Final Amended Project Plans Sampling for the Phase III RFI NAS Oceana Virginia Beach, Virginia

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Norfolk, Virginia

Under the LANTDIV CLEAN II Program

Contract No. N62470-95-D-6007
CTO-0023

December 1997

Prepared by

CH2MHILL

Baker
Environmental, Inc.

CDM
Federal Programs Corp.

03.05-12/22/97-00309

Final

Amended Project Plans
Sampling for the Phase III RFI

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Virginia Beach, Virginia

Contract Task Order 0023

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Addendum to the RFI Final Work Plan

This is an Addendum to the CH2M HILL, RCRA Facility Investigation (RFI), Work Plan, dated June, 1992. This Addendum to the RFI Final Work Plan defines sampling tasks and field investigation procedures that will be performed during the Naval Air Station, Oceana (NAS Oceana) RFI Phase III sampling. The data collection quality assurance for the RFI field activities are documented in the addendum to the Sampling and Analysis (SAP), the Data Management Plan (DMP), the Quality Assurance Project Plan (QAPP), and a revised Health and Safety Plan (HSP). Figures and tables are located at the end of the Addendums.

Sample Collection Goals and Objectives

The principal goals of the RFI Phase III sampling are to: (1) confirm the RFI analytical results at Solid Waste Management Units (SWMUs) 1, 2b, 2c, 2d, 21, 25, and 26, and (2) confirm that the post removal action contaminant levels are below the cleanup goals set for the soil at SWMU 18 and 24, and (3) fill data gaps to facilitate the development and implementation of remedial activities.

Specific sampling objectives developed to satisfy the goals of the RFI Phase III field activities for each SWMU are summarized below:

SWMU 1—West Woods Oil Disposal Pit

- Oversee the set-up and installation of solar skimmers for free product recovery in 1-MW4, 1-MW5, 1-PZ5, and 1-PZ3.
- Begin to optimize the product removal rates of the solar skimmers.
- Confirm the results of the RFI soil sampling for dioxins and furans.

SWMU 2b—Line Shack Oil Disposal Area (Bldg. 131)

- Confirm that PAHs are not elevated in site groundwater and contributing to sediment contamination in the perennially flowing surface water drainage ditch at the site.
- Confirm the results of the RFI sediment sampling performed in the perennially flowing surface water drainage ditch at the SWMU.

SWMU 2c—Line Shack Oil Disposal Area (Bldg. 400)

- Confirm the results of the RFI sediment sampling in the surface water drainage ditch at the SWMU.

SWMU 2d—Line Shack Oil Disposal Area (Bldg. 125)

- Confirm the results of the RFI groundwater sampling performed at the SWMU.

SWMU 2e—Line Shack Oil Disposal Area (Bldg. 109)

- Install a new monitoring well just downgradient of SWMU 18 to confirm previous Geoprobe sampling results and sample it for VOCs and SVOCs.

SWMU 18—Hazardous Waste Storage Area (Bldg. 204)

- Confirm that post removal action contaminant levels are below the clean-up goals set for the soil at this SWMU.

SWMU 21—Transformer Storage Yard (Bldg. 530)

- Collect soil samples to confirm the results of the RFI soil sampling event.

SWMU 24—Bowser, Building 840

- Confirm that post removal action contaminant levels are below the clean-up goals set for the soil at this SWMU.

SWMU 25—Inert Landfill

- Confirm the results of the RFI sediment sampling performed at this SWMU.
- Install one shallow monitoring well directly east of the inert landfill to monitor groundwater that might be flowing easterly from beneath the landfill.

SWMU 26—Fire Fighting Training Area (Building 220)

- Collect deeper subsurface soil samples at the area where the oil tank used for fire-fighting training was located to check for subsurface petroleum contamination.

Sampling Locations and Media

The number of samples to be collected from medium or media of concern at each SWMU is summarized in Table 1. The purpose of the RFI supplementary sampling is confirmatory in nature, therefore, every effort will be made to determine the exact location from which the previous samples were collected during the RFI sampling activities. In the event that the exact RFI sampling locations can not be identified, maps of the RFI sampling locations and surveyed coordinates (where applicable) will be used to place the supplementary sampling location as close as possible to the RFI sampling location.

The field investigation procedures and sampling tasks that will be performed during the NAS Oceana RFI Phase III sampling are documented below.

SWMU 1—West Woods Oil Disposal Pit

Floating free phase petroleum contamination has been identified in several of the groundwater monitoring wells and piezometers at SWMU 1. Two solar skimmers equipped with two recovery pumps each will be installed by IMS Environmental to begin recovering the free phase petroleum product. Historically, 1-MW4, 1-MW5, 1-PZ5, and 1-PZ3 have contained the most free product. An oil/water interface probe will be used to measure the product thickness in all of the wells and piezometers at SWMU 1. The recovery pumps will

be installed in the four monitoring wells/piezometers with the most free product. Once the setup and installation is complete, the recovery pumps will be run continuously until all of the fuel in the wells/piezometers has been removed. The pumps will then be set to run for approximately two minutes each hour, for the first 24-hour period. CH2M HILL field personnel will check on the recovery operations periodically and pump cycles will be adjusted to provide the most efficient recovery rate possible. The solar skimmers will be setup as early as possible during the week of sampling. This will enable the field team to check and adjust the pump cycle and product recovery several times before the field activities are complete.

A total of six soil samples will be collected at SWMU 1 and analyzed for dioxins and furans. Two samples will be collected where two previous samples contained dioxins and furans. The other four will be collected near the wells that contain free product as noted above. Soil sample SB-18 will be collected from a depth of 7-8 ft below ground surface. Soil sample SB-20 will be collected from a depth of 3-5 feet below ground surface. The remaining samples will be collected from a depth of 6 to 7 feet below ground surface or the top of the water table, if higher. All samples will be collected using a Geoprobe. Sampling locations are depicted in Figure 1.

SWMU 2b—Line Shack Oil Disposal Areas (Bldg. 131)

RFI supplementary sampling activities at this SWMU will address semi-volatile organic compound (SVOC) contamination previously detected in the sediments in the perennially flowing surface water drainage ditch and the groundwater during the RFI sampling at this site.

A total of three sediment samples will be collected from three locations (one from each location) within the perennially flowing surface water drainage ditch and analyzed for SVOCs and total organic compounds (TOC). Samples will be collected using a hand trowel. The results of the sediment sampling will indicate whether SVOCs, specifically polycyclic aromatic hydrocarbons (PAHs) are elevated to levels that are potentially hazardous to human health or the environment. Sampling locations are depicted in Figure 2.

A total of two groundwater samples will be collected from two monitoring wells (one from each well) and analyzed for SVOCs, excluding PAHs. In addition, the samples will be analyzed for PAHs using method 8310 to achieve lower detection limits. Groundwater samples will be collected using a low-flow Grundfos pump. The results of the groundwater sampling will indicate whether SVOCs, specifically PAHs, are elevated to levels that are potentially hazardous to human health or the environment. Water levels will be obtained prior to sampling. Sampling locations are depicted in Figure 2.

SWMU 2c—Line Shack Oil Disposal Area (Building 400)

RFI supplementary sampling activities at this site will address a data gap identified from previous sediment sampling. Previously, the sediments were analyzed for volatile organic compounds (VOCs) only. During this supplemental sampling, two sediment samples will be collected at the same locations as the previous samples and analyzed for SVOCs (minus PAHs), PAHs using a low detection limit analytical method (8310), and TOC. The results of the sediment sampling will indicate whether SVOC concentrations in sediment are elevated to levels that are potentially hazardous to human health or the environment. Sampling locations are depicted in Figure 3.

SWMU 2d—Line Shack Oil Disposal Area (Bldg. 125)

A total of five groundwater samples will be collected from five monitoring wells (one from each well) and analyzed for VOCs and SVOCs. Groundwater samples will be collected using a low-flow Grundfos pump. The results of the groundwater sampling will indicate whether VOCs, specifically 1,1-dichloroethene (DCE), and SVOC concentrations in groundwater are still elevated to levels that are potentially hazardous to human health or the environment. Water levels will be obtained prior to sampling. Sampling locations are depicted in Figure 4.

SWMU 2e—Line Shack Oil Disposal Area (Bldg. 109)

Install one shallow monitoring well (2E-MW17) located directly hydraulically downgradient of SWMU 18 where previous Geoprobe data has indicated that chlorinated VOCs are elevated. The well will be screened from 2 to 12 feet below ground surface. After development and purging the well will be sampled for VOCs and SVOCs. The well location is depicted in Figure 5.

SWMU 18—Hazardous Waste Storage Area (Bldg. 204)

A soil removal action was conducted at the storage area to remove soil contaminated with semi-volatile compounds, specifically, PAHs, and low levels of VOCs. Six confirmatory soil samples will be collected from six locations surrounding the excavation and analyzed for VOCs, PAHs, and polychlorinated biphenyls (PCBs). The results will be evaluated to confirm that the extent of the excavation was sufficient to remove the PAH-contaminated soil. . A continuous core sample will be collected from the ground surface to a depth of 1.5 feet (the depth of the original excavation) below ground surface using a Geoprobe. The core sample will be screened with a organic vapor monitor (OVM). A soil sample will be collected from the depth with the highest reading or from the 1.5-foot interval if no OVM readings exceed background levels. The samples will be collected from the native soil just outside of the perimeter of the excavation at six locations surrounding the excavation. The sampling locations are depicted in Figure 6.

SWMU 21—Transformer Storage Yard (Bldg. 830)

Previous soil sampling at this transformer storage yard indicated that the soil was contaminated with petroleum hydrocarbons. Three confirmatory soil samples will be collected and analyzed for SVOCs. One of these samples (SS-13 in the drainage ditch) will also be analyzed for PCBs. This sample will receive full QC (i.e. duplicate, MS/MSD, and equipment blank). The results will be evaluated to confirm that the soil does not contain petroleum hydrocarbons or PCB compounds that pose a risk to human health and the environment. Shallow soil samples will be collected from a depth of 0.5 to 1.0 feet below ground surface using a Geoprobe. The only exception will be the surface soil sample taken at the area of offsite runoff. This sample will be collected from 0 to 0.5 feet below ground surface using a trowel. Sampling locations are depicted in Figure 7.

SWMU 24—Bowser, Building 840

Previous soil sampling at this SWMU indicated that the soil is contaminated with petroleum hydrocarbons. Soil from the contaminated area was excavated from the site in 1995. Ten confirmatory soil samples will be collected and analyzed for VOCs and PAHs.

The results will be evaluated to confirm that the soil does not contain petroleum hydrocarbons or VOC compounds at concentrations that pose a risk to human health or the environment. A continuous core sample will be collected from the ground surface to a depth of 4 feet below ground surface using a Geoprobe. The core sample will be screened with an OVM to identify the interval with the highest organic vapor content. A soil sample will be collected from the depth with the highest reading or from the 2.5-foot interval (the depth of the original excavation) if no OVM readings exceed background levels. The samples will be collected from the native soil just outside of the perimeter of the excavation at ten locations surrounding the excavation. Sampling locations are depicted in Figure 8.

SWMU 25—Inert Landfill

Previous soil sampling in the borrow pit pond adjacent to the landfill indicated that the sediment contained low concentrations of pesticides. The pond is also adjacent to a farm field that might have intermittently been treated with pesticides. Three sediment samples will be collected along the central axis of the pond using a boat and a ponar dredge sediment sampler. One sample will be collected at the end of the pond nearest to the farm field, a second will be collected in the center of the pond, and a third will be collected at the farthest end of the pond from the farm field. The sediment samples will be analyzed for pesticides and TOC.

One shallow monitoring well will be installed just to the east of the inert landfill to monitor for any groundwater from beneath the landfill that might be migrating easterly. The well screen will extend from 2 feet below ground surface to 19 feet below ground surface. The water table is expected to be at approximately 5 feet below ground surface. Therefore the screened interval will span the top of the water table and extend into the aquifer a sufficient depth to monitor the aquifer at a depth similar to the depth of the borrow pit. After development and purging the well will be sampled for full Appendix IX parameters including both total and dissolved metals. The water table elevation in the monitoring well and the pond surface elevation at several locations will be surveyed to determine the groundwater flow direction. The proposed monitoring well location is depicted in Figure 9.

SWMU 26—Fire Fighting Training Area (Building 220)

Fire department personnel have confirmed that a partially buried tank was used in fire extinguisher training exercises in the past. The tank was approximately 8 feet in diameter and 6 feet tall. Four feet of the tank were buried in ground. There was a valved underdrain that allowed water removal from the tank to the adjacent ditch. Jet fuel and waste oil were used for the fires. The tank was usually ½ full of water with a 2-3 inch fuel mixture on top. The setup was used from the 1960s to the early 1980s.

Several soil sample were already collected from the site at a depth of 2-3 feet below ground surface. We propose to collect three additional subsurface soil samples from a depth of 4-6 feet and analyze them for BTEX and PAHs. The results will be documented in the Phase III RFI Report. The locations of these samples is depicted in Figure 10.

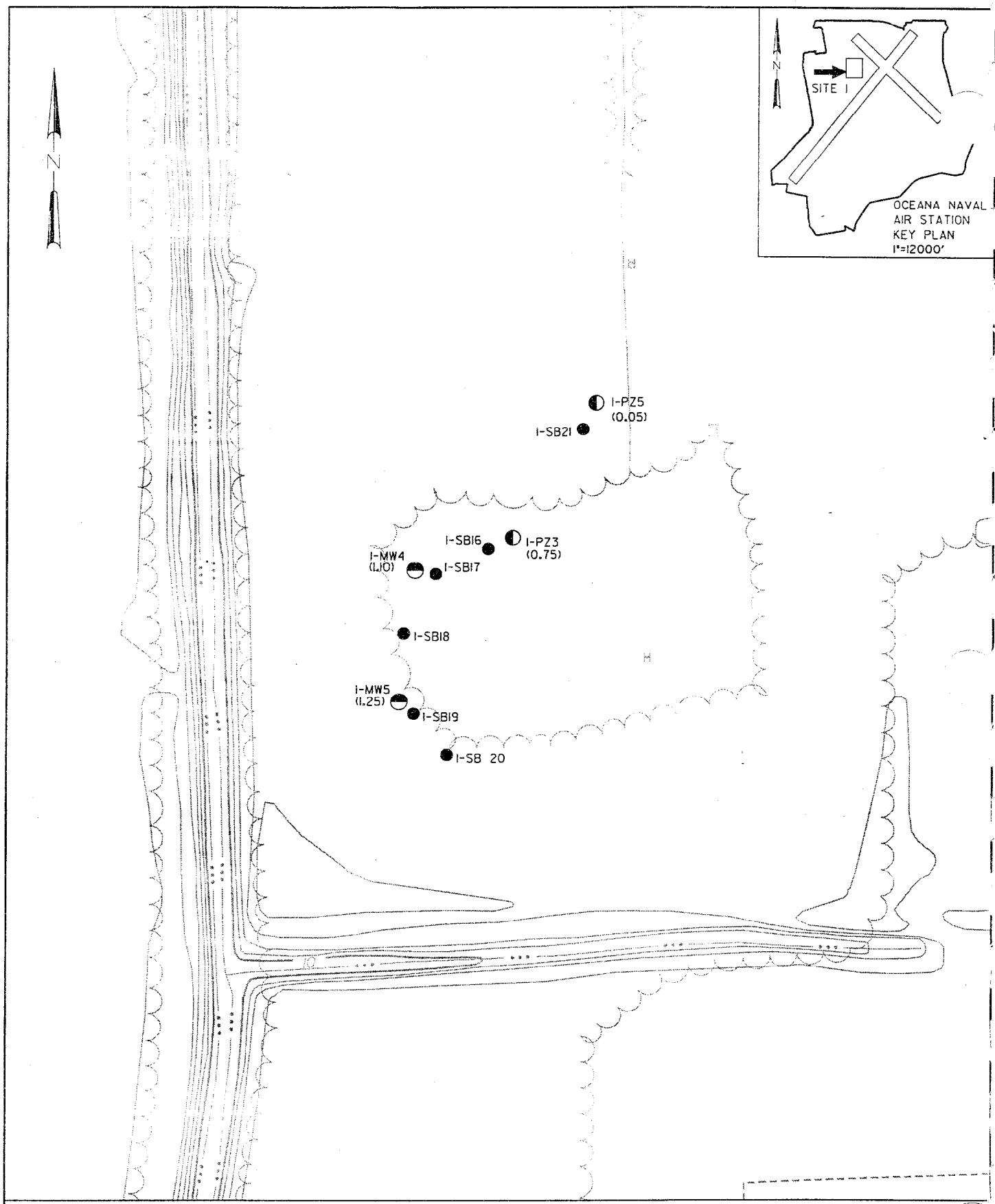


Figure 1
PHASE III RFI
SOIL SAMPLE LOCATIONS AND
FREE PRODUCT RECOVERY WELLS
AT SWMU 1
Naval Air Station, Oceana

CH2MHILL

763s2419.dgn
13-OCT-1997

ONAS0368sit1.dgn	1-49, 51-59	ONASp721189.dgn	1-59	ONAS0368we01.dgn	2-61, 63-63
ONAS0368grid.dgn	1-63	ONASt718199.dgn	1-49, 51-63		
ONAS0368Mgrd.dgn	1-63	ONASp721189.dgn	1-59		

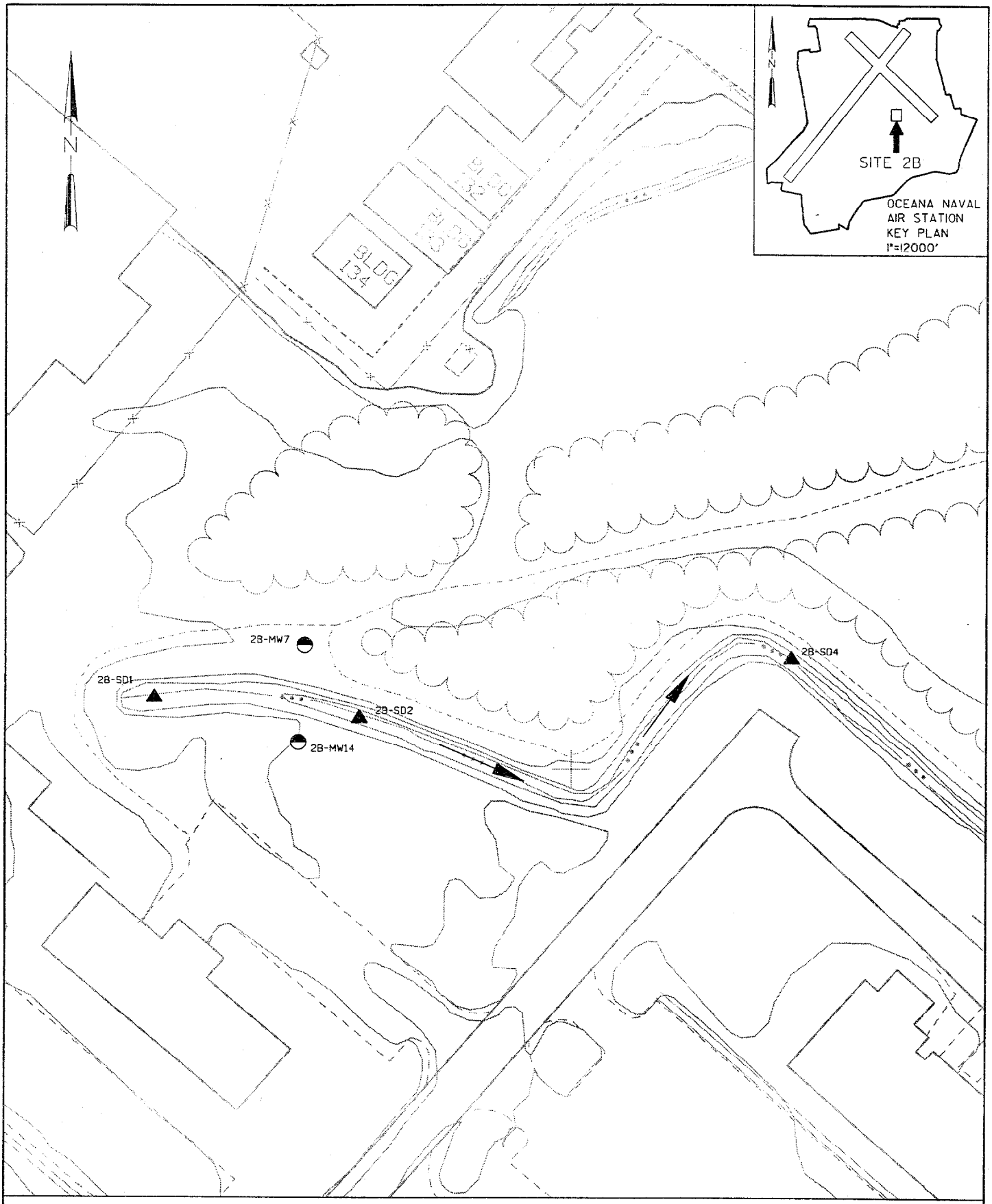
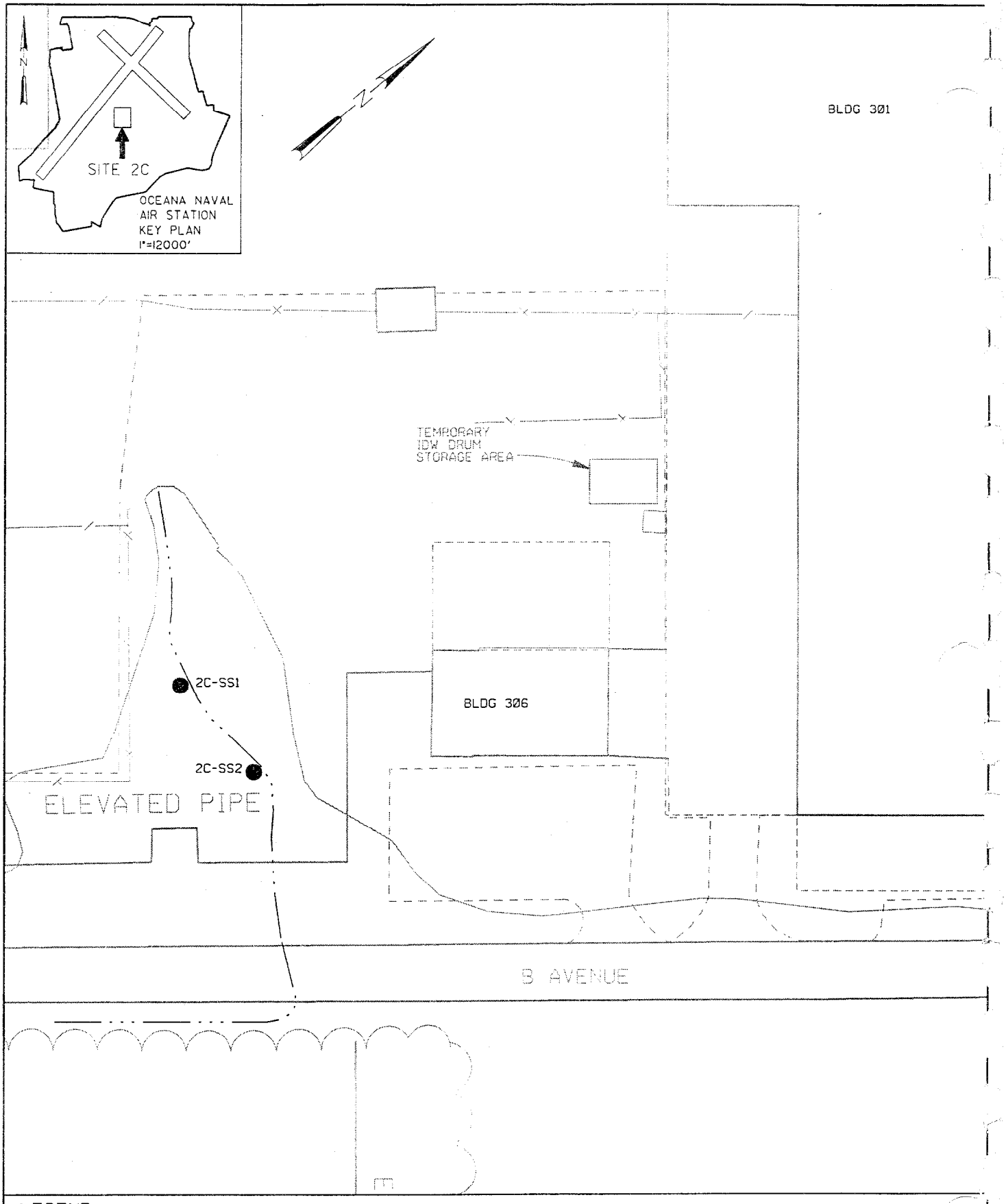


Figure 2
PHASE III RFI
SEDIMENT AND GROUNDWATER SAMPLING
LOCATIONS AT SWMU 2B
Naval Air Station, Oceana

763s2410.dgn
13-OCT-1997



LEGEND

- SEDIMENT SAMPLING LOCATION
- DRAINAGE DITCH

0 30 60 90

SCALE IN FEET

Figure 3

PHASE III RFI
SEDIMENT SAMPLING LOCATIONS
SWMU 2C
Naval Air Station, Oceana

CH2MHILL

763s2411.dgn
13-OCT-1997

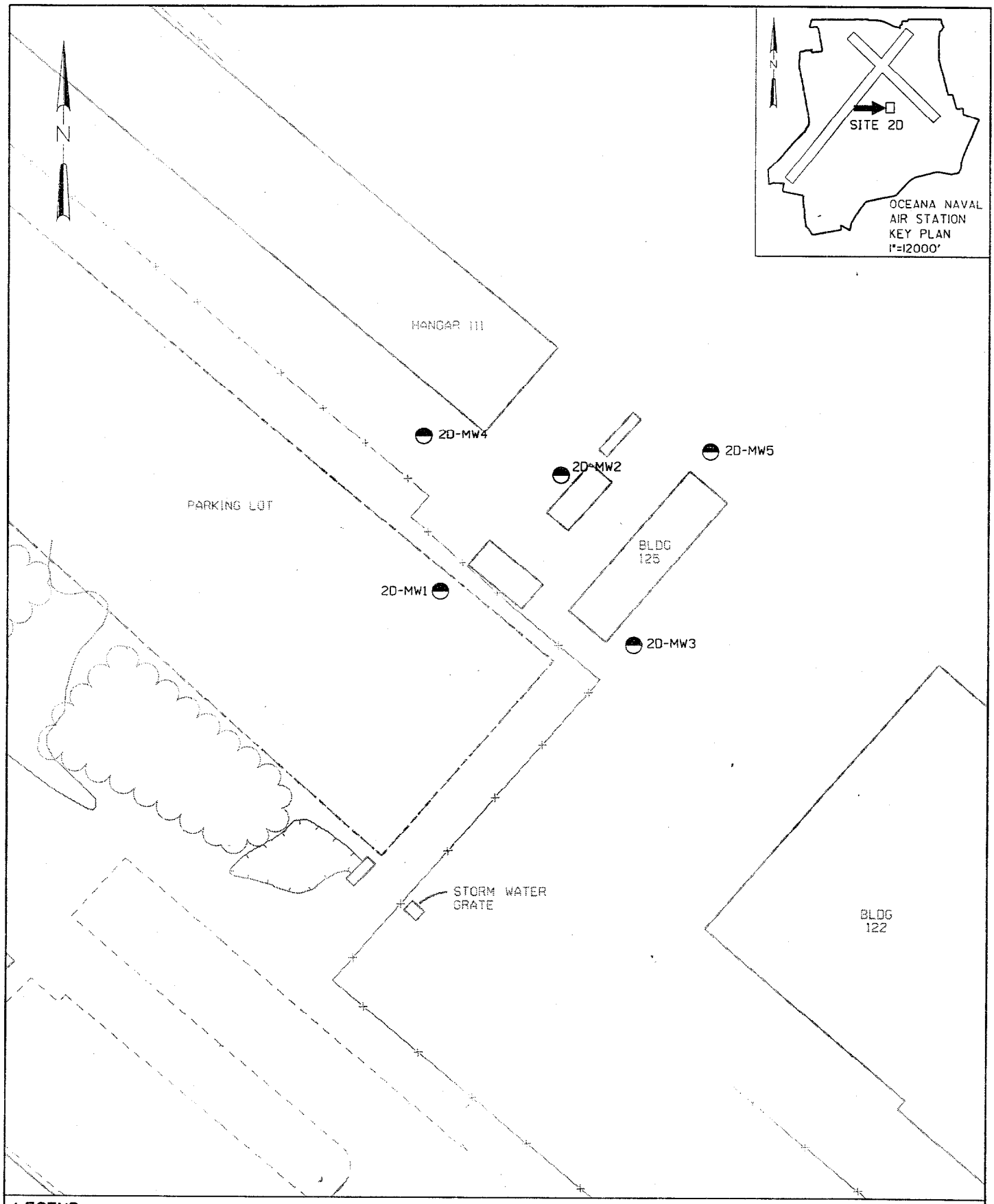


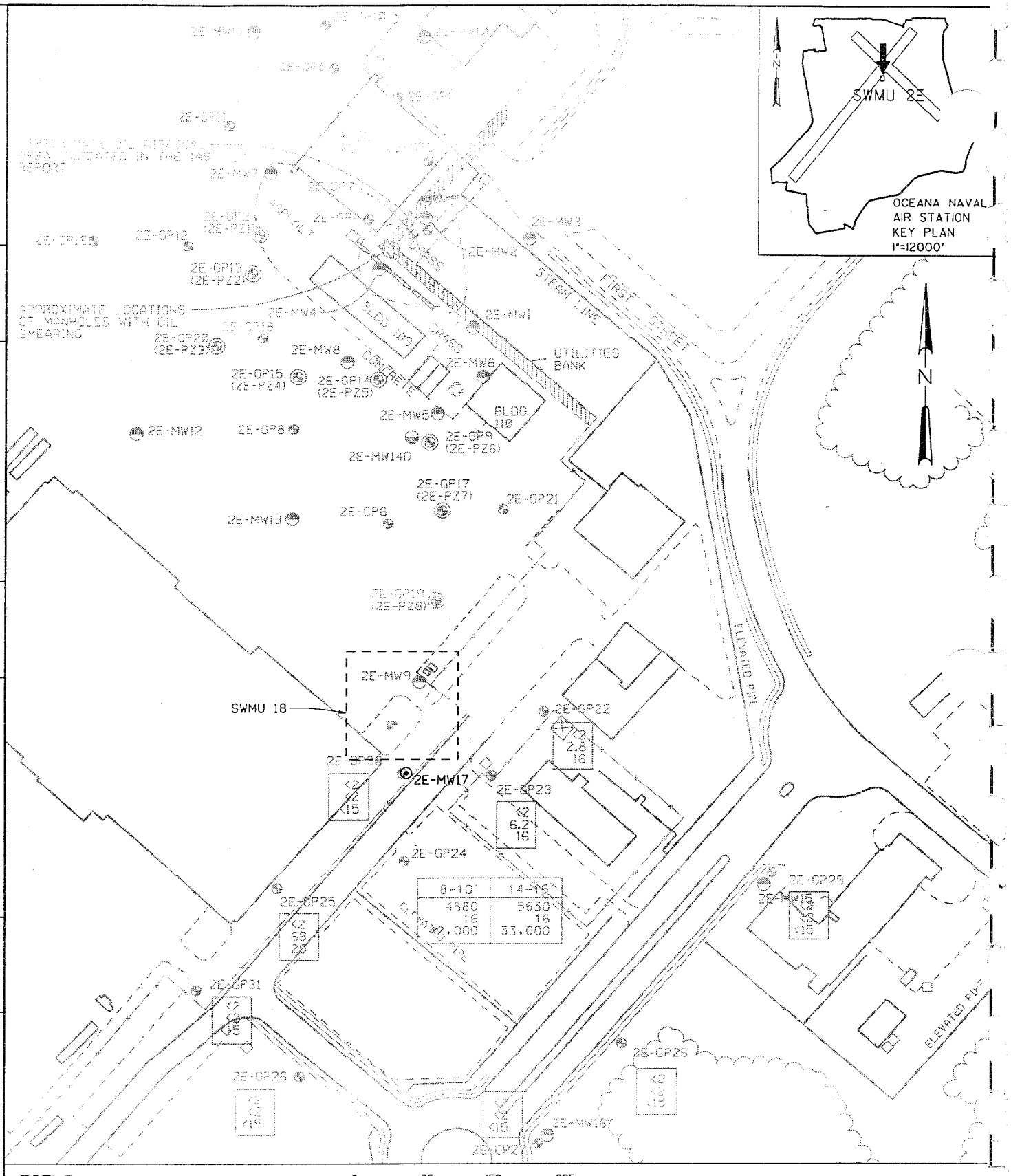
Figure 4
PHASE III RFI
GROUNDWATER SAMPLING LOCATIONS
AT SWMU 2D
Naval Air Station, Oceana

CH2MHILL

ONASu3668dr.dgn
ONASPC21183.DGN
ONAS1721183.dgn
ONASTC24183.DGN
1-3y

ONASPC24183.DGN 1-36; 41-44, 46-59
ONAS03668W12D.DGN 1-63
ONAS03668BLXT.DGN 1-63

763s2414.dgn
13-OCT-1997



LEGEND

- PROPOSED RFI PHASE III MONIOTRING WELL LOCATION
- RFI GEOPROBE SAMPLING LOCATION
- RFI GEOPROBE SAMPLING LOCATION W/PIEZOMETER
- RFI/CMS SHALLOW MONITORING WELLS
- CMS GEOPROBE SAMPLING LOCATION
- CMS DEEP MONITORING WELL

0 75 150 225
SCALE IN FEET

(ug/L)

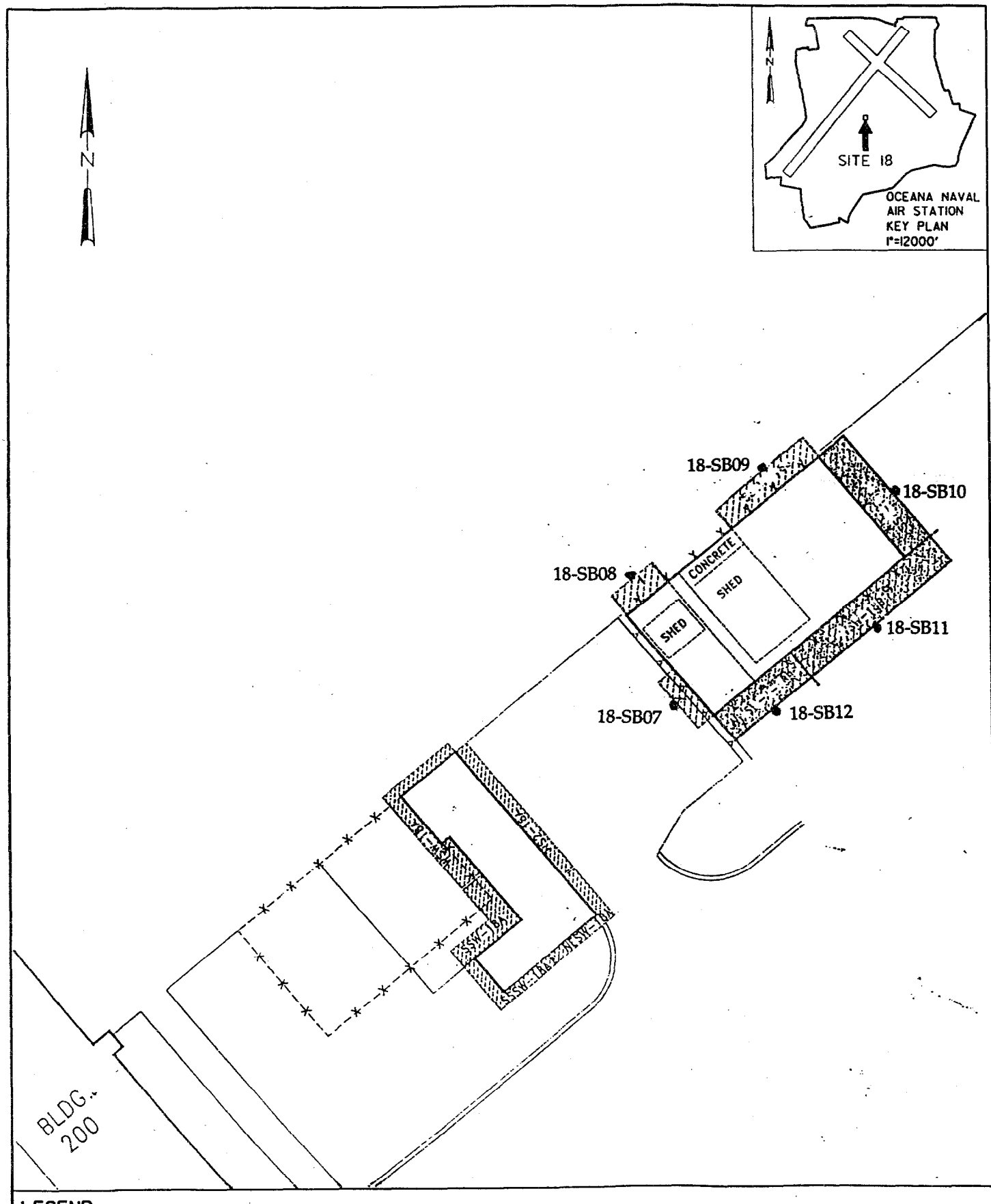
< NOT DETECTED ABOVE IDL

Figure 5
PHASE III RFI
PROPOSED MONITORING WELL LOCATION AT SWMU 2E/18
Naval Air Station, Oceana

CH2MHILL

ONAS\0366bdr.dgn 2-17, 31-63
ONAS\FC21183.DGN 1-27, 29-49, 51-60, 62-63
ONAS\0366BFX1.DGN 2-63
ONAS\T721183.DGN

763s2421.dgn
18-DEC-1997



LEGEND

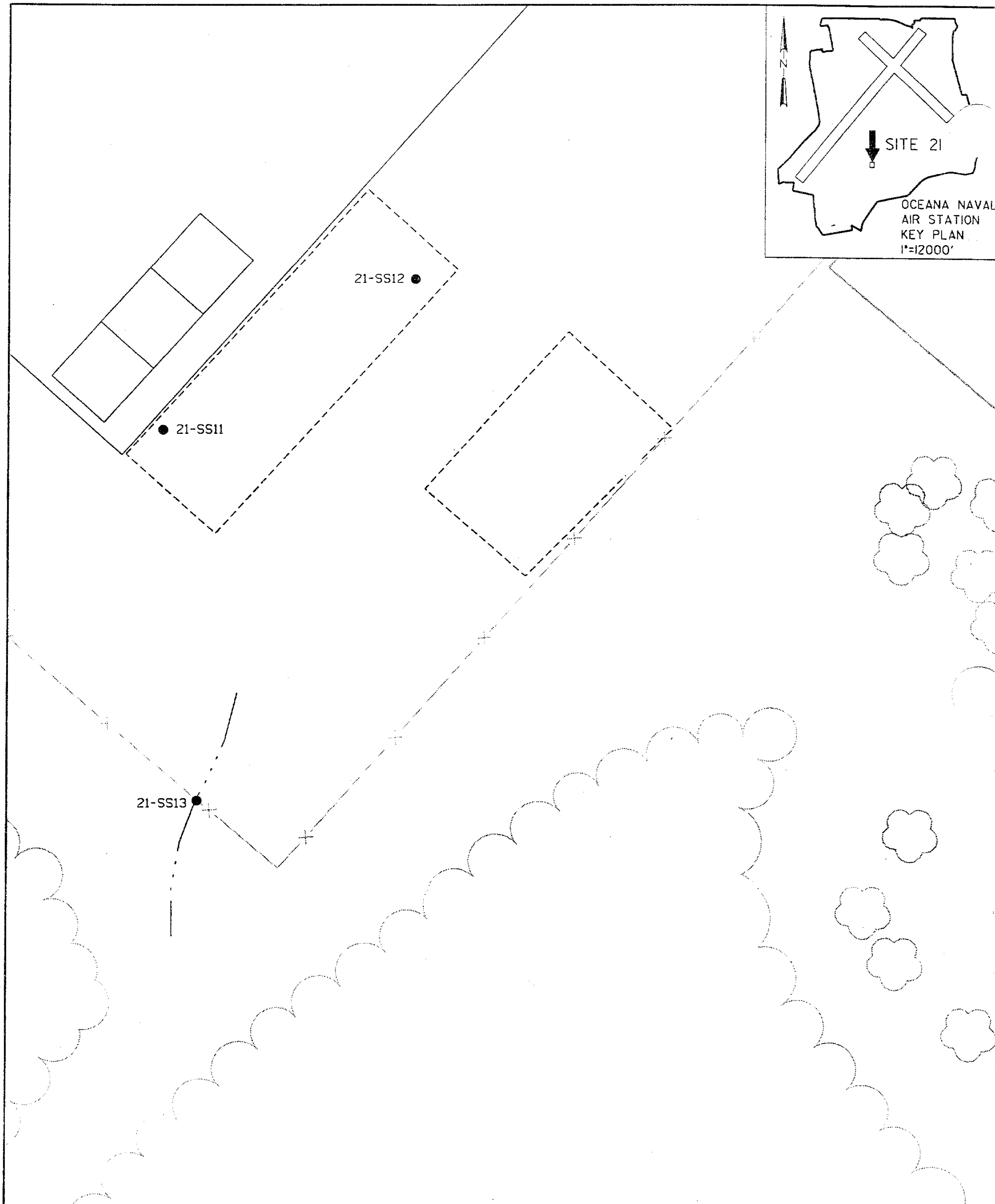
- SOIL SAMPLING LOCATION
- AREA OF EXCAVATED SOIL

0 10 20 30
SCALE IN FEET

Figure 6
PHASE III
SOIL SAMPLE LOCATIONS
AT SWMU 18
Naval Air Station, Oceana

CH2M HILL

763s2420.dgn
13-OCT-1997



LEGEND

● SOIL SAMPLING LOCATION

TRANSFORMER STORAGE AREAS

0 25 50 75
SCALE IN FEET

Figure 7
PHASE III RFI
SOIL SAMPLING LOCATIONS
AT SWMU 21
Naval Air Station, Oceana

CH2M HILL

ONAS:0368pgrd.dgn	1-63
ONAS:0368sit1.dgn	1-49, 51-59
ONAS:0368tgrd.dgn	1-63
ONAS:0368Mgrd.dgn	1-63
ONAS:0368bdr.dgn	3-4, 41-63
ONAS:t721180.dgn	1-49, 51-63
ONAS:p721180.dgn	1-59
ONAS:p721177.dgn	1-59
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ONAS:0368we21.dgn	1-63

763s2418.dgn
06-NOV-1997

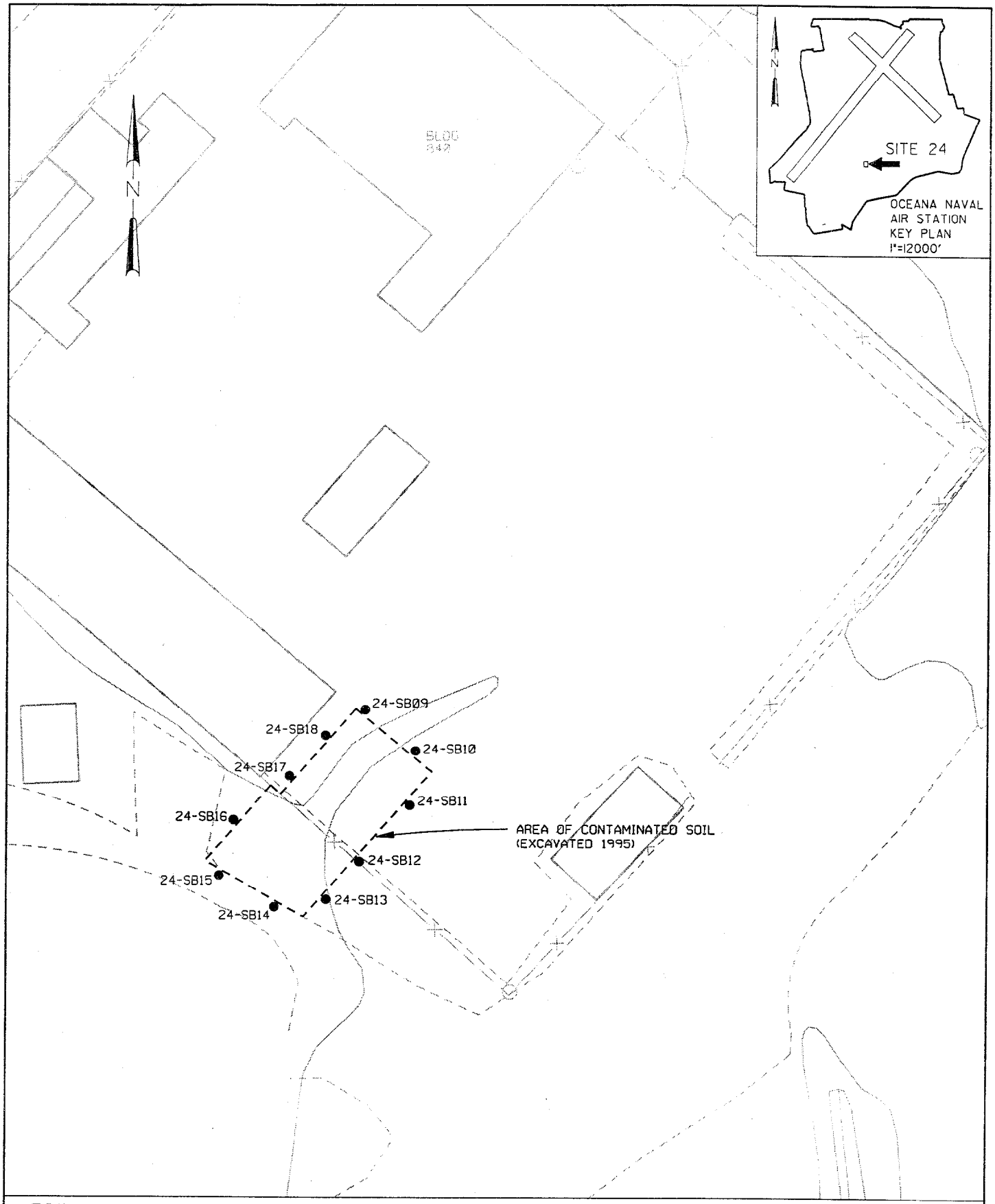
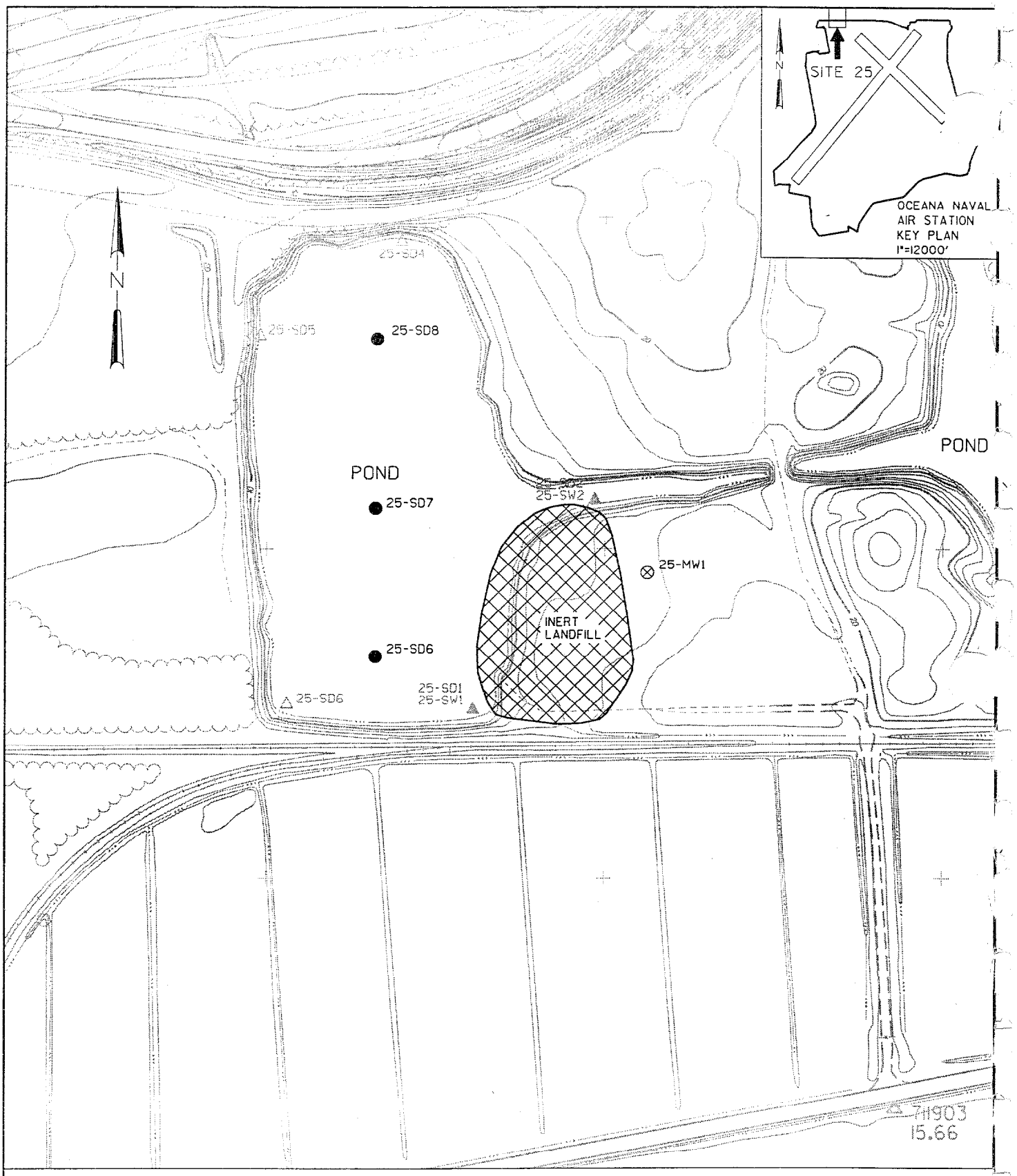


Figure 8
PHASE III RFI
SOIL SAMPLE LOCATIONS
AT SWMU 24
Naval Air Station, Oceana

763s2416.dgn
06-NOV-1997



LEGEND

- ⊗ PROPOSED SHALLOW MONITORING WELL LOCATION
- ● PHASE III SEDIMENT SAMPLING LOCATION
- △ PHASE I SEDIMENT AND SURFACE WATER SAMPLING LOCATION
- △ PHASE II SEDIMENT SAMPLING LOCATION
- ▨ APPROXIMATE LANDFILL BOUNDARY

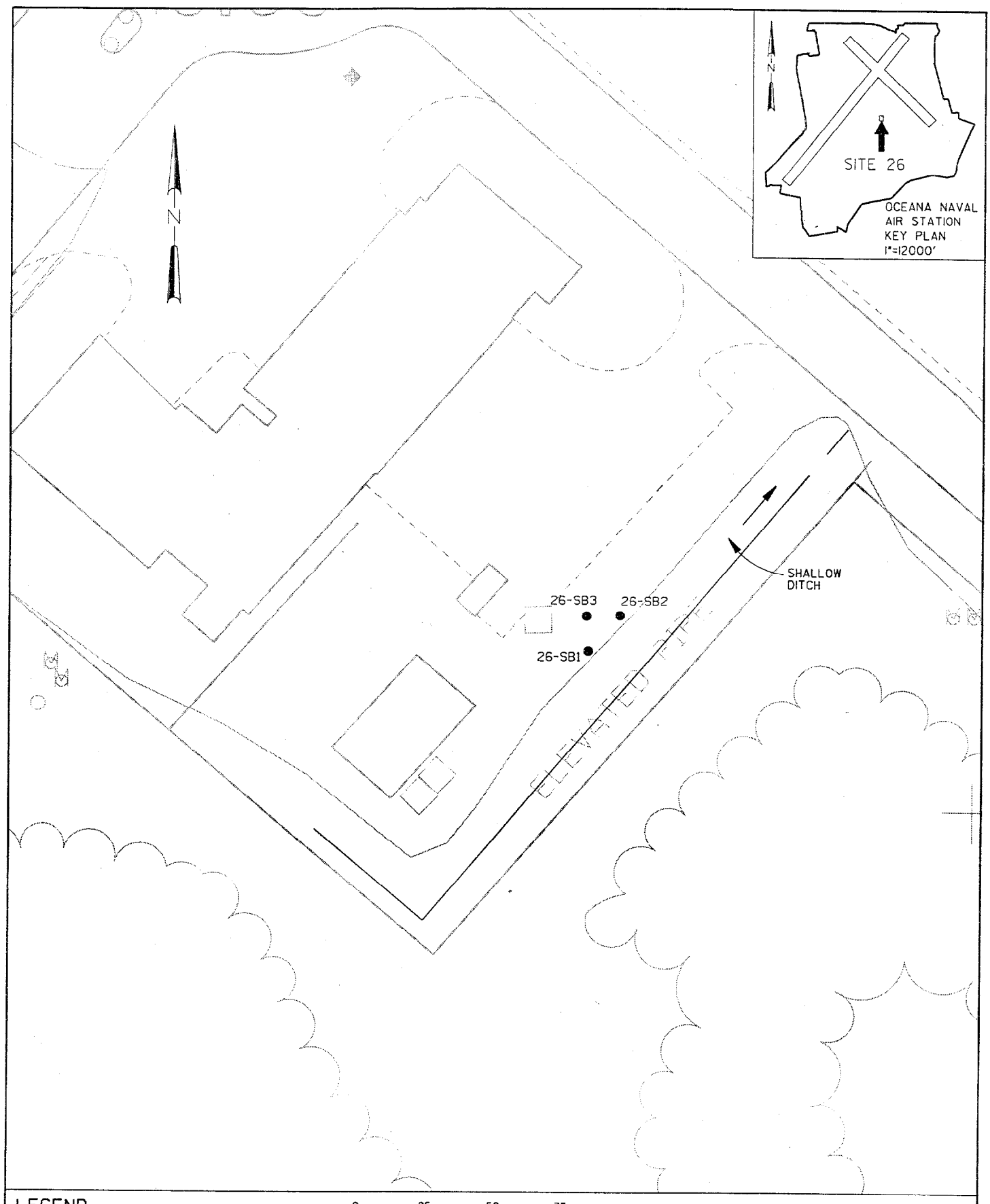
0 100 200 300
SCALE IN FEET

Figure 9
PHASE III RFI
SEDIMENT SAMPLING LOCATIONS
AT SWMU 25
Naval Air Station, Oceana

CH2MHILL

ONAS0368bgrd.dgn	I-63	
ONAS0368sit1dgn	1-49, 51-59	
ONAS0368grd.dgn	I-63	
ONAS0368Mgrd.dgn	I-63	
ONAS0368bdr.dgn	3-4, 60-63	
ONAS7718192.DGN	1-49, 51-59	
ONAS-P718192.DGN	I-63	
ONAS0368W125.DGN	I-63	

763s2417.dgn
18-DEC-1997



LEGEND

- ● SUBSURFACE SOIL SAMPLING LOCATION
- ← DIRECTION OF SURFACE WATER FLOW

0 25 50 75
SCALE IN FEET

Figure 10
PHASE III RFI
SUBSURFACE SOIL SAMPLING
LOCATIONS AT SITE 26
Naval Air Station, Oceana

763s2422.dgn
06-NOV-1997

Table 1
Analytical Sample Summary for Supplemental Sampling*
NAS Oceana, December 1997

Parameters	SWMU 1	SWMU 2b	SWMU 2c	SWMU 2d	SWMU 2e	SWMU 18	SWMU 21	SWMU 24	SWMU 25	SWMU 26	TOTAL
Soil Samples											
Volatiles						6		10			16
BTEX										3	3
Semi-Volatiles							3				3
PAHs						6		10		3	19
PCBs						6	1				7
Dioxins/Furans	6										6
Groundwater Samples											
Volatiles				5	1						6
Semi-Volatiles		2		5	1						8
PAHs		2									2
Appendix IX									1		1
Sediment Samples											
Semi-Volatiles		3	2								5
TOC		3	2						3		8
PAHs			2								2
Pesticides									3		3

* Does not include QA/QC samples

STANDARD OPERATING PROCEDURE

Installation of Shallow Monitoring Wells

I. Purpose and Scope

The purpose of this guideline is to describe methods for drilling and installation of shallow monitoring wells and piezometers in unconsolidated or poorly consolidated materials. Methods for drilling and installing bedrock monitoring wells are presented in SOP Installation of Bedrock Monitoring Wells.

II. Equipment and Materials

Drilling

- Drilling rig
- Hollow-stem augers

Well Riser/Screen

- Polyvinyl chloride (PVC), Schedule 40, minimum 2-inch ID, flush-threaded riser; alternatively, stainlesss steel riser
- PVC, Schedule 40, minimum 2-inch ID, flush-threaded, factory slotted screen; alternatively, stainless steel screen.

Bottom Cap

- PVC, threaded to match the well screen; alternatively, stainless steel
- Centering Guides (if used)

Well Cap

- Above-grade well completion: PVC, threaded or push-on type, vented
- Flush-mount well completion: PVC, locking, leak-proof seal
- Stainless steel to be used as appropriate

Sand

- Clean silica sand, provided in factory-sealed bags, well-rounded, containing no organic material, anhydrite, gypsum, mica, or calcareous material; primary (coarse) filter pack, and secondary (fine) filter pack. Grain size determined based on sediments observed during drilling.

Bentonite

- Pure, additive-free bentonite pellets
- Pure, additive-free powdered bentonite

- Coated bentonite pellets; coating must biodegrade within 7 days
- Cement-Bentonite Grout: proportion of 6 to 8 gallons of water per 94-pound bag of Portland cement; 3 to 6 pounds of bentonite added per bag of cement to reduce shrinkage

Protective Casing

- Above-grade well completion: 6-inch minimum ID steel pipe with locking cover, diameter at least 2 inches greater than the well casing, painted with epoxy paint for rust protection; heavy duty lock; protective posts if appropriate
- Flush-mount well completion: Morrison 9-inch or 12-inch 519 manhole cover, or equivalent; rubber seal to prevent leakage; locking cover inside of road box

Well Development

- Double surge block with solid bottom, top open, separated by 2 feet of slotted pipe
- Well-development pump, and associated equipment
- Containers (e.g., 55 gallon drums) for water produced from well.

III. Procedures and Guidelines

A. Drilling Method

Continuous-flight hollow-stem augers with a minimum 6-inch inside diameter (ID) will be used to drill shallow monitoring well boreholes. Split-spoon samples will be collected at selected intervals for chemical analysis and/or lithologic classification. Soil sampling procedures are detailed in SOP Shallow Soil Sampling.

The use of water to assist in hollow-stem auger drilling for monitoring well installation will be avoided, unless required for such conditions as running sands.

Hollow-stem augers, rods, split-spoon samplers, and other downhole drilling tools will be properly decontaminated prior to the initiation of drilling activities and between each borehole location. Split-spoon samplers and other downhole soil sampling equipment will also be properly decontaminated before and after each use. SOP Decon details proper decontamination procedures.

Drill cuttings and decontamination fluids generated during well drilling activities will be contained according to the procedures detailed in the Field Sampling Plan.

B. Monitoring Well Installation

Shallow monitoring wells will be constructed inside the hollow-stem augers, once the borehole has been advanced to the desired depth. If the borehole

has been drilled to a depth greater than that at which the well is to be set, the borehole will be backfilled with bentonite pellets or a bentonite-cement slurry to a depth approximately 1 foot below the intended well depth. Approximately 1 foot of clean sand will be placed on top of the bentonite to return the borehole to the proper depth for well installation.

The appropriate lengths of well screen, nominally 10 feet (with bottom cap), and casing will be joined watertight and lowered inside the augers to the bottom of the borehole. Centering guides, if used, will be placed at the bottom of the screen and above the interval in which the bentonite seal is placed.

Selection of the filter pack and well screen intervals for the shallow monitoring wells shall be made in the field. Based on lithologic samples previously obtained at the site, and comparison with samples to be obtained in the well borings, standard well screen slot of 0.010-inch and silica sand gradations conforming to Morie No. 1 are anticipated.

A primary sand pack (Morie No. 1) consisting of clean silica sand will be placed around the well screen. The sand will be placed into the borehole at a uniform rate, in a manner that will allow even placement of the sand pack. The augers will be raised gradually during sand pack installation to avoid caving of the borehole wall; at no time will the augers be raised higher than the top of the sand pack during installation. During placement of the sand, the position of the top of the sand will be continuously sounded. The primary sand pack will be extended from the bottom of the borehole to a minimum height of 2 feet above the top of the well screen. A secondary, finer-grained, sand pack will be installed for a minimum of 1 foot above the coarse sand pack. Heights of the coarse and fine sand packs and bentonite seal may be modified in the field to account for the shallow water table and small saturated thickness of the surficial aquifer.

A bentonite pellet seal at least 2 feet thick will be placed above the sand pack. The pellets will be placed into the borehole in a manner that will prevent bridging. The position of the top of the bentonite seal will be verified using a weighted tape measure. If all or a portion of the bentonite seal is above the water table, clean water will be added to hydrate the bentonite. A hydration period of at least 30 minutes will be required following installation of the bentonite seal.

Above the bentonite seal, an annular seal of cement-bentonite grout will be placed. The cement-bentonite grout will be installed continuously in one operation from the bottom of the space to be grouted to the ground surface through a tremie pipe. The tremie pipe must be plugged at the bottom and have small openings along the sides of the bottom 1-foot length of pipe. This will allow the grout to diffuse laterally into the borehole and not disturb the bentonite pellet seal.

For monitoring wells that will be completed above-grade, a locking steel protective casing set in a concrete pad will be installed. The steel protective casing will extend at least 3 feet into the ground and 2 feet above ground but

should not penetrate the bentonite seal. The concrete pad will be square or round, with a minimum radius of approximately 3.5 feet. The concrete will be sloped away from the protective casing.

Guard posts may be installed in high-traffic areas for additional protection. Four steel guard posts will be installed around the protective casing, within the edges of the concrete pad. Guard posts will be concrete-filled, at least 2 inches in diameter, and will extend at least 2 feet into the ground and 3 feet above the ground. The protective casing and guard posts will be painted with an epoxy paint to prevent rust.

For monitoring wells with flush-mount completions, Morrison 9-inch or 12-inch 519 manhole cover or equivalent, with a rubber-sealed cover and drain will be installed. The top of the manhole cover will be positioned approximately 1 inch above grade. A square concrete pad, approximately 3 feet per side, will be installed as a concrete collar surrounding the road box cover, and will slope uniformly downward to the adjacent grade. The road box and installation thereof will be of sufficient strength to withstand normal vehicular traffic.

Concrete pads installed at all wells will be a minimum of 6 inches below grade. The concrete pad will be 12-inches thick at the center and taper to 6-inch thick at the edge. The surface of the pad should slope away from the protective casing to prevent water from pooling around the casing. Protective casing, guard posts, and flush mounts will be installed into this concrete.

Each well will be properly labeled on the exterior of the locking cap or protective casing with a metal stamp indicating the permanent well number.

C. Well Development

Well development will be accomplished using a combination of surging throughout the well screen and pumping, until the physical and chemical parameters of the discharge water that are measured in the field have stabilized and the turbidity of the discharge water is substantially reduced. Fine-grained materials in the surficial aquifer at the site may not allow low turbidity results to be achieved.

The surging apparatus will include two surge blocks separated by approximately 2 feet of coarsely slotted pipe. The lower surge block will be solid; the upper surge block will be open and attached to riser pipe leading to the ground surface. Water will be pumped continuously from the surge block screened interval throughout the surging process. The pumping will be accomplished by airlift induction methods or using a centrifugal pump or equivalent.

Well development will begin by surging the well screen, starting at the bottom of the screen and proceeding upwards, throughout the screened zone.

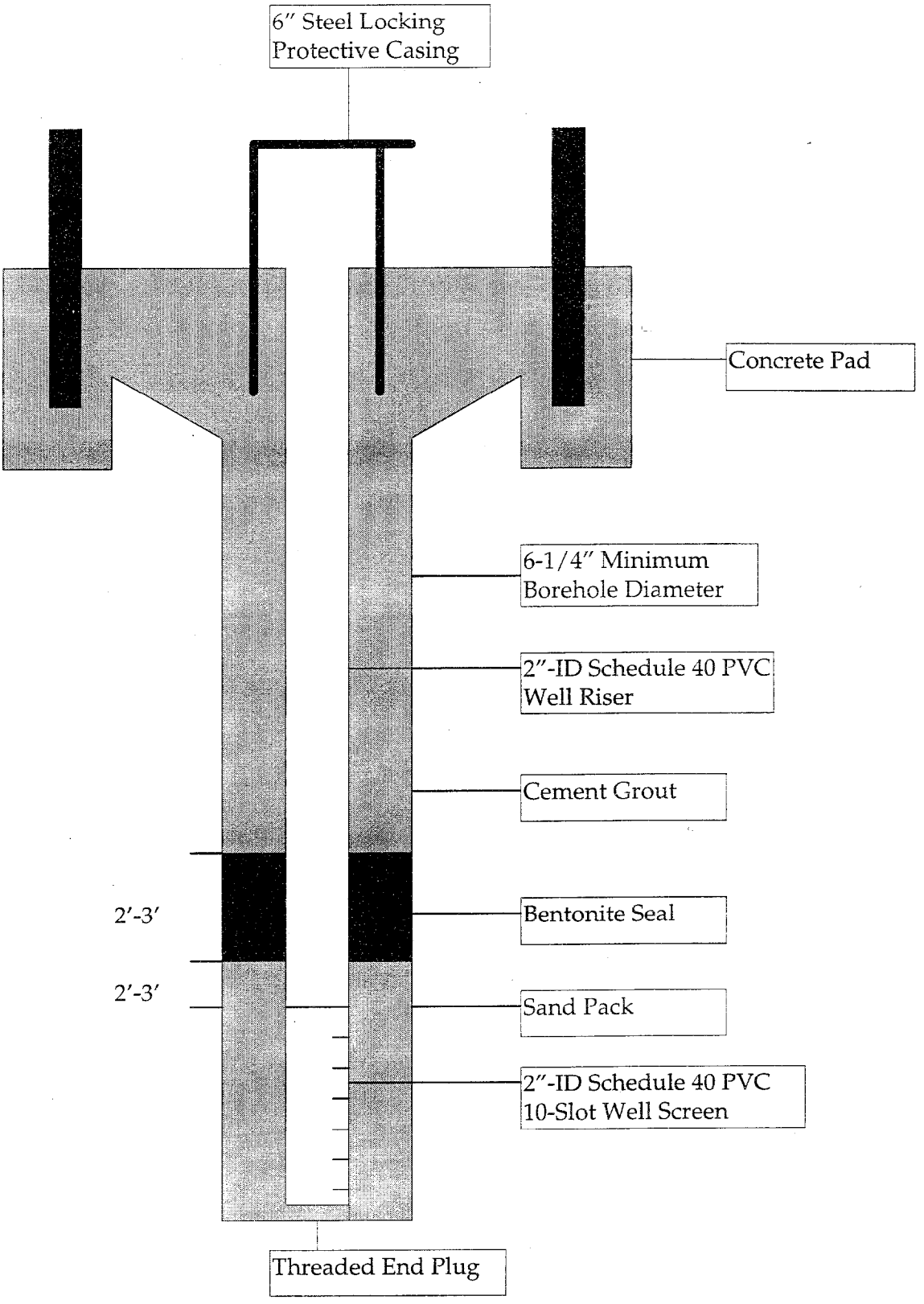
Following surging, the well will be pumped to remove the fine materials that have been drawn into the well. During pumping, measurements of pH, temperature, and specific conductance will be recorded.

Development will continue by alternately surging and pumping until the discharge water is free from sand and silt, the turbidity is substantially reduced, and the pH, temperature, and specific conductance have stabilized at regional background levels, based on historical data. Development will continue for a minimum of 30 minutes.

Well development equipment will be decontaminated prior to initial use and after the development of each well. Decontamination procedures are detailed in SOP Decontamination of Personnel and Equipment. Water generated during well development will be contained and managed as detailed in the Field Sampling Plan Investigation Denied Waste Management Plan.

IV. Attachments

Schematic diagram of shallow monitoring well construction



TYPICAL SHALLOW MONITORING WELL CONSTRUCTION

STANDARD OPERATING PROCEDURE

Groundwater Sampling from Monitoring Wells

I. Purpose and Scope

This procedure presents general guidelines for the collection of groundwater samples from monitoring wells. Low-flow purging and sampling procedures are specifically addressed. Operations manuals should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe
- pH/Eh meter: Orion Model SA250 or equivalent
- Temperature/conductivity meter: YSI Model 33 or equivalent
- Dissolved oxygen meter: YSI Model 57 or equivalent
- Water-level indicator
- In-line disposable 0.45µ filters: QED FF8100 or equivalent
- Bailer, teflon or stainless steel
- Adjustable-rate, positive-displacement pump
- Generator
- Disposable polyethylene tubing
- Plastic sheeting

III. Procedures and Guidelines

A. Setup and Purging

1. For the well to be sampled, information is obtained on well location, diameter(s), depth, and screened interval(s), and the method for disposal of purged water.

2. Instruments are calibrated according to manufacturer's instructions.

3. The well number, site, date, and condition are recorded in the field logbook.

4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed.

5. Water level measurements are collected in accordance with SOP Water Level Measurements. **Do not measure the depth to the bottom of the**

well at this time (in order to avoid disturbing any accumulated sediment). Obtain depth to bottom information from well installation log.

6. The volume in gallons of water in the well casing or sections of telescoping well casing is calculated as follows:

$0.052\ (\pi\ r^2h) = 0.163\ (r^2h) =$ gallons

where: $\pi = 3.14$

r = Radius of the well pipe in inches
h = height of water in well in feet

The volume of water in typical well casings may be calculated as follows:

2-inch diameter well:
0.163 gal/ft x ___ (linear feet of water) = gallons

4-inch diameter well:
0.653 gal/ft x ___ (linear feet of water) = gallons

6-inch diameter well:
1.469 gal/ft x ___ (linear feet of water) = gallons

The initial field parameters of pH, specific conductance, and temperature of water are measured and recorded in the field logbook. The measurement probes are inserted into the probe box. The purged groundwater is directed through the box, allowing measurements to be collected before the water contacts the atmosphere.

7. Sampling equipment is cleaned and decontaminated prior to sampling in accordance with SOP Decon (Decontamination of Personnel and Equipment).

8. Lay out polyethylene sheeting and place all equipment on the sheeting. To avoid cross-contamination, do not let any downhole equipment touch the ground surface.

9. Attach and secure the polyethylene tubing to the low-flow pump. Lower the pump slowly into the well and set it at approximately the middle of the screen. Place the pump intake at least two feet above the bottom of the well to avoid mobilization of any sediment present in the bottom. Start purging the well at 0.2 to 0.5 liters per minute. Avoid surging. Purging rates for more transmissive formations could be started at 0.5 to 1 liter per minute.

10. The water level should be monitored during purging, and ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well. (The water level should stabilize for the specific purge rate.) There should be at least one foot of water over the pump intake so there is no risk of the pump suction being broken, or

Addendum to the Sampling and Analysis Plan

This is an Addendum to the CH2M HILL, RCRA Facility Investigation, Sampling and Analysis Plan, dated June, 1992. This Addendum to the RFI Sampling and Analysis Plan (SAP) defines the sampling procedures that will be performed during the NAS Oceana RFI supplementary sampling. Detailed descriptions of the sample locations and numbers are located in the Addendum to the work plan. Detailed descriptions of QA/QC measures and analytical methods are documented in the Addendum to the Data Collection Quality Assurance Plan (DCQAP).

Sample Collection Procedures

Groundwater, soil, and sediment sampling procedures that will be followed during the RFI supplemental sampling are documented in CH2M HILL standard operating procedures (SOPs). The following SOPs are included as the Addendum to this FSP:

- Installation of Shallow Monitoring Wells
- Groundwater Sampling from Monitoring Wells
- VOC Sampling—Water
- Water Level Measurements
- Sediment Sampling
- Shallow Soil Sampling
- Direct Push Soil Sample Collection
- Volatiles Monitoring by OVM
- Decontamination of Personnel and Equipment
- Field Measurement of Conductivity and Temperature
- Field Measurement of Dissolved Oxygen
- Field Measurement of pH
- Field Rinse Blank Preparation
- Packaging and Shipping Procedures

entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (0.1 to 0.2 liters per minute) to avoid affecting well drawdown. The well should not be purged dry. If the recharge rate of the well is so low that the well is purged dry, then the contractor may wait until the well has recharged to a sufficient level and collect the appropriate volume of water for the sample with the pump.

11. During purging, the field parameters are measured frequently (every three to five minutes) until the parameters have stabilized. Field parameters are considered stabilized when pH measurements agree within 0.5 units, temperature measurements agree within 1°C, and specific conductance, Eh, and dissolved oxygen measurements agree within 10 percent.

B. Sample Collection

Once purging has been completed, the well is ready to be sampled. The elapsed time between completion of purging and collection of the groundwater sample from the well should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in bottles that are appropriate to the respective analysis and that have been cleaned to laboratory standards. Each bottle typically will have been previously prepared with the appropriate preservative, if any.

The following information, at a minimum, will be recorded in the log book:

1. Sample identification (site name, location, and project number; sample name/number and location; sample type and matrix; time and date; sampler's identity)
2. Sample source and source description
3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
4. Sample disposition (preservatives added; laboratory sent to, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)

Additional remarks

The steps to be followed for sample collection are as follows:

1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
2. The sample is slowly discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The

pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs. Samples may be field filtered before transfer to the sample bottle. Filtration must occur in the field immediately upon collection. Inorganics, including metals, are to be collected and preserved in the filtered form as well as the unfiltered form. The recommended method is through the use of a disposable in-line filtration module (0.45 micron filter) using the pressure provided by the pumping device for its operation.

3. Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to overflowing and capped.

4. The bottle is capped, then labeled clearly and carefully following the procedures in SOP Packaging and Shipping Procedures.

5. Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.

6. If the sampler is dedicated, it is returned to the well and the well is capped and locked. Nondedicated samplers are cleaned and decontaminated in accordance with SOP Decontamination of Personnel and Equipment. Disposable polyethylene tubing is disposed of with PPE and other site trash.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:

- Inspect sampling pump regularly and replace as warranted
- Inspect air/sample line quick-connects regularly and replace as warranted
- Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

STANDARD OPERATING PROCEDURE

VOC Sampling--Water

I. Purpose

To provide general guidelines for sampling aqueous volatile organic compounds.

II. Scope

Standard techniques for collecting representative samples are summarized. Site specific details are discussed in the FSP.

III. Equipment and Materials

- Sample vials, clean latex or surgical gloves, pH meter
- Hydrochloric acid (HCl) for preservation
- pH meter or pH indicating paper
- Surgical or latex gloves

IV. Procedures and Guidelines

1. Sample VOCs before sampling other analyte groups.

2. When sampling for VOCs, especially residential wells, evaluate the area around the sampling point for possible sources of air contamination by VOCs. Products that may give off VOCs and possibly contaminate a sample include perfumes and cosmetics, skin applied pharmaceuticals, automotive products (gasoline, starting fluid, windshield deicers, carburetor cleaners, etc.) and household paint products (paint strippers, thinners, turpentine, etc.).

3. To check the amount of hydrochloric acid (HCl) that needs to be added at each location, fill a test vial (40 ml) with the water to be sampled, add one drop of hydrochloric acid (HCl), gently mix, and check the pH. Repeat this cycle (if necessary) until you reach a pH of 2, counting the number of drops of HCl required. DISCARD THE TEST VIAL and add an equal number of drops of HCl to each of the sample vials. proceed to sample.

STANDARD OPERATING PROCEDURE

Water-Level Measurements

I. Purpose and Scope

The purpose of this procedure is to provide a guideline for the measurement of the depth to groundwater in monitoring wells, where a second phase of floating liquid (e.g., gasoline) is not encountered. This SOP includes guidelines for discrete measurements of static water levels and does not cover the use of continuously recording loggers.

II. Equipment and Materials

- Electronic water level meter, Solinst or equivalent, with a minimum 100-foot tape; the tape should have graduations in increments of 0.01 feet or less

III. Procedures and Guidelines

Verify that the unit is turned on and functioning properly. Slowly lower the probe on its cable into the well until the probe just contacts the water surface; the unit will respond with a tone or light signal. Sight across the top of the locking well casing adjacent to the measuring point, recording the position of the cable when the probe is at the water surface. The measuring point will be a standardized surveyed location on the top of each well casing, adjacent to the lock hasp, indicated by a notch, paint mark, or similar method. Measure the distance from this point to the closest interval marker on the tape, and record the water level reading in the log book.

Measure and record the three following additional readings: (1) the depth of the well; (2) the depth from the top of the casing to the top of the well riser; and (3) the distance to the surface of the concrete pad or to ground. Measurements are to be taken with respect to the measuring point on the top of the well casing. The depth of the well may be measured using the water-level probe with the instrument turned off.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

Prior to each use, verify that the battery is charged by pressing the test button on the water-level meter. Verify that the unit is operating correctly by testing the probe in distilled or deionized water. Leave the unit turned off when not in use.

STANDARD OPERATING PROCEDURE

Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples during field operations.

II. Scope

The sediment sampling procedures generally describe the equipment and techniques needed to collect representative sediment samples. Operators manual , if available, should be consulted for specific details

III. Equipment and Materials

- Sample collection device (hand corer, scoop, dredge, grab sampler, or other suitable device)
- Stainless steel spoon or spatula for media transfer
- Measuring tape
- Log book
- Personal protection equipment (rubber or latex gloves, boots, hip waders, etc.)
- Materials for classifying soils, particularly the percentage of fines
- Sample jars, including jars for Total Organic Carbon and pH, as appropriate

IV. Procedures and Guidelines

1. Field personnel will start downstream and work upstream to prevent contamination of unsampled areas.
2. Make a sketch of the sample area showing important nearby river features and permanent structures that can be used to locate the sample points on a map. Whenever possible, include measured distances from such identifying features. Also include depth and width of waterway, rate of flow, type and consistency of sediment, and point and depth of sample removal (along shore, mid-channel, etc).
3. Transfer sample into appropriate sample jars with a stainless steel utensil. Be especially careful to avoid the loss of the very fine clay/silt particles when collecting the sample. The fine particles have a higher adsorption capacity

than larger particles. Minimize the amount of water that is collected within the sample matrix. Decant the water off of the sample slowly and carefully to maximize retention of the very fine particles. The sampler's fingers should never touch the sediment since gloves may introduce organic interference into the sample. Classify the soil type of the sample using the Unified Soil Classification System, noting particularly the percentage of silt and clay.

4. Samples for volatile organics should immediately be placed in jars. Rocks and other debris should be removed before placement in jars.

5. For channel sampling, be on the alert for submerged hazards (rocks, tree roots, drop-offs, loss silt and muck) which can make wading difficult.

6. Sample sediment for TOC and pH also, to give context to organic and inorganic data during the risk assessment.

7. Follow the site safety plan designed for the specific nature of the site's sampling activities and locations.

8. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

V. Attachments

None.

VI. Key Checks and Items

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Beware of hidden hazards.

STANDARD OPERATING PROCEDURE

Shallow Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Vermiculite
- Fiberglass measuring tape (at least 200 feet in length)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

   a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

b. Proceed to sample the points on the grid line.

c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal measurements: one to the previous grid line, and one to the previous sample on the same grid line.

d. Proceed to sample the points on the grid line as described in Section C below.

e. Repeat 1c and 1d above until all samples are collected from the area.

2. For non-grid samples:

a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).

b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.

c. Proceed to sample as described in Section C below.

d. Repeat 2a through 2c above until all samples are collected from the area.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of rooves, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Supervisor (FTS). If the FTS concurs, the sampling point will be deleted from the program. The FTS will contact the CH2M HILL project manager (PM) immediately. The PM and Navy Technical Representative (NTR) will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the NTR in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel to scrape away surficial organic material (grass, leaves, etc.) adjacent to the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging down to a depth of about 6 inches, or the depth specified in the workplan.

b. Subsurface soil. Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take an OVM reading of the sampled soil and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/scoop and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP Decon.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with vermiculite. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

STANDARD OPERATING PROCEDURE

Direct Push (Geoprobe® Hydropunch®) Soil Sample Collection

I. Purpose

To provide a general guideline for the collection of soil samples using direct push sampling methods.

II. Scope

Standard Geoprobe soil sampling methods.

III. Equipment and Materials

- Truck-mounted hydraulic percussion hammer.
- Geoprobe sampling rods
- Geoprobe® sample liners; Teflon®, plastic (PTPE or CAB), or brass, depending upon the job requirements (one per soil sample)
- Pre-cleaned sample containers
- Clean latex or surgical gloves.

IV. Procedures and Guidelines

Soil cores may be collected continuously, or at discrete sampling intervals.

1. Decontaminate drive rods, sampler assembly, and other non-dedicated downhole equipment in accordance to SOP Decontamination of Personnel and Equipment. Install a fresh sample liner before each sample run.

2. With the piston tip in the closed position, drive sampler to the top of the target sample interval using the truck-mounted hydraulic percussion hammer.

3. Free the piston tip to retract during sample collection, and drive the sampler an additional 24 inches. Retrieve the sampler.

4. Using gloves remove the sample tube and lay on a prepared clean surface.

5. Cut the sample liner lengthwise to expose the sample. If a brass sample liner is used; remove plastic cladding, cut the liner apart into sections, and extrude the sample from each section.

6. Prepare soil sample logs and place samples in labeled glass jars.

7. Prepare sampler assembly for next run.

V. Key Checks and Items

1. Verify that the hydraulic percussion hammer is clean and in proper working order.

2. Ensure that the Geoprobe operator thoroughly completes the decontamination process between sampling locations.

3. Verify that the hole made during sampling activities has been properly backfilled.

STANDARD OPERATING PROCEDURE

Volatiles Monitoring by OVM

I. Purpose and Scope

The purpose of this procedure is to provide guidelines for the calibration and use of an OVM Organic Vapor Monitor. This is a broad guideline for field use of an OVM; for specific instruction, refer to the operators manual.

II. Equipment and Materials

- Operations manual
- An OVM hand readout unit and side pack assembly
- 100 ppm isobutylene as calibration gas
- T-type feeder tube with 1.5 liter/min. regulator

III. Procedures and Guidelines

ONLY PROPERLY TRAINED PERSONNEL SHOULD USE THIS INSTRUMENT. FOR SPECIFIC INSTRUCTIONS, SEE OPERATIONS MANUAL.

OVM, Organic Vapor Monitor

1. Introduction

   The OVM Organic Vapor Monitor is designed to detect organic materials in air. It uses a photo-ionization detector (PID) as its detection principle. This detector allows the monitor to respond to a wide variety of organic compounds.

2. Operational Checks

   - See basic operating instructions in operations manual.

3. Calibration

   - See basic operating instructions in operations manual.

IV. Key Checks and Preventive Maintenance

- Check battery.
- Zero and calibrate.
- Verify sensor probe is working.
- Recharge unit after use.

A complete preventive maintenance program is beyond the scope of this document. For specific instructions, refer to the operations manual. Some key issues are discussed below:

- A complete spare instrument should be available whenever field operations require volatiles monitoring.
- Spare parts should be on hand so minor repairs may be made in the field.
- Batteries should be charged daily.
- Occasionally allow the batteries to totally discharge before recharging to prevent battery memory from occurring.

STANDARD OPERATING PROCEDURE

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water)
- Distilled water
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) trisodium phosphate ("TSP") and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- 10% (V/V) nitric acid (HNO_3) and water solution (only ultrapure grade HNO_3 is to be used)
- Large plastic pails or tubs for TSP and water, scrub brushes, squirt bottles for TSP, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Phthalate-free gloves
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in TSP solution, then rinse with water. If disposable latex booties are worn over boots in the work area, rinse with TSP solution, remove, and discard into DOT approved 55-gallon drum.
2. Wash outer gloves in TSP solution, rinse, remove, and discard into DOT approved 55-gallon drum.
3. Remove disposable coveralls ("Tyveks") and discard into approved 55-gallon drum.
4. Remove respirator (if worn).
5. Remove inner gloves and discard.
6. At the end of the work day, shower entire body, including hair, either at the work site or at home.
7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Spread plastic on the ground to keep hoses from touching the ground
3. Turn off pump after sampling. Remove pump from well and place pump in decontamination tube, making sure that tubing does not touch the ground
4. Turn pump back on and pump 1 gallon of TSP solution through the sampling pump.
5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).
6. Rinse with 10% HNO_3 solution pumped through the pump, when sampling for inorganics (carbon steel split spoons will be rinsed with a 1% solution).
7. Rinse with 1 gallon of tap water.
8. Rinse with 1 gallon of deionized water.
9. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.

10. Collect all rinsate and dispose of in a DOT approved 55-gallon drum.

C. SAMPLING EQUIPMENT DECONTAMINATION—OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Prior to entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with TSP solution.
5. Rinse with potable water.
6. Rinse with 10% HNO_3 solution when sampling for inorganics (carbon steel split spoons will be rinsed with a 1% solution).
7. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
8. Air dry.
9. Rinse with deionized water.
10. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
11. Collect all rinsate and dispose of in a DOT approved 55-gallon drum.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with TSP solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT approved 55-gallon drum.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with TSP solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN

SEALED. Repeat the above steps using potable water.

2. Dispose of all used paper towels in a DOT approved 55-gallon drum.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Navy

2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of TSP, methanol, nitric acid, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

STANDARD OPERATING PROCEDURE

Field Measurement of Specific Conductance and Temperature

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for field measurement of specific conductivity and temperature of groundwater samples. The following general discussion applies to most commonly used meters but may differ between specific brands. The operator's manual should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Conductivity meter and electrode
- Distilled water in squirt bottle
- Standard potassium chloride (KCl) solution (0.01 N)

III. Procedures and Guidelines

A. Technical:

Detection limit = 1 µmho/cm @ 25°C; range = 0.1 to 100,000 µmho/cm

B. Calibration:

Calibrate prior to initial daily use with standard solution. The standards should have different orders of conductance. Clean probe according to manufacturer's recommendations. Duplicates should be run once every 10 samples. Calibration procedure:

1. With mode switch in OFF position, check meter zero. If not zeroed, set with zero adjust.

2. Plug probe into meter.

3. Turn mode switch to red line and turn red line knob until needle aligns with red line on dial. If they cannot be aligned, change the batteries.

4. Immerse probe in 0.01 N standard KCl solution. Do not allow the probe to touch the sample container.

5. Set the mode control to TEMPERATURE. Record the temperature on the bottom scale of the meter in degrees C.

6. Turn the mode switch to appropriate conductivity scale (i.e., x100, x10, or x1). Use a scale that will give a midrange output on the meter.

7. Wait for the needle to stabilize. Multiply reading by scale setting and record the conductivity.

8. If the conductivity meter does not perform an automatic temperature adjustment, the conductivity may be adjusted to 25°C using the formula:

$$G_{25} = G_T / [1 + 0.02 (T - 25)]$$

Where:

G_{25} = conductivity at 25°C, µmho/cm

T = temperature of sample, degrees C

G_T = conductivity of sample at temperature T, µmho/cm

The table below lists the values of conductivity that the calibration solution would have if the distilled water were totally nonconductive; however, even water of high purity will possess a small amount of conductivity.

Temperature °C	Conductivity (µmho/cm)
15	1,141.5
16	1,167.5
17	1,193.6
18	1,219.9
19	1,246.4
20	1,273.0
21	1,299.7
22	1,326.6
24	1,380.8
26	1,436.5
28	1,490.9
30	1,546.7

9. Rinse the probe with deionized water.

C. Sample Measurement:

Pour the sample into a small beaker and place the probe in the sample. Note and record the reading. Rinse the probe with deionized water when done.

IV. Attachments

- Conductivity meter calibration sheet

V. Key Checks and Preventive Maintenance

- Check battery.
- Calibrate meter.
- Clean probe with deionized water when done.
- When reading results, note sensitivity settings.
- Refer to operations manual for recommended maintenance.
- Check batteries, and have a replacement set on hand.

CONDUCTIVITY METER CALIBRATION SHEET

Date	Time	Analyst Initials	Instrument Readings: Uncalibrated @ EC=225	Instrument Readings: Calibrated @ EC=225	Comments

STANDARD OPERATING PROCEDURE

Field Measurement of Dissolved Oxygen

I. Purpose

To provide general guidelines for the calibration and use of the Dissolved Oxygen (DO) meter.

II. Scope

The following general discussion applies to more commonly used meters but may differ between specific brands. The operator's manual should be consulted for specific calibration and operation procedures.

III. Equipment and Materials

- Operations manual
- A DO probe and readout/control unit with batteries
- Electrolyte solution (KCl dissolved in deionized water) and probe membrane

IV. Procedures and Guidelines

A. Calibration

Calibrate prior to initial daily use before any readings are taken. Clean probe according to manufacturer's recommendations.

1. Prepare DO probe according to manufacturer's recommended procedures using electrolyte solution.
2. In the off position, set the pointer to zero using the screw in the center of the meter panel.
3. Turn function switch to red line and adjust using red line knob until the meter needle aligns with red mark at the 31 degrees C position.
4. Turn function switch to zero and adjust to zero using the zero control knob.
5. Attach prepared probe and adjust retaining ring finger tight.
6. Allow 15 minutes for optimum probe stabilization (when meter is off or during disconnection of the probe).
7. For YSI meters, place probe in hollow stopper that is supplied for use with the YSI Calibration Chamber.

8. Place approximately 1/2 inch of deionized water into a 4-ounce, wide mouth screw cap bottle. Keep this bottle capped and with the DO meter.

9. Just before use, shake the bottle to saturate the water with air.

10. Remove cap, place probe in bottle keeping an air-tight seal around the rubber stopper. Swirl water around in the bottle while waiting for conditions to reach equilibrium.

11. Shield chamber from sun and wind to avoid temperature fluctuations during calibration.

12. Turn function switch to temperature and record temperature reading. Determine calibration factor for that temperature and altitude correction factor from tables supplied by manufacturer.

13. Multiply the calibration factor by the correction factor to get a corrected calibration value.

14. Turn function switch to appropriate ppm range and adjust the calibrate knob until the meter reads the corrected calibration value. Wait two minutes to verify calibration value. Re-adjust as necessary.

B. Procedure

1. Before going out into the field:

   a) Check batteries
   b) Obtain fresh electrolyte solution
   c) Prepare DO probe

2. Calibrate meter using calibration procedure.

3. Place probe in water to be measured. The probe should be moved through the water at 1 ft/sec or use a probe with a built-in stirrer.

4. Allow sufficient time for probe to stabilize to water temperature and DO. Record DO meter reading.

V. Attachments

DO Meter Calibration Sheet.

VI. Key Checks and Items

- Battery check
- Calibration

VII. Preventive Maintenance

- Refer to operation manual for recommended maintenance.
- Check batteries, have replacement set on hand.

DO METER
CALIBRATION SHEET

Date	Time	Analyst's Signature	Temp (C)	Alt. (ft)	Predict (ppm 0_2)	Actual (ppm 0_2)	Comment

STANDARD OPERATING PROCEDURE

Field Measurement of pH

I. Purpose

To provide a general guideline for field measurement of pH of groundwater samples.

II. Scope

The following general discussion applies to most commonly used pH meters but may differ between specific brands. The operator's manual should be consulted for specific calibration and operating procedures.

III. Equipment and Materials

- pH buffer solution for pH 4, 7, and 10
- Deionized water in squirt bottle
- pH meter
- Combination electrodes
- Beakers
- Glassware that has been washed with soap and water, rinsed twice with hot water, and rinsed twice with deionized water

IV. Procedures and Guidelines

A. Calibration

Calibrate unit prior to initial daily use and at least once every 4 hours or every five samples, whichever is less. Calibrate with at least two solutions. Clean probe according to manufacturer's recommendations. Duplicate samples should be run once every 10 samples or every 4 hours which ever is more frequent.

1. Place electrode in pH 7 buffer solution.
2. Allow meter to stabilize and then turn calibration dial until a reading of 7.0 is obtained.
3. Rinse electrode with deionized water and place it in a pH 4 or pH 10

buffer solution.

4. Allow meter to stabilize again and then turn slope adjustment dial until a reading of 4.0 is obtained for the pH 4 buffer solution or 10.0 for the pH 10 buffer solution.

5. Rinse electrode with deionized water and place in pH 7 buffer. If meter reading is not 7.0, repeat sequence.

B. Procedure

1. Before going out into the field:

   a) Check batteries.
   b) Do a quick calibration at pH 7 and 4 to check electrode.
   c) Obtain fresh solutions.

2. Calibrate meter using calibration procedure in the operators manual.

3. Pour the sample into a clean beaker.

4. Rinse electrode with deionized water between samples.

5. Immerse electrode in solution. Make sure the white KCl junction on the side of the electrode is in the solution. The level of electrode solution should be one inch above sample to be measured.

6. Recheck calibration with pH 7 buffer solution after every five samples.

C. General

1. When calibrating the meter, use pH buffers 4 and 7 for samples with pH < 8, and buffers 7 and 10 for samples with pH > 8. If meter will not read pH 4 or 10, something may be wrong with the electrode.

2. Measurement of pH is temperature dependent. Therefore, buffers temperatures should be within about 2 degrees C of sample temperatures. For refrigerated or cool samples, use refrigerated buffers to calibrate the pH meter.

3. Weak organic and inorganic salts and oil and grease interfere with pH measurements. If oil and grease are visible, note it on the data sheet. Clean electrode with soap and water and rinse with distilled water. Then recalibrate meter.

4. Following field measurements:

   a) Report any problems.
   b) Compare with previous data.
   c) Clean all dirt off meter and inside case.
   d) Store electrode in pH 4 buffer.

5. Accuracy and precision are dependent on the instrument used; refer

to manufacturer's manual. Expected accuracy and precision are +/- 0.1 pH unit.

V. Key Checks and Items

- Check batteries
- Calibrate

VI. Preventive Maintenance

- Refer to operation manual for recommended maintenance.
- Check batteries, have a replacement set on hand.

STANDARD OPERATING PROCEDURE

Field Rinse Blank Preparation

I. Purpose

To prepare a blank to determine adequacy of decon procedures and whether any cross-contamination is occurring during sampling.

II. Scope

The general protocols for preparing the rinse blank are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II grade water)
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

A. Decontaminate all sampling equipment that has come in contact with sample according to SOP Decontamination of Personnel and Equipment.

B. To collect the sample for volatiles analysis, pour blank water over one piece of equipment and into 40-ml vials until there is a positive meniscus and seal vials. Note the sample number and associated piece of equipment in the field notebook.

For non-volatiles, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

C. Document and ship samples in accordance with the procedures for other samples.

D. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II grade water.

STANDARD OPERATING PROCEDURE

Packaging and Shipping Procedures

I. Low-Concentration Samples

A. Prepare coolers for shipment:

- Tape drains shut.
- Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
- Place mailing label with laboratory address on top of coolers.
- Fill bottom of coolers with about 3 inches of vermiculite.

B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.

C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.

D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.

E. Arrange sample bottles in coolers so that they do not touch.

F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.

G. Fill remaining spaces with vermiculite.

H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.

I. Separate copies of forms. Seal proper copies (traffic reports, packing lists) along with a return address label within a large zip-lock bag and tape to inside lid of cooler.

J Close lid and latch.

K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.

L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. **Do not** cover custody seals.

M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

II. Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with several additional restrictions. First, a special airbill including a Shipper's Certification for Restricted Articles is required. Second, "Flammable Liquid N.O.S." or "Flammable Solid N.O.S." (as appropriate) labels must be placed on at least two sides of the cooler. Third, sample containers are packaged in metal cans with lids before being placed in the cooler, as indicated below:

- Place approximately ½ inch of vermiculite in the bottom of the can.
- Position the sample jar in the zip-loc bag so that the sample tags can be read through the plastic bag.
- Place the jar in the can and fill the remaining volume with vermiculite.
- Close the can and secure the lid with metal clips.
- Write the traffic report number on the lid.
- Place "This Side Up" and "Flammable Liquid N.O.S." or "Flammable Solid N.O.S." (as appropriate) labels on the can.
- Place the cans in the cooler.
- For medium concentration samples, ship samples with ice or "blue ice" inside the coolers. (Double bag ice in zip-lock plastic bags.)

III. Special Instructions for Shipping Medium and High Concentration Samples by Federal Express

A. Label cooler as hazardous shipment:

- Write shipper's address on outside of cooler. If address is stenciled on, just write "shipper" above it.
- Write or affix sticker saying "This Side Up" on two adjacent sides.
- Write or affix sticker saying "ORM-E" with box around it on two adjacent sides. Below ORM-E, write NA#9188.
- Label cooler with "Hazardous Substance, N.O.S." and "liquid" or "solid," as applicable.

B. Complete the special shipping bill for restricted articles.

- Under Proper Shipping Name, write "Hazardous Substance, N.O.S." and "liquid" or "solid," as applicable.
- Under Class, write "ORM-E.
- "Under Identification No., write NA No. 9188.

C. For high concentration samples, ship samples with "blue ice" only inside coolers.

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	total Xylenes		5	5
PPS9	ORGANOCHLORINE PESTICIDES	SW8080		
	Aldrin		0.01	0.4
	Arochlor-1016		0.8	32
	Arochlor-1221		2	80
	Arochlor-1232		2	80
	Arochlor-1242		0.8	32
	Arochlor-1248		0.4	16
	Arochlor-1254		0.2	8
	Arochlor-1260		0.2	8
	alpha-BHC		0.01	0.4
	beta-BHC		0.02	0.8
	delta-BHC		0.01	0.4
	gamma-BHC (Lindane)		0.01	0.4
	Chlorobenzilate		0.5	20
	Chlordane		0.1	4
	4,4'-DDD		0.02	0.8
	4,4'-DDE		0.02	0.8
	Diallate		1	40
	Dieldrin		0.02	0.8
	4,4'-DDT		0.02	0.8
	Endosulfan I		0.02	0.8
	Endosulfan II		0.02	0.8
	Endosulfan sulfate		0.02	0.8
	Endrin		0.02	0.8

PCBs

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	trans-1,3-Dichloropropene		5	5
	1,4-Dioxane		200	200
	Ethylbenzene		5	5
	Ethyl methacrylate		5	5
	2-Hexanone		10	10
	Iodomethane		10	10
	Isobutyl alcohol		200	200
	Methacrylonitrile		5	5
	Methylene chloride		5	5
	Methyl methacrylate		10	10
	4-Methyl-2-pentanone		10	10
	Pentachloroethane		10	10
	Propionitrile		100	100
	Styrene		5	5
	1,1,1,2-Tetrachloroethane		5	5
	1,1,2,2-Tetrachloroethane		5	5
	Tetrachloroethene		5	5
	Toluene		5	5
	1,1,1-Trichloroethane		5	5
	1,1,2-Trichloroethane		5	5
	Trichloroethene		5	5
	Trichlorofluoromethane		5	5
	1,2,3-Trichloropropane		5	5
	Vinyl acetate		10	10
	Vinyl chloride		10	10

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	Bromodichloromethane		5	5
	Bromoform		5	5
	Bromomethane		10	10
	2-Butanone		10	10
	Carbon disulfide		5	5
	Carbon tetrachloride		5	5
	Chlorobenzene		5	5
	Chloroethane		10	10
	Chloroform		5	5
	Chloromethane		10	10
	Chloroprene		200	200
	Dibromochloromethane		5	5
	1,2-Dibromo-3-chloropropane		10	10
	1,2-Dibromoethane		5	5
	Dibromomethane		5	5
	1,2-Dichlorobenzene		5	5
	1,3-Dichlorobenzene		5	5
	1,4-Dichlorobenzene		5	5
	trans-1,4-Dichloro-2-butene		5	5
	Dichlorodifluoromethane		10	10
	1,1-Dichloroethane		5	5
	1,2-Dichloroethane		5	5
	1,1-Dichloroethene		5	5
	total-1,2-Dichloroethene		5	5
	1,2-Dichloropropane		5	5
	cis-1,3-Dichloropropene		5	5

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
ICP9	METALS/ICP	6010		
	Antimony		60	12000
	Barium		200	40000
	Beryllium		5	1000
	Cadmium		5	1000
	Chromium		10	2000
	Cobalt		50	10000
	Copper		25	5000
	Nickel		40	8000
	Silver		10	2000
	Tin		500	100000
	Vanadium		50	10000
	Zinc		20	4000
FUR9	METALS/FURNACE			
	Arsenic	SW7060	10	2000
	Lead	SW7421	3	600
	Selenium	SW7740	5	1000
	Thallium	SW7841	10	2000
HGAF	MERCURY/COLD VAPOR	SW7470	0.2	100
CNDI	CYANIDE	EPA335.2	5	500
SW1	SULFIDE	EPA376.1	100	10000
MVS9	VOLATILES	SW8240		
	Acetone		10	10
	Acetonitrile		100	100
	Acrolein		100	100
	Acrylonitrile		100	100
	Benzene		5	5

Table 8-2
Chemical Parameters and Detection Limits
Naval Air Station, Oceana

Compound	Reporting Limits		Compound	Reporting Limits	
	Aqueous µg/L	Soil mg/kg		Aqueous µg/L	Soil mg/kg
Benzo (a) anthracene	0.1	0.0033	Fluorene	1	0.0033
Benzo (a) pyrene	0.1	0.0033	Indeno (1,2,3-cd) pyrene	0.1	0.0067
Benzo (b) fluoranthene	0.1	0.0033	Naphthalene	1	0.0033
Benzo (ghi) perylene	0.1	0.0033	Phenanthrene	1	0.0067
Benzo (k) fluoranthene	0.05	0.0033	Pyrene	0.1	0.0033
Dioxins/Furans (SW-8290)					
2,3,7,8-Tetrachlorodibenzo(p)dioxin	0.00001	0.000001	2,3,7,8-Tetrachlorodibenzofuran	0.00001	0.000001
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	0.00001	0.000001	1,2,3,7,8-Pentachlorodibenzofuran	0.00001	0.000001
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	0.000025	0.0000025	2,3,4,7,8-Pentachlorodibenzofuran	0.00001	0.000001
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	0.000025	0.0000025	1,2,3,4,7,8-Hexachlorodibenzofuran	0.000025	0.0000025
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	0.000025	0.0000025	1,2,3,6,7,8-Hexachlorodibenzofuran	0.000025	0.0000025
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	0.000025	0.0000025	2,3,4,6,7,8-Hexachlorodibenzofuran	0.000025	0.0000025
Octachlorodibenzo(p)dioxin	0.00005	0.000005	1,2,3,7,8,9-Hexachlorodibenzofuran	0.000025	0.0000025
			1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.000025	0.0000025
			1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.000025	0.0000025
			Octachlorodibenzofuran	0.00005	0.000005
Other Parameters					
TPH (418.1)	0.05	1.6			
Ammonia-N (350.2)	0.2	5.0			
Nitrate/Nitrite-N (353.2mod)	0.05	0.5			
Phosphorous-P, total (365.1mod)	0.02	0.2			
Total Kjeldahl Nitrogen (351.3)	0.1	5.0			

Table 8-2
Chemical Parameters and Detection Limits
Naval Air Station, Oceana

Compound	Reporting Limits		Compound		Reporting Limits	
	Aqueous µg/L	Soil mg/kg			Aqueous µg/L	Soil mg/kg
Dibenzofuran	10	0.33	coelute	Methylmethane sulfonate	10	0.33
Dibutyl phthalate	10	0.33		n-Nitrosodimethylamine	10	0.33
1,2-Dichlorobenzene	10	0.33		n-Nitrosopiperidine	10	0.33
1,3-Dichlorobenzene	10	0.33		n-Nitroso-di-n-butylamine	10	0.33
1,4-Dichlorobenzene	10	0.33		Pentachlorobenzene	50	1.7
3,3'-Dichlorobenzidine	10	0.33		Pentachloronitrobenzene	50	1.7
Diethyl phthalate	10	0.33		Phenacetin	10	0.33
Dimethyl phthalate	10	0.33		Pronamide	10	0.33
2,4-Dinitrotoluene	10	0.33		p-Dimethylamino(azo)benzene	10	0.33
Chlorinated Pesticides and PCBs (SW-8080)						
Alpha-BHC	0.020	0.00067		Endosulfan sulfate	0.040	0.0013
Beta-BHC	0.040	0.0013		4,4-DDT	0.040	0.0013
Delta-BHC	0.020	0.00067		Methoxychlor	0.080	0.0027
Gamma-BHC (lindane)	0.020	0.00067		Endrin ketone	0.040	0.0013
Heptachlor	0.020	0.00067		Chlordane	0.20	0.0067
Aldrin	0.020	0.00067		Toxaphene	1.0	0.033
Heptachlor epoxide	0.020	0.00067		PCB-1016	1.0	0.033
Endosulfan I	0.020	0.00067		PCB-1221	2.0	0.067
Dieldrin	0.020	0.00067		PCB-1232	2.0	0.067
4,4'-DDE	0.020	0.00067		PCB-1242	1.0	0.033
Endrin	0.040	0.0013		PCB-1248	1.0	0.033
Endosulfan II	0.040	0.0013		PCB-1254	0.50	0.017
4,4'-DDD	0.040	0.0013		PCB-1260	0.50	0.017
Polynuclear Aromatic Hydrocarbons (SW-8310)						
Acenaphthene	1	0.067		Chrysene	0.1	0.0033
Acenaphthylene	1	0.067		Dibenzo (a,h) anthracene	0.1	0.0067
Anthracene	1	0.0033		Fluoranthene	0.1	0.0033

Table 8-2
Chemical Parameters and Detection Limits
Naval Air Station, Oceana

Compound	Reporting Limits		Compound		Reporting Limits	
	Aqueous µg/L	Soil mg/kg			Aqueous µg/L	Soil mg/kg
2,4-Dichlorophenol	10	0.33		Hexachlorobenzene	10	0.33
2,4-Dimethylphenol	10	0.33		Hexachlorobutadiene	10	0.33
2-Methyl-4,6-dinitrophenol	50	1.7		Hexachlorocyclopentadiene	10	0.33
2,4-Dinitrophenol	50	1.7		Hexachloroethane	10	0.33
2-Methyl phenol	10	0.33		Indeno(1,2,3-cd)pyrene	10	0.33
4-Methyl phenol	10	0.33		Isophorone	10	0.33
2-Nitrophenol	10	0.33		4-Nitroaniline	50	1,7
4-Nitrophenol	50	1.7		Nitrobenzene	10	0.33
Pentachlorophenol	50	1.7		N-Nitrosodi-n-propylamine	10	0.33
Phenol	10	0.33	coelute	N-Nitrosodiphenylamine	10	0.33
2,4,5-Trichlorophenol	50	1.7		Phenanthrene	10	0.33
Acenaphthene	10	0.33		Pyrene	10	0.33
Acenaphthylene	10	0.33		1,2,4-Trichlorobenzene	10	0.33
Anthracene	10	0.33		2,4,6-Trichlorophenol	10	0.33
Benzo(a)anthracene	10	0.33		1,2,4,5-Tetrachlorobenzene	50	1.7
Benzo(a)pyrene	10	0.33		1,2-Diphenylhydrazine	10	0.33
Benzo(b)fluoranthene	10	0.33		1-Chloronaphthalene	10	0.33
Benzo(k)fluoranthene	10	0.33		1-Naphthylamine	50	1.7
Benzo(g,h,i)perylene	10	0.33		2,3,4,6-Tetrachlorophenol	10	0.33
Benzyl alcohol	10	0.33		2,6-Dichlorophenol	10	0.33
bis(2-Chloroethyl) ether	10	0.33		2-Naphthylamine	50	0.33
bis(2-Chloroethoxy) methane	10	0.33		2-Picoline	50	1.7
bis(2-ethylhexyl)phthalate	10	0.33		3-Methyl cholanthrene	10	0.33
4-Bromophenyl phenyl ether	10	0.33		4-Aminobiphenyl	50	1.7
Butyl benzyl phthalate	10	0.33		7,12-Dimethyl(a)anthracene	10	0.33
4-Chloroaniline	10	0.33		Acetophenone	10	0.33
2-Chloronaphthalene	10	0.33		Aniline	10	0.33
4-Chlorophenyl phenyl ether	10	0.33		Benzidine	50	1.7
Chrysene	10	0.33		Diphenylamine	10	0.33
Dibenzo(a,h)anthracene	10	0.33		Ethylmethane sulfonate	10	0.33

Table 8-2
Chemical Parameters and Detection Limits
Naval Air Station, Oceana

Compound	Reporting Limits		Compound	Reporting Limits	
	Aqueous µg/L	Soil mg/kg		Aqueous µg/L	Soil mg/kg
Volatile Organic Compounds and BTEX (SW-8260)					
Acetone	10	0.01	cis-1,3-Dichloropropene	5	0.005
Acrolein	100	0.1	trans-1,3-Dichloropropene	5	0.005
Acrylonitrile	100	0.1	trans-1,4-Dichloro-2-butene	5	0.005
Benzene	5	0.005	Ethyl methacrylate	5	0.005
Bromodichloromethane	5	0.005	Ethylbenzene	5	0.005
Bromoform	5	0.005	2-Hexanone	10	0.01
Bromomethane	10	0.01	Idomethane	10	0.01
Carbon disulfide	5	0.005	Methyl ethyl ketone (2-Butanone)	10	0.01
Carbon tetrachloride	5	0.005	4-Methyl-2-pentanone	10	0.01
Chlorobenzene	5	0.005	Methylene chloride	5	0.005
Chloroethane	10	0.01	Styrene	5	0.005
2-Chloroethyl vinyl ether	10	0.01	1,1,2,2-Tetrachloroethane	5	0.005
Chloroform	5	0.005	Tetrachloroethene	5	0.005
Chloromethane	5	0.005	1,1,1-Trichloroethane	5	0.005
Dibromochloromethane	5	0.005	1,1,2-Trichloroethane	5	0.005
Dibromomethane	5	0.005	Trichloroethene	5	0.005
Dichlorodifluoromethane	10	0.01	Trichlorofluoromethane	5	0.005
1,1-Dichloroethane	5	0.005	1,2,3-Trichloropropane	5	0.005
1,2-Dichloroethane	5	0.005	Toluene	5	0.005
1,1-Dichloroethene	5	0.005	Vinyl acetate	10	0.01
1,2-Dichloroethene	5	0.005	Vinyl chloride	2	0.002
1,2-Dichloropropane	5	0.005	Xylene (total)	5	0.005
Semi-Volatile Organic Compounds (SW-8270)					
Benzoic Acid	50	1.7	Di-n-octyl phthalate	10	0.33
4-Chloro-3 methyl phenol	10	0.33	Fluoranthene	10	0.33
2-Chlorophenol	10	0.33	Fluorene	10	0.33

Additional approaches may include:

- Resampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting the data and acknowledging the level of uncertainty or inaccuracy by flagging the data and providing an explanation for the qualification.

SECTION 15

Quality Assurance Reports

A QA report will be completed at the end of the field activity to summarize the QA/QC status of the project and any problems. The report will be an assessment of the measured QA parameters (for example, precision and accuracy), results of performance audits, any reported non-conformance, and any significant QA problems and the recommended solutions. Any change in the QAPP will be summarized in a report or letter and sent to LANTDIV and distributed to the CH2M HILL project team.

SECTION 12

Preventive Maintenance

Routine maintenance procedures and schedules for sampling equipment are described in the manufacturer's instruction manuals. All records of inspection and maintenance will be dated and documented in the field notebook.

Maintenance procedures and schedules for all field and laboratory analytical instruments will follow the recommendations of the equipment manufacturers. Routine laboratory equipment maintenance will be performed by laboratory personnel as needed or as indicated in the LQAP. All records of inspection and maintenance will be dated and documented in laboratory record books.

SECTION 13

Data Assessment Procedures

The precision and accuracy of data will be routinely assessed to ensure that they meet the requirements of the DQOs.

All data will be validated by a subcontractor before interpretation. The validation will be performed according to *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, February 1994, the *USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses*, January 1993, the Region III Modifications to the Functional Guidelines, and the SW-846 Methods.

Data validation will be performed by an independent contractor, as it would not be appropriate for CH2M HILL to validate data collected by CH2M HILL staff. Data that should be qualified will be flagged with the appropriate symbol. Results for field and equipment blanks will be reviewed, and the data will be qualified further, if necessary. Finally, the data set as a whole will be examined for consistency, anomalous results, and reasonableness.

SECTION 14

Corrective Actions

The project manager is responsible for initiating corrective actions. Corrective action steps will include problem identification, investigation responsibility assignment, action to eliminate the problem, increased monitoring of the effectiveness of the corrective action, and verification that the problem has been eliminated.

Examples of corrective actions include, but are not limited to, correcting COC forms, analysis reruns (if holding time criteria permit), recalibration with fresh standards, replacement of sources of blank contamination, examination of calculation procedures, additional training in sample preparation and analysis, reassignment of analytical responsibilities using a different batch of containers, or recommending an audit of laboratory procedures.

SECTION 9

Data Reduction, Validation, and Record Keeping

Data reduction, validation, and record keeping are documented in the June 1992 QAPP and in the amendment to the Data Management Plan.

Data validation services will be procured using a BOA subcontractor. The highest level of data validation will be required; raw data including spectra and chromatograms will be provided by the laboratory for full validation.

SECTION 10

Quality Control Checks

A number of QA/QC samples will be collected to check the adequacy of sample collection and analysis and to monitor laboratory performance. Duplicates, blanks, and spiked samples are used to determine if the sampling technique affects the analytical results, to measure the internal consistency of the samples, and to estimate any variance or bias in the analytical process. The field and laboratory QA/QC sampling procedures are described below.

Field Sampling Quality Control Procedures

Quality control (QC) duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and an estimate of variance and bias. The QC samples will be collected at the same frequency as described in the June 1992 QAPP. Table 10-1 shows the samples to be collected in each media with their associated QC samples.

A temperature blank will also be sent to the lab, one per cooler, to allow the lab to determine the temperature of the samples upon receipt without disturbing field samples. It consists of reagent water in a single VOA vial.

Laboratory Analytical Quality Control Procedures

The analytical laboratory will use the quality control elements including matrix spikes, matrix spike duplicates, and laboratory blanks as specified in the *Navy Installation Restoration Laboratory Quality Assurance Guide, Interim Guidance Document*, February, 1996.

SECTION 11

Performance and Systems Audits

Performance and systems audit procedures are documented in the June 1992 QAPP.

Equipment that fails calibration or becomes inoperable during use shall be removed from service and tagged so that it is not inadvertently used. Such equipment shall be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced.

Results of activities performed using equipment that has failed recalibration shall be evaluated. If the results are adversely affected, the outcome of the evaluation will be documented and the task manager will be notified.

Table 7-1
Calibration Standards

Instrument	Calibration Standard	Span	Reading	Method
OVM	100 ppm isobutylene	RF = 0.55	100 ppm	1.5 l/m regulator T-tubing

SECTION 8

Analytical Procedures

All laboratory analyses will be performed by a Navy-approved laboratory. The laboratories will be procured using the Basic Ordering Agreements (BOAs). Laboratory methods to be used for the project are listed in Table 8-1. Methods will be the same as those used in the Phase II work. The highest level of documentation will be required.

Table 8-1
Analytical Procedures

Analysis	Methodology
Volatile Organic Compounds and BTEX (VOCs)	SW-846 8260
Semivolatile Organic Compounds (SVOCs)	SW-846 8270
Polynuclear Aromatic Hydrocarbons (PAHs)	SW-846 8310
Pesticides	SW-846 8080
Polychlorinated Biphenyls (PCBs)	SW-846 8080
Dioxins and furans	SW-846 8290
Full Appendix IX Constituents	multiple
TOC	EPA Method 415.1

Table 8-2 lists the specific chemicals to be analyzed by each method and the detection limits expected for the analyses.

SECTION 4

Quality Assurance Objectives

Data Quality Objectives (DQOs) will be established for each major sample collection effort as specified in the *Data Quality Objectives for Remedial Response Activities*, March 1987. DQOs are the quantitative and qualitative descriptions of the quality of data required to support an environmental decision or action.

The DQOs for Phase III activities are to confirm and support Phase I and Phase II information. So that new data collected can be compared with previously-collected data, analysis methods, detection limits, and quality control procedures will be matched to the earlier efforts.

The documents and amendments of the Work Plan (QAPP, FSP, DMP, and HSP) contain the plans and procedures for safe, competent sampling and for effective management of the data. Each laboratory providing analytical data for the additional characterization has developed its own Laboratory Quality Assurance Plan (LQAP). The LQAP must address the elements of the Navy QA Program as stated in the NFESC guidance document.

SECTION 5

Sample Collection Procedures

A detailed description of sampling procedures is provided in the original FSP, the addendum of the FSP, and Attachment 1 of the FSP addendum (the SOPs).

SECTION 6

Sample Custody

This information is contained in the original project plans.

SECTION 7

Field Equipment Calibration

The field equipment to be used during this investigation that will require calibration includes:

- OVM

The OVM will be calibrated before and during each day's use according to procedures and schedules outlined in the Health and Safety Plan (HASP) and in the SOPs of the FSP. The standards which will be used to calibrate these instruments are shown in Table 7-1. Standards will be purchased as necessary from appropriate vendors.

If an individual suspects an equipment malfunction, the device shall be removed from service and tagged so that it is not inadvertently used, and the equipment manager notified so that a substitute piece of equipment can be used. Backup equipment will be available in the field for use in the event of a malfunction.

Addendum to the Quality Assurance Project Plan

SECTION 1

Introduction

This Quality Assurance Project Plan (QAPP) Addendum updates the original QAPP of June 1992. The Addendum focuses on the Phase III sampling activities for soil, sediment, and groundwater at Naval Air Station (NAS) Oceana, Virginia Beach, Virginia. Phase III RFI activities will follow the original QAPP except where amended below.

When the June 1992 Work Plan was approved, the Naval Energy and Environmental Support Activity guidance document (NEESA 20.2-047B) was being used. A new interim guidance document by the Naval Facilities Engineering Service Center (NFESC) is now in effect. All field sampling and laboratory analyses will be conducted in accordance with the *Navy Installation Restoration Laboratory Quality Assurance Guide*, February 1996.

SECTION 2

Project Description

A discussion of tasks associated with Phase III RFI sampling is documented in the Addendum of the Work Plan.

SECTION 3

Project Organization

Mr. Doug Dronfield will serve as the activity manager and the primary contact at CH2M HILL. Mr. Dronfield will assume primary responsibility for ensuring that the work is performed in a manner that is acceptable to LANTDIV. With the activity manager's oversight, the project manager, Mr. Jack Robinson, will be responsible for such activities as budget and schedule review and tracking, preparation and review of invoices, personnel resources planning and allocation, and coordination with LANTDIV, the Naval Base, and subcontractors. Mr. Doug Dronfield will provide senior review.

The Phase III investigation field tasks (soil, sediment, and groundwater sampling) will be performed by the CH2M HILL supporting field personnel. CH2M HILL will notify LANTDIV and the NAS Oceana as to which CH2M HILL personnel will mobilize to the site prior to initiating field activities. A field task manager will be assigned to lead all field activities. This person will be responsible for assuring that the Sampling and Analysis Plan (SAP), as amended, is being followed, maintaining the field log book, monitoring the site for all releases, and other activities. The field staff will be responsible for collecting the samples, supervising subcontractors, completing sample paperwork, shipping samples, and the like.

Table 3-3, Analytical Data Electronic Deliverable		
Field Name	Field Type	Description
Sample_ID	A	The CH2M HILL sample ID (taken from the Chain of Custody)
Sample_Analysis	A	The method code
Date_Analyzed	D	The date the sample was analyzed.
Date_Received	D	The date the sample was received in the lab.
Lab_Sample_ID	A	The lab sample ID
Dilution_Factor	N	The dilution factor used, if applicable.
SDG_Number	A	The Sample Delivery Group (SDG) number
CAS_Number	A6-A2-A1	CAS Number (Note dashes)
Chem_Name	A	The compound being analyzed
Ana_Value	N	The analytical result
Std_Qual	A	The lab qualifiers, if any (e.g., U, UJ, B)
DV_Qual	A	Leave blank; used for data validation
Units	A	The unit of the result (e.g., MG/L)
Detect_Limit	N	The detection limit for the compound
Method	A	Analytical method used to analyze the sample fraction

Table 3-2
Sample Designation Schema

First Segment	Second Segment		Third Segment
Facility, Station, and Site Number	Sample Type	Sample Location + Sample Qualifier	Additional Qualifiers (sample depth, sampling round, etc.)
AANN	AA	NNNA or NNAA	ANN or NNNN

Notes: "A"= alphabetic "N"= numeric

Facility:

OC = NAS Oceana

Station Type:

S = Site
W = SWMU
O = Operable Unit
U = UST

SWMU Number:

Refer to work plan for SWMU numbers

Sample Type:

DS = Direct Push—Soil Sample
DW = Direct Push—Water Sample
DG = Direct Push—Soil Gas Sample
GB = Geotechnical Boring Sample
MW = Monitoring Well Sample
PW = Purge Well
PZ = Piezometer Sample
RW = Residential Well Sample
SB = Soil Boring Sample
SD = Sediment Sample
SS = Surface Soil Sample
SW = Surface Water Sample
TB = Trip Blank
EB = Equipment Blank
FB = Field Blank

Sample Location:

1. Station Samples (NNA)

   NNA—refers to sequential station number

   NN**A**—letter qualifier for deep or shallow sample (if applicable).

2. QC Samples (NNN)

   NNN—numbered sequentially for each type of blank (i.e., 1, 2, etc.) collected for that day's sampling

   N**NN**—refers to month of sampling event

Sample Qualifiers:

F = filtered sample
P = duplicate sample
K = background sample

Additional Qualifiers:

1. Monitoring Well Groundwater Sample (refers to sampling round for that well):

   R01—Round 1
   R02—Round 2
   R03—Round 3

2. Direct Push Subsurface Sample (refers to depth of sample):

   Enter depth of top of sample interval

3. QC Samples NNNN—refers to day and year of sampling event

Table 3-1
Field Station Schema

First Segment	Second Segment	
Facility, Station Type, Site Number	Station Type	Station Number, Qualifier
AANNN	AA	NNNA

Notes: "A"= alphabetic "N"= numeric

Facility: OC = NAS Oceana Station Type: S = Site W = SWMU O = Operable Unit U = UST SWMU Number: Refer to SWMU number in the work plan	Station Type: DS = Direct Push—Soil DW = Direct Push—Water DG = Direct Push—Soil Gas GB = Geotechnical Boring GG = Geophysical Grid Node MW = Monitoring Well PW = Purge Well PZ = Piezometer RW = Residential Well SB = Soil Boring SD = Sediment Sample Location SS = Surface Soil Sample Location SW = Surface Water Sample Location Station Number: Sequential Station Number Qualifier: S = Shallow D = Deep K = Background

Each sample will be designated by an alphanumeric code that will identify the facility, site, and matrix sampled and contain a sequential sample number. QA/QC samples will have a unique sample designation. The general guide for sample identification is documented in Table 3-2. If one qualifier is pertinent to the sample ID but another is not, only the applicable qualifiers will be used. A non-utilized character space does not have to be maintained.

Electronic Deliverable File Format

An offsite analytical laboratory will analyze the RFI samples and tabulate results in an electronic format specified by CH2M HILL. The data validator will add data validation qualifiers to the table of analytical results. In addition to hard copy data package deliverable, CH2M HILL will receive an electronic file from the data validator in a table format that will facilitate downloading into a database. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is tabulated in Table 3-3.

Tabular Displays

Tables will be used to display a wide variety of data including the following:

- Analytical data summaries
- Well construction information
- Well development information
- Survey information

Specifications for Field Location Data

Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides for a key in a database to which any samples collected from that location can be linked, to form a relational database structure.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the stations location by facility, site type, site number, station type, and sequential station number. The schema that will be used to identify field station data is documented in Table 3-1.

Specifications for Analytical Data

Analytical data will be generated through sampling of various media at NAS Oceana. Each analytical sample collected in the field will be assigned a unique sample identifier. The schema used as a guide for labeling analytical samples in the field is documented below. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is also documented below.

Sample Identification Schema

A standardized numbering system will be used to identify all samples collected during water, soil, and sediment sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the investigations will use the following format.

Incoming documents will be filed. If distribution is required, the appropriate number of copies will be made and distributed to project personnel. In addition, all notes from project meetings and telephone conversations will be filed along with other project documents.

Data Validation

Data validation entails a review of the quality control (QC) data and the raw sample data to verify that the analytical laboratory has operated within the required control limits, the analytical results are correctly transcribed from the instrument readouts, and which, if any, natural samples are related to any out-of-control laboratory QC samples. The objective of the data validation is to identify any qualitative, unreliable, or invalid laboratory measurements. If anomalies are discovered while reviewing laboratory data, the validation contractor will require additional written documentation from the laboratory as necessary.

The data validation process consists of a review of the following: laboratory holding times, instrument tuning and calibration, blanks, field duplicates, surrogate recovery, matrix spike/matrix spike duplicates, internal standards performance, system performance, and reported detection limits.

The laboratory responsible for analyzing the samples will send the analytical data to the validation contractor who will validate the analytical data using EPA protocols, (Laboratory Data Validation Functional Guidelines for Evaluating Organics and Inorganics Analyses and U.S. EPA Region III Functional Guideline Modifications), SW-846 methodologies, and data validation procedures reported in Sampling and Analysis Quality Assurance Requirements for the Navy Installation and Restoration Program.

Facility Maps

A number of site-wide and SWMU-specific facility maps will be generated from the RFI. The following maps will be included in the RFI reports, as appropriate:

- Topographic map of entire facility
- General base map describing important facilities and potential receptors
- Study area maps
- Site-specific ecosystem maps
- Sampling and field measurement location maps
- Cross section maps
- Maps of spatial distribution of contaminant concentrations
- Contaminant concentration and water table contour maps

Addendum to the Data Management Plan

This is an Addendum to the CH2M HILL, RCRA Facility Investigation, Data Management Plan, dated June, 1992. This Addendum to the data management plan (DMP) defines the data management procedures that will be performed during the NAS Oceana RFI supplementary sampling.

CH2M HILL will collect a variety of environmental information which will support data analysis, reporting, and presentation activities. Environmental analytical samples and various types of field data will be collected during the investigation. These data must support subsequent data analysis for site characterization and reporting. The data must also support any subsequent remedial action decisions and the presentation of investigation results to the Navy, regulatory agencies, and the public. To meet quality assurance of current regulatory requirements a complete audit trail of the information flow must be established.

This addendum to the DMP details the procedures for inventory, control, storage, validation, evaluation, and presentation of data during the RFI at NAS Oceana. A large variety of technical data will be generated during the course of the RFI. Project tracking data, schedules, progress reports, and field notes will be maintained to monitor, manage, and document the progress of the RFI. Field station data and analytical data will also be organized and maintained in a database. The electronic data deliverable formats for analytical laboratories and data validators will be specified.

Project Documentation

Data from the RFI will be compiled and summarized in tables. The following information will be included in the tables:

- Sample location number
- Date of each sample
- Parameters measured
- Results of analyses or measurements
- Reporting units
- Explanatory footnotes

All incoming data and reports will be logged and dated. All information generated from field activities will be documented on appropriate forms, including the following:

- Boring logs
- Chain-of-custody record
- Field books
- Location sketch
- Photograph log
- Sample container inventory
- Telephone conversation log

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
OCP	Endrin aldehyde		0.02	0.8
	Heptachlor		0.01	0.4
	Heptachlor epoxide		0.01	0.4
	Isodrin		0.02	0.8
	Kepone		1	40
	Methoxychlor		0.04	1.6
	Toxaphene		0.5	20
OPS9	**ORGANOPHOSPHOROUS PESTICIDES**	SW8140		
	Dimethoate		5	250
	Disulfoton		1	50
	Famphur		1	50
	Parathion ethyl		1	50
	Parathion methyl		1	50
	Phorate		1	50
	Sulfotepp		1	50
	Thionazin		1	50
	o,o,o-Triethylphosphorothioate		1	50
HES9	**HERBICIDES**	SW8150		
	2,4-D		2.5	50
	2,4,5-T		0.5	10
	2,4,5-TP (Silvex)		0.5	10
	Dinoseb		2.5	50
DXS9	**DIOXINS/FURANS**	SW8280		
	1,2,3,4,6,7,8-HpCDD		NA	
	Total HpCDD		NA	
	1,2,3,4,6,7,8-HxCDF		NA	

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	1,2,3,4,7,8,9-HpCDF		NA	
	Total HpCDF		NA	
	1,2,3,4,7,8-HxCDD		NA	
	1,2,3,6,7,8-HxCDD		NA	
	1,2,3,7,8,9-HxCDD		NA	
	Total HxCDD		0.0020	
	1,2,3,4,7,8-HxCDF		NA	
	1,2,3,6,7,8-HxCDF		NA	
	1,2,3,7,8,9-HxCDF		NA	
	2,3,4,6,7,8-HxCDF		NA	
	Total HxCDF		0.0017	
	Total OCDD		NA	
	1,2,3,7,8-PeCDD		NA	
	Total PeCDD		0.0025	
	1,2,3,7,8-PeCDF		NA	
	2,3,4,7,8-PeCDF		NA	
	Total PeCDF		0.0011	
	2,3,7,8-TCDD		0.00085	
	Total TCDD		0.0021	
	2,3,7,8-TCDF		NA	
	Total TCDF		0.0013	
SVS9	**SEMIVOLATILES**	SW8270		
	Acenaphthene		10	330
	Acenaphthylene		10	330
	2-Acetamidofluorene		10	330
	Acetophenone		10	330
	4-Aminobiphenyl		50	1600

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	Aniline		10	330
	Anthracene		10	330
	Aramite		50	1600
	Benzo (a) anthracene		10	330
	Benzo (a) pyrene		10	330
	Benzo (b) fluoranthene		10	330
	Benzo (g,h,i) perylene		10	330
	Benzoic acid		50	1600
	Benzo (k) fluoranthene		10	330
	Benzyl alcohol		10	330
	4-Bromophenylphenyl ether		10	330
	Butylbenzylphthalate		10	330
	4-Chloroaniline		10	330
	bis(2-Chloroethyl)ether		10	330
	bis(2-Chloroetho)methane		10	330
	bis(2-Chloroisopro)ether		10	330
	bis(2-Chloro-1-methylethyl) ether		10	330
	4-Chloro-3-methylphenol		10	330
	2-Chloronaphthalene		10	330
	2-Chlorophenol		10	330
	4-Chlorophenylphenylether		10	330
	Chrysene		10	330
	Dibenz(a,h)anthracene		10	330
	Dibenzofuran		10	330
	1,2-Dichlorobenzene		10	330

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	1,3-Dichlorobenzene		10	330
	1,4-Dichlorobenzene		10	330
	3,3'-Dichlorobenzidine		20	660
	2,4-Dichlorophenol		10	330
	2,6-Dichlorophenol		10	330
	Diethylphthalate		10	330
	p-Dimethylaminoazobenzene		10	330
	7,12-Dimethylbenz(a)anthr		10	330
	3,3'-Dimethylbenzidine		10	330
	a,a-Dimethylphenethylamine		50	1600
	2,4-Dimethylphenol		10	330
	Dimethyl phthalate		10	330
	Di-n-butylphthalate		10	330
	1,3-Dinitrobenzene		10	330
	4,6-Dinitro2methylphenol		50	1600
	2,4-Dinitrophenol		50	1600
	2,4-Dinitrotoluene		10	330
	2,6-Dinitrotoluene		10	330
	Di-n-octylphthalate		10	330
	Diphenylamine		10	330
	bis(2Ethylhexyl)phthalat		10	330
	Ethyl methanesulfonate		10	330
	Fluoranthene		10	330
	Fluorene		10	330
	Hexachlorobenzene		10	330

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	Hexachlorobutadiene		10	330
	Hexachlorocyclopentadien		10	330
	Hexachloroethane		10	330
	Hexachlorophene		50	1600
	Hexachloropropene		50	1600
	Indeno(123-cd)pyrene		10	330
	Isophorone		10	330
	Isosafrole		50	1600
	Methapyrilene		50	1600
	3-Methylcholanthrene		10	330
	Methyl methanesulfonate		10	330
	2-Methylnaphthalene		10	330
	2-Methylphenol		10	330
	3-Methylphenol		10	330
	4-Methylphenol		10	330
	Naphthalene		10	330
	1,4-Naphthoquinone		50	1600
	1-Naphthylamine		50	1600
	2-Naphthylamine		50	1600
	2-Nitroaniline		50	1600
	3-Nitroaniline		50	1600
	4-Nitroaniline		50	1600
	Nitrobenzene		10	330
	5-Nitro-o-toluidine		10	330
	2-Nitrophenol		10	330
	4-Nitrophenol		50	1600
	4-Nitroquinoline-1-oxide		10	330

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	N-Nitrosodiethylamine		10	330
	N-Nitrosodimethylamine		10	330
	N-Nitroso-di-n-butylamine		10	330
	N-Nitrosodi-n-propylamine		10	330
	N-Nitrosodiphenylamine		10	330
	N-Nitrosomethylethylamine		10	330
	N-Nitrosomorpholine		10	330
	N-Nitrosopiperidine		10	330
	N-Nitrosopyrrolidine		10	330
	Pentachlorobenzene		50	1600
	Pentachloronitrobenzene		50	1600
	Pentachlorophenol		50	1600
	Phenacetin		10	330
	Phenanthrene		10	330
	Phenol		10	330
	p-Phenylenediamine		50	1600
	2-Picoline		50	1600
	Pronamide		10	330
	Pyrene		10	330
	Pyridine		50	1600
	Safrole		50	1600
	1,2,4,5-Tetrachlorobenzen		50	1600
	2,3,4,6-Tetrachlorophenol		10	330
	o-Toluidine		10	330

APPENDIX IX COMPOUNDS

Test Code	Analyses	Method	Water Rep. Limit (ug/L)	Soil Rep. Limit (ug/kg)
	1,2,4-Trichlorobenzene		10	330
	2,4,5-Trichlorophenol		50	1600
	1,3,5-Trinitrobenzene		10	330
	2,4,6-Trichlorophenol		10	330

Soil detection limits on a wet weight basis.

Table 10-1
Analytical Parameter and QC Sample Summary for Phase III Sampling
NAS Oceana, August 1997

Site	Soil	Sediment	Wells	Solid medium							Aqueous medium		
				PAHs	SVOCs	TOC	VOCs	PCBs	Dioxin	Pesticides	SVOCs	VOCs	PAHs
1	5								5	3			
2b		3	2		3	3					2		2
2c		2		2	2	2							
2d			5								5	5	
18	6			6			6	6					
21	3				3			1					
24	10			10			10						
25		3				3				3			
Field Total	24	8	7	18	8	8	16	7	5	6	7	5	2
Duplicates				2	1	1	2	1	1	1	1	1	1
Equip. blank				2	3	1	2	2	1	1	1	1	1
Field blank				1	1	1	1	1	1	1	1	1	1
Trip blank							1					1	1
MS/MSD				1	1	1	1	1	1	1	1	1	1
Total Samples				23	13	11	22	11	8	9	10	9	6

Notes:
Blanks (equipment, field, or trip) for all media are aqueous samples
Matrix spike/matrix spike duplicate (MS/MSD) analyses are not included in the count for total samples as they represent additional volume for a sample, not an additional sample.

Final

Health and Safety Plan
Oceana Naval Air Station

Virginia Beach, Virginia

December 1997

Prepared for:

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the

LANTDIV CLEAN II Program
Contract N62470-955-D-6007

Prepared by

Herndon, Virginia

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Table of Contents (Continued)

CH2M HILL HEALTH AND SAFETY PLAN

(Reference CH2M HILL SOP 19, *Health and Safety Plans*)

This health and safety plan will be kept on the site during field activities and will be reviewed and updated as necessary. The plan adopts, by reference, the standards of practice (SOP) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, and CH2M HILL's *Site safety Notebook* as appropriate. The site safety coordinator (SSC) is to be familiar with these SOPs and the content of this plan. Site personnel must sign Attachment 1. In addition, this plan adopts procedures in the work plan for the project.

1 PROJECT INFORMATION AND DESCRIPTION

CLIENT OR OWNER: Department of the Navy
Atlantic Division

PROJECT NO: 138763.LT.WS

CH2M HILL PROJECT MANAGER: Jack Robinson

OFFICE: WDC

SITE NAME: Oceana Naval Air Station

SITE ADDRESS: Oceana Boulevard
Virginia Beach, Virginia

DATE HEALTH AND SAFETY PLAN PREPARED: June 1997

DATE(S) OF INITIAL VISIT: 1986

DATE(S) OF SITE WORK: November through December 1997

SITE ACCESS: The site is accessed through a secured gate located on Oceana Boulevard.

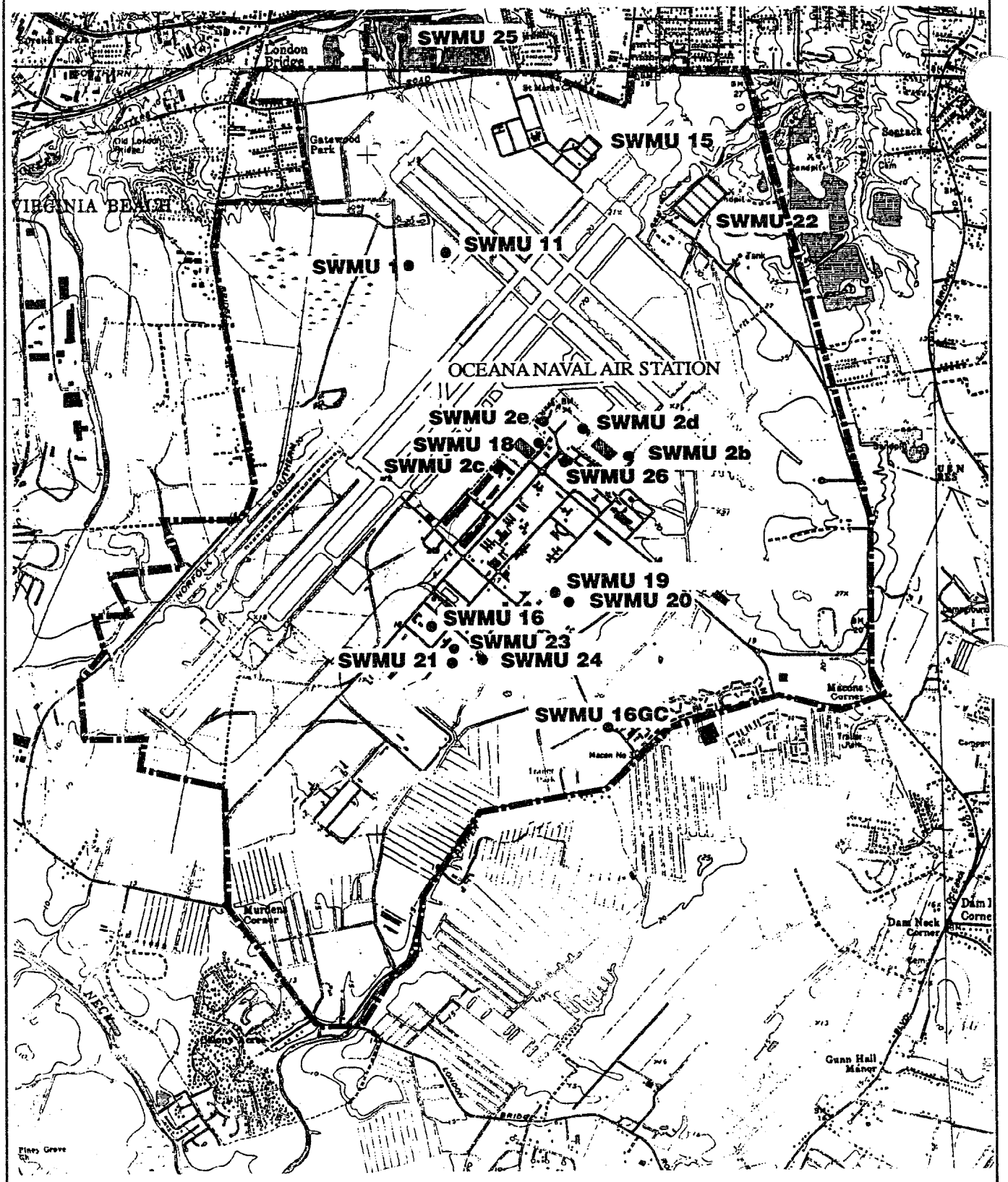
SITE SIZE: The site is comprised of approximately 5000 acres of land fronting on the Chesapeake Bay in Virginia Beach, Virginia.

SITE TOPOGRAPHY: The topography at the Oceana Naval Air Station is flat. The ground surface elevation ranges from a high of approximately 25 feet above mean sea level (msl) in the eastern portion of the facility to just above msl along the bulkhead adjacent to the Chesapeake Bay.

SITE DESCRIPTION AND HISTORY: Oceana Naval Air Station began as a small auxiliary air field constructed by the U.S. Government on 328 acres of remote, swampy land in November of 1940. The original air station consisted of 2,500 foot long asphalt runways and a workforce of 32 officers and 172 enlisted personnel. In 1943, at the height of the second World War, Congress approved plans to expand the station to accommodate 160 officers and 800 enlisted personnel. Oceana was designated a Naval Air Station in the late 1950's when it became too large to work as a subordinate to other stations in the area. Oceana then became an all weather station, and was eventually designated a Master Jet Base.

Over the years, Oceana has grown to more than 16 times it's original size. The base presently encompasses 5,916 acres and supports a naval community of more than 10,200 Navy personnel and some 11,500 dependents. The annual payroll exceeds $286 million.

The 12 F-14 Tomcat jet-fighter squadrons and the 7 A-6 Intruder medium-attack squadrons assigned to the Atlantic Fleet are based at Oceana. In addition, the station also supports a search and rescue unit and three squadrons for training aircrews and maintenance personnel.



NOT TO SCALE

Figure 1-1
LOCATIONS OF SWMUs
RCRA Facility Investigation–Naval Air Station, Oceana

2 PROJECT ORGANIZATION AND TASKS TO BE PERFORMED UNDER THIS PLAN

2.1 PROJECT ORGANIZATION

CLIENT: Mr. Jim Harris/LANTNAVFACENGCOM Navy Technical Representative

CH2M HILL:
Project Manager: Jack Robinson/CH2M HILL WDC
Lead Hydrogeologist/Field Team Leader: Adam Locke/CH2M HILL WDC
Refer to Section 4 for field staff.

CONTRACTORS and SUBCONTRACTORS: Refer to Section 4.2.

2.2 DESCRIPTION OF TASKS (Reference Section 1, "Field Activity Start-up Form," of *Site Safety Notebook*

Refer to project documents (i.e., work plan) for detailed task information. A health and safety risk analysis has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks in addition to those listed below require an approved amendment to this plan before additional work begins. Refer to Section 10.2 for procedures related to tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

The field investigation at the Oceana Naval Air Station will include the collections soil, sediment, and groundwater samples at several site. Brief descriptions of the field investigation activities are provided below.

Soil and sediment sampling activities: Three surface soil and sixteen subsurface soil samples will be collected during the field activities. Surface soil samples will be collected using disposable stainless steel trowels. A Geoprobe will be used to collect sixteen subsurface soil samples. Sediment samples will be collected using disposable trowels at five locations and using a ponar dredge and a boat at 2 locations.

Groundwater Sampling Activities - A total of seven groundwater samples will be collected from existing monitoring wells at the Oceana Naval Air Station. Samples will be collected using a redi-flo submersible sampling pump.

2.2.1 HAZWOPER-REGULATED TASKS

- Soil/Sediment Sampling
- Groundwater Sampling

2.2.2 NON-HAZWOPER-REGULATED TASKS

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the HSM is required before these tasks are conducted on regulated hazardous waste sites.**

TASK	RESTRICTIVE CONDITIONS
• Electrical installation	Not Approved
• Iron work (installing rebar)	
• Masonry work	
• General heavy equipment work (excavation, grading, etc.)	
• Mechanical installations (equipment, pumps, etc.)	
• Engineering testing/evaluation	
• Building construction	

3 HAZARD EVALUATION AND CONTROL

3.1 HEAT AND COLD STRESS (Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

3.1.1 PREVENTING HEAT STRESS

- Drink 16 ounces of water before beginning work, such as in the morning or after lunch. Disposable (e.g., 4-ounce) cups and water maintained at 50° to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Take regular breaks in a cool, preferably air-conditioned, area. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours. Monitor for signs of heat stress.
- Acclimate to site work conditions by slowly increasing workloads; e.g., do not begin site work with extremely demanding activities.
- Use cooling devices, such as cooling vests, to aid natural body ventilation. The devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- During hot weather, conduct field activities in the early morning or evening if possible.
- Provide adequate shelter to protect personnel against radiant heat (sun, flames, hot metal), which can decrease physical efficiency and increase the probability of heat stress.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequently changing clothing and by showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.

3.1.2 SYMPTOMS AND TREATMENT OF HEAT STRESS

	Heat Syncope	Heat Rash (*miliaria rubra*, "prickly heat")	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool– but not cold– water. Call ambulance, and get medical attention immediately!

3.1.3 HEAT-STRESS MONITORING

For field activities part of ongoing site work activities in hot weather, the following procedures should be used to monitor the body's physiological response to heat and to estimate the work-cycle/rest-cycle when workers are performing moderate levels of work. These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high(>50%), or when the workers exhibit symptoms of heat stress.

The heart rate should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/minute at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 110 beats/minute, or 20 beats/minute above resting pulse.

3.1.4 PREVENTING COLD STRESS

- Be aware of the symptoms of cold-related disorders, and ***wear proper clothing for the anticipated fieldwork.***
- Consider monitoring the work conditions and adjusting the work schedule, using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- ***Wind-Chill Index.*** This measure relates the dry bulb temperature and the wind velocity. It is used only to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index sometimes is limited in its usefulness because the index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it is used only as a guideline to warn workers when they are in a situation that can cause cold-related illnesses. Used in conjunction with the NSC guidelines, the wind-chill index provides a starting point for adjusting work and warm-up schedules.
- ***NSC Guidelines for Work and Warm-Up Schedules.*** The cold-exposure limits recommended by the NSC can be used in conjunction with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; ***workers should be monitored for symptoms of cold-related illness.*** If symptoms are not observed, the work duration can be increased.
- The wind-chill index and the NSC guidelines are in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual,* SOP HS-09.

3.1.5 SYMPTOMS AND TREATMENT OF COLD STRESS

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Rewarm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

3.2 PROCEDURES FOR LOCATING BURIED UTILITIES

Local Utility Mark-Out Service
Name: Public Works Department - Oceana Naval Air Station
Phone: (757) 433-3105

Name: Miss Utility
Phone: 1-800-257-7777

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural-gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary, clear locations with a utility-locating instrument (e.g., metal detector).
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon).
- When the client or other onsite party is responsible for determining the presence and locations of buried utilities, the SSC should confirm that arrangement.

3.3 GENERAL PHYSICAL (SAFETY) HAZARDS AND CONTROLS

Engineering and administrative controls are to be implemented by the party in control of the site or the hazard (i.e., CH2M HILL, subcontractor, or contractor). CH2M HILL employees and subcontractors must, at a minimum, remain aware of hazards affecting them regardless of who is responsible for controlling the hazards. Specialty subcontractors are responsible for the safe operation of their equipment (e.g., drill rig, heavy equipment). CH2M HILL employees are not to operate, or assist in the operation of, any subcontractor or contractor equipment.

Hazard (Refer to SOP, or HSP Section)	Engineering Controls, Administrative Controls, and Work Practices	Groundwater Sampling	Sediment Sampling Using a Boat	Sediment Sampling from the Shore or Water	Hand Augering	Surveying
Flying debris/objects (HS-07)	Provide shielding and PPE; maintain distance.		X	X	X	
Noise > 85 dBA	Noise protection and monitoring required.		X			
Gas cylinders (HS-21)	Instruct employees in the safe use of compressed gases. Make certain gas cylinders are properly anchored and chained. Keep cylinders away from ignition sources. Cap cylinders when not in use.	X	X	X	X	
Electrical	• Make certain third wire is properly grounded. Do not tamper with electrical wiring unless qualified to do so. Ground as appropriate. • Project field sites should have ground fault circuit interrupters (GFCIs) installed for all wiring, including extension cords. • Heavy equipment (e.g., drill rig) should remain at least 15 feet from overhead power line for power lines of 50 kV or less. For each 10kV > 50, increase distance by ½ foot. • Operate and maintain equipment according to manufacturer's instructions. • Use only extension cords that are three-wire grounded. Cords passing through work areas must be covered or elevated to protect from damage. • Use only electrical tools and equipment that are either effectively grounded or double-insulated UL approved. • Properly label switches, fuses, and circuit breakers. • Remove cord from an outlet by grasping the plug, not pulling the cord. • Protect all electrical equipment, tools, switches, etc., from elements. • Avoid physical contact with power circuit. • Only qualified electricians are to install and work on electrical circuits and equipment.	X	X			
Buried utilities, drums, tanks, etc. (Section 3.3)	Locate buried utilities, drums, tanks, etc., before digging or drilling and mark location.				X	
Slip, trip, fall hazards (e.g., wet/muddy surface, inadequate railing, unstable surface)	Provide slip-resistant surfaces, ropes, and/or other devices to be used. Brace and shore equipment	X	X	X	X	X
Back injury (HS-29)	Use proper lifting techniques, or provide mechanical lifting aids.	X	X	X	X	
Visible lightning	Stop work.	X	X	X	X	X
Fire prevention and control (HS-22)	• No spark sources are allowed within exclusion or decontamination zones. • Appropriate firefighting equipment must be available on the site. • Extinguishers are to be inspected visually every month and undergo an annual maintenance check. • Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations. Keep areas near exits and extinguishers clear. Open flames are prohibited in the vicinity of flammable materials. • Combustible materials stored outside should be at least 10 feet from the building. • Unnecessary combustible materials and flammable or combustible liquids must not be allowed to accumulate. • Flammable or combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.			X		
Inadequate illumination	Site work will be performed during daylight hours whenever possible. Work conducted during hours of darkness will require enough illumination intensity "to read a newspaper without difficulty."	X	X	X	X	X
Entanglement in rotating equipment	• Prohibit loose clothing and hair • Prohibit wearing jewelry				X	
Working near water	• U.S. Coast Guard-approved personal flotation devices (PFDs–e.g., life jacket) provided for each employee will be worn. • PFDs will be inspected before and after each use. Defective equipment will not be used. • Sampling and other equipment will be used according to the manufacturer's instructions. • A minimum of one life-saving skiff will be provided for emergency rescue. • A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope will be provided for emergency rescue. • Keep nonessential personnel 3 feet from edge of water			X		
Working on water	• Safe means of boarding or leaving a boat or a platform will be provided to prevent slipping and falling. Boat/barge must be equipped with adequate railing. • instructions/warnings (e.g., protect from pinch points, sharp objects, rope burns/entanglement). • Work requiring the use of a boat will take place only during daylight hours. • Work requiring the use of a boat will not take place during inclement weather. • The boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.). Shut off engine before refueling; do not smoke while refueling.		X			

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3.4 BIOLOGICAL HAZARDS AND CONTROLS

Hazard and Location	Control Measures
Snakes typically are found in underbrush and tall grassy areas.	If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Carry the victim or have him/her walk slowly if the victim must be moved. Try to identify the type of snake: note color, size, patterns, and markings.
Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas.	Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.
Exposure to **bloodborne pathogens** may occur when rendering first aid or CPR, or when coming into contact with medical or other potentially infectious material, or when coming into contact with landfill waste or waste streams containing such infectious material.	Training is required before a task involving potential exposure is performed. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.
Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic.	Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or the buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.
Other Potential Biological Hazards: None anticipated	None required

3.5 TICK BITES (Reference CH2M HILL HS-03, *Tick Bites*)

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size.

Prevention against tick bites includes avoiding tick areas; wearing tightly woven light-colored clothing with long sleeves and wearing pant legs tucked into boots or socks; spraying **only outside** of clothing with insect repellent containing permethrin or permanone, and spraying skin with DEET; and checking yourself frequently for ticks and showering as soon as possible. To prevent chemical repellents from interfering with sample analyses, exercise care while using repellents during the collection and handling of environmental samples.

If bitten by a tick, carefully remove the tick with tweezers, grasping the tick as close as possible to the point of attachment while being careful not to crush the tick. After removing the tick, wash your hands and disinfect and press the bite area. The removed tick should be saved. Report the bite to human resources personnel.

Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, bone pain may develop. If symptoms appear, seek medical attention.

3.6 RADIOLOGICAL HAZARDS AND CONTROLS

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual*, and *Corporate Health and Safety Program, Radiation Protection Program Manual,* for standards of practice for operating in contaminated areas.

Hazards	Controls
None	None

3.7 HAZARDS POSED BY CHEMICALS BROUGHT ON THE SITE

3.7.1 HAZARD COMMUNICATION

(Reference CH2M HILL *Hazard Communication Manual* and Section 5 of the *Site Safety Notebook*)

CH2M HILL's *Hazard Communication Program Manual,* which is available from area or regional offices and from the Corporate Human Resources Department in Denver. The project manager is to request Material Safety Data Sheets (MSDSs) from the client or from the contractors and the subcontractors for chemicals to which CH2M HILL employees potentially are exposed. The SSC is to do the following:

- Give employees required site-specific HAZCOM training.
- Confirm that the inventory of chemicals brought on the site by subcontractors is available.
- Before or as the chemicals arrive on the site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, if any.

The chemical products listed below will be used on the site. Refer to Attachment 2 for MSDSs.

Chemical	Quantity	Location
Isobutylene (calibration gas)	1 liter, compressed gas	Support Zone
Hydrochloric Acid (sample preservative)	< 500 ml	Support/Exclusion Zone
Nitric Acid (sample preservative)	< 500 ml	Support/Exclusion Zone
Sulfuric Acid (sample preservative)	< 500 ml	Support/Exclusion Zone
Sodium Hydroxide (sample preservative)	< 500 ml	Support/Exclusion Zone
Methanol (decontamination solvent)	< 1 gallon	Support/Decontamination Zone
pH Buffers (calibration standard)	< 500 ml	Support Zone
Alconox/Liquinox (detergent)	< 1 liter, powder/liquid	Support/Decontamination Zone

3.7.2 SHIPPING AND TRANSPORTATION OF CHEMICAL PRODUCTS

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods*)

Nearly all chemicals brought to the site are considered hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive the CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

3.8 CONTAMINANTS OF CONCERN (REFER TO PROJECT FILES FOR MORE-DETAILED CONTAMINANT INFORMATION)

Contaminant	Location and Highest[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Vinyl chloride	GW: 2 ppm	1 ppm	NL Ca	Weakness, abdominal pain, GI bleeding, ; pallor or cyanosis of extremities;	9.99
1,2-Dichlorocthane	GW: 0.047 ppm	1 ppm	50 ppm Ca	CNS depression; nausea, vomiting; dermatitis; irritant eyes, corneal opacity;	11.05
Benzene	GW: 0.005 ppm	1 ppm	500 ppm [Ca]	Irritant eyes, nose, respiratory system; giddiness; headache nausea, staggered gait, fatigue, anorexia, lassitude; dermatitis; bone marrow depression;	9.24
Toluene	GW: 0.003 ppm	50 ppm	500 ppm	Fatigue, weakness; confusion euphoria, dizziness, headache; dilated pupils, tearing of eyes; ears, muscle fatigue, insomnia; paresis; dermatitis	8.82
Ethyl benzene	GW: 0.008 ppm	100 ppm	800 ppm	Irritant eyes, mucous membranes; headache; dermatitis; narcotic, coma	8.76
Pentachlorophenol	GW: 0.010 ppm	0.5 mg/m^3 [skin]	2.5 mg/m^3	Irritant eyes, nose, throat; sneezing, cough; weakness, low-weight, sweating; headache, dizziness; nausea, vomiting; difficulty breathing, chest pain; high fever; dermatitis	UK
Napthalene	GW: 0.003 ppm	10 ppm	250 ppm	Eye irritant; headache; confusion, excitement,; nausea, vomit, abdominal pain; irritant bladder, profuse sweat; jaundice; renal shutdown; dermatitis	8.12
m-Xylene	GW: 0.084 ppm	100 ppm	900 ppm	Dizziness, excitement, incoherent, staggering gait; irritant eyes, nose, throat; anorexia, nausea, vomiting, abdominal pain; dermatitis	8.56
(o-,p-)Xylenes	GW: 0.084 ppm	100 ppm	900 ppm	Dizziness, excitement, incoherent, staggering gait; irritant eyes, nose, throat; , anorexia, nausea, vomiting, abdominal pain; dermatitis	8.56
Acetone	GW: 0.027 ppm	1,000 ppm	2500 ppm	Irritant eyes, nose, throat; headache, dizziness; dermatitis	9.69
4-Methyl-2-pentanone (Hexanone)	SB: 71 ppm	100 ppm	500 ppm	Narcotic, irritant eyes, skin, respiratory system.	9.30
1,1,2,2-Tetrachloroethane	SB: 100 ppm	1 ppm [skin]	100 ppm	Nausea, vomiting, abdominal pain; tremor fingers, jaundice, enlarged tend liver; dermatitis;; kidney damage	11.10
bis(2-Ethylhexyl) phthalate	GW: 0.24 ppm	NL	NL	NL	NL
Chlorobenzene	GW: 0.007 ug/l	10 ppm	1,000 ppm	Irritant skin, eye, nose; drowsiness, incoherent, in animal; liver, lung, kidney damage	9.07
Chloroform	GW: 0.004 ppm	2 ppm	500 ppm Ca	Dizziness, mental dullness, nausea, disorientation; headache, fatigue; anesthesia; hepatomegaly; irritant eyes, skin;	11.42

3.8 CONTAMINANTS OF CONCERN (REFER TO PROJECT FILES FOR MORE-DETAILED CONTAMINANT INFORMATION)					
Contaminant	**Location and Highest[a] Concentration (ppm)**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
1,2-Dichloropropane	GW: 0.047 ppm	75 ppm	400 ppm Ca	Eye and skin irritant; drowsiness, light-headed; ; in animals: liver, kidney disease	10.87
1,2,3-Trichloropropane	GW: 0.024 ppm	50 ppm	100 ppm Ca	Irritant eyes, nose, skin, throat; CNS depression, liver injury	UK
2-Methylnaphthalene	GW: 0.007 ppm	NL	NL	NL	NL
Lindane (BHC)	GW: 0.028 ppm	0.5 mg/m^3 [skin]	1,000 mg/m^3	Irritant eyes, skin, nose, throat; head; nausea; respiratory difficulty; cyan, aplastic anemia; muscle spasm; in animals; liver, kidney damage	UK
2-Chloroaniline	GW: 0.099 ppm	NL	NL	NL	NL
2,4,6-Trichlorophenol	GW: 1.9 ppm	NL	NL	NL	NL
Dinitrotoluene	GW: 0.70 ppm	1.5 mg/m^3 [skin]	50 mg/m^3 Ca	Anoxia; cyanosis; anemia; jaundice; reproductive effects	UK
2,4-Dinitrophenol	GW: 0.071 ppm	NL	NL	NL	NL
Lead	SB: 1,000 mg/kg	0.05 mg/m^3	100 mg/m^3	Weak, lassitude, insomnia; facial pallor, pale eye, anorexia, low-weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; para wrist, ankles; encephalopathy, nephropathy; irritant eyes; hypo-tension	NA
4,4-DDT	SB: 24 mg/kg	1 mg/m^3	500 mg/m^3 Ca	Pares tongue, lips, face; tremor; dizziness, confusion, malaise, headache, fatigue; convulsion; paresis hands; vomit; irritant eyes, skin	UK
4,4-DDD	SB: 4.0 mg/kg	NL	NL	NL	NL
4,4-DDE	SB: 3.8 mg/kg	NL	NL	NL	NL
Chlordane	SB: 4.9 mg/kg	0.5 mg/m^3	100 mg/m^3 Ca	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomit, diarrhea; irritability, tremor, convulsion; anuria; in animals: lung, liver, kidney damage	UK
Heptachlor	SB: 0.8 mg/kg	0.5 mg/m^3 [skin]	35 mg/m^3 Ca	In animals: tremors, convulsions, liver damage	UK
Dieldrin	SB: 3.6 mg/kg	0.25 mg/m^3 [skin]	50 mg/m^3 Ca	Headache, dizziness; nausea, vomit, malaise, sweating; myoclonic limb jerks; clonic, tonic convulsion; coma; in animals: liver, kidney damage	UK

3.8 CONTAMINANTS OF CONCERN (REFER TO PROJECT FILES FOR MORE-DETAILED CONTAMINANT INFORMATION)

Contaminant	Location and Highest[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Lindane (BHC)	SB: 1.0 mg/kg	0.5 mg/m^3 [skin]	50 mg/m^3	Irritant eyes, skin, nose, throat; head; nausea; respiratory difficulty; cyan; aplastic anemia; muscle spasm; in animals: liver, kidney damage	UK
Toxaphene	SB: 120 mg/kg	0.5 mg/m^3 [skin]	200 mg/m^3 Ca	Nausea, confusion, agitation, tremors, convulsion, unconscious; dry, red skin;	UK
Arsenic	SB: 2,000 mg/kg	0.01 mg/m^3	5 mg/m^3 Ca	Ulceration of nasal septum, dermatitis, GI disturbances, peri neur, respiratory irritant,, hyper pigment of skin	NA

Footnotes:

a: Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water),
b: Appropriate value of PEL, REL, or TLV listed
c: IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen
d: PIP = photoionization potential; NA = Not applicable; UK = Unknown

3.9 POTENTIAL ROUTES OF EXPOSURE

DERMAL: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 5.	**INHALATION:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in sections 5 and 6, respectively.	**OTHER:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before eating, drinking, or smoking).

4 PERSONNEL

4.1 CH2M HILL EMPLOYEE MEDICAL SURVEILLANCE AND TRAINING

(Reference CH2M HILL SOP HS-01, *Medical Surveillance*, and HS-02, *Health and Safety Training*)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have received 8 hours of supervisor and instrument training and can serve as site safety coordinator (SSC) for the level of protection indicated. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones that involve the potential for exposure to health and safety hazards. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones that involve the potential for exposure to health and safety hazards. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including
obtaining a physician's statement of the employee's ability to perform hazardous activities, before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Adam Locke	WDC	Field Team Leader	Level D SSC; FA-CPR
Don Martinson	WDC	Field Team Member	Level B SSC; FA-CPR
Jack Robinson	WDC	Field Team Member	Level B SSC; FA-CPR

4.2 FIELD TEAM CHAIN OF COMMAND AND COMMUNICATION PROCEDURES

4.2.1 CLIENT

Contact Name: Mr. Jim Harris/Navy Technical Representative - LANTNAVFACENGCOM
Phone: (757) 322-4776

Facility Contact Name: Will Bullard
Phone: (757) 433-2229

4.2.2 CH2M HILL

Project Manager: Jack Robinson/WDC
Health and Safety Manager: John Longo/NJO
Field Team Leader: Adam Locke/WDC
Site Safety Coordinator: Don Martinson/WDC

The SSC is responsible for contacting the field team leader and the project manager. In general, the project manager either will contact or will identify the client contact. The Health and Safety Manager (HSM) should be contacted as appropriate. The SSC or the project manager must notify the client and the HSM when a serious injury or a death occurs or when health and safety inspections by OSHA or other agencies are conducted. Refer to sections 10 through 12 for emergency procedures and phone numbers.

4.2.3 SUBCONTRACTORS

(Reference Section 3, *Corporate Health and Safety Program Manual*)

When specified in the project documents (e.g., contract), this plan may cover CH2M HILL subcontractors. However, this plan does not address hazards associated with tasks and equipment that the subcontractor has expertise in (e.g., operation of drill rig). Specialty subcontractors are responsible for health and safety procedures and plans specific to their work. Specialty subcontractors are to submit plans to CH2M HILL for review and approval before the start of fieldwork. Subcontractors must comply with the established health and safety plan(s). CH2M HILL must monitor and enforce compliance with the established plan(s).

Drilling Subcontractor: None
Subcontractor Contact:
Telephone:

Geoprobe Subcontractor: None
Contact Name:
Telephone:

Surveying Subcontractor: None
Contact Name:
Telephone:

General health and safety communication with subcontractors contracted with CH2M HILL and covered by this plan is to be conducted as follows:

- Request that the subcontractor, if a specialty subcontractor, submit a safety or health plan applicable to their expertise (e.g., drill-rig safety plan or nuclear density gauge [NDG] health plan); attach the reviewed plan.
- Supply subcontractors with a copy of this plan, and brief them on its provisions.
- Direct health and safety communication to the subcontractor-designated safety representative.
- Notify the subcontractor-designated representative if a violation of the plan(s) is observed. Specialty subcontractors are responsible for mitigating hazards in which they have expertise.
- If a hazard condition persists, inform the subcontractor. If the hazard is not mitigated, stop affected work as a last resort and notify the project manager.
- When an apparent imminent danger exists, promptly remove all affected personnel. Notify the project manager.
- Make clear that consistent violations of the health and safety plan by a subcontractor may result in termination of the subcontract.

4.2.4 CONTRACTORS

(Reference Section 3, *Corporate Health and Safety Program Manual*)

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for directing contractor personnel and is not to assume responsibility through their actions. When the contractor is in control of the site, ask the contractor to conduct a briefing of their health and safety practices and to describe how they apply to CH2M HILL's activities. Request a copy of the contractor's health and safety plan.

Contractor: None
Contact Name:
Telephone:

General health and safety communication with contractors *not* contracted with CH2M HILL is listed below. These procedures can also be applied to other third party communications (e.g., client personnel).

- Ask the contractor to brief CH2M HILL on the contractor's health and safety plan for how the plan affects CH2M HILL employees on the site.

- If acceptable to the client, communicate about health and safety directly with the contractor PM or other onsite contractor-designated representative. CH2M HILL employees are not to direct the details of the contractor's work or to advise on health and safety (e.g., how the contractor corrects unsafe conditions).

- If an observed hazard poses a risk to CH2M HILL personnel, notify the party controlling the work activity as soon as possible. Notify the project manager; the project manager will notify the client. Document oral notification in project records (i.e., the field logbook).

- If a hazardous condition endangering a CH2M HILL employee persists, inform the contractor and the project manager (the project manager will contact the client) that CH2M HILL cannot execute the assigned work until the hazard is mitigated.

- When an apparent imminent danger exists, orally warn the person(s) in danger and orally notify the contractor promptly. When an imminent danger involves a CH2M HILL employee, remove the employee and suspend CH2M HILL work immediately until the hazard has been mitigated. Inform the project manager and the contractor promptly.

- The SSC or the project manager must notify the client and CH2M HILL health and safety staff when (1) the contractor fails to remedy an unsafe condition affecting CH2M HILL personnel, (2) the contractor does not remedy the hazardous condition within a reasonable period of time, or (3) the contractor repeatedly creates the hazardous condition.

5 PERSONAL PROTECTIVE EQUIPMENT (PPE) (Reference CH2M HILL SOP HS-07, *Personal Protective Equipment*, HS-08, *Respiratory Protection*, Section 2 of the *Site Safety Notebook*)

5.1 PPE SPECIFICATIONS[a]

Task	Level	Body	Head	Respirator[b]
Surveying	D	Work clothes; steel-toe, steel-shank leather work boots; work gloves	Hardhat[c] Safety glasses Ear protection[d]	None required
Sediment, Soil and Groundwater Sampling	Modified D	**COVERALLS:** Uncoated Tyvek® **BOOTS:** Steel-toe, steel-shank chemical-resistant boots OR steel-toe, steel-shank leather work boots with outer rubber boot covers **GLOVES:** Inner surgical-style nitrile glove AND outer chemical-resistant nitrile glove.	Hardhat[c] Splash shield[c] Safety glasses Ear protection[d]	None required
Tasks requiring upgrade per sections 5.2 or 6.	C	**COVERALLS:** Polycoated Tyvek® **BOOTS:** Steel-toe, steel-shank chemical-resistant boots OR steel-toe, steel-shank leather work boots with outer rubber boot covers **GLOVES:** Inner surgical-style nitrile glove AND outer chemical-resistant nitrile glove.	Hardhat[c] Splash shield[c] Ear protection[d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H[e] cartridges or equivalent
None Authorized	B	**COVERALLS:** Polycoated Tyvek® **BOOTS:** Steel toe, steel-shank chemical-resistant boots OR steel-toe, steel-shank leather work boots with outer rubber boot covers **GLOVES:** Inner surgical-style nitrile glove AND outer chemical-resistant nitrile glove.	Hardhat[c] Splash shield[c] Ear protection[d] Spectacle inserts	Positive-pressure demand self-contained breathing apparatus (SCBA): MSA Ultralite, or equivalent

[a] Modifications are as indicated. CH2M HILL will provide PPE to only CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SSC.
[d] Ear protection should be worn while working around drill rigs or other noise-producing equipment or when conversations cannot be held at distances of 3 feet or less without shouting. Refer to Section 6 for other requirements.
[e] The GME-H cartridge is the new standard-issue cartridge. Available stock of the previously standard GMC-H cartridges may be used for tasks covered by this plan.

5.2 REASONS FOR UPGRADING OR DOWNGRADING LEVEL OF PROTECTION

Upgrade*	Downgrade
• Request from individual performing task. • Change in work task that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 6) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

*Performing a task that requires an upgrade to a higher level of protection (e.g., level D to level C) is permitted only when the PPE requirements have been specified in Section 5 and an SSC who meets the requirements specified in subsection 4.1 is present.

6 AIR MONITORING SPECIFICATIONS (Reference CH2M HILL SOP HS-06, *Air Monitoring*, and Section 2 of the *Site Safety Notebook*)

Instrument	Tasks	Action Levels[a]		Frequency[b]	Calibration
PID: OVM with 11.8 eV lamp or equivalent	Sediment, Soil and Groundwater Sampling	<1 ppm 1-5 ppm >5 ppm	Level D Level C Stop work. Notify HSM for guidance	Initially and periodically during task	Daily
Dust Monitor: Miniram model PDM-3 or equivalent	Soil sampling	0.01 mg/m^3 >0.01 mg/m^3	Level D Level C	Initially and periodically during task	Zero Daily

Note a: Action levels apply to sustained breathing-zone measurements above background.

Note b: The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes is acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time and measurement result, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3," "at surface/SB-2," etc.).

6.1 CALIBRATION SPECIFICATIONS

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 11.8 eV bulb		RF = 0.68	68 ppm	
	100 ppm isobutylene			1.5 lpm reg T-tubing
Dust Monitor: Miniram-PDM3	Dust-free air	Not applicable	0.00 mg/m^3 in "Measure" mode	Dust-free area OR Z-bag with HEPA filter

6.2 AIR SAMPLING

Sampling may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description: None anticipated

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM:
Other:

7 DECONTAMINATION (REFERENCE CH2M HILL SOP HS-13, *DECONTAMINATION*)

The SSC must monitor the effectiveness of the decontamination procedures. Decontamination procedures found to be ineffective will be modified by the SSC.

7.1 DECONTAMINATION SPECIFICATIONS

Personnel

- Boot wash/rinse
- Glove wash/rinse
- Outer-glove removal
- Body-suit removal
- Inner-glove removal
- Respirator removal
- Hand wash/rinse
- Face wash/rinse
- Shower ASAP
- **PPE-disposal method:** PPE will be placed in plastic garbage bags and drummed.
- **Water-disposal method:** Decon water will be drummed.

Sample Equipment

- Wash/rinse equipment
- Solvent-rinse equipment
- **Solvent-disposal method:** Solvents generated during equipment decontamination will be drummed.

Heavy Equipment

- Power wash
- Steam clean
- **Water-disposal method:** Water generated during the decontamination of heavy equipment will be drummed.

7.2 DIAGRAM OF PERSONNEL-DECONTAMINATION LINE

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 7-1 illustrates a typical establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

8 SPILL-CONTAINMENT PROCEDURES

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and will be disposed of properly.

9 CONFINED-SPACE ENTRY

(Reference CH2M HILL SOP HS-17, *Confined Space Entry*)

No confined-space entry will be permitted. Confined-space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.

When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and informed of their hazards.

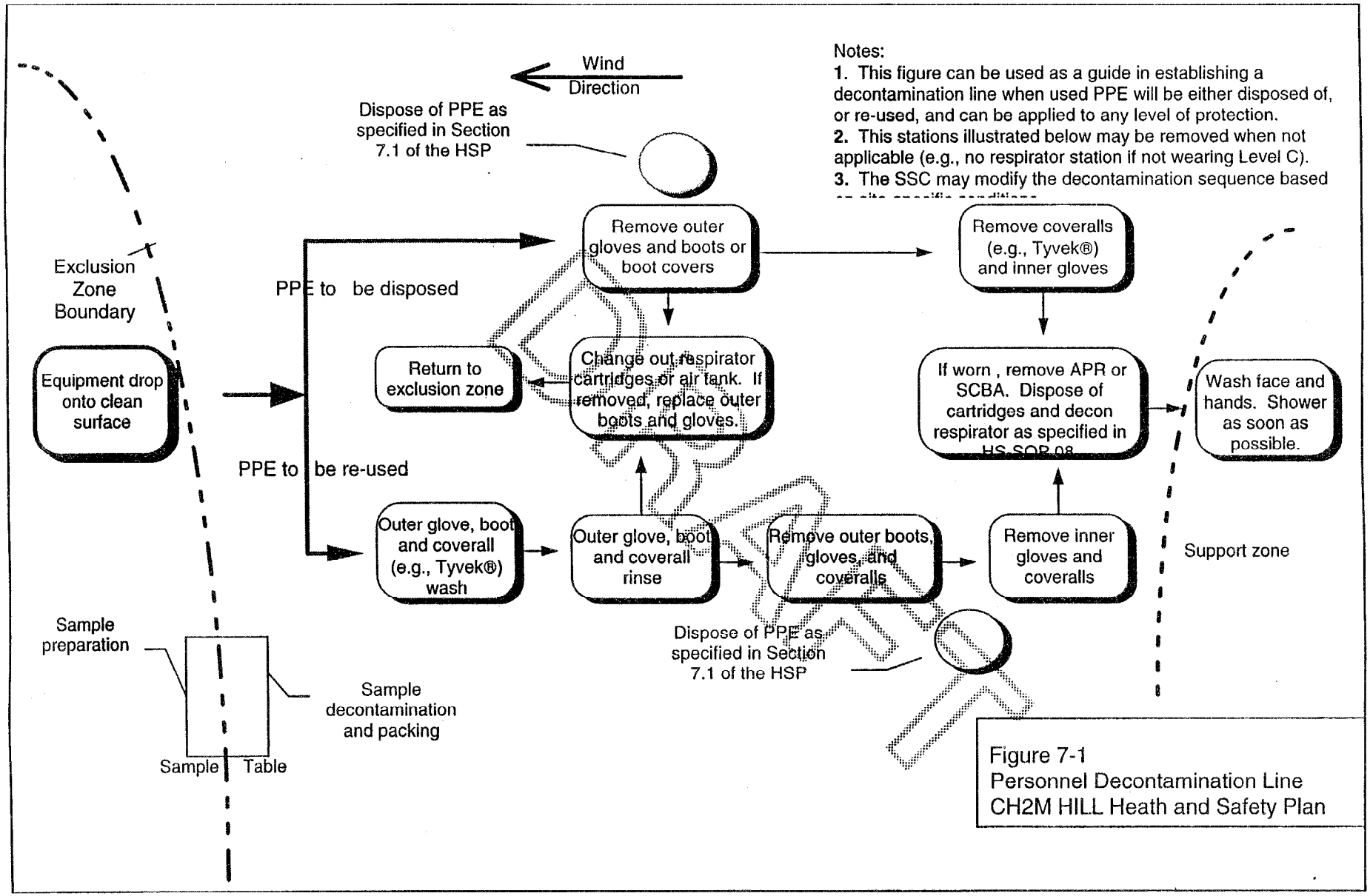


Figure 7-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

10 SITE-CONTROL PLAN

10.1 SITE-CONTROL PROCEDURES

- The site safety coordinator (SSC) will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of health and safety plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies. Refer to Section 8 of *Site Safety Notebook.*
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location at sites where project field offices, trailers, or equipment storage boxes are established. Posters can be obtained by calling either 800/548-4776 or 800/999-9111.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Determine wind direction.
- Establish work zones: support, decontamination, and exclusion zones. Delineate work zones with flags or cones as appropriate. Support zone should be upwind of the site.
- Establish decontamination procedures, including respirator-decontamination procedures, and test the procedures.
- Use access control at the entry and exit from each work zone.
- Store chemicals in appropriate containers.
- Make MSDSs available for onsite chemicals to which employees are exposed.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Establish procedures for disposing of material generated on the site.
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SSC is to conduct periodic inspections of work practices to determine the effectiveness of this plan -- refer to CH2M HILL SOP 18, *Health and Safety* Checklist, or Section 4 of *Site Safety Notebook.* Deficiencies are to be noted, reported to the HSM, and corrected.

10.2 HAZWOPER COMPLIANCE PLAN (Reference CH2M HILL SOP HS-17, *Health and Safety Plans*)

This section outlines procedures to be followed when certain activities do not require 24- or 40-hour training. ***Note, prior approval from the HSM is required before these tasks are conducted on regulated hazardous waste sites.***

- Certain parts of the site work may be covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated tasks must be included in subsection 2.2.1.
- Air sampling must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 3.8 and 6.2 for contaminant data and air sampling requirements, respectively.
- Non-Hazwoper-trained personnel must be informed of the nature of the existing contamination and its locations, the limits of their access, and the emergency action plan for the site. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements, including 29 CFR 1910.1200 (HAZCOM). Refer to subsection 3.7.1 for hazard communication requirements.
- Air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to volatile contaminants. Non-Hazwoper-trained personnel should be monitored whenever the belief is that there may be a possibility of exposure (e.g., change in site conditions), or at some reasonable frequency to confirm that there is no exposure. Refer to Section 6.1 for air monitoring requirements.
- Treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hours of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must leave the site.

If Hazwoper-regulated tasks are conducted concurrently with nonregulated tasks, non-Hazwoper-trained subcontractors must be removed from areas of exposure. If non-Hazwoper-trained personnel remain on the site while a Hazwoper-regulated task is conducted, the contaminant/exposure area (exclusion zone) must be posted, non-Hazwoper-trained personnel must be reminded of the locations of restricted areas and the limits of their access, and real-time monitoring must be conducted. Non-Hazwoper-trained personnel at risk of exposure must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.

11 EMERGENCY RESPONSE PLAN (REFERENCE CH2M HILL SOP HS-12, *EMERGENCY RESPONSE*)

11.1 PRE-EMERGENCY PLANNING

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with the facility and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Locate the nearest telephone; determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Identify and communicate chemical, safety, radiological, and biological hazards.
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Post site map marked with locations of emergency equipment and supplies, and post OSHA job-site poster. The OSHA job-site poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. Posters can be obtained by calling either 800/548-4776 or 800/999-9111.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Evaluate capabilities of local response teams where applicable.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, chemical and vapor releases.
- Review notification procedures for contacting CH2M HILL's medical consultant and team member's occupational physician.
- Rehearse the emergency response plan once before site activities begin, including driving the route to the hospital.
- Brief new workers on the emergency response plan.
- The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

11.2 EMERGENCY EQUIPMENT AND SUPPLIES

The SSC should mark the locations of emergency equipment on the site map and should post the map.

Emergency Equipment and Supplies	Location
First aid kit	Field vehicle
Eye wash	Field vehicle
Potable water	Field vehicle
Bloodborne-pathogen kit	Field vehicle
Additional equipment (specify)	None

11.3 EMERGENCY MEDICAL TREATMENT

- Notify appropriate emergency response authorities listed in sections 12 and 13 (e.g., 911).
- During a time of no emergency, contact CH2M HILL's medical consultant for advice and guidance on medical treatment.
- The SSC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Notify the field team leader and the project manager of the injury.
- Make certain that the injured person is accompanied to the emergency room.
- Notify the health and safety manager.
- Notify the injured person's human resources department within 24 hours.
- Prepare an incident report -- refer to CH2M HILL SOP 12, *Emergency Response and First Aid*, and Section 6 of *Site Safety Notebook*. Submit the report to the corporate director of health and safety and the corporate human resources department (COR) within 48 hours.
- When contacting the medical consultant, state that you are calling about a CH2M HILL matter, and give your name, your telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.

11.4 NONEMERGENCY PROCEDURES

The procedures listed above may be applied to nonemergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant.

- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name, your telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Follow these procedures as appropriate.

11.5 INCIDENT RESPONSE

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Account for personnel at the designated assembly area(s).
- Notify appropriate response personnel.
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

11.6 EVACUATION

- Evacuation routes will be designated by the SSC before work begins.
- Onsite and offsite assembly points will be designated before work begins.
- Personnel will leave the exclusion zone and assemble at the onsite assembly point upon hearing the emergency signal for evacuation.
- Personnel will assemble at the offsite point upon hearing the emergency signal for a site evacuation.
- The SSC and a "buddy" will remain on the site after the site has been evacuated (if possible) to assist local responders and advise them of the nature and location of the incident.
- The SSC accounts for all personnel in the onsite assembly zone.
- A person designated by the SSC before work begins will account for personnel at the offsite assembly area.
- The SSC will write up the incident as soon as possible after it occurs and will submit a report to the corporate director of health and safety.

11.7 EVACUATION ROUTES AND ASSEMBLY POINTS

Refer to the site map in Section 1. Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.

11.8 EVACUATION SIGNALS

Signal	Meaning
Grasping throat with hand	Emergency–help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

Client/Facility:

12 EMERGENCY RESPONSE

12.1 EMERGENCY RESPONSE TELEPHONE NUMBERS

SITE ADDRESS: Oceana Naval Air Station
Oceana Boulevard
Virginia Beach, Virginia

Phone: (757)
Cellular Phone: None

Police: Oceana Naval Air Station Police	**Phone:** (757) 433-2224
Fire: Washington Navy Yard Fire Department	**Phone:** (757) 433-3333
Ambulance: Washington Navy Yard Rescue Squad	**Phone:** (757) 433-2222
Water: Oceana Naval Air Station Utilities	**Phone:** (757) 433-3105
Gas: Oceana Naval Air Station Utilities	**Phone:** (757) 433-3105
Electric: Oceana Naval Air Station Utilities	**Phone:** (757) 433-3105

*When using a cellular phone outside the telephone's normal calling area, exercise caution in relying on the cellular phone to activate 911. When the caller is outside the normal calling area, the cellular service carrier should connect the caller with emergency services in the area where the call originated, but this may not occur. Telephone numbers of backup emergency services should be provided if a cellular phone is relied on to activate 911.

Hospital: Virginia Beach General Hospital **Phone:** (757) 481-8262

Route to Hospital: (Refer to Figure 12-1) From Site - Leave base from main entrance and turn left on Oceana Boulevard. Travel about 3 miles, turn left on Virginia Beach Boulevard, then right on First Colonial Road. Travel about 1.5 miles, Virginia Beach Hospital is on the right.

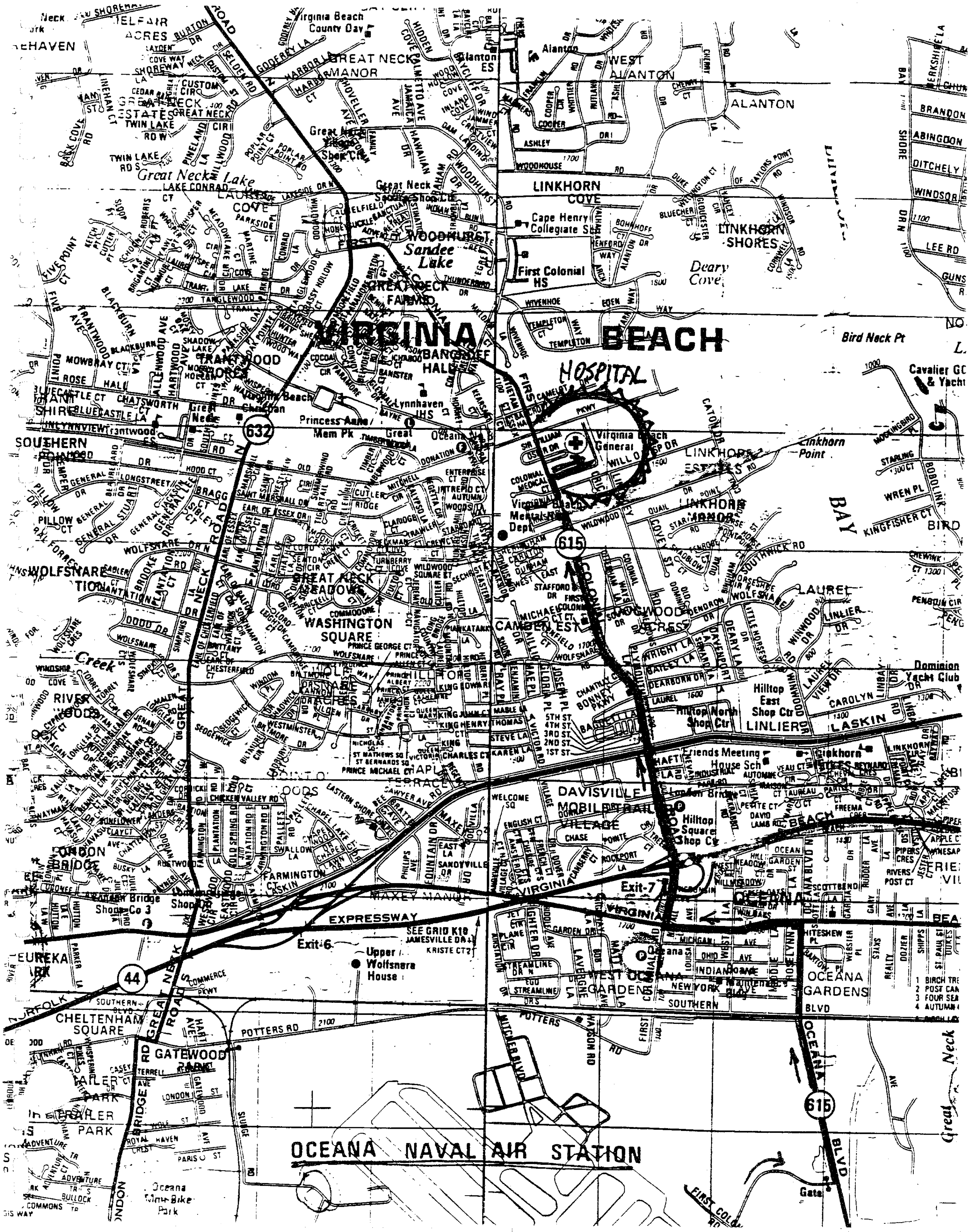
12.2 GOVERNMENT AGENCIES INVOLVED IN PROJECT

Federal Agency and Contact Name: United States Environmental Protection Agency - Vernon Butler
Phone: (215) 566-3425

State Agency and Contact Name: District of Columbia - Angelo Tompros
Phone: (202) 645-6080 ext-3011

Local Agency and contact Name: None
Phone:

Contact the project manager. Generally, the project manager will contact relevant government agencies.


VIRGINIA BEACH
HOSPITAL
Virginia Beach General
OCEANA NAVAL AIR STATION
GREAT NECK MANOR
GREAT NECK ESTATES
LINKHORN COVE
LINKHORN SHORES
LINKHORN MANOR
ALANTON
WEST ALANTON
Great Neck Lake
Sandee Lake
Deary Cove
Bird Neck Pt
Linkhorn Point
First Colonial HS
Cape Henry Collegiate Sch
Lynnhaven IHS
Princess Anne Mem Pk
Virginia Beach Mental Health Dept
WOLFSNARE
WASHINGTON SQUARE
GREAT NECK MEADOWS
CAMDEN EST
DOGWOOD ACRES
LAUREL
LINLIER
LASKIN
Hilltop East Shop Ctr
Hilltop North Shop Ctr
Hilltop Square Shop Ctr
Friends Meeting House Sch
DAVISVILLE MOBILE TRAILER VILLAGE
WEST OCEANA GARDENS
OCEANA GARDENS
OCEANA
LONDON BRIDGE
CHELTENHAM SQUARE
GATEWOOD PARK
EUREKA PARK
SOUTHERN POINTS
RIVER WOODS
Upper Wolfsnare House
Dominion Yacht Club
Cavalier GC & Yacht
EXPRESSWAY
VIRGINIA BEACH BLVD
GREAT NECK RD
FIRST COLONIAL RD
OCEANA BLVD
LONDON BRIDGE RD
POTTERS RD
SOUTHERN BLVD
LASKIN RD
Exit 6
Exit 7
SEE GRID K10
632
615
44
BAY
Great Neck

13 EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification **MUST** be made within 24 hours of the injury.

CH2M HILL Medical Consultant

Dr. Elayne F. Theriault
Environmental Medical Resources, Inc.
Atlanta, Georgia
800/229-3674 OR 770/455-0818
(After-hours calls will be returned within 20 minutes.)

Occupational Physician (Regional or Local)

Dr. Laura Staton
46440 Benedict Drive, Suite 108
Sterling, Virginia 22170
703/444-5656

Corporate Director Health and Safety

Name: Mollie Netherland/SEA
Phone: 206/453-5005

Site Safety Coordinator (SSC)

Name: Don Martinson/WDC
Phone: 703/471-1441

Medical and Training Administrator

Name: Cyndi Carel/SEA
Phone: 206/453-5005

Regional Manager

Name: Dick Bedard/BOS
Phone: 617/723-9036

Health and Safety Manager (HSM)

Name: John Longo/NJO
Phone: 201/316-9300

Project Manager

Name: Jack Robinson
Phone: 703/471-1441

Radiation Health Manager (RHM)

Name: David McCormack/SEA
Phone: 206/453-5005

Regional Human Resources Department

Name: Michelle Riley-Jones
Phone: 703/471-1441

Client

Name: Mr. Jim Harris
Phone: 757/322-4776

Corporate Human Resources Department

Name: Julie Zimmerman/COR
Phone: 303/771-0900

Federal Express Dangerous Goods Shipping

Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods

Phone: 800/255-3924

Worker's Compensation and Auto Claims

GAB Business Services, Inc.
Phone: 800/747-7222 After hours 800/621-5410

Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

14 APPROVAL

This site-specific health and safety plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

14.1 ORIGINAL PLAN

WRITTEN BY: Don Martinson/NJO **DATE:** 6/12/97

APPROVED BY: Laura Johnson/NJO **DATE:** 6/24/97

Laura Johnson

14.2 REVISIONS

REVISIONS MADE BY: **DATE:**

REVISIONS TO PLAN:

REVISIONS APPROVED BY: **DATE:**

15 DISTRIBUTION

Name	Office	Responsibility	Number of Copies
Jerri McCauslin	COR	Senior Program Assistant	1
John Longo/Laura Johnson	NJO	Health and Safety Manager/Approver	1
Jack Robinson	WDC	Project Manager	1
Don Martinson	WDC	Site Safety Coordinator	1
Client	NA	Client Project manager	

16 ATTACHMENTS

Attachment 1: Employee Signoff
Attachment 2: Applicable Material Safety Data Sheets

Attachment 1
Employee Signoff

EMPLOYEE SIGNOFF

The employees listed below have been given a copy of this health and safety plan, have read and understood it, and agree to abide by its provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE AND DATE

Attachment 2
Material Safety Data Sheets