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FINAL CORRECTIVE MEASURES STUDY WORK PLAN - SWMU 74

For NAVAL ACTIVITY PUERTO RICO
EPA I.D. No. PR2170027203
CEIBA, PUERTO RICO

Prepared for:

Department of the Navy
NAVFAC SOUTHEAST
North Charleston, South Carolina

Prepared by:

Baker

Michael Baker Jr., Inc.
Moon Township, PA

Contract No. N62470-07-D-0502
DO 0002

March 4, 2011

IQC for A/E Services for Multi-Media Environmental Compliance Engineering Support

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DELIVERY ORDER 0002

Prepared by:

MICHAEL BAKER JR., INC.
Moon Township, Pennsylvania

I certify under penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that this document and its attachments were prepared either by me personally or under my direction or supervision in a manner designed to ensure that qualified and knowledgeable personnel properly gather and present the information contained therein. I further certify, based on my personal knowledge or on my inquiry of those individuals immediately responsible for obtaining the information, that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowingly and willfully submitting a materially false statement.

Signature: Mark E. Davidson

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Date: **March 4, 2011**

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LIST OF ACRONYMS AND ABBREVIATIONS

APA	Aerial Photography Analysis
AQUIRE	Aquatic Toxicity Information Retrieval
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
BAF	Bioaccumulation Factor
Baker	Baker Environmental, Inc.
BCF	Bioconcentration Factor
bgs	below ground surface
BW	Body Weight
CAOs	Corrective Action Objectives
CCME	Canadian Council of Ministers of the Environment
CERCLA	Comprehensive Environmental Recovery, Compensation, and Liabilities Act
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
CNO	Chief of Naval Operations
COC	Contaminant of Concern
COPC	Chemical of Potential Concern
DFM	Diesel Fuel Marine
D.I.	deionized water
DI	Dietary Intake
DO	Delivery Order
DPT	Direct Push Technology
DRO	Diesel Range Organics
EC_{50}	Median Effective Concentration
Eco-SSL	Ecological Soil Screening Level
ECP	Environmental Condition of Property
ERA	Ecological Risk Assessment
FC_{xi}	Maximum Concentration of Chemical x in Food Item i
FCV	Final Chronic Value
FID	Flame Ionization Detector
FIR	Food Ingestion Rate
GRO	Gasoline Range Organics
GPS	Global Positioning System
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Table
HM	Hazardous Materials
HQ	Hazard Quotient
IRIS	Integrated Risk Information System
J	data qualifier: the analyte was positively identified; however, the concentrations value is an estimate

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

K_d	Adsorption Coefficient
K_{oc}	Organic Carbon Partition Coefficient
K_{ow}	Octanol-Water Partition Coefficient
LC_{50}	Median Lethal Concentration
LD_{50}	Median Lethal Dose
LOAEL	Lowest Observed Adverse Effect Level
LOEC	Lowest Observed Effect Concentration
LOEL	Lowest Observed Effect Level
MATC	Maximum Acceptable Toxicant Concentration
MCLs	Maximum Contaminant Levels
MHSPE	Ministry of Housing, Spatial Planning and Environment
MS/MSD	Matrix Spike/Matrix Spike Duplicate
mg/kg	milligrams per kilogram
mg/kg-bw/day	milligram per kilogram body weight per day
mg/L	milligrams per liter
NAPR	Naval Activity Puerto Rico
NAVFAC	Naval Facilities Engineering Command
NAWQC	National Ambient Water Quality Criteria
NOAA	National Oceanif and Atmospheric Administration
NCP	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
NOEL	No Observed Effect Level
NSRR	Naval Station Roosevelt Roads
NTR	Navy Technical Representative
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PDS	Proportion of Diet Composed of Soil/sediment
PI	Photo Indentified
PID	photo ionization detector
PMO	Program Management Office
POL	Petroleum, Oils and Lubricant
PPRTV	Provisional Peer Reviewed Toxicity Value
PREQB	Puerto Rico Environmental Quality Board
PRG	Preliminary Remedial Goal
PR LRA	Puerto Rico Local Reuse Authority
PSI	Physical Site Inspection
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
R	data qualifier: the sample result is rejected; the presence or absence of the analyte cannot be verified
RAGS	Risk Assessment Guidance Superfund

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RR	Records Review
SCV	Secondary Chronic Value
SDWA	Safe Drinking Water Act
SE	Southeast
SF	Slope Factor
SOP	Standard Operating Procedure
SQUIRT	Screening Quick Reference Table
SVOC	Semi-volatile organic compound
SWMU	Solid Waste Management Unit
TOC	Total organic carbon
TPH	Total Petroleum Hydrocarbons
TVHC	Total Volatile Hydrocarbons
U	data qualifier: the analyte was analyzed for, but not detected above the reported sample quantitation limit
UJ	data qualifier: the analyte was analyzed for, but not detected; the reported sample quantitation limit is qualified as estimated
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compound
VP	Valve Pit

1.0 INTRODUCTION

This work plan presents the technical approach for conducting a Corrective Measures Study (CMS) for Solid Waste Management Units (SWMU) 74 - Fuel Pipelines and Hydrant Pits, located at Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico. This CMS work plan has been prepared by Michael Baker Jr., Inc. (Baker), for the Navy Base Realignment and Closure (BRAC) Program Management Office (PMO) Southeast (SE) office under contract with the Naval Facilities Engineering Command (NAVFAC), SE (Contract Number N62470-07-D-0502, Delivery Order [DO] 0002). This work plan was developed in accordance with the Resource Conservation and Recovery Act (RCRA) 7003 Administrative Order on Consent (United States Environmental Protection Agency [USEPA] Docket No. 02-2007-7301).

1.1 NAPR Description and History

NAPR, formerly known as the Naval Station Roosevelt Roads (NSRR), occupies over 8,800 acres on the northern side of the east coast of Puerto Rico, along Vieques Passage with Vieques Island lying to the east about 10 miles off the harbor entrance. NAPR also occupies the immediately adjacent islands of Piñeros and Cabeza de Perro, as presented on Figure 1-1. The northern entrance to NAPR is about 35 miles east along the coast road (Route 3) from San Juan. The property consists of 3,938 acres of upland (developable) property and 4,955 acres of environmentally sensitive areas including wetlands, mangrove, and wildlife habitat. The closest large town is Fajardo (population approximately 37,000), which is about 5 miles north of NAPR off Route 3. Ceiba (population approximately 17,000) adjoins the west boundary of NAPR (see Figure 1-1).

The facility was commissioned in 1943 as a Naval Operations Base, and finally re-designated a Naval Station in 1957. Naval Station Roosevelt Roads (NSRR) operated as a Naval Station from 1957 until March 31, 2004. NSRR has undergone operational closure as of March 31, 2004 and has been designated as Naval Activity Puerto Rico. NAPR will continue until the real estate disposal/transfer is completed. The mission of NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal of the property.

In anticipation of operational closure of NSRR the Naval Facilities Engineering Command, Atlantic Division (LANTDIV) prepared Phase I/Phase II Environmental Condition of Property (ECP) Reports to document the environmental condition of NSRR. Section 8132 of fiscal year 2004 Defense Appropriations Act, signed into law on September 30, 2003, directed that NSRR be disestablished within 6 months, and that the real estate disposal/transfer be carried out in accordance with procedures contained in the BRAC Act of 1990. This legislation requires that the base closure be conducted in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended by the Community Environmental Response Facilitation Act (CERFA).

The Draft Phase I Environmental Condition of Property Report dated March 31, 2004 (LANTDIV, 2004a) identified new sites at NAPR based on the results of a review of records, an analysis of historic aerial photographs, physical site inspections, and interviews with persons familiar with past and current operations and activities. The new ECP sites had not been previously identified or investigated under existing environmental program areas. A Phase II ECP field investigation was conducted in 2004 to conduct environmental sampling to determine if a release/disposal actually occurred at any of the Phase I ECP sites recommended for further evaluation in the Phase I ECP and, if so, whether any potential risk to human health was present. The Final Phase I/II Environmental Condition of Property Report recommended additional

sampling (to be undertaken as part of the RCRA Program) at several sites to permit a more detailed assessment (NAVFAC Atlantic, 2005).

The USEPA issued a RCRA 7003 Administrative Order (Environmental Protection Agency [EPA] Docket No. RCRA-02-2007-7301), which identifies SWMU 74 (formerly referred to as ECP 20) having documented releases of solid and/or hazardous waste and hazardous constituents and requires an acceptable work plan to complete site characterization and a CMS to determine the final remedy. Following a public comment period the Consent Order became effective on January 29, 2007.

1.2 Site Background

The following subsections present a brief description and background on the SWMU that is addressed in this CMS work plan.

SWMU 74 also includes the previously designated Environmental Condition of Property (ECP) Site 20, which is located in two areas, within the eastern and northern part of NAPR as shown on Figure 1-2. The ECP site consisted of specific portions of the JP-5 and diesel fuel marine (DFM) fuel pipelines, and the aircraft hydrant refueling pits. SWMU 74 encompasses an area of investigation that is more comprehensive than the ECP, and it includes all of the JP-5 and DFM fuel pipelines spanning the Aircraft Hydrant Refueling System in the west to the piers in the east, but excluding the Tow Way Fuel Farm. It is estimated that approximately 60,000 feet of pipelines are present in SWMU 74, based on information provided in a fuel pipeline and tank cleaning Project Completion Report (AGVIQ-CH2MHill, 2005). SWMU 74 does not include sediments in Ensenada Honda, as these have been designated as AOC D, and have been extensively investigated in the past (Baker, 2003)

In 1995, NAVFAC, Atlantic Division evaluated the integrity of specific portions of the base petroleum, oils, and lubricant (POL) system. This evaluation identified leaks at two locations along the JP-5 line and at selected valve pits, and indicated historic petroleum product impacts to soil at various locations throughout the tested portion of the JP-5 and DFM pipelines. No action has since been taken at these locations. In addition, interviews indicated that numerous small spills and leaks of jet fuel have occurred at the aircraft hydrant refueling pits since they went into operation in the early 1960s. Seven areas were identified for investigation and assessment of impacts to the environment.

The Phase I/II ECP investigation performed in 2004 observed that there were no apparent areas of surficial staining or stressed vegetation in the seven areas investigated (NAVFAC Atlantic, 2005). Appendix A provides photographs that were obtained during the investigation to show site features/conditions. The seven areas investigated consisted of the following:

- Relatively flat area at the airfield north of Hangar 200, in the vicinity of valve pit (VP) - 2).

- Flat grassy area located south of Valley Forge Road, and just east of Forrestal Drive. This area was along the edge of thick secondary growth vegetation.

- Flat area located just south of Forrestal Drive in the southeastern portion of the site, as presented in Photograph A-1. As presented in the photograph, this portion of the site contains grass that is routinely cut by base personnel.

- A flat lying area located just south of Forrestal Drive and east of SWMU 60 (ECP Site

6). This area was along the edge of thick secondary growth vegetation.

- A flat lying area located north of Forrestal Drive and east of the baseball field. This

area was located adjacent to VP-8.

- Photograph A-2 presents another area of the site investigated consisting of an overgrown grassy area located along a power line north of SWMU 59 (ECP Site 5).

- A relatively flat lying area consisting of overgrown grass located northwest of SWMU 59, along the road that intersects both Forrestal Drive and Valley Forge Road.

It should be noted that VP-6 and VP-6A that were suspected to be located in the vicinity of two of the areas investigated, are no longer present, and the lines were decommissioned. This information was obtained through an interview with NAPR personnel (Soto, 2004).

The 2004 Phase I/II ECP investigation conducted at this site indicated that various environmental media were impacted by past operations in the area. These impacts are discussed further in Section 1.3. This CMS work plan is designed to provide a guide for selecting corrective measures to mitigate human health and ecological risks associated with contamination related to site operations.

1.3 Investigative History and Basis for the Work Plan

SWMU 74, which is comprised of multiple suspected spill areas and leaky valves and pipe runs located between Offsite Airfield and Pier 1, was first listed as a SWMU in the RCRA 7003 Administrative Order on Consent. SWMU 74 (originally known as ECP Site 20) was included in the 2004 Phase II ECP investigation performed by Baker.

As presented in the Draft Phase II ECP Work Plan (LANTDIV, 2004b), the sample locations at this site were field located with a hand held global positioning system (GPS) receiver. As previously mentioned, there were no apparent areas of surficial staining or stressed vegetation in the areas investigated. Therefore, the originally proposed sample locations within the work plan were not moved.

A total of seven soil borings were advanced near suspected leaky valves and pipeline runs as presented on Figure 1-3, which also shows locations of releases (total volatile hydrocarbon or TVHC impacts) from previous (pre-1995) tests of the system. Subsurface soil samples were collected from each boring location using a Macro Core sampler in conjunction with a Geoprobe® rig with direct push technology (DPT) methods. Subsurface soil samples were collected from two-foot intervals (i.e., 1 to 3 feet bgs, 3 to 5 feet bgs, etc…) down to the groundwater interface through the use of a Macro Core sampler in conjunction with a Geoprobe® rig with DPT methods. The depth of the soil borings at this site ranged from 10 feet bgs to a maximum of 22 feet bgs at 20E-SB05. All subsurface soil samples were screened in the field utilizing a flame ionization detector (FID) with the results recorded in the field logbook. The screening results were compared against background to indicate if the soil has been impacted by past operations.

Soil samples submitted to the fixed-base laboratory included seven subsurface soil samples (20E-SB01-02, 20E-SB02-02, 20E-SB03-04, 20E-SB04-04, 20E-SB05-05, 20E-SB06-05, and 20E-SB07-06), one from each boring. The sampling depth intervals are shown on Tables B-1 and B-2 of Appendix B. These samples were submitted to the fixed-base analytical laboratory for analysis of Appendix IX Volatile Organic Compounds (VOCs), Appendix IX Semivolatile Organic Compounds (SVOCs), total petroleum hydrocarbons (TPH) diesel range organics (DRO) and gasoline range organics (GRO).

A groundwater program followed the soil sampling program. Based on the FID levels observed at soil boring locations 20E-SB05 and 20E-SB06, as well as the decision tree presented in the work plan, the decision was made to install one temporary monitoring well at each of these two locations as presented on Figure 1-3. The temporary monitoring wells were installed and groundwater samples (20E-GW05 and 20E-GW06) were collected and submitted to the fixed-base analytical laboratory for Appendix IX VOCs, SVOCs, inorganics, as well as TPH DRO and GRO. The inorganic analysis requested was for dissolved metals only.

1.3.1 Findings of the Investigations

The following paragraphs present a summary of the findings for the sampling and analysis investigation performed at SWMU 74 mentioned above. A complete detailed evaluation of the findings from the previous investigations at SWMU 74 can be found in the Final Phase I/II Environmental Condition of Property Report (NAVFAC Atlantic, 2005).

A summary of the analytical results as published in the ECP report can be found in Tables B-1 through B-4 of Appendix B of this work plan.

It should be noted that SWMU 74 encompasses multiple geologic regions. Borings 20E-SB02 and 20E-SB06 represent near-shore flat land, exhibiting a fill/marine sediment/bedrock sequence. Groundwater was observed at boring 20E-SB06 beginning in a marine clay with some sand and gravel (10-feet bgs). Groundwater was observed at boring 20E-SB02 beginning in a marine sand (5-feet bgs). Borings 20E-SB03, 20E-SB04, and 20E-SB05 represent upland areas exhibiting a fill/residuum/bedrock sequence. Bedrock was encountered between 5- and 12-feet bgs at these borings. Groundwater was observed in the weathered bedrock fractures. At 20E-SB05 evidence of groundwater was not observed during drilling, but did flow slowly into temporary well 20E-TW05. Groundwater was measured in the well to be approximately 10-feet bgs two days after installation. Groundwater was encountered in weathered bedrock at boring 20E-SB04 between 11.5- and 13-feet bgs. Probe refusal occurred at 20E-SB03 in weathered bedrock before groundwater was encountered (15-feet bgs). Boring 20E-SB01 represented the inland flatland area. Clay and sandy fill was observed at this boring, with groundwater beginning at 4.5-feet bgs. Although boring 20E-SB07 was located near the harbor, it reflected an upland geology (the fill/residuum/bedrock sequence). Based on the presence of an excavated hill along Forrestal Drive in this area, this boring appears to be in an excavated hill area (like parts of ECP Site 18). Probe refusal occurred at 20E-SB07 in weathered bedrock before groundwater was encountered (approximately 15-feet bgs).

Evidence of fuel line impacts was observed in two borings (20E-SB05 and 20E-SB06). At 20E-SB05, a strong fuel odor and staining were observed with elevated FID readings in the residual clay and bedrock, from a depth of approximately 8- to 20-feet bgs. At 20E-SB06, a slight fuel odor (with a slight FID response and no staining) was observed from a depth of approximately 10- to 11.9-feet bgs.

The VOCs and SVOCs detected are associated with fuel contamination from past and present activities at this site. Location 20E-SB05 is associated with Valve Pit No. 8. It is likely that some leakage from this valve pit has occurred. Previous investigations near this location include those conducted at Tank 1995, where the larger fuel tanks are located just to the east of 20E-SB05. At the time of the ECP investigation, monitoring wells from this site located near 20E-SB05 had not indicated any free product in them during the previous six months. No free product has been observed since March 2006 (Tetra Tech, 2007).

The analytical results for soil and groundwater were compared to risk-screening criteria as summarized in Tables B-1 through B-4 of Appendix B. None of the organic compounds exceeded EPA Region III Residential risk based concentrations (RBCs) except dibenzo(a,h) anthracene at 20E-SB05. This was also the only location where groundwater concentrations of certain VOCs (ethylbenzene, benzene, and xylene) exceeded EPA Region III Tap Water RBCs. The concentration of ethylbenzene also exceeded its Federal MCL and its PR Water Quality Standard. Among inorganic compounds, arsenic, chromium, copper and vanadium exceeded their EPA Region III Residential RBCs in soil, and concentrations of copper and vanadium exceeded their EPA Region III Tap Water RBCs. Arsenic (at 20E-SB02) and copper (at 20E-SB04) also exceeded twice the average detected background concentrations established for NAPR in subsurface soil. Although the concentrations of vanadium in subsurface soil exceeded their RBCs, they did not exceed background levels. Lead in groundwater also exceeded its EPA action level and the Puerto Rico Water Quality Standard of 0.015 mg/L at one location (20E-SB05). This is also the location where the relatively higher fuel-related organic compounds were detected.

From the detections of fuel compounds and exceedance of criteria for ethylbenzene, benzene, xylene, and lead in the groundwater, it was concluded that the groundwater near 20E-SB05 has been impacted by activities occurring at this site. However, the soil at this location did not appear to be contaminated significantly above any RBCs. Nevertheless, because of the releases and the findings of the investigation, the ECP recommended further investigation under the RCRA Corrective Action Program. The recommendation in the ECP forms the basis for this CMS work plan.

1.4 Organization of the CMS Work Plan

This CMS Work Plan is organized into eleven sections. Section 1.0, the Introduction, is designed to introduce the reader to the basis for the work plan and a summary of the site status. Section 2.0 provides the objectives and the corrective measure standards being utilized for this project. The CMS Investigations to be performed at SWMU 74 is discussed in Section 3.0, with the corresponding CMS Investigation reporting discussed in Section 4.0. The ecological risk assessment to be performed is described in Section 5.0. Section 6.0 establishes the corrective action objectives with the identification of COCs discussed in Section 7.0. The tasks to be accomplished as part of the Corrective Measure Study are described in Section 8.0. The project schedule is provided in Section 9.0. Section 10.0 provides the project organization. Section 11.0 provides the references cited in this report.

2.0 CMS OBJECTIVES AND CORRECTIVE MEASURE STANDARDS

This section discusses the objectives of this CMS and the standards to assess the performance of the selected corrective measure. There are two distinct types of work associated with this CMS, 1) a CMS Investigation to further delineate the contamination at this SWMU and the associated report on these findings, and 2) the development of the corrective measures for SWMU 74. Development of Corrective Action Objectives (CAOs) for ecological receptors (see Section 5.8) and human health receptors (see Sections 6.4 through 6.6) are to be developed in the CMS.

2.1 Objectives

As noted above, there are two distinct tasks associated with the CMS: a CMS Investigation and the development of Corrective Measures for the CMS. The objectives of this CMS investigation, (see Sections 3.0 through 7.0 of this work plan) are as follows:

- To identify those tasks required for the performance of a CMS Investigation to further delineate the contamination which poses a risk at SWMU 74.

- To identify realistic ecological and human health exposure pathways from contamination that may be present at SWMU 74.

- To identify those tasks required for the evaluation and delineation of the contamination in the soil and groundwater that may pose a risk at SWMU 74.

The objectives of the development of the corrective measures to address the contamination present at this SWMU (see Section 8.0) are as follows:

- To develop the human health (see Sections 6.4 through 6.6) and ecological (see Section 5.8) CAOs for SWMU 74.

- To identify those tasks required for assisting in screening applicable remedial technologies for SWMU 74.

This work plan documents the scope and objectives of a full CMS for SWMU 74, as well as the activities required to implement the program. The work plan serves as a tool for assigning responsibilities and establishing the project schedule and costs. The report for this investigation will be in the form of a "Task I" CMS Report with establishment of corrective action objectives (CAOs) for SWMU 74.

If, as a result of the CMS investigation, a streamlined CMS appears appropriate, approval for that approach will be sought in a "CMS Investigation Report." A highly focused or streamlined CMS may be appropriate for SWMU 74 since this site may have "straightforward remedial solutions" where standard engineering solutions can be applied that have proven effective in similar situations (USEPA, 1994). Therefore, the screening of clean-up technologies, normally conducted in a CMS, may not occur.

2.2 Corrective Measures Standards

Corrective measure standards that may be applicable to SWMU 74 will be developed as part of the CMS "Task I" reporting effort (see Section 8.1). Once the possible corrective measures are selected for applicability to this site, the appropriate standards will be developed.

The corrective measure standards to be considered will include the applicable Federal Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (SDWA) and the Puerto Rico Environmental Quality Board (PREQB) standards. The RCRA Corrective Action Program requirements under Code of Federal Regulations (CFR) (40 CFR 264.100) will also be reviewed for applicability to the site. In addition, ecological risks will be considered in the development of corrective measures standards by incorporating standards that are determined to be protective of ecological receptors by the risk assessment process described in Section 5.0.

Background inorganic concentrations will be considered in establishing exceedances of site contamination when appropriate. The *Revised Final Summary Report for Environmental Background Concentrations for Inorganics* (Baker, 2006a) will be used.

All of the above information to be considered for the corrective measure standards will be taken into account when the corrective action objectives for human health and the environment are developed as discussed in Section 6.0.

The corrective measures standards correlate with the development of the corrective action objectives. These standards are utilized during the selection of chemicals of potential concern (COPCs) as described in Sections 5.0 and 6.0.

3.0 CMS INVESTIGATION

This section of the work plan describes the technical elements of the field investigation for SWMU 74.

The objectives of this CMS Investigation are as follows:

- To delineate the extent of inorganic and organic contamination, if any, in the surface soils
- To delineate the extent of inorganic and organic contamination, if any, in the subsurface soils
- To determine impact, if any, to the groundwater in areas near SWMU 74
- To evaluate exposure pathways that may be present at SWMU 74

No investigation of the surface water and sediments will be done. AOC D consists of the Ensenada Honda sediments, and these have been designated Corrective Action Complete without controls. SWMU 7/8 investigations have determined that no contamination is present in the Ensenada Honda due to this SWMU (Baker, 2003). In addition, pipelines which extend over the water on the piers are visible and have not had any leaks or spills associated with them.

It is expected that this investigation will take place in two phases. The first phase will include sampling in all areas along pipelines and near valve pits in order to determine if releases have occurred and if they have impacted the soils and groundwater. The second phase will be a follow on investigation to determine the extent of contamination only in areas found to be impacted during the first phase.

Table 3-1 contains the general sampling matrix proposed for the first phase of the CMS Investigation Work Plan. It is proposed to collect surface and subsurface soil and groundwater samples in locations near and around the pipelines and valve pits to evaluate if any releases impacted soils in locations near the pipelines and valve pits. Surface staining or other evidence of environmental impact will also be noted during the investigation. Groundwater samples will be taken at selected soil sample locations in order to evaluate if groundwater has been impacted near SWMU 74.

3.1 Phase I CMS Investigation

Surface and subsurface soil sampling and groundwater sampling will be conducted as part of the Phase I CMS Investigation as discussed in the following subsections. Other field activities (i.e., utility clearance, IDW management, decontamination, surveying, health and safety procedures, and chain of custody), Data validation, and field QA/QC required for both the Phase I and Phase II CMS investigations are provided in Sections 3.3 through 3.5, respectively.

3.1.1 Surface and Subsurface Soil Sample Locations

It is expected that approximately 400 locations will be sampled during Phase I. This number represents one sample location for every 100 feet of pipeline trench length, as well as two additional borings at approximately 27 valve pit locations. All samples will be analyzed for Appendix IX VOCs and metals, TPH DRO, and TPH GRO. In addition, 15 percent of the samples will be analyzed for low level PAHs. These samples will be selected based on possible presence of contamination through PID reading, visual inspection, or presence of odor, as well as by random selection. Figure 3-1 is a map locator for the different areas of SWMU 74 that will be investigated. Figures 3-2 through 3-4 show the approximate sampling locations. All sample

locations will be verified in the field using as-built drawings of pipelines such as the Project Completion Report (AGVIQ-CH2MHill, October 2005), excerpts of which are available in Appendix C. Some of the valve pits may have been removed and replaced by above-ground valves or blind flanges. The locations of the above-ground valves/flanges will be used as the indicator for a previous valve pit. The existing valve pits can be located by identifying the concrete valve boxes (several feet in width and length) that should be visually apparent. Where pipelines traverse beneath a small, above-ground structure such as concrete pad or containment basin, or near a building foundation, the nearest location within ten feet of the proposed location that does not penetrate or interfere with these structures will be selected. For the case of pipelines located below large concrete areas or surfaced parking lots, no adjustment to sampling location will be made. As noted above, sample locations will be spaced according to the pipeline trench length therefore, if a JP-5 fuel line and a DFM fuel line traverse within the same trench, then the sample locations will not be duplicated. Similarly, where pipeline and valve pit sample locations overlap, only one sample location will suffice.

The soil samples will be collected as follows. At every location, two subsurface soil samples will be collected. Surface soil samples will be collected at a frequency of one in ten locations because the pipelines are buried deeper and any release is less likely to have impacted soil shallower than the depth of the pipeline.

All sampling locations will be flagged in the field and will be surveyed for horizontal location utilizing a portable GPS unit. In addition, all valve pit locations will be surveyed for horizontal location using a portable GPS unit.

The surface soil samples will be obtained from a depth of 0 to 1 foot bgs with a stainless steel spoon (see SOP F102 in Baker, 1995). The subsurface soil samples will be obtained with the 66DT Geoprobe® drill rig capable of direct push and augering (see SOP F102 in Baker, 1995).

A boring log will be maintained indicating, lithology, water occurrence, and miscellaneous observations. Soil samples will be screened initially at 6-inch intervals with a photoionization detector (PID) to develop a semi-quantitative profile. Soil samples will be collected continuously from ground surface to the water table using 5-foot long Macro Core Sampler, with two subsurface soil samples being collected for fixed-base laboratory analysis. One subsurface soil sample per location will be collected from a depth of any suspected volatile organic contamination, determined by the PID screening. The presence of VOCs will also be used as an indicator of other fuel-related SVOCs. The other subsurface soil sample will be collected from the depth just above the water table, but not exceeding 10 feet bgs. Surface soil samples (up to 1 foot bgs) are intended to provide data for evaluation of potential ecological exposure concerns. Surface soil and subsurface soil (up to a depth of 10 feet bgs) are intended to provide data for evaluation of potential human health exposure concerns.

The soil boring samples will be labeled consecutively (beginning with 74SB01) in a manner consistent with previous sample designations at NAPR. Extensions to the sample identification will reflect the depth at which the sample was obtained. For the purposes of this work plan, two-foot discrete depths will be used. Sample identification extensions will follow the pattern shown below.

74SB01-00	SMWU 74 Sample
74SB01-00	Soil Boring Sample
74SB01-00	Soil boring location identifier
74SB01-00	0 to 1 foot bgs (surface soil) sampling interval

Subsurface soil samples will be designated as follows:

74SB01-01	First subsurface sampling interval, 1-3 feet bgs
74SB01-02	Second subsurface sampling interval, 3-5 feet bgs, and so on.

The actual sample depth (sampling interval) will be determined in the field as noted above.

Following sample collection each borehole will be backfilled with the remaining soil to the extent practicable, in order to minimize the burden of waste disposal. The surface of the borehole will then be patched with bentonite grout.

Samples will be packed in ice and shipped next day air to the fixed-base laboratory. Because of previously encountered delays associated with sample shipments from Puerto Rico to the United States, additional insurance to cover re-sampling costs should be claimed on the bill of laden. At least one member of the field team will remain on the island until verification by the laboratory of receipt of all shipments. This will minimize any potential re-sampling costs associated with mobilization. Tracking numbers for each shipment will be forwarded to the project manager for assisting in verification of receipt.

All analysis at the laboratory will be performed using current methodologies as presented in Table 3-2. The specific laboratory and third party data validator are to be determined. All analytical work that is conducted on the mainland of the U.S.A. must be certified by a licensed Puerto Rico chemist.

3.1.2 Groundwater Samples

Groundwater samples will be obtained from approximately one in ten soil boring locations (or more frequently, if determined by field observations/readings) in order to evaluate contamination that may have migrated downward toward the aquifer from the pipeline. Locations for temporary monitoring wells will be selected more frequently if elevated PID readings and or other observations (visual observations of staining, free-product, obvious odors, etc.) are noted in any subsurface boring soil core. For example if, after installing a temporary well at location A, the next soil boring at location B, located 100 feet away, also indicates that contamination is present, another well will be installed at this location. It is expected that, on the average, monitoring wells will be located along the pipeline length approximately every 1000 feet corresponding to 1 in every 10 borings. In addition, groundwater samples will be obtained from all soil boring locations around valve pits. Samples will be obtained from the top of the water table and all samples will be analyzed for Appendix IX VOCs, total and dissolved inorganics, and TPH GRO/DRO. In addition, 15 percent of the samples will be analyzed for low level PAHs. These samples will be selected based on possible presence of contamination through PID reading, visual inspection, or presence of odor in the soil boring at that location, as well as by random selection.

The temporary monitoring wells will be advanced to a maximum depth of approximately 30 feet bgs using the 66DT Geoprobe® rig capable of direct push and augering. These completed temporary monitoring wells will consist of a 1.5- inch (inside diameter), Schedule 40 polyvinyl chloride (PVC), riser with a ten-foot pre-packed sand filter screens straddling the water table, wherever the water table is noted to be present. It should be noted that many different geologic conditions are present in the SWMU 74 areas, ranging from soft clays to competent bedrock. The 66DT Geoprobe® rig is expected to be able to direct push and/or auger to depths below the water table in order to facilitate well installation, no matter what the geologic conditions. Each temporary well will be sealed with plastic sheeting at the surface to prevent inflow of surface water or accidental introduction of foreign material into the hole. The annulus around the riser

(above the filter) will be filled with bentonite chips and the risers will be cut flush to the ground. The wells will be completed with a concrete pad (approximately 1 foot in diameter, and 4 inches deep), and a metal flush-mount protective covering with a bolted-down lid. A groundwater sample will be obtained from each temporary well after allowing the groundwater to enter the screen overnight. The temporary wells will not be developed.

The groundwater will be sampled using a low-flow sampling technique to the extent that actual recovery rate at each location may allow. Appendix D includes a detailed description of the low flow sampling technique. In certain locations, adequate groundwater volume for sampling may require more than a day of recovery. Field parameters of pH, temperature, turbidity, conductivity, dissolved oxygen, and oxidation-reduction potential will be obtained with appropriate instrumentation during sampling if enough volume of groundwater is present. The groundwater samples will be placed into appropriate laboratory supplied containers. The groundwater sampled will be filtered in the field for the dissolved metals analyses.

The groundwater sample designations will correspond to the soil boring location. For example, groundwater collected from soil boring location 74SB01 will have a groundwater sample identification of 74GW01.

The temporary wells will not be abandoned in this phase. Following completion of sampling and surveying, each well will be provided with a friction-fit cap and the flush mount well cover will be bolted down until Phase II. The location of each well will be marked with paint and/or wooden stake and flag depending on surroundings until Phase II.

Samples will be packed in ice and shipped next day air to the “fixed base” laboratory. Because of previously encountered delays associated with sample shipments from Puerto Rico to the United States, additional insurance to cover re-sampling costs should be claimed on the bill of laden. At least one member of the field team will remain on the island until verification by the laboratory of receipt of all shipments. This will minimize any potential re-sampling costs associated with mobilization. Tracking numbers for each shipment will be forwarded to the project manager for assisting in verification of receipt.

All analyses at the laboratory will be performed using current methodologies as presented in Table 3-2. The specific laboratory and third party validator are to be determined at a later date. All analytical work that is conducted on the mainland of the U.S.A. must be certified by a licensed Puerto Rico chemist.

3.2 Phase II CMS Investigation

After the results of the first phase of the CMS Investigation are known, an evaluation of impacted areas in and around SWMU 74 will be made. The Draft CMS Investigation Report developed following the Phase I investigation will contain the recommendations for the work to be conducted under the Phase II CMS Investigation. The Phase II CMS investigation will delineate the extent of the observed contamination from Phase I, and collect the necessary information for the CMS Task I process described in Section 8, including ecological and human health evaluations.

For the purposes of determining potential fuel-based contamination, correlations between DRO concentrations and PAH concentrations will be established, if possible, with the Phase I analytical data, using a linear or logarithmic best fit correlation. Some minimum trigger value of DRO contamination will be established through this correlation, and this trigger value will be used to place locations from the Phase I investigation into the Phase II investigation. If no correlation

can be reliably established, minimum trigger levels will be defined as 25 percent of the PREQB soil and groundwater criteria for TPH, which at the present time are 100 mg/kg (soil) and 50 mg/L (groundwater). If the sum of DRO and GRO concentrations at any location exceeds25 mg/kg (soil) or 12.5 mg/L (groundwater), that location will be moved into the Phase II investigation.

While it is preliminary to propose actual sample locations, a general approach to the Phase II investigation is presented here. At each location where contamination is noted above screening, trigger, or background levels, an additional five to ten soil borings may be installed in order to delineate the contamination. Two subsurface soil samples and one groundwater sample may be taken from these locations. These samples will be analyzed for Appendix IX VOCs, metals, low-detection level PAHs, TPH DRO, and TPH GRO. The inclusion of low-detection level PAHs to the analytical requirement in this phase is intended to provide data for evaluation of human health and ecological concerns during the CMS for all PAHs including those with low screening levels. Samples will be selected for low-detection level PAH analysis in Phase II from those locations where Phase I samples indicate the presence of organic contaminants exceeding screening levels or otherwise elevated concentrations.

During Phase II, subsurface soil samples will be collected during boring advancement for monitoring well installation. Soil samples will be collected continuously from ground surface to the water table using 2-foot long split-spoon samplers, with two subsurface soil samples and one surface soil sample per boring location being collected for fixed-base laboratory analysis. One subsurface soil sample per location will be collected from a depth of 1.0-2.0 feet below ground surface (bgs). The other subsurface soil sample will be collected from the depth of any suspected contamination, based on PID screening, but at a depth shallower than the water table or 10 feet bgs, whichever occurs first.

Monitoring wells will be installed using hollow-stem augers (HSAs) or air rotary techniques(see SOP F103 in Baker, 1995), depending on the underlying stratigraphy. The wells will be constructed of 2-inch ID, Schedule 40 PVC, with flush joint threads. Well screens will be 10-feet long and installed to straddle the water table.

- Soil sampling will be conducted in order to classify the soil during well installation. Upon completion of soil sampling, the borehole will be reamed as necessary to the desired depth using the prescribed drilling method. The well construction materials will be installed through the HSAs, casing, or in an open borehole.

- The well screen and bottom cap will be set at the bottom of the borehole. The screen will be connected to threaded, flush-joint, riser. An expandable, water tight locking cap or slip-cap with a vent hole will be placed at the top of the casing.

- The annular space around the well screen will be backfilled with a well-graded, fine to medium sand as the HSAs or casing are being withdrawn from the borehole. The sand will extend to approximately 2 feet above the top of the screened interval. The thickness of the sand above the screened interval may be reduced if the well is too shallow to allow for placement of adequate sealing material.

- An approximately 2-foot thick sodium bentonite seal (minimum of 6 inches for very shallow wells) will be placed above the sand pack. If bentonite pellets or chips are used, they will be sized appropriately given the well and borehole diameter and placed in a careful manner that will prevent bridging. The bentonite will be hydrated with potable water, as necessary.

- The annular space above the bentonite seal will be backfilled with cement/bentonite grout to prevent surface and near subsurface water from infiltrating into the screened groundwater monitoring zone. The grout will consist of five to ten percent (by dry weight) of bentonite powder and seven gallons of potable water per 94-pound bag of portland cement. For very shallow wells, the cement/bentonite grout may be omitted.

- The depth intervals of all backfilled materials will be measured with a weighted measuring tape to the nearest 0.1-foot and recorded in the field logbook.

- Wells in high traffic areas will be completed at the surface using a "flush" manhole type cover. The flush-mounted cover will be surrounded by a concrete pad and slightly elevated above the ground surface with the concrete sloping away from the cover to the existing ground surface. However, if any of the wells are relocated into areas that are heavily vegetated; these will be provided with 2 to 3 feet of "stickup" above ground surface. Steel protective casing will be placed over the riser and surrounded by a concrete pad. The pad will be a minimum of 2 feet by 2 feet (length x width) and 6 inches in thickness (with 2 inches set into the ground outside the casing), and extending 2 feet bgs inside the annular space around the well. If water table conditions prevent having a 24-inch thick bentonite seal, the concrete pad depth in the annular space around the well may be decreased. Steel bollards will be installed around the concrete pad as additional protection and painted a bright color to aid in visibility.

- All wells will have a locking cap installed on the PVC riser or protective steel casing.

Each new permanent monitor well will be developed using pumping and surging methods (see SOP F103 in Baker, 1995) after allowing suitable time for the cement/bentonite grout to cure (typically a minimum of 24 hours). The purpose of well development is to restore the permeability of the formation which may have been reduced by the drilling operations and to remove fine-grained materials that may have entered/accumulated in the well or filter pack. The wells will be developed until the discharged water runs relatively clear of fine-grained materials. It should be noted that the water in some wells does not clear with continued development. Typical limits placed on well development may include any one or a combination of the following:

- Clarity of water based on visual determination
- A maximum time period (typically two hours for shallow wells)
- A maximum borehole volume (typically three to five borehole volumes plus the amount of any water added during the drilling or installation process)
- Stability of pH, specific conductance, and temperature measurements (typically less than 10 percent change between three successive measurements)
- Clarity based on turbidity measurements [typically less than 20 Nephelometric Turbidity Units (NTU)]
- A record of the well development will be completed to document the development process.

3.3 Other Field Activities

During each phase of the investigation, the following activities will be performed:

- Utility Clearance
- Investigation Derived Waste (IDW) Management

- Decontamination
- Surveying
- Health and Safety Procedures
- Chain of Custody

3.3.1 Utility Clearance

If this work plan is initiated while NAPR is still under operation, the following procedure must be followed to obtain utility clearance. Fifteen days prior to the initiation of the proposed fieldwork, a digging permit request will be submitted to the Facility Management Transportation and Utility Division (FMTUD) of the Public Works Department at NAPR. All proposed soil boring, as well as temporary and permanent monitoring well locations, will be cleared by the base utility department.

3.3.2 Investigation Derived Wastes (IDW)

The generation of IDW associated with soil sampling and monitoring well installation, including soil cuttings and decontamination fluids, will be collected and stored temporarily in 55-gallon drums. However, the soil cuttings from the subsurface soil sampling, as well as from the temporary monitoring wells, will be placed back into the boring from which they came, unless contamination is present. As much as possible, soils last out of the hole will be returned first, thereby, approximating original stratigraphy.

Two IDW samples will be collected during this investigation. One composite aqueous sample will be collected from all drums containing decontamination fluid (from sampling equipment and drill rig), and one composite soil sample will be collected from all drums containing drill cuttings. The samples will be analyzed for parameters as shown in Table 3-1 by methods presented in Table 3-2. These samples will provide the necessary data to be able to dispose of the generated IDW at an appropriate disposal facility. Upon completion of the field program, the drums will be moved and stored at a secure location by the contractor. The soil and water IDW will be removed and disposed of from the site by an approved vendor upon receipt and review of the IDW sample analytical data.

3.3.3 Decontamination

The drill rig, including all reusable (non-dedicated and non-disposable) soil sampling equipment (i.e. augers, bits, DPT probe, split-spoon samplers, etc.), will be decontaminated between each sampling location in accordance with SOPs F501 and F502 in Baker, 1995. The drill rigs will be decontaminated before arriving at the site and before leaving the site. The remaining contaminant-free sampling equipment and materials utilized during this investigation will be disposable.

3.3.4 Surveying

All sampling locations will be surveyed. Traditional survey equipment or survey grade GPS unit will be utilized to obtain vertical (+/- 0.01 foot) and horizontal (+/- 0.1 foot) locations and top of PVC elevations of the temporary and permanent wells for generating groundwater contours used for reporting purposes.

3.3.5 Health and Safety Procedures

The health and safety procedures previously presented in the RFI Management Plans (Baker, 1995) will be employed during this investigation.

3.3.6 Chain-of-Custody

Chain-of-Custody procedures will be followed to ensure a documented, traceable link between measurement results and the sample/parameter that they represent. These procedures are intended to provide a legally acceptable record of sample preparation, storage, and analysis.

To track sample custody transfers before ultimate disposition, sample custody will be documented using a similar chain-of-custody form as presented in the RFI Management Plans (Baker, 1995). A chain-of-custody form will be completed for each shipment in which the samples are shipped. After the samples are properly packaged, the shipping container will be sealed and prepared for shipment to the analytical laboratory.

3.4 Data Validation

All mainland laboratory data generated by the investigation will be subjected to independent, third party, validation. The USEPA Region II Data Validation Standard Operating Procedures will be followed. The specific data validator will be determined at a later date.

3.5 Field QA/QC

Quality Assurance/Quality Control (QA/QC) samples will be obtained during these investigations. These will include the collection of equipment rinsate samples, field blanks, trip blanks, field duplicates, and matrix spike/matrix spike duplicate (MS/MSD). QA/QC samples will be analyzed for parameters as shown in Table 3-1 by methods presented in Table 3-2.

Equipment rinsate blanks from reusable (non-dedicated and non-disposable) sampling equipment will be collected daily during the sampling event. Initially, samples from every other day should be analyzed. If analytes pertinent to the project are detected in any equipment rinsate blank, the remaining rinsate blanks will be analyzed. As an added level of QA/QC, a rinsate blank will also be collected from each batch of disposable sampling tools such as stainless steel spoons, Macro Core liners, groundwater sample tubing, etc. The results from the blanks will be used to verify that the decontamination of reusable equipment had rendered them free of cross-contaminating chemicals at levels of concern for the site; and to verify that disposable sampling tools were free of contaminants at levels of concern for the site. This comparison will be made during data validation, using the equipment rinsate blank analyzed for the same parameters as the related samples. One equipment rinsate will be collected per day of field sampling.

One field blank sample will be collected which will consist of lab grade deionized water (D.I.) used in the collection of the equipment rinsate sample.

Trip blank samples will be required to accompany the samples to the laboratory for volatile organic and TPH-GRO constituent samples scheduled for collection. One trip blank sample will accompany each cooler containing samples for the afore-mentioned analyses.

Soil sample field duplicates will be homogenized and split and collected at a frequency of ten percent. Groundwater duplicates will be collected at a frequency of ten percent and these will include at least one total and one filtered sample.

MS/MSD samples are collected to evaluate the matrix effect of the sample upon the analytical methodology. An MS and MSD must be performed for each group of samples of a similar matrix (e.g., surface soil). MS/MSD samples will be collected at a frequency of five percent per media.

4.0 CMS INVESTIGATION REPORT(S)

A report will be prepared on the methodologies and findings of the first phase of the CMS investigation at SWMU 74. A draft report will be submitted to the USEPA 45 days upon receipt of the validated analytical data, which will include recommendations for the sampling to be conducted during Phase II. The main elements of the document will consist of the following:

- Introduction
- Investigation Methodologies
- Nature and Extent of Contamination
- Phase II Sampling Methodology
- Conclusions and Recommendations

After approval, the second phase of the CMS Investigation will occur. A draft report will be submitted to the USEPA 45 days upon receipt of the validated analytical data. Similar to Phase I, but in a more comprehensive manner, the document will consist of the following:

- Introduction
- Investigation Methodologies
- Nature and Extent of Contamination
- Conclusions, Justifications, and Recommendations for either a streamlined CMS or a full CMS

4.1 Introduction

The introduction will consist of a discussion of the historical background of the investigations conducted at SWMU 74 and incorporate the results from this CMS investigation in that context. The introduction will also provide a regulatory framework for SWMU 74, as well as a discussion of current conditions.

4.2 Investigation Methodologies

The investigation methodologies section will detail the investigation. The section will discuss sample locations, sample collection and handling procedures, QA/QC procedures, and analytical methods used. This section will also discuss problems encountered and problem resolution.

4.3 Nature and Extent of Contamination

The nature and extent of contamination section will present analytical results and interpretation of the data. The soil data will be screened against USEPA Region IX Preliminary Remediation Goals (PRGs) and the ecological surface soil screening values developed for NAPR. The groundwater data will be compared to USEPA Region IX Tap Water PRGs and the Federal maximum contaminant levels (MCLs). Additionally, inorganics will be statistically compared against their respective background values using Navy guidance (Naval Facilities Engineering Support Center, [NFESC], 2002 and 2004). The background data to be used in the statistical evaluations are those presented in the *Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds* (Baker, 2006a). The results of the screening of the data against these criteria as well as the results of the statistical comparison to background data will be discussed. Data will be presented on tables and figures with textual explanation. Results of QA/QC procedures will also be presented.

4.4 Conclusions and Recommendations

Information from the nature and extent of contamination will be synthesized into conclusions regarding conditions at SWMU 74. In the Phase I report, recommendations for Phase II investigation locations will be made based upon these conclusions. Following the Phase II investigation, the CMS Investigation report will include recommendations for a CMS. If the results of the Phase I and Phase II investigations indicate that a streamlined CMS approach is appropriate, then a CMS will be prepared in accordance with Section 8 Tasks III and IV, otherwise a full CMS will be prepared in accordance with Section 8 Tasks I through IV.

5.0 ECOLOGICAL RISK ASSESSMENT

This section presents the technical approach (described in general terms) for conducting an ecological risk assessment (ERA) at SWMU 74 (Fuel Pipelines and Hydrant Pits) NAPR, Ceiba, Puerto Rico. The ERA process at SWMU 74 will be conducted in accordance with the Navy policy for conducting ERAs (Chief of Naval Operations [CNO], 1999) the Navy guidance for conducting ERAs (available at http://web.ead.anl.gov/ecorisk/), as well as guidance provided by the USEPA (1997a).

The Navy ERA process (see Figure 5-1) consists of eight steps organized into three tiers and represents a clarification and interpretation of the eight-step ERA process outlined in the USEPA ERA guidance for the Superfund program (USEPA, 1997a). Tier 1 of the Navy ERA process represents the screening-level ERA:

- Screening-level problem formulation and ecological effects evaluation (Step 1).
- Screening-level exposure estimate and risk calculation (Step 2).

Under Navy policy, if the results of Step 1 and Step 2 (Tier 1 screening-level ERA) indicate that, based on a set of conservative exposure assumptions, there are chemicals present in environmental media that may present a risk to receptor species/communities, the ERA process proceeds to the baseline ERA. According to Superfund guidance (USEPA, 1997a), Step 3 represents the problem formulation phase of the baseline ERA. Under Navy policy, the baseline ERA is defined as Tier 2, and the first activity under Tier 2 is Step 3a. Step 3a precedes the baseline risk assessment problem formulation (Step 3b). In Step 3a, the conservative exposure assumptions applied in Tier 1 are refined and risk estimates are recalculated using the same conceptual site model. The evaluation of risks in Step 3a may also include consideration of background data and chemical bioavailability. If the re-evaluation of the conservative exposure assumptions in Step 3a does not support an acceptable risk determination, the site continues in the baseline ERA process (i.e., Steps 3b through 7; see Figure 5-1):

As corrective action objectives (CAOs) for the protection of the environment will be developed (if necessary) based on the results of the screening-level ERA (Steps 1 and 2) and refinement of the screening-level ERA exposure assumptions (Step 3a), this section only presents the general methodology that will be used in Steps 1, 2, and 3a of the Navy ERA process.

5.1 Screening-Level Problem Formulation

The screening-level problem formulation is the first phase of the ERA process and establishes the goals, scope, and focus of the screening-level ERA. Major components of the screening-level problem formulation will include:

- **Environmental Setting** – A general description of the SWMU history and SWMU features, with emphasis on the habitats and ecological receptors known or likely to be present on or near the SWMU. This description is typically based on existing information and mapping.
- **Existing Analytical Data** – A summary of existing analytical chemistry data for ecologically relevant media at the SWMU.
- **Contaminant Fate and Transport Mechanisms** – A characterization of known or potential contaminant sources and the likely transport mechanisms (if any) to ecological habitats based on the fate properties of the site-specific chemicals. The mechanisms of toxicity for these chemicals are also considered.

- **Exposure Routes and Pathways** – An evaluation of potential exposure routes and a determination of the existence of any potentially complete exposure pathways.
- **Conceptual Model** – The screening-level problem formulation culminates in the development of a preliminary conceptual model, which describes how potential ecological receptors may be exposed to chemicals associated with the SWMU.
- **Endpoint Selection** – Assessment and measurement endpoints to be evaluated in the screening-level ERA are selected for potentially complete exposure pathways identified in the conceptual model.
- **Selection of Receptors** – Receptor species are selected based on the environmental setting and selected assessment endpoints

These major components of the screening-level problem formulation are described in more detail in the following sections. This phase of the ERA process is intended to answer two main questions: (1) do complete exposure pathways exist at the SWMU? and (2) are sufficient data available to conduct the screening-level ERA?

5.1.1 Environmental Setting

As described above, the description of the environmental setting focuses on the SWMU history (how the SWMU was used in the past and how it is currently being used), physical site features, and habitats and biota. The environmental setting will be described both for NAPR as a whole and for SWMU 74.

5.1.1.1 Site Description and Physical Features

Information on the site history provides an indication of the types of chemicals expected at the SWMU and the media in which they are likely to be present. The physical features of the SWMU, which include geological (e.g., soils), hydrogeological (e.g., surface water and groundwater flow patterns), and climatologic (e.g., precipitation) parameters, are important in determining how chemicals from source areas could be transported to ecological habitats. Sources of this information may include SWMU-specific documents, facility personnel, available mapping, soil survey documents, weather records, and site visits.

5.1.1.2 Habitat Types and Ecological Receptors

Descriptions of the habitat types and ecological receptors known or likely to be present on the SWMU are an important part of describing the environmental setting. This can encompass aquatic habitats (e.g., creeks and ponds) and receptors (e.g., fish), wetland habitats (e.g., marshes) and receptors (e.g., amphibians), and/or terrestrial habitats (e.g., forests) and receptors (e.g., wildlife and vegetation). Sources of this information may include facility-specific documents (e.g., natural resource management plans), available mapping, the literature, and site visits.

5.1.2 Existing Analytical Data

The existing analytical data for ecologically relevant media will be compiled and evaluated. The evaluation will consider such factors as sample size (number of samples for a given medium collected for analytical testing), sample location, analytical parameters, and reporting limits to determine if the available data are adequate to conduct the screening-level ERA. For example, low sample size could result in inadequate spatial coverage within habitats of potential interest to the ERA. In this case, insufficient data would be available on which to base a risk estimate.

5.1.3 Contaminant Fate and Transport Mechanisms

In the absence of measured values of chemicals within biotic media, the transport and partitioning of constituents into particular environmental compartments, and their ultimate fate in those compartments, can be predicted from key physical-chemical characteristics. The physical-chemical characteristics that are most relevant for exposure modeling in this assessment include water solubility, adsorption to solids, octanol-water partitioning, and degradability. These characteristics are defined below.

The water solubility of a compound influences it's partitioning to aqueous media. Highly water-soluble constituents, such as most VOCs, have a tendency to remain dissolved in the water column rather than partitioning to sediment (Howard, 1991). Compounds with high water solubility also generally exhibit a lower tendency to bioconcentrate in aquatic organisms and a greater likelihood of biodegradation, at least over the short term (Howard, 1991).

Adsorption is a measure of a compound's affinity for binding to solids, such as soil or sediment particles. Adsorption is expressed in terms of partitioning, either adsorption coefficient (K_d); (a unitless expression of the equilibrium concentration in the solid phase versus the water phase) or as organic carbon partition coefficient (K_{oc}) (K_d normalized to the organic carbon content of the solid phase; again unitless) (Howard, 1991). For a given organic chemical, the higher the K_{oc} or K_d, the greater the tendency for that chemical to adhere strongly to soil or sediment particles. K_{oc} values can be measured directly or can be estimated from either water solubility or the octanol-water partition coefficient using one of several available regression equations (Howard, 1991).

Octanol-water partitioning indicates whether a compound is hydrophilic or hydrophobic. The Octanol-water partition coefficient (K_{ow}) expresses the relative partitioning of a compound between octanol (lipids) and water. A high affinity for lipids equates to a high K_{ow} and vice versa. As discussed above, K_{ow} has been shown to correlate well with Bioconcentration Factors (BCFs) in aquatic organisms, adsorption to soil or sediment particles, and the potential to bioaccumulate in the food chain (Howard, 1991). Typically expressed as log K_{ow}, a value of three (3.0) or less generally indicates that the chemical will not bioconcentrate to a significant degree (Maki and Duthie, 1978).

5.1.4 Exposure Routes and Pathways

An exposure pathway links a source of contamination with one or more receptors through exposure to one or more ecologically relevant media. Exposure, and thus potential risk, can only occur if complete exposure pathways exist.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. The most common exposure routes are dermal contact, ingestion, and inhalation. Terrestrial vegetation may be exposed to chemicals present in surface soils through their root surfaces during water and nutrient uptake. Unrooted, floating aquatic plants, rooted submerged aquatic plants, and algae may be exposed to chemicals directly from the water or (for rooted plants) from sediments. Terrestrial and aquatic invertebrates may be exposed to chemicals in surface soil, sediment, or surface water through dermal adsorption and ingestion. Much of the toxicological data available for terrestrial and aquatic invertebrates are based on *in situ* studies that represent both pathways. Therefore, both pathways are typically considered together. Invertebrates also present a link between soil/sediment chemicals and invertebrate consumers through food web transfer. As such, they are typically included as prey items for upper trophic level dietary exposures.

Birds and mammals may be exposed to chemicals through: (1) the inhalation of gaseous chemicals or chemicals adhered to particulate matter; (2) the incidental ingestion of contaminated abiotic media (e.g., soil or sediment) during feeding or cleaning activities; (3) the ingestion of contaminated water; (4) the ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. Their relative importance depends in part on the chemical being evaluated. For chemicals having the potential to bioaccumulate (e.g., polychlorinated biphenyls [PCBs]), the greatest exposure to wildlife is likely to be from the ingestion of prey. For chemicals having a limited potential to bioaccumulate (.e.g., aluminum), the exposure of wildlife to chemicals is likely to be greatest through the direct ingestion of abiotic media, such as soil or sediment.

5.1.5 Conceptual Model

The conceptual model is designed to diagrammatically relate potentially exposed receptor populations with potential contaminant source areas based on the physical nature of the SWMU and potential exposure pathways. Important components of the preliminary conceptual model are the identification of potential sources of contaminants, transport pathways, exposure media, potential exposure routes, and potential receptor groups. Actual or potential exposures of ecological receptors associated with SWMU 74 will be determined by identifying the most likely pathways of contaminant release and transport. A complete exposure pathway has four components: (1) a source of chemicals that can be released to the environment; (2) a release and transport mechanism to move the chemicals from the source to an exposure point; (3) an exposure point where ecological receptors could contact the affected media; and (4) an exposure route whereby chemicals can be taken up by ecological receptors.

The main objective of the conceptual model in Step 1 of the ERA process is to identify any complete exposure pathways present at a site. The ERA will provide a conceptual model that relates directly to SWMU 74.

5.1.6 Endpoints and Risk Hypotheses

The screening-level problem formulation includes the selection of ecological endpoints. Endpoints in the screening-level ERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur (USEPA, 1992, 1997a, and 1998). Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to the site (USEPA, 1997a). Assessment endpoints contain an entity (e.g., red-tailed hawk) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1992 and 1997a) and discussed in detail in Suter II (1989, 1990, and 1993). Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem (USEPA, 1992). Effects on individuals are important for some receptors, such as rare and endangered species, but population- and community-level effects are typically more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study.

However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population- or community-level. In addition, use of criteria values designed to protect the vast majority (e.g., 95 percent) of the components of a community (e.g., Ambient Water Quality Criteria for the Protection of Aquatic Life) can be useful in evaluating potential community- and/or population-level effects.

The most appropriate generic assessment endpoint for ERAs will be the maintenance of receptor populations. Therefore, the specific objective of the ERA will be to determine if exposure to site-related chemicals present in environmental media are likely to result in declines in ecological receptor populations. Declines in populations could result in a shift in community structure and possible elimination of resident species.

Measurement endpoints are used in ERAs because it is often difficult or impossible to directly assess whether the environmental value that is to be protected (the assessment endpoint) is being impacted. For example, an assessment endpoint may involve a decline in a particular population or a shift in the structure of a community. While these things might be quantifiable, the necessary studies would generally be time-consuming and difficult to interpret. However, measurement endpoints indicative of observed adverse effects on individuals are relatively easy to measure in toxicity studies and can be related to the assessment endpoint. For example, contaminant concentrations that lead to decreased reproductive success or increased mortality of individuals in toxicity tests could, if found in the environment, result in shifts in population structure, potentially altering the community composition associated with a site.

5.1.7 Selection of Receptors

Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. Therefore, receptor species (e.g., American robin) or species groups (e.g., terrestrial invertebrates and plants) are often selected as surrogates to evaluate potential risks to larger components of the ecological community (guilds; e.g., omnivorous birds) represented in the assessment endpoints (e.g., survival and reproduction of omnivorous birds). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, at the site.
- Have a particular ecological, economic, or aesthetic value.
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present at the site for which complete exposure pathways are likely to exist.
- Can be expected to represent potentially sensitive populations at the site, because of toxicological sensitivity or potential exposure magnitude.
- Have sufficient ecotoxicological information available on which to base an evaluation.

Upper trophic level receptor species will be chosen for dietary exposure modeling based on the criteria listed above, the general guidelines presented in USEPA (1991), the environmental setting (e.g., habitats), and the assessment endpoints selected for SWMU 74. Lower trophic level receptor species (e.g., terrestrial and aquatic invertebrates and plants) are generally evaluated in screening-level ERAs based on those taxonomic groupings for which screening values have been developed. These groupings and screening values are used in most ERAs. As such, specific species of lower trophic level biota will not be chosen as receptor species because of the limited

information available for specific species and because these biota are dealt with on a community level via a comparison to medium-specific screening values. It is noted that only avian species will be selected as upper trophic level ecological receptors for evaluation in the ERA since the terrestrial mammals represented by potentially complete exposure pathways are limited to nonindigenous, nuisance species (i.e., Norway rat, Black rat, and mongoose) that have been implicated in the decline of native bird populations (United States Fish and Wildlife Service [USFWS], 1996).

5.1.8 Screening-Level Problem Formulation Decision Point

As discussed in Section 5.1, the screening-level problem formulation is intended to answer two main questions: (1) do complete exposure pathways exist at the SWMU? and (2) are sufficient data available to conduct the screening-level ERA? Complete exposure pathways from a source area are likely to exist if all of the following are present:

- Habitat that supports ecological receptor populations.
- Contaminant transport pathways to ecologically relevant media.
- Complete exposure routes.

If no complete exposure pathways exist at SWMU 74, the ERA process will terminate at the screening-level problem formulation with a conclusion of negligible risk. If one or more complete exposure pathways are known or likely to exist, the ERA process will continue to the screening-level ecological effects evaluation, screening-level exposure estimation, and screening-level risk calculation but will only evaluate those pathways that have been determined to be complete.

5.2 Screening-Level Ecological Effects Evaluation

The purpose of the screening-level ecological effects evaluation is the establishment of chemical exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. One set of screening values is typically developed for each of the selected assessment endpoints.

Two types of screening values (media-specific screening values and ingestion-based screening values) will be developed for the ERA at SWMU 74. Media-specific screening values will be developed for ecologically relevant media, while ingestion-based screening values will be developed for upper tropic level food web (dietary) exposures.

5.2.1 Media-Specific Screening Values

The sections that follow describe the various criteria and toxicological benchmarks that will be used as media-specific screening values (toxicological thresholds) for chemicals in surface soil (collected from the 0 to 1-foot depth interval), subsurface soil (collected from the 1 to 3-foot depth interval), and groundwater. The media-specific screening values represent conservative exposure thresholds above which adverse ecological effects may occur.

5.2.1.1 Soil Screening Values

USEPA Ecological Soil Screening Levels (Eco-SSLs) for terrestrial plants and invertebrates (available at http://www.epa.gov/ecotox/ecossl/) will be preferentially used as surface and subsurface soil screening values. For a given metal, if an Eco-SSL has been established for both terrestrial plants and invertebrates, the lowest value will be selected as the soil screening value.

For those chemicals lacking an Eco-SSL, the literature-based toxicological benchmarks listed below will be used as soil screening values.

- Toxicological thresholds for earthworms and microorganisms (Efroymson et al., 1997a)
- Toxicological thresholds for plants (Efroymson et al., 1997b)

If more than one screening value is available from Efroymson et al. (1997a and 1997b), the lowest value will be selected as the soil screening value. For those chemicals lacking Eco-SSLs or toxicological thresholds from Efroymson et al. (1997a and 1997b), the following literature-based values, listed in their order of decreasing preference, will be used as soil screening values.

- Toxicity reference values for plants and invertebrates listed in USEPA, 1999
- Soil standards developed by the Ministry of Housing, Spatial Planning and Environment (MHSPE, 2000), assuming a minimum default soil organic carbon content of 2.0 percent
- Canadian soil quality guidelines (agricultural land use) developed by the Canadian Council of Ministers of the Environment (CCME, 2006)

CCME soil quality guidelines will be given the lowest preference since they are background-based values that do not represent effect concentrations. A listing of the soil screening values for Appendix IX VOCs, SVOCs, and metals, selected using the preference hierarchy presented above, is provided in Table 5-1. The soil screening values summarized in Table 5-1 have previously been accepted by the USEPA for use in ERAs at NAPR (Baker, 2006b and 2006c).

5.2.1.2 Groundwater Screening Values

As the area encompassed by SMU 74 is contiguous to estuarine and open water marine habitat, groundwater data will be screened against saltwater toxicological thresholds (estuarine habitat represents a likely discharge point for groundwater). Chronic saltwater National Ambient Water Quality Criteria (NAWQC) (USEPA, 2006; available at http://www.epa.gov/waterscience/criteria/wqcriteria.html). USEPA NAWQC for arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc are expressed as dissolved concentrations. As a measure of conservatism, they will be converted to total recoverable concentrations using the appropriate conversion factors (USEPA, 2006). For those chemicals lacking a saltwater NAWQC, groundwater screening values will be identified from the following information listed in their order of decreasing preference:

- Final Chronic Values (FCVs) for saltwater contained in Ecotox Thresholds (USEPA, 1996a)
- Chronic screening values for saltwater contained in Ecological Risk Assessment Bulletins – Supplement to Risk Assessment Guidelines (RAGS) (USEPA, 2001)
- Minimum chronic toxicity test endpoints (No Observed Effect Concentration [NOEC], No Observed Effect Level [NOEL], and Maximum Acceptable Toxicant Concentration [MATC] values) for saltwater species reported in the ECOTOX Database System (Aquatic Toxicity Information Retrieval [AQUIRE] database) (USEPA, 2003a)
- Chronic Lowest Observable Effect Levels (LOELs) for saltwater contained in National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQUIRTs) (Buchman, 1999)

The order of preference was selected based on their level of protection. For example, FCVs would be expected to offer a greater degree of protection than a single species NOEC, MATC, or LOEL since their derivation considers a larger toxicological database. In the absence of the

above-mentioned FCVs, USEPA Region IV chronic screening values, chronic test endpoints, and chronic LOELs, screening values will be derived from the acute literature values listed below:

- Acute LOELs for saltwater contained in NOAA SQUIRTs (Buchman, 1999)
- Acute toxicity test endpoints (NOEC, NOEL, LOEL, Lowest Observed Effect Concentration [LOEC], median lethal concentration [LC_{50}], and median effective concentration [EC_{50}] values) for saltwater species contained in the ECOTOX Database System (AQUIRE database) (USEPA, 2003a).
- LC_{50} values for saltwater species contained in Superfund Chemical Matrix (USEPA, 1996b)

Chronic-based screening values will be extrapolated from acute NOEC, NOEL, LOEC, LOEL, LC_{50}, and EC_{50} values as follows:

- An uncertainty factor of 10 will be used to convert an acute NOEC, NOEL, LOEC, or LOEL to a chronic-based screening value
- An uncertainty factor of 100 will be used to convert an EC_{50} or LC_{50} to a chronic-based screening value

When acute toxicity data are used to extrapolate a chronic screening value, NOECs/NOELs will be given preference over LOECs/LOELs, LOECs/LOELs will be given preference over LC_{50} and EC_{50} values, and EC_{50} values will be given preference over LC_{50} values. When more than one value is available from the literature for a given test endpoint (e.g., NOEC), the minimum value will be conservatively used to extrapolate a chronic screening value. In some cases, chronic and acute LOELs for chemical classes (e.g., PAHs) are available from Buchman (1999). A LOEL based on a chemical class will be used to derive a chronic screening value only if that chemical lacked literature-based benchmarks and/or toxicity test endpoints.

For those chemicals lacking saltwater toxicological thresholds and literature values, surface water screening values will be identified or developed from freshwater values using the sources and procedures discussed in the preceding paragraphs with one exception. This exception involves the consideration of freshwater Secondary Chronic Values (SCVs) developed by the USEPA (1996a) and Suter II (1996). A listing of the groundwater screening values for Appendix IX VOCs, SVOCs, and metals, selected using the preference hierarchy presented above, is provided in Table 5-2. The screening values summarized in Table 5-2 have previously been accepted by the USEPA for use in ERAs at NAPR (Baker, 2006b and 2006c).

5.2.2 Ingestion-Based Screening Values

Ingestion-based screening values for upper trophic level dietary exposures will be derived for each receptor species and chemical evaluated for food web exposures. Toxicological information from the literature for wildlife species most closely related to the receptor species will be used if available. This information will be supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) when necessary.

Chronic No Observed Adverse Effect Levels (NOAELs) based on growth or reproduction will be preferentially used as ingestion-based screening values for upper trophic level receptors. NOAELs represent the highest dose of a chemical at which an effect being measured in a toxicity test does not occur. If several chronic toxicity studies are available from the literature for a given chemical, the most appropriate study will be selected for each receptor species based on study design, study methodology, study duration, study endpoint and test species. When chronic

NOAEL values are unavailable, estimates will be derived or extrapolated from chronic Lowest Observed Adverse Effect Levels (LOAELs) or acute values (LD_{50}). LOAELs represent the lowest dose of a chemical at which an effect being measured in a toxicity test occurs, while an LD_{50} represents the dose of a chemical at which half of the organisms being tested die. An uncertainty factor of 10 will be used to convert a reported LOAEL to a NOAEL, while an uncertainty factor of 100 will be used to convert the acute LD_{50} to a chronic NOAEL (i.e., the LD_{50} will be multiplied by 0.01 to obtain the chronic NOAEL).

As discussed in Section 5.1.7, only avian species will be evaluated for upper trophic level food web exposures. Ingestion-based screening values for birds, expressed as milligrams of chemical per kilogram body weight of the receptor per day (mg/kg-BW/day), are summarized in Table 5-3. The ingestion-based screening values listed in Table 5-3 have previously been accepted by the USEPA for use in ERAs at NAPR (Baker, 2006b and 2006c). It is noted that Sample et al. (1996) consider a scaling factor of 1.0 most appropriate for interspecies extrapolation between birds. Therefore, the NOAEL and LOAEL values summarized in Table 5-3 will not be adjusted to reflect differences in body weights between avian test species and avian receptor species. Not all chemicals analyzed in ecologically relevant media will be evaluated for food web exposures. The Appendix IX VOCs and PAHs will be evaluated for food web exposures are those with the potential to bioaccumulate to a significant extent. Bioaccumulative chemicals are defined herein as those with a maximum reported log octanol-water partition coefficient (log K_{ow}) greater than or equal to 3.0. Rationale for using a log K_{ow} of 3.0 to define an organic chemical with the potential to bioaccumulate is included as Appendix E. This approach has previously been accepted by the USEPA for the selection of organic chemicals evaluated for upper trophic level food web exposures (Baker, 2006b and 2006c). For conservatism, all Appendix IX metals will be evaluated for food web exposures.

5.3 Screening-Level Exposure Estimation

This portion of the screening-level ERA involves the identification of the data to be used to represent concentrations of chemicals to which ecological receptors may be exposed to in various media and the derivation of exposure point concentrations from those data (typically the maximum detected concentration). Exposure assumptions, exposure models, and model input parameters are also developed.

5.3.1 Selection Criteria for Analytical Data

Available analytical data for ecologically relevant media will be selected for use in the screening-level ERA based on a set of selection criteria that will include (where applicable):

- Data must be validated by a qualified data validator using acceptable data validation methods. Rejected (R) values will not be used in the ERA. Unqualified data and data qualified as J will be treated as detected. Data qualified as U or UJ will be treated as non-detected.
- Maximum reporting limits will be conservatively used to estimate exposure for non-detected chemicals.
- In some instances, duplicate samples have been or will be collected in the field. The maximum concentration of each chemical in the original or duplicate sample will be used as a conservative estimate of chemical concentrations at a particular sampling point.
- For surface soil, analytical data for samples collected from the surface to a maximum depth of one foot below ground surface (bgs) will be used since this depth range is the most active biological zone (Suter II, 1995).

- For surface water and groundwater, total (unfiltered) metals data will be used in the medium-specific screening evaluation.

5.3.2 Exposure Point Concentrations – Abiotic Media

Maximum detected concentrations in abiotic media (e.g., surface soil) will be used to conservatively estimate potential chemical exposures for the ecological receptors selected to represent the assessment endpoints. For conservatism, the maximum reporting limit for chemicals that were analyzed for but not detected also will be compared to medium-specific screening values and (where applicable) used for food web exposure modeling. This will be done to ensure that reporting limits are similar to, or less than, chemical concentrations at which potential adverse effects to ecological receptors may occur. For samples with duplicate analyses, the higher of the two concentrations will be used in the screening (when both values are detects or both values are non-detects). In cases where one result is a detection and the other a non-detect, the detected value will be used in the assessment.

5.3.3 Exposure Point Concentrations – Prey Items

Exposures for upper trophic level receptor species via the food web will be determined by estimating the chemical-specific concentrations in each dietary component using uptake and food web models. Ingestion of abiotic media, if appropriate, will also be included when calculating the total level of exposure. As indicated previously, maximum measured concentrations in abiotic media will be used in all calculations to provide a conservative assessment.

Estimates for food web exposures will be based on bioaccumulation factors developed from the literature. The uptake of chemicals from the abiotic media into these food items will be based on conservative (e.g., maximum or 90th percentile) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs). Default factors of 1.0 (dry weight to dry weight) will be used only where data are unavailable for a chemical in the literature. The completed screening-level will contain tables listing the BAFs/BCFs selected for each prey item. The methodology and models used to derive these estimates also will be included within the completed screening-level ERA.

Dietary intakes for each upper trophic level receptor species selected to represent the assessment endpoints will be calculated using the following formula (modified from USEPA [1993]):

$$DI_x = \frac{[[\sum_i [(FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]][AUF]}{BW}$$

where:

DI_x	=	Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR	=	Food ingestion rate (kg/day, dry weight)
FC_{xi}	=	Concentration of chemical x in food item i (mg/kg, dry weight)
PDF_i	=	Proportion of diet composed of food item i (dry weight basis)
SC_x	=	Concentration of chemical x in soil/sediment (mg/kg, dry weight)
PDS	=	Proportion of diet composed of soil/sediment (dry weight basis)
WIR	=	Water ingestion rate (L/day)
WC_x	=	Concentration of chemical x in water (mg/L)
BW	=	Body weight (kg, wet weight)
AUF	=	Area Use Factor (unitless)

As discussed in USEPA (1997a), exposure parameter values used in this food web model will be selected to provide for a conservative evaluation in the screening-level ERA. Examples of these conservative assumptions include:

- All of the dietary items consumed by the receptor are obtained from the site (i.e., an Area Use Factor [AUF] of 1 will be assumed) at the point of maximum concentrations.
- Chemicals are assumed to be 100 percent bioavailable.
- Maximum ingestion rates will be used (calculated maximum ingestion rates are based on the maximum body weight).
- Minimum body weights will be used.

5.4 Screening-Level Risk Calculation

The screening-level risk calculation is the final step in a screening-level ERA. In this step, the maximum exposure concentrations (abiotic media) or exposure doses (upper trophic level receptor species) are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of Ecological COPCs for each medium-pathway-receptor combination evaluated or a conclusion of negligible risk.

5.4.1 Selection of Ecological Chemicals of Potential Concern

Ecological COPCs will be selected using the hazard quotient (HQ) method. HQs are calculated by dividing the maximum chemical concentration in the medium being evaluated by the corresponding medium-specific screening value or, in the case of upper trophic level receptors, by dividing the exposure dose by the corresponding ingestion-based screening value. Chemicals with HQs greater than 1.0 will be considered ecological COPCs in the screening-level ERA.

The following conservative methodology will be used to identify ecological COPCs for abiotic media:

- The maximum detected concentration in each ecologically relevant media will be used to calculate media-specific HQs. For a given medium, chemicals with HQs greater than 1.0 based on maximum detected concentrations will be identified as ecological COPCs for that medium.
- For chemicals not detected in any samples of a particular medium, the maximum reporting limit will be used to calculate media-specific HQs. For a given medium, non-detected chemicals with HQs greater than 1.0 based on maximum reporting limits will be identified as ecological COPCs for that medium.
- Chemicals (detected and non-detected) without screening values for a given medium will be identified as ecological COPCs for that medium.

To select ecological COPCs for food web exposures, maximum chemical concentrations in ecologically relevant abiotic media will be used to estimate dietary doses for each receptor. All chemicals identified as bioaccumulative chemicals (see Appendix Ewill be evaluated for food web exposures. HQs will be calculated with NOAELs, LOAELs, and Maximum Acceptable Toxicant Concentrations (MATCs) (the geometric mean of the NOAEL and LOAEL). Calculations with NOAELs provide the most conservative risk estimate, while calculations with LOAELs provide the least conservative risk estimate. Calculations with MATCs provide realistic risk estimates since the MATC represents an estimation of the threshold concentration (i.e., the concentration above which a toxic effect on the test endpoint is produced). For the screening-

level ERA, chemicals (detected and non-detected) with NOAEL-based HQs greater than or equal to 1.0 will be identified as preliminary ecological COPCs. Identical to the media-specific screening, chemicals without ingestion-based screening values also will be retained as ecological COPCs for upper trophic level receptors.

HQs exceeding one indicate the potential for risk since the chemical concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than or equal to one do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs that are less than one indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

5.5 Uncertainties

Once the screening-level ERA is complete, the results will be evaluated to identify the type and magnitude of uncertainty associated with the risk conclusions. Reliance on results from a risk assessment can be misleading without a consideration of uncertainties, limitations, and assumptions inherent in the process. Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information.

5.6 Screening-Level ERA Decision Point

The results of the screening-level ERA will be used to evaluate the status of SWMU 74 in terms of potential ecological risk. Possible decision points following completion of the screening-level ERA are:

- **No further action is warranted**. This decision is appropriate if the screening-level ERA indicates that sufficient data are available on which to base a conclusion of no unacceptable risk (HQ values for each media-pathway-receptor combination is less than one).
- **Further evaluation is warranted**. This decision is appropriate if the screening-level ERA indicates that there is the potential for unacceptable risk for one or more media-pathway-receptor combinations. In this instance, the ERA process will proceed to Step 3a wherein the risk estimates are refined based on more realistic and site-specific assumptions and data.
- **Further data are required**. This decision is appropriate if the screening-level ERA indicates that there are insufficient data on which to base a risk estimate. This decision may also be appropriate if the potential for unacceptable risks is identified following the screening-level ERA and additional data are needed to refine these estimates in Step 3a.
- **Take remedial action**. This decision may be appropriate for sites in which the potential for unacceptable risks was identified following the screening-level ERA but these potential risks could be best addressed through remedial action (e.g., presumptive remedy, soil removal) rather than additional study.

5.7 Step 3a of the Baseline Ecological Risk Assessment

If the results of the screening-level ERA suggest that further ecological risk evaluation or data collection is warranted, the ERA process will proceed to Step 3a of the baseline ERA. This section documents the technical approach that will be used for conducting Step 3a of the baseline ERA at SWMU 74.

5.7.1 General Methodology for Step 3a

In Step 3a, the conservative assumptions employed in the screening-level ERA (Tier 1) are refined and risk estimates are recalculated using the same conceptual model. Step 3a may also include consideration of background data, and chemical bioavailability.

The specific assumptions, parameters, and methods that will be modified for the recalculation of media-specific and food web HQ values are identified below, along with justification for each modification. These refinements and methods will be used in Step 3a of the baseline ERA to weigh the evidence of potential risk for each ecological COPC identified for each media and receptor to determine whether the development of CAOs is warranted.

- Refined risk estimates will be derived using average (arithmetic mean) chemical concentrations. For individual receptor species, average chemical concentrations provide a better estimate of the likely level of chemical exposure because each receptor would be expected to forage in several different areas of the site, and, in many cases, off-site. Average concentrations are also appropriate for evaluating impacts *to populations* of lower trophic level receptors (e.g., terrestrial invertebrates). Because some of these receptors are relatively immobile, *individuals* are likely to be impacted by locations of maximum concentrations. However, evaluation of the average exposure case is more indicative of the level of impact that might be expected at the *population* level.
- Literature-based BCFs and BAFs based on, or modeled from, central tendency estimates (e.g., mean, median, midpoint) will be used in place of maximum or high-end (e.g., 90th percentile) estimates. An assumed BCF/BAF of 1.0 will still used for those chemicals lacking a literature-based BAF/BCF. The refined BCFs and BAFs for those chemicals carried into Step 3a of the baseline ERA will be summarized in tables.
- Central tendency estimates (e.g., mean, median, midpoint) for body weight and food ingestion rate will be used to develop exposure estimates for upper trophic level receptors rather than the minimum body weights and maximum food ingestion rates used in the screening-level ERA. The use of central tendency estimates is more relevant because they represent the characteristics of a greater proportion of the individuals in the population. The evaluation of food web exposures will still assumed an AUF of 1.0.
- In addition to the NOAELs-based risk estimates used in the screening-level ERA, consideration also will given to food web exposure risk estimates based on LOAELs and MATCs.
- Consideration will be given to available background data by statistically comparing site concentrations to background concentrations in accordance with Navy guidance (NFESC, 2002 and 2004). The process that will be used to statistically evaluate data is depicted on Figure 5-2. As evidenced by the figure, statistical comparisons will include descriptive summaries of each data set (maximum, minimum, and mean concentrations), statistical tests on the mean/median of the distributions (i.e., student's t-test, Wilcoxin rank sum test, Gehan test, and Satterthwaite's t-test), and statistical tests on the right tail of the distributions (i.e., quantile test and/or slippage test). The significance level (the probability criteria for rejecting the null hypotheses that data sets were sampled from the same population) will be set at 0.05 for all statistical tests (NFESC, 2002 and 2004). For a given medium, the background data to be used in the statistical evaluation will be the background data set presented and discussed within the *Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds* (Baker, 2006a).
- As exposure does not necessarily equate to risk, consideration will be given to site-specific factors that can affect the bioavailability of chemicals.

- Chemicals not identified as ecological COPCs because maximum detected concentrations (or maximum reporting limits in the case of non-detected chemicals) are less than medium-specific screening values will not evaluated in Step 3a of the baseline ERA since a conclusion of no unacceptable risk can be made with high confidence.

5.7.2 Step 3a Decision Points

Possible decision points based on the results of Step 3a include:

- **No further action is warranted.** This decision is appropriate if Step 3a of the baseline ERA indicates that there is no reasonable potential for unacceptable ecological risk within acceptable uncertainty.
- **Evaluate the need for corrective measures.** This decision is appropriate if Step 3a of the baseline ERA indicates that there is a reasonable likelihood for unacceptable ecological risks within acceptable uncertainty. Whether or not corrective measures are taken will depend upon a number of risk management factors such as the results of any human health risk assessments and the potential impact of the remedial action itself on the habitats and biota present on the site.

5.8 Ecological Corrective Action Objectives

CAOs will be established for chemicals retained as ecological COPCs in Step 3a of the Navy ERA process. CAOs for abiotic media (e.g., surface soil) will be developed by multiplying medium-specific screening values by 0.99:

$$CAO_x = (SV_x)(0.99)$$

where CAO_x is the Corrective Action Objective for chemical x and SV_x is the medium-specific screening value for chemical x, and 0.99 represents a default HQ for the derivation of CAOs. CAOs calculated using this default value correspond to medium-specific chemical concentrations that result in risk estimates equal to 0.99. As discussed in Section 5.4.1, HQ values less than 1.0 indicate that risks are unlikely. CAOs for food web exposures will be developed by modifying the dietary intake equation presented in Section 5.3.3. Using surface soil as an example, the CAOs for food web exposures will be calculated as follows:

$$CAO_x = \frac{(0.99)(SV_{xj})(BW_j)}{[[\sum_i (FIR_j)(BAF_{ix} or BCF_{ix})(PDF_{ij})] + [(FIR_j)(PDS_j)]][AUF]}$$

where:

CAO_x	=	Corrective Action Objective for chemical x (mg/kg, dry weight)
SV_{ij}	=	Ingestion-based screening value for chemical i applied to receptor j (mg chemical/kg body weight/day)
BWj	=	Body weight for receptor j (kg, wet weight)
FIR	=	Food ingestion rate for receptor j (kg/day, dry-weight)
BAF_{ix}	=	Surface soil-Biota BAF for chemical x and food item i (dry weight basis)
BCF_{ix}	=	Surface soil-Biota BCF for chemical x and food item i (dry weight basis)
PDF_{ij}	=	Proportion of diet composed of food item i for receptor j (dry weight basis)
PDS_j	=	Proportion of diet composed of surface soil for receptor j (dry weight basis)
AUF_j	=	Area Use Factor for receptor j (unitless)

For a given medium, if a chemical is retained as an ecological COPC based on the abiotic screening and food web exposure evaluation (e.g., retained as a surface soil COPC and as an upper trophic level terrestrial receptor COPC in Step 3a of the ERA process), the minimum CAO will be selected as the final CAO.

6.0 ESTABLISHMENT OF CORRECTIVE ACTION OBJECTIVES

6.1 Introduction

This section of the document will discuss the steps required to establish the site-specific objectives and clean up goals used to identify corrective measures.

The first step in evaluating corrective measures will be to develop CAOs, which consist of medium- and chemical-specific goals for protecting human health and the environment. The CAOs will be used to focus the development of corrective measure alternatives on technologies that may achieve appropriate target levels, thereby limiting the number of alternatives analyzed.

CAOs can be specific and numerical (i.e., quantitative) or general and descriptive (i.e., qualitative). They are achieved by reducing exposure (e.g., installing a soil cover or limiting access) or by reducing contaminant levels (e.g., active remediation) (USEPA, 1988). CAOs will be used to evaluate the exent of contamination within a site that may require corrective measures, and corrective measures alternative that best protects human health and the environment.

6.2 Land Use and Potentially Exposed Receptors

To focus on developing practicable and cost-effective corrective measures alternatives for the SWMU, and to streamline the environmental cleanup process for SWMU 74, EPA guidance ("Land Use in the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Remedy Selection Process," (USEPA, 1995) and U.S. Department of Defense (Longuemare, 1997) direct that CAOs should reflect the reasonably anticipated land use.

SWMU 74 is located along industrial areas of NAPR. Future property use of these sites is expected to remain industrial for the duration of Naval operations (caretaker) of NAPR, as well as after property is transferred. As a result, potential human exposure is limited to industrial or commercial property use, now and in the foreseeable future.

Therefore, based on EPA and Department of Defense guidance that CAOs should reflect actual anticipated land use, the assumed land use will be industrial, with industrial workers (i.e., civilians and or military personnel stationed at NAPR) the most likely receptors. Construction workers may be exposed to soil from the surface to a depth of ten feet below ground surface. Additionally, it is conservatively assumed that on-site trespassers could access the site and potentially be exposed to COPCs at the site. It is unlikely this site would ever be developed into a residential area given the current use of the area. If land use changes in the future, the SWMU will be reevaluated.

6.3 Selection of Contaminants of Potential Concern

The CAO development process in the CMS for SWMU 74 will identify the potential for human health risk to receptors exposed to surface soil (trespassers, industrial workers, and construction workers), subsurface soil (construction workers), and groundwater (industrial workers via inhalation of volatiles in indoor air and construction workers via dermal contact) at SWMU 74, which are affected by site-related activities. The previously mentioned potential COPCs from the EPC (NAVFAC Atlantic, 2005) will be incorporated into the CMS.

COPCs are those contaminants retained for further evaluation at this stage of the CMS process. They are contaminants that are detected in at least one sample in a given medium at concentrations that are greater than screening criteria. As noted in USEPA's Risk Assessment

Guidance for Superfund (RAGS) (USEPA, 1989), estimated concentrations, such as "J" qualified (estimated) data, will be included in the COPC screening process and subsequent quantitative risk assessment (if a contaminant is retained as a COPC). The screening criteria are USEPA Region IX residential and industrial soil PRGs, the Federal MCLs, and the USEPA Region IX Tap Water PRGs. PRGs are derived by USEPA Region IX using default exposure parameter values and the most recent toxicological criteria available. The PRGs used for this report are those issued in October 2004 (USEPA, 2004a) (or the most recent version at the time the CMS is completed) and are based on conservative residential and industrial exposure for soil and residential tap water exposure for groundwater. (The target risk used to calculate the PRGs is $1x10^{-6}$, while the target hazard quotient (HQ) is 0.1 to account for cumulative effects.)

Tables will be provided which summarize the data for the media identified at SWMU 74 (surface soil, subsurface soil, and groundwater), and the COPC selection process.

6.4 Exposure Assessment and Methodology for Development of CAOs

6.4.1 Qualitative CAOs

6.4.1.1 Groundwater

There is no direct current exposure to contaminated groundwater at SWMU 74 nor is future exposure likely based on the future land use scenarios discussed in Section 6.1.2. (Indirect exposure via inhalation of volatiles emitted from the contaminated groundwater through the overlying soils is possible, as discussed in detail below.) Groundwater is not currently used for potable purposes because drinking water is supplied via pipeline from El Yunque (rain forest), which supplies all of NSRR's present and projected needs.

Under nonresidential land use – particularly the continued industrial future land use scenario, in which the U.S. Navy determines the specific use of the property – it is reasonable to assume that no groundwater well will be installed within the limited volume of contaminated groundwater and be used for domestic purposes. Section 6.4.2 describes the methodology and exposure pathways for developing quantitative CAOs. The qualitative CAOs for contaminated groundwater are:

- To prevent further degradation of Puerto Rico's waters (Anti-degradation Policy, Regulation No. 4282, Puerto Rico Water Quality Standards Regulation, effective August 19, 1990.)

- To further restrict and prevent possible exposure to contaminated groundwater (e.g., by institutional controls).

- To protect public health and the environment in accordance with regulatory requirements (i.e., the general objective of all corrective measures).

6.4.1.2 Soil

Under the continued industrial land use scenario, contact with contaminants will occur from both surface and subsurface soil at SWMU 74. Section 6.4.2 describes the methodology and exposure pathways for developing quantitative CAOs based on these potential exposures. The qualitative CAOs for soil are:

- To prevent further degradation of Puerto Rico's waters (Anti-degradation Policy, Regulation No. 4282, Puerto Rico Water Quality Standards Regulation, effective August 19, 1990.)

- To protect human health and the environment in accordance with regulatory requirements (i.e., the general objective of all corrective measures).

6.4.2 Quantitative CAOs

Quantitative CAOs are acceptable residual contaminant concentrations. The following components will be used to determine CAOs for soil and groundwater:

- Intake by assumed exposure pathways.

- Chemical-specific toxicity data in the form of health effects criteria (see Section 6.5).

- Assumed target cancer risk level and noncancer hazard quotient.

The target risk level and HQ are general health effects levels deemed acceptable for exposure to individual carcinogenic and noncarcinogenic contaminants, respectively. The general equation for chemical intake that will be used in the human health RA is:

$$Intake(mg/kg\text{-}day) = \frac{C \times IR \times EF \times ED \times CF}{BW \times AT} \qquad \text{(Eq 6-1)}$$

where:

C	=	chemical concentration
IR	=	intake rate
EF	=	exposure frequency
ED	=	exposure duration
CF	=	conversion factor (to attain proper units)
BW	=	body weight
AT	=	averaging time for cancer or noncancer effects.

(Note: Units for the above parameters will vary depending on the medium of concern, i.e., soil or groundwater.)

This equation is algebraically combined with the general expressions for cancer risk and noncancer health effects, respectively:

$$Risk = Intake \quad SF \qquad \text{(Eq 6-2)}$$

$$HQ = Intake/RfD \qquad \text{(Eq 6-3)}$$

where:

Risk = target risk level ($1x\ 10^{-6}$, or one in 1 million excess cancer cases due to exposure to a chemical, given the assumed exposure pathway) (ratio, unitless).

SF = slope factor, or health effects criterion for cancer effects $(mg/kg/day)^{-1}$.

HQ = target HQ (1.0, implying that intake should not exceed the RfD) (ratio, unitless).

RfD = reference dose, or health effects criterion for noncancer effects. (mg/kg/day).

Assumed values for risk and HQ and chemical-specific SFs or RfDs are used to solve for the concentration term, or the pathway-specific CAO.

For the continued industrial land use scenario at this site, the industrial worker and construction worker will be used to characterize potential future exposure to contaminated soil and groundwater. Specifically for soil, industrial worker exposure is limited to surface soil (defined as zero to one foot) at SWMU 74, while construction workers may also be exposed to subsurface soil (zero to ten feet) at SWMU 74. Additionally, it is conservatively assumed that adult and/or adolescent trespassers may gain access to the site in the future and will also be used in the evaluation of potential exposure to contaminated surface soil.

The exposure pathways evaluated for developing quantitative CAOs for soil in the CMS are likely to be inadvertent ingestion (soil), inhalation of contaminants in particulates (soil); inhalation of volatiles emitted from soil and/or groundwater, and dermal absorption of contaminants following direct contact (soil and groundwater).

Industrial workers will only likely to be exposed to contaminants in groundwater via inhalation of volatiles emitted through the soil into buildings. The methodology outlined in EPA's November 29, 2002 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) (USEPA, 2002) will be used to determine whether the subsurface vapor intrusion pathway is complete and, if so, whether vapors are present at levels that may pose unacceptable exposure risk. This guidance includes a three-tiered approach for screening the exposure pathway. The three tiers involve increasing levels of complexity and specificity, and generic screening levels allow for a simple quantitative screen of contaminant concentrations.

The Johnson and Ettinger (1991) model, included as part of the guidance, may beused to quantify this exposure if the screening procedure outlined in the Subsurface Vapor Intrusion Guidance (USEPA, 2002) suggests it is necessary. EPA placed this model into a spreadsheet format and produced a User's Guide for use at contaminated sites (USEPA, 2000). The new version of the Johnson and Ettinger model states that exposure by indoor inhalation of contaminants is much greater than outdoor exposure due to greater dilution in outside air and enhanced volatilization indoors due to chimney and pressure effects. For these reasons, and because the model assumes full time exposure indoors (i.e., leaving no time for additional outdoor exposure), outdoor inhalation exposure to groundwater is not quantitatively evaluated.

6.5 Toxicity Evaluation

For the development of quantitative CAOs based on exposure to chemicals, the following health effects criteria will be of principal importance:

- RfDs for oral exposure – estimates of acceptable daily intake for chronic and subchronic exposure that will not produce deleterious noncancer effects. EPA defines subchronic exposure as periods of less than 7 years (USEPA, 1989).

Therefore, subchronic RfDs apply to construction workers, while chronic RfDs apply to industrial workers.

- Reference concentrations (RfCs) for inhalation exposure – estimates of acceptable concentrations for chronic and subchronic exposure that will not produce deleterious noncancer effects. These values are converted to inhalation RfDs by multiplying the RfC by the reference IR value of 20 m^3/day and dividing by the reference BW of 70 kilograms. RfCs are used in the Johnson and Ettinger (1991) model, while other inhalation pathways use the inhalation RfD. Subchronic inhalation RfDs and RfCs apply to the construction worker only, as discussed for RfDs for oral exposure.

- SFs for oral exposure – plausible upper-bound estimates of the probability of an individual developing cancer as a result of lifetime exposure to a potential carcinogen (USEPA, 1989).

- SFs for the inhalation route – plausible upper-bound estimates of the probability of an individual developing cancer as a result of lifetime exposure to a potential carcinogen (USEPA, 1989). Inhalation SFs are calculated from inhalation unit risk values in a similar manner as described above for inhalation RfDs. Unit risk values are used in the Johnson and Ettinger (1991) model, while all other inhalation pathways use the inhalation SF.

The primary source of chemical-specific health effects criteria which will be used during the CMS will be USEPA's Integrated Risk Information System (IRIS) database (USEPA, 2007). IRIS is a computer-housed catalog of USEPA health effects criteria and information. Data in IRIS are reviewed and updated monthly. If health effects criteria are not available in IRIS, USEPA recommends use of the Provisional Peer Reviewed Toxicity Values (PPRTVs) (database of values developed on a chemical-specific basis when requested by USEPA's Superfund program) as a secondary data source (USEPA, 2003b). Additional health effects criteria not provided in IRIS or as PPRTVs are obtained from other USEPA (e.g., Health Effects Assessment Summary Table [HEAST] [USEPA, 1997b]) and non-USEPA (e.g., Agency for Toxic Substances and Disease Registry [ATSDR] Minimal Risk Levels) sources of toxicity information. These sources should provide toxicity information based on similar methods and procedures as those used for IRIS and PPRTVs, contain values which are peer reviewed, are available to the public, and are transparent about the methods and processes used to develop the values.

Health effects criteria are available only for the oral and inhalation routes, and most of these criteria are based on the administered rather than the absorbed dose (i.e., the amount of chemical at a human exchange boundary, such as skin, that is available for absorption – but not the amount actually absorbed into the blood).

Adjustment will be made using oral absorption efficiency data (i.e., data on gastrointestinal absorption) from the species on which the oral health effects criteria are based. The administered dose oral health effects criterion will be multiplied (for RfDs) or divided (for SFs) by the gastrointestinal absorption factor to derive the absorbed dose criterion. Recommended oral absorption efficiencies for those compounds/analytes with chemical-specific dermal absorption factors from soil will be obtained from RAGS Part E (USEPA, 2004b).

6.6 Background Concentrations as CAOs

Background concentrations of inorganics may be used as quantitative CAOs when they exceed risk-based CAOs. The National Contingency Plan (NCP) preamble (55 *Federal Register*, 8717) states that preliminary remediation goals (PRGs; i.e., the CERCLA equivalent to quantitative CAOs) may be revised based on consideration of "technical factors," which may include background levels of contaminants. Therefore, if a calculated CAO is less than background inorganic constituents, the background concentration is used as the CAO.

7.0 IDENTIFICATION OF COCs

Contaminants of concern (COCs) are those contaminants detected at a site at concentrations that exceed human health based CAOs (derived using the protocol described in Section 6.0) or that pose an unacceptable ecological risk (as determined by exceedances of ecological CAOs derived using the protocol in Section 5.0). Once COCs are identified they are evaluated as potential candidates for clean-up throughout the remainder of the CMS process. This evaluation includes examination of the spatial and concentration distributions of COCs within the media in which they occur.

8.0 POTENTIAL CORRECTIVE MEASURES

This section of the CMS work plan describes the stepwise approach to be taken in performing the CMS for SWMU 74 (Fuel Pipelines and Hydrant Pits). The CMS consists of four tasks, which are described in the sections that follow.

8.1 Task I - Identification and Development of the Corrective Measure Alternative or Alternatives

This task will identify, screen, and develop the alternative or alternatives for removal, containment, treatment and/or other disposition of the contamination based on the objectives established for the corrective measure. The analysis will be based on the results of the all previous investigations at SWMU 74 as well as the CMS investigation described in Sections 3.0 of this document.

8.1.1 Description of the Current Situation

The current situation and the known nature and extent of contamination at SWMU 74 will be described in this section. A statement of the purpose for the response, based on the results of the CMS investigations will be provided, as will the actual or potential exposure pathways to potential human or ecological receptors of concern that will be addressed by the corrective measures.

8.1.2 Establishment of Corrective Action Objectives

Site specific objectives for the corrective action will be established in conjunction with the USEPA. These objectives will be based on public health and environmental criteria, information obtained from site investigations, USEPA guidance, and any applicable federal or Commonwealth of Puerto Rico statutes. The CAOs will be consistent with 40 CFR 264.100 as applicable.

8.1.3 Screening of Corrective Measure Technologies

The corrective measure technologies, which are applicable at the facility, will be reviewed based on all the available data and information at SWMU 74. This screening process focuses on eliminating those technologies that have severe limitations for a given set of waste and site-specific conditions or due to inherent technology limitations.

8.1.4 Identification of the Corrective Measure Alternative or Alternatives

The corrective measure alternative or alternatives will be developed based on the CAOs and analysis of the corrective measure technologies. Those alternatives that appear most suitable for the site based on sound engineering will be retained. Technologies can be combined to form the overall corrective action alternative or alternatives. The reasons for excluding any technology shall be documented.

8.2 Task II - Evaluation of the Corrective Measure Alternative or Alternatives

Each corrective measure technology and its components that passed through the initial screening in Task I will be described and evaluated. This evaluation will be based on technical, environmental, human health, and institutional concerns. Cost estimates for each corrective measure will also be developed.

8.2.1 Technical/Environmental/Human Health/Institutional

A description of each corrective measure alternative which includes but is not limited to preliminary process flow sheets, preliminary sizing and type of construction for buildings and structures, and rough quantities of utilities required will be provided. Each alternative will be evaluated in the following four areas:

8.2.1.1 Technical

Each corrective measure alternative will be evaluated based on performance, reliability, implementability, and safety.

8.2.1.2 Environmental

An environmental assessment will be performed for each alternative, which will focus on the facility conditions and pathways of contamination actually addressed by each alternative. The environmental assessment for each alternative will include, at a minimum, an evaluation of: the short and long term beneficial and adverse effects of the response alternative; any adverse effects on environmentally sensitive areas; and an analysis of measures to mitigate adverse effects.

8.2.1.3 Human Health

Each alternative will be assessed in terms of the extent to which it mitigates short- and long-term potential exposure to any residual contamination and protects human health both during and after implementation of the corrective measure. The assessment will describe the levels and characterizations of contaminants on-site, potential exposure routes, and potentially affected populations. Each alternative will be evaluated to determine the level of exposure to contaminants and the reduction over time. For management of mitigation measures, the relative reduction of impact will be determined by comparing residual levels of each alternative with existing criteria, standards, or guidelines acceptable to the USEPA.

8.2.1.4 Institutional

The relevant institutional needs for each alternative will be assessed. Specifically the effects of Federal, State, and local environmental and public health standards, regulations, guidance, advisories, ordinances, or community relations on the design, operation, and timing of each alternative will be examined.

8.2.2 Cost Estimate

A cost estimate of each corrective measure alternative will be developed. The cost estimate will include capital, operation, and maintenance costs.

8.3 Task III - Justification and Recommendation of the Corrective Measure or Measures

The corrective measure alternative will be recommended and justified using technical, human health, and environmental criteria. Tradeoffs among health risks, environmental effects, and other pertinent factors will be highlighted. The USEPA will select the corrective measure alternative or alternatives to be implemented based on the results of Task II and III. At a minimum the criteria in the sections that follow will be used to justify the final corrective measure or measures.

8.3.1 Technical

8.3.1.1 Performance

Corrective measure or measures that are most effective at performing their intended functions and maintaining the performance over extended periods of time will be given preference.

8.3.1.2 Reliability

Corrective measure or measures that do not require frequent or complex operation and maintenance activities and that have proven effective under waste and facility conditions similar to those anticipated will be given preference.

8.3.1.3 Implementability

Corrective measure or measures that can be constructed and operated to reduce levels of contamination to attain or exceed applicable standards in the shortest period of time will be preferred.

8.3.1.4 Safety

Corrective measure or measures that pose the least threat to the safety of nearby residents and environments as well as workers during implementation will be preferred.

8.3.2 Human Health

The corrective measure or measures will comply with existing USEPA criteria, standards, or guidelines for the protection of human health. Corrective measures that provide the minimum level of exposure to contaminants and the maximum reduction in exposure with time are preferred.

8.3.3 Environmental

The corrective measure or measures posing the least adverse impact (or greatest improvement) over the shortest period of time on the environment will be favored.

8.4 Task IV - Reports

8.4.1 Corrective Measures Study Final Report(s)

A CMS Task 1 Report will be prepared and submitted for approval within forty-five (45) days after receipt of the data validation report for data collected during the Phase II CMS Investigation described in this work plan. The Task I report shall include the items listed in Section 8.1 of this work plan, including establishment of CAOs. Alternatively, a CMS Investigation report will be prepared and submitted, proposing a streamlined CMS process.

Upon approval of the CMS Task 1 Report or CMS Investigation Report, a CMS Final Report will be prepared and submitted for approval within sixty (60) days. The CMS Final Report to be developed will include all the information gathered under the approved CMS Work Plan. At a minimum the report will include:

- A description of the facility;
  - Site topographic map & preliminary layouts.

- A summary of the corrective measure or measures;
  - Description of the corrective measure or measures and rationale for selection;
  - Performance expectations;
  - Preliminary design criteria and rationale;
  - General operation and maintenance requirements; and
  - Long-term monitoring requirements.

- A summary of the previous investigations and impact on the selected corrective measure or measures;
  - Field studies (groundwater and soil); and
  - Laboratory studies (bench-scale treatability studies)
  - Pilot-scale tests.

- Design and Implementation Precautions;
  - Special technical problems;
  - Additional engineering data required;
  - Permits and regulatory requirements;
  - Access, easements, right-of-way;
  - Health and safety requirements; and
  - Community relations activities.

- Cost Estimates and Schedules;
  - Capital cost estimate;
  - Operation and maintenance cost estimate; and
  - Project schedule (design, construction, operation).

9.0 SCHEDULE

A schedule for the implementation of this work plan, and follow-up reports for the CMS reports for SWMU 74 is provided as Figure 9-1.

It should be noted that this schedule is dependent upon EPA review time. Many other factors can also extend the schedule such as resampling if further re-characterization is required, weather delays in the field, funding is delayed by the Navy, or consensus cannot be reached on how the EPA's comments are to be incorporated.

10.0 PROJECT ORGANIZATION

An organizational chart presenting the proposed staffing for this project is provided on Figure 10-1. This section also outlines the responsibilities and reporting requirements of field personnel and staff.

10.1 Project Team Responsibilities

Mr. Mark Kimes, P.E., Activity Coordinator for all work in Puerto Rico, will manage the Baker Project Team. His responsibilities will be to direct the technical performance of the project staff, costs and schedule, ensuring that QA/QC procedures are followed during the course of the project. He will maintain communication with the BRAC PMO SE, Navy Technical Representative (NTR), Mr. Mark Davidson. Mr. John Mentz administer overall QA/QC for this project.

The field activities of this project will consist of one field team managed by the Geologist, Mr. Joseph Burawa. Mr. Burawa's responsibilities include directing the field team and subcontractors. Mr. Rick Aschenbrenner, P.E., will direct the reporting effort associated with the field investigation ensuring that all necessary staffing is utilized to assist in developing the CMS Report for SWMU 74.

10.2 Field Reporting Requirements

The Geologist will maintain a daily summary of each day's field activities. The following information will be included in this summary:

- Contractor and subcontractor personnel on site
- Major activities of the day
- Samples collected
- Problems encountered
- Other pertinent site information

The Geologist will receive direction from the Project Manager regarding any changes in scope of the investigation.

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TABLES

TABLE 3-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
ENVIRONMENTAL SAMPLES
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

		Fixed Based Analytical Lab Analysis							
Media	**Sample Depth (ft bgs)**	App IX VOCs	Low Level PAHs [4]	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO/DRO	RCRA Metals	Benzene	**Comment**
Surface Soil Samples, Phase I [a]									
74SB01-00	0.0 - 1.0	X	X	X		X			
74SB01-00D	0.0 - 1.0	X	X	X		X			Duplicate
74SB01-00MS/MSD	0.0 - 1.0	X	X	X		X			Matrix Spike/Matrix Spike Duplicate
74SB11-00	0.0 - 1.0	X	X	X		X			
(..continued…)	0.0 - 1.0	X	X	X		X			
Subsurface Soil Samples, Phase I									
74SB01-XX	(2)	X	X	X		X			
74SB01-XX	(2)	X	X	X		X			
74SB02-XX	(2)	X	X	X		X			
74SB02-XX	(2)	X	X	X		X			
(…continued…)	(2)	X	X	X		X			
Groundwater Samples, Phase I [a,b]									
74GWXX[1]	NA	X	X	X	X	X			
74GW11[1]	NA	X	X	X	X	X			
74GW21[1]	NA	X	X	X	X	X			
74GW21D[1]	NA	X	X	X	X	X			Duplicate
74GW21MS[1]	NA	X	X	X	X	X			Matrix Spike
74GW21MSD[1]	NA	X	X	X	X	X			Matrix Spike Duplicate
(…continued…)	NA	X	X	X	X	X			
Subsurface Soil Samples, Phase II									
74SBXX-XX[1][c]	(3)	X	X	X		X			
Groundwater Samples, Phase II									
74GWXX[C]	NA	X	X	X	X	X			
Other Field QA/QC Samples (each phase)									
Trip Blank Samples									
74TB-XX	NA	X				X (GRO)			One sample will accompany each cooler containing samples for VOC and TPH-GRO analysis
Equipment Rinsate Samples									
74ER01	NA	X	X		X	X			Stainless Steel Spoon
74ER02	NA	X	X		X	X			Macro Core Liner
74ER03	NA	X	X		X	X			Groundwater sample tubing
74ER-XX	NA	X	X		X	X			DPT probe or split-spoons, one per day of sampling
Field Blank Samples									
74FB01	NA	X	X	X	X				Lab Grade Deionized Water
74FB02	NA	X	X	X	X				Store-bought Distilled Warer
74FB03	NA	X	X	X	X				NAPR Potable Water

TABLE 3-1

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM
ENVIRONMENTAL SAMPLES
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

		Fixed Based Analytical Lab Analysis							
Media	**Sample Depth (ft bgs)**	App IX VOCs	Low Level PAHs (4)	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO/DRO	RCRA Metals	Benzene	**Comment**
IDW Samples (each phase)									
74IDW01	NA						X	X	Solid waste
74IDW02	NA						X	X	Aqueous waste

Notes:

(1) - The sample designator will be determined based on the soil boring location identifier.

(2) - The depth of the sample will be decided in the field, as specified in Section 3.1.

(3)- The sample depth in Phase II will be determined by results from Phase I and field decisions

(4) - Phase I PAH samples will be analyzed at 15 percent frequency based on PID, visual, or odor results, as well as from random locations

(a) - Surface soil samples will be collected at every 10th location

(b)- Groundwater samples will be collected following the field decisions described in Section 3.2

(c)- Sampling during Phase II will follow the rationale presented in Section 3.5

ft bgs - feet below ground surface.

NA - Not Applicable.

TABLE 3-2

PARAMETER LISTS AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Appendix IX - VOCs	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
Acetone	25	50	8260B (5030)(low level)
Acetonitrile	40	200	8260B (5030)(low level)
Acrolein	20	100	8260B (5030)(low level)
Acrylonitrile	20	100	8260B (5030)(low level)
Benzene	1.0	5.0	8260B (5030)(low level)
Bromodichloromethane	1.0	5.0	8260B (5030)(low level)
Bromoform	1.0	5.0	8260B (5030)(low level)
Bromomethane	1.0	10	8260B (5030)(low level)
Carbon Disulfide	1.0	5.0	8260B (5030)(low level)
Carbon Tetrachloride	1.0	5.0	8260B (5030)(low level)
Chlorobenzene	1.0	5.0	8260B (5030)(low level)
Chloroethane	1.0	10	8260B (5030)(low level)
Chloroform	1.0	5.0	8260B (5030)(low level)
Chloromethane	1.0	10	8260B (5030)(low level)
Chloroprene	1.0	5.0	8260B (5030)(low level)
3-Chloro-1-propene	1.0	5.0	8260B (5030)(low level)
1,2-Dibromo-3-chloropropane	1.0	10	8260B (5030)(low level)
Dibromochloromethane	1.0	5.0	8260B (5030)(low level)
1,2-Dibromoethane	1.0	5.0	8260B (5030)(low level)
Dibromomethane	1.0	5.0	8260B (5030)(low level)
trans-1,4-Dichloro-2-butene	2.0	10	8260B (5030)(low level)
Dichlorodifluoromethane	1.0	5.0	8260B (5030)(low level)
1,1-Dichloroethane	1.0	5.0	8260B (5030)(low level)
1,2-Dichloroethane	1.0	5.0	8260B (5030)(low level)
trans-1,2-dichloroethene	1.0	5.0	8260B (5030)(low level)
1,1-Dichloroethene	1.0	5.0	8260B (5030)(low level)
Methylene Chloride	5.0	5.0	8260B (5030)(low level)
1,2-Dichloropropane	1.0	5.0	8260B (5030)(low level)
cis-1,3-Dichloropropene	1.0	5.0	8260B (5030)(low level)
trans-1,3-Dichloropropene	1.0	5.0	8260B (5030)(low level)

TABLE 3-2

PARAMETER LISTS AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Appendix IX - VOCs (Cont.)	Quantitation Limits*		Method Number (Description)
	Water (µg/L)	Low Soil (µg/kg)	
Ethyl benzene	1.0	5.0	8260B (5030)(low level)
Ethyl methacrylate	1.0	5.0	8260B (5030)(low level)
2-Hexanone	10	25	8260B (5030)(low level)
Iodomethane	5.0	5.0	8260B (5030)(low level)
Isobutanol	40	200	8260B (5030)(low level)
Methacrylonitrile	20	100	8260B (5030)(low level)
2-Butanone	10	25	8260B (5030)(low level)
Methyl methacrylate	1.0	5.0	8260B (5030)(low level)
4-Methyl-2-pentanone	10	25	8260B (5030)(low level)
Pentachloroethane	5.0	25	8260B (5030)(low level)
Propionitrile	20	100	8260B (5030)(low level)
Stryene	1.0	5.0	8260B (5030)(low level)
1,1,1,2-Tetrachloroethane	1.0	5.0	8260B (5030)(low level)
1,1,2,2-Tetrachloroethane	1.0	5.0	8260B (5030)(low level)
Tetrachloroethene	1.0	5.0	8260B (5030)(low level)
Toluene	1.0	5.0	8260B (5030)(low level)
1,1,1-Trichloroethane	1.0	5.0	8260B (5030)(low level)
1,1,2-Trichloroethane	1.0	5.0	8260B (5030)(low level)
Trichloroethene	1.0	5.0	8260B (5030)(low level)
Trichlorofluoromethane	1.0	5.0	8260B (5030)(low level)
1,2,3-Trichloropropane	1.0	5.0	8260B (5030)(low level)
Vinyl Acetate	2.0	10	8260B (5030)(low level)
Vinyl Chloride	1.0	10	8260B (5030)(low level)
Xylene	2.0	10	8260B (5030)(low level)
Total Petroleum Hydrocarbons			
Diesel Range Organics (DRO)	100	3300	5030B/8015B
Gasoline Range Organics (GRO)	50	250	3550B/8015B

TABLE 3-2

PARAMETER LISTS AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		
Low Level PAHs	**Water (µg/L)**	**Low Soil (µg/kg)**	**Method Number (Description)**
Acenaphthene	0.2	6.7	8270C
Acenaphthylene	0.2	6.7	8270C
Anthracene	0.2	6.7	8270C
Benzo(a)anthracene	0.2	6.7	8270C
Benzo(b)fluoranthene	0.2	6.7	8270C
Benzo(k)fluoranthene	0.2	6.7	8270C
Benzo(g,h,i)perylene	0.2	6.7	8270C
Benzo(a)pyrene	0.2	6.7	8270C
Chrysene	0.2	6.7	8270C
Dibenzo(a,h)anthracene	0.2	6.7	8270C
Fluoranthene	0.2	6.7	8270C
Fluorene	0.2	6.7	8270C
Indeno(1,2,3-cd)pyrene	0.2	6.7	8270C
1-Methylnaphthalene	0.2	6.7	8270C
2-Methylnaphthalene	0.2	6.7	8270C
Naphthalene	0.2	6.7	8270C
Phenanthrene	0.2	6.7	8270C
Pyrene	0.2	6.7	8270C
	Quantitation Limits*		
Appendix IX - Metals	**Water (µg/L)**	**Low Soil (µg/kg)**	**Method Number (Description)**
Antimony	20	2.0	6010B (Inductively Coupled Plasma)
Arsenic	10	1.0	6010B (Inductively Coupled Plasma)
Barium	10	1.0	6010B (Inductively Coupled Plasma)
Beryllium	4.0	0.4	6010B (Inductively Coupled Plasma)
Cadmium	5.0	0.5	6010B (Inductively Coupled Plasma)
Chromium	10	1.0	6010B (Inductively Coupled Plasma)
Cobalt	10	1.0	6010B (Inductively Coupled Plasma)
Copper	20	2.0	6010B (Inductively Coupled Plasma)
Lead	5.0	0.5	6010B (Inductively Coupled Plasma)
Mercury	0.2	0.02	7470A/7471A (Cold Vapor AA)
Nickel	40	4.0	6010B (Inductively Coupled Plasma)
Selenium	10	1.0	6010B (Inductively Coupled Plasma)
Silver	10	1.0	6010B (Inductively Coupled Plasma)
Thallium	10	1.0	6010B (Inductively Coupled Plasma)
Tin	10	5.0	6010B (Inductively Coupled Plasma)
Vanadium	10	1.0	6010B (Inductively Coupled Plasma)
Zinc	20	2.0	6010B (Inductively Coupled Plasma)

TABLE 3-2

PARAMETER LISTS AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Quantitation Limits*		
RCRA Metals	**Water (µg/L)**	**Low Soil (µg/kg)**	**Method Number (Description)**
Arsenic	1	10.0	6010B (3050/3010) (Inductively Coupled Plasma)
Barium	1	10.0	6010B (3050/3010) (Inductively Coupled Plasma)
Cadmium	0.5	5.00	6010B (3050/3010) (Inductively Coupled Plasma)
Chromium	1	10.0	6010B (3050/3010) (Inductively Coupled Plasma)
Lead	0.5	5.0	6010B (3050/3010) (Inductively Coupled Plasma)
Mercury	0.02	0.20	7471A/7470A (Cold Vapor AA)
Selenium	1	10.0	6010B (3050/3010) (Inductively Coupled Plasma)
Silver	1	10.0	6010B (3050/3010) (Inductively Coupled Plasma)

Notes:

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the

µg/kg - micrograms per kilogram
ng/L - nanograms per liter
ng/g - nanograms per gram
mg/kg - milligrams per kilogram
NA - Not Applicable

TABLE 5-1
SOIL SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Volatile Organics (ug/kg):			
1,1,1,2-Tetrachloroethane	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,1,1-Trichloroethane	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,1,2,2-Tetrachloroethane	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,1,2-Trichloroethane	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,1-Dichloroethane	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,1-Dichloroethene	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,2,3-Trichloropropane	NA	---	---
1,2-Dibromo-3-chloropropane	NA	---	---
1,2-Dibromoethane (EDB)	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
1,2-Dichloroethane	402 (1)	MHSPE 2000	---
1,2-Dichloropropane	700,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
2-Butanone (Methyl ethyl ketone)	NA	---	---
2-Hexanone	NA	---	---
3-Chloropropene (Allyl chloride)	NA	---	---
4-Methyl-2-pentanone (MIBK)	NA	---	---
Acetone	NA	---	---
Acetonitrile	NA	---	---
Acrolein (Propenal)	NA	---	---
Acrylonitrile	1,000,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Benzene	101 (1)	MHSPE 2000	---
Bromodichloromethane	NA	---	---
Bromoform	NA	---	---
Bromomethane (Methyl bromide)	NA	---	---
Carbon disulfide	NA	---	---
Carbon tetrachloride	1,000,000	Efroymson et al. 1997a	Toxicological threshold for microbial processes
Chlorobenzene	40,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Chloroethane	NA	---	---
Chloroform	1,002 (1)	MHSPE 2000	---
Chloromethane (Methyl chloride)	NA	---	---
Chloroprene	NA	---	---

TABLE 5-1
SOIL SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
Volatile Organics (ug/kg):			
cis-1,3-Dichloropropene	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
Dibromochloromethane	NA	---	---
Dibromomethane (Methylene bromide)	NA	---	---
Dichlorodifluoromethane	NA	---	---
Ethylbenzene	5,003 (1)	MHSPE 2000	---
Ethyl methacrylate	NA	---	---
Iodomethane (Methyl iodide)	NA	---	---
Isobutanol (Isobutyl alcohol)	NA	---	---
Methacrylonitrile	NA	---	---
Methylene chloride (Dichloromethane)	1,004 (1)	MHSPE 2000	---
Methyl methacrylate	NA	---	---
Pentachloroethane	NA	---	---
Propionitrile	NA	---	---
Styrene	10,030 (1)	MHSPE 2000	---
Tetrachloroethene	400 (1)	MHSPE 2000	---
Toluene	13,001 (1)	MHSPE 2000	---
1,2-Dichloroethene (total)	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
trans-1,2-Dichloroethene	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
trans-1,3-Dichloropropene	100	CCME 2006	Canadian soil quality guideline based on agricultural land uses
trans-1,4-Dichloro-2-butene	1,000,000	Efroymson et al. 1997a	Toxicological threshold for microbial processess
Trichloroethene	6,010 (1)	MHSPE 2000	---
Trichlorofluoromethane	NA	---	---
Vinyl acetate	NA	---	---
Vinyl chloride	11.0 (1)	MHSPE 2000	---
Xylene	2,501 (1)	MHSPE 2000	---
PAHs (ug/kg):			
1-Methylnaphthalene	1,200	---	Value for benzo(a)pyrene used as a surrogate
2-Methylnaphthalene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Acenaphthene	20,000	Efroymson et al. 1997b	Toxicological threshold for plants
Acenaphthylene	1,200	---	Value for benzo(a)pyrene used as a surrogate

TABLE 5-1
SOIL SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Soil Screening Value	Reference	Comment
PAHs (ug/kg):			
Anthracene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Benzo(a)anthracene	1,200	USEPA 1999	Value for benzo(a)pyrene used as a surrogate
Benzo(a)pyrene	1,200	USEPA 1999	Toxicological threshold for plants
Benzo(b)fluoranthene	1,200	USEPA 1999	Toxicological threshold for plants
Benzo(g,h,i)perylene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Benzo(k)fluoranthene	1,200	USEPA 1999	Value for benzo(a)pyrene used as a surrogate
Chrysene	1,200	USEPA 1999	Value for benzo(a)pyrene used as a surrogate
Dibenzo(a,h)anthracene	1,200	USEPA 1999	Value for benzo(a)pyrene used as a surrogate
Fluoranthene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Fluorene	30,000	Efroymson et al. 1997a	Toxicological threshold for earthworms
Indeno(1,2,3-cd)pyrene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Naphthalene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Phenanthrene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Pyrene	1,200	---	Value for benzo(a)pyrene used as a surrogate
Inorganics (mg/kg):			
Antimony	78	USEPA 2005a	Ecological soil screening level for invertebrates
Arsenic	18	USEPA 2005b	Ecological soil screening level for plants
Barium	330	USEPA 2005c	Ecological soil screening level for invertebrates
Beryllium	40	USEPA 2005d	Ecological soil screening level for invertebrates
Cadmium	32	USEPA 2005e	Ecological soil screening level for plants
Chromium (total)	0.4	Efroymson et al. 1997a	Toxicological threshold for earthworms
Cyanide	0.9	CCME 2006	Canadian soil quality guideline based on agricultural land uses
Cobalt	13	USEPA 2005f	Ecological soil screening level for plants
Copper	70	USEPA 2006a	Ecological soil screening level for plants
Lead	120	USEPA 2005g	Ecological soil screening level for plants
Mercury	0.1	Efroymson et al. 1997a	Toxicological threshold for earthworms
Nickel	30	Efroymson et al. 1997b	Toxicological threshold for plants
Selenium	1	Efroymson et al. 1997b	Toxicological threshold for plants
Silver	560	USEPA 2006b	Ecoloigcal soil screening level for plants
Thallium	1	Efroymson et al. 1997b	Toxicological threshold for plants
Vanadium	2	Efroymson et al. 1997b	Toxicological threshold for plants
Zinc	50	Efroymson et al. 1997b	Toxicological threshold for plants

TABLE 5-1
SOIL SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Notes:

NA = Not Available
MHSPE = Ministry of Housing, Spatial Planning and Environment
CCME = Canadian Council of Ministers of the Environment
USEPA = United States Environmental Protection Agency
PAH = Polynuclear Aromatic Hydrocarbon
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram

(1) The screening value shown is an average of the target and intervention soil standards. The value is based on a default organic carbon content of 0.02 (2 percent), which represents a minimum value (adjustment range is 2 to 30 percent).

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USEPA. 2005b. Ecological Soil Screening Levels for Arsenic (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-62.

USEPA. 2005c. Ecological Soil Screening Levels for Barium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

TABLE 5-1
SOIL SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Table References (continued):

USEPA. 2005a. Ecological Soil Screening Levels for Antimony (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-61.

USEPA. 2005b. Ecological Soil Screening Levels for Arsenic (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-62.

USEPA. 2005c. Ecological Soil Screening Levels for Barium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

USEPA. 2005d. Ecological Soil Screening Levels for Beryllium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-63.

USEPA. 2005e. Ecological Soil Screening Levels for Cadmium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-65.

USEPA. 2005f. Ecological Soil Screening Levels for Cobalt (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-67

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TABLE 5-2
GROUNDWATER SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment
Volatile Organics (ug/L):			
1,1,1,2-Tetrachloroethane	902	Buchman 1999	Acute LOEL with a safety factor of 10
1,1,1-Trichloroethane	312	USEPA 2001	EPA Region 4 chronic screening value
1,1,2,2-Tetrachloroethane	90.2	USEPA 2001	EPA Region 4 chronic screening value
1,1,2-Trichloroethane	340	USEPA 2003	Minimum acute value (48-hr LC_{50} for *Pleuronectes platessa* [sand dab]) with a safety factor of 100
1,1-Dichloroethane	47.0 [2]	USEPA 1996a	Tier II Value
1,1-Dichloroethene	2,240	USEPA 2001	EPA Region 4 chronic screening value
1,2,3-Trichloropropane	274 [2]	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
1,2-Dibromo-3-chloropropane	100	USEPA 2003	Minimum acute value (48-hr EC_{50} for *Mercenaria mercenaria* [hard clam]) with a safety factor of 100
1,2-Dibromoethane (EDB)	48.0	USEPA 2003	Minimum acute value (48-hr LC_{50} for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 100
1,2-Dichloroethane	1,130	USEPA 2001	EPA Region 4 chronic screening value
1,2-Dichloropropane	2,400	USEPA 2001	EPA Region 4 chronic screening value
2-Butanone (Methyl ethyl ketone)	40,000	USEPA 2003	Minimum acute value (96-hour NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 10
2-Hexanone	98.8 [2]	Suter II 1996	Tier II secondary chronic value
3-Chloropropene (Allyl chloride)	3.40 [2]	USEPA 2003	Minimum acute value (48-hr LC_{50} for *Xenopus laevis* [clawed toad]) with a safety factor of 100
4-Methyl-2-pentanone (MIBK)	164	Suter II 1996	Tier II Secondary Chronic Value
Acetone	1,000	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Lumbriculus variegatus* [Oligochaete]) with a safety factor of 100
Acetonitrile	160,000 [2]	USEPA 2003	Minimum chronic value (21-day NOEC for *daphnia magna* based on reproduction)
Acrolein (Propenal)	0.55	USEPA 2001	EPA Region 4 chronic screening value
Acrylonitrile	58.1	USEPA 2003	Minimum acute value (96-hr $LC_{50\ for}$ *Americamysis bahia* [opossum shrimp]) with a safety factor of 100
Benzene	109	USEPA 2001	EPA Region 4 chronic screening value
Bromodichloromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Bromoform	640	USEPA 2001	EPA Region 4 chronic screening value
Bromomethane (Methyl bromide)	120	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
Carbon disulfide	650 [2]	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Alburnus alburnus* [bleak]) with a safety factor of 100
Carbon tetrachloride	1,500	USEPA 2001	EPA Region 4 chronic screening value
Chlorobenzene	105	USEPA 2001	EPA Region 4 chronic screening value
Chloroethane	NA	---	---
Chloroform	815	USEPA 2001	EPA Region 4 chronic screening value
Chloromethane (Methyl chloride)	2,700	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Menidia beryllina* [inland silverside]) with a safety factor of 100
Chloroprene	NA	---	---
cis-1,3-Dichloropropene	7.90	USEPA 2001	EPA Region 4 chronic screening value (cis and trans)
Dibromochloromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Dibromomethane (Methyl bromide)	6,400	Buchman 1999	Chronic LOEL for chemical class
Dichlorodifluoromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Ethylbenzene	4.30	USEPA 2001	EPA Region 4 chronic screening value
Ethyl methacrylate	NA	---	---

TABLE 5-2
GROUNDWATER SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment
Volatile Organics (ug/L):			
Iodomethane (Methyl iodide)	NA	---	---
Isobutanol (Isobutyl alcohol)	10,000	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Alburnus alburnus* [bleak]) with a safety factor of 100
Methacrylonitrile	NA	---	---
Methylene chloride (Dichloromethane)	2,560	USEPA 2001	EPA Region 4 chronic screening value
Methyl methacrylate	1,300 [2]	USEPA 2003	Minumum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
Pentachloroethane	281	Buchman 1999	Chronic LOEL
Propionitrile	15,200 [2]	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Pimephales promelas* [fathead minnow]) with a safety factor of 100
Styrene	510	USEPA 2003	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 10
Tetrachloroethene	45.0	USEPA 2001	EPA Region 4 chronic screening value
Toluene	37.0	USEPA 2001	EPA Region 4 chronic screening value
trans-1,2-dichloroethene	22,400	Buchman 1999	Acute LOEL (summation of all isomers) with a safety factor of 10
trans-1,3-Dichloropropene	7.90	USEPA 2001	EPA Region 4 chronic screening value (cis and trans)
trans-1,4-Dichloro-2-butene	NA	---	---
Trichloroethene	200	Buchman 1999	Acute LOEL with a safety factor of 10
Trichlorofluoromethane	6,400	Buchman 1999	Chronic LOEL for chemical class
Vinyl acetate	100	USEPA 2003	Minimum acute value (48-hr LC_{50} for *Crangon crangon* [sand shrimp]) with a safety factor of 100
Vinyl chloride	87.8 [2]	Suter II 1996	Tier II secondary chronic value
Xylene	41.0 [3]	USEPA 2003	Minimum acute value (96-hr EC_{50} for *Strongylocentrotus droebachiensis* [green sea urchin]) with a safety factor of 100
PAHs (ug/L):			
1-Methylnaphthalene	19.0	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Cancer magister* [dungeness crab]) with a safety factor of 100
2-Methylnaphthalene	3.00	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Gadus morhua* [Atlantic cod]) with a safety factor of 100
Acenaphthene	9.70	USEPA 2001	EPA Region 4 chronic screening value
Acenaphthylene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Anthracene	50.0	USEPA 1996b	Acute value (LC_{50}) with a safety factor of 100
Benzo(a)anthracene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Benzo(a)pyrene	10.0	USEPA 1996b	Acute value (LC_{50}) with a safety factor of 100
Benzo(b)fluoranthene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Benzo(g,h,i)perylene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Benzo(k)fluoranthene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Chrysene	10.0	USEPA 1996b	Acute value (LC_{50}) with a safety factor of 100
Dibenzo(a,h)anthracene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Fluoranthene	11.0	USEPA 1996a	Final Chronic Value
Fluorene	10.0	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Nereis arenaceodentata* [polychaete]) with a safety factor of 100
Indeno(1,2,3-cd)pyrene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10
Naphthalene	23.5	USEPA 2001	EPA Region 4 chronic screening value
Phenanthrene	8.30	USEPA 1996a	Final Chronic Value
Pyrene	30.0	Buchman 1999	Acute LOEL for chemical class with a safety factor of 10

TABLE 5-2
GROUNDWATER SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Surface Water Screening Value [1]	Reference	Comment
Inorganics (ug/L):			
Antimony	500	Buchman 1999	Proposed CCC
Arsenic	36.0	USEPA 2006	Total recoverable CCC for trivalent arsenic
Barium	50,000	USEPA 2003	Minimum acute value (96-hr NOEC for *Cyprinodon variegatus* [sheepshead minnow]) with a safety factor of 100
Beryllium	310	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Fundulus heteroclitus* [mummichog]) with a safety factor of 100
Cadmium	8.85	USEPA 2006	Total recoverable CCC
Chromium (total)	50.4	USEPA 2006	Total recoverable CCC for hexavalent chromium
Cobalt	45.0	USEPA 2003	Minimum acute value (96-hr LC_{50} for *Nitocra spinipes* [Harpacticoid copepod]0 with a safety factor of 100
Copper	3.73	USEPA 2006	Total recoverable CCC
Lead	8.52	USEPA 2006	Total recoverable CCC
Mercury	1.11	USEPA 2006	Total recoverable CCC
Nickel	8.28	USEPA 2006	Total recoverable CCC
Selenium	71.1	USEPA 2006	Total recoverable CCC
Silver	0.23	USEPA 2001	EPA Region 4 chronic screening value
Thallium	21.3	USEPA 2001	EPA Region 4 chronic screening value
Tin	NA	---	---
Vanadium	120 [2]	USEPA 2003	Minimum chronic value (28-day NOEC for *Pimephales promelas* [fathead minnow] based on growth)
Zinc	85.6	USEPA 2006	Total recoverable CCC

Notes:

NA = Not Available
EPA = Environmental Protection Agency
CCC = Criteria Continuous Concentration
LOEL = Lowest Observed Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NOEC = No Observed Effect Concentration
USEPA = United States Environmental Protection Agency
CCC = Criteria Continuoous Concentration
EC_{50} = Median Effective Concentration
LC_{50} = Median Lethal Concentration

PAH = Polynuclear aromatic Hydrocarbon
µg/L = microgram per liter

[1] The values shown are marine/estuarine screening values unless otherwise noted.
[2] The chemical lacks a marine/estuarine surface water screening value. The value shown is a freshwater screening value.
[3] The value shown is for o-xylene.

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TABLE 5-2
GROUNDWATER SCREENING VALUES
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

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TABLE 5-3
INGESTION-BASED SCREENING VALUES FOR BIRDS
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference
Volatile Organics:									
1,1,1,2-Tetrachloroethane	---	---	---	---	---	---	NA	NA	---
Carbon tetrachloride	---	---	---	---	---	---	NA	NA	---
Chlorobenzene	---	---	---	---	---	---	NA	NA	---
Chloroform	---	---	---	---	---	---	NA	NA	---
Ethylbenzene	---	---	---	---	---	---	NA	NA	---
Pentachloroethane	---	---	---	---	---	---	NA	NA	---
Styrene	---	---	---	---	---	---	NA	NA	---
Toluene	---	---	---	---	---	---	NA	NA	---
Trichloroethene	---	---	---	---	---	---	NA	NA	---
Xylene	Quail	0.191	Subacute	?	"Toxicity"	---	405	40.5	Hill and Camardese 1986
PAHs:									
1-Methylnaphthalene	Mallard duck	1.04	7 months	Oral in diet	Hepatic	Not Applicable	228	22.8	Patton and Dieter 1980
2-Methylnaphthalene	Mallard duck	1.04	7 months	Oral in diet	Hepatic	Not Applicable	228	22.8	Patton and Dieter 1980
Acenaphthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Acenaphthylene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Anthracene	Mallard duck	1.043	7 months	Oral in diet	Hepatic	Not Applicable	228	22.8	Patton and Dieter 1980
Benzo(a)anthracene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Benzo(a)pyrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Benzo(b)fluoranthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Benzo(g,h,i)perylene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Benzo(k)fluoranthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Chrysene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Dibenz(a,h)anthracene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Fluoranthene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Fluorene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Indeno(1,2,3-cd)pyrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Naphthalene	Mallard duck	1.04	7 months	Oral in diet	Hepatic	Not Applicable	228	22.8	Patton and Dieter 1980
Phenanthrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Pyrene	Chicken	1.50	34 days	Oral in diet	Reproduction	Not Applicable	395	39.5	Rigdon and Neal 1963
Inorganics:									
Antimony	Northern bobwhite	0.19	6 weeks	Oral	?	Unknown	47,400	4,740	Opresko et al. 1993
Arsenic	Chicken	Unknown	19 days	Oral in diet	Mortality	Unknown	22.4	2.24	USEPA 2005a
Barium	One-day old chicks	0.121	4 weeks	Oral in diet	Mortality	Barium hydroxide	41.7	20.8	Sample et al. 1996
Beryllium	---	---	---	---	---	---	NA	NA	---
Cadmium	Multiple species	Unknown	Various	Oral in diet	Reproduction/growth	Unknown	11.47	1.47 (1)	USEPA 2005b
Chromium	Multiple species	Unknown	Various	Oral in diet	Reproduction/growth	Trivalent chromium	26.6	2.66 (1)(2)	USEPA 2005c
Cobalt	Multiple species	Unknown	Various	Oral in diet	Growth	Unknown	76.1	7.61 (1)	USEPA 2005d
Copper	Chicken	Unknown	84 days	Oral in diet	Reproduction	Unknown	12.1	4.05	USEPA 2006a
Lead	Chicken	Unknown	4 weeks	Oral in diet	Reproduction	Unknown	3.26	1.63	USEPA 2005e
Mercury	Mallard duck	1.00	3 generations	Oral in diet	Reproduction	Methyl mercury dicyandiamide	0.078	0.026	USEPA 1997
Nickel	Mallard duckling	0.782	90 days	Oral in diet	Growth/mortality	Nickel sulfate	107	77.4	Sample et al. 1996
Selenium	Mallard duck	1.00	100 days	Oral in diet	Reproduction	Selanomethionine	0.80	0.40	Sample et al. 1996
Silver	Turkey	Unknown	5 weeks	Oral in diet	Growth	Unknown	20	2.02	USEPA 2006b
Thallium	European starling	Unknown	acute	Oral	Unknown	Unknown	3.50	0.35	USEPA 1999

TABLE 5-3
INGESTION-BASED SCREENING VALUES FOR BIRDS
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	Test Material	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference
Inorganics:									
Tin	Japanese quail	0.15	6 weeks	Oral in diet	Reproduction	bis(Tributyltin)-oxide	16.9	6.80	Sample et al. 1996
Vanadium	Chicken	Unknown	5 weeks	Oral in diet	Growth	Unknown	0.688	0.344	USEPA 2005f
Zinc	White leghorn hen	1.935	44 weeks	Oral in diet	Reproduction	Zinc sulfate	131	14.5	Sample et al. 1996

Notes:

NA = Not Available
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
USEPA = United States Environmental Protection Agency
mg/kg/day = milligram per kilogram-body weight per day
PAH = Polynuclear Aromatic Hydrocarbon
kg = kilogram

(1) The NOAEL value represents a geometric mean of NOAEL values for growth and/or reproduction. The NOAEL value was used in the derivation of the avian ecological soil screening level.
(2) The NOAEL value shown is for trivalent chromium.

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USEPA. 2005a. Ecological Soil Screening Levels for Arsenic (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-62.

USEPA. 2005b. Ecological Soil Screening Levels for Cadmium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-65.

USEPA. 2005c. Ecological Soil Screening Levels for Chromium (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-66.

USEPA. 2005d. Ecological Soil Screening Levels for Cobalt (Interim Final). Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-67

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FIGURES

111626_74_00.dwg

4 0 2 4 8

1 inch = 4 miles

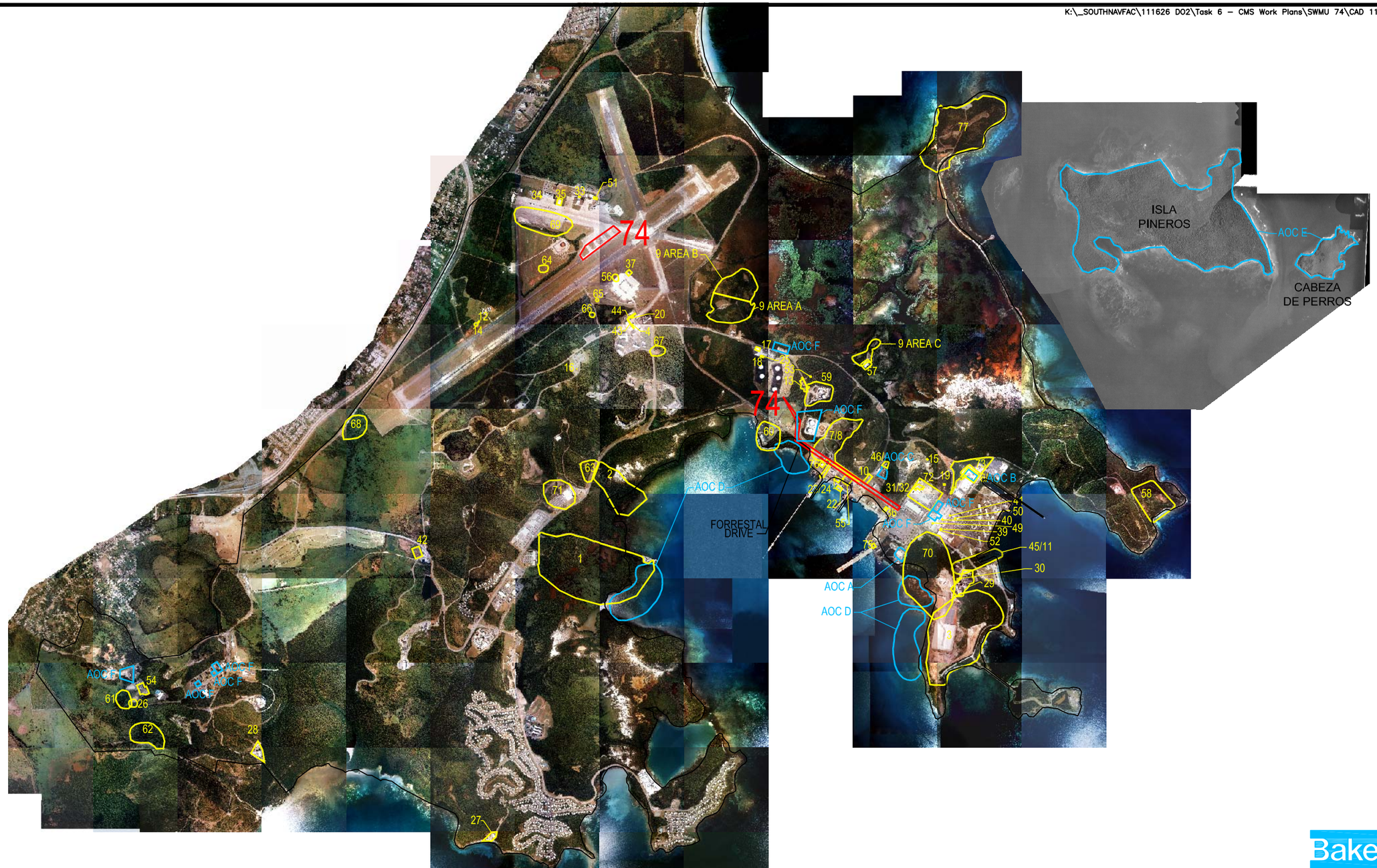
Baker

FIGURE 1-1
REGIONAL LOCATION MAP
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN

SOURCE: METRODATA, INC., 1999.

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\111626 DO2\Task 6 – CMS Work Plans\SWMU 74\CAD 111626_74_01



Baker

LEGEND

1 – SWMUs

74 – ORIGINAL ECP SITE 20 BOUNDARY

AOC D – AOCs

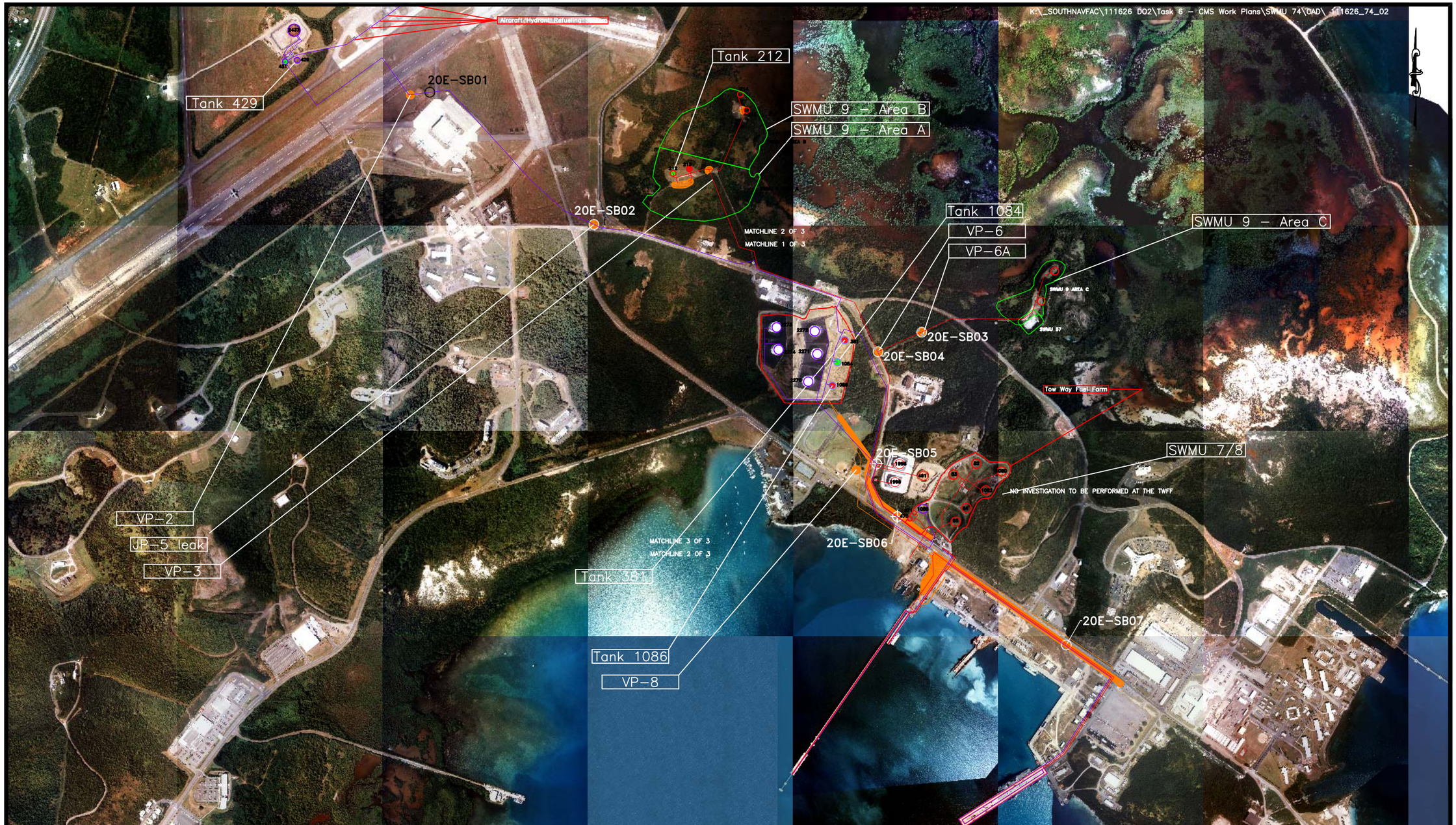
SOURCE: GEO–MARINE, INC., SEPTEMBER 6, 2000.

3000 0 1500 3000

1 inch = 3000 ft.

FIGURE 1–2
SWMU/AOC LOCATION MAP
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO



1200 0 600 1200

1 inch = 1200 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

LEGEND

- SUBSURFACE SOIL AND GROUNDWATER SAMPLE LOCATION (ECP 2004)
- SUBSURFACE SOIL SAMPLE LOCATION (ECP 2004)
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- DFM PIPELINE
- SWMU BOUNDARY

FIGURE 1-3
ECP SAMPLE LOCATION MAP
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

1200 0 600 1200
1 inch = 1200 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

LEGEND

FIGURE 3-1
MAP LOCATOR
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

450 0 225 450

1 inch = 450 ft.

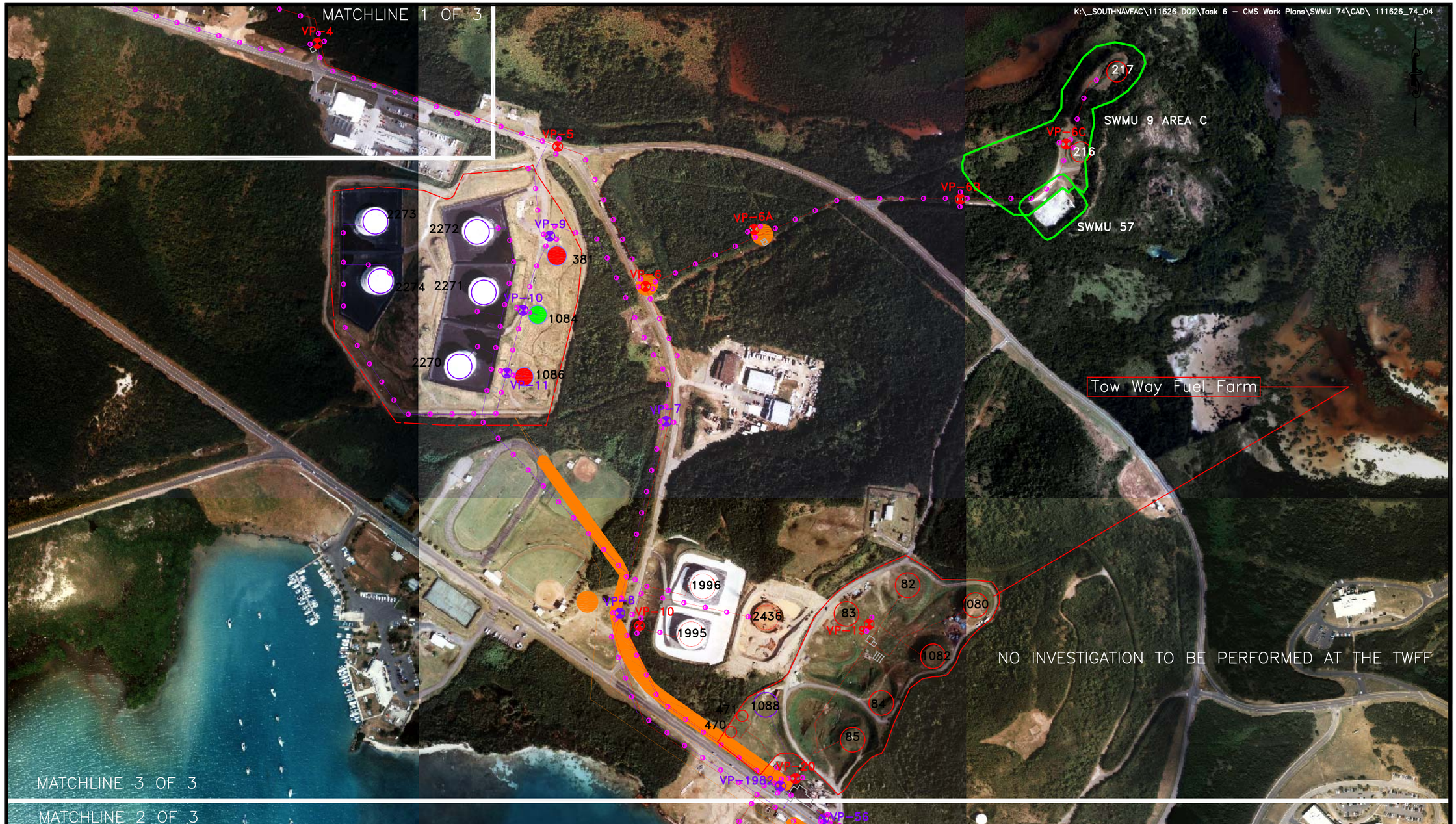
Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

LEGEND

- PROPOSED SOIL BORING LOCATION
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- JP-5 VALVE PIT LOCATIONS
- DFM PIPELINE
- DFM VALVE PIT LOCATIONS
- SWMU BOUNDARY

FIGURE 3-2
PROPOSED SAMPLE LOCATIONS
1 OF 3
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO



450 0 225 450

1 inch = 450 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

LEGEND

- PROPOSED SOIL BORING LOCATION
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- JP-5 VALVE PIT LOCATIONS
- DFM PIPELINE
- DFM VALVE PIT LOCATIONS
- SWMU BOUNDARY

FIGURE 3-3
PROPOSED SAMPLE LOCATIONS
2 OF 3
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

450 0 225 450
1 inch = 450 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

LEGEND

- PROPOSED SOIL BORING LOCATION
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- JP-5 VALVE PIT LOCATIONS
- DFM PIPELINE
- DFM VALVE PIT LOCATIONS
- SWMU BOUNDARY

FIGURE 3-4
PROPOSED SAMPLE LOCATIONS
3 OF 3
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

Figure 5-1: Navy Ecological Risk Assessment Tiered Approach

RPM Input and Risk Management Consideration[3]

Step 8: Risk Management

Tier 1. Screening Risk Assessment (SRA): Identify pathways and compare exposure point concentrations to bench marks.

Step 1: Site visit; Pathway Identification/Problem Formulation; Toxicity Evaluation

Step 2: Exposure Estimate; Risk Calculation (SMDP) [1]

Proceed to Exit Criteria for SRA

Exit Criteria for the Screening Risk Assessment: Decision for exiting or continuing the ecological risk assessment.

1) Site passes screening risk assessment: A determination is made that the site poses acceptable risk and shall be closed out for ecological concerns.

2) Site fails screening risk assessment: The site must have both complete pathway and unacceptable risk. As a result the site will either have an interim cleanup or moves to the second tier.

Tier 2. Baseline Ecological Risk Assessment (BERA): Detailed assessment of exposure and hazard to "assessment endpoints" (ecological qualities to be protected). Develop site specific values that are protective of the environment.

Step 3a: Refinement of Conservative Exposure Assumptions[2] (SRA)---- **Proceed to Exit Criteria for Step 3a**

Step 3b: Problem Formulation - Toxicity Evaluation; Assessment Endpoints; Conceptual Model; Risk Hypothesis (SMDP)

Step 4: Study Design/DQO - Lines of Evidence; Measurement Endpoints; Work Plan and Sampling & Analysis Plan (SMDP)

Step 5: Verification of Field Sampling Design (SMDP)

Step 6: Site Investigation and Data Analysis [SMDP]

Step 7: Risk Characterization

Proceed to Exit Criteria for BERA

Exit Criteria Step 3a Refinement

1) If re-evaluation of the conservative exposure assumptions (SRA) support an acceptable risk determination then the site exits the ecological risk assessment process.

2) If re-evaluation of the conservative exposure assumptions (SRA) do not support an acceptable risk determination then the site continues in the Baseline Ecological Risk Assessment process. **Proceed to Step 3b**.

Exit Criteria Baseline Risk Assessment

1) If the site poses acceptable risk then no further evaluation and no remediation from an ecological perspective is warranted.

2) If the site poses unacceptable ecological risk and additional evaluation in the form of remedy development and evaluation is appropriate, proceed to third tier.

Tier 3. Evaluation of Remedial Alternative (RAGs C)

a. Develop site specific risk based cleanup values.

b. Qualitatively evaluate risk posed to the environment by implementation of each alternative (short term) impacts and estimate risk reduction provided by each (long-term) impacts; provide quantitative evaluation where appropriate. Weigh alternative using the remaining CERCLA 9 Evaluation Criteria. Plan for monitoring and site closeout.

Notes: 1) See USEPA's 8 Step ERA Process for requirements for each Scientific Management Decision Point (SMDP).
2) Refinement includes but is not limited to background, bioavailability, detection frequency, etc.
3) Risk Management is incorporated throughout the tiered approach.

FIGURE 5-2

STATISTICAL ANALYSIS PROCESS
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

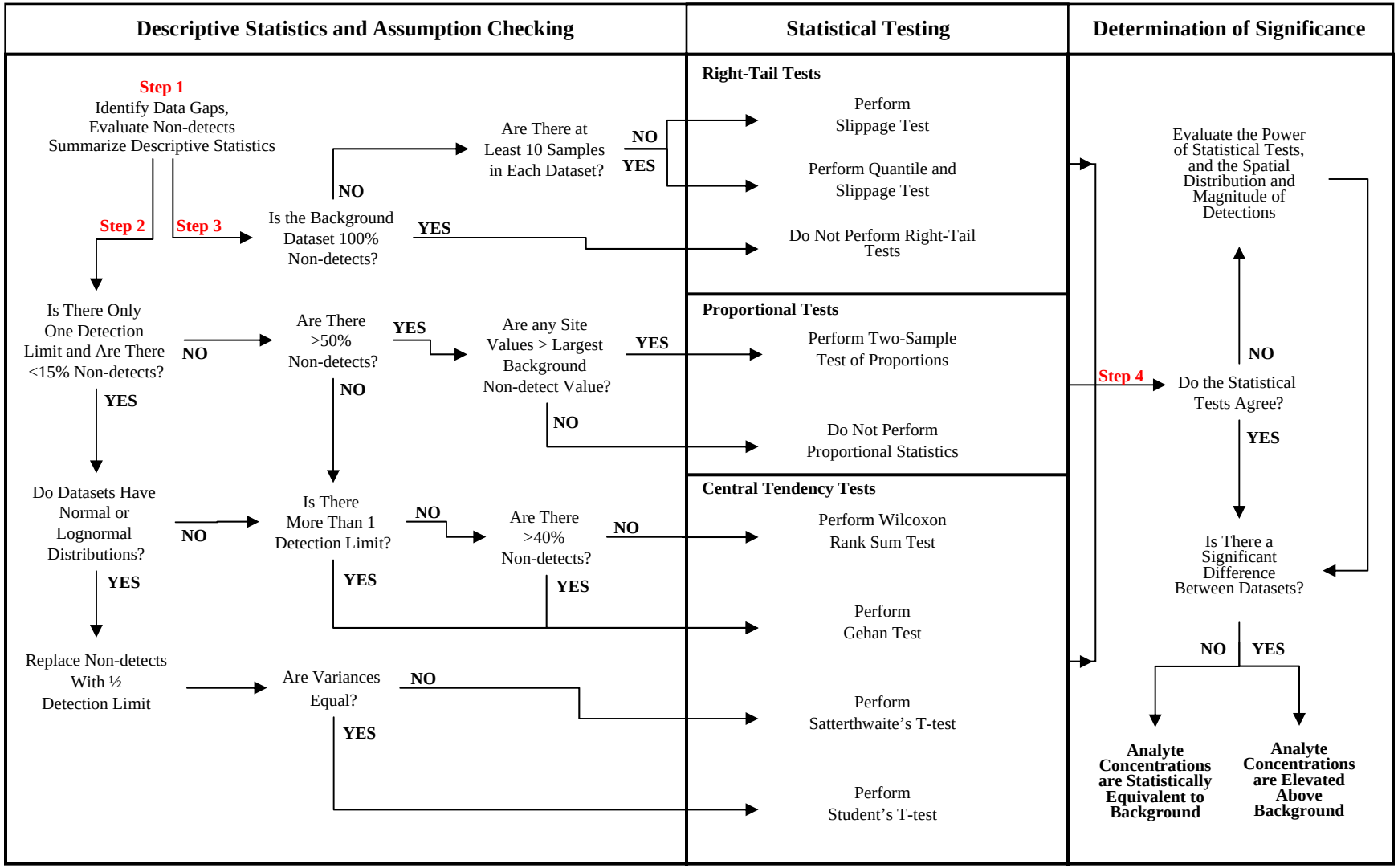


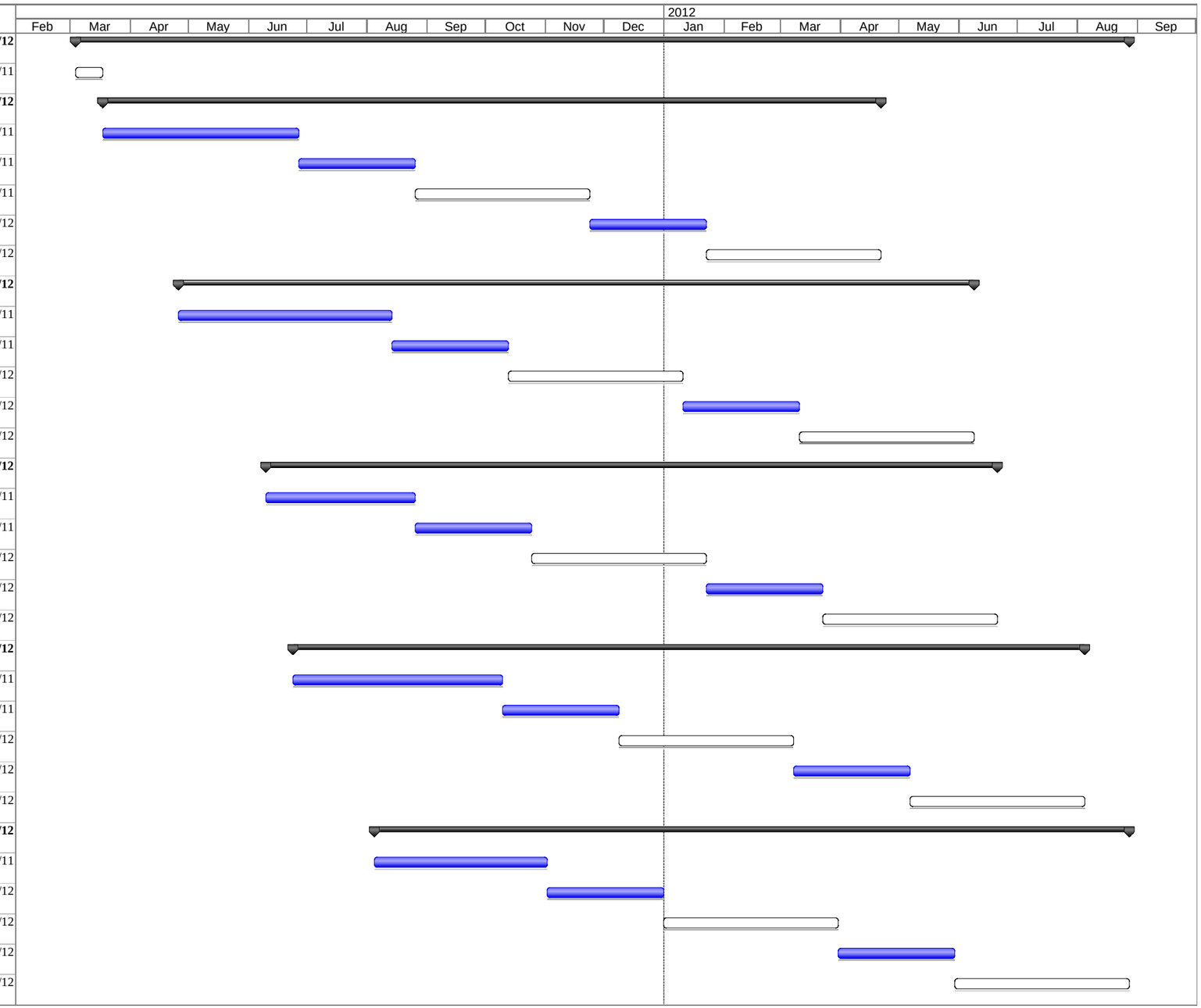
Figure Adapted from NFESC, 1998

T-tests performed on log-transformed data if datasets have lognormal distributions.

Revised: March 4, 2011

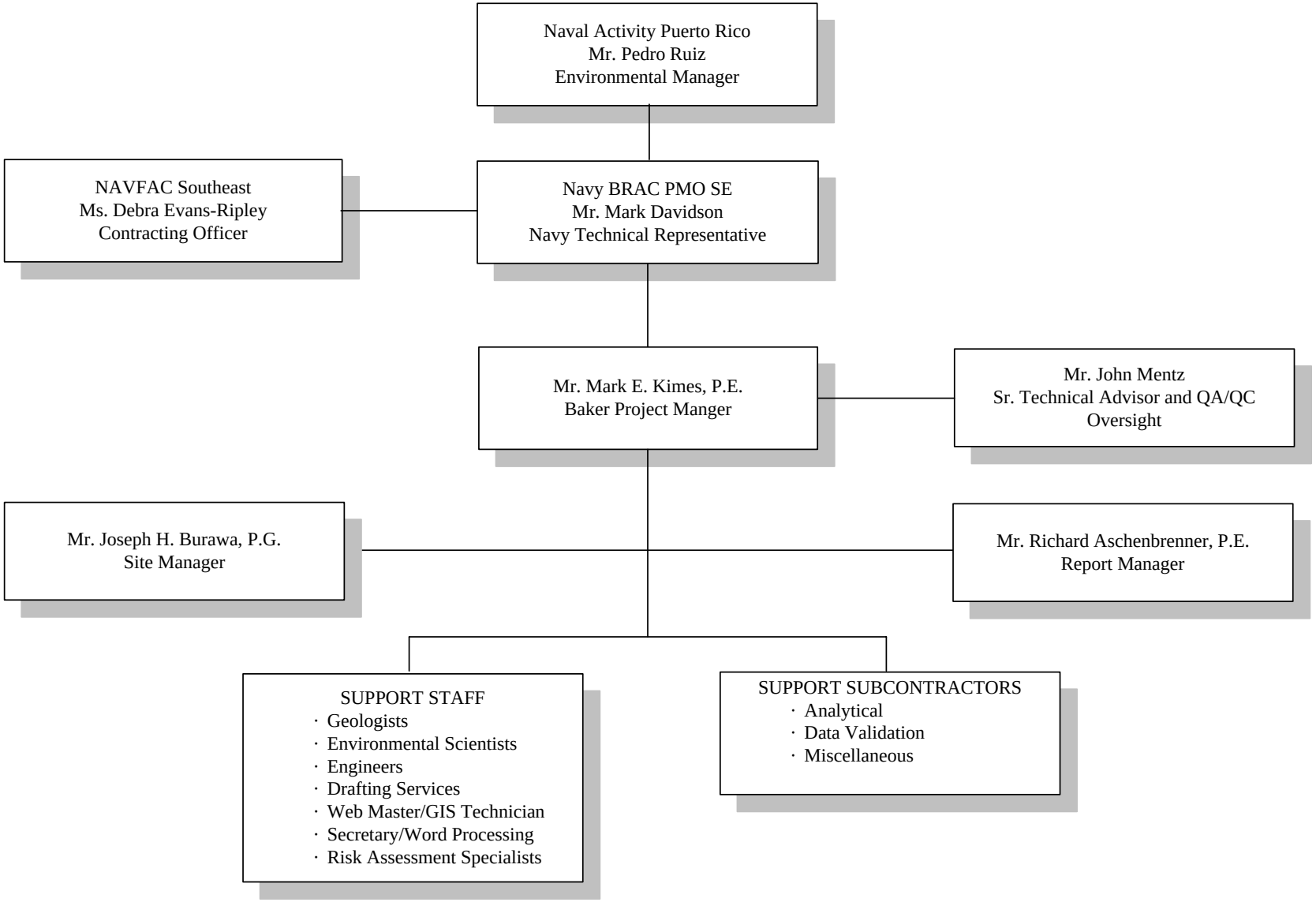
FIGURE 9-1
SCHEDULE FOR IMPLEMENTATION OF ADDENDUM A, PHASE II OF THE CMS INVESTIGATION
SWMU 74 - FUELING PIPELINES AND HYDRANT PITS
NAVAL ACTIVITY PUERTO RICO

ID	Task Name	Duration	Start	Finish
1	**SWMU 74 Phase II of the CMS Investigation**	**387 days**	**3/4/11**	**8/28/12**
2	Regulator Approval of Addendum A - Phase II of the CMS Investigations to the Final CMS Investigation Work Plan for SWMU 74	14 edays	3/4/11	3/18/11
3	**Airfield Area**	**286 days**	**3/18/11**	**4/22/12**
4	Phase II of the CMS Field Investigation - Airfield Area	101 edays	3/18/11	6/27/11
5	Draft Phase II CMS Investigation Report Development	60 edays	6/27/11	8/26/11
6	Regualtor Review	90 edays	8/26/11	11/24/11
7	Final Phase II CMS Investigation Report Development	60 edays	11/24/11	1/23/12
8	Regulator Review and Approval	90 edays	1/23/12	4/22/12
9	**JP-5 Hill and DFM Area**	**294 days**	**4/26/11**	**6/9/12**
10	Phase II of the CMS Field Investigation -JP-5 Hill and DFM Area	110 edays	4/26/11	8/14/11
11	Draft Phase II CMS Investigation Report Development	60 edays	8/14/11	10/13/11
12	Regualtor Review	90 edays	10/13/11	1/11/12
13	Final Phase II CMS Investigation Report Development	60 edays	1/11/12	3/11/12
14	Regulator Review and Approval	90 edays	3/11/12	6/9/12
15	**Fueling Piers Area**	**269 days**	**6/10/11**	**6/21/12**
16	Phase II of the CMS Field Investigation -Fueling Piers Area	77 edays	6/10/11	8/26/11
17	Draft Phase II CMS Investigation Report Development	60 edays	8/26/11	10/25/11
18	Regualtor Review	90 edays	10/25/11	1/23/12
19	Final Phase II CMS Investigation Report Development	60 edays	1/23/12	3/23/12
20	Regulator Review and Approval	90 edays	3/23/12	6/21/12
21	**SWMU 9 Area A/B**	**291 days**	**6/24/11**	**8/5/12**
22	Phase II of the CMS Field Investigation -JP-5 Hill and DFM Area	108 edays	6/24/11	10/10/11
23	Draft Phase II CMS Investigation Report Development	60 edays	10/10/11	12/9/11
24	Regualtor Review	90 edays	12/9/11	3/8/12
25	Final Phase II CMS Investigation Report Development	60 edays	3/8/12	5/7/12
26	Regulator Review and Approval	90 edays	5/7/12	8/5/12
27	**SWMU 9 Area C**	**277 days**	**8/5/11**	**8/28/12**
28	Phase II of the CMS Field Investigation -JP-5 Hill and DFM Area	89 edays	8/5/11	11/2/11
29	Draft Phase II CMS Investigation Report Development	60 edays	11/2/11	1/1/12
30	Regualtor Review	90 edays	1/1/12	3/31/12
31	Final Phase II CMS Investigation Report Development	60 edays	3/31/12	5/30/12
32	Regulator Review and Approval	90 edays	5/30/12	8/28/12



Revised: December 6, 2007

FIGURE 10-1
PROJECT ORGANIZATION
CMS WORK PLAN – SWMU 74
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO



APPENDIX A
PHOTOGRAPHS OF SWMU 74, ECP SITE 20

Photograph A-1. SWMU 74 – Grass-covered area just south of Forrestal Drive

Photograph A-2. SWMU 74 – Vegetated area along a power line

APPENDIX B
SUMMARY OF ANALYTICAL RESULTS FROM PHASE II ECP STUDY

TABLE B-1

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS, MAY 2004
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID	EPA Region III	**EPA Region III**	20E-SB01	20E-SB02	20E-SB03	20E-SB03	20E-SB04	20E-SB05	20E-SB06	20E-SB07
Sample ID	Industrial	**Residential**	20E-SB01-02	20E-SB02-02	20E-SB03-04	20E-SB03-04D	20E-SB04-04	20E-SB05-05	20E-SB06-05	20E-SB07-06
Sample Date	RBCs	**RBCs**	5/12/2004	05/11/04	5/12/2004	5/12/2004	05/11/04	05/11/04	05/11/04	05/11/04
Sample Depth (ft bgs)	(ug/kg)	(ug/kg)	3.00 - 5.00	3.00 - 5.00	7.00 - 9.00	7.00 - 9.00	7.00 - 9.00	9.00 - 11.00	9.00 - 11.00	11.00 - 13.00
Volatile Organic Compounds (ug/kg)										
Ethylbenzene	10,000,000	780,000	5.8 U	5.2 U	5.5 U	5.6 U	6.1 U	35	5.6 U	5.8 U
2-Butanone	61,000,000	4,700,000	29 U	26 U	28 U	28 U	31 U	85	28 U	29 U
Chlorobenzene	2,000,000	160,000	2.4 J	3.3 J	5.5 U	5.6 U	6.1 U	13 U	5.6 U	5.8 U
Acetone	92,000,000	7,000,000	58 U	52 U	55 U	56 U	61 U	280	56 U	58 U
Tetrachloroethene	5,300	1,200	3.3 J	5.2 J	5.5 U	5.6 U	6.1 U	13 U	5.6 U	5.8 U
Semivolatile Organic Compounds (ug/kg)										
Chrysene	390,000	87,000	390 U	46 J	370 U	380 U	57 J	460 U	380 U	400 U
Dibenzo(a,h)anthracene	390	87	390 U	370 U	370 U	380 U	410 U	**120** J	380 U	400 U
Fluoranthene	4,100,000	310,000	390 U	40 J	370 U	380 U	40 J	460 U	380 U	400 U
Indeno(1,2,3-cd)pyrene	3,900	870	390 U	32 J	370 U	380 U	410 U	130 J	380 U	400 U
Pyrene	3,100,000	230,000	390 U	44 J	370 U	380 U	48 J	36 J	380 U	400 U
Benzo(a)anthracene	3,900	870	390 U	370 U	370 U	380 U	47 J	460 U	380 U	400 U
Benzo(g,h,i)perylene	NE	NE	390 U	370 U	370 U	380 U	410 U	140 J	380 U	400 U
Total Petroleum Hydrocarbons (mg/kg)										
Diesel Range Organics	NE	NE	2.1 J	3.3 J	3.1 J	1.9 J	3.4 J	35	2.5 J	4 U
Gasoline Range Organics	NE	NE	0.27 U	0.28 U	0.26 U	0.28 U	0.3 U	25	0.28 U	0.28 U

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was anlyzed for, but was not detected at or above the MDL/PQL.
NE - Not Established.
ft bgs - feet below ground surface.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Bold - exceeds EPA Region III Residential RBC's

TABLE B-1

SUMMARY OF ORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS, MAY 2004
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (ug/kg)	**EPA Region III Residential RBCs** (ug/kg)	Number Exceeding EPA Region III Industrial RBCs	Range Exceeding EPA Region III Industrial RBCs	**Number Exceeding EPA Region III Residential RBCs**	**Range Exceeding EPA Region III Residential RBCs**	Location of Maximum Detection
Volatile Organic Compounds (ug/kg)							
Ethylbenzene	10,000,000	780,000	0/8	---	0/8	---	20E-SB05-05
2-Butanone	61,000,000	4,700,000	0/8	---	0/8	---	20E-SB05-05
Chlorobenzene	2,000,000	160,000	0/8	---	0/8	---	20E-SB02-02
Acetone	92,000,000	7,000,000	0/8	---	0/8	---	20E-SB05-05
Tetrachloroethene	5,300	1,200	0/8	---	0/8	---	20E-SB02-02
Semivolatile Organic Compounds (ug/kg)							
Chrysene	390,000	87,000	0/8	---	0/8	---	20E-SB04-04
Dibenzo(a,h)anthracene	390	87	0/8	---	1/8	120J	20E-SB05-05
Fluoranthene	4,100,000	310,000	0/8	---	0/8	---	20E-SB02-02, 20E-SB04-04
Indeno(1,2,3-cd)pyrene	3,900	870	0/8	---	0/8	---	20E-SB05-05
Pyrene	3,100,000	230,000	0/8	---	0/8	---	20E-SB04-04
Benzo(a)anthracene	3,900	870	0/8	---	0/8	---	20E-SB04-04
Benzo(g,h,i)perylene	NE	NE	NE	---	NE	---	20E-SB05-05
Total Petroleum Hydrocarbons (mg/kg)							
Diesel Range Organics	NE	NE	NE	---	NE	---	20E-SB05-05
Gasoline Range Organics	NE	NE	NE	---	NE	---	20E-SB05-05

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was anlyzed for, but was not detected at or above the MDL/PQL.
NE - Not Established.
ft bgs - feet below ground surface.
ug/kg - micrograms per kilogram.
mg/kg - milligrams per kilogram.
Bold - exceeds EPA Region III Residential RBC's

TABLE B-2

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS, MAY 2004
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (mg/kg)	**EPA Region III Residential RBCs** (mg/kg)	2x Average Detected Background (mg/kg)	20E-SB01 20E-SB01-02 5/12/2004 3.00 - 5.00	20E-SB02 20E-SB02-02 05/11/04 3.00 - 5.00	20E-SB03 20E-SB03-04 5/12/2004 7.00 - 9.00	20E-SB03 20E-SB03-04D 5/12/2004 7.00 - 9.00	20E-SB04 20E-SB04-04 05/11/04 7.00 - 9.00	20E-SB05 20E-SB05-05 05/11/04 9.00 - 11.00	20E-SB06 20E-SB06-05 05/11/04 9.00 - 11.00	20E-SB07 20E-SB07-06 05/11/04 11.00 - 13.00
Appendix IX Inorganics (mg/kg)											
Silver	510	39	0.46	0.15 B	1 U	1.1 U	1 U	1.2 U	1.3 U	0.22 B	1.1 U
Arsenic	1.9	0.43	2.05	**0.85** B	**2.2**	1.1 U	1 U	1.2 U	**1.1** B	1 U	1.1 U
Barium	7,200	550	222	140 N*	21	67 N*	68 N*	27	71	56	41
Beryllium	200	16	0.74	0.29 B	0.073 B	0.33 B	0.33 B	0.33 B	0.24 B	0.19 B	0.18 B
Cadmium	100	7.8	0.74	0.57 U	0.2 B	1.1 U	0.52 U	0.6 U	0.66 U	0.52 U	0.55 U
Cobalt	2,000	160	30.0	22	9.6	27	33	23	14	28	17
Chromium	310	23	133	15	**32**	**67**	**120**	4.6	14	21	10
Copper	4,100	310	193	150	54	76	88	**340**	120	140	120
Nickel	2,000	160	31.9	13	9.9	23	32	9.7	9.5	12	13
Lead	800[1]	400[1]	8.68	3.2	11	1.4	1.6	8.1	8.9	6.6	1.3
Tin	61,000	4,700	2.96	3 B	2.1 B	2.9 B	2.4 B	2.7 B	3 B	2.9 B	2.5 B
Vanadium	100	7.8	462	**190** N	**61**	**170** N	**200** N	**120**	**290**	**160**	**180**
Zinc	31,000	2,300	88.6	170 NE*	27	92 NE*	96 NE*	66	58	93	73
Mercury	31[2]	2.3[2]	0.093	0.0094 B	0.0052 B	0.02 U	0.02 U	0.007 B	0.025 U	0.022 U	0.023 U

Notes:

B - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.

U - The compound was analyzed for, but was not detected at or above the MDL/PQL.

N - The matrix spike recovery is not within control limits.

* - Duplicate analysis is not within control limits.

[1] - USEPA Region 9 soil screening levels obtained from: http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf

[2] - Value based on the RBC for Mercuric Chloride.

NE - Not Established.

ft bgs - feet below ground surface.

mg/kg - milligrams per kilogram.

Shaded - exceeds EPA Region III Industrial RBC's

Bold - exceeds EPA Region III Residential RBC's

Underlined - exceeds 2x Average Detected Background

E - The reported value is an estimated because of the presence of matrix interference.

TABLE B-2

SUMMARY OF INORGANIC DETECTIONS IN SUBSURFACE SOIL
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS, MAY 2004
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date Sample Depth (ft bgs)	EPA Region III Industrial RBCs (mg/kg)	**EPA Region III Residential RBCs (mg/kg)**	2x Average Detected Background (mg/kg)	Number Exceeding EPA Region III Industrial RBCs	Range Exceeding EPA Region III Industrial RBCs	**Number Exceeding EPA Region III Residential RBCs**	**Range Exceeding EPA Region III Residential RBCs**	Number Exceeding 2x Average Detected Background	Range Exceeding 2x Average Detected Background	Location of Maximum Detection
Appendix IX Inorganics (mg/kg)										
Silver	510	39	0.46	0/8	---	0/8	---	0/8	---	20E-SB06-05
Arsenic	1.9	0.43	2.05	1/8	2.2	3/8	0.85B - 2.2	1/8	2.2	20E-SB02-02
Barium	7,200	550	222	0/8	---	0/8	---	0/8	---	20E-SB01-02
Beryllium	200	16	0.74	0/8	---	0/8	---	0/8	---	20E-SB03-04, 20E-SB03-04D, 20E-SB04-04
Cadmium	100	7.8	0.74	0/8	---	0/8	---	0/8	---	20E-SB02-02
Cobalt	2,000	160	30.0	0/8	---	0/8	---	1/8	33	20E-SB03-04D
Chromium	310	23	133	0/8	---	3/8	32 - 120	0/8	---	20E-SB03-04D
Copper	4,100	310	193	0/8	---	1/8	340	1/8	340	20E-SB04-04
Nickel	2,000	160	31.9	0/8	---	0/8	---	1/8	32	20E-SB03-04D
Lead	800[1]	400[1]	8.68	0/8	---	0/8	---	2/8	8.9 - 11	20E-SB02-02
Tin	61,000	4,700	2.96	0/8	---	0/8	---	2/8	3B - 3B	20E-SB01-02, 20E-SB05-05
Vanadium	100	7.8	462	7/8	120 - 290	8/8	61 - 290	0/8	---	20E-SB05-05
Zinc	31,000	2,300	88.6	0/8	---	0/8	---	4/8	)2NE* - 170NE	20E-SB01-02
Mercury	31[2]	2.3[2]	0.093	0/8	---	0/8	---	0/8	---	20E-SB01-02

Notes:

B - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.

U - The compound was analyzed for, but was not detected at or above the MDL/PQL.

N - The matrix spike recovery is not within control limits.

* - Duplicate analysis is not within control limits.

[1] - USEPA Region 9 soil screening levels obtained from: http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf

[2] - Value based on the RBC for Mercuric Chloride.

NE - Not Established.

ft bgs - feet below ground surface.

mg/kg - milligrams per kilogram.

Shaded - exceeds EPA Region III Industrial RBC's

Bold - exceeds EPA Region III Residential RBC's

Underlined - exceeds 2x Average Detected Background

E - The reported value is an estimated because of the presence of matrix interference.

TABLE B-3

SUMMARY OF ORGANIC DETECTIONS IN GROUNDWATER
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS, MAY 2004
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

Site ID Sample ID Sample Date	Federal MCLs (ug/L)	**EPA Region III Tap Water RBCs** (ug/L)	PR Water Quality Standards (ug/L)	20E-SB05 20E-GW05 05/15/04	20E-SB06 20E-GW06 05/15/04	Number Exceeding Federal MCLs	Range Exceeding Federal MCLs	**Number Exceeding EPA Region III Tap Water RBCs**	**Range Exceeding EPA Region III Tap Water RBCs**	Number Exceeding PR Water Quality Standards	Range Exceeding PR Water Quality Standards	Location Maximum Detection
Volatile Organic Compounds (ug/L)												
Ethylbenzene	700	130	700	**840** D	1 U	1/2	840	1/2	840	1/2	840	20E-GW05
Benzene	5	0.34	5	**3.2**	1 U	0/2	---	1/2	3.2	0/2	---	20E-GW05
Iodomethane	NE	NE	NE	0.25 J	1 U	NE	---	NE	---	NE	---	20E-GW05
Acetone	NE	550	NE	79	25 U	NE	---	0/2	---	NE	---	20E-GW05
Carbon disulfide	NE	100	NE	1 U	1.2	NE	---	0/2	---	NE	---	20E-GW06
Xylene	10,000	21	NE	**410**	2 U	0/2	---	1/2	410	NE	---	20E-GW05
Semivolatile Organic Compounds (ug/L)												
Not Detected												
Total Petroleum Hydrocarbons (mg/L)												
Diesel Range Organics	NE	NE	NE	1.6	0.15	NE	---	NE	---	NE	---	20E-GW05
Gasoline Range Organics	NE	NE	NE	51	0.01 J	NE	---	NE	---	NE	---	20E-GW05

Notes:

J - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was analyzed for, but was not detected at or above the MDL/PQL.
D - The reported result is from a secondary dilution.
ug/L - micrograms per liter.
mg/L - milligrams per liter.
NE - Not Established.

Shaded - exceeds EPA Region III Industrial RBC's
Bold - exceeds EPA Region III Residential RBC's
Underlined - exceeds 2x Average Detected Background

TABLE B-4

SUMMARY OF INORGANIC DETECTIONS IN GROUNDWATER
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS, MAY 2004
SWMU 74 CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

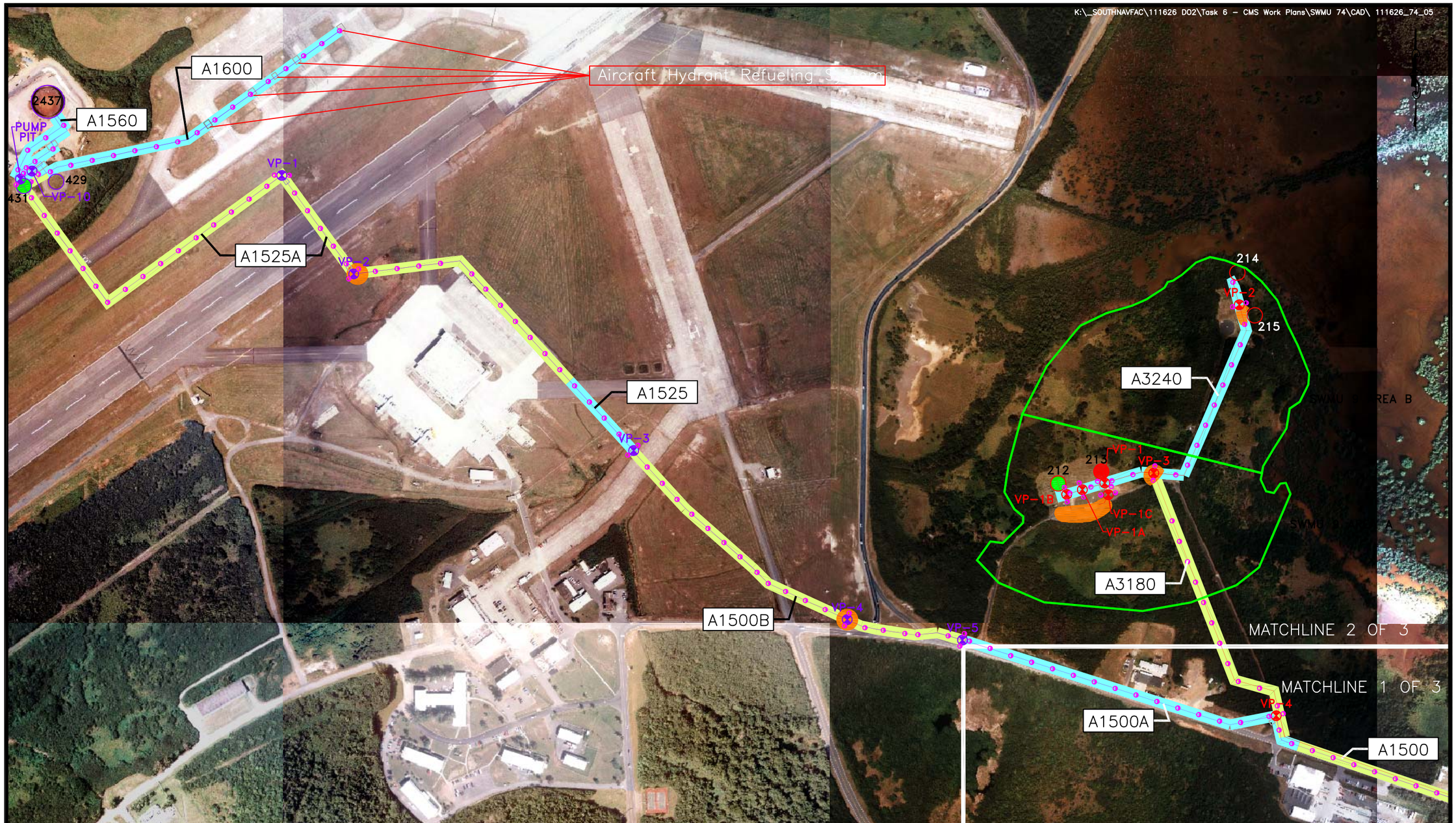
Site ID Sample ID Sample Date	Federal MCLs (mg/L)	**EPA Region III Tap Water RBCs** (mg/L)	PR Water Quality Standards (mg/L)	20E-SB05 20E-GW05 05/15/04	20E-SB06 20E-GW06 05/15/04	Number Exceeding Federal MCLs	Range Exceeding Federal MCLs	**Number Exceeding EPA Region III Tap Water RBCs**	**Range Exceeding EPA Region III Tap Water RBCs**	Number Exceeding PR Water Quality Standards	Range Exceeding PR Water Quality Standards	Location Maximum Detection
Appendix IX (Dissolved) Metals (mg/L)												
Barium	2	0.26	NE	0.19	0.24	0/2	---	0/2	---	NE	---	20E-GW06
Cobalt	NE	0.073	NE	0.022	0.0015 B	NE	---	0/2	---	NE	---	20E-GW05
Copper	0.1	0.011	NE	**0.017** B	0.011 B	0/2	---	1/2	0.017B	NE	---	20E-GW05
Nickel	NE	0.073	NE	0.0055 B	0.04 U	NE	---	0/2	---	NE	---	20E-GW05
Lead	0.015[(1)]	NE	0.015	0.031	0.005 U	1/2	0.031	NE	---	1/2	0.031	20E-GW05
Vanadium	NE	0.0037	NE	**0.014**	**0.011**	NE	---	2/2	0.011 - 0.014	NE	---	20E-GW05

Total Cyanide and Sulfide (mg/L)
Not Detected

Notes:
B - The reported result is an estimated concentration that is less than the PQL, but greater than or equal to the MDL.
U - The compound was analyzed for, but was not detected at or above the MDL/PQL.
[(1)] - EPA action level.
NE - Not Established.
mg/L - milligrams per liter.

Shaded - exceeds Federal MCLs
Bold - exceeds EPA Region III Tap Water RBCs RBC's
Underlined - exceeds PR Water Quality Standards

APPENDIX C
AS-BUILT DRAWINGS FROM PROJECT COMPLETION REPORT FOR FUEL PIPE LINES



450 0 225 450

1 inch = 450 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

AS-BUILT LEGEND

- REFERENCE FOR PIPELINE AS-BUILT DRAWINGS (TYPICAL)

A1500B – DRAWING NUMBER FROM PIPELINE AS-BUILT DRAWINGS (AGVIQ-CH2M HILL, 2005)

SOURCE: PIPELINE AS-BUILT DRAWINGS FROM AGVIQ-CH2M HILL, 2005

LEGEND

- PROPOSED SOIL BORING LOCATION
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- JP-5 VALVE PIT LOCATIONS
- DFM PIPELINE
- DFM VALVE PIT LOCATIONS
- SWMU BOUNDARY

FIGURE C-1
REFERENCE FOR PIPELINE AS-BUILTS DRAWINGS
1 OF 3
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO

450 0 225 450

1 inch = 450 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

AS-BUILT LEGEND

- REFERENCE FOR PIPELINE AS-BUILT DRAWINGS (TYPICAL)
- A3620 – DRAWING NUMBER FROM PIPELINE AS-BUILT DRAWINGS (AGVIQ-CH2M HILL, 2005)

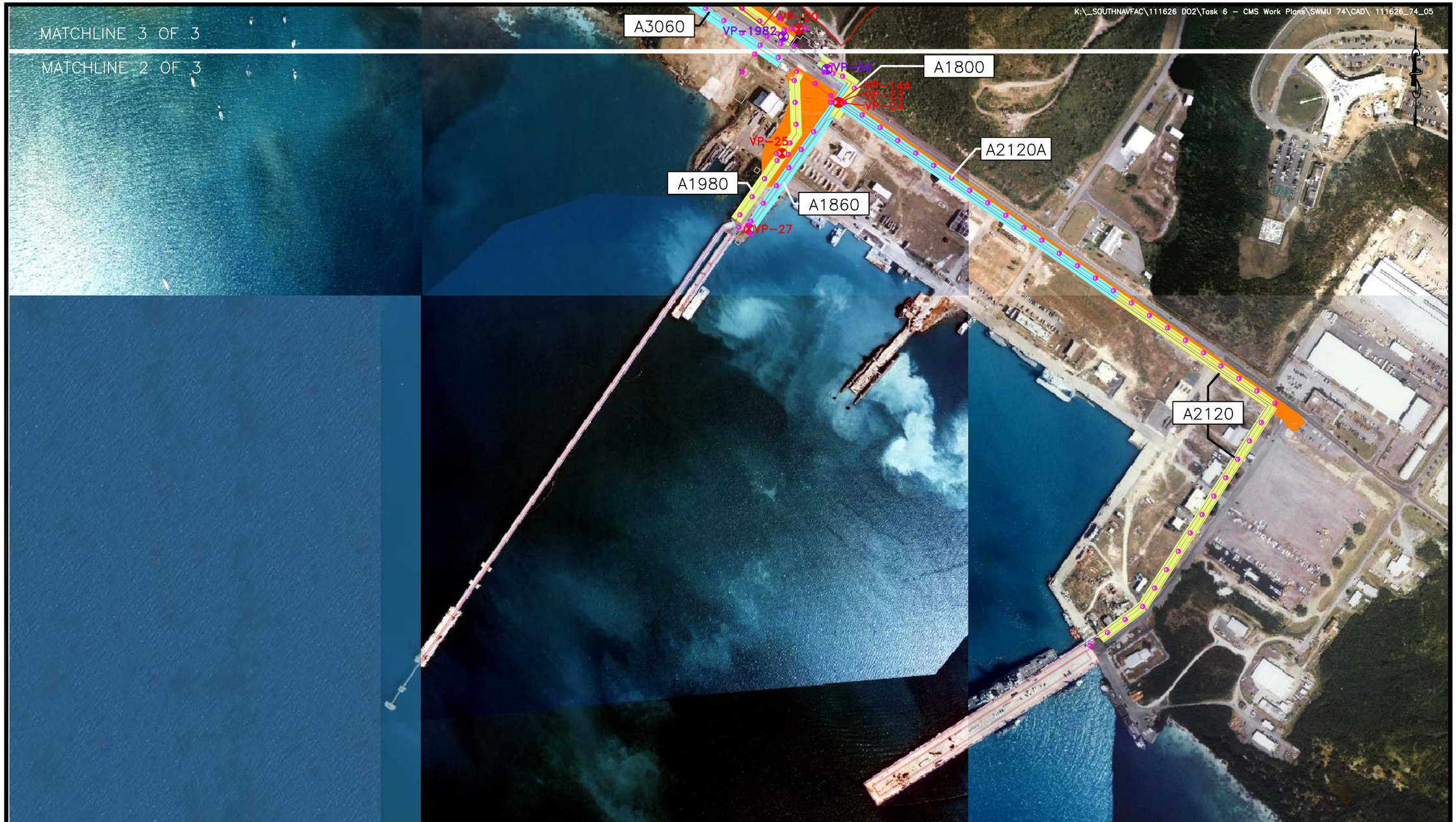
SOURCE: PIPELINE AS-BUILT DRAWINGS FROM AGVIQ-CH2M HILL, 2005

LEGEND

- PROPOSED SOIL BORING LOCATION
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- JP-5 VALVE PIT LOCATIONS
- DFM PIPELINE
- DFM VALVE PIT LOCATIONS
- SWMU BOUNDARY

FIGURE C-2
REFERENCE FOR PIPELINE AS-BUILTS DRAWINGS
2 OF 3
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO



450 0 225 450

1 inch = 450 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

AS-BUILT LEGEND

- REFERENCE FOR PIPELINE AS-BUILT DRAWINGS (TYPICAL)

A2120 – DRAWING NUMBER FROM PIPELINE AS-BUILT DRAWINGS (AGVIQ-CH2M HILL, 2005)

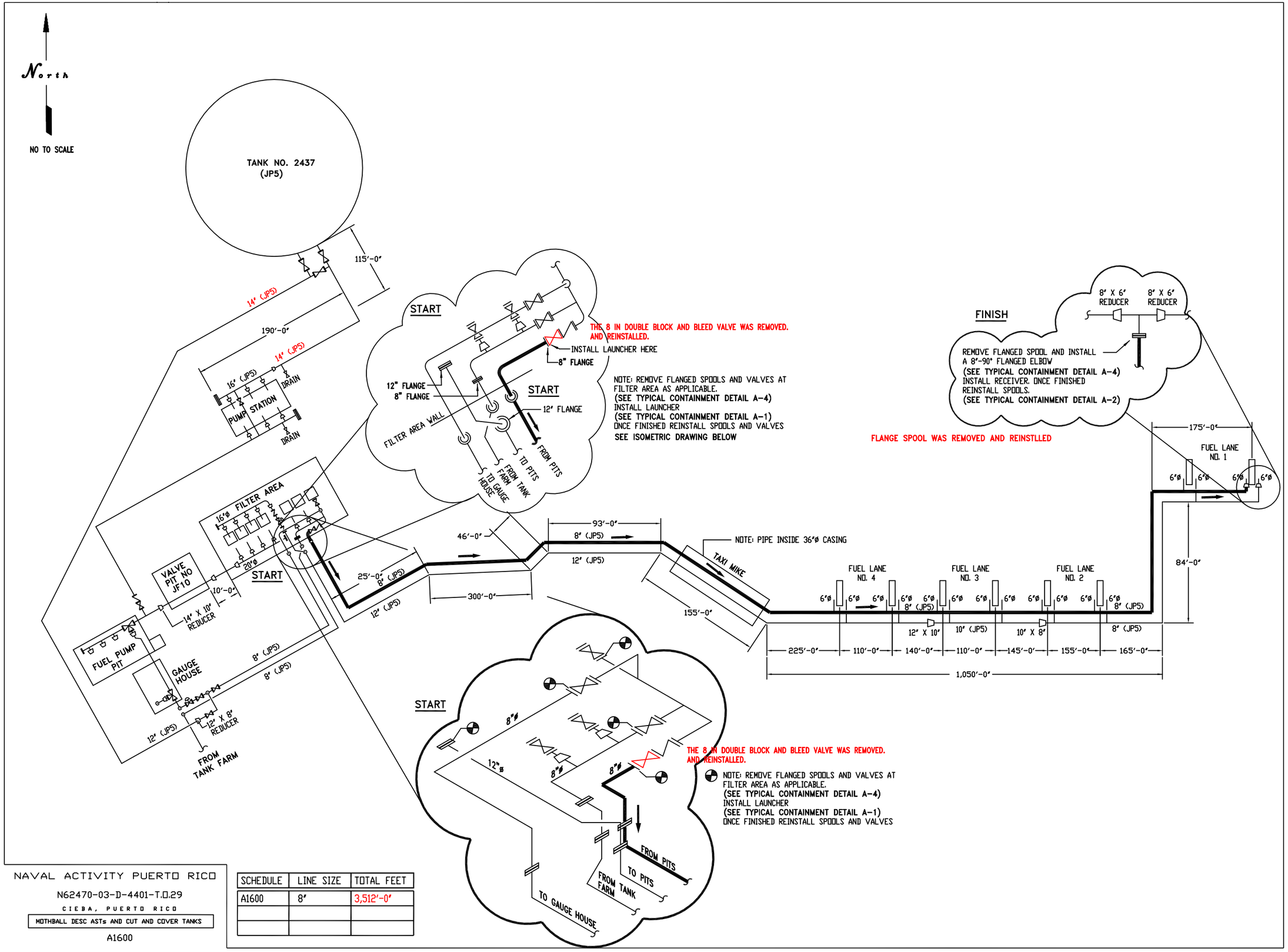
SOURCE: PIPELINE AS-BUILT DRAWINGS FROM AGVIQ-CH2M HILL, 2005

LEGEND

- PROPOSED SOIL BORING LOCATION
- TANK FAILED INTEGRITY TEST
- TANK AREA IMPACTED BY TVHC
- VALVE PIT IMPACTED BY TVHC
- PIPELINE/OTHER IMPACTED BY TVHC
- JP-5 PIPELINE
- JP-5 VALVE PIT LOCATIONS
- DFM PIPELINE
- DFM VALVE PIT LOCATIONS
- SWMU BOUNDARY

FIGURE C-3
REFERENCE FOR PIPELINE AS-BUILTS DRAWINGS
3 OF 3
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO



SCHEDULE	LINE SIZE	TOTAL FEET
A1600	8"	3,512'-0"

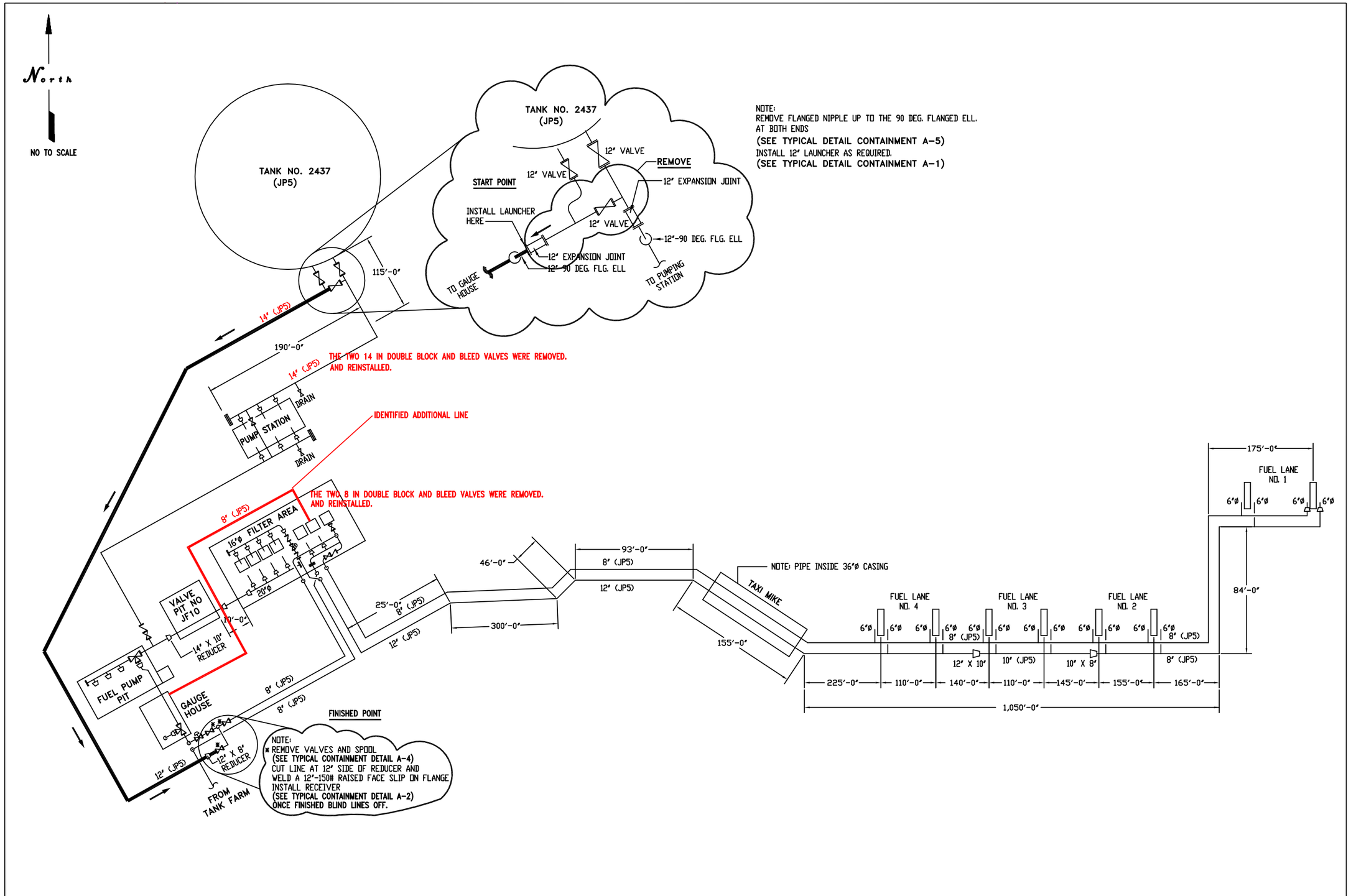
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1600



NAVAL ACTIVITY PUERTO RICO

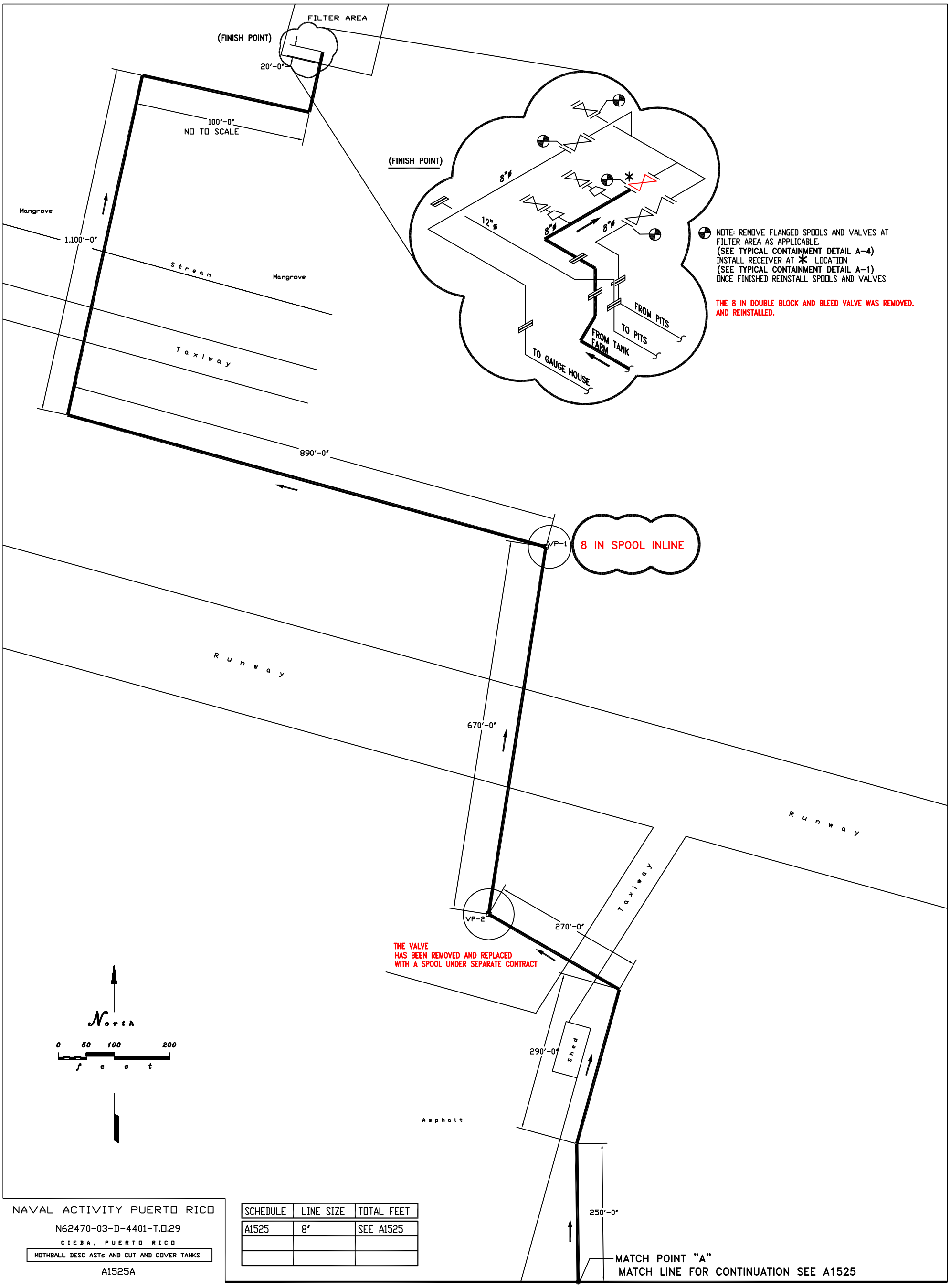
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1560

SCHEDULE	LINE SIZE	TOTAL FEET
A1560	12"	1,520'-0"
A1560	8"	158'-0"



NAVAL ACTIVITY PUERTO RICO

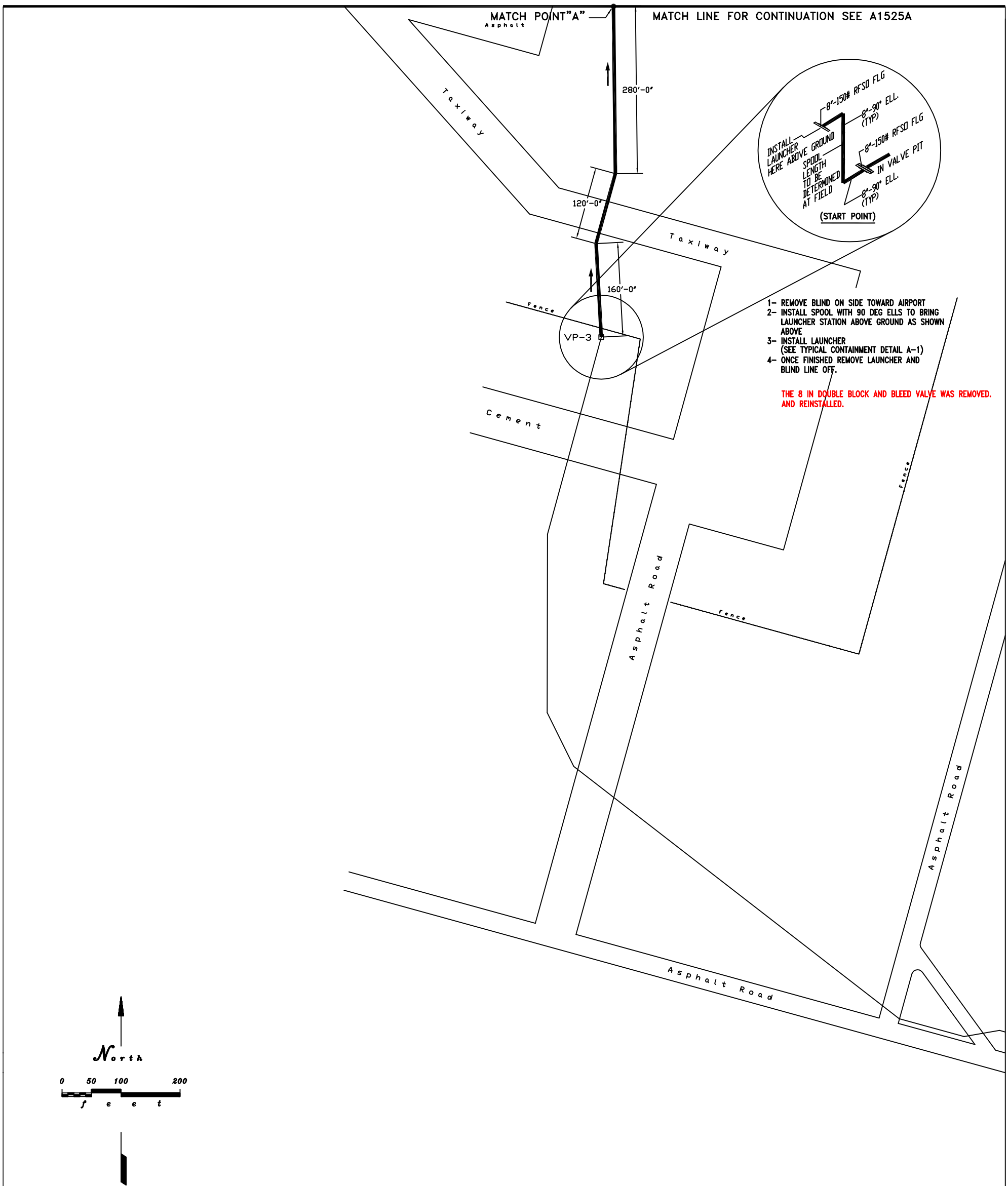
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1525A

SCHEDULE	LINE SIZE	TOTAL FEET
A1525	8"	SEE A1525



NAVAL ACTIVITY PUERTO RICO

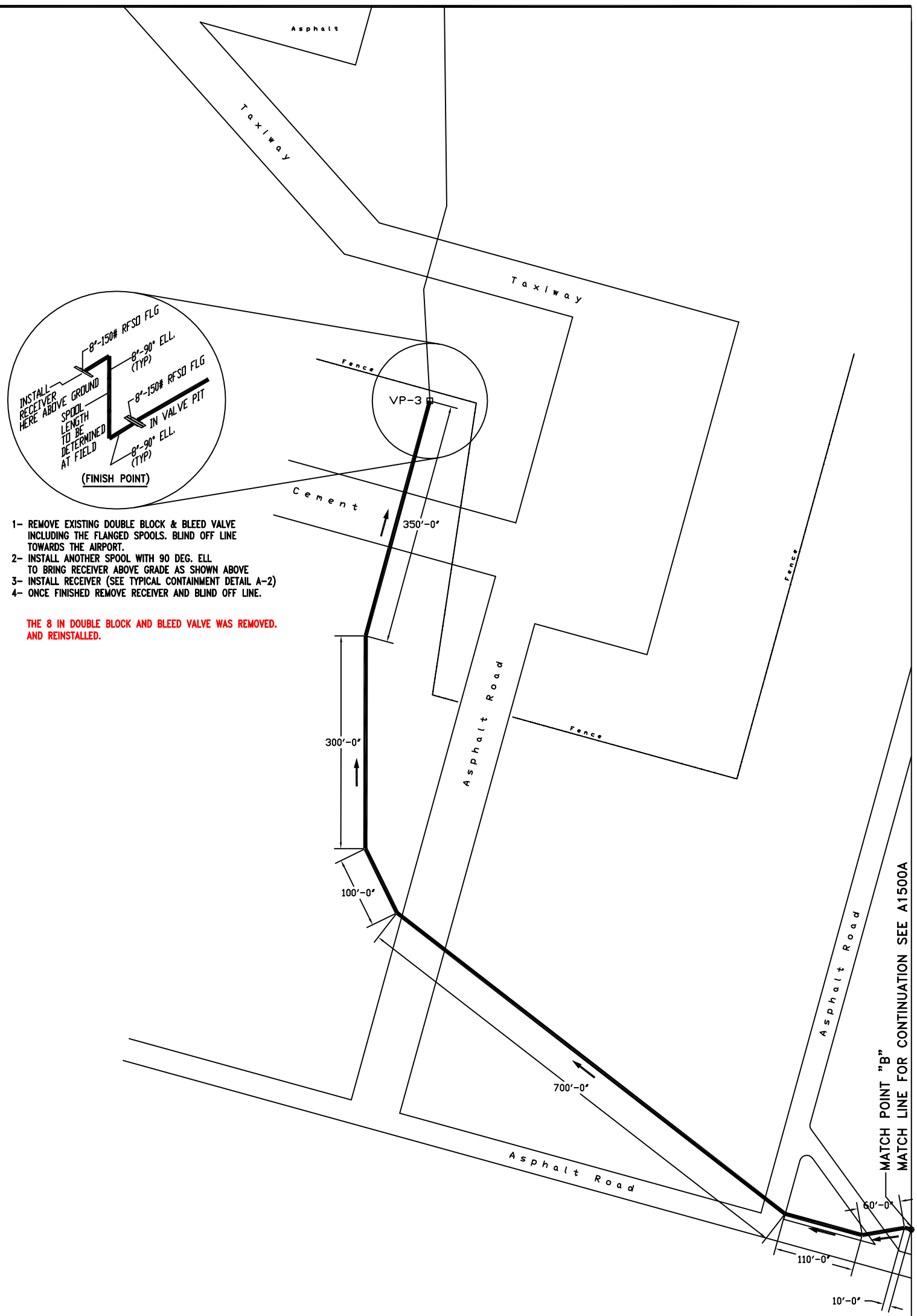
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

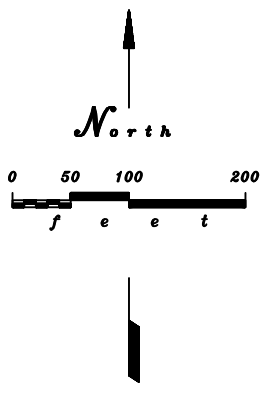
A1525

SCHEDULE	LINE SIZE	TOTAL FEET
A1525	8"	3,533'-0"



1- REMOVE EXISTING DOUBLE BLOCK & BLEED VALVE INCLUDING THE FLANGED SPOOLS. BLIND OFF LINE TOWARDS THE AIRPORT.
2- INSTALL ANOTHER SPOOL WITH 90 DEG. ELL TO BRING RECEIVER ABOVE GRADE AS SHOWN ABOVE
3- INSTALL RECEIVER (SEE TYPICAL CONTAINMENT DETAIL A-2)
4- ONCE FINISHED REMOVE RECEIVER AND BLIND OFF LINE.

THE 8 IN DOUBLE BLOCK AND BLEED VALVE WAS REMOVED. AND REINSTALLED.



NAVAL ACTIVITY PUERTO RICO

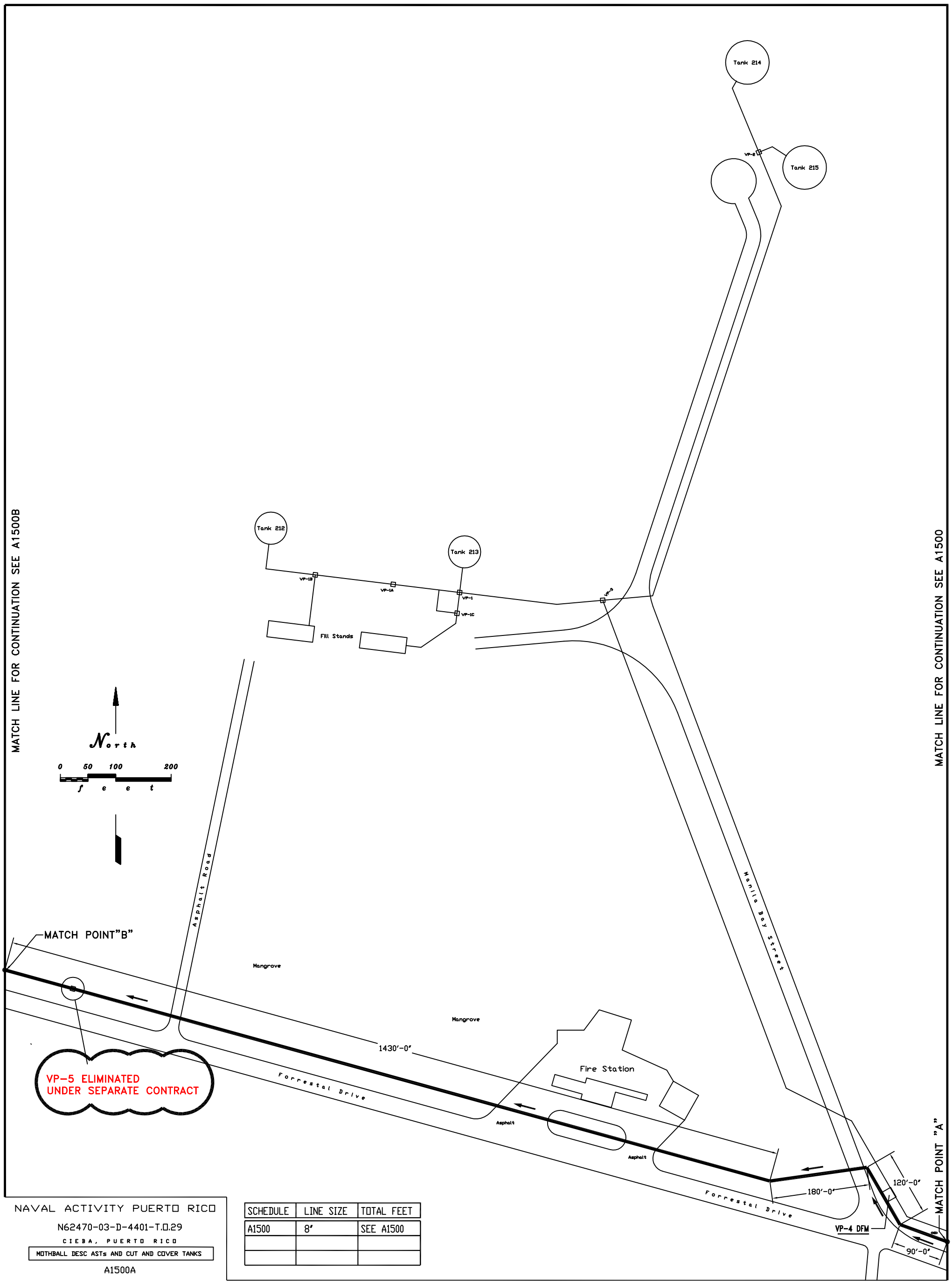
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1500B

SCHEDULE	LINE SIZE	TOTAL FEET
A1500	8"	SEE A1500



NAVAL ACTIVITY PUERTO RICO

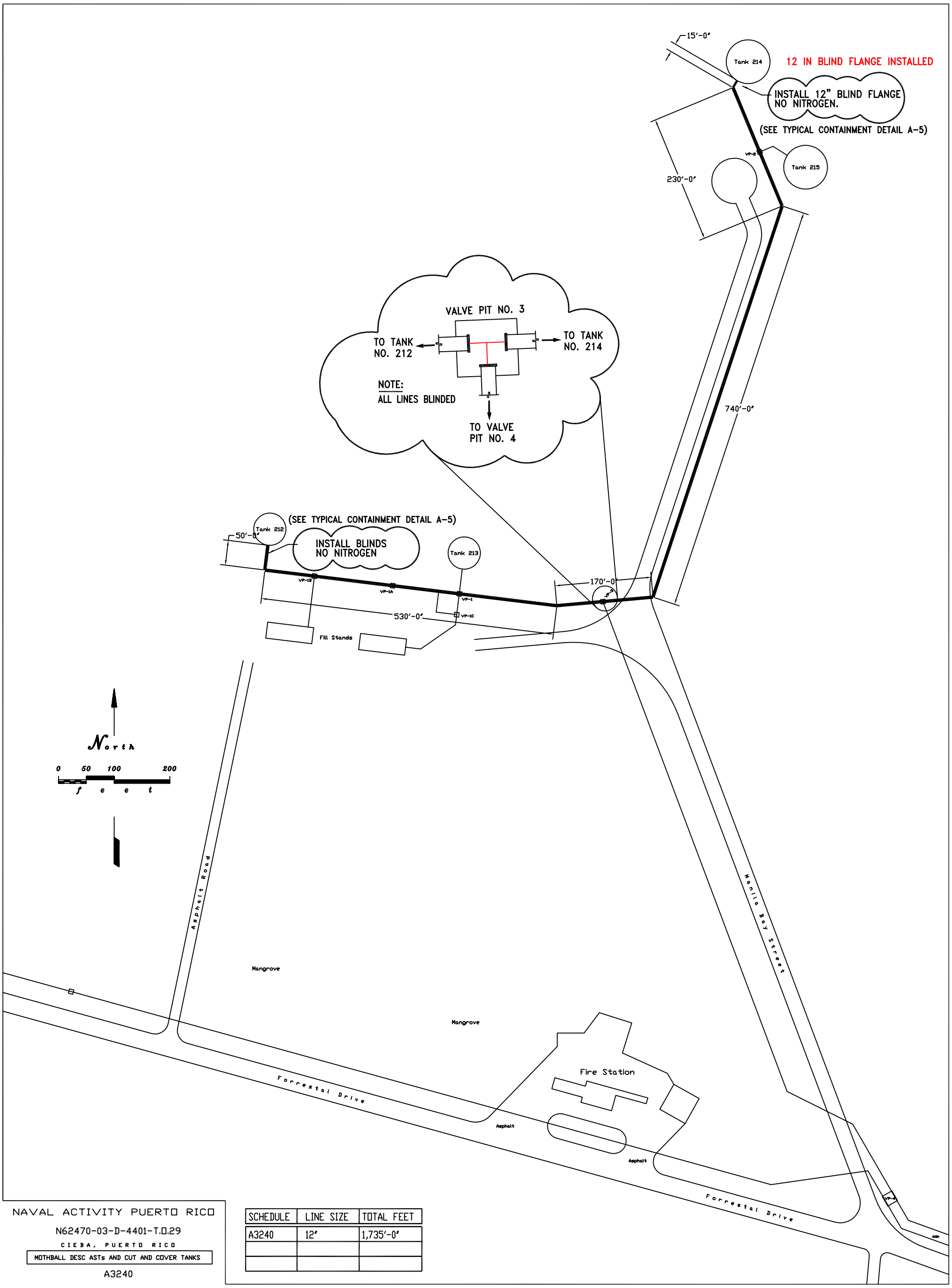
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1500A

SCHEDULE	LINE SIZE	TOTAL FEET
A1500	8"	SEE A1500



NAVAL ACTIVITY PUERTO RICO

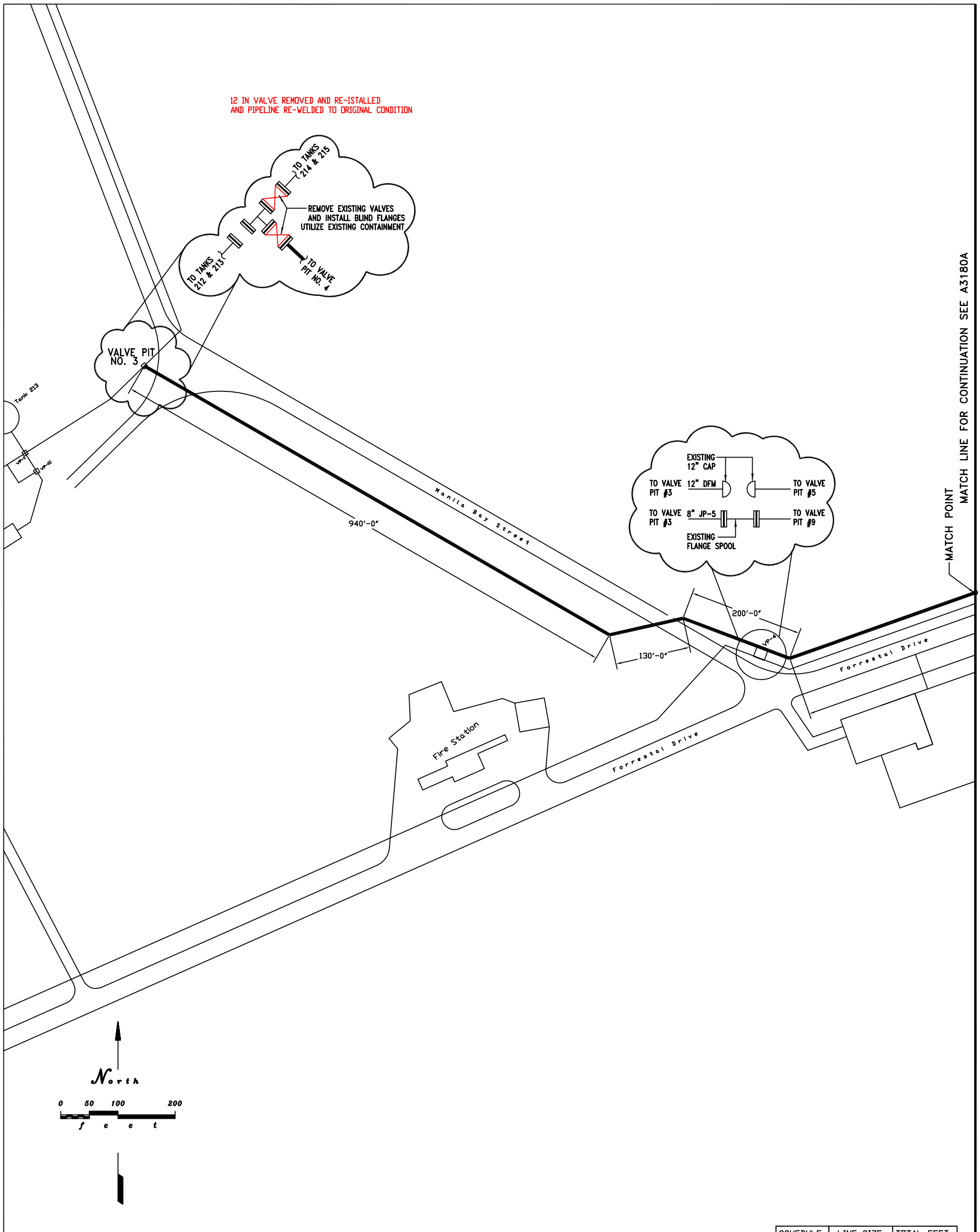
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3240

SCHEDULE	LINE SIZE	TOTAL FEET
A3240	12"	1,735'-0"



NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

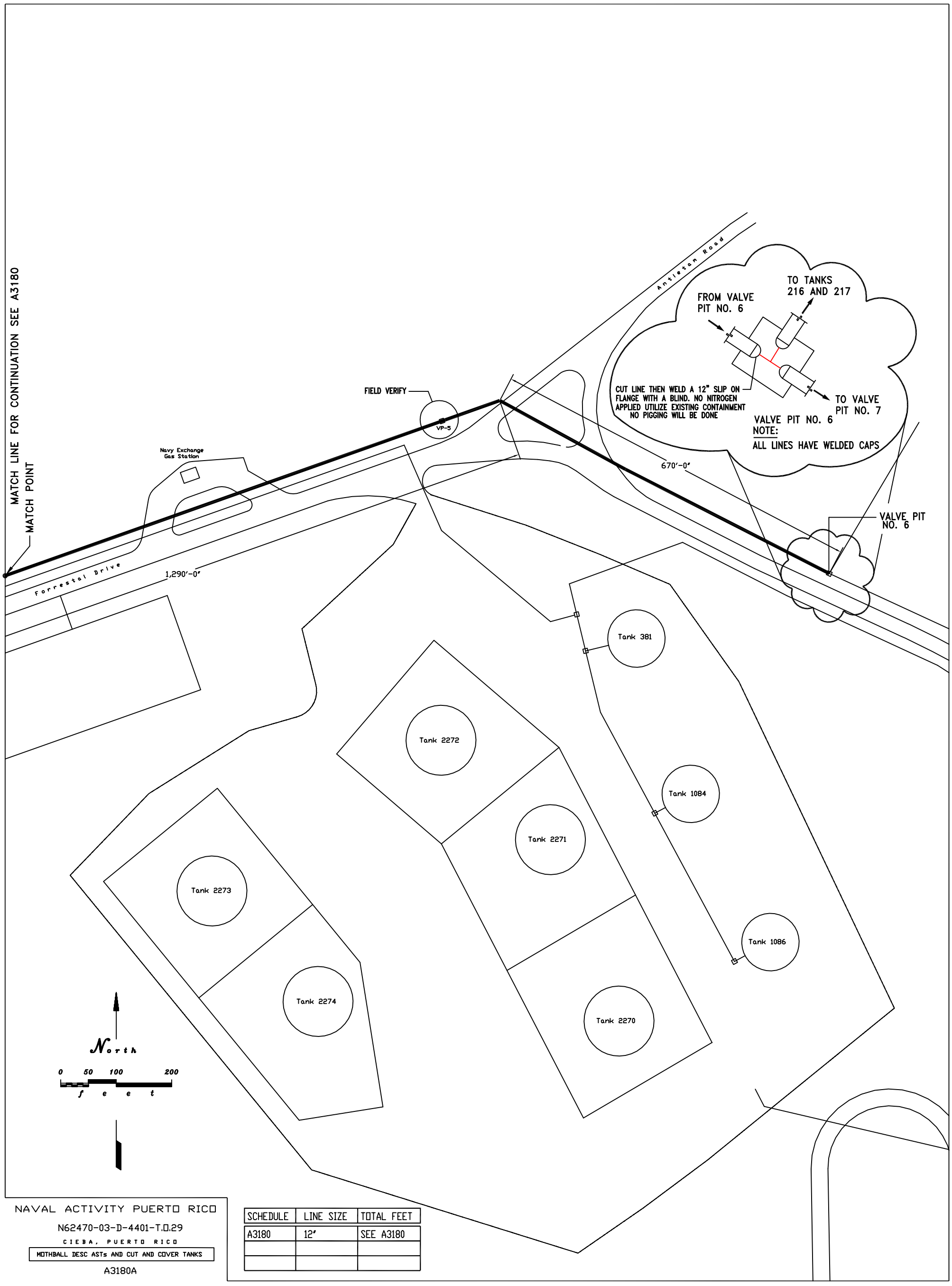
CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3180

SCHEDULE	LINE SIZE	TOTAL FEET
A3180	12"	3,240'-0"

NOTE: NO PIGGING OR NITROGEN IN THIS AREA LINE WILL BE CAPPED ONLY.



NAVAL ACTIVITY PUERTO RICO

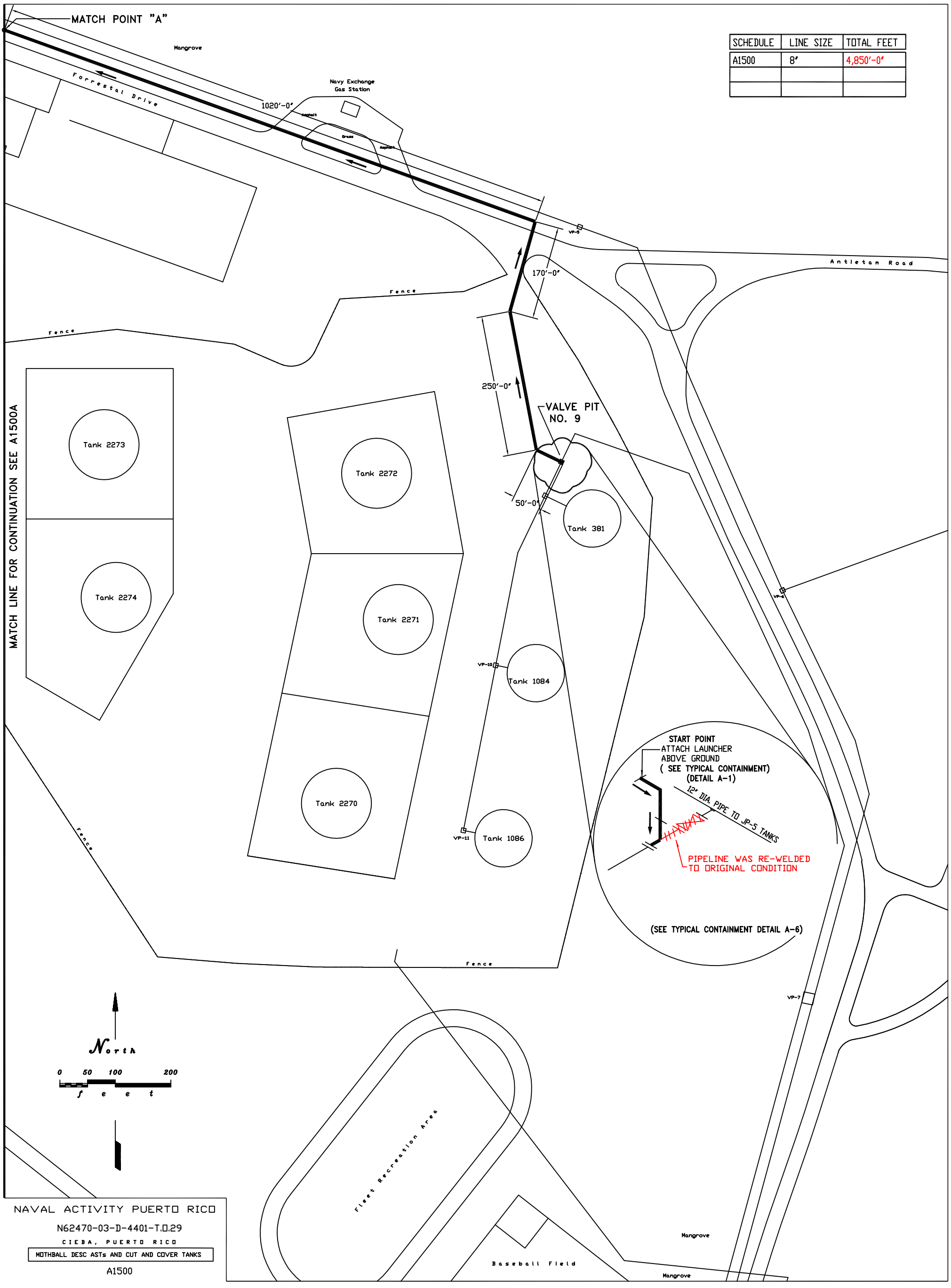
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3180A

SCHEDULE	LINE SIZE	TOTAL FEET
A3180	12"	SEE A3180



SCHEDULE	LINE SIZE	TOTAL FEET
A1500	8"	4,850'-0"

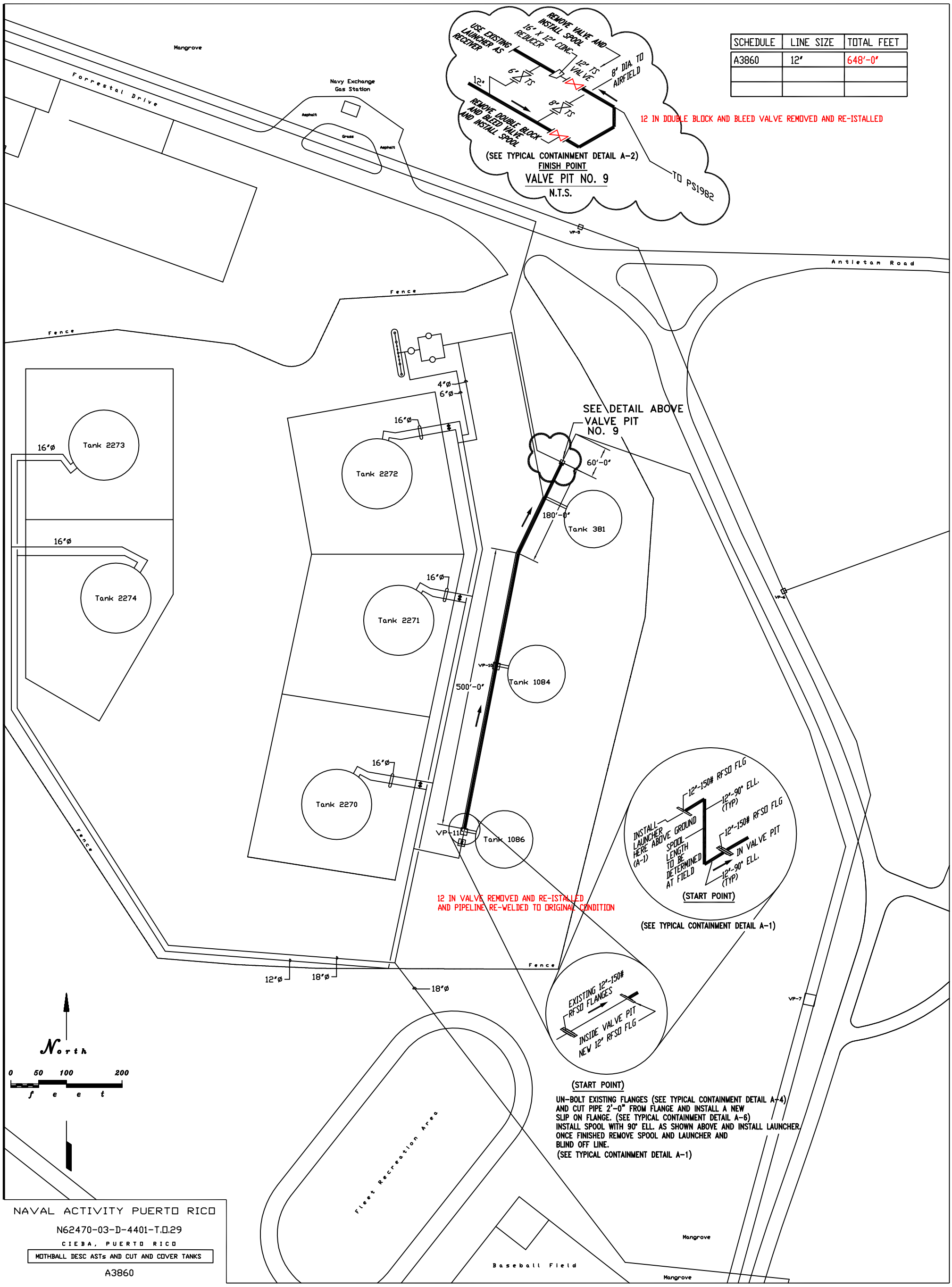
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1500



SCHEDULE	LINE SIZE	TOTAL FEET
A3860	12"	648'-0"

NAVAL ACTIVITY PUERTO RICO

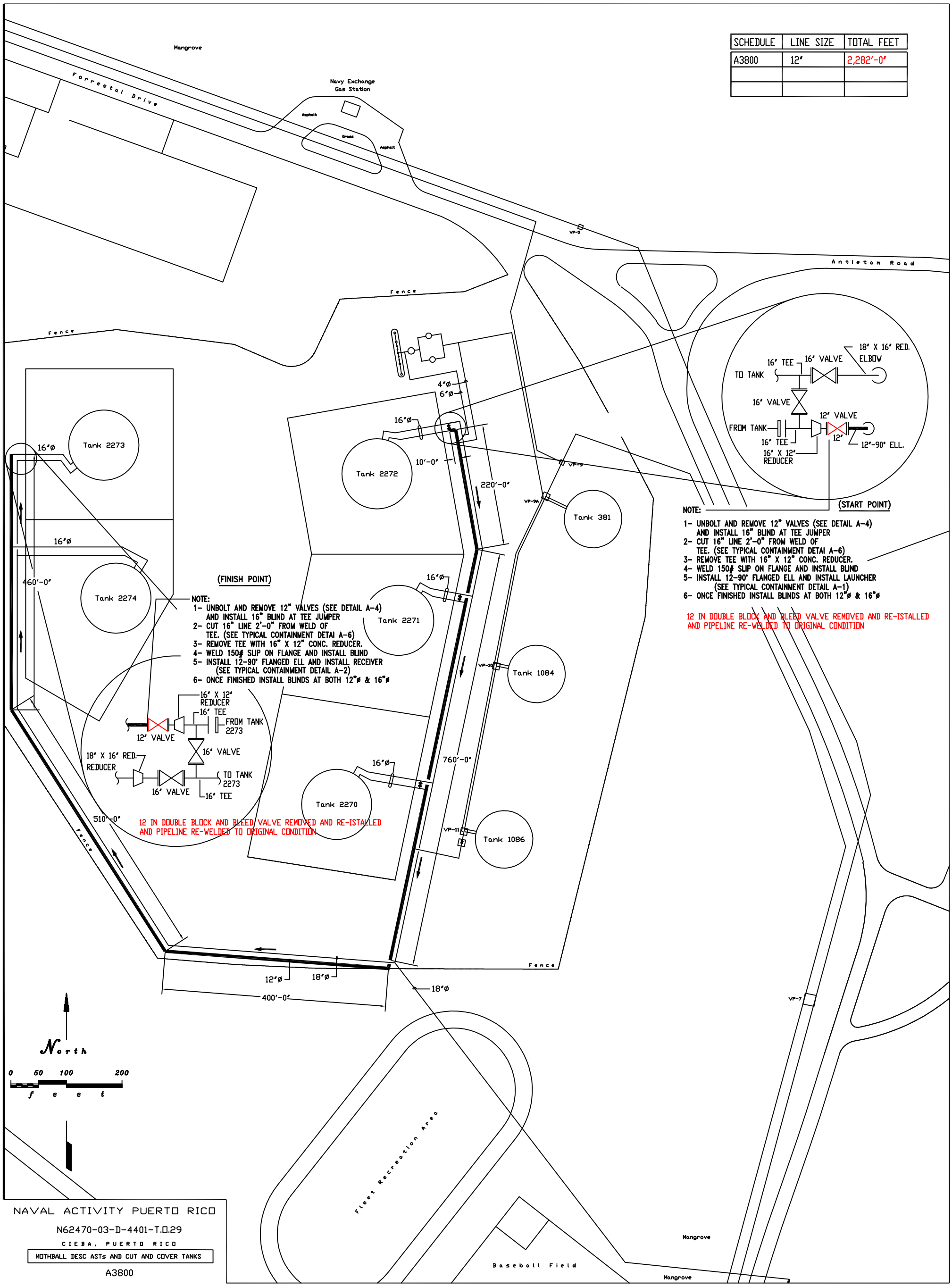
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3860

SCHEDULE	LINE SIZE	TOTAL FEET
A3800	12"	2,282'-0"



NAVAL ACTIVITY PUERTO RICO

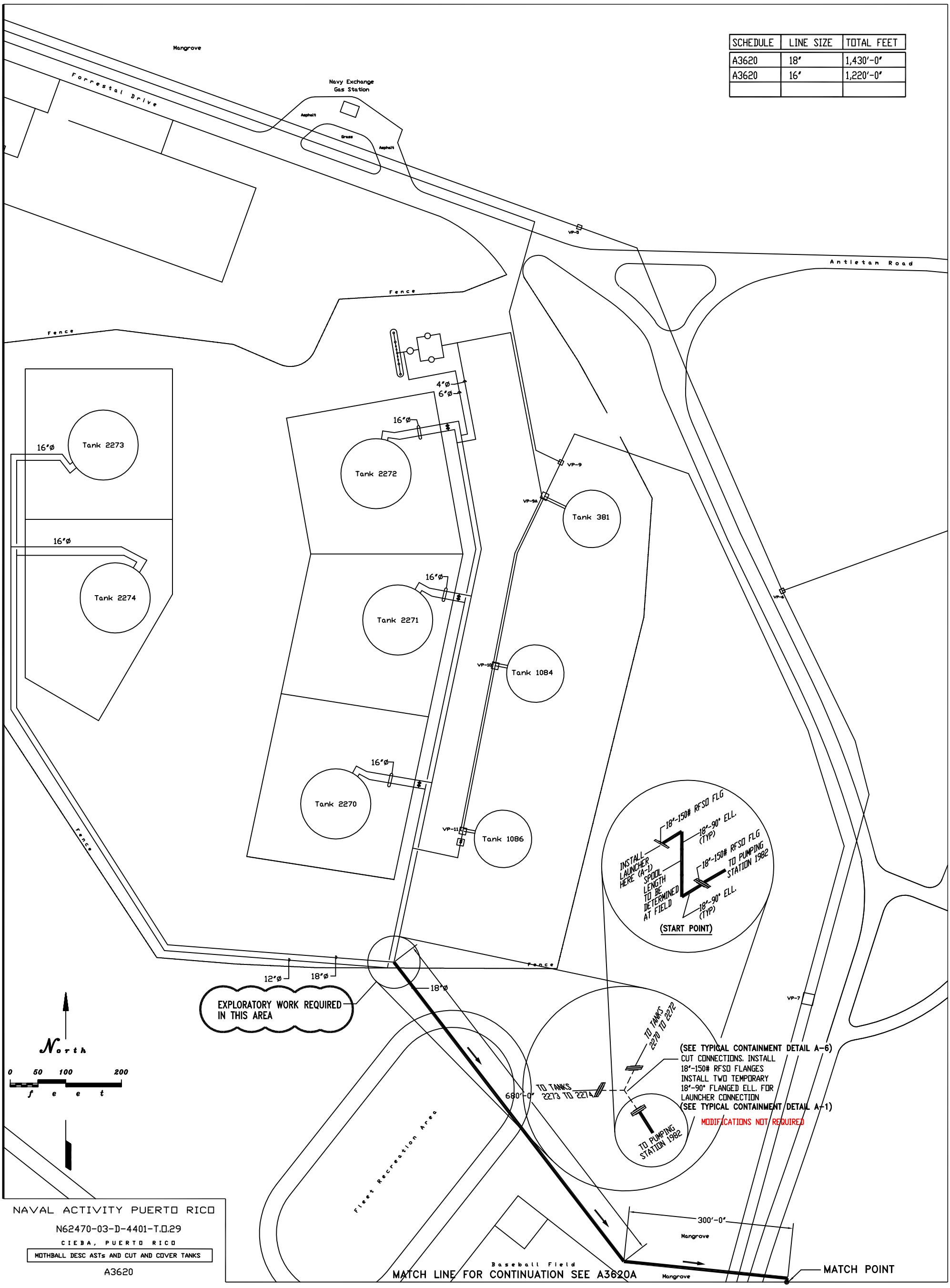
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3800

SCHEDULE	LINE SIZE	TOTAL FEET
A3620	18"	1,430'-0"
A3620	16"	1,220'-0"



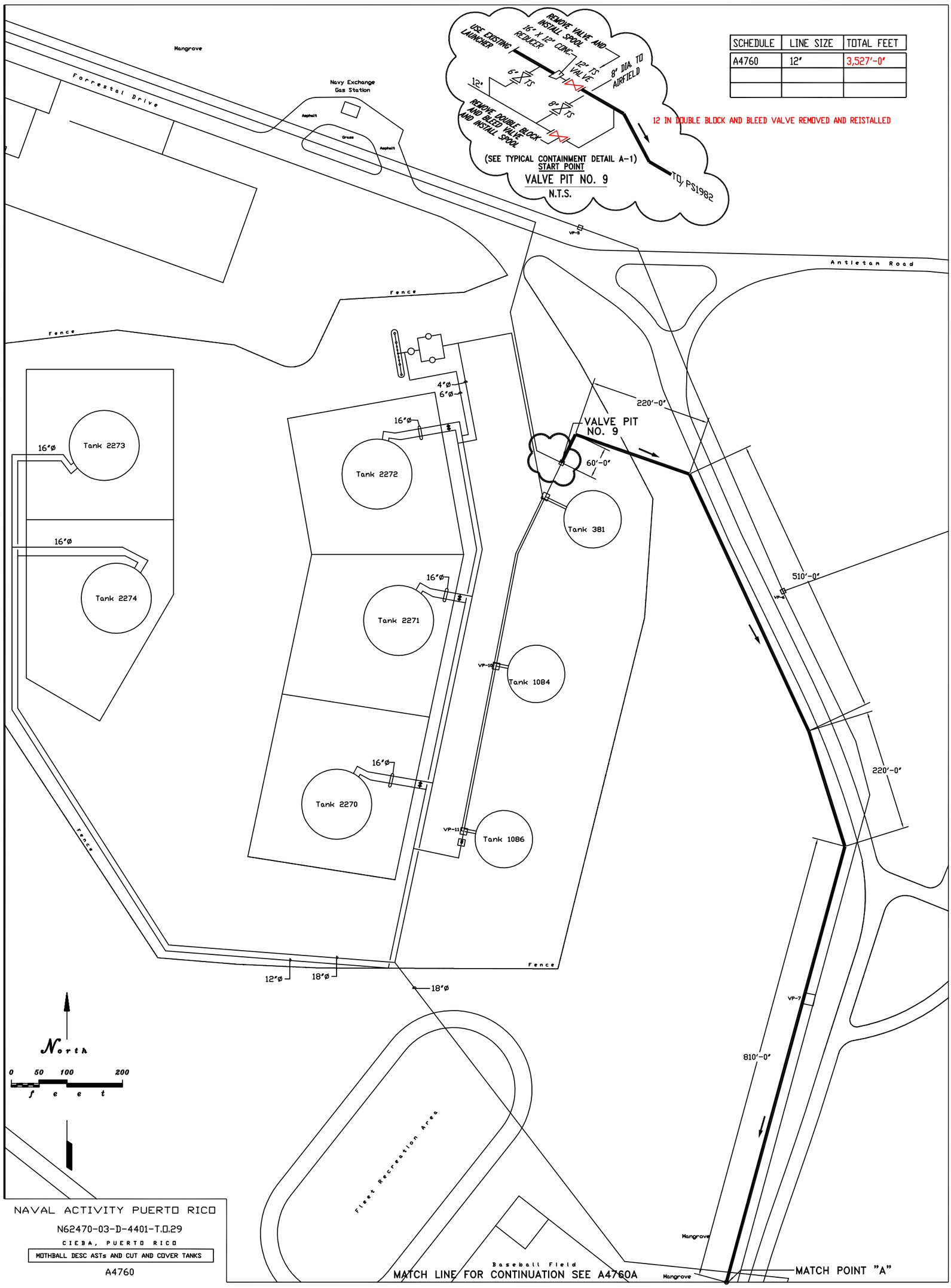
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3620



SCHEDULE	LINE SIZE	TOTAL FEET
A4760	12"	3,527'-0"

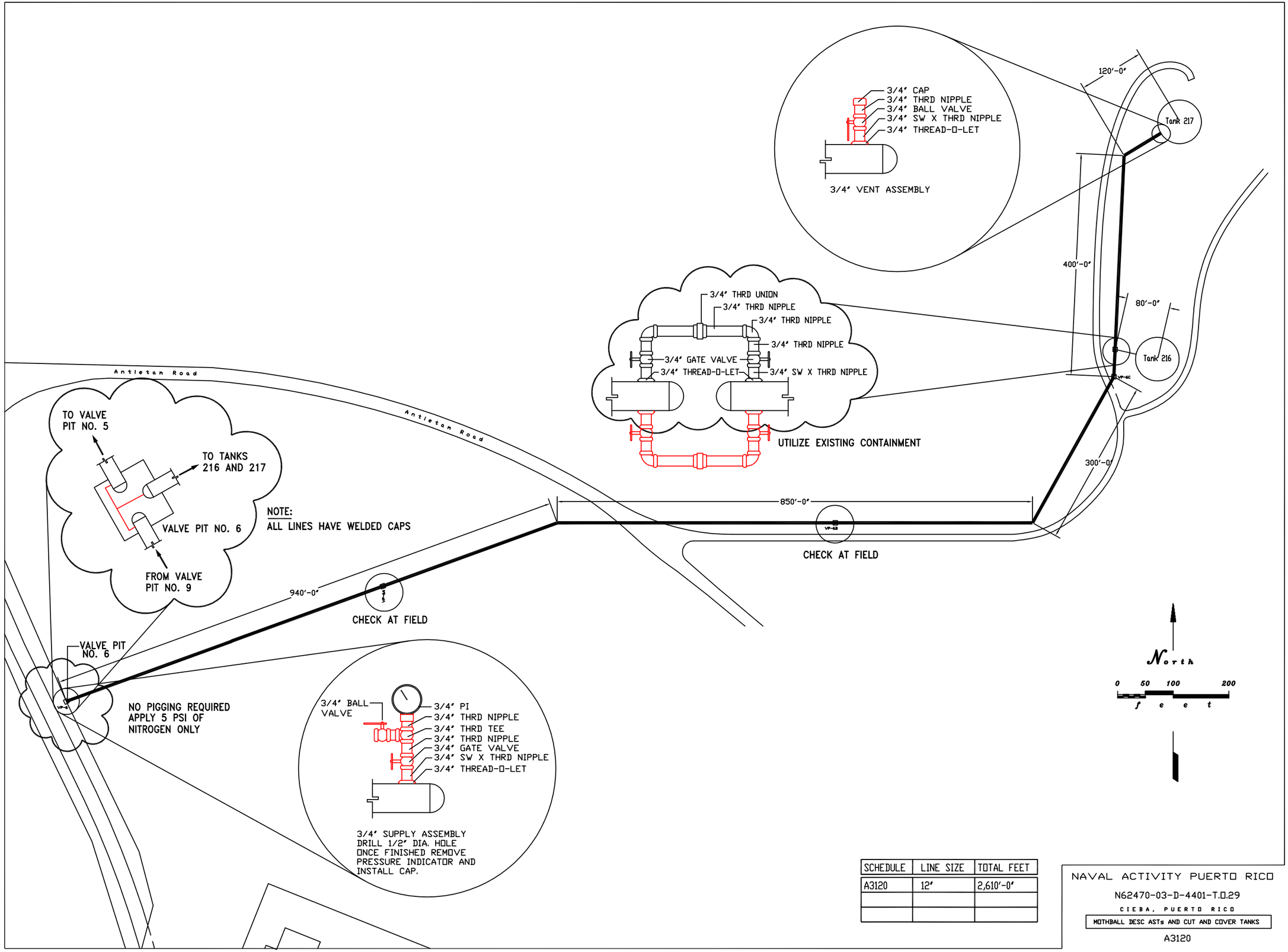
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A4760



SCHEDULE	LINE SIZE	TOTAL FEET
A3120	12"	2,610'-0"

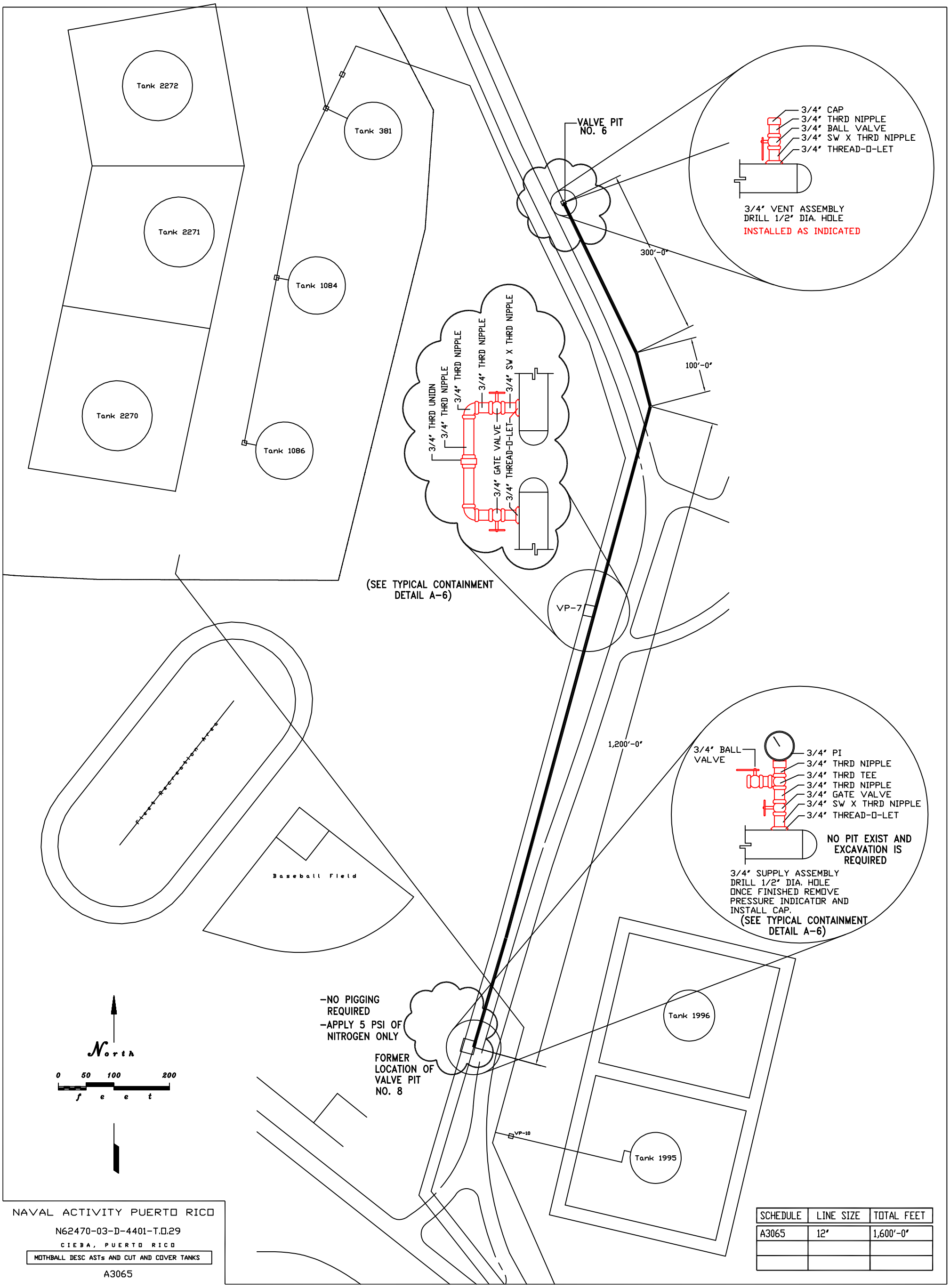
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3120



SCHEDULE	LINE SIZE	TOTAL FEET
A3065	12"	1,600'-0"

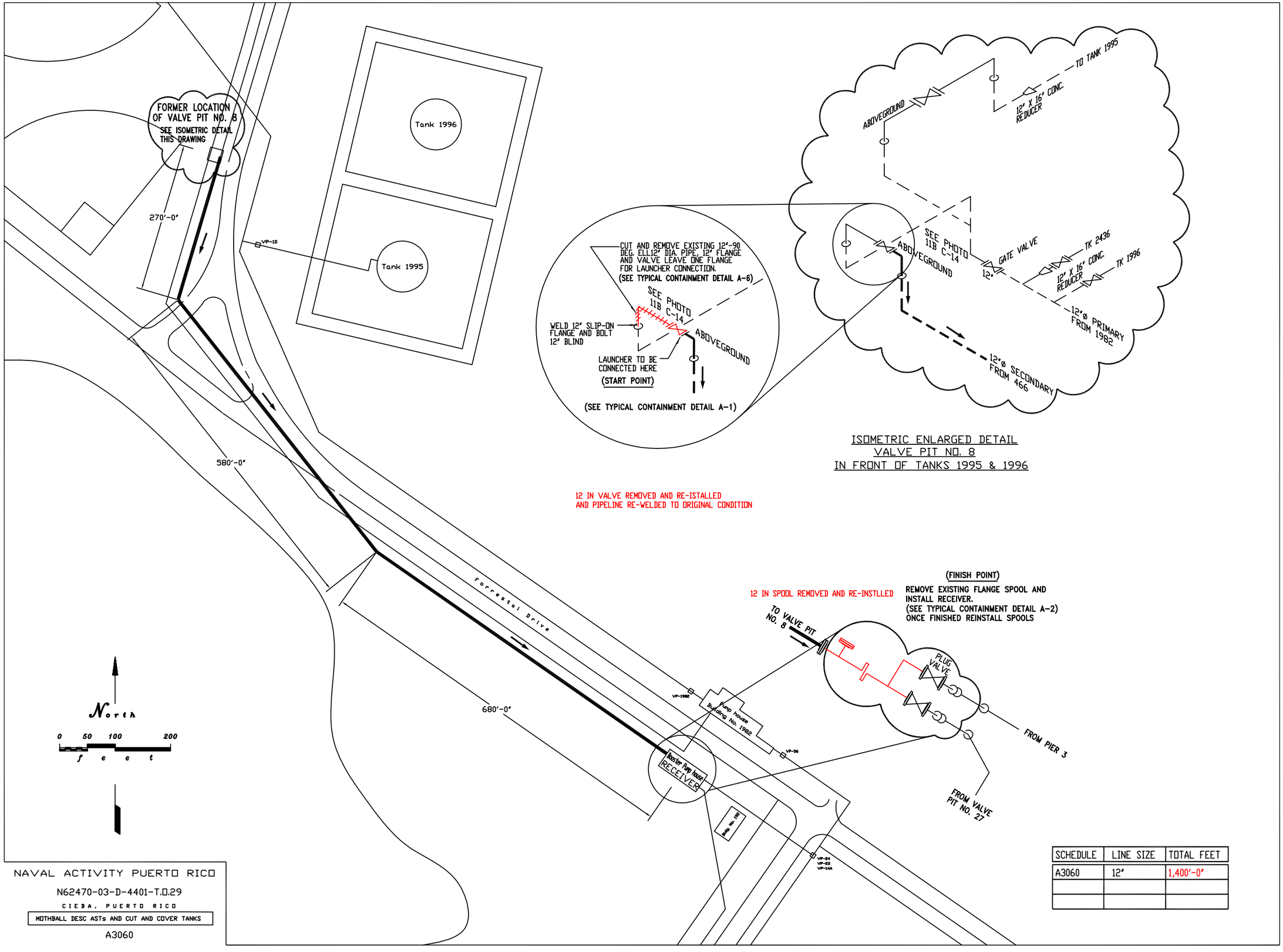
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3065



SCHEDULE	LINE SIZE	TOTAL FEET
A3060	12"	1,400'-0"

NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3060

(SEE TYPICAL CONTAINMENT DETAIL A-2)

REMOVE EXISTING BLIND FLANGE AND INSTALL SPOOL WITH ELBOWS AS SHOWN. (PREVIOULY BLINDED IN SHEDULE NO. A3340

ABOVEGROUND

12 IN DOUBLE BLOCK AND BLEED VALVE REMOVED AND RE-ISTALLED AND PIPELINE RE-WELDED TO ORIGINAL CONDITION

(FINISH POINT)

INSTALL RECEIVER HERE

12"-90° ELL. (ADDED)

16" X 12" CONC. REDUCER

FROM TK 1996

EXISTING 12-90° ELL AND 12" -150# SLIP ON FLG

Tank 1996

100'-0"

200'-0"

VP-10

Tank 1995

Tank 82

Tank 1080

Tank 83

VP-19

Tank 84

Tank 1082

(START POINT)

CHECK VALVE

PLUG VALVE

16"ø

CHECK VALVE

PLUG VALVE

16"ø

TANK

REMOVE BOTH VALVES

(SEE TYPICAL CONTAINMENT DETAIL A-4)

INSTALL 16"-90° FLANGED ELL. AND CONNECT LAUNCHER. ONCE FINISHED REMOVE ELL. AND RECONNECT VALVES

(SEE TYPICAL CONTAINMENT DETAIL A-1)

12 IN PLUG VALVE REMOVED AND RE-ISTALLED AND PIPELINE RE-WELDED TO ORIGINAL CONDITION

Tank 85

Forrestal Drive

VP-20

VP-19B2

Pumphouse Building No. 1992

VP-36

Booster PUMP HOUSE

Bldg No. 1991

VP-24
VP-23
VP-14A

North

0 50 100 200

feet

SCHEDULE	LINE SIZE	TOTAL FEET
A3400	16"	160'-0"

NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3400

Tank 1996

Tank 1995

VP-10

233'-0"

22'-0"

FINISH POINT

INSTALL RECEIVER HERE

12"-90° ELL. (TYP)

SPOOL LENGTH TO BE DETERMINED AT FIELD

FROM TK 1995

12"-90° ELL. (TYP)

NOTE:
REMOVE VALVE, CUT PIPE 12" BACK AND WELD A 12" SLIP ON FLANGE.
(SEE TYPICAL CONTAINMENT DETAIL A-6)
INSTALL SPOOL TO BRING RECEIVING STATION UP TO GRADE AND INSTALL RECEIVER.
(SEE TYPICAL CONTAINMENT DETAIL A-2)

12 IN DOUBLE BLOCK AND BLEED VALVE REMOVED AND RE-ISTALLED AND PIPELINE RE-WELDED TO ORIGINAL CONDITION

12 IN PLUG VALVE REMOVED AND RE-ISTALLED AND PIPELINE RE-WELDED TO ORIGINAL CONDITION

START POINT

6"Ø

16"Ø

CHECK VALVE

PLUG VALVE

CHECK VALVE

PLUG VALVE

TANK

16"Ø

16" X 12" CONC. REDUCER

CUT EXISTING 12" LINE, WELD
(SEE TYPICAL CONTAINMENT DETAIL A-6)
WELD A 12" SLIP ON FLANGE AND INSTALL THE LAUNCHER. ONCE FINISHED REMOVE LAUNCHER AND RE-INSTALL SPOOL
(SEE TYPICAL CONTAINMENT DETAIL A-1)

NOTE:
A 12"-150# SORF FLANGE WILL HAVE TO BE WELDED TO REMOVED SPOOL FOR FINAL ASSEMBLY

Forrestal Drive

Tank 82

Tank 1080

Tank 83

VP-19

Tank 84

Tank 1082

Tank 85

VP-20

VP-1982

Pump house Building No. 1982

VP-56

Booster PUMP HOUSE

Bldg No. 1981

VP-24
VP-23
VP-14A

North

0 50 100 200

feet

SCHEDULE	LINE SIZE	TOTAL FEET
A3460	12"	177'-0"

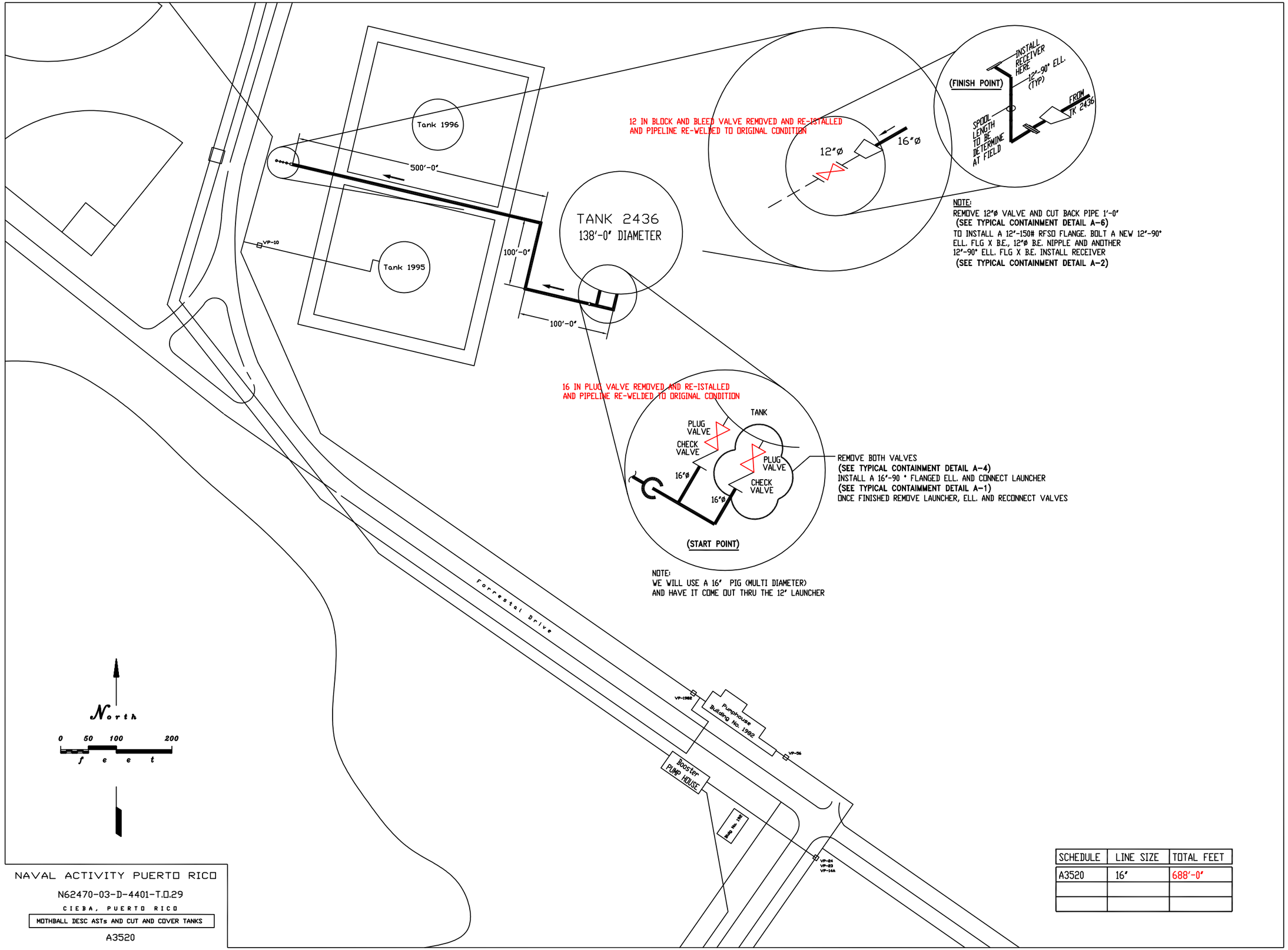
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3460



SCHEDULE	LINE SIZE	TOTAL FEET
A3520	16"	688'-0"

NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3520

MATCH LINE FOR CONTINUATION SEE A3620

MATCH POINT

250'-0"

200'-0"

20'-0"

360'-0"

840'-0"

Forrestal Drive

Tank 1996

Tank 1995

18"ø

18" X 16" CONC REDUCER

16"ø

TO PUMPING STATION NO. 1982

Tank 82

Tank 1082

Tank 83

Tank 84

Tank 1080

Tank 85

FINISH POINT

REMOVE VALVES (SEE TYPICAL CONTAINMENT A-4) AND INSTALL RECEIVER (SEE TYPICAL CONTAINMENT A-2)

16 IN DOUBLE BLOCK AND BLEED VALVE REMOVED AND RE-ISTALLED

Pumphouse Building No. 1982

Booster PUMP HOUSE

North

0 50 100 200

feet

SCHEDULE	LINE SIZE	TOTAL FEET
A3620	16"	SEE A3620
A3620	18"	SEE A3620

NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A3620A

NAVAL ACTIVITY PUERTO RICO

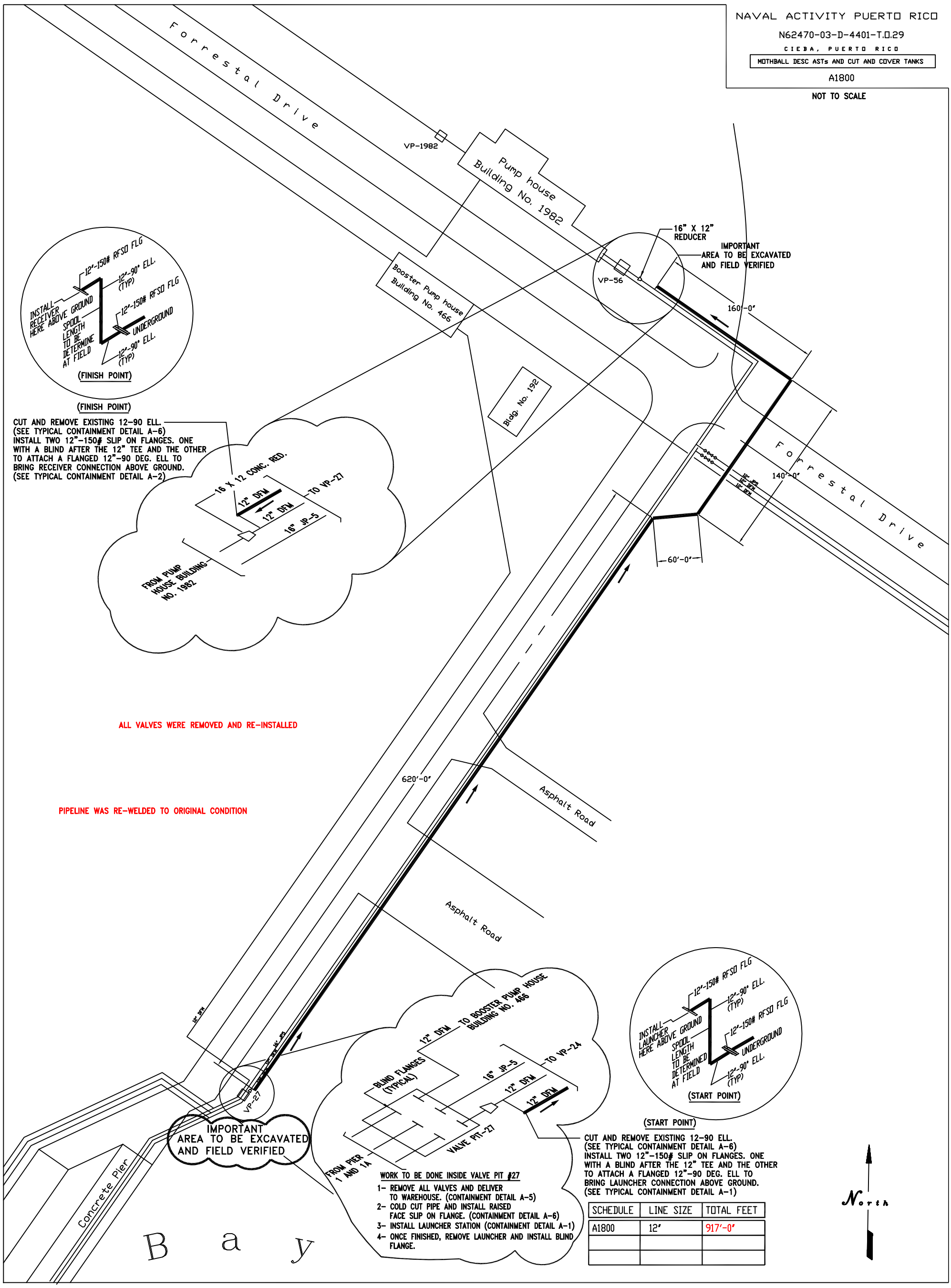
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1800

NOT TO SCALE



SCHEDULE	LINE SIZE	TOTAL FEET
A1800	12"	917'-0"

NAVAL ACTIVITY PUERTO RICO

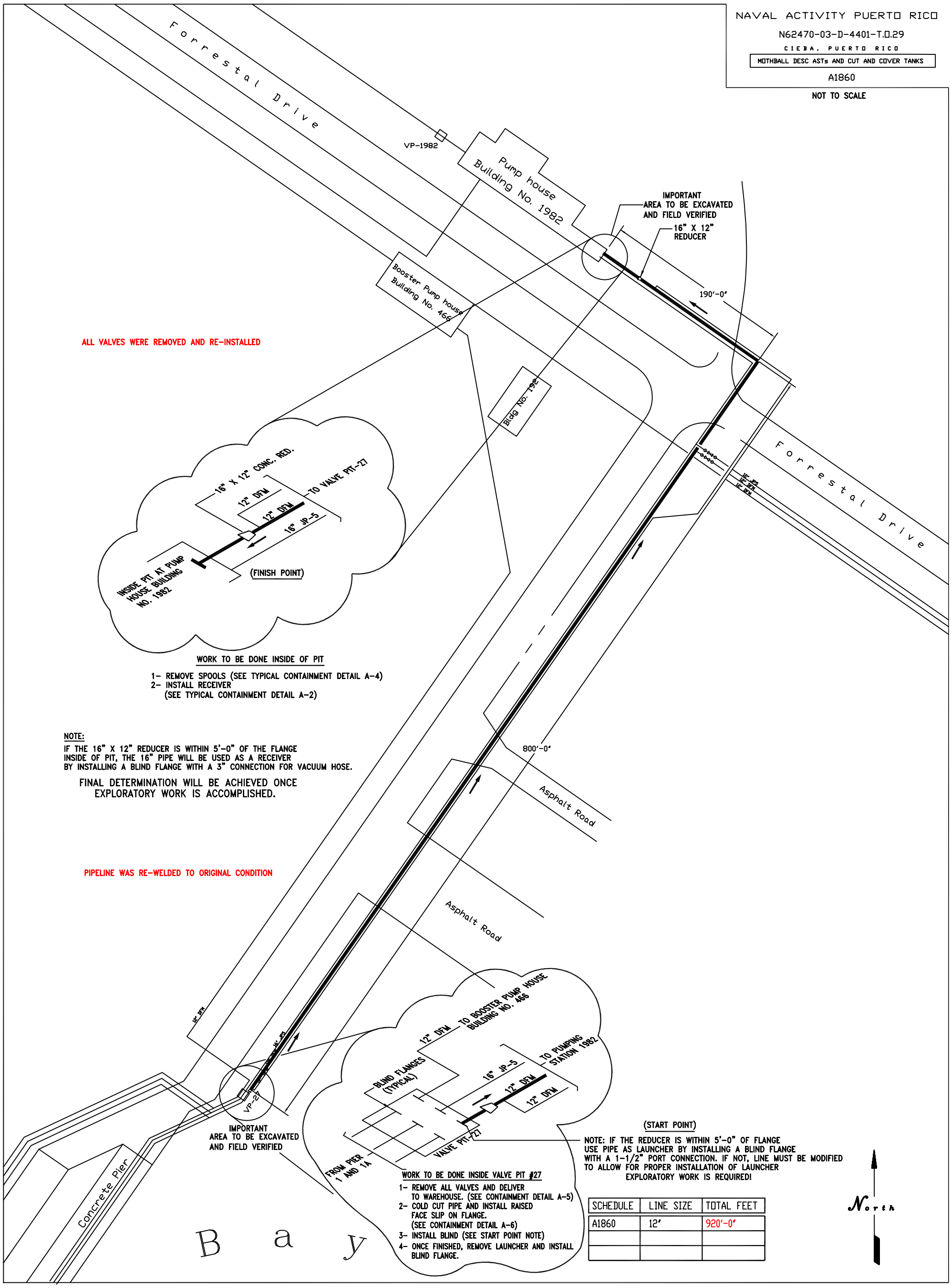
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1860

NOT TO SCALE



SCHEDULE	LINE SIZE	TOTAL FEET
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NAVAL ACTIVITY PUERTO RICO

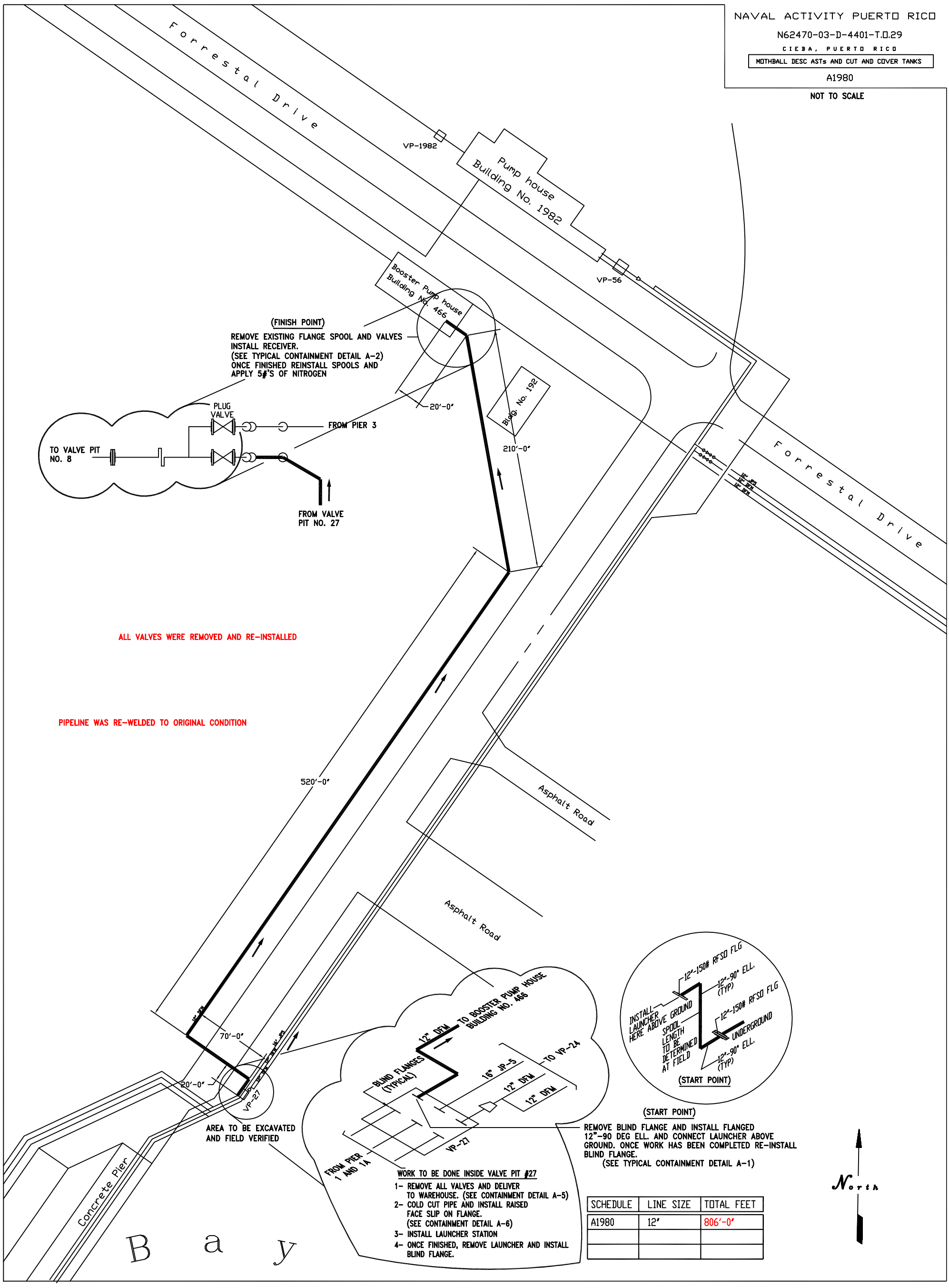
N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A1980

NOT TO SCALE



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A1980	12"	806'-0"

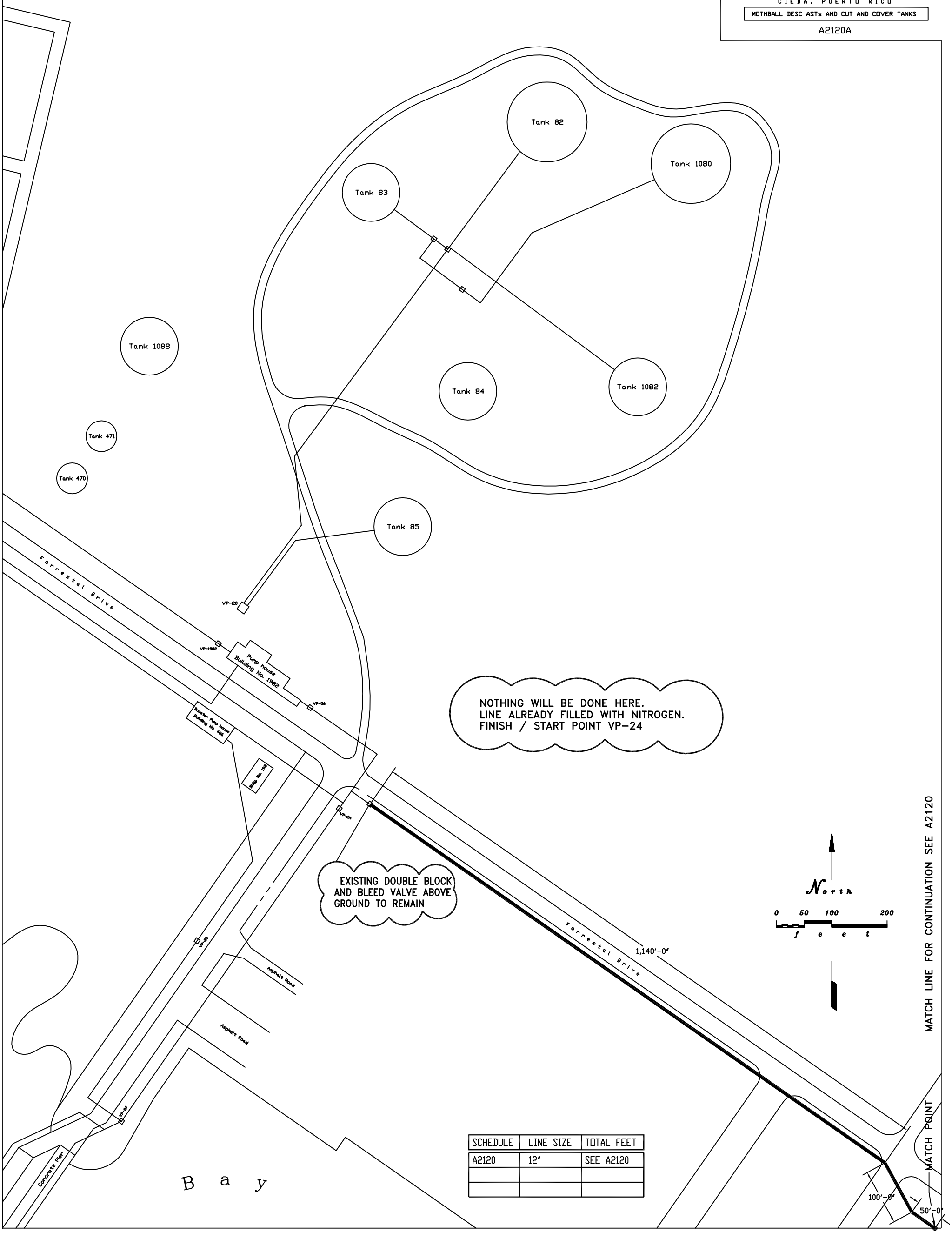
NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

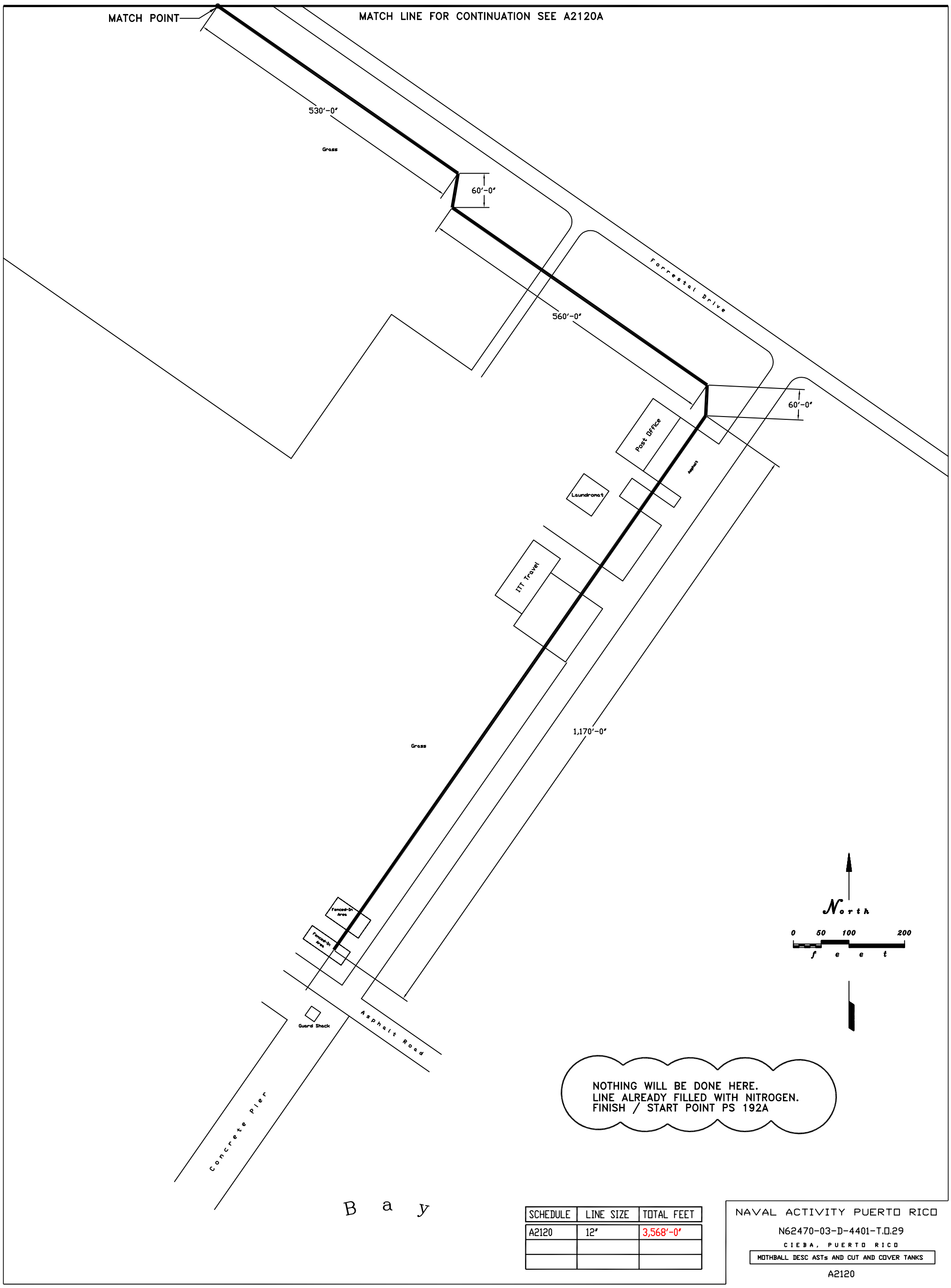
CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A2120A



SCHEDULE	LINE SIZE	TOTAL FEET
A2120	12"	SEE A2120



SCHEDULE	LINE SIZE	TOTAL FEET
A2120	12"	3,568'-0"

NAVAL ACTIVITY PUERTO RICO

N62470-03-D-4401-T.O.29

CIEBA, PUERTO RICO

MOTHBALL DESC ASTs AND CUT AND COVER TANKS

A2120

APPENDIX D
USEPA REGION II GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

I. SCOPE & APPLICATION

This Low Stress (or Low-Flow) Purging and Sampling Procedure is the EPA Region II standard method for collecting low stress (low flow) ground water samples from monitoring wells. Low stress Purging and Sampling results in collection of ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by minimizing stress on the geological formation and minimizing disturbance of sediment that has collected in the well. The procedure applies to monitoring wells that have an inner casing with a diameter of 2.0 inches or greater, and maximum screened intervals of ten feet unless multiple intervals are sampled. The procedure is appropriate for collection of ground water samples that will be analyzed for volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and microbiological and other contaminants in association with all EPA programs.

This procedure does not address the collection of light or dense non-aqueous phase liquids (LNAPL or DNAPL) samples, and should be used for aqueous samples only. For sampling NAPLs, the reader is referred to the following EPA publications: DNAPL Site Evaluation (Cohen & Mercer, 1993) and the RCRA Ground-Water Monitoring: Draft Technical Guidance (EPA/530-R-93-001), and references therein.

II. METHOD SUMMARY

The purpose of the low stress purging and sampling procedure is to collect ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing.

Sampling at the prescribed (low) flow rate has three primary benefits. First, it minimizes disturbance of sediment in the bottom of the well, thereby producing a sample with low turbidity (i.e., low concentration of suspended particles). Typically, this saves time and analytical costs by eliminating the need for collecting and analyzing an additional filtered sample from the same well. Second, this procedure minimizes aeration of the ground water during sample collection, which improves the sample quality for VOC analysis. Third, in most cases the procedure significantly reduces the volume of ground water purged from a well and the costs associated with its proper treatment and disposal.

III. ADDRESSING POTENTIAL PROBLEMS

Problems that may be encountered using this technique include a) difficulty in sampling wells with insufficient yield; b) failure of one or more key indicator parameters to stabilize; c) cascading of water and/or formation of air bubbles in the tubing; and d) cross-contamination between wells.

Insufficient Yield

Wells with insufficient yield (i.e., low recharge rate of the well) may dewater during purging. Care should be taken to avoid loss of pressure in the tubing line due to dewatering of the well below the level of the pump=s intake. Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should therefore be avoided to the extent possible in all cases. Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. Alternatively, ground water samples may be obtained with techniques designed for the unsaturated zone, such as lysimeters.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fails to stabilize after 4 hours, one of four options should be considered: a) continue purging in an attempt to achieve stabilization; b) discontinue

purging, do not collect samples, and document attempts to reach stabilization in the log book; c) discontinue purging, collect samples, and document attempts to reach stabilization in the log book; or d) Secure the well, purge and collect samples the next day (preferred). The key indicator parameter for samples to be analyzed for VOCs is dissolved oxygen. The key indicator parameter for all other samples is turbidity.

Cascading

To prevent cascading and/or air bubble formation in the tubing, care should be taken to ensure that the flow rate is sufficient to maintain pump suction. Minimize the length and diameter of tubing (i.e., 1/4 or 3/8 inch ID) to ensure that the tubing remains filled with ground water during sampling.

Cross-Contamination

To prevent cross-contamination between wells, it is strongly recommended that dedicated, in-place pumps be used. As an alternative, the potential for cross-contamination can be reduced by performing the more thorough Adaily@ decontamination procedures between sampling of each well in addition to the start of each sampling day (see Section VII, below).

Equipment Failure

Adequate equipment should be on-hand so that equipment failures do not adversely impact sampling activities.

IV. PLANNING DOCUMENTATION AND EQUIPMENT

< Approved site-specific Field Sampling Plan/Quality Assurance Project Plan (QAPP). This plan must specify the type of pump and other equipment to be used. The QAPP must also specify the depth to which the pump intake should be lowered in each well. Generally, the target depth will correspond to the mid-point of the most permeable zone in the screened interval. Borehole geologic and geophysical logs can be used to help select the most permeable zone. However, in some cases, other criteria may be used to select the target depth for the pump

intake. In all cases, the target depth must be approved by the EPA hydrogeologist or EPA project scientist.

< Well construction data, location map, field data from last sampling event.

< Polyethylene sheeting.

< Flame Ionization Detector (FID) and Photo Ionization Detector (PID).

< Adjustable rate, positive displacement ground water sampling pump (e.g., centrifugal or bladder pumps constructed of stainless steel or Teflon). A peristaltic pump may only be used for inorganic sample collection.

< Interface probe or equivalent device for determining the presence or absence of NAPL.

< Teflon or Teflon-lined polyethylene tubing to collect samples for organic analysis. Teflon or Teflon-lined polyethylene, PVC, Tygon or polyethylene tubing to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.

< Water level measuring device, minimum 0.01 foot accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).

< Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).

< Power source (generator, nitrogen tank, etc.).

< Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephalometer is used to measure turbidity.

< Decontamination supplies (see Section VII, below).

< Logbook (see Section VIII, below).

< Sample bottles.

< Sample preservation supplies (as required by the analytical methods).

< Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

1. Start at the well known or believed to have the least contaminated ground water and proceed systematically to the well with the most contaminated ground water. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations.

2. Lay out sheet of polyethylene for placement of monitoring and sampling equipment.

3. Measure VOCs at the rim of the unopened well with a PID and FID instrument and record the reading in the field log book.

4. Remove well cap.

5. Measure VOCs at the rim of the opened well with a PID and an FID instrument and record the reading in the field log book.
6. If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Note that the reference point should be surveyed for correction of ground water elevations to the mean geodesic datum (MSL).

7. Measure and record the depth to water (to 0.01 ft) in all wells to be sampled prior to purging. Care should be taken to minimize disturbance in the water column and dislodging of any particulate matter attached to the sides or settled at the bottom of the well.

8. If desired, measure and record the depth of any NAPLs using an interface probe. Care should be taken to minimize disturbance of any sediment that has accumulated at the bottom of the well. Record the observations in the log book. If LNAPLs and/or DNAPLs are detected, install the pump at this time, as described in step 9, below. Allow the well to sit for several days between the measurement or sampling of any DNAPLs and the low-stress purging and sampling of the ground water.

Sampling Procedures

9. Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.

10. Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

11. Purge Well: Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

12. Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO)

approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

±0.1 for pH
±3% for specific conductance (conductivity)
±10 mv for redox potential
±10% for DO and turbidity

Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

13. Collect Samples: Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.

    Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary. If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Ground water purged from the well prior to sampling can be used for this purpose.

14. Remove Pump and Tubing: After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.

15. Measure and record well depth.

16. Close and lock the well.

VI. FIELD QUALITY CONTROL SAMPLES

Quality control samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. The appropriate EPA Program Guidance should be consulted in preparing the field QC sample requirements of the site-specific QAPP.

All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples should be collected during the sampling event:

< Field duplicates
< Trip blanks for VOCs only
< Equipment blank (not necessary if equipment is dedicated to the well)

As noted above, ground water samples should be collected systematically from wells with the lowest level of contamination through to wells with highest level of contamination. The equipment blank should be collected after sampling from the most contaminated well.

VII. DECONTAMINATION

Non-disposable sampling equipment, including the pump and support cable and electrical wires which contact the sample, must be decontaminated thoroughly each day before use (Adaily decon@) and after each well is sampled (Abetween-well decon@). Dedicated, in-place pumps and tubing must be thoroughly decontaminated using Adaily decon@ procedures (see #17, below) prior to their initial use. For centrifugal pumps, it is strongly recommended that non-disposable sampling equipment, including the pump and support cable and electrical wires in contact with the sample, be decontaminated thoroughly each day before use (Adaily decon@).

EPA=s field experience indicates that the life of centrifugal pumps may be extended by removing entrained grit. This also permits inspection and replacement of the cooling water in centrifugal pumps. All non-dedicated sampling equipment (pumps, tubing, etc.)

must be decontaminated after each well is sampled (Abetween-well decon,@ see #18 below).

17. **Daily Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Disassemble pump.

E) Wash pump parts: Place the disassembled parts of the pump into a deep basin containing 8 to 10 gallons of non-phosphate detergent solution. Scrub all pump parts with a test tube brush.

F) Rinse pump parts with potable water.

G) Rinse the following pump parts with distilled/ deionized water: inlet screen, the shaft, the suction interconnector, the motor lead assembly, and the stator housing.

H) Place impeller assembly in a large glass beaker and rinse with 1% nitric acid (HNO_3).

I) Rinse impeller assembly with potable water.

J) Place impeller assembly in a large glass bleaker and rinse with isopropanol.

K) Rinse impeller assembly with distilled/deionized water.

18. **Between-Well Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.
B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Final Rinse: Operate pump in a deep basin of distilled/deionized water to pump out 1 to 2 gallons of this final rinse water.

VIII. FIELD LOG BOOK

A field log book must be kept each time ground water monitoring activities are conducted in the field. The field log book should document the following:

< Well identification number and physical condition.
< Well depth, and measurement technique.
< Static water level depth, date, time, and measurement technique.
< Presence and thickness of immiscible liquid layers and detection method.
< Collection method for immiscible liquid layers.
< Pumping rate, drawdown, indicator parameters values, and clock time, at three to five minute intervals; calculate or measure total volume pumped.
< Well sampling sequence and time of sample collection.
< Types of sample bottles used and sample identification numbers.
< Preservatives used.
< Parameters requested for analysis.

- Field observations of sampling event.
- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.

IX. REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

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APPENDIX E
IDENTIFICATION OF BIOACCUMULATIVE CHEMICALS

APPENDIX E

IDENTIFICATION OF BIOACCUMULATIVE CHEMICALS

Only those organic chemicals with a log octanol-water partition coefficient (K_{ow}) value greater than or equal to 3.0 will be considered a bioaccumulative chemical. Justification for defining bioaccumulative organic chemicals as those with log K_{ow} values greater than or equal to 3.0 is provided below.

- The potential for organic chemicals to accumulate in organisms has been shown to correlate well with the K_{ow}. USEPA (1985), as sited in USEPA/ACOE (1998), recommends that only chemicals for which the log K_{ow} is greater than 3.5 be considered for evaluation of bioaccumulation potential since chemicals with log K_{ow} values less than 3.5 are not likely to bioaccumulate to a significant degree.

- Although organic chemicals with log K_{ow} values in the 2 to 7 range have at least some potential to bioconcentrate (Connell, 1990), significant bioconcentration does not generally occur for chemicals with log K_{ow} values less than 3.0 (Maki and Duthie, 1978) to 5.0 (Gobas and Mackay, 1990). Most work with bioconcentration (uptake from the surrounding medium, such as water) and bioaccumulation (uptake from all exposure routes, including via food) of organic chemicals has concerned chemicals with log K_{ow} values of 3.0 or more (USEPA, 1995a), since organic chemicals with lower log K_{ow} values generally have little potential for significant bioaccumulation.

- The USEPA has developed a number of scoring algorithms to evaluate the relative hazard of chemicals to human or ecological receptors. All of these algorithms have a component that addresses bioaccumulation potential. The evaluation of bioaccumulation potential is generally based on measured or estimated (using log K_{ow} values) BCFs or BAFs, or less commonly using log K_{ow} itself. For example, USEPA (1980) developed a bioaccumulation potential scoring system that considered organics with BCF values of less than 100 (equivalent to a log K_{ow} of approximately 3.0) to have negligible potential to bioaccumulate in aquatic food webs, while organic chemicals with BCFs in the 100 to 1,000 range (equivalent to log K_{ow} values of about 3.0 to 4.3) are considered to have low bioaccumulation potential. The more recent Scoring and Ranking Assessment Model (SCRAM), developed by EPA Region 5 for the Great Lakes, has similar bioaccumulation scoring cut-offs (USEPA, 2000).

- The proposed categorization of persistent, bioaccumulative, and toxic (PBT) chemicals under the Toxic Substances Control Act (TSCA) defines chemicals with a tendency to accumulate in organisms as those with a BCF or BAF of greater than 1,000 (Federal Register 63(192):53417; 10/5/98). Using the equation listed below (USEPA, 1995b), a BCF/BAF of 1,000 equates to a log K_{ow} value of approximately 4.3.

$$Log\ BCF = [(0.79)(\log K_{ow}) - 0.40] \qquad \text{(Equation E-1)}$$

- The Beta Test Version 1.0 of the EPA Waste Minimization Prioritization Tool (WMPT), used to develop a list of PBTs for the Resource Conservation and Recovery Act (RCRA) program, defined organic chemicals with a low potential to bioaccumulate as those with log K_{ow} values of less than 3.5 and those with a high potential to bioaccumulate as those with log K_{ow} values greater than 5.0 (USEPA, 1998). The 1998 version of the EPA WMPT defines bioaccumulation potential based on BCF or BAF values (rather than on log K_{ow} values directly), with a scoring "fenceline" for organic chemicals with a low

bioaccumulation potential defined as a BCF or BAF of less than 250. Although the tool no longer uses log K_{ow} directly, log K_{ow} values can be used to estimate a BCF or BAF value. Using Equation E-1, a BCF/BAF of 250 equates to a log K_{ow} value of approximately 3.5.

- Garten and Trabalka (1983) have reviewed terrestrial food web data and concluded that only organic chemicals with log K_{ow} values greater than 3.5 have the potential to significantly bioaccumulate from food to birds to mammals.

The information listed above indicates that a log K_{ow} of 3.0 to 3.5 is a reasonable, non-arbitrary parameter value to use in defining an organic chemical with the potential to bioaccumulate. For conservatism, the low end (3.0) of this log K_{ow} range will be used to define a bioaccumulative organic chemical. Table E-1 lists log K_{ow} values (range and recommended value) for volatile and semi-volatile organic chemicals that will be analyzed for in media collected from SWMU 69. Log K_{ow} values were primarily obtained from the USEPA (1995c and 1996). The recommended value from these sources generally represents a "high-end" or best estimate from empirical data. The organic chemicals that will be evaluated in the dietary intake models are those with a log K_{ow} value of greater than or equal to 3.0. For conservatism, the maximum value in the log K_{ow} range is used for this determination not the recommended value.

Inorganic chemicals were not quantitatively screened for bioaccumulation potential since log K_{ow} values are not available for these chemicals. However, cyanide was eliminated from the list since it is readily metabolized and is not known to bioaccumulate (Eisler, 1991). Although all Appendix IX metals are retained for evaluation in the upper trophic level food chain models, only mercury and selenium are known to biomagnify in food chains (in organic forms; Suter, 1993) and only cadmium, copper, and zinc generally have the potential to bioaccumulate significantly. The other metals are retained by default.

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TABLE E-1
LOG K_{ow} VALUES FOR ORGANIC CHEMICALS
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Log K_{ow} Range	Recommended Log K_{ow}	Reference	Bioaccumulative Chemical [1]
Volatile Organics:				
1,1,1,2-Tetrachloroethane	2.63 to 3.03	2.63	USEPA 1995	Yes
1,1,1-Trichloroethane	2.47 to 2.51	2.48	USEPA 1995	No
1,1,2,2-Tetrachloroethane	2.31 to 2.64	2.39	USEPA 1995	No
1,1,2-Trichloroethane	2.03 to 2.07	2.05	USEPA 1995	No
1,1-Dichloroethane	1.78 to 1.85	1.79	USEPA 1995	No
1,1-Dichloroethene	2.13 to 2.37	2.13	USEPA 1995	No
1,2,3-Trichloropropane	1.98 to 2.63	2.25	USEPA 1995	No
1,2-Dibromo-3-chloropropane	2.26 to 2.41	2.34	USEPA 1995	No
1,2-Dibromoethane (EDB)	Not Reported	2.00	USEPA 1996	No
1,2-Dichloroethane	1.4 to 1.48	1.47	USEPA 1995	No
1,2-Dichloropropane	1.94 to 1.99	1.97	USEPA 1995	No
2-Butanone (Methyl ethyl ketone)	0.28 to 0.69	0.28	USEPA 1995	No
2-Hexanone	Not Reported	1.38	USEPA 1996	No
3-Chloropropene (Ally chloride)	Not Reported	1.93	SRC 1998	No
4-Methyl-2-pentanone (MIBK)	Not Reported	1.31	SRC 1998	No
Acetone	-0.21 to -0.24	-0.24	USEPA 1995	No
Acetonitrile	-0.34 to -0.39	-0.34	USEPA 1995	No
Acrolein (Propenal)	-0.01 to 0.90	-0.01	USEPA 1995	No
Acrylonitrile	-0.92 to 1.20	0.25	USEPA 1995	No
Benzene	1.83 to 2.50	2.13	USEPA 1995	No
Bromodichloromethane	1.88 to 2.14	2.10	USEPA 1995	No
Bromoform	2.30 to 2.38	2.35	USEPA 1995	No
Bromomethane (Methyl bromide)	Not Reported	1.19	USEPA 1996	No
Carbon disulfide	1.84 to 2.16	2.00	USEPA 1995	No
Carbon tetrachloride	2.03 to 3.10	2.73	USEPA 1995	Yes
Chlorobenzene	2.56 to 3.79	2.86	USEPA 1995	Yes
Chloroethane	Not Reported	1.43	USEPA 1996	No
Chloroform	1.81 to 3.04	1.92	USEPA 1995	Yes
Chloromethane (Methyl chloride)	Not Reported	0.91	USEPA 1996	No
Chloroprene	2.03 to 2.13	2.08	USEPA 1995	No
cis-1,3-Dichloropropene	Not Reported	2.06	SRC 1998	No
Dibromochloromethane	2.13 to 2.24	2.17	USEPA 1995	No
Dibromomethane (Methylene bromide)	Not Reported	1.53	USEPA 1996	No
Dichlorodifluoromethane	2.0 to 2.37	2.16	USEPA 1995	No
Ethylbenzene	3.07 to 3.57	3.14	USEPA 1995	Yes
Ethyl methacrylate	1.59 to 1.65	1.59	USEPA 1996	No
Iodomethane (Methyl iodide)	Not Reported	1.51	SRC 1998	No
Isobutanol (Isobutyl alcohol)	0.65 to 0.76	0.75	USEPA 1995	No
Methacrylonitrile	0.54 to 0.70	-0.54	USEPA 1996	No
Methylene chloride (Dichloromethane)	1.22 to 1.40	1.25	USEPA 1995	No
Methyl methacrylate	1.11 to 1.38	1.38	USEPA 1995	No
Pentachloroethane	Not Reported	3.06	USEPA 1996	Yes
Propionitrile (ethyl cyanide)	Not Reported	0.16	SRC 1998	No
Styrene	2.76 to 3.16	2.94	USEPA 1995	Yes
Tetrachloroethene	2.53 to 2.98	2.67	USEPA 1995	No
Toluene	2.21 to 3.13	2.75	USEPA 1995	Yes
trans-1,2-Dichloroethene	1.77 to 2.10	2.07	USEPA 1995	No
trans-1,3-Dichloropropene	Not Reported	2.03	SRC 1998	No
trans-1,4-Dichloro-2-butene	Not Reported	2.60	SRC 1998	No
Trichloroethene	2.42 to 3.14	2.71	USEPA 1995	Yes
Trichlorofluoromethane	2.44 to 2.58	2.53	USEPA 1995	No

TABLE E-1
LOG K_{ow} VALUES FOR ORGANIC CHEMICALS
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
CORRECTIVE MEASURES STUDY WORK PLAN
NAVAL ACTIVITY PUERTO RICO, CEIBA, PUERTO RICO

	Log K_{ow} Range	Recommended Log K_{ow}	Reference	Bioaccumulative Chemical [1]
Volatile Organics:				
Vinyl acetate	0.21 to 0.83	0.73	USEPA 1995	No
Vinyl chloride	1.23 to 1.52	1.50	USEPA 1995	No
Xylene [2]	2.77 to 3.54	3.13	USEPA 1995	Yes
PAHs:				
1-Methylnaphthalene	Not Reported	3.87	SRC 1998	Yes
2-Methylnaphthalene	Not Reported	3.90	USEPA 1996	Yes
Acenaphthene	3.77 to 4.49	3.92	USEPA 1995	Yes
Acenaphthylene	Not Reported	4.10	USEPA 1996	Yes
Anthracene	3.45 to 4.80	4.55	USEPA 1995	Yes
Benzo(a)anthracene	4.00 to 5.79	5.70	USEPA 1995	Yes
Benzo(a)pyrene	5.98 to 6.42	6.11	USEPA 1995	Yes
Benzo(b)fluoranthene	5.79 to 6.40	6.20	USEPA 1995	Yes
Benzo(g,h,i)perylene	6.63 to 7.05	6.70	USEPA 1995	Yes
Benzo(k)fluoranthene	6.12 to 6.27	6.20	USEPA 1995	Yes
Chrysene	5.41 to 5.79	5.70	USEPA 1995	Yes
Dibenzo(a,h)anthracene	6.50 to 6.88	6.69	USEPA 1995	Yes
Fluoranthene	4.31 to 5.39	5.12	USEPA 1995	Yes
Fluorene	4.04 to 4.40	4.21	USEPA 1995	Yes
Indeno(1,2,3-cd)pyrene	6.58 to 6.72	6.65	USEPA 1995	Yes
Naphthalene	3.01 to 4.70	3.36	USEPA 1995	Yes
Phenanthrene	4.28 to 4.57	4.55	USEPA 1995	Yes
Pyrene	4.76 to 5.52	5.11	USEPA 1995	Yes

Notes:

K_{ow} = Ocatnol-Water Partitian Coefficient
SRC = Syracuse Research Corporation
USEPA = United States Environmental Protection Agency

[1] An organic chemical is considered a bioaccumulative chemical if its Log K_{ow} value is greater than or equal to 3.0. When a range of Log K_{ow} values is reported, the upper value within the range was conservatively used to identify bioaccumulative chemicals.

[2] The log K_{ow} values shown are for o-xylene

Table references:

USEPA. 1996. Superfund Chemical Data Matrix. EPA/540/R-96/028

USEPA. 1995. Internal Report on Summary of Measured, Calculated and Recommended Log K_{ow} Values. Environmental Research Laboratory, Athens, GA. April 10, 1995.

Syracuse Research Corporation (SRC). 1998. Experimental Octanol/Water Partition Coefficient (Log P) Database. http://www.syrres.com/esc/default.htm

ADDENDUM A
PHASE II OF THE CMS INVESTIGATION WORK PLAN

ADDENDUM A
PHASE II OF THE CMS WORK PLAN FOR SWMU 74

This addendum to the *Final Corrective Measures Study (CMS) Work Plan for SWMU 74* (Baker 2007) dated December 6, 2007, presents details regarding the field sampling activities that are to be conducted for Phase II of the CMS Investigation at SWMU 74. The approved Final CMS Work Plan for SWMU 74 provides the procedures, protocols and overall framework that will be followed throughout the CMS process; however, the Final CMS Work Plan did not identify the specific sampling that is to be conducted for Phase II. The *Revised Final Phase I of the Corrective Measures Study Investigation for SWMU 74* (Baker 2010) provided detailed recommendations for additional investigation activities. This addendum presents the Phase II recommendations detailed in the Phase I Report in a format consistent with the Final CMS Work Plan to facilitate implementation in the field.

The Phase I CMS Investigation Report divided SWMU 74 into five geographical areas because of the large size and broad geographical coverage of the SWMU, and to assist in development of the CMS Investigation Report. The geographical areas are shown on Figure 1 and include:

- Airfield Area
- SWMU 9 Area A/B
- JP-5 Hill and DFM Area
- SWMU 9 Area C
- Fueling Piers Area

This geographical division of SWMU 74 will be carried forward through the CMS process. For example, the Phase II investigation and reporting tasks will be implemented independently for each geographical area (i.e, five Phase II CMS Investigations and five Phase II CMS Investigation Reports will be prepared, one for each area).

The sampling objectives and scope of the Phase II field investigation for each area are discussed subsequent sections of this Addendum. As this Addendum is a supplement to the Final CMS Work Plan, unless otherwise specified herein, the procedures and protocols given in the Final CMS Work Plan will be followed for implementation of Phase II of the CMS Investigation for SWMU 74.

SAMPLING OBJECTIVES AND APPROACH

The objective of the Phase II investigation for SWMU 74 is to delineate the extent of observed contamination identified during the Phase I investigation and to collect the necessary information for the CMS Task I process described in Section 8 of the Final CMS Work Plan for SWMU 74, including ecological and human health evaluations. The field procedures given in the Final CMS Work Plan (Baker 2007) will be followed for this Phase II Investigation, except as outlined in the following paragraphs.

The Phase II Investigation will consist of the collection of surface and subsurface soil samples as well as groundwater samples. Where specified, surface soil samples will be collected from a depth of 0 to 1 foot below ground surface (bgs) using a stainless steel spoon, a stainless steel bucket auger or a MacroCore Sampler. Shallow subsurface soil samples will be collected from a depth of 1 to 3 feet bgs using direct push technology. The subsurface soil (greater than 3 feet bgs) samples (typically two per boring) will be collected from the depth of any suspected contamination, based on PID, visual or olfactory screening, but at a depth shallower than the water table or 10 feet bgs, whichever occurs first. For conditions where the water table is greater than 10 feet bgs, if PID measurements or visual or olfactory screening indicate potential contamination between 10 feet bgs, and the water table, one of the subsurface soil samples may

be collected from the deeper interval at the discretion of the field geologist. Sampling procedures and drilling methodology for borings and well installations will follow the Final CMS Work Plan (Baker 2007).

In selected borings, permanent monitoring wells will be installed following the procedures given in Section 3.2 – Phase II CMS Investigation in the Final CMS Work Plan. Monitoring wells will be installed using hollow-stem augers, air rotary or direct push methods, depending on underlying stratigraphy. The wells will be constructed of 2-inch ID, schedule 40 PVC with flush joint threads. Well screens will be 10-feet long and installed to straddle the water table. Each new monitoring well will be developed using pumping and surging methods or low flow pumping after allowing suitable time for the cement/bentonite grout to cure (typically a minimum of 24 hours). Groundwater samples will be collected using a low-flow sampling technique to the extent that the actual recovery rate at each location may allow. In certain locations, adequate groundwater volume for sampling may require a day or more of recovery.

Synoptic groundwater elevation measurements for each area will be collected after allowing the well to remain undisturbed for at least 48 hours to determine groundwater gradients and flow directions for each investigation area with groundwater impact. Slug testing will also be performed at the newly installed groundwater monitoring wells to determine hydraulic conductivity values at each location. This will aid in understanding contaminant migration potential via groundwater.

Note that contingency borings are specified for most of the areas that are to be investigated during Phase II. These contingency borings will only be installed if there is a field indication (i.e., PID measurements or visual or olfactory screening) that the area of contamination has not been fully delineated, or at the discretion of the field geologist. As a general rule, contingency borings will be installed as “step-outs” from the proposed boring location, if needed at a distance of approximately 10 to 25 feet, based on site conditions. However, the contingency boring locations and depths may be adjusted in the field as necessary to provide the beset delineation coverage. The contingency borings/samples also may be shifted from one area to another to provide adequate delineation. It is likely that not all of the contingency borings will be installed during this Phase II investigation.

Samples will be analyzed for Appendix IX volatile organic compounds (VOCs), metals (total and dissolved for groundwater), low level polynuclear aromatic hydrocarbons (LLPAHs), total petroleum hydrocarbons (TPH) diesel range organics (DRO), and TPH gasoline range organics (GRO) following the methods specified in the Final CMS Work Plan. Similar to the Phase I investigation, the Phase II investigation will focus on delineating TPH contamination associated with SWMU 74. A screening value of 25% of the Puerto Rico Environmental Quality Board (PREQB) TPH criteria for soil and groundwater was used in the Phase I investigation (25 mg/kg TPH (GRO, DRO, and/or Total) in soil and 12.5 mg/L in groundwater) as a screening tool to identify areas potentially impacted by hydrocarbon releases from the SWMU 74 pipelines and hydrant pits. For this Phase II investigation, the PREQB criteria for TPH (GRO, DRO, and/or Total) in soil (100 mg/kg) and for TPH (GRO, DRO, and/or Total) in groundwater (50 mg/L) will be used as the principle criteria to delineate the potential extent of contamination.

AIRFIELD AREA INVESTIGATION

Phase II CMS investigation activities at the Airfield Area will include further characterization of surface soil, shallow and deep subsurface soil, and groundwater. The Phase I investigation has identified locations within three segments or areas within the Airfield Area of SWMU 74 to be delineated: Segment A – Aircraft Hydrant Refueling Area; Segment B – Day Tank Area; and Segment C – Airfield Fuel Pipeline Area. A key map showing these areas is provided as Figure 2. Proposed sample locations for these three areas are shown in Figures 3 through 5. Tables 1 through 3 summarize the samples to be

collected and their associated laboratory analyses. Table 4 provides a summary of the QA/QC samples that will be collected in association with the Airfield Area investigation.

Segment A - Aircraft Hydrant Refueling Area

The Aircraft Hydrant Refueling Area will be referred to as Segment A, and is shown on Figure 3. Activities for Phase II of the CMS Investigation in this area consist of both surface soil and subsurface soil delineation. Sample locations are provided on Figure 3; sample designations and analyses are summarized on Table 1.

- Six surface and subsurface soil sample locations (designated 74SB500 through 74SB505) are proposed around 74SB05 and 74SB06 to further delineate the TPH. No wells are proposed in this area since 74SB05 was a well location and no significant TPH was observed in the groundwater at this location. However, if PID measurements or other visual/olfactory observations indicate potential contamination, up to an additional four soil borings (designated as 74SB506 to 74SB509) may be installed to delineate contamination in this area. Note that soil sampling will be limited to the vegetated areas and that boring through the concrete apron will not be conducted as the airfield is currently active and sampling through the apron or runways would potentially disrupt current operations.

- Three surface (0 to 1 foot bgs) and shallow subsurface (1 to 3 feet bgs) soil sample locations are proposed around 74SB01 to further delineate the TPH impacts horizontally and to a depth of three feet. These surface soil sample locations are designated 74SB510 through 74SB512. If PID measurements or other visual/olfactory observations indicate potential contamination, up to an additional four shallow borings (to a depth of three feet) may be installed in this area (boring location designations of 74SB513 to 74SB516). If PID measurements or other visual/olfactory observations indicate potential contamination at a depth of three feet, two of the borings may be advanced to the water table with the collection of subsurface soil samples following the procedure outlined in the Sampling Objectives and Approach.

Segment B - Day Tank Area

The Day Tank Area will be referred to as Segment B, and is presented on Figure 4. The Phase II investigation activities in Segment B consist of surface and subsurface soil sample collection and groundwater well installation and sampling. Sample locations are provided on Figure 4; sample designations and analyses are summarized on Table 2.

- Twenty two boring locations (74SB517 to 74SB538) are proposed for the Day Tank Area to further delineate the fuel related impacts to surface and subsurface soil. Up to an additional twelve contingency soil borings (74SB539 to 74SB550) (two of which may be converted to monitoring wells) may be installed at the discretion of the field geologist and based on PID measurements or other visible/olfactory signs of contamination.

- Of the 22 boring locations, five will be constructed into groundwater monitoring wells (74SB517, 74SB522, 74SB524; 74SB527, 74SB529). The two existing monitoring wells 74SB22 and 74SB26 also will be included in the Phase II investigation sampling.

Segment C - Airfield Fuel Pipeline Area

The Airfield Fuel Pipeline will be referred to as Segment C, and is presented on Figure 5. The Phase II investigation activities for Segment C will consist of collection of surface soil samples. Sample locations are provided on Figure 5; sample designations and analyses are summarized on Table 3.

- Five surface soil samples (locations designated as 74SB551 through 74SB555) will be collected surrounding 74SB34 to further delineate the TPH impacts in the surface soil. Based on the results of the PID measurements or other visual/olfactory observations, an additional three surface (0 to 1 foot bgs) and shallow subsurface (1` to 3 ft bgs) soil samples (at locations 74SB556 to 74SB558) may be collected to complete the delineation. If PID measurements or other visual/olfactory observations indicate potential contamination at a depth of three feet, two of the borings may be advanced to the water table with the collection of subsurface soil samples following the procedure outlined in the Sampling Objectives and Approach.

SWMU 9 AREA A/B

Phase II investigation activities at the SWMU 9 Area A/B will include further characterization of surface soil, shallow and deep subsurface soil, and groundwater. Proposed sample locations are shown in Figure 6. Table 5 summarizes the samples to be collected and their associated laboratory analyses. Table 6 provides a summary of the QA/QC samples that will be collected in association with the SWMU 9 Area A/B investigation.

- Six surface and subsurface soil sample locations (74SB559 through74SB564) are proposed around 74SB81 to further horizontally delineate the TPH impacts to the subsurface soil. Two of these boring locations (74SB662 and 74SB563) will be converted to groundwater monitoring wells to determine potential impacts to groundwater in this area. Based on the results of the PID measurements or visual/olfactory observations, an additional four locations (74SB565 through 74SB568) may be sampled for surface and subsurface soil to complete the delineation.

- Six surface and subsurface soil sample locations (74SB569 through 74SB574) are proposed around 74SB86 to further horizontally delineate the TPH impacts to the subsurface soil. Two of these boring locations (74SB569 and 74SB570) will be converted to groundwater monitoring wells to determine potential impacts to groundwater in this area. Based on the results of the PID measurements or visual/olfactory observation, an additional four locations (74SB575 through 74SB578) may be sampled for surface and subsurface soil to complete the delineation.

- Three borings (at locations 74SB579 to 74SB581) will be advanced in which three groundwater monitoring wells will be installed surrounding valve pit VP-11 to further delineate VOC and LLPAH impacts to groundwater is this area. Surface, subsurface soil and groundwater samples will be collected at the three well locations. In addition, the two existing wells at valve pit VP-11 (74VP11a and 74VP11b) will be sampled.

- Six borings (at locations 74SB582 through 74SB587) will be advanced in the vicinity of VP-3. Three of these borings (74SB582, 74SB584 and 74SB585) will be converted to groundwater monitoring wells that will be installed surrounding valve pit VP-3 at the Airfield fence line to delineate LLPAHs in groundwater at 74VP3b. Surface and subsurface soil will be collected from the six locations; groundwater will be collected from the three new wells and two existing wells (74VP3a and 74VP3b).

- Six groundwater monitoring wells (at locations 74SB588 to 74SB593) will be installed in the SWMU 9 Area A tank area to delineate VOC, LLPAH, metals, and TPH impacts to the groundwater surrounding 74VP1Aa/9 and 74VP1Cb/9. In addition, surface and subsurface soil samples will be collected at these six well locations. The six existing valve pit well locations (74VP1Aa/9, 74VP1Ab/9, 75VP1Ba/9, 74VP1Bb/9, 74VP1Ca/9 and 74VP1Cb/9 will also be resampled.

- Within the tank area, an additional 29 borings will be advanced (at locations 74SB594 to 74SB622) surrounding 74SB108, 74SB109, 74SB113, 74SB114, 74VP1Ba/9, 74VP2a/9, and 74VP3b/9 from which surface and subsurface soil samples will be collected. Based on the results of the PID measurements or visual/olfactory observations, an additional twelve locations (74SB623 to 74SB634) may be sampled to complete the delineation.

- Six surface (0 to 1 foot bgs) and shallow subsurface (0 to 3 feet bgs) soil sample locations (74SB635 to 74SB640) are proposed around 74SB91 to further delineate the TPH impacts horizontally and to a depth of three feet. Based on the results of the PID measurements or visual/olfactory observations, up to an additional four shallow borings at locations 74SB641 through 74SB644 (to a depth of three feet) may be collected from this area to complete the delineation.

- Six surface (0 to 1 foot bgs) soil sample locations (74SB645 through 74SB650) are proposed around 74SB121 to further delineate the TPH impacts horizontally and to a depth of three feet. Based on the results of the PID measurements or visual/olfactory observations, up to an additional four shallow borings (74SB651 through 74SB654) (to a depth of three feet) may be collected from this area to complete the delineation.

JP-5 HILL AND DFM AREA

Phase II investigation activities at the JP-5 Hill and DFM Area will include further characterization of surface soil, subsurface soil, and groundwater. The Phase I investigation subdivided this area into two segments: Segment A - JP-5 Hill Tank Area and Segment B - DFM Tank Area. A key map showing the limits of each segment is shown on Figure 7. Proposed sample locations for these two areas are shown on Figures 8 and 9. Tables 7 and 8 summarize the samples to be collected and their associated laboratory analyses. Table 9 provides a summary of the QA/QC samples that will be collected in association with the JP-5 Hill and DFM Area investigation.

Segment A – JP-5 Hill Tank Area

The JP-5 Hill Tank Area will be referred to as Segment A, and is presented on Figures 7 and 8. Phase II investigation activities in this area consist of additional characterization and delineation of contamination in surface and subsurface soil and groundwater. Sample locations are provided on Figure 8; sample designations and their associated analyses summarized on Table 7.

- Six surface and subsurface soil sample locations (74SB655 to 74SB660) will be advanced around 74VP9b/JP5 to further horizontally delineate the TPH impacts to the subsurface soils. Since the subsurface impacts are shallow, no groundwater monitoring wells are proposed for this area. However, if field screening indicates potential contamination at depths greater than those detected during Phase I activities, then groundwater monitoring may be necessary. Based on the results of the PID measurements or visual/olfactory observations, an additional four boring locations (74SB661 to 74SB664) may be sampled to complete delineation. Also, if PID measurements or

visual/olfactory observations indicate potential contamination at depths greater than those detected during Phase I activities, then installation of up to two groundwater monitoring wells with the associated collection of groundwater samples may be necessary.

- Ten surface and subsurface soil sample locations (74SB665 to 74SB674) will be advanced around 74SB138 and 74VP10a/JP5 to further delineate the TPH impacts to subsurface soils. Although impacts to groundwater were minimal, two of these borings (74SB665 and 74SB666) will become groundwater sampling locations to confirm the Phase I results. Additionally, groundwater samples from 74VP10a/JP5 and 74SB137 will be collected. Based on the results of the PID measurements or visual/olfactory observations, an additional four boring locations (74SB675 to 74SB678) may be sampled to complete delineation.

- Twelve surface and subsurface soil sample locations (74SB679 to 74SB690) are proposed around 74SB150 and 74SB151 to further delineate the TPH impacts to the soils. Since the subsurface impacts are shallow, no groundwater monitoring wells are proposed for this area. However, if field screening indicates potential contamination at depths greater than those detected during Phase I activities, groundwater monitoring may be necessary. Based on the results of the PID measurements or visual/olfactory observations, an additional four boring locations (74SB691 to 74SB694) may be sampled to complete delineation. Also, if PID measurements or visual/olfactory observations indicate potential contamination at depths greater than those detected during Phase I activities, then installation of up to two groundwater monitoring wells with the associated collection of groundwater samples may be necessary.

- Existing groundwater monitoring wells (from which samples were not collected during Phase I because of a lack of water) to be sampled during Phase II include; 74VP9a/JP5, 74VP11a/JP5, 74VP11b/JP5, 74SB137, 74SB273, and 74SB285. If there is not a sufficient volume of water for sample collection, then the existing well will be abandoned and a replacement well will be installed in a more productive groundwater bearing interval. Replacement well names will be given an “R” designation (e.g., 74VP9a/JP5R, etc.).

Segment B - DFM Tank Area

The DFM Tank Area will be referred to as Segment B, and is presented on Figure 9. The Phase II investigation activities in Segment B consist of surface and subsurface soil sampling and groundwater well installation and sampling. Sample locations are provided on Figure 9; sample designations and their associated analyses summarized on Table 8.

- TPH DRO contamination was detected in the 9 to 11 foot bgs depth interval at locations 74SB155, 74SB156 and 74SB157 and in the 7 to 9 foot bgs depth interval at 74SB156. Ten borings (74SB695 to 74SB704) will be advanced in the vicinity of these three locations, of which three (74SB695, 74SB696 and 74SB697) will be converted to groundwater monitoring wells. Surface and subsurface soil samples will be collected from each boring location and groundwater samples will be collected from the three new wells. Based on the results of PID measurements or visual/olfactory observations, an additional eight boring locations (74SB705 to 74SB712) may be sampled to complete the delineation.

- Five surface and subsurface soil sample locations (74SB713 to 74SB717) are proposed around 74SB210 to further define TPH and BTEX (VOC analysis) impacts to the soils. One of these locations ((74SB713) will be converted to a monitoring well. Based on the results of field screening, four (74SB718 to 74SB721) additional boring locations (74SB718 to 74SB721) may

be sampled to complete delineation; two of these locations (74SB720 an 74SB721) may be converted to monitoring wells.

- Three surface and subsurface soil sample locations (74SB754 to 74SB756) are proposed around 74VP10/DFM to further define TPH and BTEX (VOC analysis) impacts to the soils.

SWMU 9 AREA C

Phase II activities at the SWMU 9 Area C will include further characterization of surface soil, subsurface soil, and groundwater. Proposed Phase II sample locations are shown on Figure 10. Table 10 summarizes the samples to be collected and their associated laboratory analyses. Table 11 provides a summary of the QA/QC samples that will be collected in association with the SWMU 9 Area C investigation.

- Eight surface and subsurface soil sample locations (74SB722 to 74SB729) are proposed around 74SB174 to further horizontally delineate the TPH and LLPAH impacts to the subsurface soils. Two of these boring locations (74SB722 and 74SB723) will become groundwater well locations to determine impacts to groundwater in this area. An additional four (74SB730 to 74SB733) locations may be added to complete delineation based on field observations.

- Four surface (0 to 1 foot bgs) and shallow subsurface (1 to 3 feet bgs) soil sample locations (74SB734 to 74SB737) are proposed around 74SB191 to further delineate the TPH in the surface soil impacts horizontally and to a depth of three feet.

- Four borings (74SB738 to 74SB741) are proposed surrounding valve pit VP-6C to delineate TPH in the subsurface soil at 74VP6Cb and VOCs in the groundwater at 74VP6Ca. All four borings will be sampled for surface and subsurface soils, and two of the borings (74SB738 and 74SB739) will be converted to groundwater monitoring wells. A total of four wells will be sampled, the two existing wells (74SB6Ca and 74VP6Cb) at valve pit VP-6C and the two newly installed wells (74SB738 and 74SB739). An additional six boring locations (74SB742 to 74SB747) may be added to complete delineation based on field observations.

- Groundwater samples will be collected from existing groundwater monitoring wells 74VP6Aa and 74VP6Ab, if there is a sufficient volume of water for sampling. If there is not sufficient water in one or both wells, then replacement monitoring wells will be installed in a more productive water bearing zone. Replacement wells will be given an “R” designation (e.g., 74VP6AaR).

FUELING PIERS AREA

Phase II activities at the Fueling Piers Area will include further characterization of surface soil in the vicinity of 74SB231. Additionally, well 74SB24b will be resampled to confirm the detection of benzo(a)anthracene. Proposed Phase II sample locations are shown on Figure 11. Table 12 summarizes the samples to be collected and their associated laboratory analyses. Table 13 provides a summary of the QA/QC samples that will be collected in association with the Fueling Piers Area investigation.

- Six surface (0 to 1 foot bgs) and shallow subsurface (1 to 3 feet bgs) soil sample locations (74SB748 to 74SB753) are proposed around 74SB231 to further horizontally delineate the TPH horizontally and to a depth of three feet.

- Benzo(a)anthracene was detected in the groundwater at well 74SB246 at a low estimated concentration. This well location will be resampled to confirm this detection.

OTHER FIELD ACTIVITIES

Sampling locations will be surveyed for horizontal and vertical control. All field activities including utility clearance, health and safety procedures, sampling and analysis, investigation derived waste (IDW) management, decontamination, surveying, chain of custody and quality assurance/quality control procedures will follow the EPA-approved Final CMS Work Plan for SWMU 74 (Baker 2007).

REPORTING

As indicated previously, one Phase II CMS Investigation report will be prepared for each of the SWMU 74 geographic area resulting in a total of five investigation reports. Other reporting requirements are as specified in the Final CMS Work Plan (Baker 2007).

REFERENCES

Baker, 2010. Revised Final Phase I of the Corrective Measures Study Investigation SWMU 74 – Fuel Pipelines and Hydrant Pits for Naval Activity Puerto Rico, EPA I.D. PR2170027203, Ceiba, Puerto Rico. July 9, 2010.

Michael Baker Jr., Inc. (Baker). 2007. Final Corrective Measures Study (CMS) Work Plan for SWMU 74 for Naval Activity Puerto Rico, EPA I.D. PR2170027203, Ceiba, Puerto Rico. December 6, 2007.

TABLES

TABLE 1 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT A - AIRCRAFT HYDRANT REFUELING AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB500-00	0.0-1.0	X	X	X		X	X	
74SB500-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB500-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB501-00	0.0-1.0	X	X	X		X	X	
74SB502-00	0.0-1.0	X	X	X		X	X	
74SB503-00	0.0-1.0	X	X	X		X	X	
74SB504-00	0.0-1.0	X	X	X		X	X	
74SB505-00	0.0-1.0	X	X	X		X	X	
74SB506-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB506-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB506-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB507-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB508-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB509-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB510-00	0.0-1.0	X	X	X		X	X	
74SB511-00	0.0-1.0	X	X	X		X	X	
74SB512-00	0.0-1.0	X	X	X		X	X	
74SB513-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB514-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB515-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB516-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
Shallow Subsurface Soil Samples								
74SB500-01	1.0-3.0	X	X	X		X	X	
74SB500-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB500-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB501-01	1.0-3.0	X	X	X		X	X	
74SB502-01	1.0-3.0	X	X	X		X	X	
74SB503-01	1.0-3.0	X	X	X		X	X	
74SB504-01	1.0-3.0	X	X	X		X	X	
74SB505-01	1.0-3.0	X	X	X		X	X	
74SB506-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB506-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB506-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB507-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB508-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB509-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB510-01	1.0-3.0	X	X	X		X	X	
74SB511-01	1.0-3.0	X	X	X		X	X	
74SB512-01	1.0-3.0	X	X	X		X	X	
74SB513-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring

TABLE 1 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT A - AIRCRAFT HYDRANT REFUELING AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples (continued)								
74SB514-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB515-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB516-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
Subsurface Soil Samples[(1)]								
74SB500-XX	TBD	X	X	X		X	X	
74SB500-XXD	TBD	X	X	X		X	X	Duplicate
74SB500-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB500-XX	TBD	X	X	X		X	X	
74SB501-XX	TBD	X	X	X		X	X	
74SB501-XX	TBD	X	X	X		X	X	
74SB502-XX	TBD	X	X	X		X	X	
74SB502-XX	TBD	X	X	X		X	X	
74SB503-XX	TBD	X	X	X		X	X	
74SB503-XX	TBD	X	X	X		X	X	
74SB504-XX	TBD	X	X	X		X	X	
74SB504-XX	TBD	X	X	X		X	X	
74SB505-XX	TBD	X	X	X		X	X	
74SB505-XXD	TBD	X	X	X		X	X	Duplicate
74SB505-XX	TBD	X	X	X		X	X	
74SB506-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB506-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB506-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB506-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB507-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB507-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB508-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB508-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB509-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB509-XX	TBD	X	X	X		X	X	Contingency Deep Boring

Notes:

[(1)] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.

App IX - Appendix IX

VOCs - Volatile Organic Compounds

PAHs - Polynuclear Aromatic Hydrocarbons

TBD - To Be Determined in the Field

TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics

TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics

TABLE 2 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT B - DAY TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB517-00	0.0-1.0	X	X	X		X	X	
74SB517-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB517-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB518-00	0.0-1.0	X	X	X		X	X	
74SB519-00	0.0-1.0	X	X	X		X	X	
74SB520-00	0.0-1.0	X	X	X		X	X	
74SB521-00	0.0-1.0	X	X	X		X	X	
74SB522-00	0.0-1.0	X	X	X		X	X	
74SB523-00	0.0-1.0	X	X	X		X	X	
74SB524-00	0.0-1.0	X	X	X		X	X	
74SB525-00	0.0-1.0	X	X	X		X	X	
74SB526-00	0.0-1.0	X	X	X		X	X	
74SB527-00	0.0-1.0	X	X	X		X	X	
74SB527-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB528-00	0.0-1.0	X	X	X		X	X	
74SB529-00	0.0-1.0	X	X	X		X	X	
74SB530-00	0.0-1.0	X	X	X		X	X	
74SB531-00	0.0-1.0	X	X	X		X	X	
74SB532-00	0.0-1.0	X	X	X		X	X	
74SB533-00	0.0-1.0	X	X	X		X	X	
74SB534-00	0.0-1.0	X	X	X		X	X	
74SB535-00	0.0-1.0	X	X	X		X	X	
74SB536-00	0.0-1.0	X	X	X		X	X	
74SB537-00	0.0-1.0	X	X	X		X	X	
74SB537-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB537-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB538-00	0.0-1.0	X	X	X		X	X	
74SB539-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB539-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB539-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB540-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB541-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB542-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB543-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB544-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB545-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB546-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB547-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT B - DAY TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples (continued)								
74SB549-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB549-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB550-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
Shallow Subsurface Soil Samples								
74SB517-01	1.0-3.0	X	X	X		X	X	
74SB517-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB517-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB518-01	1.0-3.0	X	X	X		X	X	
74SB519-01	1.0-3.0	X	X	X		X	X	
74SB520-01	1.0-3.0	X	X	X		X	X	
74SB521-01	1.0-3.0	X	X	X		X	X	
74SB522-01	1.0-3.0	X	X	X		X	X	
74SB523-01	1.0-3.0	X	X	X		X	X	
74SB524-01	1.0-3.0	X	X	X		X	X	
74SB525-01	1.0-3.0	X	X	X		X	X	
74SB526-01	1.0-3.0	X	X	X		X	X	
74SB527-01	1.0-3.0	X	X	X		X	X	
74SB527-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB528-01	1.0-3.0	X	X	X		X	X	
74SB529-01	1.0-3.0	X	X	X		X	X	
74SB530-01	1.0-3.0	X	X	X		X	X	
74SB531-01	1.0-3.0	X	X	X		X	X	
74SB532-01	1.0-3.0	X	X	X		X	X	
74SB533-01	1.0-3.0	X	X	X		X	X	
74SB534-01	1.0-3.0	X	X	X		X	X	
74SB535-01	1.0-3.0	X	X	X		X	X	
74SB536-01	1.0-3.0	X	X	X		X	X	
74SB537-01	1.0-3.0	X	X	X		X	X	
74SB537-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB537-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB538-01	1.0-3.0	X	X	X		X	X	
74SB539-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB539-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB539-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB540-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB541-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB542-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB543-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT B - DAY TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples (continued)								
74SB544-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB545-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB546-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB547-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB548-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB549-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB549-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB550-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
Subsurface Soil Samples[(1)]								
74SB517-XX	TBD	X	X	X		X	X	
74SB517-XXD	TBD	X	X	X		X	X	Duplicate
74SB517-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB517-XX	TBD	X	X	X		X	X	
74SB518-XX	TBD	X	X	X		X	X	
74SB518-XX	TBD	X	X	X		X	X	
74SB519-XX	TBD	X	X	X		X	X	
74SB519-XX	TBD	X	X	X		X	X	
74SB520-XX	TBD	X	X	X		X	X	
74SB520-XX	TBD	X	X	X		X	X	
74SB521-XX	TBD	X	X	X		X	X	
74SB521-XX	TBD	X	X	X		X	X	
74SB522-XX	TBD	X	X	X		X	X	
74SB522-XXD	TBD	X	X	X		X	X	Duplicate
74SB522-XX	TBD	X	X	X		X	X	
74SB523-XX	TBD	X	X	X		X	X	
74SB523-XX	TBD	X	X	X		X	X	
74SB524-XX	TBD	X	X	X		X	X	
74SB524-XX	TBD	X	X	X		X	X	
74SB525-XX	TBD	X	X	X		X	X	
74SB525-XX	TBD	X	X	X		X	X	
74SB526-XX	TBD	X	X	X		X	X	
74SB526-XX	TBD	X	X	X		X	X	
74SB527-XX	TBD	X	X	X		X	X	
74SB527-XXD	TBD	X	X	X		X	X	Duplicate
74SB527-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB527-XX	TBD	X	X	X		X	X	
74SB528-XX	TBD	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT B - DAY TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB528-XX	TBD	X	X	X		X	X	
74SB529-XX	TBD	X	X	X		X	X	
74SB529-XX	TBD	X	X	X		X	X	
74SB530-XX	TBD	X	X	X		X	X	
74SB530-XX	TBD	X	X	X		X	X	
74SB531-XX	TBD	X	X	X		X	X	
74SB531-XX	TBD	X	X	X		X	X	
74SB532-XX	TBD	X	X	X		X	X	
74SB532-XXD	TBD	X	X	X		X	X	Duplicate
74SB532-XX	TBD	X	X	X		X	X	
74SB533-XX	TBD	X	X	X		X	X	
74SB533-XX	TBD	X	X	X		X	X	
74SB534-XX	TBD	X	X	X		X	X	
74SB534-XX	TBD	X	X	X		X	X	
74SB535-XX	TBD	X	X	X		X	X	
74SB535-XX	TBD	X	X	X		X	X	
74SB536-XX	TBD	X	X	X		X	X	
74SB536-XX	TBD	X	X	X		X	X	
74SB537-XX	TBD	X	X	X		X	X	
74SB537-XXD	TBD	X	X	X		X	X	Duplicate
74SB537-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/ Matrix Spike Duplicate
74SB537-XX	TBD	X	X	X		X	X	
74SB538-XX	TBD	X	X	X		X	X	
74SB538-XX	TBD	X	X	X		X	X	
74SB539-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB539-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB539-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB539-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB540-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB540-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB541-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB541-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB542-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB542-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB543-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB543-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB544-XX	TBD	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT B - DAY TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB544-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB544-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB545-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB545-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB546-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB546-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB547-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB547-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB548-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB548-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB549-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB549-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB549-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB549-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB550-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB550-XX	TBD	X	X	X		X	X	Contingency Deep Boring
Groundwater Samples[2]								
74GW22	NA	X	X	X	X	X	X	Existing Well
74GW26	NA	X	X	X	X	X	X	Existing Well
74GW517	NA	X	X	X	X	X	X	
74GW522	NA	X	X	X	X	X	X	
74GW524	NA	X	X	X	X	X	X	
74GW527	NA	X	X	X	X	X	X	
74GW529	NA	X	X	X	X	X	X	
74GWXX	NA	X	X	X	X	X	X	Contingency Monitoring Well
74GWXX	NA	X	X	X	X	X	X	Contingency Monitoring Well

Notes:

[1] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.

[2] Groundwater sample designations based on associated soil boring designation. For example, sample 74GW562 is collected from the monitoring well installed at74SB562.

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 3 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
AIRFIELD AREA - SEGMENT C - AIRFIELD PIPELINE AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB551-00	0.0-1.0	X	X	X		X	X	
74SB551-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB551-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB552-00	0.0-1.0	X	X	X		X	X	
74SB553-00	0.0-1.0	X	X	X		X	X	
74SB554-00	0.0-1.0	X	X	X		X	X	
74SB555-00	0.0-1.0	X	X	X		X	X	
74SB556-XX[(1)]	TBD	X	X	X		X	X	Contingency Surface or Shallow Subsurface Soil Sample
74SB556-XXD	TBD	X	X	X		X	X	Contingency Shallow Borings/Duplicate
74SB556-XXMS/MSD	TBD	X	X	X		X	X	Contingency Shallow Borings/Matrix Spike/Matrix Duplicate
74SB557-XX[(1)]	TBD	X	X	X		X	X	Contingency Surface or Shallow Subsurface Soil Sample
74SB558-XX[(1)]	TBD	X	X	X		X	X	Contingency Surface or Shallow Subsurface Soil Sample

Notes:

[(1)] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.
App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 4

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
AIRFIELD AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level	App IX Metals	App IX Metals	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Trip Blanks	74TB01	X				X				
	74TB02	X				X				
	74TB03	X				X				
	74TB04	X				X				
	74TB05	X				X				
	74TB06	X				X				
	74TB07	X				X				
	74TB08	X				X				
	74TB09	X				X				
	74TB10	X				X				
	74TB11	X				X				
	74TB12	X				X				
	74TB13	X				X				
	74TB14	X				X				
	74TB15	X				X				
	74TB16	X				X				
	74TB17	X				X				
Equipment Rinsates	74ER01	X	X	X		X	X			Soil Sampling Equipment
	74ER02	X	X	X		X	X			Soil Sampling Equipment
	74ER03	X	X	X		X	X			Soil Sampling Equipment
	74ER04	X	X	X		X	X			Soil Sampling Equipment
	74ER05	X	X	X		X	X			Soil Sampling Equipment
	74ER06	X	X	X		X	X			Soil Sampling Equipment
	74ER07	X	X	X		X	X			Soil Sampling Equipment
	74ER08	X	X	X		X	X			Soil Sampling Equipment
	74ER09	X	X	X		X	X			Soil Sampling Equipment
	74ER10	X	X	X		X	X			Soil Sampling Equipment
	74ER11	X	X	X		X	X			Soil Sampling Equipment
	74ER12	X	X	X		X	X			Soil Sampling Equipment
	74ER13	X	X	X		X	X			Soil Sampling Equipment
	74ER14	X	X	X		X	X			Groundwater Sampling Equipment
	74ER15	X	X	X		X	X			Groundwater Sampling Equipment
	74ER16	X	X	X		X	X			Groundwater Sampling Equipment
	74ER17	X	X	X		X	X			Groundwater Sampling Equipment
Field Blanks	74FB03	X	X	X		X	X			Store Bought Distilled Water
	74FB04	X	X	X		X	X			Lab Grade Deionized Water
IDW	74IDW03							X	X	Solid
	74IDW04							X		Aqueous

TABLE 4

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
AIRFIELD AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TCLP - Toxicity Characteristic Leaching Procedure
IDW - Investigation Derived Waste

TABLE 5 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB559-00	0.0-1.0	X	X	X		X	X	
74SB559-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB559-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB560-00	0.0-1.0	X	X	X		X	X	
74SB561-00	0.0-1.0	X	X	X		X	X	
74SB562-00	0.0-1.0	X	X	X		X	X	
74SB563-00	0.0-1.0	X	X	X		X	X	
74SB564-00	0.0-1.0	X	X	X		X	X	
74SB565-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB565-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB565-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB566-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB567-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB568-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB569-00	0.0-1.0	X	X	X		X	X	
74SB570-00	0.0-1.0	X	X	X		X	X	
74SB571-00	0.0-1.0	X	X	X		X	X	
74SB572-00	0.0-1.0	X	X	X		X	X	
74SB573-00	0.0-1.0	X	X	X		X	X	
74SB573-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB574-00	0.0-1.0	X	X	X		X	X	
74SB575-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB576-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB577-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB578-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB579-00	0.0-1.0	X	X	X		X	X	
74SB580-00	0.0-1.0	X	X	X		X	X	
74SB581-00	0.0-1.0	X	X	X		X	X	
74SB582-00	0.0-1.0	X	X	X		X	X	
74SB583-00	0.0-1.0	X	X	X		X	X	
74SB584-00	0.0-1.0	X	X	X		X	X	
74SB585-00	0.0-1.0	X	X	X		X	X	
74SB586-00	0.0-1.0	X	X	X		X	X	
74SB587-00	0.0-1.0	X	X	X		X	X	
74SB587-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB587-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB588-00	0.0-1.0	X	X	X		X	X	
74SB589-00	0.0-1.0	X	X	X		X	X	
74SB590-00	0.0-1.0	X	X	X		X	X	
74SB591-00	0.0-1.0	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples (continued)								
74SB592-00	0.0-1.0	X	X	X		X	X	
74SB593-00	0.0-1.0	X	X	X		X	X	
74SB594-00	0.0-1.0	X	X	X		X	X	
74SB595-00	0.0-1.0	X	X	X		X	X	
74SB596-00	0.0-1.0	X	X	X		X	X	
74SB597-00	0.0-1.0	X	X	X		X	X	
74SB597-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB598-00	0.0-1.0	X	X	X		X	X	
74SB599-00	0.0-1.0	X	X	X		X	X	
74SB600-00	0.0-1.0	X	X	X		X	X	
74SB601-00	0.0-1.0	X	X	X		X	X	
74SB602-00	0.0-1.0	X	X	X		X	X	
74SB603-00	0.0-1.0	X	X	X		X	X	
74SB604-00	0.0-1.0	X	X	X		X	X	
74SB605-00	0.0-1.0	X	X	X		X	X	
74SB606-00	0.0-1.0	X	X	X		X	X	
74SB607-00	0.0-1.0	X	X	X		X	X	
74SB607-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB607-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB608-00	0.0-1.0	X	X	X		X	X	
74SB609-00	0.0-1.0	X	X	X		X	X	
74SB610-00	0.0-1.0	X	X	X		X	X	
74SB611-00	0.0-1.0	X	X	X		X	X	
74SB612-00	0.0-1.0	X	X	X		X	X	
74SB613-00	0.0-1.0	X	X	X		X	X	
74SB614-00	0.0-1.0	X	X	X		X	X	
74SB615-00	0.0-1.0	X	X	X		X	X	
74SB616-00	0.0-1.0	X	X	X		X	X	
74SB617-00	0.0-1.0	X	X	X		X	X	
74SB617-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB618-00	0.0-1.0	X	X	X		X	X	
74SB619-00	0.0-1.0	X	X	X		X	X	
74SB620-00	0.0-1.0	X	X	X		X	X	
74SB621-00	0.0-1.0	X	X	X		X	X	
74SB622-00	0.0-1.0	X	X	X		X	X	
74SB623-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB624-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB625-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB625-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB626-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples (continued)								
74SB627-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB628-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB629-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB630-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB631-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB632-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB633-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB634-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB635-00	0.0-1.0	X	X	X		X	X	
74SB636-00	0.0-1.0	X	X	X		X	X	
74SB637-00	0.0-1.0	X	X	X		X	X	
74SB638-00	0.0-1.0	X	X	X		X	X	
74SB639-00	0.0-1.0	X	X	X		X	X	
74SB639-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB639-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB640-00	0.0-1.0	X	X	X		X	X	
74SB641-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB641-00D	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring/Duplicate
74SB641-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring/Matrix Spike/Matrix Duplicate
74SB642-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB643-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB644-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB645-00	0.0-1.0	X	X	X		X	X	
74SB646-00	0.0-1.0	X	X	X		X	X	
74SB647-00	0.0-1.0	X	X	X		X	X	
74SB648-00	0.0-1.0	X	X	X		X	X	
74SB649-00	0.0-1.0	X	X	X		X	X	
74SB650-00	0.0-1.0	X	X	X		X	X	
74SB651-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB652-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Borings
74SB653-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
74SB654-00	0.0-1.0	X	X	X		X	X	Contingency Shallow Boring
Shallow Subsurface Soil Samples								
74SB559-01	1.0-3.0	X	X	X		X	X	
74SB559-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB559-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB560-01	1.0-3.0	X	X	X		X	X	
74SB561-01	1.0-3.0	X	X	X		X	X	
74SB562-01	1.0-3.0	X	X	X		X	X	
74SB563-01	1.0-3.0	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples (continued)								
74SB564-01	1.0-3.0	X	X	X		X	X	
74SB565-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB565-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB565-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB566-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB567-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB568-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB569-01	1.0-3.0	X	X	X		X	X	
74SB570-01	1.0-3.0	X	X	X		X	X	
74SB571-01	1.0-3.0	X	X	X		X	X	
74SB572-01	1.0-3.0	X	X	X		X	X	
74SB573-01	1.0-3.0	X	X	X		X	X	
74SB573-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB574-01	1.0-3.0	X	X	X		X	X	
74SB575-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB576-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB577-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB578-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB579-01	1.0-3.0	X	X	X		X	X	
74SB580-01	1.0-3.0	X	X	X		X	X	
74SB581-01	1.0-3.0	X	X	X		X	X	
74SB582-01	1.0-3.0	X	X	X		X	X	
74SB583-01	1.0-3.0	X	X	X		X	X	
74SB584-01	1.0-3.0	X	X	X		X	X	
74SB585-01	1.0-3.0	X	X	X		X	X	
74SB586-01	1.0-3.0	X	X	X		X	X	
74SB587-01	1.0-3.0	X	X	X		X	X	
74SB587-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB587-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB588-01	1.0-3.0	X	X	X		X	X	
74SB589-01	1.0-3.0	X	X	X		X	X	
74SB590-01	1.0-3.0	X	X	X		X	X	
74SB591-01	1.0-3.0	X	X	X		X	X	
74SB592-01	1.0-3.0	X	X	X		X	X	
74SB593-01	1.0-3.0	X	X	X		X	X	
74SB594-01	1.0-3.0	X	X	X		X	X	
74SB595-01	1.0-3.0	X	X	X		X	X	
74SB596-01	1.0-3.0	X	X	X		X	X	
74SB597-01	1.0-3.0	X	X	X		X	X	
74SB597-01D	1.0-3.0	X	X	X		X	X	Duplicate

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples (continued)								
74SB598-01	1.0-3.0	X	X	X		X	X	
74SB599-01	1.0-3.0	X	X	X		X	X	
74SB600-01	1.0-3.0	X	X	X		X	X	
74SB601-01	1.0-3.0	X	X	X		X	X	
74SB602-01	1.0-3.0	X	X	X		X	X	
74SB603-01	1.0-3.0	X	X	X		X	X	
74SB604-01	1.0-3.0	X	X	X		X	X	
74SB605-01	1.0-3.0	X	X	X		X	X	
74SB606-01	1.0-3.0	X	X	X		X	X	
74SB607-01	1.0-3.0	X	X	X		X	X	
74SB607-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB607-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB608-01	1.0-3.0	X	X	X		X	X	
74SB609-01	1.0-3.0	X	X	X		X	X	
74SB610-01	1.0-3.0	X	X	X		X	X	
74SB611-01	1.0-3.0	X	X	X		X	X	
74SB612-01	1.0-3.0	X	X	X		X	X	
74SB613-01	1.0-3.0	X	X	X		X	X	
74SB614-01	1.0-3.0	X	X	X		X	X	
74SB615-01	1.0-3.0	X	X	X		X	X	
74SB616-01	1.0-3.0	X	X	X		X	X	
74SB617-01	1.0-3.0	X	X	X		X	X	
74SB617-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB618-01	1.0-3.0	X	X	X		X	X	
74SB619-01	1.0-3.0	X	X	X		X	X	
74SB620-01	1.0-3.0	X	X	X		X	X	
74SB621-01	1.0-3.0	X	X	X		X	X	
74SB622-01	1.0-3.0	X	X	X		X	X	
74SB623-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB624-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB625-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB625-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB626-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB627-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB628-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB629-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB630-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB631-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB632-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB633-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples (continued)								
74SB634-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB635-01	1.0-3.0	X	X	X		X	X	
74SB636-01	1.0-3.0	X	X	X		X	X	
74SB637-01	1.0-3.0	X	X	X		X	X	
74SB638-01	1.0-3.0	X	X	X		X	X	
74SB639-01	1.0-3.0	X	X	X		X	X	
74SB639-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB640-01	1.0-3.0	X	X	X		X	X	
74SB641-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB641-01D	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring/Duplicate
74SB641-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring/Matrix Spike/Matrix Duplicate
74SB642-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB643-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB644-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB651-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB652-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB653-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
74SB654-01	1.0-3.0	X	X	X		X	X	Contingency Shallow Boring
Subsurface Soil Samples(1)								
74SB559-XX	TBD	X	X	X		X	X	
74SB559-XXD	TBD	X	X	X		X	X	Duplicate
74SB559-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB559-XX	TBD	X	X	X		X	X	
74SB560-XX	TBD	X	X	X		X	X	
74SB560-XX	TBD	X	X	X		X	X	
74SB561-XX	TBD	X	X	X		X	X	
74SB561-XX	TBD	X	X	X		X	X	
74SB562-XX	TBD	X	X	X		X	X	
74SB562-XX	TBD	X	X	X		X	X	
74SB563-XX	TBD	X	X	X		X	X	
74SB563-XX	TBD	X	X	X		X	X	
74SB564-XX	TBD	X	X	X		X	X	
74SB564-XXD	TBD	X	X	X		X	X	Duplicate
74SB564-XX	TBD	X	X	X		X	X	
74SB565-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB565-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB565-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB565-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB566-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB566-XX	TBD	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB567-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB567-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB568-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB568-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB569-XX	TBD	X	X	X		X	X	
74SB569-XX	TBD	X	X	X		X	X	
74SB570-XX	TBD	X	X	X		X	X	
74SB570-XX	TBD	X	X	X		X	X	
74SB571-XX	TBD	X	X	X		X	X	
74SB571-XX	TBD	X	X	X		X	X	
74SB572-XX	TBD	X	X	X		X	X	
74SB572-XX	TBD	X	X	X		X	X	
74SB573-XX	TBD	X	X	X		X	X	
74SB573-XXD	TBD	X	X	X		X	X	Duplicate
74SB573-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB573-XX	TBD	X	X	X		X	X	
74SB574-XX	TBD	X	X	X		X	X	
74SB574-XX	TBD	X	X	X		X	X	
74SB575-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB575-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB576-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB576-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB576-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB577-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB577-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB578-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB578-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB579-XX	TBD	X	X	X		X	X	
74SB579-XX	TBD	X	X	X		X	X	
74SB580-XX	TBD	X	X	X		X	X	
74SB580-XX	TBD	X	X	X		X	X	
74SB581-XX	TBD	X	X	X		X	X	
74SB581-XX	TBD	X	X	X		X	X	
74SB582-XX	TBD	X	X	X		X	X	
74SB582-XXD	TBD	X	X	X		X	X	Duplicate
74SB582-XX	TBD	X	X	X		X	X	
74SB583-XX	TBD	X	X	X		X	X	
74SB583-XX	TBD	X	X	X		X	X	
74SB584-XX	TBD	X	X	X		X	X	
74SB584-XX	TBD	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB585-XX	TBD	X	X	X		X	X	
74SB585-XX	TBD	X	X	X		X	X	
74SB586-XX	TBD	X	X	X		X	X	
74SB586-XX	TBD	X	X	X		X	X	
74SB587-XX	TBD	X	X	X		X	X	
74SB587-XXD	TBD	X	X	X		X	X	Duplicate
74SB587-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB587-XX	TBD	X	X	X		X	X	
74SB588-XX	TBD	X	X	X		X	X	
74SB588-XX	TBD	X	X	X		X	X	
74SB589-XX	TBD	X	X	X		X	X	
74SB589-XX	TBD	X	X	X		X	X	
74SB590-XX	TBD	X	X	X		X	X	
74SB590-XX	TBD	X	X	X		X	X	
74SB591-XX	TBD	X	X	X		X	X	
74SB591-XX	TBD	X	X	X		X	X	
74SB592-XX	TBD	X	X	X		X	X	
74SB592-XXD	TBD	X	X	X		X	X	Duplicate
74SB592-XX	TBD	X	X	X		X	X	
74SB593-XX	TBD	X	X	X		X	X	
74SB593-XX	TBD	X	X	X		X	X	
74SB594-XX	TBD	X	X	X		X	X	
74SB594-XX	TBD	X	X	X		X	X	
74SB595-XX	TBD	X	X	X		X	X	
74SB595-XX	TBD	X	X	X		X	X	
74SB596-XX	TBD	X	X	X		X	X	
74SB596-XX	TBD	X	X	X		X	X	
74SB597-XX	TBD	X	X	X		X	X	
74SB597-XXD	TBD	X	X	X		X	X	Duplicate
74SB597-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB597-XX	TBD	X	X	X		X	X	
74SB598-XX	TBD	X	X	X		X	X	
74SB598-XX	TBD	X	X	X		X	X	
74SB599-XX	TBD	X	X	X		X	X	
74SB599-XX	TBD	X	X	X		X	X	
74SB600-XX	TBD	X	X	X		X	X	
74SB600-XX	TBD	X	X	X		X	X	
74SB601-XX	TBD	X	X	X		X	X	
74SB601-XX	TBD	X	X	X		X	X	
74SB602-XX	TBD	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB602-XXD	TBD	X	X	X		X	X	Duplicate
74SB602-XX	TBD	X	X	X		X	X	
74SB603-XX	TBD	X	X	X		X	X	
74SB603-XX	TBD	X	X	X		X	X	
74SB604-XX	TBD	X	X	X		X	X	
74SB604-XX	TBD	X	X	X		X	X	
74SB605-XX	TBD	X	X	X		X	X	
74SB605-XX	TBD	X	X	X		X	X	
74SB606-XX	TBD	X	X	X		X	X	
74SB606-XX	TBD	X	X	X		X	X	
74SB607-XX	TBD	X	X	X		X	X	
74SB607-XXD	TBD	X	X	X		X	X	Duplicate
74SB607-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB607-XX	TBD	X	X	X		X	X	
74SB608-XX	TBD	X	X	X		X	X	
74SB608-XX	TBD	X	X	X		X	X	
74SB609-XX	TBD	X	X	X		X	X	
74SB609-XX	TBD	X	X	X		X	X	
74SB610-XX	TBD	X	X	X		X	X	
74SB610-XX	TBD	X	X	X		X	X	
74SB611-XX	TBD	X	X	X		X	X	
74SB611-XX	TBD	X	X	X		X	X	
74SB612-XX	TBD	X	X	X		X	X	
74SB612-XXD	TBD	X	X	X		X	X	Duplicate
74SB612-XX	TBD	X	X	X		X	X	
74SB613-XX	TBD	X	X	X		X	X	
74SB613-XX	TBD	X	X	X		X	X	
74SB614-XX	TBD	X	X	X		X	X	
74SB614-XX	TBD	X	X	X		X	X	
74SB615-XX	TBD	X	X	X		X	X	
74SB615-XX	TBD	X	X	X		X	X	
74SB616-XX	TBD	X	X	X		X	X	
74SB616-XX	TBD	X	X	X		X	X	
74SB617-XX	TBD	X	X	X		X	X	
74SB617-XXD	TBD	X	X	X		X	X	Duplicate
74SB617-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB617-XX	TBD	X	X	X		X	X	
74SB618-XX	TBD	X	X	X		X	X	
74SB618-XX	TBD	X	X	X		X	X	
74SB619-XX	TBD	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB619-XX	TBD	X	X	X		X	X	
74SB620-XX	TBD	X	X	X		X	X	
74SB620-XX	TBD	X	X	X		X	X	
74SB621-XX	TBD	X	X	X		X	X	
74SB621-XX	TBD	X	X	X		X	X	
74SB622-XX	TBD	X	X	X		X	X	
74SB622-XXD	TBD	X	X	X		X	X	Duplicate
74SB622-XX	TBD	X	X	X		X	X	
74SB623-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB623-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB624-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB624-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB625-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB625-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB625-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB625-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB626-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB626-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB627-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB627-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB628-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB628-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB629-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB629-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB630-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB630-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB630-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB631-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB631-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB632-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB632-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB633-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB633-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB634-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB634-XX	TBD	X	X	X		X	X	Contingency Deep Boring
Groundwater Samples[2]								
74GW562	NA	X	X	X	X	X	X	
74GW562D	NA	X	X	X	X	X	X	Duplicate
74GW562MS	NA	X	X	X	X	X	X	Matrix Spike
74GW562MSD	NA	X	X	X	X	X	X	Matrix Spike Duplicate

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Groundwater Samples (continued)[2]								
74GW563	NA	X	X	X	X	X	X	
74GW569	NA	X	X	X	X	X	X	
74GW570	NA	X	X	X	X	X	X	
74GW579	NA	X	X	X	X	X	X	
74GW580	NA	X	X	X	X	X	X	
74GW581	NA	X	X	X	X	X	X	
74VP11a	NA	X	X	X	X	X	X	
74VP11b	NA	X	X	X	X	X	X	
74GW582	NA	X	X	X	X	X	X	
74GW584	NA	X	X	X	X	X	X	
74GW584D	NA	X	X	X	X	X	X	Duplicate
74GW585	NA	X	X	X	X	X	X	
74VP3a	NA	X	X	X	X	X	X	
74VP3b	NA	X	X	X	X	X	X	
74VP1Aa/9	NA	X	X	X	X	X	X	
74VP1Ab/9	NA	X	X	X	X	X	X	
74VP1Ba/9	NA	X	X	X	X	X	X	
74VP1Bb/9	NA	X	X	X	X	X	X	
74VP1Ca/9	NA	X	X	X	X	X	X	
74VP1Cb/9	NA	X	X	X	X	X	X	
74GW588	NA	X	X	X	X	X	X	
74GW588D	NA	X	X	X	X	X	X	Duplicate
74GW588MS	NA	X	X	X	X	X	X	Matrix Spike
74GW588MSD	NA	X	X	X	X	X	X	Matrix Spike Duplicate
74GW589	NA	X	X	X	X	X	X	
74GW590	NA	X	X	X	X	X	X	
74GW591	NA	X	X	X	X	X	X	
74GW592	NA	X	X	X	X	X	X	
74GW593	NA	X	X	X	X	X	X	

Notes:

[1] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.

[2] Groundwater sample designations based on associated soil boring designation. For example, sample 74GW562 is collected from the monitoring well installed at74SB562.

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 6 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Trip Blanks	74TB18	X				X				
	74TB19	X				X				
	74TB20	X				X				
	74TB21	X				X				
	74TB22	X				X				
	74TB23	X				X				
	74TB24	X				X				
	74TB25	X				X				
	74TB26	X				X				
	74TB27	X				X				
	74TB28	X				X				
	74TB29	X				X				
	74TB30	X				X				
	74TB31	X				X				
	74TB32	X				X				
	74TB33	X				X				
	74TB34	X				X				
	74TB35	X				X				
	74TB36	X				X				
	74TB37	X				X				
	74TB38	X				X				
	74TB39	X				X				
	74TB40	X				X				
	74TB41	X				X				
	74TB42	X				X				
	74TB43	X				X				
	74TB44	X				X				
	74TB45	X				X				
	74TB46	X				X				
	74TB47	X				X				
	74TB48	X				X				
	74TB49	X				X				
	74TB50	X				X				
	74TB51	X				X				
	74TB52	X				X				
	74TB53	X				X				
	74TB54	X				X				

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Trip Banks (continued)	74TB55	X				X				
	74TB56	X				X				
	74TB57	X				X				
	74TB58	X				X				
	74TB59	X				X				
	74TB60	X				X				
	74TB61	X				X				
	74TB62	X				X				
	74TB63	X				X				
	74TB64	X				X				
	74TB65	X				X				
	74TB66	X				X				
	74TB67	X				X				
	74TB68	X				X				
	74TB69	X				X				
	74TB70	X				X				
	74TB71	X				X				
	74TB72	X				X				
	74TB73	X				X				
	74TB74	X				X				
	74TB75	X				X				
	74TB76	X				X				
	74TB77	X				X				
Equipment Rinsates	74ER18	X	X	X		X	X			Soil Sampling Equipment
	74ER19	X	X	X		X	X			Soil Sampling Equipment
	74ER20	X	X	X		X	X			Soil Sampling Equipment
	74ER21	X	X	X		X	X			Soil Sampling Equipment
	74ER22	X	X	X		X	X			Soil Sampling Equipment
	74ER23	X	X	X		X	X			Soil Sampling Equipment
	74ER24	X	X	X		X	X			Soil Sampling Equipment
	74ER25	X	X	X		X	X			Soil Sampling Equipment
	74ER26	X	X	X		X	X			Soil Sampling Equipment
	74ER27	X	X	X		X	X			Soil Sampling Equipment
	74ER28	X	X	X		X	X			Soil Sampling Equipment
	74ER29	X	X	X		X	X			Soil Sampling Equipment
	74ER30	X	X	X		X	X			Soil Sampling Equipment
	74ER31	X	X	X		X	X			Soil Sampling Equipment

TABLE 6

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Equipment Rinsates (continued)	74ER32	X	X	X		X	X			Soil Sampling Equipment
	74ER33	X	X	X		X	X			Soil Sampling Equipment
	74ER34	X	X	X		X	X			Soil Sampling Equipment
	74ER35	X	X	X		X	X			Soil Sampling Equipment
	74ER36	X	X	X		X	X			Soil Sampling Equipment
	74ER37	X	X	X		X	X			Soil Sampling Equipment
	74ER38	X	X	X		X	X			Soil Sampling Equipment
	74ER39	X	X	X		X	X			Soil Sampling Equipment
	74ER40	X	X	X		X	X			Soil Sampling Equipment
	74ER41	X	X	X		X	X			Soil Sampling Equipment
	74ER42	X	X	X		X	X			Soil Sampling Equipment
	74ER43	X	X	X		X	X			Soil Sampling Equipment
	74ER44	X	X	X		X	X			Soil Sampling Equipment
	74ER45	X	X	X		X	X			Soil Sampling Equipment
	74ER46	X	X	X		X	X			Soil Sampling Equipment
	74ER47	X	X	X		X	X			Soil Sampling Equipment
	74ER48	X	X	X		X	X			Soil Sampling Equipment
	74ER49	X	X	X		X	X			Soil Sampling Equipment
	74ER50	X	X	X		X	X			Soil Sampling Equipment
	74ER51	X	X	X		X	X			Soil Sampling Equipment
	74ER52	X	X	X		X	X			Soil Sampling Equipment
	74ER53	X	X	X		X	X			Soil Sampling Equipment
	74ER54	X	X	X		X	X			Soil Sampling Equipment
	74ER55	X	X	X		X	X			Soil Sampling Equipment
	74ER56	X	X	X		X	X			Soil Sampling Equipment
	74ER57	X	X	X		X	X			Soil Sampling Equipment
	74ER58	X	X	X		X	X			Soil Sampling Equipment
	74ER59	X	X	X		X	X			Soil Sampling Equipment
	74ER60	X	X	X		X	X			Soil Sampling Equipment
	74ER61	X	X	X		X	X			Soil Sampling Equipment
	74ER62	X	X	X		X	X			Soil Sampling Equipment
	74ER63	X	X	X		X	X			Soil Sampling Equipment
	74ER64	X	X	X		X	X			Soil Sampling Equipment
	74ER65	X	X	X		X	X			Soil Sampling Equipment
	74ER66	X	X	X		X	X			Soil Sampling Equipment
	74ER67	X	X	X		X	X			Soil Sampling Equipment
	74ER68	X	X	X	X	X	X			Groundwater Sampling Equipment

TABLE 6 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 9 AREA A/B AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Equipment Rinsates (continued)	74ER69	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER70	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER71	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER72	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER73	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER74	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER75	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER76	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER77	X	X	X	X	X	X			Groundwater Sampling Equipment
Field Blanks	74FB01	X	X	X		X	X			Store Bought Distilled Water
	74FB02	X	X	X		X	X			Lab Grade Deionized Water
IDW	74IDW01							X	X	Solid
	74IDW02							X		Aqueous

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TCLP - Toxicity Characteristic Leaching Procedure
IDW - Investigation Derived Waste

TABLE 7 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 HILL TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB655-00	0.0-1.0	X	X	X		X	X	
74SB655-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB655-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB656-00	0.0-1.0	X	X	X		X	X	
74SB657-00	0.0-1.0	X	X	X		X	X	
74SB658-00	0.0-1.0	X	X	X		X	X	
74SB659-00	0.0-1.0	X	X	X		X	X	
74SB660-00	0.0-1.0	X	X	X		X	X	
74SB661-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB661-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB661-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB662-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB663-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB664-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB665-00	0.0-1.0	X	X	X		X	X	
74SB666-00	0.0-1.0	X	X	X		X	X	
74SB667-00	0.0-1.0	X	X	X		X	X	
74SB668-00	0.0-1.0	X	X	X		X	X	
74SB669-00	0.0-1.0	X	X	X		X	X	
74SB669-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB670-00	0.0-1.0	X	X	X		X	X	
74SB671-00	0.0-1.0	X	X	X		X	X	
74SB672-00	0.0-1.0	X	X	X		X	X	
74SB673-00	0.0-1.0	X	X	X		X	X	
74SB674-00	0.0-1.0	X	X	X		X	X	
74SB675-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB676-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB677-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB678-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB679-00	0.0-1.0	X	X	X		X	X	
74SB680-00	0.0-1.0	X	X	X		X	X	
74SB681-00	0.0-1.0	X	X	X		X	X	
74SB682-00	0.0-1.0	X	X	X		X	X	
74SB683-00	0.0-1.0	X	X	X		X	X	
74SB683-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB683-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB684-00	0.0-1.0	X	X	X		X	X	
74SB685-00	0.0-1.0	X	X	X		X	X	
74SB686-00	0.0-1.0	X	X	X		X	X	
74SB687-00	0.0-1.0	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 HILL TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
74SB688-00	0.0-1.0	X	X	X		X	X	
Surface Soil Samples (continued)								
74SB689-00	0.0-1.0	X	X	X		X	X	
74SB690-00	0.0-1.0	X	X	X		X	X	
74SB691-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB692-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB693-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB693-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB694-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
Shallow Subsurface Soil Samples								
74SB655-01	1.0-3.0	X	X	X		X	X	
74SB655-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB655-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB656-01	1.0-3.0	X	X	X		X	X	
74SB657-01	1.0-3.0	X	X	X		X	X	
74SB658-01	1.0-3.0	X	X	X		X	X	
74SB659-01	1.0-3.0	X	X	X		X	X	
74SB660-01	1.0-3.0	X	X	X		X	X	
74SB661-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB661-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB661-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB662-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB663-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB664-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB665-01	1.0-3.0	X	X	X		X	X	
74SB666-01	1.0-3.0	X	X	X		X	X	
74SB667-01	1.0-3.0	X	X	X		X	X	
74SB668-01	1.0-3.0	X	X	X		X	X	
74SB669-01	1.0-3.0	X	X	X		X	X	
74SB669-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB670-01	1.0-3.0	X	X	X		X	X	
74SB671-01	1.0-3.0	X	X	X		X	X	
74SB672-01	1.0-3.0	X	X	X		X	X	
74SB673-01	1.0-3.0	X	X	X		X	X	
74SB674-01	1.0-3.0	X	X	X		X	X	
74SB675-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB676-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB677-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB678-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB679-01	1.0-3.0	X	X	X		X	X	
74SB680-01	1.0-3.0	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 HILL TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
74SB681-01	1.0-3.0	X	X	X		X	X	
74SB682-01	1.0-3.0	X	X	X		X	X	
Shallow Subsurface Soil Samples (continued)								
74SB683-01	1.0-3.0	X	X	X		X	X	
74SB683-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB683-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB684-01	1.0-3.0	X	X	X		X	X	
74SB685-01	1.0-3.0	X	X	X		X	X	
74SB686-01	1.0-3.0	X	X	X		X	X	
74SB687-01	1.0-3.0	X	X	X		X	X	
74SB688-01	1.0-3.0	X	X	X		X	X	
74SB689-01	1.0-3.0	X	X	X		X	X	
74SB690-01	1.0-3.0	X	X	X		X	X	
74SB691-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB692-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB693-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB693-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB694-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
Subsurface Soil Samples[(1)]								
74SB655-XX	TBD	X	X	X		X	X	
74SB655-XXD	TBD	X	X	X		X	X	Duplicate
74SB655-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB655-XX	TBD	X	X	X		X	X	
74SB656-XX	TBD	X	X	X		X	X	
74SB656-XX	TBD	X	X	X		X	X	
74SB657-XX	TBD	X	X	X		X	X	
74SB657-XX	TBD	X	X	X		X	X	
74SB658-XX	TBD	X	X	X		X	X	
74SB658-XX	TBD	X	X	X		X	X	
74SB659-XX	TBD	X	X	X		X	X	
74SB659-XX	TBD	X	X	X		X	X	
74SB660-XX	TBD	X	X	X		X	X	
74SB660-XXD	TBD	X	X	X		X	X	Duplicate
74SB660-XX	TBD	X	X	X		X	X	
74SB661-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB661-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB661-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB661-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB662-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB662-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB663-XX	TBD	X	X	X		X	X	Contingency Deep Boring

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 HILL TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
74SB663-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB664-XX	TBD	X	X	X		X	X	Contingency Deep Boring
Subsurface Soil Samples (continued)[(1)]								
74SB664-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB665-XX	TBD	X	X	X		X	X	
74SB665-XX	TBD	X	X	X		X	X	
74SB666-XX	TBD	X	X	X		X	X	
74SB666-XX	TBD	X	X	X		X	X	
74SB667-XX	TBD	X	X	X		X	X	
74SB667-XX	TBD	X	X	X		X	X	
74SB668-XX	TBD	X	X	X		X	X	
74SB668-XX	TBD	X	X	X		X	X	
74SB669-XX	TBD	X	X	X		X	X	
74SB669-XXD	TBD	X	X	X		X	X	Duplicate
74SB669-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB669-XX	TBD	X	X	X		X	X	
74SB670-XX	TBD	X	X	X		X	X	
74SB670-XX	TBD	X	X	X		X	X	
74SB671-XX	TBD	X	X	X		X	X	
74SB671-XX	TBD	X	X	X		X	X	
74SB672-XX	TBD	X	X	X		X	X	
74SB672-XX	TBD	X	X	X		X	X	
74SB673-XX	TBD	X	X	X		X	X	
74SB673-XX	TBD	X	X	X		X	X	
74SB674-XX	TBD	X	X	X		X	X	
74SB674-XXD	TBD	X	X	X		X	X	Duplicate
74SB674-XX	TBD	X	X	X		X	X	
74SB675-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB675-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB676-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB676-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB676-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB677-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB677-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB678-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB678-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB679-XX	TBD	X	X	X		X	X	
74SB679-XX	TBD	X	X	X		X	X	
74SB680-XX	TBD	X	X	X		X	X	
74SB680-XX	TBD	X	X	X		X	X	
74SB681-XX	TBD	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 HILL TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
74SB681-XX	TBD	X	X	X		X	X	
74SB682-XX	TBD	X	X	X		X	X	
Subsurface Soil Samples (continued)[1]								
74SB682-XX	TBD	X	X	X		X	X	
74SB683-XX	TBD	X	X	X		X	X	
74SB683-XXD	TBD	X	X	X		X	X	Duplicate
74SB683-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB683-XX	TBD	X	X	X		X	X	
74SB684-XX	TBD	X	X	X		X	X	
74SB684-XX	TBD	X	X	X		X	X	
74SB685-XX	TBD	X	X	X		X	X	
74SB685-XX	TBD	X	X	X		X	X	
74SB686-XX	TBD	X	X	X		X	X	
74SB686-XX	TBD	X	X	X		X	X	
74SB687-XX	TBD	X	X	X		X	X	
74SB687-XX	TBD	X	X	X		X	X	
74SB688-XX	TBD	X	X	X		X	X	
74SB688-XXD	TBD	X	X	X		X	X	Duplicate
74SB688-XX	TBD	X	X	X		X	X	
74SB689-XX	TBD	X	X	X		X	X	
74SB689-XX	TBD	X	X	X		X	X	
74SB690-XX	TBD	X	X	X		X	X	
74SB690-XX	TBD	X	X	X		X	X	
74SB691-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB691-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB692-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB692-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB693-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB693-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB693-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB693-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB694-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB694-XX	TBD	X	X	X		X	X	Contingency Deep Boring
Groundwater Samples[2]								
74GW665-10	NA	X	X	X	X	X	X	
74GW665-10D	NA	X	X	X	X	X	X	Duplicate
74GW665-10MS	NA	X	X	X	X	X	X	Matrix Spike
74GW665-10MSD	NA	X	X	X	X	X	X	Matrix Spike Duplicate
74GW666-10	NA	X	X	X	X	X	X	
74GWVP10a/JP5	NA	X	X	X	X	X	X	
74GW137-10	NA	X	X	X	X	X	X	

TABLE 7

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 HILL TANK AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
74GWVP9a/JP5	NA	X	X	X	X	X	X	
74GWVP11a/JP5	NA	X	X	X	X	X	X	
Groundwater Samples (continued)[2]								
74GWVP11b/JP5	NA	X	X	X	X	X	X	
74GW273-10	NA	X	X	X	X	X	X	
74GW285-10	NA	X	X	X	X	X	X	

Notes:

[1] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.

[2] Groundwater sample designations based on associated soil boring designation. For example, sample 74GW562 is collected from the monitoring well installed at74SB562.

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 8 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 Hill DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB695-00	0.0-1.0	X	X	X		X	X	
74SB695-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB695-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB696-00	0.0-1.0	X	X	X		X	X	
74SB697-00	0.0-1.0	X	X	X		X	X	
74SB698-00	0.0-1.0	X	X	X		X	X	
74SB699-00	0.0-1.0	X	X	X		X	X	
74SB700-00	0.0-1.0	X	X	X		X	X	
74SB701-00	0.0-1.0	X	X	X		X	X	
74SB702-00	0.0-1.0	X	X	X		X	X	
74SB703-00	0.0-1.0	X	X	X		X	X	
74SB704-00	0.0-1.0	X	X	X		X	X	
74SB705-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB705-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB705-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB706-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB707-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB708-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB709-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB710-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB711-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB712-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB713-00	0.0-1.0	X	X	X		X	X	
74SB713-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB714-00	0.0-1.0	X	X	X		X	X	
74SB715-00	0.0-1.0	X	X	X		X	X	
74SB716-00	0.0-1.0	X	X	X		X	X	
74SB717-00	0.0-1.0	X	X	X		X	X	
74SB718-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB719-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB720-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB720-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB721-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB754-00	0.0-1.0	X	X	X		X	X	
74SB755-00	0.0-1.0	X	X	X		X	X	
74SB756-00	0.0-1.0	X	X	X		X	X	

TABLE 8 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 Hill DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples								
74SB695-01	1.0-3.0	X	X	X		X	X	
74SB695-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB695-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB696-01	1.0-3.0	X	X	X		X	X	
74SB697-01	1.0-3.0	X	X	X		X	X	
74SB698-01	1.0-3.0	X	X	X		X	X	
74SB699-01	1.0-3.0	X	X	X		X	X	
74SB700-01	1.0-3.0	X	X	X		X	X	
74SB701-01	1.0-3.0	X	X	X		X	X	
74SB702-01	1.0-3.0	X	X	X		X	X	
74SB703-01	1.0-3.0	X	X	X		X	X	
74SB704-01	1.0-3.0	X	X	X		X	X	
74SB705-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB705-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB705-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB706-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB707-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB708-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB709-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB710-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB711-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB712-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB713-01	1.0-3.0	X	X	X		X	X	
74SB713-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB714-01	1.0-3.0	X	X	X		X	X	
74SB715-01	1.0-3.0	X	X	X		X	X	
74SB716-01	1.0-3.0	X	X	X		X	X	
74SB717-01	1.0-3.0	X	X	X		X	X	
74SB718-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB719-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB720-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB720-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB721-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB754-01	1.0-3.0	X	X	X		X	X	
74SB755-01	1.0-3.0	X	X	X		X	X	
74SB756-01	1.0-3.0	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 Hill DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples[(1)]								
74SB695-XX	TBD	X	X	X		X	X	
74SB695-XXD	TBD	X	X	X		X	X	Duplicate
74SB695-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB695-XX	TBD	X	X	X		X	X	
74SB696-XX	TBD	X	X	X		X	X	
74SB696-XX	TBD	X	X	X		X	X	
74SB697-XX	TBD	X	X	X		X	X	
74SB697-XX	TBD	X	X	X		X	X	
74SB698-XX	TBD	X	X	X		X	X	
74SB698-XX	TBD	X	X	X		X	X	
74SB699-XX	TBD	X	X	X		X	X	
74SB699-XX	TBD	X	X	X		X	X	
74SB700-XX	TBD	X	X	X		X	X	
74SB700-XXD	TBD	X	X	X		X	X	Duplicate
74SB700-XX	TBD	X	X	X		X	X	
74SB701-XX	TBD	X	X	X		X	X	
74SB701-XX	TBD	X	X	X		X	X	
74SB702-XX	TBD	X	X	X		X	X	
74SB702-XX	TBD	X	X	X		X	X	
74SB703-XX	TBD	X	X	X		X	X	
74SB703-XX	TBD	X	X	X		X	X	
74SB704-XX	TBD	X	X	X		X	X	
74SB704-XX	TBD	X	X	X		X	X	
74SB705-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB705-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB705-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB705-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB706-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB706-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB707-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB707-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB708-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB708-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB709-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB709-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB710-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB710-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate

TABLE 8

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 Hill DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB710-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB711-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB711-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB712-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB712-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB713-XX	TBD	X	X	X		X	X	
74SB713-XXD	TBD	X	X	X		X	X	Duplicate
74SB713-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB713-XX	TBD	X	X	X		X	X	
74SB714-XX	TBD	X	X	X		X	X	
74SB714-XX	TBD	X	X	X		X	X	
74SB715-XX	TBD	X	X	X		X	X	
74SB715-XX	TBD	X	X	X		X	X	
74SB716-XX	TBD	X	X	X		X	X	
74SB716-XX	TBD	X	X	X		X	X	
74SB717-XX	TBD	X	X	X		X	X	
74SB717-XX	TBD	X	X	X		X	X	
74SB718-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB718-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB719-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB719-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB720-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB720-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB720-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB720-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB721-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB721-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB754-XX	TBD	X	X	X		X	X	
74SB754-XXD	TBD	X	X	X		X	X	Duplicate
74SB754-XX	TBD	X	X	X		X	X	
74SB755-XX	TBD	X	X	X		X	X	
74SB755-XX	TBD	X	X	X		X	X	
74SB756-XX	TBD	X	X	X		X	X	
74SB756-XX	TBD	X	X	X		X	X	

TABLE 8 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
JP-5 Hill DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Groundwater Samples[(2)]								
74GW695-10	NA	X	X	X	X	X	X	
74GW695-10D	NA	X	X	X	X	X	X	Duplicate
74GW695-10MS	NA	X	X	X	X	X	X	Matrix Spike
74GW695-10MSD	NA	X	X	X	X	X	X	Matrix Spike Duplicate
74GW696-10	NA	X	X	X	X	X	X	
74GW697-10	NA	X	X	X	X	X	X	
74GW713	NA	X	X	X	X	X	X	
74GW720	NA	X	X	X	X	X	X	Contingency Deep Boring
74GW721	NA	X	X	X	X	X	X	Contingency Deep Boring

Notes:

[(1)] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.

[(2)] Groundwater sample designations based on associated soil boring designation. For example, sample 74GW562 is collected from the monitoring well installed at74SB562.

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 9 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
JP-5 HILL AND DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level	App IX Metals	App IX Metals	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Trip Blanks	74TB78	X				X				
	74TB79	X				X				
	74TB80	X				X				
	74TB81	X				X				
	74TB82	X				X				
	74TB83	X				X				
	74TB84	X				X				
	74TB85	X				X				
	74TB86	X				X				
	74TB87	X				X				
	74TB88	X				X				
	74TB89	X				X				
	74TB90	X				X				
	74TB91	X				X				
	74TB92	X				X				
	74TB93	X				X				
	74TB94	X				X				
	74TB95	X				X				
	74TB96	X				X				
	74TB97	X				X				
	74TB98	X				X				
	74TB99	X				X				
	74TB100	X				X				
	74TB101	X				X				
Equipment Rinsates	74ER78	X	X	X		X	X			Soil Sampling Equipment
	74ER79	X	X	X		X	X			Soil Sampling Equipment
	74ER80	X	X	X		X	X			Soil Sampling Equipment
	74ER81	X	X	X		X	X			Soil Sampling Equipment
	74ER82	X	X	X		X	X			Soil Sampling Equipment
	74ER83	X	X	X		X	X			Soil Sampling Equipment
	74ER84	X	X	X		X	X			Soil Sampling Equipment
	74ER85	X	X	X		X	X			Soil Sampling Equipment
	74ER86	X	X	X		X	X			Soil Sampling Equipment
	74ER87	X	X	X		X	X			Soil Sampling Equipment
	74ER88	X	X	X		X	X			Soil Sampling Equipment
	74ER89	X	X	X		X	X			Soil Sampling Equipment
	74ER90	X	X	X		X	X			Soil Sampling Equipment
	74ER91	X	X	X		X	X			Soil Sampling Equipment
	74ER92	X	X	X		X	X			Soil Sampling Equipment
	74ER93	X	X	X		X	X			Soil Sampling Equipment
	74ER94	X	X	X		X	X			Soil Sampling Equipment
	74ER95	X	X	X		X	X			Soil Sampling Equipment

TABLE 9 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
JP-5 HILL AND DFM AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level	App IX Metals	App IX Metals	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Equipment Rinsates (continued)	74ER96	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER97	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER98	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER99	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER100	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER101	X	X	X	X	X	X			Groundwater Sampling Equipment
Field Blanks	74FB01	X	X	X	X	X	X			Store Bought Distilled Water
	74FB02	X	X	X	X	X	X			Lab Grade Deionized Water
IDW	74IDW01							X	X	Solid
	74IDW02							X		Aqueous

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TCLP - Toxicity Characteristic Leaching Procedure
IDW - Investigation Derived Waste

TABLE 10 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA C AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB722-00	0.0-1.0	X	X	X		X	X	
74SB722-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB722-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB723-00	0.0-1.0	X	X	X		X	X	
74SB724-00	0.0-1.0	X	X	X		X	X	
74SB725-00	0.0-1.0	X	X	X		X	X	
74SB726-00	0.0-1.0	X	X	X		X	X	
74SB727-00	0.0-1.0	X	X	X		X	X	
74SB728-00	0.0-1.0	X	X	X		X	X	
74SB729-00	0.0-1.0	X	X	X		X	X	
74SB730-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB730-00D	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB730-00MS/MSD	0.0-1.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB731-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB732-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB733-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB734-00	0.0-1.0	X	X	X		X	X	
74SB735-00	0.0-1.0	X	X	X		X	X	
74SB736-00	0.0-1.0	X	X	X		X	X	
74SB736-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB737-00	0.0-1.0	X	X	X		X	X	
74SB738-00	0.0-1.0	X	X	X		X	X	
74SB739-00	0.0-1.0	X	X	X		X	X	
74SB740-00	0.0-1.0	X	X	X		X	X	
74SB741-00	0.0-1.0	X	X	X		X	X	
74SB742-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB743-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB744-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB745-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB746-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
74SB747-00	0.0-1.0	X	X	X		X	X	Contingency Deep Boring
Shallow Subsurface Soil Samples								
74SB722-01	1.0-3.0	X	X	X		X	X	
74SB722-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB722-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB723-01	1.0-3.0	X	X	X		X	X	

TABLE 10

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA C AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Shallow Subsurface Soil Samples (continued)								
74SB724-01	1.0-3.0	X	X	X		X	X	
74SB725-01	1.0-3.0	X	X	X		X	X	
74SB726-01	1.0-3.0	X	X	X		X	X	
74SB727-01	1.0-3.0	X	X	X		X	X	
74SB728-01	1.0-3.0	X	X	X		X	X	
74SB729-01	1.0-3.0	X	X	X		X	X	
74SB730-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB730-01D	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB730-01MS/MSD	1.0-3.0	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB731-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB732-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB733-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB734-01	1.0-3.0	X	X	X		X	X	
74SB735-01	1.0-3.0	X	X	X		X	X	
74SB736-01	1.0-3.0	X	X	X		X	X	
74SB736-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB737-01	1.0-3.0	X	X	X		X	X	
74SB738-01	1.0-3.0	X	X	X		X	X	
74SB739-01	1.0-3.0	X	X	X		X	X	
74SB740-01	1.0-3.0	X	X	X		X	X	
74SB741-01	1.0-3.0	X	X	X		X	X	
74SB742-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB743-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB744-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB745-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB746-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
74SB747-01	1.0-3.0	X	X	X		X	X	Contingency Deep Boring
Subsurface Soil Samples[(2)]								
74SB722-XX	TBD	X	X	X		X	X	
74SB722-XXD	TBD	X	X	X		X	X	Duplicate
74SB722-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB722-XX	TBD	X	X	X		X	X	
74SB723-XX	TBD	X	X	X		X	X	
74SB723-XX	TBD	X	X	X		X	X	
74SB724-XX	TBD	X	X	X		X	X	
74SB724-XX	TBD	X	X	X		X	X	
74SB725-XX	TBD	X	X	X		X	X	

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA C AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB725-XX	TBD	X	X	X		X	X	
74SB726-XX	TBD	X	X	X		X	X	
74SB726-XX	TBD	X	X	X		X	X	
74SB727-XX	TBD	X	X	X		X	X	
74SB727-XXD	TBD	X	X	X		X	X	Duplicate
74SB727-XX	TBD	X	X	X		X	X	
74SB728-XX	TBD	X	X	X		X	X	
74SB728-XX	TBD	X	X	X		X	X	
74SB729-XX	TBD	X	X	X		X	X	
74SB729-XX	TBD	X	X	X		X	X	
74SB730-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB730-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB730-XXMS/MSD	TBD	X	X	X		X	X	Contingency Deep Boring/Matrix Spike/Matrix Duplicate
74SB730-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB731-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB731-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB732-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB732-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB733-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB733-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB738-XX	TBD	X	X	X		X	X	
74SB738-XX	TBD	X	X	X		X	X	
74SB739-XX	TBD	X	X	X		X	X	
74SB739-XX	TBD	X	X	X		X	X	
74SB740-XX	TBD	X	X	X		X	X	
74SB740-XXD	TBD	X	X	X		X	X	Duplicate
74SB740-XXMS/MSD	TBD	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB740-XX	TBD	X	X	X		X	X	
74SB741-XX	TBD	X	X	X		X	X	
74SB741-XX	TBD	X	X	X		X	X	
74SB742-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB742-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB743-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB743-XXD	TBD	X	X	X		X	X	Contingency Deep Boring/Duplicate
74SB743-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB744-XX	TBD	X	X	X		X	X	Contingency Deep Boring

TABLE 10

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
SWMU 9 AREA C AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Subsurface Soil Samples (continued)[1]								
74SB744-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB745-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB745-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB746-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB746-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB747-XX	TBD	X	X	X		X	X	Contingency Deep Boring
74SB747-XX	TBD	X	X	X		X	X	Contingency Deep Boring
Groundwater Samples[2]								
74GW722-10	NA	X	X	X	X	X	X	
74GW722-10D	NA	X	X	X	X	X	X	Duplicate
74GW722-10MS	NA	X	X	X	X	X	X	Matrix Spike
74GW722-10MSD	NA	X	X	X	X	X	X	Matrix Spike Duplicate
74GW723-10	NA	X	X	X	X	X	X	
74GW738-10	NA	X	X	X	X	X	X	
74GW739-10	NA	X	X	X	X	X	X	
74VP6Aa	NA	X	X	X	X	X	X	
74VP6Ab	NA	X	X	X	X	X	X	
74VP6Ca	NA	X	X	X	X	X	X	
74VP6Cb	NA	X	X	X	X	X	X	

Notes:

[1] XX - This indicates the designation for the depth interval from which the sample will be collected (i.e., 01 = 1-3ft bgs, 02 = 3-5 ft bgs, etc.). This will be established in the field.

[2] Groundwater sample designations based on associated soil boring designation. For example, sample 74GW562 is collected from the monitoring well installed at74SB562.

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 11

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
SWMU 9 AREA C AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level	App IX Metals (Total)	App IX Metals	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Trip Blanks	74TB102	X				X				
	74TB103	X				X				
	74TB104	X				X				
	74TB105	X				X				
	74TB106	X				X				
	74TB107	X				X				
	74TB108	X				X				
	74TB109	X				X				
	74TB110	X				X				
	74TB111	X				X				
	74TB112	X				X				
	74TB113	X				X				
Equipment Rinsates	74ER102	X	X	X		X	X			Soil Sampling Equipment
	74ER103	X	X	X		X	X			Soil Sampling Equipment
	74ER104	X	X	X		X	X			Soil Sampling Equipment
	74ER105	X	X	X		X	X			Soil Sampling Equipment
	74ER106	X	X	X		X	X			Soil Sampling Equipment
	74ER107	X	X	X		X	X			Soil Sampling Equipment
	74ER108	X	X	X		X	X			Soil Sampling Equipment
	74ER109	X	X	X		X	X			Soil Sampling Equipment
	74ER110	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER111	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER112	X	X	X	X	X	X			Groundwater Sampling Equipment
	74ER113	X	X	X	X	X	X			Groundwater Sampling Equipment
Field Blanks	74FB01	X	X	X	X	X	X			Store Bought Distilled Water
	74FB02	X	X	X	X	X	X			Lab Grade Deionized Water
IDW	74IDW01							X	X	Solid
	74IDW02							X		Aqueous

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TCLP - Toxicity Characteristic Leaching Procedure
IDW - Investigation Derived Waste

TABLE 12

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - ENVIRONMENTAL SAMPLES
FUELING PIERS AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE FINAL CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

		Fixed Based Lab Analysis						
Media	**Sample Depth (ft bgs)**	APP. IX VOCs	App IX Low-Level PAHs	App IX Metals (Total)	App IX Metals (Dissolved)	TPH GRO	TPH DRO	**Comment**
Surface Soil Samples								
74SB748-00	0.0-1.0	X	X	X		X	X	
74SB748-00D	0.0-1.0	X	X	X		X	X	Duplicate
74SB748-00MS/MSD	0.0-1.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB749-00	0.0-1.0	X	X	X		X	X	
74SB750-00	0.0-1.0	X	X	X		X	X	
74SB751-00	0.0-1.0	X	X	X		X	X	
74SB752-00	0.0-1.0	X	X	X		X	X	
74SB753-00	0.0-1.0	X	X	X		X	X	
Shallow Subsurface Soil Samples								
74SB748-01	1.0-3.0	X	X	X		X	X	
74SB748-01D	1.0-3.0	X	X	X		X	X	Duplicate
74SB748-01MS/MSD	1.0-3.0	X	X	X		X	X	Matrix Spike/Matrix Spike Duplicate
74SB749-01	1.0-3.0	X	X	X		X	X	
74SB750-01	1.0-3.0	X	X	X		X	X	
74SB751-01	1.0-3.0	X	X	X		X	X	
74SB752-01	1.0-3.0	X	X	X		X	X	
74SB753-01	1.0-3.0	X	X	X		X	X	

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TBD - To Be Determined in the Field

TABLE 13 Revised: March 4, 2011

SUMMARY OF SAMPLING AND ANALYTICAL PROGRAM - QA/QC SAMPLES
FUELING PIERS AREA
SWMU 74 - FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS INVESTIGATION
NAVAL ACTIVITY PUERTO RICO

		Fixed Base Lab Analysis								
Sample Media	**Media**	APP. IX VOCs	App IX Low-Level	App IX Metals (Total)	App IX Metals	TPH GRO	TPH DRO	Reactivity, Corrosivity and Ignitability	TCLP Metals	**Comment**
Trip Blanks	74TB114	X				X				
	74TB115	X				X				
Equipment Rinsates	74ER114	X	X	X		X	X			Soil Sampling Equipment
	74ER115	X	X	X	X	X	X			Groundwater Sampling Equipment
Field Blanks	74FB01	X	X	X	X	X	X			Store Bought Distilled Water
	74FB02	X	X	X	X	X	X			Lab Grade Deionized Water
IDW	74IDW01							X	X	Solid
	74IDW02							X		Aqueous

Notes:

App IX - Appendix IX
VOCs - Volatile Organic Compounds
PAHs - Polynuclear Aromatic Hydrocarbons
TPH GRO - Total Petroleum Hydrocarbons Gasoline Range Organics
TPH DRO - Total Petroleum Hydrocarbons Diesel Range Organics
TCLP - Toxicity Characteristic Leaching Procedure
IDW - Investigation Derived Waste

FIGURES

1200 0 600 1200
1 inch = 1200 ft.

Baker

SOURCE: GEO-MARINE, INC., SEPTEMBER 6, 2000

LEGEND

- SWMU BOUNDARY
- GEOGRAPHIC AREAS IN THE PHASE I CMS INVESTIGATION REPORT

FIGURE 1
INDEX MAP OF SWMU 74 AREAS
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A - PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

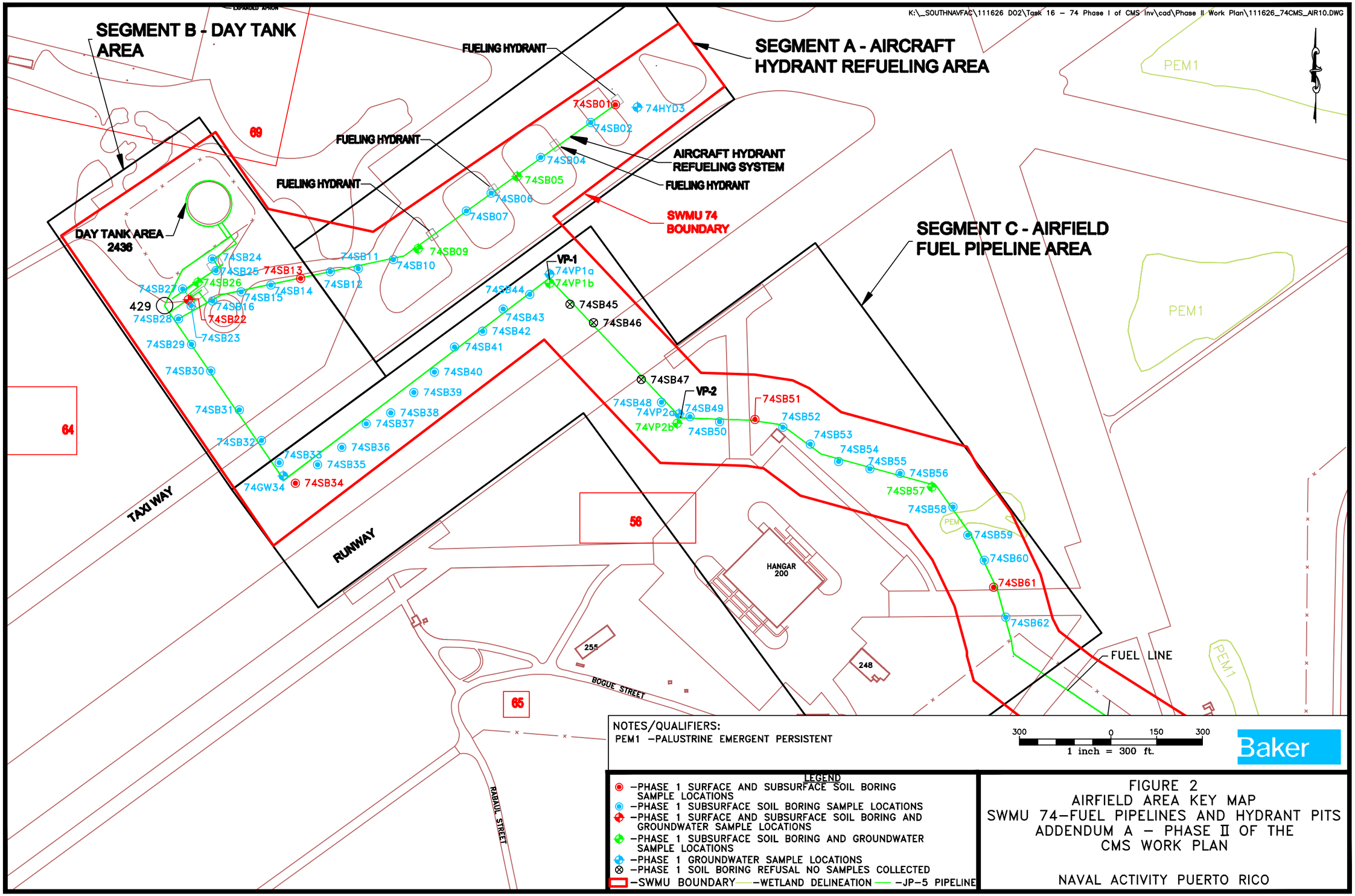
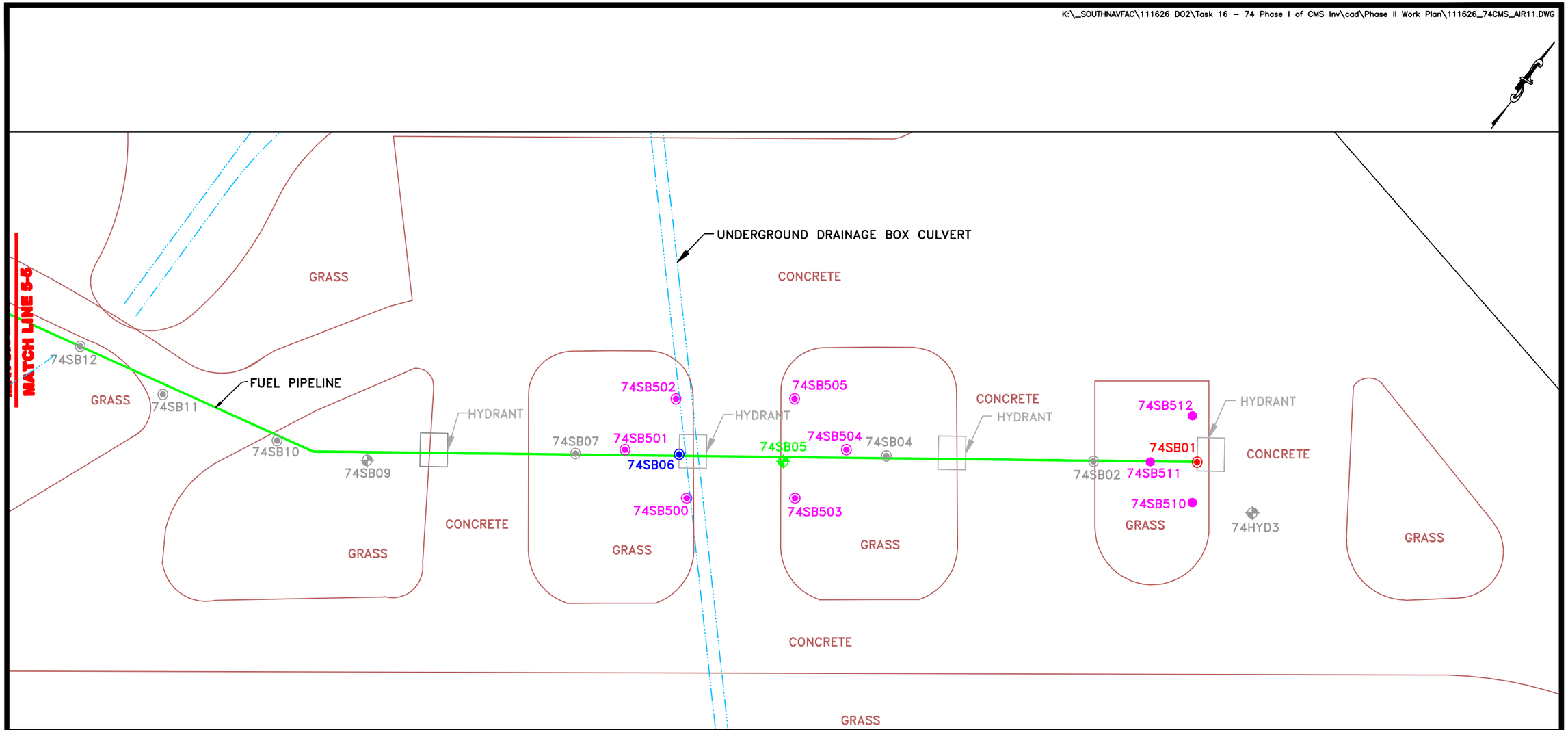


FIGURE 2
AIRFIELD AREA KEY MAP
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE
CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\111626 D02\Task 16 – 74 Phase I of CMS Inv\cad\Phase II Work Plan\111626_74CMS_AIR11.DWG



SEGMENT A – AIRCRAFT HYDRANT REFUELING AREA

74SB506 TO 74SB509: CONTINGENCY SHALLOW BORINGS TO THREE FEET WITH SURFACE AND SHALLOW SUBSURFACE SOIL SAMPLES.

74SB513 TO 74SB516: CONTINGENCY DEEP BORINGS WITH ONE SURFACE, ONE SHALLOW SUBSURFACE AND TWO SUBSURFACE SOIL SAMPLES.

100 0 50 100

1 inch = 100 ft.

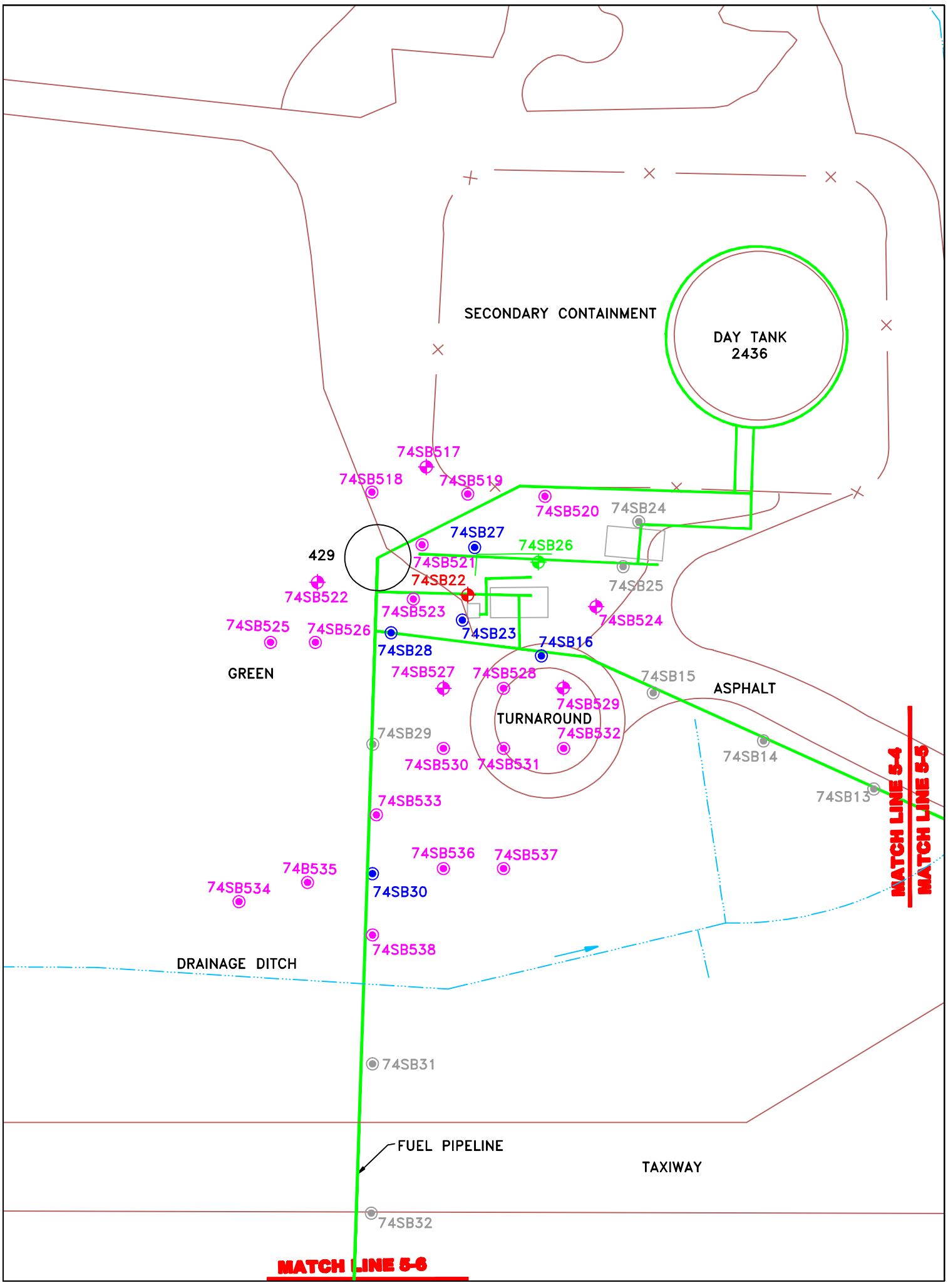
Baker

LEGEND

- –PHASE 1 SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PHASE 1 SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PHASE 1 SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –PHASE 1 GROUNDWATER SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SHALLOW SUBSURFACE BORING SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –DRAINAGE DITCH
- –JP–5 PIPELINE

FIGURE 3
PHASE II PROPOSED SAMPLE LOCATIONS
SEGMENT A – AIRCRAFT HYDRANT REFUELING AREA
AIRFIELD AREA
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\111626 D02\Task 16 – 74 Phase I of CMS Inv\cad\Phase II Work Plan\111626_74CMS_AIR11.DWG



SEGMENT B – DAY TANK AREA

74SB539 TO 74SB550: CONTINGENCY DEEP BORINGS WITH ONE SURFACE, ONE SHALLOW SUBSURFACE AND TWO SUBSURFACE SOIL SAMPLES.

MONITORING WELLS MAY BE INSTALLED AT UP TO TWO ADDITIONAL LOCATIONS.

100 0 50 100
1 inch = 100 ft.

Baker

LEGEND

- –SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –JP–5 PIPELINE
- –DRAINAGE DITCH
- –FENCE LINE

FIGURE 4
PHASE II PROPOSED SAMPLE LOCATIONS
SEGMENT B – DAY TANK AREA – AIRFIELD AREA
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO

K:_SOUTHNAVFAC\111626 DO2\Task 16 – 74 Phase I of CMS Inv\cad\Phase II Work Plan\111626_74CMS_AIR11.DWG

VP-1
74VP1a
74VP1b
74SB44
74SB43
74SB45
74SB46
74SB42
74SB41
74SB40
74SB39
74SB38
74SB37
74SB36
74SB35
74SB33
74GW34
74SB551
74SB34
74SB555
74SB553
74SB552
74SB554
FUEL PIPELINE
UNDERGROUND DRAINAGE BOX CULVERT
74SB47
VP-2
74SB48
74VP2a
74VP2b
74SB49
74SB50
74SB51
74SB52
74SB53
74SB54
74SB55
74SB56
74SB57
74SB58
PEM1
74SB59
74SB60
74SB61
74SB62
HANGAR 200
255
248
372
BOGUE STREET
RUNWAY
TAXIWAY
TURNAROUND
ASPHALT
GRASS
DRAINAGE DITCH
FUEL PIPELINE

NOTES/QUALIFIERS:
PEM1 –PALUSTRINE EMERGENT PERSISTENT

200 0 100 200
1 inch = 200 ft.

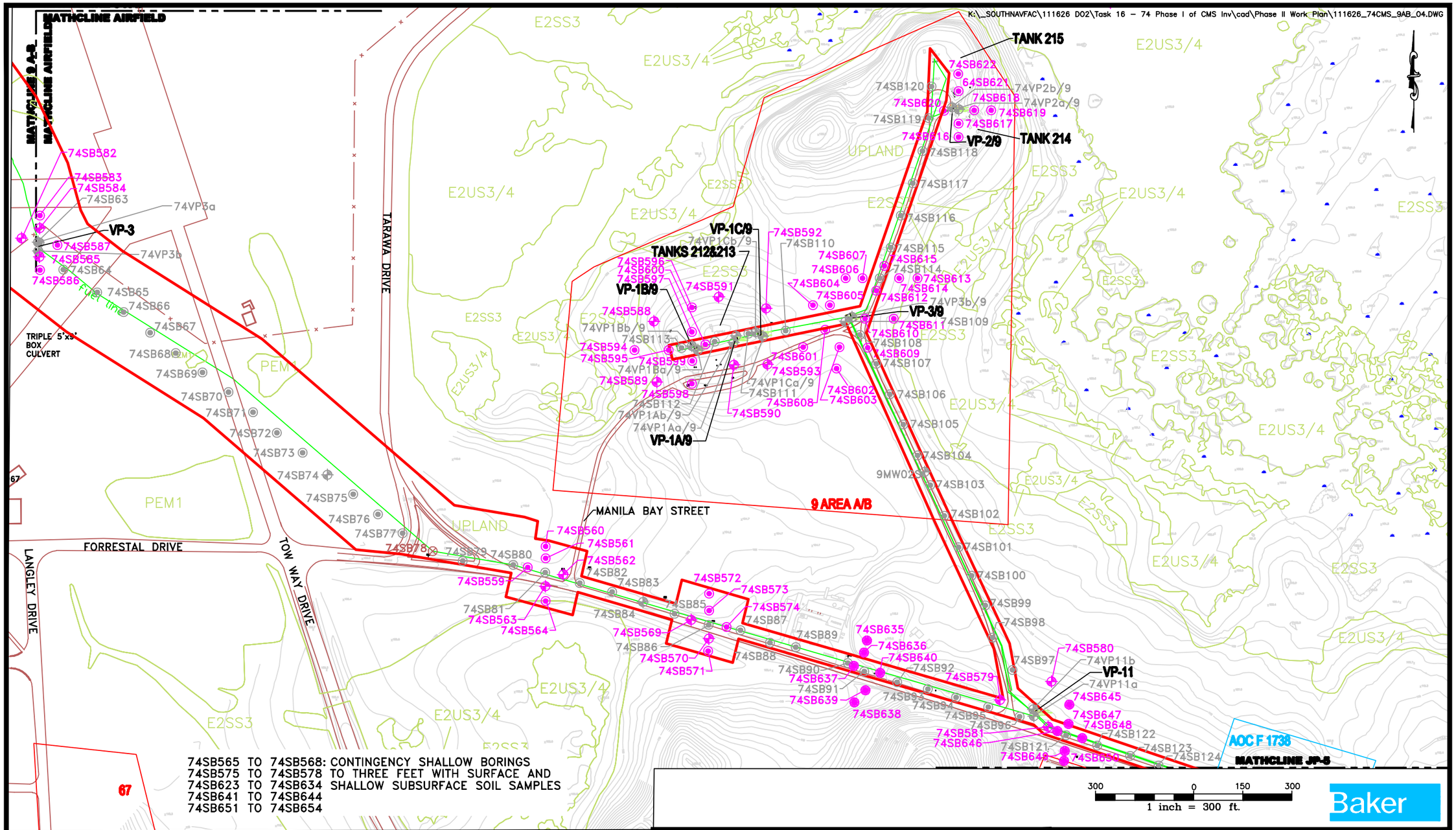
Baker

SEGMENT C – AIRFIELD FUEL PIPELINE AREA

74SB756 TO 74SB758: CONTINGENCY SURFACE OR SHALLOW SUBSURFACE SOIL SAMPLES.

LEGEND
–SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–GROUNDWATER SAMPLE LOCATIONS
–SOIL BORING REFUSAL NO SAMPLES COLLECTED
–PROPOSED SURFACE SOIL BORING SAMPLE LOCATIONS
–PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–JP–5 PIPELINE –DRAINAGE DITCH –FENCE LINE

FIGURE 5
PHASE II PROPOSED SAMPLE LOCATIONS
SEGMENT C – AIRFIELD FUEL PIPELINE AREA
AIRFIELD AREA
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

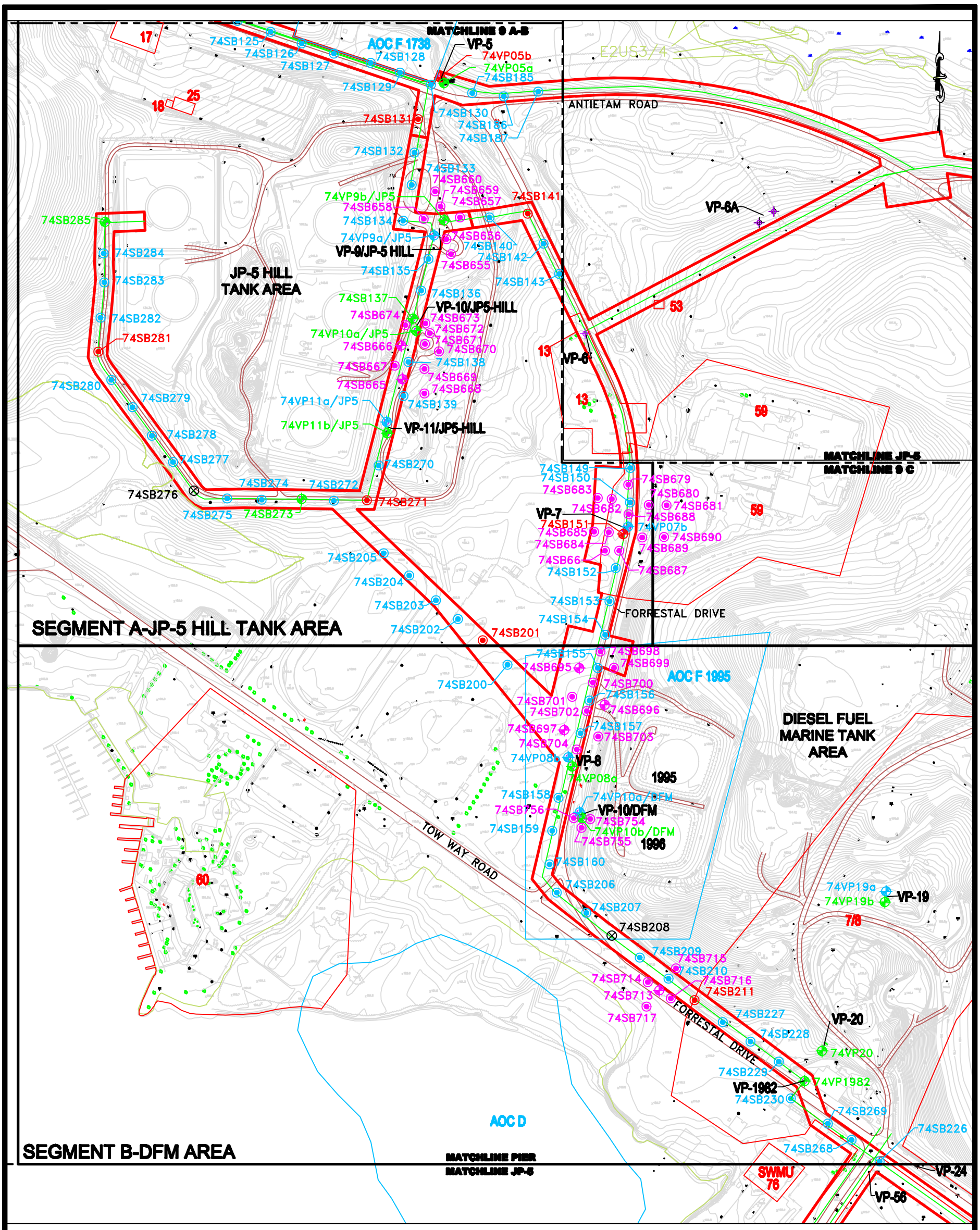


74SB565 TO 74SB568: CONTINGENCY BORINGS WITH
74SB575 TO 74SB578 TWO SUBSURFACE BORINGS
74SB623 TO 74SB634

NOTES:
UPLAND –UPLAND
E2US3/4 –ESTUARINE INTERTIDAL UNCONSOLIDATED SHORE MUD/ORGANIC
E2SS3 –ESTUARINE INTERTIDAL SCRUB–SHRUB BROAD LEAVED EVERG
PEM1 –PALUSTRINE EMERGENT PERSISTENT

–SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–GROUNDWATER SAMPLE LOCATIONS
–SOIL BORING REFUSAL NO SAMPLES COLLECTED
–PROPOSED SURFACE AND SHALLOW SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–PROPOSED SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS

FIGURE 6
PROPOSED SAMPLE LOCATIONS
SWMU 9 AREA A/B
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO



NOTES:
E2US3/4– ESTUARINE INTERTIDAL UNCONSOLIDATED SHORE MUD/ORGANIC

300 0 150 300
1 inch = 300 ft.

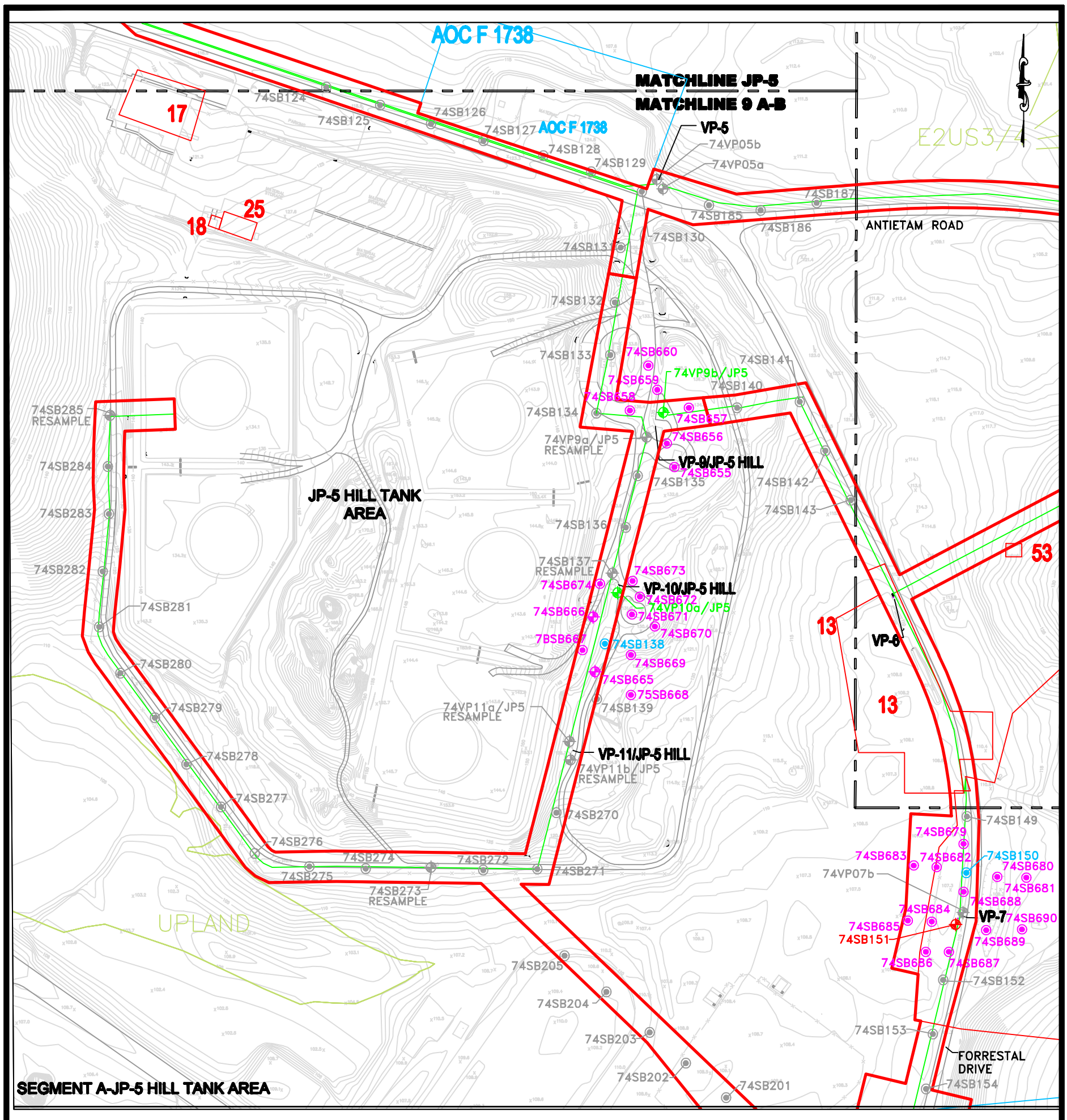
K:_SOUTHNAVFAC\111626 D02\Task 16 – 74 Phase I of CMS Inv\cad\Phase II Work Plan\111626_74CMS_JP5_05.DWG

Baker

LEGEND
- –SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –GROUNDWATER SAMPLE LOCATIONS
- –SOIL BORING REFUSAL NO SAMPLES COLLECTED
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SWMU BOUNDARY
- –WETLAND DELINEATION
- –JP–5 PIPELINE

FIGURE 7
PHASE II SAMPLE AREA KEY MAP
JP–5 HILL AND DFM AREA
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE CMS WORK PLAN

NAVAL ACTIVITY PUERTO RICO



74SB661 TO 74SB664: CONTINGENCY BORINGS WITH ONE SURFACE,
74SB675 TO 74SB678 ONE SHALLOW SUBSURFACE AND TWO
74SB691 TO 74SB694 SUBSURFACE SOIL SAMPLES

NOTES:
E2US3/4 –ESTUARINE INTERTIDAL UNCONSOLIDATED SHORE MUD/ORGANIC
UPLAND –UPLAND

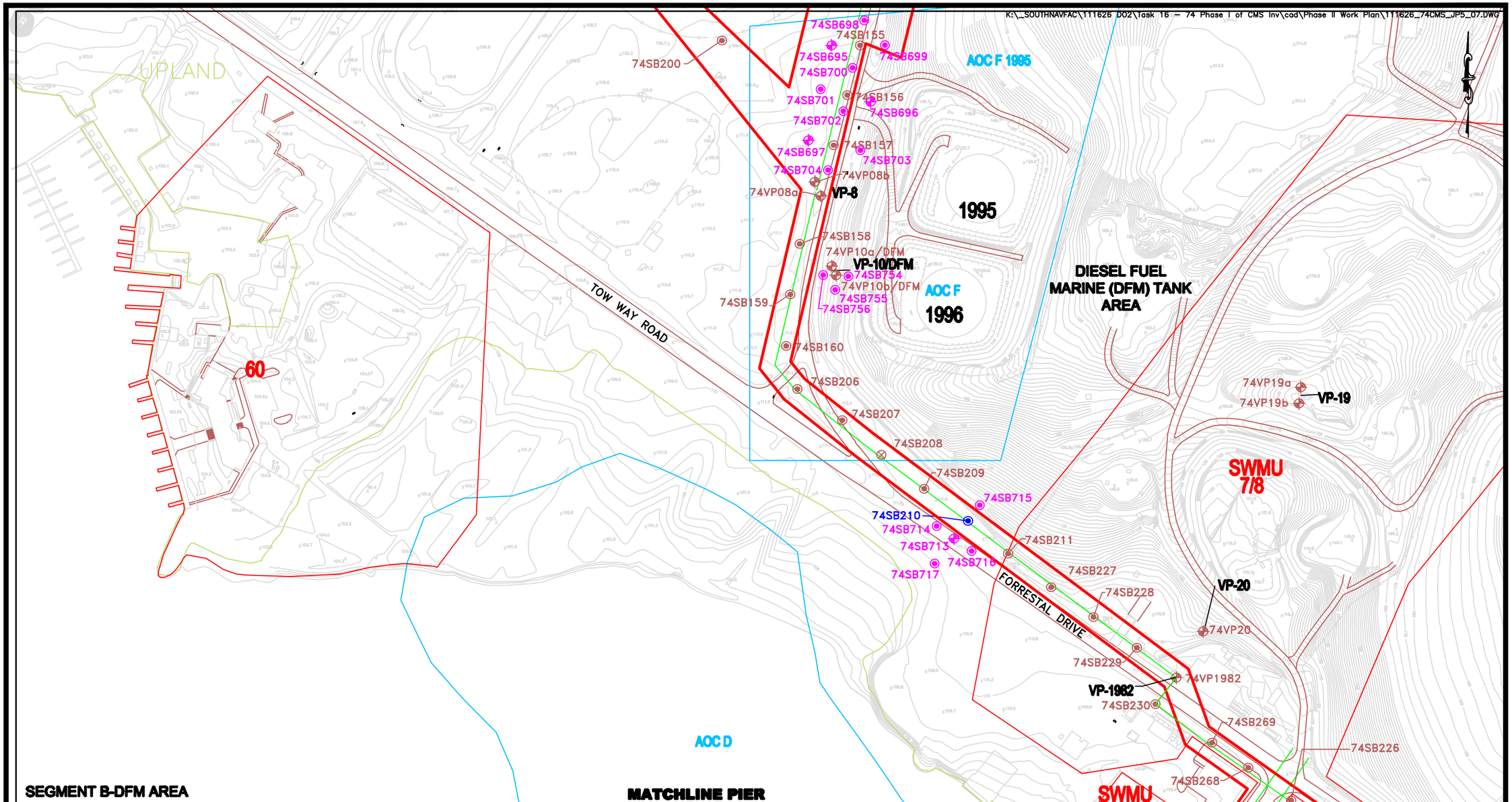
200 0 100 200
1 inch = 200 ft.

K:_SOUTHNAVFAC\111626 DO2\Task 16 – 74 Phase I of CMS Inv\cad\Phase II Work Plan\111626_74CMS_JP5_06.DWG

Baker

–SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–GROUNDWATER SAMPLE LOCATIONS
–SOIL BORING REFUSAL NO SAMPLES COLLECTED
–PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
–PROPOSED SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
–JP–5 PIPELINE –WETLAND DELINEATION –SWMU BOUNDARY

FIGURE 8
PHASE II PROPOSED SAMPLE LOCATIONS
SEGMENT A – JP–5 HILL TANK AREA
JP–5 HILL AND DFM AREA
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO



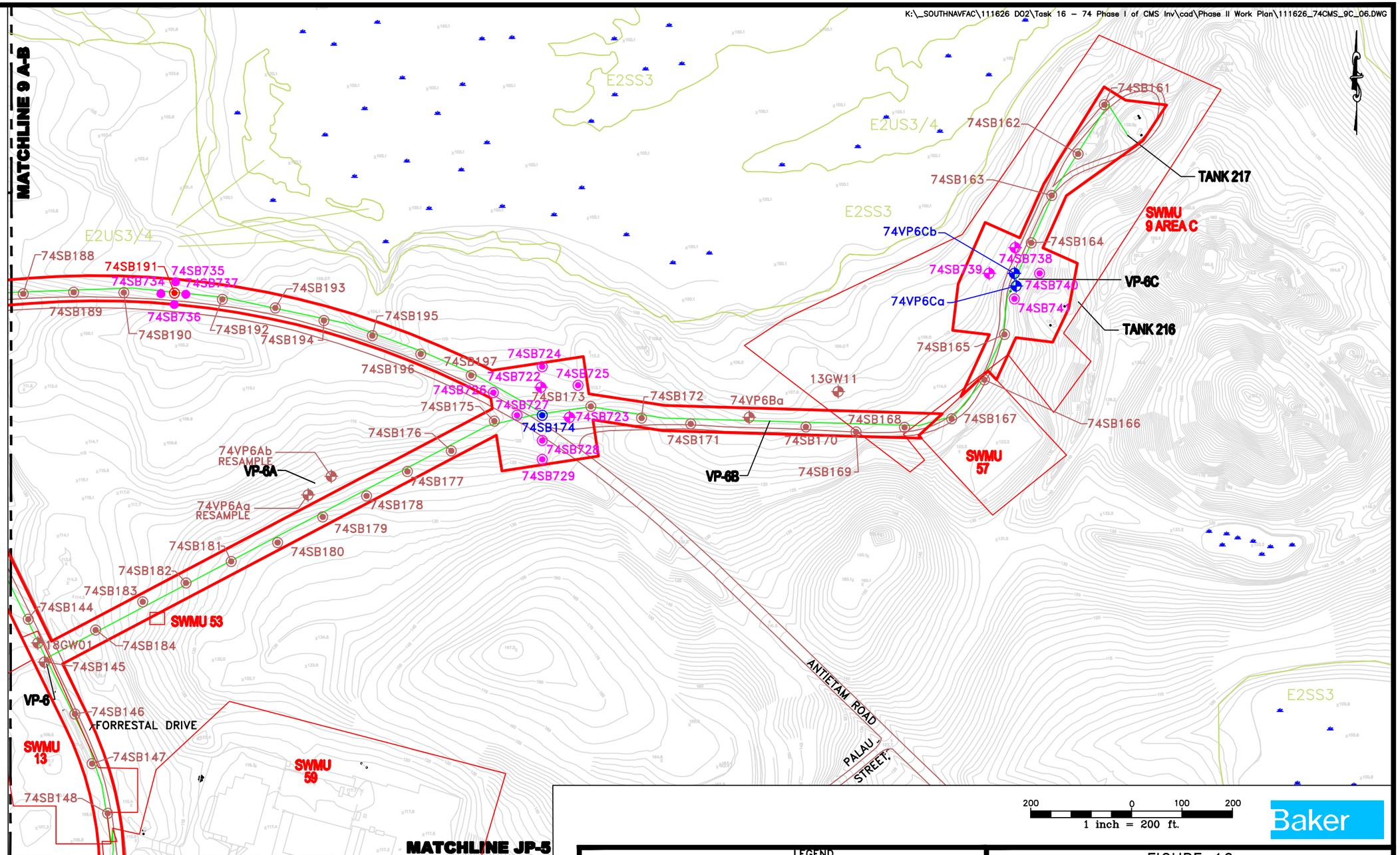
74SB705 TO 74SB712: CONTINGENCY DEEP BORINGS WITH ONE
74SB718 TO 74SB721 SURFACE, ONE SHALLOW SUBSURFACE AND
TWO SUBSURFACE SOIL SAMPLES

200 0 100 200
1 inch = 200 ft.

Baker

- –SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –GROUNDWATER SAMPLE LOCATIONS
- –SOIL BORING REFUSAL NO SAMPLES COLLECTED
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –JP-5 PIPELINE
- –WETLAND DELINEATION
- –SWMU BOUNDARY

FIGURE 9
PHASE II PROPOSED SAMPLE LOCATIONS
SEGMENT B – DFM AREA
JP-5 HILL AND DFM AREA
SWMU 74-FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO



74SB730 TO 74SB733: CONTINGENCY DEEP BORINGS WITH ONE
74SB742 TO 74SB747 SURFACE, ONE SHALLOW SUBSURFACE AND
TWO SUBSURFACE SOIL SAMPLES

NOTES:

E2US3/4 –ESTUARINE INTERTIDAL UNCONSOLIDATED SHORE MUD/ORGANIC
E2SS3 –ESTUARINE INTERTIDAL SCRUB–SHRUB BROAD LEAVED EVERG

LEGEND

- –SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –GROUNDWATER SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SHALLOW SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –WETLAND DELINEATION
- –JP–5 PIPELINE
- –SWMU BOUNDARY

FIGURE 10
PHASE II PROPOSED SAMPLE LOCATIONS
SWMU 9 AREA C
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO

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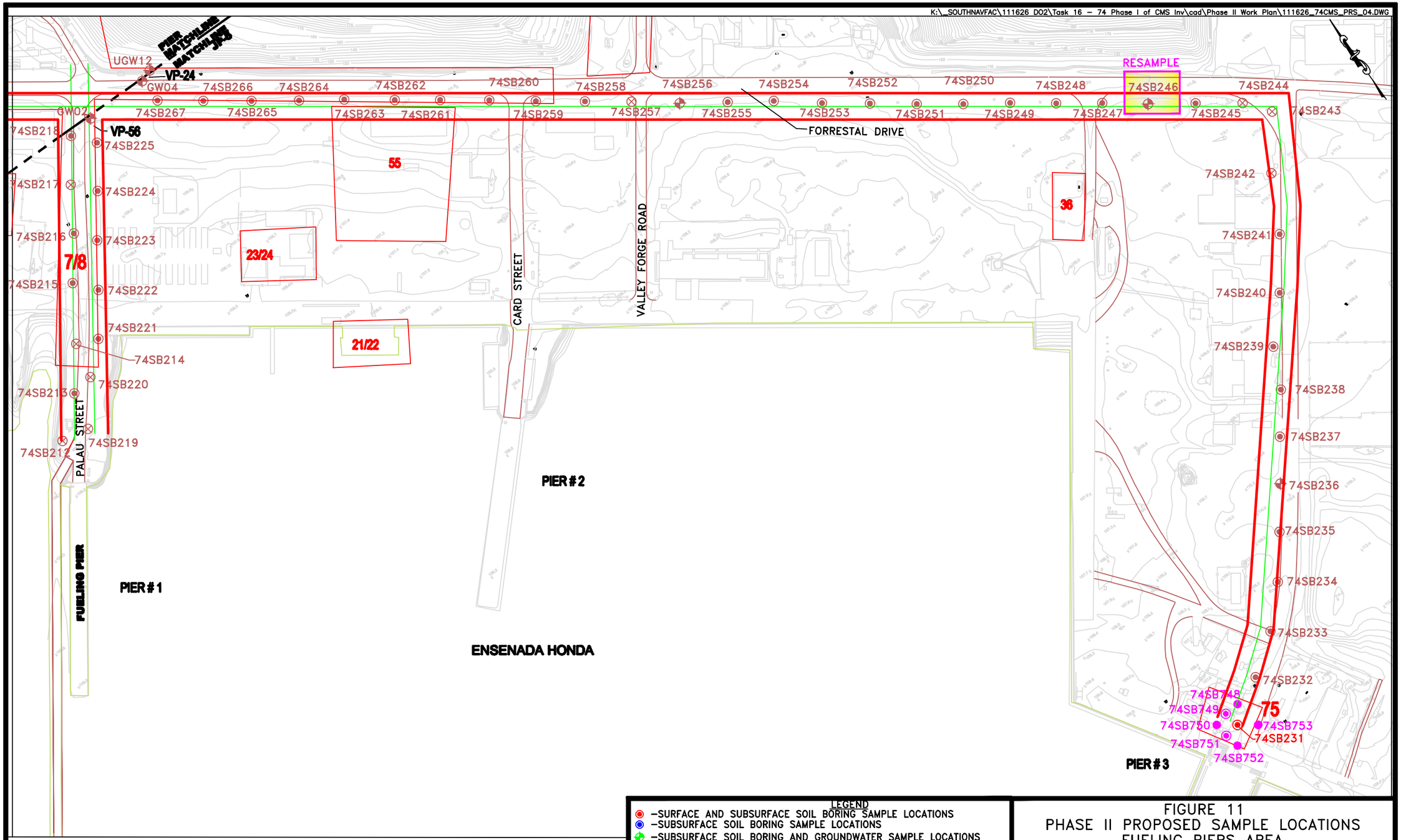

LEGEND

- –SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –SUBSURFACE SOIL BORING AND GROUNDWATER SAMPLE LOCATIONS
- –GROUNDWATER SAMPLE LOCATIONS
- –SOIL BORING REFUSAL NO SAMPLES COLLECTED
- –PROPOSED SURFACE AND SHALLOW SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –PROPOSED SURFACE AND SUBSURFACE SOIL BORING SAMPLE LOCATIONS
- –WETLAND DELINEATION
- –JP–5 PIPELINE
- –SWMU BOUNDARY

FIGURE 11
PHASE II PROPOSED SAMPLE LOCATIONS
FUELING PIERS AREA
SWMU 74–FUEL PIPELINES AND HYDRANT PITS
ADDENDUM A – PHASE II OF THE
CMS WORK PLAN
NAVAL ACTIVITY PUERTO RICO