Chapter 5.
Surface Water Hydrology and Water Quality

Affected Environment

Data Sources

The evaluation of hydrology is based on information contained in the Draft Hamilton Wetlands Conceptual Restoration Plan (Woodward-Clyde 1998) and in the following other principal sources:

- Flood and Drainage Baseline Study for Hamilton Army Airfield (Bissell & Karn/Greiner 1993);
- Perimeter Drainage Ditch Engineering Evaluation Report, BRAC Property, Hamilton Army Airfield (U.S. Army Corps of Engineers 1997); and
- unpublished hydrologic analyses by Philip Williams & Associates, prepared in 1998 as supporting documentation for the Draft Hamilton Wetlands Conceptual Restoration Plan.

The evaluation of water quality is based on information presented in the Hamilton Army Airfield disposal and reuse EIS (U.S. Army Corps of Engineers 1996a) and the San Francisco Bay Region RWQCB's Water Quality Control Plan (Basin Plan) (California Regional Water Quality Control Board, San Francisco Bay Region 1997).

The project site is at the base of the coastal mountains on the edge of San Pablo Bay. Numerous small creeks carry runoff from the mountains to the tidal lowlands along the bay. Drainage patterns in the HAAF, SLC, and BMKV parcels have been substantially altered by human activity since the mid-1800s and presently depend on the operation of drainage infrastructure, including levees, culverts, ditches, and pumping stations.

Climate

The regional climate is characterized as Mediterranean, with warm, dry summers and cool, wet winters. Average summer temperatures range from 52°F to 78°F, and average winter temperatures range from 41°F to 55°F (National Oceanic and Atmospheric Administration 1997).

Rainfall in the San Francisco Bay region is strongly influenced by geographic features and varies significantly with elevation and by location within the region. Average annual rainfall at HAAF and in the Pacheco and San Jose Creek watersheds varies from approximately 24 to 30 inches, and average annual precipitation at HAAF is 26 inches (U.S. Army Corps of Engineers 1996a; National Oceanic and Atmospheric Administration 1997). Approximately 90% of the average annual rainfall occurs in the period between November and March.

Wind data are available for a 31-year period of record (California Department of Water Resources 1978). Winds are predominantly from the northwest and southeast, aligned with the HAAF runway. Mean wind speeds are less than 10 knots.

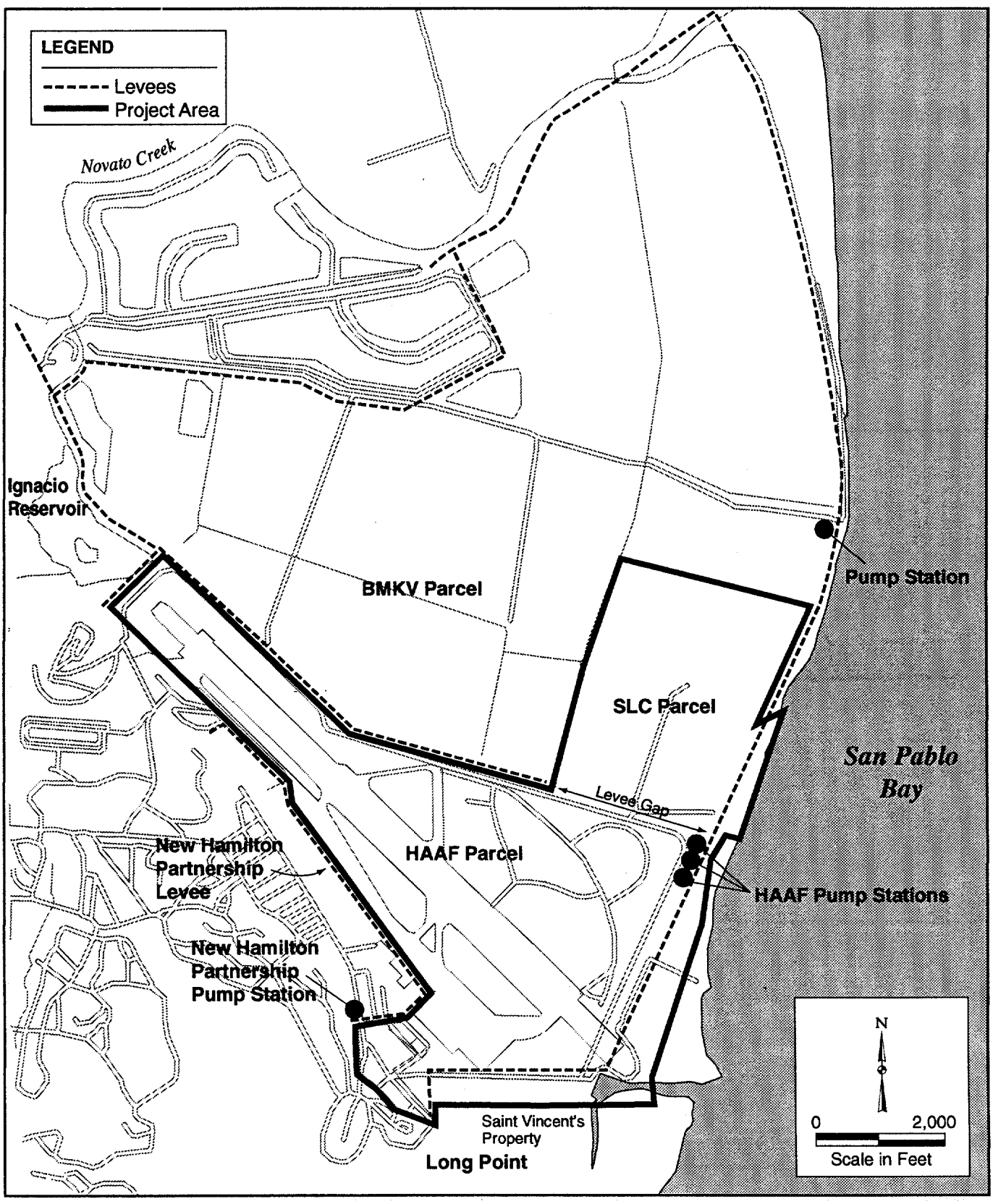
Tides and Levees

Tidal characteristics at HAAF are summarized in Table 5-1 based on Tide Gage #941-5252 at the mouth of the Petaluma River. Lands in the vicinity of HAAF are deeply subsided, with elevations as low as -7 feet NGVD. Protection of these lands from inundation by San Pablo Bay requires a system of perimeter and interior levees, and drainage must be collected from the interior areas and pumped to San Pablo Bay.

Table 5-1.
Tidal Characteristics at HAAF

Tide	Elevation (NGVD)
100-year high tide	7.0 feet*
Mean higher high water	3.4 feet
Mean tide	0.6 foot
Mean lower low water	-2.6 feet

* Federal Emergency Management Agency 100-year tide.



SOURCE:
U.S. Army Corps of Engineers 1996a.

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Figure 5-1
Levee Locations

The Corps recently surveyed the levees near the site to determine their top elevations (unpublished Corps data). Figure 5-1 shows the location of levees in the vicinity of the site. HAAF is surrounded on the north, east, and south by approximately 15,000 linear feet of levees except in a 2,575-foot gap on the northeastern corner of the property, where the levees were removed sometime between 1968 and 1972 (unpublished Corps data). The external levee protecting HAAF from San Pablo Bay has top elevations between 5.3 and 8.8 feet, with most of the crest near 7.0 feet in elevation. The external levee along San Pablo Bay protecting the SLC and BKMV parcels varies in elevation between 5.6 and 9.9 feet, with the crest heights predominantly in the range of 6.5 to 8.5 feet. The external levee protecting the St. Vincent's property has crest elevations between 6.6 feet and 10.0 feet, with most of the crest elevations in the range of 7.5 to 8.5 feet.

The internal levees in the vicinity of HAAF are generally lower than the perimeter levees; the crest heights are shown in Table 5-2.

Table 5-2.
Internal Levee Crest Heights in the Vicinity of HAAF

Location	Range of Crest Elevations (NGVD)
Ignacio Reservoir/HAAF parcel	8.5 to 10.0 feet
Ignacio Reservoir/BKMV parcel	8.0 to 10.7 feet
BKMV/HAAF parcels	0.8 to 4.7 feet (except gap); -3.3 to -5.9 feet (in gap)
St. Vincent's property/HAAF parcel	3.0 to 4.4 feet
New Hamilton Partnership development	8.0 feet, with a splash wall at 12.0 feet

Source: Unpublished Corps data.

Based on the surveyed levee heights, none of the external levees in the vicinity of HAAF provide 100-year tidal protection. Figure 5-2 shows the estimated 100-year tidal floodplains in the vicinity of HAAF.

Surface Water Drainage Patterns

Surface water runoff from the areas west of the project site is carried by Pacheco Creek and Arroyo San Jose. Historically, these streams were part of a network of natural channels that drained through the low-lying area where Ignacio Reservoir is now located to Novato Creek. Pacheco Creek and Arroyo San Jose both have their headwaters on Big Rock Ridge, at elevations of 1,300–1,600 feet NGVD. Pacheco Creek has a watershed area of approximately 1.9 square miles and Arroyo San Jose has a watershed area of approximately 5.4 square miles, which is tributary to Ignacio Reservoir. Ignacio Reservoir drains to Novato Creek through a leveed channel with a flap gate outlet (Bissell & Karn/Greiner 1993 and unpublished Corps data). Figure 5-3 shows regional drainage features in the area.

The HAAF, SLC, and BMKV parcels and the St. Vincent's property (located south of the HAAF parcel) are all served by local drainage facilities, including drains, channels, culverts, and pump stations with outfalls into San Pablo Bay. Ground elevations in these areas are generally from 0 to -4 feet NGVD, several feet below the mean higher high water elevation of 3.4 feet. The general pattern of drainage on and near the project site is shown in Figure 5-3.

Major drainage features and hydrologic resources in the project area are described briefly below.

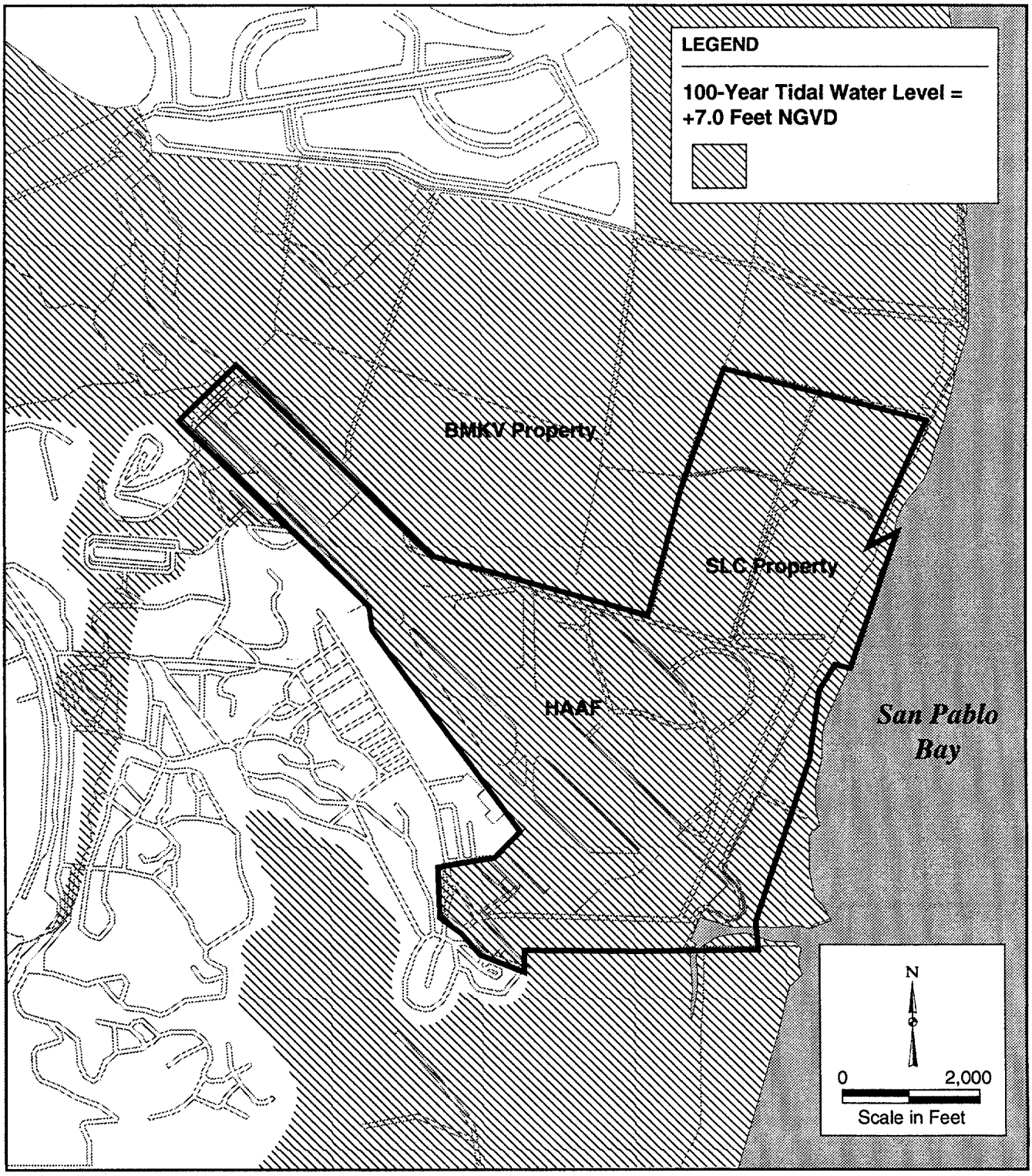
Pacheco Creek

Pacheco Creek originates on Big Rock Ridge approximately 3 miles west of HAAF at an elevation of approximately 1,300 feet. The creek crosses U.S. Highway 101 near the Alameda del Prado/Nave Drive, and crosses Nave Drive, Marin Valley Road, Bolling Drive, Main Entrance Road, and State Access Road in a series of culverts. The creek has a watershed with an area of approximately 1.9 square miles. The computed 10-year and 100-year peak discharges for Pacheco Creek are 470 and 770 cubic feet per second (cfs), respectively (Bissell & Karn/Greiner 1993). With the exception of low-lying areas near Ammo Hill, the 10-year peak discharge is contained within the creek banks, culverts, and road crossings in the vicinity of the project site. The capacity of Pacheco Creek is substantially lower near the southern and western sides of Ammo Hill than it is upstream, resulting in overflow of the banks during even low flows near Ammo Hill.

The peak 100-year discharge exceeds the channel and culvert capacities in several locations, including Bolling Road, Main Entrance Road, and the area near Ammo Hill. The 100-year peak discharge would also flood the areas between Bunker Hill and Ammo Hill that are at elevations less than 10 feet. The Army recently completed construction of a berm around a portion of Landfill 26. The purpose of the berm is to protect the landfill from overflow from Pacheco Creek up to the 100-year flood. ~~This flood overflow passes around the Landfill 26 area and into the northwestern part of the HAAF parcel. The creek passes between Ammo Hill and Bel Marin Keys Industrial Park before discharging into Ignacio Reservoir (Pacheco Pond).~~

Arroyo San Jose

Arroyo San Jose also originates on Big Rock Ridge approximately 5 miles west of the HAAF parcel at an elevation of approximately 1,600 feet. The creek crosses U.S. Highway 101 near the Ignacio Boulevard/Bel Marin Keys Boulevard interchange and discharges into Ignacio Reservoir. Arroyo San Jose has a watershed of approximately 5.4 square miles, and the computed 10-year and 100-year peak discharges are 1,200 and 2,300 cfs, respectively (Bissell & Karn/Greiner 1993). The 10-year peak discharge is contained within the channel banks and road crossings between U.S. Highway 101 and Ignacio Reservoir. High tides on San Pablo Bay raise the water surface elevation in Ignacio Reservoir and affect water surface elevations in the lower portion of Arroyo San Jose and Pacheco Creek. The 100-year peak discharge would cause flooding in the Los Robles Mobile Home Park and the Bel Marin Keys Industrial Park if accompanied by a high tide on San Pablo Bay (Bissell &



SOURCE:
Bissel & Karn/Greiner 1993.

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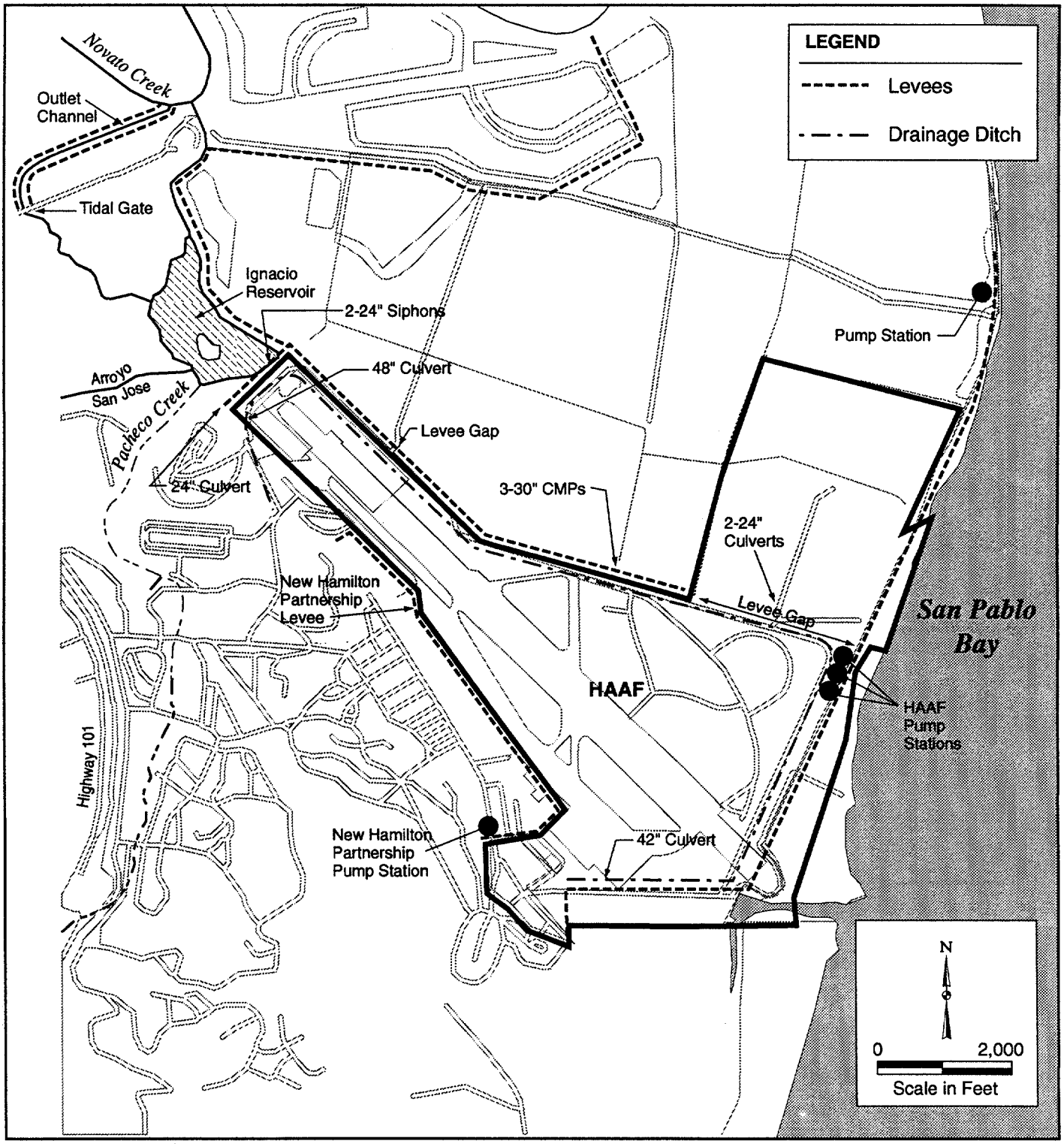
Figure 5-2
Estimated 100-Year Tidal Floodplain



Jones & Stokes Associates, Inc.

Figure 5-3
Regional Drainage Features

Karn/Greiner 1993). At lower tides, the 100-year peak discharge is not expected to cause flooding in these areas.

Ignacio Reservoir

Both Pacheco Creek and Arroyo San Jose discharge into Ignacio Reservoir (also called Pacheco Pond). This reservoir was built by the Marin County Flood Control and Water Conservation District (MCFCWCD) and is operated jointly by MCFCWCD and the California Department of Fish and Game. The reservoir occupies approximately 120 acres and has a storage capacity of 480 acre-feet (unpublished Corps data). The reservoir discharges to Novato Creek through a leveed channel with a flap gate at the outlet. The outlet is located at the Bel Marin Keys Boulevard bridge. High tides in San Pablo Bay prevent outflow from Ignacio Reservoir and may cause flow reversal in the outlet channel if the flap gates do not operate properly (Bissell & Karn/Greiner 1993). Ground elevations near the reservoir are near mean sea level.

The reservoir was constructed to provide flood protection by providing storage for discharges from Pacheco Creek and Arroyo San Jose. However, the storage capacity of the reservoir is ~~inadequate~~ not always adequate to provide 100-year flood protection and prevent overflow of the reservoir. ~~At~~ For example, during a high tide of 7 feet, the reservoir would need a capacity of approximately 600 acre-feet to accommodate 100-year inflows from Pacheco Creek and Arroyo San Jose (unpublished Corps data). The reservoir is also operated to provide freshwater wetland and wildlife habitat. Flashboards are used at the outlet to control water levels during nonflood periods.

~~High flows in Pacheco Creek and Arroyo San Jose cause the reservoir level to rise.~~ Two 24-inch siphons were installed by the U.S. Air Force to provide an overflow from the ~~pond~~ reservoir onto the HAAF parcel (Bissell & Karn/Greiner 1993). The siphons were designed to prevent overtopping and damage to the airfield levee, but they are no longer operational. According to the draft restoration plan, the reservoir instead overtops levees to flow into agricultural fields north of the reservoir, into Novato Creek, and into the BMKV parcel. Low points in the levees between Ignacio Reservoir and Novato Creek, and between the reservoir and agricultural lands to the ~~north~~ northeast, are ~~given in the draft restoration plan as~~ 6.2 feet and ~~5.6~~ 8.0 feet, respectively.

Bel Marin Keys V

The BMKV parcel is currently in agricultural use and is drained by a system of channels. Under normal runoff conditions, most of the runoff from the parcel drains to a pump station at the northeast corner of the property that discharges to San Pablo Bay. Approximately 100 acres drain to the channel system on the SLC parcel to the east, and these flows are conveyed by gravity to the HAAF perimeter ditch system through two 24-inch culverts (described above).

Under flood conditions (greater than approximately 10-year events, according to the draft restoration plan), the BMKV parcel receives overflows from Ignacio Reservoir and from the HAAF parcel through a levee gap approximately 2,000 feet southeast of the northwest corner of the HAAF property. Flood overflows cause ponding on the BMKV parcel under current conditions and leave the property ~~either~~ by overflowing the drainage divide between the BKMV and SLC parcels ~~or~~

~~through three 30-inch culverts through the HAAF perimeter levee~~. Recent investigation by the Army concluded that the three 30-inch culverts between the HAAF and BMKV parcels are not operational.

SLC Parcel

The SLC parcel presently drains to the HAAF perimeter ditch system through a network of channels on the SLC parcel. Flows in the channel system are conveyed to the HAAF perimeter ditch system near the NSD dechlorination facility in two 24-inch pipes. The HAAF perimeter ditch system conveys these flows to HAAF pump stations that discharge to San Pablo Bay.

St. Vincent's Property

The St. Vincent's property south of HAAF is served by a system of drainage channels that discharge through a pump station to San Pablo Bay. In general, ground elevations on the St. Vincent's property drain away from HAAF, and most of this property does not contribute flows to the perimeter ditch system. However, a channel along the northern boundary of the St. Vincent's property intercepts flows from the western portion of the DoD housing and Long Point peninsula area. A portion of the St. Vincent's property also drains to this channel. In addition, overflows from the drainage system on the St. Vincent's property may flow to this channel during periods of high runoff. The channel carries flows to a culvert crossing of the HAAF perimeter levee near the southwestern corner of the airfield and then into the perimeter ditch (unpublished Corps data). The channel carrying flows from the DoD housing area may also overtop onto the St. Vincent's property, where these flows are intercepted by the St. Vincent's property drainage system and conveyed to the associated pump station.

HAAF Drainage

Drainage from the HAAF parcel is collected in a perimeter ditch system and conveyed to three pump stations on the margin of San Pablo Bay. The drainage system is described in detail in an engineering evaluation of the ditch system prepared by International Technology Corporation for the Corps (U.S. Army Corps of Engineers 1997). Drainage subareas for the HAAF parcel are delineated in the Flood and Drainage Baseline Study (unpublished Corps data).

The perimeter ditch system is served by three pump stations on the margin of San Pablo Bay: Buildings 35, 39, and 41. These three pump stations have a combined capacity of approximately 230 cfs and are equipped with both diesel-powered and electric motor-driven pumps (unpublished Corps data).

In addition to the HAAF parcel, the perimeter ditch system receives drainage from several adjacent 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);

- drainage from the area of Landfill 26 and Ammo Hill that is conveyed to the ditch system through 48-inch and 24-inch flap-gated culverts, respectively;

- flood overflows from Pacheco Creek that are conveyed into the ditch system through the 48-inch and 24-inch flap-gated culverts that serve the Landfill 26, Ammo Hill, and POL Hill areas;

- flood overflow (under some conditions) from Ignacio Reservoir and the BKMV parcel through a levee gap approximately 2,000 feet southeast of the northwest corner of the HAAF parcel; and

- ~~flood overflow (under some conditions) from Ignacio Reservoir and the BMKV parcel through three 30-inch culverts through the perimeter levee (located high on the slope); and~~

- flood overflow and normal drainage through two 24-inch gated culverts on the SLC parcel.

In addition, flood overflow from Ignacio Reservoir could be conveyed from the reservoir to HAAF through the two 24-inch siphons (these siphons are currently not operational).

Existing Water Quality Conditions

The existing soil conditions are important in determining water quality at the Hamilton wetland restoration site. The site is a former tidal salt marsh and mudflat. Soils in this area can affect water quality because of the presence of acid-sulfate soils. These soils have a low pH (high acidity) and are the result of draining the historic salt marsh and the subsequent natural processes that occurred with the oxidation of sediments that had previously been submerged and under anaerobic (oxygen-deprived) conditions. Acid-sulfate soil conditions may affect the quality of runoff because low pH levels can lead to water quality problems such as release of sulfuric acid, aluminum toxicity and the potential for release of other metals, and fluctuations in nutrient levels.

As described in detail in Chapter 10, "Hazardous Substances, Waste, and Site Remediation", the facilities in the HAAF and SLC parcels have been surveyed for the presence of hazardous materials. Specific areas of potential concern are the inactive petroleum, oils, and lubricants line; revetment area; east levee landfill; aircraft maintenance areas; burn pits; pump stations; and areas of DDT in the outboard marsh. However, the transfer or sale of property or other activity resulting in construction or rehabilitation involving wetland creation could take place only after cleanup activities were completed by

the Army and certified by the issuance of a Finding of Suitability for Transfer. These issues are discussed further in Chapter 10.

Urban Runoff

Urban runoff from the adjacent properties is collected by a series of storm sewers and drainage channels around the perimeter of the airfield that drain to pump stations discharging into San Pablo Bay. Surface water quality data for these areas of the HAAF parcel are limited.

Natural areas have been disturbed over the years by grading and construction. Runoff from paved areas such as the airfield is generally rapid. Water quality of runoff from the remaining natural, wooded or grassy areas is likely to be good. Urban runoff from paved areas and other impervious surfaces can contain a variety of pollutants that can degrade water quality. The airfield area is most likely the greatest contributor of pollutants to the drainage system. Activities such as aircraft and vehicle maintenance can contribute a substantial amount of the pollutant load in runoff to the drainage channels. Pollutants commonly found in urban runoff include heavy metals and petroleum hydrocarbons.

The historic discharge of urban runoff from the former HAAF has affected the upper intertidal zone of the salt marsh near the pump station outfall. Elevated levels of metals, including high lead levels, and petroleum hydrocarbons have been found in sediments in this area. The solvent trichloroethylene and metals have been found in the perimeter drainage channel.

San Pablo Bay

San Pablo Bay is the receiving water for all drainage from the Hamilton wetland restoration site, including Novato Creek and Pacheco Pond. The bay receives substantial inflow from the Sacramento and San Joaquin Rivers as well as smaller amounts of inflow from the Petaluma and Napa Rivers and Sonoma Creek. Water quality is maintained by circulation and flushing as a result of tidal action and freshwater inflow. Water quality and salinity in the bay are determined by the relative mix of these water sources. Turbidity can be high because of the relatively shallow depths of water and the substantial currents that resuspend bottom sediments. Tidal flows nourish and sustain the saltmarsh habitat along the levee at the east end of the HAAF parcel adjacent to San Pablo Bay.

Water quality in San Pablo Bay has been evaluated as part of a study of San Francisco Bay (Aquatic Habitat Institute 1990). San Pablo Bay is listed as a “water quality limited segment” in the Basin Plan. Preliminary data from the Aquatic Habitat Institute study indicate that levels of some pollutants may be lower than indicated by previous data; however, several pollutants are still present at levels of concern in San Pablo Bay and San Francisco Bay as a whole. The EPA water quality criterion for copper has been exceeded in San Pablo Bay. Water quality is impaired because of mercury, and a health advisory has been issued for the entire San Francisco Bay estuary (California Regional Water Quality Control Board, San Francisco Bay Region 1997) because of mercury levels in aquatic life. Selenium is also a concern and is contributing to the “water quality limited” designation.

Groundwater

The shallow groundwater at the Hamilton wetland restoration site has a high salinity because of the historic influence of San Pablo Bay. Groundwater is of poor quality and is not used as a potable water source. A deep, higher quality aquifer is present at an unknown depth. Because of the prevalence of bay muds, runoff is unlikely to recharge the deeper groundwater under the Hamilton wetland restoration site (EIP Associates 1993). Groundwater is influenced by freshwater levels in Pacheco Pond and may be less saline in this area. The general direction of groundwater flow is to the east (Woodward-Clyde 1985). However, the low transmissivity of bay muds greatly reduces the movement of shallow groundwater into San Pablo Bay. Groundwater also discharges to the stormwater drainage channel located around the perimeter of the airfield and may contain pollutants from contaminated areas.

Groundwater quality in the HAAF and SLC parcels has been affected by contaminants. The main contaminants of concern that have been found in groundwater are petroleum hydrocarbons, such as gasoline and oils, and solvents. These contaminants are discussed in more detail in Chapter 10, "Hazardous Substances, Waste, and Site Remediation".

Wetland Water Quality

Wetland water quality is influenced by wetland depth and morphology and the relationship of the wetland to the upstream watershed. The hydrologic regime determines the frequency, depth, and duration of the water's influence on vegetation and the aquatic functions that the wetland provides. Wetlands with little flushing and high nutrient and contaminant loading rates can become stagnant, resulting in low dissolved oxygen content, decreased aquatic habitat quality, and adverse effects on fish and wildlife. These conditions can also promote excess algal growth and increase mosquito breeding potential. An adequate supply of fresh water to the wetland improves the capacity for removal of nutrients and contaminants. In a salt marsh environment, adequate tidal flushing maintains good water quality by reducing the potential for development of these conditions.
Wetlands can improve the quality of source waters by decreasing water velocity, inducing sediment deposition, and removing excess nutrients and contaminants. Nutrients and contaminants can adsorb (attach themselves) to sediments in a wetland and be removed by deposition, chemical breakdown, and assimilation into plant and animal tissues.

Water Quality Regulations

Basin Plan

The Basin Plan (California Regional Water Quality Control Board, San Francisco Bay Region 1997) and its subsequent amendments establish water quality objectives that apply to all inland surface

waters, including enclosed bays and estuaries. Narrative and numerical objectives are presented in the Basin Plan that would protect beneficial uses in the region. These objectives include limits on levels of general water quality constituents (pH, dissolved oxygen, salinity, turbidity, and total dissolved solids), heavy metals, and certain toxic organic compounds. EPA's water quality criteria are also applicable for certain heavy metals and organic compounds in surface waters upstream of San Pablo Bay. Beneficial uses protected by the Basin Plan that would be applicable to the Hamilton wetland restoration project include wildlife and fish habitat, estuarine habitat, and preservation of rare and endangered species.

In establishing these objectives, the San Francisco RWQCB considers the potential impact on beneficial uses within the area of influence of a discharge and the existing quality of receiving waters based on the appropriate water quality objectives. A finding regarding the beneficial uses to be protected would be made by the San Francisco RWQCB, which would establish waste discharge requirements (WDRs) to protect those uses. WDRs issued for a project, based on water quality objectives, may contain more or less restrictive conditions that take into account not only actual and potential beneficial uses, but also factors such as economic considerations. Because San Pablo Bay is considered to be a "water quality limited segment" in the Basin Plan, more stringent water quality objectives and treatment levels could be required for any discharge to this area. WDRs typically address turbidity, suspended solids, and other water quality issues.

Enclosed Bays and Estuaries Plan

The Enclosed Bays and Estuaries Plan (EBEP) (California State Water Resources Control Board 1990) set forth new objectives for the protection of aquatic life and human health. The water quality objectives in this plan were developed to apply statewide, and they apply to all estuarine waters in the project region. The plan contains objectives for regulating priority toxic pollutants, as listed under the Clean Water Act.

The EBEP has been the subject of a recent lawsuit brought against the California State Water Resources Control Board by a group of municipalities and one private company, alleging that the plan violated provisions of the Porter-Cologne Water Quality Act and CEQA. On October 15, 1993, a tentative decision was issued that overturned the plan, leaving the state technically without enforceable numerical objectives for those toxic pollutants regulated in the plan. It is unknown at this time when the plan will be readopted, how the current objectives will change, and how this could affect the development of wetlands.

Discharge of Waste to Land Regulations

The disposal of dredged material to land is regulated by the California Code of Regulations (CCR), Title 23, Division 3, Chapter 15, "Discharge of Waste to Land Regulations", and is under the authority of the San Francisco RWQCB. Disposal of dredged material to augment existing levees or create upland habitat is considered upland disposal, and project approval by the San Francisco RWQCB would be based on the concentration of constituents of concern in the dredged sediment and on site-specific conditions.

Clean Water Act

Wetland creation using dredged material is considered aquatic disposal under Section 404 of the Clean Water Act and is regulated by the California State Water Resources Control Board and the San Francisco RWQCB under Section 401 of the Clean Water Act. The San Francisco RWQCB is responsible for ensuring that water quality objectives in the Basin Plan are not exceeded by a dredged material disposal project. WDRs issued by the San Francisco RWQCB could require that discharge from a project comply with screening criteria and testing guidelines for wetland creation and upland beneficial reuse to ensure that disposal does not result in degradation of the existing site.

Environmental Consequences and Mitigation Measures

Approach and Methods

Hydrologic resources and surface water drainage patterns in the project area have been documented extensively in previous work (U.S. Army Corps of Engineers 1989 and 1997, Bissell & Karn/Greiner 1993, unpublished Corps data, and Woodward-Clyde 1998 and associated background information). The potential environmental consequences of the project alternatives on hydrologic resources have been evaluated primarily through review and analysis of available information. Based on an understanding of present hydrologic conditions, the potential mechanisms through which the project alternatives may have an impact on existing resources have been identified. Potential impacts are identified based on impact mechanisms, and additional required technical analysis is identified where required to quantify or mitigate for project impacts.

Potential water quality impacts were identified by comparing the Hamilton wetland restoration plan (Woodward-Clyde 1998) to the applicable laws and regulations regulating water quality in California. The water quality analysis also relies on other chapters in this EIR/EIS, especially Chapter 4, “Geology and Soils”; Chapter 6, “Tidal Hydraulics”; and Chapter 10, “Hazardous Substances, Waste, and Site Remediation”.

Impact Mechanisms

Hydrology

The proposed action would convert existing leveed lowlands in the HAAF parcel (and the SLC property under some alternatives) to tidal wetland. Levees around the perimeter of the proposed tidal wetland would be constructed to protect adjacent lands from tidal flooding. These parcels would be subject to the tidal elevations characteristic of San Pablo Bay.

Before property transfer, most drainage and flooding issues will be resolved by the Army (see Chapter 3, "Project Alternatives under Consideration"). ~~The impact mechanisms for the restoration project include the effects of placing fill on existing or proposed drainage facilities for adjacent property.~~ The Army's goal is to resolve flooding and drainage issues with surrounding parcels and therefore ensure that the flooding and drainage characteristics of surrounding parcels are not adversely affected by base closure. This includes the St. Vincent's and Las Gallinas Sanitary District properties, Landfill 26, and the SLC and BMKV parcels. In addition, the Army has indicated that it will prepare environmental documentation for modification of the flood and drainage facilities on the surrounding parcels. The impacts of making these modifications are not analyzed in this EIR/EIS.

The impact mechanisms for the restoration project include the effects of placing fill on existing or proposed drainage facilities for adjacent property. During construction, existing drainage facilities would be decommissioned or their operation disrupted. Interim drainage facilities will be in place to prevent ponding, maintain site access, and protect adjacent land uses.

Exceedance of Water Quality Objectives

The presence of contaminants in dredged material in the HAAF and SLC parcels is of concern if these areas are to be flooded for a wetland creation project. Water quality issues associated with wetlands created without dredged material (Alternatives 2 and 4) are related to maintaining adequate flow and circulation. The primary water quality concern associated with disposal of dredged material (Alternatives 3 and 5) is the potential for formation of acid-sulfate soils. During the drying process, sulfides formed under anaerobic conditions while submerged are oxidized to sulfate, which then forms sulfuric acid on contact with water from runoff or rain. The acidic conditions and low pH (<5.5) can adversely affect aquatic life and wetland vegetation.

Other water quality issues associated with wetlands created with dredged material include the following:

- increasing concentrations of sulfide, ammonia, and phosphorus in brackish water and freshwater environments to levels exceeding those permitted by water quality objectives, both in drainage water from recently placed dredged material and in leached runoff after placement, and

- increasing concentrations of heavy metals in drainage water from dredged material after placement as a result of the conversion of soil chemistry from anaerobic (reducing) to aerobic (oxidizing) conditions, which increases the dissolved, readily soluble concentration of many heavy metals.

Dredged material could contain contaminants and other chemical constituents that pose a threat to water quality. Figure 5-4 depicts the upland and aquatic pathways by which contaminants can threaten water quality in a wetland environment. The five contaminant pathways are:

- effluent discharge;

- u runoff;
- u leachate runoff;
- u seepage by soluble diffusion and soluble convection through tidal pumping and capillary action; and
- u bioturbation, which includes both plant uptake through roots and animal uptake through soil consumption or contact.

These pathways also indicate the biotic resources potentially affected by the mobilization and accumulation of toxic contaminants. Water quality degradation could occur initially in surface water that comes into contact with levees or wetland slopes. As seepage of surface water and leachate from sediment occurs, degradation of shallow groundwater could also occur.

Dredged sediment with chemical concentrations less than the concentrations listed in Chapter 10 is acceptable for potential use in all wetland creation projects at any depth within the wetland (Wolfenden and Carlin 1992). Dredged material at lower concentrations is also acceptable for levee restoration and maintenance, landfill daily cover, and upland creation. The wetland restoration project would accept only dredged material that meets cover material criteria.

Dredged material with sediment concentrations within the ranges listed in Chapter 10 is acceptable for wetland creation noncover material, as long as a minimum of 3 feet of cover material or native material is placed on the top and sides of the noncover material. Noncover material would then be isolated by the cover material from exposure to biological communities. For tidal wetland systems, a greater amount of side coverage may be necessary because of tidal fluctuations.

Thresholds of Significance

For this EIR/EIS, a proposed action is considered to have a significant impact on surface water hydrology if it would:

- u substantially alter drainage patterns, flow rates, or volumes;
- u increase the risk of flood peaks or volumes that would damage infrastructure or property or endanger public safety;
- u result in hydrologic changes that could adversely affect existing or planned biological communities;
- u result in the need for new drainage facilities and capital expenditures; or
- u increase the potential for erosion or sediment deposition.

Thresholds identified in this chapter apply primarily to surface water hydrology of lands adjacent to the proposed action. Potential impacts on the project site and San Pablo Bay related to tidal hydraulics are addressed in Chapter 6.

According to Appendix G of the State CEQA Guidelines, applicable regulations, and professional judgment, a project is considered to have a significant impact on water quality if it would:

- u increase the frequency or severity of exceedances of the water quality objectives for San Pablo Bay or other water bodies or
- u impair the quality of shallow groundwater.

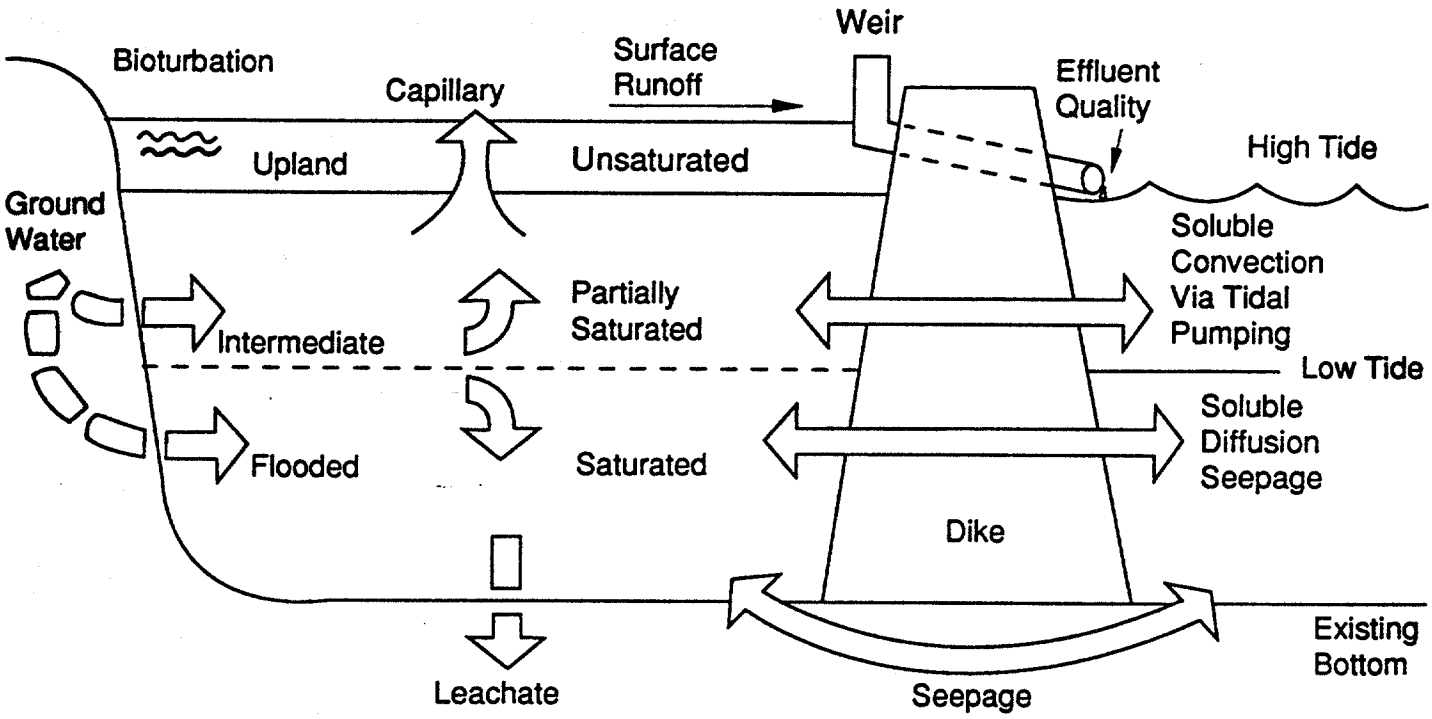
Impacts and Mitigation Measures of Alternative 1: No Action

Under Alternative 1, the HAAF parcel would remain in Army ownership and drainage facilities would continue to be operated and maintained by the Army or a new owner. Existing drainage and flood control characteristics of the HAAF, SLC, and surrounding parcels would remain unchanged. Because drainage and flood control facilities would continue to be operated and maintained, the level of protection afforded the HAAF parcel and surrounding parcels would not change. Therefore, Alternative 1 would have no hydrologic or water quality effects.

Impacts and Mitigation Measures Common to Alternatives 2, 3, 4, and 5

Impact 5.1: Loss of Drainage Capacity from New Hamilton Partnership Development

Drainage from the lands adjoining the western side of the HAAF parcel is collected in a system of pipes and channels. The New Hamilton Partnership has recently constructed a stormwater pumping station near the southwest corner of the HAAF parcel to serve a portion of this drainage that is operated by the City, and plans to construct a second outfall in the area of Reservoir Hill. The New Hamilton Partnership has also constructed a levee to protect its development from tidal floodwaters (top elevation of 8.0 feet with a splash wall to 12.0 feet). The conversion of the HAAF parcel to tidal wetlands would encroach on the outlet channel for the New Hamilton Partnership outfalls and exposure of the levee to risk from tidal flooding. However, the New Hamilton Partnership has already accounted for potential conversion of the HAAF parcel in the design of facilities constructed to date and in its plans for additional facilities. Because the conceptual restoration plan does not allow for drainage for the second outfall facilities, this impact is significant. To reduce this impact to a less-than-significant level, the Corps and Coastal Conservancy or successors in interest shall implement Mitigation Measure 5.1.



Source: Wolfenden and Carlin 1992.

Jones & Stokes Associates, Inc.

Figure 5-4
Potential Contaminant Mobility Pathways

Mitigation Measure 5.1: Provide Allowance for Drainage Similar to Design Specified for New Hamilton Partnership East Outfall. The Corps and Coastal Conservancy or successors in interest shall provide allowance for drainage similar to the design specified for the New Hamilton Partnership east outfall. This can be accomplished by not filling above the invert of the outfall. The drainage channel must allow for free drainage into the wetland.

Impact 5.2: Potential Exceedance of Water Quality Objectives

As described under "Impact Mechanisms", implementation of the proposed action could create a water body with inadequate freshwater or tidal flushing, resulting in stagnation, depressed dissolved oxygen concentrations, and algal bloom, which may lead to offensive odors. Assuming adequate flow and the absence of hazardous materials, water quality in created wetlands would probably be similar to that of incoming water sources such as Novato Creek, Pacheco Creek, and San Pablo Bay. This impact is considered less than significant and no mitigation is required.

Impact 5.3: Potential for Degradation of Water Quality in Restored Wetlands

NSD releases treated wastewater through a 54-inch reinforced-concrete pipe into San Pablo Bay. The outfall line follows the boundary between the SLC and HAAF parcels and discharges through a diffuser into the bay. Before the treated wastewater is released into the bay, the NSD dechlorination plant performs final treatment of the wastewater discharge stream. Treated wastewater is released only during winter and spring months because the treated wastewater is reclaimed and used for irrigation purposes during dry months.

The overall NSD discharge flow rate is approximately 0.01% of the average tidal flow discharge in San Pablo Bay. Diffusion and mixing by the tidal and wind-driven circulation in the bay provide ample opportunity for dilution of the wastewater discharge stream. Because of the high degree of dilution that the discharge stream undergoes upon release into San Pablo Bay and the relative separation of the diffuser from the entrance channels of the proposed tidal wetlands, the impact of return flows from the NSD facilities entering the proposed tidal wetlands is considered less than significant and no mitigation is required.

Impact 5.4: Potential Degradation of Groundwater Quality

Inundation of the project area could degrade shallow groundwater through saltwater intrusion or leaching of hazardous materials. However, the shallow groundwater in the project area already has a high salinity because of the historic influence of San Pablo Bay. Because bay water is of poor quality, it is not used as a potable water source. Because of the presence of bay muds at the site, surface water and shallow groundwater are unlikely to recharge deeper groundwater; therefore, saltwater leaching and intrusion of hazardous materials are unlikely to occur. This impact is considered less than significant and no mitigation is required.

Impacts and Mitigation Measures Unique to Alternative 2

No impacts and mitigation measures are unique to Alternative 2.

Impacts and Mitigation Measures Unique to Alternative 3

Impact 5.5: Potential Degradation of Surface Water Quality

Runoff. Disposal of dredged sediments at the site would increase the amount of vegetation and soils cover, which would decrease the rapid runoff that presently occurs on the mostly paved site. In addition, runoff of accumulated pollutants (e.g., oil, grease, heavy metals, pesticide residues, fertilizers, and coliform bacteria) from roadways, parking lots, rooftops, and other surfaces would decrease. This reduction in water quality degradation could be substantial, thereby producing beneficial impacts. (U.S. Army Corps of Engineers and Port of Oakland 1998a.)

Reopening the restored area to tidal action would create conditions appropriate for typical salt marsh vegetation. Water quality in the restored marsh would be largely determined by circulation. Decant water released from dredged materials would have no effect on local salinity because the discharged water would have virtually the same salt concentration as the bay water. (U.S. Army Corps of Engineers and Port of Oakland 1998a.)

Acid-Sulfate Soils. Disposal of dredged sediments would result in the saturation of existing acid-sulfate soils. Such conditions could affect the quality of runoff because of the low pH levels. The water quality problems associated with low pH include release of sulfuric acid, aluminum toxicity and the potential for release of other metals, and fluctuations in nutrient levels. These constituents could be discharged to San Pablo Bay or leach through onsite soils to groundwater. However, the procedure used to create wetlands would include surface flooding of onsite sediments. Surface flooding of existing acid-sulfate soils would prevent migration of acid-sulfate conditions into the water column and would greatly dilute the small amount of sulfuric acid that could be released. Dredged material would be applied as a wet slurry and would not be allowed to dry out. The material would also act as a cover for existing acid-sulfate soils. (U.S. Army Corps of Engineers and Port of Oakland 1998a.) Because surface flooding would be used, impacts with respect to acid-sulfate soils are considered less than significant.

Leaching of Contaminants from Dredged Sediments. The project could result in potential leaching of contaminants from levees or berms constructed on dredged sediments, physical erosion and transport of the sediment by surface water currents and runoff, and selective uptake and biomagnification of contaminants in plants and animals. However, the sediments selected for use as cover material for tidal and seasonal wetland restoration at the project site would need to meet the RWQCB screening criteria, which would minimize the potential for bioaccumulation. Maintaining wet, anoxic sediment conditions would minimize pH changes and increases in leachability of heavy metals and other substances. Restricting disposal of sediments to those passing the cover screening criteria would ensure that no adverse impacts on surface water quality would occur. This would be

enhanced by the site design, which would promote sedimentation as a physical sink for incoming tidal sediment. (U.S. Army Corps of Engineers and Port of Oakland 1998a.)

Increased Turbidity, Erosion, and Sedimentation. After the perimeter levee is breached and full tidal circulation is restored across the site, some of the dredged material would be remobilized. Tidal flows and velocities at the perimeter levee breach locations would increase localized erosion in the existing tidal slough channels and the bordering marsh. Remobilization of the dredged material by tidal currents and wind-generated waves across the open fetch of the southern portion of the site would increase local turbidity and sedimentation until the eroded material is redeposited. No substantial offsite transport is anticipated. The impacts of increased turbidity and sedimentation would be short term, and offsite transport would eventually be eliminated when equilibrium is established in the restored tidal marsh and tidal sloughs. This localized, short-term impact is considered less than significant because high turbidity is characteristic of the water in dynamic tidal marsh environments. (U.S. Army Corps of Engineers and Port of Oakland 1998a.)

Short-term increases in erosion and sedimentation would occur during construction because of the removal of topsoil and associated vegetation in some areas. Most of the area to receive fill is currently paved; therefore, minimal soil and vegetation would be removed. This increase in erosion and sedimentation would be temporary and is considered a less-than-significant impact.

In addition, the following actions that would occur as part of the project would further reduce any impacts on water quality:

- Adherence to NPDES erosion and sedimentation controls and BMPs and compliance with an NPDES General Stormwater Permit for construction activities of 5 acres or more during site construction, in combination with the containment berms incorporated into the site design, would reduce increased sedimentation into adjacent surface waters.

- Surface water would be monitored and discharged only after meeting state water quality standards.

- Vegetation would be established to further reduce contaminant concentrations in surface runoff during the dry oxidized stage.

In summary, the area of dredged material would not result in any significant adverse water quality impacts.

Water Quality Monitoring Program. A water quality monitoring program would be developed to ensure adequate wetland hydrologic and biological functions, including circulation, proper conditions for plant growth, and high-quality habitat for aquatic organisms and wildlife. Before the construction phase of the project, water quality monitoring and reporting requirements for the project site will be established by the San Francisco RWQCB in the project-specific WDRs. The WDRs will require sampling and analysis to provide background water quality information on the project's discharge. These data will be used to evaluate water quality of the discharge and determine compliance with the WDRs. Monitoring and reporting requirements will be based on site-specific conditions such as beneficial uses, existing water quality, quality of dredged material, and wetland management goals.

The monitoring program shall be initiated before implementation of the project to determine background concentrations of constituents of concern, will continue during construction to identify any adverse impacts.

Water samples should be collected and analyzed at frequencies ranging from monthly to quarterly and during both high and low tides after placement of dredged material. Monitoring frequency may be reduced if data indicate that the created wetland is in compliance with WDRs and is not adversely affecting water quality. During dredged material placement, daily and/or weekly monitoring should be required for key constituents of concern, such as nitrate, ammonia, phosphorus, and heavy metals. Other water quality parameters to be monitored will include salinity, temperature, pH, dissolved oxygen, and suspended solids.

Exceedance of monitoring standards may require temporary delays in material placement or the installation of turbidity curtains or other physical measures to control the flow of water and sediments.

Impacts and Mitigation Measures Unique to Alternative 4

No impacts and mitigation measures are unique to Alternative 4.

Impacts and Mitigation Measures Unique to Alternative 5

Impact 5.6: Potential Degradation of Surface Water Quality

This impact is the same as Impact 5.5 described above for Alternative 3. This impact is considered less than significant.

Potential Issues and Resolutions under the Bel Marin Keys V Scenario

Potential Issue: Loss of Drainage Capacity from New Hamilton Partnership Development

This issue is similar to Impact 5.1 described above for Alternatives 2-5. A potential resolution to this issue would be similar to Mitigation Measure 5.1.

Potential Issue: Potential Exceedance of Water Quality Objectives

This issue is similar to Impact 5.2 described above for Alternatives 2-5 and is not considered to be significant.

Potential Issue: Potential for Degradation of Water Quality in Restored Wetlands

This issue is similar to Impact 5.3 described above for Alternatives 2-5 and is not considered to be significant.

Potential Issue: Potential Degradation of Groundwater Quality

This issue is similar to Impact 5.4 described above for Alternatives 2-5 and is not considered to be significant.

Potential Issue: Potential Degradation of Surface Water Quality

This issue is similar to Impact 5.5 described above for Alternative 3 and is not considered to be significant.