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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN II)
Northern and Central California, Nevada, and Utah
Contract No. N62474-94-D-7609
Contract Task Order No. 284

Prepared for

DEPARTMENT OF THE NAVY
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FINAL
QUALITY ASSURANCE PROJECT PLAN ADDENDUM
FOR
FACILITYWIDE GROUNDWATER MONITORING

NAVAL STATION TREASURE ISLAND
SAN FRANCISCO, CALIFORNIA

DS.0284.17062-1

May 29, 2001

Prepared by

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Craig C. Freeman, Project Manager

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REVIEW AND APPROVALS

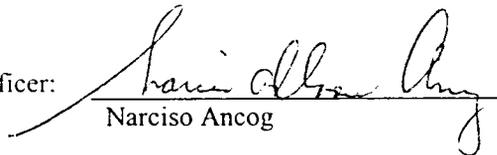
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FOR FACILITYWIDE GROUNDWATER MONITORING

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TOTAL DISSOLVED AND SUSPENDED SOLIDS
ADDENDUM
TO THE FIELD SAMPLING PLAN AND
QUALITY ASSURANCE PROJECT PLAN
FOR FACILITYWIDE GROUNDWATER MONITORING

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ACRONYMS AND ABBREVIATIONS

AGS	AGS, Inc.
AST	Aboveground storage tank
BCT	Base Closure Team
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
BRAC	Base Realignment and Closure
CAP	Corrective action plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CMW	Compliance monitoring well
CTO	Contract task order
DCB	1,2-dichlorobenzene
DQO	Data quality objective
ERM	ERM-West, Inc.
EPA	U.S. Environmental Protection Agency
EWI	Environmental work instruction
Fe ²⁺	Iron (II)
FSP	Field sampling plan
HSP	Health and safety plan
ID	Identification
IDW	Investigation-derived waste
LIMS	Laboratory information management system
LFR	LFR Levine-Fricke
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
µmhos/cm	Micromhos per centimeter
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mL	Milliliter
Mn ²⁺	Manganese (II)
MNA	Monitored natural attenuation
MS	Matrix spike
MSD	Matrix spike duplicate
MTBE	Methyl-tert-butyl ether
NAVSTA TI	Naval Station Treasure Island

ACRONYMS AND ABBREVIATIONS (Continued)

PAH	Polynuclear aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PM	Project manager
POC	Point of compliance
PPE	Personal protective equipment
PRC	PRC Environmental Management, Inc.
QA	Quality assurance
QAO	Quality assurance officer
QAPP	Quality assurance project plan
QC	Quality control
RI/FS	Remedial investigation/feasibility study
RPM	Remedial project manager
RWQCB	Regional Water Quality Control Board
SCM	Site conceptual model
SOW	Statement of work
SVOC	Semivolatile organic compound
SWDIV	Southwest Division, Naval Facilities Engineering Command
TPH	Total petroleum hydrocarbons
TPH-d	Total petroleum hydrocarbons-diesel
TPH-e	Total petroleum hydrocarbons-extractable (diesel and motor oil ranges)
TPH-g	Total petroleum hydrocarbons-gasoline
TPH-mo	Total petroleum hydrocarbons-motor oil
TPH-p	Total petroleum hydrocarbons-purgeable (gasoline range)
TtEMI	Tetra Tech EM Inc.
UST	Underground storage tank
VOC	Volatile organic compound
YBI	Yerba Buena Island

A1 INTRODUCTION

Tetra Tech EM Inc. (TtEMI) received Contract Task Order (CTO) No. 284 under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62474-94-D-7609 (CLEAN II) from the Department of the Navy, Naval Facilities Engineering Command, Southwest Division (SWDIV) and Engineering Field Activity West, to conduct facilitywide interim groundwater monitoring at environmental restoration sites at the former Naval Station Treasure Island (NAVSTA TI) in San Francisco, California. The scope of work (SOW) for this CTO is detailed in the project work plan and work plan modifications no. 1, 2, and 3 (TtEMI 1999b, 1999e, 2000d, 2000f). The groundwater monitoring to be completed under this CTO is conducted in support of two ongoing environmental restoration efforts: (1) a remedial investigation/feasibility study (RI/FS) at sites where substances defined as hazardous under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) have been detected (CERCLA sites), and (2) an investigation and remedial action in accordance with California underground storage tank (UST) regulations at sites where petroleum constituents have been identified (petroleum program sites). Accordingly, the information gained from groundwater sampling events is being used, as appropriate, to complete RIs and FSs for CERCLA sites and corrective action plans (CAP), interim action plans, construction summary reports, and closure reports for petroleum program sites.

This quality assurance project plan (QAPP) addendum has been prepared to support year 2001 groundwater monitoring activities at NAVSTA TI, and amends the project QAPP for the facilitywide groundwater monitoring program (TtEMI 2000b). Year 2000 groundwater sampling and analysis was successfully completed, and no deficiencies were noted in the 2000 QAPP. The updates incorporated into this 2001 QAPP addendum relate to continued work in year 2001 on previously defined data collection requirements for established environmental investigation sites (sections A3.1 through A3.9), the addition of new investigations sites (sections A3.10 through A3.16), and other minor updates for year 2001 groundwater monitoring. This 2001 QAPP addendum also incorporates all relevant information from the Navy's response to comments on the 2000 QAPP (TtEMI 2000c), which previously amended the draft 2000 QAPP as final. No ambient metals field sampling activities, however, are carried forward into this document because the calculation of ambient concentrations of metals in groundwater at NAVSTA TI has been completed (TtEMI 2000e, 2001b). Furthermore, the contents of this document

were detailed to representatives from the U.S. Environmental Protection Agency (EPA) and the State of California Regional Water Quality Control Board (RWQCB) at a meeting on April 16, 2001.

No regulatory agency objections on the 2001 groundwater monitoring approach and content were noted, and written concurrence was subsequently provided by the RWQCB (RWQCB 2001).

This QAPP addendum and the 2000 QAPP, along with the accompanying 2001 field sampling plan (FSP), form the sampling and analysis requirements for this CTO. All sampling and analysis to be completed in 2001 under the facilitywide groundwater monitoring program will be conducted in accordance with this QAPP addendum, the 2000 QAPP, and 2001 FSP. Accordingly, these three documents will be immediately available to all staff supporting work under this CTO. To simplify usage of this addendum, sections unchanged from the 2000 QAPP are identified as such in gray font in the table of contents, and are not presented further in this document to eliminate unnecessary repetition and printing.

The QAPP and QAPP addendum document policies, project organization, and quality assurance and quality control (QA/QC) procedures to be implemented for groundwater monitoring field activities at NAVSTA TI. The QAPP fully describes the project data quality objectives (DQO), which have been developed through the seven-step DQO process (EPA 1999a, 2000), and follows EPA guidance and requirements for preparation of QAPPs (EPA 1998, 1999b), as well as guidance from SWDIV.

In support of the data collection and measurement activities detailed in this QAPP, field activities will be conducted in accordance with TtEMI's CLEAN II Program Health and Safety Plan (HSP), Revision I (PRC Environmental Management Inc. [PRC] 1995) and the NAVSTA TI basewide HSP (PRC 1997); the health and safety requirements and procedures detailed in the HSPs will be reviewed for currency and updated, if necessary, prior to field mobilization. Additionally, in light of the voluminous amount of information supporting this facilitywide groundwater monitoring effort, a summary presentation of the site background and results of previous investigations is presented in this QAPP addendum and the 2000 QAPP, while more detailed site background and analysis of site information is presented in several NAVSTA TI groundwater monitoring reports (TtEMI 1999c, 2000g, 2000h).

A1.2 USAGE OF THE DOCUMENT

To ensure the quality and usability of the data collected, all sampling and analysis to be completed in year 2001 under the facilitywide groundwater monitoring program will be conducted in accordance with this QAPP addendum, the 2000 QAPP, and 2001 FSP.

A1.3.3 Facilitywide Groundwater Monitoring Program

Potential impacts to groundwater as a result of releases from operations when NAVSTA TI was an active base are being studied under the facilitywide groundwater monitoring program. As outlined on Figure A-2, groundwater impacts have been investigated under the facilitywide groundwater monitoring program at 14 sites or combined sites (to maximize understanding of hydrogeologic conditions and groundwater quality, groundwater investigations at adjoining sites have been combined: sites 04 and 19, sites 14 and 22, and sites F2A and F2B). There are 14 sites or combined sites where groundwater monitoring will be conducted under the 2001 facilitywide groundwater monitoring program:

- Site 06 – Fire Training School (petroleum program site)
- Site 11 – Yerba Buena Island Landfill (CERCLA site)
- Site 12 – Old Bunker Area (CERCLA site with a petroleum investigation sub-area)
- Site 14/22 – New Fuel Farm (Site 14) and Navy Exchange Service Station (Site 22) (both petroleum program sites)
- Site 180C – UST 180C (petroleum program site)
- Site 201 – UST 201 (petroleum program site)
- Site 21 – Vessel Waste Oil Recovery Area (CERCLA site)
- Site 227 – UST 227 (petroleum program site)
- Site 24 – 5th Street Fuel Releases/Dry Cleaning Facility (CERCLA site)
- Site 25 – Seaplane Maintenance Area (petroleum program site)
- Site 368B – UST 368B (petroleum program site)
- Site D4B – Pipeline Site D4B (petroleum program site)
- Site F2A/F2B – Pipeline Sites F2A and F2B (both petroleum program sites)
- Site USCG – Pipeline Site U.S. Coast Guard (petroleum program site)

Seven of these sites, which were either previously monitored by other Navy contractors or recently became the subject of a groundwater investigation that included the installation of monitoring wells, are new to the facilitywide groundwater monitoring program (sites 180C, 201, 227, 368B, D4B, F2A/F2B, and USCG).

As a result of previous monitoring and, as applicable, remedial activities, groundwater monitoring has been completed or placed in abeyance at 10 sites or combined sites where analytes of concern were not detected at elevated levels (sites 01, 04/19, 07/10, 09, 15, 17, 1A, 1E, 20, and 368A). Wells from inactive sites will be used for facilitywide measurement of water levels, as needed, and in a limited number of cases, monitoring wells from inactive sites may be used as down-, cross-, or upgradient wells to collect data for an active investigation area. Additionally, no groundwater monitoring is currently proposed at Pipeline Site D1B, an area undergoing pilot remedial activities and no monitoring wells are present.

In support of environmental monitoring and restoration activities, a total of 242 groundwater monitoring and remediation wells are maintained at NAVSTA TI: 171 monitoring wells and 71 remediation wells. Additionally, 13 monitoring wells are proposed for installation at Site 21 in July 2001 (TtEMI 2001a), and will be sampled under the facilitywide groundwater monitoring program in accordance with the requirements of this QAPP addendum, the 2000 QAPP, and the 2001 FSP.

A2.1 PROJECT ORGANIZATION AND PERSONNEL

The following personnel are involved in field efforts at NAVSTA TI. In some cases, more than one responsibility has been assigned to one person.

<u>Name</u>	<u>Responsibility</u>	<u>Location</u>	<u>Telephone</u>
Ellen Casados	Navy Remedial Project Manager	Naval Facilities Engineering Command, San Diego, CA	(619) 532-0968
Narciso Ancog	Navy QA Officer	Naval Facilities Engineering Command, San Diego, CA	(619) 532-2540
Daniel Chow	Program Manager	TtEMI, San Francisco, CA	(415) 222-8222
Greg Swanson	Program QA Manager	TtEMI, San Diego, CA	(619) 718-9676
Victor Early	Installation Coordinator	TtEMI, San Francisco, CA	(415) 222-8332

<u>Name</u>	<u>Responsibility</u>	<u>Location</u>	<u>Telephone</u>
Craig Freeman	Project Manager	TtEMI, San Francisco, CA	(415) 222-8209
Ron Ohta	Project QA Manager	TtEMI, Sacramento, CA	(916) 853-4506
Conrad Sherman	Program Health and Safety Manager	TtEMI, San Francisco, CA	(415) 222-8377
William Warren	Project Health and Safety Coordinator	TtEMI, San Francisco, CA	(415) 222-8293
Kevin Hoch	Project Chemist	TtEMI, San Francisco, CA	(415) 222-8304
Teri Pham	Field Team Leader, On-site Health and Safety Officer	TtEMI, San Francisco, CA	(415) 222-8271
Winnie Kwong	Database Manager	TtEMI, San Francisco, CA	(415) 222-8328
Susan Gallagher	Sample Tracking Coordinator	TtEMI, San Francisco, CA	(415) 222-8329

Project team member roles and responsibilities are outlined in the facilitywide groundwater monitoring organization flowchart (Figure A-6); team member responsibilities are presented in detail in Section A2.2 of the 2000 QAPP.

A2.4 PROJECT SCHEDULE

The implementation schedule for sampling, analysis, and associated reporting is presented as Table 8-1 in the 2001 FSP.

A3 SITE BACKGROUND AND PROBLEM DEFINITION

Information related to year 2001 data collection requirements for established environmental investigation sites is presented in sections A3.1 through A3.9, while information on new investigation sites is presented in sections A3.10 through A3.16. All sites are shown on the updated facilitywide map (Figure A-2); detailed site-specific maps are located in the 2001 FSP.

A3.1 SITE 06 – FIRE TRAINING SCHOOL

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 06 – Fire Training School, a petroleum program site (Figure A-2 and FSP Figure 3-3).

Background information on Site 06 is presented in the 2000 QAPP, whereas the information in the following section updates the purpose of the investigation for year 2001 groundwater monitoring activities.

A3.1.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect data on total petroleum hydrocarbons (TPH) (TPH-extractables [TPH-e] and TPH-purgeables [TPH-p]); volatile organic compounds (VOC) (petroleum constituent information); and semivolatile organic compounds (SVOC) and metals (data related to previous burn activities at the site), as well as limited fate and transport data. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.2 SITE 09 – FOUNDRY

Groundwater monitoring data collected in 2000 and in previous monitoring years have satisfied groundwater monitoring DQOs for Site 09 – Foundry, a CERCLA site (Figure A-2 and FSP Figure 3-4). Suspension of groundwater monitoring was recommended and concurrence secured at a meeting on the 2001 NAVSTA TI facilitywide groundwater monitoring program held at State of California RWQCB offices on April 16, 2001 (RWQCB 2001).

A3.2.3 Purpose of Current Investigation

No additional groundwater monitoring data is required at this site in year 2001.

A3.3 SITE 11 – YERBA BUENA ISLAND LANDFILL

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 11 – Yerba Buena Island Landfill, a CERCLA site (Figure A-2 and FSP Figure 3-5).

Background information on Site 11 is presented in the 2000 QAPP, whereas the information in the following section updates the purpose of the investigation for year 2001 groundwater monitoring activities.

A3.3.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this CERCLA site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect data on metals, SVOC, total TPH (TPH-e and TPH-p), and VOC (petroleum constituent information) concentrations in groundwater, as well as related fate-and-transport data. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.4 SITE 12 – OLD BUNKER AREA

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 12 – Old Bunker Area, a CERCLA site (Figure A-2 and FSP Figure 3-6). The information presented in the following sub-sections updates the background and purpose of the investigation for year 2001 groundwater monitoring activities at Site 12.

A3.4.1 Background

The area within Site 12 was previously used as an aircraft runway and for various other activities, including ammunition storage, debris and trash disposal, and oil storage. Suspected sources of contamination at this site were identified as the debris disposal areas, former ammunition bunker areas, and a former oil UST. A petroleum release sub-area is located within the southern portion of Site 12, adjacent to Building 1311.

Additionally, a recently investigated area known as the Former Storage Yard is located within the southeastern area of Site 12. The Former Storage Yard was identified using aerial photographs taken in 1946 and 1947, which showed it as a storage area. The Former Storage Yard covers 175,000 square feet. Naval housing units, some of which are currently occupied, were constructed in this area in the 1960s. Historical information documenting the materials stored in the area has not been located. A field investigation of the area was conducted between October 1999 and May 2000, and polychlorinated biphenyl (PCB) concentrations were detected in soil. As a result of this initial environmental investigation, the Navy removed an extensive area of soil in the Halyburton Court area.

The hydrogeologic setting of Site 12 is characterized by fill material that is predominantly composed of fine- to medium- and coarse-grained sand. Groundwater generally flows towards the shoreline. Detailed descriptions of the site history and background of Site 12 are presented in the Site 12 draft RI report (TtEMI 1999d).

A3.4.3 Purpose of Current Investigation

The purposes of the current groundwater investigation at this site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to (1) collect data on metals, PCB, SVOC, total TPH (TPH-e and TPH-p), and VOC concentrations in groundwater and related fate-and-transport data from monitoring wells installed in potential debris disposal areas; (2) collect total data on total TPH (TPH-e and TPH-p), VOCs (petroleum constituent information), metals and SVOCs (as related to potential presence of waste oils or unknown fuels), and related fate-and-transport data from monitoring wells in the petroleum release sub-area adjacent to Building 1311; and (3) collect PCB and SVOC data from monitoring well 12-MW032, which is installed downgradient of the soil removal area within the Former Storage Yard. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.5 SITE 14 – NEW FUEL FARM AND SITE 22 – NAVY EXCHANGE SERVICE STATION

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 14 – New Fuel Farm and Site 22 – Navy Exchange Service Station, a combined petroleum program site (Figure A-2 and FSP Figure 3-7). Background information on Site 14/22 is presented in the 2000 QAPP, whereas the information in the following section updates the purpose of the investigation for year 2001 groundwater monitoring activities.

A3.5.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect data on total TPH (TPH-e and TPH-p); VOCs (petroleum constituent information); and SVOCs and metals (data related to the potential presence of waste oils in groundwater at the site), as well as limited fate and transport data. A

summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.6 SITE 15 – OLD FUEL FARM

Groundwater monitoring data collected in 2000 and in previous monitoring years have satisfied groundwater monitoring DQOs for Site 15 – Old Fuel Farm, a petroleum program site (Figure A-2 and FSP Figure 3-8). Suspension of groundwater monitoring was recommended and concurrence secured at a meeting on the 2001 NAVSTA TI facilitywide groundwater monitoring program held at State of California RWQCB offices on April 16, 2001 (RWQCB 2001).

A3.6.3 Purpose of Current Investigation

No additional groundwater monitoring data is required at this site in year 2001.

A3.7 SITE 21 – VESSEL WASTE OIL RECOVERY AREA

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 21 – Vessel Waste Oil Recovery Area, a CERCLA site (Figure A-2 and FSP Figure 3-10). Background information on Site 21 is presented in the 2000 QAPP, whereas the information in the following section updates the purpose of the investigation for year 2001 groundwater monitoring activities.

A3.7.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this CERCLA site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect VOC and related fate-and-transport data. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.8 SITE 24 – 5TH STREET FUEL RELEASES / DRY CLEANING FACILITY

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 24 – 5th Street Fuel Releases/Dry Cleaning Facility, a CERCLA site (Figure A-2 and FSP

Figure 3-11). Background information on Site 24 is presented in the 2000 QAPP, whereas the information in the following section updates the purpose of the investigation for 2001 groundwater monitoring activities.

A3.8.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this CERCLA site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect VOC and related fate-and-transport data. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.9 SITE 25 – SEAPLANE MAINTENANCE AREA

Consistent with project DQOs (Section A1.4, QAPP), year 2001 groundwater monitoring data is required for Site 25 – Seaplane Maintenance Area, a petroleum program site (Figure A-2 and FSP Figure 3-12). Background information on Site 25 is presented in the 2000 QAPP, whereas the information in the following section updates the purpose of the investigation for 2001 groundwater monitoring activities.

A3.9.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p); VOC data (petroleum constituent information); and metals data (data related to the potential presence of aviation fuel in groundwater at the site), as well as limited fate and transport data. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.10 SITE 180C – UST 180C

Site 180C – UST 180C, a petroleum program site, is located near Site 25 toward the southern shore of Treasure Island (Figure A-2 and FSP Figure 3-13). The following sections provide background information related to the site and an evaluation of groundwater analytical results. A groundwater site conceptual model is presented as Figure A-16.

A3.10.1 Background

Building 180 was constructed in 1943 as an aircraft hanger (Navy 1995). From 1946 until 1997, the building was used as a "self help" center and transportation shop. Little information exists on the exact locations of operations at the building. Hazardous materials utilized by these operations may have included aviation fuel, engine oil, lubricants, and cleaning solvents. UST 180C was a 4,000-gallon steel waste oil tank that was formerly located at the northeast corner of Building 180, approximately 450 feet from the shoreline. The tank was reported to be in good condition when it was removed in May 1992 (PRC 1994a). Building 180 is currently used on a periodic basis for a variety of special events.

The hydrogeologic setting of UST site 180C is characterized by artificial fill material that is predominantly composed of silty sand underlain by fine sands with traces of silt (ERM-West, Inc. [ERM] 1997). Groundwater is encountered at approximately 6 feet below ground surface (bgs). Groundwater flows south towards the shoreline, with eastward deflections that are likely artifacts of gradient changes induced by tidal flux or a freshwater source to the west near Building 1. Subsurface storm drains that cross the site near the former UST may influence groundwater locally.

A3.10.2 Groundwater Status

Review of past groundwater analytical data details a pattern of elevated TPH-diesel (TPH-d) near the south end of the UST. Floating product has been consistently observed at monitoring well 180C-MW4 since its installation in 1999. Grab groundwater samples collected in 1995 delineated an area of TPH that extended partially under Building 180, immediately south of the location of the former UST. Low levels of polynuclear aromatic hydrocarbons (PAH) have also been detected at the site. An interim action to address the floating product is currently being planned for this site and is expected to be implemented in 2001.

During the most recent sampling event in December 1999, cis-1,2-dichloroethene, chlorobenzene, 1,2-dichlorobenzene (DCB), and 1,4-DCB were observed at 180C-MW4 at 0.0028, 0.076, 0.42, and 0.098 milligrams per liter (mg/L), respectively. These results confirm earlier detections of DCB at two grab groundwater locations slightly upgradient of this well. These chlorinated compounds are apparently related to the waste oils that were stored in the UST. In 1995, low concentrations of 1,1,1-trichloroethane were detected at monitoring wells 180C-MW1 through 180C-MW3 and several grab groundwater sampling

locations. This compound was not detected at any of the monitoring wells during the subsequent four sampling rounds between October 1997 and December 1999, and appears to have been anomalous.

A3.10.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH (TPH-e and TPH-p), VOC, SVOC, and metals data and related fate-and-transport data. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.11 SITE 201 – UST 201

Site 201 – UST 201, a petroleum program site, is located toward the center of Treasure Island, along the east side of Building 201 (Figure A-2 and FSP Figure 3-14). The following sections provide background information related to UST 201 and an evaluation of groundwater analytical results from 1999 and previous sampling years. A groundwater site conceptual model is presented as Figure A-17.

A3.11.1 Background

Building 201 was constructed in 1944 as a galley and mess hall (Navy 1995). It continued to be used for food service until approximately 1961 when it was converted for use as a retail store and warehouse. UST 201 was a 2,000-gallon steel diesel fuel tank that the Navy closed in place in September 1992 (PRC 1994a). The former tank is located beneath a portion of Building 201, adjacent to the loading dock along the east side of the building, approximately 1,000 feet from the shoreline. The UST would have been filled from the fuel storage area (aboveground storage tank [AST] 103) using pipeline D4 (see Section A3.10 for more details regarding pipeline D4). Building 201 is currently vacant.

The hydrogeologic setting of UST site 201 is characterized by artificial fill material that is predominantly composed of fine- to medium-grained sand, with occasional thin clay layers. Groundwater is encountered at approximately 6 feet bgs. Groundwater flows east towards the shoreline, with a relatively flat gradient of 0.002 feet per foot (AGS, Inc. [AGS] 2000).

A3.11.2 Groundwater Status

Review of current and past groundwater analytical data details a pattern of TPH-d detections in groundwater at monitoring well 201-MW1. TPH-d in the well ranged from 0.12 mg/L in October 1998 to 1.8 mg/L in December 1999. Four additional monitoring wells (201-MW2 through 201-MW5) were installed in late 1999, and had concentrations of TPH-d ranging from less than 0.05 mg/L at 201-MW3 to 1.1 mg/L at 201-MW2. TPH-gasoline (TPH-g); benzene, toluene, ethylbenzene, and xylene (BTEX); methyl-tert-butyl ether (MTBE); and lead have not been detected at the site. None of the monitoring wells at this site were sampled during 2000.

A3.11.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p), VOC data (petroleum constituent information), and fate-and-transport data related to detected TPH concentrations. Three additional rounds of groundwater monitoring are planned for 2001. A summary of year 2001 data collection requirements can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.12 SITE 227 – UST 227

Site 227 – UST 227, a petroleum program site, is located near the western shore of Treasure Island at Building 227, near the intersection of Avenue B and 4th Street (Figure A-2 and FSP Figure 3-15). The following sections provide background information related to UST 227 and an evaluation of groundwater analytical results from 1999 and previous sampling years. A groundwater conceptual model is presented as Figure A-18. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.12.1 Background

Building 227 was constructed in 1944 as a galley and officer's dining hall (Navy 1995). It continued to be used for food service until approximately 1988 when it was converted for use as the Fog Watch Club. UST 227 was a 1,000-gallon steel diesel fuel tank that was formerly located adjacent to the northeast corner of Building 227, approximately 200 feet from the western shoreline of Treasure Island. The UST

was installed in the mid-1940s, and the Navy removed the UST and associated piping in July 1992 (PRC 1994a). Numerous holes were observed in the walls of the UST when it was removed.

Building 227 is currently vacant.

According to a 1945 Navy drawing, a 1.5-inch diesel pipeline extended to Building 227, from the terminus of the D2 pipeline at 5th Street and Avenue D (Navy 1945). The approximately 1,200-foot pipeline was apparently out of service by 1949. Recent efforts to locate the pipeline were unsuccessful (Tetra Tech, Inc. 1997). This pipeline was apparently removed after the demolition of the exposition-era “palaces,” and specifically Palace K, in the late 1940s. Investigation of soil and groundwater along the former alignment of this pipeline, known as Pipeline Site D2B, detected only minimal contamination. The Navy expects to close site D2B without further investigation.

The hydrogeologic setting of UST 227 is characterized by artificial fill material that is predominantly composed of fine-grained sand, with some gravel and silt (AGS 2000). Groundwater is encountered at approximately 8 feet bgs. Groundwater in the immediate vicinity of the UST flows northeast away from the shoreline and apparently toward a 24-inch storm drain that runs along the east side of Avenue B, approximately 65 feet downgradient from the former UST (ERM 1997). A 12-inch spur of this storm drain, which drains the parking lot immediately north of Building 227, passes within 15 feet of the former UST location and is apparently positioned several feet below dry season water levels. The former UST was located approximately 250 feet from San Francisco Bay. The groundwater gradient is variable across the site, depending upon the proximity of the storm drain, at approximately 0.002 to 0.003 feet per foot (AGS 2000).

A3.12.2 Groundwater Status

Review of past groundwater analytical data details a pattern of elevated TPH-d in saturated zone soils and groundwater surrounding the location of the former UST. In 1997, floating product was observed at a direct push sampling location immediately north of the former UST, near a storm drain manhole. Although free product may have reached the storm drain at some point in the past, the total TPH concentration (0.25 mg/L) in a groundwater sample collected in December 1999 from a monitoring well in this vicinity (227-MW4) was less than the NAVSTA TI total TPH screening criterion of 1.4 mg/L (TtEMI 2001c). TPH has not been detected at other monitoring wells at the site; however, the storm drain may prevent groundwater from flowing to monitoring well 227-MW5. TPH contamination likely spreads at least a short distance under

Building 227 since the UST was located within approximately 5 feet of the building. Groundwater flow under Building 227, once a sufficient distance from the storm drain, may be shoreward. Grab groundwater samples were recently collected along the perimeter of Building 227 to determine whether TPH has migrated directly toward the shoreline. TPH-g, BTEX, and MTBE have not been detected at any of the monitoring wells. The monitoring wells at the site were not sampled in 2000. An interim action to address contaminated soil and potential floating product is currently being planned for this site and is expected to be implemented in 2001.

A3.12.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p), VOC data (petroleum constituent information), and fate-and-transport data related to detected TPH concentrations. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.13 SITE 368B – UST 368B

Site 368B – UST 368B, a petroleum program site, is located at the north end of Building 368, approximately 1,000 feet from the western Treasure Island shoreline (Figure A-2 and FSP Figure 3-16). The following sections provide background information related to UST 368B and an evaluation of groundwater analytical results from 1999 and previous sampling years. A groundwater conceptual model is presented as Figure A-19.

A3.13.1 Background

Building 368 was constructed in 1957 as the enlisted men's dining hall (Navy 1995), and the Job Corps (U.S. Department of Labor) continues to use the building as a cafeteria. UST 368B was a 1,000-gallon steel diesel fuel tank that was located near the northeast corner of the building. The Navy removed the UST and associated piping in July 1992 (PRC 1994a). During removal of the UST, a 0.5-inch-diameter hole was observed in the wall of the tank.

The hydrogeologic setting of UST site 368B is characterized by artificial fill material that is predominantly composed of fine-grained sand with traces of silt. Groundwater is encountered at approximately 5.0 feet bgs (AGS 2000). Groundwater flows west towards the shoreline, with a gradient of 0.002 feet per foot (ERM 1997).

A3.13.2 Groundwater Status

Review of past groundwater analytical data details a pattern of elevated TPH-d in saturated zone soils and groundwater surrounding and immediately downgradient of the location of the former UST. Although most of the monitoring wells at the site were installed in 1995, monitoring wells 368B-MW4 and 368B-MW5 were installed in late 1999. In December 1999, TPH-d was detected at 0.45 mg/L in source area monitoring well 368B-MW4. TPH-d has not been detected at other monitoring wells at the site. TPH contamination likely spreads at least a short distance under Building 368; however, the existence of a basement level to this building may restrict the migration of the contamination. A grab groundwater sample was recently collected along the west side of Building 368 to determine whether TPH has migrated further to the southwest of the former UST, toward the shoreline. TPH-g, BTEX, and MTBE have not been detected at any of the monitoring wells. The monitoring wells were not sampled in 2000.

A3.13.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p), VOC data (petroleum constituent information), and fate-and-transport data related to detected TPH concentrations. Three additional rounds of groundwater monitoring are planned for 2001. A summary of year 2001 data collection requirements can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.14 SITE D4B – PIPELINE SITE D4B

Pipeline Site D4B, a petroleum program site, is located near the center of Treasure Island and includes petroleum-affected areas centered on Building 29 and Avenue I near its intersection with 6th Street, north of Building 99 (Figure A-2 and FSP Figure 3-11). The following sections provide background

information related to Pipeline Site D4B and an evaluation of groundwater analytical results from 2000 and previous sampling years. A groundwater conceptual model is presented as Figure A-20.

A3.14.1 Background

Pipeline D4 was a 2-inch diameter steel line that was used to transport diesel fuel to the former galley and mess hall at Building 201 (Navy 1945). The pipeline was installed in approximately 1945 and probably operated at least until 1961 when Building 201 was converted for use as a retail store and warehouse (Navy 1944, 1995). The pipeline was used to fill UST 201, which is located under the loading dock area of the building (see Section A3.11 for details regarding this UST). Pipeline D4 followed a relatively straight course north down Avenue I, from its intersection with the D2 pipeline at 6th Street to its termination at Building 201.

For convenience, the D4 pipeline has been divided into northern and southern study areas, referred to as sites D4A and D4B, respectively. Investigations at Pipeline Site D4A have revealed only minimal petroleum contamination, and the Navy expects to close the site without the need for further action. The southern portion of pipeline D4 (site D4B) extends from 6th Street (adjacent to Building 99) to approximately 8th Street. Buildings 29 and 260 flank Avenue I to the west and east in this area. The northern boundary of Site 24 overlaps with the southern two-thirds of Pipeline Site D4B.

In 1997, the Navy excavated and removed 977 linear feet of the D4 pipeline (Cal, Inc. 1998). The line was encountered between approximately 1.5 and 2.0 feet bgs. During its removal, no evidence of laterals having branched from the line was observed. A 40-foot section of the line, where it would have crossed 6th Street, could not be located during the excavation and was assumed to have been previously removed. In two locations immediately adjacent to Building 29, the pipeline had ruptured and resulted in visible soil contamination. During the fuel pipeline removal activities, these areas were excavated to approximately 6 feet bgs to remove contaminated soil (TtEMI and Jonas and Associates 1999). Based on visible staining, additional contamination that could not be removed appeared to extend under Building 29.

In addition to the D4 pipeline, part of the former D2 pipeline was located within the boundary of Pipeline Site D4B. In this area, the D2 pipeline was a 2-inch steel diesel pipeline that connected the D4 line to AST 103 (located at 5th Street and Avenue H) and continued eastward along 6th Street to the former UST

at Building 230. During the pipeline interim action in 1997, the Navy excavated and removed approximately 480 linear feet of the D2 pipeline from along 6th Street and south of Building 96 (TtEMI and Jonas and Associates 1999). During the excavation, the Navy was unable to locate either an approximately 80-foot section of pipe that ran adjacent to the west side of Building 96 or a 350-foot section on Avenue H that ran between AST 103 and 6th Street. Visibly contaminated soil was observed and excavated at two locations along the pipeline. One of these excavations was at the intersection of pipelines D2 and D4, adjacent to the north side of Building 99. The other soil excavation location was north of Building 230.

Aside from the pipelines, potential contaminant sources within site D4B include the former laundry operations at Building 99 (Site 24) and a suspected UST associated with Building 29. See Section A3.8 of this QAPP addendum for details regarding Site 24. Building 29 was built in 1942 for use as a galley and mess hall (Navy 1995). According to an historic Navy drawing, UST 29 supplied "fuel oil" to the galley and was located in an alcove along the east side of the building (Navy 1942). The UST may have only been in service from 1942 until 1945 when the building was converted for use as the Radio School (Navy 1995). The building is currently vacant. Several studies have been conducted in attempt to locate the tank, including geophysical and air excavation techniques (ERM 1996). The UST was not located; however, a remnant of an apparent UST vent pipe still exists.

The hydrogeologic setting of Pipeline Site D4B is characterized by artificial fill material that is predominantly composed of fine- to medium-grained sand, with some shell fragments and occasional thin clay layers (AGS 1998). Groundwater at the site is encountered at approximately 6 feet bgs. Groundwater flows east towards the shoreline.

A3.14.2 Groundwater Status

Review of current and past groundwater analytical data details a pattern of elevated TPH-d in saturated zone soils and groundwater within the central area of Pipeline Site D4B (AGS 1998; TtEMI and LFR Levine-Fricke [LFR] 2000, 2001a). The affected area extends from near the center of Building 29 to approximately 200 feet downgradient, to the east, under Building 260. Laterally, the area covers roughly 150 feet along Avenue I, from monitoring well 29-MW3 to a point slightly beyond monitoring well 29-MW2. Reported TPH-d concentrations in grab groundwater samples have ranged as high as 300 mg/L at a boring approximately 40 feet downgradient from 29-MW1. In December 1997, TPH-d was observed at

concentrations of 3.5 and 0.16 mg/L at monitoring wells 29-MW2 and 29-MW3, respectively (AGS 1998). TPH-g was also detected at a concentration of 0.16 mg/L at 29-MW2, but the detection may have been related to degradation by-products of the diesel rather than a release of gasoline. No BTEX was detected during this sampling event. MTBE and lead were also analyzed but were not detected. These three monitoring wells (29-MW1 through 29-MW3) have not been sampled since 1997, and the other monitoring well at the site (D4B-MW01) was installed in March 2001 and has not yet been sampled. It should be noted that a "solventy" odor was observed during installation and development of well D4B-MW01, and the well appears to be near the edge of the Site 24 tetrachloroethene (PCE) plume.

Along the north side of Building 99, TPH-d has been observed in several grab groundwater samples at a maximum concentration of 4.1 mg/L. This area of contamination probably resulted from at least one rupture in the D2 line and encompasses the soil excavation area adjacent to Building 99 discussed above (Section A3.14.1). TPH contamination may have spread under a portion of Building 99 and will be investigated further as part of Site 24 activities. The nearest downgradient well, 24-MW04, has not been sampled recently for TPH, but samples collected during five sampling events from 1992 to 1995 contained no detectable TPH-d.

A3.14.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p), VOC data (petroleum constituent information), and fate-and-transport data related to detected TPH concentrations. VOC data will also be used to support the Site 24 groundwater investigation. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.15 SITE F2A/F2B – PIPELINE SITES F2A AND F2B

Combined Site F2A/F2B – Pipeline Sites F2A and F2B is a petroleum program site located along 5th Street; this site stretches from near the center of Treasure Island at Avenue H to the eastern shoreline at Avenue N (Figure A-2 and FSP Figure 3-11). The following sections provide background information related to pipeline sites F2A and F2B and an evaluation of groundwater analytical results from 2000 and previous sampling years. A groundwater conceptual model is presented as Figure A-21.

A3.15.1 Background

Former pipeline F2 consisted of three independent, approximately 1,200-foot lines that transported fuel along 5th Street, from the fuel storage area at ASTs 103 and 104 (Avenue H) to pipeline D1 and the former fueling pier at Avenue N. Former pipeline F2 also connected into the D2 line near the intersection of 5th Street and Avenue H. Two sections of the former F2 pipelines were 8-inch steel bunker fuel lines, while the third section was a 4-inch diesel fuel line (Cal, Inc. 1998). The Navy installed the lines in approximately 1945. The former F2 pipelines have been divided into eastern and western study areas, referred to as sites F2A and F2B, respectively. The F2A site comprises an area to either side of 5th Street between Avenues M and N. The F2B site surrounds 5th Street from Avenue M to the vicinity of Avenue H. Most of the area of these sites is within the southern half of Site 24.

In 1997, the Navy excavated and removed the F2 pipelines. The lines were encountered between 2.0 and 3.5 feet bgs. During their removal, it did not appear that any laterals had branched from the line. A 160-foot portion of the 4-inch diesel line, where it would have crossed Avenue M, could not be located during the excavation and was assumed to have been previously removed. The Navy conducted soil excavations at the following four locations along pipeline F2 (5th Street): two areas to either side of Avenue N, adjacent to the north side of Building 92, and along the east side of the AST 104 berm (TtEMI and Jonas and Associates 1999). In addition, a concrete vault was excavated at the northwest corner of Avenue M and 5th Street. During removal of the vault, an unknown volume of free product was recovered. Other areas of free product were observed between Building 92 and Avenue N but were generally not addressed during the removal action. A fourth 180-foot section of pipeline was also removed from a location approximately 65 feet north of the other F2 pipelines, at their intersection with Avenue N. The pipeline segment was a 1.5-inch fuel oil line that supplied fuel to former Building 14 (Heating Plant No. 1). Building 14 was built no later than 1942 and demolished in 1962 (Navy 1995). The pipeline was encountered at approximately 2.5 feet bgs. According to an historic Navy drawing, this fuel line connected into two USTs or ASTs adjacent to the south side of Building 14 and then turned south across 5th Street to the galley and mess hall at Building 8 (Navy 1944). The two approximately 100-foot segments of this pipeline, which apparently crossed 5th Street and connected the line into the D1 pipeline (at the east end) and Building 8 (at the west end), were not located during the F2 pipeline excavation. Recent geophysical surveys conducted in the area of the Building 14 tanks indicated that no USTs currently exist at the site.

Aside from the pipelines, potential contaminant sources within sites F2A and F2B include former UST 234 and associated piping, ASTs 103 and 104, and operations at Sites 04/19, 05, 17, and 24. UST 234 was a 600-gallon steel fuel oil tank that apparently supplied fuel to a boiler in Building 234 (Cal, Inc. 1998). Building 234 was constructed in 1944 as the nurse's quarters and had been demolished by 1977 (Navy 1995). UST 234 was removed during the pipeline removal action along with approximately 90 feet of piping. Post-removal grab samples and subsequent pipeline-related characterization sampling indicate that UST 234 did not release petroleum to the environment. The Navy anticipates closure of this UST site without further action. Details regarding groundwater monitoring at the other sites may be found in the discussion for Site 24 (Section A3.8).

The hydrogeologic setting of pipeline sites F2A and F2B is characterized by artificial fill material that is predominantly composed of fine- to course-grained sand, with some shell fragments and occasional thin clay layers (Navy 1998). Groundwater depth varies across the site and is encountered at approximately 6 feet bgs near Avenue H and approximately 8 feet bgs near the eastern shoreline. Groundwater flows east towards the shoreline.

A3.15.2 Groundwater Status

Review of groundwater analytical data details a pattern of elevated extractable TPH (diesel and motor oil range) in groundwater along 5th Street. The extent of soil and groundwater contamination along the pipeline alignment has been defined using both in situ measurements of TPH (laser-induced fluorescence) and standard ex situ discrete sample laboratory analysis (Navy 1998; TtEMI and LFR 2001a, 2001b). Several areas of free product have been detected, including two areas at Pipeline Site F2A that are currently the subject of an interim action to recover the free product. No analytical data are currently available from monitoring wells within the most contaminated area of these sites. Several existing monitoring wells associated with the investigations at Sites 04/19, 17, and 24 provide crossgradient and upgradient data for pipeline sites F2A and F2B. In addition, three monitoring wells (F2A-MW01, F2A-MW02, and F2B-MW01) were recently installed at the F2 pipeline sites to enhance upgradient and crossgradient coverage.

The only detections of BTEX, phenanthrene, and chlorobenzene were associated with TPH-g, TPH-d, and TPH-motor oil (TPH-mo) reported in a grab groundwater location slightly upgradient of F2A-MW02. These detections appear to be associated with a localized release, and all other TPH-g detections at these two sites are likely related to diesel sources. Anomalous low concentrations of MTBE were detected at two

separate grab groundwater locations at site F2A, but no TPH was detected in these same samples. PCE and related chlorinated degradation products have been detected at several grab groundwater locations near Sites 5 and 17 and are likely the result of degreasing activities at the former heating plant and ASTs 103 and 104.

A3.15.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p), VOC data (petroleum constituent information), SVOC data (potential presence of bunker fuel), and fate-and-transport data related to detected TPH concentrations. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A3.16 SITE USCG – PIPELINE SITE U.S. COAST GUARD

Site USCG – Pipeline Site USCG, a petroleum program site, is located along the east shore of Yerba Buena Island (YBI) and includes petroleum-affected areas covering the western edge of Site 11 and most of the low-lying, central portion of the U.S. Coast Guard facility (Figure A-2 and FSP Figure 3-17). The following sections provide background information related to Pipeline Site USCG and an evaluation of groundwater analytical results. A groundwater conceptual model is presented as Figure A-22.

A3.16.1 Background

The USCG pipeline site encompasses a broad, mostly level area that historically had at least two fuel pipelines that ran along the inland edge of the site. The pipelines were part of the FO3 pipeline that extended from former fueling piers (Piers 3 and 4) and ASTs 169 and 214, along the north side of YBI (Dames and Moore 1988). According to a 1929 Navy drawing, a 3-inch fuel oil line followed the original shoreline from a point near Building 213 and north of Building 40 to the vicinity of the U.S. Coast Guard pier (Navy 1929). The pipeline apparently supplied fuel to former Building 47 (Receiving Ship Boiler House) and a former AST known as Oil Tank No. 4 (Navy 1929, 1995). The pipeline probably also supplied fuel to other points near the end of the pipeline, such as the pier and former Building 70A (Kitchen and Heating Plant).

In the late 1930s or early 1940s, much of the area that is now the USCG pipeline site was reclaimed from the bay. By approximately 1943, the Navy had apparently relocated the FO3 pipeline to an alignment south of Building 40. Reportedly, this pipeline was a 2-inch diesel line that transported fuel to former Buildings 57 (Schoolhouse), 70A, and 238 (Recreation Building) (Navy 1954; Dames and Moore 1988). A 1,000-gallon UST may have existed adjacent to the west side of former Building 238; the UST would have fed a boiler room within the building (AGS 2001). By 1961, Buildings 70A, 238, and others were demolished (Navy 1995). The area was subsequently regraded, and the current U.S. Coast Guard complex was built. Although portions of the two pipelines may have been removed during various construction activities within the USCG site, no records have been located that document their fate prior to the Navy fuel pipeline removal action in 1997. The U.S. Coast Guard does not appear to have had any use for the pipelines.

During the Navy fuel pipeline removal action, the Navy excavated and removed approximately 1,360 linear feet of the FO3 pipeline (Cal, Inc. 1998). The lines were encountered between 2.0 and 3.0 feet bgs. A 3-inch and 4-inch pair of diesel pipelines was removed adjacent to Macalla Road, between the north side of YBI and a point immediately north of Building 270. Both ends of these pipelines were found uncapped, and elevated TPH concentrations were reported in the confirmation sample collected at the south end of the lines. Their alignment closely matched the 2-inch line shown on a 1954 Navy drawing. The 4-inch pipeline branched in a valve box southeast of Building 213 and followed the alignment of a 3-inch line shown on a 1929 Navy drawing. The line continued to a point north of Building 40 where it terminated (pipeline was found capped during its removal) (TtEMI and Jonas and Associates 1999). The two pipelines have not been traced further into the U.S. Coast Guard facility.

Aside from the pipelines, several other potential sources exist within Pipeline Site USCG, including existing USTs 204A and 204B, former UST 270, several former and existing U.S. Coast Guard USTs, other miscellaneous tanks, and activities at Site 11 (see Section 3.5 for a discussion of Site 11). In 2000, USTs 204A and 204B were tentatively located using geophysical techniques (LFR 2001a, 2001b). These 5,000-gallon gasoline tanks were apparently installed in 1936 and were associated with a garage (Building 204) that was built in 1934 (Navy 1936, 1995). USTs 204A and 204B have yet to be sampled or removed. UST 270 was a 550-gallon diesel tank that apparently supplied fuel to Building 270 (Heating Plant). Since Building 270 was constructed in approximately 1961, it is probable that UST 270 was installed at the same time (Navy 1995). Pipeline fuel service was likely terminated during this

period as the U.S. Coast Guard facility was constructed. UST 270 was removed in March 1990 after a surface spill impacted the area around the tank (PRC 1990).

The U.S. Coast Guard has removed two USTs from within Pipeline Site USCG and continues to operate two other diesel USTs of 6,000- and 10,000-gallon capacities. In addition, two abandoned USTs are apparently located at the western edge of site. One of the removed tanks (UST K01) was located adjacent to the east side of U.S. Coast Guard Building 20 and was removed in 1990 (Tetra Tech, Inc. 1996). The type, capacity, contents, and purpose of this UST are unknown. The second tank (UST K03) was removed in June 1996 from a location along the east side of Building 40. The 550-gallon fiberglass heating oil UST was apparently installed in 1975 and supplied fuel to a boiler inside Building 40. Aside from the potential Building 238 UST, the only other existing or formerly suspected tanks within Pipeline Site USCG were associated with Building 213 (Firehouse). A 550-gallon abandoned diesel fuel AST, which is located in a bermed structure along the east side of Building 213, supplied fuel to a boiler in the building. The Navy also investigated reported vent pipes along the east wall of the building, but a geophysical survey of the area concluded that a UST was not present (ERM 1995).

The hydrogeologic setting of Pipeline Site USCG is characterized by artificial fill material that is predominantly composed of loose fine-grained sand, with trace silt and gravel. Areas with large gravel fractions have been encountered in the saturated zone soils along the southwestern shoreline. The northern, upslope edge of the site intercepts the Franciscan formation bedrock that underlies YBI. Groundwater is not encountered in areas of shallow bedrock but has been observed between approximately 4.5 and 20 feet bgs in areas of artificial fill. Anticipated groundwater flow is generally south towards the shoreline, with tidally-induced deflections.

A3.16.2 Groundwater Status

Review of current and past analytical data details a pattern of elevated TPH-d in saturated zone soils and groundwater covering the broad area of the site (ERM 1999; LFR 2001a, 2001b). Areas of floating product have been observed in several parts of the site, including near the termination of the pipelines that were removed (near Buildings 40 and 270) and immediately downgradient from UST 270. Floating product has also been observed in two locations in the western portion of the site, west of Building 26 and south of Building 22, and at the eastern edge of the site, within Site 11. Detections of TPH-g at the site appear to be related to the more volatile diesel constituents. BTEX and MTBE have also been sporadically detected in

grab groundwater samples, especially at those locations where high TPH-d concentrations were also observed. These compounds have not been detected in monitoring well samples. Some of the TPH-g in the area near USTs 204A and 204B may be related to gasoline believed to have been stored in these tanks. Although PAH data have only been collected in association with the grab groundwater sampling in 2000, several PAHs have been periodically detected across the site.

A3.16.3 Purpose of Current Investigation

The purpose of the current groundwater investigation at this petroleum program site, as defined within the facilitywide groundwater monitoring program (QAPP Section A1.3.2), is to collect total TPH data (TPH-e and TPH-p), VOC data (petroleum constituent information), SVOC data (potential presence of unknown fuel), and fate-and-transport data related to detected TPH concentrations. A summary of year 2001 data collection requirements, including monitoring well sampling frequency, can be found in Table 4-1 of the accompanying year 2001 FSP.

A5.1 PROJECT SCOPE AND ENVIRONMENTAL MEDIA

Groundwater samples will be collected from monitoring wells located throughout NAVSTA TI (Figure A-2 and FSP figures 3-3 through 3-17). As detailed in Table 4-1 of the accompanying 2001 FSP, samples from each site will be analyzed for the following site-specific analytes of concern, as appropriate: metals, PCBs, SVOCs, TPH-e, TPH-p, and VOCs. In addition, site-specific fate and transport data will be collected from groundwater samples submitted for the following analyses: major anions, methane, ethane, ethene, nitrate, sulfide, VOCs, alkalinity, iron (Fe^{2+}), and manganese (Mn^{2+}). Sampling frequency and the analytical suite for each monitoring well is identified in Table 4-1 of the 2001 FSP; the corresponding groundwater monitoring schedule is presented as Table 8-1 in the FSP.

Water level measurements will be collected quarterly from monitoring wells throughout NAVSTA TI (Section 4.2, FSP). In situ measurement of groundwater parameters, including dissolved oxygen, oxidation-reduction potential, pH, temperature, and specific conductivity, will be taken during groundwater sampling (Section 4.3, FSP). Investigation-derived waste (IDW) will be handled according to the Program Waste Management Plan for Investigation-Derived Waste (PRC 1994b), as outlined in Section 4.8 of the accompanying 2001 FSP.

B3.1 SAMPLE COLLECTION AND DECONTAMINATION

Sample collection and decontamination methods and requirements are defined in Section 4.0, Field Methods and Procedures in the associated 2001 FSP.

B3.2 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES

The analytical methods, type of sample containers to be used for each analysis, sample volumes required, preservation requirements for all samples, and maximum holding times for sample extraction and analysis are presented in Appendix 2 of this QAPP addendum.

B5 ANALYTICAL METHODS

The analytical methods that will be used to analyze samples collected under the NAVSTA TI facilitywide groundwater monitoring program are detailed in Appendix 2. The analytical methods were selected to provide data of necessary quality to meet the DQOs for this project and to maintain data consistency and comparability. The data collected under the current facilitywide groundwater monitoring program must be comparable to previously-collected NAVSTA TI groundwater data to allow for the evaluation of DQO process-identified decisions (QAPP Section 1.4). As detailed in Table 2-1 (Appendix 2), Contract Laboratory Program (CLP) methods were chosen for most analyses to promote comparability of data with previous analytical results. Analytical methods and corresponding detection and reporting limits are presented in Table 2-3 (Appendix 2). Low-level analytical methods will be used for metals, PCBs, SVOCs, and VOCs because the detection limits for these methods are sufficiently low to allow data to be used for screening purposes in comparison to identified screening criteria (Table 2-3 in Appendix 2). Standard analytical methodologies will be used for TPH-p and TPH-e because the detection limits are sufficiently low to allow data to be used for screening purposes in comparison to identified screening criteria (Table 2-3 in Appendix 2). EPA Method 8015B will be utilized for the analysis of both TPH-e and TPH-p. Methods consistent with EPA SW846 (EPA 1995a) will be employed for the remaining analysis. Any modifications to the analytical methods presented in Appendix 2 will be submitted for Navy and regulatory agency review prior to use. A subcontract laboratory will analyze the samples using EPA-approved methodologies for which it has been certified by

the California Department of Health Services through the Environmental Laboratory Accreditation Program and approved by the Navy.

The laboratory analytical, data reporting, and validation procedures will be carried out in accordance with the Navy Installation Restoration Chemical Data Quality Manual (U.S. Navy, Naval Facilities Engineering Service Center [NFESC] 1999) and the protocols documented in the 2000 QAPP. At least 10 percent of all analytical data received from the laboratory will be subjected to full validation as described in Section D1.2.3.3 of the 2000 QAPP, while the remaining 90 percent will undergo cursory validation as described in Section D1.2.3.2 of the 2000 QAPP. Subcontracted laboratories will retain a staff that possesses analytical expertise in (1) organic and inorganic analyses, (2) QA/QC procedures, (3) production of CLP and CLP-type data packages, and (4) operation and maintenance of the laboratory information management system (LIMS). The laboratory will have sufficient, qualified personnel and appropriate analytical instrumentation available to technically and contractually carry out work required for NAVSTA TI. The contract-required quantitation and detection limits for the methods are listed in Appendix 2.

To ensure comparability with previously collected fate and transport data, on-site analysis and field measurements will be conducted using identical methods to those used in previous groundwater monitoring events. Field test kits (Hach 1997) will be utilized for time-critical analyses (Tables 2-1 and 2-2, Appendix 2). Insitu groundwater parameter measurements (Table 2-1, Appendix 2) will be collected with a high precision water quality meter, as detailed in Section 4.3 of the accompanying FSP.

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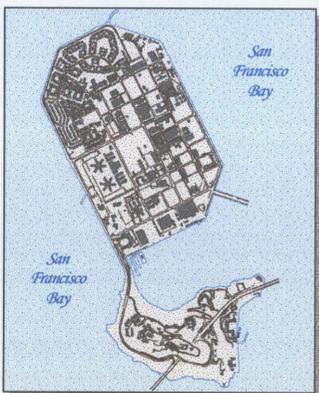
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FIGURES

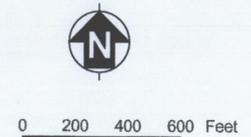


AREA OF INTEREST



LEGEND:

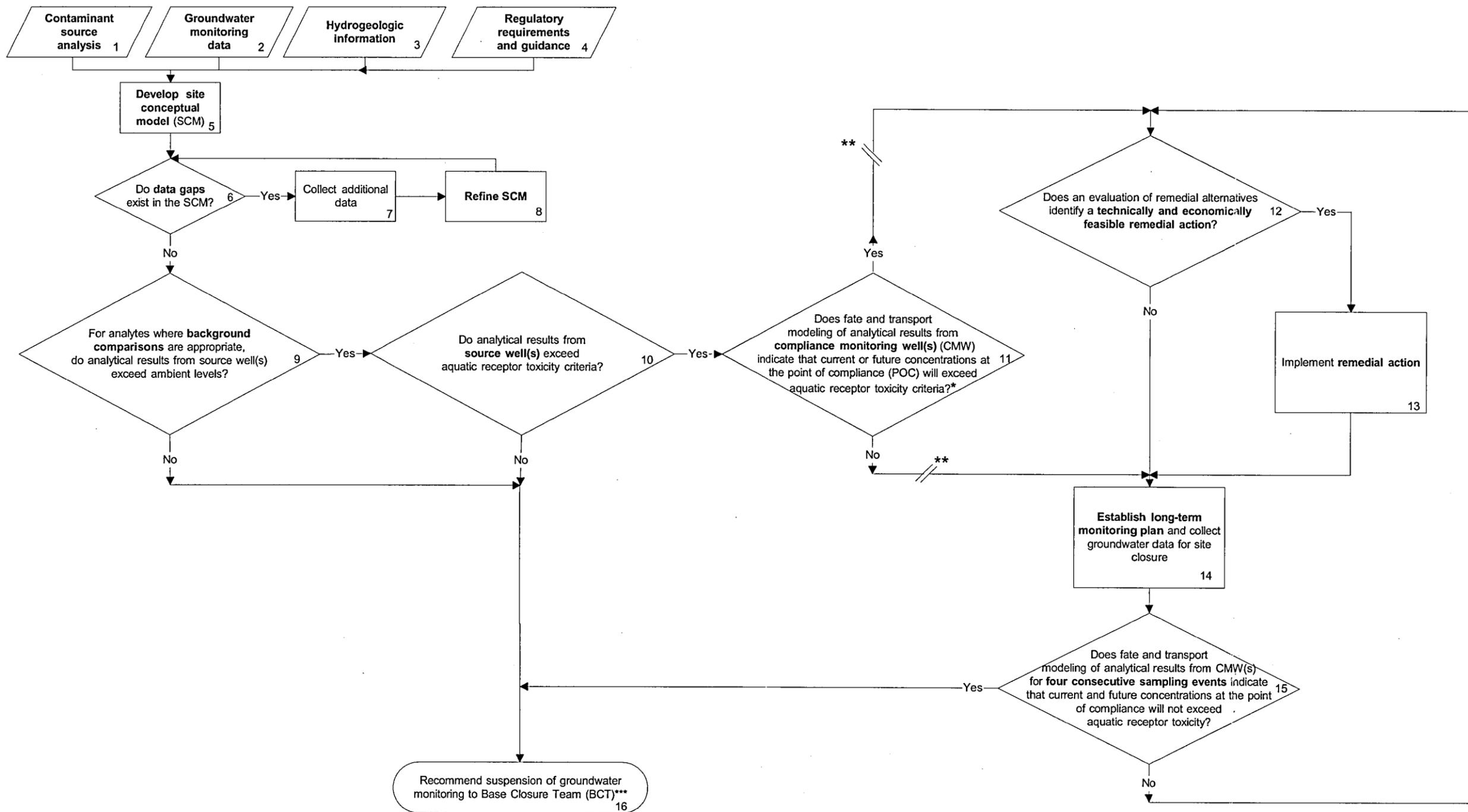
- MONITORING WELLS**
 - ◆ MONITORING WELL LOCATION
 - ◆ REMEDIATION WELL
 - NOTE: PROPOSED WELLS ARE SHOWN IN PARENTHESES
 - MODIFICATIONS TO THESE WELLS WILL BE SHOWN IN FINAL FIELD SAMPLING PLAN
- ABOVEGROUND STORAGE TANKS**
 - ◆ ACTIVE
 - ◆ REMOVED
 - ◆ DIP TANK
- UNDERGROUND STORAGE TANKS (UST)**
 - CLOSED-IN-PLACE
 - INACTIVE
 - REMOVED
- FORMERLY SUSPECTED STORAGE TANKS**
 - ▲ ABOVEGROUND STORAGE TANKS
 - ▲ UNDERGROUND STORAGE TANKS
- FUEL LINES**
 - FUEL LINE ABANDONED-IN-PLACE
 - FUEL LINE REMOVED
 - FUEL LINE NOT LOCATED
- SITE CLASSIFICATIONS**
 - ACTIVE GROUNDWATER MONITORING SITES
 - ACTIVE PIPELINE GROUNDWATER MONITORING SITES
 - SITES NOT REQUIRING GROUNDWATER MONITORING
 - INACTIVE GROUNDWATER MONITORING SITES
- 16** PETROLEUM PROGRAM SITES
- 28** CERCLA PROGRAM SITES
- ROAD
- BUILDING
- SHORELINE



Tt Tetra Tech EM Inc.

NAVAL STATION TREASURE ISLAND, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

FIGURE A-2
FACILITYWIDE MAP

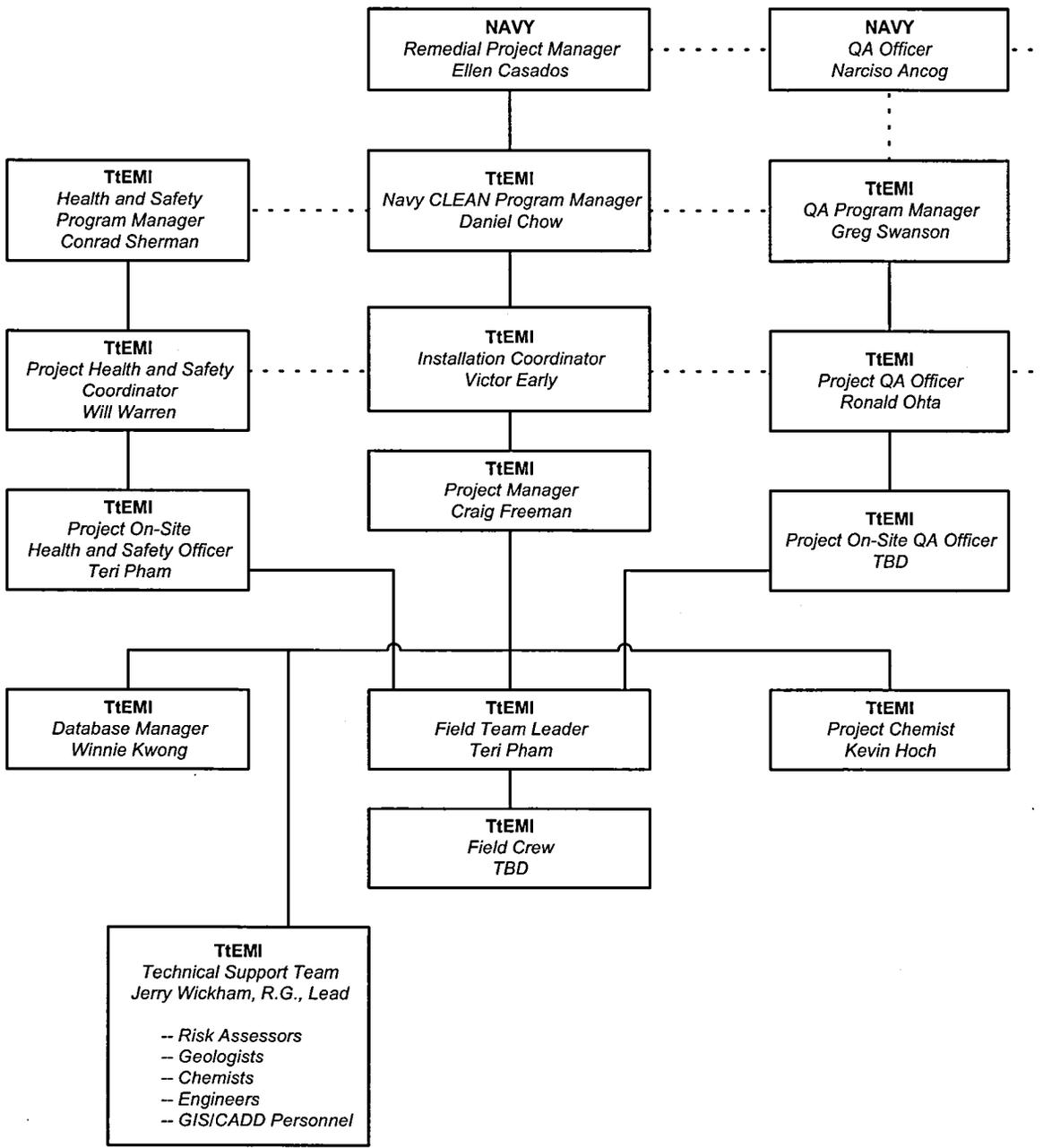


Notes:

- * Continued groundwater monitoring is recommended pending completion of applicable decision document under remedial investigation or corrective action plan.
- ** Regulatory agency concurrence on activities proposed for cells 12 through 15 remains outstanding. As noted in the QAPP text (TIEMI 2000b), activities to be completed under this project are primarily focused on cells 1 through 10.
- *** The need for additional characterization, including evaluation of remedial alternatives, between cells 10 and 16 is currently being assessed by the BCT. Evaluation of groundwater site closure will be completed in the applicable decision document and subject to BCT review.

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 SAN DIEGO, CALIFORNIA

FIGURE A-3
FACILITYWIDE GROUNDWATER
MONITORING PROGRAM FLOWCHART
NAVAL STATION TREASURE ISLAND

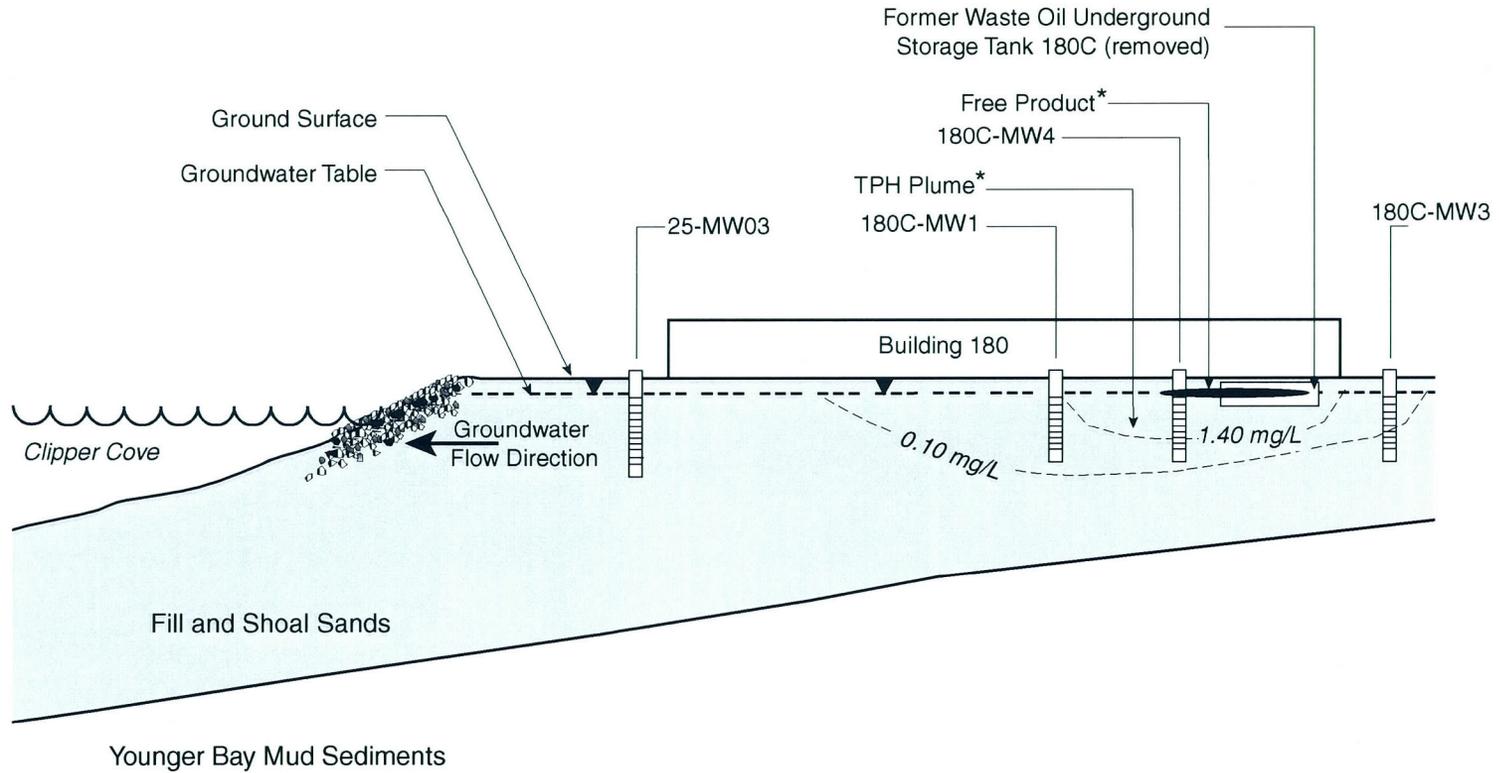


— Lines of Authority
 - - - Lines of Communication
 TBD To be determined



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FIGURE A-6
FACILITYWIDE GROUNDWATER
MONITORING ORGANIZATION FLOWCHART
NAVAL STATION TREASURE ISLAND



Notes: Schematic representation, not to scale.

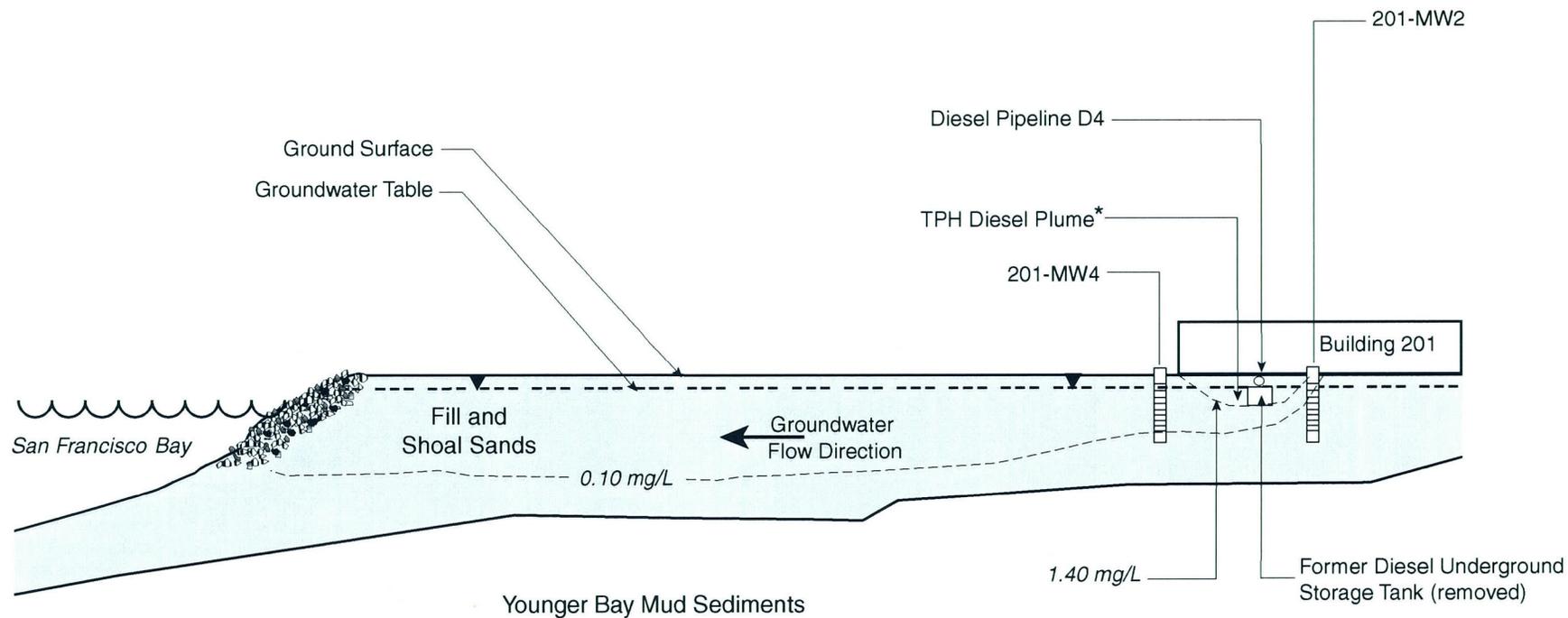
* Schematized TPH plume and free product area. Size and extent of affected area is based on interpretation of current data; actual extent may differ.

▼ Groundwater level

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 SAN FRANCISCO, CALIFORNIA

Figure A-16
Groundwater Conceptual Model
Site 180C - UST 180C

 Tetra Tech EM Inc.



Notes: Schematic representation, not to scale.

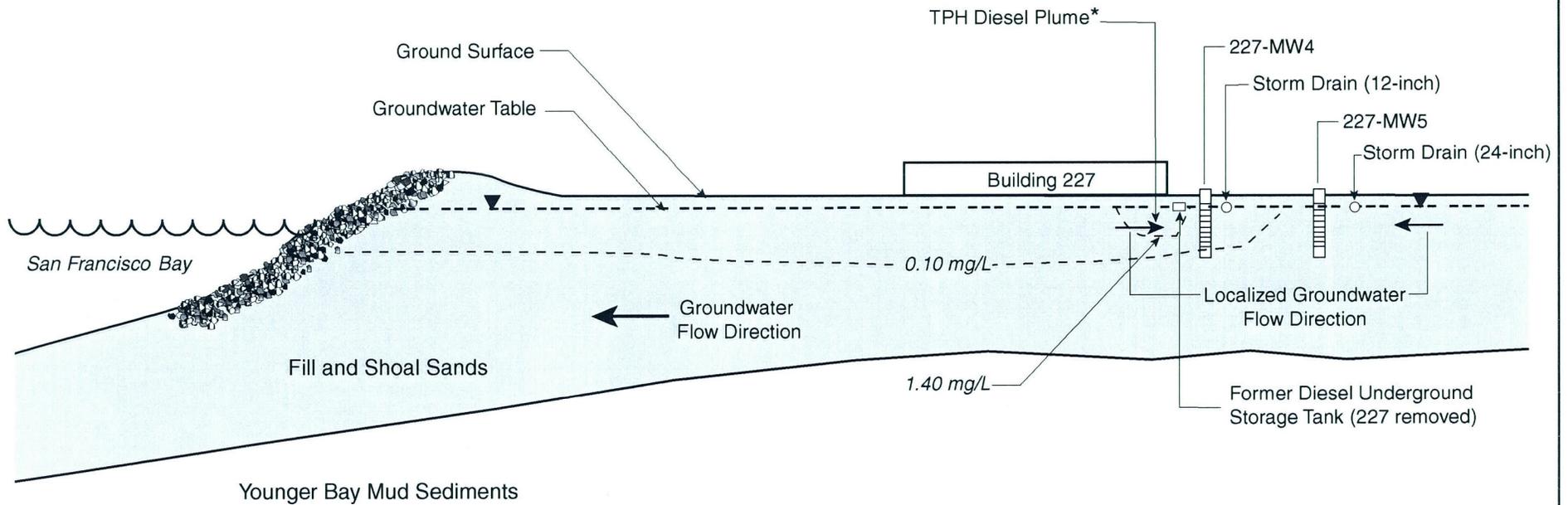
* Schematicized TPH plume. Size and extent of affected area is based on interpretation of current data; actual extent may differ.

▼ Groundwater level

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 SAN FRANCISCO, CALIFORNIA

Figure A-17
Groundwater Conceptual Model
Site 201 - UST 201

 Tetra Tech EM Inc.



Notes: Schematic representation, not to scale.

* Schematicized TPH plume. Size and extent of affected areas is based on interpretation of current data; actual extent may differ.
Groundwater level

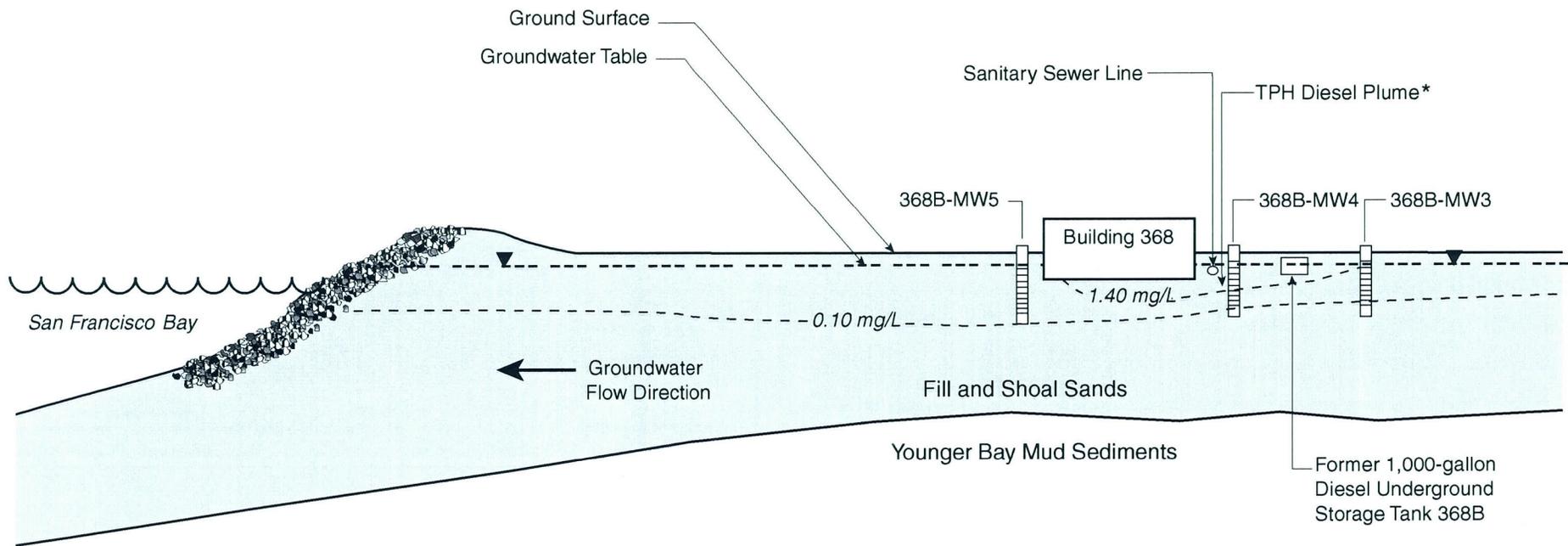
▼ Groundwater Flow Direction



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Figure A-18
Groundwater Conceptual Model
Site 227 - UST 227

 Tetra Tech EM Inc.



Notes: Schematic representation, not to scale.

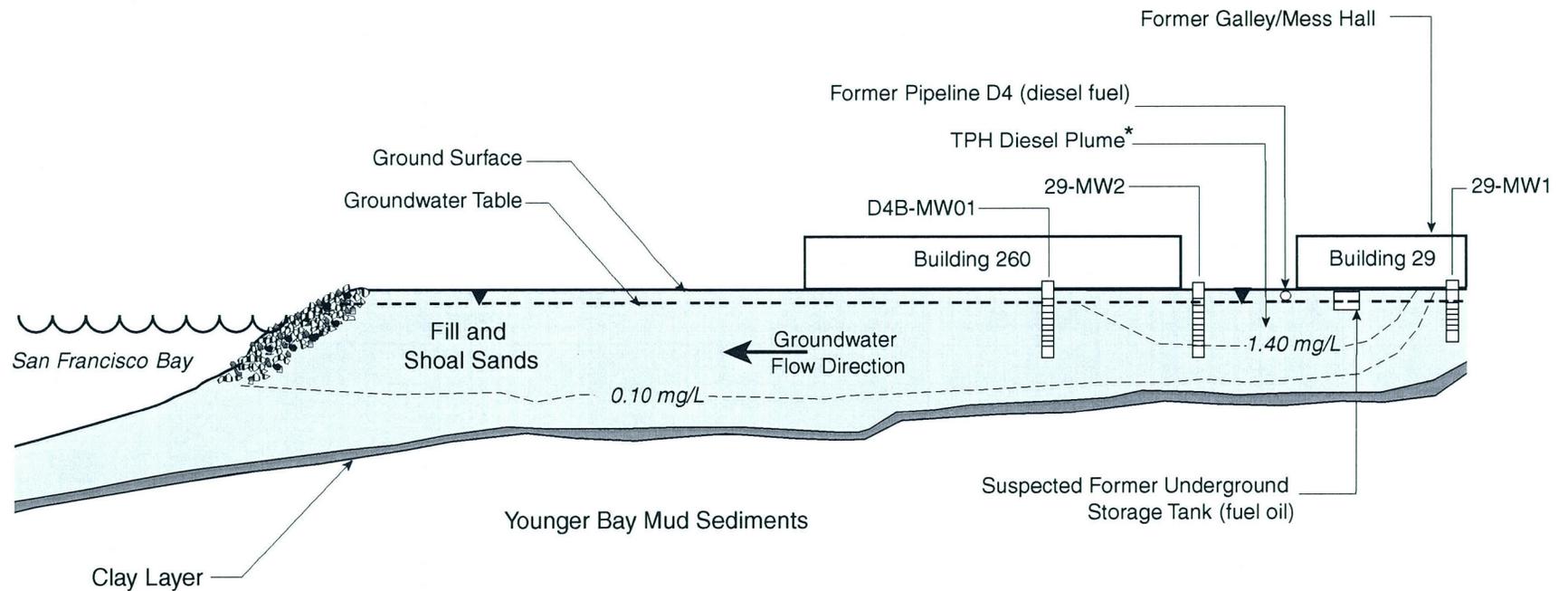
* Schematicized TPH plume. Size and extent of affected areas is based on interpretation of current data; actual extent may differ.

▼ Groundwater level

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 SAN FRANCISCO, CALIFORNIA

Figure A-19
Groundwater Conceptual Model
Site 368B - UST 368B

 Tetra Tech EM Inc.



Notes: Schematic representation, not to scale.

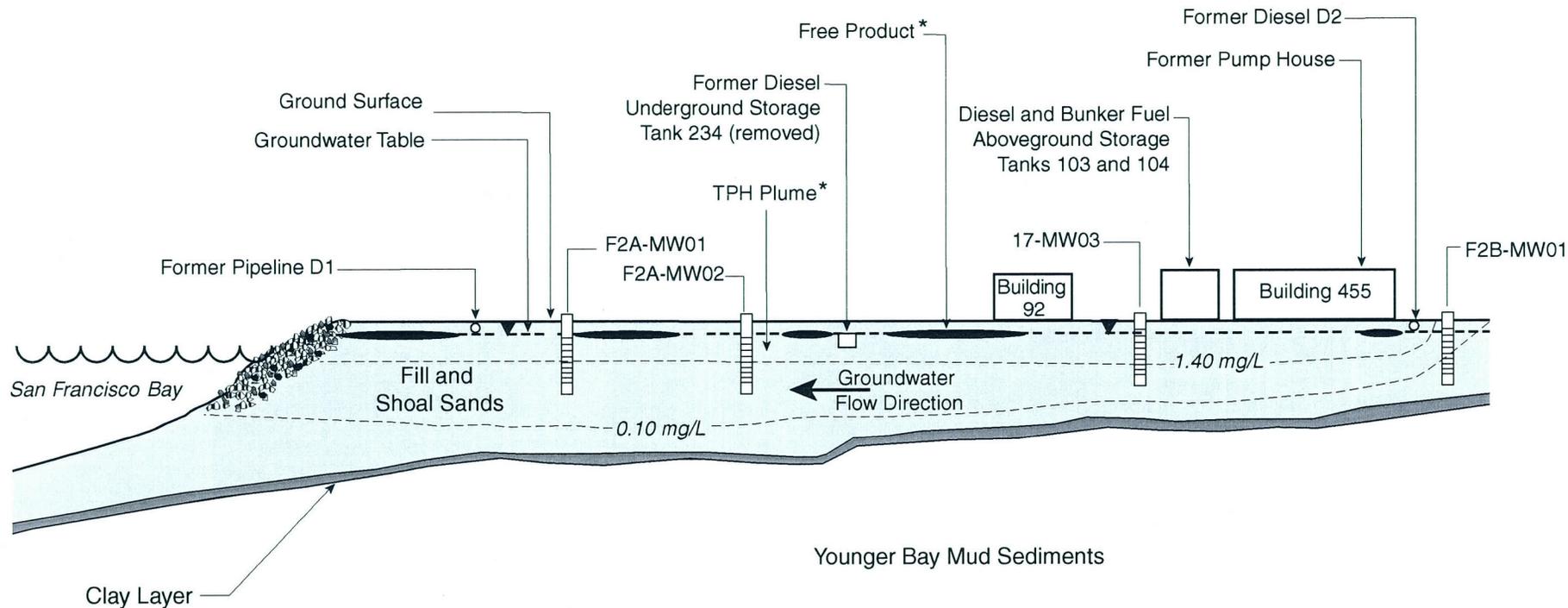
* Schematized TPH plume. Size and extent of affected area is based on interpretation of current data; actual extent may differ.

▼ Groundwater level

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 SAN FRANCISCO, CALIFORNIA

Figure A-20
Groundwater Conceptual Model
Site D4B - Pipeline Site D4B

 Tetra Tech EM Inc.



Notes: Schematic representation, not to scale. For readability, former Pipeline F2, which runs along 5th Street from Pipeline D1 to Pipeline D2, not projected on figure.

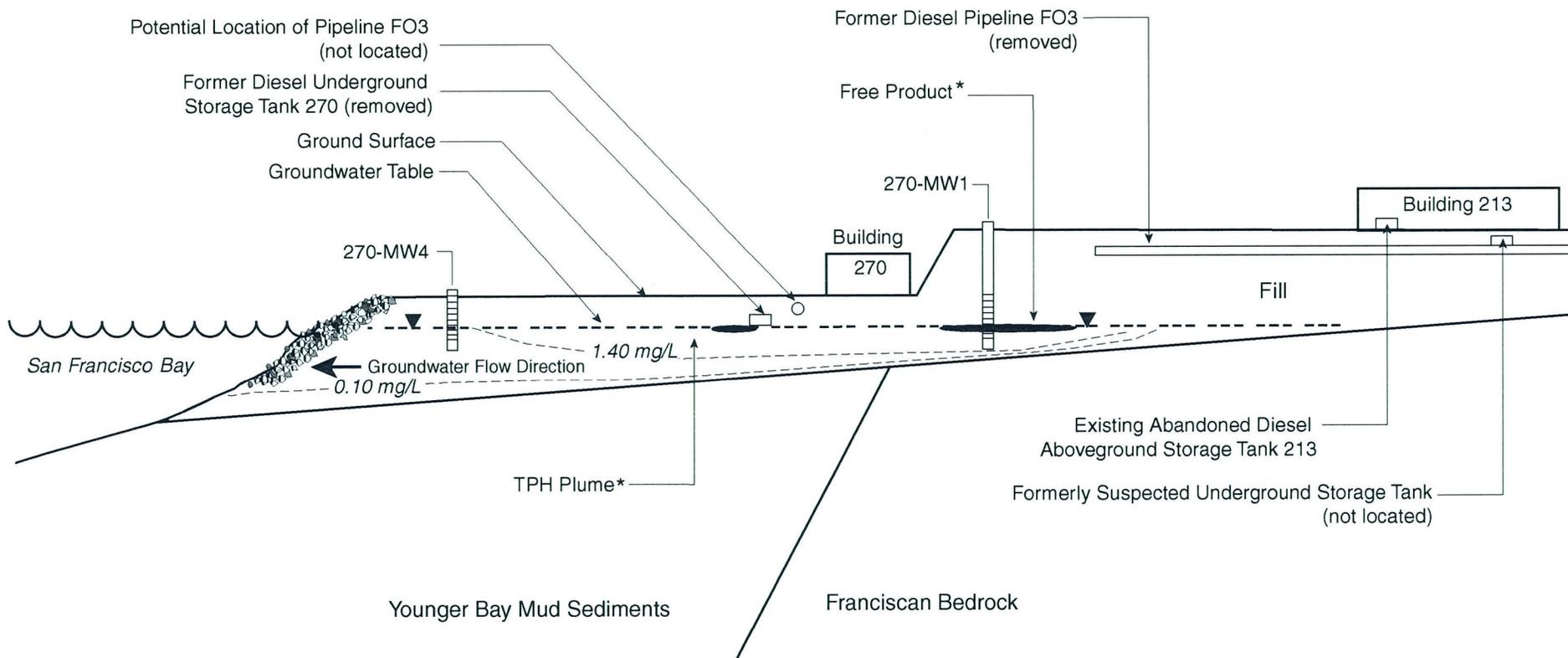
* Schematized TPH plume and free product areas. Size and extent of affected area is based on interpretation of current data; actual extent may differ.

▼ Groundwater level

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Figure A-21
Groundwater Conceptual Model
Site F2A and F2B - Pipeline Sites F2A and F2B

 Tetra Tech EM Inc.



Notes: Schematic representation, not to scale.

* Schematicized TPH plume and free product areas. Size and extent of affected areas is based on interpretation of current data; actual extent may differ.

▼ Groundwater level

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Figure A-22	
Groundwater Conceptual Model	
Site USCG - Pipeline Site U.S. Coast Guard	
 Tetra Tech EM Inc.	

APPENDIX 1
FIELD FORMS AND
QUALITY CONTROL REPORTS

**TETRA TECH EM INC.
MONITORING WELL INSPECTION FORM**

Monitoring Well No.: _____

Date: _____

Detail the condition of the items identified below, as applicable to each individual well.

External well identification: _____

Internal well identification: _____

Does access to this well require special keys or authorization? Yes ___ No ___ If so, describe. _____

Well vault or stickup: _____

Well lid and bolt anchors (if applicable): _____

Concrete pad: _____

Well cap: _____

Well lock: _____

Lock type and model no.: _____

Water level measuring mark and/or notch: _____

Was there standing water in the well vault/well stickup? Yes _____ No _____

If "Yes", describe: _____

Note any abnormalities regarding the well vault in relation to the surrounding grade: _____

(inspection information continued on reverse)

TETRA TECH EM INC.
MONITORING WELL INSPECTION FORM
(CONTINUED)

If necessary, using the following space, note any discrepancies between the well location portrayed on the well location map and the location of the well as identified in the field.

Location sketch:

Where needed, refresh the external well IDs, replace malfunctioning locks, and replace missing or defective lid bolts. Identify all other light maintenance completed during well inspection:

Additional comments:

Prepared by: _____ Date: _____

**TETRA TECH EM INC.
FIELD LOG FOR ALKALINITY ANALYSIS**

Sample Date: _____
Analysis Date: _____

Method: Digital Titrator/H₂SO₄ _____
Reagent Lot #: _____
Field Chemist: _____
Batch #: Alk- _____

#	Sample ID	Time of Analysis	Volume	Concentration (mg/L)	Comments
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
Dup					

**TETRA TECH EM INC.
FIELD LOG FOR IRON (II) ANALYSIS**

Sample Date: _____
Analysis Date: _____

Method: Colorimeter _____
Reagent Lot #: _____
Field Chemist: _____
Batch #: Fe- _____

#	Sample ID	Time	Volume	Field Filtered?	Concentration (mg/L)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
Dup						

**TETRA TECH EM INC.
FIELD LOG FOR MANGANESE (II) ANALYSIS**

Sample Date: _____
Analysis Date: _____

Method: Color Disc
Reagent Lot #: _____
Field Chemist: _____
Batch #: Mn- _____

#	Sample ID	Time of Analysis	Volume	Field Filtered?	Concentration (mg/L)	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
Dup						

TETRA TECH EM INC.
MONITORING WELL NOTES FORM

Well No.:

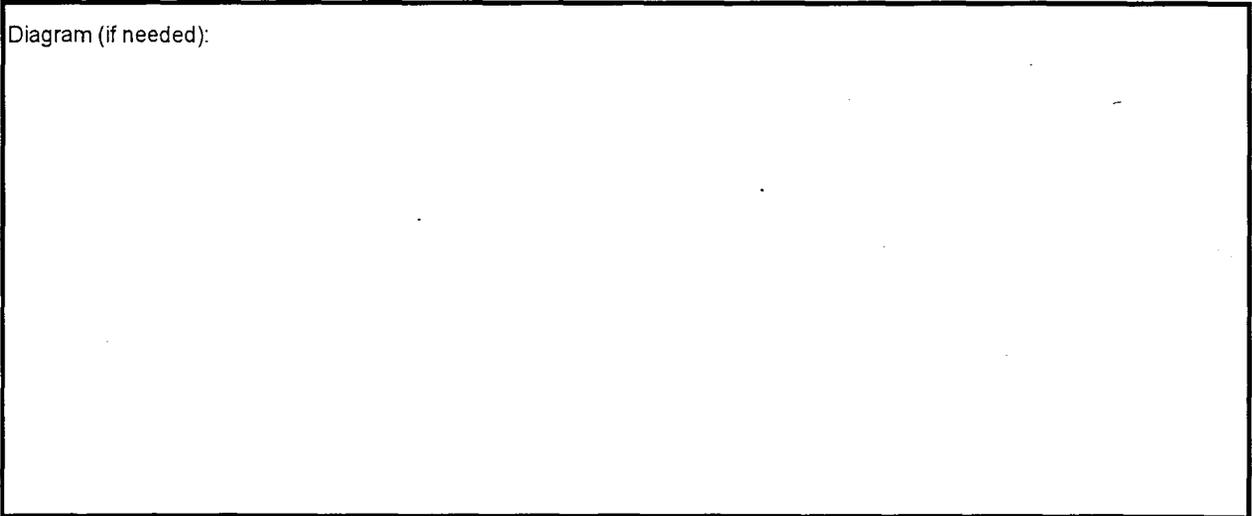
Day:

Date:

Time:

Notes:

Diagram (if needed):



Field Staff: _____

Signature: _____

Date: _____



Tetra Tech EM Inc.

Daily Quality Control Report

(Page 1 of 2)

Project Name:		Date:
Project Number:		Day:
Weather:	Wind:	
Temperature:	Humidity:	
Personnel on Site Field Team Leader: Subcontractors on Site:		
Equipment on Site		
Work Performed (Including Sampling)		
Quality Control Activities		
Health and Safety Levels and Activities		
Problems Encountered / Corrective Action Taken		



Tetra Tech EM Inc.

Daily Quality Control Report

(Page 2 of 2)

Deviations from Field Work Plan

Additional Notes

Anticipated Activities for Tomorrow

Distribution:

Submitted By:

Signature

Date

Audit Report



Tetra Tech EM Inc.

Project Name: _____ Date of Audit: _____

Project No.: _____ Project Manager: _____

Audit Team Members: _____

Brief Description of Project:

Audit Summary:

Corrective Action Required:

Quality Improvement Opportunities:

Remarks:

Auditor Signature: _____ Date: _____

cc: TtEMI Program QA Manager

Corrective Action Request Form
(Page 1 of 2)



Tetra Tech EM Inc.

Project Name: _____

Date: _____

Project No.: _____

Project Manager: _____

Location: _____

To (Project Manager): _____

From (Audit Team Members): _____

Description of Problem:

Corrective Action Required:

The above corrective action must be completed by (Date): _____

Acknowledgement of Receipt

(Signature and Date)

Corrective Action Request Form
(Page 2 of 2)



Tetra Tech EM Inc.

Corrective Action Taken:

Project Manager:

(Signature and Date)

Audit Team Members:

Corrective Action *is / is not* satisfactory

(Date and Initial)

Remarks:

QC Coordinators:

Corrective Action *is / is not* satisfactory

(Date and Initial)

Remarks:

cc: Program QA Manager

APPENDIX 2

ANALYTICAL METHODS PROTOCOL

TABLE 2-1
GROUNDWATER ANALYTICAL PROTOCOL
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND

Analysis	Method/ Reference	Sample Volume, Container	Extra MS/MSD Volume	Preservation	Analytical Holding Time
Off-Site Laboratory Analyses – Analytes of Concern Data					
Metals	CLP Metals – low level	One 500-mL polyethylene container	One 500-mL polyethylene container	Preserve with HNO ₃ to pH less than 2 and cool to 4 °C.	Hg: 28 days; Others: 6 months
PCBs	EPA 8082 – low level	Two 1-L amber glass containers	Four 1-L amber glass containers	Unpreserved. Cool to 4 °C.	7 days ¹
Semivolatile Organic Compounds	CLP SVOC – low level	Two 1-L amber glass containers	Four 1-L amber glass containers	Unpreserved. Cool to 4 °C.	7 days ¹
TPH-extractable (diesel and motor oil range)	EPA 8015B with silica gel cleanup	Two 1-L amber glass containers	Four 1-L amber glass containers	Unpreserved. Cool to 4 °C.	7 days ¹
TPH-purgeable (gasoline range)	EPA 8015B	Three 40-mL VOC vials	Three 40-mL VOC vials	Sample must be collected without headspace ² . Preserve with HCl to pH less than 2 and cool to 4 °C.	14 days (7 days if unpreserved)
Volatile Organic Compounds ³	CLP VOC – low level	Three 40-mL VOC vials	Three 40-mL VOC vials	Sample must be collected without headspace ² . Preserve with HCl to pH less than 2 and cool to 4 °C.	14 days (7 days if unpreserved)

TABLE 2-1 (CONTINUED)
GROUNDWATER ANALYTICAL PROTOCOL
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND

Analysis	Method/ Reference	Sample Volume, Container	Extra MS/MSD Volume	Preservation	Analytical Holding Time
Off-Site Laboratory Analyses – Monitored Natural Attenuation Data					
Major Anions (chloride and sulfate)	EPA 300.0	One 500-mL polyethylene container	One 500-mL polyethylene container	Unpreserved. Cool to 4 °C.	28 days
Methane, Ethane, and Ethene	RSK-175	Three 40-mL VOC vials	Three 40-mL VOC vials	Sample must be collected without headspace ² . Preserve with HCl to pH less than 2 and cool to 4 °C.	14 days
Nitrate	MCAWW Method 353.2	Two 40-mL VOC vials	Four 40-mL VOC vials	Preserve with H ₂ SO ₄ to pH less than 2 and cool to 4 °C.	28 days
Sulfide	EPA 376.1/376.2	One 500-mL polyethylene container	One 500-mL polyethylene container	Preserve with zinc acetate and sodium hydroxide (NaOH) to pH greater than 9 and cool to 4 °C.	28 days

TABLE 2-1 (CONTINUED)
GROUNDWATER ANALYTICAL PROTOCOL
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND

Analysis	Method/ Reference	Sample Volume, Container	Extra MS/MSD Volume	Preservation	Analytical Holding Time
Field Test Kit Analyses – Monitored Natural Attenuation Data					
Alkalinity	Hach Method #8203	One 1-L amber glass container (combined with manganese II and iron II)	Not applicable.	Unpreserved. Minimize contact with atmospheric oxygen: gently fill container and leave no headspace. Keep out of sunlight and analyze within 1 hour of collection.	Analyze as soon as possible.
Iron (II) (Fe ²⁺)	Hach Method #8146, Pocket Colorimeter	One 1-L amber glass container (combined with manganese II and alkalinity)	Not applicable.	Unpreserved. Minimize contact with atmospheric oxygen: gently fill container and leave no headspace. Filter if turbid ⁴ . Keep out of sunlight and analyze within 1 hour of collection.	Analyze as soon as possible.
Manganese (II) (Mn ²⁺)	Hach Method #8149	One 1-L amber glass container (combined with iron II and alkalinity)	Not applicable.	Unpreserved. Minimize contact with atmospheric oxygen: gently fill container and leave no headspace. Filter if turbid ⁴ . Keep out of sunlight and analyze within 1 hour of collection.	Analyze as soon as possible.

TABLE 2-1 (CONTINUED)
GROUNDWATER ANALYTICAL PROTOCOL
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND

Analysis	Method/ Reference	Sample Volume, Container	Extra MS/MSD Volume	Preservation	Analytical Holding Time
Field Measurement⁵ – Monitored Natural Attenuation Data					
Dissolved Oxygen	Water quality meter.	Not applicable.	Not applicable.	Limit introduction of atmospheric oxygen during measurement.	Analyze immediately.
Oxidation-Reduction Potential	Water quality meter.	Not applicable.	Not applicable.	Time sensitive.	Analyze immediately.
pH	Water quality meter.	Not applicable.	Not applicable.	Time sensitive.	Analyze immediately.
Specific Conductance	Water quality meter.	Not applicable.	Not applicable.	Time sensitive.	Analyze immediately.
Temperature	Water quality meter.	Not applicable.	Not applicable.	Time sensitive.	Analyze immediately.
Turbidity	Water quality meter.	Not applicable.	Not applicable.	Time sensitive.	Analyze immediately.

Notes:

- 1 Seven days to extraction, 40 days from extraction to analysis.
- 2 In rare cases, groundwater may react with the hydrochloric acid (HCl) preservative in the sample container, preventing collection of preserved sample without bubbles. In these cases, VOC, MEE, and TPH-p samples will be collected in unpreserved sample vials, and field staff will record on the well sampling sheet and chain-of-custody that groundwater from the well had reacted with the HCl preservative and that an unpreserved sample was collected and submitted for prompt laboratory analysis.
- 3 Includes analysis for Isopropylbenzene (Cumene).
- 4 Where formation water exhibits turbidity greater than 100 nephelometric turbidity units, Iron (II) and Manganese (II) samples will be filtered with a 0.45-micron filter prior to analysis.
- 5 Field data to be measured with YSI Inc. multi-parameter water quality analyzer and flowcell, model 6820 or equivalent.
- CLP Contract Laboratory Program
- EPA U.S. Environmental Protection Agency
- Hach The Hach Company (Hach 1997)
- H₂SO₄ Sulfuric acid
- HCl Hydrochloric acid
- HNO₃ Nitric acid
- L Liter
- mL Milliliter
- MCAWW Methods for chemical analysis of water and waste
- MS/MSD Matrix spike/matrix spike duplicate. Identified volumes to be collected in addition to those for the original sample.
- TPH Total petroleum hydrocarbons
- SVOC Semivolatile organic compound
- VOC Volatile organic compound

TABLE 2-2
FIELD TEST KIT METHODS
MONITORED NATURAL ATTENUATION DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND

Parameter	Hach Method Information					Resupply Information	
	Range	Smallest Increment	Method	Catalogue Number	Kit Includes	Reagent	Catalogue Number
Iron (II)	0 to 3,000 µg/L	10 µg/L	Colorimeter	46700-22 (colorimeter)	Kit & 100 tests	100 packets	1037-69
Manganese (II)	0 to 700 µg/L	50 µg/L	Color Disc	23508-00	Kit & 50 tests	100 tests (full reagent set)	22433-00
Alkalinity	10,000 to 4,000,000 µg/L	10,000 µg/L	Digital Titrator / Sulfuric acid	20637-00	Kit & 100 tests	100 packets	22719-00

Notes:

Hach The Hach Company (Hach 1997)
µg/L Micrograms per liter

**TABLE 2-3
COMPARISON OF DETECTION LIMITS AND SCREENING CRITERIA
OFF-SITE LABORATORY ANALYSES - ANALYTE OF CONCERN DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND**

All concentrations in micrograms per liter (µg/L). Notes detailed below.

Compound	Project Required Detection Limit	Laboratory Low Level Reporting Limit	NAVSTA TI Screening Criterion ^{a,b}	PRDL Below Criterion ^{c?}	LLLRL Below Criterion ^{c?}
METALS					
Aluminum	50.00	14.30	NC		
Antimony	6.00	2.70	4,300	Yes	Yes
Arsenic	10.00	1.90	15.0	Yes	Yes
Barium	200.00	5.60	NC		
Beryllium	4.00	0.20	NC		
Cadmium	1.00	0.30	9.3	Yes	Yes
Calcium	5,000.00	124.00	NC		
Chromium ^d	10.00	0.90	50	Yes	Yes
Cobalt	50.00	2.00	NC		
Copper	4.00	1.70	6.6	Yes	Yes
Iron	100.00	25.40	NC		
Lead	3.00	1.00	5.6	Yes	Yes
Magnesium	5,000.00	133.00	NC		
Manganese	15.00	0.40	900	Yes	Yes
Mercury	0.20	0.10	0.100	No	Equals ^c
Molybdenum	5.00	1.50	NC		
Nickel	8.00	1.70	8.2	Yes	Yes
Potassium	5,000.00	261.00	NC		
Selenium	5.00	2.40	71	Yes	Yes
Silver	2.00	1.90	2.2	Yes	Yes
Sodium	5,000.00	443.00	NC		
Thallium	2.00	2.70	6.3	Yes	Yes
Vanadium	50.00	1.50	NC		
Zinc	20.00	1.60	81	Yes	Yes
POLYCHLORINATED BIPHENYLS^e					
Aroclor-1016	0.50	0.025	0.00017	No	No ^c
Aroclor-1221	0.50	0.025	0.00017	No	No ^c
Aroclor-1232	0.50	0.025	0.00017	No	No ^c
Aroclor-1242	0.50	0.025	0.00017	No	No ^c
Aroclor-1248	0.50	0.025	0.00017	No	No ^c
Aroclor-1254	0.50	0.025	0.00017	No	No ^c
Aroclor-1260	0.50	0.025	0.00017	No	No ^c

TABLE 2-3
COMPARISON OF DETECTION LIMITS AND SCREENING CRITERIA
OFF-SITE LABORATORY ANALYSES - ANALYTE OF CONCERN DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND

All concentrations in micrograms per liter (µg/L). Notes detailed below.

Compound	Project Required Detection Limit	Laboratory Low Level Reporting Limit	NAVSTA TI Screening Criterion ^{a,b}	PRDL Below Criterion ^{c?}	LLLRL Below Criterion ^{c?}
SEMIVOLATILE ORGANIC COMPOUNDS					
1,2,4-Trichlorobenzene	10.00	2.50	129	Yes	Yes
1,2-Dichlorobenzene	5.00	1.25	129	Yes	Yes
1,3-Dichlorobenzene	5.00	1.25	129	Yes	Yes
1,4-Dichlorobenzene	5.00	1.25	129	Yes	Yes
2,2'-Oxybis(1-Chloropropane)	10.00	2.50	170,000	Yes	Yes
2,4,5-Trichlorophenol	25.00	6.25	9,800	Yes	Yes
2,4,6-Trichlorophenol	10.00	2.50	6.5	No	Yes
2,4-Dichlorophenol	10.00	2.50	790	Yes	Yes
2,4-Dimethylphenol	10.00	2.50	110	Yes	Yes
2,4-Dinitrophenol	25.00	6.25	NC		
2,4-Dinitrotoluene	10.00	2.50	9.1	No	Yes
2,6-Dinitrotoluene	10.00	2.50	118	Yes	Yes
2-Chloronaphthalene	10.00	2.50	4,300	Yes	Yes
2-Chlorophenol	10.00	2.50	400	Yes	Yes
2-Methylnaphthalene	10.00	2.50	60	Yes	Yes
2-Methylphenol	10.00	2.50	NC		
2-Nitroaniline	25.00	6.25	NC		
2-Nitrophenol	10.00	2.50	970	Yes	Yes
3,3'-Dichlorobenzidine	10.00	2.50	0.077	No	No ^c
3-Nitroaniline	25.00	6.25	NC		
4,6-Dinitro-2-Methylphenol	25.00	6.25	765	Yes	Yes
4-Bromophenyl-Phenylether	10.00	2.50	NC		
4-Chloro-3-Methylphenol	10.00	2.50	NC		
4-Chloroaniline	10.00	2.50	NC		
4-Chlorophenyl-Phenylether	10.00	2.50	NC		
4-Methylphenol	10.00	2.50	NC		
4-Nitroaniline	25.00	6.25	970	Yes	Yes
4-Nitrophenol	25.00	6.25	970	Yes	Yes
Acenaphthene	10.00	2.50	710	Yes	Yes
Acenaphthylene	10.00	2.50	60	Yes	Yes
Anthracene	10.00	2.50	110,000	Yes	Yes
Benzo(a)Anthracene	10.00	2.50	0.049	No	No ^c
Benzo(a)Pyrene	10.00	2.50	0.049	No	No ^c
Benzo(b)Fluoranthene	10.00	2.50	0.049	No	No ^c
Benzo(g,h,i)Perylene	10.00	2.50	60	Yes	Yes

**TABLE 2-3
COMPARISON OF DETECTION LIMITS AND SCREENING CRITERIA
OFF-SITE LABORATORY ANALYSES - ANALYTE OF CONCERN DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND**

All concentrations in micrograms per liter (µg/L). Notes detailed below.

Compound	Project Required Detection Limit	Laboratory Low Level Reporting Limit	NAVSTA TI Screening Criterion ^{a,b}	PRDL Below Criterion ^{c?}	LLLRL Below Criterion ^{c?}
SEMIVOLATILE ORGANIC COMPOUNDS (continued)					
Bis(2-Chloroethoxy)Methane	10.00	2.50	NC		
Bis(2-Chloroethyl)Ether	10.00	2.50	1.4	No	No ^c
Bis(2-Chloroisopropyl)Ether	10.00	2.50	NC		
Bis(2-Ethylhexyl)Phthalate	4.00	1.00	5.9	Yes	Yes
Butylbenzylphthalate	10.00	2.50	5,200	Yes	Yes
Carbazole	10.00	2.50	NC		
Chrysene	10.00	2.50	0.049	No	No ^c
Di-N-Butylphthalate	10.00	2.50	12,000	Yes	Yes
Di-N-Octylphthalate	10.00	2.50	588.8	Yes	Yes
Dibenz(a,h)Anthracene	10.00	2.50	0.049	No	No ^c
Dibenzofuran	10.00	2.50	6,400	Yes	Yes
Diethylphthalate	10.00	2.50	120,000	Yes	Yes
Dimethylphthalate	10.00	2.50	2,900,000	Yes	Yes
Fluoranthene	10.00	2.50	16	Yes	Yes
Fluorene	10.00	2.50	14,000	Yes	Yes
Hexachlorobenzene	10.00	2.50	0.00077	No	No ^c
Hexachlorobutadiene	10.00	2.50	50	Yes	Yes
Hexachlorocyclopentadiene	10.00	2.50	17,000	Yes	Yes
Hexachloroethane	10.00	2.50	8.9	No	Yes
Indeno(1,2,3-cd)Pyrene	10.00	2.50	0.049	No	No ^c
Isophorone	10.00	2.50	600	Yes	Yes
N-Nitroso-Di-N-Propylamine	10.00	2.50	1.4	No	No ^c
N-Nitrosodiphenylamine	10.00	2.50	16	Yes	Yes
Naphthalene	10.00	2.50	470	Yes	Yes
Nitrobenzene	10.00	2.50	1,900	Yes	Yes
Pentachlorophenol	25.00	6.25	7.9	No	Yes
Phenanthrene	10.00	2.50	60	Yes	Yes
Phenol	10.00	2.50	4,600,000	Yes	Yes
Pyrene	10.00	2.50	11,000	Yes	Yes

**TABLE 2-3
COMPARISON OF DETECTION LIMITS AND SCREENING CRITERIA
OFF-SITE LABORATORY ANALYSES - ANALYTE OF CONCERN DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND**

All concentrations in micrograms per liter (µg/L). Notes detailed below.

Compound	Project Required Detection Limit	Laboratory Low Level Reporting Limit	NAVSTA TI Screening Criterion ^{a,b}	PRDL Below Criterion ^{c?}	LLLRL Below Criterion ^{c?}
TOTAL PETROLEUM HYDROCARBONS^f					
TPH - Extractable (diesel range)	100.00	NA	1,400	Yes	NA
TPH - Extractable (motor oil range)	100.00	NA	1,400	Yes	NA
TPH - Purgeable (gasoline range)	50.00	NA	1,400	Yes	NA
Total TPH			1,400	Yes	NA
VOLATILE ORGANIC COMPOUNDS					
1,1,1-Trichloroethane	2.00	2.00	6,240	Yes	Yes
1,1,2,2-Tetrachloroethane	2.00	2.00	11	Yes	Yes
1,1,2-Trichloroethane	2.00	2.00	42	Yes	Yes
1,1-Dichloroethane	2.00	2.00	NC		
1,1-Dichloroethene	2.00	2.00	3.2	Yes	Yes
1,2-Dichloroethane	0.50	0.50	99	Yes	Yes
1,2-Dichloroethene, Total	2.00	2.00	NC	Yes	Yes
cis-1,2-Dichloroethene	2.00	2.00	44,800	Yes	Yes
trans-1,2-Dichloroethene	2.00	2.00	140,000	Yes	Yes
1,2-Dichloropropane	2.00	2.00	39	Yes	Yes
2-Butanone	2.00	2.00	NC		
2-Hexanone	2.00	2.00	NC		
4-Methyl-2-Pentanone	2.00	2.00	NC		
Acetone	2.00	2.00	NC		
Benzene	0.50	0.50	71	Yes	Yes
Bromodichloromethane	2.00	2.00	46	Yes	Yes
Bromoform	2.00	2.00	360	Yes	Yes
Bromomethane	1.00	1.00	4,000	Yes	Yes
Carbon Disulfide	2.00	2.00	NC		
Carbon Tetrachloride	0.50	0.50	4.4	Yes	Yes
Chlorobenzene	2.00	2.00	129	Yes	Yes
Chloroethane	2.00	2.00	NC		
Chloroform	2.00	2.00	470	Yes	Yes
Chloromethane	2.00	2.00	6,400	Yes	Yes
cis-1,3-Dichloropropene	0.50	0.50			
Dibromochloromethane	2.00	2.00	34	Yes	Yes
Ethylbenzene	2.00	2.00	29,000	Yes	Yes
Isopropylbenzene (Cumene) ^g	0.50	0.50	NC		
Methylene Chloride	2.00	2.00	1,600	Yes	Yes

**TABLE 2-3
COMPARISON OF DETECTION LIMITS AND SCREENING CRITERIA
OFF-SITE LABORATORY ANALYSES - ANALYTE OF CONCERN DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND**

All concentrations in micrograms per liter (µg/L). Notes detailed below.

Compound	Project Required Detection Limit	Laboratory Low Level Reporting Limit	NAVSTA TI Screening Criterion ^{a,b}	PRDL Below Criterion ^{c?}	LLLRL Below Criterion ^{c?}
VOLATILE ORGANIC COMPOUNDS (continued)					
Methyl-tert-butyl-ether	2.00	2.00	8,000	Yes	Yes
Styrene	2.00	2.00	NC		
Tetrachloroethene	2.00	2.00	8.85	Yes	Yes
Toluene	2.00	2.00	5,000	Yes	Yes
trans-1,3-Dichloropropene	0.50	0.50	NC	Yes	Yes
Trichloroethene	2.00	2.00	81	Yes	Yes
Vinyl Acetate	2.00	2.00	NC		
Vinyl Chloride	0.50	0.50	525	Yes	Yes
Xylene (Total)	2.00	2.00	NC		

Notes:

- a -- Toxicity screening criteria detailed in "Draft Groundwater Screening Criteria" (TtEMI 2001b).
- b -- Where ambient metals concentration in groundwater exceeds corresponding toxicity screening criterion, the ambient value was used. Ambient metals concentrations detailed in "Final Estimation of Ambient Concentrations of Metal in Groundwater Technical Memorandum" (TtEMI 2001a).
- c -- Laboratory analytical methods are detailed in Table 2-1. Only Navy- and U.S. Environmental Protection Agency (EPA)-approved laboratory analytical methods will be used. In some cases, analyte reporting limits for Navy- and EPA-approved analytical methods are not below the corresponding screening criterion. However, the reporting limits identified herein are sufficiently low to allow data to be used for screening purposes.
- d -- Criterion applies to Cr+6; detections of total Cr will be used for screening purposes.
- e -- Polychlorinated biphenyls screening criterion applies to the sum of detected Aroclors (TtEMI 2001b).
- f -- Petroleum screening criterion applies to the sum of purgeable and extractable detections (TtEMI 2001b).
- g -- Isopropylbenzene was detected in previous groundwater sampling as a tentatively identified compound (TIC).

CLP -- EPA contract laboratory program.
 LLLRL -- Laboratory low level reporting limit.
 NA -- Not applicable (low level reporting limits not required).
 NAVSTA TI -- Naval Station Treasure Island.
 NC -- No screening criterion established (TtEMI 2001b).
 PRDL -- Project required detection limit.

**TABLE 2-4
DETECTION LIMITS
OFF-SITE LABORATORY ANALYSES – MONITORED NATURAL ATTENUATION DATA
FACILITYWIDE GROUNDWATER MONITORING PROGRAM
NAVAL STATION TREASURE ISLAND**

All concentrations in micrograms per liter (µg/L).

Analyte	Project Required Reporting Limit	Laboratory Reporting Limit
Major Anions		
Chloride	500.0	500.0
Sulfate	500.0	500.0
Methane, Ethane, Ethene		
Methane	2.0	2.0
Ethane	5.0	5.0
Ethene	6.0	6.0
Nitrate	100.0	100.0
Sulfide	10.0	10.0

Notes:

Laboratory analytic methods detailed in Table 2-1.
Monitored natural attenuation (MNA) data does not require comparison to NAVSTA TI screening criteria.