Appendix G
Hydrology and Water Quality Report

This section provides a regional hydrologic context to Newark Areas 3 & 4, discusses environmental and geologic settings, and describes existing water resources within the study area.

1.1 Regulatory Setting

1.1.1 *Federal Regulations*

1.1.1.1 *National Flood Insurance Program.* To mitigate the costs of flood disaster relief, the U.S. Congress passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. These acts were meant to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains.

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in floodplains.

As part of the NFIP, FEMA publishes Flood Insurance Rate Maps (FIRMs) that identify flood hazard zones within a community. The extent of FEMA-designated floodplains in the Proposed Project area is discussed in the environmental setting above.

A Zone AE floodplain delineates the boundary of a 100-year flood, which is defined as having a one percent annual chance of being exceeded in any given year. Base flood elevations are established and shown on the effective FIRM. Development with the Zone AE will have to comply with the NFIP regulations and any related local regulations, including:

- Flood insurance requirements for any structures within the floodplain (unless adjacent grade has been elevated to a level at or above the base flood elevation);
- Flood proofing of any subsurface parking structures;
- Conditional Letter of Map Revision (CLOMR) applications for structures within the floodplain that are desired to be removed from the flood insurance requirements, and/or for any onsite projects which impact the flood boundary.

A Zone X floodplain delineates the boundary of either a 500-year flood, areas of 100-year flooding with average depths of less than 1 foot or drainage areas less than 1 square mile, or areas protected by levee from the 100-year flood. Development with the Zone X will have to comply with the NFIP regulations and any related local regulations, including:

- Optional flood insurance requirements for any structures within the floodplain;
- Conditional Letter of Map Revision (CLOMR) applications for structures within the floodplain that are desired to be removed.

1.1.1.2 ***Clean Water Act.*** The Clean Water Act (CWA), formally known as the United States' Federal Water Pollution Control Act Amendments of 1972 and subsequent amendments, which governs discharges to the waters of the U.S., which includes oceans, bays, rivers, streams, lakes, ponds, and wetlands.

There are several sections of the Clean Water Act (CWA) that regulate impacts on waters of the United States. Title I, Section 101 specifies the objectives of the CWA implemented largely through the sections of Title III (Standards and Enforcement). The discharge of dredged or fill material into waters of the United States is subject to permitting specified Section 404 (Discharges of Dredge or Fill Material) of Title IV (Permits and Licenses). Section 401 (Certification) specifies additional requirements for permit review, particularly at the state level.

In fact, several federal regulations are implemented at a state level. In California, therefore, sections of the Clean Water Act are implemented and enforced by the California State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCBs). Their functions are described further below under "State Regulations."

<u>Section 303 – TMDL Program</u>

Section 303 of the CWA and California's Porter-Cologne Water Quality Control Act require the State of California to adopt water quality standards to protect beneficial uses of state waters. Section 303(d) of the CWA requires the state to develop a list of water bodies that do not meet water quality standards, establish priority rankings for waters on the list, and develop actionable targets, known as Total Maximum Daily Loads (TMDLs), to guide the application of state water quality standards. The water-quality impaired waters are often referred to as 303(d) impaired waters. These waters are impaired by the presence of pollutants, including sediment, and have no remaining capacity to accept these pollutants without harming beneficial uses of the waters.

The San Francisco Bay is listed as 303(d) impaired waters. Various sections of San Francisco Bay are impaired by chlordane, DDT, diazinon, dieldrin, dioxins, furans, mercury, PCBs, selenium, and nickel – all of which are constituents of urban runoff, as well as exotic species, which can disrupt the survival of native species.

<u>Section 401 – Water Quality Certification</u>

CWA Section 401 requires that an applicant pursuing a federal permit to conduct any activity that may result in a discharge of a pollutant to obtain a Water Quality Certification (or waiver). The RWQCBs issue Water Quality Certifications in California. Under CWA, the state must issue or waive Section 401 certification for the project to be permitted under Section 404. Water Quality Certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the U.S. Construction of the Proposed Project would require Section 401 certification if Section 404 is triggered, as explained below.

Section 402 – NPDES Program

Along with CWA Section 401, CWA Section 402 establishes the National Pollutant Discharge Elimination System (NPDES) permit for the discharge of any pollutant into waters of the U.S. The NPDES program is the primary federal program regulating point source and nonpoint source discharges to waters of the U.S.

The EPA has delegated administration of the NPDES program to the State Water Board and Regional Boards in California. The SWRCB and RWQCBs also regulate other waste discharges to land within California through the issuance of waste discharge requirements under authority of the Porter-Cologne Water Quality Act. Both general and individual permits are issued for certain activities.

Construction projects are regulated under a statewide general construction permit, known as the NPDES General Permit for Discharges of Storm Water Runoff Associated with Construction Activity. The appropriate RWQCB enforces this permit. The general construction permit requires all construction projects disturbing over one acre of soil to prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) during construction. The SWPPP includes pollution prevention measures, such as erosion and sediment control measures and measures to control non-stormwater discharges and hazardous waste spills, demonstration of compliance with all applicable local and regional erosion and sediment control standards, identification of responsible parties, a detailed construction timeline, and a monitoring and maintenance schedule of best management practices (BMPs). A Notice of Intent (NOI) must also be submitted to the RWQCB and should include site-specific information and the certification of compliance with the terms of the general construction permit.

The regional permit governing non-construction activity on the Proposed Project site is discussed in the regional regulations below.

Section 404 – U.S. Army Corps of Engineers Permit

Section 404 of the CWA regulates the discharge of dredged and fill materials into waters of the U.S. Project developers must obtain a U.S. Army Corps of Engineers permit for all discharges of dredged of fill material into such waters before proceeding with a proposed activity. Before any actions that may impact surface waters are carried out, a delineation of jurisdictional waters of the United States must be completed following U.S. Army Corps of Engineers' protocols to determine whether the project area encompasses wetlands or other waters of the U.S. that qualify for CWA protection.

Wetlands are defined for regulatory purposes as areas "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3, 40 CF 230.3).

Under the Section 404 permit program, general permits (known as nationwide permits) have been adopted, and coverage under nationwide permits is possible when the amount of fill is relatively small (usually less than half an acre). Projects that do not qualify for a nationwide permit must obtain an individual permit, which has a longer and more involved permitting process.

1.1.2 *State Regulations*

The following sections briefly describe state water programs, plans, and policies that are applicable to the Proposed Project and its vicinity.

1.1.2.1 *Porter-Cologne Water Quality Control Act.* The Porter-Cologne Water Quality Control Act of 1969 established the SWRCB and the nine regional basins governed by the RWQCBs. The SWRCB is the primary state agency responsible for protecting the quality of the state's surface and groundwater supplies, while the Regional Boards are responsible for developing and enforcing water quality objectives and implementation plans, known as Basin Plans. The California SWRCB and its RWQCBs act as the lead agencies for the EPA to implement aspects of the CWA. They perform their duties through implementation of the regional Basin Plans and the NPDES program.

The Porter-Cologne Act authorizes the SWRCB to enact state policies regarding water quality in accordance with Section 303 of the CWA. In addition, the act authorizes the SWRCB to issue Waste Discharge Requirements (WDRs) for projects that would discharge to state waters.

The Basin Plans are required to:

- Identify beneficial uses of waters to be protected;
- Establish water quality objectives for the reasonable protection of the beneficial uses; and
- Establish an implementation program for achieving the water quality objectives.

Basin Plans also provide the technical basis for determining WDRs, taking enforcement actions, and evaluating clean water grant proposals. Basin Plans are updated and reviewed every three years in accordance with Article 3 of the Porter-Cologne Act and Section 303(c) of the CWA.

The Proposed Project is within the jurisdiction of the San Francisco RWQCB, which adopted the most recent edition of its Basin Plan in 1995.

As the San Francisco RWQCB Basin Plan indicates, existing beneficial uses of South San Francisco Bay, to which this area empties, include commercial fishing, industrial service supply, fish migration, navigation, preservation of rare and endangered species, recreation, shellfish harvesting, and wildlife habitat. The South Bay also has a potential use for fish spawning.

1.1.3 *Local Regulations*

Several local agencies, including the County of Alameda, the Alameda County Health Department, and the County Agricultural Commissioner, also have jurisdiction over the Proposed Project.

1.1.3.1 Alameda Countywide Clean Water Program. The Proposed Project is within an area governed by the Alameda Countywide NPDES permit. Several agencies within Alameda County formed the Alameda Countywide Clean Water Program to apply and administer the NPDES permit for this area. Within the regional NPDES permit, there are several requirements.

Newark General Plan

General Plans regulate the design of new development through various sections, known as elements. Relevant sections to hydrology and water quality include the Conservation Element, Open Space Element, and Safety Element.

1.2 Environmental Setting

1.2.1 *Regional Setting*

The City of Newark lies in the alluvial plain of the Coast Range in western Alameda County. It extends from the eastern shore of the San Francisco Bay toward the Coast Range. Newark is surrounded by the City of Fremont. Newark Areas 3 & 4 lie alongside the Cargill salt evaporation ponds on the western boundary of the city. The area's regional context is illustrated by Figure 1-1.

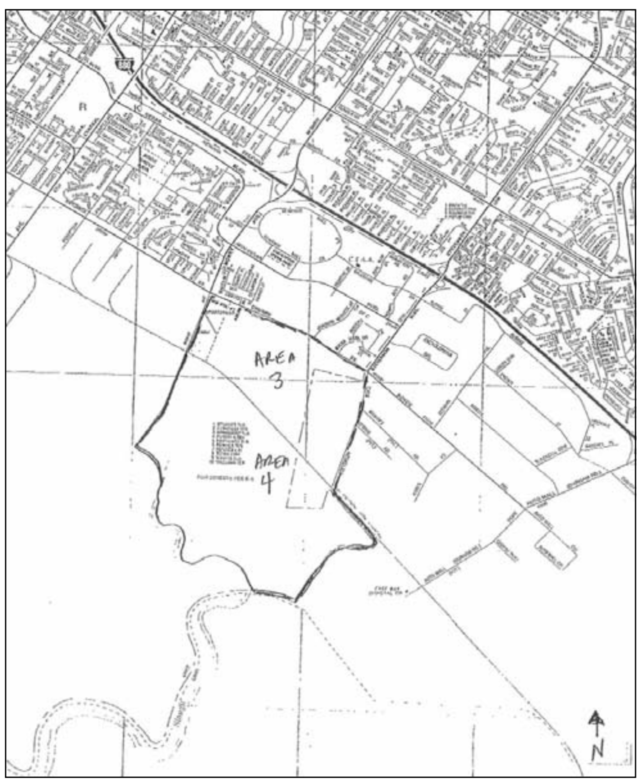

Figure 1-1: Newark Areas 3 & 4 Vicinity Map

1.2.2 *Climate*

The climate of Newark is characterized by mild winters and cool summers. The yearly average temperatures range from a minimum of 46.3° F to a maximum of 68.4° F. The rainy season generally lasts from early December through February with an annual rainfall of 15 inches.

1.1.3 *Land Use*

The majority of the upstream watershed feeding Lines B, D, and N is highly urbanized. Agricultural land use dominates the existing Area 4. Area 3 has commercial and industrial uses as well as Sportsfield Park. Figure 1-2 provides an aerial view of existing land uses within Areas 3 & 4.

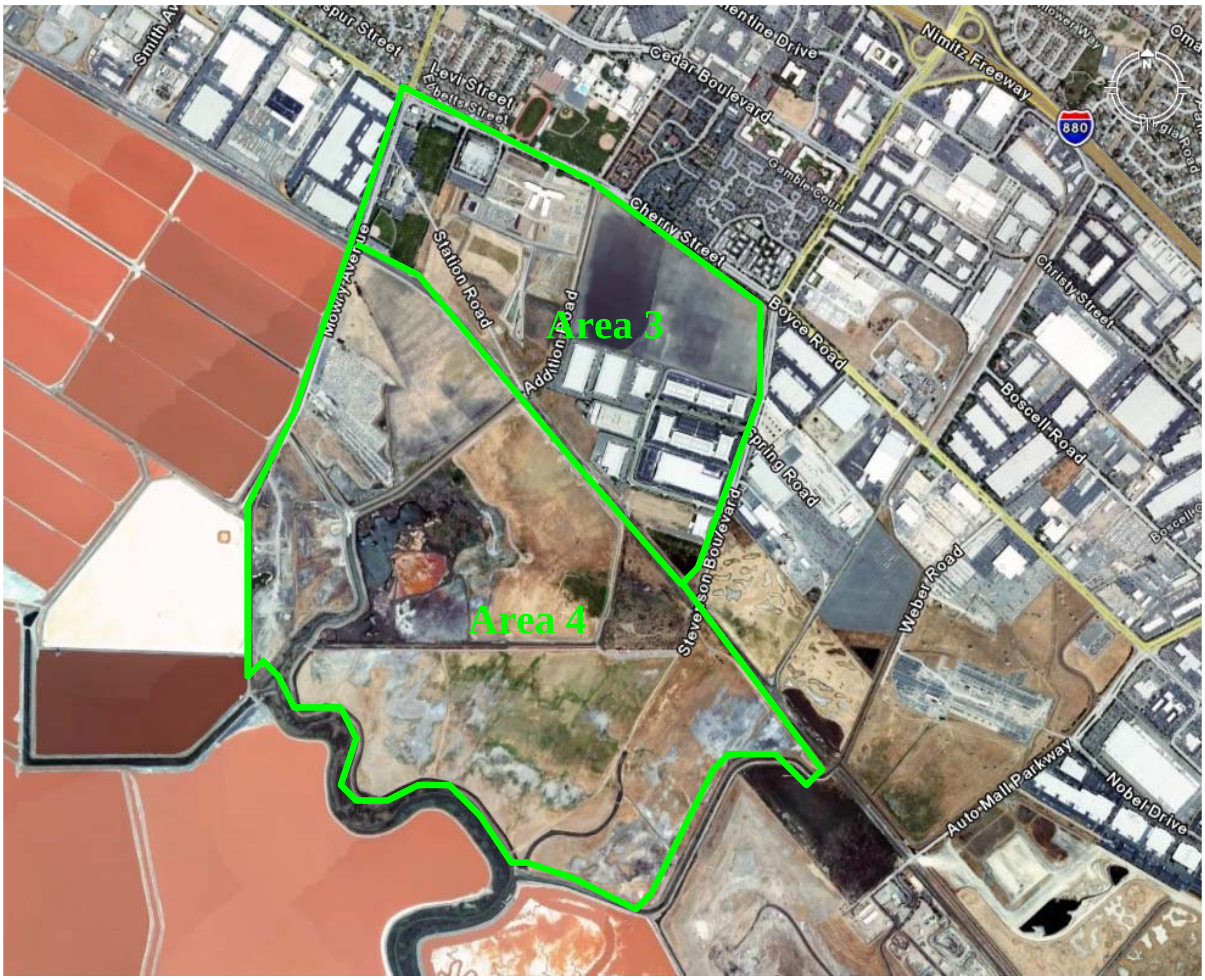

Figure 1-2: Aerial Photo Showing Landuses

1.3 Surface Water Hydrology

1.3.1 *Drainage Patterns*

Three Alameda County Flood Control channels (Lines B, D, and N) run through or around the perimeter of the project area. These three channels have a total drainage area of 13.3 square miles, not including a portion of the onsite drainage. The maintained flood control channels generally consist of well defined channels confined between the adjoining levees.

Interior runoff from Areas 3 & 4 naturally flows from northeast to southwest according to the existing topography. The Southern Pacific Railroad as well as several internal levees are barriers impeding these natural flows. Interior drainage is collected in ditches that run along the inboard sides of the levees to an existing pump that elevates the water 10-12 feet to the top of the levee where it can enter Mowry Slough. A schematic of these drainage features are shown in Figure 1-3.

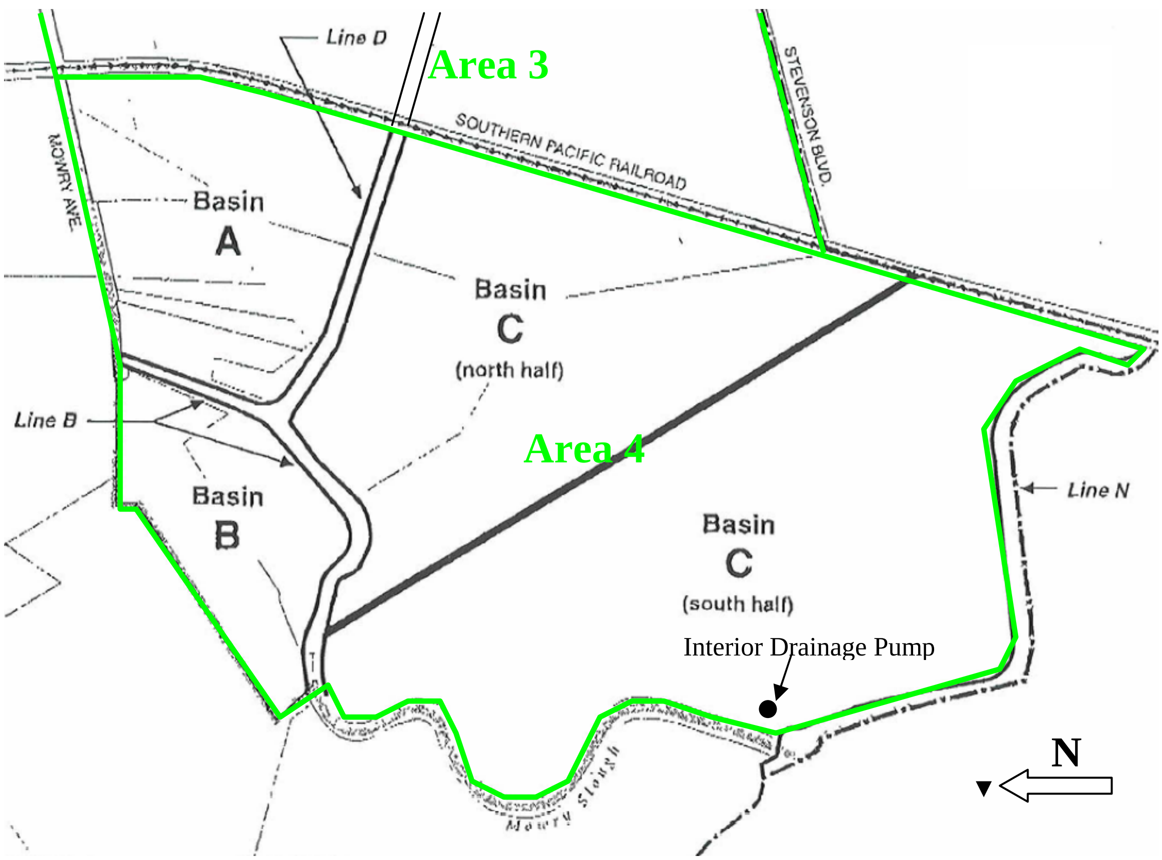

Figure 1-3: Drainage Schematic

1.3.1.1 *Line B.* Line B flows along the west and south borders of the property before becoming Mowry Slough. At Mowry Slough, Line B drains 7.26 square miles resulting in a 100-year peak discharge of 1,020 cfs according to the FEMA Flood Insurance Study for the City of Newark, effective February 9, 2000.

1.3.1.2 *Line D.* Line D cuts through the western portion of the property and confluences with Line B. At the confluence of Line B, Line D drains 3.65 square miles resulting in a 100-year peak discharge of 980 cfs according to the FEMA Flood Insurance Study for the City of Newark, effective February 9, 2000.

1.3.1.3 ***Line N.*** Line N runs along the eastern boundary of the property before joining Mowry Slough. At the Southern Pacific Railroad, Line N drains 2.4 square miles resulting in a 100-year peak discharge of 750 cfs according to the FEMA Flood Insurance Study for the City of Fremont, effective February 9, 2000.

1.3.1.4 ***Mowry Slough.*** Mowry Slough runs along the southern boundary of the property. Mowry Slough carries the discharges from all the ACFCWCD Lines that run around and through the property out to San Francisco Bay. Mowry Slough, as well as the lower portions of the other Lines are tidally influenced.

A summary of the information available for these channels is found in Table 1-1.

Table 1-1: Flood Insurance Study Data

Line	Drainage Area (sq. mi.)	100-yr Flow (cfs)	Effective FIS
B	7.26 at Mowry Slough	1,020	City of Newark 2/9/00
D	3.6.5 at Line B Confluence	980	City of Newark 2/9/00
N	2.4 at SPRR	750	City of Fremont 2/9/00

1.3.2 *Riparian Corridors*

The levees create natural barriers for the riparian corridors associated with the ACFCWCD Lines and Mowry Slough. Lines D and N are narrow, 60-foot wide trapezoidal channels with little or no vegetation. Line B gradually widens from 80 to 200 feet, increasing in vegetation and habitat with the increase of width. Mowry Slough is known for its lush, marshland habitat and diversity of wildlife. It reaches widths of 400 feet as it meanders almost 4 miles until it reaches the open water of San Francisco Bay.

1.3.3 *Significant Surface Water Hazards*

Surface water resources within and around Newark Areas 3 & 4 can potentially pose a threat to public welfare and property.

1.3.3.1 ***Flooding.*** During more extreme storm water runoff events, the Plan Area is prone to both riverine- and tidally-induced flooding. The Federal Emergency Management Agency (FEMA) has applied hydrologic and hydraulic models to produce a set of maps that identify flood hazards within the area. Their Flood Insurance Rate Map (FIRM) for the City of Newark was last revised in February 2000, and remains the official effective document governing the National Flood Insurance Program (NFIP). The effective FIRM boundaries are outlined on Figure 1-4.

FEMA's policy is to disregard any flood protection benefit provided by a levee that is not certified as meeting NFIP standards for freeboard and geotechnical stability. The majority of Area 4 relies on the integrity of the Line B, Line N and Mowry Slough levees for flood protection, and none of these levees is certified. Consequently the FIRM shows a Special Flood Hazard Area (SFHA) with one-percent flooding as if these uncertified levees did not exist. The SFHA covering a majority of Area 4 is mapped as Zone AE (Elevation 8 feet NGVD; or 11 feet NAVD), which is the one-percent stillwater surge at this location on San Francisco Bay. (The stillwater surge is equivalent to the tide elevation without wind wave action.)

A significant portion of Area 3 adjacent to Line D is designated as Shaded Zone X on the FIRM. This zone designation signifies that the area is protected from one-percent flooding by levees, is subject to one-percent flooding less than one foot deep and/or is subject to the 0.2 percent (500-year) flooding. Based on available topography and the one-percent water surface profile for Line D published in the effective Flood Insurance Study for Newark, it appears that this flood hazard zone represents one-percent (100-year) flooding with an average depth of one foot or less.

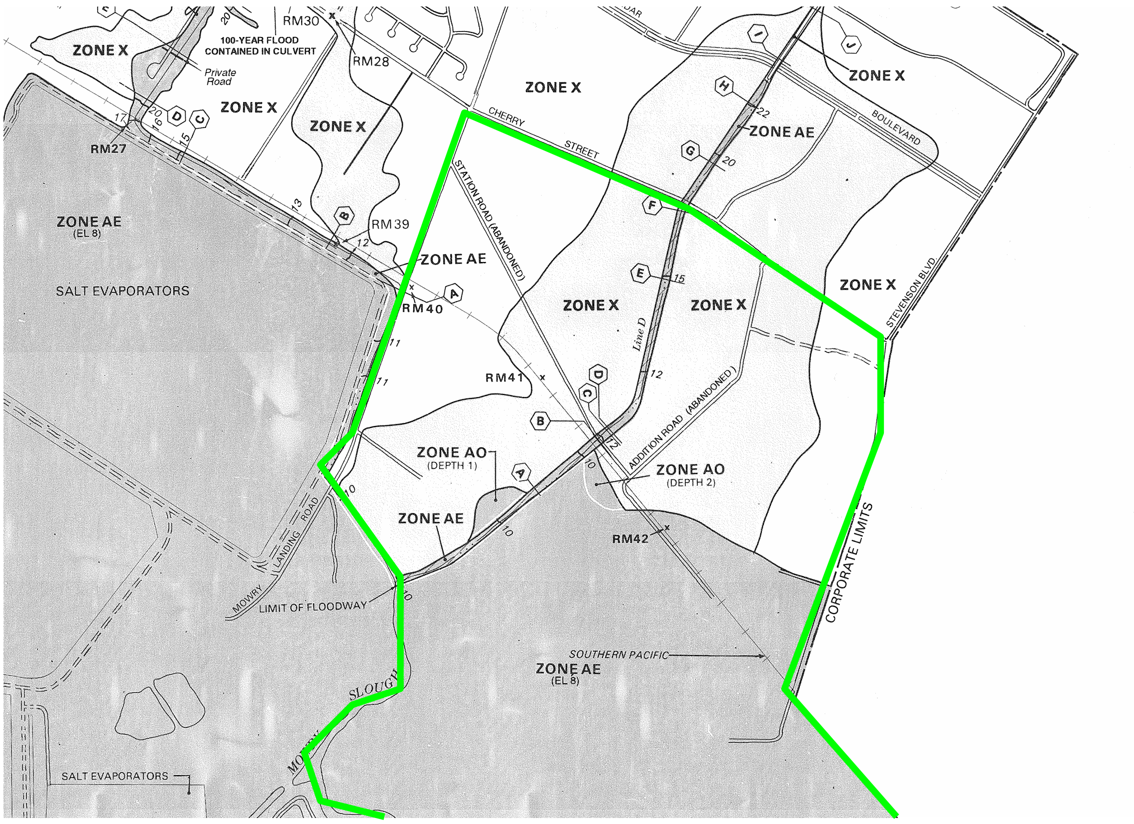

Figure 1-4: FIRM Effective February 9, 2000

1.3.3.2 ***Levee Failure.*** With the existing topography/grading, the Plan Area is subject to deep inundation should any of the levees surrounding the Plan Area fail. All levees are not FEMA-certified, so it must be assumed that any of them could fail in a large storm or high tide event. Since most of Area 4 is surrounded on all sides by levees, once a levee is overtopped or fails, there is no means of escape for the water other than through a failed levee section, if there is such a failure. An area protected by an overtopped levee could potentially fill up to until the water ponds to the tops of other levee segments before spilling back into an adjacent watercourse. Pumping may be the only option for eliminating residual water after a levee is breached or overtopped.

The Plan Area could be inundated with significant water depths within hours of levee failure. Basin A flooding would be most greatly influenced by high riverine flows. If Line B breaks at the beginning of a 24-hour 100-year storm event, Basin A could fill up to elevation 7.6 (approximate low spot on the levee for release) within about 4 hours. This would inundate about half of the area of Basin A to depths of up to 7 feet. If both Lines B and D were to fail, it would fill in half the time.

The worst case levee failure scenario for Basin C would be tidally induced. According to the FEMA Flood Insurance Study, the 100-year high tide is at an elevation of 8.0 feet. With levee failure, a flood elevation of 8.0 feet inundates most of Basin C with depths of up to 9 feet. Wave runup, which generally would increase flood depths, is not a concern for this site since the series of salt pond levees combined with the long distances of shallow depths would dampen wave energy to a negligible amount. This is why the floodplain is mapped as Zone AE and not Zone VE as is often typical for coastal flooding.

Potential inundation resulting from levee failure could damage property and structures within the Plan Area and pose a severe hazard to public safety. The probability of such failure is possible and should be considered a significant hazard, unless measures are taken to certify the levees through FEMA. In order for a levee to be certified, a levee must satisfy the following requirements:

- Freeboard - Minimum freeboard required 3 feet above the Base Flood Elevation (BFE) all along length, and an additional 1 foot within 100 feet of structures (such as bridges) or wherever flow is restricted. Coastal levees must be 1 foot above the greater of the 1% wave or maximum wave runup associated with the 100-year stillwater surge elevation.
- Embankment Protection.
- Embankment and Foundation Stability Analyses.
- Settlement Analyses.
- Interior Drainage Plan
- Flood Warning System
- Operation Plan
- Manual Backup for Automated Systems
- Periodic Inspection
- Maintenance Plan

Though several of these requirements cannot be ascertained at this level of planning, it is clear that the freeboard requirement is severely lacking. There is no point along any of the existing levees protecting the Plan Area that has sufficient freeboard to meet NFIP criteria. Some portions appear to be lacking in required freeboard by as much as 4 or 5 feet.

1.4 Groundwater

Newark Areas 3 & 4 has shallow groundwater due to the low elevations and proximity to the bay and aquifers. Portions of Area 4 have groundwater surfacing as indicated by several small ponded areas near the junction of Lines B and D. There is an Alameda Reclamation Program (ARP) well within the Plan Area, namely “Site A Well”, as shown in Figure 1-5. There are also several monitoring wells not shown.

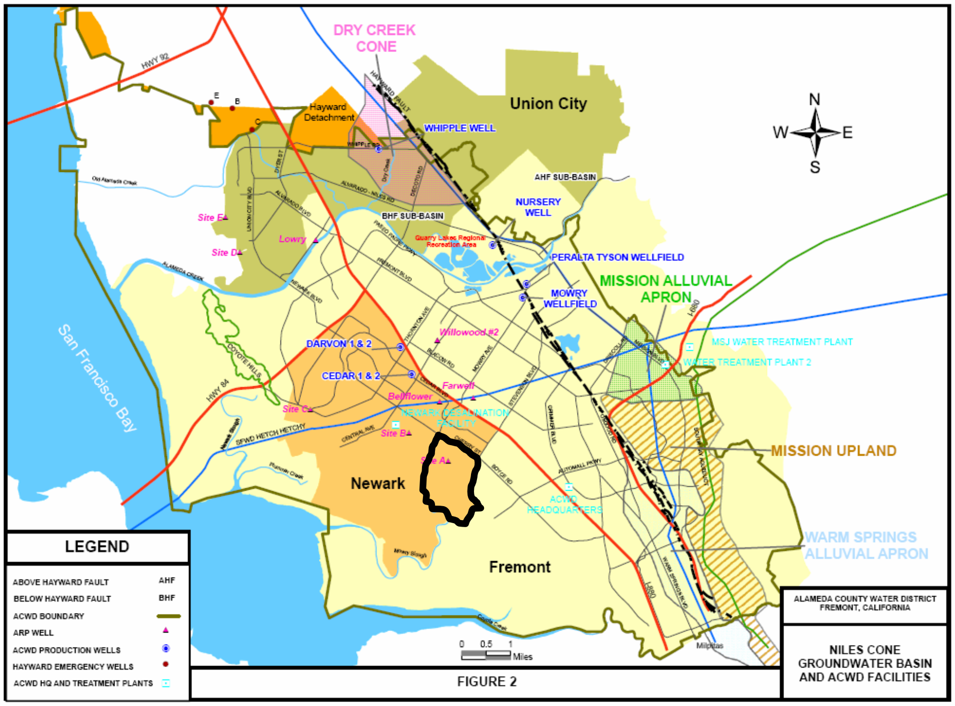

Figure 1-5: Niles Cone Groundwater Basin (source ACWD)

Newark lies within the Niles Cone Groundwater Basin which flows generally from the mountains towards the Bay. There are four different aquifers underlying the area – Newark, Centerville, Fremont, and Deep. The Plan Area overlays the aquifers in the Nile Cone Groundwater Basin as shown in Figure 1-6.

Since the Plan Area covers the most downstream portion of the aquifer, it has little to no effect on the balance of the groundwater basin. Any water recharging on the site flows into the Bay and leaves the system.

1.5 Water Quality

1.5.1 *Surface Water Quality*
Surface water quality testing results are not available for the area.

1.5.2 *Ground Water Quality*
Ground water quality is closely monitored in the Niles Cone basin. ACWD publishes a Groundwater Monitoring Report semi-annually. There are several monitoring wells on the site itself. The results of the testing at these monitoring wells, as found in the 2006 Report, for the four underlying aquifers are shown in Table 1-2.

High total dissolved solids (TDS) and chloride concentrations at the Newark wells indicate brackish water due to seawater intrusion. The TDS reading for Site Well #3 is essentially the same as ocean water (35,000 ppm) as is the chloride reading (sea water is 19,000 ppm).

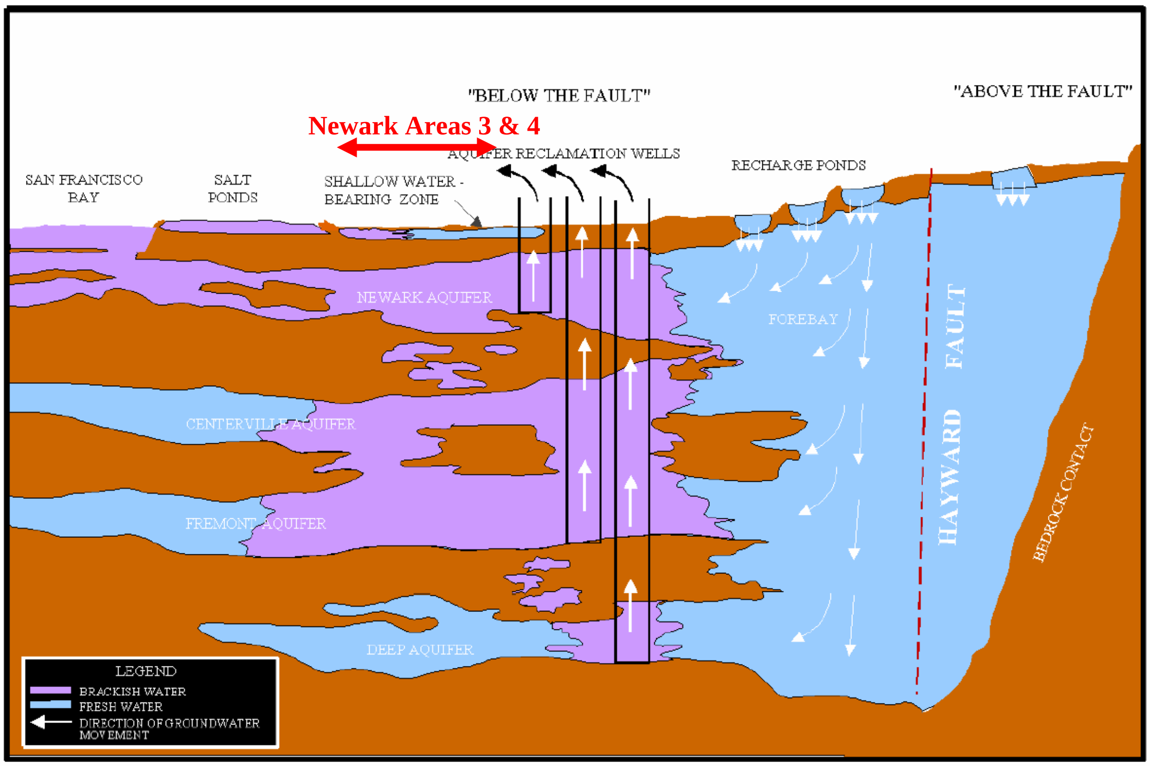

Figure 1-6: Niles Cone Groundwater Basin Cross-Section Schematic (source ACWD)

Table 1-2: Groundwater Quality Test Results (source ACWD)

Aquifer	TDS (ppm)	Chloride (ppm)
Newark (site well #1)	7,410	3,500
Newark (site well #2)	18,900	8,800
Newark (site well #3)	35,700	24,900
Centerville	540	176
Fremont	382	14
Deep	480	136

ENVIRONMENTAL IMPACTS

Approach to Analysis

The impact evaluation identifies potentially significant hydrologic impacts of the project both during project construction and at build-out, and describes mitigation measures to reduce those impacts.

Thresholds of Significance

Appendix G of the CEQA Guidelines and the Regulatory Setting requirements considers the proposed project to have a significant environmental impact with regard to hydrology and water quality if it would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete ground water supplies or interfere substantially with ground water recharge such that there would be a net deficit in aquifer volume or a lowering of the local ground water table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);
- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site;
- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site;
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- Expose people or structures to inundation by seiche, tsunami, or mudflow.

Impacts would be considered significant if the project does not meet Regional Water Quality Control Board (RWQCB) surface water and groundwater quality objectives; would cause substantial erosion and sedimentation problems; or would cause a flood hazard or exacerbate an existing flood hazard, including hazards from a seiche, tsunami, or mudflow.

Proposed Project

Area 3 of the Specific Plan consists of approximately 296 acres and is bounded by Mowry Avenue, Cherry Street, Stevenson Boulevard, and the Union Pacific railroad tracks. Area 3 includes both developed properties and undeveloped (vacant) land. Existing developed land uses on Area 3 include the City's George M. Silliman Recreation Complex, City of Newark Fire Station No. 3, Ohlone College Campus, and light industrial/commercial buildings.

Residential land uses are proposed west of Cherry Street and north of Stevenson Boulevard (Land Use Plan Sub-Area A). The Specific Plan proposes a range of residential densities, including various sizes of single family detached lot and multi-family attached residential units. Up to 189 multi-family units are proposed. An elementary school site is also proposed within the 78-acre planned residential area along Cherry Street, and the sub-area will also include park uses.

Area 4 of the Specific Plan consists of 560 acres and is surrounded by Mowry Avenue, the Union Pacific railroad tracks, the City of Newark/City of Fremont city limits (generally Stevenson Boulevard), and Mowry Slough.

Planning for the development in Area 4 has been undertaken with the intent of avoiding and minimizing impacts to wetlands to the maximum extent practicable. The land use plan for Area 4 includes up to 316 acres of potential development. Development within the land use plan may include a golf course, single-family detached houses, and neighborhood parks. The Specific Plan divides the development envelope into three sub-areas. Sub-Area D located north of the ACFC&WCD drainage canal could only have golf course or other recreational uses, or open space, but no residential development. The central area (Sub-Area C) could be developed with golf course or other recreational uses, and/or residential uses. The southern area (Sub-Area B) could be developed with residential uses, but no golf course.

The Specific Plan does not identify the exact location and configuration of residential lots, golf course, or other recreational uses, as that will be determined through subsequent entitlement processes and analyses. Consequently, the exact amount and location of wetlands which will be avoided or impacted by the development, and the configuration of the remaining agricultural areas will be determined at the time of subdivision map approval. Residential, golf course or neighborhood park use development will only occur within the Specific Plan development areas shown in Figure 1, up to a maximum of 1,260 residential units.

Sub-Area E is outside the development envelope and could be utilized for wetland preservation, wetland creation and enhancement, or remain unchanged (continued agricultural operation). Portions of Sub-Areas B, C, and D could also have areas that are not developed with residential or golf course uses that could be utilized for wetland preservation, wetland creation/enhancement or remain unchanged (continue agricultural operation).

Depending on future detailed development plans, implementation of the Specific Plan may result in filling (impacting) wetlands within the central residential/golf course plan area (Sub-Area C) and southern residential plan area (Sub-Area B). The quantity of filled wetlands could range from zero acres to 93 acres. This section evaluates the full range of potentially impacted/filled wetlands.

Analyses also assume the worst-case development depending upon the potential impact being analyzed. For instance, Sub-Area C may develop as residential units and/or golf course. If the entire sub area develops as residential, there may be more potential impact to stormwater runoff; whereas if the entire sub area is a golf course, there may be more impact in terms of short-term on-site groundwater use and therefore groundwater hydrology. Areas with no change to existing General Plan and zoning designations are indicated.

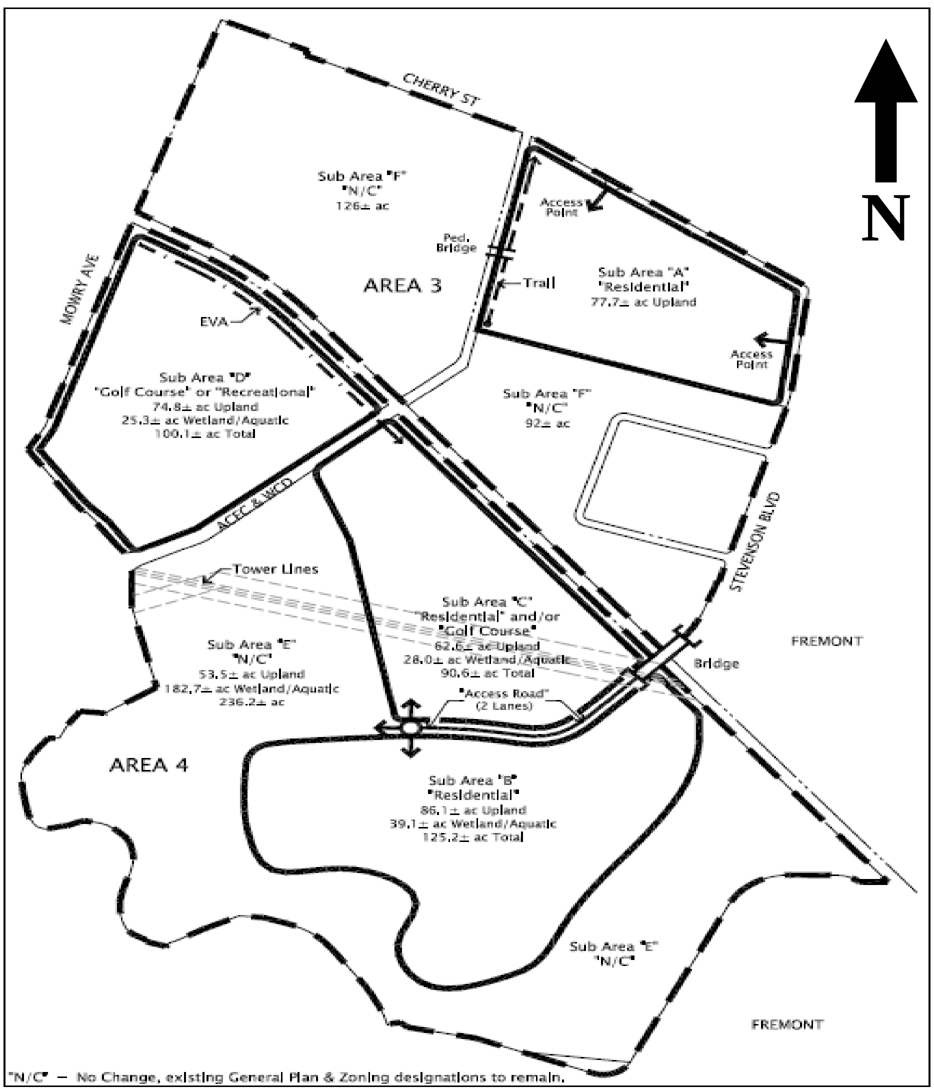

Figure 1: Land Use Diagram

Drainage Conditions – Area 3

Runoff from the existing Sub-Area A site naturally flows south, as shown in Figure 2, where it is intercepted by a drainage ditch running along the southern boundary of the property and released through dual 42-inch diameter flapgated outfalls into Alameda County Flood Control and Water Conservation District (ACFCWCD) Line D, which abuts the west side of the property.

Figure 2: Existing Drainage Basins – Area 3

This sub-area will continue to drain to the outfall after the project is completed, as shown in a conceptual grading and drainage plan (Figure 3). Newly created impervious area would likely cover about 65% of Sub-Area A, which is a typical estimate for medium density residential development. The sub-area is presently undeveloped and consists of native grasses that are occasionally disked. There will be no change to existing drainage patterns in Sub-Area F.

Drainage Conditions – Area 4

Interior runoff from Area 4 naturally flows from northeast to southwest according to the existing topography. The Southern Pacific Railroad and several internal levees are barriers that impede natural flows from either entering or leaving the site. Interior drainage is collected in ditches that run along the inboard sides of the levees, terminating at an existing pump that lifts the water 10 to 12 feet over the top of the levee where it discharges to Mowry Slough. A schematic of these drainage features is shown in Figure 4.

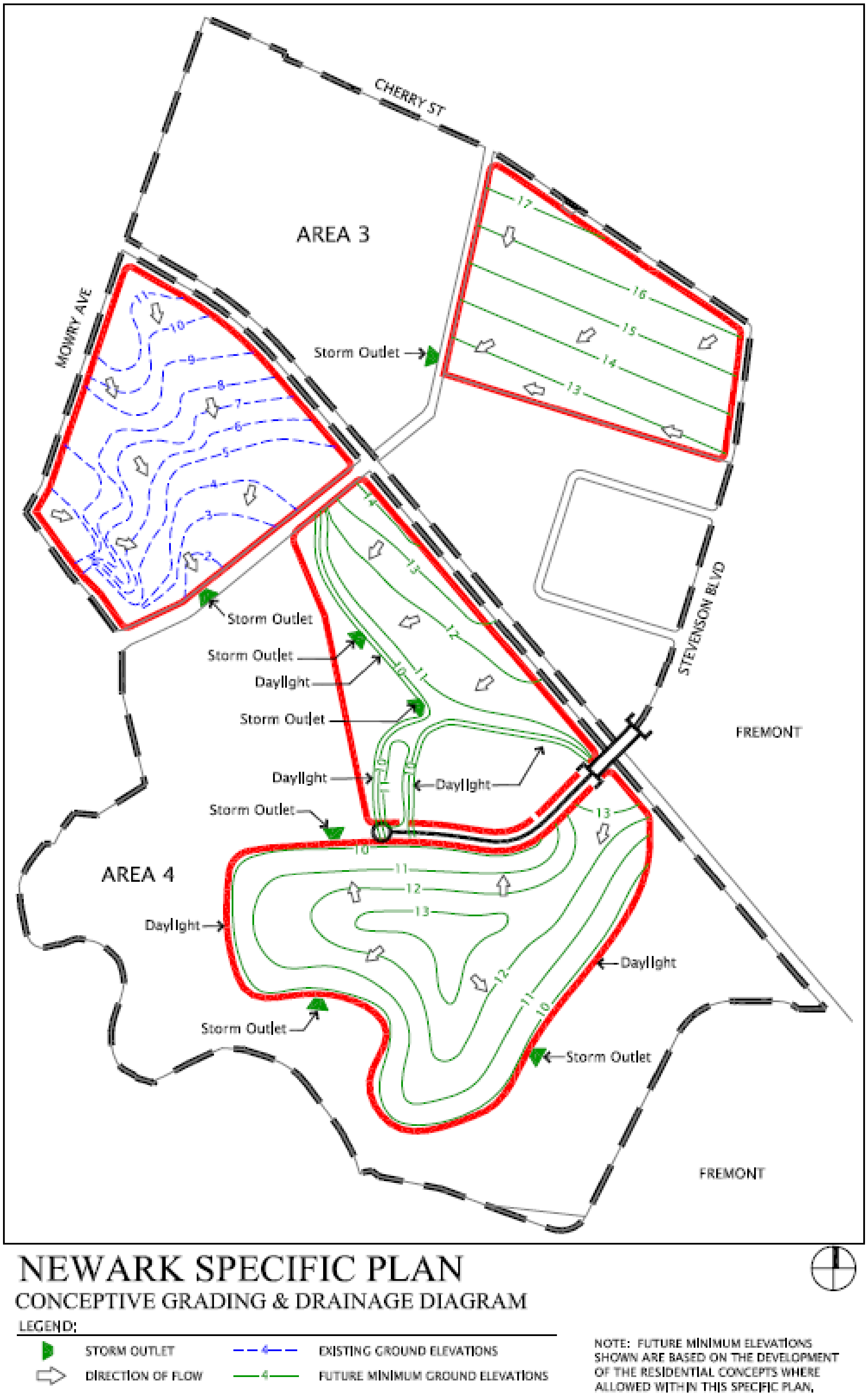

Figure 3: Conceptual Grading and Drainage Plan

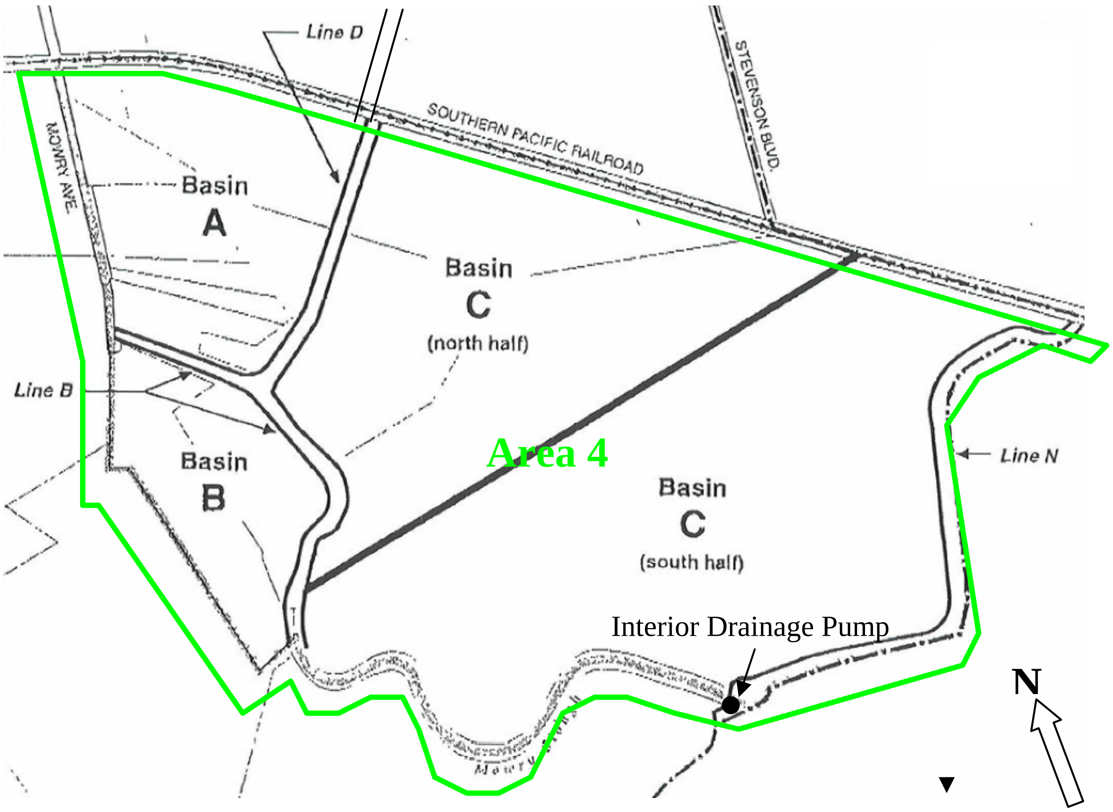

Figure 4: Existing Drainage Schematic – Area 4

Proposed development within Sub-Areas B and will be graded to drain toward Sub-Area E, which will either remain in its existing condition or be utilized for wetland preservation, creation and enhancement. Drainage patterns within Sub-Area E under any of those scenarios would be largely unchanged. Sub-Area D, whether golf course or residential, will be graded to drain directly into ACFC&WCD Line D which is tidally influenced in this reach.

Assessment of Project Impacts

The conceptual land use and grading plans previously described are utilized to assess potential project impacts against the significance thresholds outlined in Appendix G of the CEQA Guidelines.

Impact HYDRO-1 Violate Water Quality Standards or Waste Discharge Requirements

The Newark project would not violate any water quality standards as administered through the NPDES permit. The potential to increase pollutants and sedimentation will be mitigated as set forth in the required Stormwater Pollution Prevention Plan (SWPPP) and Stormwater Management Plan (SWMP) to be prepared at the time of project design. Wastewater from the project site is planned to be delivered via piped sanitary sewer lines to the sanitary sewer treatment plant, subject to the requirements of the NPDES permit and the Union Sanitary District (USD). Therefore, the project will have a ***less-than-significant impact after mitigation***.

Impact HYDRO-2 Substantially Deplete Ground Water Supplies or Interfere Substantially with Groundwater Recharge

Newark Areas 3 & 4 has relatively shallow depths to groundwater due to low ground elevations and proximity to San Francisco Bay. Portions of Area 4 experience an exposed groundwater table as indicated by several small ponded areas near the junction of Lines B and D. An Aquifer Reclamation Program (ARP) well ("Site A Well") is located within the Plan Area as shown in Figure 5. (ARP wells remove saline water from degraded portions of the aquifers.) There are also several groundwater monitoring wells that are not shown.

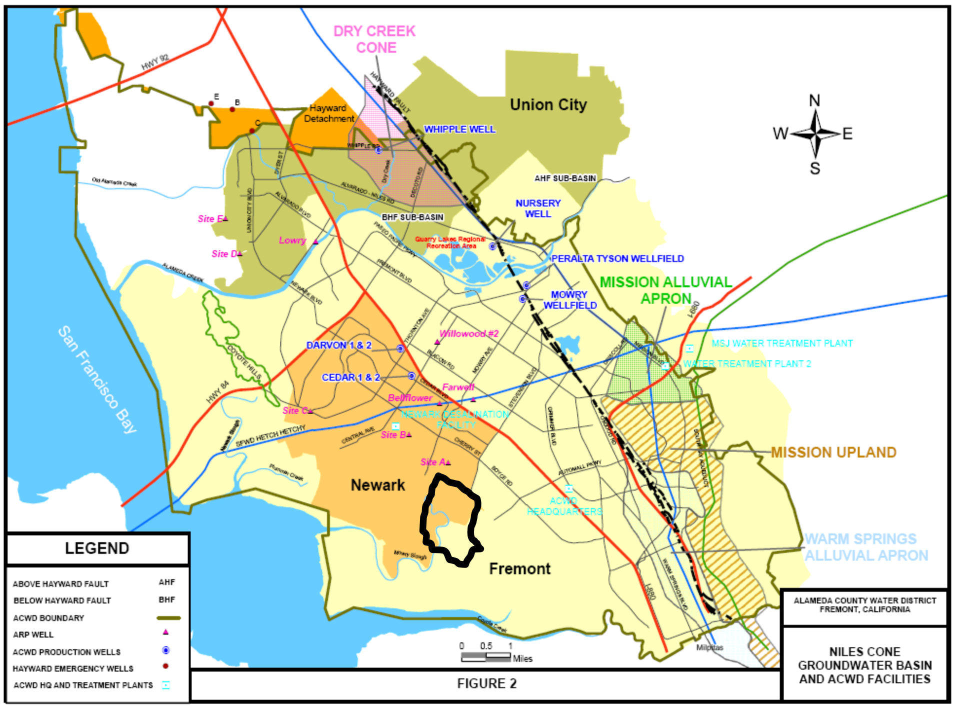

Figure 5: Niles Cone Groundwater Basin (source ACWD)

Newark lies within the Niles Cone Groundwater Basin that flows generally from the mountains toward the Bay. There are four different aquifers underlying the area – Newark, Centerville, Fremont, and Deep. The Plan Area lies over the aquifers in the Nile Cone Groundwater Basin (Figure 6).

Groundwater quality is closely monitored within the Niles Cone basin. Alameda County Water District (ACWD) publishes a Groundwater Monitoring Report semi-annually. There are several monitoring wells on the site itself. The results of the testing at these monitoring wells, as found in the 2006 Report, for the four underlying aquifers are shown in Table 1.

High total dissolved solids (TDS) and chloride concentrations at the Newark wells indicate brackish water due to seawater intrusion. The TDS reading for Site Well #3 is essentially the same as ocean water (35,000 ppm) as is the chloride reading (sea water is 19,000 ppm).

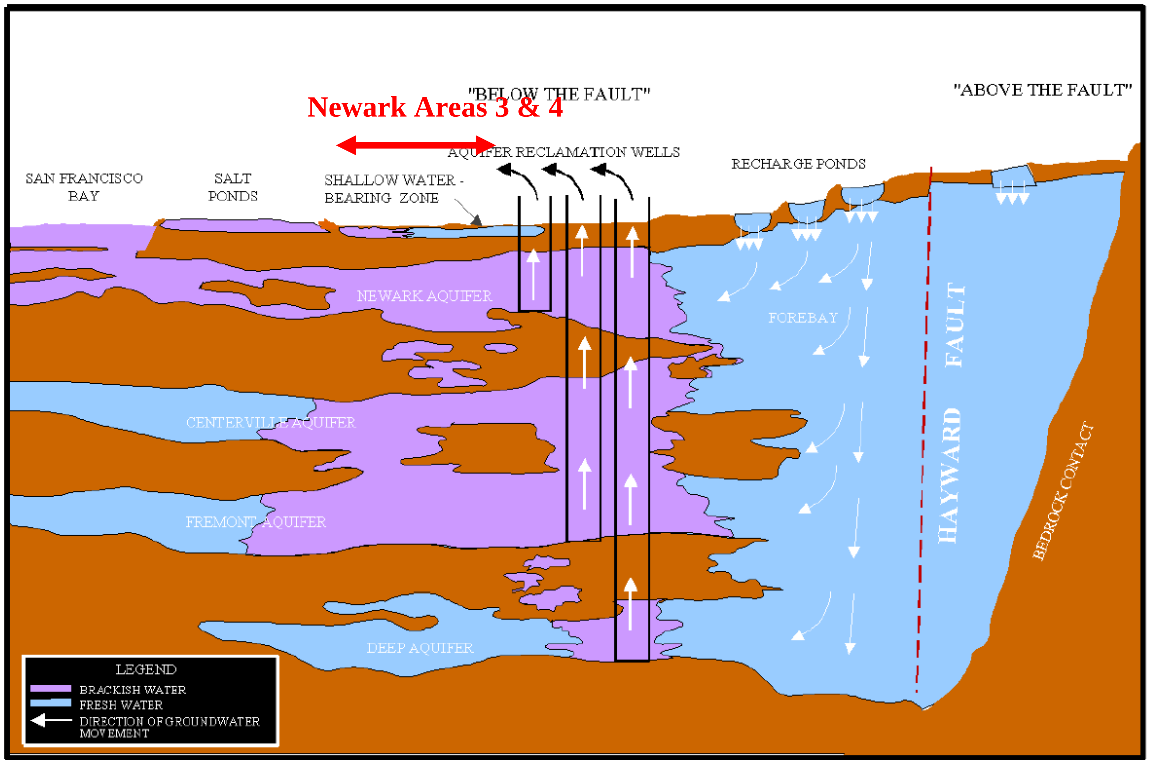

Figure 6: Niles Cone Groundwater Basin Cross-Section Schematic (source ACWD)

Table 1: Groundwater Quality Test Results (source ACWD)

Aquifer	TDS (ppm)	Chloride (ppm)
Newark (site well #1)	7,410	3,500
Newark (site well #2)	18,900	8,800
Newark (site well #3)	35,700	24,900
Centerville	540	176
Fremont	382	14
Deep	480	136

The Plan Area is downgradient from the ASR wells and adjacent to the salt ponds. The site lies over the shallow water bearing zone, which is underlain by an aquitard through which there is almost no recharge to the brackish water aquifers below and even less recharge to the deep fresh water aquifer. The primary source of recharge for the Niles Cone Groundwater Basin is local runoff from the Alameda Creek watershed, which is captured in the recharge facilities shown diagrammatically in Figure 6. These facilities are located well upstream of the Plan Area, so decreased surface soil permeability due to the Project will have no effect on groundwater recharge. The only recharge area within the Plan Area is identified as a shallow water bearing zone, which is not used for water supply.

It would be possible for the Project to impact groundwater supplies if there is an increase in water demand due to project development that would increase local groundwater pumping or place a significant burden on regional water supplies.

Estimated water demands for the golf course, residential units, new elementary school and additional building areas are included in the Water Supply Assessment (WSA) for the Plan Area. In fact the WSA describes a project with more residential units than currently planned.

Alameda County Water District (ACWD) is the water retailer whose current service area includes the Plan Area. The District's primary sources of water supply are the California State Water Project (SWP), the San Francisco Regional Water System, and local supplies from the Alameda Creek Watershed and Niles Cone Groundwater Basin (that portion that underlies the ACWD service area).

In accordance with California Water Code §10910 the ACWD completed a WSA to demonstrate the adequacy of water supplies for the Plan Area in normal hydrologic conditions and drought conditions. Development of the Plan Area was included in the most recent demand forecasts within the Urban Water Management Plan (UWMP), upon which the ACWD based its WSA. ACWD estimates a 1,100 acre-feet per year ultimate water demand for the Project. (ACWD, 2008) Once a reclaimed water supply is available, demand for potable water will be reduced to about 550 acre-feet per year. Before reclaimed water is available, the golf course will be irrigated using an existing onsite well with an estimated demand of 490 acre-feet per year. This well will draw from ACWD's managed groundwater resources in the Niles Cone without placing a burden on the District's potable water production facilities.[1]

Therefore, the project will have a ***less-than-significant*** impact on groundwater supplies or areas of groundwater recharge.

Impact HYDRO-3 Substantially Alter Drainage Patterns Resulting in Increased Erosion or Siltation

Erosion and sedimentation are concerns in both the construction and post-development phases of the Project. During construction, the removal of vegetation can create erosion potential on the site itself, although both Areas 3 and Area 4 are flat, greatly decreasing the risk. A Stormwater Pollution Prevention Plan (SWPPP) has not yet been prepared for the specific plan site but will be required before construction can begin. This plan will outline Best Management Practices (BMPs) for erosion and sedimentation control, the location of each BMP, and BMP maintenance.

The existing drainage pattern on the project site, as inferred from site topography, is dispersed overland flow concentrating to areas of lower elevation. These drainage patterns will be altered by the project. Runoff will be concentrated on the rooftops and collected into storm drain systems. The amount of overland stormwater flow on-site will likely be reduced since most of the water will be collected and carried to stormwater treatment areas in underground pipe. Overall the potential for on-site erosion from such flow should be reduced.

However, increased imperviousness creates the potential for hydromodification, which is a downstream change in runoff volume, magnitude, and duration caused by changes in land use. Flow frequency curves show the proportion of time when a flow rate is exceeded and should remain the same after development

[1] Alameda County Water District, "Water Supply Assessment for Newark Areas 3 & 4 Specific Plan EIR Project," November, 2008.

to ensure no increase in erosion or flooding downstream. Increases of flows downstream between 10% of the 2-year discharge and the 10-year discharge are considered to cause increased erosion within unstable earthen channels. The lower flow threshold corresponds to a stream flow that produces the critical shear stress that initiates bed movement or erodes the toe of stream banks. Flows below the 10-year event contribute approximately 90% of the work done on the channel boundary and thus the 10-year flow is considered to be a reasonable upper threshold for hydromodification.

Increased sedimentation due to Area 4 development will not be an issue. All runoff from Area 4 is contained on the inboard side of the levees until it reaches the pump and is discharged into Mowry Slough. Mowry Slough is tidally influenced and therefore ***exempt*** from hydromodification plan (HMP) requirements.

The outfall for Area 3 is 900 feet upstream of the railroad. Based on the HMP Susceptibility Map published by the Alameda Countywide Clean Water Program dated January 26, 2007, Line D is shown to be tidally influenced downstream of the railroad. This leaves 900 feet of channel that is said to be subject to HMP requirements, although there is no visible channel instability with respect to erosion, and in fact, the subject reach of Line D exhibits signs of sediment deposition (Figure 7).

Figure 7: Line D at Area 3 Outfall

Potential Mitigation Measure HYDRO-3

Using the Bay Area Hydrology Model (BAHM), a detention basin has been sized assuming that the 900 feet of Line D actually need erosion protection. Conditions input into the BAHM model include two different scenarios – a pre-project scenario and a post-project scenario. The post-project scenario includes the HMP basin in the calculations. Rainfall is based on the specified site location, calibrated for Alameda County. The soils are SCS Type D. The proposed land use for Sub-Area C is as shown in Figure 1, with residential development assumed to replace agricultural use. The resulting basin is roughly 6 feet deep (without freeboard) with 3:1 side slopes and a total basin footprint of 2 acres.

The basin assumes free outflow conditions (no backwater effects) at all times, as this is the assumption that BAHM makes. This is not, however, possible for this site. At 6 feet deep, the invert of the basin is at approximately 6 feet NGVD essentially matching the Line D channel invert. The 10-year water surface elevation (WSE) at the outfall is 9 feet NGVD, so whenever the WSE in the channel is higher than the WSE of the basin, no water can be released. In addition, even when the WSE in the channel is extremely low, the flapgate is large and heavy requiring considerable head to force it open. Since HMP detention regulates low flows through a series of orifices, the flows regulated by the basin outlet would be impeded by the flapgate, negating the regulating effects of the outlet structure. With these considerations, it is determined that HMP detention is infeasible for this site and should not be included in the final project design.

Overall, the project could potentially have a significant impact on off-site erosion. However, on-site mitigation is infeasible. As discussed for Impact HYDRO-4 below, it is also extremely unlikely that the increase in actual Line D discharge downstream of the Area 3 outfall would be substantial enough to change the 900 feet of earthen channel in question from a stable reach prone to deposition into an unstable reach prone to additional erosion. The impact of hydromodification due to Area 3 development on the 900-foot reach of Line D appears to be ***less than significant***. At later stages of planning, a SWPPP and a SWMP will be prepared to avoid on-site erosion, which is discussed in Mitigation Measure HYDRO-5.

Impact HYDRO-4 Substantially Alter Drainage Patterns Resulting in Increased Flooding

The potential for increased off-site flooding due to site development has been evaluated with the use of numeric models. Since the numeric model used to create the effective FEMA Flood Insurance Study is not available, new models have been created and calibrated so that the results corresponded to published FIS data. Increased on-site discharge will be mitigated by grading and drainage improvements.

The Soil Conservation Service (SCS) Unit Hydrograph Method is used per Alameda County standards. The Alameda County Type I Storm Distribution for 24-hour accumulated rainfall is assumed with a total storm depth of 3.38 inches based on a 100-year storm with a mean annual precipitation of 14 inches.

The nearest location of published 100-year discharge data for Line D is 900 feet downstream of the Area 3 outfall, at the Southern Pacific Railroad. At this location, Line D is listed as having a 100-year discharge of 940 cfs with a drainage area of 3.34 miles. As it is unclear if any drainage is able to enter Line D below the Area 3 outfall, it is assumed that these numbers would apply directly at the outfall. The model divides the drainage area into two basins – a main watershed and Area 3.

An existing conditions model has been created and calibrated by adjusting the curve number (CN) for the main watershed. CN values are chosen from the SCS National Engineering Handbook. For Area 3 (100% D-type soils), the existing condition of range (annual grass) has a CN of 74 and the proposed condition of medium density urban area has a CN of 88. The main watershed is built out with medium to high density urban land use over varying indeterminate soil types. By calibrating the existing conditions model to the published discharge, a CN of 87 is estimated for the main watershed.

Time of concentration for the main watershed is calculated by estimating the average velocity in a typical cross section through Line D. The average flow velocity is 6.3 fps. The total travel distance is approximately 25,200 feet resulting in a travel time of 67 minutes. Ten minutes are added to account for an initial roof to gutter time, creating a total time of concentration of 1.3 hours. For Area 3 the existing time of concentration is a compilation of overland sheet flow through short grass (velocity = 0.6 fps) and flow through a typical cross section of the existing ditch (velocity = 2.8 fps). The total time of concentration is 0.7 hour. The proposed condition assumes a typical storm drain velocity of 5 fps plus a roof to gutter time of 10 minutes resulting in a total time of concentration of 0.3 hour.

The existing conditions model calibrates to a peak flow in Line D of 938 cfs. (Compared to 940 cfs published.) The post-project condition model also estimates a peak 100-year discharge of 938 cfs. Since the main watershed is long and narrow and Area 3 is near the outlet of the watershed, the increased imperviousness produces a shorter time of concentration. The site discharge is increased, but the shorter time of concentration allows the peak to be discharged to Line D an hour before the peak of main watershed reaches the outfall. Therefore, the increased discharge from Area 3 does not affect the 100-year discharge in Line D.

Development in Area 4 would not impact flooding in the Plan Area or downstream of the Plan Area since the flood zone represents the 100-year tide elevation in San Francisco Bay. Augmented flows from increased impervious areas are released directly to the Bay and cannot affect Bay tides.

Overall, the project would have a ***less-than-significant*** impact to on- or off-site flooding.

Impact HYDRO-5 Create or Contribute Runoff Water That Would Exceed the Capacity of Existing or Planned Stormwater Drainage Systems or Provide Substantial Additional Sources of Polluted Runoff

Quantity of Surface Water Runoff

There is no existing storm drain utility system. An adequate system will be designed as part of the project that utilizes the existing dual 42-inch diameter outfalls in Area 3 and the pump outfall in Area 4 (although this pump may be resized and replaced). There will be a ***less-than-significant*** impact downstream of the outfalls due to the quantity of runoff as discussed in HYDRO-4 and no mitigation is required.

Quality of Surface Water Runoff

Newark Areas 3 & 4 Specific Plan development could adversely impact water quality. Pollutants and chemicals associated with urban development could run off new roadways and other transportation facilities such as parking lots and walkways. The pollutants could then flow into the drainage channels and San Francisco Bay. These pollutants could include, but may not be limited to, heavy metals from automobile emissions, oil, grease, debris, and air pollution residue. Contaminated urban runoff that remains relatively untreated could result in incremental long-term degradation of water quality.

Short-term adverse impacts to water quality may also occur during construction of the project when areas of disturbed soils become susceptible to water erosion and downstream sedimentation. This impact is of particular concern where projects are located on previously contaminated sites. Detailed soils reports will be evaluated prior to construction to determine if contaminated soils are a concern for this site. Grading and vegetation removal in proximity to drainage features could result in an increase in bank erosion, affecting both water quality and slope stability along the drainage feature.

Under existing conditions, fertilizer and organic compounds are the most likely pollutants of concern since the project site shows signs of having been used for agriculture. Given that agricultural activities would cease following project construction, the project could potentially reduce any existing organic contributions to the surface water, a benefit to water quality.

However, there are several pollutants that the project development could contribute to the surface water, including sediment and typical urban pollutants. In contrast to other potential pollutants, sediment is typically of greatest potential concern during the construction phase of development. After a project has been constructed and the landscaping has been installed, erosion and sedimentation from residential development sites are usually minimal. Pollutants other than sediment which might typically degrade surface-water quality during project construction include petroleum products (gasoline, diesel, kerosene, oil, and grease), hydrocarbons from asphalt paving, paints, and solvents, detergents, nutrients (fertilizers), pesticides (insecticides, fungicides, herbicides, rodenticides), and litter. Once the housing and roadways have been constructed, typical urban runoff contaminants might include all of the above constituents, as well as trace metals from pavement runoff, nutrients, and bacteria from pet wastes, and landscape maintenance debris. Since the drainage systems discharge directly to the wetlands or drainage channels, these pollutants could affect aquatic and wetland habitats and sensitive species. Without mitigation, the effects on surface water quality could potentially be ***significant***.

Therefore, the following mitigation measures are recommended to reduce the effects on surface quality to a ***less-than-significant*** level:

Mitigation Measure HYDRO-5

Potential construction-phase and post-construction pollutant impacts from development can be controlled below the level of significance through preparation and implementation of an erosion control plan, a stormwater pollution prevention plan (SWPPP) and a stormwater management plan (SWMP) consistent with recommended design criteria, in accordance with the NPDES permitting requirements enforced by the Regional Board. The erosion control plan forms a significant portion of the construction-phase controls required in a SWPPP, which also details the construction-phase housekeeping measures for control of contaminants other than sediment. The SWMP implements treatment measures and best management practices (BMPs) for control of pollutants once the project has been constructed. Both the SWPPP and the SWMP set forth the BMP monitoring and maintenance schedule and identifies the responsible entities during the construction and post-construction phases.

The applicant's SWPPP shall prescribe construction-phase BMPs to adequately contain sediment on-site and prevent construction activities from degrading surface runoff. The erosion control plan in the SWPPP would include components for erosion control, such as phasing of grading, limiting areas of disturbance, designation of restricted-entry zones, diversion of runoff away from disturbed areas, protective measures for sensitive areas, outlet protection, and provision for revegetation or mulching. The plan would also prescribe treatment measures to trap sediment once it has been mobilized, at a scale and density appropriate to the size and slope of the catchment. These measures typically include inlet protection, straw bale barriers, straw mulching, straw wattles, silt fencing, check dams, terracing, and siltation or sediment ponds. BMPs shall be implemented in accordance with criteria in the California Stormwater BMP Handbook for Construction[2] or other accepted guidance and shall be reviewed and approved by the County prior to issuance of grading or building permits. The applicant shall identify the SWPPP Manager who will be the responsible party during the construction phase to ensure proper implementation, maintenance and performance of the BMPs.

The applicant's SWMP shall implement post-construction water quality BMPs that control pollutant levels to pre-development levels, or to the maximum extent practicable (MEP). Neighborhood- and/or lot-level BMPs to promote "green" treatment of storm runoff shall be emphasized, consistent with Regional Board guidance for NPDES Phase 2 permit compliance. These types of BMPs include infiltration basins and trenches, rain gardens, grassy swales, media filters, and biofiltration features. Since the site has mostly D soils of low permeability and a high water table, BMPs that enhance water quality but do not rely on infiltration are most appropriate for this site. BMPs shall be designed in accordance with engineering criteria in the California Stormwater BMP Handbook for New and Redevelopment[3] or other accepted guidance and designs shall be reviewed and approved by the City prior to issuance of grading or building permits for the roadway or driveways. These types of structural BMPs are intended to supplement other storm water management program measures, such as street sweeping and litter control, outreach regarding appropriate fertilizer and pesticide use practices, and managed disposal of hazardous wastes. The applicant shall prepare a clearly defined operations and maintenance plan for water quality and quality control measures. The design and maintenance documents shall include measures to limit vector concerns, especially with respect to control of mosquitoes. The applicant shall identify the responsible parties and provide adequate funding to operate and maintain stormwater improvements (through a HOA, Geological Hazard Abatement District, CSD, CFD or similar organization). If lot-level BMPs are accepted by the City as a suitable control measure, the applicant shall establish a mechanism for enforcement to assure that BMP functioning is being maintained as designed. The applicant shall also establish financial assurances, as deemed appropriate by the Department of Resource Management, enabling the City to maintain the stormwater improvements should the HOA or other entity disband or cease to perform its maintenance responsibilities.

Impact HYDRO-6 Otherwise Substantially Degrade Water Quality

The groundwater table is shallow and exposed at the ground surface in locations throughout Area 4. Groundwater levels and saturation in the lower portions of Area 4, such as the borrow ditch along the southwestern edge, a remnant slough near the pump, and the southeastern corner of the area are affected by the elevation of stored stormwater runoff in the ditch system, which could potentially change after

---

[2] *California Storm Water Quality Association, 2003, California Storm Water Best Management Practice Handbook – Construction.*

[3] *California Storm Water Quality Association, 2003, California Storm Water Best Management Practice Handbook – New Development and Redevelopment.*

development. Therefore calculations have been made to determine the changes in pump discharge required to maintain the total volume of water in the system as occurs in the existing condition. Since Area 4 is a hydrologically closed system excepting Sub-Area D which drains directly to ACFC&WCD Line D, the total volume of water stored in the system is determined primarily by the volume of water pumped into Mowry Slough. Any change in volume or discharge can be mitigated by a commensurate change in the pumping rate.

Volumes of 24-hour runoff for various storm frequencies are calculated before and after project completion assuming the greatest potential change in runoff coefficient. That is Sub-Area C is assumed to develop with residential units in lieu of golf course. The difference between post-project and pre-project runoff volume remaining in the low elevations of Area 4 could be mitigated by altering the pump flow. The basic volume calculation is:

$$Volume = (C)(A)(P)$$

where C is a volumetric runoff coefficient (Table 3)

A is the tributary area

P is the 24-hour statistical rainfall depth (Table 4)

The volumetric runoff coefficient is based on runoff coefficients for the Rational Method, but modified to provide a better estimate of runoff volume since the Rational Method is intended for peak flow rate calculations, not for the calculation of runoff hydrographs or flow volumes. For weighted runoff coefficients less than 0.70, 0.15 is added to develop a coefficient for runoff volume computations.[4] Runoff coefficients for D-type soils from the Santa Clara County Drainage Manual (2008, Table 3-1) are used in the weighting process. The Alameda County Drainage Manual is not used because it does not contain procedures for volume calculations. Due to Newark's close proximity to Santa Clara County, it is assumed that values used in the calculations appropriately reflect conditions at the site.

Existing conditions with wetlands and open space are considered to be equivalent to "shrub land" with D-types soils. Developed areas are considered to be "medium density residential". The runoff coefficients are adjusted as described above for volume calculations as shown in Table 2.

Table 2: Existing Runoff Coefficients

	Runoff Coeff.	C for Volume Calculation
Shrub Land (Open)	0.30	0.45
Medium Density Residential (Developed)	0.60	0.75

Rainfall statistics prepared by the Santa Clara Valley Water District are used to establish the 24-hour rainfall depth using the formula:

$$P = A + B(MAP)$$

[4] Santa Clara County Drainage Manual (2008), page 64.

where A and B are statistically derived coefficients and MAP is the mean annual precipitation (14 inches at the project site). Table 5 summarizes the runoff volume and required pump capacity change calculations.

Table 3: Runoff Volume Coefficients for Post-Project Conditions in Area 4

	Area Open (acres)	Area Developed (acres)	% Developed	Weighted C
Existing Condition	452.0	0	0%	0.45
Post-Project Condition	236.2	215.8	48%	0.59

Table 4: Precipitation Depth (inches)

Return Period	A	B	P
2-yr	0.314185	0.096343	1.66
10-yr	0.567017	0.162550	2.84
25-yr	0.675008	0.195496	3.41
100-yr	0.814046	0.243391	4.22

Table 5: Runoff Volume Calculations

Return Period	P (inches)	Volume (ac-ft)		Reqd. Pump Capacity Increase for No Change in Ponded Elevation (gpm)
		Existing	Post-Project	
2-yr	1.66	28	37	2,020
10-yr	2.84	51	63	2,750
25-yr	3.41	58	76	4,030
100-yr	4.22	72	94	4,930

The maximum increase in pump capacity required to maintain existing levels of inundation within the interior ditch system is less than 5,000 gpm, which is a relatively nominal increase in pumping capacity. A simple adjustment to the level controls might also be made to slightly increase the volume of water that can be stored in the ditches. It may even be determined that the increase in ditch inundation could benefit groundwater saturation and potentially the quality of nearby groundwater driven wetlands and that the pump outflows should not be increased. For either plan, surface water runoff volumes increase, showing that the wetlands would not be in danger of water quality degradation or outright starvation. In addition, care has been taken in the site plans to ensure that wetlands are hydraulically connected to each other to prevent water starvation within any part of the wetlands.

Proposed golf course development has not been analyzed in numeric detail since the Alameda County Drainage Manual indicates identical runoff coefficient values for both undeveloped land and golf courses, and there would be no change in runoff volumes due to development.

In conclusion the project would not otherwise substantially degrade water quality.

Impact HYDRO-7 Place Housing within a 100-Year Flood Hazard Area

The effective FEMA Flood Insurance Rate Map (FIRM) dated February 9, 2000 shows a susceptibility to flooding for most of Area 3 and Area 4. The flood hazard through the development area of Area 3 is classified as shaded Zone X, indicating that the shaded area has shallow flooding of less than 1 foot for the 100-year base flood or is prone to 500-year flooding. Available information suggests that the shaded Zone X designation represents shallow 100-year flooding since the limits match daylighted Base Flood Elevations (BFEs, or contours of equal 100-year flood elevations) from Zone AE channel flooding using existing topography. Area 4 is largely covered with a Zone AE of elevation 8 feet NGVD. This indicates tidal flooding from San Francisco Bay. The FIRM is shown in Figure 8.

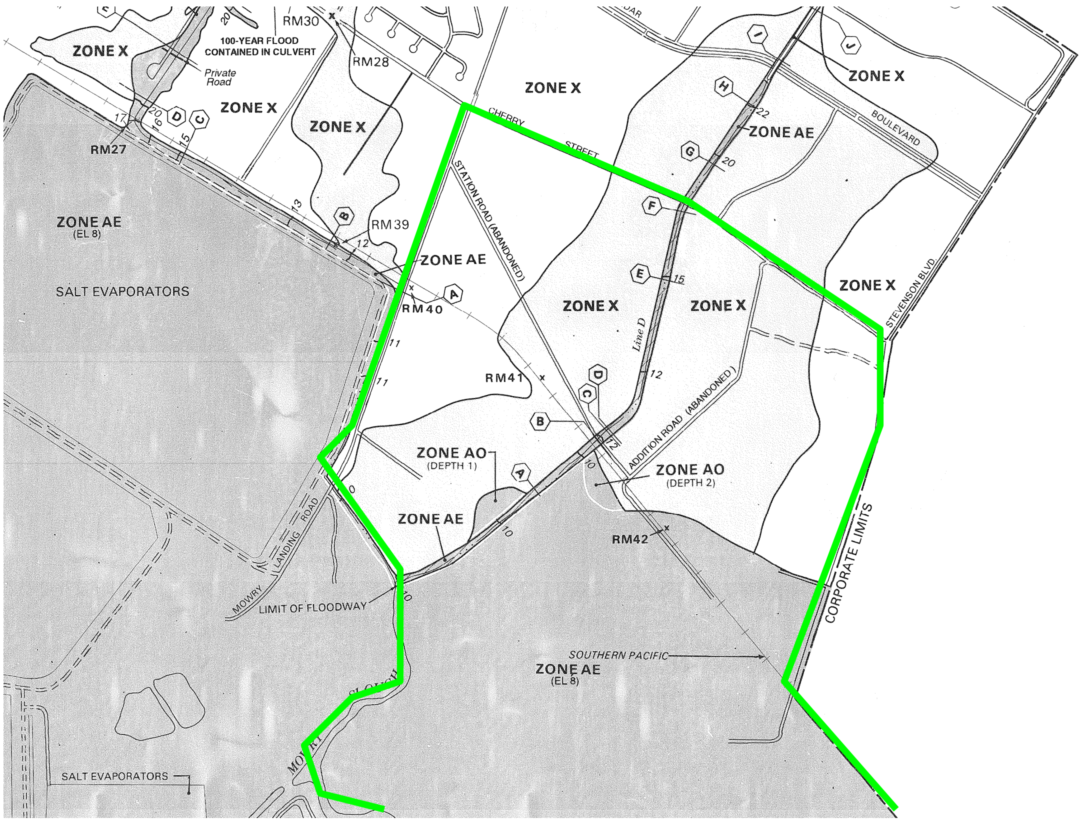

Figure 8: FIRM Effective February 9, 2000

Mitigation Measure HYDRO-7

All housing will be placed on fill above the specified base flood elevation for each area whether or not any levees fail. This will remove the significant risk of loss due to flooding. Therefore, the project would have a ***less-than-significant impact after mitigation***.

Impact HYDRO-8 Place within a 100-year Flood Hazard Area Structures that Would Impede or Redirect Flood Flows

As mitigation from Impact HYDRO-7, Area 3 will be graded so that all building pads will be above the BFEs mapped for ACFCWCD Line D. The fill would not affect mapped flood hazards upstream or downstream of the project site. In order for offsite flood elevations to be increased, the development would have to block the active conveyance of flood flows. Both the upstream and downstream boundaries of the property are already blocked in terms of flood conveyance for Line D; upstream by a large berm and neighboring development, and downstream by a solid concrete wall. These blockages largely remove active flow conveyance through the site (which is characterized by flooding less than a foot deep) outside of the channel itself. Therefore, proposed fill does not significantly change active flow conveyance through this reach of Line D. Fill placed within Area 4 will not impact flooding in the area or downstream since the impedance of tidal conveyance cannot influence the water surface elevation in San Francisco Bay. Therefore, the project would have a ***less-than-significant*** impact on the impedance of flood flows.

Impact HYDRO-9 Expose People or Structures to a Significant Risk of Loss, Injury or Death Involving Flooding, Including Flooding as a Result of Levee or Dam Failure

As discussed in HYDRO-7, all housing pads are placed above the 100-year base flood elevation, which assumes outboard levee failure. Therefore people and structures have not been exposed to additional flood risk due to the failure of these outboard levees and the impact is ***less than significant***.

Based on the Dam Failure Inundation Map for Fremont/Newark published by the Association of Bay Area Governments (ABAG) as shown in Figure 9, most of Fremont and Newark, including the project site, would be inundated if any of the upstream reservoirs (Calaveras, Del Valle or Turner) fails.

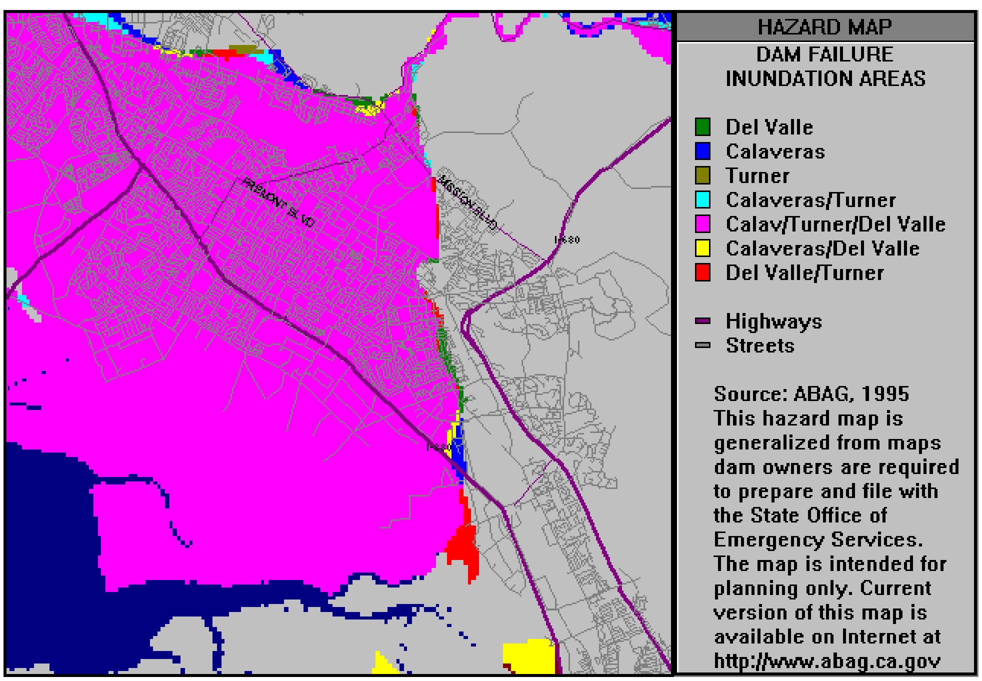

Figure 9: Dam Failure Inundation Map

All of these dams fall under the jurisdiction of the California Division of Safety of Dams. The Division inspects each dam on an annual basis to ensure the dam is safe, performing as intended, and is not developing problems. All of the dams are classified as high hazard dams, because their failure would result in a significant loss of life and property damage. Calaveras Dam is owned by the SFPUC. This hydraulic fill dam completed in 1925 was deemed seismically unsafe and the maximum reservoir level was lowered to a safe level in 2001. The dam will be replaced and construction is scheduled to begin Spring 2009. Del Valle Dam is owned by the California DWR. It is an earth fill dam built in 1968. James H. Turner Dam is owned by the SFPUC. It is also an earth fill dam, completed in 1964.

Calaveras Dam is the only dam of the three dams contributing to Newark's inundation hazard area with widely available documentation indicating a higher than normal risk of failure and the SFPUC has taken short term and long term steps to mitigate that risk.

Impact HYDRO-10 Expose People or Structures to Inundation by Seiche, Tsunami or Mudflow

The resonant oscillation of water in an enclosed body of water is a seiche. The San Francisco Bay is considered to be an enclosed body of water and is in the general vicinity of Area 4. However, there are several levees between the bay and the site that would dampen any effects of the seiche.

The Association of Bay Area Governments (ABAG) produces Tsunami Evacuation Maps for the Bay Area. A map does not exist for Alameda County. Therefore, it is assumed that tsunamis would not impact Alameda County and thus not affect the site.

Landslides and mudflows tend to occur in steeply sloped areas. The project site flat and is not down-slope of any steeply sloped areas. ABAG Hazard Maps for both Landslide and Debris Flow show that the project site is located neither within an identified landslide or mudflow hazard area nor near one.

Therefore, the project would have a ***less-than-significant*** impact with regards to inundation by seiche, tsunami or mudflow.

CUMULATIVE IMPACTS

This section analyzes potential cumulative hydrologic and water quality impacts that could occur from the combination of the proposed project with other reasonably foreseeable projects in the near vicinity. CEQA’s concept of a cumulative impact is a change in the environment that results from adding the effects of the project to those effects of cumulative projects in the project vicinity. A cumulative impact related to hydrology would be an impact caused by the project that, when added to impacts of related past, present, and probably future projects, would rise to the level of significance.

The watershed upstream of Area 3 is completely urbanized. Therefore, future projects would entail redevelopment and would not be expected to significantly impact area hydrology. Area 4 is a closed hydrologic system and outfalls directly to San Francisco Bay. Future projects will not create a cumulative flooding impact since tidal influences rule and as long as any project complies with City, State and federal regulations regarding water quality within existing land use designations there should be no cumulative water quality impact on Mowry Slough or San Francisco Bay. There would be a ***less-than-significant*** cumulative impact associated with hydrologic and water quality impacts.

Climate Change Predictions

It is understood that carbon dioxide and other anthropogenic (i.e. manmade) green house emissions act as heat trapping greenhouse gasses, which increase troposphere temperatures. Climate change refers to an identifiable change in the state of the climate that persists for an extended period of time. The use of the phrase 'climate change' does not necessarily distinguish whether changes are due to natural processes versus human activity. It should be noted that many of the impacts of global warming occur quite slowly. Thus, even if carbon emissions are stabilized or greatly reduced in coming years, some impacts such as sea level rise will continue to occur, albeit potentially at a slower pace than predicted by most global climate change models. The Intergovenmental Panel on Climate Change is tasked with gathering, reviewing, and synthesizing the multitude of published studies on climate change.

The range of best estimate likely temperature increases by the year 2099 is 0.6 – 4.0 degrees Celsius (1 to 7 degrees Fahrenheit), depending on the global climate model utilized.[5] Scaled climate models for northern California estimate global temperature increases up to 4.5 degrees Celsius (9 degrees Fahrenheit) by 2100.[6] This increase in global temperatures may have multiple impacts on hydrology and water quality in Newark, even if the changes in local and regional temperatures are not yet known.

<u>Sea Level Rise</u>

One of the most publicized impacts of global warming is sea level rise. Depending on the emission scenario used, the predicted likely global sea level rise ranges from 0.18 – 0.59 meters (Kundzewicz, 2007), or 0.6 – 1.9 feet by the year 2099. (The upper limit of this range is lower than the upper range stated in previous IPCC reports.) The two primary factors affecting global sea level rise are thermal expansion of ocean waters due to increased atmospheric temperature, and melting ice.

Regional, scaled down analyses that aim to predict mean sea level rise for the North American West Coast at times predict greater sea level rises, up to 76 cm (2.4 feet) by 2100 (Cayan, 2007;) or fall within the range predicted by the IPCC 2007 Assessment Report.[7] Both the San Francisco Bay Conservation and Development Commission and the California Department of Water Resources reports give a higher value

---

[5] Kundzewicz, Z.W., L.J. Mata, N.W. Arnell, P. Döll, P. Kabat, B. Jiménez, K.A. Miller, T. Oki, Z. Sen and I.A. Shiklomanov, 2007: Freshwater resources and their management. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 173-210.

[6] Cayan, D. R., Maurer, E. P., Dettinger, M. D., Tyree, M., and Hayhoe, K., 2008: 'Climate change scenarios for the California region', Climatic Change, 87, Suppl. 1, 21–42 doi: 10.1007/s10584-007-9377-6.

[7] Hayhoe, K. et al., 2004: 'Emission pathways, climate change, and impacts on California', PNAS, V.101 N.43, 12422-12427.

for the upper range of sea level rise (4.6 feet) over the next century although source information for these values is not provided.

Given this range of predicted mean sea level rise, many local agencies and seem to have adopted a ‘rule of thumb’ value of either three feet or one meter (3.3 feet) of expected sea level rise by 2100 for discussion and analyses. Confidence in these predictions decreases the further into the future the analysis is projected, due to unknowns about future emission scenarios or potential climate feedback loops.

During storm events, ocean water increases in elevation due to low barometric surface pressure. This phenomenon is called storm surge. The one-percent storm surge for San Francisco Bay at Newark Slough is 7.5 feet NGVD, compared to a mean high tide of about 4.4 feet NGVD.[8] Wave runup is the elevation wind-driven waves will reach as waves break on land, which is not anticipated to be an issue within the Plan Area. Both storm surge and wave runup may be affected by global warming. However, these impacts are not particularly well understood at this time. Extreme wave heights and surge fluctuations tend to increase from the south to the north along California Coast, as a result of increasing storm intensities along the northern coast (Cayan, 2007).

The one-percent storm surge in San Francisco Bay at Newark represents is 3.1 feet. It is likely that the incidence of extreme high sea level has increased at a broad range of sites worldwide since 1975. The occurrence of hourly observed high sea levels (above the 99.99th percentile thresholds) in San Francisco Bay has increased sharply since 1969. The maximum observed sea level has also increased since that time, although the period of 1987-2004 had a slightly lower peak sea level than 1969-1987. Recent studies have concluded that if sea level rise is on the lower end of the current predicted ranges, the occurrence of extremely high sea level events will increase, but the increase in extremes would be not so different from the increasing trend that has been seen in California for the past several decades. If, however, sea level increases reach the higher end of the range, extreme events would increase not only in their frequency but also their duration, substantially beyond the historic trend seen in the 19th and 20th centuries (Cayan, 2007).

In short, it is expected that as sea levels rise, not only will the occurrence of high sea level, or surge, events increase, but so may the amount of surge itself (currently about 3.1 feet above mean-high high water in Newark). Fill will be placed within the Plan Area to a minimum elevation of 11.25 feet NGVD, providing 3.75 feet of freeboard above the current one-percent stillwater elevation and 3.25 feet of freeboard over the regulatory base flood elevation of 8 feet NGVD. If the predicted likely scenario of a 2 feet rise in sea level with an accompanying rise in extreme storm surge comes to fruition by 2099, absent settlement the placed fill would then provide 1.75 feet of freeboard. However, quantitative estimates for the increased storm surge have not been made, and are unlikely to be determined in the foreseeable future.

<u>Precipitation</u>

[8] U.S. Army Corps of Engineers, San Francisco District, “San Francisco Bay Tidal Stage vs. Frequency Study,” October 1984.

Long term historic analyses of precipitation in the state of California show that there is no statistically significant change in total annual mean precipitation from 1890 through 2000, although the variability of total rainfall in any given year appears to have an increasing trend.[9]

While the total annual mean precipitation is not predicted to change significantly, the timing and intensity of storm events is expected to change, with a tendency in California for a modest increase in the number and magnitude of large precipitation events, with longer dry periods between events. (Cayan, 2007) Climate models predict (and historic records reflect) that proportionally less rainfall will fall during spring and summer months (April – July) and more in winter months (November – March) in northern California due to global climate change (Cayan 2007; DWR 2006). These shifts in precipitation timing and intensity may have impacts on flooding and water supply, as discussed in more detail below.

<u>Flooding</u>

The paragraphs above detail the expected changes and uncertainties of sea level increases, storm surge and precipitation. Together, these factors may have significant impacts to the flooding risks in the Plan Area. That said, an understanding and consensus of how climate change will affect extreme events has yet to be determined, and this has been identified as one of the key uncertainties in the IPCC 2007 Assessment Report. While quantitative values for sea level increases exist, there are very few predictive values for increased storm surge.

It is unknown whether the net effect of changes in precipitation timing and intensity will result in an increase of local runoff in Alameda County. Although precipitation events are expected to be more intense, they are also expected to be spaced father apart. A longer period between storms would allow for drying of the watershed. Currently, runoff estimates for extreme storm events assume that soils are at a certain level of saturation. If the soils have the opportunity to dry between storm events, this may offset the increased precipitation intensity such that there is little or no net effect on runoff. Local reservoir operation may also need to be updated to reflect changing patterns in precipitation timing and intensity.

Flooding from San Francisco Bay and the creeks discharging to the Bay are likely to be the primary aspect of increased flood risks to Newark due to global warming. Due to the wide ranges and remaining uncertainty in predicted long term sea level increases, storm surge, and wave runup, it is not feasible to presently mitigate for this unknown risk. There is no agreed upon final elevation or amount of freeboard that would be appropriate. In general, sea level rise is expected to occur gradually, offering a long time horizon for planning and implementation strategies for mitigation. That said, its rise is also inevitable, given the long scale process of thermal expansion that accounts for the majority of sea level rise. Planning for the long term eventuality of higher mean sea levels, increased storm surge and wave runup in a flexible and time-scale appropriate approach is recommended.

Newark's Municipal Code calls for residential structures to be "elevated to or above the base flood elevation or to a minimum of six inches above the building pad which shall be at a minimum elevation of

[9] State of California the Resources Agency Department of Water Resources, July 2006: 'Progress on Incorporating Climate Change into Management of California's Water Resources', Technical Memorandum Report.

11.25 feet on the National Geodetic Vertical Datum (NGVD), whichever affords the greater degree of flood damage protection.” With an additional 0.5 foot added to the 100-year (tidally driven) flood elevation of 8 feet NGVD, the Municipal Code’s minimum building pad elevation would still afford the greater degree of flood damage protection, and would exceed the current NFIP coastal freeboard criterion for stillwater surge of 2 feet.

LEVEL OF SIGNIFICANCE AFTER MITIGATION

Impacts after mitigation would be ***less-than-significant***.

NEWARK AREAS 3 & 4
CLIMATE CHANGE IMPACT ADDENDUM

Introduction

In February 2009 Schaaf & Wheeler presented potential climate change impacts to the City of Newark (City) as a part of the cumulative impacts section of an Administrative Draft Environmental Impact Report (ADEIR) for Newark Areas 3 and 4 (Project). This discussion focused on the current status of climate change understanding, research, and projections, and how these projected changes may impact the Project. The ADEIR concluded that the only readily quantifiable cumulative impact is sea level rise, noted the uncertainty in sea level rise predictions, and found that although anticipated sea level rise might reduce freeboard afforded by Project fill, the Project itself should not be in jeopardy from 100-year tidal flooding.

Since the completion of the ADEIR, several additional studies have been published, many of which focus on climate change projections and impacts to California. The purpose of this report addendum is to present findings from the updated studies with emphases on new information contained therein, and to revise the anticipated impacts, conclusions, and recommendations as warranted by the additional studies.

Most of these updated studies are from the California Climate Change Center (CCCC). Established in 2003 by the California Energy Commission's Public Interest Energy Research (PIER) Program to document climate change research relative to the state, core research activities take place at the Scripps Institution of Oceanography and the University of California, Berkeley, complemented by efforts at other research institutions. The CCCC Report Series, which make up the majority of updated studies reviewed for this addendum, detail ongoing center-sponsored research. Priority research areas defined in PIER's five year climate change research plan are: monitoring, analysis, and modeling of climate; analysis of options to reduce greenhouse gas emissions; assessment of physical impacts and of adaptation strategies; and analysis of the economic consequences of both climate change impacts and the efforts designed to reduce emissions.

Reports reviewed for this addendum include:

- Water Resource Policies and Authorities Incorporating Sea-level Change Considerations in Civil Works Programs (United States Army Corps of Engineers, July 1, 2009);
- Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment (California Climate Change Center, August 2009);
- Using Future Climate Projections to Support Water Resource Decision Making in California (California Climate Change Center, August 2009);
- Projections of Potential Flood Regime Changes in California (California Climate Change Center, August 2009);
- The Impacts of Sea-Level Rise on the California Coast (California Climate Change Center, August 2009); and
- 2009 California Climate Adaptation Strategy, Public Review Draft (California Natural Resources Agency, August, 2009).

All of the above reports have been published by the respective agencies sponsoring each report, and as such have not necessarily undergone the peer-review process required for publication in scholarly journals. All of the California Climate Change Center (CCCC) reports include a preface which clarifies that the report presents interim project results, and information contained within the reports is subject to change.

This addendum is formatted to generally repeat the sections of the ADEIR. However, only relevant new or updated information is presented.

Current Status of Climate Change Understanding and Research

This addendum to the ADEIR updates the current status of climate change understanding and research to October 2009. Several reports which specifically focus on climate change projection and impacts to the State of California have been published since the ADEIR was prepared. While this addendum offers an updated summary of these projections and impacts, it should be noted that uncertainty is an inherent quality of any climate change projections, becoming more uncertain the farther into the future these projections are forecast.

Climate Change Impacts to Water Resources in Newark, California

The study reports listed above include updated projections and impacts relevant to sea level rise, storm surge and wave height, precipitation, and flooding. Temperature change, water supply and water quality projections and impacts are not significantly different as a result of this updated review, and as such those discussion topics from the ADEIR are not included in this addendum. This should not be construed to imply that these issues are any less of a concern, only that those concerns are not affected by the reports reviewed for this addendum.

Only relevant updated information for sea level rise, storm surge, precipitation, and flooding are discussed herein. A more general background on the projections and impacts of these parameters can be found in the ADEIR.

Sea Level Rise

Two of the above listed reports deal directly with sea level rise projections, and their incorporation into general project planning. Each of these reports is described in more detail below.

The United States Army Corps of Engineers (USACE) published an engineering circular (July 1, 2009) to direct the consideration of sea level rise estimates in project planning and design. While this methodology is required only for USACE civil work activities, it offers a valuable guidance for any planning effort. In summary, the USACE report recommends that the planning, engineering and designing for projects within the tidal zone or with downstream tidal boundary conditions consider how sensitive and adaptable the project is to a range of sea level rise estimates (low, intermediate and high). Specifically, the USACE directs determination of "how sensitive alternative plans and designs are to these rates for future local mean sea-level change, how this sensitivity affects calculated risk, and what design of operations and maintenance measures should be implemented to minimize adverse consequences while maximizing beneficial effects".

The "low" sea level rise estimate recommended by the USACE report is based on local historic tide gauges. In San Francisco, the Presidio tide gauge has the longest period of record and is consistently used for historic sea level trends in San Francisco Bay. The long term average sea level rise at the Presidio gauge is 2.01 millimeters per year (mm/yr), with a 95% confidence limit of plus or minus 0.21 mm/yr (NOAA, Station

9414290). "Intermediate" and "high" sea level rise estimates are based on the National Resource Council (NRC) curves and equations developed for a 1987 Report (*Responding to Changes in Sea Level: Engineering Implications*), modified to account for the updated annual estimate of sea level rise made in the 2007 IPCC report, and manipulated to include consideration of the date of the equation development. The "intermediate" sea level rise projection is based on the modified NRC Curve I, and the "high" sea level rise projection on the modified NRC Curve III. This equation is:

$$E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2)$$

where:

t_1 = time between construction date and 1986;

t_2 = time between date at which sea level rise projection is desired and 1986;

$E(t)$ = eustatic sea-level, in meters, as a function of (t);

b = Variable; 2.36E-5 for modified NRC Curve I and 1.005E-4 for modified NRC Curve III.

Table 1 presents the range of sea level rise potential for the City of Newark using this methodology, assuming adoption of the Presidio gauge for the local historic sea level trend, and construction of a given project in 2010.

Table 1: Range of Sea Level Rise Projections Using USACE Methodology with Presidio Gage and 2010 Construction Year

USACE Methodology Sea Level Rise Projection Range (feet)			
Year	**Low**	**Intermediate**	**High**
2025	0.1	0.2	0.4
2050	0.3	0.5	1.4
2075	0.4	0.9	2.8
2100	0.6	1.5	4.6

A draft version of the *Impacts of Sea-Level Rise on the California Coast*, developed by The Pacific Institute for the CCCC was released in March 2009, with much publicity surrounding the new 2100 sea level rise estimate of "5 feet" (March 12, 2009 *San Francisco Chronicle* article). The development of this sea level rise estimate is presented in somewhat more detail, however, in the *Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment* Report (August 2009), also produced for the CCCC. In short, the sea level rise estimates adopted by the CCCC are based on an empirical formula developed by Rahmstorf (2007) which relates global mean sea level rise to global mean surface air temperature. The report states (and shows graphically) that the Rahmstorf predicted values are then manipulated to include the impact of reservoirs and dams, but exactly what this modification entails, and its justification, is unclear. The supporting article for this modification, *Impact of Artificial Reservoir Water Impoundment on Global Sea Level*,[1] appears to focus on the impact of reservoir and dam storage to historic sea level trends, and Schaaf & Wheeler is unable to locate any published article which details a modified Rahmstorf method.

Using the above methodology, the 2009 Assessment Report gives a range of sea level rise of 30-45 cm (12 – 18 inches) by 2050 (relative to 2000 levels). Although other CCCC reports, as well as the San Francisco Bay Conservation and Development District have adopted a 2100 sea level rise projection of 1.4 meters (4.6 feet), this projection is not explicitly stated in the text of the 2009 Assessment Report (it can only be deduced from included graphs). It should be noted that the range of sea level rise estimates produced from this methodology is about 0.6 m – 1.45 m (2.0 – 4.8 feet). The 4.6 feet of rise by 2100 predicted at the upper end of this range is similar to the USACE methodology high range for 2100 for San Francisco Bay, as shown in Table 1.

In summary, significant uncertainties remain in sea level rise projections, particularly as one forecast's farther into the future. The most current available estimates for sea level rise by 2050 range from 0.3 foot to 1.5 feet, and by 2100 from 0.6 foot to 4.8 feet.

<u>Storm Surge and Wave Runup</u>

Updated reports repeat the general trend of increasing extreme high sea levels (surge) presented in the ADEIR. In short, it is expected that as mean sea level rises, not only will the occurrence of high sea level, or surge, events increase, but so may the amount of surge itself (currently about 3.1 feet above mean-higher high water in Newark). This increased storm surge elevation will decrease project freeboard in Newark; however quantitative estimates for the increased storm surge have not been made, and are unlikely to be determined in the foreseeable future.

[1] Chao, B.F., Wu, Y.H., Li, Y.S., April 11, 2008: 'Impact of Artificial Reservoir Water Impoundment on Global Sea Level', Science Magazine, Volume 320, pp. 212-214.

In general, wave runup in San Francisco Bay is a function of local bathymetry and wind patterns, which are not well-captured by regional climate models. Discussed in more detail below, 'storminess' trends due to climate change are uncertain and differ in both magnitude and direction in different reports. As such, this addendum makes no changes to the findings presented in the ADEIR.

Project Impact from Projected Sea Level Rise

The one-percent storm surge for San Francisco Bay at Newark Slough is 7.5 feet NGVD, compared to a mean high tide of about 4.4 feet NGVD.[2] Wave runup is the elevation wind-driven waves will reach as waves break on land, which is not anticipated to be an issue within the Plan Area. Both storm surge and wave runup may be affected by climate change. However, these impacts are not particularly well understood at this time. Extreme wave heights and surge fluctuations tend to increase from the south to the north along California Coast, as a result of increasing storm intensities along the northern coast (Cayan, 2007; ADEIR).

Although uncertainty remains, recent studies have concluded that if sea level rise is on the lower end of the current predicted ranges, the occurrence of extremely high sea level events will increase, but the increase in extremes would be not so different from the increasing trend that has been seen in California for the past several decades. Common practice, consequently, is to treat projections of future mean sea level rise as equivalent to a shift in vertical datum.

In short, it is expected that as sea levels rise, not only will the occurrence of high sea level, or surge, events increase, but so may the amount of surge itself (currently about 3.1 feet above mean-high high water in Newark). Fill will be placed within the Plan Area to a minimum elevation of 11.25 feet NGVD, providing 3.75 feet of freeboard above the current one-percent stillwater elevation of 7.5 feet and 3.25 feet of freeboard over the regulatory base flood elevation of 8 feet NGVD. If the predicted 'intermediate' scenario of a 1.5 feet rise in sea level with an accompanying rise in extreme storm surge comes to fruition by 2100; absent fill settlement, the placed fill would then provide 2.25 feet of freeboard. For the 'high' sea level rise scenario, the one-percent surge would inundate the Project by nearly one foot. However, quantitative estimates for the increased storm surge have not been made, and are unlikely to be determined in the foreseeable future.

[2] U.S. Army Corps of Engineers, San Francisco District, "San Francisco Bay Tidal Stage vs. Frequency Study," October 1984.

Precipitation

The ADEIR concluded that although there is no scientific consensus, the most recent global and regional models predict that total mean precipitation will modestly decrease in the latter half of the next century. Further, that while total rainfall may decrease a modest increase in the number and magnitude of large precipitation events, with longer dry periods between events is predicted.

The most updated *Climate Change Scenarios* report (2009) states that the occurrence of significant storms declines at least marginally and that the occurrence of high daily precipitation events generally remains about the same through 2100 as it does in the historical projections. It should be noted that this conclusion is markedly different from previous conclusions by the same authors,[3] and that several CCCC reports reviewed for this addendum state the conclusion that was previously presented: that there is a modest tendency for increases in the numbers and magnitudes of large precipitation events.

The most current studies reviewed for this addendum both conflict previous conclusions and other updated studies, further exemplifying that there is no consensus regarding the potential impacts of climate change on the frequency or magnitude of large storm events.

Flooding

For this addendum, Schaaf & Wheeler reviewed the Projections of *Potential Flood Regime Changes in California* report, produced for the CCCC (August 2009). In general, this report is only able to project flood regime changes in those watershed areas affected by snowmelt and distribution of precipitation between rain and snow. These projections are not useful to the Project, given that snowfall in Newark is exceedingly rare.

While increased flood risk is very generally identified as an impact of climate change in most reports, in general, the knowledge about this impact is limited to those impacts caused by increased sea level rise and occurrence and magnitude of extreme high tide events, as described in more detail previously. Whether climate change will result in increased runoff in areas with no snow is unknown.

---

[3] Cayan, D. R., Maurer, E. P., Dettinger, M. D., Tyree, M., and Hayhoe, K., 2007: 'Climate change scenarios for the California region', Climatic Change, 87, Suppl. 1, 21–42 doi: 10.1007/s10584-007-9377-6.

Regulations, Policies and Actions Related to Climate Change

Federal

United States Army Corps of Engineers

The recent engineering circular presenting guidance on incorporating sea level rise into project planning, engineering, and design is described in detail previously in this report. While incorporation of these guidelines is only required for USACE civil works projects, and as such does not directly affect the Project, but it may be a useful tool for sea level rise analysis.

State

California Department of Water Resources

The California Department of Water Resources (DWR) recently published a draft *2009 California Climate Adaptation Strategy* Report (August 2009). This report includes several proposed actions to incorporate climate change impacts to the California Environmental Quality Act (CEQA) process. These actions include near term goals of continuing to address climate change impacts from projects on wildlife, including cumulative impacts, and the development of internal guidance by the Department of Fish and Game (DFG) to help staff address climate adaptation and to ensure climate change impacts are appropriately address in CEQA documents.

Long term actions include:

- Based on climate change scenarios, the development by DFG of thresholds of significant for the adaptive capacity of species related to direct, indirect and cumulative impacts of projects;
- Encouragement of local governments to adopt climate change adaptation actions for conservation, land use, research and regulatory measures;
- Achieve consistency in state and local regulations, general plans, and ordinances and develop sustainable funding mechanisms to support climate change planning efforts that focus on biodiversity conservation.

Local

San Francisco Bay Conservation and Development District

The San Francisco Bay Conservation and Development District (BCDC) has proposed several changes to their authority including expanding BCDCs regulatory authority to allow BCDC to decide if and under what conditions shoreline development may be authorized. In May 2009, BCDC submitted preliminary recommendations for amendments to the Bay Plan to incorporate climate change. This proposal adopts sea level rise estimates of 16 inches (1.3 feet) by 2050 and 55 inches (4.6 feet) by 2100. Proposed changes to the Bay Plan which may be relevant to the Project include the following:[4]

- "Addressing the impacts of sea level rise and shoreline flooding may require large-scale flood protection projects, including some that extend across jurisdictional or property boundary. Coordination with adjacent property owners or jurisdictions to create contiguous, effective shoreline protection is critical when planning and constructing flood protection projects. Failure to coordinate may result in inadequate shoreline protection. (e.g., a protection system with gaps or one that causes accelerated erosion in adjacent areas)"

- "New shoreline protection projects and the maintenance or reconstruction of existing projects should be authorized if: (a) the project is necessary to project the shoreline from erosion or to protect shoreline development from flooding; (b) the type of the protective structure is appropriate for the project site, the uses to be protected, and the erosion and flooding conditions at the site, (c) the project is properly engineering to provide erosion control and flood protection for the expected life of the project based on a 100-year flood event that takes future sea level rise into account; (d) the project is properly designed and constructed to prevent significant impediments to physical and visual public access; and (e) the protection is integrated with adjacent shoreline protection measures."

- "…the Commission should…encourage new projects on the shoreline to be set back from the edge of the shore above a 100-year flood level that takes future sea level rise into account for the expected life of the project, or otherwise be specifically designed to tolerate sea level rise and storms and to minimize environmental impacts; discourage new projects that will require new structural shoreline protection during the expected life of the projects, especially where no shoreline protection currently exits [*sic*]; determine whether alternative measures

[4] Travis, W., Executive Director, Lacko, L., Senior Planner, San Francisco Bay Conservation and Development Commission. Memo to the Commissioners and Alternates, San Francisco, CA. April 7, 2009.

that would involve less fill or impacts to the Bay are feasible; require an assessment of risks from a 100-year flood that takes future sea level rise into account for the expected life of the project; and require that where shoreline protection is necessary, ecosystem impacts are minimized."

- "The Commission may approve fill that is needed to provide flood protection for existing projects. New projects on fill or near the shoreline should either be set back from the edge of the shore so that the project will not be subject to dynamic wave energy, be built so the bottom floor level of structures will be above a 100-year flood elevation that takes future sea level rise into account for the expected life of the project, be specifically designed to tolerate periodic flooding, or employ other effective means of addressing the impacts of future sea level rise and storm activity. Right-of-way for levees or other structures protecting inland areas from tidal flooding should be sufficiently wide on the upland side to allow for future levee widening to support additional levee height so that no fill for levee widening is placed in the Bay."

- "Design and evaluation (of any ecosystem restoration project) should include an analysis of: (a) how the system's adaptive capacity can be enhanced so that it is resilient to sea level rise an climate change…(h) an appropriate buffer, where feasible, between shoreline development and habitats to protect wildlife and provide space for marsh migration as sea level rises…"

- "Public access should be sited, designed, managed, and maintained to avoid significant adverse impacts from sea level rise and shoreline flooding."

These changes, if approved, may have significant impacts on the approach to development, planning, and design of both flood control projects and new or re-development within portions of the Plan Area; particularly with respect to the determination of an appropriate project life.

If the 'high' sea level rise scenario proves to be true, adaptive strategies to improve flood protection (for example levees or floodwalls) may prove to be necessary in the future.

Conclusions

The ADEIR concluded that the only quantifiable flood risk impact to Newark due to climate change is the increase in sea level rise, and a wide range, with no assigned certainties or upper bounds to that range, is projected. While this update does not change that basic conclusion, reports specific to the state of California as well as the BCDC have now adopted specific values for sea level rise projections: 16 inches (1.3 feet) by 2050 and 55 inches (4.6 feet) by 2100.

Storm surge, wave runup, precipitation, and flooding have been reviewed based on updated studies not available when the ADEIR was prepared. These updated studies do not make any numerical forecasts for the aforementioned parameters. While the overall precipitation trends of modest drying is repeated in these updated reports, the previous projection of an increased number and magnitude of significant rainfall events (with longer drying periods between storms) is updated to project either no change, or a minor decrease in the magnitude and frequency of these significant rainfall events. In conclusion, significant uncertainty remains regarding the projections of how climate change will impact the magnitude and frequency of significant rainfall events.

The Project will provide 3.75 feet of freeboard above the current one-percent stillwater elevation. Using the USACE methodology and assuming construction in 2010 (for consistency), available project freeboard would not be overwhelmed by projected sea level rise through 2178 for the 'intermediate' scenario, but would be overwhelmed by 2089 for the 'high' sea level rise scenario.

Given the uncertainty in these sea level rise projection scenarios, it is not clear that the additional foot of fill needed for theoretical protection against rising one-percent storm surge for an additional ten years or so, particularly when the weight of such additional fill accelerates settlement. An adaptive strategy against rising sea level, which might include an earthen levee or structural floodwall along the perimeter of the fill, is more appropriate and can take advantage of more complete climate change data and predictions in the future.

Bibliography

Barnett, T. P., Malone, R., Pennell, W., Stammer, D., Semtner, A., Washington, W., 2004: 'The Effects of Climate Change on Water Resources in the West: Introduction and Overview', Climatic Change, 62, 1-11.

Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 2008: 'Climate Change and Water'. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva 210 pp.

Bromirski, P., R. Flick, and D.R.Cayan, 2003: 'Storminess variability along the California Coast', 1858-2000. *J. Climate*, **16**, 982–993.

Cayan, D. R., Bromirski, P.D., Hayhoe, K., Tyree, M., Dettinger, M. and Flick, R.E., 2008: 'Climate Change Projections of Sea Level Extremes Along the California Coast', Climatic Change 87, Suppl 1, 57-73 doi: 10.1007/s10583-007-9376-7.

Cayan, D. R., Maurer, E. P., Dettinger, M. D., Tyree, M., and Hayhoe, K., 2007: 'Climate change scenarios for the California region', Climatic Change, 87, Suppl. 1, 21–42 doi: 10.1007/s10584-007-9377-6.

Dettinger, M.E., Cayan, D.R., Meyer, M.K., Jeton, A.E., 2004: 'Simulated Hydrologic Responses to Climate Variations and Change in the Merced, Carson, and American River Basins, Sierra Nevada, California, 1900-2099', Climatic Change, 62, 283-317.

Field, C.B., L.D. Mortsch,, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running and M.J. Scott, 2007: North America. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 617-652.

Gleick, P.H. and E.P. Maurer. 1990: 'Assessing the costs of adapting to sea-level rise: A case study of San Francisco Bay', Pacific Institute for Studies in Development, Environment, and Security, Berkeley, California and the Stockholm Environment Institute, Stockholm, Sweden. 57 pp. with 2 maps.

Hayhoe, K. et al., 2004: 'Emission pathways, climate change, and impacts on California', PNAS, V.101 N.43, 12422-12427.

Knowles, N., Cayan, D., 2004: 'Elevation Dependence of Projected Hydrologic Changes in the San Francisco Estuary and Watershed', Climatic Change, 62, 319-366.

Kundzewicz, Z.W., L.J. Mata, N.W. Arnell, P. Döll, P. Kabat, B. Jiménez, K.A. Miller, T. Oki, Z. Sen and I.A. Shiklomanov, 2007: Freshwater resources and their management. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to theFourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 173-210.

Maurer, E. P., 2007: 'Uncertainty in hydrologic impacts of climate change in the Sierra Nevada, California under two emissions scenarios', Climatic Change, 82, 309–325, doi:310.1007/s10584-10006-19180-10589.

Miller, N. L. November 2003. 'California Climate Change, Hydrologic Response and Flood Forecasting'. Conference paper: *International Expert Meeting on Urban Flood Management.*

Moffatt and Nichol, Engineers, Wetlands Research Associates, Inc., 1988: 'Sea Level Rise: Predications and Implications for San Francisco Bay', prepared for San Francisco Bay Conservation and Development Commission.

Nicholls, R.J., P.P. Wong, V.R. Burkett, J.O. Codignotto, J.E. Hay, R.F. McLean, S. Ragoonaden and C.D. Woodroffe, 2007: Coastal systems and low-lying areas. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 315-356.

San Francisco Bay Conservation and Development Commission, 2008: 'A Sea Level Rise Strategy for the San Francisco Bay Region', http://www.bcdc.ca.gov/planning/climate_change/SLR_strategy.pdf

State of California the Resources Agency Department of Water Resources, October 2008: 'Managing an Uncertain Future Climate Change Adaptation Strategies for California's Water'.

State of California the Resources Agency Department of Water Resources, July 2006: 'Progress on Incorporating Climate Change into Management of California's Water Resources', Technical Memorandum Report.

United States Government Accountability Office, Report to the Committee on Homeland Security and Governmental Affairs, U.S. Senate, 2007: 'Climate Change Financial Risks to Federal and Private Insurers in Coming Decades Are Potentially Significant', GAO-07-285.

Watson, R.T., Zinyowwera, M.C., Moss, R.H., Dokken, D.J., 1997: *The Regional Impacts of Climate Change: An Assessment of Vulnerability Summary for Policy Makers. A special Report of Working Group II published for the Intergovernmental Panel on Climate Change*