November 17, 2017

Mr. Keith Nowell
Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502-6540

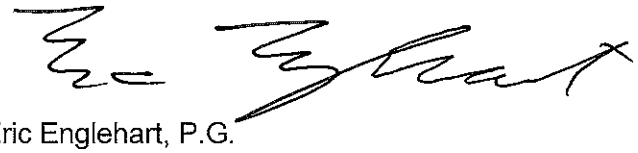
Subject: **Data Gap Work Plan and Focused Site Conceptual Model**
Port of Oakland, Former Carnation Terminal, Berth 30
Fuel Leak Case No. RO0000059
Alameda County, California
Amec Foster Wheeler Project No. 8416182190.1a

Dear Mr. Nowell:

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), is providing the *Data Gap Work Plan and Focused Site Conceptual Model* for your review. This work plan was prepared to fulfill the requirements of the Alameda County Department of Environmental Health request, dated July 14, 2016.

I declare, under penalty of perjury, that the information and/or recommendations contained in the work plan are true and correct to the best of my knowledge.

Yours very truly,



Eric Englehart, P.G.
Environmental Programs and Planning
Port of Oakland

November 16, 2017

Project 8416182190.1a

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Port of Oakland, Former Carnation Terminal, Berth 30
Fuel Leak Case No. RO0000059
Alameda County, California

Dear Mr. Nowell:

On behalf of the Port of Oakland (the Port), Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) has prepared this Data Gap Work Plan (Work Plan) and Focused Site Conceptual Model (SCM) for a former underground storage tank (UST) site located at Berth 30 at the Port of Oakland (the Site). This Work Plan and SCM were prepared in response to a July 14, 2016 letter from the Alameda County Department of Environmental Health (ACDEH; 2016) requesting a Data Gap Work Plan and SCM to provide supporting documentation for case closure under the State Water Resources Control Board's Low Threat Underground Storage Tank Case Closure Policy (LTCP).

In their letter, ACDEH indicated they had reviewed the data presented in two previous investigation work plans for the Site (Innovative Technical Solutions, Inc. [ITSI], 1996 and AECOM Technical Services Inc. [AECOM], 2012)[1] and information in ACDEH case files to determine if the Site was eligible for closure as a low risk site under the LTCP. In technical comments provided in their letter, ACDEH identified data gaps that needed to be addressed to meet criteria for case closure under the LTCP. This Work Plan and the SCM (Table 1; Appendix A) have been developed to address these technical comments.

BACKGROUND

The following presents a description of the site location, previous removal actions, and previous work plans and investigations performed at the Site.

Site Location

The Site is located in the northwestern portion of the City of Oakland immediately adjacent to the Oakland Harbor (Figure 1). Historical and current land use is commercial and industrial. The Site was formerly occupied by Carnation and the UST was located at the eastern end of the Carnation facility and reportedly stored diesel fuel. The area is now occupied by the

[1] The previous work plans were not implemented by ITSI and AECOM.

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TransPacific Container Service Corporation Terminal. Based on the scope of redevelopment of the area and consequent destruction of landmarks used to identify the UST location, the exact location of the former UST could not be determined and it's estimated location was determined by taking measurements from currently existing landmarks that are present on historical aerial photographs and Sanborn maps that were reviewed by Amec Foster Wheeler.

UST Removal

In November 1988, a 15,000-gallon UST, which reportedly stored diesel fuel, was removed from the Site by Aqua Science Engineering as part of demolition of the former Carnation Terminal. Two soil samples were collected from the bottom of the UST excavation and two soil samples were collected from the excavation sidewalls at approximately 10 feet below ground surface (bgs). Groundwater was encountered at 11 feet bgs; one grab groundwater was collected from water within the excavation. The soil and groundwater samples were analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene, and xylenes (BTEX). Analytical results showed that TPH was detected in two soil samples - one bottom sample (TA-1) collected from the southern end of the excavation and one sidewall sample (TA-3) collected from the eastern side of the excavation. TPH as gasoline (TPHg) was detected at 3,800 milligrams per kilogram (mg/kg), unknown hydrocarbons at 2,600 mg/kg, and BTEX at 1.1, 4.4, 2.5, and 116 mg/kg, respectively in sample TA-1. TA-3 contained unknown hydrocarbons at 49 mg/kg. TPH and BTEX were not detected in the other two excavation soil samples. Unknown hydrocarbons were detected in the grab groundwater sample at a concentration of 2.4 milligrams per liter.

Soil Excavation

Following removal of the UST, Baseline Environmental Consulting (Baseline) was retained by the Port to direct remediation of petroleum hydrocarbons detected in soil within the UST excavation. Based on evidence of TPH in soil sample TA-1, in January 1989, approximately 35 cubic yards of soil were excavated from the southern end of the former UST excavation. Following removal of the soil, one confirmation soil sample and one grab groundwater sample were collected from the enlarged excavation and analyzed for TPH and BTEX. Sample results showed that the soil sample collected at 8 feet bgs contained unspecified petroleum hydrocarbons at 220 mg/kg and BTEX was not detected. TPH and BTEX were not detected in the grab groundwater sample. ITSI prepared a work plan in June 1996 that included collecting soil and grab groundwater samples from four borings in the vicinity of the former UST excavation. Preliminary to drilling and sampling at the Site, an aerial photographic evaluation was performed and a geophysical investigation conducted to identify the location of the former UST excavation. The results of the geophysical investigation were inconclusive. The drilling and soil and groundwater sampling program proposed in their work plan was not performed by ITSI.

In response to a 2010 request by ACDEH that soil and groundwater samples from the Site be analyzed for methyl tertiary butyl ether (MTBE), a limited investigation work plan was prepared by AECOM in January 2012 on behalf of the Port. This work plan proposed drilling and sampling two borings at the southern end of the UST excavation and one boring at the center of the

former excavation. Soil and groundwater samples were to be analyzed for MTBE. This work plan was not implemented.

DATA GAPS

The following are the technical comments provided by ACDEH in its July 14, 2016 letter. These technical comments identify data gaps that need to be met to meet LTCP criteria for case closure.

1. **LTCP General Criteria e - Site Conceptual Model:** According to the LTCP, the SCM is a fundamental element of a comprehensive site investigation. The SCM establishes the source and attributes of the unauthorized release; describes all affected media (including soil, groundwater, and soil vapor, as appropriate); local geology, hydrogeology; and other physical site characteristics that affect contaminant environmental transport and fate; and identifies all confirmed and potential contaminant receptors (including water supply wells, surface water bodies, structures and their inhabitants). The SCM is relied upon by practitioners as a guide for investigative design and data collection. All relevant site characteristics identified by the SCM shall be assessed and supported by data so that the nature, extent and mobility of the release have been established to conformance with applicable criteria in this policy.

   Our review of the case files indicates that insufficient data collection and analysis has not been presented to assess the nature and extent, and mobility of the release and to support compliance with General Criteria e as discussed in Media Specific Criteria for Groundwater, Vapor Intrusion to Indoor Air, and Direct Contact and Outdoor Air Exposure as described in Technical Comments 4, 5, and 6 presented below.

2. **LTCP General Criteria f – Secondary Source Has Been Removed to the Extent Practicable:** "Secondary source" is defined as petroleum-impacted soil or groundwater located at or immediately beneath the point of release from the primary source. Unless site attributes prevent secondary source removal (e.g. physical or infrastructural constraints exist whose removal or relocation would be technically or economically feasible), petroleum-release sites are required to undergo a secondary source removal to the extent practicable as described in the policy. "To the extent practicable" means implementing a cost-effective corrective action which removes or destroys-in-place the most readily recoverable fraction of source-area mass. It is expected that most secondary mass removal efforts will be completed in one year or less. Following removal or destruction of the secondary source, additional removal or active remedial actions shall not be required by regulatory agencies unless (1) necessary to abate a demonstrated threat to human health or (2) the groundwater plume does not meet the definition of low threat as described in this policy.

   Soil samples TA-1, TA-2, TA-3, and TA-4 were collected one foot above groundwater level at a depth of approximately 10 feet bgs from the tank pit following removal of the 15,000-gallon UST. The sample locations are depicted on Figure 2 of the report entitled *Report on Underground Tank Removal and Remediation Activities* (TNK)

dated March 1989 and prepared by Baseline. Soil sample TA-1 collected below the base of the former UST in the southern portion of the tank pit and in the general vicinity of the former dispenser island, was reported to contain 3,800 mg/kg TPHg and 2,600 mg/kg of TPH having largest peaks in the C12-C24 range which did not match hydrocarbons standards. Additionally, soil sample TA-1 was reported to contain 1.2 mg/kg benzene, 7.4 mg/kg toluene, 2.5 mg/kg ethylbenzene, and 116 mg/kg xylene (collectively BTEX). Subsequent to the removal of 35 cubic yards of soil from the vicinity of TA-1, a soil sample, identified as South End -SE was collected from the south end of the excavation at a depth of 8 feet bgs.

The sample location depicted for SE is northerly and farther inside the pit and collected at a shallower depth than the TA-1 location. Therefore, it is unclear what sample SE represents as the location described appears to be in an open area of the tank pit. Additionally, no samples were recovered beneath the nearby dispenser island depicted south of the tank pit. Hence, ACDEH can come to no conclusion with regard to secondary source removal in the southern tank pit and dispenser areas.

3. **LTCP Criteria G – Soil and Groundwater Have Been Tested for MTBE:** Health and Safety Code section 25296.15 prohibits closing a UST case unless the soil, groundwater, or both, as applicable have been tested for MTBE and the results of that testing are known to the Regional Water Board. The exception to this requirement is where a regulatory agency determines that the UST that leaked has only contained diesel or jet fuel. Before closing a UST case pursuant to this policy, the requirements of section 25296.15, if applicable, shall be satisfied.

   ACDEH's review of the case files indicates that site soil or groundwater have not been analyzed for MTBE. As mentioned above, soil sample TA-1 was reported to contain 3,800 mg/kg TPHg, indicating a gasoline release occurred at the Site. Please present a strategy in the Data Gap Work Plan (described in Technical Comment 7 below) to address the item discussed above. Alternatively, please provide justification of why the site satisfies this general criterion in the focused SCM described in Technical Comment 7 below.

4. **LTCP Media Specific Criteria for Groundwater:** To satisfy the media specific criteria for groundwater, the contaminant plume that exceeds water quality objectives must be stable or decreasing in areal extent, and meet all of the additional characteristics of one of the five classes of sites listed in the policy. Our review of the case files indicates that insufficient data collection and analysis has been presented to support the requisite characteristics of plume stability or plume classification as follows:

   Grab groundwater sample TA-5, recovered from the tank pit, was reported to contain TPH at a concentration of 2,400 micrograms per liter but was not analyzed for TPHg although TPHg was reported in soil sample TA-1 at a concentration of 3,800 mg/kg. As the nearest surface water body, San Francisco Bay, is located within about 50 feet from the former tank pit, as stated in the 1989 TNK report, the Site does not meet the media-specific criteria for groundwater for Scenarios 1 through 4.

Media-specific criteria for groundwater Scenario 5 may be met if ACDEH determines, based on an analysis of site specific conditions that under current and reasonably anticipated near-term future scenarios, the contaminant plume poses a low threat to human health and safety and to the environment and water quality objectives will be achieved within a reasonable time frame. As the groundwater at the Site is reportedly to be tidally influenced, its close proximity to San Francisco Bay, and the incomplete SCM, ACDEH cannot make a determination if Scenario 5 is met without additional information.

Please present a strategy in the Data Gap Work Plan (described in Technical Comment 7 below) to address the items listed above. Alternatively, please provide justification of why the Site satisfies the Media-Specific Criteria for Groundwater in the focused SCM described in Technical Comment 7 below.

5. **LTCP Media Specific Criteria for Vapor Intrusion to Indoor Air:** The LTCP describes conditions, including bioattenuation zones, which if met will assure that exposure to petroleum vapors in indoor air will not pose unacceptable health risks to human occupants of existing or future site buildings, and adjacent parcels. Appendices 1 through 4 of the LTCP criteria illustrate four potential exposure scenarios and describe characteristics and criteria associated with each scenario**.**

   Our review of the case files indicates that the site collection and analysis fail to support the requisite characteristics of one of the four scenarios. Specifically, it appears that petroleum contamination is present, as evidenced by residual soil concentrations of TPH over 100 mg/kg in the 5 to 10 foot interval ACDEH indicated the presence of petroleum contamination as evidenced by residual soil concentration of TPH over 100 mg/kg in the 5 to 10 foot interval. Therefore, please present a strategy in the Data Gap Investigation Work Plan described in Technical Comment 7 below to collect additional data to satisfy the bioattenuation zone characteristics of Scenarios 1, 2, or 3, or to collect soil gas data to satisfy Scenario 4.

   Alternatively, please provide justification of why the Site satisfies the Media-Specific Criteria for Vapor Intrusion to Indoor Air in a SCM that assures that exposure to petroleum vapors in indoor air will not pose unacceptable health risks.

6. **LTCP Media Specific Criteria for Direct Contact and Outdoor Air Criteria**: The LTCP describes conditions where direct contact with contaminated soil or inhalation of contaminants volatilized to outdoor air poses a low threat to human health. According to the policy, release sites where human exposure may occur satisfy the media-specific criteria for direct contact and outdoor air exposure and shall be considered low threat if the maximum concentration of petroleum constituents in soil are less than or equal to those listed in Table 1 for the specified depth bgs. Alternatively, the policy allows for a site-specific risk assessment that demonstrates that maximum concentration in soil will have no significant risk of adversely affecting human health, or controlling exposure through the use of mitigation measures, or institutional or engineering controls.

Our review of the case files indicates that insufficient data collection and analysis has been presented to satisfy the media-specific criteria for direct contact and outdoor air exposure. Specifically, no soil samples have been collected in the 0- to 5-foot bgs interval. Also, soil samples were not recovered from beneath the fuel dispenser island depicted south of tank pit sample TA-1, the area demonstrating the most elevated contamination.

Additionally, the 15,000-gallon UST removed from the Site was identified as a diesel tank and generically as a UST. Soil sample TA-1 was reported to contain significant concentrations of TPHg. Therefore, it is unclear to ACDEH what materials were stored in the tank over its history of operation.

Therefore, please present a strategy in the Data Gap Work Plan described in Technical Comment 7 below to collect sufficient data to satisfy the direct contact and outdoor air exposure criteria in the areas of likely dispenser location. Sample and analyze soil within the 0- to 5-foot and 5- to 10-foot intervals, at the groundwater interface, lithologic changes, and at areas of obvious impact. Also collect a groundwater sample from each boring and propose the requisite analysis including naphthalene and polycyclic aromatic hydrocarbons (PAH) analysis.

Alternatively, please provide justification of why the site satisfies the Media-Specific Criteria for Direct Contact and Outdoor Air Exposure in the focused SCM described in Technical Comment 7 below that assures that exposure to petroleum constituents in soil will have no significant risk of adversely affecting human health.

7. **Data Gap Investigation Work Plan and Focused Site Conceptual Model:** Please prepare a Data Gap Investigation Work Plan to address the technical comments listed above. Please support the scope of work in the Data Gap Investigation Work Plan with a focused SCM and Data Quality Objectives that relate the data collection to each LTCP criteria. For example please clarify which scenario within each Media-Specific Criteria a sampling strategy is intended to apply to.

   The ACDEH requested the focused SCM be presented in a tabular format and highlight the major SCM elements and associated data gaps, which need to be addressed to progress the site to case closure under the LTCP.

FIELD INVESTIGATION

The following describes the scope and approach to the proposed field investigation to address data gaps 1, 2, 3, 4, and 6 identified by ACDEH. The proposed data gap investigation has been designed to collect additional data to assess the following:

- The nature and extent of contamination from past releases from the former UST;
- The mobility of contaminants released from the former UST;
- If the remedial activities performed in January 1989 effectively removed secondary sources in the vicinity of the southern portion of the former UST excavation and dispenser island;

- The concentration of TPH in soil in the 0 to 5 foot depth interval to assess potential risks to human health from direct contact or from inhalation of outdoor air;
- The presence of MTBE in soil and groundwater in the vicinity of the former UST; and
- Demonstrate that the contaminant plume poses low threat to human health and the environment and that water quality objectives will be achieved within a reasonable time frame.

Data Quality Objectives are presented in Table 2 of Appendix A. A preliminary SCM has been prepared to provide a guide to understanding of the potential fate and transport of past releases from the former UST. This Work Plan and the SCM (Appendix A) have been prepared to address technical comment 7. Technical comment 5 is not fully addressed within this Work Plan. The need for future soil gas sampling will be assessed based on the results of soil and groundwater sampling to be performed during this investigation.

The following sections describe the field program that is proposed to meet the objectives listed above. The investigation program will focus on collection and analysis of soil and groundwater samples from soil borings at five locations in the vicinity of the former UST. Drilling locations are based on the approximate location of the former UST excavation, which is based on review of historical aerial photographs and Sanborn maps as discussed above. The locations were selected to further investigate the presence and extent of previously detected petroleum hydrocarbons (TPHg, diesel range hydrocarbons, and BTEX) in soil at the southern end of the former UST location and the former fuel dispenser island and assess if groundwater has been impacted by TPH, MTBE, and/or BTEX.

Borehole Clearance and Permitting

Drilling locations will be marked in the field and a private geophysical subsurface utility locator will check each drilling location to ensure the areas are free of utilities. Underground Service Alert North will also be notified a minimum of 48 hours prior to commencing drilling. Additionally, drilling permits will be obtained from Alameda County prior to commencement of subsurface investigation work.

Soil Boring Advancement and Soil Sampling

Five soil borings will be drilled and temporary wells installed and sampled in the vicinity of the former UST. Three soil borings will be drilled at the southern end of the former UST excavation, one in the center of the former UST excavation, and one beneath the location of the former dispenser island. The borings will be advanced to approximately 4 feet below the water table using a direct push drill rig equipped with a sample corer lined with clear acetate sleeves. It is anticipated that groundwater will be encountered between approximately 8 to 10 feet bgs; therefore, it is planned that the borings will extend to depths of 12 to 14 feet bgs. One soil sample will be collected within the 0- to 5-foot depth interval of each boring based on visual evidence of contamination, petroleum odor, elevated photoionization detector readings, lithologic changes, or at approximately 2.5 feet bgs if no evidence of contamination or lithologic

changes are observed. A second soil sample will be collected from each boring just above the soil/water interface.

The lithology of the borings will be continuously logged by a geologist or engineer working under the supervision of a California-registered geologist. Soil samples will be collected from targeted sample depths by removing soil from the cut acetate liner and placing it directly into laboratory-provided glass jars. Soil samples will be analyzed for gasoline and diesel range organics (GRO and DRO) by Environmental Protection Agency (EPA) Test Method 8015 and for BTEX and MTBE by EPA Test Method 8260. The 5035 Terracore™ preservation method will be utilized for GRO, BTEX, and MTBE analyses. Samples analyzed by the Terracore method will be placed into Terracore vials using clean Terracore plungers provided by the laboratory. Labels will be affixed to the sides of sample jars and Terracore vials and stored in a cooler with ice. The labels will be marked with the sample identification, the date and time that the sample was collected, the site name, sampler initials, and the Amec Foster Wheeler project number.

Installation of Temporary Wells and Groundwater Sampling

After each boring has been advanced and soil samples collected, temporary wells consisting of 5 feet of slotted 1-inch polyvinyl chloride (PVC) casing and blank 1-inch PVC casing[2] will be lowered into the borehole. The wells will be sampled using a peristaltic pump, clean stainless steel bailer, or unused disposable bailer after sufficient groundwater enters the casing to allow for samples to be collected. Samples will be analyzed for GRO, DRO, BTEX, and MTBE. In addition, per the ACDEH letter, groundwater samples from each boring will also be analyzed for naphthalene and PAHs by EPA Test Method 8310. Sample containers will be labeled, placed in zippered plastic bags, and placed in a cooler with ice.

Borehole and Temporary Well Abandonment

Upon completion of groundwater sampling, the temporary well casings will be removed from the boreholes, and the boreholes will be backfilled with bentonite/cement grout using a tremmie pipe. In areas where asphalt pavement is present, the surface of the grouted borehole will be covered with asphalt patch or the grout will be stained black to match the surrounding pavement. Boring locations will be surveyed by the field geologist or engineer using a hand-held global positioning system unit.

Decontamination and Investigation-Derived Waste Management

Drilling equipment and reusable sampling equipment will be decontaminated with a steam cleaner or low-phosphate soap solution and clean water rinse between borings and before leaving the site. PVC casing removed from the boreholes will be steam cleaned and then disposed as trash. The decontamination rinsate and sample purge water will be contained and

[2] The length of the blank casing will cut and fitted onto the slotted casing such that once the casing has been introduced into the borehole, the slotted screen extends approximately 4 feet below and 1 foot above the water table.

transferred to a 55-gallon Department of Transportation (DOT)-approved drum. Soil cuttings will also be placed into a 55-gallon DOT-approved drum.

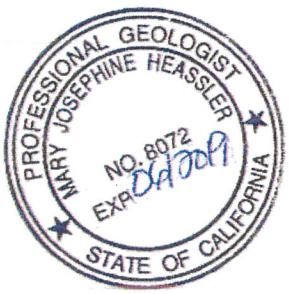
The soil and waste water containers will be labeled and moved to a secure location identified by the Port. After completion of the sampling program, a composite sample of the waste water (purge water and decontamination rinsate) will be collected for waste characterization. Analytical results for soil samples collected from the borings and the results of a composite sample of the waste soil analyzed for CAM-17 metals by EPA Test Method 6010 will be used for waste characterization. Based on the analytical results, the soil cuttings and waste water will be profiled and disposed offsite at a licensed facility.

REPORTING

After completion of the field investigation, a report will be prepared describing the field program, presenting observations during drilling, figures showing sample locations, boring logs, well completion details, and tables summarizing soil and groundwater analytical results. The report will also include an update to the SCM. Analytical results will be screened against current commercial/industrial Environmental Screening Levels. The report will provide an analysis of whether results indicate that the areas of contamination are adequately characterized, whether chemical concentrations are at levels that pose risk based on commercial/industrial land uses, and provide a case supporting case closure under the LCTP or identifying additional actions necessary to meet closure criteria. These additional actions may potentially include additional sampling including collection of soil gas samples.

We trust that this Work Plan provides sufficient detail concerning the proposed soil and groundwater data gap investigation at the Former Carnation Terminal, Berth 30. Please contact either of the undersigned if you have questions or comments.

Sincerely yours,
Amec Foster Wheeler Environment & Infrastructure, Inc.



Gary A. Lieberman
Associate Geologist

Mary Jo. Heassler, PG 8072
Associate Geologist

GAL/MJH/sc
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Attachments:

Figure 1	Site Vicinity Map
Figure 2	Proposed Boring and Monitoring Well Locations
Figure 3	Sample Locations

Appendix A – Site Conceptual Model and Data Gap Analysis

REFERENCES CITED

Alameda County Department of Environmental Health, 2016. Request for Data Gap Work Plan and Focused Site Conceptual Model; Fuel Leak Case No. RO0000059 and GeoTracker Global ID T0600101098. Port of Oakland/ Albers Mill/ Berth 30, 2700 7th St., Oakland, CA 94607. July 14.

AECOM Technical Services Inc. 2012. Limited Soil and Groundwater Investigation Workplan Underground Storage Tank Site, Former Carnation Terminal, Berth 30, Oakland, CA. January 27.

Baseline Environmental Consulting, 1989. Report on Underground Storage Tank Removal and Remediation Activities, 2700 7th Street, Oakland, CA. March.

Innovative Technical Solutions, Inc., 1996. WorkPlan for Soil and Water Investigation at Former Carnation Terminal Site, Berth 30, 2700 7th Street, Oakland, CA. June.

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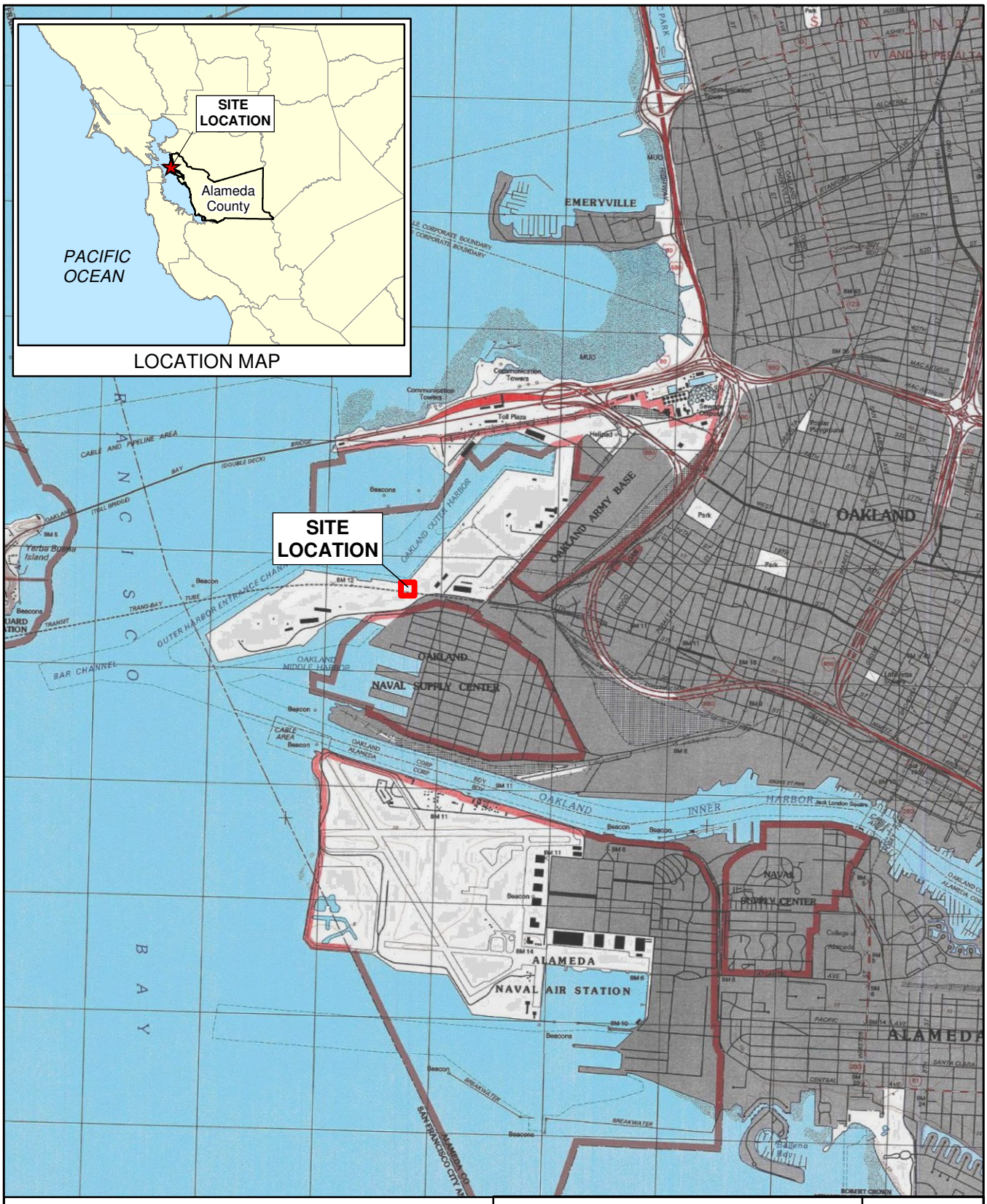
FIGURES



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SITE LOCATION AND TOPOGRAPHIC MAP
UST Excavation Sampling
Port of Oakland
Oakland, California

amec foster wheeler

Figure 1

Date: 11/17/2017 | Project No. 8416182190

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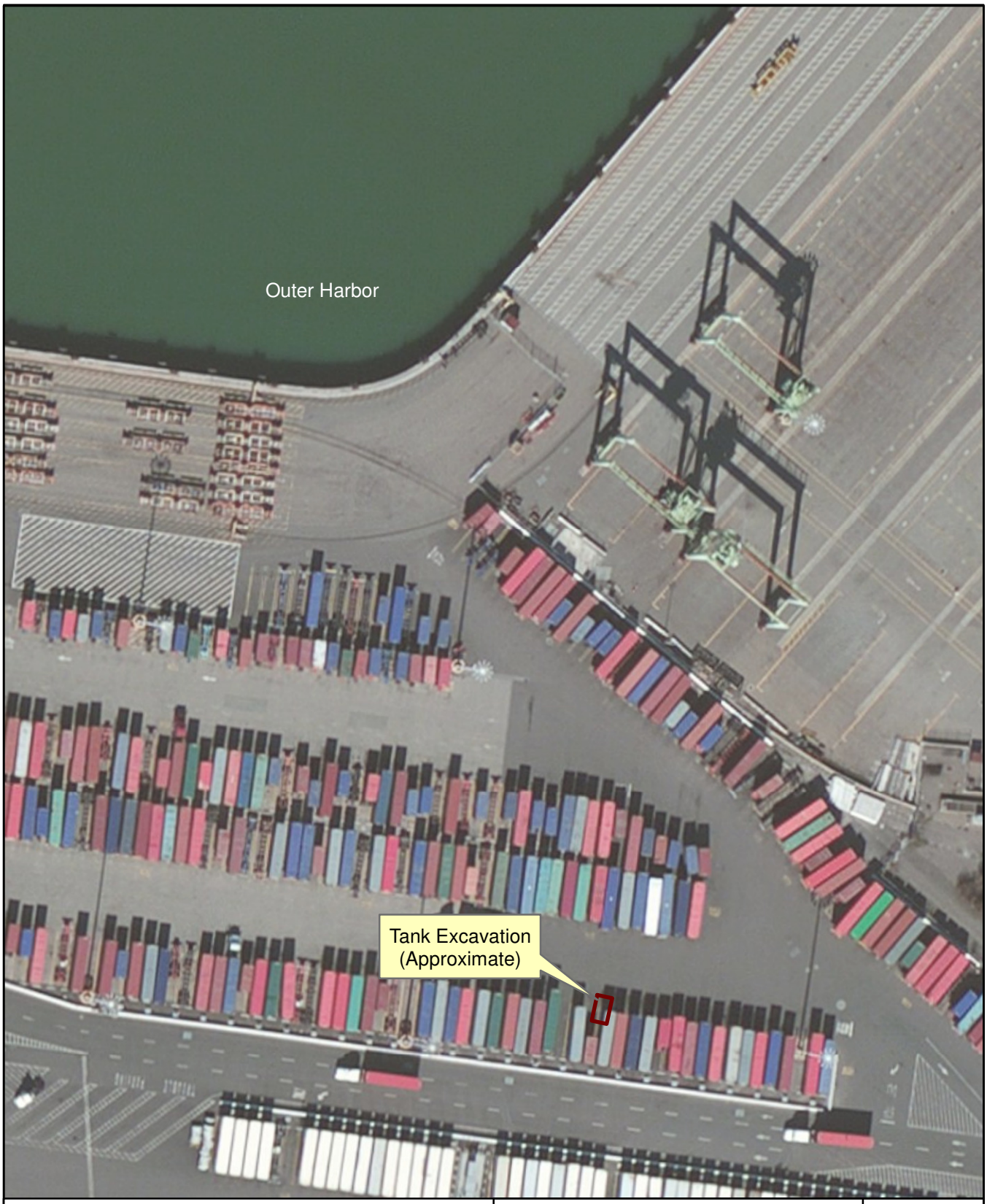

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UST SITE LOCATION

UST Excavation Sampling
Port of Oakland
Oakland, California

amec foster wheeler

Date: 11/17/2017 | Project No. 8416182190

Figure
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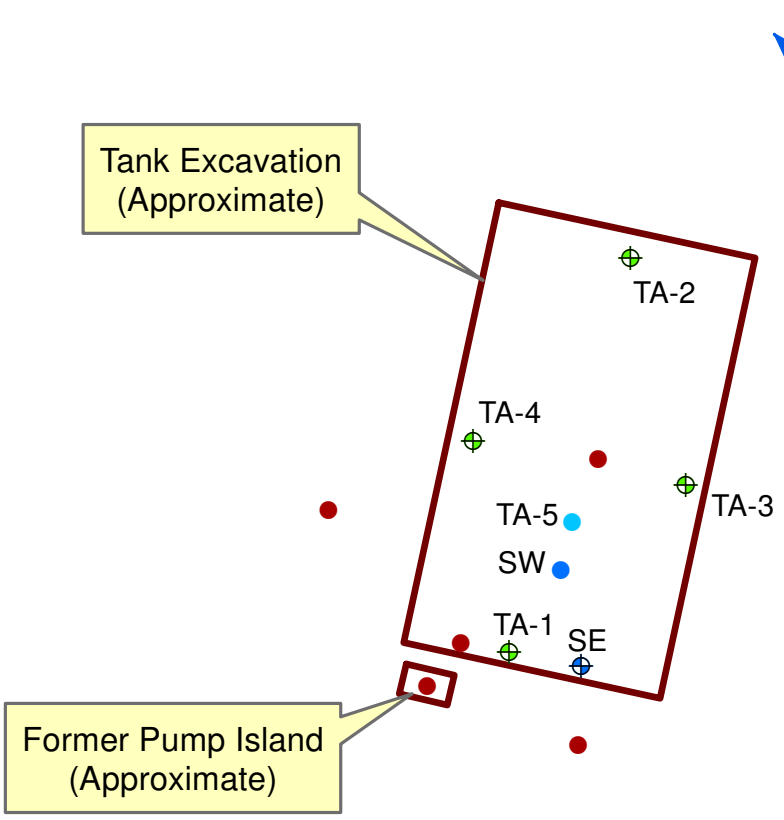

EXPLANATION

- Previous Groundwater Sample Location - Baseline
- Previous Soil Sample Location - Baseline
- Previous Groundwater Sample Location - Aqua Science Engineers
- Previous Soil Sample Location - Aqua Science Engineers
- Proposed Soil and Groundwater Boring

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SAMPLE LOCATIONS

UST Excavation Sampling
Port of Oakland
Oakland, California

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Figure 3

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APPENDIX A

Site Conceptual Model and Data Gap Analysis

TABLE 1

INITIAL SITE CONCEPTUAL MODEL (SCM)

Data Gap Work Plan and Focused Site Conceptual Model
Alameda County, California

SCM Element	SCM Sub Element	Description	Data Gap	How to Address
Land Use	Potential Receptors	The Site is located in the northwestern portion of the City of Oakland, immediately adjacent to the Oakland Outer Harbor (Figure 1). Historical and current land use in the Site vicinity is commercial and industrial. Port of Oakland Maritime shipping terminals are located along the adjacent waterfront to the north, west, and south. The Site is within the current TransPacific Container Service Corporation Terminal.	None	NA
Geology and Hydrogeology	Regional	The Site is located within the Santa Clara Valley: East Bay Plain Groundwater Basin. According to the Basin Plan (RWQCB, 2015) existing beneficial use of groundwater in the East Bay Plain comprises municipal, processing, industrial, and agricultural use. The area lies within a tectonic depression that has been filled with alluvial fan deposits (Santa Clara Formation or equivalent) overlain by alternating sequences of estuarine and alluvial deposits of the Alameda Formation. The Alameda formation has been subdivided into Yerba Buena Cay (Old Bay Mud), San Antonio, Merritt, Posey, and Young Bay Mud members. In the Oakland area, aquifer units comprise the Merritt Sand and deeper gravel units (Norfleet Consultants, 1998).	None	NA
	Site	***Geology:*** Soils encountered in the former UST excavation comprised interbedded sands and crushed shell fragments that were likely deposited as bay dredge fill. Other shallow soil encountered during subsurface investigations at other Port terminals comprised fill material overlying marine sand, clay and silt deposits (Young Bay Mud). ***Hydrogeology:*** Shallow groundwater has been encountered at the Site and vicinity at depths of approximately 8 to 11 feet below ground surface (bgs) and is reportedly locally tidally influenced. The hydraulic gradient and groundwater flow direction have not been evaluated at the Site but groundwater most likely flows northwest towards San Francisco Bay.	• Identification of lithologic units that may affect fate and transport of contaminants; e.g., the location and depth of more permeable soils or soil that may act as an aquitard. • Site-specific groundwater flow direction and gradient.	The direct push rig will collect continuous core that will be lithologically logged by a field geologist or engineer and lithologic changes identified. If the vertical extent of petroleum hydrocarbon contamination in soil is not confirmed following this data gap investigation, deeper borings will be advanced at the Site that will provide additional geologic information. If the presence of petroleum hydrocarbons and constituents in groundwater above environmental screening levels (ESLs) is confirmed, and the lateral extent not characterized, additional investigation will be performed that would include installation of permanent monitoring wells. The wells will be surveyed, groundwater levels measured, and the direction of groundwater flow and groundwater gradient calculated.
Surface Water Bodies	Potential Receptors	Storm water runoff at the Site flows into catch basins that flow through storm sewers that discharge directly into the San Francisco Bay northwest of the Site. The closest surface water body is San Francisco Bay approximately 50 feet northwest of the Site.	None	NA
Nearby Wells	Potential Receptor	There are multiple groundwater monitoring wells within 1,500 feet of the Site (to the northeast and southeast) that are associated with leaking underground storage tank (LUST) and other remediation sites. No water production supply wells have been identified in the Site vicinity.	None	NA

TABLE 1

INITIAL SITE CONCEPTUAL MODEL (SCM)

Data Gap Work Plan and Focused Site Conceptual Model
Alameda County, California

SCM Element	SCM Sub Element	Description	Data Gap	How to Address
Release Source and Potential Migration Pathways	Contaminant Fate and Transport	Petroleum released from leaks from the former dispenser island and/or the former UST may have been adsorbed to fine grained shallow soils around the dispenser island and deeper soils (below 10 feet) below the former UST. Petroleum hydrocarbons from leaks from the UST may also have been released directly to groundwater below the former UST. Petroleum hydrocarbons may have migrated from shallow soils and entered groundwater as a dissolved phase and then moved downgradient of the former UST and dispenser island. Soil removal performed in 1989 may not have completely removed all of the impacted soil around the former UST and dispenser island. Residual hydrocarbons in soil may serve as a secondary and continuing source of petroleum hydrocarbons to shallow groundwater or may contain volatile constituents that may migrate upwards through the vadose soil. Although the UST reportedly contained diesel fuel, previous analysis of soil samples collected from the Site indicated that the soil had been impacted by gasoline range hydrocarbons. Previous analysis did not include methyl tertiary butyl ether (MTBE), naphthalene, or polycyclic aromatic hydrocarbons (PAHs) that are mobile, volatile, and/or potentially carcinogenic constituents of gasoline and diesel fuels.	• Presence of residual hydrocarbons in soil in the vicinity of the former UST and dispenser island. • Presence of hydrocarbons in groundwater downgradient of the UST. • Nature of petroleum hydrocarbons stored in former UST and presence and concentrations of petroleum-related chemicals (MTBE, napthalene, and PAHs) that are highly mobile, volatile, and/or are potentially carcinogenic has not been fully evaluated.	Collection of soil and groundwater samples at the location of the former dispenser island, midpoint of the former UST excavation, south of location of the excavation sample with the highest concentration of petroleum hydrocarbons, and downgradient of sample with highest concentrations of petroleum hydrocarbons. Analysis of soil and groundwater samples for TPH as gasoline, diesel, and motor oil, MTBE, PAHs, naphthalene, and BTEX to assess the presence of chemicals that are mobile, may pose risk to human health, and/or have the potential to volatilize into indoor or outdoor air.

Abbreviations

bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
ESL = Environmental Screening Levels
LUST = leaking underground storage tank
MTBE = methyl tertiary butyl ether
NA = Not Applicable
PAH = polycyclic aromatic hydrocarbons
RWQCB = Reginal Water Quality Control Board
SCM = Site Conceptual Model
TPH = total petroleum hydrocarbons
UST = underground storage tank

Reference

Norfleet Consultants, 1998. Groundwater Study and Water Supply History of the East Bay Plain, Alameda and Contra Costa Counties, CA. June 15.

TABLE 2

DATA GAPS AND PROPOSED INVESTIGATION

Data Gap Work Plan and Focused Site Conceptual Model
Alameda County, California

Item	Data Gap	Proposed Investigation	Data Quality Objective	Analysis
1	Additional sampling at the site is required to satisfy that the secondary source of petroleum hydrocarbons has been removed to the extent practicable, as detailed in LTCP General Criteria f. Specifically, a confirmation soil sample collected following the 1989 excavation of 35 cubic yards of soil around former sample TA-1 (that contained elevated petroleum hydrocarbons), was collected north of TA-1 and at a shallower depth (8 feet below ground surface [bgs]) than the depth from which TA-1 was collected. TA-1 was collected at the soil/groundwater interface; specifically at 10 feet bgs. Therefore, it is not clear if all of the petroleum impacted soil surrounding sample TA-1 had been effectively removed by excavation. Additionally, no samples were collected beneath the nearby fuel dispenser island to assess if a possible release at that location had impacted shallow soil.	Five soil borings will be drilled and temporary wells installed and sampled in the vicinity of and in the assumed downgradient location of former excavation confirmation sample TA-1 and the former dispenser island (Figure 1). The borings will be advanced to approximately 4 feet below the water table using a direct push drill rig. Soil samples will be collected from depths equivalent to sample TA-1 (10 feet bgs or the soil/groundwater interface) to assess if petroleum hydrocarbon impacted soil detected at that location was effectively removed in 1989. Shallow soil samples (0 to 5 feet bgs) will also be collected from borings drilled in the vicinity of the former dispenser island to assess whether spills or leaks from the dispenser island have impacted shallow soil. Grab groundwater samples will be analyzed to assess if groundwater has been impacted by potential releases of petroleum hydrocarbons from the former UST and dispenser island.	Are there petroleum hydrocarbons in soil around former sample TA-1, indicating that the 1989 remedial excavation did not remove all of the petroleum hydrocarbon-impacted soil? Are there petroleum hydrocarbons in shallow soil in the vicinity of the former dispenser island indicating that there was a former release at that location?	*Soil and Groundwater:* Gasoline and diesel range organics (GRO and DRO) by EPA Method 8015M, benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tertiary butyl ether (MTBE) by EPA Method 8260B, napththalene and polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8310.
2	Health and Safety Code section 25296 prohibits closing UST sites without first sampling soil and groundwater for methyl tertiary butyl ether (MTBE). Samples collected from the site have not been analyzed for MTBE.	Soil and groundwater samples collected in the vicinity of the former UST excavation and the dispenser island will be analyzed for MTBE.	Is MTBE present in soil or groundwater in the vicinity of the UST indicating that there was a release of fuels containing that additive and that MTBE is a constituent of concern within the groundwater plume?	*Soil and Groundwater:* MTBE by EPA Method 8260B.
3	There is insufficient groundwater data to support the requisite characteristics of plume stability. Specifically, the nature and extent of impacts to groundwater have not been fully assessed. Grab groundwater sample TA-5 collected following completion of tank removal activities contained elevated TPH as diesel (TPHd) but the sample was not analyzed for TPH as gasoline (TPHg), although elevated TPHg was detected in soil samples collected from the UST excavation. Additionally, no groundwater samples have been collected from locations downgradient of the former UST In addition, previous samples had not been analyzed for potentially carcinogenic/and or volatile petroleum hydrocarbon constituents - PAHs and naphthalene.	Grab groundwater samples will be collected from all five borings drilled in the vicinity of and downgradient of the former UST excavation and the dispenser island. Samples will be analyzed for TPHg, PAHs, naphthalene, and BTEX.	Are TPHg, naphthalene, PAHs, and BTEX present in groundwater in the vicinity of and downgradient of the former UST? Is the extent of petroleum hydrocarbons in groundwater exceeding ESLs characterized?	*Groundwater:* TPH GRO and DRO by EPA Method 8015M, BTEX and MTBE by EPA Method 8260B, napththalene and PAHs by EPA Method 8310.

TABLE 2

DATA GAPS AND PROPOSED INVESTIGATION

Data Gap Work Plan and Focused Site Conceptual Model
Alameda County, California

Item	Data Gap	Proposed Investigation	Data Quality Objective	Analysis
4	Insufficient data have been collected to assess whether concentrations of residual petroleum hydrocarbons in soil are at levels that pose potential risk to occupants of future site buildings or site workers from volatilization vapor intrusion or direct contact.	One soil sample will be collected at depths of 0 to 5 feet bgs from each of the five borings. Samples will be collected from soil exhibiting visual evidence of contamination, petroleum odors, or elevated photoionization detector readings, or if no evidence of contamination is observed, at a depth of approximately 2.5 feet bgs. A second soil sample will be collected from each boring just above the soil/water interface (anticipated to occur between 8 and 10 feet bgs). The need for future soil gas sampling will be assessed based on the results of soil and groundwater sampling to be performed during this investigation. The results of this sampling will be presented in the subsequent sampling report.	Are volatile petroleum hydrocarbons present in shallow soil in the vicinity of the former UST and dispenser island at concentrations that could result in vapor intrusion to indoor air or volatilization to outdoor at concentrations that pose potential risk to site workers and future building occupants? Are petroleum hydrocarbon constituents at concentrations in the soil that pose risk to commercial and industrial workers at the site if they are exposed to the soil from dermal contact, incidental ingestion, or inhalation of vapors?	TPH GRO and DRO by EPA 8015M, BTEX by EPA Method 8260B, and napthalene by EPA Method 8310.
5	Insufficient data have been collected to assess the nature and extent of the contaminant plume, whether it is stable, and whether it poses low risk to human health and the environment.	Soil and groundwater analytical data collected as part of this investigation will be evaluated in terms of risk based levels and levels for protection of water quality as defined by the Regional Water Quality Control Board's Environmental Screening Levels (ESLs).	Are petroleum hydrocarbons and constituents present in soil and groundwater at concentrations that exceed screening levels for protection of industrial and commercial worker health, ecological saltwater receptors, ecological terrestrial receptors, and groundwater and surface water quality?	TPH GRO and DRO by EPA 8015M, BTEX and MTBE by EPA Method 8260B.

Abbreviations

bgs = below ground surface
BTEX = benzene, toluene, ethylbenzene, and xylenes
DRO = diesel range organics
EPA = Environmental Protection Agency
ESL = Environmental Screening Levels
GRO = gasoline range organics
LTCP = Low Threat Underground Storage Tank Case Closure Policy
LUST = leaking underground storage tank
MTBE = methyl tertiary butyl ether
NA = Not Applicable
PAH = polycyclic aromatic hydrocarbons
RWQCB = Reginal Water Quality Control Board
SCM = Site Conceptual Model
TPH = total petroleum hydrocarbons
TPHd = total petroleum hydrocarbons as diesel
TPHg = total petroleum hydrocarbons as gasoline
UST = underground storage tank