SECTION 1

Introduction

This Focused Feasibility Study (FFS) was originally prepared by IT Corporation (IT) for the U.S. Army Corps of Engineers (USACE), Sacramento District, under Contract No. DACW05-95-D-001, Delivery Order 0006, of the Total Environmental Restoration Contract. Based on comments received from regulatory agencies, the February 2001 draft of the FFS prepared by IT was revised by CH2M HILL at the request of USACE. This final FFS reflects the revisions made by CH2M HILL.

1.1 Background

This FFS was prepared for the Hamilton Army Air Field (HAAF) Inboard Area. HAAF is a former military installation located on a diked and subsided bayfront parcel in the City of Novato, Marin County, California (Figure 1-1). The Inboard Area lies inboard of the perimeter levee and encompasses most of the former airfield (Figure 1-2). The Inboard Area sites and other portions of HAAF were identified for operational closure under the Base Realignment and Closure Act (BRAC) of 1988. For purposes of environmental remediation under the Comprehensive, Environmental, Resource, Compensation, and Liability Act (CERCLA), the Inboard Area sites are distinguished from other BRAC areas at the former HAAF.

Historically, the Inboard Area was part of a tidal wetland. Through the BRAC process, the Inboard Area will be transferred to the California State Coastal Conservancy (SCC) and become part of the Hamilton Wetland Restoration Project. The Hamilton Wetlands Restoration Project is a federal project authorized by the Water Resources Development Act of 1999. The USACE, San Francisco District, will manage the project, and the SCC is the local sponsor. Local and regional public, government, and resource agencies have expressed a desire for the wetlands to be restored.

Several issues related to residual contamination have been identified within the Inboard Area. These issues include residual installation-wide pesticides, and PAHs in soil near the runway. The Army has identified these issues as not being CERCLA releases. Therefore, these issues are not addressed in the comprehensive remedial investigation, interim removal actions, human health and ecological risk assessment and this FFS. DTSC believes that these issues are releases under CERCLA. The Army has agreed to develop options in the ROD/RAP to address potential threats to human health or the environment in future wetland.

1.2 Purpose and Scope

The purpose of the FFS is to identify sites within the Inboard Area that require further action and to develop, evaluate, and recommend alternatives for these Inboard Area sites to protect human health and the environment in the future wetland restoration. Each

alternative considered in this FFS is consistent with the planned use of the property (wetland restoration). Specific aspects of the Hamilton Wetland Restoration Project were considered in identifying, evaluating, and selecting remedial alternatives for the Inboard Area sites.

This feasibility study is focused in the sense that development of remedial alternatives was streamlined to consider only applications that are consistent with the future wetland land use scenario. The following steps were conducted for the FFS effort:

- Develop a conceptual model for the FFS evaluation based on estuarine and human receptors at each of the Inboard Area sites (except the Northwest Runway Area which has only upland receptors) and additional freshwater receptors at Building 82/87/92/94 Area, Spoils Piles A, B, and N, and the PDD-Unlined Portion.
- Review data collected by remedial investigation (RI) activities and during previous and subsequent investigative activities.
- Analyze the results of the human health and ecological risk assessment (U.S. Army, 2001) provided in Appendix A to determine what sites proceed forward for further evaluation.
- Review hazard indexes (HI) for receptors at each site and determine if any HIs are greater than 1.0. If no HIs are greater than 1.0 then no further action is required. If any HIs are greater than 1.0 then determine if site-specific FFS chemicals of potential concern (COPCs) are present.
- Review ecological hazard quotient (HQ), human health HQ, and human health incremental lifetime cancer risk (ILCR) and determine if the HQs are greater than 1.0 or the ILCR is greater than $1x10^{-6}$. If the HQs are less than 1.0 and the ILCR is less than $1x10^{-6}$, the chemical is not a site-specific FFS COPC. If either HQ is greater than 1.0 or the ILCR is greater than $1x10^{-6}$, the chemical is a site-specific FFS COPC.
- Review comparator values developed through negotiations with the Regulatory Agencies and Resource Trustees.
- Compare the site-specific FFS COPCs to the comparator values.
  - If all 95 UCL (or maximum in some cases) COPC concentrations are less than the comparator values, the site does not require further action.
  - If all 95 UCL (or maximum in some cases) are greater than the comparator value, the site requires further evaluation, and the site-specific FFS COPC becomes a chemical of concern (COC).
- Develop remedial action objectives (RAO) and applicable or relevant and appropriate requirements (ARAR).
- Identify remedial alternatives.
  - Alternative 1 – No Further Action
  - Alternative 2 – Institutional Controls (IC)
  - Alternative 3 – Excavation and Offsite Disposal
  - Alternative 4 – Excavation and Onsite Disposal

- Conduct detailed and comparative analyses of the remedial alternatives for each Inboard Area site with COCs.
- Recommend the preferred alternative for each Inboard Area site.

The FFS process is shown in Figure 1-3.

The objective of this FFS is to recommend appropriate remedies by developing and analyzing remedial alternatives for those sites that require further action. The FFS is based on the results of the human health and ecological risk assessment (U.S. Army, 2001), process knowledge, and best engineering judgement. The ultimate goal of this effort is to provide a rational basis for the selection and subsequent implementation of a proposed cost-effective remedial alternative for each Inboard Area site to protect public health and the environment. In conjunction with the FFS, a proposed plan in the form of a draft Record of Decision/Remedial Action Plan (ROD/RAP) has been developed and will be available for public comment. The final ROD/RAP will consider comments from the public and document the chosen remedies for each Inboard Area site.

1.3 Regulatory Framework

The Inboard Area is being transferred in accordance with the BRAC Act (U.S. Public Law 100-526). The process of transferring federal lands mandates a process of environmental investigations in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The process of transferring federal lands mandates a process of environmental investigations. The process includes identification, assessment, and, as needed, remediation and closure. The assessment of the environmental conditions was conducted through the Comprehensive Remedial Investigation Report (RI) (IT, 1999a), the Interim Removal Actions (IT, 1999b and IT, 2000), and the Human Health and Ecological Risk Assessment (IT, 2001). This FFS, which is a continuation of the process, is used to develop remedial actions where further action is needed to protect human health and the environment.

The HAAF is not regulated under the CERCLA as a Superfund site and is not on the National Priority List (NPL). The U.S. Army is using its lead agency status and authority under CERCLA to implement the environmental restoration activities at HAAF. The FFS has been prepared in accordance with CERCLA, as amended by the Superfund Amendments Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Guidance documents used in the preparation of this FFS report included the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 Code of Federal Regulations [CFR] 300.430) and the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988a).

The regulatory agencies involved in the BRAC closure process for the Inboard Area include the:

- California Environmental Protection Agency, Department of Toxic Substances Control (DTSC); since HAAF is not on the NPL, the DTSC is the lead regulatory agency
- U.S. Environmental Protection Agency (EPA)

- California Regional Water Quality Control Board (RWQCB)

The agencies involved in the wetland restoration activities at HAAF include the:

- Bay Conservation and Development Commission (BCDC)
- State of California Coastal Conservancy (SCC)
- USACE, San Francisco District

There are also Resource Trustee agencies involved in the closure process for the Inboard Area, including the:

- U.S. Fish and Wildlife Service (USFWS)
- California Department of Fish and Game (CDFG)
- National Marine Fisheries Service
- National Oceanic and Atmospheric Administration (NOAA)

1.4 Installation History

Hamilton Army Airfield is located approximately 22 miles north of San Francisco, California, in Marin County, California, and encompasses an area of roughly 1,600 acres. As shown on Figure 1-2, the Inboard Area is located primarily within the northeastern portion of HAAF. HAAF was constructed on reclaimed tidal wetlands by the U.S. Army Air Corps in 1932. Prior to 1932, the area was known as Marin Meadows and had been used as ranch and farm land since the Mexican Land Grant (USACE, undated). Military operations began in December 1932. Bombers and, later, transport and fighter aircraft were based at the airfield. HAAF played a major role in World War II as a training field and staging area for Pacific Theater operations. During the war, the Base hospital served as an acute care and rehabilitation facility for thousands of war casualties each month. The Airfield was renamed Hamilton Air Force Base in 1947 when it was transferred to the newly created U.S. Air Force.

In the mid-1960s, the U.S. Air Force began to curtail Base operations due to increased complaints about aircraft noise and concerns for air traffic and public safety (ETC, 1994a). In 1974, the U.S. Air Force deactivated the Base and initiated disposal of the property. The residential portion of the installation was transferred to the U.S. Navy in 1975 and to the U.S. Coast Guard in 1998.

In 1976, the U.S. Army began using the runway and ancillary facilities and several other buildings for regular U.S. Army and U.S. Army Reserve operations. In 1976, the State of California determined that lands subject to tidal action belong to the State. Consequently, the State claimed a portion of the land outside the levees that encircle the site (i.e., North Antenna Field and the Coastal Salt Marsh). The Army continued to use portions of the Base on a permit basis until 1984. In 1984, when portions of the airfield were officially acquired by the Army, property management responsibilities were transferred to the Presidio of San Francisco, and the base was renamed Hamilton Army Airfield. Aircraft operations were again discontinued in 1994 when the Airfield was closed.

1.5 Hydrogeological Setting, Ecological Communities, and Land Uses

This section describes the hydrogeology, land use, and biological habitats and biota currently existing within the Inboard Area. This background information aids in the understanding of past work conducted at the Inboard Area sites and, in part, the basis for development of remedial alternatives.

1.5.1 Existing Hydrogeological Setting

Three shallow hydrogeologic units occur within the Inboard Area: fill, soft Bay Mud, and desiccated Bay Mud. The "fill" was originally used to reclaim the bay margin lowlands for agriculture and has very similar content and hydrogeological properties to the Bay Mud. A different type of "fill" referenced in the RI (IT, 1999a) is the imported construction material used for geotechnical applications and foundation and drainage properties and is not part of the hydrogeologic unit. This type of "fill" is found in pipeline trenches and as a bridging layer beneath some of the formerly developed areas. This fill will be referred to as "imported fill" when used. Permeabilities and groundwater flow characteristics are summarized below:

- Fill materials have moderate to low hydraulic conductivities. Preferential groundwater flow through the fill may be controlled by the distributions of different fill types.
- Soft Bay Mud generally has low hydraulic conductivity. Preferential flow, if existent, is probably horizontal and confined to peat layers or shell lenses which are discontinuous and limited in aerial extent.
- Desiccated Bay Mud has low hydraulic conductivity with some fracture permeability. The desiccation cracks are potentially transient in nature and may heal or infill during periods of saturation.

The developed airfield is located on the eastern side of the Novato Creek groundwater basin and is part of the regional San Pablo groundwater basin defined by the drainage entering San Pablo Bay. Existing and potential beneficial uses of groundwater within the Novato Creek basin include municipal and domestic water supply, rare and endangered species preservation, freshwater wildlife habitats, and recreational use (RWQCB, 1995). The BRAC property has a relatively low potential for beneficial groundwater use based on the San Francisco Bay Basin (Region 2) Water Quality Control Plan beneficial-use criteria.

Groundwater beneath the BRAC property is not now, nor is likely to be, used for drinking water. State Water Resources Control Board Policy 88-63 (1988) specifies the criteria for determining whether groundwater is a source of drinking water, that is, if it is suitable for municipal or domestic water supply. One of the criteria for suitability as drinking water is low total dissolved solids (TDS). The policy defines water with TDS in excess of 3,000 milligrams per liter (mg/L) as unsuitable for drinking. The TDS concentrations in groundwater from monitoring wells across the BRAC property range from one to 18 parts per thousand (ppt) (equivalent to 819 to 18,270 mg/L) (IT, 1999a). These findings indicate that groundwater beneath the BRAC property is generally unsuitable for drinking because the average TDS concentration (5 ppt or 4,898 mg/L) exceeds the 3,000-mg/L limit.

As part of the remedial assessment summary for the General Services Administration (GSA) Phase II Sale Area (IT, 1998), the available well records at the Department of Water Resources and Marin County Environmental Health were reviewed to evaluate the regional beneficial uses of groundwater within the vicinity of the HAAF. The review included all domestic, industrial, and irrigation supply wells within a two-mile radius of the airfield and included available Department of Water Resources well logs and Marin County Environmental Health records. There are 11 supply wells located within a two-mile radius of the HAAF. Most of the wells in the vicinity of the HAAF are used for domestic or irrigation supply, and all of these wells appear to be outside the influence of historical HAAF activities. Only one well is located within one-mile of the site boundaries, and the entire airfield is downgradient (east), isolated from all of the existing supply wells.

Groundwater is generally not extracted in the Bay plain east of Novato because of poor water quality, low well yield, and decreasing saturated aquifer thickness. Redevelopment plans for the HAAF include importing municipal water for residential and industrial uses and reducing the necessity of installing any groundwater extraction wells. Well-integrity criteria and potential rapid degradation of water quality from salinity generally preclude groundwater extraction.

In summary, high salinities and low yields from groundwater support the conclusion that groundwater beneath the HAAF is not beneficial for human use. In a decision consistent with this position, the San Francisco RWQCB set aside groundwater concerns about the airfield parcel and notified the Army by letter in 1991 that the Army need not further assess groundwater along the onshore fuel line due to the low permeability soils.

The other consideration of interest for potential significance to ecological receptors are the results obtained from monitoring efforts in 1993 and 1994 of the BRAC property. Although this study was somewhat troubled by laboratory contamination of samples, it was still sufficiently demonstrated that total recoverable petroleum hydrocarbon, diesel, JP-4, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), and other organic contaminants were not present in groundwater throughout the Airfield sites. In 1994 and 1995, the Army conducted further studies to address the issues of metals and background levels for inorganic compounds in BRAC property groundwater. Results reflected the brackish nature of BRAC property groundwater with high TDS levels in that numerous metals appeared in both background wells and site-specific wells. Metals concentrations (unfiltered only) for site-specific wells fell generally within the range of observed values from background wells. The lack of ability to distinguish between dissolved metals and metals that might be adsorbed upon soil particles presented a confounding factor for interpretation, but the broad consensus was that the BRAC property groundwater did not pose a threat due to inorganic compounds.

Based upon these findings, it is concluded that BRAC property groundwater was not adversely affected by Army activities at Hamilton. Therefore, groundwater is not evaluated further in this FFS report.

1.5.2 Hydrology

HAAF is in the southern portion of the Novato Creek Drainage Basin and Watershed (USACE, 1993). Historically, tidal marsh and mudflats covered the area. The main slough

channel drainage system in the HAAF panhandle (the rectangular area to the east of Ammo Hill and to the northwest of the triangular pond will be referred to as the "panhandle" in this document) area drained to the northwest into the tidal reaches of Novato Creek (PWA, 1998), which then drained into San Pablo Bay. Using a system of levees and drainage ditches, the area that is now HAAF was reclaimed for agricultural use in the late 1800s. The surface water flow pattern was further modified through a series of Perimeter Drainage Ditches (PDDs), culverts, and levees on the property.

Today, regional surface water flow is generally from the upland areas in the west toward the San Pablo Bay in the east. From areas west of HAAF, surface water is carried by Pacheco Creek and Arroyo San Jose, which occur along the northwestern boundary of HAAF. Both Pacheco Creek and Arroyo San Jose discharge into the Ignacio Reservoir, which occupies approximately 120 acres and has a storage capacity of 480 acre-feet (Jones & Stokes Associates, Inc., 1998). The reservoir drains into Novato Creek through a leveed channel with a flap gate outlet, located at the Bel Marin Keys Boulevard bridge. This water is then conveyed through a network of drainage ditches and the PDD, which conveys drainage to three pump stations (Buildings 35, 39, and 41) on the margin of San Pablo Bay.

Stormwater drainage system conduits ranging in diameter from less than 12 inches to as large as 54 inches in diameter are distributed in several general areas of the HAAF. The component lines in each network span various distances and lie at various depths, usually no deeper than three to five feet below current grade. One network drains the mid-airfield just north of the revetment area. Another network drains the revetment area itself, while a third drains the aircraft maintenance area to the west of the revetments. The drains in the Aircraft Maintenance and Storage Facility Area (AMSF) convey water to discharge into the PDD to the west of the central portion of the airfield (CH2M HILL, 2001).

Runoff from the Landfill 26 area and 40 acres in the northern Reservoir Hill area enters the panhandle and drains into the PDD located parallel to the northern border of the airfield.

The runoff from the north side of Reservoir Hill enters the panhandle through a culvert in the south corner of the panhandle. Modified underground storm drains along the northwest and southwest sides of the panhandle convey Reservoir Hill runoff into the northern PDD. The northern PDD conveys stormwater to the eastern end of the airfield, where the aforementioned three pumps transport runoff from the airfield into San Pablo Bay (Jones & Stokes Associates, Inc., 1998).

Seasonal surface runoff from the Landfill 26 area is routed around the landfill in grass-lined swales and temporary ponds into a small depression north of the landfill. This pond releases runoff to the panhandle via a four-foot diameter tide-gated culvert which empties into a drainage ditch, and then enters a seasonal wetland mitigation site. When water in the wetland reaches an elevation of –3 feet NGVD, it spills over a constructed weir into the northern PDD (PWA, 1998). In 10-year and larger storm events, Pacheco Creek overtops its banks and overflows into the Landfill 26 drainage system.

A second PDD, located along the southern and eastern sides of the airfield, carries runoff from other parts of the airfield and from adjacent property west and south of the airfield to the HAAF pumps (PWA, 1998). Indeed, the southern PDD system receives drainage from several proximate areas:

- Drainage flows through a 42-inch gated culvert through the perimeter levee near the southwest corner of HAAF on the St. Vincent's property which carries flows from the western portion of the DoD housing and Long Point peninsula upland areas adjacent to the airfield and from a portion of the St. Vincent's property
- Drainage from the New Hamilton Partnership development, the eastern portion of the DoD housing area, and other areas adjacent to the west side of the airfield that are conveyed to the ditch in two outfalls: one near Reservoir Hill (west outfall) and one near the southwest corner of the airfield (east outfall) (Jones & Stokes Associates, Inc., 1998).

1.5.3 Existing/Future Land Use

The BRAC property has been inactive since the mid-1980s with the exception of infrequent runway use prior to 1994. There is no residential housing or developed recreational areas within the Inboard Area. However, adjacent properties that were part of the larger HAAF, particularly to the west, have been or are in the process of being developed for residential and/or commercial uses.

Wetlands restoration on the portion of the airfield parcel and the adjoining abandoned antenna field that together constitute the wetland project area is consistent with and helps implement applicable local, regional, and state plans, including the Hamilton Reuse Plan, the City of Novato General Plan, and the San Francisco Bay Conservation and Development Commission San Francisco Bay Plan. There are three wetland project objectives that satisfy the above mentioned plans: (1) to create a diverse array of wetland and wildlife habitats that benefit a number of threatened, endangered, and other species, (2) to reduce in-water disposal of cover material and beneficially reuse cover materials as feasible, and (3) to facilitate the base-closure and reuse process.

This FFS evaluates the need for remediation and the remedial alternatives based on beneficial use as a wetlands. Under the future wetlands end use, the existing levee surrounding the airfield will be breached, and water from San Pablo Bay would be allowed to reclaim the airfield, eventually returning the area to a wetlands state. Because much of the Inboard Area has subsided to elevations below that of a productive salt marsh, the restored wetlands must rise to a level that will sustain a permanent marsh habitat through the placement of imported fill material augmented by natural sedimentation. Main tidal channels will be constructed within the cover material and lower order channels will form naturally.

The initial construction phase of the wetlands restoration project is scheduled for approximately five to eight years. Following construction, the levee will be breached and the wetlands will be allowed to equilibrate and mature. The wetland is expected to reach maturity in approximately 50 years.

1.5.4 Existing Biological Communities

This section contains descriptions of habitats and biota currently existing within the Inboard Area and in the Coastal Salt Marsh (CSM) that borders the east BRAC property boundary. This summary is not intended to be an exhaustive compilation of plants and wildlife, but rather a list of potential ecological receptors.

Several studies since 1986 have characterized the biological resources (flora and fauna) in the vicinity of the Inboard Area and CSM. The surveys were conducted in support of environmental impact reports for Base closure and subsequent use of BRAC property. The discussions of biological resources in this section are based upon reports by EIP Associates (1986 and 1993) and USACE (1994). Information in these reports includes results of botanical field surveys conducted in August 1993 and May 1994 and wildlife surveys conducted in May 1994.

Additional wildlife investigations were conducted in 1997 and 1998 and include the following:

- A bat survey (LSA, 1997a)
- California Clapper Rail (*Rallus longirostris obsoletus*) and California black rail (*Laterallus jamaicensis coturniculus*) Survey (LSA, 1998)
- Burrowing Owl (*Athene cunicularia*) Study and Relocation (LSA, 1997b)
- Red Legged Frog (*Rana aurora*) Survey (LSA, 1997c).

There are some differences among the various HAAF BRAC project documents as to which special status species, of those not actually observed on the property or salt marsh areas, are likely to be present. The Hamilton Wetland Restoration Plan, Volume II: Final EIR/EIS (Jones & Stokes Associates, Inc., 1998) lists 56 special-status species and evaluates their potential for occurrence or reports documented observations. It is concluded from this information that after elimination of species for which habitat is lacking or species which may make only incidental use of the site, 12 species are known to occur or are assumed to use suitable habitat at the site. These species included:

- Longfin smelt (Spirinchus thaleichthys)
- Central California steelhead (Oncorhynchus mykiss)
- Chinook salmon (Oncorhynchus tshawytscha)
- Double-crested cormorant (Phalacrocorax auritus)
- California brown pelican (Pelicanus occidentalis californicus)
- California clapper rail
- California black rail
- Northern harrier (Circus cyaneus)
- Burrowing owl
- Salt marsh common yellowthroat (Geothrypis trichas sinuosa)
- San Pablo song sparrow (Melospiza melodia samuelis)
- Salt marsh harvest mouse (Reithrodontomys raviventris).

1.6 Historical Investigations

This FFS is primarily based on the information presented in the RI (initiated in 1996) (IT, 1999a), the 1998 Interim Removal Action Report (IT, 1999b), the 1999 Interim Removal Action Report (IT, 2000), the Foster Wheeler Remedial Design Investigation Report (FW, 2000), and the Human Health and Ecological Risk Assessment (U.S. Army, 2001) for which site-specific field investigations and interim removal actions at the Inboard Area is documented.

These primary documents include information from the investigative documents referenced below:

- Report of Findings, Survey of Toxic and Hazardous Materials on Excess Property (USADEH, 1985)
- GSA Sale Area Confirmation Study for Surface and Subsurface Hazardous Materials Contamination (WCC, 1985)
- Confirmation Study for Hazardous Waste (WCC, 1987)
- *Hamilton AFB Storage Tank Removal Project* (IT, 1987)
- Enhanced Preliminary Assessment (Weston, 1990)
- Final Engineering Report, Miscellaneous Contaminated Sites (IT, 1991)
- Final Environmental Investigation Report (ESI, 1993)
- Community Environmental Response Facilitation Act Plan (ETC, 1994a)
- Supplement to the Final Environmental Investigation Report (USACE, 1994)
- HAAF BRAC property, Site Description and Programmatic Approach (Army, 1994)
- Ground Geophysical Surveys of Hamilton Army Air Base (Terrasoft, 1994)
- Additional Environmental Investigation of the BRAC property (WCFS, 1996)
- Environmental Investigation Report, Onshore Fuel Line (IT, 1996)
- Comprehensive Remedial Investigation Report (IT, 1999a).

1.7 Nature and Extent of Contamination

As described in Section 1.3, the Inboard Area was used for a variety of military functions. These functions, which could have potentially impacted soil, were supported by underground storage tanks (UST), aboveground storage tanks (AST), transformers and transformer pads, storm drain and sanitary sewer systems, the Former Sewage Treatment Plant (FSTP) (including sludge drying beds), fuel lines, revetment areas, and the Perimeter Drainage Ditch (PDD) which collected runoff from the Base as well as the surrounding agricultural lands. Based on historical investigation, the contaminants detected at various sites include:

- Total petroleum hydrocarbons (TPH) measured as diesel, gasoline, JP-4, or motor oil
- Metals
- Dioxins and furans
- Volatile organic compounds (VOC)
- Semi-volatile organic compounds (SVOC) including Polynuclear aromatic hydrocarbons (PAH)

- Polychlorinated biphenyls (PCB)
- Pesticides

The chemicals were generally detected in surficial soils at trace concentrations. A detailed description of the site characterization activities is provided in the RI (IT, 1999a), the interim removal action reports (IT, 1999b and IT, 2000), and the Foster Wheeler (FW) remedial design report (FW, 2000).

1.8 Description of Inboard Area Sites

This section provides a brief description of each Inboard Area site evaluated in this FFS. Figure 1-2 shows the general location of each Inboard Area site. Additional information on these sites, including characterization results, can be found in the RI (IT, 1999a).

The baseline risk assessment for HAAF was prepared for 63 Inboard Area sites. The sites were divided into 58 Inboard Area sites and five CSM sites (not addressed by this FFS). The Seasonal Wetland was considered as an Inboard Area site in the Risk Assessment; however, it is not a part of the BRAC property and is not identified as a site in the final Community Environmental Response Facilitation Act (CERFA) report (ETC, 1994a). Hence, it was not considered in this FFS. Therefore, 57 Inboard Area sites were identified within the Inboard Area and carried through the FFS for evaluation as listed below.

- Former Sewage Treatment Plant (FSTP)
- Building 20
- Building 26
- Building 35/39 Area
- Building 41 Area
- Building 82/87/92/94 Area
- Building 84/90 Area
- Building 86
- PDD
- PDD Spoils Piles A, B, C, D, E, F, G, H, I, J, K, L, M, and N
- East Levee Generator Pad
- Onshore Fuel Line (ONSFL) – 54-inch Drain Line Segment
- ONSFL – Hangar Segment
- ONSFL – Northern Segment
- Northwest Runway Area
- Tarmac East of Outparcel A-5

- Revetments 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, and 28
- Revetment 18/Building 15

Building 86 is combined with the Building 82/87/92/94 Area in Section 4 for the purposes of evaluating remedial alternatives.

Each Inboard Area site was investigated during the RI. Following the RI, interim removal actions were conducted in 1998 and 1999. Interim removal action guidance levels were recommended by regulatory agencies and regulatory trustees for the interim removal actions at HAAF. Effects Range-Medium (ER-M) guidelines, a toxicity-based indicator of potential adverse impact on estuarine benthic invertebrate, were selected for the interim removal action guidance levels at the time the actions were conducted. The non-petroleum interim removal action guidance levels were ER-M guidelines derived from NOAA Technical Memoranda, "The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program" and "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." The petroleum interim removal action guidance levels were based on San Francisco Airport site cleanup levels and RWQCB, San Francisco Bay Region saltwater protection zone tier 1 standards. The interim removal action guidance levels were used to establish excavation limits; they were not used as strict cleanup goals.

Interim removal actions were conducted in 1998 and 1999 at sites where one or more samples contained a chemical at a concentration at or above its ER-M guideline (Long et al., 1995). The interim removal actions involved excavation of impacted soil with offsite disposal of the excavated soil (IT, 1999b and IT, 2000). Confirmation soil samples were collected after excavation to confirm the achievement of interim removal action guidance levels.

Interim removal actions were performed in 1998 at the following Inboard Area sites:

- Revetment 18/Building 15
- Building 20
- Building 82 (Transformer Pad)
- Building 92/94 (Transformer Pad)
- East Levee Generator Pad (Tank Pads)
- PDD-Unlined
- PDD Spoils Piles (A, B, C, D, E, G, H, I, J, K, L, M, and N)
- Revetment 10
- Building 35/39
- Building 41
- FSTP
- Building 86 (storm drains)

Additional removal activities were conducted in 1999 at sites where confirmation samples exceeded the interim removal action guidance levels at the 1998 interim removal action (IT, 1999b) excavation sites. The majority of the confirmation samples from the 1999 interim removal actions were analyzed only for the chemicals of interest based on the previous

sampling. The 1999 interim removal actions were conducted at the following Inboard Area sites:

- Building 82
- PDD Spoils Piles (B, C, E, H, I, J, and L)
- Revetment 9
- Building 35/39
- Building 41
- FSTP

In some cases, the figures provided in Appendix B (area and volume calculations), include the 1998 excavation confirmation sample locations which exceed the comparator values even though a subsequent excavation (1999 interim removal action [IT, 2000]) was conducted.

The following sections give a description of each Inboard Area site.

1.8.1 Former Sewage Treatment Plant

The FSTP is located at the eastern edge of the Inboard Area, close to Perimeter Road and the PDD and immediately southwest of the Pump Station Area (PSA). The FSTP consisted of several buildings, a digester, and four sludge drying beds. The beds were unlined and contained within earthen berms. Sewage generated at the HAAF was processed by primary and secondary treatment at the plant. Treated effluent water was discharged into San Pablo Bay via an outfall pipe. Beginning in 1986, sewage from remaining operating areas of the HAAF was directed to the Novato Sanitation District.

The FSTP buildings were demolished (Jordan, 1990 and Weston, 1990) and the sludge, berms, and bed dikes were removed in 1987.

Investigations during the RI characterized the contamination present at the FSTP. The 1998 Interim Removal Actions (IT, 1999b) resulted in the removal of approximately 4,000 cubic yards (yd^3) of soil centered on the former sludge drying beds to a depth of 5 to 7 feet below ground surface (bgs). In the southeast corner of the excavation, removal continued to a depth of 10 feet bgs. A total of 37 confirmation samples were collected from the excavations and analyzed for TPH-E, PAHs, PCBs, pesticides, and metals. Confirmation sampling indicated detections of unknown extractable hydrocarbon (UHE), metals, and pesticides above the interim removal action guidance levels. A combination of sloping and backfilling was used following the confirmation sampling.

As part of the 1999 interim removal actions (IT, 2000), approximately 140 yd^3 of soil were excavated to a depth of 4 feet bgs to address a black sludge layer identified in 1998. The black sludge layer (which was the objective of the excavation) extended beyond the original anticipated boundary for the excavation. The layer was followed and removed until no longer visible. Four confirmation samples were collected following the excavation and sampled for TPH-E, metals, PAHs, pesticides, and PCBs. Confirmation sampling indicated detections of metals, pesticides, and TPH-diesel above the interim removal action guidance levels in one of the confirmation samples. The excavation was backfilled with onsite borrow material to ensure stability of the outboard levee.

1.8.2 Building 20

Building 20, the westernmost airfield building, is located along the northern Perimeter Road near the Landfill 26 borrow area. The building was used to provide electricity for runway lighting, radar, or other activities. A transformer pad is located adjacent to the east wall, and the former UST was buried on the southwest side of the building. The transformers and UST were removed.

Investigations during the RI characterized the contamination present at Building 20. The 1998 interim removal actions (IT, 1999b) resulted in the removal of approximately 150 yd^3 of soil at the former UST location to a depth of 10 feet bgs. Ten confirmation samples were collected at Building 20 and analyzed for TPH-E, TPH-P, BTEX, PAHs, and metals. Confirmation sampling indicated detections of metals only; lead was detected below its interim removal action guidance level. The excavation was backfilled.

1.8.3 Building 26

Building 26 is located along the northern Perimeter Road, approximately 500 feet southeast of Building 20. A transformer pad (with the transformers removed) is located on the west side of the building. A former UST was located adjacent to the south side of the transformer pad, and a former AST was located inside the building. A concrete pad on the south side of the building contains concrete pillars and steel structures that may have supported an antenna or tower.

During the RI, samples were collected around the transformer pad and potholes were excavated around the former UST location. Samples were analyzed for TPH-P, TPH-E, BTEX, PAHs, and lead. Sampling indicated detections of petroleum hydrocarbons and metals. TPH was detected at 5 feet bgs and lead did not exceed its soil baseline concentration in the pothole samples. The lateral impact of fuel contamination on soil located southwest of the former UST was not defined during the RI. The excavation was backfilled.

1.8.4 Building 35/39 Area

The Building 35/39 Area is located at the north end of the pump station near the northeast corner of the Inboard Area. Both buildings contain high-capacity pumps for the removal of water from the BRAC property via the Perimeter Drainage Ditch. The water is discharged via outfall pipes into the outfall drainage ditch, located immediately outside the perimeter levee which flows into San Pablo Bay. Features in this area include Building 35, which contains a large pump, and former AST 6. AST 6 was located at the northeast corner of Building 35. Former AST 5 was located southeast of Building 39. Three active transformers are located midway between the two buildings, and outfall pipes are located at each building to discharge water from the pumps through the levee into the outfall drainage ditch. There were no documented releases at this location.

Investigations during the RI characterized the contamination present at the Building 35/39 Area. The 1998 interim removal actions (IT, 1999b) resulted in the removal of approximately 50 yd^3 of soil impacted by elevated concentrations of diesel and PAH to a depth of 5 feet bgs. The excavation was located south of Building 39 and southeast of AST-5. The excavation was based on sample PS-SS-04 collected in 1991. The sample contained total

recoverable petroleum hydrocarbons at 166,000 milligrams per kilogram (mg/kg) (ESI, 1993) in the surface soils. Four sidewall and one bottom confirmation samples were collected from the excavation and analyzed for TPH extractables, PAHs, and lead. Confirmation sampling indicated detections of UHE in the northern sidewall sample and the bottom sample above its interim removal action guidance level. Lead was detected below its interim removal action guidance level. The excavation was backfilled.

As a part of the 1999 interim removal actions (IT, 2000), AST-5 and -6 were removed and approximately 332 yd^3 of soil were excavated to a depth of 7.5 feet bgs from the area around former AST 6. Due to stability issues, the excavation was kept 5 feet from the footings of the concrete sump and discharge pipeline; therefore, the impacted soil was removed to the extent practicable. Ten confirmation samples were collected (two from each sidewall and the bottom) and analyzed for TPH-E, pesticides, PCBs, and lead. Confirmation sampling indicated detections of lead, TPH, pesticides, UHE, and PAHs. Pesticides and UHE were detected above their interim removal action guidance levels on the southeastern side of the excavation and UHE was also detected above its interim removal action guidance level on the west-southwestern side of the excavation. The excavation was backfilled.

1.8.5 Building 41 Area

The Building 41 Area is a former pump station and is located in the southern portion of the Pump Station Area. Two former 1,100-gallon diesel USTs located on the north western side of the building supplied fuel for the pumps at the building. Features in the vicinity of the Building 41 include:

- Four inoperable diesel powered pumps inside Building 41
- Two former ASTs east of Building 41
- Former Building 40
- A generator in former Building 40 for emergency power
- Three former transformers on a concrete pad three feet northeast of Building 40
- An outfall pipe that extends 80 feet southeast of Building 41, through the levee, to a discharge point in the outfall drainage ditch.

Investigations during the RI characterized the contamination present at the Building 41 area. The 1998 interim removal actions (IT, 1999b) resulted in the removal of approximately 250 yd^3 of soil located west of Building 40 at the former AST location to a depth of 5 feet bgs. Four sidewall and one bottom confirmation samples were collected from the excavation and analyzed for TPH-E, PAHs, and lead. Confirmation sampling indicated detections of UHE in the excavation from two sidewall samples and a bottom sample (620 mg/kg, 3,100 mg/kg, and 360 mg/kg, respectively). Lead was detected below its interim removal action guidance level. The excavation was backfilled.

As a part of the 1999 interim removal actions (IT, 2000), approximately 490 yd^3 of soil were removed at the former tank locations to a depth of 9 feet bgs. Due to stability issues, the excavation remained at least five feet from the building footings and the wall of the lined PDD to protect the integrity of these foundations. Thirteen confirmation samples were

collected from the excavation (5 bottom samples and 8 sidewall samples) and analyzed for TPH. Confirmation sampling indicated detections of TPH-D in seven of the samples (ranging from 110J mg/kg to 1,200J mg/kg), above the interim removal action guidance level.

1.8.6 Building 82/87/92/94 Area

Building 82

Building 82 is a single-story structure located south of former Building 86 and about 50 feet from Perimeter Road. Building 82 was built in the area of former Building 91; Building 91 was an air freight terminal. Building 82 was historically used for flight operations, aircraft rescue, and first aid. It is currently used by the BEC for office use. A transformer was previously located on a concrete pad northwest of Building 82.

Investigations during the RI characterized the contamination present at Building 82. The 1998 Interim Removal Actions (IT, 1999b) resulted in the removal of approximately 170 yd^3 of soil at the transformer pad to a depth of 4 feet bgs. Ten confirmation samples (seven sidewall and three bottom samples) were collected and analyzed for TPH-E, TPH-P, and PCBs. Confirmation sampling indicated detections of UHE, unknown purgeable hydrocarbon (UHP) and PCBs in one bottom and two sidewall samples above the interim removal action guidance levels. The excavation was backfilled.

As part of the 1999 Interim Removal Actions (IT, 2000), an additional removal action took place to address the TPH and UHE contamination detected at the Building 82 transformer pad area. Approximately 317 yd^3 of soil were excavated to depths ranging from 4.5 to 6.5 feet bgs. Four confirmation samples were collected from the excavation: one sidewall , two bottom samples, and one pothole soil sample. Confirmation sampling indicated detections of TPH-P, TPH-E, lead, and PCBs below interim removal action guidance levels.

Two additional pothole samples were excavated to a depth of 7 feet bgs to the south of the main excavation to investigate the extent of the TPH contamination along the sewer line (IT 2000). There was no visual evidence of contamination. The samples were analyzed for TPH-E, TPH-P, and PCBs. Sampling indicated detections of diesel in all samples below its interim removal action guidance level at depths ranging from 0.5 to 7 feet bgs. The excavation was backfilled.

Groundwater was observed in the potholes. Temporary wells were installed in each of the potholes, and a third well was installed in the southeast corner of the main excavation. The groundwater from the pothole wells was collected and sampled for PCBs and TPH-E. Sampling indicated detections of TPH-E below established water screening levels (IT 2000) in the well between the southmost pothole and the main excavation.

Building 87

Building 87 is located immediately south of the aircraft parking lot and was used for storage of unopened packaged products (five gallons or less) such as paint, oil, grease, antifreeze, and solvents. The area surrounding Building 87 was used to hold 55-gallon drums of solvent and cleaning compounds on horizontal dispensing racks. A metal CONEX container was located north of Building 87 and contained unleaded gasoline in five-gallon containers.

The racks and drums were occasionally moved to various locations surrounding the building (ESI, 1993). There were no documented releases of hazardous materials at this site.

No RI investigations were conducted at Building 87 because the results of previous investigations adequately characterized the site. In a 1993 investigation conducted by ESI, soil samples were collected from the test pits and storm drain sediment. Three soil borings and monitoring well AM-MW-104 were drilled. Soil sampling indicated detections of metals above their baseline concentrations. PAHs, metals, and VOCs were detected in the sediments; the concentrations of PAHs and metals were above soil baseline concentrations. TPH was not detected in soil or sediment samples. Metals also were detected in the groundwater.

Building 92/94

Buildings 92 and 94 are single-story structures located north of Building 82 and to the west of former Building 86. Their former use was for aircraft maintenance and storage and storage of supplies for aircraft rescue and offices; they are currently used for storage of sampling equipment and records storage. Three transformers were previously located on a concrete pad between Buildings 92 and 94, referred to as the Building 92/94 transformer pad. Asphalt on the south, west, and east sides of the pad is deteriorated. A storage area (Storage Area 3) was located on the eastern side of Building 94. The storage area consisted of five metal containers used to store maintenance related fluids, such as fuel, paint, and solvents. The area was not surrounded by curbing or other surface containment. There were no documented releases of hazardous materials at these buildings.

Investigations during the RI characterized the contamination present at Buildings 92 and 94. The Interim Removal Actions (IT, 1999b) resulting in the removal of approximately 125 yd^3 of soil at the transformer pad to a depth of 4 feet bgs. Eight confirmation samples were collected from the excavation area and analyzed for PCBs. Confirmation sampling indicated a detection of PCB below the interim removal action guidance level.

1.8.7 Building 84/90 Area

The Building 84/90 Area is located at the southeastern end of the Aircraft Maintenance Storage Facility (AMSF) area, northwest of Perimeter Road and south of the taxiways. The two buildings were constructed in 1961.

Building 84

Building 84 was used for repair of aircraft electronics equipment (WCFS, 1996). A fenced enclosure located just northeast of the building formerly contained a concrete slab and three transformers. The transformers were removed in 1995 (RCI, 1996). Three electrical units of unknown use are located on the north exterior wall beneath an awning.

During the RI, one surface soil sample was collected near the awning on the north side of Building 84 to assess potential impact near stained concrete and asphalt. The sample, collected beneath deteriorated asphalt near the former transformer pad, was analyzed for TPH-P, TPH-E, BTEX, VOCs, PAHs and metals. Sampling indicated detections of four metals and one PAH above of soil baseline concentrations. In addition, four surface soil samples were also collected from the soil in the area believed to adjoin the former location of

the transformer pad. These samples were analyzed for PCBs. PCBs were not detected at the former transformer pad.

Building 90

Building 90 was used for aircraft maintenance activities (WCFS, 1996). These activities included aircraft equipment repair, oil changing, jet and propeller engine repair and service, aircraft bodywork, painting and washing, and fuel testing. The southern end of the building is a small utility/electrical room. Two wash racks adjoin the west side of the building. A small sump is on the southern side of the building. This sump was used as a receiving structure for a floor drain inside the southern shed of Building 90. A fence-enclosed transformer pad adjoins the south side of the building. The transformers were removed in February 1991 by the Navy Public Works Commission. Hazardous substances used and wastes generated during these activities reportedly included stripping and degreasing solvents, batteries, petroleum, oils, lubricants, antifreeze, and paints.

During the RI, five soil borings were drilled at various locations around Building 90. Samples were collected at three depths in each boring and analyzed for TPH-P, TPH-E, BTEX, VOCs, PAHs, and metals. Sampling indicated detections of PAHs below soil baseline concentrations and metals above soil baseline concentrations. UHE was also detected in one sample below the step-out criterion. Groundwater also was sampled from one of the soil borings drilled west of the building, adjacent to the edge of the wash racks. The groundwater sample was analyzed for TPH-P, TPH-E, BTEX, VOCs, PAHs, and lead. Lead was detected in the groundwater sample. Four surface soil samples were also collected at the Building 90 transformer pad and analyzed for PCBs. PCBs were detected at the former transformer pad.

1.8.8 Building 86

Building 86 was an aircraft maintenance hangar, located about 50 feet southeast of the New Hamilton Partnership (NHP) levee and used primarily for light maintenance of aircraft. A flammable materials locker and at least one recirculating solvent parts cleaner were located in Building 86. Substances used and waste generated at the hangar included stripping and degreasing solvents, oils, and paints. Waste material from activities at Building 86 were taken to a storage area located on the southwest corner of the building (Storage Area 2) (ESI, 1993) by Army personnel. Storage Area 2 consisted of 55-gallon drums and smaller containers, which stored waste oils, waste fuel, and other maintenance related fluids. The materials were stored within a metal container that rested on a gravel surface. Storage Area 1 was located near the northeast corner of Building 86 and was a drum storage area. Drums were placed horizontally on metal storage and dispensing racks.

Building 86 was demolished and removed in 1998. The remaining building pad is adjoined by concrete aircraft aprons on the north, east, and south and by a concrete slab on the west.

Investigations during the RI characterized the contamination present at Building 86. Removal activities were conducted in 1998. During the 1998 interim removal actions, a storm drain investigation was conducted at Building 86. Ten soil borings were drilled along storm drain line SD-1, located south of the building. Samples were collected at depths ranging from 1 to 5 feet below the bottom of the storm drain line. The samples were analyzed for TPH-E, TPH-P, PAHs, and metals. Sampling indicated a detection of nickel

above its interim removal action guidance level at a depth of 11.5 feet bgs in a soil sample collected along the portion of SD-1 located southeast of Building 86. Sampling also indicated detections of several PAHs above their respective interim removal action guidance levels at a depth of 10 feet bgs in the soil sample collected along the portion of SD-1 located north of Building 87.

1.8.9 Perimeter Drainage Ditch

The PDD is a man made drainage channel that encircles all but the western margin of the Inboard Area. It was constructed to convey surface water runoff to the pump stations for lifting and discharge into the outfall drainage ditch and San Pablo Bay. The PDD conveys water from portions of the GSA properties and from privately owned agricultural lands adjoining the airfield. Further information about the PDD is presented in the Perimeter Drainage Ditch Engineering Evaluation Report (IT, 1997a).

Additionally, there is an open drainage ditch at the base of Reservoir Hill in the GSA Phase I Sale Area that connects to the north end of the PDD by an underground storm drain pipe (WCFS, 1996). The northern section of PDD is unlined from the western property boundary to the confluence with the 54-inch storm drain line.

Investigations during the RI characterized the contamination present at the unlined PDD. The 1998 interim removal actions (IT, 1999b) included dewatering of the ditch and sediment removal from the PDD. An estimated 2,800 yd^3 of sediment and vegetation were removed from the 17,500-foot-long PDD channel, including the lined and unlined portions. In the unlined portion, one sidewall sample and one bottom sample was collected every 200 linear feet for a total of 20 sidewall and 20 bottom samples.

Samples were analyzed for TPH-E, TPH-P, PAHs, pesticides, PCBs, and metals. A dioxin analysis was also performed on five confirmation samples collected from the bottom of the excavation. Confirmation sampling indicated detections of UHE, metals, and pesticides. UHE, nickel, DDE, and DDT were detected above their interim removal action guidance levels. UHE was detected above its interim removal action guidance level in one sample collected from the southern section of the unlined PDD; benzo(b)fluoranthene was also detected at its maximum concentration at this location. Nickel, DDE, and DDT were detected above interim removal action guidance levels in several locations. The maximum concentration of DDE and DDT were detected in the northern section of the unlined PDD. Nickel was detected above its interim removal action guidance level in the northern and southern sections of the unlined PDD. DDD was also detected in several confirmation samples; a guidance level was not provided for this constituent. The maximum concentration of DDD was detected in the northern section of the unlined PDD. Dioxins and furans were detected in the northern section of the unlined PDD. Dioxins were detected in two PDD samples and furan was detected in one of these samples.

Two surface soils samples were collected from cracks located on the northeastern side of the concrete-lined PDD during the remedial design investigation (FW, 2000). The samples were analyzed for pesticides, herbicides, metals, TPH-E, PCBs, and PAHs. Pesticides, herbicides, and metals were detected in both samples. PAHs were detected in the southern sample. PCBs and TPH-E were not detected in either sample.

1.8.10 Perimeter Drainage Ditch Spoils Piles

During the course of military operations at the airfield, periodic dredging of the PDD occurred. Fourteen dredge spoil stockpiles were identified based on previous investigation maps, review of aerial photographs, and field reconnaissance. The spoils piles are designated A through N. Locations were later verified (except for Spoils Pile F) by further field reconnaissance after mowing the vegetation. There is no physical evidence of the exact location of Spoils Pile F; however, previous investigations conducted by Woodward Clyde and Jordan documented the pile to be northeast of Building 41.

The 1998 interim removal actions (IT, 1999b) included removal of soil from 13 of the 14 PDD spoils piles (A through E and G through N). Material from the 13 spoils piles were removed down to the approximate original grade and the materials were transported to an offsite Class II disposal facility. Confirmation samples were collected at a total of 25 discrete locations within the 13 footprints of the spoils piles after removal and analyzed for TPH-E, PAHs, pesticides, PCBs, and metals. Samples were based on one sample approximately every 50-foot by 50-foot grid section.

During the 1999 Interim Removal Actions (IT, 2000), the footprints of seven spoils piles (B, C, E, H, I, J, and L), where the 1998 interim removal action (IT, 1999b) took place, were further excavated to a depth of 1.5 feet bgs based on chemicals of interest identified from the 1998 Interim Removal Action confirmation sample results. Following is a summary of the 1999 site-specific actions:

- Spoils Pile B – The chemicals of interest for Spoils Pile B were pesticides and metals. Approximately 591 yd^3 of soil were removed from the Spoils Pile B to a depth of 1.5 feet bgs to address contamination from lead, mercury, silver, DDE, and DDT. Four confirmation samples were collected from the bottom of the excavation and analyzed for the contamination of interest. Mercury and DDT were detected in all four samples. Silver and lead were detected in three of the samples. The following additional pesticides, DDD, DDE, endrin aldehyde, and endrin ketone, were also detected in one sample. The removal action guidance levels were not exceeded for the analytes with established interim removal action guidance levels.

- Spoils Pile C – The chemicals of interest for Spoils Pile C were pesticides. Approximately 17 yd^3 of soil were removed from the Spoils Pile C to a depth of 1.5 feet bgs to address contamination from DDE. One confirmation sample was collected from the bottom of the excavation and analyzed for pesticides. Confirmation sampling indicated detections of DDD, DDE, and DDT below the interim removal action guidance levels.

- Spoils Pile E – The chemicals of interest for Spoils Pile E were pesticides. Approximately 261 yd^3 of soil were removed from two separate excavation areas along the footprint of Spoils Pile E to address contamination from DDE. The excavation extended to a depth of 1.5 feet bgs. A confirmation sample was collected from each excavation and analyzed for pesticides. Confirmation sampling indicated detections of DDE and DDT in both confirmation samples below the interim removal action guidance levels.

- Spoils Pile H – The chemicals of interest for Spoils Pile H were pesticides and TPH. Approximately 290 yd^3 of soil were removed from the Spoil Pile H to a depth of 1.5 feet bgs to address contamination from DDE, DDT, and UHE. Two confirmation samples

and a duplicate were collected from the bottom of the excavation and analyzed for pesticides and TPH-E. Confirmation sampling indicated detections of TPH-D in one sample and in the duplicate of the other sample as well as DDE and DDT in both confirmation samples below the interim removal action guidance levels.

- Spoils Pile I – The chemicals of interest for Spoils Pile I were pesticides and TPH. Approximately 70 yd^3 of soil were removed from Spoils Pile I to a depth of 1.5 feet bgs to address contamination from UHE and DDT. One confirmation sample was collected and analyzed for pesticides and TPH-E. Confirmation sampling indicated no detections of pesticides or TPH.
- Spoils Pile J – The chemicals of interest for Spoils Pile J were pesticides and PAHs. Approximately 13 yd^3 of soil were removed from Spoils Pile J to a depth of 1.5 feet bgs to address contamination from benzo(a)pyrene, benzo(a)anthracene, DDE, and DDT. One confirmation sample and a duplicate were collected from the bottom of the excavation and analyzed for pesticides and PAHs. Confirmation sampling indicated detections of three pesticides (DDD, DDE, and DDT) and four PAHs below interim removal action guidance levels. DDT was detected in the duplicate sample above interim removal action guidance levels; the concentration was estimated with a high bias.
- Spoils Pile L – The chemical of interest for Spoils Pile L was nickel. Approximately 6 yd^3 of soil were removed from Spoils Pile L to a depth of 1.5 feet bgs to address nickel contamination. One confirmation sample was collected from the bottom of the excavation. Confirmation sampling indicated detections of nickel below its interim removal action guidance level.

The spoils piles excavations were sloped following the 1999 interim removal actions.

1.8.11 East Levee Generator Pad

A transformer pad and a generator pad were located adjacent to one another at a former AST site. The site is located just inboard of the east levee, midway between the FSTP and the south end of the runway. Although this site is located directly across the east levee from the southwest corner of the East Levee Construction Debris Disposal Area (a Coastal Salt Marsh site), it is not associated with the historic disposal area.

Investigations during the RI characterized the contamination present at the East Levee Generator Pad. The 1998 interim removal actions (IT, 1999b) resulted in the removal of the generator pad, the adjacent AST cradle and concrete slab, an empty 55-gallon drum, and approximately 380 yd^3 of impacted soil to a depth of 5 feet bgs. Fifteen confirmation samples were collected (nine sidewall and six bottom samples) from the excavation and analyzed for TPH-E, PAHs, and metals. Confirmation sampling indicated detections of lead and other metals below their interim removal action guidance levels. UHE and PAHs were not detected. A combination of sloping and backfilling was performed for the excavation.

1.8.12 Onshore Fuel Line

The onshore fuel line (ONSFL) originally conveyed aviation gasoline and, later, JP-4 liquid fuels from the Offshore Fuel System to several locations around the airfield, including

fueling stations near the edge of the tarmac and the former tank farm on the Petroleum, Oil, and Lubricant Outparcel. The fuel line was constructed between 1935 and 1945 and was last used in 1975 (IT, 1997b). The fuel line included an offshore portion, between the unloading terminal in the Bay and the booster pump station just inside the east levee, and the onshore portion, which extended from the booster pump station to the airfield hangars. The offshore fuel system was closed under a separate action in 1998.

The ONSFL system was evaluated in the RI and risk assessment as three distinct segments:

- 54-inch Drain Line Segment
- Hangar Segment
- Northern Segment

The fuel lines were removed in 1995 except for the portion from the PDD to the levee which was removed in 1998. TPH-P, ethylbenzene, xylenes, PAHs, and lead were detected in the samples collected after removal of the fuel lines.

The soil beneath the board-mounted transformer, located at the booster pump station in the northeastern corner of the BRAC property, was investigated for PCBs during the RI. PCBs were not detected. Additional sampling also was conducted along previous sample areas of the fuel line to determine the extent of fuel contamination for locations with high concentrations of fuel contamination. Results of the sampling indicated that most of the contamination is within 20 feet of the trench; however, one location required stepouts to 50 feet beyond the trench.

1.8.13 Northwest Runway Area

The Northwest Runway Area is located at the extreme northern end of the Inboard Area. The site is located along the southeastern slope of the northern perimeter levee, between Ignacio Reservoir Marsh and an alkali marsh. Although investigated as part of the GSA Phase II Sale Area (IT, 1998), the Northwest Runway Area is primarily located within the Inboard Area. This site was originally identified as of potential concern as a result of geophysical survey anomalies. Subsequent soil and groundwater investigations that included installing three trenches and four test pits did encounter debris that is indicative of landfill activity.

This site has been investigated since 1985, and the methods have included geophysical, radiological, and explosive surveys and collection of soil and groundwater samples. Soil samples were collected from three test pits and three excavation trenches located along the northwestern runway area. Metals, DDD, TPH, and bis(2-ethylhexyl)phthalate (a common laboratory contaminant) were detected in the soil samples. Scrap metal was discovered; however, no evidence of landfill activity was identified. Metals were detected below baseline concentrations.

Four groundwater monitoring wells (MW-PVC-1, -2, -3, and -4) were installed in 1985. They were sampled for pesticides, petroleum hydrocarbons, VOCs, SVOCs, and metals during nine sampling events conducted between October 1985 and September 1986. A total of 36 groundwater samples were collected. Five VOCs, one pesticide, and 12 SVOCs were detected sporadically in the groundwater samples. Arsenic, barium, boron, copper, lead, nickel vanadium, and zinc were consistently detected above ambient levels in all four wells

(IT, 1998). In 1997, four additional direct-push soil samples were collected and temporary monitoring wells were installed in the boreholes. The soil samples were collected at depths of 5, 10, and 15 feet bgs and analyzed for metals, VOC, TPH-E, TPH-P, pesticides, and PAHs. Water samples collected from the temporary wells were analyzed for metals, TPH-P, and VOCs. The wells also were analyzed for pesticides, TPH-E, PAHs, and general chemistry parameters when sufficient water volume was available. The levels of metals in the soils appeared to be within ambient ranges and metals in groundwater appeared to be associated with the freshwater/saline water transition zone present at this site.

1.8.14 Tarmac East of Outparcel A-5

The tarmac east of Outparcel A-5 directly adjoins and includes a portion of the NHP levee constructed at the boundary between the GSA and BRAC properties. The tarmac area, located northwest of former Building 86, is a concrete-paved taxiway connecting the AMSF with the northwestern portion of the runway.

The tarmac was identified for further investigation when a petroleum hydrocarbon and PAH plume at Outparcel A-5 was found to extend northeast onto the BRAC property. During the RI, three potholes were excavated to a depth of 10 feet bgs and sampled at three depth intervals (0-4 feet bgs, 4 feet bgs, and below 9 feet bgs). The samples were analyzed for TPH-P, TPH-E, BTEX, lead, and PAHs. Sampling indicated detections of PAHs below soil baseline concentrations; lead above its soil baseline concentration (at a depth of 4.5 feet bgs), and UHP below the stepout criterion. BTEX and TPH-E were not detected.

1.8.15 Revetment Area

The revetment area, located east of the airfield, is transected by concrete-paved taxiways which connect 28 circular parking areas (revetment turnouts) and extensive undeveloped areas. All revetments were historically used for aircraft staging and refueling prior to 1974, except for Revetment 6 (Engine Test Pad) and Revetment 10 (firefighter training area) which were used as an engine test pad and firefighter training area respectively. Fuels, solvents, and vehicles were periodically ignited and doused at Revetment 10 from 1975 to 1987. Aircraft fueling via fuel trucks was also reported to have occurred in this area. Due to their close geographic proximity, Revetment 18 includes the Building 15 area. Building 15 is located south of the revetment along the northern perimeter of the Inboard Area. The building formerly contained a generator that provided electrical power for airfield activities, such as runway lighting. A concrete transformer pad is located adjacent to the west wall of the building. An AST, which stored fuel for the generator, was located north of Building 15 and was removed in 1997. Three transformers (removed in 1995) were also located on the concrete pad adjacent to the building.

Twenty-four of the revetment turnouts are paved with concrete, and four revetments (9, 11, 12 and 23) are "unpaved." The "unpaved" revetments are actually paved with a thin layer of asphalt that has been covered over with sedimentation. Each concrete revetment is approximately 120 feet in diameter, with the exception of Revetment 6, which is approximately 200 feet in diameter. Each of the turnouts is nearly encircled by an earthen berm approximately one foot high. A thin layer of sediment, grass, and weeds is now present at many of the turnouts.

The revetments discussions are grouped in this FFS to provide a clearer summary of the investigations conducted at each revetment and the results of these investigations. The following is the breakout of these groups:

- Revetments 1, 2, 3, 4, 7, 8, 13 through 17, 19, 20, 21, 22, and 24 through 28
- Revetment 5
- Revetment 6
- Revetments 9, 11, 12, and 23
- Revetment 10
- Revetment 18/Building 15

Revetments 1, 2, 3, 4, 7, 8, 13 through 22, and 24 through 28

During the 1993 Engineering-Science Inc. (ESI) investigation, the degree of surface soil contamination was determined by collecting surface soil samples from beneath the revetment pads. Five soil samples were collected from each area and composited at a laboratory. The samples were analyzed for SVOCs, TPH, and lead. TPH and lead were detected at Revetments 1, 2, 3, 4, 7, 8, 13 through 22, 24, and 28. Bis(2-ethylhexyl)phthalate (a common laboratory contaminant) was detected at Revetments 3 and 8. SVOCs were detected in the composite soil samples at Revetments 7, 15, 19 (only in the duplicate sample), 20, and 27.

Additional sampling was conducted at Revetments 17, 20, 26, and 27 in 1993. Four soil borings were drilled around each pad and soil samples were collected at 4 to 5 feet bgs. The soil samples were analyzed for TPH, BTEX, and lead. TPH was detected at Revetments 17, 26, and 27. Lead and one PAH were detected above baseline concentrations; however, BTEX was not detected.

ESI installed two additional wells, RV-MW-103 at Revetment 20 and RV-MW-102 at Revetment 26 in 1993. Two rounds of groundwater monitoring were conducted at RV-MW-103. Recharge was insufficient at RV-MW-102; therefore, the groundwater was not sampled. The groundwater samples were analyzed for TPH, BTEX, and lead. No constituents were detected in the groundwater.

RI activities were conducted at Revetments 17 and 27. Soil samples were collected from the revetments to obtain more accurate TPH results than previously reported. Two soil samples were collected at Revetment 17, and one soil sample was collected at Revetment 27. Lead was detected below its baseline concentration at Revetments 17 and 27.

During Phase 1 of the Design Data Summary investigation, soil samples were collected in the general areas of Revetments 1, 4, 14, 17, 21, and between Revetments 7 and 28. Herbicides were detected in surface soil samples collected southwest of Revetment 1, in the area of Revetments 4, 14 17, and 21, and between Revetments 7 and 28. Herbicides were also detected in two subsurface samples collected at depths ranging from 2 to 3 feet bgs (between Revetments 7 and 28) and 5 to 6 feet bgs (in the Revetment 21 area). Pesticides were detected in all of the surface soil samples collected from the revetment areas. Pesticides were also detected in two subsurface samples at depths ranging from 2 to 3 feet bgs (southwest of Revetment 1) and 10 to 11 feet bgs (in the Revetment 21 area). UHE and UHP were detected in a sample collected in the area of Revetment 14. UHP was detected in one soil sample collected in the Revetment 21 area.

During Phase 2 of the investigation, surface soil samples were collected at three locations surrounding Revetments 1, 2, 4, 7, 13, 15, and 19 and one sample was collected beneath the pavement at each location. In addition, thirteen (13) soil sample were collected (one sample from beneath the pavement at Revetments 3, 8, 14, 16, 17, 20, 21, 22, and 24 through 28). The soil samples were analyzed for TPH, PAHs, VOCs, and metals. UHE and UHP were detected in the surface soil samples collected from Revetments 1, 7, 13, 19, 21, 22, and 26. UHE also was detected in the surface soil samples at Revetments 2, 14, 24, 25, and 28, and UHP was detected at Revetments 3 and 4. TPH-D also was detected at Revetment 19. Metals were detected in the surface soil samples collected from all of the revetments. PAHs were detected in the surface soil samples collected from Revetments 1, 2, 4, 7, 13, 19, 21, 22, 24, and 25, and VOCs were detected in all of the surface samples collected from the revetments except Revetment 14.

Revetment 5

In 1993, ESI collected five surface soil samples from Revetment 5 and composited the samples at a laboratory. The samples were analyzed for SVOCs, TPH, and lead. TPH and lead were detected in the samples.

Woodward-Clyde installed monitoring wells RVT-MW1 through RVT-MW3 around a catch basin located next to Revetment 5 in 1996 (IT, 1999a). The groundwater samples collected from these wells were analyzed for TPH, oil and grease, PAHs, VOCs, BTEX, pesticides, herbicides, and metals. Ten (10) metals were detected in the groundwater, but no organics were detected (IT, 1999a).

During Phase 2 of the Design Data Summary investigation, a sample was collected beneath the pavement at Revetment 5. The sample was analyzed for TPH, PAHs, VOCs, and metals. UHP and VOCs were detected in the surface soil sample collected at Revetment 5.

Revetment 6

In 1990, monitoring well RV-MW-101 was installed adjacent to Revetment 6 by Jordan (IT, 1999a). One groundwater sample was collected and analyzed for VOCs, SVOCs, TPH, and lead. Cyanide and five metals were detected.

Two rounds of groundwater monitoring were conducted at RV-MW-101. The groundwater samples were analyzed for TPH, BTEX, and lead. Cyanide and five metals were the only constituents detected in groundwater.

In 1993, ESI collected surface and subsurface soil samples from the edge of Revetment 6. The samples were analyzed for VOCs, SVOCs, TPH, and lead. Lead, toluene, and bis(2-ethylhexyl)phthtalate (a common laboratory contaminant) were detected in the soil. Lead was detected below baseline concentrations. One boring was also completed as a monitoring well; no analytes were detected in the groundwater well (IT, 1999a).

Woodward-Clyde also collected two soil samples at depths ranging from 2.5 to 3 feet bgs and analyzed them for TRPH, oil and grease, BTEX, and PAHs in 1996; no analytes were detected (IT, 1999a).

One soil sample was collected from Revetment 6 during the RI to obtain more accurate TPH results than previously reported. Toluene and lead were detected in the samples. Lead was detected below its baseline concentration.

During Phase 1 of the Design Data Summary investigation, one surface soil sample was collected in the general area of Revetment 6. Pesticides and herbicides were detected in the soil sample.

During Phase 2 of the investigation, surface soil samples were collected at three locations surrounding the revetments, and one sample was collected from beneath the pavement. In addition, one sample was collected from beneath the pavement at revetments with no previous detection in the composite sample. The soil samples were analyzed for TPH, PAHs, VOCs, metals, and dioxins and furans. Dioxins were detected in three surface soil samples collected from the site. Metals, VOCs, PAHs, UHE, and UHP also were detected in the surface soil samples.

Revetments 9, 11, 12, and 23 (unpaved revetments)

Revetments 9, 11, 12, and 23 were investigated by Woodward-Clyde in 1996. Soil samples were collected from depths ranging from 0 to 6 inches bgs and 1 to 1.5 feet bgs; soil borings were also installed in two additional locations (IT, 1999a). The soil samples were analyzed for TPH-D, TPH-G, TPH-JP-4, TPH-motor oil, BTEX, PAHs, VOCs, metals, and oil and grease. Ten (10) metals were detected above baseline concentrations, and TPH, BTEX, and VOCs were not detected. Acenaphthene was detected above its baseline concentration at Revetment 9 at a depth of 6 inches bgs; it was not detected at 1.5 feet bgs. In 1996, eight temporary monitoring wells, RVT-TW1 through RVT-TW8, were installed in soil borings at the unpaved revetments. Groundwater samples were collected and analyzed for TPH-D, TPH-G, TPH-JP-4, BTEX, and PAHs. Xylene was detected in the groundwater at Revetment 9, and ethylbenzene was detected at Revetment 12.

RI activities were conducted at Revetments 11 and 23. Soil samples were collected from the revetments to obtain more accurate TPH results than previously reported. Three soil samples were collected from Revetment 11 and one soil sample was collected at Revetment 23. TPH-G and UHE were detected in the soil at Revetment 11. Five metals were detected at Revetment 23; vanadium, copper, and zinc were detected at or above their baseline concentrations.

An interim removal action was conducted at Revetment 9 in 1999. Approximately 144 yd^3 of soil were removed to a depth of 1 foot bgs from Revetment 9 based on elevated concentrations of lead detected in samples collected in 1995 (IT, 2000). Two confirmation soil samples and one duplicate soil sample were collected from the excavation. Lead was detected below its interim removal action guidance level. The excavation was sloped.

Revetment 10

In 1987, WC collected soil samples from three soil borings at Revetment 10 (the firefighter training area). One soil boring was located on the northwestern side of the firefighter training area, and the other two soil borings were located south and east of the training area. The samples were collected at depths ranging from 1 to 9 feet bgs and analyzed for TPH, PAHs, VOCs, and metals. Seven metals were detected at concentrations exceeding baseline

concentrations, and the highest detection of TPH was detected at a depth of 1 foot bgs (IT, 1999). PAHs were not detected.

In 1993, ESI collected four new soil borings (15 feet bgs.) and two shallow test pits (approximately 6 feet bgs.) were excavated around the concrete pad (one excavation was also completed at the center of the pad) to address subsurface soil contamination. Surface soil samples were also collected around the concrete pad, in the bermed area, and at the former ground level surface exposed during excavation of the test pits. Four groundwater monitoring wells were also installed in the four new soil borings (BP-MW-101 through 104) located around the concrete pad. The soil and groundwater samples were analyzed for VOCs, SVOCs, TPH and lead. Toluene, anthracene, chrysene, bis(2-ethylhexyl)phthalate (a common laboratory contaminant), and lead were detected in the soil samples. Lead and four PAHs were detected above baseline concentrations. Ethylbenzene, toluene, xylene, and 1,3-dimethylbenzene were detected in subsurface soil samples. Methyl ethyl ketone (MEK) and TPH were found in the groundwater samples.

During the RI, a PCB investigation was conducted at Revetment 10. One soil sample was collected from outside the berm at a depth of 1 foot bgs and one soil sample was collected at a depth of 1.5 feet bgs from beneath the concrete pad. PCBs were not detected in the soil samples collected from the firefighter training area.

An interim removal action was conducted at Revetment 10 in 1998. The soil beneath Revetment 10 was excavated, and confirmation samples were collected from the initial excavation; the concrete pad and four monitoring wells, BP-MW-101 through BP-MW-104, were removed before the excavation activities began. Approximately 2,400 yd^3 of soil were removed from the initial excavation to a depth ranging from 5 to 7 feet bgs; the center of the excavation was excavated to a depth of 7 feet bgs. An additional 75 yd^3 soil were removed from three contingency excavations conducted within the initial excavation in December 1998 (IT, 2000). Sixty-four (64) confirmation samples were collected from within the excavation and at a few locations outside of the initial excavation. The confirmation samples were analyzed for TPH-E, TPH-P, BTEX, PAHs, and metals (CAM 17 and boron). Ten samples were also analyzed for PCBs, and 12 samples collected outside of the initial excavation were analyzed for dioxins and furans. UHE was detected above its interim removal action guidance level in one soil sample located in the northern part of the initial excavation at a depth of 6 feet bgs. This area was over-excavated to a depth of 8 feet bgs, and confirmation samples were analyzed for TPH-E. TPH-E was detected below interim removal action guidance levels. Nickel was detected above its interim removal action guidance level in a soil sample located in the southern section of the initial excavation at a depth of 7 feet bgs. This area was over-excavated to a depth of 9 feet bgs, and one confirmation sample was collected directly below the previous sample location and analyzed for nickel. Nickel was detected below the interim removal action guidance level. Two dioxins were detected in one shallow soil sample collected on the northeastern side of the initial excavation. Soil was over-excavated to a depth of 2 feet bgs and extended 10 feet east of the initial excavation. Three dioxins and one furan were detected at a depth of 1 foot bgs in the confirmation sample collected following the overexcavation. The excavation was sloped.

During Phase 1 of the Design Data Summary investigation, one surface sample was collected outside of the revetment area. Pesticides and herbicides were detected in the soil sample.

Revetment 18/Building 15 Area

Building 15 was investigated to determine environmental impacts from fuel storage and PCB contamination at the transformer location during the RI (IT, 1999). The AST and associated piping were removed. One soil sample was collected southeast of the AST at 1.5 feet bgs and analyzed for TPH-E, TPH-P, BTEX, lead, and PAHs. UHE was detected in the confirmation soil sample above the stepout criterion and lead was detected above its baseline concentration for soil. The excavation was extended to 10 feet bgs and two pothole samples were collected at 7 and 8.5 feet bgs east of the former AST. UHE was detected above the stepout criterion at 7 feet bgs, and TPH was not detected at 8.5 feet bgs. Four stepout potholes were also excavated to a depth of 10 feet bgs about 20 feet from each side of the excavation, and one groundwater sample was collected from the stepout pothole east of the concrete pad. The stepout pothole samples were collected at depths of 5 and 10 feet bgs. UHE was not detected in the stepout soil samples; however, it was detected in the groundwater sample.

An interim removal action was conducted in the Revetment 18/Building 15 Area in 1998. Approximately 170 yd^3 of soil were removed to a depth of 8.5 feet bgs from the former AST and transformer area at Building 15. Seven confirmation samples were collected (six sidewall and one bottom sample) and analyzed for TPH-E and lead. Lead and UHE were detected below interim removal action guidance levels at depths ranging from 5.5 to 9.5 feet bgs. The excavation was sloped.

During Phase 1 of the Design Data Summary investigation, one surface soil sample was collected in the general area of Revetment 18. Pesticides, UHP, and PAHs were detected in the soil sample.

During Phase 2 of the Design Data Summary investigation, one soil sample was collected from beneath the pavement of Revetment 18. The sample was analyzed for TPH, PAHs, VOCs, and metals. VOCs were detected in the soil sample.

Except for the few revetments previous described, investigations of the revetment area have been oriented to consider all of the individual revetments as a single site due to the same historical activities at each turnout. However, for the human health and ecological risk assessment (U.S. Army, 2001), the individual revetments have been considered separate sites; this is based on home range considerations for ecological receptors.

1.9 Summary of Human Health and Ecological Risk Assessment

The baseline risk assessment utilized a conservative approach to estimate the potential risk the Inboard Area sites could pose to human health and the environment during the development and maturation of the wetland. The conservative aspects of the assessment included assuming that exposure pathways were complete at all Inboard Area sites even where the exposure pathways are not complete or would not be complete once cover material is placed for the wetland restoration. For example, the baseline risk assessment

assumed that human and ecological receptors were in direct contact with contaminants at a site even where existing contamination is currently covered or is planned to be covered in the future wetland restoration project. Exposure to human or ecological receptors would not occur in this case. As a result, the baseline risk assessment presents a conservative estimate of where and when remedial actions may be necessary to protect human health and the environment for the Inboard Area sites.

The overall objective of the combined human health and ecological risk assessment (U.S. Army, 2001) was to evaluate whether residual contaminants at each Inboard Area site would pose a risk to human health or the environment if exposure was not controlled or mitigated during the development and maturation of the wetland.

The risk assessment evaluated all of the following ecological and human health receptors for each site:

- Ten estuarine receptors (ecological) (high marsh [HM], intertidal marsh [IN], and subtidal marsh [SUB])
  - Algae (SUB)
  - Pickleweed (HM)
  - Amphipod (IN)
  - Bay Shrimp (SUB)
  - Northern Anchovy (SUB)
  - Juvenile salmonid (SUB)
  - California Clapper Rail (IN)
  - California black rail (IN)
  - Double-crested cormorant (SUB)
  - Salt marsh harvest mouse (HM)
- Five freshwater receptors (ecological)
  - Algae
  - Amphipods
  - Mosquitofish
  - Great Blue Heron
  - Snipe
- Six grassland habitat (ecological)
  - Terrestrial plants
  - Black-tailed deer
  - California vole
  - Raccoon
  - burrowing owl
  - northern harrier

- Three human health receptors (human health)
  - Marsh Recreational User – The exposure pathways considered for this receptor included incidental ingestion of impacted soil, direct skin contact with impacted soil, skin contact with surface water, and incidental ingestion of surface water
  - Recreational Angler – The exposure pathways considered for this receptor included ingestion of fish living in surface water and ingestion of shellfish living in the water at the sediment/surface water interface
  - Grassland Recreational User – The exposure pathways considered for this receptor included incidental ingestion of impacted soil, direct skin contact with impacted soil and inhalation of windborne soil

The results of the baseline risk assessment are evaluated in this FFS to determine how the potential risk should be addressed by proposed remedial actions. The conceptual model developed for the baseline risk assessment is refined for use in this FFS. The FFS conceptual model is based on potential exposure pathways and human and ecological receptors for a wetland end use. The FFS conceptual model identifies and evaluates receptors based on the general habitat types (upland, estuarine, freshwater, or recreational) that are expected to be developed at each Inboard Area site. These general habitat types are established by the preferred wetland configuration (Jones & Stokes Associates, Inc., 1998). Although the final design of the wetland restoration has not been finalized, the general habitat types and receptors at a specific location are not expected to change significantly due to the physical constraints of the Inboard Area site. For example, a planned upland area is not likely to become a subtidal channel, and vice versa.

The FFS conceptual model assumes estuarine and human recreational receptors at each Inboard Area site and additional freshwater receptors at the Building 82/87/92/94 Area; PDD Spoils Piles A, B and N; and the PDD-unlined portion (see Appendix A). Only grassland receptors are assumed for the Northwest Runway Area.

A summary of the human health and ecological risk assessment results for the Inboard Area site receptors is presented in Appendix A.

1.10 Summary of Sites to be Evaluated in this Focused Feasibility Study

The hazard indices (HI) developed in the baseline risk assessment were are used in the FFS to determine if a site requires remedial action. To require further action and evaluation, a site has to have at least one receptor with an HI greater than 1. The receptors evaluated included those identified in the FFS conceptual model described in the previous section. Table 1-1 shows the sites that do not have at least one receptor with an HI greater than 1.0.

Because these sites do not require further action to protect human health and the environment, they are not evaluated any further in this FFS.

For each remaining site that required further evaluation, site-specific FFS COPCs are established based on the receptors that were expected to be present during the development

and maturation of the wetland and the potential risk posed by residual contaminants. The site-specific FFS COPCs were determined by reviewing the risk assessment COPCs at each site for the receptors identified by the FFS conceptual model. If the ecological HQ was greater than 1.0, or the human health HQ was greater than 1.0, or the ILCR was greater than $1x10^{-6}$, then the contaminant was considered a site-specific FFS COPC. The site-specific FFS COPCs are listed in Table 1-2.

The site-specific FFS COPCs were then compared to selected comparator values. These comparator values were based primarily on ambient soil and bay sediment levels and also included RWQCB surface sediment criteria, Regulatory Agencies and Resource Trustees values, and baseline risk assessment target concentration values (U.S. Army, 2001). These comparator values were developed through negotiations with the Regulatory Agencies and Resources Trustees.

Typically, clean up goals are based on risk evaluations and negotiations between regulators and responsible parties. However, the science of ecological risk estimation is not to the point where scientists can definitively determine whether specific chemical concentrations actually pose a risk to ecological receptors. Therefore, it is difficult to establish pre-use clean up goals for ecological receptors. At HAAF, where ecological receptors are the primary concern, comparator values were established in lieu of specific clean up goals. These comparator values were derived from ambient chemical concentrations and guidelines for placement of dredge materials in wetlands (also based primarily on ambient values). These levels are described in this document as comparator and were discussed and agreed upon by the U.S. Army, regulators and the RART. For the purposes of this document, comparator values can be thought of as clean up goals in the context that COC concentrations that are above their comparator values are considered for remedial action.

Table 1-3 presents the data evaluated for chemicals assessed in this FFS and the selected comparator (this includes values provided by the regulators and target concentrations from the risk assessment) value. Ambient soil concentrations for the BRAC property, HAAF upland soil ambient levels, and San Pablo Bay sediment ambient levels were used in selection of the comparators for selected metals (in some cases the recommended ambient values were superceded by the ER-L values). The ER-Ls (Long et al., 1995) and RWQCB Wetland Surface Sediment Guidelines were evaluated as possible comparators for the selected metals, as well as the selected PAHs, petroleum hydrocarbons, pesticides, and PCBs. Table 1-4 presents the source of the comparator values for both the inboard and upland environments.

Several analytes with HQs that exceeded the criteria for inclusion in this FFS did not have values presented by the regulators. In these cases, the target concentrations from the human health and ecological risk assessment (U.S. Army, 2001) were used to establish a comparator. The target concentrations do not include any type of site utilization factors. All of the analytes considered in this FFS that did not have regulator-presented comparators, were identified as non-bioaccumulators. Since the majority of the selected comparators were based on protection of benthos, non-wildlife receptors were used in selecting the target concentration to be used as the comparator value. The most appropriate target concentrations from the non-wildlife receptors were chosen as the comparator in these cases. Table 1-5 presents all of the analytes assessed in the FFS, and compares the comparators to the target concentrations for estuarine and freshwater receptors.

For each site, the site-specific FFS COPC 95 UCL (or maximum in some cases) concentrations were compared to the comparator values. If the 95 UCL concentration was greater than the comparator value, then the contaminant was considered a COC. COCs are provided in Table 1-6. The site had to have at least one COC to be considered for further evaluation in this FFS. Table 1-7 shows the sites that did not have COCs.

The conceptual model developed for this FFS assumes that where COCs are present, a site would pose a potential human and/or ecological risk if the receptors were exposed to the residual contamination during the development and maturation of the wetland. For each of the remaining sites (Table 1-8), COCs were used to identify areas that require action, develop remedial action objectives, and identify remedial action alternatives.