	7	8	15	**69**
TRPH	EPA 418.1	8	-	-	-	8	-	1	1	**9**
LEAD	EPA 6010	9	-	-	-	9	1	2	3	**12**

DATE: 5/22/96

TABLE 3

NAVAL AIR STATION, ALAMEDA
SITE-7C FIELD INVESTIGATION
SAMPLING AND ANALYSIS OBJECTIVES

Sample Analysis / Sample Objective	8015(g)/BTXE	8015M/JP5 & Motor oil	6010/Lead	8015M/Motor Oil 418.1/TRPH
(1) Define Limits of TPH Plume	Depth: 2.5, 5.0, 6.5 Location: MJ-1, 2, 3, 5, 8, 9 13, 15, 16, 18, 19, 20	Depth: 2.5, 5.0, 6.5 Location: MJ-4, 6, 7, 10, 11 13, 14, 17		
(2) Define Distribution of TPH Concentration	Depth: 2.5, 5.0 Location: MJ-1, 2, 3, 5, 8, 9 13, 15, 16, 18, 19, 20	Depth: 2.5, 5.0, 6.5 Location: MJ-4, 6, 7, 10, 11 13, 14, 17		
(3) Assess TPH Near Subsurface Utilities	Depth: 2.5, 5.0, 6.5 Location: MJ-3, 6, 11, 14 18, 20	Depth: 2.5, 5.0, 6.5 Location: MJ-3, 6, 11, 14 18, 20		
(4) Assess Lead			Depth: 0-0.5 Location: S9-S17	
(5) Assess Surface Motor Oil				Depth: 0-0.5 Location: S1-S8

DATE: 5/22/96

TABLE 4 (1 of 3)
NAVAL AIR STATION, ALAMEDA
SITE-7C FIELD INVESTIGATION
SAMPLING AND ANALYSIS MATRIX

Sample Location	Field Sample ID	Sample Depth (feet)	Analyte/Analytical Method	
			TPH(g) w/BTXE EPA 8015M/8020	TPH-Extractable EPA 8015 Modified
MJ1	A7C-MJ1-2.5-R	2.5	X	X
	A7C-MJ-1-5-R	5.0	X	X
MJ-2	A7C-MJ2-2.5-R	2.5	X	X
	A7C-MJ2-5R	5.0	X	X
MJ-3	A7C-MJ3-2.5-R	2.5	X	X
	A7C-MJ3-5-R	5.0	X	X
	A7C-MJ3-5-DUP	5.0	X	X
	A7C-MJ3-6.5	6.5	X	X
MJ-4	A7C-MJ4-2.5-R	2.5	X	X
	A7C-MJ4-5-R	5.0	X	X
	A7C-MJ4-6.5	6.5	X	X
MJ-5	A7C-MJ5-5-R	5.0	X	X
MJ-6	A7C-MJ6-2.5-R	2.5	X	X
	A7C-MJ6-5-R	5.0	X	X
	A7C-MJ6-5-DUP	5.0	X	X
	A7C-MJ6-6.5	6.5	X	X
MJ-7	A7C-MJ7-2.5-R	2.5	X	X
	A7C-MJ7-5-R	5.0	X	X
	A7C-MJ7-5-DUP	5.0	X	X
	A7C-MJ7-6.5	6.5	X	X
MJ-8	A7C-MJ8-2.5-R	2.5	X	X
	A7C-MJ8-5-R	5.0	X	X
MJ-9	A7C-MJ9-2.5-R	2.5	X	X
	A7C-MJ9-5-R	5.0	X	X
MJ-10	A7C-MJ10-2.5-R	2.5	X	X
	A7C-MJ10-5-R	5.0	X	X
	A7C-MJ10-5-DUP	5.0	X	X
	A7C-MJ10-6.5	6.5	X	X

DATE: 5/22/96

TABLE 4 (2 of 3)
NAVAL AIR STATION, ALAMEDA
SITE-7C FIELD INVESTIGATION
SAMPLING AND ANALYSIS MATRIX

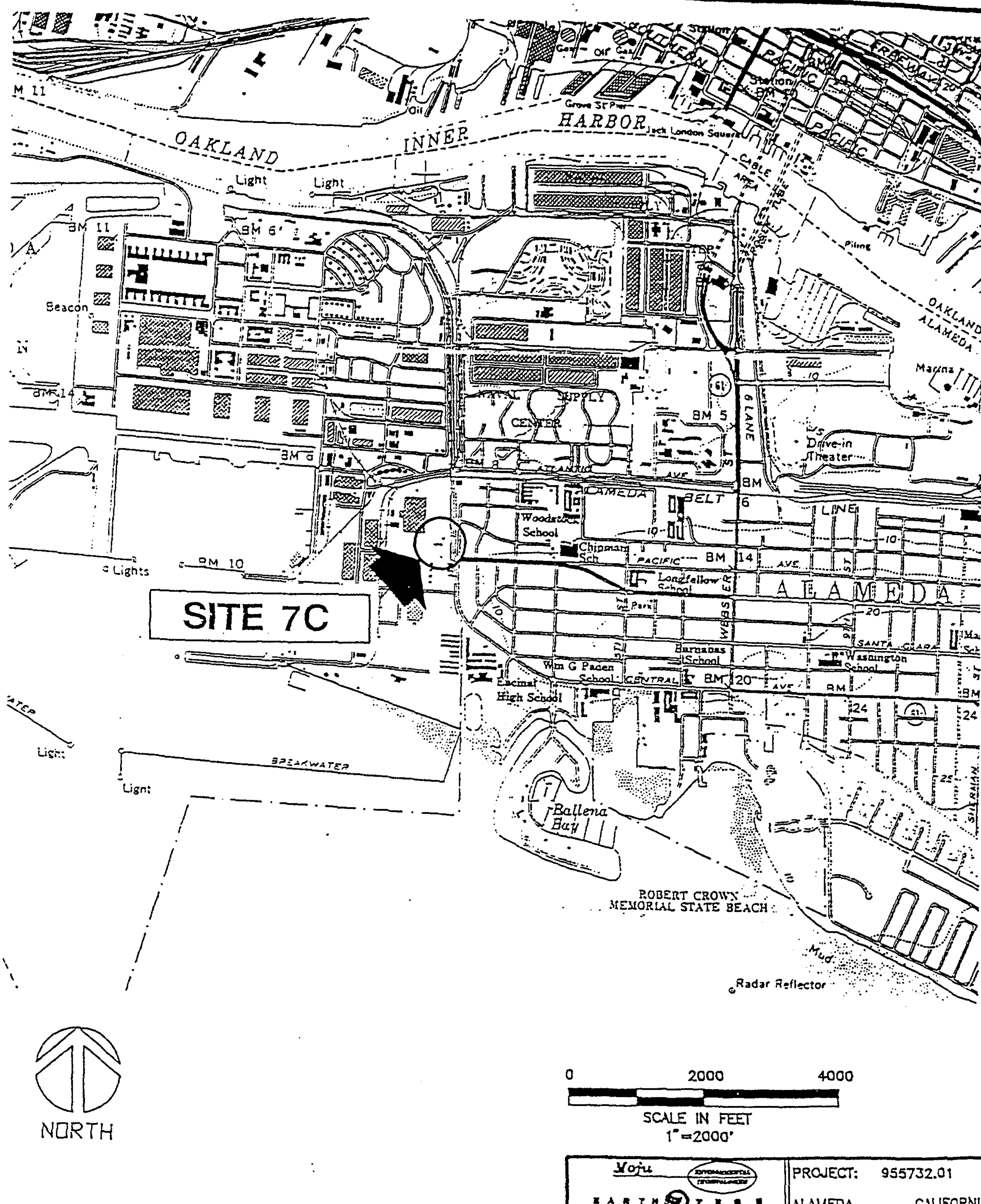
Sample Location	Field Sample ID	Sample Depth (feet)	Analyte/Analytical Method	
			TPH(g) w/BTXE EPA 8015M/8020	TPH-Extractable EPA 8015 Modified
MJ-11	A7C-MJ11-2.5-R	2.5	X	X
	A7C-MJ11-5-R	5.0	X	X
	A7C-MJ11-5-DUP	5.0	X	X
	A7C-MJ11-6.5	6.5	X	X
MJ-12	A7C-MJ12-2.5-R	2.5	X	X
	A7C-MJ12-5-R	5.0	X	X
MJ-13	A7C-MJ13-2.5-R	2.5	X	X
	A7C-MJ13-5-R	5.0	X	X
	A7C-MJ13-6.5	6.5	X	X
MJ-14	A7C-MJ14-2.5-R	2.5	X	X
	A7C-MJ14-5-R	5.0	X	X
	A7C-MJ14-5-DUP	5.0	X	X
	A7C-MJ14-6.5	6.5	X	X
MJ-15	A7C-MJ15-5-R	5.0	X	X
MJ-16	A7C-MJ16-2.5-R	2.5	X	X
	A7C-MJ16-5-R	5.0	X	X
MJ-17	A7C-MJ17-2.5-R	2.5	X	X
	A7C-MJ17-5-R	5.0	X	X
	A7C-MJ17-5-DUP	5.0	X	X
	A7C-MJ17-6.5	6.5	X	X
MJ-18	A7C-MJ18-2.5-R	2.5	X	X
	A7C-MJ18-5-R	5.0	X	X
	A7C-MJ18-6.5	6.5	X	X
MJ-19	A7C-MJ19-5-R	5.0	X	X
MJ-20	A7C-MJ20-5-R	5.0	X	X

DATE: 5/22/96

TABLE 4 (3 of 3)
NAVAL AIR STATION, ALAMEDA
SITE-7C FIELD INVESTIGATION
SAMPLING AND ANALYSIS MATRIX

Sample Location	Field Sample ID	Sample Depth (feet)	Analyte/Analytical Method	
			EPA 8015M/Motor Oil EPA 418.1/TRPH	Lead EPA 6010
S1	A7C-S1-0-R	Surface	X	-
S2	A7C-S2-0-R	Surface	X	-
S3	A7C-S3-0-R	Surface	X	-
S4	A7C-S4-0-R	Surface	X	-
S5	A7C-S5-0-R	Surface	X	-
S6	A7C-S6-0-R	Surface	X	-
S7	A7C-S7-0-R	Surface	X	-
S8	A7C-S8-0-R	Surface	X	-
S9	A7C-S9-0-R	Surface	-	X
S10	A7C-S10-0-R	Surface	-	X
S11	A7C-S11-0-R	Surface	-	X
S12	A7C-S12-0-R	Surface	-	X
S13	A7C-S13-0-R	Surface	-	X
S14	A7C-S14-0-R	Surface	-	X
S15	A7C-S15-0-R	Surface	-	X
S16	A7C-S16-0-R	Surface	-	X
S17	A7C-S17-0-R	Surface	-	X
S17	A7C-S17-0-DUP	Surface	-	X

DATE: 5/22/96



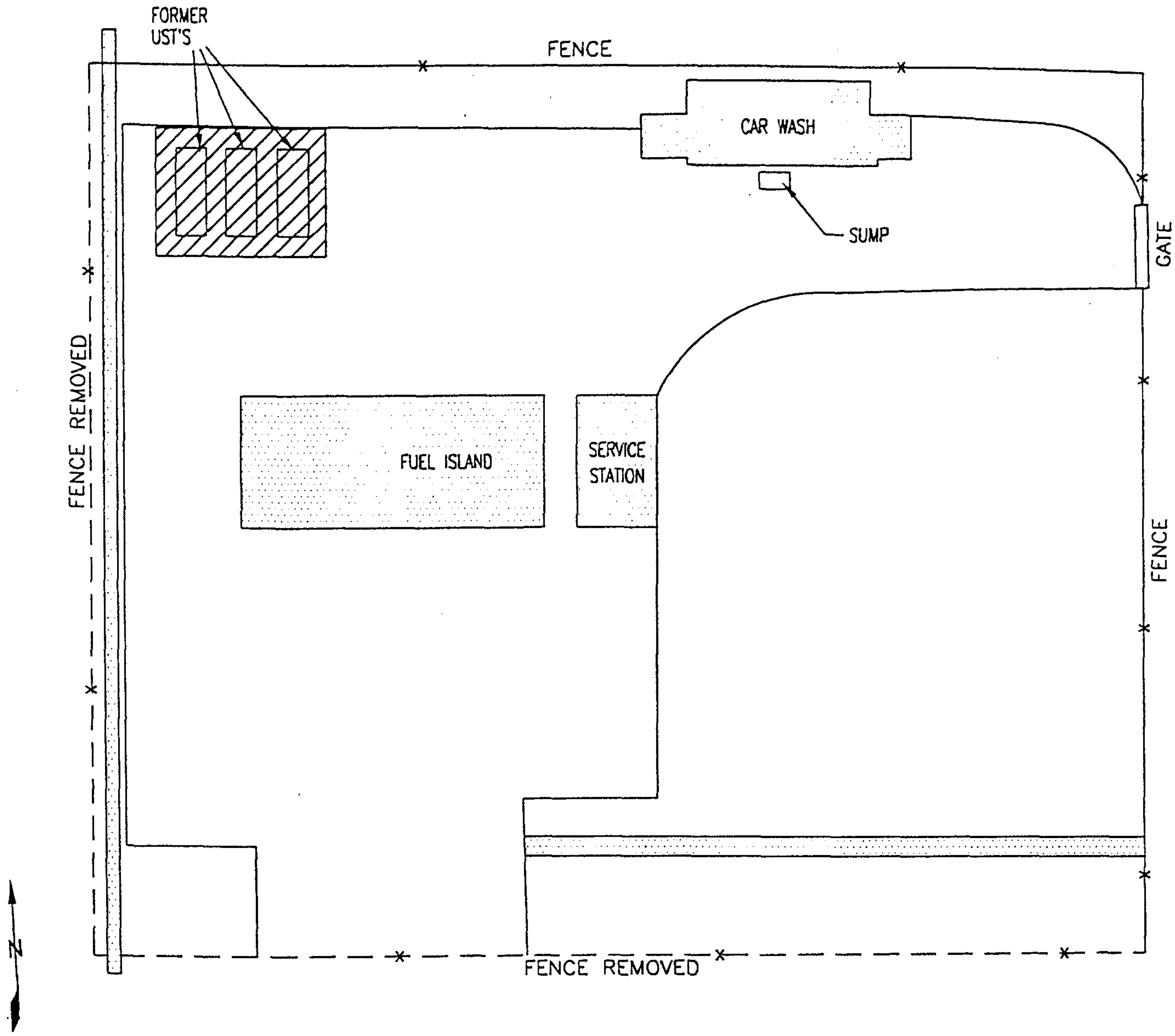
SOURCE: USGS 7 1/2 MINUTE TOPOGRAPHIC QUADRANGLE, OAKLAND WEST, CALIFORNIA, PHOTOREVISED 1980 AT SCALE 1:24,000

EARTH TECH	PROJECT: 955732.01
	ALAMEDA CALIFORNIA

SITE 7C
NAS ALAMEDA

VICINITY MAP

May 1996 FIGURE 1



LEGEND

UST'S EXCAVATION

CONCRETE FOUNDATIONS AND SIDEWALK

ASPHALT

0 50 100

SCALE IN FEET 1" =50'

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PROJECT: 95-A7C-01

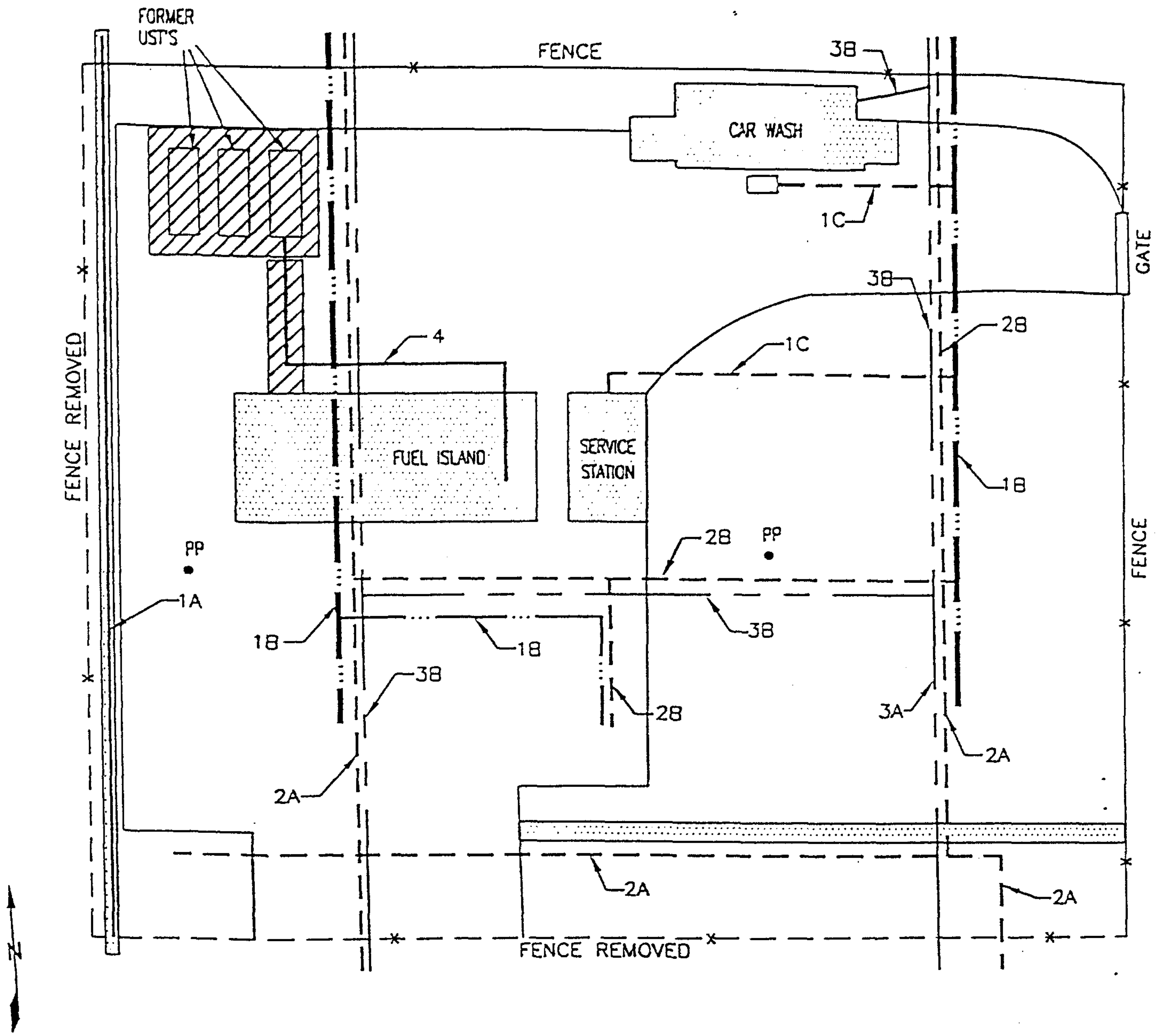
ALAMEDA CALIFORNIA

SITE 7C
NAS ALAMEDA

SITE PLAN

May 1996

FIGURE 2



LEGEND

(hatched)	UST AND PIPING EXCAVATION
PP ●	POWER POLE
(dotted)	CONCRETE
1A	8" TRANSITE SANITARY
1B	6" VC SANITARY
1C	4" CL SANITARY
2A	6" CL WATER
2B	4" WATER STEEL
2C	2" OR SMALLER WATER STEEL
3A	4" GAS STEEL
3B	2" OR SMALLER GAS STEEL
4	UST PIPES (REMOVED)

0 50 100

SCALE IN FEET 1"=50'

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ALAMEDA CALIFORNIA

SITE 7C
NAS ALAMEDA

SITE PLAN WITH A DETAILED SUBSURFACE UTILITIES PLAN

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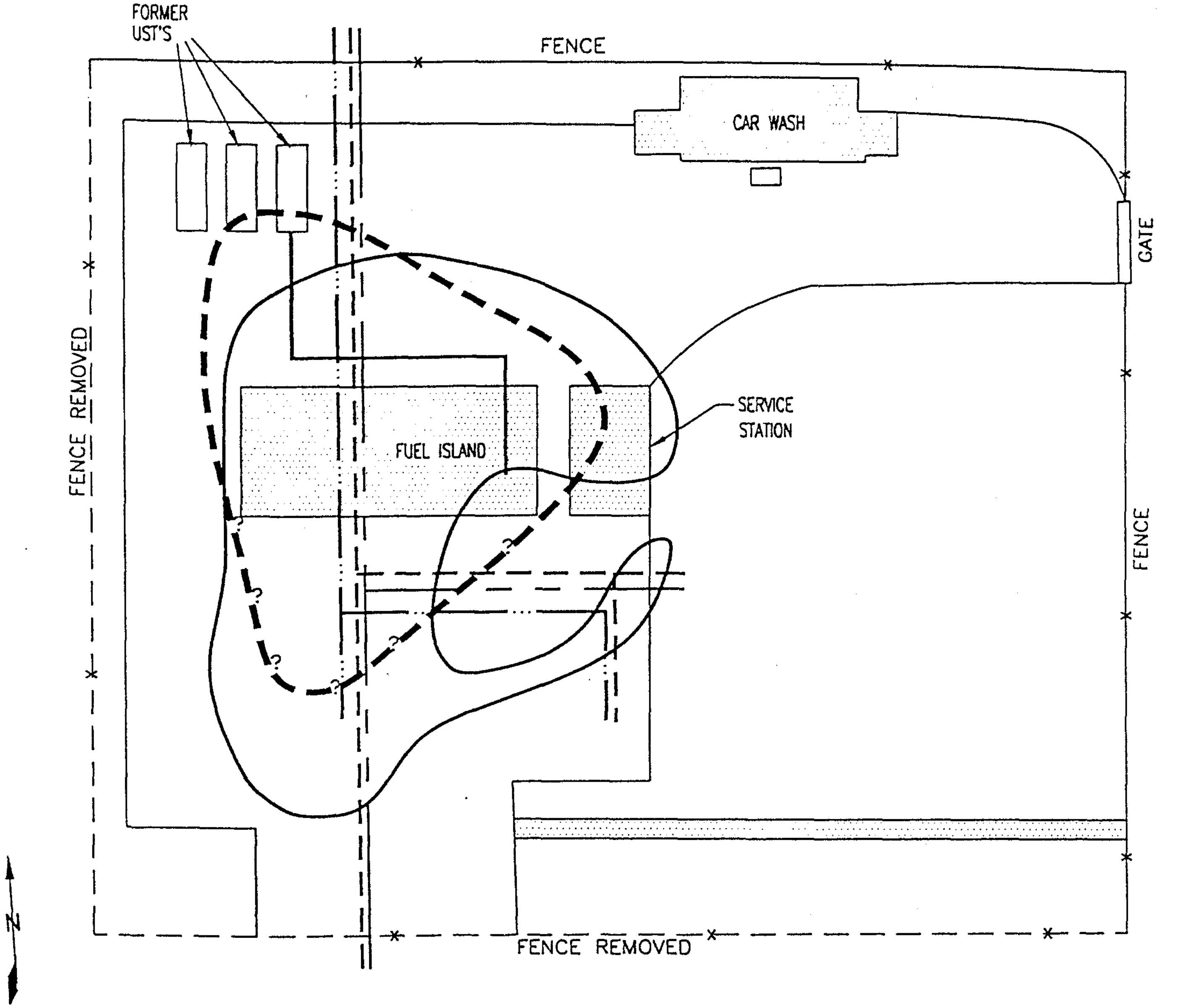
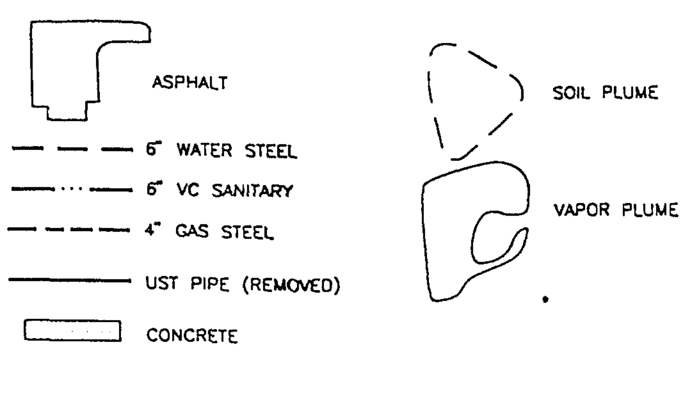
FIGURE 3



LEGEND



0 50 100

SCALE IN FEET 1"=50'

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ALAMEDA CALIFORNIA

SITE 7C

NAS ALAMEDA

SOIL AND SOIL-VAPOR PLUMES AND POSSIBLE UTILITIES MIGRATION PATHWAYS

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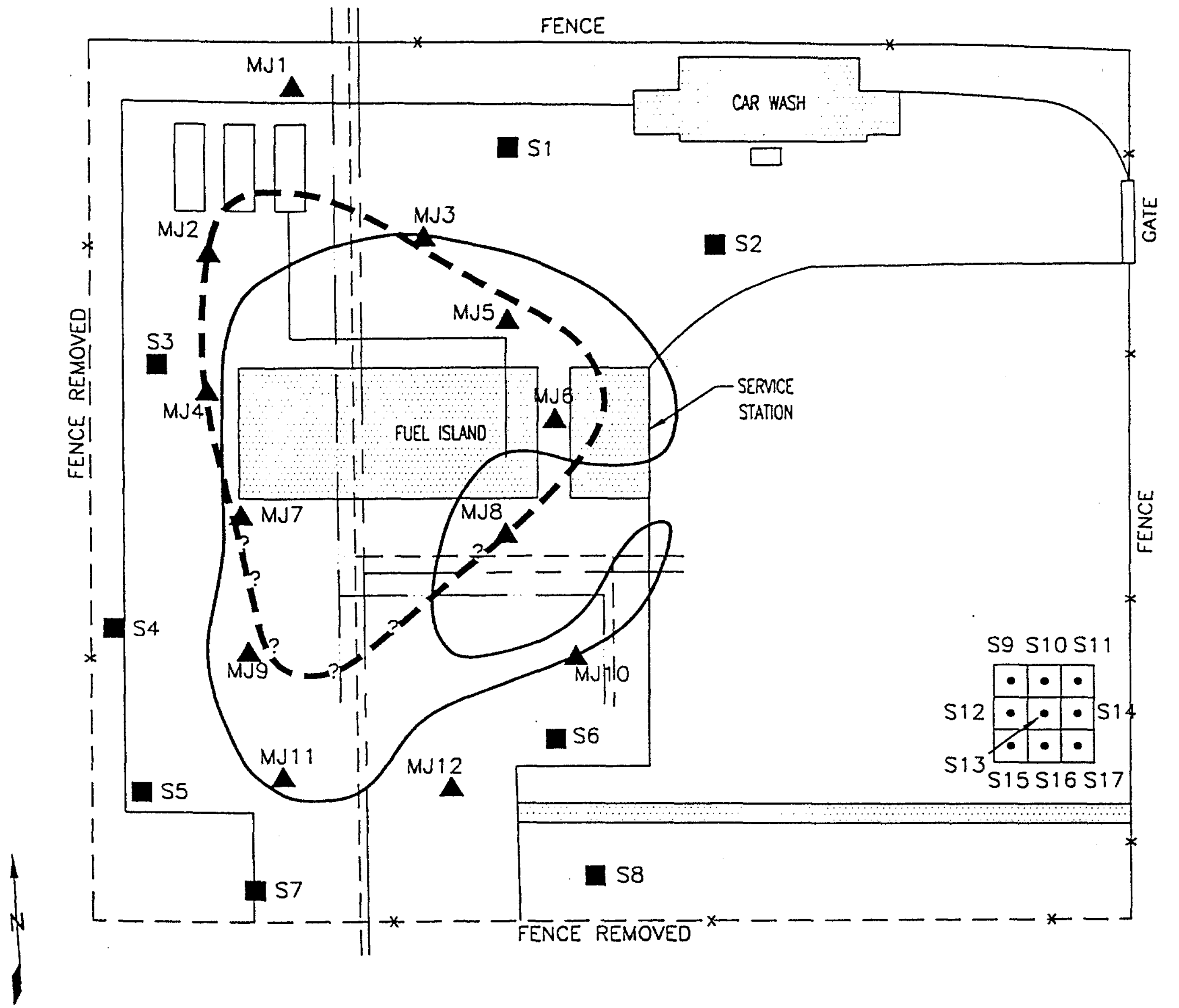
FIGURE 4



LEGEND

- ASPHALT
- SOIL PLUME
- VAPOR PLUME
- 6" WATER STEEL
- 6" VC SANITARY
- 4" GAS STEEL
- UST PIPE (REMOVED)
- CONCRETE
- S-8 SUB-PAVEMENT AND SURFACE SAMPLES FOR MOTOR OIL
- S17 SURFACE SAMPLES FOR LEAD
- MJ12 SOIL BORINGS

0 50 100

SCALE IN FEET 1"=50'

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NAS ALAMEDA

PROPOSED SOIL SAMPLING AND SOIL BORING LOCATIONS WITH UTILITIES

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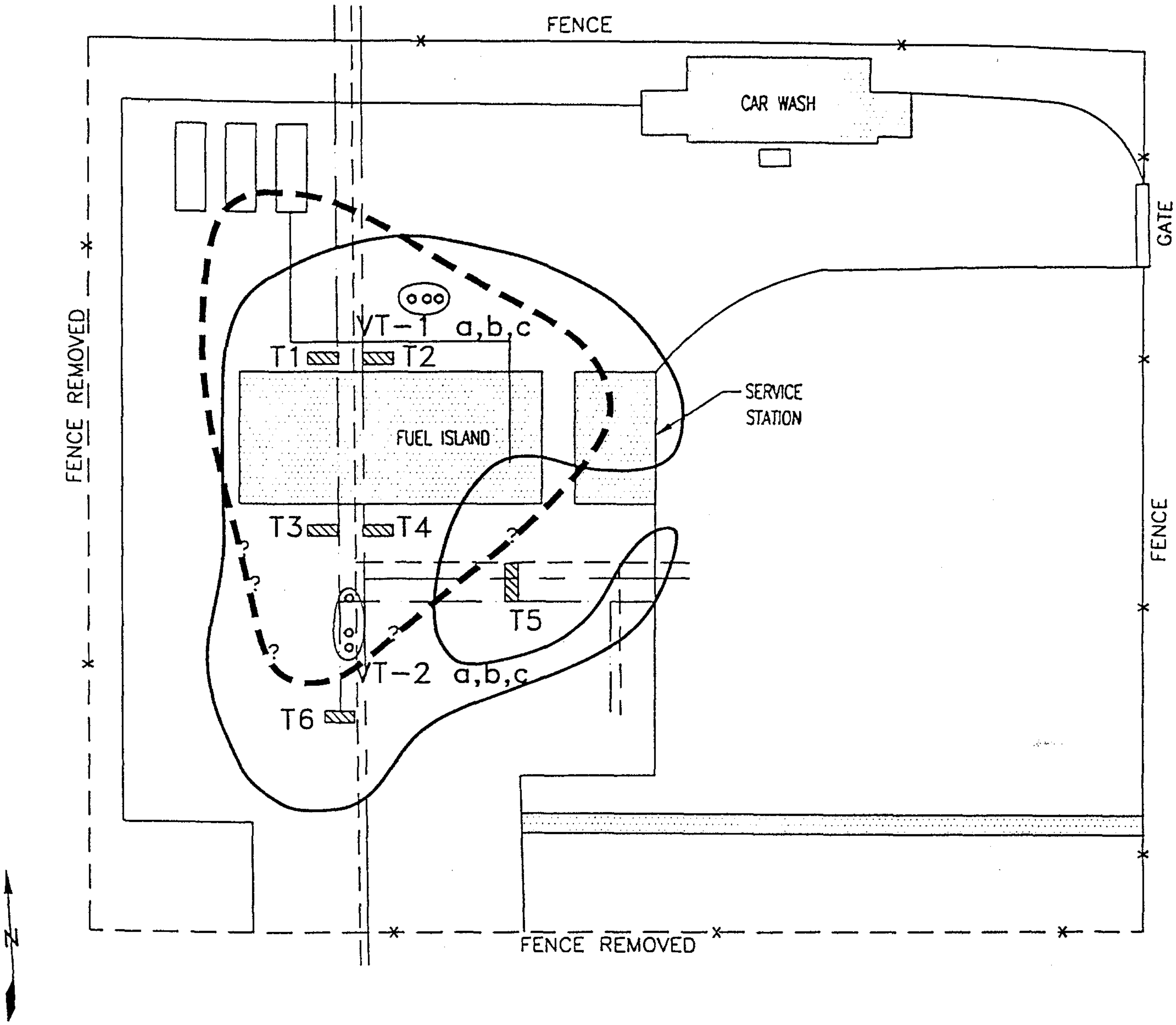
FIGURE 5



LEGEND

ASPHALT

SOIL PLUME

SUBSURFACE UTILITIES

VAPOR PLUME

CONCRETE

VT-1 a,b,c

T6 TRENCH

VAPOR EXTRACTION TEST GROUP

0 50 100

SCALE IN FEET 1"=50'

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SITE 7C

NAS ALAMEDA

PROPOSED LOCATIONS FOR TRENCHES AND VAPOR EXTRACTION TESTS

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FIGURE 6

Figure 7

PROJECT ORGANIZATION CHART