

ATTACHMENT 2

Proposed General Plan Amendment to
Comply with 2007 Flood Legislation

3. LAND USE ELEMENT

NOTE: Proposed amendments to the Land Use Element are shown below in red underline (insertions).

3.8 LAND USE GOALS, POLICIES AND IMPLEMENTATION MEASURES

POLICIES RELATED TO FLOOD HAZARDS

3-211. Identify and annually review those areas covered by the General Plan that are subject to flooding as shown on floodplain mapping prepared by the Federal Emergency Management Agency (FEMA) and the California Department of Water Resources.

3-212. Discourage redesignation of lands within mapped flood hazard areas to urban land use designations unless adequate mitigation for flood-related risks can be provided.

8. CONSERVATION ELEMENT

NOTE: Proposed amendments to the Conservation Element are shown below in red ~~strikeout~~ (deletions) and underline (insertions). The sequential numbering of goals, policies, and implementation measures in subsections 8.13 Harbors and 8.14 Air Resources will be revised upon final adoption of the amendments to subsection 8.12 Water Resources.

8.12 WATER RESOURCES

INTRODUCTION

Contra Costa County has a moderate climate, similar to a Mediterranean climate. Measurable rainfall recorded annually in the City of Richmond averages about 21.8 inches per year, with the majority falling between October and April. Average temperatures are mild, and generally range between 50 and 66 degrees F in Richmond.

The County is bounded by San Francisco Bay and San Pablo Bays to the west, by Suisun Bay and the channels of the (Sacramento and San Joaquin Rivers), and the south by Alameda County. The San Francisco Bay Delta System (including San Pablo Bay) is generally regarded as the most important water body in California. It is used extensively for both recreational and commercial purposes, and supports a diverse flora and fauna. Water from about 40 percent of the land in California drains into the Bay and comprises most of the State's agricultural and urban supplies.

The San Francisco Bay has been greatly altered from its natural conditions by human activities. The quality of waters of the San Francisco and San Pablo Bays vary seasonally. For most of the year, water quality is similar to that of the Pacific Ocean. From December through April, water quality is affected by freshwater inflow from the Sacramento-San Joaquin Delta and from other local, smaller tributaries that drain urbanized portions of Contra Costa County and the entire Bay Area.

Water quality in the Delta is affected by a multitude of factors including upstream reservoir releases; tidal changes; the discharge of agricultural diverters; and the export rates of the State Water Project and the Central Valley Project. A number of statutes have been enacted specifically regarding the Delta. The California State Water Resources Control has been conducting hearings regarding the Bay/Delta system and the future of water diversion from this system.

The California State Regional Water Quality Control Board (RWQCB), San Francisco Bay Region, is the government agency responsible for protecting the health of San Francisco Bay. A water quality control or "basin plan" has been prepared that serves as a blueprint for water pollution control activities in the Bay. The basin plan identifies a number of beneficial uses of the Bay that must be protected, including non-contact recreation; wildlife habitat; preservation of rare and endangered species; estuarine habitat; warm freshwater and cold freshwater fish habitat; fish spawning and migration; industrial service supply; navigation; and commercial and sport fishing.

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All of Contra Costa County's water drains either directly or indirectly into the Bay/Delta system. Water from the western, urbanized portion of the County drains directly into San Francisco Bay or San Pablo Bay, while that from the northern and eastern portions drain into Suisun Bay and the Delta river channels, eventually flowing into San Pablo and San Francisco Bays. The south-central portion of the County is within the Alameda Creek drainage basin; this area's water drains south to Alameda Creek, then west to the San Francisco Bay.

Lesser developed portions of the County utilize septic systems for their wastewater disposal. The water quality of creeks within urbanized areas has been degraded by the presence of high levels of suspended solids, together with traces of contaminants associated with the operation of motor vehicles such as oil and grease, gasoline and other hydrocarbons, lead, rubber, etc. No serious water quality problems exist within the County; however, an unknown quantity of hazardous wastes are currently disposed of by illegal or unsafe means. These disposal practices could lead to surface and groundwater contamination that may not be detected.

Certain portions of the County are more prone to flooding than other portions. In general, the low-lying areas adjacent to San Francisco, San Pablo and Suisun Bays, and the eastern portion of the County near the San Joaquin River are the most susceptible to flooding.

Urban and Rural Creeks

When Contra Costa County was sparsely populated and predominantly rural, creeks and streams flowed uninterrupted from the coastal hills to the Bay and Delta. These watercourses supported a wide variety of plant, animal, and aquatic life. Riparian vegetation and streamside habitats minimized erosion, sustained perennial streams, contributed to groundwater reserves, moderated temperature extremes and provided an attractive and pleasant environment. It is of benefit to County residents to preserve vestiges of this pre-settlement environment and to work toward re-establishing this environmental heritage.

As agricultural land in portions of the County was converted to urban uses, permeable ground surfaces were replaced with impervious surfaces. Paving, roofs, and efficient drainage systems reduced the proportion of rainfall percolating into the ground and increased the volume and velocity of surface runoff carried to the creek channels. This resulted in increased flood frequency and severity, channel cutting and loss of vegetation in upper watersheds, and silting in lower channels.

Creeks and streams were relocated and realigned to accommodate increased flows. Channels were increased in width and depth and lined with concrete or rip-rap. Creeks were placed in conduits and culverts. Although these improvements have been effective in transporting stormwater runoff and in reducing flooding and property damage, these benefits have come at the expense of natural channels and native riparian habitat, which are difficult to replace and are sometimes irreplaceable.

Traditionally, the more efficient the drainage system feeding into a natural watercourse, the greater the damage to natural waterways and streamside vegetation and the greater the downstream flood damage risk. The continued use of traditional drainage facilities in individual development projects exacerbates

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these problems. Many undeveloped properties lie upstream from established urban development. Each new development project which increases peak runoff, although seemingly insignificant, contributes to a future need to make improvements to existing downstream public flood control facilities and natural channels at substantial cost to county residents. The use of alternate stormwater management techniques such as the floodplain, the levied floodway, the bypass channel, and the detention basin can either lessen or eliminate completely the need for these improvements, reducing public costs and providing a more diverse and attractive environment.

While it may be desirable to keep all of the remaining creeks and streams in their natural state, this is not always possible. Within existing developed areas, structural modifications to watercourses are often the only viable alternative. The shortage of available land within a built-up urbanized area, as well as its high cost, may rule out the possibility of keeping a watercourse in its natural state. Where this is the case, alternate structural approaches can be utilized which are designed to be compatible with their environment. Instead of rip-rap and concrete, slope protection devices can be used to stabilize banks. Landscaping can also be used to soften the visual impact of structurally modified watercourses.

Control of flooding is not the only drainage concern. With increased development and stormwater runoff, a wide variety of nutrients and toxic substances have been introduced into county waters. Nutrient wastes in the form of sewage, agricultural fertilizers, and manure lead to reduced dissolved oxygen in surface waters and limit the capacity of water to support aquatic organisms. Toxic substances, such as industrial wastes, insecticides and herbicides, can poison wildlife and become concentrated in the food chain. Both types of pollutants can adversely affect the quality of groundwater.

Erosion and sedimentation often inflict heavy public costs for flood control, harbor and channel dredging, post-flood clearing and private property damage, besides damaging aquatic life and carrying toxic substances into public and private water supplies. Design and construction techniques have been developed which are cost-effective and essential to erosion and sedimentation reduction.

There is also a need to provide enhanced opportunities for public access to creeks, streams, and drainage channels, where conditions and liability constraints permit. Total county population will continue to increase and with it the demand for recreation facilities will grow. Drainage features which can be made into parks or open space, or incorporated as assets into new development projects, will be used and appreciated by present and future county residents.

The Contra Costa County Flood Control and Water Conservation District is empowered to control flood and storm waters throughout the county. Even though the district has no direct influence over the County or the cities regarding land use and planning matters, the district does develop drainage plans for entire watersheds which cross jurisdictional boundaries. These drainage plans specify the flood control improvements needed to serve planned development in the area and are used to set drainage fees assessed against new development.

A more complete discussion of adopted and proposed drainage plans, as well as numerous flood control goals, policies and implementation measures, are included

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in the "Drainage and Flood Control" section of the Public Facilities/Services Element (Chapter 7). Readers should note that there is a great deal of overlap between these two sections of the General Plan; some goals and policies are repeated in both sections. Both this section and the "Drainage and Flood Control" section in Chapter 7 should be consulted together for a full understanding of County policies regarding flood control, waterways and riparian areas.

Map of Rivers, Creeks, and Drainages

Figure 8-6 maps the locations of rivers, creeks, drainages, and watershed boundaries within the County. These waterways have a number of important functions. Depending on capacity, these may accommodate floodwaters for purposes of groundwater recharge and stormwater management.

WATER RESOURCES GOALS

- 8-T. To conserve, enhance and manage water resources, protect their quality, and assure an adequate long-term supply of water for domestic, fishing, industrial and agricultural use.
- 8-U. To maintain the ecology and hydrology of creeks and streams and provide an amenity to the public, while at the same time preventing flooding, erosion and danger to life and property.
- 8-V. To preserve and restore remaining natural waterways in the county which have been identified as important and irreplaceable natural resources.
- 8-W. To employ alternative drainage system improvements which rely on increased retention capacity to lessen or eliminate the need for structural modifications to watercourses, whenever economically possible.
- 8-X. To enhance opportunities for public accessibility and recreational use of creeks, streams, drainage channels and other drainage system improvements.

GENERAL WATER RESOURCES POLICIES

- 8-74. Preserve watersheds and groundwater recharge areas by avoiding the placement of potential pollution sources in areas with high percolation rates.
- 8-75. Preserve and enhance the quality of surface and groundwater resources.
- 8-76. Ensure that land uses in rural areas be consistent with the availability of groundwater resources.
- 8-77. Provide development standards in recharge areas to maintain and protect the quality of groundwater supplies.
- 8-78. Support the efforts of local, regional, State, and federal agencies to improve flood management facilities along the County's creeks and streams while conserving the riparian habitat.
- 8-79. Support improvements to flood control facilities that provide opportunities for stormwater detention and groundwater recharge.

Policies to Protect and Maintain Riparian Zones

- 8-80.** Where feasible, existing natural waterways shall be protected and preserved in their natural state, and channels which already are modified shall be restored. A natural waterway is defined as a waterway which can support its own environment of vegetation, fowl, fish and reptiles, and which appears natural.
- 8-81.** Creeks and streams determined to be important and irreplaceable natural resources shall be retained in their natural state whenever possible to maintain water quality, wildlife diversity, aesthetic values, and recreation opportunities.
- 8-82.** Wherever possible, remaining natural watercourses and their riparian zones shall be restored to improve their function as habitats.
- 8-83.** Fisheries in the streams within the County shall be preserved and re-established wherever possible.
- 8-84.** Riparian habitat shall be protected by providing for channel cross-sections adequate to carry 100-year flows, as per policies contained in the Public Facilities/Services Element. If it is not possible to provide a channel cross section sufficient to carry the 100-year flow, then detention basins should be developed.
- 8-85.** The remaining willow riparian areas in East County shall be protected from intensive cattle grazing.
- 8-86.** Riparian resources in the Delta and along the shoreline shall be protected and enhanced.
- 8-87.** Urban creeks and streams shall be protected and enhanced where possible to maintain existing flood capacity.
- 8-88.** The natural functions of riparian corridors and water channels shall be restored and maintained to reduce flooding, convey stormwater flows, and improve water quality.

Policies for New Development Along Natural Watercourses

- 8-89.** Natural watercourses shall be integrated into new development in such a way that they are accessible and provide a positive visual element.
- 8-90.** Existing native riparian habitat shall be preserved and enhanced by new development unless public safety concerns require removal of habitat for flood control or other public purposes.
- 8-91.** On-site water control shall be required of major new developments so that no increase in peak flows occurs relative to the site's pre-development condition, unless the Planning Agency determines that off-site measures can be employed which are equally effective in preventing adverse downstream impacts.
- 8-92.** New development which modifies or destroys riparian habitat because of needed flood control, shall be responsible for restoring and enhancing an equivalent amount of habitat within or near the project area.

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- 8-93.** Setback areas shall be provided along natural creeks and streams in areas planned for urbanization. The setback areas shall be of a width adequate to allow maintenance and to prevent damage to adjacent structures, the natural channel and associated riparian vegetation. The setback area shall be a minimum of 100 feet; 50 feet on each side of the centerline of the creek.
- 8-94.** Deeded development rights for lands within established setback areas along creeks or streams shall be sought to assure creek preservation and to protect adjacent structures and the loss of private property.
- 8-95.** Grading, filling and construction activity near watercourses shall be conducted in such a manner as to minimize impacts from increased runoff, erosion, sedimentation, biochemical degradation, or thermal pollution.
- 8-96.** Revegetation of a watercourse shall employ native vegetation, providing the type of vegetation is compatible with the watercourse's maintenance program and does not adversely alter channel capacity.
- 8-97.** Particular care shall be exercised by development proposals to preserve and enhance riparian corridors along creeks which connect to the freshwater marsh segments of coastal areas in the North Central and East County areas.
- 8-98.** Applications to expand marine uses shall be carefully evaluated to ensure that a gain, not a loss, of any associated riparian vegetation will result. Runoff of pollutants into marsh and wetland areas from nearby urban development, should be prevented by prohibiting any storm sewer outflow pipe in such areas and by requiring berm or gutter structures at the outer boundary of the buffer zones which would divert runoff to sewer systems for transport out of the area.

WATER RESOURCES IMPLEMENTATION MEASURES

Riparian Resources Inventory

- 8-co. Work with appropriate agencies to inventory the County's riparian resources and to identify areas warranting preservation and enhancement.

Zoning and Code Revisions

- 8-cp. Review and revise the County ordinance code to provide for the protection and enhancement of watercourses and riparian vegetation, as outlined in the above policies (e.g. building setback requirements, regulations limiting the removal of trees and vegetation, etc.).

Other Programs

- 8-cq. Develop a program that fosters the participation of public agencies, private organizations and individuals in the development of watershed management practices that reduce soil loss and excessive runoff (i.e. control of grazing in upper watersheds, timing of release of water from upstream dams, revegetation of upper watersheds), and that minimize the effect on downstream areas.

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- 8-cr. Develop a program for the restoration of riparian vegetation in rural creeks where grazing activities are reducing the extent of the vegetation and are eroding channel banks.
- 8-cs. Develop guidelines for creek maintenance practices which assure that native vegetation is not removed unnecessarily. These guidelines should also assure that maintenance is scheduled to minimize disruption of wildlife breeding practices.
- 8-ct. Re-evaluate the flood control drop structures and long spillways that have been constructed in many of the creeks in North Central County (Walnut Creek, Concord, and Pleasant Hill) to determine the feasibility of constructing fish bypass facilities which would allow anadromous species access to inland spawning sites.

Development Review Process

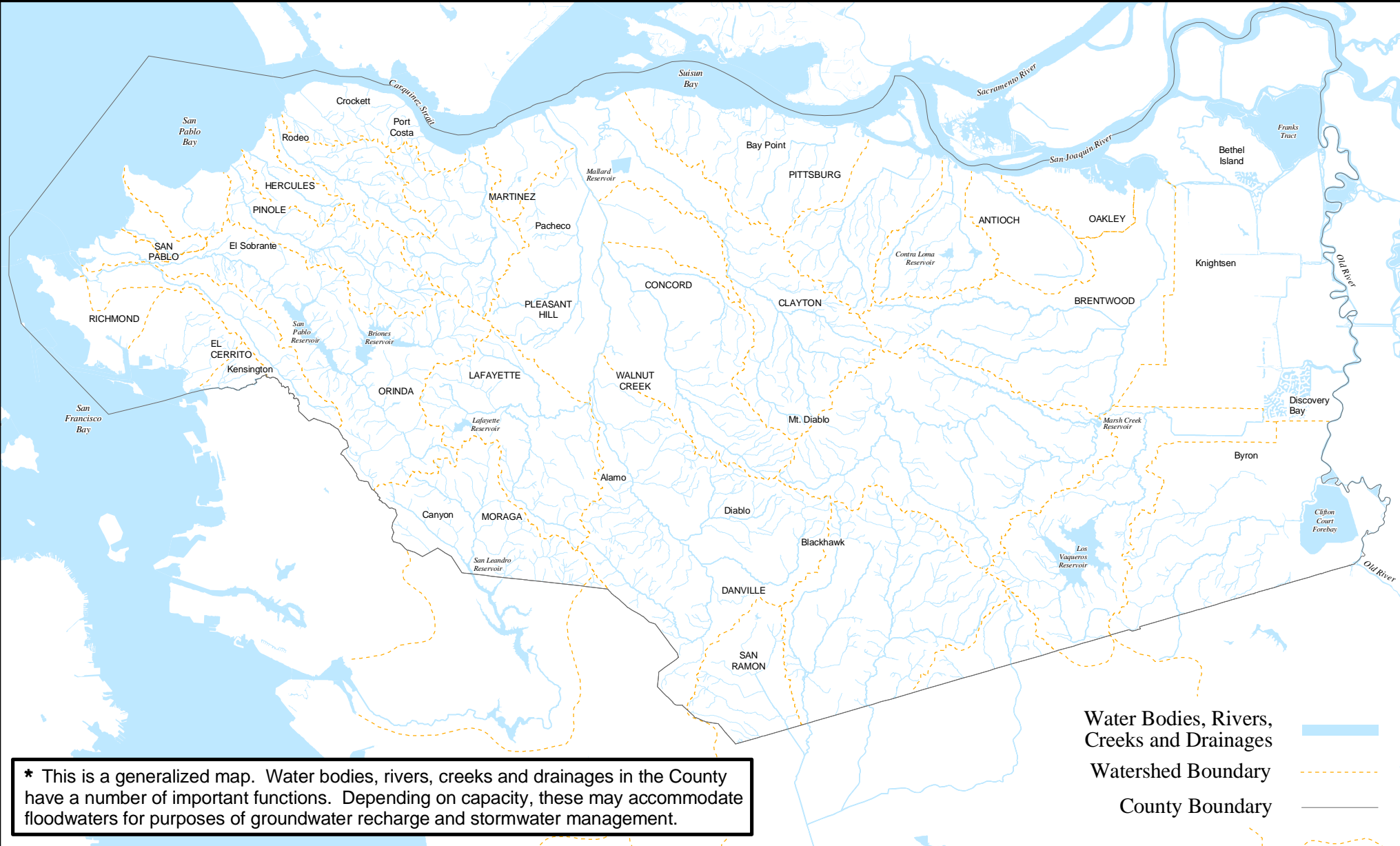
- 8-cu. Review all public and private projects adjacent to and within creeks and streams to determine their conformance with the policies of this General Plan.
- 8-cv. As a priority, define and implement a development review process for new projects that ensures conformance with the stream and riparian corridor protection policies of this plan.
- 8-cw. During the review of proposed development plans, the County staff shall require a building setback of at least 100 feet along natural creeks and streams, and seek to obtain deeded development rights on lands within setback areas.
- 8-cx. New parcels which are created shall include adequate space outside of the watercourses' setback areas for pools, patios, and appurtenant structures to ensure that property owners will not place improvements within the areas which require protection.
- 8-cy. Through the environmental review process, the likely effects of construction and other proposed activities on nearby natural watercourses and related open space shall be determined. Measures shall be identified that will mitigate these effects and encourage the preservation of natural waterways and related open space. Such measures may include, but are not limited to:
 - (1) Clustering of buildings and other site design features;
 - (2) Restoration or enhancement of other riparian habitat within or near the project area; and
 - (3) Purchase of development rights for lands within other stream setback areas.
- 8-cz. When alteration of streambanks or streambeds is proposed, notify the State Department of Fish and Game in accordance with their authority under State law and/or when their assistance is needed.
- 8-da. As a condition of approval for discretionary permits which intensify cattle grazing, 100-foot buffer zones along creek systems should be declared "riparian preserves"; establish cooperative agreements with land owners to fence off the areas from livestock; and, institute appropriate planting

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programs, as needed to replace vegetation. If necessary, install simple gravity flow pipeline systems to transport water from pool areas in the creek to water trough sites for cattle outside the riparian zone.

- 8-db. Require proposed recreation or housing projects which utilize the shoreline and water resources of the Delta to create slough systems with significant riparian plant communities equal in size to the project area itself. Prohibit construction of barren waterways.
- 8-dc. Require large industrial projects and expansions in the coastal regions of Antioch and Pittsburg to preserve and, if necessary, create a riparian buffer zone of at least 100 feet between the high tide line and the development edge. Apply conditions of project approval that minimize any surface runoff or storm sewer outflows from contaminating the riparian buffer zones.
- 8-dd. Require groundwater monitoring programs for all large-scale commercial and industrial facilities using wells.
- 8-de. Require proof of adequate groundwater in areas not served by municipal water purveyors. Require test wells or the establishment of community water systems in these areas. Deny discretionary applications unless a geologic report establishes that groundwater supplies are adequate and will not be adversely impacted by the cumulative amount of additional development.
- 8-df. Review and comment on projects and environmental documents that propose wastewater disposal methods which discharge into natural waterways. Request reclamation conservation and re-use programs to minimize discharges and protect water quality and aquifer recharge areas.
- 8-dg. Review of subdivisions using septic systems shall be conducted by the County's Environmental Health Department to ensure that leachates do not contaminate groundwater recharge areas. Consider on-site wastewater management districts in important recharge areas.
- 8-dh. Actively pursue the abatement of failing septic systems near waterways.
- 8-di. Encourage the construction of wastewater disposal systems designed to reclaim and re-use treated wastewater on agricultural crops, and for other irrigation and wildlife enhancement projects.
- 8-dj. Encourage new projects to use landscaping practices and plants that will reduce demand on water, retain runoff, decrease flooding, and recharge groundwater.
- 8-dk. Encourage multi-purpose flood management projects that incorporate recreation, resource conservation, preservation of natural riparian habitat and topography, and scenic values of the County's streams and creeks.

Figure 8-6 Water Bodies, Rivers, Creeks and Drainages*



* This is a generalized map. Water bodies, rivers, creeks and drainages in the County have a number of important functions. Depending on capacity, these may accommodate floodwaters for purposes of groundwater recharge and stormwater management.

Water Bodies, Rivers, Creeks and Drainages
 Watershed Boundary
 County Boundary

8- Page

1:300,000

0 2.5 5 10 Miles

ANTIOCH Incorporated Areas
 Alamo Unincorporated Areas

CONTRA COSTA COUNTY

Map Created on June 9, 2016
 by Contra Costa County Department of Conservation and Development, GIS Group
 30 Muir Road, Martinez, CA 94553
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10. SAFETY ELEMENT

NOTE: Proposed amendments to the Safety Element are shown below in red ~~strikeout~~ (deletions) and underline (insertions). The sequential numbering of goals, policies, and implementation measures in subsections 10.9 Hazardous Materials Uses, 10.10 Water Supply Requirements, and 10.11 Public Protection Services and Disaster Planning will be revised upon final adoption of the amendments to subsection 10.8 Flood Hazards.

10.8 FLOOD HAZARDS

INTRODUCTION

Substantial areas within Contra Costa County are subject to flooding. According to records maintained by the Federal Emergency Management Agency (FEMA), the majority of the County's creeks and shoreline areas lie within the 100-year flood plain, i.e., an area subject to flooding in a storm that is likely to occur (according to averages based upon recorded measurements) once every 100 years. The FEMA records are maintained as a means of determining flood insurance rates through the National Flood Insurance Program.

In the West and Central County, these areas include portions of the shoreline in the vicinity of Richmond, Hercules, Rodeo, Crockett, Port Costa, and Martinez; most creeks in urbanized areas, including Concord, Walnut Creek, and the San Ramon Valley; and reservoirs and creeks located on undeveloped East Bay Regional Park District (EBRPD) and East Bay Municipal Utility District (EBMUD) lands. In the East County, substantial acreage lies within the 100-year flood plain, including Bethel Island, the Veale Tract, Holland Tract, Franks Tract, Jersey Island, and the area in the Byron vicinity. Portions of the Pittsburg, Antioch, and Brentwood areas, as well as a number of creeks in East County, are also subject to flooding.

The most serious flood hazard that exists in Contra Costa County relates to the system of levees that protect the islands and adjacent mainland in the San Joaquin-Sacramento River Delta area in eastern Contra Costa. Levees are basically long, continuous dams that keep water out of a lower area, such as the Delta islands, many of which are at an elevation just above or below sea level.

The islands in the California Delta were drained during the nineteenth century to create high quality agricultural land. Since then, the peat-laden soil of many of the islands has oxidized, resulting in a sinking of their island floors and consequently requiring the construction of higher and heavier levees. Levee failure occurs in some areas where levees rest on soft mud, silt, or peat.

The islands continue to flood. In general, the islands have been reclaimed after each flood. However, Franks Tract State Park, essentially a lake east of Bethel Island, and the Big Break area of water north of Oakley, are visible reminders that it is not always practical or economical to reclaim flooded lands. Flooding problems in the Delta area have also been exacerbated by boat movement (primarily recreational) on the waterways which causes waves that accelerate the natural process of levee erosion.

The threat of levee failure during periods of high water is constant. In the years 1973, 1980, 1982, 1983, and 1986, one or more Delta island levees failed or were overtopped, and some of these events were summer breaks that did not occur at

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times of high storm runoff. Some islands in the Delta have been flooded two or three times since 1980.

The possibility that flooding will occur on the islands in the Delta is greatly increased by two ongoing, natural processes, which compound the dangers that periodic high tides or strong winter storms may breach a portion of the existing levee system. The two natural processes which impact the integrity of the levee are rising sea levels, caused by ~~the world-wide "greenhouse effect,"~~ climate change and "subsidence."

~~The greenhouse effect is a phenomenon that~~ Climate change is projected to cause a rise in sea level over the next century, thus creating potential flooding problems. Hydrologists estimate the rate of rise may increase from the present one-half foot per century to approximately two to eight feet. The anticipated rise is believed to be caused by warming of the global climate due to accumulation in the atmosphere of gases such as carbon dioxide, methane, and chlorofluorocarbons which result from fossil fuel burning and deforestation of tropical rain forests. Since many factors affect global climates, the rate of change over a relatively short time-period, even a century, is very difficult to establish. The U.S. Environmental Protection Agency suggests that a rate of four feet per century be assumed for planning purposes for the San Francisco Bay Area. It is important to note that the existing FEMA flood hazard maps do not include ~~the greenhouse effect~~ climate change in their potential flooding analysis.

In Contra Costa County, subsidence is caused by the natural process of oxidation of island peat soils, resulting in a gradual sinking of the ground. As many of the islands in the Delta (along with their levees) sink in elevation, the levees that protect the island's agricultural and/or residential uses must be raised and reinforced by adding more earth fill to the top of the levees. Recent evidence indicates that many islands have experienced significant subsidence over the last several decades. For example, it is estimated that Webb Tract in Contra Costa County has subsided up to 17 feet, and Bacon Island adjacent to Contra Costa County has subsided approximately 14 feet. Most reclaimed portions of the Delta in the County have subsided at least 10 feet. Areas that have experienced a measurable amount of subsidence are illustrated in Figure 10-8, Flood Hazards Map included in a later section of this chapter. These areas are highly susceptible to flooding.

A number of causes for subsidence have been identified. The oxidation-decay and shrinkage of peat and other soils which are rich in organic matter and fine clay particles may be the largest contributor to the problem. However, the withdrawal of shallow ground water for surface drainage may also cause surface compaction and/or soil shrinkage, which results in a loss of elevation. There is also evidence that the pumping of groundwater, oil, or gas supplies from underneath several of the islands may be contributing to the natural consolidation and subsidence. Natural "tectonic" subsidence may also be contributing to the problem.

There are great difficulties involved in estimating the amounts and rates of subsidence from island to island in the Delta, since subsidence changes the elevation of bench marks, the survey points from which elevations are determined. It is first necessary to establish elevation control from stable areas outside the Delta, which requires very long survey lines. Recent work is concentrating on the use of an unmanned space satellite as a "survey platform" from which to study changes in elevations.

The consequence of subsidence and the possibility of sea levels rising due to the greenhouse effect is the increased potential that levees will fail and tidewater and high

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river water will inundate farmed and populated areas in the Delta. The California Delta in Contra Costa and in the adjoining counties has historically been devoted to agriculture and its population has remained small. However, growing commercial recreation and residential uses, as evidenced by the success of year-round subdivisions such as Discovery Bay, are leading to increases in the permanent population of the area. It will become increasingly more important, but also more difficult, for the County to provide adequate flood protection to residents and businesses in the Delta area. New urban development should be allowed ed only if long term, year-round flood protection can be provided to the area.

Allowing more residential and commercial development on or near the islands of the Delta increases the disaster potential of subsidence and flooding when levees fail. Approving land uses in the Delta area that support significant new populations must be carefully measured in terms of the potential loss of lives and property that could occur in the event of a major flood. The economic consequences of certain development should also be studied.

Seismicity presents additional special problems in the Delta. Delta levees are, in places, underlain by sands that are susceptible to ground failures including liquefaction during an earthquake. Strong earthquake shaking can cause the entire levee foundation to lose strength, leading to levee failure. Many levees are themselves constructed of liquefiable sand.

According to a report prepared for the East Bay Municipal Utility District, whose aqueduct pipes cross the Delta, twelve separate faults are capable of causing ground motion sufficient to cause liquefaction, requiring accelerations on the order of 7 to 27 percent of gravity (0.07 to 0.27g), with shaking lasting from about 5 to 23 seconds. A 1985 study by a State Department of Water Resources geologist noted levee slips and cracks from five recent earthquakes, some as distant as 150 miles away from Contra Costa County. A large nearby earthquake could cause a number of simultaneous levee failures, making repairs difficult because the levees are the only land access to many points following a levee break.

In addition to the flooding hazards associated with levee failure caused by an earthquake, fault ruptures or ground shaking during an earthquake can cause the collapse of dams, as well as seiche and tsunami ("tidal waves").

Dam safety is regulated by the State Department of Water Resources, Division of Safety of Dams. All large reservoirs in the County have been investigated and many have been strengthened. Further, the California Office of Emergency Services has produced inundation maps and emergency plans covering various scenarios of dam failure in the County.

The safety of small dams, which are mostly used for stock watering and other agricultural activities, is largely a private concern, with present standards set by the County Grading Ordinance. Many small dams predate even this regulation. However, seismic activity is not considered a significant hazard to small dams.

Tsunamis are sea waves created by undersea fault movement. Traveling through the deep ocean, a tsunami wave is a broad, shallow, and fast moving wave. When it reaches the coastline, the wave form pushes upward from the ocean bottom and becomes a high swell of water that breaks and washes inland with great force. The waves may reach fifty feet in height on unprotected coasts, and one recorded tsunami (~~in Japan in 1896~~ Indian Ocean - 2004) resulted from a 9.0 magnitude earthquake and killed nearly 30,000 290,000 people and destroyed over 10,000 homes across 15 countries.

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Several people were drowned in Crescent City, California, in 1964 by the tsunami generated by the "Good Friday" Alaska earthquake.

Historic records of the Bay Area used by one study indicate that 19 tsunamis were recorded in San Francisco Bay during the period of 1868-1968. The maximum wave height recorded at the Golden Gate Tide Gage was 7.4 feet, which may be regarded as a reasonable maximum for future events.

The available data indicate a systematic diminishment of wave height from the Golden Gate to about half that height on the shoreline near Richmond, and to nil at the head of the Carquinez Strait. Thus, the damage potential of a tsunami will tend to be greater in the Richmond area and show a general decrease toward the head of Carquinez Strait.

Flooding can also result from seiche, which is a long wave-length, large-scale wave action set up in a closed body of water such as a lake or reservoir. Seiche is known to occur during earthquakes, but is not well understood. No occurrences have been recorded in the Bay Area. Elongated and deep (relative to width) bodies of water seem most likely to be affected, and earthquake wave orientation may also play a role in seiche formation. Seiche can temporarily flood a shoreline in a manner similar to tsunami; however, its destructive capacity is not as great. Seiche may cause overtopping of impoundments such as dams, particularly when the impoundment is in a near-filled condition, releasing flow downstream.

Maps of Flood Hazard Areas

Figure 10-8a depicts the general location of the FEMA flood hazard areas throughout Contra Costa County. Flood Hazard Areas are those areas which have statistical chance of flooding once in 100 or 500 years. This map is not intended to be used to locate parcel-specific sites in relation to Flood Hazard Areas, but to convey the general extent and location of such areas. ~~The map also indicates areas of subsidence in the County, but does not presently include consideration of the greenhouse effect. Figure 10-8b depicts areas of existing and planned development within 100- and 500-year floodplains. Figure 10-8c depicts the general locations of dam failure inundation areas throughout the County.~~

FLOOD HAZARD GOALS

- 10-G. To ensure public safety by directing development away from areas which may pose a risk to life ~~from~~ as a result of flooding, and to mitigate flood risks to property along with the associated economic loss.
- 10-H. To mitigate the risk of flooding and hazards to life, health, structures, transportation and utilities due to subsidence, especially in the San Joaquin-Sacramento Delta area.
- ~~10-I. To reduce to a practical minimum the potential for life loss, injury, and economic loss due to levee failure and consequent flooding.~~
- ~~10-J. To implement appropriate land use planning practices to improve flood risk management and reduce the consequences of flooding.~~
- ~~10-K. To promote public awareness of the risks and requirements associated with owning land and living within a floodplain.~~
- ~~10-L. To participate in efforts to secure adequate funding for improvement of flood management infrastructure.~~

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10-M. To coordinate with local, regional, State, and federal agencies responsible for flood protection within the unincorporated areas of the County to improve flood risk management.

GENERAL POLICIES

- 10-33. The areas designated on Figure 10-8 shall be considered inappropriate for conventional urban development due to unmitigated flood hazards as defined by FEMA. Applications for development at urban or suburban densities in areas where there is a serious risk to life shall demonstrate appropriate solutions or be denied.
- 10-34. In mainland areas affected by creeks, development within the 100-year flood plain shall be limited until a flood management plan can be adopted, which may include regional and local facilities if needed. The riparian habitat shall be protected by providing a cross section of channel suitable to carry the 100-year flow. Flood management shall be accomplished within the guidelines contained in the Open Space ~~and~~ Conservation Elements.
- 10-35. In mainland areas along the rivers and bays affected by water backing up into the watercourse, it shall be demonstrated prior to development that adequate protection exists either through levee protection or change of elevation.
- 10-36. On islands in East County, development shall not be allowed until a study is performed to resolve issues and determine appropriate locations for development. This study shall be a high priority for the County and should include the following:
- o a risk assessment of development in that area; and
 - o an analysis of flooding due to runoff and tides, settlement of shallow soils, deep subsidence, liquefaction, and adequacy of insurance programs.
- 10-37. A uniform set of flood damage prevention standards should be established by the cooperative efforts of all County, State, and federal agencies with responsibilities for flood control works and development in flood-prone areas in the County.
- 10-38. Flood-proofing of structures shall be required in any area subject to flooding; this shall occur both adjacent to watercourses as well as in the Delta or along the waterfront. Flood-proofing includes, but is not necessarily limited to: anchoring to prevent flotation, collapse, or lateral movement; using flood-resistant construction materials; employing construction methods and practices that minimize flood damage; elevating building pads above the base flood elevation plus required freeboard; elevating habitable building floors above the base flood elevation plus required freeboard; and providing adequate venting to allow for equalization of hydrostatic flood forces. Appropriate flood-proofing methods shall be determined by the Floodplain Administrator on a project-by-project basis.
- 10-39. In developing areas which are subject to the provisions of the Flood Insurance Program, for which there is no reasonable expectation of flood control project participation by the Corps of Engineers and where a significant number of properties will be affected, the Flood Control District shall be permitted to

10. Safety Element

construct 100- ~~or 200~~-year flood protection works when so directed by the Board of Supervisors.

- 10-40. Planning Agency and Flood Control District review of any significant project proposed for areas in the County which are not presently in Flood Zones shall include an evaluation of the potential downstream flood damages which may result from the project.
- ~~10-41. When feasible, critical public facilities such as emergency command centers, communication facilities, and shelters; hospitals and health care facilities; and police and fire stations should be constructed outside of areas subject to flooding or inundation.~~
- ~~10-42. When construction within areas of flooding or inundation is unavoidable, critical public facilities shall be constructed in a manner that allows them to maintain structural integrity and ensure functional operation to the greatest extent feasible.~~
- ~~10-43. The County shall support local, regional, State, and federal government efforts to improve protection against flooding, subsidence, and inundation.~~
- ~~10-44. Development shall be restricted in areas where flood-related hazards cannot be adequately addressed.~~
- ~~10-45. Require project applicants to secure an encroachment permit from the Central Valley Flood Protection Board (CVFPB) for any project that falls within the CVFPB's jurisdiction (e.g., levees, regulated streams, and designated floodways).~~
- ~~10-46. Utilize the best available flood hazard information and mapping from local, regional, State, and federal agencies to inform land use and public facilities investment decisions.~~
- ~~10-47. Work with local, regional, State, and federal agencies to maintain an adequate flood management information base, prepare risk assessments, and identify strategies to mitigate flooding impacts.~~
- ~~10-48. Work with responsible parties to ensure flood management facilities and structures (e.g., pump stations, levees, canals, channels, and dams) are properly maintained.~~

FLOOD HAZARD POLICIES

- ~~10-49. Buildings in urban development near the shoreline and in flood-prone areas shall be protected from flood dangers, including consideration of rising sea levels caused by ~~the greenhouse effect~~ climate change.~~
- ~~10-50. Habitable areas of structures near the shore line and in flood-prone areas shall be sited above the highest water level expected during the life of the project, or shall be protected for the expected life of the project by levees of an adequate design.~~
- ~~10-51. Rights-of-way for levees protecting inland areas from tidal flooding shall be sufficiently wide on the upland side to allow for future levee widening to support additional levee height.~~
- ~~10-52. The County shall review flooding policies in the General Plan on an annual basis; in order to incorporate any new scientific findings regarding project sea level rise due to ~~the greenhouse effect~~ climate change.~~

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- 10-53. The County shall review flooding policies as they relate to properties designated by FEMA as within both the 100- and the 500-year floodplains.
- 10-54. New development and substantial improvements or upgrades in the 100- and 500-year flood hazard zones shall be constructed in accordance with applicable County, State, and federal regulations including compliance with the minimum standards of FEMA's National Flood Insurance Program (NFIP) to avoid or minimize the risk of flood damage.
- 10-55. Development located within the Sacramento-San Joaquin Valley portion of the County shall be evaluated for consistency with the California Department of Water Resources' Urban Level of Flood Protection Criteria. The County shall not issue ministerial permits for new single-family residences, approve discretionary permits or entitlements that would increase density, approve subdivision maps, or enter into development agreements for any property within a 200-year flood hazard zone in an urban or urbanizing area, unless an adequate finding can be made pursuant to State law.
- 10-56. Cooperate with local, regional, State, and federal agencies in their efforts to provide flood protection infrastructure that achieves at least 200-year flood protection for urban and urbanizing areas within the Sacramento-San Joaquin Valley portion of the County by 2025.
- 10-57. Prohibit permanent structures in a designated floodway where such structures could increase risks to human life or restrict the carrying capacity of the floodway.

Policies Regarding Subsidence

- 10-58. Whenever studies indicate subsidence is or may become a flood-threatening problem, the County should continue to monitor subsidence until flood protection is assured.
- 10-59. In accordance with the following policies, the General Plan shall not permit a substantial non-agricultural, residential population to be subjected to increased flood hazard due to subsidence.
- 10-60. Low-density development of lands subject to subsidence shall take into account and fully mitigate the potential impacts of flooding based on the best currently available techniques.
- 10-61. Any development approvals for areas subject to subsidence shall include conditions which account for the need to support Delta reclamation and irrigation districts, and to strengthen weak and low levees prior to development.
- 10-62. The pumping of substantial quantities of water, oil, and gas in an area protected by levees is inconsistent with new major development approvals.

Policies Regarding Flooding Due to Levee or Dam Failure, or Tsunami

- 10-63. In order to protect lives and property, intensive urban and suburban development shall not be permitted in reclaimed areas unless flood protection in such areas is constructed, at a minimum, to the standards of the Flood Disaster Protection Act of 1973. Levees protecting these areas shall meet the standards of the U.S. Army Corps of Engineers.

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- 10-64. Delta levees shall be rehabilitated and maintained to protect beneficial uses of the Delta and its water. Only those uses appropriate in areas subject to risk of flooding and seismic activity, such as agriculture and recreation, should be planned and approved. This policy shall not apply to Bethel Island or Discovery Bay.
- 10-65. Development of levee rehabilitation plans should consider methods to foster riparian habitat to the fullest extent possible consistent with levee integrity.
- 10-66. Agencies whose projects benefit from Delta levee protection, including the State and federal government (water, highway, fish and wildlife, and recreational projects), PG&E, and private railroad companies, shall participate in funding Delta levee improvements and maintenance.
- 10-67. The potential effects of dam or levee failure are so substantial that geologic and engineering investigation shall be warranted as a prerequisite for authorizing public and private construction of either public facilities or private development in affected areas.
- 10-68. Development proposals should be reviewed with reference to dam failure inundation maps, as these become available, in order to determine evacuation routes.
- 10-69. Dam and levee failure, as well as potential inundation from tsunamis and seiche, shall be a significant consideration of the appropriateness of land use proposals.
- 10-70. Dams and levees should be designed to withstand the forces of anticipated (design) earthquakes at their locations.
- 10-71. Important dams and coastal levees shall be regarded as critical facilities that should not be sited over the trace of an active or potentially active fault.
- 10-72. Structures for human occupancy, and particularly critical structures, and potentially dangerous commercial or industrial facilities (e.g., plants for the manufacture or storage of hazardous materials) shall be protected against tsunami hazard.
- 10-73. Support the efforts of levee owners and local, regional, State, and federal agencies to design and reconstruct levees that do not meet adopted State and/or federal flood protection standards to bring them into compliance.

FLOOD HAZARD IMPLEMENTATION MEASURES

- 10-s. Revise the creek setback ordinance for residential and commercial structures in order to prevent property damages from bank failure along natural water courses.
- 10-t. Encourage the County Flood Control District to proceed with drainage improvements in areas subject to flooding from inadequate facilities, and to ensure that additional new drainage facilities, including road culverts and bridges, are designed to pass the flow specified by County Ordinance Code.
- 10-u. Develop Flood Control Zone plans based on the concepts found in this General Plan. As adopted zone plans are revised, they should be brought into conformity with these concepts.

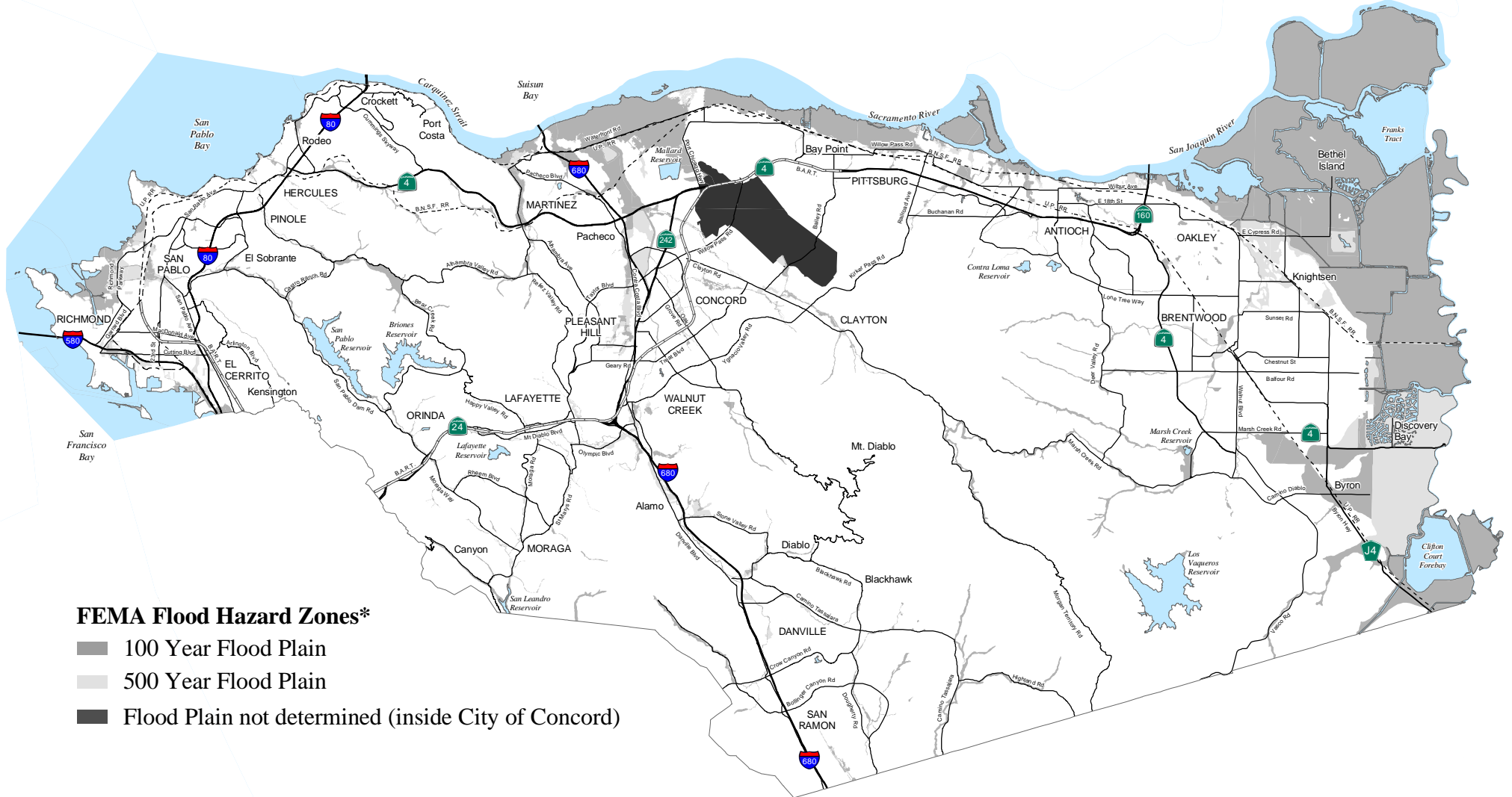
10. Safety Element

- 10-v. Draft and adopt a flood management plan for mainland areas affected by creeks, in accordance with the guidelines contained in the Safety Element and Open Space/Conservation Element of this General Plan.
- 10-w. Conduct a study of flooding conditions on islands in East County, including a risk assessment of development in that area and an analysis of flooding due to runoff and tides, settlement of shallow soils, deep subsidence, liquefaction, and adequacy of insurance programs.
- 10-x. Establish a uniform set of flood damage prevention standards in cooperation with appropriate County, State, and federal agencies.
- 10-y. Through the environmental review process, ensure that potential flooding impacts, due to new development, including on-site and downstream flood damage, subsidence, dam or levee failure, and potential inundation from tsunamis and seiche, are adequately assessed. Impose appropriate mitigation measures (e.g. flood-proofing, levee protection, Delta reclamations).
- 10-z. Develop and implement Delta levee rehabilitation plans in cooperation with local, regional, State, and federal agencies and the private sector, in accordance with the policies of this General Plan.
- 10-aa. ~~Adopt ordinances~~ Continue implementing the FEMA Flood Insurance Program through enforcement of County Ordinance Code Chapter 82-28, Floodplain Management.
- 10-ab. Prohibit new structures which would restrict maintenance or future efforts to increase the height of the levees from being constructed on top or immediately adjacent to the levees.
- 10-ac. All analysis of levee safety shall include consideration of the worst case situations of high tides coupled with storm-driven waves.
- ~~10-ad. Encourage operators of water, sewer, gas, electricity, communications, and other essential services to upgrade facilities as necessary to improve resiliency in areas subject to flood hazards.~~
- ~~10-ae. Endeavor to upgrade critical County-owned infrastructure to be able to withstand major flood events.~~
- ~~10-af. For areas that could become isolated in the event of a major flood event, formulate plans to ensure that adequate medical aid, water supply, waste disposal, and other public health and safety services will be available.~~
- ~~10-ag. Encourage the California Department of Water Resources to prepare 200-year flood zone maps for the entirety of Contra Costa County.~~
- ~~10-ah. Until such time as 200-year flood zone maps are available, use 500-year flood zone maps as the proxy when appropriate.~~
- ~~10-ai. Review and update, as necessary, appropriate General Plan elements to reflect current floodplain mapping data available from local, regional, State, and federal agencies to ensure the best available flood risk mapping information is contained in the General Plan.~~
- ~~10-aj. Adopt the County's local hazard mitigation plan as part of the General Plan Safety Element to qualify for the greatest share of State-eligible, post-disaster costs under the California Disaster Assistance Act.~~

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- 10-ak. Maintain and update emergency response plans that address potential flooding in levee and dam inundation areas.
- 10-al. Require new residential projects within the inundation area of a levee or dam to include a deed notification to future owners explaining that the property may be subject to flooding if the levee or dam were to fail or be overwhelmed.

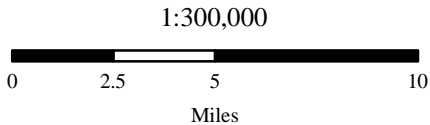
Figure 10-8a Flood Hazard Areas



FEMA Flood Hazard Zones*

- 100 Year Flood Plain
- 500 Year Flood Plain
- Flood Plain not determined (inside City of Concord)

* This is a generalized map. For site specific information please refer to Flood Insurance Rate (FIRM) maps prepared by the Federal Emergency Management Agency (FEMA).

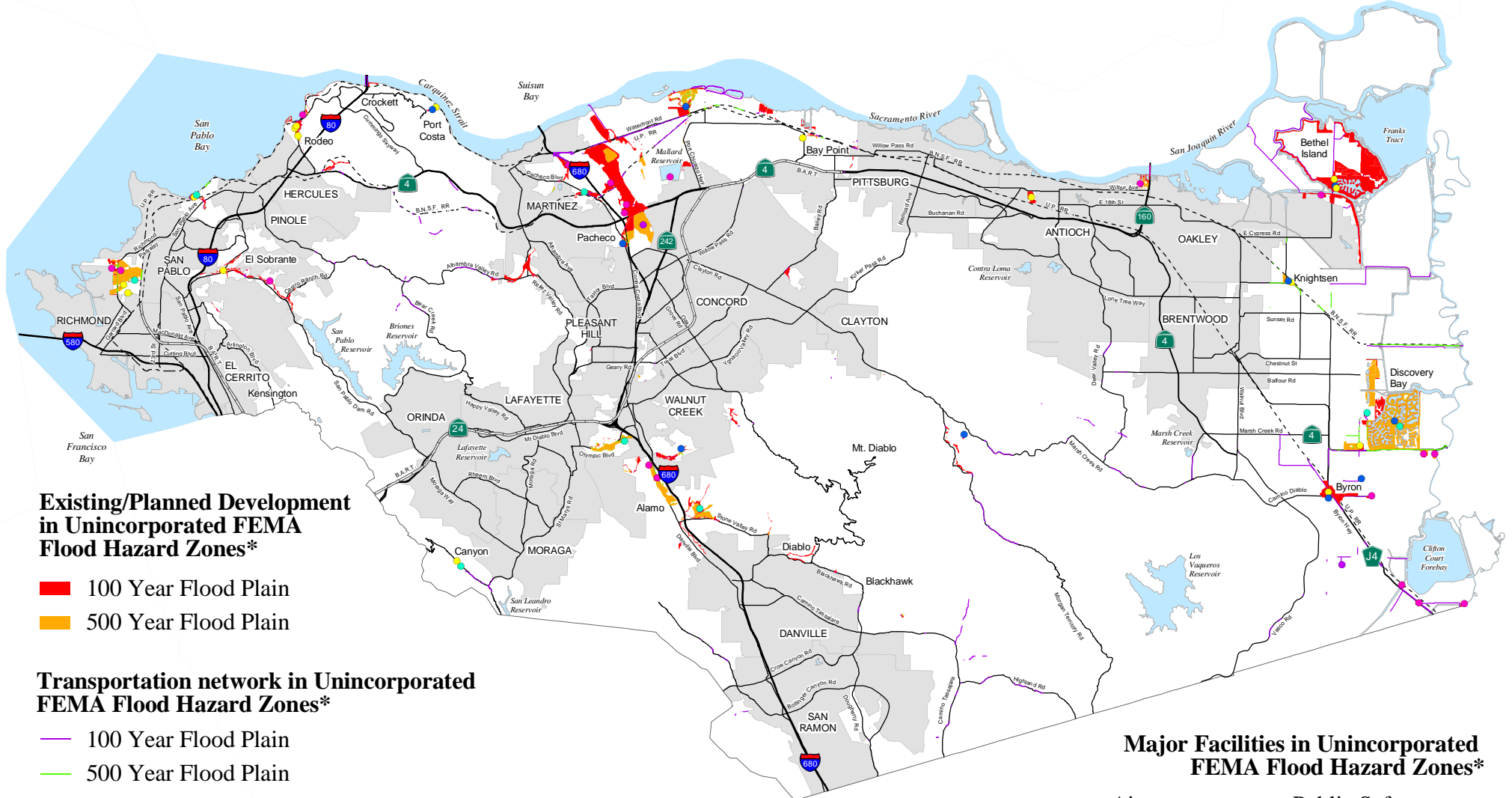


ANTIOCH Incorporated Areas
Alamo Unincorporated Areas

— Freeways and Highways
— Major Roads
— Bay Area Rapid Transit
- - - Railroads

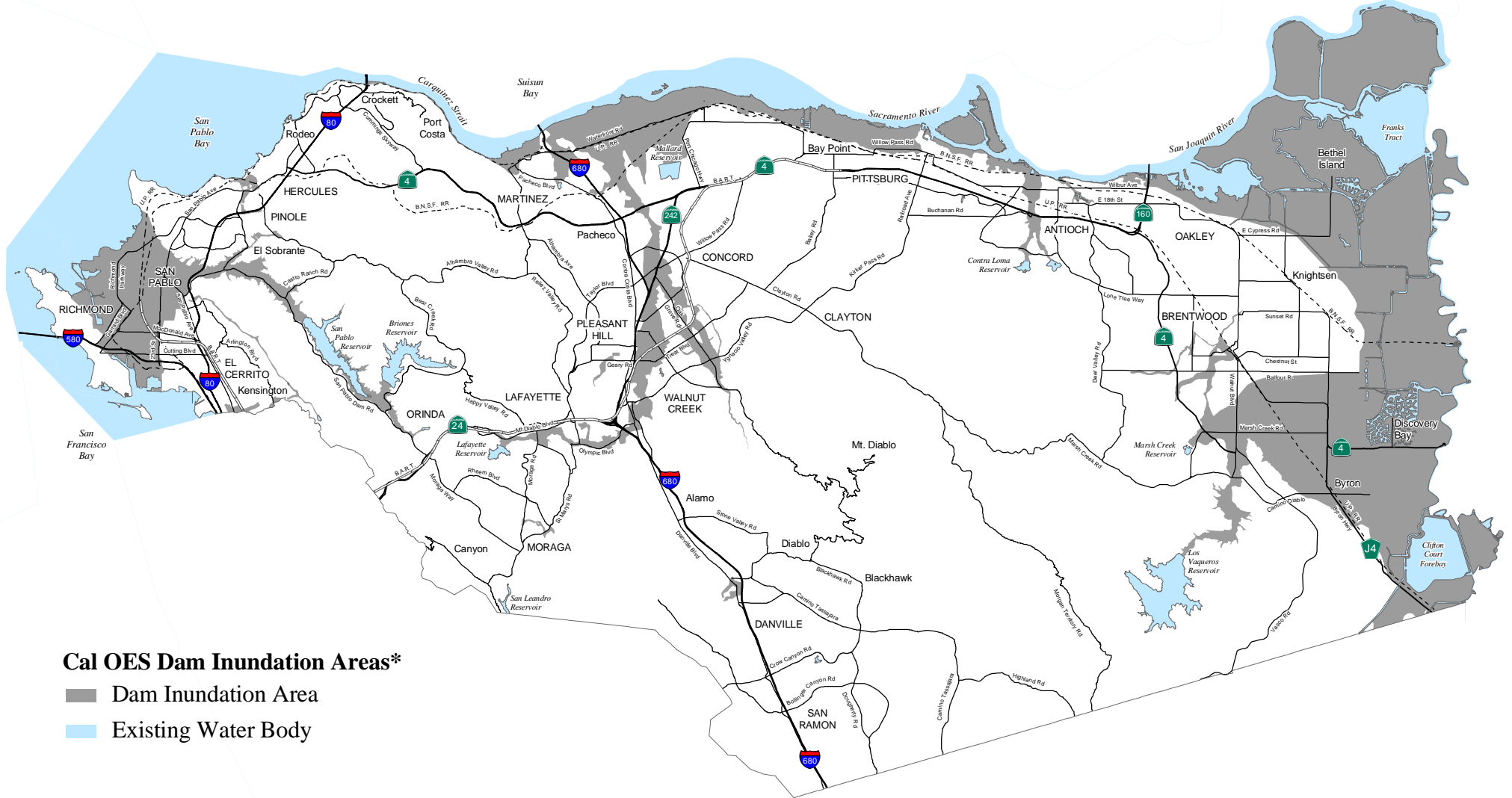


Figure 10-8b Existing and Planned Development in Unincorporated Flood Hazard Areas



* This is a generalized map. For site specific information please refer to Flood Insurance Rate (FIRM) maps prepared by the Federal Emergency Management Agency (FEMA).

Figure 10-8c Dam Inundation Areas



Cal OES Dam Inundation Areas*

- Dam Inundation Area
- Existing Water Body

* This is a generalized map. For site specific information please refer to the Cal OES Dam Safety Program from the California Governor's Office of Emergency Services.