1 Declaration

1.1 Site Name and Location

This decision document amends the August 2007 Record of Decision (ROD) titled *Final Record of Decision, Operable Unit 5/IR-02 Groundwater, Alameda Point and FISCA.* The 2007 ROD and this amendment address shallow groundwater underlying a portion of Operable Unit (OU)-5 and former Fleet and Industrial Supply Center Oakland, Alameda Facility/Alameda Annex (FISCA), which are located in Alameda, California. The U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number on the National Priority List (NPL) that is applicable to this ROD amendment is CA2170023236. OU-5 is located east of Main Street and is considered part of the former Naval Air Station (NAS) Alameda, which now is referred to as Alameda Point. OU-5 consists of Installation Restoration (IR) Sites 25, 30, and 31. "IR-02 Groundwater," as identified in the 2007 ROD, is the shallow groundwater underlying portions of three FISCA IR sites, IR Sites IR-01, IR-02, and IR-03. These FISCA sites are located adjacent to OU-5, to the east and south.

This ROD Amendment addresses dissolved-phase benzene and naphthalene in the shallow groundwater underlying portions of each of the OU-5 sites and FISCA IR Sites IR-01, IR-02, and IR-03. Specifically, the shallow groundwater addressed in the 2007 ROD and this amendment is the "Shallow Fill Aquifer", which is defined as the first water-bearing zone (FWBZ) groundwater that extends to the top of the Young Bay Mud Aquitard. This aquitard is located between approximately 15 and 20 feet below ground surface (bgs).

The shallow groundwater beneath portions of OU-5 and FISCA IR Sites IR-01, IR-02, and IR-03 is grouped together to facilitate the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. "OU-5/FISCA IR-02 Groundwater" and "shallow" groundwater are used for brevity throughout this amendment.

1.2 Statement of Basis and Purpose

This amendment to the 2007 ROD selects the remedy of no further action for shallow groundwater at OU-5/FISCA IR-02. The amendment is based on data collected after issuance of the 2007 ROD and additional evaluations of historical (pre-ROD) and post-ROD data. The remedy in this ROD amendment was selected in accordance with CERCLA (1980), as amended by the Superfund Amendments and Reauthorization Act of 1986 (Title 42 of the *United States Code (USC)* Sections 9601, et seq.), and in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 of the *Code of Federal Regulations (CFR)*, Part 300).

The remedy in this amendment to the 2007 ROD is based on information in the **Administrative Record**[1] file (40 C.F.R. § 300.825(a) (2)). A site-specific Administrative Record Index is included as part of this ROD amendment. Information in the Administrative Record that forms the basis for the remedy in this amendment was developed based on site histories, extensive field investigations, laboratory analytical results, interpretation of data, current and reasonable anticipated future land use, and a thorough assessment of potential human health and ecological risks for OU-5/FISCA IR-02 shallow groundwater. The post-ROD assessments used current toxicities and risk assessment methodologies for evaluating vapor intrusion.

This amendment follows the implementation of the 2007 ROD's selected remedy for shallow groundwater (Alternative 4), which consists of biosparging with soil vapor extraction (SVE) in the plume centers, nutrient/microorganism enhancement as required, monitored natural attenuation (MNA), and institutional controls (ICs). The determination that no further action is needed for shallow groundwater at OU-5/FISCA IR-02 to protect human health and the environment is based on no unacceptable risk for the current (residential and school) land uses and potential future land uses. Further rationale for the ROD amendment, including a summary of results of key evaluations and risk assessments, is presented in Section 1.3. Because there is no unacceptable risk for residential and school or other potential uses, there are no land-use restrictions, environmental monitoring, Resource Conservation and Recovery Act (RCRA) corrective actions, or other actions required for OU-5/FISCA IR-02 shallow groundwater.

The NAS Alameda Federal Facility Agreement (FFA) was signed by the DON and EPA on July 5, 2001, and by the State of California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) and the San Francisco Bay Regional Water Quality Control Board (Water Board) in 2005. The FFA documents how the DON intends to meet its statutory obligations and implement CERCLA in partnership with EPA, DTSC, and the Water Board. The DON and EPA, as the lead regulatory agencies, co-selected the no further action remedy. The DTSC and Water Board concur on this amendment to the ROD for OU-5/FISCA IR-02 shallow groundwater.

[1] **Bold blue text** identifies detailed site information available in the Administrative Record and listed in the References table at the end of this ROD amendment. **Bold blue text** serves as a hyperlink to the referenced information. This ROD amendment is available on CD. To the extent there may be any inconsistencies between the referenced information hyperlinked in this ROD amendment and the information in this basic ROD amendment itself, the language in this basic ROD amendment has precedence. The hyperlink will open a text box at the top of the screen. A blue box surrounds applicable information in the hyperlinked text.

1.3 Assessment of the Site and Selected Amended Remedy Rationale

This section provides the rationale for the selected amended remedy and summarizes results of key assessments for shallow groundwater at OU-5/FISCA IR-02. The rationale for this no further action amendment to the 2007 ROD is that there is no unacceptable risk to human health or the environment. This conclusion is supported by site histories, extensive sampling during multiple investigations (initial groundwater sampling in 1988), evaluations of stratification of benzene and naphthalene concentrations (highest concentrations at depth at the Marsh Crust), levels of total dissolved solids (TDS) and naturally occurring constituents, and several assessments of potential ecological and human health risks for current and reasonably anticipated future land uses.

Specifically, results of the evaluations of extensive data for OU-5/FISCA IR-02 shallow groundwater show that there is no unacceptable risk for current residential and school uses and any potential future land uses, as follows:

- no unacceptable vapor intrusion risk based on multiple assessments and EPA indoor air sampling in 2013,
- no unacceptable risk for other potential pathways, and
- no unacceptable risk for the hypothetical drinking water pathway because it is not feasible to extract the shallow groundwater for drinking water purposes (low yield and other characteristics of the shallow FWBZ groundwater prohibit the installation and/or operation of a shallow groundwater well for drinking water purposes).

Results documenting no unacceptable risk to human health and the environment for shallow groundwater at OU-5/FISCA IR-02 are summarized in Section 1.3.1. Investigations and risk assessments are further described in Sections 2.3 and 2.5, respectively.

In addition to the determination of no unacceptable risk based on evaluation of data for OU-5/FISCA IR-02 shallow groundwater, there are multiple site-specific factors that further ensure the protectiveness of the no further action remedy for shallow groundwater at OU-5/FISCA IR-02. These site-specific factors include the following:

- Dissolved benzene and naphthalene concentrations are located at the bottom of the shallow FWBZ, adjacent to the Marsh Crust.
- Clays are present in the OU-5/FISCA IR-02 area above the Marsh Crust in most areas, thereby restricting potential vapor migration.
- OU-5/FISCA IR-02 shallow groundwater does not meet standards for industrial or irrigation use due to naturally occurring constituents, so would not be expected to be used for these or any other purposes.
- Within the OU-5/FISCA IR-02 area of current residential and school uses, water for all uses is supplied by a utility company from off-site sources.
- City of Alameda regulations, Alameda County regulations, and State of California regulations prohibit intrusive activities and specifically prohibit well installation in the shallow FWBZ groundwater.

Site-specific data are described in Sections 1.3.1 and 1.3.2.

1.3.1 Summary of Key Results of Evaluations

Results of key evaluations and risk assessments for shallow groundwater at OU-5/FISCA IR-02 are presented below in chronological order.

Based on results of investigations conducted between 1988 and 1999, the Water Board issued a letter in June 1999 (Concurrence Letter) addressing the shallow groundwater that is the subject of the 2007 ROD and this ROD amendment to document their evaluation and findings related to the shallow groundwater. The 1999 Water Board letter concurred with the DON's position that OU-5/FISCA IR-02 shallow groundwater does not meet the criteria for sources of drinking water pursuant to State Water Resources Control Board Resolution 88-63 and Regional Water Quality Control Board Resolution 89-39.

The 2002 OU-5 remedial investigation (RI) risk assessment included evaluation of 42 soil gas samples collected throughout OU-5/FISCA IR-02 that were analyzed for volatile organic compounds (VOCs) and for naphthalene (not included in the analysis for VOCs). The RI report states that little volatilization or release of benzene and naphthalene into vadose zone soil is occurring. The RI report risk assessment used two transport models and documented estimated **cancer risks for residential use based on the soil gas data** at well below 10^{-6} (10^{-8} to 10^{-9} cancer risks). The non-cancer risk for residential use, expressed by the hazard index (HI), is less than 1.

The 2004 groundwater RI/Feasibility Study (FS) risk assessment for OU-5/FISCA IR-02 included all available soil gas sampling results, and HydroPunch® data collected at approximately 20 feet bgs. The resulting total carcinogenic risks for groundwater for all potential receptors and pathways except drinking water use (including for residential and educational receptors) are within the risk management range of 10^{-4} to 10^{-6} specified in the NCP. Additionally, the HI values are below 1. The 2004 RI/FS for OU-5/FISCA IR-02 also evaluated **risk using soil gas data** for residents, school workers, and school students. For the residential scenario, the cancer risk based on the soil gas data is 5×10^{-8} for OU-5 and 1×10^{-6} for FISCA IR-02, and the HI values are less than 1 for both. For the school worker and school student receptors, the cancer risks based on soil gas data at OU-5/FISCA IR-02 are below 10^{-6} (10^{-7} to 10^{-8} cancer risks) and the non-cancer HI values are less than 1.

The 2007 ROD identifies the chemicals of concern (COC) for OU-5/FISCA IR-02 shallow groundwater as benzene and naphthalene, summarizes results of the risk assessment, and documents that the carcinogenic risks as a result of groundwater use for irrigation and other commercial uses are within the EPA's risk management range. Alternative 4 of the FS was selected as the remedy for OU-5/FISCA IR-02 shallow groundwater. Alternative 4 consists of biosparging with SVE in the plume centers, nutrient/microorganism enhancement as required, MNA, and ICs.

In 2007 and 2008 a pre-design investigation was conducted to address data gaps identified in the RI/FS report and to support remedial design preparation. This investigation included extensive continuous soil core collection and sampling, soil gas sampling, and multi-interval groundwater sampling. Results of this investigation document high TDS and naturally occurring constituents in shallow groundwater (due to saltwater intrusion, not a COC), confirm the stratification of the

shallow groundwater COC concentrations, with the highest concentrations at depth adjacent to the **Marsh Crust** throughout the plume area, and delineate the lithologies in the plume area. This investigation is further described in Section 2.3.2.

The **treatment system** was installed between 2008 and 2009. Consistent with the 2007 ROD RGs, the installed treatment system consisted of biosparge wells with depths determined to place the 2-foot-long biosparge well screens to extend up to 6 inches into the Bay Sediment Unit to provide oxygen delivery immediately adjacent to the Marsh Crust. Operation of the treatment system began in 2009 and ended in early 2013. Modeling conducted as part of the remedial action estimated that the treatment resulted in destruction of approximately 9.5 pounds of benzene and 86 pounds of naphthalene, which is documented in the Technical Memorandum issued in December 2012 (2012 Technical Memorandum).

In 2012, the DON conservatively evaluated **pre-treatment concentrations** using the current risk assessment vapor intrusion methodologies. Results of soil gas sampling show low to non-detect concentrations of benzene and naphthalene in soil gas above locations where groundwater concentrations are high at the Marsh Crust. Due to the Marsh Crust depth and extensive clay layer above the Marsh Crust/treatment zone limiting vapor diffusion, the groundwater treatment and concentrations in the groundwater adjacent to the Marsh Crust do not appear to affect the vapor intrusion pathway. Key vapor intrusion risk assessment details follow.

The **2012 risk assessment** evaluated historical and post-ROD data focusing on the vapor intrusion pathway. Input parameters for the vapor intrusion risk evaluation were coordinated with the regulatory agencies. This assessment used the most recent EPA Integrated Risk Information System (IRIS) toxicity criteria for all COCs and also used the current DTSC values. The risk assessment was conservatively conducted (1) using the existing soil gas data from 32 locations at OU-5 and FISCA IR-02; (2) using the current vapor intrusion evaluation methodology; (3) applying the DTSC 2011 attenuation factor for existing residential buildings at each sampling location; and (4) using DTSC toxicity criteria for benzene and naphthalene. Cancer risks for benzene from vapor inhalation for residential receptors are between 4.8×10^{-8} and 4.8×10^{-7}. Cancer risks for naphthalene from vapor inhalation for residential receptors are between 5.6×10^{-8} and 5.0×10^{-6}. In addition, results from 2002 crawl space and indoor air sampling indicate that **benzene concentrations in crawl spaces** are lower than in indoor air, indicating that benzene in indoor air is not due to vapors from groundwater. The 2012 assessment of vapor intrusion risk is further described in Section 2.5.1.

In 2012 the **completeness and significance of the vapor intrusion exposure pathway** at OU-5/FISCA IR-02 also were evaluated to assess whether the benzene and naphthalene in shallow groundwater pose a potential indoor air inhalation risk to residents. Results of the evaluation support the no further action decision for OU-5/FISCA IR-02 shallow groundwater. This detailed evaluation included the following lines of supporting evidence:

- Direct measurements from sampling soil gas, shallow groundwater, crawl space air, indoor air, and outdoor ambient air;
- Results from modeling the migration of volatile compounds using different models in multiple assessments; and

- Results of additional characterization of the subsurface and stratigraphy relative to factors known either to enhance or diminish the potential for vapor intrusion.

The lines of evidence above are described in Sections 2.3 and 2.5. The 2012 evaluation concludes that the weight of evidence from evaluation of multiple lines of evidence collected during the past 20 years supports the conclusion that vapor intrusion and subsequent indoor air inhalation exposure to volatile compounds from groundwater do not pose risk to residential receptors.

In October 2013, the EPA conducted **sub-slab soil gas and indoor and outdoor air sampling** to further evaluate the potential vapor intrusion risk based on current sampling. The sub-slab sample results were non-detect for all naphthalene samples. For benzene, the sub-slab sample results were non-detect except at one of four child daycare locations, where a value of 2 parts per billion by volume (ppbv) was qualified as estimated below the quantitation limit. This result is below the California Human Health Screening Level for sub-slab air of 11.3 ppbv for benzene. Indoor air results for all samples were non-detect for naphthalene. Benzene results for indoor air were consistent with outdoor air results. The results of EPA's 2013 indoor air and sub-slab sampling support previous risk assessments showing no unacceptable vapor intrusion risk due to groundwater.

Results of the extensive sampling and multiple risk assessments conducted from 1988 through EPA's 2013 sampling event at OU-5/FISCA IR-02 provide a high level of confidence in the protectiveness of the no further action remedy for OU-5/FISCA IR-02 shallow groundwater. Results of ecological risk assessment show that the presence of terrestrial receptors is limited, and there is no significant ecological risk to current and expected future terrestrial receptors.

In addition, at OU-5/FISCA IR-02, multiple site-specific characteristics of the shallow FWBZ groundwater make the hypothetical use for drinking water not feasible. There is no viable potential pathway for ingestion of OU-5/FISCA IR-02 shallow groundwater because there is insufficient yield, i.e. the shallow groundwater cannot be extracted for drinking. The characteristics of OU-5/FISCA IR-02 shallow groundwater that preclude its use for drinking water include the following:

- The RI/FS Report documents that the maximum artificial fill thickness is approximately 15 to 20 feet in the OU-5/FISCA IR-02 area. This is too thin for the shallow FWBZ at OU5/FISCA IR-02 to meet minimum construction requirements for community potable or industrial water supply wells. The required annular sanitary seal for a well cannot be installed due to the thin fill, so a well that could produce water for drinking cannot be constructed and operated.

- The thickness of the shallow FWBZ at OU-5/FISCA IR-02 is only approximately 2 feet thick in some areas, with an average thickness of 6 feet. In addition, there are significant clay lithologies present, as documented in the continuous coring conducted as part of the pre-design investigation. The very small water bearing zone thickness combined with the clay that does not yield much water result in a low yield for the shallow FWBZ at OU-5/FISCA IR-02. Therefore, insufficient water is available for extraction and a sustained yield for drinking water use is not possible.

- The high TDS (average of 16,075 mg/L) as a result of saltwater intrusion and high naturally occurring sulfates, iron, and alkalinity, as further described below, make the naturally occurring shallow groundwater quality at OU-5/FISCA IR-02 unusable for potable water and unsuitable for any use.

    - The average TDS concentration of 16,075 mg/L in the OU-5/FISCA IR-02 shallow groundwater significantly exceeds State of California and EPA criteria for drinking water. In addition, the TDS in the shallow groundwater exceeds acceptable levels for crop irrigation or livestock watering (i.e., below 5,000 mg/L) or landscape watering (i.e., below 2,000 mg/L). Industrial supply is not a potential beneficial use of the OU-5/FISCA IR-02 shallow FWBZ groundwater due to TDS concentrations greater than 1,000 mg/L.

    - For sulfates, concentrations should be below 250 mg/L to avoid laxative effects. OU-5/FISCA IR-02 sulfate concentrations are up to 2,780 mg/L.

    - For iron, a concentration of 0.3 mg/L is considered acceptable for domestic use. OU-5/FISCA IR-02 iron concentrations are up to 10 mg/L.

    - For alkalinity, the recommended range for potable water is between 30 and 400 mg/L. OU-5/FISCA IR-02 alkalinity concentrations are up to 4,250 mg/L.

In summary, shallow groundwater does not pose an unacceptable risk to human health or the environment under the current or expected future (residential and school) land uses or any other land uses. Therefore, the no further action remedy allows unrestricted site use.

1.3.2 Additional Site-Specific Protectiveness Factors

Separate from the assessment of extensive data for OU-5/FISCA IR-02 shallow groundwater that shows there is no unacceptable risk and there is not sufficient shallow groundwater to extract, a number of other site-specific factors provide further protectiveness and are briefly described in this section. These factors are summarized below.

Dissolved benzene and naphthalene concentrations are located at the bottom of the shallow FWBZ, adjacent to the Marsh Crust. This provides further protectiveness because the dissolved benzene and, to a lesser degree naphthalene, are typically present at the top of the water table, which provides more of a potential for migration of vapors and vapor intrusion. Stratification with the high concentrations at approximately 18 feet bgs significantly minimizes the potential for any vapor intrusion concerns.

Clays are present in the OU-5/FISCA IR-02 area above the Marsh Crust in most areas. This provides further protectiveness because the clays restrict potential vapor migration.

Within the OU-5/FISCA IR-02 area of current residential and school uses, water for all uses is supplied by a utility company from off-site sources. East Bay Municipal Utility District (EBMUD) has historically provided the water supply, currently provides it, and is expected to continue to provide the water service in the future.

City of Alameda regulations, Alameda County regulations, and State of California regulations prohibit intrusive activities and specifically prohibit well installation in the shallow FWBZ groundwater. OU-5/FISCA IR-02 is located within the area regulated by the City of Alameda's Marsh Crust Ordinance No. 2824. This Ordinance prohibits excavations and intrusive activities, and drilling is one type of intrusive activity. In addition, drilling of wells in the saline shallow FWBZ is prohibited by Alameda County Title 6 Chapter 6.88, "Water Wells" and by "Water Well Standards: State of California"(Bulletin No. 74) and "Cathodic Protection Well Standards: State of California" (Bulletin No 74-1). These existing regulations provide further assuredness that the no further action remedy is protective.

1.4 Statutory Determinations

The DON, EPA, and the State of California (referring collectively to the DTSC and Water Board) have concluded that the selected remedy of no further remedial action is appropriate for OU-5/FISCA IR-02 shallow groundwater because the shallow groundwater does not pose an unacceptable risk to human health or the environment. A five-year review is not required because this remedy does not result in hazardous substances, pollutants, or contaminants remaining on site at levels exceeding action levels or that require limitations in land use or restricted exposure.

1.5 Data Certification Checklist

The data certification checklist information provided in Table 1 is included in Section 2 of this ROD amendment. Additional information is provided in the Administrative Record for this site.

TABLE 1: DATA CERTIFICATION CHECKLIST

Checklist Item	Description
Identification of chemicals of potential concern (COPC) and their concentrations	COPCs in shallow groundwater throughout OU-5/FISCA IR-02 were characterized based on data from several investigations. Descriptions of these investigations are provided in Section 2.3 of this ROD amendment.
Risk assessments representative of the COPCs	A human health risk assessment (HHRA) and screening-level ecological risk assessment (ERA) were conducted as part of the RI/FS using data representative of current and future conditions at OU-5/FISCA IR-02. The baseline HHRA findings are supported by subsequent risk assessment evaluations of the potential for vapor intrusion using data collected to date in combination with current DTSC and EPA vapor intrusion assessment methodologies and toxicity criteria. Risk assessment results are presented in Section 2.5 of this ROD amendment.
How source materials constituting principal threats are addressed	As discussed in Section 2.6 of this ROD amendment, there are no wastes constituting principal threats at OU-5/FISCA IR-02.
Current and reasonably anticipated future land-use assumptions and current and potential future beneficial uses of groundwater	OU-5 currently is a residential area containing occupied and unoccupied U.S. Coast Guard (USCG) housing, an unoccupied high school, and a day care center. The long-term reuse of OU-5 is anticipated to be residential and educational. The western portion of IR-02 currently contains occupied housing. The remainder of IR-02 currently is under development for mixed residential and commercial use. Drinking water is supplied to OU-5/FISCA IR-02 by the East Bay Municipal Utility District, and shallow groundwater at the site is not expected to be used for domestic purposes in the future. Groundwater in the FWBZ is sufficiently impaired relative to multiple quality parameters that non-potable beneficial uses for car washing, landscaping, or irrigation likely are not realistic based on operational constraints. Current and potential future site uses are discussed in Section 2.4 of this ROD amendment.

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1.6 Authorizing Signatures

This signature sheet documents the DON's and the EPA's co-selection of no further action for shallow groundwater in this ROD amendment for OU-5/FISCA IR-02 at Alameda Point and FISCA. It also documents the concurrence of the State of California through the DTSC and the Water Board. The respective parties may sign this sheet in counterparts.

Signature **Date**

Mr. Derek Robinson
Base Realignment and Closure Environmental Coordinator
Base Realignment and Closure Program Management Office West
Department of the Navy

Signature **Date**

Ms. Angeles Herrera
Assistant Director, Superfund Division
Federal Facilities and Cleanup Branch
United States Environmental Protection Agency, Region 9

Signature **Date**

Ms. Karen M. Toth, P.E.
Unit Chief
Brownfields and Environmental Restoration Program
California Environmental Protection Agency
Department of Toxic Substances Control

Signature **Date**

Mr. Bruce H. Wolfe
Executive Officer
California Environmental Protection Agency
San Francisco Bay Regional Water Quality Control Board

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2 Decision Summary

2.1 Site Description and History

OU-5/FISCA IR-02 is located within two former DON installations in Alameda, California: OU-5 is located on the **former NAS Alameda, now referred to as Alameda Point**, and IR-02 is located on the **former FISCA**.

Alameda Point is located on the western tip of Alameda Island, which is surrounded by San Francisco Bay and the Oakland Inner Harbor (Figure 1). FISCA is located along the southern shore of the Oakland Inner Harbor east of Alameda Point. In this ROD amendment, the site collectively is referred to as OU-5/FISCA IR-02 or is discussed as either OU-5 to represent the property within Alameda Point or IR-02 to represent the property within FISCA.

NAS Alameda ceased operations in 1997. When NAS Alameda and FISCA were designated for closure, the Alameda Point Base Realignment and Closure (BRAC) Cleanup Team (BCT) became responsible for the environmental cleanup program. The BCT consists of representatives from the DON, EPA, DTSC, and Water Board. FISCA was transferred under an early transfer conveyance to the City of Alameda in June 2000, and after that conveyance, the DON continued to investigate and remediate FISCA sites under a revised Federal Facility Site Remediation Agreement (FFSRA) entered into with DTSC.

OU-5/FISCA IR-02 includes six IR sites (Figure 2). These IR sites are included in the 2007 ROD and this amendment, but are not included in the site name for brevity's sake. Previous site documentation refers to OU-5 as IR Site 25. Shallow groundwater beneath OU-5 at Alameda Point and IR-02 at FISCA is addressed in one ROD because there is one plume.

FIGURE 1: Alameda Point Location Map

FIGURE 2: OU-5/FISCA IR-02 Site Location Map

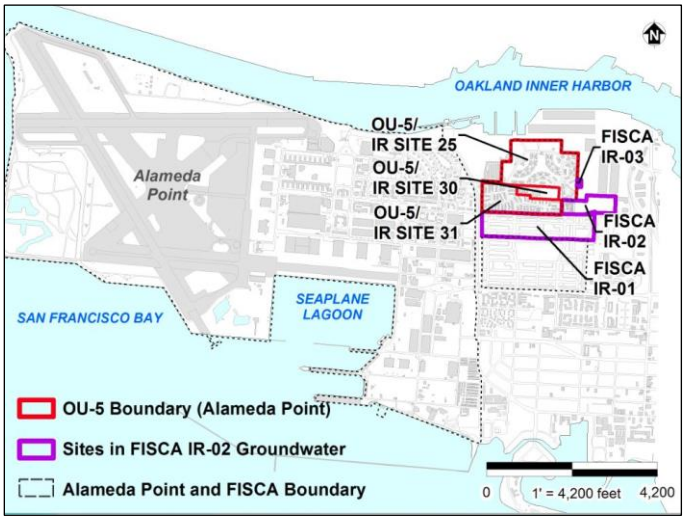
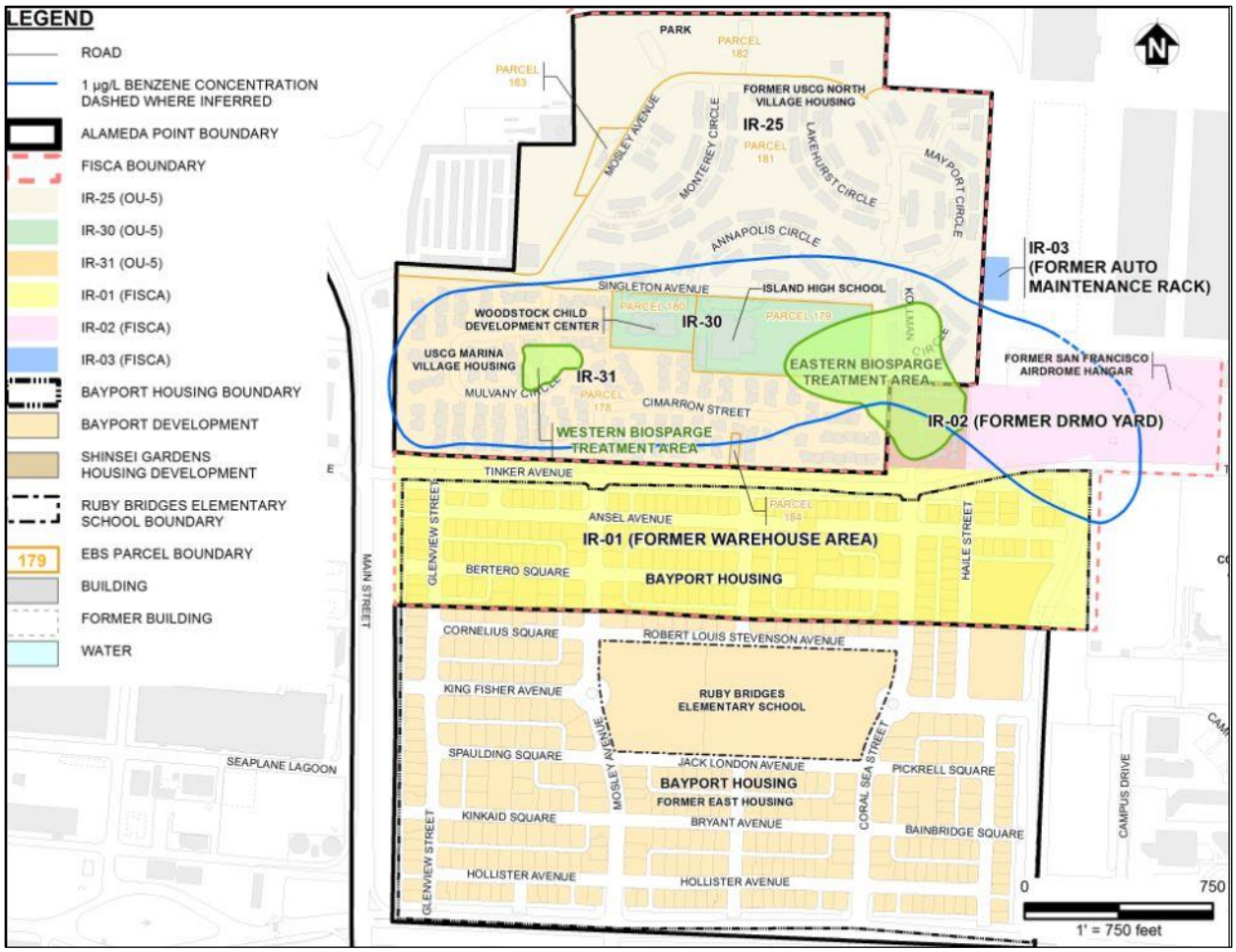


Figure 3 shows the **key features at the site**. **Plume boundaries,** defined as shallow groundwater containing benzene exceeding 1 µg/L, are shown on Figure 3 for the FWBZ and are based on the August 2013 annual plume perimeter monitoring well sample results.

FIGURE 3: OU-5/FISCA IR-02 Site Delineation and Site Features



OU-5, located east of Main Street on Alameda Point, consists of IR Site 25, IR Site 30, and IR Site 31. The OU-5 property historically was used for housing and storage. IR Site 25 is located on the northeast side of Alameda Point and occupies approximately 42 acres. IR Site 25 includes currently unoccupied housing, a park, and the USCG Housing Maintenance Office. IR Site 30 is located south of IR Site 25 and occupies approximately 6 acres. IR Site 30 includes currently unoccupied Island High School and the Woodstock Child Development Center. IR Site 31 is located south and west of IR Site 30 and occupies approximately 25 acres. USCG Marina Village Housing is located at IR Site 31.

FISCA IR-02 shallow groundwater includes portions of the three FISCA sites: IR-01, IR-02, and IR-03. IR-01 is a former warehouse area south of IR Site 31 on the southwest side of FISCA. Bayport Housing has since been constructed at IR-01. IR-02 is located on the south-central side of FISCA. Until 1997, the Defense Logistics Agency Defense Reutilization and Marketing

Office used the western portion of IR-02 as a screening lot and for temporary equipment storage. The eastern portion of IR-02 was used as a scrap yard and for temporary storage of discarded automobiles, stockpiled scrap metal, and surplus equipment. The Shinsei Garden Housing Development is a multi-family residential development constructed on the western portion of IR-02. The remainder of IR-02 currently is under development for mixed residential and commercial use. IR-03 is located on the west-central side of FISCA. It formerly consisted of an automotive drive-up maintenance rack over an asphalt-paved area. The area remains undeveloped.

2.2 Site Characteristics

Alameda Point **geology** is characterized by unconsolidated sedimentary deposits, and surface conditions are characterized by flat topography. There are no streams or surface water bodies at the site. Urban habitat vegetation, which is characterized by ornamental shrubs, trees, and landscaped areas, generally supports few wildlife species due to human disturbances and limited vegetation.

Surface and near-surface soil at the site consists of artificial fill (to approximately 17 feet bgs) placed during the historical filling of the tidal marshlands, which occurred from approximately 1900 to 1930. The **Bay Sediment Unit (BSU)** underlying the artificial fill material ranges from 25 to 100 feet thick and consists of gray to black, high-plasticity clay, with occasional abundant organic material deposited in an estuarine environment.

The **hydrogeology** at Alameda Island includes a shallow water table aquifer above the deeper regional aquifers. The BSU forms an aquitard between the FWBZ and second water-bearing zone (SWBZ), the deeper, confined aquifer beneath the site. Shallow groundwater has a lateral flow direction that is variable but generally is north to northwest toward Oakland Inner Harbor. Local variation likely results primarily from the variable permeability of the shallow aquifer fill material.

Shallow groundwater is not used for drinking water, and water service is provided by the EBMUD from a separate source.

2.3 Previous Investigations, Removal Actions, and a Remedial Action

A series of environmental investigations, removal actions, and a remedial action were conducted at OU-5/FISCA IR-02 between 1988 and 2013 to assess potential sources of contamination and implement remedial action for shallow groundwater at the site. Findings from investigations involving air sampling conducted to evaluate protectiveness at military housing are not included in the 2007 ROD but are described in this section to further support this ROD amendment. Soil removal and remedial actions listed in the 2007 ROD for soil with different COCs (metals and polychlorinated biphenyls [PCB]) are not described below because these soil actions are not relevant to the shallow groundwater COCs (benzene and naphthalene) addressed in this amendment. Investigations and actions are summarized in Table 2, with key investigations described after this table. No enforcement activities have occurred in association with OU-5/FISCA IR-02, and there are no RCRA units at OU-5/FISCA IR-02.

TABLE 2: TIME LINE SUMMARY OF PREVIOUS INVESTIGATIONS, REMOVAL ACTIONS, AND A REMEDIAL ACTION FOR OU-5/FISCA IR-02 GROUNDWATER

Previous Investigation or Action[a]	Date	Findings
Preliminary Assessment/Site Investigation, Naval Supply Center, Alameda Annex and Facility	1988	This assessment/investigation identifies sites that pose potential risks to human health or the environment and areas where hazardous materials were stored, transferred, processed, and disposed of. VOCs were identified in shallow groundwater.
Air Sampling and Analysis, Naval Family Housing Area	1993	This analysis presents the earliest indoor and outdoor air sampling results. Air samples were collected in 1992 at Marina Village Housing. The report concludes that indoor air results for Marina Village houses are similar to ambient and typical indoor air levels.
RI, Fleet and Industrial Supply Center Oakland	1996	The ERA in this RI Report concludes that there is no ecological risk to San Francisco Bay due to lateral groundwater movement or storm sewer system discharge. Additionally, the ERA concludes that the site supports only limited habitat, the presence of terrestrial receptors is limited, and future land uses would not create additional ecological habitat.
Screening Level ERA for Alameda Point	1999	This ERA concludes that there is no significant risk to terrestrial ecological receptors, the site supports only limited habitat, the presence of terrestrial receptors is limited, and future land uses would not create additional ecological habitat.
Baseline HHRA	2000	The HHRA presents a qualitative human health evaluation that identifies commercial car wash and landscaping irrigation workers as hypothetical receptors.
Soil Removal at IR Site 25 (Parcel 181)	2000	This report documents removal of soil with elevated levels of polycyclic aromatic hydrocarbons (PAH) from the Clover Park play area at IR Site 25 to eliminate risk to children in the play area. Soil in the play area was excavated to 4 feet bgs and transported off site to an approved landfill. An estimated total of 900 cubic yards of soil was removed.
Environmental Baseline Survey (EBS), Zone 16, Parcels 178 through 184, Alameda Point	2001	The EBS report presents the results of soil, soil gas, and shallow groundwater samples collected as part of the EBS for the OU-5 parcels. VOCs were detected in soil, soil gas, and shallow groundwater samples.
Time-critical Removal Action (TCRA) for USCG North Village Housing and Estuary Park at IR Site 25	2001-2002	The TCRA addressed potential health risk from PAH-impacted soil through the removal of the upper 2 feet of soil in areas with elevated PAH concentrations. The total excavation area was approximately 26 acres. The excavation was backfilled with clean imported fill, topsoil, and sod. Excavated soil was disposed of at an off-site disposal facility.

Previous Investigation or Action[a]	Date	Findings
OU-5 RI	2002	The RI report presents the results of RI sampling and risk assessment for OU-5. Soil gas data were collected to evaluate potential residential indoor air risk due to VOCs migrating from the soil and groundwater into a residence. Vertical stratification of benzene in shallow groundwater was discovered. Resulting cancer risks for the maximum soil gas concentrations of all VOCs were well below 10^{-6} (10^{-8} to 10^{-9}), and HI values were below 1.
Residential Risk Evaluation for USCG Housing (by USCG)	2002	This evaluation presents results of indoor and outdoor air and crawl space sampling conducted for this report and provides a risk assessment using data collected during the OU-5 RI. Results indicate that risks to USCG personnel residing in this housing are similar to risks to other individuals residing in the San Francisco Bay Area.
Groundwater RI/FS, IR Site 25 and Alameda Annex IR-02	2004	The RI/FS report includes an HHRA, identifies applicable and relevant or appropriate requirements (ARAR), and develops and evaluates remedial action objectives (RAO) and remedial alternatives. This HHRA concludes that risks are acceptable except for unacceptable risk for hypothetical potable water use. The FS cites proposed RGs of 1 µg/L for benzene and 100 µg/L for naphthalene.
TCRA, IR Site 30	2004	The TCRA, which included addition of soil cover materials and soil removal, was conducted as a proactive measure to protect human health and the environment while the RI was being completed.
Soil RI, IR Site 30 School and Child Development Center	2005	The RI report presents RI sampling results and the associated HHRA. HHRA results indicate that no action is required for soil.
Basewide Groundwater Monitoring	2002-2007	Basewide groundwater monitoring reports present groundwater monitoring results and discuss plume status, natural degradation, and groundwater flow directions and gradients.
Soil RI, IR Site 31 Marina Village Housing	2007	The RI report presents RI sampling results and the associated HHRA. HHRA results indicate that no action is required for soil.
ROD, OU-5/FISCA IR-02 Groundwater	2007	The ROD documents the selected remedy for the shallow groundwater. The selected remedy is Alternative 4: biosparging in the plume centers, with SVE and nutrients/ microorganism enhancement (as required), MNA for the remaining plume, and ICs during the implementation of the remedial action.

Previous Investigation or Action[a]	Date	Findings
Remedial Design (RD)/Remedial Action Work Plan (RAWP) for OU-5/FISCA IR-02 Groundwater	2007-2010	The RD RAWP documents pre-design investigation results and presents the RD. Investigation results indicate that benzene and naphthalene concentrations increase with depth, with the highest concentrations at the Marsh Crust and low to non-detect concentrations at the top of the water table. A ubiquitous, competent, fairly continuous clay layer between shallow groundwater and the ground surface at or above the groundwater table would retard vapor migration.
Results for Groundwater Monitoring Conducted from 2009 through 2013	2009-2013	Biosparge zone and the biosparge perimeter groundwater monitoring wells were sampled for benzene and naphthalene. Results confirm a decrease in the overall size of the plume and a decrease in benzene and naphthalene concentrations at most locations over the 4-year period of operation.
OU-5/FISCA IR-02 Groundwater Data Evaluation Technical Memorandum (referred to as 2012 Technical Memorandum in this ROD addendum)	2012	The 2012 Technical Memorandum reevaluates shallow groundwater quality and potential human health risks associated with shallow groundwater underlying OU-5 (IR Sites 25, 30, and 31) and FISCA IR-02. It documents that no further action for shallow groundwater is protective of humans living or working above the plume from the potential migration of benzene and naphthalene vapors into indoor air.
EPA Sub-slab Soil Gas and Indoor and Outdoor Air Sampling	2013	Soil gas and indoor air sampling was conducted. The sub-slab soil gas and indoor air results were non-detect for all naphthalene samples. For benzene, the sub-slab soil gas results were non-detect except at one of four child daycare locations, where a value of 2 ppbv was qualified as estimated below the quantitation limit. Benzene results for indoor air were consistent with outdoor air results. These results indicate that there is no indoor air contamination due to shallow groundwater.

Note:
a Documents describing the investigations and actions are available in the Administrative Record and provide detailed information used to support the remedy selection for shallow groundwater at OU-5/FISCA IR-02.

2.3.1 Summary of Pre-ROD Investigation Data

Because pre-2007 indoor air and crawl space air data are not described in the 2007 ROD and because the potential vapor intrusion pathway is relevant to this ROD amendment, this section describes investigations during which these air data were gathered. Risk assessment results related to the vapor intrusion pathway for the pre-remediation data are described in Section 2.5.

Air Sampling and Analysis, Naval Family Housing Area (Marina Village Housing), 1993

In July 1992, samples were collected of indoor air in Marina Village houses, outdoor air, and indoor air from houses located outside of Marina Village Housing. No sub-slab or soil gas samples were collected during this sampling event. Air samples were collected from 30 houses in Marina Village Housing, most of which were occupied. All samples were analyzed for benzene,

and samples from 15 of the houses also were analyzed for VOCs, which include naphthalene. The samples were collected using SUMMA air canisters allowed to fill over 1 hour. Field duplicates were collected to assess the precision of the sample collection and analysis methods, and field duplicates from two houses were analyzed for VOCs.

Benzene was detected in all of the 1992 indoor air samples, with results ranging from 0.47 to 23 part-per-billion (ppb). Naphthalene was non-detect in one indoor air sample, and 9 of the 15 Marina Village houses had naphthalene results less than 26 ppb, the naphthalene result for the outdoor air sample. Naphthalene indoor air results ranged from non-detect to 280 ppb. For benzene, the field duplicate relative percent difference (RPD) results for the 1992 indoor air sampling showed good precision. However, for VOCs, the 1992 indoor air sampling results were significantly different, with naphthalene showing the greatest RPD of all of the VOCs. At one of the two buildings where a field duplicate sample was collected, naphthalene results for the two samples were 12 ppb and 150 ppb (an RPD of 170). The 1993 report states that this level of variability is not uncommon with VOC analysis of air samples and needs to be considered in the interpretation and assessment of the 1992 VOC air data.

There was no correlation of the 1992 benzene and naphthalene indoor air results. The highest benzene level of 23 ppb was in a sample with a naphthalene result of 22 ppb. The highest naphthalene result was in a sample containing 3.1 ppb of benzene. Given the co-location of benzene and naphthalene in the shallow groundwater plume, the volatile property of benzene, and the RPD results for naphthalene air data, the data from this investigation indicate that the naphthalene levels presented in this report are not due to naphthalene that has volatilized from OU-5/FISCA IR-02 shallow groundwater.

Off-site indoor air results were similar to on-site results. The 1993 report notes that the Agency for Toxic Substances and Disease Registry (ATSDR) identifies the largest sources of naphthalene emissions to ambient air as the combustion of fossil fuels and the volatilization of mothballs. In addition to comparison to off-site background levels during the 1992 sampling, the report compared the Marina Village Housing indoor air levels to the national VOC database and results from other studies. The 1993 report concludes that indoor air results for benzene and naphthalene in Marina Village houses are similar to ambient and typical indoor air levels.

Environmental Baseline Survey, 2001

The EBS report issued in 2001 presents the results of the various phases of EBS investigation. During the EBS, air data were collected from the school (George P. Miller Elementary School at that time). Six air samples and two field duplicates were collected from three locations within the crawl space of the school building in November 1994 as part of the EBS. The air samples were collected using SUMMA canisters filled for a combination of 1-hour and 8-hour periods and were analyzed for benzene. Because benzene is more volatile than naphthalene, in this investigation, the laboratory did not analyze samples for naphthalene. Benzene was not detected in any of these crawl space air samples.

Residential Risk Evaluation for USCG Housing, 2002

Indoor air, outdoor air, and crawl space sampling were conducted in 2002 at North Village Housing (including Kollman Circle) and Marina Village Housing. At North Village Housing, 34 air samples were collected (17 indoor air samples, 12 crawl space samples, and 5 outdoor air samples). At Marina Village Housing, 19 air samples were collected (13 indoor air samples and 6 outdoor air samples; due to housing construction, there are no crawl spaces at Marina Village). All air samples were collected using SUMMA air canisters with sampling integrated over a 24-hour period. These samples were analyzed for VOCs. The indoor air quality assessment evaluated ten VOCs. Naphthalene was not one of the 10 VOCs evaluated.

The 2002 report concludes that (1) VOC concentrations in crawl space air do not differ from indoor air concentrations and (2) indoor air VOC concentrations are consistent with both outdoor air concentrations and ambient air measurements collected by the California Air Resources Board (CARB) for the Bay area. Thus, indoor air concentrations in these housing areas are not elevated over ambient levels for the San Francisco Bay area.

Evaluation of air sampling results at houses with both crawl space data and indoor air data (as well as outdoor air data) is important in determining the source of the concentrations. Table 3 presents the 2002 benzene air results for houses where both crawl space and indoor air data were collected. At some locations, outdoor air samples also were collected.

TABLE 3: BENZENE CONTAMINATION DISTRIBUTIONS AT CRAWL SPACE AIR, INDOOR AIR, AND OUTDOOR AIR LOCATIONS

Housing Area	Address	Crawl Space Air Benzene Concentration ($\mu g/m^3$)	Indoor Air Concentration ($\mu g/m^3$)	Outdoor Air Concentration ($\mu g/m^3$)
North Housing Area	103 F Singleton	1.10	2.6	2.6
	2000 D Mayport	2.70	3.9	5.2
	2004 D Mayport	2.40	2.9	2.8
	2006 E Mayport	1.80	4.6	3.1
Kollman Circle	2000 A Kollman	1.05	0.59	Not Measured
	2000 E Kollman	0.49	0.88	Not Measured
	2002 C Kollman	0.46	0.65	Not Measured
	2004 C Kollman	0.46	0.52	Not Measured
	2006 B Kollman	0.65	0.52	Not Measured
	2006 E Kollman	0.49	0.55	0.49
	2008 D Kollman	0.49	0.59	Not Measured
	2010 C Kollman	0.52	0.62	Not Measured

Note:
Air data were collected in 2002.
Source: Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Tetra Tech EC, Inc. (TtEC). 2012.

If VOCs are migrating from subsurface sources (such as groundwater or soil vapor) to indoor air and the building has a crawl space, then the VOC concentrations should be higher in crawl space air than in indoor air. At 10 of the 12 addresses where both crawl space and indoor air data were collected, the crawl space benzene results were lower than the indoor air results. At the other two

sampling locations, benzene results were similar (0.65 microgram per cubic meter [µg/m^3] in the crawl space and 0.59 µg/m^3 in indoor air at one location, and 0.65 µg/m^3 in the crawl space and 0.52 µg/m^3 in indoor air at the other location).

Crawl space and indoor air data were evaluated statistically, and statistical results also indicated that benzene concentrations in crawl space air were lower than in indoor air. The crawl space benzene air sampling results also were less than outdoor air levels except in one sample, where the results were the same. These air analytical results also support the conclusion that shallow groundwater is not the source of indoor air concentrations. Further evaluation of these data is included in the 2012 Technical Memorandum.

2.3.2 Summary of ROD and Post-ROD Data

The ROD and post-ROD data and evaluations are described in this section because in conjunction with the risk assessments, they provide the foundation for this ROD amendment. The risk assessments are described in Section 2.5.

Summary of Record of Decision, 2007

The **2007 ROD** identifies the COCs for the site as dissolved-phase benzene and naphthalene in shallow groundwater. The RAO for shallow groundwater is to protect human health by preventing exposure of potential residents and occupational workers to benzene and naphthalene in shallow groundwater at OU-5/FISCA IR-02.

Pre-Design Investigation and Remedial Design/Remedial Action Work Plan (RD/RAWP), 2007 – 2010

A pre-design investigation was conducted in 2007 and 2008 to address data gaps identified in the RI/FS report. The investigation included collection of continuous cores, soil gas samples, soil samples, and multi-depth groundwater samples all presented in the RD/RAWP. Fifty-nine continuously cored soil borings were collected during this pre-design investigation. These cores showed a competent, fairly continuous, ubiquitous clay layer that is typically over 2 feet thick between groundwater and the ground surface in the vadose zone across the site at or above the groundwater table. The cores showed some variability; although the clay layer typically is slightly over 2 feet thick, it is thinner in some portions of the site. The clay layer has been shown through soil gas measurements above and below the layer to be effectively limiting the upward migration of benzene and naphthalene volatilized out of shallow groundwater into soil gas. Therefore, site data indicate that the variability in the clay layer has not resulted in increased soil gas measurements above it.

In 2007, a **passive soil gas survey** was conducted as part of the pre-design investigation to support the RD/RAWP. The survey was conducted throughout the estimated plume center identified during the RI/FS to refine plume center HydroPunch® and soil boring locations. Eighty-seven Gore-Sorber modules installed in May 2007 were removed 1 month later. Benzene and naphthalene were not detected in Gore-Sorber modules at the Kollman Circle housing area, where high benzene and naphthalene concentrations had been reported in shallow groundwater, indicating that vertical migration of soil gas is limited.

In 2007 and 2008, **soil and groundwater samples** were collected from HydroPunch® and monitoring well locations along the plume center and along the plume boundary. Table 4 presents the results of multi-depth soil and groundwater sampling.

Results confirm that contaminant concentrations increase with depth, with the highest concentrations at the Marsh Crust and low to non-detect concentrations at the top of the water table.

TABLE 4: VERTICAL SOIL AND GROUNDWATER CONTAMINATION DISTRIBUTIONS AT HYDROPUNCH SAMPLING LOCATIONS

Location	Soil			Groundwater		
	Sampling Depth (feet bgs)	Benzene (µg/kg)	Naphthalene (µg/kg)	Sampling Depth (feet bgs)	Benzene (µg/L)	Naphthalene (µg/L)
PC2–1	8–8.5	5.5 U	5.5 UJ	6.5–9.5	1.7	1.2 J
	13–13.5	5.8 U	11 J	12–15	170	1,500 J
	15–15.5	1,300 J	640,000	14.5–17.5	580	9,600
PC2–3	9.5–10	5.7 U	5.7 UJ	8–11	0.50 U	0.64 J
	13–13.5	4,600 J	830,000	11–14	1,800	6,100 J
PC2–4	9.5–10	9.4 U	9.4 U	8–11	no water	no water
	13–13.5	5.8 U	4.9 J	12–15	0.50 U	2.0 U
	18.5–19	29,000 J	2,700,000 J	16–19	160	1,800
PC2-6	13–13.5	5.5 U	5.5 U	11.5–14.5	0.50 U	2.3
	16.5–17	15,000 J	5,100,000	15–18	490	4,400
PC3–4	13–13.5	5.4 U	3.0 J	12.5–13.5	0.50 U	0.68 J
	16–16.5	1,000	120,000	14.5–17.5	1,300	5,800
PC3–10	7–7.5	7.1 U	7.1 U	(clay)	no sample	no sample
	13.75–14.25	9.7 U	9.7 U	(clay)	no sample	no sample
	15–16	610 J	340,000	14–17	84	1,600
PC3–12	9.5–10	10 U	10 U	(clay)	no sample	no sample
	13–13.5	310 J	42,000	(clay)	no sample	no sample
	15–15.5	2,100	800,000	13–16	34	33
PC3–13	9.5–10	9.1 U	9.1 U	7.5–10.5	no water	no water
	13–13.5	7.9 U	7.9 U	12–15	8.1	660
	16.5–17	5,000 J	1,800,000	15–18	730	7,300
PC3–14	7.5–8	6.0 U	6.0 U	6–9	0.50 U	2.0 U
	11–11.5	11 U	11 U	(clay)	no sample	no sample
	13.5–14	8.7	1,800 J	12.5–15.5	90	390
	15.5–16	31,000 J	4,100,000 J	(silt and clay)	no sample	no sample

Notes: The data were collected in 2007 and 2008 as part of the pre-design investigation.
Highlighted cells show the shallowest depth result for each groundwater sampling location.
In some cases, this highlighted depth is at or near the Marsh Crust.
µg/kg = Microgram per kilogram
µg/L = Microgram per liter
J = Estimated value
U = Analyte not detected above project reporting limit
Source: Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. TtEC. 2012.

Groundwater samples collected during the pre-design investigation also were analyzed for TDS, sulfate, iron, and alkalinity to determine if groundwater in the shallow, FWBZ meets municipal

or domestic supply criteria. These are naturally occurring constituents, not COCs. Table 5 summarizes the results. As Table 5 shows, shallow groundwater sample results exceed drinking water and domestic water supply suitability criteria for TDS, sulfate, iron and alkalinity. Shallow groundwater quality in the FWBZ of OU-5/FISCA IR-02 does not meet drinking water or domestic supply criteria.

TABLE 5: COMPARISON OF GROUNDWATER SAMPLE RESULTS TO WATER QUALITY CRITERIA

Water Quality Parameter	Source for Water Quality Criterion	Criterion (mg/L)	Site Average Concentration (mg/L)	Site Maximum Concentration (mg/L)
TDS	State Water Resources Control Board (SWRCB) Resolution No. 88-63, Class II Groundwater	3,000	16,075	38,300
	Safe Drinking Water Act of 1974, Class III Groundwater	10,000	16,075	38,300
Sulfate	EPA National Secondary Drinking Water Regulations, May 2009	250	133	2,780
Iron	EPA National Secondary Drinking Water Regulations, May 2009	1	3	10
Alkalinity	Illinois Department of Public Health pamphlet titled "Commonly Found Substances in Drinking Water and Available Treatment"	500	2,111	4,550

Notes:
The data were collected in 2007 and 2008 as part of the pre-design investigation.
mg/L = Milligram per liter
Source: Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. TtEC. 2012.

Results for Groundwater Monitoring, 2009 – 2013

Treatment systems were installed between October 2008 and October 2009 in the two areas of the shallow groundwater plume with the highest benzene and naphthalene concentrations. The treatment systems cover approximately 6 acres and consist of over 300 biosparge wells on approximately 20-foot centers, 15 SVE wells, and 7 new monitoring wells. The biosparge wells are screened at the Marsh Crust based on findings from the pre-design investigation, previous investigations, and a pilot study. Biosparging and groundwater monitoring were initiated in March 2009 and continued until February 2013. For the biosparging, the two-foot long biosparge well screen typically extended up to six inches into the Bay Sediment Unit to ensure oxygen delivery to the Marsh Crust, which is located at the bottom of the FWBZ and top of the Bay Sediment Unit. The biosparge zone monitoring wells (identified with the BZMW prefix) were designed to monitor the progress of the groundwater treatment. **Groundwater monitoring results** confirm a decrease in the overall size of the plume shown in Figure 3 and a decrease in benzene and naphthalene concentrations from baseline concentrations at all biosparge treatment area sampling locations 6 months after the 4-year period of operation, even though groundwater concentrations fluctuated during operation of the treatment system. The concentration fluctuations in the groundwater observed during operation most likely were due to treatment system operation. The system operation can create a dynamic environment where air injection at

the Marsh Crust, even at low volume, will cause groundwater movement resulting in temporary fluctuation in contaminant concentrations. Based on the location of the Marsh Crust at depth adjacent to the Bay Sediment Unit (approximately 17 feet below surface), the generally thick overlying clay layer, and soil gas and groundwater data indicating low or non-detect results at the top of the water table, the groundwater concentrations adjacent to the Marsh Crust are not representative of water table concentrations.

Technical Memorandum, 2012

The 2012 Technical Memorandum evaluated pre-2007 ROD and post-2007 ROD TDS shallow groundwater data. The TDS shallow groundwater data collected during the pre-design investigation were further evaluated to determine whether the shallow FWBZ groundwater meets federal drinking water criteria and the criteria for sources of drinking water in California SWRCB Resolution No. 88-63. The 2012 Technical Memorandum provided conservative risk assessment evaluations and reevaluated vapor intrusion risk using current toxicity data and current vapor intrusion risk assessment methodologies.

TDS analysis was conducted to evaluate whether the OU-5/FISCA IR-02 shallow FWBZ groundwater meets municipal or domestic supply criteria using the most recent post-ROD data. The federal standard for TDS of 10,000 mg/L in the Safe Drinking Water Act of 1974 applies for making this determination. SWRCB Resolution No. 88-63 (Sources of Drinking Water) states that groundwater is considered to be suitable, or potentially suitable, for municipal or domestic water supply with the exception of groundwater where TDS exceeds 3,000 mg/L. The 2012 Technical Memorandum includes the OU-5/FISCA IR-02 groundwater analytical results and the evaluation of potable and other potential non-potable uses for the FWBZ groundwater. The average TDS concentration in the OU-5/FISCA IR-02 FWBZ of 16,075 mg/L exceeds the federal TDS criterion of 10,000 mg/L for Class III groundwater as well as the State of California criteria of 3,000 mg/L.

In addition to TDS, the OU-5/FISCA IR-02 FWBZ shallow groundwater does not meet other drinking water or domestic water supply suitability criteria, as evaluated in the 2012 Technical Memorandum and summarized below:

- Iron - An iron concentration less than 0.3 mg/L is considered to be acceptable for domestic use, while concentrations greater than 1.0 mg/L are considered to be unsuitable for use. The average iron concentration in the OU-5/FISCA IR-02 FWBZ groundwater is 3 mg/L.
- The recommended range for alkalinity in drinking water supplies is 30 to 400 mg/L. The average alkalinity concentration in the OU-5/FISCA IR-02 FWBZ groundwater is 2,111 mg/L.
- The maximum thickness of the OU-5/FISCA IR-02 FWBZ is approximately 9 feet, which precludes meeting the California Department of Water Resources annular sanitary seal criteria.
- The sustained yield criterion of 200 gallons per day may not be possible in several areas of the plume, and pumping-induced intrusion of saltwater would further degrade water quality.

The 2012 Technical Memorandum concluded that there are no potential agricultural or industrial uses for the 5/FISCA IR-02 FWBZ groundwater. The 2012 Technical Memo documented that agricultural supply is not a potential beneficial use of the FWBZ groundwater because the average OU-5/FISCA IR-02 shallow FWBZ TDS concentration of 16,075 mg/L significantly exceeds acceptable levels for crop irrigation or livestock watering (i.e., below 5,000 mg/L) or landscape watering (i.e., below 2,000 mg/L). In addition, the 2012 Technical Memorandum determined that industrial supply was not a potential beneficial use of the FWBZ groundwater due to TDS concentrations greater than 1,000 mg/L and there is insufficient sustainable yield, as described in Sections 1.3.1 and 2.7.

The conservative risk assessments in the 2012 Technical Memorandum use historical and current vapor intrusion evaluation methodologies, crawl space air and soil gas data collected from multiple depths over a widespread area, and groundwater data from the RI/FS from locations potentially at or near the water table to reevaluate vapor intrusion risk. Results document no unacceptable risks from vapor intrusion or other existing pathways due to OU-5/FISCA IR-02 shallow groundwater. These additional assessments of risk are described in Section 2.5.1.

EPA Sub-slab Soil Gas and Indoor and Outdoor Air Sampling, 2013

In September 2013, the EPA issued a **Final Quality Assurance Project Plan** to collect air and soil gas samples at locations within the OU-5/FISCA IR-02 plume. EPA's plan states that the investigation is "to evaluate the worst case scenario for vapor intrusion based on accessible buildings and constraints on drilling." In October 2013, the EPA conducted sub-slab soil gas and indoor and outdoor air sampling at the unoccupied Island High School and at the child daycare center to evaluate (1) sub-slab soil vapor COC concentrations and (2) potential indoor air contamination due to the potential volatilization of groundwater contaminants to the indoor air exposure pathway. Tables 6 and 7 present the indoor and outdoor air and sub-slab soil gas sampling results, respectively, for benzene and naphthalene.

As shown in Table 7, the sub-slab sample results were non-detect for all naphthalene samples. For benzene, the sub-slab sample results were non-detect except at one of the four child daycare locations, where a value of 2 parts per billion by volume (ppbv) of benzene was qualified as estimated below the quantitation limit. This level is below the California Human Health Screening Level for sub-slab air (11.3 ppbv for benzene). Indoor air results for all samples were non-detect for naphthalene. Benzene results for indoor air were consistent with outdoor air. These results indicate that there is no indoor air contamination due to the volatilization of groundwater contaminants to the indoor air exposure pathway. Since the largely non-detect sub-slab soil gas sample results for benzene and all non-detect results for naphthalene show that groundwater is not a source for indoor air concentrations, the remaining potential sources for the benzene indoor air concentrations are various materials (such as carpeting) inside the building and the outdoor air, which contains similar benzene concentrations. This investigation provides another line of evidence regarding the strength of the RI/FS risk assessment results and 2012 Technical Memorandum and supports a no further action remedy for OU-5/FISCA IR-02 groundwater.

TABLE 6: 2013 EPA OU-5AIR SAMPLING RESULTS

Sample Location	Benzene (pptv)	Naphthalene (pptv)
APTOU5-IA1 - Island High School Indoor Air Southeast Classroom	120	ND
APTOU5-IA2 - Island High School Indoor Air Eastern Bathroom	120	ND
APTOU5-IA3 - Island High School Indoor Air Southwest Annex	130	ND
APTOU5-IA4 - Child Daycare Center Indoor Air Southwest Classroom	140	ND
APTOU5-IA5 - Child Daycare Center Indoor Air Northwest Classroom	150	ND
APTOU5-IA8 - Child Daycare Center Indoor Air Southwest Classroom (duplicate APTOU5-IA4)	140	ND
APTOU5-OA1 - Island High School Outdoor Air Western Edge	120	ND
APTOU5-OA2 - Child Daycare Center Outdoor Air Western Edge	120	ND

Notes: Federal screening criteria for benzene: 97.1 pptv (Based on the November 2013 Regional Screening Levels for Residential Indoor Air converted to parts per trillion per volume (pptv) using the molecular weight of each compound and a conversion factor)
State screening criteria for benzene: 26.3 pptv (Based on the 2005 California Human Health Screening Levels for Indoor Air converted to pptv using the molecular weight of each compound and a conversion factor)
ND = Non-detect

TABLE 7: 2013 EPA OU-5 SUB-SLAB SOIL GAS SAMPLING RESULTS

Sample Location	Benzene (ppbv)	Naphthalene (ppbv)
APTOU5-SS1 - Island High School Outside Western Main Building	ND	ND
APTOU5-SS2 - Island High School Southwest Site Corner	ND	ND
APTOU5-SS3 - Child Daycare Center Southwest Corner Classroom	ND	ND
APTOU5-SS4 - Child Daycare Center Southwest Corner Classroom (duplicate of APTOU5-SS3)	ND	ND
APTOU5-SS5 - Child Daycare Center Northwest Corner Classroom	ND	ND
APTOU5-SS6 - Child Daycare Center Northwest Corner Parking Area	2 C1, J	ND

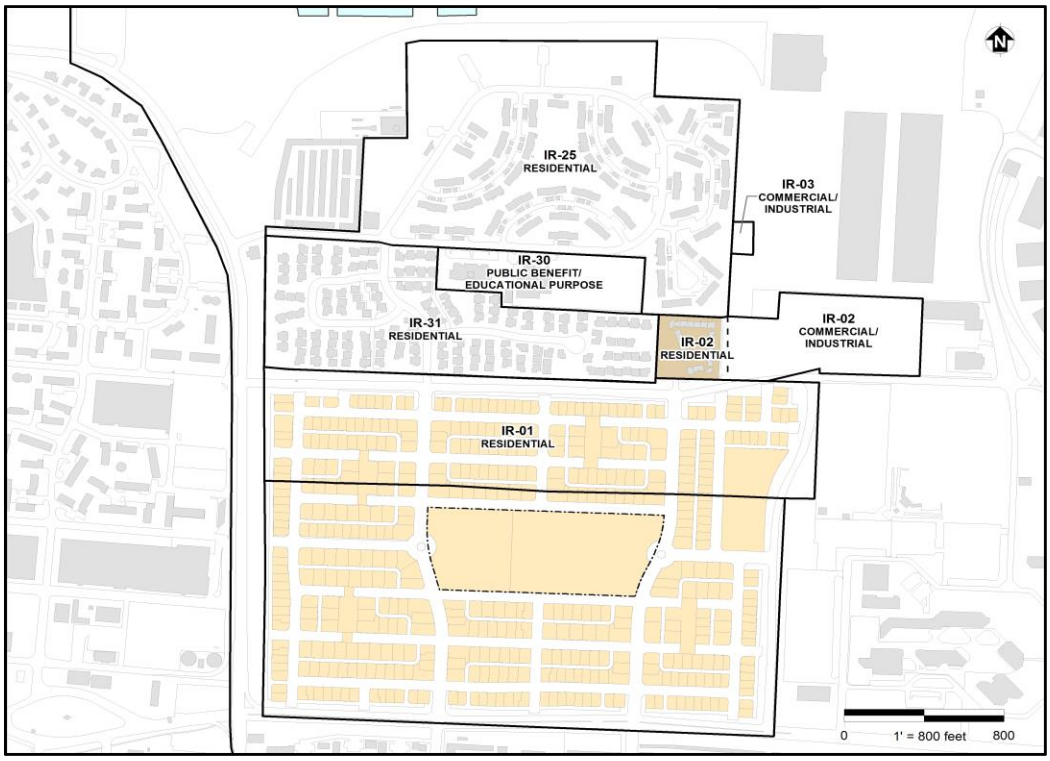
Notes: Federal screening criteria for benzene: 0.097 ppbv (Based on the November 2013 Regional Screening Levels for Residential Indoor Air converted to parts per billion per volume (pptv) using the molecular weight of each compound and a conversion factor)
State screening criteria for benzene: 11.3 ppbv (Based on the 2005 California Human Health Screening Levels for Indoor Air converted to ppbv using the molecular weight of each compound and a conversion factor)
ND = Non-detect
J = Estimated value
C1 = Concentration below quantitation limit

2.4 Current and Potential Future Site and Resource Uses

Figure 4 shows the current and proposed land uses for OU-5 and FISCA IR-02. Under the **Alameda Point General Plan Amendment** (amended in 2003), Chapter 9, Figure 9-2, the proposed land use for the OU-5 area includes residential and educational uses.

The OU-5 area consists of occupied and unoccupied multiple-unit housing structures, open space park areas, a daycare center, and the unoccupied Island High School (formerly George P. Miller Elementary School). The current site use and the planned future site use are the same. Under the Alameda Point General Plan Amendment, the proposed land uses for FISCA IR-01, IR-02, and IR-03 include residential and commercial/industrial usage. IR-01 is used for residential purposes (within the Bayport Housing development). IR-02 has a western part used for residential purposes, with the remaining part used for commercial/industrial purposes. IR-03 is used for commercial/industrial purposes. Construction of the Bayport Housing residential development was completed at FISCA IR-01 and at the former East Housing Property within Alameda Point (Figure 3). The Shinsei Garden Housing Development was completed in the western portion of IR-02. The remainder of IR-02 currently is under development for residential and commercial use. FISCA IR-03 remains undeveloped. OU-5/FISCA IR-02 does not have any naturally occurring surface streams or ponds.

FIGURE 4: Community Reuse Plan



Drinking water is supplied to OU-5/FISCA IR-02 by the EBMUD, and groundwater at the site is not expected to be used for domestic purposes in the future. Data collected during the pre-design investigation show that shallow groundwater quality is not adequate for potable use due to

concentrations of TDS, sulfate, iron, and alkalinity in the FWBZ at OU-5/FISCA IR-02. Neither TDS nor sulfate can be economically removed from domestic drinking water or small- to medium-sized industrial water supplies using conventional techniques. The SWBZ already has been classified as a Class III aquifer because of its high TDS and saline content, making it unsuitable for domestic, agricultural, industrial, or municipal beneficial uses. The 2012 Technical Memorandum documents that the FWBZ groundwater at OU-5/FISCA IR-02 does not meet the **criteria for a potential drinking water source** in California (SWRCB Resolution No. 88-63) and also does not meet federal requirements for a drinking water source; a summary of the evaluation is presented in Section 2.3.2. Finally, the aquifer is not a geothermal energy source. In summary, no drinking water wells are located at the site, shallow groundwater does not meet the specifications of a potential drinking water source, and no future potable or non-potable groundwater uses have been identified for OU-5/FISCA IR-02 shallow groundwater.

2.5 Site Risks

This section presents risk assessment results. Section 2.5.1 summarizes the HHRA results. A detailed description of the vapor intrusion pathway potential risks is provided because the data and risk evaluations of this pathway highlight the protectiveness of a no further action remedy for OU-5/FISCA IR-02 shallow groundwater. Section 2.5.2 summarizes the ERA.

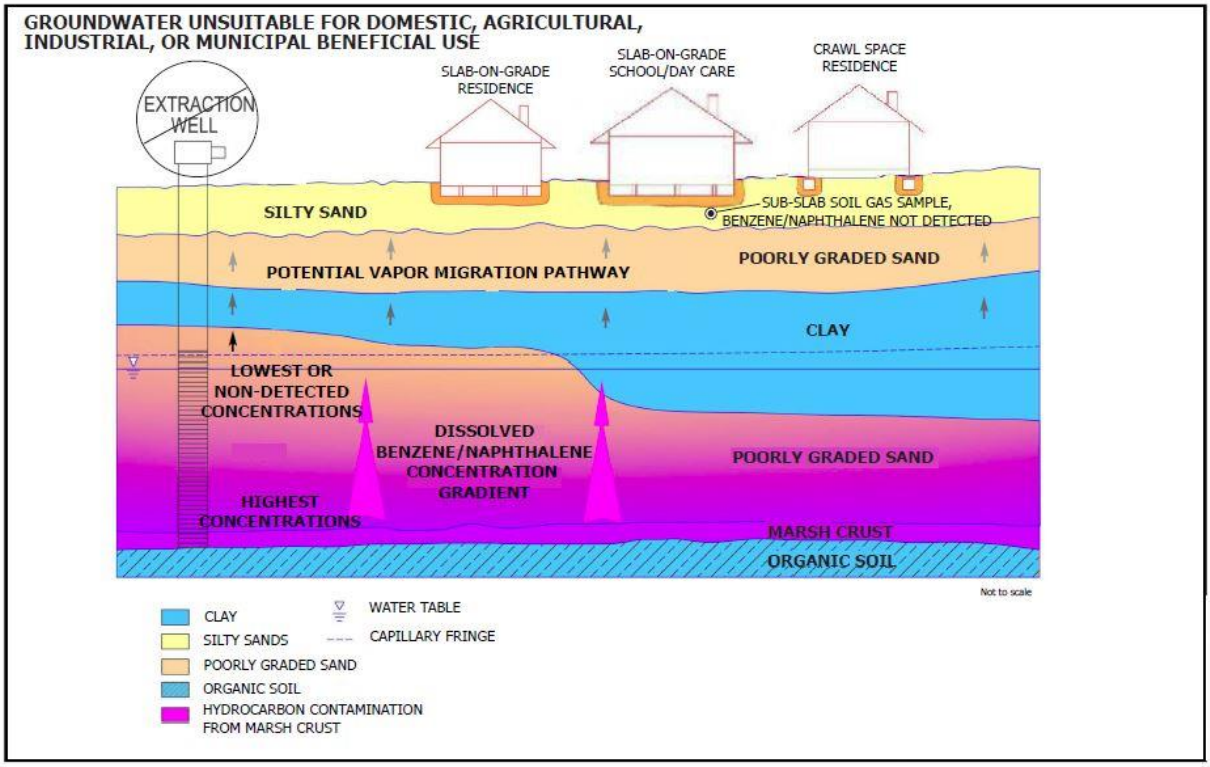
Post-ROD data collection filled the data gaps identified during the 2004 RI/FS and resulted in a modification to the 2007 ROD's conceptual site model (CSM) that identifies potential point-source surface releases in addition to the Marsh Crust as a source of the benzene and naphthalene shallow groundwater concentrations. The revised **CSM** was developed based on the results of multiple lines of evidence, including pre-design continuous soil coring, additional multi-depth soil and groundwater sampling, and hydrocarbon fingerprinting and stable isotope C-13 and H-2 signature analysis of soil and groundwater. Figure 5 shows the CSM. There is no complete pathway for the hypothetical drinking water use because there is insufficient (low) sustainable yield, i.e., there is little water in the thin shallow FWBZ and the water is too difficult, if not impossible, to remove from the ground.

2.5.1 Human Health Risk Assessment

An HHRA does not predict actual health effects but instead is used as a tool for making risk management decisions. In accordance with EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30, the risk management range is defined as 10^{-4} to 10^{-6}. The risk management range was established by the EPA to set guidelines for making risk management decisions. EPA OSWER Directive 9355.0-30 states the text quoted below.

> "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4} and the noncarcinogenic hazard quotient (HQ) is less than 1, action generally is not warranted unless there are adverse environmental impacts."

FIGURE 5: Conceptual Site Model



Site-specific factors typically are considered when making decisions about whether action is required at sites where cancer risks are in the risk management range. Risks less than 1×10^{-6} are considered negligible. When risks exceed 10^{-4}, action generally is required.

The **2004 RI/FS baseline HHRA** discussions for exposure pathways other than vapor intrusion to indoor air are discussed in detail in the 2007 ROD. Although the vapor intrusion pathway is included in the total risk presented in the 2007 ROD, this pathway and the risk associated with it are not presented. Based on the shallow groundwater quality evaluation in the 2012 Technical Memorandum, the only potential exposure pathway for OU-5/FISCA IR-02 shallow groundwater is potential indirect inhalation of benzene and naphthalene due to vapor intrusion. Therefore, that pathway is described in detail in this section.

Potential vapor intrusion into a residence, school, or daycare center has been a focus for risk assessments at this site for over 20 years due to the presence of residential housing, a school, and a child daycare center overlying the OU-5/FISCA IR-02 shallow groundwater plume. Therefore, rather than only one risk assessment for the vapor intrusion pathway in the RI/FS, there have been multiple investigations and risk assessments. Structures overlying this site include the following:

- The unoccupied North Village Housing area (including the Kollman Circle housing area): houses that have crawl spaces;

- The USCG Marina Village Housing area: slab-on-grade housing units still in use and occupied;
- The Shinsei Garden Housing Development: a new apartment complex constructed in 2008 to 2009 with a vapor barrier and sub-slab depressurization system;
- Island High School: currently unoccupied and formerly the George P. Miller Elementary School; and
- Woodstock Child Development Center.

A significant and consistent body of evidence supports the conclusion that there are no unacceptable cancer or non-cancer risks due to benzene and naphthalene concentrations in OU-5/FISCA IR-02 groundwater. This evidence includes a combination of the following:

- Direct measurements from the sampling of soil gas, groundwater, crawl space air, indoor air, and outdoor ambient air in relation to the site's residential areas;
- Results of modeling of the migration of volatile constituents released from groundwater or overlying soil gas up through the soil column into a residential building, and assessment of the risk implications of the projected indoor air concentrations of the volatile constituents; and
- Results of additional characterization of the physical features and stratigraphy of the site relative to factors known to either enhance or diminish potential vapor intrusion.

Risk assessments that evaluate the vapor intrusion pathway within OU-5/FISCA IR-02 are summarized below in chronological order, followed by an HHRA summary. All risk assessments used pre-remediation data, so rebound of groundwater concentrations at the Marsh Crust that were for groundwater treated by the OU-5/FISCA IR-02 remediation system is not relevant.

Residential Risk Evaluation for USCG Housing, 2002

As discussed in more detail in Section 2.3.1, indoor air, outdoor air, and crawl space sampling were conducted in 2002 at North Village Housing (including Kollman Circle) and Marina Village Housing. A total of 34 air samples were collected at North Village Housing. A total of 19 air samples were collected at Marina Village Housing. This section focuses on the risk assessment results for these samples. As cited in recent vapor intrusion guidance, evaluation of air sampling results at houses with both crawl space and indoor air data as well as outdoor air data is important in evaluating the source of the concentrations. Table 3 provides these concentrations. At 10 of the 12 addresses where both crawl space and indoor air data were collected, the crawl space benzene results were lower than the indoor air results. At the other two sampling locations, benzene results were similar in crawl space and indoor air. Crawl space and indoor air data were evaluated statistically, and statistical results also indicate that benzene concentrations in crawl space air were lower than in indoor air. The crawl space benzene air sampling results also were less than outdoor air levels except in one sample where the results were the same. The 2002 report concludes that (1) VOC concentrations in crawl space air do not differ from indoor air concentrations and (2) indoor air VOC concentrations are consistent with both outdoor air concentrations and ambient air measurements collected by the CARB. These air analytical results support the conclusion that shallow groundwater is not the source of VOCs detected in indoor air.

In addition to the statistical evaluation of the air sampling results, risk assessment was conducted to evaluate potential vapor intrusion risk using both HydroPunch® and soil gas data. Risk estimates used the maximum detected concentration of each chemical detected. **For 30-year exposure, the residential cancer risk** using soil gas data was 1.46×10^{-7}. For 30-year exposure, the residential cancer risk using data HydroPunch® data was 1.1×10^{-6}. The HI value was less than 1.

OU-5 RI HHRA, 2002

The 2002 OU-5 RI risk assessment includes evaluation of results for 42 soil gas samples collected throughout OU-5/FISCA IR-02 analyzed for naphthalene and VOCs. The RI report risk assessment uses two transport models and documents estimated **cancer risks for residential use based on the soil gas data** at well below 10^{-6} (10^{-8} to 10^{-9} cancer risks). The non-cancer HI value was less than 1. The RI report states that the soil gas sampling results show that little volatilization or release of benzene and naphthalene into vadose zone soil is occurring.

Groundwater RI/FS, 2004

The HHRA for OU-5/FISCA IR-02 shallow groundwater considers the following indirect exposures to COPCs in FWBZ groundwater from potential vapor intrusion:

- A school exposure scenario (school children and adult workers) based on the assumption of theoretical exposure to volatile COPCs migrating upward from groundwater into the indoor air of an existing or future school; and
- Vapor intrusion into occupied or potentially occupied residential buildings at the site.

For the school scenario, the HHRA estimates the theoretical inhalation of COPCs by adult workers and children resulting from vapor migration from groundwater into indoor school air using the Johnson and Ettinger **vapor migration model**. Lastly, for the residential scenario, the HHRA evaluates theoretical inhalation exposure resulting from vapor migration from groundwater into indoor air. Tier 2 exposure point concentrations (EPC) for benzene and naphthalene were calculated from kriged (a geostatistical evaluation based on a mathematical function known as a semivariogram) groundwater concentrations for a 500-foot and 725-foot radius around the monitoring well with the highest detected concentration of benzene or naphthalene.

Two different approaches were used to calculate EPCs for vapor intrusion, one based on groundwater monitoring results and one based on soil gas measurements. The first approach used the Tier 2 groundwater EPCs as input to the Johnson and Ettinger vapor migration modeling. The second approach used the measured soil gas concentrations as the driver inputs to the Johnson and Ettinger modeling. The maximum benzene soil gas concentrations in the Alameda Point and FISCA (referred to as Alameda Annex in this report) areas of the plume were used as the EPCs for each of these areas.

The HHRA evaluates vapor intrusion using shallow groundwater data from multiple depths down to 20 feet bgs and soil gas data. Current guidance indicates that only groundwater data within a few feet of the water table should be considered in evaluation of potential vapor

intrusion risk. Table 8 summarizes the HI values and the carcinogenic risks for reasonable maximum exposure (RME) for potential residential and school exposure scenarios using the soil gas data.

TABLE 8: 2004 BASELINE HHRA RESULTS MODELED FROM SOIL GAS DATA (NO POTABLE GROUNDWATER USE)

Exposure Scenario	Location	Noncarcinogenic HI – RME	Carcinogenic Risk – RME
Resident	Alameda Annex	0.0092	1×10^{-6}
	Alameda Point	0.0076	5×10^{-8}
School Worker	Alameda Annex	0.0087	8×10^{-7}
	Alameda Point	0.0076	5×10^{-8}
School Student	Alameda Annex	0.0084	2×10^{-7}
	Alameda Point	0.0076	5×10^{-8}

Source: Final Groundwater Remedial Investigation/Feasibility Study, Alameda Point Site 25/Alameda Annex IR-02. Section 6, Page 6-5. Engineering/Remediation Resources Group, Inc. (ERRG). 2004.

Using soil gas data, the HHRA vapor intrusion risk assessment estimates RME incremental lifetime cancer risk (ILCR) values ranging from 5×10^{-8} to 8×10^{-7} for school worker and student receptors and 5×10^{-8} to 1×10^{-6} for residents. Using groundwater data from all depths, RME ILCR results are within or below the risk management range. The RI/FS concludes that there are no unacceptable risks to residents, school workers, or students due to vapor intrusion. In addition, there are no unacceptable risks for industrial uses such as car-washing, landscaping, or irrigation.

IR Site 30, School and Child Development Center RI HHRA, 2005

The RI HHRA for the school and child daycare center prepared in 2005 includes evaluation of potential vapor intrusion risk due to vapors from soil and groundwater. The vapor intrusion risk was calculated using shallow groundwater data from the IR Site 30 RI and the 2002 OU-5 RI. Based on **groundwater as the potential source of indoor air vapors**, the highest potential future risk (residential scenario) was 2×10^{-6} (using Cal/EPA methodology, including naphthalene). The HI value for this pathway was less than 1. The Office of Environmental Health Hazard Assessment School Model also was used to calculate the total risk for all exposure pathways for the educational scenario. The risk was 1×10^{-6} for benzene and naphthalene using this model. The RI report cites the 1994 non-detect benzene crawl space air results at the school as further evidence that vapors are not migrating from soil or groundwater into indoor air. A no-action ROD for IR Site 30 soil was signed in 2009.

IR Site 31, Marina Village Housing RI HHRA, 2007

The RI HHRA for Marina Village Housing (IR Site 31) prepared in 2007 includes evaluation of potential vapor intrusion risk due to vapors from soil and groundwater. The vapor intrusion risk was calculated using shallow groundwater data from the IR Site 31 RI and the 2002 OU-5 RI. The EPC for vapor migration modeling was the maximum concentration for each volatile chemical found in any groundwater sample within the shallow OU-5/FISCA IR-02 plume (that is, one hypothetical sample with maximum concentrations of all volatile chemicals that conservatively was assumed to be representative). **For groundwater, the total RME residential**

cancer risk for all volatile compounds for the inhalation of vapors in indoor air from groundwater was 8×10^{-7} using EPA protocol and 1×10^{-5} using DTSC protocol. The RI report indicates that the DTSC risk is driven by naphthalene concentrations in groundwater at depth, which are not representative of shallower groundwater at the water table. The maximum naphthalene concentration for the IR Site 31 RI HydroPunch® data was from a depth of 16.5 feet bgs. If the next highest naphthalene groundwater concentration in Marina Village Housing is used, then the report states that the total vapor intrusion risk using DTSC protocol would be 1×10^{-6} for all volatile chemicals. The IR Site 31 RI report also notes that air sampling results at Marina Village Housing in 2002 show that benzene concentrations in crawl spaces were lower than in indoor air, indicating that the benzene in indoor air is not due to benzene in groundwater. A no-action ROD for IR Site 31 soil was signed in 2008.

2012 Technical Memorandum

The findings of the RI/FS **HHRA of potential vapor intrusion** are supported by the risk assessment performed in the 2012 Technical Memorandum using the current DTSC toxicity data and approach. The 2012 Technical Memorandum evaluates the vapor intrusion pathway using soil gas measurements (at 32 locations) spread throughout the OU-5/FISCA IR-02 plume. Sampling points included locations where shallow groundwater contamination previously had been confirmed and where shallow groundwater contamination had not been observed. When possible, soil gas samples were collected from two depths: 2 and approximately 5 feet bgs. Table 9 summarizes the projected indoor air inhalation risks based on soil gas sampling results for benzene and naphthalene. This table also shows the results of applying the default **DTSC attenuation factor for existing residential buildings** of 0.002 to project benzene and naphthalene indoor air concentrations for each soil gas sampling location. The higher of the indoor air concentrations projected from the soil gas samples from 2 and approximately 5 feet bgs then was conservatively used as the projected indoor air concentration for that location. Lastly, the **DTSC toxicity criteria** for benzene and naphthalene were applied to calculate the projected indoor air inhalation ILCR and non-cancer HI values for both constituents as shown in Table 9.

With respect to benzene, Table 9 shows that all projected HQ values were many orders of magnitude below the threshold of 1.0. The RME results for the projected benzene ILCRs ranged from 4.8×10^{-8} to 4.8×10^{-7}. With respect to naphthalene, Table 9 shows that all the projected HQ values also were well below 1.0. The RME results for the projected naphthalene ILCR values ranged from 5.6×10^{-8} to 5.0×10^{-6}. These results serve as another line of evidence that even using the highest projected values and current DTSC toxicity data and protocol, no further action is protective for OU-5/FISCA IR-02 groundwater.

The 2012 Technical Memorandum also evaluates the air data shown in Table 3 and reviews other risk assessment results. The 2002 air data for 12 individual houses within Kollman Circle and other locations within the plume was modeled. Using DTSC 2011 and 2012 criteria (including the DTSC toxicity data and approach), the cancer risk for residential receptors (due to benzene) was 10^{-6} for most individual locations, with a maximum risk of 3.2×10^{-5}.

In addition to the risk assessment using soil gas and air data, the 2012 Technical Memorandum evaluates potential vapor intrusion risk using groundwater data by performing location-specific

vapor intrusion modeling using the Johnson and Ettinger model with all the DTSC toxicity and default input parameter adjustments for a **slab-on-grade residential structure**. The modeling used shallow groundwater concentrations measured across the site from the depth interval at or near the local water table. This selection of groundwater sampling results is supported by the fact that **groundwater concentrations at the water table dictate the volatilization of dissolved constituents out of the liquid phase and into soil gas**.

Vapor intrusion risk was evaluated using groundwater data from 37 locations at or near the water table. Of these locations, results for 16 locations were non-detect for both benzene and naphthalene. These locations were reviewed to identify those with a higher likelihood to result in potential vapor intrusion either because (1) of the reported groundwater concentrations, (2) the vadose zone at that location consisted of more permeable material, or (3) the vadose zone was thinner. Based on this review, four locations were selected for additional modeling: OS-HP2, OS-HP-10, PC2-1, and PC3-13.

TABLE 9: PROJECTION OF INDOOR AIR INHALATION RISK DUE TO BENZENE AND NAPHTHALENE FROM SOIL GAS SAMPLED IN JUNE 2001

Soil Gas Sampling Location (June 2001)	Maximum Projected Benzene Indoor Air ILCR[a] (unitless)	Maximum Projected Benzene Indoor Air HQ[a] (unitless)	Maximum Projected Naphthalene Indoor Air ILCR[a] (unitless)	Maximum Projected Naphthalene Indoor Air HQ[a] (unitless)
OU5-SG1	4.8×10^{-8}	0.0001	5.87×10^{-7}	0.0045
OU5-SG2	7.4×10^{-8}	0.0001	4.75×10^{-7}	0.0036
OU5-SG3	4.8×10^{-8}	0.0001	6.15×10^{-7}	0.0047
OU5-SG4	1.6×10^{-7}	0.0002	1.51×10^{-6}	0.0115
OU5-SG5	7.2×10^{-8}	0.0001	2.54×10^{-7}	0.0019
OU5-SG6	4.8×10^{-8}	0.0001	3.91×10^{-7}	0.0030
OU5-SG7	4.8×10^{-8}	0.0001	5.03×10^{-7}	0.0038
OU5-SG8	4.8×10^{-8}	0.0001	2.60×10^{-7}	0.0020
OU5-SG9	1.0×10^{-7}	0.0001	5.87×10^{-8}	0.0004
OU5-SG10	3.1×10^{-7}	0.0004	1.20×10^{-7}	0.0009
OU5-SG11	4.8×10^{-8}	0.0001	8.66×10^{-7}	0.0066
OU5-SG12	1.7×10^{-7}	0.0002	4.75×10^{-7}	0.0036
OU5-SG13	1.6×10^{-7}	0.0002	4.75×10^{-7}	0.0036
OU5-SG14	4.8×10^{-8}	0.0001	3.35×10^{-7}	0.0026
OU5-SG15	7.4×10^{-8}	0.0001	2.29×10^{-7}	0.0017
OS-SG1	4.8×10^{-7}	0.0006	3.07×10^{-7}	0.0023
OS-SG2	2.4×10^{-7}	0.0003	2.79×10^{-7}	0.0021
OS-SG3	1.2×10^{-7}	0.0002	3.63×10^{-7}	0.0028
OS-SG4	4.8×10^{-8}	0.0001	3.35×10^{-7}	0.0026
OS-SG5	4.8×10^{-8}	0.0001	5.59×10^{-8}	0.0004
OS-SG6	4.8×10^{-8}	0.0001	5.03×10^{-7}	0.0038
OS-SG7	4.8×10^{-8}	0.0001	1.01×10^{-7}	0.0008
OS-SG8	4.8×10^{-8}	0.0003	1.31×10^{-7}	0.0010
OS-SG9	1.9×10^{-7}	0.0001	7.82×10^{-7}	0.0060
OS-SG10	4.8×10^{-8}	0.0001	3.91×10^{-7}	0.0030
OS-SG11	1.0×10^{-7}	0.0001	4.75×10^{-7}	0.0036
OS-SG12	3.3×10^{-7}	0.0005	1.06×10^{-6}	0.0081
OS-SG13	4.8×10^{-8}	0.0001	1.23×10^{-6}	0.0094

Soil Gas Sampling Location (June 2001)	Maximum Projected Benzene Indoor Air ILCR[a] (unitless)	Maximum Projected Benzene Indoor Air HQ[a] (unitless)	Maximum Projected Naphthalene Indoor Air ILCR[a] (unitless)	Maximum Projected Naphthalene Indoor Air HQ[a] (unitless)
OS-SG14	3.6×10^{-7}	0.0003	4.19×10^{-7}	0.0032
OS-SG15	1.0×10^{-7}	0.0001	5.31×10^{-7}	0.0040
OS-SG16	2.4×10^{-7}	0.0003	5.03×10^{-6}	0.0384
OS-SG17	7.6×10^{-8}	0.0001	2.52×10^{-7}	0.0019
Minimum	**4.8×10^{-8}**	**0.0001**	**5.59×10^{-8}**	**0.0004**
Maximum	**4.8×10^{-7}**	**0.0006**	**5.03×10^{-6}**	**0.0384**

Notes:
a DTSC Toxicity Criteria: Inhalation Unit Risks and Chronic Reference Concentrations
Source: Final Technical Memorandum OU-5/FISCA IR-02 Groundwater Data Evaluation. TtEC. 2012.

For comparison purposes, the projected indoor air inhalation RME risks for each of the four cases warranting verification modeling were estimated using both the EPA **Integrated Risk Information System (IRIS) toxicity criteria** and the DTSC toxicity criteria. Table 10 summarizes the estimated risks. For each of the four highlighted water table groundwater sampling locations (which represent locations with conditions that could result in vapor intrusion), Table 10 lists the projected ILCR and non-cancer HQ values for benzene and naphthalene. Results are shown separately for the two sets of toxicity criteria.

TABLE 10: PROJECTION OF INDOOR AIR INHALATION RISK DUE TO BENZENE AND NAPHTHALENE FROM NEAR WATER TABLE GROUNDWATER AT FOUR "WORST-CASE" LOCATIONS USING EPA, IRIS, AND CAL/EPA DTSC TOXICITY CRITERIA

Criterion	ILCR from Vapor Intrusion to Indoor Air		Incremental Non-Cancer HQ from Vapor Intrusion to Indoor Air	
	Benzene (unitless)	Naphthalene (unitless)	Benzene (unitless)	Naphthalene (unitless)
OS-HP2 (June 2001)				
IRIS Toxicity Criteria	2.0×10^{-7}	Not applicable	0.0019	0.0410
DTSC Toxicity Criteria	6.9×10^{-7}	1.8×10^{-6}	0.0009	0.0140
OS-HP-10 (June - 2001)				
IRIS Toxicity Criteria	7.9×10^{-7}	Not applicable	0.0079	0.0570
DTSC Toxicity Criteria	3.0×10^{-6}	2.5×10^{-6}	0.0040	0.0190
PC2-1 (July/August 2007)				
IRIS Toxicity Criteria	4.0×10^{-7}	Not applicable	0.0040	0.0018
DTSC Toxicity Criteria	1.5×10^{-6}	7.9×10^{-8}	0.0020	0.0006
PC3-13 (July/Aug - 2007)				
IRIS Toxicity Criteria	1.6×10^{-6}	Not applicable	0.0160	0.8100
DTSC Toxicity Criteria	6.0×10^{-6}	3.6×10^{-5}	0.0080	0.2700

Source: Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. TtEC. 2012.

There also are differences in the values of the remaining Unit Risk Factors and Reference Concentrations for benzene and naphthalene between the two sources. The most conservative value from the range of Unit Risk Factors for benzene reported in IRIS was used in these projections. Once again, all the projected HQ values for both chemicals were less than the HQ

threshold value of 1.0. Specifically, all HQ values for benzene were less than 0.010 using both the DTSC and IRIS criteria except at one location, where the maximum HQ for benzene was 0.016. All HQ values for naphthalene were less than 0.10 using both the DTSC and IRIS criteria except at one location, where the maximum HQ for naphthalene was 0.81. Using IRIS toxicity criteria, the projected RME ILCR values for benzene were 10^{-7} except at one location, where the ILCR was 1.6×10^{-6}. Using DTSC toxicity criteria, the projected RME ILCR values for naphthalene ranged from 7.9×10^{-8} to 3.6×10^{-5}. Using DTSC toxicity criteria, the projected RME ILCR values for benzene ranged from 6.9×10^{-7} to 6.0×10^{-6}. In addition, many of the water table sampling results for these locations were non-detect for benzene and naphthalene.

HHRA Summary

In summary, using soil gas data, the RI/FS vapor intrusion risk assessment estimates RME ILCR values ranging from 5×10^{-8} to 10^{-6} for residents and from 5×10^{-8} to 8×10^{-7} for school student receptors. Using groundwater data from all depths, all RI/FS RME ILCR results were within the risk management range except for drinking water use. Collection of additional data provided results that show that the potential uses of shallow groundwater evaluated in the RI/FS are not viable based on water quality data collected after issuance of the 2007 ROD. The final RI/FS report concludes that "potential inhalation of VOCs in indoor air by residential and school receptors does not pose an unacceptable risk."

The findings of the RI/FS risk assessment of no unacceptable potential vapor intrusion risk are supported by the 2012 Technical Memorandum HHRA performed using the current DTSC toxicity data and approach and soil gas data from multiple depths over a widespread area. Using the more recent DTSC approach and soil gas data, the 2012 vapor intrusion evaluations estimate the RME ILCR values for benzene as ranging from 4.8×10^{-8} to 4.8×10^{-7} across the site and for naphthalene as ranging from 5.6×10^{-8} to 5.0×10^{-6} across the site.

The 2012 Technical Memorandum HHRA performed using shallow groundwater data collected near the water table also shows that there are no unacceptable risks for the vapor intrusion pathway due to OU-5/FISCA IR-02 groundwater. Based on the shallow groundwater data, all HI values were below 1 using EPA and DTSC criteria for both benzene and naphthalene. Using EPA IRIS toxicity criteria, the projected RME ILCR values for benzene at these locations were 10^{-7} except at one location, where the ILCR was 1.6×10^{-6}. All cancer risks for these "worst-case" locations were 10^{-6} to 10^{-8} for benzene and naphthalene using DTSC criteria except for one location with a naphthalene risk of 3.6×10^{-5}. Accordingly, even the individual locations with optimum conditions for vapor migration do not indicate unacceptable indoor air inhalation risk.

The RI/FS conclusion that there are no unacceptable risks to the residents, school workers, or students at the site as the result of vapor intrusion due to OU-5/FISCA IR-02 shallow groundwater is supported by multiple sampling events and the HHRAs summarized in this section, including the 2012 HHRA using current DTSC toxicity data and protocols. This conclusion also is supported by the 2013 EPA air sampling results.

2.5.2 Ecological Risk Assessment

Results of the previous ERAs conducted for both Alameda Point and FISCA conclude that (1) there is no significant risk to terrestrial ecological receptors due to lateral groundwater movement and (2) there is no ecological risk to the San Francisco Bay due to storm sewer system discharge. Additionally, the ERAs conclude that the site supports only limited habitat, the presence of terrestrial receptors is limited, and future land uses would not create additional ecological habitat. A large factor affecting the ERAs is the marginal quality of the general site area with respect to terrestrial ecological receptors. Based on current reuse plans, this situation would be true for future scenarios as well.

2.6 Principal Threat Waste

No principal threat wastes have been identified for OU-5/FISCA IR-02 groundwater. Principal threat wastes are source materials considered to be highly toxic or highly mobile, or that would present a significant risk to human health or the environment if exposure occurs. Additional evaluations were performed using soil gas measurements from across the site, and the RME results for the projected benzene indoor air inhalation ILCR values ranged from 4.8×10^{-8} to 4.8×10^{-7}. The RME results from the additional evaluations of projected naphthalene indoor air inhalation ILCR values ranged from 5.6×10^{-8} to 5.0×10^{-6}. All lines of evidence from previous investigations and assessments show that dissolved benzene and naphthalene in OU-5/FISCA IR-02 groundwater do not pose an indoor air inhalation risk to residents or a potential risk to future residents, children, or students who may routinely occupy buildings at the site.

2.7 Selected Remedy

The selected remedy for OU-5/FISCA IR-02 shallow groundwater is no further action. Shallow groundwater does not pose an unacceptable risk to human health or the environment under the current or expected future (residential and school) land uses or any other land uses. This determination is based on extensive field investigations, laboratory analyses, data evaluations, review of current and future land use, and thorough assessment of potential human health risk and ecological risk. The site has been extensively sampled and assessed during multiple investigations conducted from 1988 through EPA's 2013 sampling event. The Water Board provided a letter concurring that the shallow groundwater at OU-5/FISCA IR-02 meets the criteria in SWRCB Resolution No. 88-63 and Regional Water Quality Control Board Resolution 89-39, demonstrating that the quality and nature of the shallow OU-5/FISCA IR-02 groundwater is not suitable for drinking water. The OU-5/FISCA IR-02 shallow groundwater also does not meet federal requirements for a drinking water source. The post-2007 ROD, pre-treatment investigations and additional groundwater and soil gas evaluations provide additional lines of evidence regarding the strength of the RI/FS risk assessment results, the lack of a significant vapor intrusion pathway due to a combination of depth of contaminants and site lithology, and the high level of confidence in the protectiveness of no further action for OU-5/FISCA IR-02 groundwater. Based on the previous sampling results, in 2013, EPA selected locations for sub-slab, indoor air, and outdoor air sampling. All naphthalene results were non-detect, and benzene sub-slab results largely were non-detect. Indoor air and outdoor air results for benzene were similar, indicating that indoor air results may be influenced by outdoor air as well as potential benzene sources within the building. Multiple HHRAs and the ERAs show that groundwater at

the site does not pose an unacceptable risk to human health or the environment, and the 2013 air sampling results also support this conclusion.

In addition, at OU-5/FISCA IR-02, multiple site-specific characteristics of the shallow FWBZ groundwater make the hypothetical use for drinking water not feasible. There is no viable potential pathway for ingestion of OU-5/FISCA IR-02 shallow groundwater because there is insufficient yield, i.e. the groundwater cannot be extracted for drinking. The characteristics of OU-5/FISCA IR-02 shallow groundwater that preclude its use for drinking water include the following:

- The RI/FS Report documents that the maximum artificial fill thickness is approximately 15 to 20 feet in the OU-5/FISCA IR-02 area. This is too thin for the shallow FWBZ at OU5/FISCA IR-02 to meet minimum construction requirements for community potable or industrial water supply wells. The required annular sanitary seal for a well cannot be installed due to the thin fill, so a well that could produce water for drinking cannot be constructed and operated.

- The thickness of the shallow FWBZ at OU-5/FISCA IR-02 is only approximately 2 feet thick in some areas, with an average thickness of 6 feet. In addition, there are significant clay lithologies present, as documented in the continuous coring conducted as part of the pre-design investigation. The very small water bearing zone thickness combined with the clay that does not yield much water result in a low yield for the shallow FWBZ at OU-5/FISCA IR-02. Therefore, insufficient water is available for extraction and a sustained yield for drinking water use is not possible.

- The high TDS (average of 16,075 mg/L) as a result of saltwater intrusion and high naturally occurring sulfates, iron, and alkalinity, as described below, make the naturally occurring shallow groundwater quality at OU-5/FISCA IR-02 unusable for potable water and unsuitable for any use.

    - The average OU-5/FISCA IR-02 shallow FWBZ TDS concentration in the groundwater of 16,075 mg/L significantly exceeds State of California and EPA criteria for drinking water. In addition, the TDS in the shallow groundwater exceeds acceptable levels for crop irrigation or livestock watering (i.e., below 5,000 mg/L) or landscape watering (i.e., below 2,000 mg/L). Industrial supply is not a potential beneficial use of the OU-5 FISCA IR-02 shallow FWBZ groundwater due to TDS concentrations greater than 1,000 mg/L.

    - For sulfates, concentrations should be below 250 mg/L to avoid laxative effects. OU-5/FISCA IR-02 sulfate concentrations are up to 2,780 mg/L.

    - For iron, a concentration of 0.3 mg/L is considered acceptable for domestic use. OU-5/FISCA IR-02 iron concentrations are up to 10 mg/L.

    - For alkalinity, the recommended range for potable water is between 30 and 400 mg/L. OU-5/FISCA IR-02 alkalinity concentrations are up to 4,250 mg/L.

Separate from the assessment of extensive data for OU-5/FISCA IR-02 shallow groundwater that shows there is no unacceptable risk and there is not sufficient shallow groundwater to extract, a number of other site-specific factors provide further protectiveness and are briefly summarized below.

Dissolved benzene and naphthalene concentrations are located at the bottom of the shallow FWBZ, adjacent to the Marsh Crust. This provides further protectiveness because the dissolved benzene and, to a lesser degree naphthalene, are typically present at the top of the water table, which provides more of a potential for migration of vapors and vapor intrusion. Stratification with the high concentrations at approximately 18 feet bgs significantly minimizes the potential for any vapor intrusion concerns.

Clays are present in the OU-5/FISCA IR-02 area above the Marsh Crust in most areas. This provides further protectiveness because the clays restrict potential vapor migration.

If any small quantity of shallow groundwater were extractable, the OU-5/FISCA IR-02 shallow groundwater does not meet standards for industrial or irrigation use due to naturally occurring constituents resulting from salt water intrusion. As summarized in Section1.3.1, in addition to insufficient fill thickness/insufficient yield for potable or industrial supply well installation, very high TDS, sulfates, iron, and alkalinity make OU-5/FISCA IR-02 groundwater unsuitable for any use.

Within the OU-5/FISCA IR-02 area of current residential and school uses, water for all uses is supplied by a utility company from off-site sources. EBMUD has historically provided the water supply, currently provides it, and is expected to continue to provide the water service in the future.

City of Alameda regulations, Alameda County regulations, and State of California regulations prohibit intrusive activities and specifically prohibit well installation in the shallow, FWBZ groundwater. OU-5/FISCA IR-02 is located within the area regulated by the City of Alameda's Marsh Crust Ordinance No, 2824. This Ordinance prohibits excavations and intrusive activities, and drilling is one type of intrusive activity. In addition, drilling of wells in the saline shallow FWBZ is prohibited by Alameda County Title 6 Chapter 6.88, "Water Wells" and by "Water Well Standards: State of California"(Bulletin No. 74) and "Cathodic Protection Well Standards: State of California" (Bulletin No 74-1). These existing regulations provide further assuredness that the no further action remedy is protective.

No land-use restrictions, environmental monitoring, RCRA corrective actions, or other actions are required for groundwater at this site. Nonetheless, one more round of groundwater sampling at OU-5/FISCA IR-02 will be completed under the Basewide Groundwater Monitoring Program, and the results will be included in the next Basewide Five-Year Review report.

2.8 Community Participation

A Community Relations Plan for Alameda Point was developed to document interests, issues, and concerns raised by the community regarding ongoing investigation and cleanup activities and to describe a specific program designed to address these issues and concerns. The initial plan

for Alameda Point was prepared in February 1989 and was revised most recently in 2006. The revisions incorporate the most recent assessment of community issues, concerns, and informational needs related to the ongoing environmental investigation and remediation program at Alameda Point.

As described in further detail, below, public participation and documentation procedures have been followed for this ROD Amendment as specified in CERCLA Section 117 and Title 40 of the Code of Federal Regulations, Section 300.435(c)(2)(ii). Community participation in the environmental investigation and remediation program at Alameda Point and FISCA has been encouraged through the formation of the RAB, public mailings, and specific community participation efforts related to OU-5/FISCA IR-02 as discussed below.

2.8.1 Restoration Advisory Board

The Alameda Point RAB was established in 1993. Original membership in the board was solicited by the DON through newspaper notices and included business and homeowner representatives, residents, local elected officials, and regulatory agency staff.

The RAB currently consists of members of the DON, the community, and regulatory agencies. The RAB meetings are open to the public. Meetings are held in the evenings after normal working hours on the second Thursday of every other month at Building 1, Room 140, at 950 West Mall Square at Alameda Point. RAB members also review and comment on technical documents.

During the monthly RAB meetings, the DON and regulators report information to the RAB members about OU-5/FISCA IR-02, including the availability of site documents. Copies of the RAB meeting minutes and documents describing environmental investigations and removal actions are available at the following Alameda Point information repository and Administrative Record file locations:

Alameda Point Information Repository
950 West Mall Square
Building 1, Room 240
Alameda, California 94501

Administrative Record
Naval Facilities Engineering Command, Southwest
2965 Mole Road, NBSD Building 3519
San Diego, CA 92136

The Alameda public library also will maintain new DON environmental documents during review periods. The Alameda public library is located at 1550 Oak Street, Alameda, CA 94501. RAB meeting minutes and upcoming RAB meeting agendas also are available at the **DON BRAC Program Management Office website** at www.bracpmo.navy.mil.

2.8.2 Public Mailings

Public mailings, including information updates, fact sheets, and Proposed Plans, have been used to ensure a broad distribution of information throughout the local community. Since March 1990, information updates announcing the program process at OU-5/FISCA IR-02 have been delivered to residents living near Alameda Point and FISCA and mailed to city, state, and federal officials;

agencies; local groups; and individuals identified in the Community Relations Plan. Updates and fact sheets have included information concerning the following:

- Status of environmental investigations
- Removal action activities
- Remedy selection process
- Opportunities for the public to participate in investigation and remediation efforts
- History and geology of the area
- Access to the Administrative Record for Alameda Point

Proposed Plans provide an overview of environmental investigation results (including HHRA and ERA results), present remedial alternatives for a site or group of sites, and describe the preferred alternative. The updates, fact sheets, and Proposed Plans are mailed to between 400 and 1,400 households, businesses, public officials, and agencies in an effort to reach community members. The public documents related to OU-5/FISCA IR-02 are summarized in Table 11.

2.8.3 Community Participation for OU-5/FISCA IR-02

As discussed in Sections 2.8.1 and 2.8.2, the DON conducts multiple community participation activities. Key reports related to OU-5/FISCA IR-02 that were provided to the community follow. The RI/FS report was finalized in October 2004. The Proposed Plan was released to the public in March 2006. The final ROD was released to the public in August 2007. The DON issued the final RD/RAWP in October 2008. In December 2012, the DON issued the OU-5/FISCA IR-02 Technical Memorandum. In May 2014, the DON released to the public a Proposed Plan outlining no further action for groundwater as detailed in this amendment to the OU-5/FISCA IR-02 ROD and solicited public input on this remedy.

TABLE 11: SUMMARY OF ALAMEDA POINT FACT SHEETS, NEWSLETTERS, AND PROPOSED PLANS RELATED TO OU-5/FISCA IR-02

Reference	Title
DON 1990a	Fact Sheet 1: Remedial Investigation/Feasibility Study Update
DON 1990b	Fact Sheet 2: Remedial Investigation/Feasibility Study Update
DON 1991	Fact Sheet 3: Remedial Investigation/Feasibility Study Update
DON 1993	Fact Sheet 4: Installation Restoration Program Update
DON 1995	Fact Sheet 5: BRAC Cleanup Plan
DON 1996	Fact Sheet 7: History and Geology
DON 2003	Alameda Point Focus Environmental July 2003 Newsletter
DON 2004	Newsletter Regarding the Navy's Environmental Activities at Alameda Point
DON 2005	Alameda Point Focus, Environmental February 2005 Newsletter
DON 2006a	Alameda Point Focus, Environmental Fall 2005/Winter 2006 Newsletter
DON 2006b	Proposed Plan for Operable Unit 5/IR-02 Groundwater, Former NAS Alameda and Alameda Annex (FISCA)
DON 2007b	Alameda Point Focus, Environmental Fall 2006/Winter 2007 Newsletter
DON 2007c	Alameda Point Focus, Environmental Fall 2007 Newsletter
DON 2008	OU-5/FISCA IR-02 Remedial Action Fact Sheet
DON 2010	Alameda Point Focus, Environmental Summer 2010 Newsletter

Reference	Title
DON 2011	Fact Sheet - Five-Year Review of Alameda Point and Fleet and Industrial Supply Center Oakland, Alameda Facility/Alameda Annex
DON 2012	Alameda Point Focus, Environmental Spring 2012 Newsletter
DON 2013a	Alameda Point Focus, Environmental Spring 2013 Newsletter
DON 2014	Proposed Plan for Alameda Point Operable Unit 5/FISCA IR-02 Groundwater, Alameda

These documents are available to the public at the information repository maintained at Alameda Point and in the Administrative Record file maintained at the Naval Facilities Engineering Command, Southwest, in San Diego, California. The information repository also contains a complete index of the Administrative Record file.

A 30-day public comment period for the OU-5/FISCA IR-02 Proposed Plan describing this ROD amendment extended from May 5 through June 5, 2014. In addition, a public meeting was held on May 20, 2014. A notice of the public comment period and public meeting was published in the *Alameda Journal*, *Alameda Sun*, and *East Bay Express* newspapers.

At the May 20, 2014 public meeting, the BRAC Environmental Coordinator and Remedial Project Manager were available to discuss OU-5/FISCA IR-02 and describe the selected remedy. Representatives from the DON and environmental regulatory agencies also were available to answer questions. A court reporter prepared a transcript of the meeting. No public comments on the OU-5/FISCA IR-02 Proposed Plan were received during the public comment period.

3 Responsiveness Summary

The participants at the public meeting held on May 21, 2014, included representatives of the public, DON, EPA, DTSC, and Water Board. The **meeting transcript** is included as part of this ROD amendment. Because no public comments were received, responses to comments are not included in a Responsiveness Summary as part of this ROD amendment.

Item	Reference Phrase in ROD[a]	Location in ROD	Referenced Document Available in the Administrative Record
1	**Administrative Record file**	Section 1.2	Alameda Point Information Repository 950 West Mall Square Building 1, Room 240 Alameda, California 94501 Administrative Record Naval Facilities Engineering Command, Southwest 2965 Mole Road, NBSD Building 3519 San Diego, CA 92136
2	**cancer risks for residential use based on the soil gas data**	Section 1.3.1	Final OU-5 Remedial Investigation, Alameda Point. Section 5.9.2.2, Page 5-40, Section 5.9.3.2, Page 5-43, Tables 5-52 to 5-57. Neptune and others. 2002.
3	**risk using soil gas data**	Section 1.3.1	Final Groundwater Remedial Investigation/Feasibility Study, Alameda Point Site 25/Alameda Annex IR-02. Section 6, Pages 6-4 to 6-5, and Section 10, Page 10-1. ERRG. 2004.
4	**Marsh Crust**	Section 1.3.1	Final Remedial Design/Remedial Action Work Plan, OU-5/IR-02 Groundwater, Revision 2. Section 3.4, Pages 3-8 through 3-10. TtEC. 2010.
5	**treatment system**	Section 1.3.1	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 2.8, Page 11, Figure 1. Tetra Tech EC, Inc. (TtEC). 2012.
6	**pre-treatment concentrations**	Section 1.3.1	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 3, Pages 11 and 15, Section 5, Pages 18 through 32. TtEC. 2012.
7	**2012 risk assessment**	Section 1.3.1	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Appendix C, including figures and tables. TtEC. 2012.
8	**benzene concentrations in crawl spaces**	Section 1.3.1	Residential Risk Evaluation for U.S. Coast Guard Housing, Alameda, California. Page 9. Tetra Tech EM Inc. (TtEM). 2002.
9	**completeness and significance of the vapor intrusion exposure pathway**	Section 1.3.1	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 5.2.1.2 through Section 6.0, Pages 23 through 34. TtEC. 2012.

Item	Reference Phrase in ROD[a]	Location in ROD	Referenced Document Available in the Administrative Record[1]
10	**sub-slab soil gas and indoor and outdoor air sampling**	Section 1.3.1	Alameda OU-5/IR-02 Subsurface and Indoor Air Data Correspondence. U.S. Environmental Protection Agency (EPA). December 13, 2013.
11	**former NAS Alameda, now referred to as Alameda Point and former FISCA**	Section 2.1	Final Groundwater Remedial Investigation/Feasibility Study, Alameda Point Site 25/Alameda Annex IR-02. Section 1, Page 1-1. ERRG. 2004.
12	**key features at the site**	Section 2.1	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Sections 2.1 and Section 2.2, Page 5-6, Figure 1. TtEC. 2012.
13	**Plume boundaries**	Section 2.1	August 2013 Analytical Results for OU-5/FISCA IR-02 Groundwater, Alameda Point and FISCA, Alameda, California. Figure 2. Department of Navy (DON). 2013.
14	**geology**	Section 2.2	Final Technical, Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 2.3, Page 6, Figures 2 through 9. TtEC. 2012.
15	**Surface and near-surface soil**	Section 2.2	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 2.3, Page 6, Figures 2 through 9. TtEC. 2012.
16	**Bay Sediment Unit (BSU)**	Section 2.2	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 2.3, Page 6. TtEC. 2012.
17	**hydrogeology**	Section 2.2	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 2.4, Pages 6 and 7, Figures 2 through 9. TtEC. 2012.
18	**2007 ROD**	Section 2.3.2	Final Record of Decision, OU-5/IR-02 Groundwater. Section Declaration, Page D-2, Section 2.2.1, Page 2-4, Section 5.3, Pages 5-4 through 5-6. TtEC. 2007.
19	**passive soil gas survey**	Section 2.3.2	Final Remedial Design/Remedial Action Work Plan, OU-5/IR-02 Groundwater. Section 3.2, Page 3-2, Figure 3-2, Figure 3-3, Appendix A, and Appendix B. TtEC. 2010
20	**soil and groundwater samples**	Section 2.3.2	Final Remedial Design/Remedial Action Work Plan, OU-5/IR-02 Groundwater, Revision 2. Section 3.3, Pages 3-3 through 3-8, Figure 3-8. TtEC. 2010.
21	**Treatment systems**	Section 2.3.2	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 2.8, Page 11. TtEC. 2012.
22	**Groundwater monitoring results**	Section 2.3.2	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 3, Page 11, Attachment 2. TtEC. 2012.

Item	Reference Phrase in ROD[a]	Location in ROD	Referenced Document Available in the Administrative Record[1]
23	**Final Quality Assurance Project Plan**	Section 2.3.2	Final Quality Assurance Project Plan for Sampling and Analysis of Indoor Air, Outdoor Air, and Sub-Slab Gas, Alameda Point Operable Unit 5/Installation Restoration Site 2, Alameda, California. Pages 14-20. EPA. September 19, 2013.
24	**Alameda Point General Plan Amendment**	Section 2.4	Alameda Point General Plan Amendment. City of Alameda. May 2003.
25	**criteria for a potential drinking water source**	Section 2.4	Final Technical Memorandum, OU-5/FISCA IR-02 Groundwater Data Evaluation. Section 4.3, Page 18. TtEC. 2012.
26	**CSM**	Section 2.5	Final Remedial Design/Remedial Action Work Plan, OU-5/IR-02 Groundwater, Revision 2. Section 3.8, Page 3-14. TtEC. 2010.
27	**2004 RI/FS baseline HHRA**	Section 2.5.1	Final Groundwater Remedial Investigation/Feasibility Study, Alameda Point Site 25/Alameda Annex IR-02. Section 6, Pages 6-1 through 6-9. ERRG. 2004.
28	**For 30-year exposure, the residential risk**	Section 2.5.1	Residential Risk Evaluation for U.S. Coast Guard Housing. Appendix A, Tables A-11 and A-18. Tetra Tech EM, Inc. 2002.
29	**cancer risks for residential use based on the soil gas data**	Section 2.5.1	Final OU-5 Remedial Investigation, Alameda Point. Section 5.9.2.2, Page 5-40, Section 5.9.3.2, Page 5-43, Tables 5-52 to 5-57. Neptune and others. 2002.
30	**vapor migration model**	Section 2.5.1	Johnson and Ettinger Models. On-line Address: www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm. US EPA. 2013.
31	**groundwater as the potential source of indoor air vapors**	Section 2.5.1	Final Soil Remedial Investigation Report, IR Site 30. Appendix I, Tables I6-1 and I6-2 for groundwater. Bechtel Environmental, Inc. 2005.
32	**For groundwater, the total RME residential cancer risk**	Section 2.5.1	Final Soil Remedial Investigation Report, IR Site 31 Marina Village Housing. Appendix I, Tables I6-1 and I6-2 for groundwater. CDM Federal Programs Corporation. 2007.
33	**HHRA of potential vapor intrusion**	Section 2.5.1	Final Groundwater Remedial Investigation/Feasibility Study, Alameda Point Site 25/Alameda Annex IR-02. Section 6, Pages 6-1 through 6-9. ERRG. 2004.
34	**DTSC attenuation factor for existing residential buildings**	Section 2.5.1	Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. Table 2, Appendix B, Page B-1. DTSC. 2011.

Item	Reference Phrase in ROD[a]	Location in ROD	Referenced Document Available in the Administrative Record
35	**DTSC toxicity criteria**	Section 2.5.1	Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. Appendix C, Pages C-2 through C-5. DTSC. 2011.
36	**slab-on-grade residential structure**	Section 2.5.1	Johnson and Ettinger Models. On-line Address: www.oehha.ca.gov/tcdb/index.asp. DTSC. 2012.
37	**groundwater concentrations at the water table dictate the volatilization of dissolved constituents out of the liquid phase and into soil gas**	Section 2.5.1	Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. Pages 1 and 9. DTSC. 2011.
38	**Integrated Risk Information System (IRIS) toxicity criteria**	Section 2.5.1	Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. Appendix C, Page C-5. DTSC. 2011.
39	**DON BRAC Program Management Office website**	Section 2.8.1	www.bracpmo.navy.mil
40	**meeting transcript**	Section 3	Public Meeting, Alameda Point Public Library, May 20, 2014.

Note:

a **Bold blue text** is hyperlinked to detailed site information available on the ROD amendment's reference CD that also is contained in the publicly available Administrative Record. For access to information contained in the Administrative Record for Former NAS Alameda, please contact the following: Administrative Record, Naval Facilities Engineering Command, Southwest, Attn: Ms. Diane Silva, 2965 Mole Road, NBSD Building 3519, San Diego, CA 92136, Telephone No. (619) 532-3676.