APPENDIX G
Hydrology and Water Quality Report

Hydrology and Water Quality
for
San José, California

Envision San José 2040

December 6, 2010

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1. Introduction

The City of San José's General Plan was adopted in 1994, and is used by the City in making day-to-day decisions regarding land use, development, and City services. In June 2007 the City Council of San José initiated a comprehensive update of the City's General Plan, titled Envision San José 2040.

The first step of any general plan is to obtain a comprehensive understanding of existing conditions. To that end, existing conditions within the City of San José Urban Growth Boundary as related to hydrology, water quality, and water supply, including regional surface water and groundwater issues are described in Section 2 of this report. This section examines the environmental setting of the City Urban Growth Boundary including a discussion of land use as it relates to water resources, surface water features, water quality, and flood risks. San José's water supplies are described in Section 3, including groundwater resources and groundwater quality. The regulatory framework for water resources in the City is presented in Section 4, and Section 5 presents General Plan impacts and mitigation measures related to hydrology and water quality. Brief discussions of possible climate change impacts relevant to City planning are woven throughout the report, and a more detailed evaluation is appended to this report.

2. Environmental Setting

2.1 Regional Setting

Located in the heart of Silicon Valley between the Santa Cruz Mountains and Diablo Range, the City of San José is approximately 40 miles southeast of San Francisco, at the lower end of San Francisco Bay, 30 miles inland from the Pacific Ocean. San José is the county seat of Santa Clara County. The Santa Cruz Mountains separate San José from the Pacific coastline. Santa Clara Valley, which stretches to the southeast from San Francisco Bay, comprises the lowlands that lie between the forested Santa Cruz Mountains and the drier grasslands, chaparral, and oak savanna of the Diablo Range, which separates the Santa Clara Valley from San Joaquin Valley to the east. The area's regional context is shown in Figure 1.

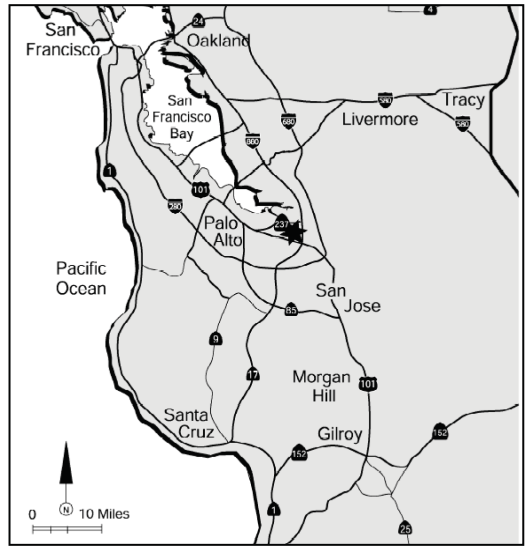

Figure 1. General Vicinity Map

San José is located on the easterly side of the Santa Clara Valley. The City's southern urban growth boundary nearly coincides with Monterey Bay's northern watershed boundary. San José is bordered by the cities of Milpitas to the north; Santa Clara, Campbell, Cupertino, Saratoga, and Los Gatos to the west; and Morgan Hill to the southeast along Highway 101. East of San José is the Diablo Range, which runs between Mount Diablo and Mount Hamilton, and bordering on the south are the Santa Cruz Mountains. Parts of San José extend into the foothills of both of these ranges. There are no other major geographical boundaries, primarily because San José has developed over time through various annexations of smaller urban areas. There are, however, several major watercourses that run through San José, including the Coyote Creek and Guadalupe River systems, which ultimately discharge into the South Bay.

Major transportation thoroughfares in and through San José include U.S. Highways 101, 280, 680, and 880; State Highways 17, 85, and 87; the Caltrain passenger train line; the Santa Clara Valley Transportation Authority (VTA) Light Rail line; and the Norman Y. Mineta San José International Airport.

San José's incorporated area is 178 square miles,[1] making it the largest city in the Bay Area. The urban area within the Urban Growth Boundary (UGB) is about 139 square miles based on Geographic Information System (GIS) data provided by the City. The UGB and Sphere of Influence for San José are shown in Figure 2. This analysis of existing hydrologic conditions within San José is limited to the UGB.

2.2 Topography

The topography of San José varies with the lowest elevations near sea level at the South Bay in the northwestern Alviso area, downtown and airport elevations near 90 feet above sea level, and elevations reaching greater than 300 feet in the foothills at the edges of the city. The mountain ranges just outside of the city reach over 4,000 feet in elevation.

Most of the city lies on the floor of Santa Clara Valley. There are sections of the city subdivided by hills, most notably in Almaden Valley, where the Santa Teresa Hills rise to over 1,000 feet in elevation. Slopes vary from essentially zero to two percent on the valley floor with some steeper slopes in the foothills.

2.3 Climate

San José has a Mediterranean-type climate, characterized by sharply contrasting wet and dry seasons with warm, dry summers and cool, moist winters. Summer temperatures normally range from a high near 80°F to a low around 60°F. Winter temperatures are normally temperate with highs around 60°F during the day and lows around 40°F at night. However, it is not unusual for temperatures to rise above 100°F every summer or to fall below 40°F occasionally in the winter. Some of the higher elevation areas of Almaden or Evergreen, whose weather patterns are not as influenced by the large surrounding surface water bodies, may experience less moderate temperatures, with lower lows and higher highs.

The average yearly rainfall varies across the City, dictated largely by topography. Isohyets (lines which connect points of equal annual precipitation) in the area are generally parallel to topographic contours. The mean annual precipitation downtown is a modest 14.5 inches, increasing to 22 inches in the foothills in eastern San José. Average annual precipitation generally decreases from south to north. Most of the precipitation occurs between November and April with generally sparse precipitation between May and October. The wettest month of the year is usually January, with an average rainfall of about 3 inches. Snowfall is not a significant form of precipitation in San José; there are only a handful of documented significant snowfalls in over 100 years.

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[1]City of San José's webpage. www.sanjoseca.gov/about.asp. Accessed on February 13, 2009.

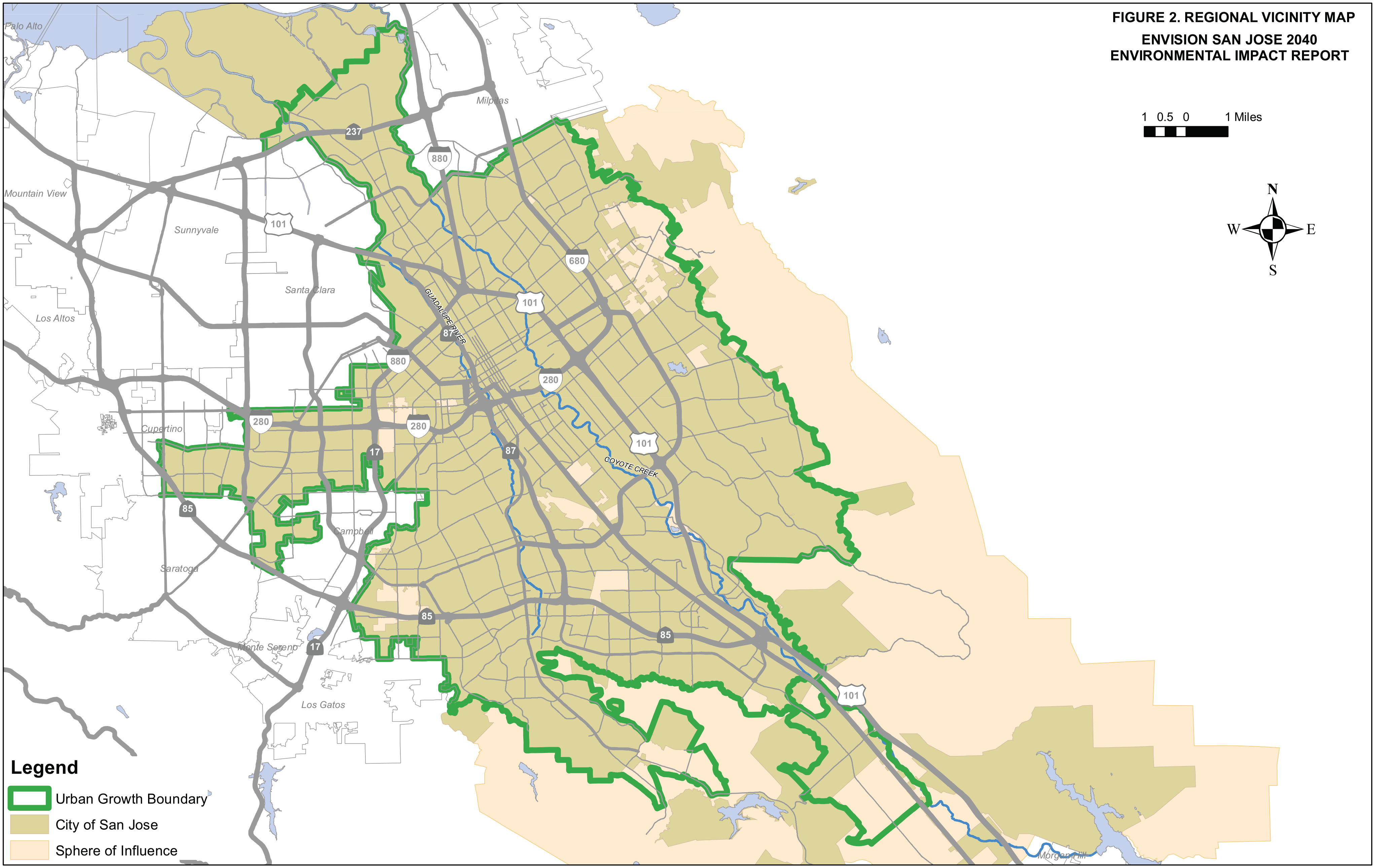

FIGURE 2. REGIONAL VICINITY MAP
ENVISION SAN JOSE 2040
ENVIRONMENTAL IMPACT REPORT
1 0.5 0 1 Miles
N
W
E
S
Palo Alto
Mountain View
Sunnyvale
Santa Clara
Los Altos
Cupertino
Saratoga
Campbell
Monte Sereno
Los Gatos
Milpitas
Morgan Hill
GUADALUPE RIVER
COYOTE CREEK
237
880
101
680
87
280
17
85
Legend
Urban Growth Boundary
City of San Jose
Sphere of Influence

Average rainfall and its seasonality can also vary due to external weather altering events, such as El Niño or periodic drought. El Niño can produce a significant increase over normal rainfall and extend the duration of the wet season. On the other hand, several droughts of five to seven years have been documented in the San José area over the last 100 years. Studies of tree rings indicate at least three 10- to 20-year periods of below-average precipitation since the mid-1500s.[2] Average annual evapo-transpiration in San José is approximately 50 inches;[3] a potential water loss that is substantially higher than the mean annual precipitation. Evapo-transpiration (ET) is defined as the combination of evaporation and transpiration of water from the land's surface to the atmosphere. Sources of evaporation include the ground surface, the capillary fringe of the groundwater table, and the transpiration of groundwater by plants whose roots tap the capillary fringe of the groundwater table. Transpiration is essentially the evaporation of water from plant leaves.

The amount of precipitation in San José that is carried away by flowing watercourses as stormwater runoff varies greatly and depends on factors such as topography, soil characteristics, depth to groundwater, and density of urban development. Influenced by the same factors, infiltration of precipitation into the underlying soils is also highly variable. Flooding in San José is discussed in detail later in this section.

2.4 Land Uses

San José was an agricultural community with rural development patterns until the mid-twentieth century. Around that time, San José's economy began shifting towards commercial technology firms. Ultimately San José implemented various growth measures and consolidated outlying areas to encourage residential development within the city's core and near existing development, infrastructure, and urban services. The Urban Growth Boundary, adopted in 1996, is in fact meant to further manage the city's growth, consolidate development and preserve open space.

The essential land uses of San José, thus, have development focused in the valley floor with undeveloped land in the foothills mostly protected from further development. There is still some vacant, undeveloped land remaining on the valley floor. The existing developed area of San José consists of the common varied uses of a major metropolitan area, including light industrial, commercial, educational, medical, and varying densities of residential development. Older residential portions of the City tend to be relatively less dense, although the current trend in San José is to develop increasingly denser forms of residences, including high-rise

[2]Watershed Management Initiative, *Watershed Characteristics Report*, August 2003

[3]California Irrigation Management Information System. *Monthly Average ETo Report*, Station # 69, San José.

condominium towers downtown. Downtown San José and nearby transit corridors are also home to City and County government offices. Portions of the City within the UGB are currently undeveloped or utilized as open space or agricultural fields, including the Coyote Valley area near Morgan Hill. The foothills and mountainous areas surrounding San José tend to be used as rangeland or left undeveloped as grasslands, shrublands, woodlands, and forests. Figure 3 shows the various land uses within the UGB, as defined in the City's 2020 General Plan.

As part of the Envision San José 2040 General Plan update, the City prepared an Existing Land Use and Development Trends Background Report. The description of existing land uses is based on recent land use surveys conducted for portions of the city, together with zoning data, General Plan land use designation data and aerial photography of areas.

Existing development within San José falls under the following land use categories:[4]

- **Residential:** 43 percent of San José's urban service area is used for residential development, with a majority as single-family detached housing;
- **Industrial:** 8 percent of the urban service area is currently used for manufacturing, heavy industry, research and development, light manufacturing, and high technology firms;
- **Commercial:** 5 percent of the urban service area is used for a variety of commercial uses including retail stores and services, professional and medical offices and services, auto sales, and entertainment uses such as movie theaters, restaurants, bars and nightclubs.
- **Vacant/Undeveloped:** 6 percent of the urban service area is vacant or unused, with a little less than half of this vacant land zoned for residential use.
- **Public/Quasi-Public:** 17 percent of the urban service area is used for parks and open space, government and institutional uses, schools, and airports.
- **Rights-of-Way:** 21 percent of the urban service area is used for public rights-of-way which include public roadways and light rail or heavy rail corridors (i.e. Union Pacific Railroad).

[4]City of San José, Department of Planning, Building, Code Enforcement, March 21, 2008: *Existing Land Use and Development Trends Background Report*.

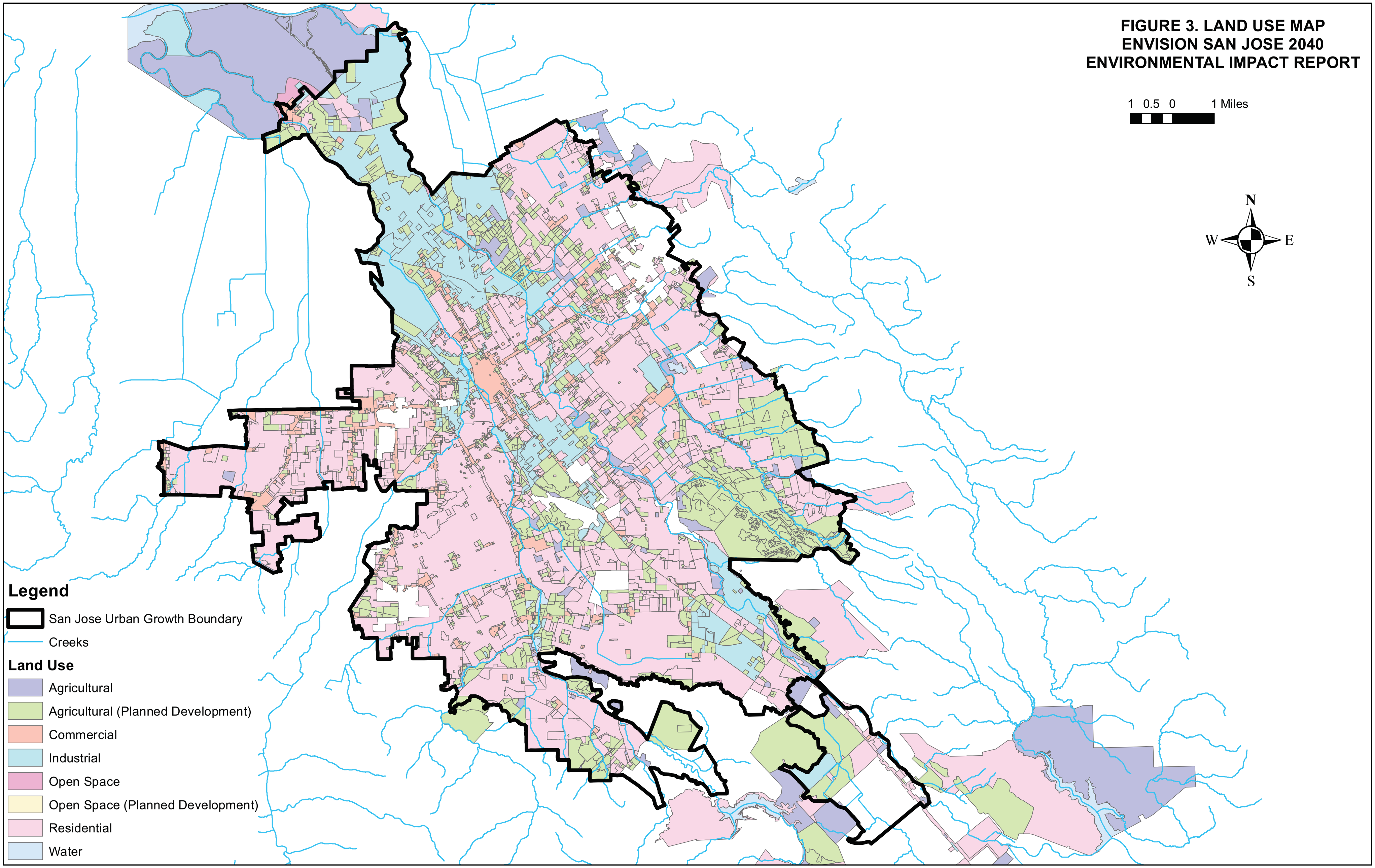
FIGURE 3. LAND USE MAP
ENVISION SAN JOSE 2040
ENVIRONMENTAL IMPACT REPORT
1 0.5 0 1 Miles
N
W
E
S
Legend
San Jose Urban Growth Boundary
Creeks
Land Use
Agricultural
Agricultural (Planned Development)
Commercial
Industrial
Open Space
Open Space (Planned Development)
Residential
Water

Coyote Valley makes up a large portion of the vacant land (1,600 acres or about 33 percent of the UGB) and is located in the southeastern edge of San José. Coyote Valley may be the location of significant future development. Both industrial land uses and mixed commercial/residential land uses have been explored for this area, although at this time the exact nature or timeline of development is unknown.

San José also has considerable riparian corridors immediately adjacent to its various stream channels. San José's Riparian Corridor Policy Study defined riparian corridors as: "…any defined stream channels including the area up to the bankfull flow line, as well as all riparian (streamside) vegetation in contiguous adjacent uplands. Characteristic woody riparian vegetation species could include (but are not limited to) willow, alder, box elder, Fremont cottonwood, bigleaf maple, western sycamore, and oaks. Stream channels include all perennial and intermittent streams shown as a solid or dashed blue line on U.S. Geological Survey topographic maps, and ephemeral streams or 'arroyos' with well defined channels and some evidence of scour or deposition."[5] The combined area of riparian corridors in San José is approximately 20 square miles.[6] Much of the historic riparian corridor areas within San José are zoned and developed for residential, commercial, or other non-natural uses.

A vacant land inventory done in 2007 for the City identified 4,906 acres (7.7 square miles) of total vacant land dispersed throughout the city. The planned use of these areas is as follows:

- **Residential:** 808 acres (16%);
- **Industrial:** 3,234 acres (66%);
- **Commerical:** 125 acres (3%); and
- **Public/Quasi-Public:** 739 acres (15%), such as transportation facilities, schools, hospitals, and parks.

At the time of the 2007 vacant land inventory, a large portion of the total vacant land (1,616 acres - 33%) was slated for industrial development in north Coyote Valley at the southeastern edge of San José. This area is known as the Coyote Valley Research Park (CVRP). On March 18, 2008 the Coyote Housing Group terminated its agreement with the City to fund the preparation of the Coyote Valley Specific Plan (CVSP). The City has since taken the work completed prior to this termination and developed the Coyote Valley Plan: A Vision for Sustainable Development. This Vision Plan does not meet the regulatory requirements of a specific plan;

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[5]The Habitat Restoration Group & Jones and Stokes Associates. City of San José, March 1999: *Riparian Corridor Policy Study*.

[6]Based on an estimate of half of the riparian corridors of Coyote Creek and Guadalupe River as reported in Table 4-13 of Watershed Management Institute. *Watershed Characteristics Report*, August 2003.

however it is expected to be a baseline resource for future development within Coyote Valley. Although included in the CVSP efforts and subsequent Vision Plan, CVRP was planned and permitted prior to the preparation of the Coyote Valley Vision and is free to develop as Campus Industrial land usage as market conditions allow.

Finally, of note in terms of hydrology and water quality is the fact that there have historically been a number of mineral mines and quarries within San José and its vicinity. In particular, mercury mines were heavily utilized in New Almaden just south of the city, and more recently, alluvial gravels have been quarried in and around San José. Today at least two active quarries remain in the area.

2.5 Geology and Soils

The oldest rocks in Santa Clara County are of the Franciscan-Knoxville group of Upper Jurassic age, forming the largest single geologic unit in the area. Overlying these Jurassic rocks are marine sedimentary rocks of Cretaceous age. The valley floor is composed to a depth of about 1,500 feet of an accumulation of Quaternary clay, sand, and gravel, deposited by rivers and the Bay for perhaps 30,000 years.

The geologic structure of the area is controlled by faulting, the trend of which is northwesterly, as is common in California. San José lies in one of the most seismically-active regions of the world, with the San Andreas Fault to the west in the Santa Cruz Mountains and the Hayward and Calaveras faults in the mountainous areas to the east. The Santa Clara Valley is essentially a large trough that has been filled by gravel, sand, silt, and clay eroded from the adjacent mountains.

The earthquake faults in the area have the potential not only to cause damage from dramatic movement of the ground but also from liquefaction of particular soils. The United States Geological Survey (USGS) has recently released a report mapping liquefaction probabilities for earthquakes of different magnitudes on the San Andreas, Hayward, and Calaveras Faults. The most susceptible areas identified are around the Guadalupe River and Coyote Creek near downtown San José and north to the Bay. A magnitude 7.8 earthquake on the San Andreas Fault, similar in scale to the 1906 San Francisco earthquake, is estimated to have a 30-40 percent probability of liquefaction in these areas. Smaller magnitude earthquakes on the other two faults are estimated to have a lower probability of liquefaction throughout San José, and a 20 percent or less probability along the same areas of the two watercourses.

Soils in San José and in the Santa Clara Valley are generally clays in the low-lying areas neighboring the Bay, loam and gravelly loam in the upper portions of San José, and eroded rocky clay loams in the hills. The percolation capacity of soils is characterized by Soil

Conservation Service (SCS; now Natural Resources Conservation Service or NRCS) Hydrologic Soil Groups "A" through "D", with "A" soils having the highest percolation rates. Figure 4 shows SCS soil groups in San José.[7] The low-lying areas of San José are characterized by clay loam or silty clay loam, Group "D" soils with very low infiltration rates. Outside of these low-lying areas and through south San José are located mostly loam or silt loam, Group "B" soils with moderate infiltration rates. There is also some clay loam, Group "C" soils with slow infiltration rates interspersed in parts of San José, particularly in the hilly areas. Development over much of San José has reduced the percolation capacity of the native soil type, which may reduce natural replenishment and increase surface water runoff.

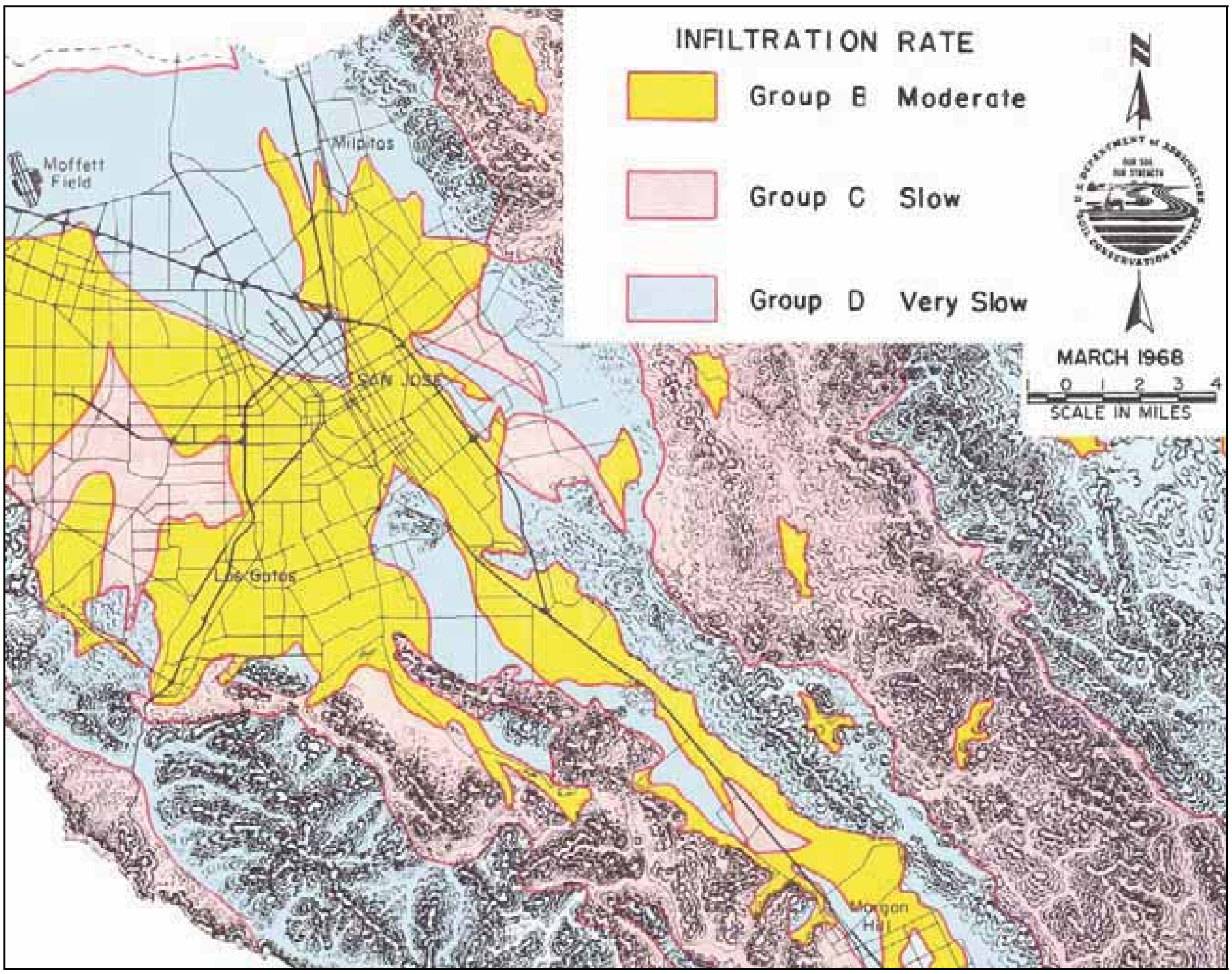


Figure 4. Soils Map of San José

Another useful way of categorizing San José's soils is by physiographic land divisions, taking into account topography and the origin of landforms. Soils in San José may be categorized into five major types of landforms:

[7]United States Department of Agriculture, Soil Conservation Service, 1968: *Soils of Santa Clara County*.

- **Alluvial fan soils**, located on the valley floor bordering watercourses, form from sediment deposited by these watercourses. They tend to be deep soils and are easily penetrated by both roots and water due to the lack of cohesive clay in the subsoils, making them some of the most desirable for agricultural production.
- **Basin-land soils** have a heavy texture and contain large amounts of clay. Formed in relatively flat places, they tend not to be well drained and sometimes contain alkali deposits leaving them unfit for agricultural production. The northern portion of San José, adjacent to the Bay, has a large proportion of basin-land soil.
- **Low terrace land** is found in many places around the edges of the Santa Clara Valley, occupying terrace positions above the general level of the valley floor. Most of these soils are remnants of older valley-filling materials; they tend to have significant percentages of clay in their subsoil and can be difficult for both roots and water to penetrate.
- **High terrace land** occurs along the edges of the valley, merging into the hills and older, higher terraces. These areas are typically rolling, and the soils are more fully developed and more erosive than those on lower terraces.
- **Upland, or primary, soils**, which are derived from the weathering of underlying bedrock, occupy much of the slopes of the Diablo Range and Santa Cruz Mountains. Some of the flatter, upland soils are farmed or grazed, but these soils are presently of little agricultural importance but support a diverse range of plants and animals.

The erosion potential is low for the valley floor soils in San José. Soils in the foothills have a greater potential for erosion. Most of San José is highly urbanized and classified as having *Xerorthents* – well disturbed and highly variable soils. The urban areas and mud flat lands are also characterized by clay alluvium soils of the Botella, Reyes, Novato, Tamba, Clear Lake, Pescadero, and Cropley Series.

Serpentine soils are also found in parts of San José, such as the hills in the Silver Creek area. Gravelly loam soils of the Henneke, Montara, and Okiota Series also occur in San José in this area. These gravelly loam soils are characterized by the significant presence of gravels. Just east of the Silver Creek hills around Yerba Buena Creek are some clay loam soils of the Azule, Inks, Altamont Series. Pockets of silt loam soils of the Millsholm, Los Osos, and Los Gatos Series and loam soils of the Gaviota, Vallecitos, Los Gatos Series are found in the surrounding hilly areas of San José. The Coyote Valley area is characterized by Clear Lake clay, Zamora clay loam, and various designations of silty clay, clay loam, and silty clay loam soils.

2.6 Surface Water

Historically, many of the creeks in San José were dry during the summer. As patterns of water use and water importation changed, many creeks experienced increased summer flow. Today some streams are perennial in their lower reaches due to urban runoff, high groundwater, or a combination of both. To recharge the groundwater basin, stored and imported water is released from water supply reservoirs and other parts of the water distribution system during summer months into many creeks that would otherwise be dry. Although many of the creeks have historically run dry in the summer, rainfall during the winter and some summer storms cause flooding along these same watercourses, as well. These surface water elements and flood risks are described in more detail below.

2.6.1 Surface Water Reservoirs

Part of Anderson Reservoir on Coyote Creek lies within San José city limits (but outside the Urban Growth Boundary), and three other nearby reservoirs – Almaden Reservoir, Calero Reservoir, and Guadalupe Reservoir – directly affect the watersheds and streams of San José. Also close to San José are Williams, Lexington, Cherry Flat, Vasona and Coyote Reservoirs. All reservoirs except Cherry Flat are located near the southern border of San José. Cherry Flat Reservoir is located northeast of San José, and is connected to Upper Penitencia Creek. Chesbro Reservoir is also located near San José, but it is connected to Llagas Creek, which does not flow through the Urban Growth Boundary. (Llagas Creek drains to the Pajaro River and Monterey Bay.) Therefore, Chesbro Reservoir is not included in this study. Figure 5 shows these reservoir locations.

Almaden, Calero, Guadalupe, Vasona, and Coyote reservoirs were constructed in the mid-1930s to store water for the recharge of groundwater basins during the summer months.[8] Almaden Reservoir has a storage capacity of 1,586 acre-feet (ac-ft) and a drainage area of 12 square miles. Calero Reservoir has a storage capacity of 10,050 ac-ft and a drainage area of 7 square miles. Guadalupe Reservoir has a storage capacity of 3,723 ac-ft and a drainage area of 6 square miles. Vasona Reservoir has a storage capacity of 400 ac-ft and a drainage area of 43 square miles. Coyote Reservoir is the largest of the five, with a storage capacity of 22,925 ac-ft and a drainage area of 121 square miles. All five reservoirs are owned by the Santa Clara Valley Water District (SCVWD). Lexington Reservoir was built in 1952, has a storage capacity of 19,834 ac-ft, and a drainage area of 37.5 square miles. It is also owned by SCVWD. Williams Reservoir is a small reservoir located along Los Gatos Creek, upstream of Lexington Reservoir. It is owned by the San José Water Company and has a storage capacity of 157 ac-ft.

[8]Watershed Management Institute. *Watershed Characteristics Report*, August 2003, Chapter 7

Anderson Reservoir is by far the largest reservoir serving San José, with a storage capacity of 89,073 ac-ft and a drainage area of 193 square miles. It was built in 1950 on a 500-acre dairy and cattle ranch along Coyote Creek. Anderson Reservoir is the largest man-made lake in Santa Clara County. To aid downstream agencies and as required by state law, SCVWD has developed inundation maps that estimate which areas could be flooded in the unlikely event of an uncontrolled release of water from the Anderson Reservoir (See Figure 5). Anderson Reservoir is owned by Santa Clara Valley Water District.

Cherry Flat Reservoir is a small reservoir located northeast of San José, along Upper Penitencia Creek. It was constructed in 1932 and is owned by the City of San José. Cherry Flat Reservoir has a capacity of 100 ac-ft. (Table 1 presents a comprehensive listing of reservoir data.)

Beneficial Uses of Reservoirs

Although the primary purpose of the District's reservoirs is to store water for direct municipal use or groundwater recharge, they also provide an incidental flood management function. Floodwaters from the upland portions of their respective drainage basins may be held back by the reservoirs until high flows in the downstream creeks and channels have receded.[9] They are also used extensively for recreation and have significant wildlife habitat value. All of the reservoirs owned by the District are leased to the Santa Clara County Department of Parks and Recreation. Depending on the reservoir, permitted activities include power-boating, sailing, fishing, swimming, and picnicking. Table 2 summarizes the beneficial uses of each reservoir.

All eight reservoirs affecting San José provide some type of *environmental benefit*. All reservoirs are used to support warm water ecosystems, and all but two are also used to support coldwater ecosystems. These ecosystems can include, but are not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. All eight reservoirs are also used for fish spawning and for supporting wildlife habitats.

Water supply is the most important benefit that all the reservoirs provide to some extent. Two of the reservoirs are used for agricultural supply or ranching, including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing. Several are used for groundwater recharge. Groundwater recharge refers to the use of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers. Groundwater recharge is discussed in detail in the water supply section of this report. Nearly all of the reservoirs serve as municipal and domestic water supply for community, military, or individual water supply systems.

[9]Ibid, Chapter 8 (8.4.1.3 Flood Management Facilities)

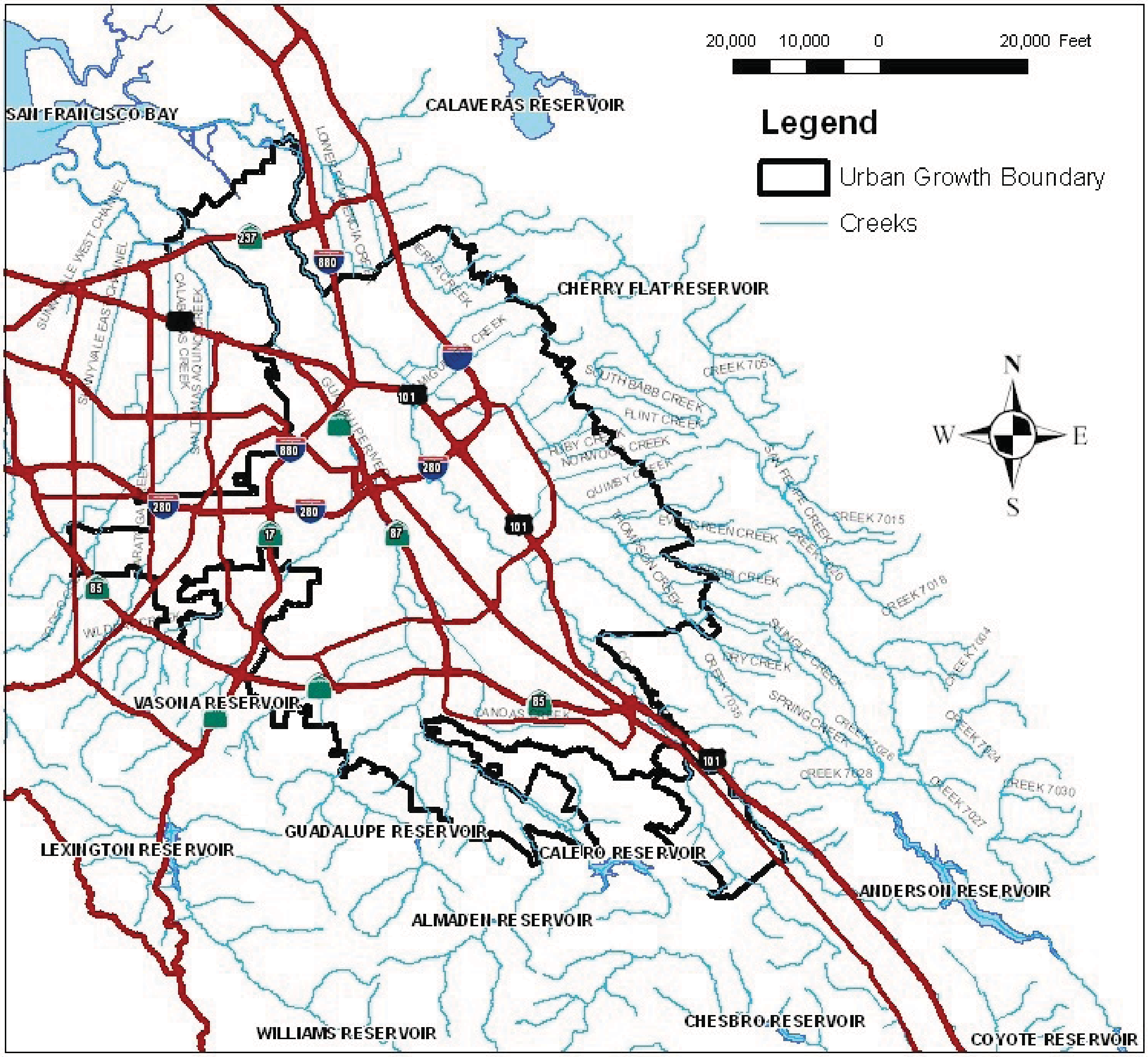


Figure 5. Surface Water Reservoirs near San José, California

Reservoirs can provide an additional *recreational benefit*. Water contact recreation refers to the uses of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, waterskiing, skin and scuba diving, surfing, whitewater activities, fishing, and uses of natural hot springs. All of the reservoirs provide some amount of water contact recreation, though it is generally restricted to prevent contamination. Non-contact water recreation refers to uses of water for recreational activities involving proximity to water but not normally involving contact with water where water ingestion is reasonably possible. These uses in the greater San José area include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities. To protect drinking water from harmful fuel contaminants, power boats are forbidden in some reservoirs.

Table 1. Reservoirs In or Near the City of San José by Watershed

Lake/Reservoir	Stream Location	Year Constructed	Drainage Area (Sq Mi)	Surface Area (Acres)	Storage Capacity (Ac-ft)	Spillway Crest Elevation (Feet)	Reservoir Length (Miles)	Ownership[1]
Guadalupe River Watershed								
Almaden Reservoir	Alamitos Creek	1935	12.0	59	1,586	607	1.1	SCVWD
Calero Reservoir	Arroyo Calero Creek	1935	6.9	347	10,050	484	2.2	SCVWD
Guadalupe Reservoir	Guadalupe Creek	1935	5.9	79	3,723	617	1.1	SCVWD
Lexington Reservoir	Los Gatos Creek	1952	37.5	475	19,834	650	2.5	SCVWD
Vasona Lake/Reservoir	Los Gatos Creek	1935	43.9	57	400	295	0.8	SCVWD
Williams Reservoir	Los Gatos Creek	Unknown			157			SJWC
Coyote Creek Watershed								
Anderson Reservoir	Coyote Creek	1950	192.7	1,245	89,073	625	7.8	SCVWD
Coyote Reservoir	Coyote Creek	1936	121.0	648	22,925	777	4.8	SCVWD
Cherry Flat Reservoir	Upper Penitencia Creek	1932			100	1,680		SJCAED

Source: WMI Water Characteristics Report Unabridged, Table 7-7

[1] Key: SCVWD = Santa Clara Valley Water District
SJCAED = City of San José, Conventions, Arts, & Entertainment Department
SJWC = San José Water CompanyTable 2: Beneficial Uses of Reservoirs in San José Watersheds

Table 2. Beneficial Uses of Reservoirs in San José Watersheds

Reservoir	Agricultural Supply	Cold Freshwater Habitat	Groundwater Recharge	Municipal and Domestic Supply	Water Contact Recreation	Non-contact Water Recreation	Fish Spawning	Warm Freshwater Habitat	Wildlife Habitat
Guadalupe Reservoir		E	E	E	E	E	E	E	E
Coyote Reservoir	E	E		E	E	E	E	E	E
Cherry Flat Reservoir	E			E	L	E	E	E	E
Lexington Reservoir		E		E	E	E	E	E	E
Vasona Reservoir		E	E		E	E	E	E	E
Calero Reservoir			E	E	E	E	E	E	E
Almaden Reservoir		E	E	E	E	E	E	E	E
Anderson Reservoir		E	E	E	L	E	E	E	E

Source: WMI Watershed Characteristics Report, Table 7-9

Legend: E = Existing Beneficial Use; L = Limited Beneficial Use

2.6.2 Flood Management

The SCVWD seeks to protect homes and businesses from damage in a flood equal to or less than the one percent flood. The one percent flood is the flow of water that has a one percent chance of being equaled or exceeded in any given year. It is sometimes referred to as the "100-year flood." Of the 642 miles of creeks and drainage channels managed by the Water District, about 350 miles of channel can convey the one percent flow without overbank flooding. As a result of the District's flood protection efforts, portions of Santa Clara County qualify for reduced flood insurance rates under the National Flood Insurance Program (NFIP).

NFIP regulations define the "base flood" as a flood magnitude that has a one percent chance of being equaled or exceeded in any given year. As noted above, this is often referred to as a "one-percent" or "100-year" flood. This level of risk, however, should not be confused with a flood that *will* occur once every one hundred years, but one that might occur once every one hundred years or so, *on the average,* over a very long period of time. In fact, over the life of a 30-year mortgage, there is a 26 percent chance of experiencing a flood equal or greater in magnitude than the base flood as demonstrated by Table 3, which provides an interesting perspective on flood risk based on the binomial probability theorem.

Table 3. Relative Risk of Various Flood Events

	10-year	25-year	100-year
Annual risk of event	10%	4%	1%
Risk of at least one event in 5 years	41%	18%	5%
Risk of at least one event in 10 years	65%	34%	10%
Risk of at least one event in 30 years	96%	71%	26%
Risk of at least one event in 50 years	99%	87%	39%
Risk of at least one event in 100 years	99.997%	98%	63%

The District has a comprehensive flood management plan program that is conducting an ongoing review of flood protection needs on all creeks in Santa Clara Valley. A number of potential flood protection projects are being considered, including projects on the east-side tributaries of Coyote Creek (Berryessa, Upper Penitencia, and Lower Silver Creeks) and on the middle reaches of the Guadalupe River. The District also maintains its flood control channels to ensure that the capacity of the channels is not reduced by accumulated debris or excessive growth of vegetation.

Regulatory Floodplains

Flood areas are divided into zones by the Federal Emergency Management Agency (FEMA), and published in Flood Insurance Rate Maps (FIRMs). Zone designations are as follows:

- **Zone AE** areas have a 1% probability of flooding in any given year (also known as the "100-year floodplain"), and where predicted flood water elevations above mean sea level have been established. Properties in Zone AE are considered to be at high risk of flooding under the NFIP. Flood insurance is *required* for all properties in Zone AE that have federally-backed mortgages. Construction in these areas must meet local floodplain ordinance requirements, including evidence that principal structures are above the Base Flood Elevation (BFE) as shown on the adopted FIRM maps.
- **Zone A** areas have a 1% probability of flooding in any given year (also known as the "100-year floodplain"), and where predicted flood water elevations have *not* been established. Properties in Zone A are considered to be at high risk of flooding under the NFIP, and flood insurance is *required* for all properties in Zone A that have federally-backed mortgages. Construction in these areas must meet local floodplain ordinance requirements. New construction in Zone A areas may also require submission of engineering cross-sections of the waterway to determine Base Flood Elevations and floodway and flood fringe boundaries.
- **Zone AH** areas have a 1% annual chance of shallow flooding, usually in the form of standing water, with an average depth ranging from 1 to 3 feet. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones. Flood insurance is *required* for all properties in Zone AH that have federally-backed mortgages.
- **Zone AO** areas have a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses are shown within these zones. Flood insurance is *required* for all properties in Zone AO that have federally-backed mortgages.
- ***Shaded* Zone X** areas have a 0.2% probability of flooding in any given year (also known as the "500-year floodplain"). Areas protected by certified levees are also designated as Shaded Zone X, as are areas with 1% flooding less than one foot in depth. Properties in Shaded Zone X are considered to be at moderate risk of flooding under the National Flood Insurance Program. Flood insurance is *not* required for properties in any Zone X (shaded or unshaded). Local floodplain ordinance requirements do *not* apply to Zone X.
- ***Unshaded* Zone X** areas are **above** the 0.2% flood elevation. Properties in unshaded Zone X are considered to be at low risk of flooding under the National Flood Insurance

Program. Flood insurance is *not* required for properties in Zone X (shaded or unshaded). Local floodplain zoning ordinances do *not* apply to Zone X.

- **Zone D** areas are unstudied areas where flood hazards are undetermined but flooding is possible. Flood insurance is typically *not* required for properties in Zone D. Local floodplain ordinance requirements do not apply, but construction recommendations are provided if there is flooding data available from other sources.

Figure 6 shows the floodplain designations within the Urban Growth Boundary of San José, based on the DFIRM published May 18, 2009.

Regulatory Floodway

A "Regulatory Floodway" is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the 1% flood without cumulatively increasing the water surface elevation more than a designated height. Communities regulate development in these floodways to ensure that there are no increases in upstream flood elevations greater than this designated height.

For streams and other watercourses where FEMA has provided Base Flood Elevations (BFEs), but no floodway has been designated, the community must review floodplain development on a case-by-case basis to ensure that increases in water surface elevations do not occur, or identify the need to adopt a floodway if adequate information is available. Figure 7 shows the Regulatory Floodways in or near San José designated by FEMA on the Digital Flood Insurance Rate Map (DFIRM) published May 18, 2009.

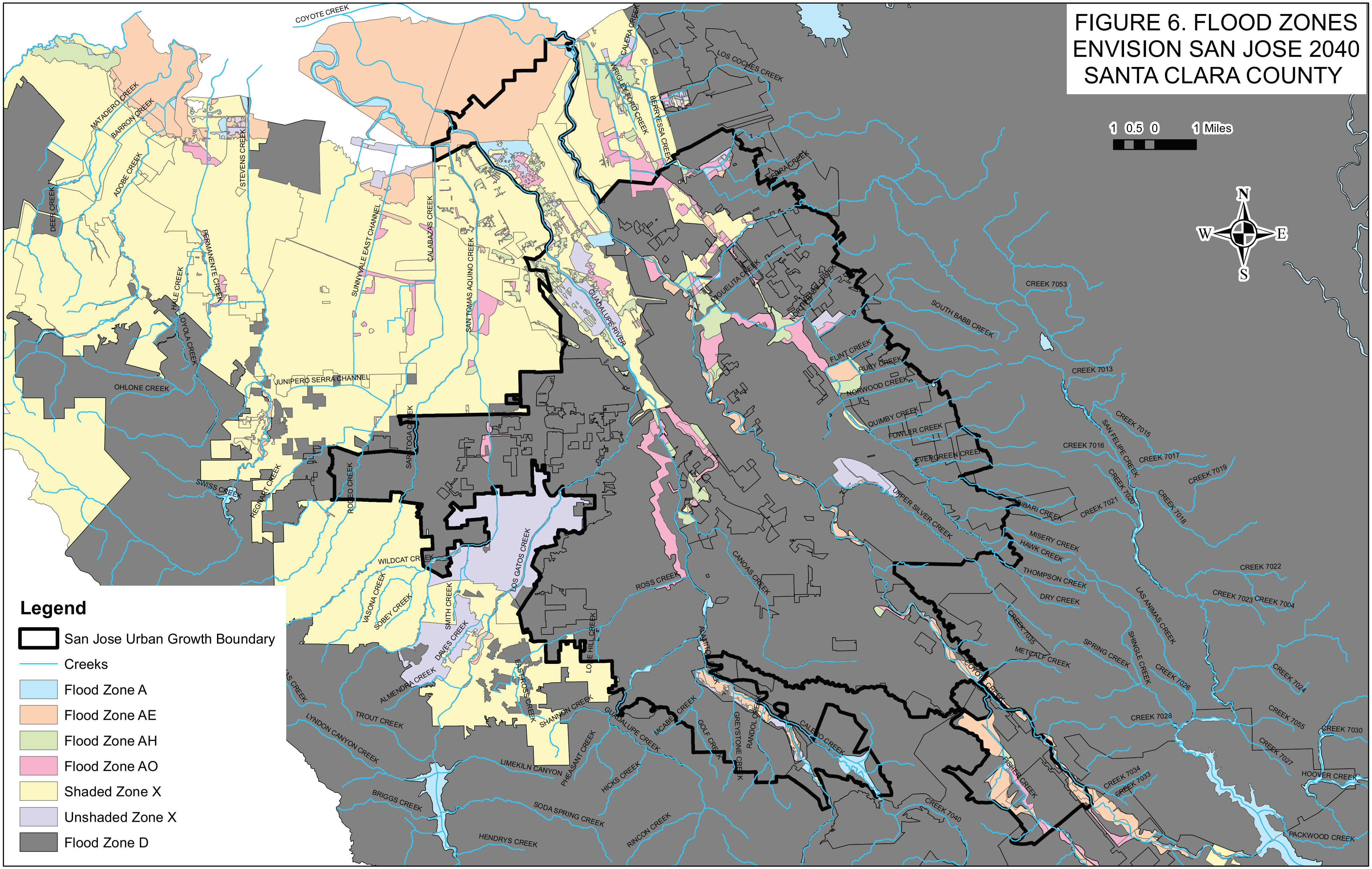
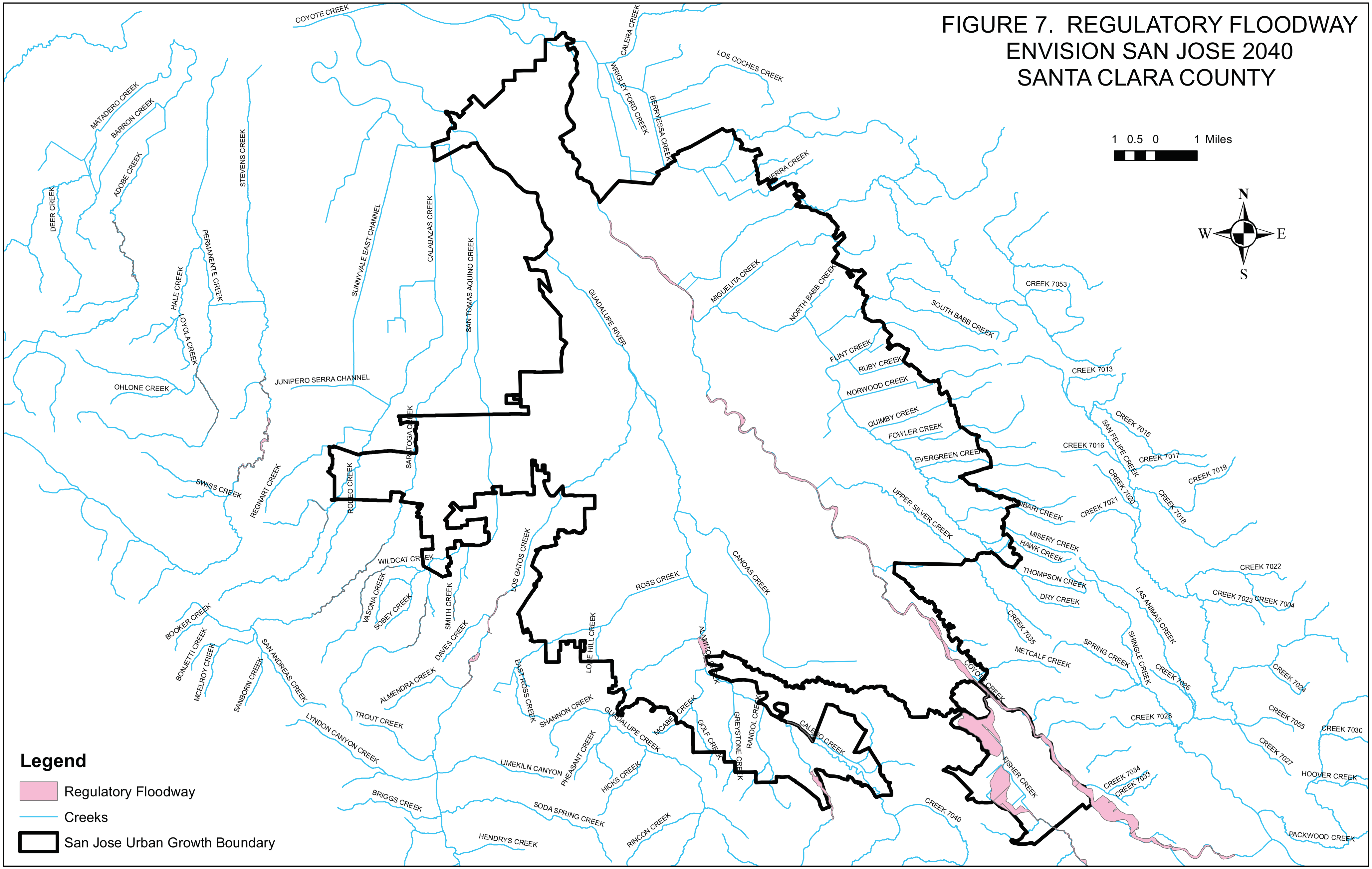


FIGURE 6. FLOOD ZONES
ENVISION SAN JOSE 2040
SANTA CLARA COUNTY
1 0.5 0 1 Miles
N
W
E
S
Legend
San Jose Urban Growth Boundary
Creeks
Flood Zone A
Flood Zone AE
Flood Zone AH
Flood Zone AO
Shaded Zone X
Unshaded Zone X
Flood Zone D
COYOTE CREEK
MATADERO CREEK
BARRON CREEK
ADOBE CREEK
DEER CREEK
STEVENS CREEK
PERMANENTE CREEK
HALE CREEK
LOYOLA CREEK
OHLONE CREEK
JUNIPERO SERRA CHANNEL
SUNNYVALE EAST CHANNEL
CALABAZAS CREEK
SAN TOMAS AQUINO CREEK
SARATOGA CREEK
RODEO CREEK
SWISS CREEK
REGNART CREEK
WILDCAT CREEK
VASONA CREEK
SOBEY CREEK
SMITH CREEK
DAVES CREEK
ALMENDRA CREEK
LOS GATOS CREEK
EAST ROSS CREEK
LONE HILL CREEK
SHANNON CREEK
TROUT CREEK
LYNDON CANYON CREEK
BRIGGS CREEK
LIMEKILN CANYON
PHEASANT CREEK
SODA SPRING CREEK
HENDRYS CREEK
HICKS CREEK
RINCON CREEK
GUADALUPE CREEK
MCABEE CREEK
GOLF CREEK
GREYSTONE CREEK
CALERA CREEK
WRIGLEY FORD CREEK
BERRYESSA CREEK
LOS COCHES CREEK
GUADALUPE RIVER
ROSS CREEK
CANOAS CREEK
FLINT CREEK
RUBY CREEK
NORWOOD CREEK
QUIMBY CREEK
FOWLER CREEK
EVERGREEN CREEK
UPPER SILVER CREEK
SOUTH BABB CREEK
CREEK 7053
CREEK 7013
CREEK 7015
SAN FELIPE CREEK
CREEK 7016
CREEK 7017
CREEK 7019
CREEK 7020
CREEK 7018
CREEK 7021
MISERY CREEK
HAWK CREEK
THOMPSON CREEK
DRY CREEK
CREEK 7035
METCALF CREEK
SPRING CREEK
SHINGLE CREEK
LAS ANIMAS CREEK
CREEK 7022
CREEK 7023
CREEK 7004
CREEK 7026
CREEK 7024
CREEK 7028
CREEK 7055
CREEK 7030
CREEK 7027
HOOVER CREEK
CREEK 7034
CREEK 7033
CREEK 7040
PACKWOOD CREEK
FISHER CREEK

FIGURE 7. REGULATORY FLOODWAY
ENVISION SAN JOSE 2040
SANTA CLARA COUNTY



2.6.3 Surface Water Quality

The 1996 federal Safe Drinking Water Act requires states to develop programs to assess sources of drinking water for potential contamination. In response, the California Department of Public Health (formerly known as the Department of Health Services) has developed the Drinking Water Source Water Assessment Program (DWSAP), requiring public water systems to evaluate their surface and ground water sources for potential contamination from nearby sources.

Waters in San José can be broken into three categories: groundwater, surface water, and imported water. Groundwater is the most significant local source of water supply, and its quality is discussed in detail in the groundwater quality section of this report. Imported water quality is controlled by those wholesalers providing the water to the retailers or Santa Clara Valley Water District, and is treated at one of the District's water treatment facilities prior to delivery to customers. Surface water, while also treated prior to delivery, originates more locally, and thus water quality can be assessed and mitigated locally. Specific surface water contaminants and associated mitigation activities are discussed below.

Mercury

Mercury, also called quicksilver, can be toxic in soluble forms, when inhaled as a vapor, or ingested with contaminated fish. Mercury poisoning causes damage to the central nervous system and various body organs and can be fatal.

Jacques Gulch flows through the Almaden Quicksilver County Park into Almaden Reservoir, which discharges to Alamitos Creek, a tributary to the Guadalupe River. This gulch picks up mercury in the form of calcine along its flow path. The calcine is from roasted mine waste, left by historical mining in the upper Guadalupe River watershed. The SCVWD's Jacques Gulch Restoration Project, anticipated to start in the summer of 2009 along Jacques Gulch, is purposed to reduce the amount of mercury transported into the Guadalupe River watershed. However, historic mercury discharges to the Guadalupe River system and the San Francisco Bay have led to existing problems with mercury contamination of Bay Area sediments and aquatic life.

Questions as to the mercury levels in Almaden Reservoir arose in 2003 in connection with a SCVWD-planned project on the Almaden Dam. As recently as 2003, no data were available to assess the concentration of mercury in the waters of Almaden Reservoir. Data from 1999 on the soils of Almaden Reservoir indicate mercury concentrations of 0.8-0.9 mg/kg of soil. Background concentrations are estimated to be 0.4-1.0 mg/kg, so the reservoir sediments are not considered to be especially contaminated. Since mercury has a high affinity for soil, it is assumed to adsorb to soil readily and not necessarily pose a high risk to recharging groundwater.

Biological Contaminants

Bacteria and other biological contaminants can be introduced to drinking water sources primarily at surface water creeks and reservoirs, particularly if they are near agricultural or wildlife-rich lands. Broken and leaking sanitary sewer system components and septic tanks can also contribute biological contaminants to both surface and ground water sources. These biological contaminants can cause severe illness or even death, especially among vulnerable populations, such as children, the elderly or immuno-deficient individuals.

One identified source of bacterial contamination that affects San José's water supply is the Calero Ranch Stables, whose stormwater runoff flows into Calero Creek and Calero Reservoir, resulting in a notice of violation from the RWQCB. A contingency plan was developed to specify operating procedures for the stables until their lease expires in 2010, after which time the SCVWD anticipates the stables will be relocated to better protect the nearby surface waters from contamination.

Urban Stormwater Runoff and Trash

Under the EPA's National Pollutant Discharge Elimination System (NPDES) Program, the RWQCB has increasingly regulated urban stormwater runoff and its associated pollutants. Most recently, total maximum daily loads (TMDLs) for trash of a certain size have been drafted to regulate the amount of trash entering the Bay Areas watercourses and ultimately the Bay itself. Urban pollutants are primarily managed through source reductions, site planning, or treatment technologies.

The treatment technologies are often referred to as Best Management Practices (BMPs) and include vegetated practices, such as grassy swales and bioretention areas, as well as more traditionally fabricated devices, such as vortex separators and filter systems. Within the Santa Clara Valley, a common NPDES permit is held by the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), an association of the various towns and cities within Santa Clara County. San José is part of SCVURPPP and implements urban runoff pollution prevention mechanisms, such as site planning and various BMPs, through planning and design review of development and redevelopment plans within San José.

Other Surface Water Quality Issues

The Guadalupe River watershed is home to numerous hazardous waste sites that may contribute pollutants from either surface runoff from these sites or high groundwater flow through the contaminated soils of these sites. There are several reported releases of hazardous materials, mostly from leaking underground storage tanks, along the Guadalupe River through San José. There are also a number of potential hazardous, toxic, or radioactive waste (HTRW) sites that could contribute harmful pollutants to the Guadalupe River. These sites include roadway overpasses, auto repair shops, industrial sites, and agricultural lands.

The SFRWQCB Basin Plan also lists several Inactive Mine Sites, within the Guadalupe River and Coyote Creek watersheds. These sites have the potential to leach mercury or other harmful pollutants into storm drainage. Identified mercury mine sites include Hillsdale, Silver Creek, and various mines in what is now Almaden Quicksilver Park. Other identified sites include the inactive manganese mine Pine Ridge and inactive copper mine Hooker Creek. The RWQCB has ongoing monitoring throughout the Bay Area for various contaminants. Related to San José's watersheds, the RWQCB monitors for copper and nickel, specifically at the following sites:

- Just downstream of Alviso along the Alviso Slough;
- In the San Francisco Bay just downstream of the Alviso Slough discharge (Coyote Creek and Guadalupe River confluence);
- In the slough area of Coyote Creek just downstream of the confluence with Mud Slough.[10]

The SFRWQCB Basin Plan lists publicly-owned Wastewater Treatment Plants (WWTP) outfalls and major industrial discharge outfalls in the Bay Area. The only WWTP outfall listed for San José is the San José/Santa Clara Water Pollution Control Plant, a 167 million gallon per day, advanced tertiary WWTP that collects and treats wastewater from San José, Santa Clara, Milpitas, Campbell, Cupertino, Los Gatos, Saratoga, and Monte Sereno.[11] This WWTP discharges most of its treated water through Artesian Slough into the South San Francisco Bay. About 10% of the treated water is currently recycled for irrigation and industrial uses.[12] There are no major industrial discharge outfalls identified in San José.[13]

2.6.4 Tidally Influenced Areas

San José Urban Growth Boundaries include the Alviso Area, which is adjacent to the salt marshes formed by San Francisco Bay; and as such, both the land and its drainage facilities are affected by water levels in the Bay and adjacent marshes. All of the creeks that pass through the City eventually discharge to the Bay, and their capacities and characteristics are also influenced by San Francisco Bay water levels.

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[10]California Regional Water Quality Control Board, San Francisco Bay Region. *San Francisco Bay Basin (Region 2). Water Quality Control Plan (Basin Plan).*

[11]Ibid.

[12]City of San José. Environmental Services.

[13]Basin Plan, 2007.

The Local Mean Sea Level (LMSL) elevation in the San Francisco Bay is often used synonymously with the National Geodetic Vertical Datum (NGVD 29 or NGVD). The relationship between LMSL and NGVD changes depending on location, and near San José 0 feet MSL is about equal to 0.15 foot NGVD. The Mean Higher-High Tide in Alviso Slough in this region is about 4.45 feet NGVD, or 4.3 feet LMSL.[14]

As discussed elsewhere, land subsidence has occurred in parts of San José, particularly in the Alviso area. Meanwhile, averaged over the past 100 years sea level as measured at the Presidio (San Francisco) gage has been rising at a rate of 0.004 feet per year.[15] Due to land subsidence, however, the relative sea level changes (i.e. deepening of water) of San Francisco Bay in the vicinity of San José / Alviso may be greater than this rate. It should be noted that land subsidence in this vicinity has decreased sharply since dewatering of the aquifer through water mining (groundwater extracted in greater volumes than groundwater is recharged) ended in the mid to late 1960s.

One widely publicized effect of global climate change is sea level rise. Although this document does not attempt to define the anthropogenic (human) factors contributing to climate change, the fact that climate change is occurring is unequivocal.[16] The increase in global mean sea level may have impacts to San José, particularly the Alviso area and in tidally influenced reaches of streams and creeks. Depending on the emission scenario used, the predicted *likely* global sea level rise ranges from 0.18 – 0.59 meter (IPCC 4th Assessment Report), or 0.6 foot – 1.9 feet by the year 2099. (The IPCC reports do not provide mid-range estimates; e.g. sea level rise by 2050.) 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. The IPCC estimates that of the global sea level rise that has occurred since 1993, thermal expansion of the ocean has contributed 57% of the total rise, decreases in the extent of glaciers and ice caps have contributed 28%, and the remaining 15% is due to losses from the polar ice sheets. It must be noted that this range does not include uncertainties in climate-carbon cycle feedbacks or the full effect of changes to ice sheet flow, because a basis in published literature is lacking. Thus these values do not represent an upper bound to projected sea level rise.

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[14]NOAA Station Data for Gold Street Bridge over Alviso Slough, ID 9414551

[15]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.

[16]Field, C.B., et.al, 2007: North America. *Climate Change 2007: Impacts, Adaptation and Vulnerability.* …Cambridge University Press, Cambridge, UK, 617-652.

Long term projections show that climate change sufficient to eliminate the Greenland Ice Sheet (one millennium exposed to an average temperature rise in excess of 1.9 – 4.6 degrees Celsius) results in an additional seven meters (23 feet) of global sea level rise. The IPCC does not offer any uncertainty scale for this possibility.

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,[17] or fall within the range predicted by the IPCC 2007 Assessment Report.[18] Both San Francisco Bay Conservation and Development Commission and California Department of Water Resources reports give a higher value for the upper range of sea level rise (4.6 feet) over the next century. Although source information for this value is not provided, at least one published report proposed 4.6 feet (1.3 meters) as the upper confidence limit to global sea level rise by 2100.[19] A recent report studying the economic impacts of sea level rise along the California coast used this estimate of 4.6 feet of sea level rise as the basis for that analysis,[20] although the reference for the sea level rise projection is currently unpublished.[21]

Confidence in any sea level rise prediction decreases the further into the future that analysis is projected, due to unknowns about future emission scenarios or potential climate feedback loops.

Increasing sea levels could have multiple general impacts within the City of San José. Discharge pipes, both for storm and treated wastewaters, will operate differently under higher average tide cycles. Inundation of, or a changing salinity profile within, adjacent marshes and sloughs could have environmental impacts and expose the Alviso area to additional flood risks from the Bay. Streams, creeks and rivers that outlet to the Bay will also have higher water surface elevations for their respective downstream boundary conditions, which may increase water levels throughout a river system during extreme events. Rising sea levels may affect the protection level and certification processes for coastal and riverine levee systems such as Guadalupe River and Coyote Creek.

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[17]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

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

[19]Rahmstorf, S., December 14 2006: *A Semi-Empirical Approach to Predicting Sea Level Rise*. Science Express, Vol. 315 No. 5810 pp. 368-370.

[20]California Climate Change Center, March 2009: *The Impacts of Sea Level Rise on the California Coast*, Draft. CEC-500-2009-024-D. p. 1

[21]Ibid, p.91

Water supply could be affected by increased sea levels in a variety of ways. Depending on the severity of sea level increases, pumps and pipes which deliver potable water to both SCVWD and SFPUC may become inundated or otherwise have their operation affected. Salt water intrusion could have impacts on water supply to the Santa Clara Valley Water District (SCVWD) and retailers who serve potable water to the City. The impact of salt water intrusion to groundwater wells would be most pronounced for imported water sources, but may also impact local groundwater wells in northern San José.

In addition to sea level rise, climate change may impact other flood related factors such as storm surge, wave height and run-up, and rainfall intensity. At this time, no consensus on quantitative estimates for these impacts exists within the scientific community. Generally more intense but less frequent precipitation is predicted, with storm patterns shifting to earlier in the water year (October – September). More intense storms may cause increased storm surge and wave heights in the Bay, although how these conditions would impact San José is unknown since the relatively shallow marsh areas of the South Bay may dampen this potential impact.

A more detailed discussion of climate change and its potential impact on San José may be found in an appendix to this report.

2.6.5 Other Surface Water Hazards

Tsunami

The Association of Bay Area Governments (ABAG) produces Tsunami Evacuation Maps for the Bay Area. There are no tsunami hazard areas shown within or near San José. Therefore, it is assumed that tsunamis would not impact the area.

Dam Failure

Based on the Association of Bay Area Governments (ABAG) Dam Failure Inundation Maps for the area, much of San José has the potential to be inundated if a reservoir fails. Figure 8 shows a compilation of the Dam Failure Inundation Maps for San José. Any colored area stands to be inundated should an upstream reservoir fail. All of the dams potentially affecting San José fall under the jurisdiction of the California Division of Safety of Dams (DSOD) and some also fall under Federal Energy Regulatory Commission (FERC) jurisdiction. The DSOD 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.

As part of its comprehensive dam safety program, the Santa Clara Valley Water District routinely monitors and studies the condition of each of its ten dams to ensure public safety.

Although all of their dams have withstood earthquakes in the past, the District continues to analyze their seismic safety as new technology and geologic information becomes available. The stored capacity of Coyote Reservoir, for instance, has been reduced in the past due to concerns for seismic safety. More recently the District completed a preliminary evaluation that suggests Anderson Dam could be adversely affected by soil liquefaction if a major earthquake were to hit the Calaveras or Coyote Creek faults. Consequently the District will maintain a reservoir surface at least 30 feet below the crest of the dam (about 87% capacity) until further engineering studies conclude that such a restriction is no longer necessary.[22]

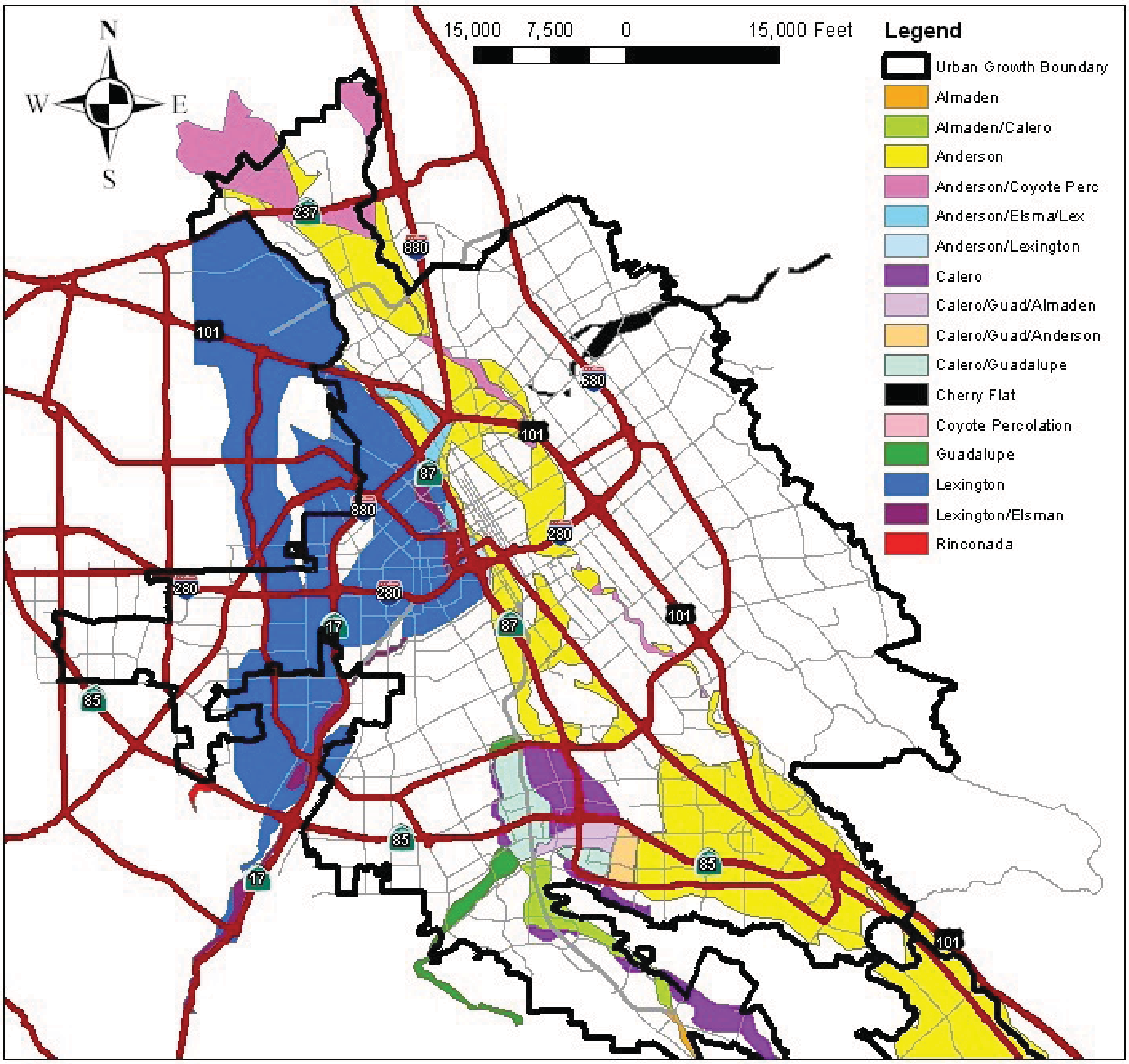

Figure 8. ABAG Dam Failure Inundation Map

[22]Santa Clara Valley Water District, January 6, 2009: *Seismic Stability studied as part of Santa Clara Valley Water District's Comprehensive Dam Safety Program.* Press Release.

2.7 Watersheds within the City of San José

Within the Urban Growth Boundary of San José are three watersheds: San Tomas, Guadalupe, and Coyote. Each of these watersheds is made up of its main creek, from which the watershed derives its name, as well as many smaller tributaries. Watershed elements include not only these tributaries but also dams, reservoirs, and groundwater recharge basins. Figure 9 shows an overview of the three watersheds within the San José Urban Growth Boundary, and each of these watersheds and its elements is described in more detail below.

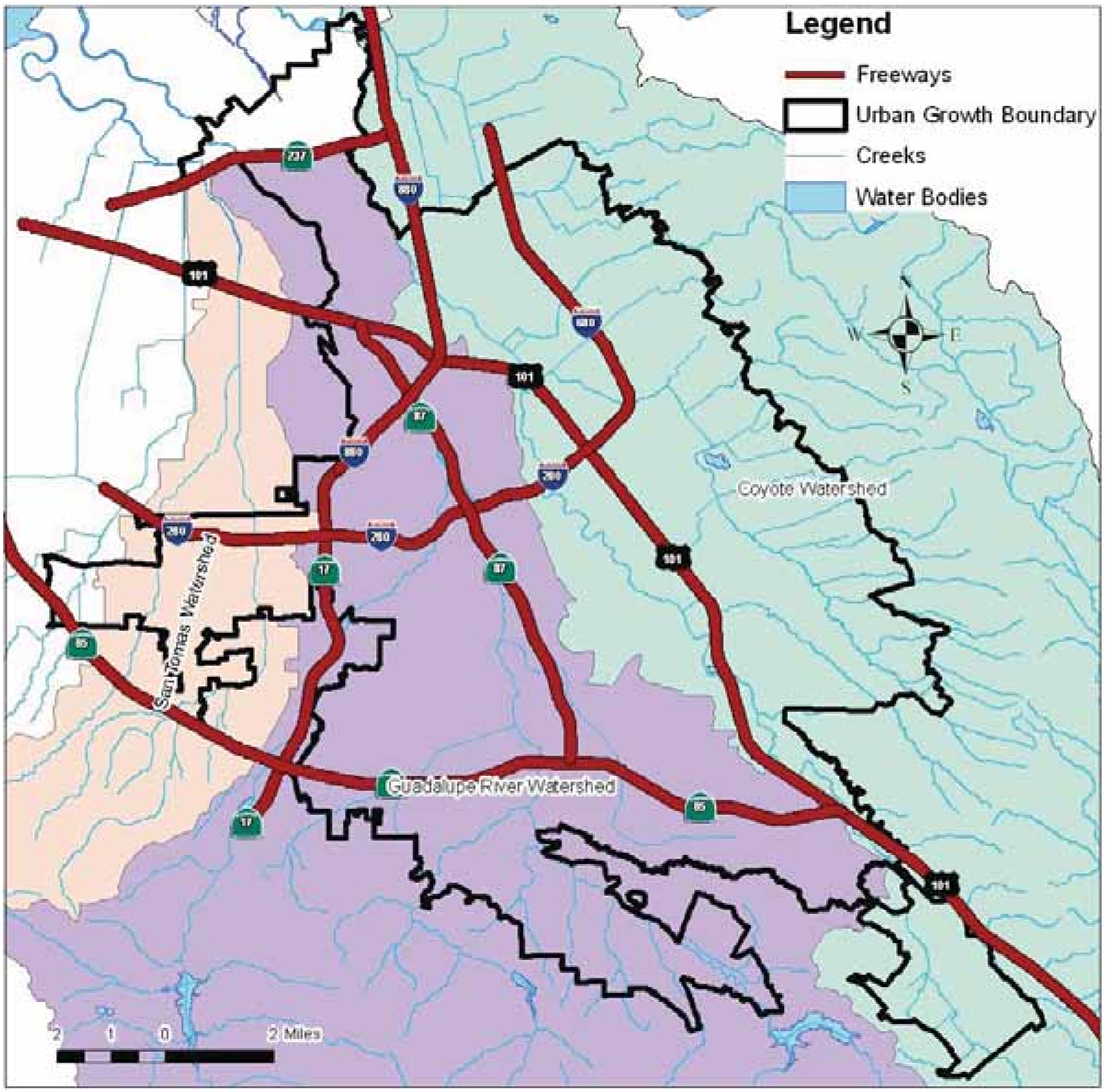

Figure 9. Watersheds within the City of San José Urban Growth Boundary

2.7.1 San Tomas Watershed

Saratoga Creek and San Tomas Aquino Creek are located in the San Tomas watershed, which drains a total area of approximately 45 square miles. The Calabazas Creek watershed borders the San Tomas watershed to the west, and the Guadalupe River watershed borders it to the east. Saratoga Creek flows into San Tomas Aquino Creek, which discharges to the San Francisco Bay via Guadalupe Slough. Only about one mile of Saratoga Creek and two miles of San Tomas Aquino Creek run through the city of San José, as shown in Figure 10 below.

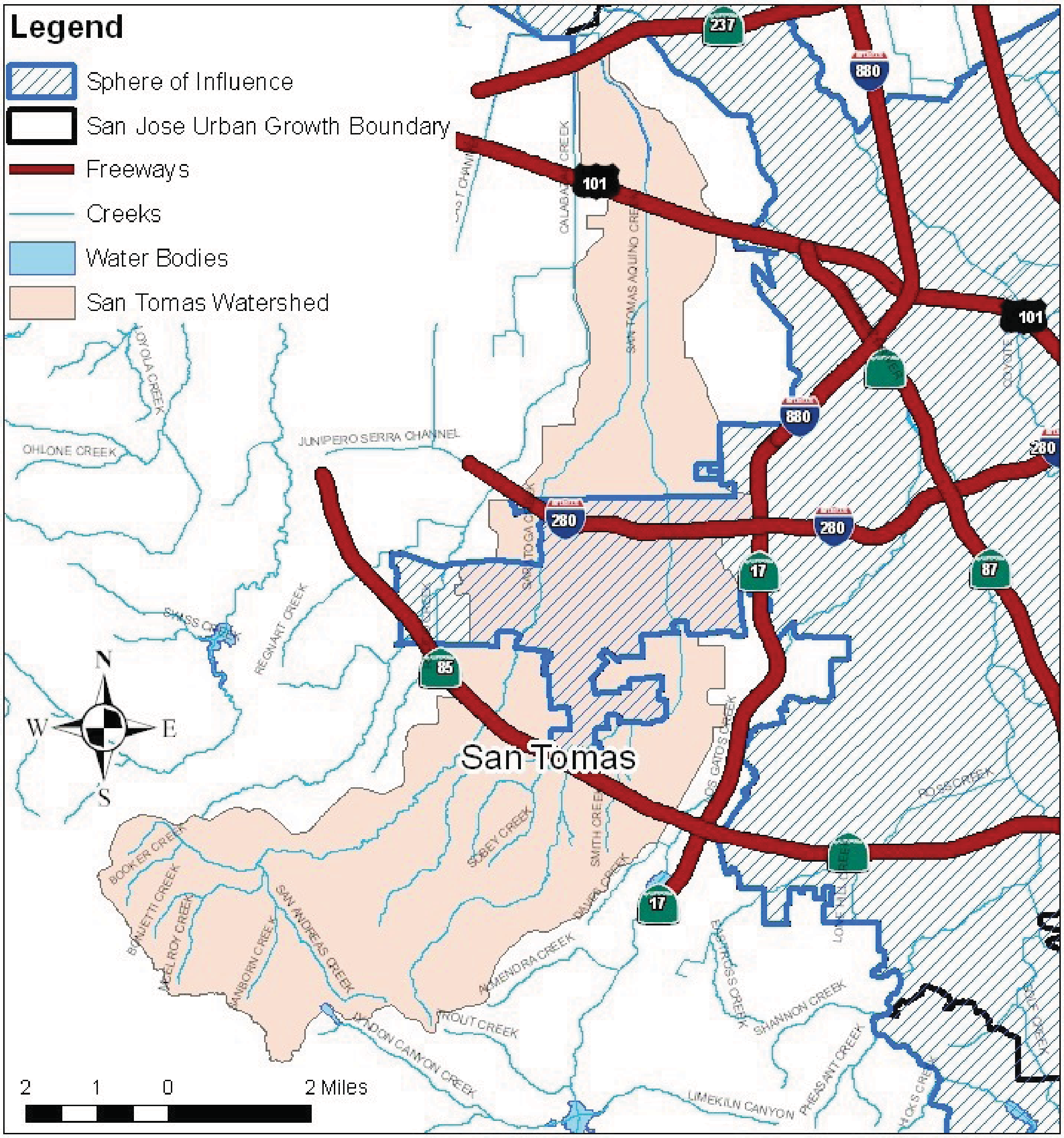

Figure 10. San Tomas Watershed

Land Use

The City has GIS Zoning information – dating at the earliest from August 2005 and much of it updated as recently as December 2008 – for City-owned parcels within the Urban Growth Boundary. This information can be sorted in terms of zoning designation and major watershed to estimate significant land uses within each San José watershed. Based on this zoning data, significant land uses within the San Tomas watershed are proportioned as follows:

- Agricultural: 8%;
- Commercial: 11%;
- Residential: 81%.

These percentages indicate that a significant majority of the developed urban area is for residential use, although there is about a tenth each for agricultural and commercial use. Most of the areas zoned for agricultural use, however, are planned for development according to the zoning information.

Saratoga Creek

The Saratoga Creek watershed drains an area of approximately 17 square miles on the northeast facing slope of the Santa Cruz Mountains. The Saratoga Creek watershed begins at an elevation of approximately 3,100 feet above sea level along Skyline Boulevard at the crest of the Santa Cruz Mountains. The upper portion of the watershed is a bowl-shaped area that is about 4½ miles across at the widest point. The lower portion of the watershed between the City of Saratoga and its confluence with San Tomas Aquino Creek varies between ¼ and 1 mile wide. The creek flows in a northeasterly direction through the cities of Saratoga, Cupertino, San José and Santa Clara, and ultimately ends at its confluence with San Tomas Aquino Creek in the City of Santa Clara just south of Monroe Street. It is a little over 15 miles in length.

Tributaries

Saratoga Creek has several small adjoining tributaries near the foothills of the Santa Cruz Mountains. Among these are San Andreas Creek, Sanborn Creek, McElroy Creek, Bonjetti Creek, and Booker Creek.

Flood History

The earliest floods of record on Saratoga Creek date to the year 1861. Other floods have occurred in the years 1892, 1910, 1940, 1943, 1955, and 1958. The largest flood recorded on Saratoga Creek occurred on December 22, 1955. On that day, the peak flow recorded at the USGS Gaging Station No. 1695 (located in the City of Saratoga) was 2,730 cfs.

Improvements

Construction of flood control channel improvements was completed on the lowermost reach of Saratoga Creek between Cabrillo Avenue and the confluence with San Tomas Aquino Creek in 1980. Between 1984 and 1986, the 3-mile section of the Saratoga Creek channel between Pruneridge Avenue and Cabrillo Avenue was modified to increase channel capacity. The channel was excavated and a gabion lining was installed. Native vegetation has been planted within and above the gabions.

Erosion/Sedimentation

Saratoga Creek is a primarily soft-lined channel and is therefore susceptible to erosion. However, it is not listed on the 2006 303(d) List of Water Quality Limited Segments Requiring TMDLs for sediment or any other pollutant. Saratoga Creek is listed in Appendix G of the HMP Report as non-exempt. Implementation of hydromodification control is required or encouraged on almost all of Saratoga Creek, with the exception of projects within the creek's tidal waters, which are exempt per the Permit Provision C.3.f.ii.

303(d) Impaired Water Bodies

Saratoga Creek was added to the 1998 303(d) list for Diazinon 18. In 2006, it was moved by USEPA from the 303(d) list to the being addressed list because of a completed United States Environmental Protection Agency approved Total Maximum Daily Load (TMDL).

There are also ongoing discussions between the State and Regional Boards and the regulated municipalities of listing several Bay Area water bodies for trash. In addition to Diazinon, the Final 2010 303(d) Integrated Report identifies Saratoga Creek and Lower San Francisco Bay, to which San José's watersheds ultimately drain, as being required to have a TMDL for trash.[23]

San Tomas Aquino Creek

San Tomas Aquino Creek originates in the foothills of the Santa Cruz Mountains and its watershed covers approximately 45 square miles. The river flows in a northerly direction through the Cities of Campbell and Santa Clara, and ultimately ends at the upper (southern) end of Guadalupe Slough.

Tributaries

In addition to incoming flows from Saratoga Creek, San Tomas Aquino Creek also receives water from Vasona Creek and its tributaries that drain portions of Saratoga and Campbell. Smaller tributaries include Wildcat Creek, Smith Creek, East Smith Creek and Mistletoe Creek.

[23]California Water Resources Control Board, Final 2010 Integrated Report (CWA Section 303(d) List/305(b) Report).

Flood History

A levee-raising project was completed on San Tomas Aquino Creek from the Bayshore Freeway (U.S. Highway 101) to Guadalupe Slough in the early 1980s. Major portions of the creek have been channelized for flood control, particularly in the lower reaches. As a result, segments of the creek lack riparian vegetation.

Erosion/Sedimentation

Per Permit Provision C.3.f.ii., projects located within areas that drain to stream channel segments that are unlikely to erode or experience other impacts from increased flows are exempt from HMP requirements. San Tomas Aquino Creek is almost entirely hard-lined downstream of McCoy Avenue near the border of Campbell and San José, and is therefore not susceptible to erosion and sedimentation downstream of that transition.[24] Upstream of McCoy Avenue, implementation of hydromodification control is required or encouraged for new projects. San Tomas Aquino Creek does not appear on the 2006 303(d) List of Water Quality Limited Segments Requiring TMDLs for sediment or any other pollutant.

303(d) Impaired Water Bodies

The Final 2010 303(d) Integrated Report identifies San Tomas Aquino Creek as being required to have a TMDL for trash.[25]

2.7.2 Guadalupe River Watershed

The Guadalupe River drains a 170 square mile area through San José, Los Gatos, Monte Sereno, Campbell, and Santa Clara. Elevations in the watershed range from mean sea level at the Bay to over 4,000 feet above sea level at its uppermost ridge. The Coyote Creek watershed borders the Guadalupe River watershed to the east and the watersheds for San Tomas Creek and Saratoga Creek border to the west.

The headwaters of the Guadalupe River and its tributaries are in the Santa Cruz Mountains. The lower reaches of the Guadalupe River are confined between levees as it flows north through the urbanized areas of San José to San Francisco Bay. The Guadalupe River historically connected to San Francisco Bay through the Guadalupe Slough in the salt marshes north of Alviso. In the late 1800s, the flow of the Guadalupe River was rerouted for navigation purposes from Guadalupe Slough into Alviso Slough, which was previously not fed by any upland streams. Within the slough area, the Guadalupe River is surrounded by salt ponds, some of which are being restored to interact tidally with the surrounding creeks and the Bay.

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[24]Santa Clara Valley Urban Runoff Pollution Prevention Program, April 2005: *Hydromodification Management Plan Final Report*, Appendix G. (HMP Report)

[25]State Water Resources Control Board. *Final 2010 California 303(d)/305(b) Integrated Report*

The Guadalupe River has one major tributary, Los Gatos Creek, upstream of which the river is known as the Upper Guadalupe River. Further upstream, it is known as Guadalupe Creek. Other connecting creeks include Alamitos, Ross, and Canoas Creeks. There are also several surface reservoirs in the Guadalupe River system and groundwater recharge (percolation) ponds that border the system. Figure 11 indicates the components and watershed limits of the Guadalupe River system, as well as the portion that is within the San José Urban Growth Boundary.

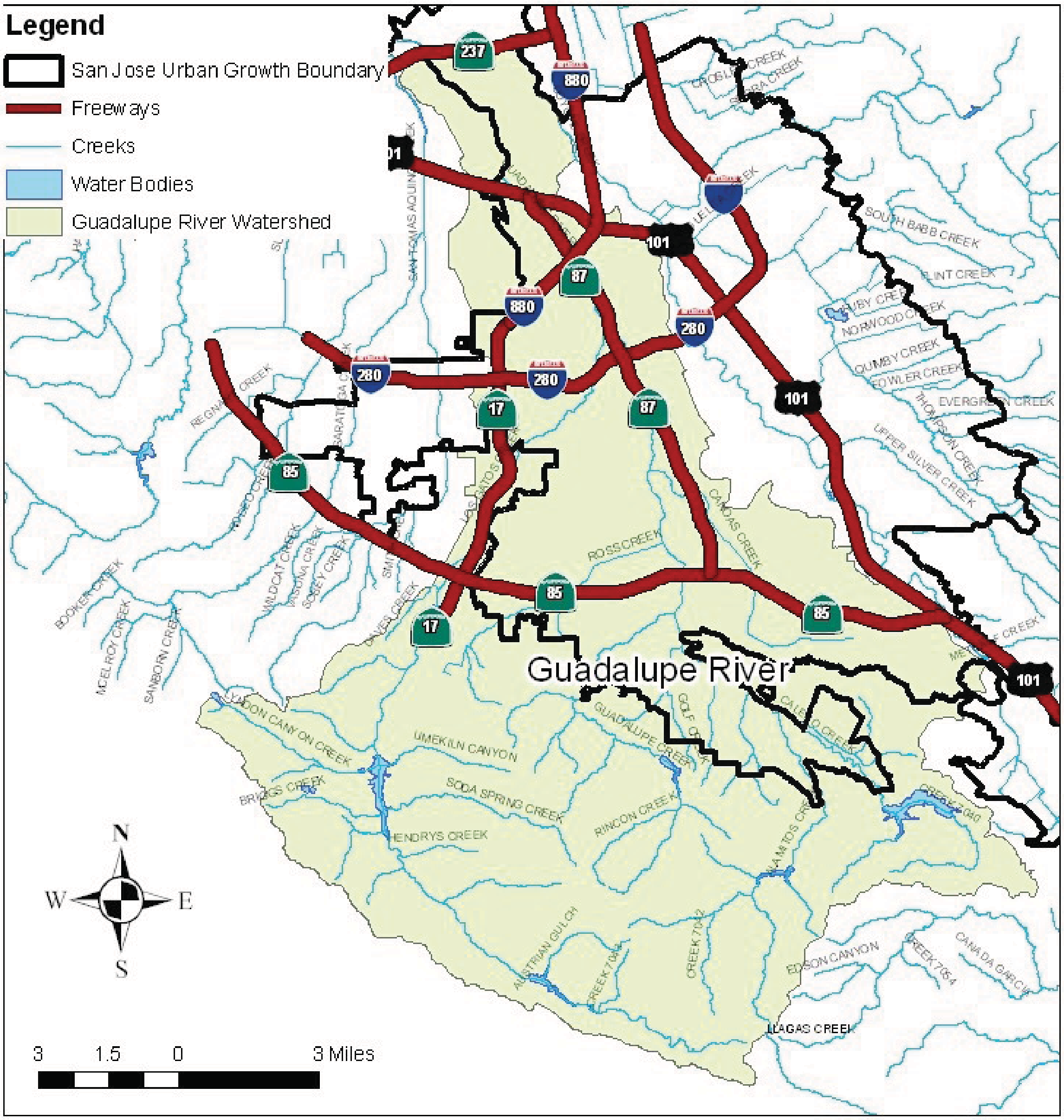

Figure 11. Guadalupe Watershed

River System Components

The major components of the Guadalupe River are described below, followed by details of the Guadalupe River's surface reservoirs and their respective dams. Major creek stretches or water bodies are in bold upon first mention. Reservoirs and tributaries to those creeks are italicized. In addition to the figure above, creeks and reservoirs in the watershed are listed in Table 4 for clarification of the river system's structure.

Table 4. Guadalupe River Watershed Elements

Major Creeks	Tributaries	Reservoirs
Guadalupe Creek*	Rincon Creek	Guadalupe Reservoir
	Los Capitancillos Creek	
	Hicks Creek	
	Pheasant Creek	
	Shannon Creek	
Alamitos Creek*	Herbert Creek	Almaden Reservoir
	Barrett Canyon	
	Larrabee Gulch	
	Jacques Gulch	
	Arroyo Calero*	Calero Reservoir
	Ravine Creek	
	Santa Teresa Creek	
	Randol Creek*	
	Greystone Creek*	
	Golf Creek*	
	McAbee Creek*	Almaden Lake*
Ross Creek*	East Ross Creek	
	Short Creek	
	Lone Hill Creek*	
Canoas Creek*	small Santa Teresa Hills creeks*	
Los Gatos Creek*		Lake Elsman
	Hendrys Creek	Lexington Reservoir
	Moody Gulch	
	Lime Kiln Canyon Creek	Lake Ranch Reservoir
	Dry Creek	Vasona Reservoir
*=Part or all of the water body is located within San Jose's Urban Growth Boundary		

The Guadalupe River begins at the confluence of **Guadalupe Creek** and **Alamitos Creek** at *Almaden Lake* on the edge of Almaden Valley, just downstream of Coleman Road and Almaden Expressway in San José. In this upstream location, Guadalupe River is known as Guadalupe Creek. At this point, it travels another 2 miles before joining with **Ross Creek**. After another 2 miles, **Canoas Creek** joins the Guadalupe Creek. After another 3.5 miles past the confluence with Canoas Creek, Guadalupe Creek merges with **Los Gatos Creek** to form the Guadalupe River. Finally, the Guadalupe River travels another 7 miles to the northwest where it discharges into the Alviso Slough and eventually **San Francisco Bay**. San José's Urban Growth Boundary and the limits of the General Plan end where Guadalupe Rivers merges with Alviso Slough.

The tributaries of the Guadalupe River and their extent within San José are described in the subsections below.

Guadalupe Creek begins as an unmodified creek at Mt. Umunhum and travels northeast for about 2 miles to the southern entrance of the *Guadalupe Reservoir*, where it joins with the mostly parallel *Rincon Creek* from the west and *Los Capitancillos Creek* from the east. At the northwestern end of the Guadalupe Reservoir, Guadalupe Creek then heads northwest for another 2 miles, merging with the short *Hicks Creek* along the way. Guadalupe Creek then turns northeast again as it merges with the 2,300-foot, unmodified *Pheasant Creek* and 5,900-foot, unmodified *Shannon Creek* from the west. At this point, Guadalupe Creek enters San José in the Almaden Valley area and travels another 3 miles to join with **Alamitos Creek**. Guadalupe Creek is reported to be a natural, unmodified creek for about three-quarters of its length and an excavated, earthen channel for the other quarter.

Alamitos Creek starts at the *Almaden Reservoir*. Almaden Reservoir is fed by the 4,200-foot, unmodified *Herbert Creek*, which comes from the southwest and starts near Bald Mountain; the 2,000-foot, unmodified *Barrett Canyon* from the south; the 4,700-foot, unmodified *Larrabee Gulch* from the southwest; and the 4,900-foot, unmodified *Jacques Gulch* from the northwest. Once leaving Almaden Reservoir, Alamitos Creek then travels northeast for 2 miles, passes through Almaden Canyon, and then travels another 1.5 miles before entering San José in the Almaden Valley area.

Once in San José, Alamitos Creek travels another mile to the northeast before merging with *Arroyo Calero Creek* (often referred to simply as *Calero Creek*). Alamitos Creek travels another 4,000 feet to the northwest and then merges with *Randol Creek*. After traveling another 4,200 feet to the northwest, Alamitos Creek then merges with *Greystone Creek*. After that confluence, Alamitos Creek heads generally northwest another 4,400 feet, then turns north for 800 feet before joining with *Golf Creek*. After traveling north a final 1,800 feet, Alamitos Creek discharges into *Almaden Lake*. About two-thirds of Alamitos Creek is reported to be unmodified from its natural state. The rest of the creek has been modified in various ways, primarily with earthen levees for 2.2 miles.

Arroyo Calero Creek starts at *Calero Reservoir*, fed by *Ravine Creek*, travels northwest for about 3 miles, until a merge with Alamitos Creek at Singer Park, a mile north of Almaden Expressway. The Calero Reservoir is also is used to store water imported as part of the San Luis Project. *Santa Teresa Creek* is the only major tributary to Calero Creek. Santa Teresa Creek begins in the Santa Teresa Hills and flows southwest and then northwest for about 2.5 miles to join with Calero Creek. A section of Santa Teresa Creek was widened, and levees were added in the late 1970s.

However, 9,900 feet of Santa Teresa Creek is reported to be unmodified. Calero Creek itself is reported to be almost entirely unmodified along its nearly 6-mile length.

Randol Creek starts in the heights of Almaden Quicksilver Park and heads north about 2 miles before merging with *Alamitos Creek*, 2,000 feet north of Almaden Expressway. The lower reaches of Randol Creek were modified for flood protection in the 1970s. Of its nearly 2-mile length, 4,300 feet has been modified to be some sort of concrete channel – box culvert, pipe, trapezoidal channel, or U-framed channel.

Greystone Creek also starts in Almaden Quicksilver Park just north of Randol Creek, heads north for about 3 miles, then merges with Alamitos Creek, about 1,200 feet northeast of the Almaden Expressway and Camden Avenue intersection. Greystone Creek was modified in the 1970s for flood protection, particularly along its lower reaches. It is reported to be some sort of concrete channel for a total of 5,900-feet.

Golf Creek starts at the northern edge of Almaden Quicksilver Park, heads north for about a mile, then turns east for 1,200 feet, heads generally north for another 3,700 feet, then finally turns east again for about 1,200 feet before joining *Alamitos Creek*. The confluence is about 300 feet east of Almaden Expressway just south of the intersection with Mazzone Drive. Golf Creek is reported to be modified along its entire length and was modified in the 1970s in its lower reaches for flood control. Golf Creek has one tributary, the 2,100-foot *McAbee Creek*, which is reported to be a pipe culvert along its entire length.

Ross Creek is fed by several smaller tributaries in the Santa Cruz Mountains between Guadalupe Creek and Los Gatos Creek, including the 5,800-foot unmodified *East Ross Creek*, the 2,400-foot unmodified *Short Creek*, and the 4,800-foot *Lone Hill Creek*, which is mostly contained in concrete culverts or otherwise a U-frame concrete channel. Ross Creek is channelized or contained in concrete culverts along 4.5 miles of its 6-mile length, particularly downstream of its headwaters in the mountains and all along the stretch through San José in the Cambrian area. Ross Creek joins the **Guadalupe River** at Almaden Expressway about 1,000 feet north of Branham Lane.

Canoas Creek is generally fed from smaller creeks in the Santa Teresa Hills and is contained within San José in the Santa Teresa and Blossom Valley areas. Canoas Creek was realigned in the 1960s, and the existing channel is now a concrete culvert, trapezoidal or U-shaped concrete channel, or excavated earth channel with a concrete bottom along its entire 7.3-mile length. Canoas Creek joins the **Guadalupe River** near the Almaden Expressway overcrossing, about 1,200 feet south of Curtner Avenue.

Los Gatos Creek starts at Loma Prieta, also the source of Llagas and Uvas Creeks, south of San José, about 10 miles south of the Highway 85/87 junction. From its height near 3,500 feet, Los Gatos Creek travels northwesterly for about 4 miles, through *Lake Elsman* and, after another 4 miles, joins with *Hendrys Creek* and *Moody Gulch* at *Lexington Reservoir*, which also receives drainage from *Lake Ranch Reservoir*, and an unnamed creek in *Lime Kiln Canyon*. Los Gatos Creek then heads northeasterly for about 3.5 miles, following Highway 17, to *Vasona Reservoir*. Los Gatos Creek then continues traveling northeasterly along Highway 17 for about 4 miles, past Los Gatos Creek Park, which has percolation ponds, then crosses South Bascom Avenue, where it enters San José.

Once in San José Los Gatos Creek travels 1.5 miles to the northeast through the Willow Glen area as an unmodified channel before merging with *Dry Creek* near Meridian Avenue, south of I-280. *Dry Creek* starts near South Bascom Road and Union Avenue, travels northeasterly, until Meridian Avenue, then turns north until junction with Los Gatos Creek. After the confluence with *Dry Creek*, Los Gatos Creek travels another mile, crosses I-280 into Downtown San José, and then heads north. Finally, it merges with the **Guadalupe River** at Highway 87 about 1 mile northwest of the I-280/Highway 87 Interchange.

There are several major surface water reservoirs along the Guadalupe River, all of which are primarily used for water supply purposes although they can also provide incidental flood control benefits. These reservoirs and their respective dams are listed in Table 5 below. There are also some percolation basins with small dams along the Guadalupe Creek and Los Gatos Creek, but these are not listed. None of these major reservoirs and dams is in San José, but they can affect the water supply and flood control aspects of the Guadalupe River system through San José. The only SCVWD percolation ponds in San José are along Guadalupe Creek generally between Camden Avenue and Highway 85. There is also a small diversion dam near this area called Masson Dam, which has a fish ladder. No further details on Masson Dam could be found other than that the SCVWD has removed sediment from the Guadalupe Creek behind this dam in the recent past. Also along the Guadalupe River are a few fish passage structures. Three structures were installed in 1999: two open-channel rock weirs at Old Hillside Boulevard and Branham Lane and a flashboard ladder at Blossom Hill Road. Guadalupe Creek also has an open-channel rock weir installed in 2000 at the Masson Dam.

Table 5. Reservoirs within Guadalupe River Watershed

Reservoir/Dam	Creek	Owner	Yr Built	Type	Height (ft)	Volume (ac-ft)	Drainage Area (sq. mi.)
Almaden	Alamitos	SCVWD	1935	Earth	105	1,586	12.5
Almaden Valley	Tributary Alamitos	SJWC	1965	Earth	38	27	N/A
Lake Elsman/ Austrian	Los Gatos	SJWC	1950	Earth	185	6,200	9.8
Calero	Arroyo Calero	SCVWD	1935	Earth	98	9,934	7.1
Guadalupe	Guadalupe	SCVWD	1935	Earth	129	3,415	6.0
Lexington/ James J. Lenihan	Los Gatos	SCVWD	1952	Earth	195	19,044	27.7
Vasona	Los Gatos	SCVWD	1935	Earth / Rock	30	400	44.2
Williams	Los Gatos	SJWC	1895	Gravity	69	160	5.7

Land Use

Of the Guadalupe River's total watershed, 63 square miles (37%) are estimated to be impervious from urban development. The Guadalupe River watershed is largely undeveloped in its upstream region with a large proportion legally protected against further development. These protected areas comprise over 75% of the headwaters of Los Gatos Creek and about 50% of the headwaters of Alamitos Creek, a smaller tributary. Almost 48 square miles of the total watershed is protected by public agencies, property easements, or private land trusts.

Most of the headwaters drain from permeable, protected areas, although there are also small pockets of high-density residential development in this upstream region. Land use in the downstream region is comprised of mostly high-density residential use with commercial and public/quasi-public uses interspersed. Some industrial development and the San José International Airport are also located in the northern, downstream portion of the watershed near the Bay. Unique to the watersheds in the area, the Guadalupe River watershed has some agriculture in its downstream region in San José.

In terms of the whole watershed (as of 1995) 30% is used for residential development most of which is high-density of four or more dwelling units per acre. Another 35% of the watershed is forested and undeveloped, and rangeland accounts for 15% of the watershed. The land uses on the remaining 20% of the watershed vary widely from industrial to agricultural, with none of these other uses individually comprising more than 5% of the watershed.[26]

The City's GIS Zoning information within the Urban Growth Boundary can be used as with the San Tomas watershed to estimate significant land uses within the Guadalupe River watershed.

[26]Watershed Management Initiative, *Watershed Characteristics Report*, August 2003

Based on this zoning data, significant land uses within the Guadalupe River watershed are proportioned as follows:

- Agricultural: 20%;
- Commercial: 6%;
- Industrial: 15%;
- Residential: 58%.

These percentages indicate that a majority of the developed urban area is for residential use, although agricultural use is also prevalent in the Guadalupe River watershed within the Urban Growth Boundary. Much of this agricultural land is zoned for development.

Improvements

Modification of the Guadalupe River and its tributaries is recorded as early as 1866, when a canal was dug to alleviate flooding and improve conditions for rapidly expanding orchards near the river. Other improvements have continued through the present. Many of the existing modifications to the channels are detailed above.

The most significant recent improvements to the Guadalupe River system, especially in San José, are part of the Guadalupe Park and Gardens projects. Trails, parks, gardens, and flood control enhancements were constructed over 12 years between Interstates 280 and 880.

The SCVWD installed new gates for Vasona Dam in 1997, and the San José Water Company also completed construction of a replacement raw water pipeline in Lexington Reservoir in 2006. The outlet pipe of the Lenihan Dam that creates the Lexington Reservoir is also currently being replaced by the SCVWD. Construction began in the fall of 2007 and is scheduled to be completed in the winter of 2008/09. The new outlet will be contained within a tunnel dug through the hillside east of the dam. To accommodate the construction of the new outlet pipe, the water levels of the reservoir have been noticeably lowered during construction; these water levels are scheduled to be returned to normal levels following the rainy winter of 2008/09. The SCVWD also has a planned Almaden Dam restoration project that is a 10-year program to replace the intake structure, install seepage monitoring system, and perform routine maintenance. Table 6 below describes the SCVWD's projects pertaining to the Guadalupe River system from the SCVWD's most recent Capital Improvement Program.[27]

[27] Santa Clara Valley Water District. 2007/2008 (5-Year) Capital Improvement Program.

Table 6. Guadalupe River System Projects Identified in SCVWD CIP

Name	Purpose(s)	Est. Cost $ millions	River Section	Progress	Completion Date
Alviso Slough Restoration	Restoration, Navigation	2.6	B/w Gold St. Bridge and County Marina	Planning, no funding for design	Future
Pond A8 Applied Study	Restoration	3.6	U/S Alviso Slough	Design	2010
Lower Guadalupe River Flood Protection	Flood/bank protection, trail/habitat	89.8	Alviso Marina to I-880	Completed	2008
Guadalupe River Downtown Flood Protection	Flood protection, trail/habitat enhancements	263.4	I-880 to I-280 (Reaches 1-3C)	Completed	2008
Upper Guadalupe River, Flood Protection	Flood protection, habitat	256.0	I-280 to Blossom Hill Rd.	Design/ Construction	2007-2015
Guadalupe Ck Management	Vegetation maintenance	Unknown	Almaden Expwy to Masson Dam	Construction	2008
Guadalupe Dam Outlet Works Rehab	Water supply	Unknown	Guadalupe Reservoir	Future Project, Low Priority	Future
Alamitos Diversion Dam Improvements	Water supply, recreation enhancements	3.0	1,300 ft U/S of Blossom Hill Rd.	Planning/ Design	2010
Almaden Dam Outlet Works Improvement	Correct problem of sediment flushing	20.5	D/S end of Almaden Reservoir	On hold, Planning in 2011	2018
Almaden-Calero Canal Rehab	Restore capacity	10.9	Almaden Dam	Design	2012
Calero Dam Outlet Works Rehab	Water supply	Unknown	Calero Reservoir	Future Project, Low Priority	Future
Calero/Fellows Dike Improvements	Safety issues, restore capacity	12.6	U/S end of Calero Reservoir	Planning/ Design	2012
Canoas Creek Improvements	Bank stabilization	Unknown	B/w Hillsdale/ Capital Expwy east of Hwy 87	Construction	2009?
Canoas Creek Improvements	Flood protection	Unknown	Guadalupe River to Cottle Road	Proposed Future Project	Future
Jacques Gulch Restoration	Remove mercury; Stabilize banks	13.8	Tr. to Almaden Reservoir	Planning/ Design	2011
Lenihan Dam Outlet Modifications	Resolve safety issues	65.5	D/S end of Lexington Reservoir	Construction	2010
Los Gatos Creek	Flood Protection	Unknown	Twin Brook Dr.	Future Project	Future
Kirk Ditch Improvements	Improve maint./ safety	2.6	250 ft parallel to Los Gatos Ck	Planning/ Design	2010
Kirk Diversion Dam Improvements	Flood protection, improve safety	2.5	Los Gatos Ck 4,000' D/S of Lark	Planning	2011
Kirk Diversion Fish Screen	Environmental protection	1.3	U/S of Kirk Diversion Dam	Construction	2009
Vasona Canal Improvement	Water supply	0.2	Vasona to Stevens Creek watershed	Planning only	2009

Drainage and Flooding

Several urban storm drainage systems ultimately drain into the Guadalupe River system. Direct storm runoff in the drainage basin is extremely variable and has been modified by dam construction and urbanization.

Historically, the Guadalupe River and its tributaries have been known to flood areas of San José, including portions of low-lying freeways in 1995 (see Figure 12 below). A 100-year flood is estimated to inundate 2,310 acres in San José, as depicted in Figure 13, which also shows the Upper Guadalupe River Flood Protection Project reaches. Severe flooding along the Guadalupe River has also occurred in 1862, 1895, 1911 (also shown in Figure 12 below), 1955, 1958, 1963, 1969, 1982, and 1986. Alamitos and Calero Creek are also reported to have had major flooding in 1931, 1937, 1940, 1941, 1943, 1945, 1952, 1955, 1958, 1962, 1967, and 1968. Other flooding on the Guadalupe River system is reported for Ross Creek and Canoas Creek.

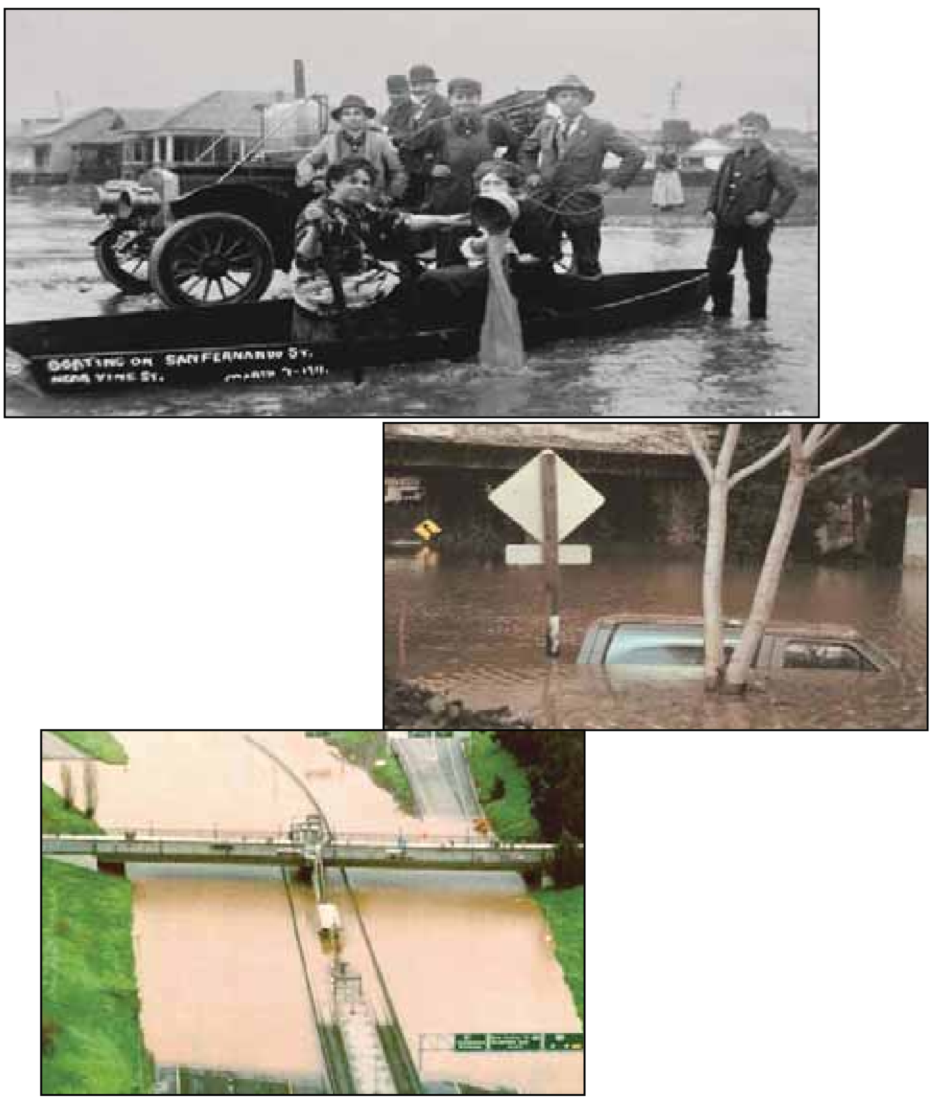

Figure 12. Historic Flooding along Guadalupe River (Source: SCVWD Archives)

Figure 13. Upper Guadalupe River Flood Protection Project Reaches and 100-Year Floodplain

Flood control projects have been fairly extensive on the Guadalupe River. The Santa Clara Valley Water District has improved portions of the river and still has plans for more improvements. The design and constructions of these improvements is part of developing the Guadalupe River Park & Gardens in downtown San José. The last part of this project, improvements along six miles of the river from I-280 south to Blossom Hill Road near Highway 85, will improve a stretch of river that has flooded five times since 1982. Improvements include removing nine concrete barriers, planting of thousands of native trees and other vegetation, widening of the river in some places, and raising of levees. This flood protection work is scheduled to be completed by 2016 and provide 100-year flood protection, versus the existing 25-year flood protection, as well as raise the levees to meet FEMA's freeboard standards.[28]

Erosion/Sedimentation

Both erosion and sedimentation are ongoing problems in natural portions of the Guadalupe River system. Erosion and sedimentation are caused by unstable banks and the natural geomorphic processes of watercourses. The most severe erosion problems are reported to be within Reaches 7 and 9, from Willow Street to Curtner Avenue, with much of the resulting sediment load washing downstream and depositing between I-880 and Highway 101. Sediment deposition is also reported to occur within Reach 12. Average annual sediment yield of the Guadalupe River basin has been estimated from 1,800 to 2,000 tons per year per square mile of watershed. This is equivalent to between 300,000 and 350,000 tons per year, if the whole watershed were to contribute at this rate. However, modeling results of the Guadalupe River have suggested that dams and urbanization have significantly reduced the natural runoff sediment load of the watershed.[29]

Hydromodification, change in a watersheds runoff characteristics caused by changes in land use conditions, has recently become a concern of the San Francisco Regional Water Quality Control Board for the Guadalupe River and other watercourses throughout the San Francisco Bay Area. Development patterns increase the imperviousness of land and conveyance of stormwater runoff, thereby increase stormwater runoff and durations at all storm levels, particularly for smaller (<10-year) storms. The increased runoff and duration of flows tends to cause greater erosion in receiving drainage channels if they are unprotected. Hydromodification basins and other measures are being required to mitigate the effects of the increased erosion by keeping site runoff to pre-development levels for various small, storm levels.

[28]Santa Clara Valley Water District. Upper Guadalupe River Flood Protection Project pamphlet. December 1, 2008.
[29]U.S. Army Corps of Engineers, 1991: General design memorandum: Guadalupe River, California. Sacramento District. Sacramento, CA.

Development or redevelopment within the watershed of the Guadalupe River's tidal waters is exempt from implementing hydromodification controls due to the natural sediment movement during tidal fluctuations. Development or redevelopment within most of the downtown San José area is also exempt from implementing hydromodification controls because it is already highly urbanized and nearly completely built-out.

303(d) Impaired Water Bodies

Several water bodies within the Guadalupe River system are listed as impaired in the 303(d) list of water quality limited segments.[30] The main listed contaminant for these water bodies is mercury, whose potential source is listed as mine tailings and surface mining. Those water bodies listed as impaired by mercury include 7.1 miles of Alamitos Creek, 334 acres of Calero Reservoir, 8.1 miles of Guadalupe Creek, 63 acres of Guadalupe Reservoir, and 18 miles of Guadalupe River. These water bodies did not have a TMDL for mercury developed at the printing of the list in 2006, but TMDLs are scheduled to be developed as part of the Santa Clara Basin Watershed Management Initiative. The 18 miles of Guadalupe River is also listed as being impaired from and having an approved TMDL for diazinon, whose potential source is urban runoff and storm sewers carrying pesticide residue. Los Gatos Creek is also listed as being impaired from and having an approved TMDL for diazinon along 19 miles of the creek. The only other water body within the Guadalupe River watershed on the 303(d) List is 10 miles of Rincon Creek, which is listed as being impaired from and requiring TMDLs for Boron and Toxicity, both of which have unknown sources. The proposed TMDL completion date for Rincon Creek is 2019. The Final 2010 303(d) Integrated Report identifies Guadalupe River and Lower San Francisco Bay, to which the Guadalupe River system drains, as being required to have a TMDL for trash. Almaden Lake and Almaden Reservoir are also identified in this report as requiring TMDLs for mercury (in tissue).

2.7.3 Coyote Creek Watershed

The Coyote Creek watershed is the largest watershed in Santa Clara County. Elevations in the watershed range from mean sea level to over 4,000 feet above sea level. Over 320 square miles of land area drains to San Francisco Bay via Coyote Creek and its tributaries, which are located within unincorporated areas of the county, the City of San José, and the City of Milpitas. Coyote Creek originates in the mountains of the Diablo Range northeast of Morgan Hill and drains most of the west-facing slope of the Range as it flows northwest approximately 42 miles before entering the South Bay.

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[30] State Water Resources Control Board. *Final 2010 Integrated Report (CWA Section 303(d) List/305(b) Report)*

Two major reservoirs lie in the upper watershed: Coyote, the upper reservoir, built in 1936, and Anderson Reservoir, built in 1950. Nine major tributaries to Coyote Creek lie within the drainage area to these two reservoirs. Below Anderson Reservoir, Coyote Creek flow is diverted for groundwater recharge via the Metcalf Pond and the Ford Road ponds. Downstream of the recharge basins Coyote Creek flows through unincorporated, predominately agricultural land between Morgan Hill and San José. Continuing northwest Coyote Creek flows through the urbanized areas of San José and connects with the watershed's major tributaries: Upper and Lower Silver Creeks, Miguelita Creek, and Upper and Lower Penitencia Creeks. The lower reaches of Coyote Creek have been partially modified for flood protection including levees and bypasses. The creek transitions from a freshwater creek to an estuarine environment as it approaches the Bay.

Figure 14 below indicates Coyote Creek's watershed limits and tributaries within the Urban Growth Boundary of San José.

<u>River System Components</u>

The major components of the Coyote Creek are described below, followed by details of the Coyote Creek's surface reservoirs and their respective dams. Major creek stretches are in bold upon first mention. Reservoirs and tributaries are italicized. Creeks and reservoirs in the watershed are also listed in Table 7.

Coyote Creek begins at the confluence of several small tributaries within its headwaters in the Diablo Range. Ten miles downstream it enters *Coyote Reservoir*. Two miles downstream of Coyote Reservoir the Creek enters *Anderson Reservoir*. Downstream of Anderson Reservoir, water is diverted into a 6-mile canal and discharged for groundwater recharge in *Metcalf Pond* and the *Ford Road ponds*. Consequently, the reach between *Anderson Reservoir* and *Metcalf Pond* runs dry in all but the wettest years. Downstream of the percolation ponds, the stream channel runs dry or intermittently most summers. Six miles downstream from *Metcalf Pond*, **Upper Silver Creek** joins Coyote Creek. After another 5 miles, **Lower Silver Creek** joins Coyote Creek with **Upper Penitencia Creek** joining a mile downstream of that. Continuing downstream another 8 miles, Coyote Creek confluences with **Lower Penitencia Creek** and becomes marshy for about 2 miles before discharging to **San Francisco Bay**.

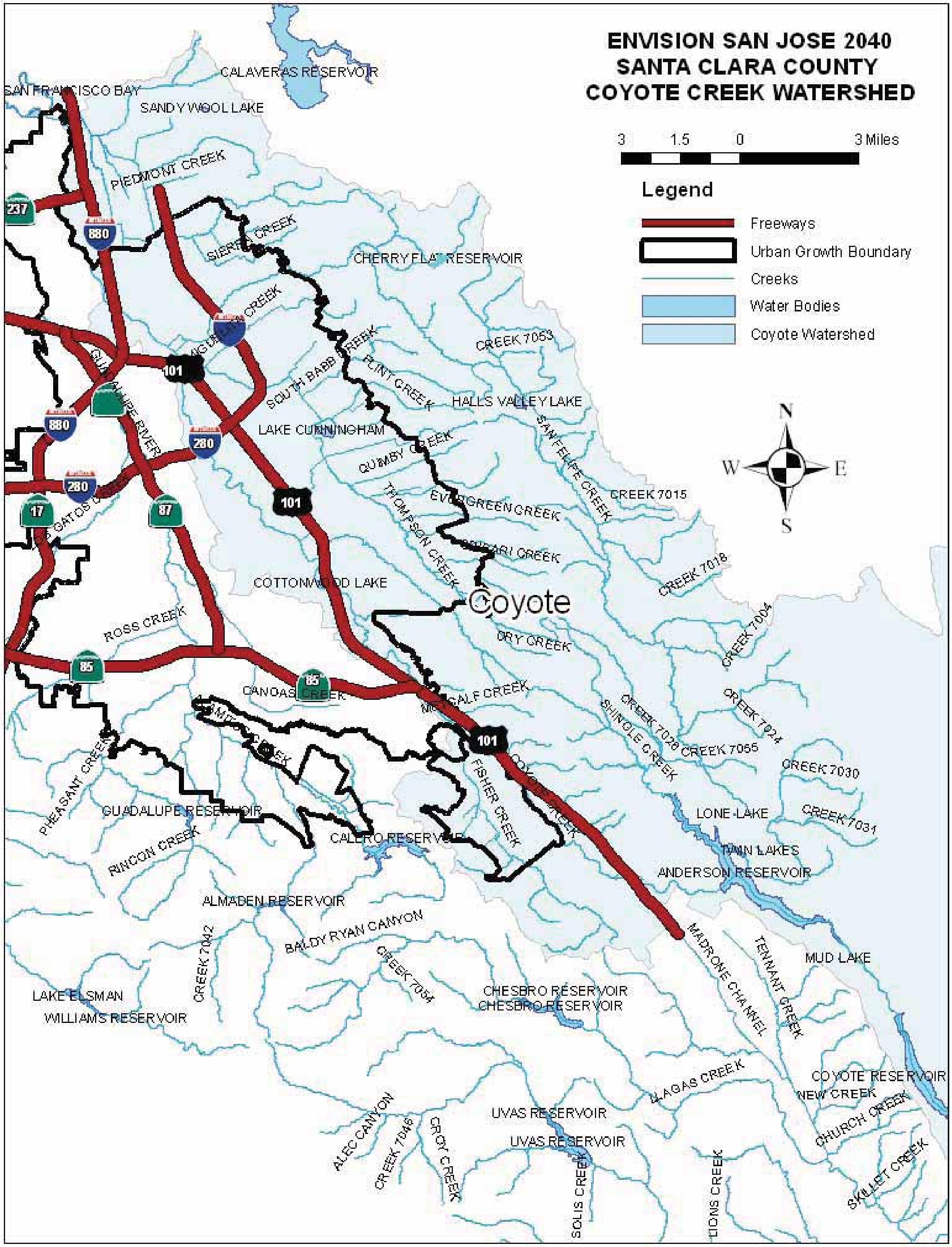

Figure 14. Coyote Creek Watershed and Tributaries

Table 7. Coyote Creek Watershed Components

Major Creeks	Tributaries	Reservoirs
Coyote Creek	Fisher Creek	Coyote Reservoir Anderson Reservoir
	Upper Silver Creek	
	Lower Silver Creek	
	Upper Penitencia Creek	
	Lower Penitencia Creek	
Thompson Creek	Cribrari Creek	
	Yerba Buena Creek	
	Evergreen Creek	
	Fowler Creek	
	Quimby Creek	
	Norwood Creek	
	Flint Creek	
	Ruby Creek	
Lower Silver Creek	Thompson Creek	Lake Cunningham
	South Babb Creek	
	North Babb Creek	
	Miguelita Creek	
Upper Penitencia Creek	Arroyo Aguague	Cherry Flat

Fisher Creek is a heavily modified earthen channel generally privately owned and maintained for agricultural drainage. Fisher Creek begins as a roadside drainage ditch between Tilton and Madrone Avenues in southern Coyote Valley. Running generally northwest, Fisher Creek follows a natural meandering path. This reach of the Creek is ephemeral in nature (i.e. generally dries in summer). Downstream of Palm Avenue, Fisher Creek becomes a man made ditch, maintained primarily for agricultural purposes. Downstream from Bailey Avenue, Fisher Creek banks are modified by levees until its confluence with Coyote Creek. This reach aids in draining the low-lying area known as Laguna Seca.

Upper Silver Creek originates in the Diablo Range approximately 1000 feet north of Metcalf Road. It meanders northwest as a natural channel through the range until one mile upstream of Highway 101 where it becomes a concrete-lined trapezoidal channel for the remainder of its length. Upper Silver Creek has its confluence with Coyote Creek half a mile downstream of Highway 101.

Lower Silver Creek starts at the intersection of South King Road and Barberry Lane as a buried storm drain culvert. One mile downstream the creek daylights and joins **Thompson Creek**, continuing one mile around *Lake Cunningham* as an excavated earth channel. Flowing northwest, *South Babb Creek* joins Lower Silver one mile downstream of Lake Cunningham. After another half mile, *North Babb Creek* joins as Lower Silver Creek turns west. About one mile downstream of this confluence Lower Silver crosses Interstate 680 and becomes concrete-lined. Two miles further downstream *Miguelita Creek* joins Lower Silver Creek and the creek becomes earthen and turning southwest travels another half mile to its confluence with Coyote Creek. Much of Lower Silver Creek is leveed.

South Babb Creek begins broken in several branches in the hills around Clayton Road. These branches combine at the terminus of Fleming Avenue. The creek continues southwest as a natural channel for 1.5 miles. A couple hundred feet downstream Clayton Road, it becomes a concrete trapezoidal channel for a mile as it travels southwest to it confluence with Lower Silver Creek. This creek was used as the example for the Santa Clara Valley Urban Runoff Pollution Prevention Program's (SCVURPPP) Hydromodification Plan Manual due to its sensitivity to low flow erosion in its upper reaches.

North Babb Creek begins near the intersection of Hobie Lane and Mahoney Avenue. It is either buried underground or in a concrete trapezoidal channel for its entire length of one mile as it flows southwest to meet Lower Silver Creek.

Miguelita Creek begins to the south of Alum Rock Park. It flows southwest as a natural channel until it reaches McKee Road where it is buried for the most of the rest of its two mile length and joins Lower Silver Creek.

Thompson Creek originates in the Diablo Range near San Felipe Road and flows northwest. The natural channel meanders approximately 4 miles downstream where it is joined by *Cribari Creek*. *Yerba Buena Creek* joins after 1.5 miles and *Evergreen Creek* after another half mile. Thompson continues as a natural channel for another mile where it is joined by *Fowler Creek*. Half a mile downstream *Quimby Creek* joins and *Norwood Creek* joins a mile after that at the confluence with Lower Silver Creek.

1. *Cribari Creek* starts near the top of the range above the southern side of The Villages Golf and Country Club flowing westward as a natural channel. It is buried for a half mile through development before joining Thompson Creek.

2. *Yerba Buena Creek* starts near the top of the range above the northern side of The Villages Golf and Country Club and flows westward as a natural channel for its entire length, subsequently joining Thompson Creek.

3. *Evergreen Creek* starts near the top of the range above Montgomery Hill Park and remains a natural channel for its entire length, flowing westward to join Thompson Creek.

4. *Fowler Creek* is as a natural channel near the top of the range above Fowler Road. The creek is buried for 0.5 mile as it continues to its westward outfall at Thompson Creek.

5. *Quimby Creek* starts as a natural channel near the top of the range along Chaboya Road. The creek flows westward and is culverted for a half mile before daylighting into an excavated earthen channel for a mile before joining Thompson Creek.
6. *Norwood Creek* starts as a natural channel near the top of the range above Norwood Avenue. It enters a sediment control facility on the eastern edge of development and directed into a concrete pipe. The creek remains underground flowing westward for 2 miles until its confluence with Thompson Creek.

Flint and Ruby Creeks join together before their confluence with Lower Silver Creek. Flint Creek begins as a natural channel near the top of the range near Higuera Highland Lane. It enters a sediment control facility upstream of Mount Pleasant Road and then flow via underground culvert for one mile to its confluence with Ruby Creek. Ruby Creek technically begins in the sediment control facility at the intersection of Klein Road and Murillo Avenue where local runoff is relieved of sediment. It is again culverted for 1.5 miles until just before its confluence with Flint Creek. Flint Creek then joins Lower Silver Creek 1,000 feet downstream.

Lake Cunningham is a large storage area where Flint, Ruby, and Thompson Creeks all join together to become Lower Silver Creek. This area contains a large amount of active storage available for flood control. Cunningham Avenue functions as a dam. The culvert running under Cunningham Avenue restricts the flow to Lower Silver Creek. Flow that exceeds the culvert capacity discharges over Park Road into Lake Cunningham. Lake Cunningham is depended upon for flood control. Flood maps in the area reflect flooding conditions assuming the Cunningham Avenue does not fail in its function as a dam. That said, Cunningham Avenue has not been certified as a levee or dam which means that future flood maps could be revised to reflect flooding conditions assuming that Cunningham Avenue does not meet NFIP standards for levee protection, and add several thousand properties to the floodplain.

Upper Penitencia Creek begins near the top of the range above *Cherry Flat Reservoir*. It enters the reservoir after one mile and continues westward as a natural channel. After two miles, it is joined by *Arroyo Aguague*. Water is diverted from the Creek into percolation ponds 4 miles downstream of the Arroyo Aguague confluence. The creek continues southwest for another 1.5 miles where it crosses I-680. The remaining 2 miles of Upper Penitencia Creek to the confluence with Coyote Creek is reported to have earthen levees in sections.

Several major surface water reservoirs within the watershed have a variety of uses including water supply, groundwater recharge, and flood control. The reservoirs and their respective dams that are registered as under the jurisdiction of the State of California (Division of Dam Safety) are listed in Table 8.

Table 8. Registered Dams in Coyote Creek Watershed

Reservoir/ Dam	Creek	Owner	Year Built	Type	Height (ft)	Capacity (ac-ft)	Drainage Area (sq. mi.)
Cherry Flat	Penitencia Creek	City of San José	1936	Earth	60	500	2.41
Coyote	Coyote Creek	SCWVD	1936	Earth/Rock	140	23666	119.8
Coyote Creek	Coyote Creek	Hidden Valley Lake Assoc.	1968	Earth	92	3375	5.5
Coyote Percolation	Coyote Creek	SCWVD	1934	Flashboard/ Buttress	19	72	227
Grant Company 2	Arroyo Aguague	County of Santa Clara	1927	Earth	27	400	0.58
Kuhn	Trib. Dry Creek	Peggy Kuhn Thompson	1947	Earth	67	85	0.1
Laurel Springs Club	Mid Fork Coyote Cr	Laurel Springs Club	1968	Earth	28	250	2.64
Leroy Anderson	Coyote River	SCVWD	1950	Earth	235	91280	194.3

It should be noted that Lake Cunningham (on Lower Silver Creek) is not listed here since it is not registered with the State. Cunningham Avenue acts as a dam to create the lake. Cunningham Avenue does not undergo annual inspections that state jurisdictional dams are subjected to. If the Cunningham Avenue "dam" were to fail, there may be significant flooding impacts downstream. There are also some percolation basins along Coyote Creek, but these are not registered with the State or listed in Table 8.

Land Use

The Coyote Creek watershed contains the largest contiguous agricultural areas in the Basin and a large proportion of undeveloped land in its upper zone. The upper zone is mainly rangeland and forest, about one-third legally protected from substantial development as open space. Urbanized land use is confined to the downstream region of the lower zone and several small areas in the lower zone near the main stem of Coyote Creek.

In terms of the whole watershed (as of 1995) 9% is used for residential development, with essentially all of that residential development classified as high-density of four or more dwelling units per acre. Another 51% of the watershed is forested and undeveloped; rangeland uses account for 30% of the watershed; and 6% is used for agriculture. The land uses on the remaining 4% of the watershed vary widely from industrial to public facilities.[31]

[31] Watershed Management Initiative, *Watershed Characteristics Report*, August 2003

The City's GIS Zoning information within the Urban Growth Boundary can be used to estimate significant land uses within the Coyote River watershed. Based on this zoning data, significant land uses within the Coyote River watershed are proportioned as follows:

- Agricultural: 34%;
- Commercial: 3%;
- Industrial: 12%;
- Residential: 51%.

These percentages indicate that a majority of the developed urban area is for residential use, although agricultural use is also prevalent in the Coyote River watershed within the Urban Growth Boundary. Much of this agricultural land is zoned for development.

Improvements

Historically the drainage network of creeks and tributaries of the Coyote Creek watershed was highly discontinuous. Most of the tributaries ended in alluvial fans, spreading the runoff across the valley floor, as shown in Figure 15 below. With development came the necessity to channelize and divert seasonal flooding. Over the years, drainage ditches, channels, and levees have been constructed to carry the water directly to Coyote Creek to prevent flooding. Thompson and Lower Silver Creeks in particular intercept the majority of runoff from the Diablo Range which historically spread out over alluvial fans and flooded the valley. Figure 15 illustrates the change in drainage patterns from 1800 to 2006 (Source: Coyote Creek Watershed Historical Ecology Report). Table 9 describes the SCVWD's projects pertaining to the Coyote Creek system from the SCVWD's most recent Capital Improvement Program.

Table 9. Coyote Watershed Projects Identified by SCVWD CIP

Name	Purpose	Cost ($ millions w/ inflation)	River Section	Progress	Target Completion
Coyote Creek Flood Protection	Flood Protection	40.6	Montague Expressway to I-280	Planning	2016
Lower Silver Creek Reach 1-3	Flood Protection	79.2	Coyote Creek to I-680	Complete	2006
Lower Silver Creek Reach 4-6	Flood Protection	8.4	I-680 to Cunningham Ave.	Design/ Construction	TBD
Thompson Creek Stream Stabilization	Erosion Control/ Restoration	2.7	Quimby Road to Aborn Road	Planning/ Design	2012
Upper Penitencia Creek Flood Protection	Flood Protection	15	Coyote Creek to Dorel Dr.	Planning Phase Only	2011

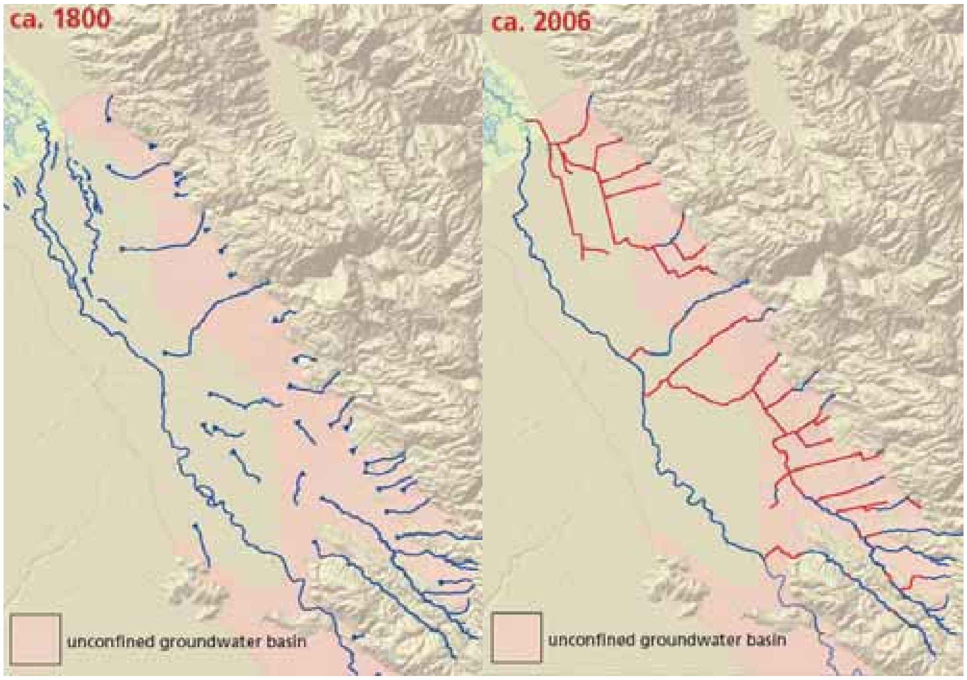

Figure 15. Changing Drainage Patterns in Coyote Creek Watershed, 1800 to 2006

Erosion/Sedimentation

Coyote Creek watershed's South Babb Creek was used as the example for the Santa Clara Valley Urban Runoff Pollution Prevention Program's (SCVURPPP) Hydromodification Plan Manual due to its sensitivity to low flow erosion in its upper reaches. Hydromodification basins and other measures are generally required to mitigate the effects of the increased erosion by keeping site runoff to pre-development levels for various storm levels. Development or redevelopment within the watershed of the Coyote Creek's tidal waters is exempt from implementing hydromodification controls due to the natural sediment movement during tidal fluctuations. Development or redevelopment within most of the downtown San José area is also exempt from implementing hydromodification controls because it is already highly urbanized and nearly completely built-out. Any channel within the Coyote Creek watershed that is not hardened or tidal could potentially be susceptible to erosion. Certain reaches (like South Babb Creek) are known to be particularly susceptible to erosion, but erosion studies have not been completed for all water courses.

303(d) Impaired Water Bodies

The Coyote Creek watershed has only Coyote Creek listed on the 303(d) Impaired Water Bodies watch list. Coyote Creek is listed as having a 2007, USEPA-approved TMDL for diazinon along 55 miles, whose potential sources are urban runoff and storm sewers that carry pesticide residues. The Final 2010 303(d) Integrated Report identifies Coyote Creek, (Upper) Silver Creek, and Lower San Francisco Bay as being required to have a TMDL for trash.

3. Water Supplies

Potable and non-potable water is supplied to the City of San José via one of three water retailers: Great Oaks Water Company, San José Water Company, or San José Municipal Water System. The service area for each of these water suppliers within the San José Urban Growth Boundary is shown in Figure 16. This figure is created using GIS layers available from SCVWD. It should be noted that some service areas actually overlap, which is not captured in this figure. For example, Great Oaks Water Company has service areas in the south-western portion of the Urban Growth Boundary, which is shown as solely a San José Municipal Water System below.

Santa Clara Valley Water District is the primary wholesale water supplier in Santa Clara County and acts as a steward for water resources in the County. The District owns and manages ten local surface reservoirs and associated creeks and recharge facilities, manages the county's groundwater sub-basins and three water treatment plants, imports water from the Central Valley Project and the State Water Project and delivers recycled water to parts of the county.

Both San José Water and San José Municipal purchase some of their water supplies directly from SCVWD, and also provide non-potable recycled water from the South Bay Water Recycling system. San José Municipal and SCVWD purchase water from the San Francisco Public Utilities Commission (SFPUC). All of Great Oaks water supply is pumped groundwater. Thus, indirectly through its retail water suppliers, the City of San José water supply can be broken into four inter-related components: SFPUC, SCVWD, groundwater and recycled water. Each of these components is subsequently explored in more detail.

3.1 San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is a department of the City and County of San Francisco providing water, wastewater, and municipal power services to San Francisco. Under contractual agreement with 28 wholesale water agencies, the SFPUC also supplies water to 1.6 million customers within three other counties, including Santa Clara County.

SFPUC relies primarily on snowmelt delivered to the Hetch Hetchy Reservoir via the Tuolumne River, with the remainder supplied by local runoff in Alameda and Santa Clara Counties. SFPUC has made recent efforts to expand and diversify its water supply portfolio. A technical memorandum developed various diversified portfolios, including water conservation, groundwater, recycled water, and desalination.[32]

[32]San Francisco Public Utilities Commission Water Enterprise – Water Resources Planning Division, May 2006: *Diversifying San Francisco's Retail Water Portfolio,* Technical Memorandum.

In May 2008 the SPFUC passed a resolution calling for further steps to develop/expand recycled water as a water source.[33] SFPUC supplies about 16% of the Santa Clara Valley Water District's total water supply, and virtually all of San José Municipal Water System's water supply to North San José / Alviso area is purchased from SFPUC.

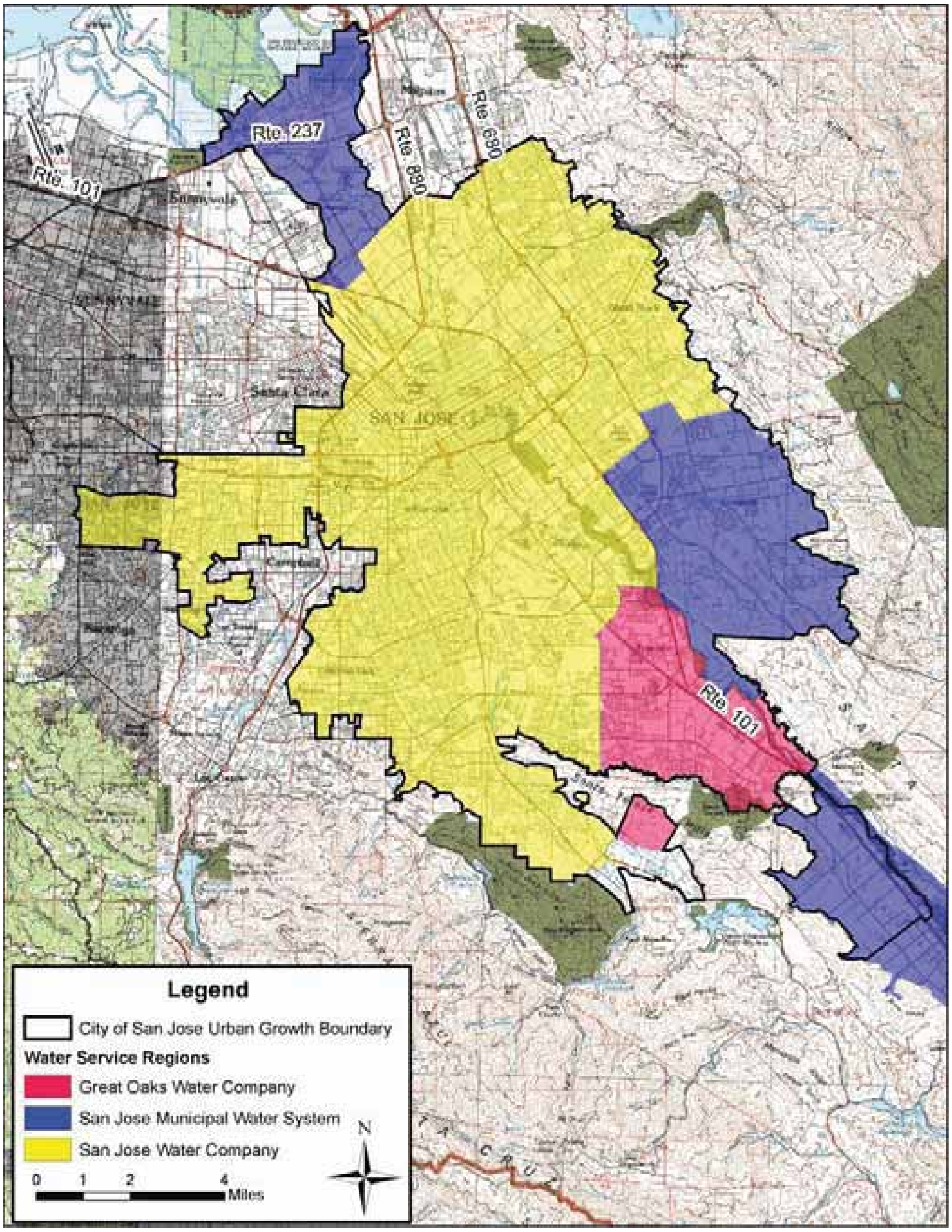

Figure 16. Retailer Service Regions in San José (SCVWD GIS)

[33]San Francisco Public Utilities Commission Citizens' Advisory Committee, June 16, 2008: *Recycled Water Resolution for the Water Subcommittee*.

3.2 Santa Clara Valley Water District

The SCVWD manages the water resources within the County of Santa Clara including surface reservoirs, creeks and recharge facilities, groundwater sub-basins and water treatment plants, recycled water and water imports. The SCVWD's water supply relies on groundwater, imported water from the State Water and Central Valley Projects, the SFPUC Hetch Hetchy system, recycled water, and local surface water. Local and imported water is used to recharge the groundwater basin and delivered to potable water treatment plants. Treated water is subsequently delivered to retailers. Figure 17 shows the average distribution of District water supply since 1989.[34]

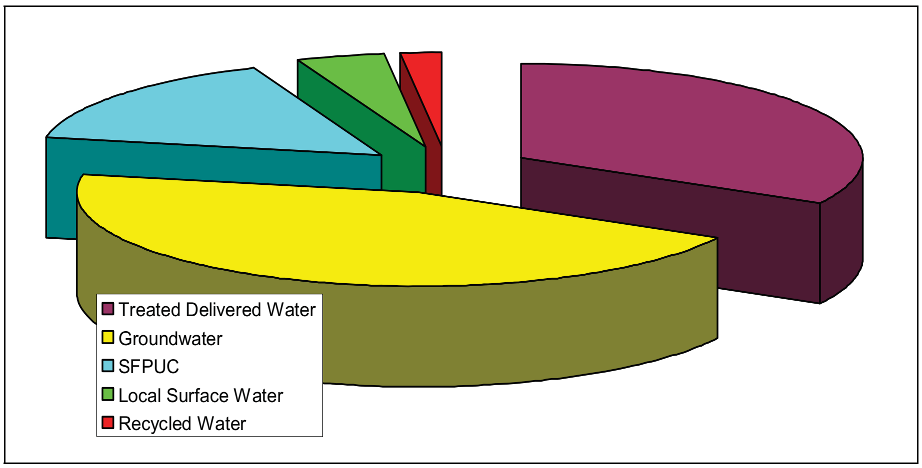

Figure 17. Relative Contribution of District Water Sources from 1989 to 2005

The largest supply of water to the District is groundwater (~45%), followed by treated delivered water, which makes up about one third of total District supplies. "Treated water" refers to water delivered by the California Department of Water Resources (DWR) or U.S. Bureau of Reclamation (USBR) to SCVWD facilities and treated either on site or prior to delivery. Imported water comes to the county from Northern California watersheds via the Sacramento-San Joaquin Delta. This water is delivered by the State Water Project (SWP), operated and maintained by DWR; and the Central Valley Project (CVP), operated and maintained by USBR. Imported water is conveyed to Santa Clara County through two main conveyance facilities: the South Bay Aqueduct, which carries SWP water from the South Bay Pumping Plant; and the Santa Clara Conduit and Pacheco Conduit, which bring CVP water from the San Luis Reservoir. The District has a contract for 100,000 acre-feet per year (afy) from the SWP. The District's contract for CVP supply is 152,500 afy, of which 130,000 afy is for municipal and industrial needs and 22,500 afy is for agricultural needs.[35]

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[34]Based on values from Santa Clara Valley Water District, 2005: *Urban Water Management Plan*, p. 19.
[35]Ibid. p. 57

The SFPUC is the third largest District water supplier and conveys water into Santa Clara County and other counties via its own facilities. The District does not control or administer SFPUC deliveries to the county; however, it is expected that many of the SFPUC retailers would pump additional groundwater if there was a shortfall in SFPUC deliveries. Local surface water and recycled water make up the remainder of the District's historic water supplies.

An Urban Water Management Plan (UWMP) is a planning document prepared by large water retailers. Figure 18 details the District's physical water treatment, storage and distribution facilities, which are described in the current 2005 SCVWD UWMP text as well:[36]

> "The District operates and maintains several local pipelines to transport imported raw water and locally conserved water to various locations for treatment and distribution or for groundwater recharge. This conveyance system consists of the Central Pipeline, the Rinconada Force Main, the Almaden Valley Pipeline, the Calero Pipeline, the Cross Valley Pipeline, the Penitencia Force Main, the Santa Teresa Force Main, the Vasona Canal, Kirk Ditch, the Anderson Force Main, the Coyote/Madrone Pipeline, Madrone Channel, the Almaden-Calero Canal, the Main Avenue Pipeline, the Greystone Pipeline, and Page Ditch. Another facility, the Stevens Creek Pipeline, taps off the Rinconada Force Main and conveys raw water to recharge facilities on the county's west side. The District is also under agreement with the U.S. Bureau of Reclamation to operate and maintain the Santa Clara Conduit and the Pacheco Conduit (San Felipe Unit).
>
> "The Rinconada WTP was constructed in 1967 and can sustain a maximum flow rate of 75 mgd. Upgrades are in the planning stage to increase production at Rinconada to 100 mgd. The Penitencia WTP was constructed in 1974 and can sustain a maximum flow rate of 42 mgd. The Santa Teresa WTP was constructed in 1989 and can sustain a maximum flow rate of 100 mgd.
>
> "Treated water pipelines that distribute water from the treatment plants to the water retail agencies include the West Pipeline, the Campbell Distributary, the Santa Clara Distributary, the Mountain View Distributary and the Sunnyvale Distributary from Rinconada WTP; the Snell Pipeline and Graystone Pipeline from Santa Teresa WTP; and the East Pipeline, Parallel East Pipeline, and Milpitas Pipeline, which can be fed from the Santa Teresa WTP or from Penitencia WTP."

[36]Ibid. p. 21-22

Figure 18. District Water Supply Facilities Map[37]

The District also participates in various exchanges and options, including, but not limited to San Benito County Water District exchanges, Pajaro Valley Water Management Agency and Westlands Water District agreement, and banking available supplies for future use via the Semitropic Water Storage District.[38]

The SCVWD completed an Urban Water Management Plan (UWMP) in 2005 which projects water supply and demand through 2030 for normal, single dry and multiple dry year scenarios. The UWMP finds that with water conservation savings, current District supplies are adequate to meet current and near future demand (to 2020) in normal and dry year scenarios,[39] while new investment in water supplies is needed to meet additional future demand past the year 2020. A variety of 'key programs' to protect existing water supplies and advance planning efforts are identified and additional water supply options are presented in the District's 2003 Integrated Water Resource Plan Study (IWRP).[40]

[37]Ibid, Figure 3-3
[38]Ibid, p. 58-59
[39]Ibid, p. 133
[40]Ibid, p. ES-4

These additional water supply measures include maximizing water conservation, advanced treatment of recycled water for groundwater recharge, development of desalination, expanded banking participating, and a new 100,000 acre-foot reservoir, any combination of which could reduce shortages through 2030 to negligible levels.[41] In summary the District UWMP concludes that water supply will be adequate to meet County-wide projected demands through 2030 with a combination of water conservation, "No Regrets" portfolio implementation, and significant investments in safeguarding existing and developing new supplies. The Department of Water Resources requires UWMPs to be updated every five years. Thus, the District's UWMP is due to be updated in 2010.

3.3 Groundwater

Groundwater is an important source of water for the Santa Clara Valley Water District (providing about 45% of total District supplies), and all of the service providers that supply water to the City rely at least in part on groundwater for their water supplies. The Santa Clara Valley Groundwater Basin is the source for all groundwater in the County, and is divided into three sub-basins: the Santa Clara Valley Sub-basin (which can be further separated into its confined and unconfined portions), the Coyote Valley Sub-basin, and the Llagas Sub-Basin. The former two basins underlie San José. The three sub-basins occupy approximately the northern-most 44 miles of the Santa Clara Valley; a northwest trending feature situated at the southern end of the San Francisco Bay and bounded to the east by the Diablo Range and to the west by the Santa Cruz Mountains. Each of these groundwater basins is shown in Figure 19, and each basin and their relationship is described in more detail below. The relative available supply from each groundwater basin is summarized in Table 10.

Table 10. Storage Capacities and Withdrawals for Groundwater Sub-Basins[42]

	Operational Storage Capacity (afy)	Average Historic Annual Withdrawal 1999-2004 (afy)	Maximum Annual Historic Withdrawal 1999-2004 (afy)
Santa Clara Valley Sub-basin	350,000	107,000	200,000
Coyote Valley Sub-basin	23,000 - 30,000	7,300	8,000
Llagas Sub-basin	152,000 - 165,000	45,000	92,000
TOTAL	530,000	159,300	300,000

[41]Ibid, p. 85
[42]Ibid, Table 3-4, p. 28-30, p. 32 & p. 122

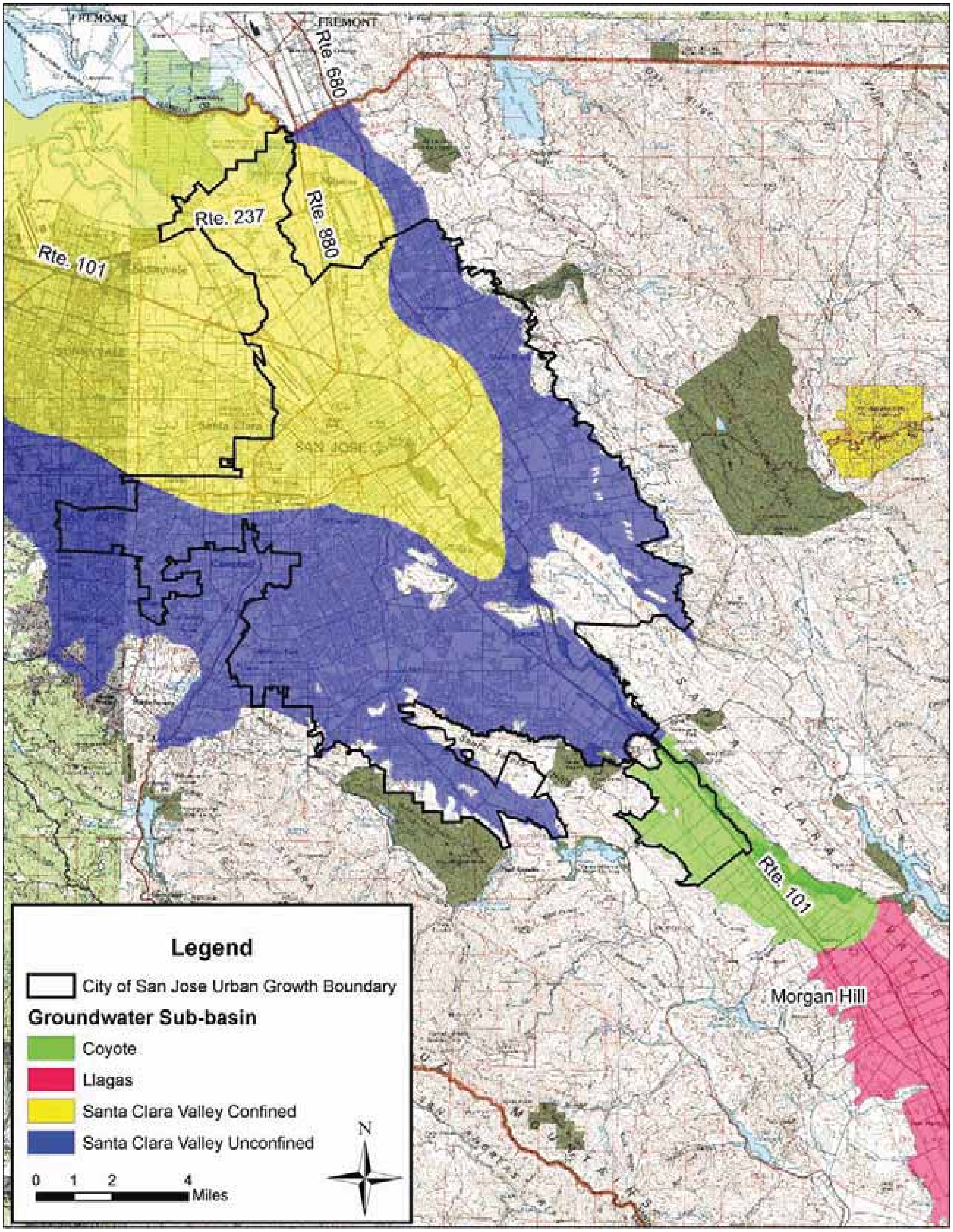

Figure 19. Santa Clara Valley Groundwater Basins

The values summarized by Table 10 are based on data presented in the UWMP. Note that the District defines operational storage capacity as the volume of groundwater that can be stored in a basin or sub-basin as a result of District management measures. Operational storage capacity is generally less than total storage capacity as it accounts for the avoidance of land subsidence and high groundwater conditions, as well as available pumping capacity.

3.3.1 Santa Clara Valley Sub-Basin

All three water retailers and SCVWD use groundwater from the Santa Clara Valley Sub-basin (SCVSB) as a source of supply. Underlying the majority of the City UGB, and virtually all of its developed area, the SCVSB is bounded by the Santa Cruz Mountains to the west and the Diablo Range to the east. Approximately 22 miles long, the sub-basin narrows from a width of about 15 miles at the City's northern boundary, to about a half a mile wide at its southern edge, which is referred to as the Coyote Narrows. The total area of the SCVSB is about 225 square miles, and it is not currently identified as adjudicated (a legal process of determining rights to water in an aquifer).[43]

The District estimates the long-term operational storage capacity of the Santa Clara Valley Sub-basin to be 350,000 acre-feet, and has determined groundwater withdrawal from the Sub-basin should not exceed 200,000 acre-feet in any one year. Historic groundwater withdrawal from the SCVSB is 107,000 afy on average for 1999 through 2004.[44]

3.3.2 Coyote Valley Sub-Basin

The Coyote Valley Sub-basin is approximately 7 miles long and 2 miles wide, with a corresponding surface area of about 15 square miles. It is bounded to the north by the Coyote Narrows; a constriction in the permeable basin materials where the two bordering mountain ranges converge towards one another. It is defined at its southern edge by a proscribed boundary at Cochrane Road that generally coincides with a groundwater divide between the Coyote and Llagas Sub-basins. Although the SCVWD utilizes the Llagas groundwater basin for its water supplies, it lies far south of the San José Urban Growth Boundaries, and as such is discussed herein only in its relation and relevance to the Coyote Sub-basin.

The Coyote sub-basin generally drains north through the Coyote Narrows into the Santa Clara Valley Sub-basin, while groundwater in the Llagas Sub-basin drains to the south. Due to changes in hydrogeologic conditions such as rainfall, recharge, pumping, and groundwater basin exchanges, the actual location of the groundwater divide between the Llagas and Coyote

[43]California Department of Water Resources, 2003: *California's Groundwater*, Bulletin 118.
[44]SCVWD UWMP p. 32

sub-basins has historically been observed to move as much as one mile to the north or south of the designated boundary at Cochrane Road. When the divide moves to the north, some water from Coyote sub-basin will flow south into the Llagas sub-basin. Average flow from the Coyote Sub-basin to the Llagas Sub-basin is estimated to be approximately 2,400 acre-ft per year.[45]

3.3.3 Groundwater Discharge Components

Discharge components refer to water uses or losses within the groundwater basin. They include in order of magnitude: direct groundwater extractions (i.e. pumping); subsurface outflow to another groundwater basin; discharges to surface water; direct consumption by plants, and the direct evaporation of surface water. Direct groundwater extraction via pumping is by far the most significant groundwater discharge component.

The total number of wells operating in the Santa Clara Valley groundwater basin is not precisely known. While the majority of wells are metered, there are un-metered private wells. Where meter data is not available, groundwater production has been estimated using efficiency or flow testing, power use, and/or crop factors. Table 11 summarizes District-estimated historic pumping for each sub-basin.[46]

Table 11. Historical Groundwater Pumping (acre-feet)

Year	Sub-basin			Total (acre-feet)
	Coyote	Llagas	Santa Clara Valley	
1999	8,400	45,200	106,800	160,400
2000	7,900	44,300	112,600	164,800
2001	6,900	47,000	115,400	169,300
2002	6,700	44,600	104,700	156,000
2003	6,800	41,600	96,500	144,900
2004	7,300	45,900	105,700	158,900

3.3.4 Groundwater Recharge Components

Recharge components refer to water gains within the groundwater basin. They include in order of magnitude: direct surface water recharge (natural and artificial); the deep percolation of precipitation; septic system discharges to groundwater; and the deep percolation of irrigation return water. Recharge of the Santa Clara Valley Basin occurs both naturally and artificially, through SCVWD management.

[45]Santa Clara Valley Water District, April 2002: *Operational Storage Capacity of the Coyote and Llagas Groundwater Sub-basins.*
[46]SCVWD UWMP p. 32

Unmanaged natural sources of recharge to the groundwater basin include rainfall, pipeline leakage, net irrigation return flows to the basin, underground seepage from the surrounding hills, and infiltration of flow in streams which drain areas of the Santa Cruz Mountains to the west.[47] Of these, deep percolation of rainfall accounts for most of the natural inflow to the basin.[48] The open bodies of water (lakes, gravel pits, etc.) that evaporate water from the basin are also available to directly infiltrate rainwater in lesser amounts. Table 12 presents SCVWD estimates of the total annual amount of natural groundwater recharge in each sub-basin.[49] It should be noted that these values are calculated based on known pumping, recharge, and change in storage from groundwater elevation maps. The period of record of groundwater pumping in the Llagas Sub-basin is much shorter than the other sub-basins, and so there is less confidence in the estimates of natural recharge for the Llagas Sub-basin.

Table 12. Estimated Natural Groundwater Recharge (afy) for Various Rainfall Conditions

	Santa Clara Sub-basin	Coyote Sub-basin	Llagas Sub-basin	Total
Average	32,000	2,600	19,000	53,600
Wet	52,000	4,000	31,000	87,000
Single Dry	25,000	1,600	7,000	33,600
Multiple Dry Year	29,000	2,400	19,000	50,400

The District has the ability to facilitate enhanced groundwater recharge (i.e. artificial or managed recharge) to all three of the Santa Clara County groundwater basins through 80 of its 90 miles of stream channels and 71 off-stream ponds. The recharge program consists of both releasing locally stored and imported water into District streams and ponds, and managing and maintaining the streams and ponds to ensure continued recharge. The total capacity of the SCVWD recharge systems is about 138,000 acre-feet.[50] Table 13 presents the amount of groundwater recharged to the whole Santa Clara Valley Basin for various rainfall conditions.[51]

[47]DWR Bulletin 118
[48]Santa Clara Valley Water District, July 2002: *Groundwater Conditions 2001.*
[49]SCVWD UWMP p. 36

[50]Ibid, p. 30
[51]Ibid, p. 31

Table 13. Managed Groundwater Total Recharge for all Sub-basins (ac-ft/yr)

Source	Normal Year	Single Dry Year	Multiple Dry Years
Total Managed Recharge: Local and Imported Sources	116,000	49,000	92,000

Less significant groundwater recharge components mentioned previously include percolation of rainfall and irrigation return water. Both of these components are most pronounced in the Coyote Valley Sub-basin, because the Santa Clara Sub-basin is almost entirely developed with a higher concentration of impervious area and relatively few agricultural lands. The California Department of Water Resources estimates that a little more than two inches of rainfall over the Coyote Valley floor reaches the groundwater aquifer through deep percolation, providing about 1,700 acre-feet of supply to the basin every year. About ten percent of agricultural irrigation water returns to the aquifer through deep percolation, and about half of all residential water uses from the aquifer return as septic system discharge. Septic discharges are filtered through sandy soils and unconsolidated deposits before reaching the water table, similar to a slow sand filtration system found in a water treatment facility.

3.3.5 Groundwater Levels

Groundwater levels respond to changes in the balance between groundwater recharge and withdrawal, and indicate the relative amount of water stored in an aquifer at a given point in time. The District maintains groundwater elevation data for monitoring wells in the Santa Clara Valley Sub-basin dating back to 1915, the Coyote Sub-basin dating back to 1937, and the Llagas Sub-basin dating back to 1969. Because most wells were designed as production wells, they are screened at multiple depths, and therefore elevation data represents an average of the conditions in the various water-bearing formations. Data is currently collected monthly for index wells and quarterly for other monitoring wells. Long-term average depth to groundwater levels are shown in Figure 20.

By 1916, when the District began to monitor water levels, groundwater had been used as a water supply source for more than 60 years. Subsidence of nearly four feet had been recorded in San José; and the Almaden, Calero, Guadalupe, Stevens Creek, Vasona, and Coyote dams had been constructed to store excess winter streamflow for dry-month releases into recharge facilities. Countywide groundwater levels increased from the late '30s into the beginning of the below-normal precipitation in 1944. Between 1944 and 1950, a combination of low precipitation and use of groundwater for almost all of the county's water needs corresponded to an extreme drop in groundwater elevations. In 1950 construction of Anderson Dam was complete. In 1952 the county began importing Hetch Hetchy water; however, the county population doubled between 1950 and 1960, and water levels in the northern Santa Clara Sub-basin declined further.

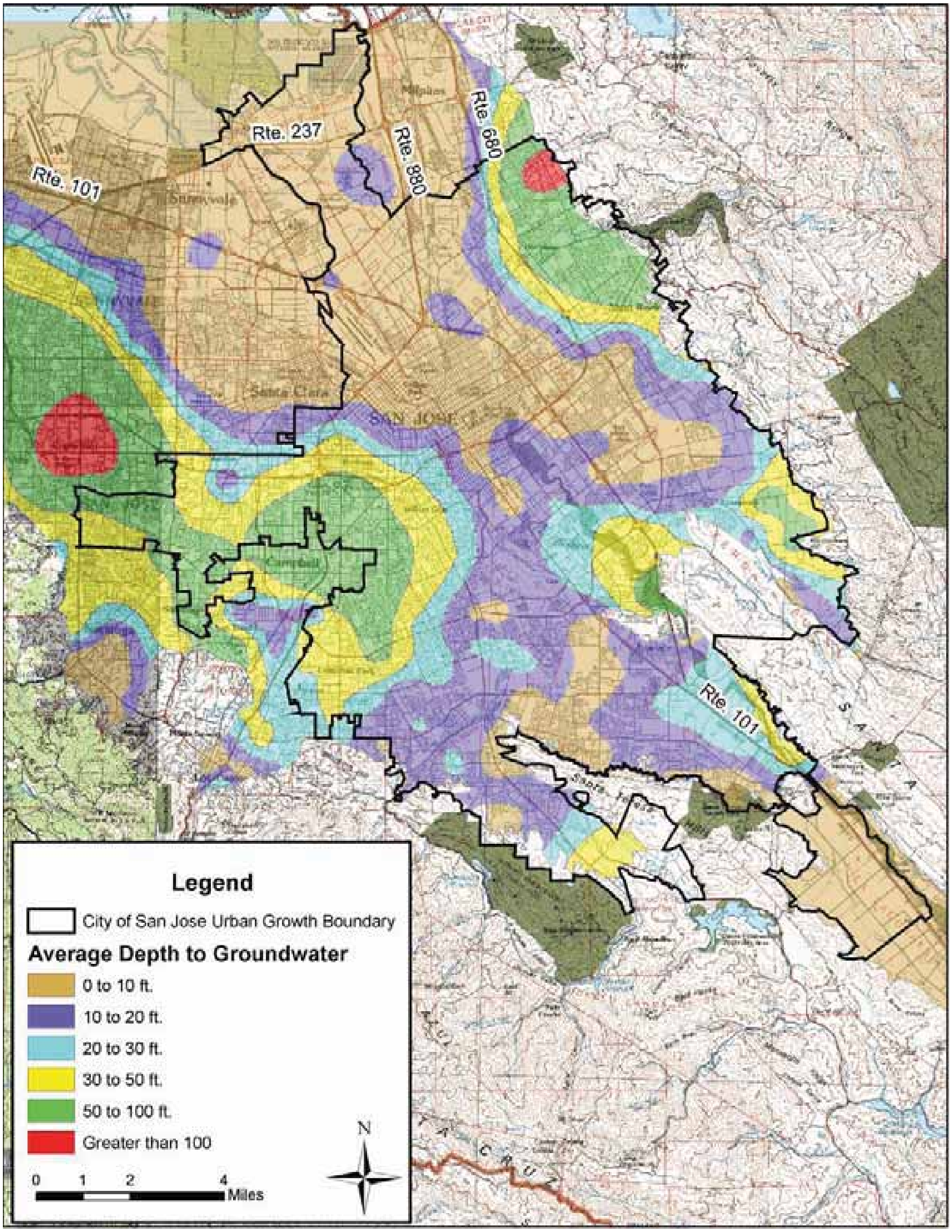

Figure 20. Average Depth to Groundwater in San José 1980-2003 (SCVWD GIS)

In the early 1960s the district contracted with the State for an entitlement of 100,000 acre-feet per year through the South Bay aqueduct. In 1967 the District began delivering surface water treated at the new Rinconada Water Treatment Plant (WTP) to north county residents, reducing groundwater extraction and allowing for some basin recovery. Between 1960 and 1970, the county population again doubled. In 1974 Penitencia WTP began delivering treated water to some county residents, reducing some of the demand for groundwater. In 1987 delivery of water from the Central Valley Project began, and in 1989 the Santa Teresa WTP began treating and delivering surface water.

Groundwater elevation and land subsidence are related in San José. When groundwater levels decline, clay layers, previously saturated, are exposed and at risk of dewatering. As these clay layers dewater they compress, and do not expand when re-wetted. This compression causes land subsidence. The lowest groundwater elevations in the Santa Clara Valley Basin were recorded in about 1964. Since that time, imports from State and Federal water supplies both decreased groundwater extraction and increased groundwater recharge with the result that groundwater levels have generally risen. Within a few years of these changes, additional land subsidence had virtually stopped.[52]

Rising groundwater has other impacts. As shown in Figure 19, the Santa Clara Sub-basin is made up of two parts, a confined sub-basin and un-confined sub-basin. The northern, confined sub-basin is made up of an upper layer (Zone A) which is separated from the lower layer (Zone B) by an impermeable clay layer. This clay layer is at a gradient, with a higher elevation along the southern edge of the confined section and sloping downwards as it traverses north towards San Francisco Bay. At the interface of the unconfined and confined sub-basins, groundwater from the unconfined layer may enter both Zone A and Zone B and travels generally northward. As the clay layer slopes downward, pressure in the confined Zone B increases because it is controlled by the groundwater elevation at the interface between the confined and unconfined sub-basins. Thus, within the confined sub-basin when the clay layer separating Zones is breached, groundwater from Zone B has much greater head (up to 10 feet) compared to groundwater from Zone A. In several locations within the City of San José, breaching of this layer has required ongoing, full time pumping to avoid flooding of roads or buildings from groundwater which is pressure released from Zone B. Shallow nuisance groundwater is also occurring even where the confining layer has not been breached due to rising levels of water in the perched Zone A layer.

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[52]Santa Clara Valley Water District, May 2000: *Relationship between Groundwater Elevations and Land Subsidence in Santa Clara County (Figure).*

3.3.6 Groundwater Quality

Groundwater quality in Santa Clara County is generally quite good. That said, contamination sites and elevated nitrate concentrations have been observed. The SCVWD monitors groundwater quality for a variety of parameters, including calcium, sodium, iron, nitrate, chloride, organic solvents or gasoline additives. The type of monitoring at any given well depends on the well location, historic and existing land uses, and the availability of groundwater data in the area. In addition, water retailers and property owners also conduct groundwater monitoring. At polluted sites, responsible parties monitor the effectiveness of cleanup efforts.

San José Water Company (SJWC), whose service area encompasses Cupertino, Saratoga, Monte Sereno, Los Gatos, Campbell, and much of San José, completed their source water assessment for the California Department of Public Health in 2002, and an Annual Water Quality Report in 2007. SJWC reports that their wells are vulnerable to various potential contaminants from dry cleaners, gas stations, auto repair shops, low-density septic systems, industrial sites, and known contaminant plumes, among other sources. SJWC reports that physical barriers, treatment systems, and monitoring programs in place ensure that their supplied water is not adversely affected.[53]

Great Oaks Water Company (GOWC), whose service area borders the SJWC service area at Snell Avenue, serves primarily the Edenvale and Coyote Valley areas with only groundwater. GOWC has also completed their source water assessments, which indicate potential contamination from nearby septic systems, sewer collection systems, agricultural wells, gas stations, parks, highways, and industrial facilities, among other sources. However, the GOWC wells are constructed to minimize the influence of potential contaminants.[54]

The San José Municipal Water System (SJMW) provides water to the Evergreen, Edenvale, Coyote Valley, and North San José/Alviso service areas. For all of these areas, water quality vulnerabilities due to land use practices (i.e. agricultural and urban runoff, livestock grazing, etc.) are identified. Additional vulnerabilities include chemical and petroleum processing activities, illegal or unauthorized dumping, storage tank leaks and sewer collection systems. No contamination associated with any of these activities has been detected, however.[55] The most actively monitored groundwater pollutants are discussed in more detail below.

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[53] San José Water Company, 2007: *Annual Water Quality Report*

[54] Great Oaks Water Company, 2007: *Annual Water Quality Report*

[55] City of San José, San José Municipal Water System Environmental Services Department, 2007: *Water Quality Report*.

Nitrate

The nitrate concentration range in the principal aquifer of the Santa Clara Valley sub-basin is 13 to 16 mg/L, and the SCVWD has found that nitrate concentrations in this sub-basin appear to be stable. The nitrate concentration range for the Coyote sub-basin is 10 to 47 mg/L, with the wells with nitrate concentrations above the drinking water standard located in the southern half of the sub-basin. The nitrate concentration range for the upper aquifer zone of the Llagas sub-basin is 16 to 46 mg/L. The nitrate concentration range for the lower principal aquifer zone is 25 to 34 mg/L. The drinking water maximum contaminant level (MCL) for nitrate is 45 mg/L.

Drinking water standards in areas of high nitrate are met through blending or treatment by the well owner. In addition, the SCVWD has implemented a nitrate management program since 1992. Over half of the 600 private wells tested in the Llagas and Coyote Valley Sub-basins between 1997 and 2001 exceeded the federal safe drinking standard for nitrate, although all public supply water wells meet drinking water standards.[56] This led to a regular monitoring program of Nitrate in the Coyote and Llagas sub-basins beginning in 1999, with 55 wells tested quarterly or biannually. In 2002, 33 wells in these sub-basins exceeded water quality standards for Nitrate loading. In 2003, 39 wells exceeded this threshold.[57]

Perchlorate

Perchlorate, a chemical used in rocket fuel and highway flares, has been detected in the Llagas Sub-basin south of Coyote Valley, contaminating wells in southeast Morgan Hill, San Martin and a few in north Gilroy. The contamination has been traced to a highway flare manufacturing plant operated by Olin Corporation from 1956 to 1997 on Tennant Avenue in Morgan Hill. Perchlorate affects the function of the thyroid gland (pregnant women and infants are most at risk), and water contaminated with the chemical should be avoided for drinking and cooking. Perchlorate has been found above California's perchlorate Public Health Goal (PHG) and notification level of 6 parts per billion in nearly 250 private and public wells, including several municipal wells in Morgan Hill and several mutual water company wells. More than 500 private wells are contaminated with perchlorate at levels below the Public Health Goal.

The initial area of plume investigation was bound by Tennant Avenue on the north, Masten Avenue to the south, between Monterey Highway on the west and Center Avenue to the east. At one time, it was believed that the contaminated groundwater flowed only southeast from the site of initial contamination. (Coyote Valley is about two miles to the northwest.) As recently as early November 2003, however, the *Gilroy Dispatch* reports that new information indicates "the

[56]SCVWD Groundwater Management Plan, p 41
[57]Santa Clara Valley Water District, January 2005: *Groundwater Conditions 2002/2003*.

chemical can migrate north in some gradients or sections after all." The California Regional Water Quality Control Board, Central Coast Region, has issued a Cleanup and Abatement Order to Olin, and has ordered Olin to provide an alternate water supply to those with wells showing perchlorate at or above the PHG.

Other Groundwater Pollutants

Nitrate and perchlorate are currently the primary groundwater contaminant concerns in the Santa Clara Valley groundwater basin, although several other contaminants are monitored by SCVWD including volatile organic compounds (VOCs), fuel additives such as MTBE, synthetic organic compounds (SOCs) such as PCBs, and other unregulated chemicals. In 2003 no monitoring wells had levels of VOCs or SOCs above drinking water standards. MTBE contamination has impacted two public water supply wells in Santa Clara Valley. SCVWD participates in or administers programs to address these pollutants including the "Solvents and Toxics Liason Program", the "Leaking Underground Storage Tank Oversight Program".[58]

3.4 Recycled Water

Recycled water refers to the treatment, management, and non-potable re-use of wastewater. Both the Santa Clara Valley Water District and the San Francisco Public Utilities Commission have identified expanded use of recycled water as a water supply source to meet future demands. In the San José area, recycled water is managed by the South Bay Water Recycling (SBWR) program. SBWR includes San José, Santa Clara and Milpitas, five sanitation districts, the U.S. Bureau of Reclamation, Environmental Protection Agency, California Department of Water Resources, Department of Health Services, Regional Water Quality Control Board, Santa Clara County Health Department, and Santa Clara Valley Water District. Figure 21 shows the system map for the SBWR pipelines.

The SBWR system consists of over 100 miles of pipe. During the summer months, an average of 15 million gallons (46 af) of recycled water are produced and distributed to over 550 customers per day. All recycled water in the SBWR is treated to a disinfected tertiary level before being delivered to customers. The San José/Santa Clara Water Pollution Control Plant is the primary provider of recycled water in the County, although three other wastewater treatment facilities outside the City of San José also produce recycled water. The District works with the wastewater authorities in the county on partnerships to promote water recycling for non-potable uses such as irrigation and industrial uses through financial incentives and technical assistance.

[58]Ibid.

The existing SBWR system was recently expanded with the construction of the Silver Creek Pipeline Extension to deliver water to the Metcalf Energy Center (MEC). The MEC currently uses about 4,000 afy of recycled water via the Silver Creek Pipeline. The Silver Creek Pipeline that delivers water to the MEC has an additional 5 million gallons per day capacity which is secured for the District's future use via an agreement between the District and the SBWR program. The total recycled water utilized by the Santa Clara Valley Water District in 2004 was 11,000 afy. The SCVWD projects that it will deliver a total of 31,200 afy of recycled water by 2030, of which approximately 16,200 afy will be available and utilized in San José.[59]

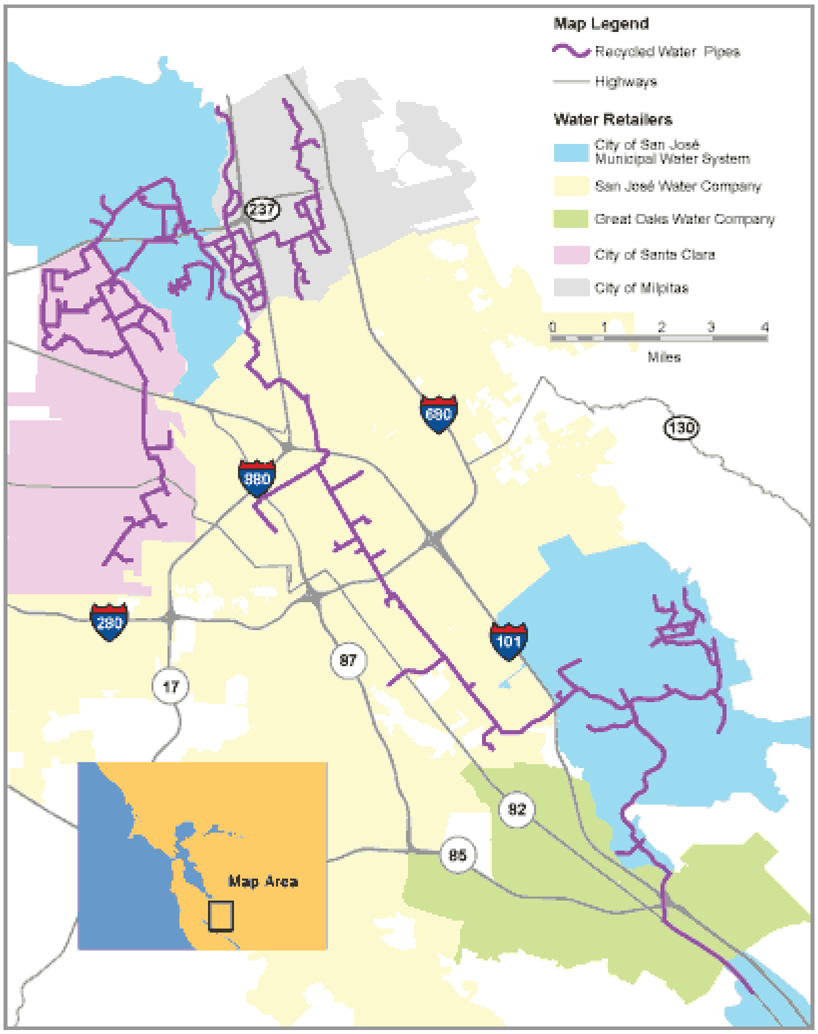

Figure 21. SBWR System (City of San Jose Environmental Services)

[59] SCVWD UWMP, p. 48

4. Regulatory Framework

There are a variety of federal, state, and local laws and regulations pertaining to water resources that may impact San José planning. In addition, since San José is adjacent to the San Francisco Bay marshlands, climate change impacts may result in future regulations relevant to the City. These existing and potential regulations are presented in more detail below.

4.1 Federal Regulations

4.1.1 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 the FEMA-designated floodplains in the UGB is discussed previously.

4.1.2 Clean Water Act

The major federal legislation governing water quality is the Clean Water Act, as amended by the Water Quality Act of 1987 (Act). The U.S. Environmental Projection Agency (EPA) is the federal agency for water quality management nationwide. The Clean Water Act establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under the Clean Water Act, EPA has implemented pollution control programs such as setting wastewater standards and water quality standards for all contaminants in surface waters.

Three key regulatory programs are outlined in the Clean Water Act. Sections 303 and 304 of the Act call for the establishment of water quality standards, criteria, and guidelines, including for wastewater effluent. A water quality standard, under federal regulations (40 CFR 131.2) must define the water quality goals of a water body (or portion thereof) but designating the use(s) to be made of the water and setting criteria necessary to protect those uses. Under Section 303(d) States are required to identify impaired surface water bodies and develop total maximum daily loads (TMDLs) for contaminants of concern. As part of implementing Section 303, federal regulations (40 CFR 131.6) also require that each state develop and implement an "Antidegradation Policy" to protect develop, adopt, and implement measures to protect surface water quality and support existing uses. Activities that may result in discharges to Waters of the United States and that require a federal permit are regulated under Section 401 of the Act. Water Quality Certification by the state is required for activities such as placement of fill in wetlands or bodies of water.

The EPA's regulations, as called for under Section 402 of the Clean Water Act, also include the National Pollutant Discharge Elimination System (NPDES) permit program, which controls sources that discharge pollutants into waters of the United States (e.g., streams, lakes, bays, etc.). These regulations are implemented at the regional level by water quality control boards, which for the San José area is the San Francisco Bay Regional Water Quality Control Board (RWQCB). Historically, efforts to prevent water pollution have focused on "point" sources, meaning the source of the discharge was from a single location (e.g., a wastewater treatment plant, power plant, factory, etc.). Recent efforts also are focusing on pollution caused by "non-point" sources, meaning the discharge comes from multiple locations. The best example of this latter category is urban runoff, the source of which is a myriad of surfaces (e.g., roadways, rooftops, parking lots, etc.) that are found in a typical city or developed area. The RWQCB is tasked with protecting the quality of surface waters and groundwaters by issuing and enforcing compliance with the National Pollutant Discharge Elimination System (NPDES) permits and by preparation and revision of regional Water Quality Control Plan, also known as the Basin Plan. The RWQCB's latest Basin Plan was approved in January 2007.[60]

4.1.3 National Pollutant Discharge Elimination System Permit

The National Pollutant Discharge Elimination System (NPDES) Permit, though a federal program, is administered on the local level and will therefore be discussed in the Local Regulations section.

4.1.4 Section 404 of the Federal Clean Water Act

The U.S Army Corps of Engineers (Corps) is involved with the permitting process associated with all projects that have the potential to impact wetlands or other Corps jurisdictional waters, riparian areas, or endangered species through fill, development in or alteration of wetlands or jurisdictional waters. The Corps contacts the appropriate agencies (including the U.S Department of Fish and Wildlife and the National Marine Fisheries Service) and oversees and coordinates the permit application process.

[60] California Water Quality Control Board *Basin Plan*

Under the Section 404 permit process, the U.S. Fish and Wildlife Service (FWS) acts as a consultant for the Corps. Their primary responsibility is to enforce the Endangered Species Act. Any project that affects jurisdictional waters and has the potential to impact endangered species habitat must request FWS to initiate Section 7 Consultation.

The National Oceanic and Atmospheric Administration (NOAA) also acts as a consultant for the Corps. NOAA is responsible for the management, conservation and protection of living marine resources within the United States' Exclusive Economic Zone (water three to 200 mile offshore). NOAA works with communities on fishery management issues and works to promote sustainable fisheries and to prevent lost economic potential associated with over fishing, declining species and degraded habitats. Since degradation of waterways, riparian and coastal habitat can affect local fisheries NOAA may be requested to initiate Section 7 Consultation on projects that degrade these areas.

The Corps is responsible for contacting the appropriate consultant for the habitats and species involved.

4.2 State Regulations

4.2.1 Porter-Cologne Water Quality Control Act

The State of California's Porter-Cologne Water Quality Control Act provides the basis for water quality regulation within California and the Act assigns primary responsibility for the protection and enhancement of water quality to the State Water Resources Control Board (SWRCB) and the nine regional water quality control boards. The SWRCB provides state-level coordination of the water quality control program by establishing state-wide policies and plans for the implementation of state and federal laws and regulations.

The San Francisco Bay office of the Regional Water Quality Control Board (Regional Board or RWQCB Region 2) regulates water quality in the Bay area in accordance with the Water Quality Control Plan or 'Basin Plan'.[61] The Basin Plan presents the beneficial uses, which the Regional Board has specifically designated for local aquifers, streams, marshes, rivers, and the Bay, as well as the water quality objectives, and criteria that must be met to protect these uses. The RWQCB implements the Basin Plan by issuing and enforcing waste discharge requirements to control water quality and protect beneficial uses.

[61] Ibid.

4.2.2 NPDES Municipal Stormwater Permit

The National Pollutant Discharge Elimination System Permit, though a state program, is administered on the local level and will therefore be discussed in the Local Regulations section.

4.2.3 NPDES General Permit for Construction Activity

For any proposed project that would disturb more than 1.0 acre of land, the project applicant is required to submit a Notice of Intent to the State Board and apply for coverage under the NPDES Construction General Permit. Effective July 1, 2010, all dischargers are required to obtain coverage under the Construction General Permit Order 2009-009-DWQ, adopted by the RWQCB on September 2, 2009. Construction activities subject to this permit include grading, clearing, or any activities that cause ground disturbance such as stockpiling or excavation. Regular maintenance activities performed to restore original line, grades, or capacities of facilities are not subject to this permit requirement. Administration of these permits has not been delegated to cities, counties, or Regional Boards but remains with the State Board. Enforcement of permit conditions, however, is the responsibility of Regional Board staff, assisted by local municipal or county staff.

The City of San José requires the project applicant to prepare a Storm Water Pollution Prevention Plan (SWPPP) and submit it for review prior to commencing construction. Once grading begins, the SWPPP must be kept on-site and updated as needed during construction. The SWPPP details the site-specific best management practices (BMPs) to control erosion and sedimentation and maintain water quality during the construction phase. The SWPPP also contains a summary of the structural and non-structural BMPs to be implemented during the post-construction period, pursuant to the nonpoint source practices and procedures encouraged by the City of San José and the Regional Board.

4.2.4 NPDES Industrial Discharge Permit(s)

To minimize the impact of stormwater discharges from industrial facilities, the NPDES program includes an industrial stormwater permitting component that covers 29 industrial sectors that require authorization under an NPDES industrial stormwater permit for stormwater discharges. Industrial facilities will need to obtain NPDES permit coverage through the state. Facilities with the following industrial activities require permit coverage: facilities subject to federal stormwater effluent discharge standards in 40 CFR Parts 405-471; heavy manufacturing (for example, paper mills, chemical plants, petroleum refineries, and steel mills and foundries); coal and mineral mining and oil and gas exploration and processing; hazardous waste treatment, storage, or disposal facilities; landfills, land application sites, and open dumps with industrial wastes; metal scrap yards, salvage yards, automobile junkyards, and battery reclaimers; steam electric power generating plants; transportation facilities that have vehicle maintenance, equipment cleaning, or airport deicing operations; treatment works treating domestic sewage with a design flow of one million gallons a day or more; light manufacturing. (For example, food processing, printing and publishing, electronic and other electrical equipment manufacturing, and public warehousing and storage.)

4.2.5 California Fish and Game Code - Lake and Streambed Alteration

The California Department of Fish and Game (DFG) is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the Fish and Game Code (Section 1602) requires an entity to notify DFG of any proposed activity that may substantially modify a river, stream, or lake.

If DFG determines that the activity may substantially adversely affect fish and wildlife resources, a Lake or Streambed Alteration Agreement will be prepared. The Agreement includes reasonable conditions necessary to protect those resources and must comply with the California Environmental Quality Act (CEQA). The entity may then proceed with the activity in accordance with the final Agreement.

4.2.6 California Department of Public Health Drinking Water Program

The Drinking Water Program (DWP) within the Division of Drinking Water and Environmental Management regulates public water systems, oversees water recycling projects, permits water treatment devices, certifies drinking water treatment and distribution operators, supports and promotes water system security, provides support for small water systems and for improving technical, managerial, and financial (TMF) capacity and provides funding opportunities for water system improvements. The operation of a drinking water system is regulated under both Title 17 and Title 22 of the California Code of Regulations.

Under the California Water Code, the SWRCB is responsible for formulating and adopting state policy for water recycling, while the California Department of Health Services [now the California Department of Public Health (DPH)] is responsible for establishing uniform statewide criteria to ensure that the use of recycled water would not be detrimental to public health. The currently adopted regulations and statutes governing water reuse in the state of California are compiled in the California Health Laws Related to Recycled Water, aka "The Purple Book". These rules and regulations were compiled in 2001, and are based on the health and safety code (Articles 2 and 7), the California water code (most notably sections 13540-13583), and the California Code of Regulations (Title 22, Sections 60301 – 60355). Title 22 establishes water quality standards and treatment reliability criteria for water recycling, as well as setting bacteriological water quality standards on the basis of the expected degree of public contact with recycled water. The highest level of treatment required by Title 22 (recycled water with a high potential for public contact) is disinfected tertiary treatment. As mentioned previously, all recycled water in the SBWR meets this standard. Any uses of recycled water not addressed by these statewide criteria are established by the state Department of Public Health on a case-by-base basis.

4.2.7 Senate Bills 221 and 610 - Sufficiency of Water Supplies

Senate Bill 221 authored by State Senator Sheila Kuehl (D-Santa Monica) prohibits the approval by local government of a tentative or parcel map, or development agreement, for residential subdivisions without first obtaining written proof that "sufficient water supply" for the development exists. "Subdivision" is defined to be a development of more than 500 dwelling units, or one that results in an increase of at least 10 percent in the number of the public water system's existing service connections. "Sufficient water supply" is defined as the total water supplies available during normal, single-dry, and multiple-dry years within a 20-year projection period that meets the projected demand associated with the proposed subdivision development in addition to any existing and planned future use demand.

State Senator Jim Costa (D-Fresno) wrote Senate Bill 610 requiring a water supply assessment for any "project" that is determined by a city or county to be subject to the California Environmental Quality Act (CEQA). Under the Bill, "project" is defined as any of the following:

1. A proposed residential development of more than 500 dwelling units;
2. A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space;
3. A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space;
4. A proposed hotel or motel, or both, having more than 500 rooms;
5. A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1000 persons, occupying more than 40 acres of land, or having more than 50,000 square feet of floor area;
6. A mixed-use project that includes one or more of the projects specified above; or
7. A project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.

It is possible that future development within the San José Urban Growth Boundary under the Envision San José 2040 General Plan Update will meet at least one of the above criteria, requiring an SB610 Water Supply Analysis.

A Water Supply Assessment does not need to be prepared for a proposed project if it is part of a larger project for which an assessment has been prepared, and for which the supplier has concluded that water supplies are sufficient to meet demand associated with the project, in addition to other existing and planned future use demands.

4.2.8 Urban Water Management Plans

The California Department of Water Resources (DWR) provides urban water management planning services to local and regional urban water suppliers. In 1983, the California Legislature enacted the Urban Water Management Planning Act (Water Code Sections 10610 - 10656). The Act states that every urban water supplier that provides water to 3,000 or more customers, or that provides over 3,000 acre-feet of water annually, should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The Act describes the required contents of the Urban Water Management Plans as well as how urban water suppliers should adopt and implement the plans. Program staff assists urban water suppliers with preparing comprehensive and useful water management plans, implementing water conservation programs, and understanding the requirements of the Act. Since San José has a large water customer base, Urban Water Management Plans must be created or revised as necessary with the assistance of DWR to ensure that water demands are adequately met. The Santa Clara Valley Water District completes Urban Water Management Plans approximately every 5 years, most recently in 2005. The City of San José is included in the District Urban Water Management Plan.

4.2.9 Dam Safety

Also part of the DWR, the Division of Safety of Dams is responsible for regular inspection of the dams in the area. Much of San José is in a dam failure inundation zone. It is the responsibility of DWR and other local agencies to minimize the risk of dam failure. Dams regulated by DWR are identified in California Water Code Sections 6002, 6003, and 6004 and regulations for dams and reservoirs are included in the California Code of Regulations.[62]

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[62]California Department of Water Resources, Division of Safety of Dams, *Statutes and Regulations Pertaining to Supervision of Dams and Reservoirs*.

4.3 Local Regulations

4.3.1 City of San José

NPDES Permit

The 1987 amendments to the Clean Water Act [Section 402(p)] provided for U.S. EPA regulation of several new categories of nonpoint pollution sources within the existing National Pollutant Discharge Elimination Program (NPDES). In Phase I, NPDES permits were issued for urban runoff discharges from municipalities of over 100,000 people, from plants in industries recognized by the EPA as being likely sources of storm water pollutants, and from construction activities which disturb more than 5 acres. Phase II implementation, effective March 10, 2003, extended NPDES urban runoff discharge permitting to cities of 50,000 to 100,000 people, and to construction sites which disturb between one and 5 acres.

The EPA has delegated management of California's NPDES Municipal Stormwater Permit program to the State Water Resources Control Board and the nine Regional Water Quality Control Board offices. In both Phase I and Phase II, urbanized counties and cities that implemented a comprehensive storm water management plan (SWMP) for urban runoff management meeting Regional Board standards could apply to the Regional Board for a joint city-county NPDES Municipal Stormwater Permit. Upon acceptance, the authority to regulate storm runoff discharges from municipal storm drain systems was transferred to the permit holders, allowing them to more effectively integrate the storm-water control program with other nonpoint source control programs.

Each incorporated city and town in Santa Clara County, including the City of San José, joined with the County of Santa Clara to form the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) in applying for a regional NPDES permit. SCVURPPP was established with offices in San José as part of the regional NPDES permit to apply for and administer the permit for the County and its cities and towns. SCVURPPP received its first 5-year Phase I NPDES Municipal Stormwater Permits in 1990, reissued in 1995, 2001, and 2009. As part of the NPDES permit requirements, the Program produced an Urban Runoff Management Plan and submits annual work plans and reports to the Regional Board. Included in this is the Hydromodification Management Plan (HMP). The goal of an HMP is to manage increased peak runoff flows and volumes (hydromodification) to avoid erosion of stream channels and degradation of water quality both on and off the project site.

The most recent NPDES permit (Order No. R2-2009-0074, adopted by the RWQCB October 14, 2009) is significantly changed from the previous permit. Language is generally more proscriptive, and meeting specific numeric criteria for various pollutant reduction efforts is required. Beginning December 1, 2011 the impervious surface threshold for regulated projects is decreased from 10,000 square feet to 5,000 square feet for special land use categories (auto service facilities, gas stations, restaurants, parking lots, etc.). Some of the other additions to the NPDES permit include an expansion of trash reduction efforts and requirements and the requirement for all regulated projects to implement source control measures (i.e. BMPs and/or LID efforts) onsite.

Storm Water Management Plan

The Storm Water Management Plan (SWMP) was prepared to supplement the joint NPDES Phase I Municipal Storm Water permit to be issued to the co-permittees, by the San Francisco Bay Regional Water Quality Control Board (SCBRWQCB). The intent of the Management Plan is to identify specific tasks and programs to reduce the discharge of pollutants in storm water to the Maximum Extent Practical (MEP) in a manner designed to achieve compliance with water quality standards and objectives. The Management Plan identifies measures to effectively prohibit non-storm water discharges into municipal storm drain systems and watercourses within the permittees' jurisdictions. The Management Plan fulfills the Regional Water Board's permit application requirements.

The SWMP seeks to control post-development storm water runoff through source control and treatment control Best Management Practices (BMP's). SWMP measures will be required on new projects that create or replace more than 10,000 square feet of impervious surface.

Updated General Plan Policies

San José's Draft 2040 General Plan policies and actions relevant to water resources and flooding are identified below.[63]

- Environmental Considerations/Hazards Policy 5.1: The City shall require evaluation of flood hazards prior to approval of development projects within a Federal Emergency Management Agency (FEMA) designated floodplain. New development and substantial improvements to existing structures shall be reviewed to ensure it is designed to provide protection from flooding with a one percent annual chance of occurrence, commonly referred to as the "100-year" flood or whatever designated benchmark FEMA may adopt in the future. New development should also provide protection for less frequent flood events when required by the State.

[63] http://www.sanjoseca.gov/planning/gp_update/DraftPlan/008_Chapter03_9-20-2010.pdf .

- Environmental Considerations/Hazards Policy 5.2: Allow development only when adequate mitigation measures are incorporated into the project design to prevent or minimize siltation of streams, flood protection ponds, and reservoirs.
- Environmental Considerations/Hazards Policy 5.3: Preserve designated floodway areas for non-urban uses.
- Environmental Considerations/Hazards Policy 5.4: Develop flood control facilities in cooperation with the Santa Clara Valley Water District to protect areas from the occurrence of the "1%" or "100-year" flood or less frequent flood events when required by the State.
- Environmental Considerations/Hazards Policy 5.5: Prepare and periodically update appropriate emergency plans for the safe evacuation of occupants of areas subject to possible inundation from dam and levee failure and natural flooding. Include maps with pre-established evacuation routes in dam failure plans.
- Environmental Considerations/Hazards Policy 5.6: Support State and Federal legislation which provides funding for the construction of flood protection improvements in urbanized areas.
- Environmental Considerations/Hazards Policy 5.7: Allow new urban development only when mitigation measures are incorporated into the project design to ensure that new urban runoff does not increase flood risks elsewhere.
- Environmental Considerations/Hazards Policy 5.8: Cooperate with the Santa Clara Valley Water District to develop and maintain additional flood protection retention facilities in areas where they are needed or where the design capacity of existing retention facilities cannot be restored.
- Environmental Considerations/Hazards Policy 5.9: Work with local, regional, state and federal agencies to ensure new and existing levees provide adequate flood protection and actively partner with the Santa Clara Valley Water District and other levee owners with respect to National Flood Insurance Program (NFIP) levee recertification.
- Environmental Considerations/Hazards Policy 5.10: Encourage the preservation of urban creeks and rivers to maintain existing floodplain storage. When in-channel work is proposed, engineering techniques which include the use of plant materials (bio-engineering) are encouraged.

- Environmental Considerations/Hazards Policy 5.11: Reduce the amount of impervious surfaces as a part of redevelopment and roadway improvements through the selection of materials, site planning, and street design where possible.
- Environmental Considerations/Hazards Policy 5.12: Locate critical or public facilities (such as the Water Pollution Control Plant, local hospitals, police and fire service facilities, and schools) above the 500-year floodplain or protect such facilities up to the magnitude 500-year flood. Construction standards based on FEMA guidelines may include freeboard, elevation above the 500-year floodplain and elevated access ramps.
- Environmental Considerations/Hazards Policy 5.13: As a part of the City's policies for addressing the effects of climate change and projected water level rise in San Francisco Bay, the City requires evaluation of projected inundation for development projects near San Francisco Bay or at flooding risk from local waterways which discharge to San Francisco Bay. For projects affected by increased water levels in San Francisco Bay, the City requires incorporation of mitigation measures prior to approval of development projects. Mitigation measures incorporated into project design or project location shall prevent exposure to substantial flooding hazards from increased water levels in San Francisco Bay during the anticipated useful lifetime of structures.
- Environmental Considerations/Hazards Action 5.14: Implement the requirements of FEMA relating to construction in Special Flood Hazards Areas as illustrated on Flood Insurance Rate Maps. Periodically update the City's Flood Hazard Regulations to implement FEMA requirements.
- Environmental Considerations/Hazards Action 5.15: The City will participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed minimum NFIP requirements. Flood insurance premium rates for property owners within the city may be discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS, which are to reduce flood damage to insurable property; strengthen and support the insurance aspects of the NFIP; and encourage a comprehensive approach to floodplain management.
- Environmental Considerations/Hazards Action 5.16: Implement the Post-Construction Urban Runoff Management_requirements of the City's Municipal NPDES Permit to reduce urban runoff from project sites.

- Environmental Considerations/Hazards Action 5.17: Implement the Hydromodification Management requirements of the City's Municipal NPDES Permit to manage runoff flow and volume from project sites.
- Environmental Considerations/Hazards Action 5.18: Maintain City storm drainage infrastructure in a manner that reduces flood hazards. As the storm drainage system is extended or modified, provide capacity to adequately convey the 10-year storm event.
- Environmental Considerations/Hazards Action 5.19: Develop and maintain a Storm Drainage Master plan and work with other agencies to develop broader Watershed Management Plans to model the City's hydrology.
- Environmental Considerations/Hazards Action 5.20: Monitor information from regional, state, and federal agencies on water level rises in San Francisco Bay on an on-going basis. Use this information to determine if additional adaptive management actions are needed to deal with flooding hazards from increasing sea levels for existing or new development and infrastructure.
- Environmental Resources Policy 9.1: Manage stormwater runoff in compliance with the City's Post-Construction Urban Runoff (6-29) and Hydromodification Management (8-14) Policies.
- Environmental Resources Policy 9.2: Coordinate with regional and local agencies and private landowners to plan, finance, construct, and maintain regional stormwater management facilities.
- Environmental Resources Policy 9.3: Ensure that private development in San José includes adequate measures to treat stormwater runoff.
- Environmental Resources Policy 9.4: Assess the potential for surface water and groundwater contamination and require appropriate preventative measures when new development is proposed in areas where storm runoff will be directed into creeks upstream from groundwater recharge facilities.
- Environmental Resources Policy 9.5: Ensure that all development projects in San José maximize opportunities to filter, infiltrate, store and reuse or evaporate stormwater runoff onsite.
- Environmental Resources Policy 9.6: Eliminate barriers to and enact policies in support of the reuse of stormwater runoff for beneficial uses in existing infrastructure and future development in San José.

- Environmental Resources Policy 9.7: Encourage stormwater reuse for beneficial uses in existing infrastructure and future development through the installation of rain barrels, cisterns, or other water storage and reuse facilities.
- Environmental Resources Policy 9.8: Consider the characteristics and condition of the local watershed and identify opportunities for water quality improvement when developing new or updating existing development plans or policies including, but not limited to, specific or area land use plans.
- Environmental Resources Action 9.9: Partner with public, private, and non-profit agencies on public outreach and education on the importance of responsible stormwater management.
- Environmental Resources Action 9.10: Continue to participate in the Santa Clara Valley Urban Runoff Pollution Prevention Program (SVURPPP) and take other necessary actions to formulate and meet regional water quality standards which are implemented through the National Pollution Discharge Elimination System (NPDES) permits and other measures.
- Measurable Sustainability Policy 20.1: Lead through advocacy with local, regional and state agencies to ensure the protection and enhancement of the quality of San José's water sources.
- Measurable Sustainability Policy 20.2: Avoid locating new development or authorizing activities with the potential to negatively impact groundwater quality in areas that have been identified as having a high degree of aquifer vulnerability by the Santa Clara Valley Water District or other authoritative public agency.
- Measurable Sustainability Policy 20.3: Protect groundwater as a water supply source through flood protection measures and the use of stormwater infiltration practices that protect groundwater quality. In the event percolation facilities are modified for infrastructure projects, replacement percolation capacity will be provided.

City of San José Urban Runoff Policy 6-29

The Policy requires all new and redevelopment projects to implement Post-Construction Best Management Practices (BMPs) and Treatment Control Measures (TCMs). This Policy also establishes specified design standards for Post-Construction TCMs for Applicable Projects defined as:

Applicable Project: new development project that creates ten thousand (10,000) square feet or more of Impervious Surface Area; new streets, roads, highways and freeways built under the City's jurisdiction that create ten thousand (10,000) square feet or more of Impervious Surface Area and Significant Redevelopment Projects.

The policy also establishes minimum Post-Construction TCMs and BMPs for all Land Uses of Concern, including Expansion Projects. This Policy further establishes the criteria for determining the situations in which it is impracticable to comply with the design standards for Applicable Projects, including the criteria for evaluating the equivalency of Alternative Compliance Measure(s). At the City's discretion, if it determines that installation of Post-Construction TCMs is impracticable in a specific project, it may approve a request that a proposed project may provide an Alternative Measure in lieu of demonstration compliance with the numeric sizing standard, (where installation of Post-Construction TCMs are impracticable).

All projects shall be encouraged to minimize impervious surface through techniques such as those described in the Bay Area Storm Water Management Agencies Association's (BASMAA's) "Start at the Source Design Guidance Manual for Stormwater Quality Protection," 1999 edition, and the SCVURPPP Stormwater Handbook, including the use of permeable pavement, where appropriate.

Vegetative swales or other biofilters are recommended as the preferred choice for Post-Construction TCMs for all projects with suitable stormwater quality and landscape areas, because these measures are relatively economical and require limited maintenance. For projects where landscape based treatment is impracticable, or insufficient to meet required design criteria, other Post-Construction TCMs should be incorporated. Projects generating heavy pollutants ("Land Uses of Concern"), including expansion of such uses, shall include Post Construction TCMs and BMPs to treat project specific storm water pollutants as specified in this policy. All Post-Construction BMPs/TCMs must be maintained to operate effectively.

Hydromodification Policy 8-14

The Policy requires stormwater discharges from new and redevelopment projects that create or replace one acre or more of impervious surface to be designed and built to control project-related hydromodification, where such hydromodification is likely to cause increased erosion, silt pollutant generation, or other impacts to beneficial uses of local rivers, streams, and creeks. The Policy establishes specified performance criteria for Post-Construction hydromodification control measures and identifies projects which are exempt from hydromodification requirements.

Floodplain Ordinance – Municipal Code 17.08

Municipal Code 17.08 covers the requirements for building in various types of flood zones. This includes requirements for elevation, fill, flood passage, floodproofing, maximum flow velocities, and utility placement for multiple types of development including mobile homes, subdivisions, etc, located within a floodplain. The requirements are extensive and project-specific; therefore, the Code should be referenced for specific requirements.

Riparian Corridor Policy

The City of San José has a Riparian Corridor Policy promote the preservation of riparian corridors, the areas along natural streams, and how these corridors should be treated for consistency with the General Plan. The following guidelines are relevant for hydrology and water quality:[65]

- Guideline 6A: Grading – The integrity of riparian corridors, in terms of width, linear continuity and native plant species composition, should be preserved unless no other alternative exists. No grading should be allowed within the riparian corridor except for approved construction projects for trails, bridges, interpretive facilities, recreation facilities, slope stabilization, flood improvements, or habitat improvements.
- Guideline 6F: Flood Control Channel Maintenance – Vegetation removal in improved and/or constructed flood control channels should be in accordance with an approved operations and management plan for the flood control project area.
- Guideline 6G: Maintenance of Natural Channels – In general, the streambed and stream banks of natural channels should be allowed to remain undisturbed. The removal of streambank vegetation within natural channels should be limited to specific fallen trees, root wads, and trees rooted on the channel bottom which clearly present an obstruction to natural streamflow and/or could significantly increase the likelihood of bank erosion.
- Guideline 7A: Erosion Control/Slope Protection – In areas where the creek channel is deeply incised and banks are unstable, actively eroding, or identified as hazardous to public safety, banks should be stabilized/protected using biotechnical bank protection measures.
- Guideline 7B: Water Quality/Drainage and Runoff – The direct discharge of industrial effluent into the riparian channel, corridor or floodplain is prohibited. Impervious surfaces should be graded to drain away from an adjacent riparian corridor to protect

[65]The Habitat Restoration Group & Jones and Stokes Associates. City of San José, March 1999: *Riparian Corridor Policy Study*.

water quality and to minimize erosion potential. Direct surface drainage from all new development should be treated through the use of Best Management Practices (BMP's) used to control water quality. Outfalls should be fitted with energy dissipaters. Retention areas should be sited at least 25 feet from the edge of riparian areas.

- Guideline 7C: Flood Control – Where armoring materials are necessary for flood and slope protection, planting pockets and terraces should be created as an integral part of the structures. Bypass channels or culverts are the preferred methods to improve flood flows and channel capacity. Pipe outlets should not be allowed to damage the natural channel. Channel widening may be considered when minimizing the disturbance of natural vegetation as much as possible. Maintenance roads and utilities should be incorporated with disturbed soils, such as levees.
- Guideline 7D: Agricultural Runoff – Surface drainage from growing areas should not be permitted to run directly into the corridor; runoff from these areas should be directed to retention areas for infiltration and settlement prior to entry to the corridor.

San José's Green Vision

San José's Green Vision is a comprehensive strategy to show the world how environmental responsibility makes financial sense and stimulates economic opportunity. It includes 10 goals to serve as a roadmap to reduce the carbon footprint of the city by more than half within 15 years. One of these goals is to recycle or beneficially reuse 100% of San José's wastewater (100 million gallons per day). This will be accomplished through a combination of water conservation, expanded use of recycled water, and habitat protection.

San José's Green Building Policies

In 2001, the City Council of the City of San José first adopted a Green Building Policy (Policy No. 8-13), and in March 2007, City Council amended the Green Building Policy to mandate that City and Agency facilities over 10,000 square feet attain a LEED Silver certification through the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) program, and to encourage green building in the private sector.

In April 2008, City Council adopted recommendations from the Santa Clara County Cities Association to recognize Build It Green's (BIG) GreenPoint Rated (GPR) and USGBC's LEED green building rating systems as reference standards for new residential and non-residential construction, and to incorporate the use of a green building checklist for planning applications. City Council adopted these recommendations in order to promote regional consistency, raise awareness of green building practices, and to make progress on Green Vision Goal No. 4.

The City Council adopted the Private Sector Green Building Policy (Policy No. 6-32) in October 2008. The policy requires that industrial, commercial, and residential projects achieve minimum green building performance levels using the City Council adopted reference standards. This policy applies to those development projects that first make application for a development permit to the Planning Division on or after January 1, 2009. The green building rating systems assign points based in part on installation of water efficient fixtures and landscaping, minimization of hardscape, and use of drought-tolerant native species.

4.3.2 Santa Clara Valley Water District

The Santa Clara Valley Water District operates as the flood control agency for the County. Their stewardship also includes creek restoration and pollution prevention efforts. All projects that could potentially affect the quantities of flows released to County watercourses, disturb creeks, alter creek geometry or that include development in floodplains must be approved by the SCVWD. The District role and responsibility in water supply and resources management is explored in detail in the Water Supply section of this report.

4.3.3 San Francisco Bay Conservation and Development Commission

The Bay Conservation and Development Commission (BCDC) has regulatory responsibility over development in San Francisco Bay and along the Bay's nine-county shoreline. It is necessary to obtain a BCDC permit prior to undertaking most work in the Bay or within 100 feet of the shoreline, including filling, dredging, shoreline development and other work. There are several different types of permit applications, depending on the size, location, and impacts of a project.

4.4 Current Status of Regulations Pertaining to Climate Change

As described in the Climate Change Appendix to this report, climate change impacts, particularly sea level rise, may have various impacts to the City. The current status of potential regulations pertaining to climate change is summarized below. Research and regulations regarding climate change are regularly, and sometimes rapidly, updated and modified; thus this section should be considered representative, and may not represent a complete list of current or pending regulations.

4.4.1 Federal

At a Federal level there are currently very few recommendations or guidelines for incorporating the risks of sea level rise into project planning, and virtually no required measures. It should be noted, however, that with the administration change of 2009, based on President Obama's statements that global warming is a priority of the new administration, relatively rapid changes in the Federal government's involvement in global warming analyses and impacts may be forthcoming. Thus far it appears that those changes will be focused on emission standards as opposed to impact mitigation.

Flood Programs - Federal Emergency Management Agency

Although the Federal Emergency Management Agency (FEMA) has issued several statements in the last decade pertaining to climate change and the risks of global warming, at this time FEMA policy has not changed to reflect these risks or impacts. Sea level rise is not directly considered in the National Flood Insurance Program (NFIP). In 2001 FEMA published a report on the projected impact of relative sea level rise on the NFIP, which concluded that the NFIP would not be significantly impacted by sea level rises under one foot by the year 2100, and the gradual timeframe of sea level rise provides ample opportunity for the NFIP to consider alternatives and implement them. The report recommended that FEMA should continue to monitor analyses and predictions of sea level rise and strengthen the Community Rating System (CRS) by encouraging measures that would mitigate the impacts of sea level rise. (FEMA, 1991)

In March 2007 the United States Government Accountability Office published a report on the financial risks to federal and private insurers as a result of climate change, and recommended that the NFIP analyze the potential long-term fiscal implications of climate change and report these findings to Congress (GAO-07-285, March 2007). It is foreseeable that when this analysis takes place, changes to the NFIP will be made to lessen the financial risk to the insurers. Potential policy changes may include increased freeboard requirements for Bay or Riverfront levees and/or some consideration or discussion of sea level change in floodplain analyses, but when or if any policy changes will occur is unknown.

Sea Level Rise - United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) Planning Guidance Notebook offers some guidance on incorporating sea level rise into projects. This notebook recommends that relative sea level change should be considered in every coastal and estuarine feasibility study that the Corps undertakes; that planning should consider what impact a higher relative sea level rises rate would have on the design based on the historical rate; that sensitivity analysis should be conducted to determine what effect changes in sea level would have on plan evaluation and selections; and finally that if the plan selection is sensitive to sea level rise, then design considerations could allow for future modification when the impacts of future sea level rise can be confirmed.[66] These analyses and considerations are recommendations and not requirements.

[66]United States Army Corps of Engineers, April 22, 2000: *Planning Guidance Notebook*. ER 1105-2-100

In spring 2007 a measure that would require the USACE to consider climate change in the design and construction of water resources projects was narrowly defeated in the Senate. It is our understanding that USACE is in the process of developing a document which considers sea level rise scenarios and includes recommendations for an approach to consider sea level rise in design applications. The publication date for this document is unknown.

Research on Climate Change - National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) is the federal agency that appears to have taken the lead in analyses of the impacts of global warming to the United States of America. NOAA is primarily a scientific research and reporting agency, with little regulatory power. From the NOAA webpage:

> "NOAA is charged with helping society understand, plan for, and respond to climate variability and change. This is achieved through the development and delivery of climate information services, the implementation of a global observing system, and focused research and modeling to understand key climate processes. The NOAA climate mission is an end-to-end endeavor focused on providing a predictive understanding of the global climate system so the public can incorporate the information and products into their decisions."

Recent budget proposals from President Obama suggest that this responsibility may shift from NOAA to NASA in the near future.

4.4.2 State

California has been on the leading edge of creating legislation to mitigate both greenhouse gas emissions and the impacts of climate change. At this time, several concrete steps have been taken to reduce greenhouse gas emissions in the state, while specific impact mitigation strategies have been recommended but not fully developed.

Assembly Bill 32

The California Global Warming Solution Act, also known at Assembly Bill 32 (AB32), was signed into law by Governor Schwarzenegger in 2006. AB32 requires the California Air Resources Board (CARB) to:

- Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions by January 1, 2008.
- Adopt mandatory reporting rules for significant sources of greenhouse gases by January 1, 2009.

- Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms and other actions.
- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas, including provisions for using both market mechanisms and alternative compliance mechanisms.
- Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB.
- Ensure public notice and opportunity for comment for all CARB actions.
- Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability, conformance with other environmental laws and ensure that the rules do not disproportionately impact low-income communities.

In September, 2008, Governor Schwarzenegger signed Senate Bill 375, which builds on AB32 by requiring the CARB to develop regional greenhouse gas emission reduction targets to be achieved from the automobile and light truck sectors for 2020 and 2035. Both AB32 and Senate Bill 375 focus on reducing greenhouse gas emissions, as opposed to predicting or mitigating climate change impacts in California.

AB 32 Scoping Plan

The AB 32 Scoping Plan contains the main strategies California will use to reduce the greenhouse gases (GHG) that cause climate change. The Scoping Plan has a range of GHG reduction actions which include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, market-based mechanisms such as a cap-and-trade system, and an administrative fee to fund the program. The AB 32 Scoping Plan was approved at the Air Resources Board hearing on December 11, 2008.

Six greenhouse gas emission reduction measures are proposed for the Water sector in the Scoping Plan. They address water use efficiency, water recycling, water system energy efficiency, reuse of urban runoff, increased renewable energy production and public goods charges for funding investments that improve water and energy efficiency. [67]

[67] California Air Resources Board, October 2008: *Climate Change Proposed Scoping Plan; A framework for Change*.

California Environmental Quality Act

The California Governor's Office of Planning and Research created a technical advisory which includes the recommended approach for incorporating climate change impacts to the CEQA process. The recommended approach includes identifying project GHG emissions, determining significance, and mitigating the impacts.[68]

California Adaptation Strategy

In November 2008 Governor Schwarzenegger signed Executive Order S-13-08 (EO), which calls for the development of California's first statewide climate change adaptation strategy to assess the state's expected climate change impacts, vulnerabilities, and recommend climate adaptation policies. This is the first legislative action to initiate active planning for the impacts of global warming in the state of California. In addition to the climate change adaptation strategy, the EO also requests that the National Academy of Science establishes an expert panel to report on sea level rise impacts in California, issues interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects, and initiates a report on critical infrastructure (planned and existing) vulnerable to sea level rise. All state agencies planning construction projects are directed to consider a range of sea level rise scenarios for the years 2050 and 2100 to assess project vulnerability and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise.[69]

California Climate Action Team

The California Climate Action Team (CAT) was established by Governor Schwarzenegger under an Executive Order on June 1, 2005. The purpose of the CAT is to coordinate state-level actions relating to Climate Change. The Team is led by the Secretary of the California Environmental Protection Agency and includes the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the Air Resources Board, Chairperson of the Energy Commission and President of the Public Utilities Commission. The Climate Action Team is charged with implementing global warming emission reduction programs and reporting on the progress made toward meeting the statewide greenhouse gas targets that were established in the AB32. The first report was sent to the Governor and the Legislature in 2006, and should be updated bi-annually thereafter.

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[68]Ibid

[69]California Office of the Governor, November 14, 2008: Press Release; "…Executive Order Directing State Agencies to Plan for Sea Level Rise and Climate Impacts".

California Water Plan

Following the passage of AB 32 in 2006 which called for a reduction in greenhouse gas emissions, DWR voluntarily joined the California Climate Action Registry. DWR addresses climate change in its California Water Plan, updated every five years, that provides a framework for water managers, legislators, and the public to consider options and make decisions regarding California's water future. In July 2008 DWR published a technical memorandum report on the progress of incorporating climate change into the management of California's water resources. The focus of this report was the impact of global warming to California's water supply, although increased flood risks were presented in brief. In October 2008 the Department released a climate change white paper that proposes a series of adaptation strategies for state and local water managers to improve their capacity to handle change. On a regional level these strategies include integrated water management and increased water use efficiency.

4.4.3 Local

San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is a department of the City and County of San Francisco that provides water, wastewater, and municipal power services to San Francisco. Under contractual agreement with 28 wholesale water agencies, the SFPUC also supplies water to 1.6 million additional customers within three Bay Area counties, including customers in San José. SFPUC has made recent efforts to expand and diversify its water supply portfolio. A technical memorandum developed various diversified portfolios, including water conservation, groundwater, recycled water, and desalination.[70] In May 2008 the SPFUC passed a resolution calling for further steps to develop and expand recycled water as a water source.[71]

San Francisco Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development District (BCDC) is a state agency created in 1965 to regulate development in the Bay and along its shoreline for the purpose of limiting and controlling the amount of fill placed in the Bay. In October 2007 BCDC released an eight year regional strategy for controlling greenhouse gases and preparing for the impacts of sea level rise of San Francisco Bay. BCDC does not have the authority or responsibility to initiate many of the identified strategies. In September 2008 BCDC released a revised strategy which considers the regulatory limitations of the agency. In this strategy, several changes to the authority of BCDC are proposed, including: expanding BCDC's regulatory authority to allow

[70]SFPUC Water Resources Planning, 2007
[71]SFPUC CAC June 16, 2008

BCDC to decide if and under what conditions shoreline development may be authorized and expanding BCDCs permit and planning jurisdiction eastward to include the Delta shorelines of Solano and Contra Costa County. The latter proposal has no impact on San José, but the former proposal could have significant impact to shoreline re-development in San José. The likelihood of BCDC gaining this increased regulatory authority is unknown.

5. Impacts and Mitigation Measures

5.1 Thresholds of Significance

The proposed City of San José General Plan update would cause 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 or National Pollutant Discharge Elimination System (NPDES) requirements; 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.

The City of San José is a member of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), an association of thirteen cities and towns in Santa Clara Valley that share a common NPDES permit to discharge water to the San Francisco Bay (NPDES Permit No. CAS612008, October 14, 2009).[72] The provisions of the SCVURPPP NPDES Permit require each of the co-permittees, including the City of San José, to implement measures to reduce stormwater pollution from new or redevelopment projects.

The San José Department of Planning, Building, and Code Enforcement (PBCE) is the lead City agency responsible for implementing the requirements of the Permit related to development. In addition to the SCVURPPP NPDES Permit provisions, all construction projects in the City of San José that impact an area greater than or equal to one (1) acre are regulated by the NPDES General Permit for Storm Water Discharges Associated with Construction Activity (General Permit, No. 99-08-DWQ).[73] The 1999 permit was superseded on July 1, 2010 by the State Water Resources Control Board's General Permit No. 2009-0009-DWQ. The 2009 permit includes additional procedures for construction sites, such as erosion risk determination and monitoring requirements for pH and turbidity, and also combines the regulation of linear underground/overhead projects (LUPs) with conventional construction sites. LUPs between one (1) and five (5) acres are currently regulated for construction-level stormwater quality impacts by Water Quality Order No. 2003-0007-DWQ.

5.2 Construction Related Water Quality Impacts

Impact HYD1: New development or redevelopment under the General Plan Update would include construction related activities that could expose soil to erosion during storm events, thereby degrading water quality.

5.2.1 Impact Analysis

The construction of infill or redevelopment projects under the proposed General Plan Update may consist of grading, demolition, and vegetation removal activities that can increase on-site soil erosion during rainfall events. Uncontrolled runoff from construction areas can increase the delivery of sediment and debris to the storm drain system and nearby waterways.

[72]http://www.waterboards.ca.gov/sanfranciscobay/board_decisions/adopted_orders/2009/R2-2009-0074.pdf
[73]http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/finalconstpermit.pdf

Additionally, the refueling, parking, and storage of construction equipment and other vehicles on-site during construction can lead to oil, grease, or related pollutant leaks and spills that may infiltrate to ground water, or discharge to surface water or City storm drains, causing water quality degradation.

Development sites in the City of San José would be required to prepare grading and storm water pollution prevention plans to comply with City, State, and Federal drainage requirements, including utilizing best management practices (BMPs) for the prevention of erosion due to construction activities, the control of loose sediment or debris, and the prevention and cleaning of oil, grease, or other pollutant spills. Details regarding existing and proposed requirements are provided below.

5.2.2 General Plan Goals, Policies and Actions

The following proposed General Plan policies and actions provide program-level mitigation for construction related water quality impacts:

Action ER-9.10[74] Continue to participate in the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) and take other necessary actions to formulate and meet regional water quality standards which are implemented through the NPDES permits and other measures.

5.2.3 Existing Codes and Regulations

The following codes and regulations address construction related water quality impacts.

City of San José Municipal Code 17.04 – Part 6: Excavation and Grading

The existing San José Municipal Code requires a permit or notice of exemption for any grading within the City, including both excavation and fill. The Permit application must include a set of plans and specifications, supporting data, and a soil engineering report. Additional reporting is required if the project area is located in a special geologic hazard area. An erosion control plan for applicable projects is required prior to the start of the rainy season (prior to October 1st of every year). Other devices to control erosion and sediments are required where necessary to provide safety and protect water quality.

SCVURPPP NPDES Provisions

As members of the SCVURPPP, construction activities in the City of San José are required to meet the provisions of Section C.6 of the NPDES permit, which covers construction site control. Specifically, the City is required to implement a construction site inspection and control

[74]Reference for all Environmental Resources (ER) policies and actions: http://www.sanjoseca.gov/planning/gp_update/DraftPlan/008_Chapter03_9-20-2010.pdf.

program to prevent construction site discharges of pollutants and impacts on beneficial uses of receiving waters. Construction sites are required to have site specific and seasonally appropriate best management practices (BMPs) in the following six categories: erosion control, run-on and runoff control, sediment control, active treatment systems (as necessary), good site management and non-stormwater event management. The NPDES permit requires the preparation of an erosion/pollution control plan or Stormwater Pollution Prevention Plan (SWPPP) for all construction sites.

The City of San José regulates the stormwater management of construction sites via municipal code Title 20, section 100.470, which requires projects disturbing less than one acre to conform with the SCVURPPP NPDES permit, which mandates the use of BMPs to control the discharge of stormwater pollutants including sediments during construction activities. This section of code allows the City to require a project-specific erosion control plan. Stormwater management for projects that disturb more than one acre is described below.

General Permit NPDES Provisions

Projects that disturb more than one acre are required to obtain coverage under the General Permit for Construction described previously. Effective July 1, 2010 all projects, regardless of size, will be required to obtain coverage under a new General Permit (2009-0009-DWQ, September 2, 2009).

The City of San José also regulates stormwater management of construction sites disturbing more than one acre via municipal code Title 20, Section 100.480. Under this code the City requires the preparation of a SWPPP and filing of a notice of intent with the State Water Resources Control Board. Project applicants may be required to prepare an erosion control plan. Additional post-construction stormwater management requirements contained in Title 20 are described elsewhere in this report.

5.2.4 Level of Significance

Any future development proposed consistent with the updated San José General Plan will be subject to the above-described General Plan policies, existing codes, and regulations regarding the protection of water quality during construction activities. As such, construction related activities allowed under the proposed General Plan Update will have **less than significant impacts**.

5.3 Impervious Area Related Water Quality Impacts

Impact HYD2: Implementation of the proposed General Plan Update could result an increase in impervious area, leading to decreased runoff water quality. Increased runoff peak, volume, and duration from new or redeveloped impervious areas may lead to erosion and degradation of adjacent streams. Poor quality runoff from urban runoff may also impact groundwater quality.

5.3.1 Impact Analysis

Runoff from impervious surfaces tends to be of a decreased quality compared to runoff from pervious surfaces. Urban and roadway runoff typically contains oils, grease, fuel, antifreeze, and byproducts of combustion (lead, cadmium, nickel and other metals) as well as nutrients, sediments, and other pollutants. An increase in impervious surface due to development or redevelopment may increase these urban runoff pollutants delivered to the storm drain network and thence natural creeks or rivers. Groundwater quality can be impacted by low-quality urban runoff entering the groundwater table.

Hydrograph modification (also known as "hydromodification") refers to the impact of urbanization on stormwater runoff and streamflow. An increase of impervious area through urbanization of watersheds not only increases the peak flow delivered to streams, but also increases the frequency and duration of flows in streams. This combination of higher peaks and increased volume can result in erosion of creek beds and banks and in excess deposition of sediment further downstream.

5.3.2 General Plan Policies and Actions

The following General Plan policies and actions provide program-level mitigation for water quality impacts from impervious areas:

Policy ER-9.1 Manage stormwater runoff in compliance with the City's Post-Construction Urban Runoff (6-29) and Hydromodification Management (8-14) Policies.

Policy ER-9.3 Ensure that private development in San José includes adequate measures to treat stormwater runoff.

Policy ER-9.5 Ensure that all development projects in San José maximize opportunities to filter, infiltrate, store and reuse or evaporate stormwater runoff onsite.

Action ER-9.10 Continue to participate in the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) and take other necessary actions to formulate and meet regional water quality standards which are

	implemented through the National Pollution Discharge Elimination System (NPDES) permits and other measures.
Policy MS-20.2[75]	Avoid locating new development or authorizing activities with the potential to negatively impact groundwater quality in areas that have been identified as having a high degree of aquifer vulnerability by the Santa Clara Valley Water District or other authoritative public agency.
Policy MS-20.3	Protect groundwater as a water supply source through flood protection measures and the use of stormwater infiltration practices that protect groundwater quality. In the event percolation facilities are modified for infrastructure projects, replacement percolation capacity will be provided.
Action EC-5.16[76]	Implement the Post-Construction Urban Runoff Management requirements of the City's Municipal NPDES Permit to reduce urban runoff from project sites.
Action EC-5.17	Implement the Hydromodification Management requirements of the City's Municipal NPDES Permit to manage runoff flow and volume from project sites.

5.3.3 Existing Codes and Regulations

The following existing codes and regulations also address impervious area related water quality impacts.

City Council Policy 6-29: Post-Construction Urban Runoff Management

City Council Policy 6-29 establishes an implementation framework for incorporating stormwater runoff pollution control measures to comply with the SCVURPPP NPDES Permit requirements.[77] The Policy requires all new and redevelopment projects to implement post-construction best management practices (BMPs) and Treatment Control Measures (TCMs). Projects which meet specific thresholds (the creation, on or above ground through installation, construction, or replacement of 10,000 square feet or more of impervious surface) must meet specified design standards for post-construction TCMs. Minimum BMPs and TCMs are established for "Land Uses of Concern," and the criteria for determining practicability of complying with the Policy and alternative measures are established. "Land Uses of Concern"

[75]Reference for all Measurable Sustainability (MS) policies and actions: http://www.sanjoseca.gov/planning/gp_update/DraftPlan/008_Chapter03_9-20-2010.pdf.
[76]Reference for all Environmental Considerations/Hazards (EC) policies and actions: http://www.sanjoseca.gov/planning/gp_update/DraftPlan/008_Chapter03_9-20-2010.pdf.
[77]http://www.sanjoseca.gov/planning/stormwater/Policy_6-29_Memo_Revisions.pdf

include gas stations or equipment fueling facilities, auto wrecking yards, loading docks, or other land uses which generate amounts of heavy pollution equivalent to these uses, including expansion of such uses. Examples include outdoor manufacturing areas, animal care, horticultural activities, etc.

City Council Policy 8-14: Post- Construction Hydromodification Management

City Council Policy 8-14 establishes an implementation framework for incorporating hydromodification control measures to comply with the SCVURPPP NPDES Permit requirements.[78] New or redevelopment projects which meet the criterion for Hydromodification Management are required to be designed and built to control project-related hydromodification. That criterion is the creation or replacement of one acre or more of impervious surface located in sub-watershed or catchment areas that are less than 65% impervious or are "Under Review", as defined on the Santa Clara Permittees' Hydromodification Management Applicability Map. For Hydromodification Management Projects, specific Hydromodification Management Controls, standards, performance criteria, and impracticality provisions are provided.

5.3.4 Level of Significance

Any future development proposed consistent with the updated San José General Plan will be subject to the above described General Plan policies, existing codes, and regulations regarding protection of water quality due to increases in impervious area. As such, increase in impervious area due to the General Plan Update will have **less than significant impacts**.

5.4 Groundwater Related Impacts

Impact HYD3: Urbanization in the form of additional impervious area due to new development or redevelopment may decrease groundwater infiltration, impacting groundwater supply availability.

5.4.1 Impact Analysis

Converting pervious surfaces to impervious surfaces may decrease groundwater infiltration into the underlying groundwater basin.

As described in detail in the existing conditions section, the Santa Clara Valley Water District (SCVWD) groundwater basin is divided into three sub-basins: the Santa Clara Valley Sub-basin (which can be further separated into its confined and unconfined portions), the Coyote Valley Sub-basin, and the Llagas Sub-Basin.

[78] http://www.sanjoseca.gov/planning/stormwater/pdfs/FinalRevisedPolicy_8-14.pdf

The former two basins underlie San José. Groundwater is an important source of potable water to the Santa Clara Valley Water District (SCVWD), providing approximately 160,000 acre-feet per year to local water retailers and private well owners, representing about 45 percent of total SCVWD water supply.[79] The SCVWD operates and maintains 18 major recharge systems, which consist of both in-stream and off-stream facilities. Percolation ponds within the City of San José are shown in Figure 22. Planned growth areas do not overlay and will not affect the operation of any of the percolation or recharge facilities.

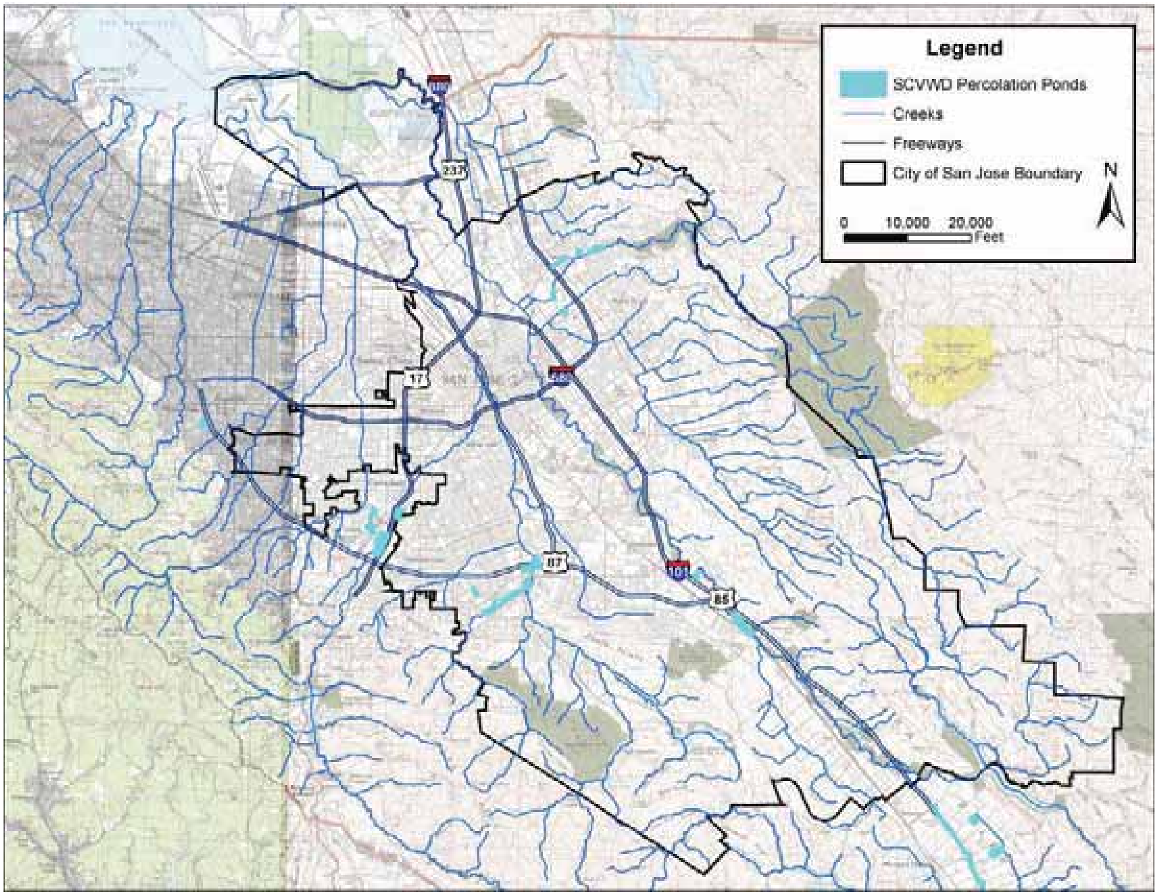

Figure 22. Santa Clara Valley Groundwater Percolation Ponds

Groundwater quality is influenced by the makeup of the sediments through which groundwater moves as well as the introduction of contaminants from man-made sources. Locally, nitrate is a groundwater contaminant of concern (primarily in the Coyote Sub-basin) along with volatile organic compounds (VOCs), fuel additives such as MTBE (which may leak into the groundwater from underground storage tanks), and organic compounds such as Polychlorinated biphenyls (PCBs) associated with accidental releases from industrial and

[79]Santa Clara Valley Water District, 2005: *Urban Water Management Plan*

commercial uses. High salt concentrations have also been identified in the upper aquifer zone near San Francisco Bay.

In portions of the Berryessa, Cambrian/Pioneer, Coyote, and Willow Glen Planning Areas, water can percolate relatively easily into the unconfined Santa Clara Sub-basin or Coyote Sub-basin due to the higher infiltration rates of underlying soil and rock materials (i.e. significant coverage with Group "B" soils from Figure 4). New development in these Planning Areas could be more likely to introduce additional sources of contaminants (i.e. oil, grease, heavy metals, fertilizers, and pesticides from parking areas and landscape areas, and stored hazardous materials from outdoor chemical storage areas) into underlying groundwater aquifer. In the Central and South Planning Areas (also with significant Group "B" soils), the underlying groundwater aquifer is more protected due to the confining layer. In northern areas of the City, listed compounds could be introduced into the shallow aquifer near the soil surface.

Regulations designed to control contaminants in surface water (stormwater runoff), including those under the NPDES program, also reduce the potential for contamination of groundwater with compounds found on developed sites. As described below, in some cases infiltration of stormwater is limited for the purpose of groundwater protection where groundwater is close to the surface or where activities such as heavy vehicular traffic or industrial uses pose a threat to groundwater quality.

5.4.2 General Plan Goals, Policies and Actions

The following proposed General Plan policies and actions provide program-level mitigation for groundwater quality related impacts:

Policy MS-20.2 — Avoid locating new development or authorizing activities with the potential to negatively impact groundwater quality in areas that have been identified as having a high degree of aquifer vulnerability by the Santa Clara Valley Water District or other authoritative public agency.

Policy MS-20.3 — Protect groundwater as a water supply source through flood protection measures and the use of stormwater infiltration practices that protect groundwater quality. In the event percolation facilities are modified for infrastructure projects, replacement percolation capacity will be provided.

Policy ER-9.5 — Ensure that all development projects in San José maximize opportunities to filter, infiltrate, store and reuse or evaporate stormwater runoff onsite;.

Action EC-5.16 — Implement the Post-Construction Urban Runoff Management requirements of the City's Municipal NPDES Permit to reduce urban runoff from project sites.

5.4.3 Existing Codes and Regulations

The following existing codes and regulations also address impacts related to groundwater quality:

City Council Policy 6-29: Post-Construction Urban Runoff Management

City Council Policy 6-29 establishes an implementation framework for incorporating stormwater runoff pollution control measures to comply with the SCVURPPP NPDES Permit requirements.[80] In addition to requiring the use of BMP devices, many of which rely on infiltration, Policy 6-29 also sets limitations on the use of infiltration treatment measures for the purpose of groundwater protection. At a minimum, infiltration devices must: be implemented at a level appropriate to protect groundwater quality; not cause or contribute to degradation of groundwater quality objections; be adequately maintained to maximize pollutant removal capabilities; maintain a vertical distance between the base of the infiltration device and seasonal high groundwater of at least 10 feet; and be located a minimum of 100 feet horizontally from any known water supply wells. Additionally, unless first treated by another means, infiltration devices are not recommended in industrial areas, areas subject to high vehicular traffic, automotive repair shops, car washes, vehicle storage areas (i.e. bus or truck yard), nurseries, or any other land use which may be determined by the City to post a high thread to groundwater quality.

SCVURPPP NPDES Provisions

As members of the SCVURPPP, new and redevelopment in the City of San José is required to meet the provisions of section C.3 of the NPDES permit, which address the treatment of both soluble and insoluble stormwater runoff pollutant discharges, primarily through the implementation of low impact development techniques. The City of San José regulates the stormwater management of construction sites via municipal code Title 20, section 100.470, which requires projects disturbing less than one acre to conform to the SCVURPPP NPDES permit.

Similar to City Council Policy 6-29, the SCVURPPP NPDES permit contains limitations on the use of infiltration devices for stormwater treatment to in order to protect groundwater quality.

5.4.4 Level of Significance

Any future development proposed consistent with the updated San José General Plan will be subject to the above described General Plan policies, existing codes, and regulations regarding

[80] http://www.sanjoseca.gov/planning/stormwater/Policy_6-29_Memo_Revisions.pdf

infiltration and groundwater protection. As such, the proposed in the General Plan Update will have **less than significant impacts to groundwater quality**.

5.5 Flood Hazard Impacts

Impact HYD4: Implementation of the proposed General Plan Update could result in the exposure of additional people and/or structures to potential risks from flooding hazards.

5.5.1 Impact Analysis

Flood hazard impacts may be caused by development within existing flooding risk areas (i.e. the 100-year flood hazard), or increased runoff from development sites. These impacts are described in detail below, followed by general plan goals, policies, and action items and existing codes and regulations related to each impact. Figures 24 through 35 at the end of this section summarize the flood hazard risks for each Growth and Planning Area within the City.

Flooding

Portions of the City of San José are within Special Flood Hazard Areas (SFHAs) identified by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs). FEMA SFHAs are subject to inundation of floodwaters during the one-percent (100-year) storm event. Flooding sources may include San Francisco Bay, rivers and creeks running through and adjacent to the City, and local drainage areas. The general extent of existing flooding within the City is shown in Figure 6, and various FEMA designated flooding zones are described in detail in the Existing Conditions section of this report.

The San José General Plan Update divides the City into planning areas, and identifies specific growth areas within each planning area. With the exception of the Calero and San Felipe Planning Areas, which contain no growth areas, all of the planning areas contain at least one identified growth area that is within an SFHA.

Development and redevelopment is generally allowed within areas designated by FEMA as an SFHA, consistent with the Code of Federal Regulations for the National Flood Insurance Program (NFIP). The City of San José regulates development within SFHAs via Municipal Code Title 17, Chapter 17.08, Special Flood Hazard Area Regulations, which is described in more detail below.

Drainage

Development and redevelopment included in the San José General Plan Update may increase impervious surface areas, leading to increased runoff volume and peak rates.

The City of San José has no City-wide storm drain master plan, although several area-specific stormwater drainage studies have been conducted. Increased runoff to the storm drain system due to new development or redevelopment may adversely impact the operation of the storm drain network. Additional flow delivered to a storm drain system at or under capacity may increase flooding of adjacent properties. Given the age of the system, and an original design standard of providing capacity to accommodate stormwater runoff from a three-year event, it may be assumed that parts of the City's storm drain network are currently under-capacity.

5.5.2 General Plan Goals, Policies and Actions

The following proposed General Plan policies and actions provide program-level mitigation for flood hazard related impacts:

Policy EC-5.1 The City shall require evaluation of flood hazards prior to approval of development projects within a Federal Emergency Management Agency (FEMA) designated floodplain. New development and substantial improvements to existing structures shall be reviewed to ensure they are designed to provide protection from flooding with a one percent annual chance of occurrence, commonly referred to as the "100-year" flood, or whatever designated benchmark FEMA may adopt in the future. New development should also provide protection for less frequent flood events when required by the State.

Policy EC-5.2 Allow development only when adequate mitigation measures are incorporated into the project design to prevent or minimize siltation of streams, flood protection ponds, and reservoirs.

Policy EC-5.3 Preserve designated floodway areas for non-urban uses.

Policy EC-5.7 Allow new urban development only when mitigation measures are incorporated into the project design to ensure that new urban runoff does not increase flood risks elsewhere.

Policy EC-5.9 Work with local, regional, state and federal agencies to ensure new and existing levees provide adequate flood protection and actively partner with the Santa Clara Valley Water District and other levee owners with respect to National Flood Insurance Program (NFIP) levee recertification.

Policy EC-5.12 Locate critical or public facilities (such as the Water Pollution Control Plant, local hospitals, police and fire service facilities, and schools) above the 500-year floodplain or protect such facilities up to the magnitude 500-year flood. Construction standards based on FEMA guidelines may include freeboard, elevation above the 500-year floodplain and elevated access ramps.

Action EC-5.14 Implement the requirements of FEMA relating to construction in Special Flood Hazards Areas (SFHAs) as illustrated on Flood Insurance Rate Maps (FIRMs). Periodically update the City's Flood Hazard Regulations to implement FEMA requirements.

Action EC-5.15 The City will participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS). The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed minimum NFIP requirements. Flood insurance premium rates for property owners within the city may be discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS, which are to reduce damage to insurable property; strengthen and support the insurance aspects of the NFIP; and encourage a comprehensive approach to floodplain management.

Action EC-5.18 Maintain City storm drainage infrastructure in a manner that reduces flood hazards. As the storm drainage system is extended or modified, provide capacity to adequately convey the 10-year storm event.

Action EC-5.20 Monitor information from regional, state, and federal agencies on water level rises in San Francisco Bay on an on-going basis. Use this information to determine if additional adaptive management actions are needed to deal with flooding hazards from increasing sea levels for existing or new development and infrastructure.

5.5.3 Existing Codes and Regulations

The following existing codes and regulations also address flood hazard impacts.

Flooding

Municipal Code Title 17, Chapter 17.08, Special Flood Hazard Area Regulations

The City of San José regulates developments in FEMA SFHA via municipal code Title 17, Chapter 17.08, Special Flood Hazard Area Regulations. Per these requirements, a development permit must be obtained before any construction or other development within any area of special flood hazard. Any new construction or substantial improvements of structures within the SFHA must be protected from flood damage, provide adequate drainage paths around structures to guide flood water around and away from proposed structures, and structures must be elevated above water surface elevations. Development within the floodway is prohibited, unless certification by a professional engineer is provided demonstrating that encroachments will not result in any increase in flood levels. In locations where there is no designated floodway, no new development or fill is permitted in the SFHA unless it is demonstrated that the cumulative effect of the proposed development, combined with other existing and anticipated development, will not raise the water surface elevation more than one foot at any point in the community.

Drainage

Municipal Code Title 15, Chapter 15.16, Part 4: Storm Drainage Fees

San José collects storm drainage fees for the purpose of constructing, reconstructing, and maintaining the storm drainage system. Storm drainage fees are required when an owner improves land by constructing or modifying buildings or structures, or grading or paving of land, when a building permit is issued, when land is connected to the storm drainage system, or prior to subdivision of land into two or more parcels.

Municipal Code Title 20, Chapter 100.610: Site Development Permit

With a few specific exceptions, the City of San José requires a development permit prior to the issuance of any building or installation permit for any of the following activities: erection, construction, enlargement, placement or installation of a building or structure on any site, a single family dwelling on a single lot as provided for in Section 20.100.1030-A4; exterior alteration of a building or structure; use of a lot for storage purposes, installation of pavement on any portion of a lot; or underground installation.

A site development permit shall only be granted if, among other requirements, the environmental impacts of the project, including storm water runoff, does not have an unacceptable negative impact of adjacent property or properties. Note that an unacceptable negative impact for the purposes of permit review and issuance may be determined even if impacts are insignificant for purposes of the California Environmental Quality Act (CEQA). Under this requirement, the City may deny a development permit application if the project causes increased runoff that would impact the flood risk of adjacent properties.

5.5.4 Level of Significance

Any future development proposed consistent with the updated San José General Plan will be subject to the above described General Plan policies, existing codes, and regulations regarding flood protection and mitigation of flood hazards. As such, the proposed General Plan Update will have **less than significant impacts to flood hazards**.

5.6 Other Surface Water Hazard Impacts

Impact HYD5: Implementation of the proposed General Plan Update could result in the exposure of additional people and/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.

Impact HYD6: Implementation of the proposed General Plan Update could result in the exposure of additional people and/or structures to inundation by seiche, tsunami, or mudflow.

5.6.1 Impact Analysis

Other surface water hazard impacts may be caused by development within identified special hazard areas; for example, an area subject to inundation from a dam or levee failure, seiche, tsunami, or mudflow. Surface water hazards are more fully described by Existing Conditions Section 2.6.5.

Dam and Levee Failure

Figure 8 in Section 2.6.5 shows the ABAG dam failure inundation map and locations within the General Plan area that could be inundated should an upstream dam fail. Levees that do not meet NFIP criteria and are assumed to fail for flood hazard mapping purposes are already incorporated into the SFHAs discussed and shown herein.

Seiche

A seiche is the resonant oscillation of water in an enclosed body of water, but earthquake-generated tsunamis are generally not considered seiches. The largest enclosed body of water with the potential to affect development allowed under the proposed General Plan is the San Francisco Bay north of Alviso. However, the ring levees within the Cargill Salt Pond restoration area would dampen any effects of a seiche in San Francisco Bay.

Tsunami

ABAG's tsunami evacuation maps for the Bay Area do not show tsunami hazard areas within San José. The ABAG tsunami maps are based on the California Emergency Management Agency's July 2009 Tsunami Inundation Maps for Emergency Planning. Relevant to San José, the maps for the Mountain View and Milpitas Quadrangles indicate that the limits of tsunami inundation near San José are only within close proximity to the San Francisco Bay along the sloughs of Coyote Creek. While there are small tsunami inundation areas shown near the northern San José City Limit (i.e., in Alviso), these areas are more than a mile outside of San José's Urban Growth Boundary. Therefore, it is assumed that tsunamis would not impact the General Plan area.

Mudflow

A mudflow is the rapid movement of a large mass of mud formed from loose soil and water. The term "debris flow" is often used synonymously. Mudflows tend to occur in steeply sloped areas. ABAG hazard maps (2007) for both landslide and debris flow sources show areas susceptible to mudflow. An excerpt from the landslide hazard map is included as Figure 23.

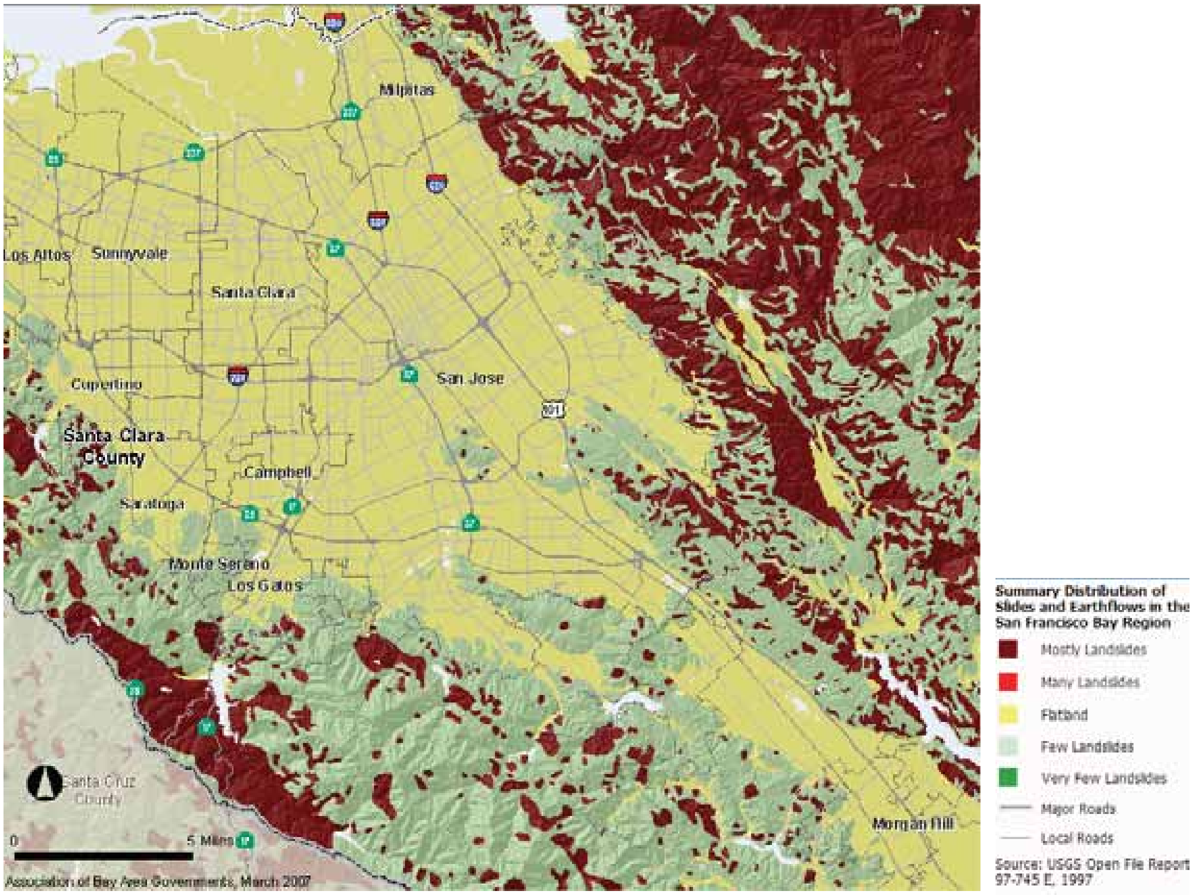

Figure 23. Mudflow Susceptibility

5.6.2 General Plan Policies

The following proposed General Plan policies and actions provide program-level mitigation for other surface water hazard impacts:

Policy EC-5.5 Prepare and periodically update appropriate emergency plans for the safe evacuation of occupants of areas subject to possible inundation from dam and levee failure and natural flooding. Include maps with pre-established evacuation routes in dam failure plans.

Policy EC-5.9 Work with local, regional, state and federal agencies to ensure new and existing levees provide adequate flood protection and actively partner with the Santa Clara Valley Water District and other levee owners with respect to National Flood Insurance Program (NFIP) levee recertification.

5.6.3 Existing Codes and Regulations

The following existing codes and regulations also address surface water hazard impacts.

Dam Safety

All dams potentially affecting San José fall under the jurisdiction of the California Division of Safety of Dams (DSOD), and some also fall under Federal Energy Regulatory Commission (FERC) jurisdiction. The DSOD inspects each dam annually to ensure the dam is safe, performing as intended, and not developing problems. All of the dams are classified as high hazard dams because their failure would result in significant loss of life and property damage.

As part of its comprehensive dam safety program, the Santa Clara Valley Water District routinely monitors and studies the condition of each of its ten dams to ensure public safety. Although all of their dams have withstood earthquakes in the past, the District continues to analyze their seismic safety as new technology and geologic information becomes available. The stored capacity of Coyote Reservoir, for instance has been reduced in the past due to concerns for seismic safety. More recently the District completed a preliminary evaluation that suggests Anderson Dam could be adversely affected by soil liquefaction if a major earthquake were to hit the Calaveras or Coyote Creek faults.

State, local and federal oversight of dam safety is considered to mitigate the risk of inundation due to dam failure to an acceptable level.

Mudflows

Municipal Code Title 17, Chapter 10.220: Geologic Hazard

The City of San José defines a "geologic hazard" as any condition in earth, whether naturally occurring or artificially created, that is dangerous or potentially dangerous to life, limb, property, or improvements due to movement, failure or shifting of earth, including landslides, mudslides and rock falls.

San José City Ordinance requires that any applicant for a building permit must obtain a geologic hazard clearance including a project-specific geologic evaluation. Conditions of acceptance may include, but are not necessarily limited to mitigation measures identified in the geologic evaluation; slope stabilization; surface and subsurface drainage control; off-site improvements to mitigate a geologic hazard which potentially affects either the site proposed for development or applicable off-site areas; use restrictions to avoid or mitigate hazardous geologic conditions; implementation of an approved erosion control plan; and adequate guarantees that all private improvements, located within a geologic hazard zone will be properly maintained.

5.6.4 Level of Significance

Any future development proposed consistent with the updated San José General Plan will be subject to the above described General Plan policies, existing codes, and regulations regarding the mitigation of surface water flood hazards. As such, the proposed General Plan Update will have **less than significant impacts to surface water hazards**.

5.7 Summary of Surface Water Hazard Risks for Planning Areas

This section contains summary tables and figures presenting the flood hazard and surface water hazard risks by Growth Area for each San José Planning Area. The quantification of risk herein is general. More detailed, site-specific risk assessments will be required prior to further planning and design.

The tables and figures indicate stormwater flooding impacts, where applicable, with their associated FEMA SFHA zones, which FEMA uses to describe the level and nature of flooding within each SFHA. Relevant zone definitions are as follows:

- Zone A designates floodplain areas with a 1% annual chance of flooding. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within Zone A areas.
- Zone AE designates floodplain areas where base flood elevations have been determined. AE Zones replace the A1-A30 Zones used previously.
- Zone AH designates floodplain areas with a 1% annual chance of shallow flooding, usually in the form of ponded water, with an average depth ranging from 1 to 3 feet. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
- Zone AO designates river or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses are shown within these zones (e.g., AO (1 foot)).
- Zone X designates floodplain areas with a moderate flood hazard, usually the area between the limits of the 1% (100-year) and 0.2% (500-year) floods.
- Zone D designates areas unstudied for floodplains, where flood hazards are undetermined but flooding is possible.

The tables also include assessments of other surface water hazards based on the dam failure inundation map shown in Figure 8 and the mudflow susceptibility map shown in Figure 23.

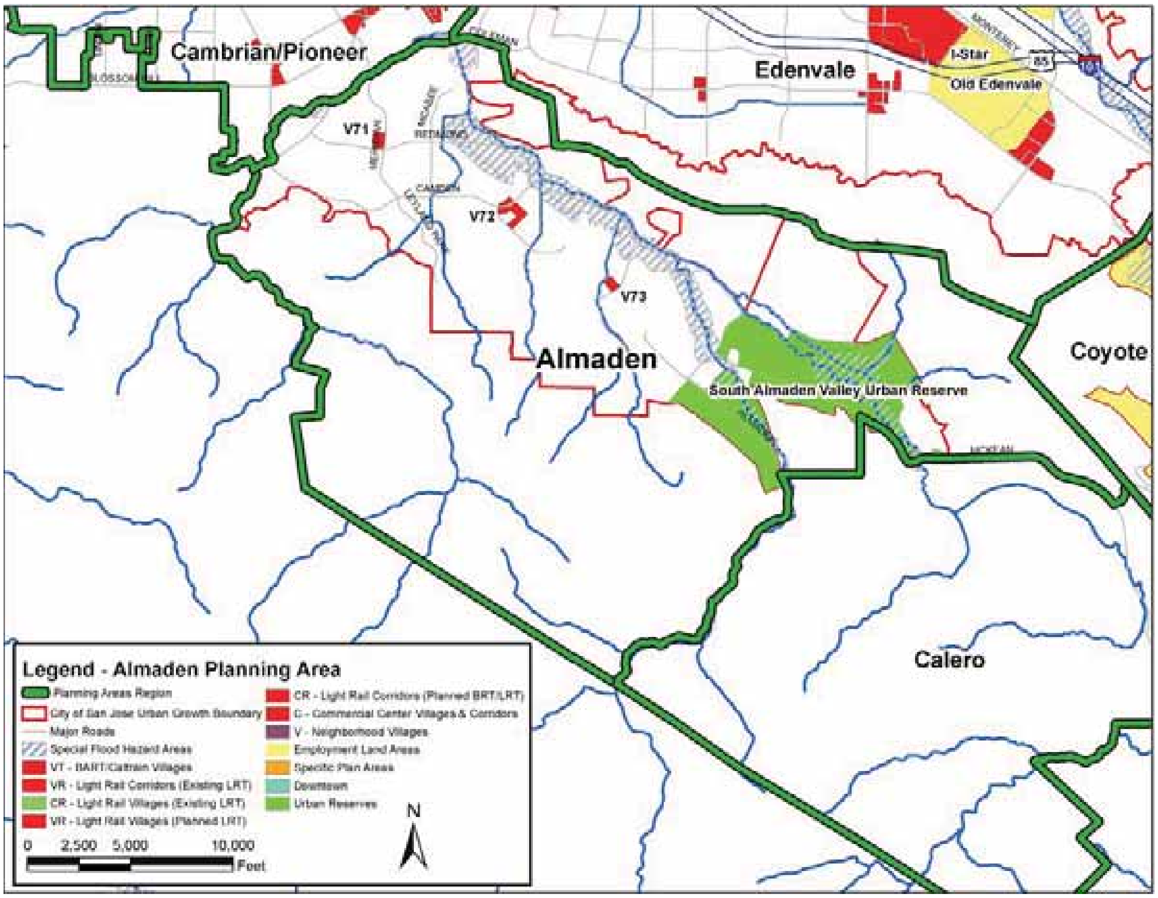

Figure 24. Almaden Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
V71	Guadalupe River	Golf Creek/Guadalupe Creek	-	-
V72	Guadalupe River	Alamitos Creek/Greystone Creek	-	-
V73	Guadalupe River	Randol Creek	A	-

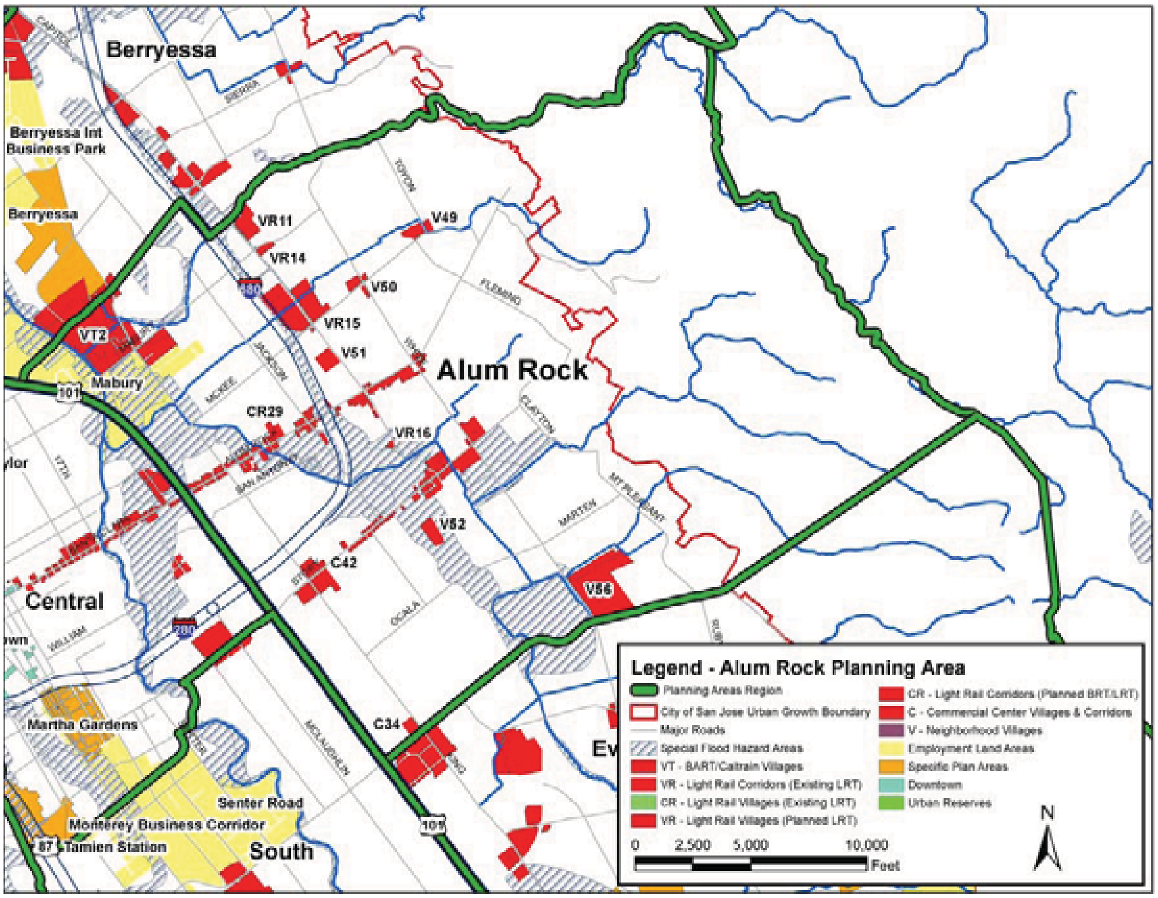

Figure 25. Alum Rock Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C34	Coyote	Coyote Creek	-	-
C42	Coyote	Lower Silver Creek	A/AH/AO /X	-
CR29	Coyote	Lower Silver Creek/North Babb Creek	A/AH/AO	-
V49	Coyote	Miguelita Creek/Silver-Thompson Creek	-	-
V50	Coyote	Lower Silver Creek/Silver-Thompson Creek	-	-
V51	Coyote	Lower Silver Creek	-	-
V52	Coyote	Lower Silver Creek	AO	-
V56	Coyote	Flint Creek/Ruby Creek	AH	-
VR11	Coyote	Miguelita Creek/Upper Penitencia Creek	A/AO	Cherry Flat
VR14	Coyote	Miguelita Creek	AO	Cherry Flat
VR15	Coyote	Lower Silver Creek/Miguelita Creek/ Silver-Thompson Creek	AO	-
VR16	Coyote	Lower Silver Creek	AO	-
VT2	Coyote	Coyote Creek/Miguelita Creek/ Upper Penitencia Creek	A/AE/AH/ AO/X	Anderson Res. Cherry Flat
Mabury	Coyote	Coyote Creek/Lower Silver Creek/ Miguelita Creek/Upper Penitencia Creek	AE/AH	Anderson Res.

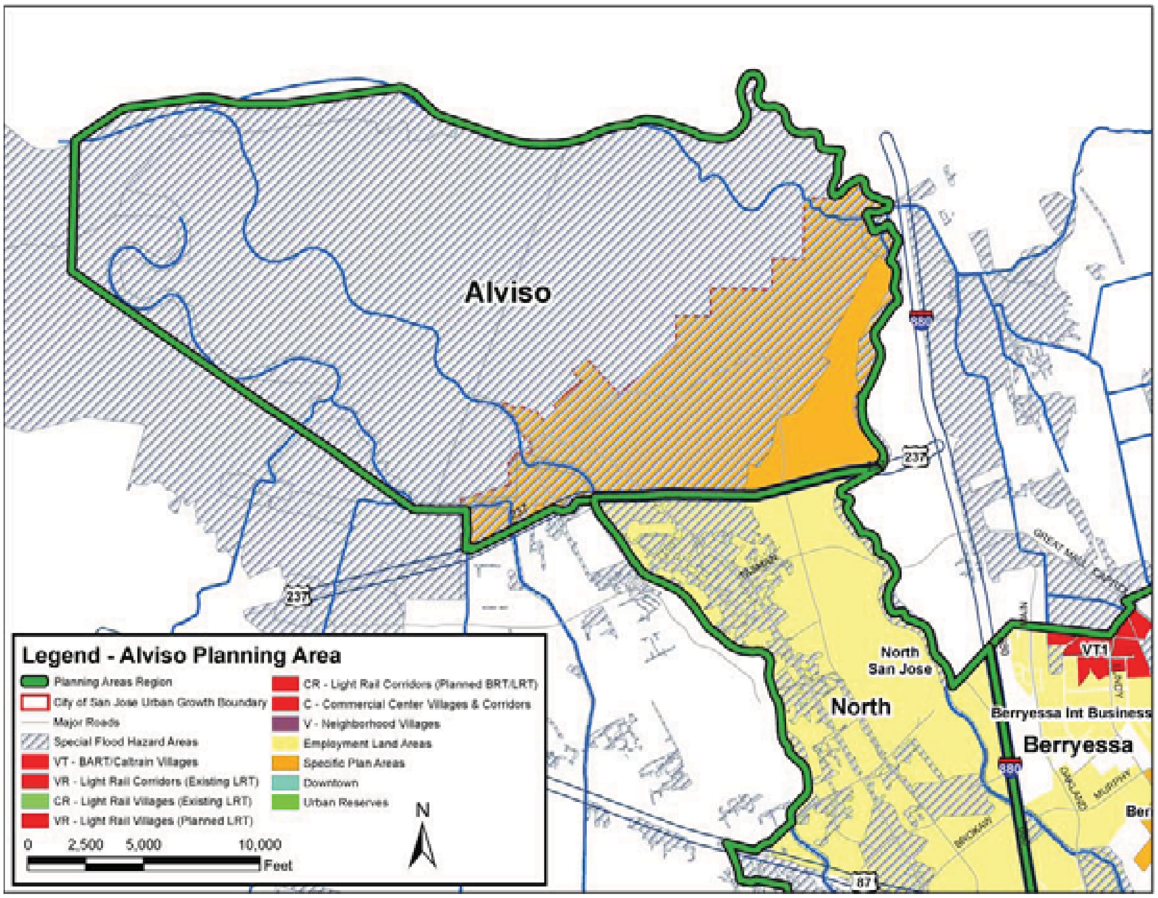

Figure 26. Alviso Planning Area Flood Hazard Risks

Specific Plan Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
Alviso Master Plan	San Francisco Bay	-	A/AE	Anderson Res.

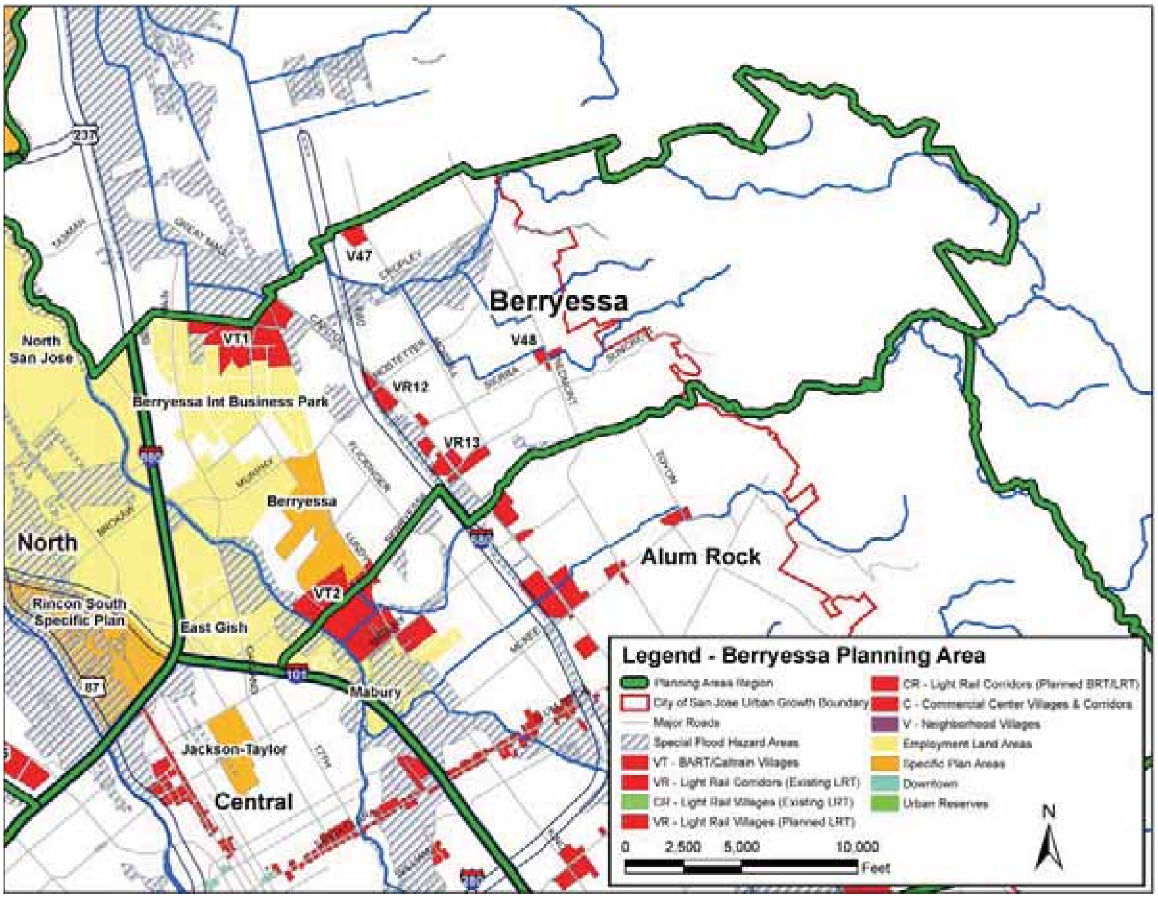

Figure 27. Berryessa Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
V47	Coyote	Berryessa Creek	-	-
V48	Coyote	Sierra Creek	-	-
VR11	Coyote	Upper Penitencia Creek	A	-
VR12	Coyote	Penitencia East Channel	A/AO	-
VR13	Coyote	Coyote Creek/Penitencia East Channel/Upper Penitencia Creek	AE/AO	-
VT1	Coyote	Lower Penitencia Creek/ Penitencia East Channel	AO	-
VT2	Coyote	Coyote Creek	AE/AH	Anderson Res Cherry Flat
Berryessa International Business Park	Coyote	Lower Penitencia Creek/ Penitencia East Channel	AO	-
East Gish	Coyote/ Guadalupe	Coyote Creek/Guadalupe River	AE/AO	-
NSJ	Coyote/ Guadalupe	Coyote Creek/Guadalupe River/ Lower Penitencia Creek	A/AE/AH/ AO/X	-

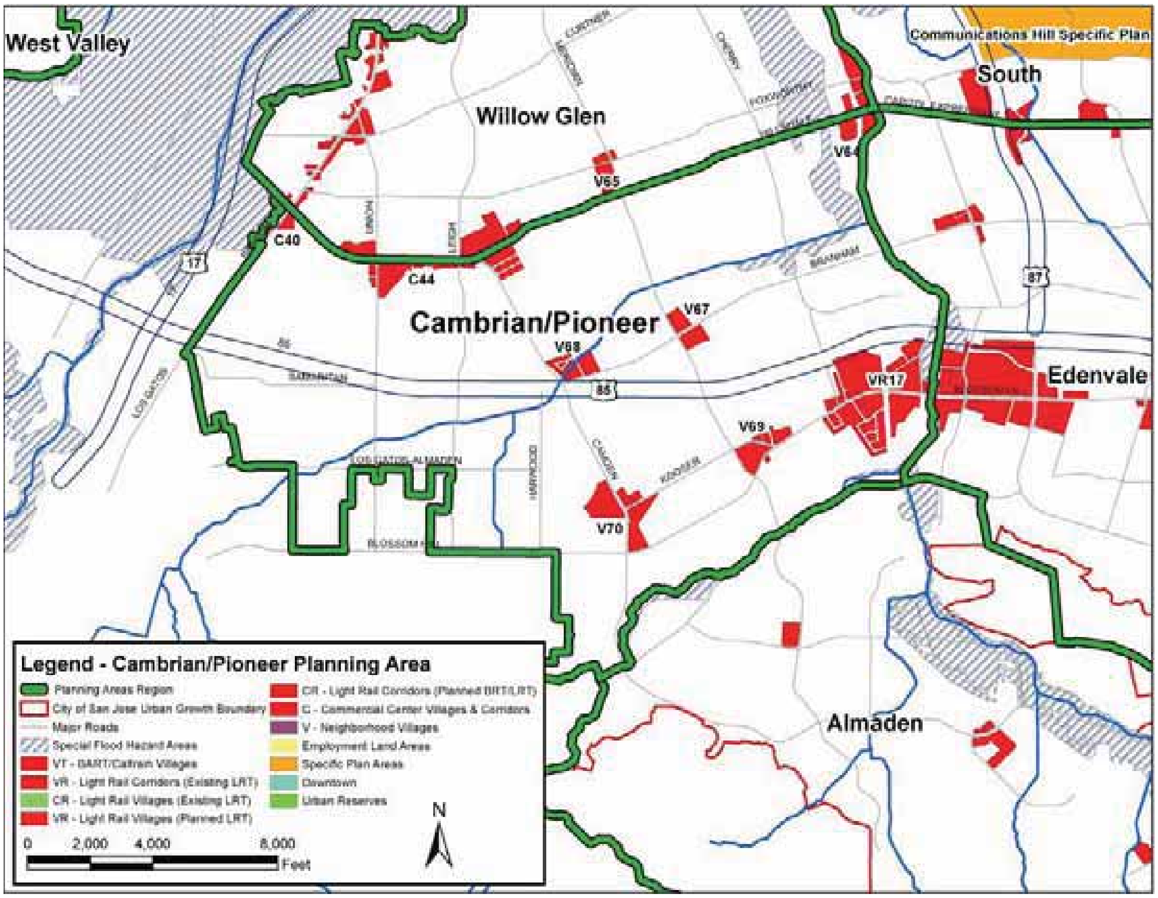

Figure 28. Cambrian Pioneer Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C40	Guadalupe	Los Gatos Creek	X	Lexington Res.
C44	Guadalupe	Guadalupe Creek/ Los Gatos Creek/Ross Creek	-	-
V64	Guadalupe	Guadalupe River	-	Calero/Guadalupe Reservoirs
V67	Guadalupe	Ross Creek	-	-
V68	Guadalupe	Ross Creek	A	-
V69	Guadalupe	Guadalupe River/Ross Creek	-	Guadalupe Res.
V70	Guadalupe	Guadalupe River/Ross Creek	-	-
VR17	Guadalupe	Guadalupe River	-	Calero/Guadalupe /Almaden Res.

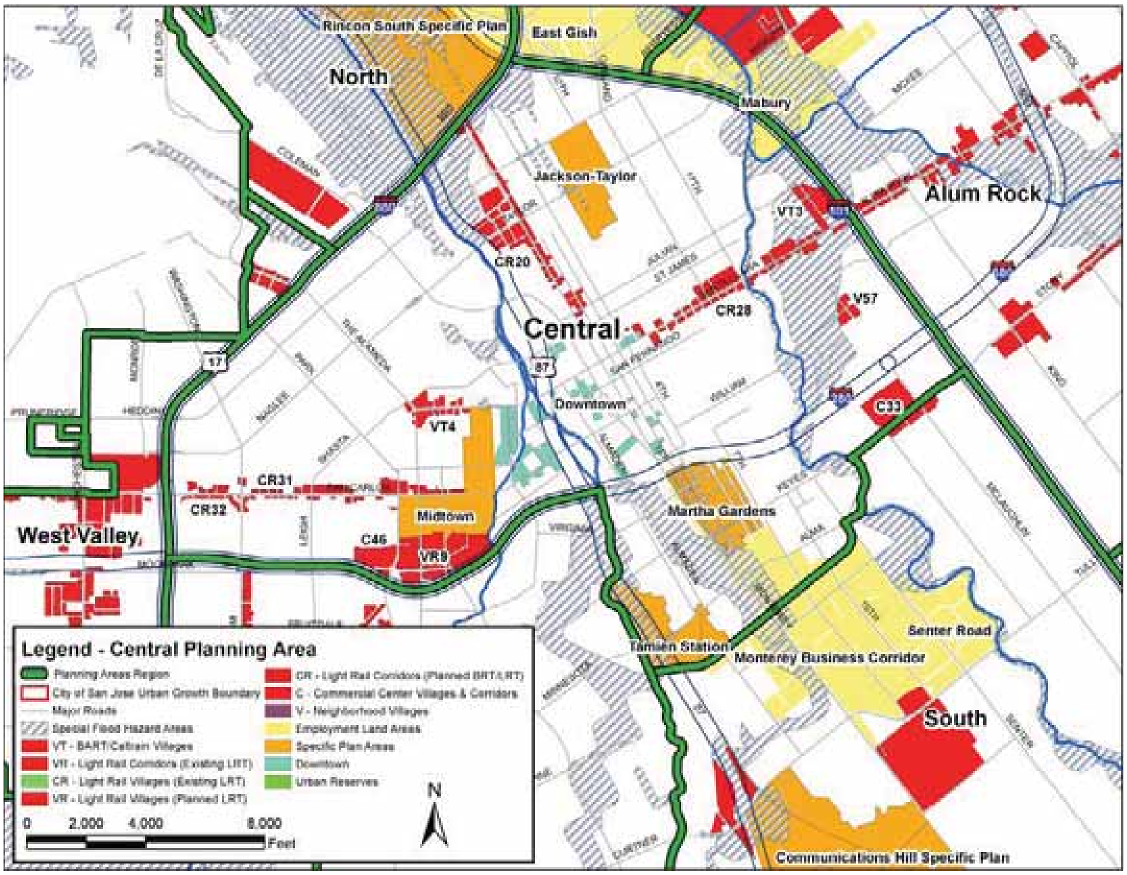

Figure 29. Central Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C33	Coyote	Coyote Creek	-	-
C46	Guadalupe	Los Gatos Creek	-	Lexington Res.
CR20	Guadalupe	Guadalupe River	AH/X	Anderson Res.
CR28	Coyote/ Guadalupe	Coyote Creek/Guadalupe River/ Lower Silver Creek	AE/AO	Anderson Res.
CR31	Guadalupe	Guadalupe River/Los Gatos Creek	-	Lexington Res.
CR32	Guadalupe	Guadalupe River/Los Gatos Creek	-	Lexington Res.
V57	Coyote	Coyote Creek	-	Anderson Res.
VR9	Guadalupe	Los Gatos Creek	A	Lexington Res.
VT3	Coyote	Coyote/Lower Silver Creek	AH/AO	Anderson Res.
VT4	Guadalupe	Guadalupe River	-	Lexington Res.
Mabury	Coyote	Coyote Creek/Lower Silver Creek/Miguelita Creek/Upper Penitencia Creek	AE/AH	Anderson Res.
Monterey Business Corr.	Coyote/ Guadalupe	Coyote Creek/Guadalupe River	AE/AH/AO	Anderson Res.
Jackson-Taylor Residential	Guadalupe	Guadalupe River	AO	Anderson Res.
Martha Gardens	Guadalupe	Guadalupe River	AE/AO	Anderson Res.
Midtown	Guadalupe	Guadalupe River/Los Gatos Creek	AO	Lexington/Elsman
Tamien Station	Guadalupe	Guadalupe River	AH/AO	Anderson Res.

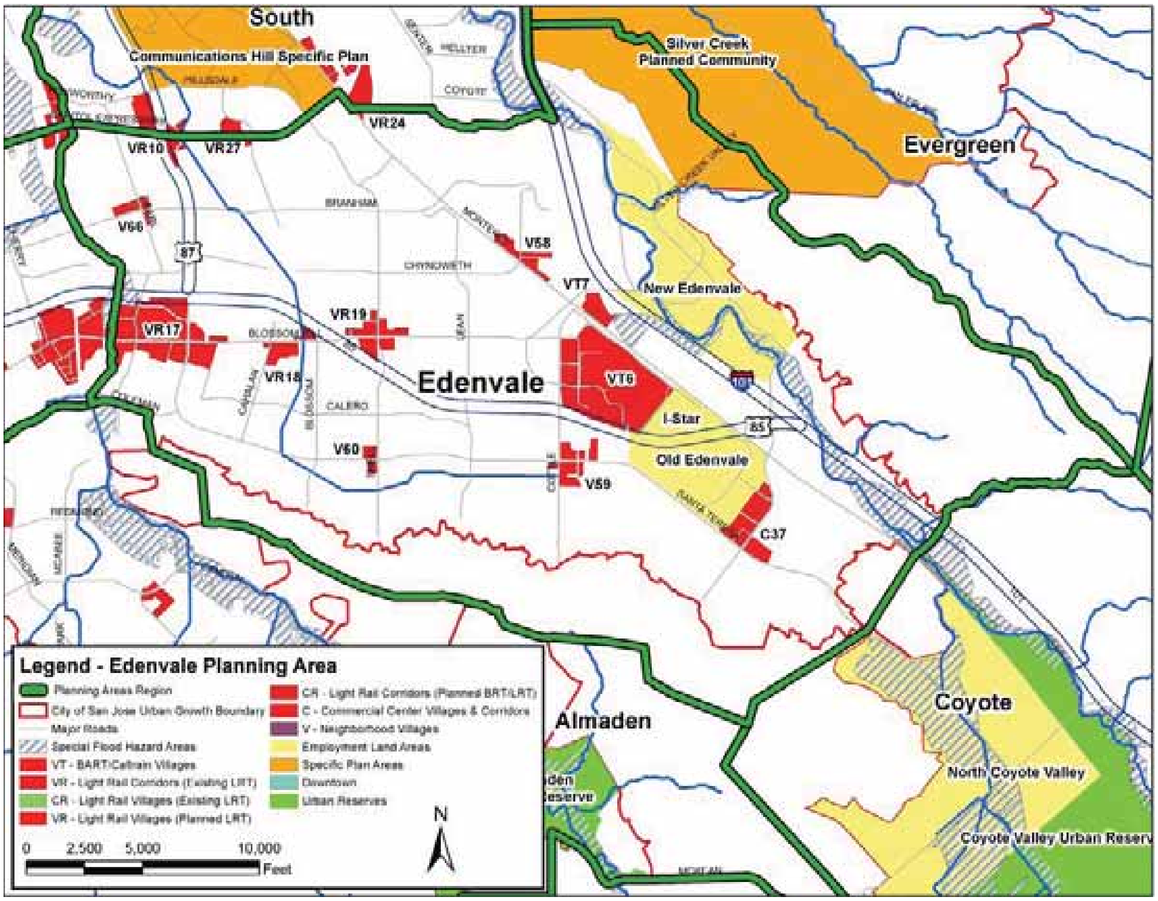

Figure 30. Edenvale Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C37	Guadalupe River	Canoas Creek	-	Anderson Res.
V58	Coyote/Guadalupe	Canoas/Coyote Creek	-	Anderson Res.
V59	Guadalupe River	Canoas Creek	-	Anderson Res.
V60	Guadalupe River	Canoas Creek	-	Anderson Res.
V66	Guadalupe River	Canoas Ck/Guadalupe	-	Calero Res.
VR10	Guadalupe River	Canoas Ck/Guadalupe	A	Calero/Anderson Resrvs.
VR17	Guadalupe River	Canoas Ck/Guadalupe	A	Calero/Guadalupe/ Almaden Resrvs.
VR18	Guadalupe River	Canoas Creek	-	Calero/Guadalupe/ Almaden/ Anderson Resrvs.
VR19	Coyote/Guadalupe	Canoas Creek	-	Anderson Res.
VR24	Guadalupe River	Canoas/Coyote Creek	-	Anderson Res.
VR27	Guadalupe River	Canoas Creek	-	high landslide risk Anderson Res.
VT6	Guadalupe River	Canoas Creek	-	Anderson Res.
VT7	Coyote/Guadalupe	Canoas/Coyote Creek	-	Anderson Res.
I-Star	Guadalupe River	Canoas Creek	-	Anderson Res.
New Edenvale	Coyote/Guadalupe	Canoas/Coyote Creek	AE/AO	Anderson Res.
Old Edenvale	Guadalupe River	Canoas Creek	-	Anderson Res.

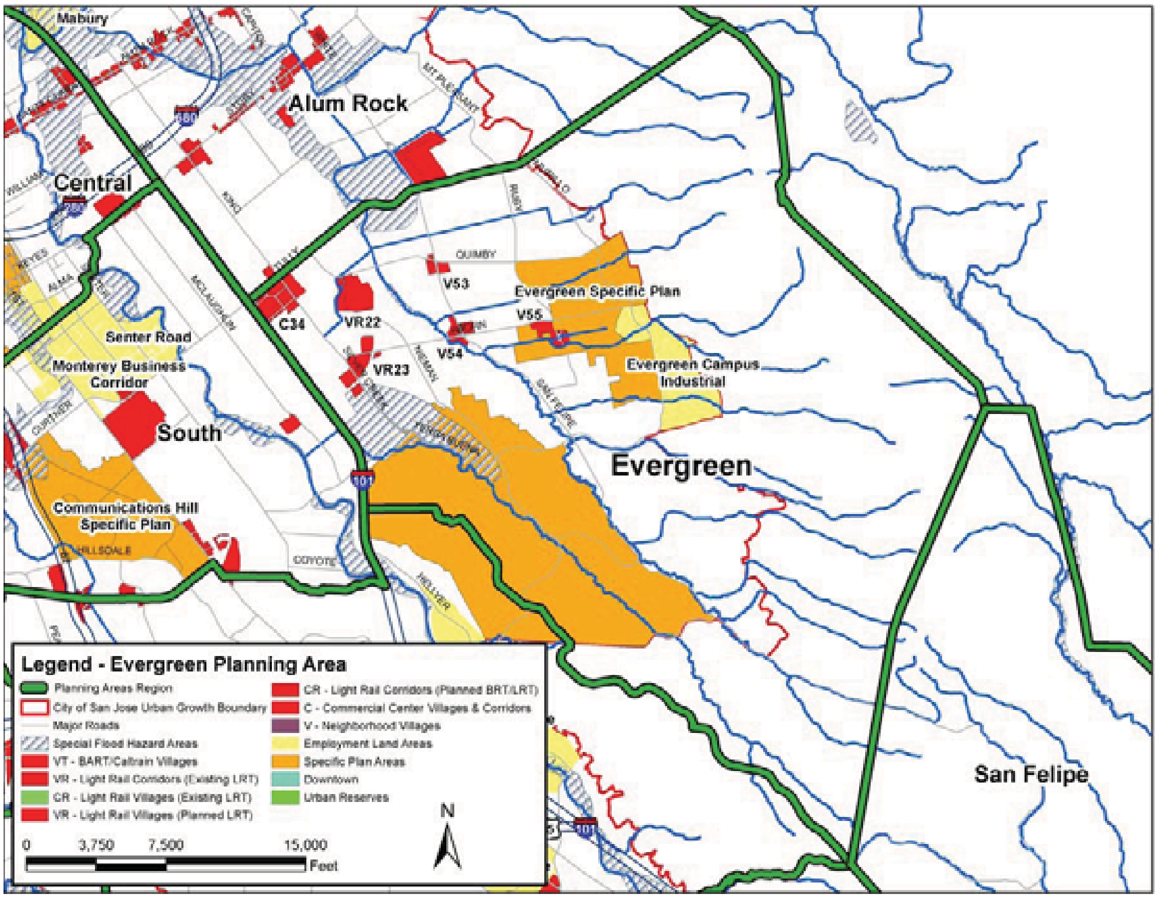

Figure 31. Evergreen Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C34	Coyote	Coyote Creek	-	-
V53	Coyote	Norwood Creek/Thompson Creek	-	-
V54	Coyote	Thompson Creek/Quimby Creek	A	-
V55	Coyote	Fowler Creek/Quimby Creek	-	-
VR22	Coyote	Lower Silver Creek/Thompson Creek	A	-
VR23	Coyote	Thompson Creek/Silver-Thompson Creek	X	-
Evergreen Campus Industrial	Coyote	Evergreen Creek/Fowler Creek/ Thompson Creek	-	moderate landslide
Evergreen	Coyote	Evergreen Creek/Fowler Creek/ Thompson Creek/Quimby Creek	-	moderate landslide
Silver Creek	Coyote	Coyote Creek/Thompson Creek/ Upper Silver Creek	AE/AO/X	high landslide

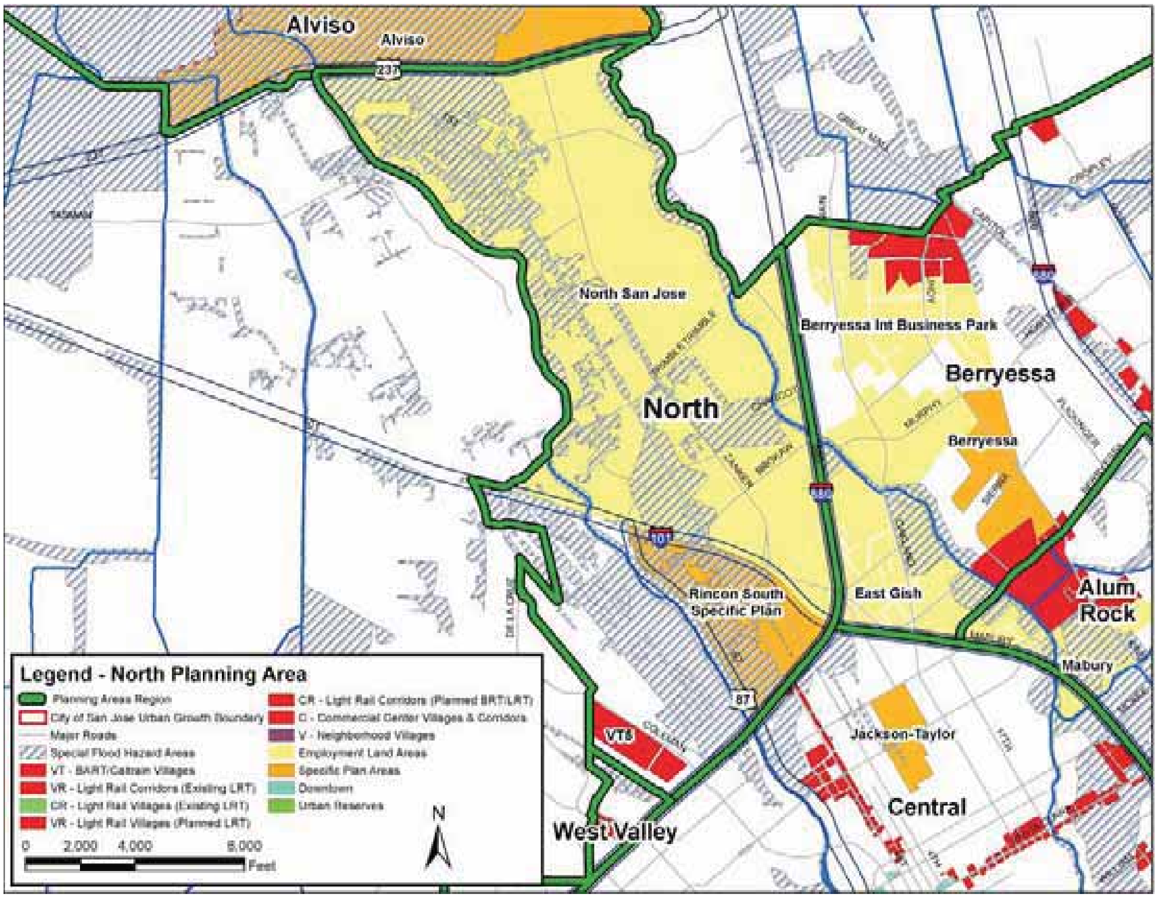

Figure 32. North Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
VT5	Guadalupe River	Guadalupe River	-	Lexington Res.
North San Jose	Coyote/Guadalupe River	Coyote Creek/Guadalupe River/Lower Penitencia Creek	A/AE/AH/AO/X	Anderson/Lexington Resvrs.
Rincon South	Guadalupe River	Guadalupe River	AH/AO/X	-

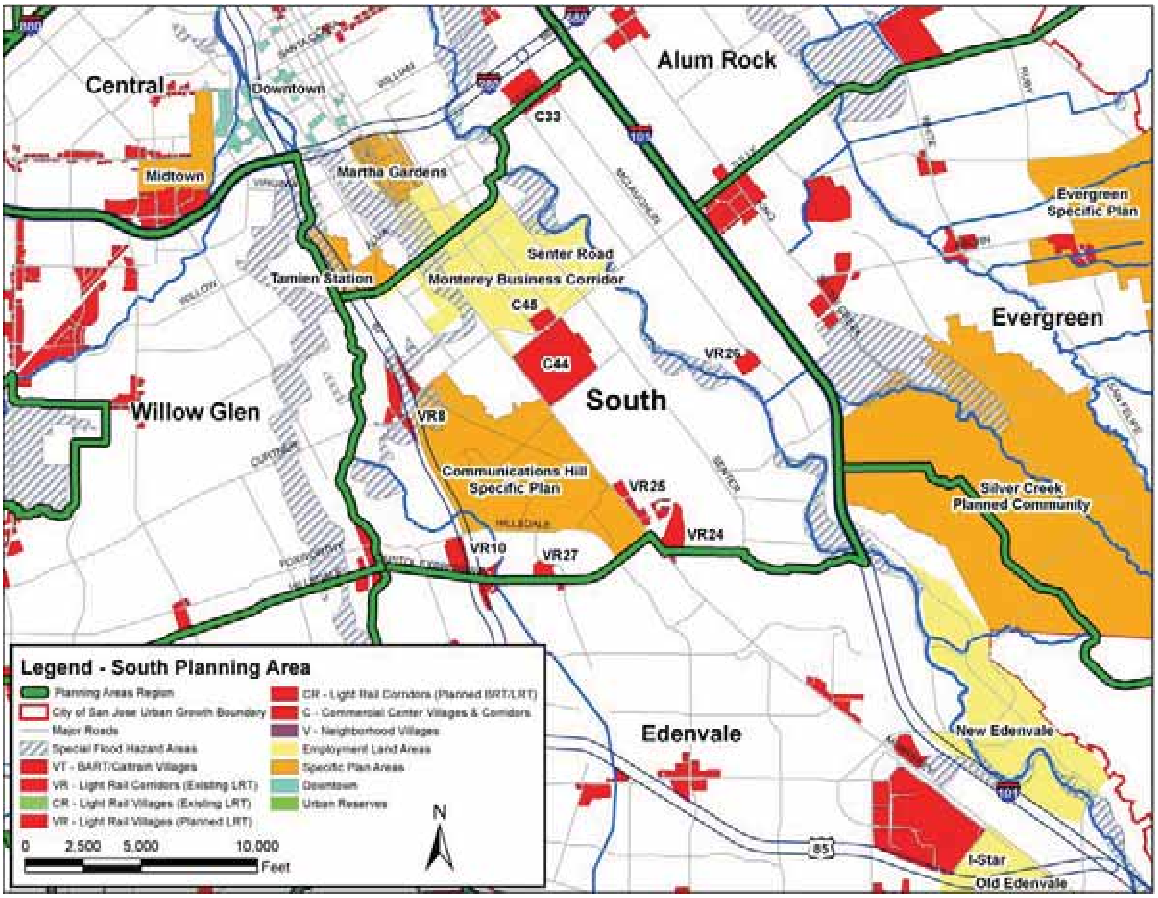

Figure 33. South Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C33	Coyote	Coyote Creek	-	-
C44	Coyote	Coyote Creek	-	Anderson Res.
C45	Coyote	Coyote Creek	-	-
VR10	Guadalupe	Canoas Creek	A	Calero/Anderson Res.
VR24	Coyote/Guadalupe	Canoas Creek/Coyote Creek	-	Anderson Res.
VR25	Coyote/Guadalupe	Canoas Creek/Coyote Creek	-	Anderson Res.
VR26	Coyote	Coyote Creek	-	-
VR27	Guadalupe	Canoas Creek	-	high landslide Anderson Res.
VR8	Guadalupe	Guadalupe River	AE/AH	Anderson Res.
Monterey Business Corridor	Coyote/Guadalupe	Coyote Creek/Guadalupe River	AH/AO	Anderson Res.
Senter Road	Coyote	Coyote Creek	AE	Anderson Res.
Communications Hill	Coyote/Guadalupe	Canoas Creek/ Coyote Creek/Guadalupe River	AH	high landslide Anderson Res.

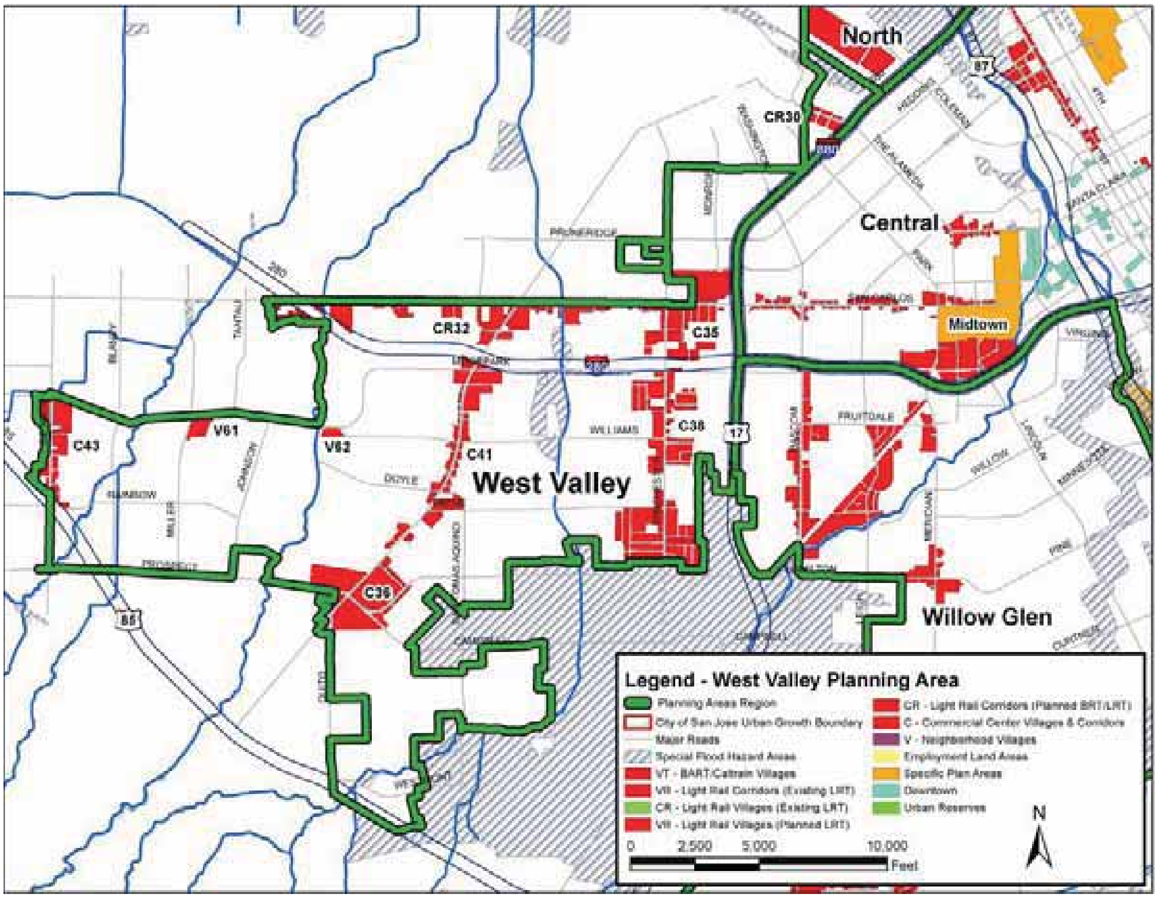

Figure 34. West Valley Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C35	Guadalupe/San Tomas	Guadalupe River/San Tomas-Aquino Creek	-	Lexington Res.
C36	San Tomas	San Tomas-Aquino Creek/ Saratoga Creek	-	-
C38	Guadalupe/San Tomas	Los Gatos/San Tomas-Aquino Creek	X	Lexington Res.
C41	San Tomas	San Tomas-Aquino Creek	-	-
C43	Calabazas	Calabazas Creek/Regnart Creek	-	-
CR30	Guadalupe	Guadalupe River	-	Lexington Res.
CR32	San Tomas	San Tomas-Aquino Creek/ Saratoga Creek	-	Lexington Res.
V61	San Tomas	Saratoga Creek	-	-
V62	San Tomas	Saratoga Creek	-	-

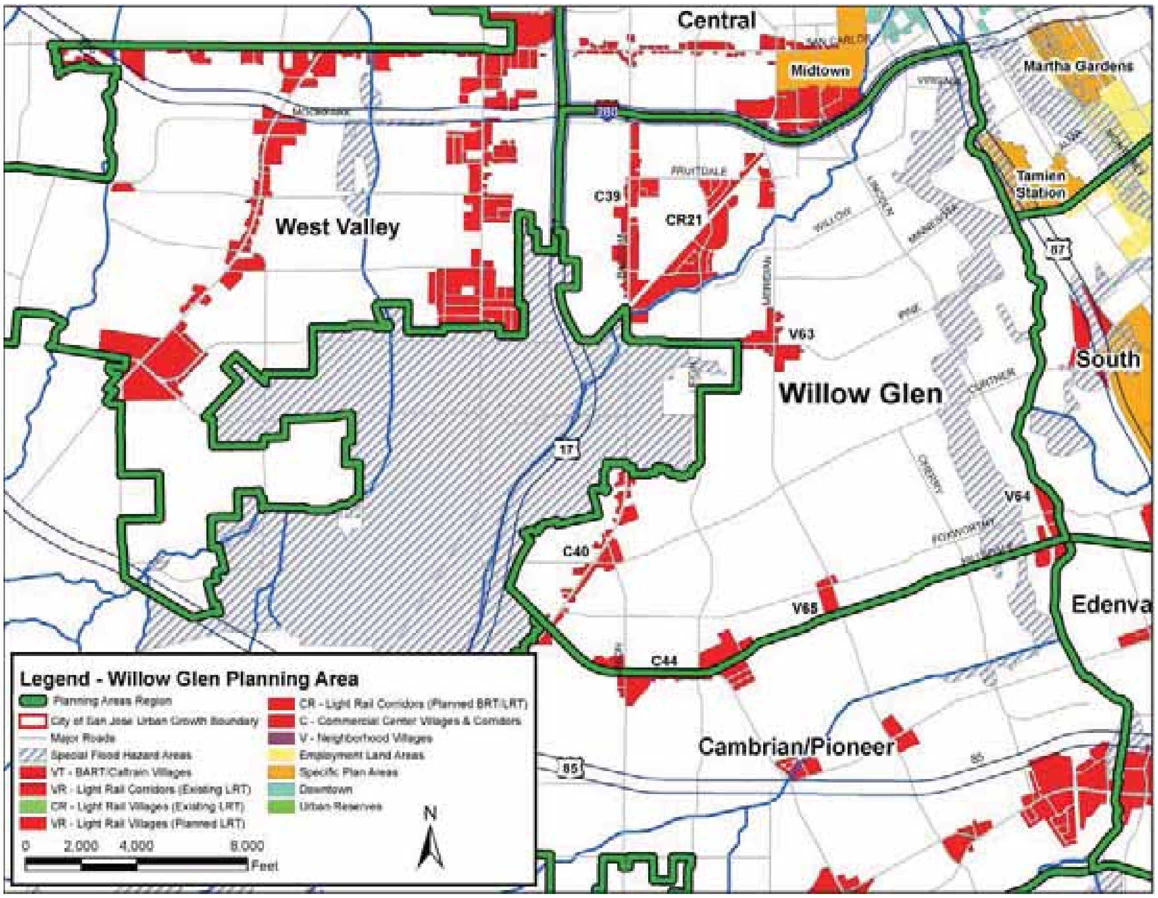

Figure 35. Willow Glen Planning Area Flood Hazard Risks

Growth Area	Watershed	Sub-Watershed / Flooding Source	SFHA Zone	Other Surface Water Hazards
C39	Guadalupe River	Los Gatos Creek	-	Lexington Res.
C40	Guadalupe River	Guadalupe River/Los Gatos Creek	X	Lexington Res.
C44	Guadalupe River	Guadalupe River/Los Gatos Creek/Ross Creek	-	-
CR21	Guadalupe River	Los Gatos Creek	A	Lexington Res.
V63	Guadalupe River	Los Gatos Creek	-	-
V64	Guadalupe River	Guadalupe River	-	Calero/Guadalupe Resrvs.
V65	Guadalupe River	Guadalupe River	-	-

5.8 Cumulative Impacts of Sea Level Rise

Impact HYD7: Rising sea levels due to global climate change may increase or adversely impact flood hazards, water quality, and natural resources within the City of San José.

5.8.1 Impact Analysis

The impacts of Global Climate Change to the City of San José are presented in depth in an Appendix to this report. Currently, the state of California generally projects mean sea levels to rise as a result of climate change by up to 18 inches relative to current sea level in 2050 and by up to 55 inches in 2100.[81] The NOAA VDatum program is used to determine the relationship between existing local mean sea level and the NAVD88 datum in the vicinity of San Francisco Bay near Alviso:[82]

0 feet Local Mean Sea Level (LMSL) = 4.12 feet NAVD88.

Thus, an increase of 18-inches to the existing mean sea level corresponds to an elevation of 5.6 feet NAVD88, and an increase of 55-inches to existing mean sea level corresponds to an elevation of 8.7 feet NAVD88. For comparison, the mean-high-high-water (MHHW) tide level in the vicinity of San José is 8.2 feet, while the one-percent stillwater storm surge predicted by FEMA for existing conditions is 12 feet NAVD88. Thus, the 55-inch sea level rise scenario is a water surface elevation only 0.5 feet above the existing MHHW, and 3.3 feet below the existing one-percent storm surge. As such, it is likely that the greatest impacts to the City of San José due to sea level rise will not result from the sea level rise itself, but from the impact to high tides and storm induced surge when combined with the mean sea level increase.

Figure 36 shows the elevations ranges described above. The Alviso Specific Plan Area and a portion of the North San Jose Employment Lands near SR 237 are located within the elevation ranges shown in Figure 36. Santa Clara County LiDAR elevation data (2006, 1-foot contours) has been used to generate Figure 36.

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[81]Cayan, D. R., Tyree, M., Dettinger, M., Hidalgo, H., Das, T., Maurer, E., Bromirski, P., Graham, N., and Flick, R., August 2009: 'Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment', California Climate Change Center. CEC-500-2009-014-F.
[82]NOAA Vertical Datums Transformation Tool 2.2.4

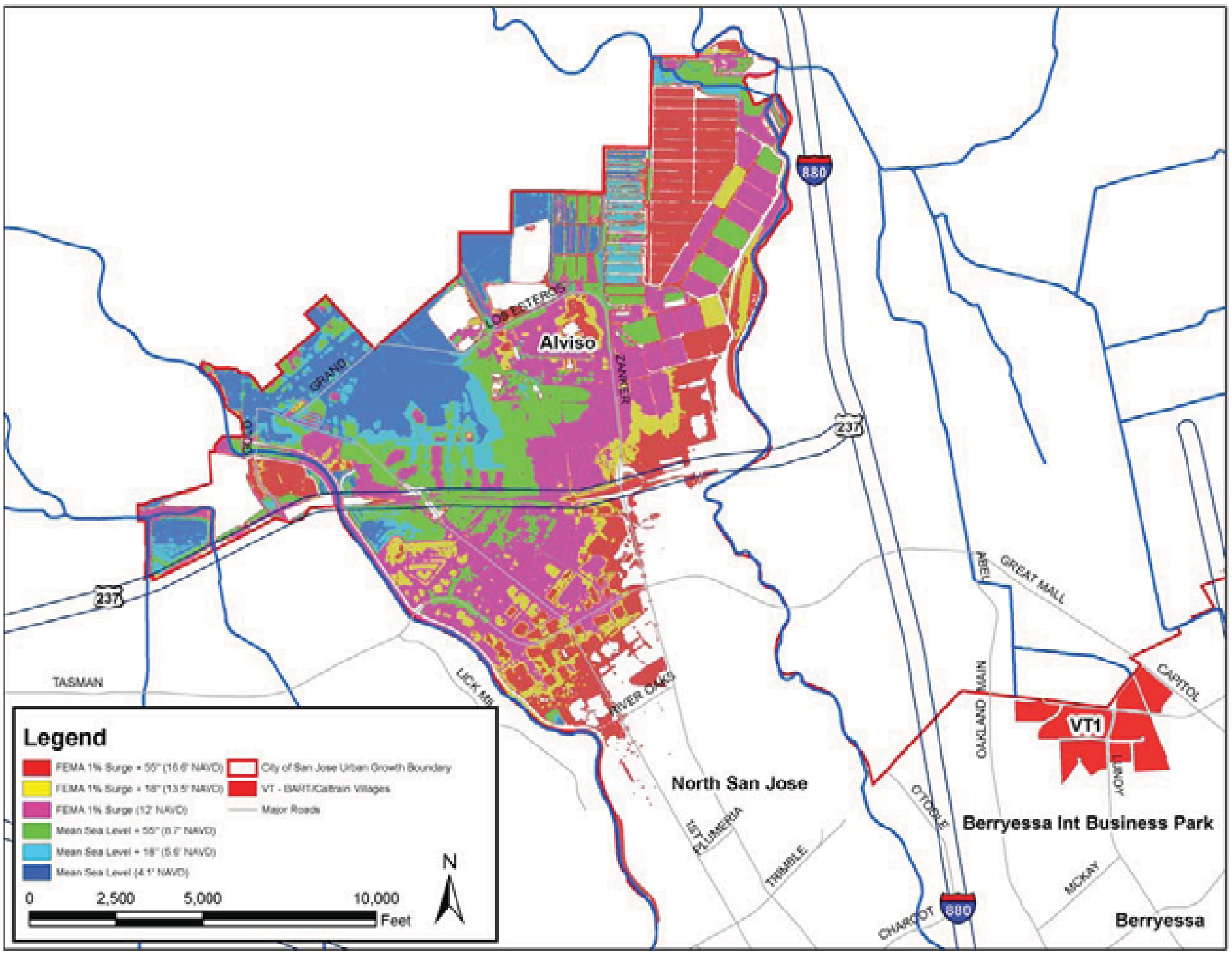

Figure 36. Mean Sea Level and FEMA 1% Storm Surge Elevations with Sea Level Rise

In addition to possible inundation close to San Francisco Bay, rising sea levels may impact the City of San José flood hazards in a variety of ways. Increasing sea levels can be expected to create a backwater effect, increasing riverine flooding or decreasing levee freeboard throughout the City. Stormdrain pipes or pumps that discharge to San Francisco Bay could experience changes to their hydraulic operations. With increasing sea levels the City could experience a loss of valuable existing real estate, critical public infrastructure (such as Water Pollution Control Plant facilities and storm water pump stations), and natural resources, including natural wetland and marsh habitat.

Other climate change impacts that could affect hydrologic behavior in San José include changes to precipitation patterns and trends, storm surge and intensity, wave runup, and antecedent moisture conditions. At this time, a consensus on quantitative estimates or trend directions for these impacts does not exist. As such, a quantitative analysis on these potential climate change impacts to the City of San José is not feasible. The Climate Change Appendix has more detail.

5.8.2 General Plan Goals & Policies

The following proposed General Plan policies and actions provide program-level mitigation for sea level rise related impacts:

Policy EC-5.13 As a part of the City's policies for addressing the effects of climate change and projected water level rises in San Francisco Bay, the City requires evaluation of projected inundation for development projects near San Francisco Bay or at flooding risk from local waterways which discharge to San Francisco Bay. For projects affected by increased water levels in San Francisco Bay, the City requires incorporation of mitigation measures prior to approval of development projects. Mitigation measures incorporated into project design or project location shall prevent exposure to substantial flooding hazards from increased water levels in San Francisco Bay during the anticipated useful lifetime of structures.

Action EC-5.20 Monitor information from regional, state, and federal agencies on water level rises in San Francisco Bay on an on-going basis. Use this information to determine if additional adaptive management actions are needed to deal with flooding hazards from increasing sea levels for existing or new development and infrastructure.

5.8.3 Existing Codes and Regulations

The City of San José does not currently have any municipal codes or ordinances that relate to sea level rise, however several State-wide Bills, Ordinances, or Codes may affect the impacts of climate change to the City.

5.8.4 Level of Significance

Unlike FEMA flood hazard zones, hazard zones for future sea level rise and storm surge have not yet been adopted by regulatory agencies. Based on the most recent projections of sea level rise by the California Climate Change Center, existing and future development within the City closest to San Francisco Bay could be subject to increased flood hazard risks during the affective lifetime of the developments. A proposed new General Plan policy calls for an evaluation of sea level rise impacts on individual projects, and mitigation measures incorporated into projects affected by sea level rise.

One potential mitigation project for rising sea levels is the construction of regional bayfront levees. There are two key elements to consideration of structural projects to mitigate rising sea levels: coordination with neighboring communities, and uncertainty in sea level rise projections. At this time, San Jose may take concrete steps toward the long term goal of Bayfront levees to protect from rising sea levels, including conducting preliminary feasibility analyses for levee locations, and coordinating efforts with neighboring communities and the US Army Corps of

Engineers. It must be noted that the construction of new bayfront levees, or significant modification of existing levees, may have significant environmental impacts.

If future sea level rise does occur as currently projected, that rise may **significantly impact** existing property and infrastructure of the City of San José due to increased flood hazards.

The General Plan proposes an adaptive management approach to respond to increasing sea levels due to global climate change. While the proposed General Plan policy and action regarding sea level rise provide an initial mechanism for identifying and mitigating possible future impacts to buildings and infrastructure, a regional or area-wide solution, such as the construction of new levees, may be required to protect existing development in the Alviso Specific Plan Area, the northern portion of the North San Jose Employment Lands, and critical public infrastructure in North San Jose. Currently there is no mechanism in place that would provide for the large scale improvements and multiple agency coordination that would be required for regional or area-wide protective measures. Possible impacts from sea level rise and associated flood risk, therefore, would remain significant. **(Significant Impact)**

Appendix:

Climate Change and San José

Envision San José 2040

September 3, 2010

Schaaf & Wheeler
Consulting Civil Engineers
100 N Winchester Blvd, Suite 200
Santa Clara, California 95050
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Introduction

The California Environmental Quality Act (CEQA) requires the City of San José to consider the effects of climate change in its general planning efforts. This hydrology and water quality appendix summarizes the current general scientific consensus regarding climate change, the uncertainty regarding that consensus, potential climate change impacts, and how they apply to San José; specifically as related to flood protection, water supplies, and water quality. Federal, state, and local regulations, policies, and actions related to climate change are summarized, and their potential impacts to the City of San José are discussed.

This appendix does not attempt to detail the specific causes of climate change, nor the distribution between anthropogenic (i.e. human induced) versus natural sources of carbon dioxide in the atmosphere. Rather, the potential impacts of climate change to the City of San José's water resources are detailed, both in magnitude and uncertainty, and steps the City could take to mitigate those potential impacts are discussed in concept. The responses discussed herein focus on mitigating the impacts of climate change rather than mitigating carbon emissions. Much of this information is repeated in the Schaaf & Wheeler *Hydrology & Water Quality Report*, Section 2.6.4, Tidally Influenced Areas and Section 4.4, Current Status of Regulations Pertaining to Climate Change.

Current Status of Climate Change Understanding and Research

It is well understood that carbon dioxide and other anthropogenic emissions act as heat trapping greenhouse gasses that tend to increase troposphere temperatures. Throughout the 1980s scientists began to note increases in these emissions and postulated that the increases in atmospheric carbon dioxide may cause a range of impacts, some of which may be adverse. "Climate change" refers to an identifiable change in the state of the climate that persists for an extended period of time. The use of this phrase does not necessarily distinguish between changes that are due to natural processes versus human activities. "Climate variability," however, refers to natural climate cycles or changes that are not caused by human activities. Many of the impacts of climate change 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. As public awareness of climate change is heightened, an increasing number of analyses are conducted and reports published every year. Tasked with gathering, reviewing, and synthesizing the multitude of published studies is the Intergovernmental Panel on Climate Change.

Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 to provide an objective source of information about climate change. The IPCC does not independently conduct research or gather data. Instead it acts as a comprehensive assessor of the latest scientific, technical, and socio-economic literature produced worldwide relevant to the understanding of human-induced climate change, its impacts, and mitigation strategies. The IPCC was set up by the World Meteorological Organization and by the United Nations Environment Programme.

The First Assessment Report was released by the IPCC in 1990, the Second in 1995, the Third in 2001, and the Fourth in 2007. The conclusion that human-induced climate change is occurring has been progressively more certain in each Assessment Report, with the 2007 Assessment Report stating that there is *very high confidence* (at least 9 out of 10 chance of being correct) that the global average net effect of human activities since 1750 has been one of warming, and that human induced warming over the last three decades has *likely* (greater than 66% probability) had a discernible influence at the global scale. Global warming refers to the general warming of the climate system, and the fact that global warming is occurring is unequivocal, based on IPCC findings. The next IPCC Assessment Report is scheduled for publication in 2012.

Uncertainty and Scale

IPCC uses a system of self-explanatory terms to convey qualitative and quantitative uncertainty. Three approaches are used to describe uncertainty. Where uncertainty is assessed qualitatively, a relative sense of the amount and quality of evidence to support a statement is provided through use of terms such as: high agreement, much evidence; high agreement, medium evidence; medium agreement, medium evidence; etc. Where uncertainty is assessed quantitatively using expert judgment of the correctness of underlying data or analyses, a scale of confidence levels is used to express the assessed change of a finding being correct: very high confidence (at least 9 out of 10); high confidence (about 8 out of 10); medium confidence (about 5 out of 10); low confidence (about 2 out of 10); and very low confidence (less than 1 out of 10). Finally, where uncertainty in specific quantitative outcomes is assessed using expert judgment and statistical analysis, then likelihood ranges are used to express the probability of occurrence: virtually certain (>99%); extremely likely (>95%); very likely (>90%); likely (>66%); more likely than not (>50%); about as likely as not (33%-66%); unlikely (<33%); very unlikely (<10%); extremely unlikely (<5%); and exceptionally unlikely (<1%).[1]

[1] IPCC Synthesis, 2007

Throughout this report, when these phrases are used based on IPCC findings they have been italicized as a visual reminder of the terms discussed in this introductory paragraph.

There are several global climate models that have been developed to estimate future impacts of climate change and global warming. Within each model there are various future condition scenarios representing the range of potential future carbon dioxide and other greenhouse gas emission levels. The more conservative approach is to assume that these emissions increase at a rate equal to or greater than recent trends. Generally the emissions and global warming predictions and impacts are directly proportional – the greater the emissions, the more severe the warming trend.

The vast majority of climate models are global in scale, and although general trends and impact estimates may be concluded from these models, there are multiple issues encountered when trying to downscale either results or models to determine trends or impacts in a localized area. The IPCC has produced a Special Report on the Regional Impacts of Climate Change which analyzes impacts at a continental or sub-continental scale; however this report focuses on impacts due to regional vulnerabilities as opposed to regional differences in physical impacts. Efforts to downscale from the global climate model to the catchment scale for hydrologic analyses and to utilize regional climate models to drive hydrologic models have shown that different ways of creating regional scenarios from the same source can lead to substantial differences in the estimated regional effect of climate change and that errors in the modeling procedure or differences in climate models are greater than hydrologic model uncertainty.[2]

There is no single agreed upon methodology for downscaling climate change results for use in regional hydrology, and results may differ substantially depending on the source model and method used. The process of downscaling does not resolve any of the uncertainty inherent in global climate models, and introduces new sources of uncertainty such that overall trends are less well defined compared to global models. For example, depending on the global climate model and scaling methodology used the estimated range of impact to mean annual precipitation in California varies in both magnitude and sign by at least 10%.[3] What this means is that while global climate change trends are relatively well known and documented, regional and local trends, particularly hydrologic parameters such as rainfall and runoff, are less well known.

[2] Kundzewicz, 2007
[3] Dettinger, 2004

California Climate Action Team

The California Climate Action Team (CAT) was established by Governor Schwarzenegger under an Executive Order on June 1, 2005. The purpose of the CAT is to coordinate state-level actions relating to climate change, and to complete the mandated preparation of biennial science assessment reports on climate change impacts and adaptation options for California. The Team is led by the Secretary of the California Environmental Protection Agency and includes the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the Air Resources Board, Chairperson of the Energy Commission and President of the Public Utilities Commission. The Climate Action Team is charged with implementing global warming emission reduction programs and reporting on the progress made toward meeting the statewide greenhouse gas targets that were established in the Assembly Bill 32 (described in more detail later in this report). The first report was sent to the Governor and the Legislature in 2006, and should be updated bi-annually thereafter.

Reports published by the CAT offer a comprehensive summary of the understanding of climate change impacts to California on a biennial basis. The third biennial report was released in draft form in April 2009, and is expected to be finalized sometime in 2010.

California Climate Change Center

The California Climate Change Center (CCCC) was established in 2003 by the California Energy Commission's Public Interest Energy Research (PIER) Program to document climate change research relative to the state. CCCC 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 effort, 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. In recent years, the state-wide trend has been for CCCC publications to form the basis for state-wide adoptions of climate change estimates such as sea level rise projections. Currently, the CCCC generally projects mean sea levels to rise as a result of climate change by up to 18 inches relative to current sea level in 2050 and by up to 55 inches in 2100.

Climate Change Impacts to the City of San José

The IPCC range of best estimate *likely* temperature increases by the year 2099 is 0.6 – 4.0 degrees Celsius (1 – 7 degrees Fahrenheit), depending on the global climate model utilized.[4]

Regionally scaled-down climate models for northern California estimate global temperature increases up to 4.5 degrees Celsius (9 degrees Fahrenheit) by 2100.[5] An increase in global temperatures in the IPCC range may have multiple impacts on the water resources of the City of San José, even if the changes in local and regional temperature are not yet known.

Sea Level Rise

One of the most publicized impacts of global warming, and the impact with the most direct consequences to the City of San José, is sea level rise. Sea level rise can be defined as global or relative. Global sea level rise is defined as the increase of global average sea level. Throughout the world, land may be uplifting or subsiding. This will impact the relative change in depth of water at any given location, depending on the rate of movement compared to the rate of global sea level rise. In addition coastal bays such as San Francisco Bay may not experience sea level rise at the same rate as the global average. Relative sea level rise refers to the rise of sea levels accounting for local hydraulics, land uplifting or subsidence.

An example of the importance of global vs. relative sea level rise can be seen when examining the historic sea level trends in San Francisco Bay at the National Ocean and Atmospheric Administration (NOAA) gages for San Francisco (at the Presidio) and Alameda (Pier 3 at the Naval Air Station). The Alameda gage shows a long-term average mean sea level rise of 0.82 millimeter per year (NOAA, Alameda Mean Sea Level Trend), while the San Francisco gage long-term average mean sea level rise is 2.01 millimeters per year (NOAA, San Francisco Mean Sea Level Trend). Although the San Francisco gage period of record is longer, essentially the same rate of sea level rise is found if it is truncated to match the Alameda gage period of record. The reasons for this difference are unknown, and likely due to a combination of factors, but it serves to exemplify the complexity between local trends, global predictions, and site-specific hydraulics.

Intergovernmental Panel on Climate Change

Depending on the emission scenario used, the predicted *likely* global sea level rise ranges from 0.18 – 0.59 meter, or 0.6 – 1.9 feet by the year 2099.[6] IPCC reports do not provide mid-range estimates; e.g. sea level rise by 2050. The upper limit of this range is lower than the upper range

[4] Synthesis, 2007
[5] Cayan, 2007
[6] IPCC 4th Assessment Report

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. The IPCC estimates that of the global sea level rise that has occurred since 1993, thermal expansion of the ocean has contributed 57% of the total rise, decreases in the extent of glaciers and ice caps have contributed 28% of the total rise, and the remaining 15% of rise is due to losses from the polar ice sheets. It must be noted that this range does not include uncertainties in climate-carbon cycle feedbacks or the full effect of changes to ice sheet flow, because a basis in published literature is lacking. Thus these values do not represent an upper bound to projected sea level rise. Long-term projections show that global warming sufficient to eliminate the Greenland Ice Sheet (one millennium exposed to an average temperature rise in excess of 1.9 – 4.6 degrees Celsius) results in an additional seven meters (23 feet) of global sea level rise. The IPCC does not offer any uncertainty scale for this possibility.

State of California – Rahmstorf Method

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 a new 2100 sea level rise estimate of "5 feet".[7] This report was finalized in August 2009.[8] The sea level rise estimates adopted by the CCCC are based on an empirical formula developed by Rahmstorf which relates global mean sea level rise to global mean surface air temperature.[9] The 2009 Assessment Report states (and shows graphically) that the Rahmstorf predicted values modify previous sea level rise estimates to include the impact of reservoirs and dams, but exactly what this modification entails, and its justification, is unclear.[10] Using this methodology, the CCCC 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 and the San Francisco Bay Conservation and Development Commission (BCDC) 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).

A subsequent report by Rahmstorf and others updates the original method to include the effects of reservoir storage on sea level rise projections.[11] It is unknown if or how this updated methodology differs from the method used by the CCCC for the 2009 Assessment Report described above. The updated Rahmstorf methodology predicts mean average increases in sea

[7] Kay, 2009
[8] Herberger, 2009
[9] Rahmstorf, 2007
[10] Cayan, 2009
[11] Vermeer, 2009

level rise (from 1990 levels) between 1.04 meters (3.4 feet) and 1.43 meters (4.7 feet). Although this report has been quoted as predicting sea level rise up to 1.9 meters (6.2 feet), it should be noted that this peak value represents both a standard deviation from the mean temperature prediction (captured in the 1.04-1.43 meter prediction range), and an additional standard deviation (~7%) from the statistical fit of the observation-based rate of sea level rise with equation parameters.

United States Army Corps of Engineers

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 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 rise, in meters, as a function of (t);

b = variable: 2.36E-5 for NRC Curve I; 1.005E-4 for NRC Curve III.

Table 1 presents the range of sea level rise projections for San Francisco Bay at San José (Alviso District) 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. Sea Level Rise (USACE Methodology)

USACE Methodology Sea Level Rise Projections (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

Interestingly, although the methodology is different, the ‘High’ sea level rise projections in the USACE method are almost identical to those predicted using the state of California adopted Rahmstorf method previously described.

Confidence in any sea level rise prediction decreases the further into the future that analysis is projected, due to unknowns about future emission scenarios, potential climate feedback loops and the severity of melting ice. It is important to note that emphasis should not be placed on a particular specific value for sea level rise. Not only is a consensus on a particular value unlikely, but the selection of the year 2100 as a reporting point for sea level rise projections is arbitrary. Even with drastic reductions in carbon emissions sea levels are expected to continue to rise beyond 2100 due at least to continued thermal expansion of ocean waters. Thus, any planning for sea level rise impacts should recognize the inherent uncertainty and long term ongoing nature of these projections.

Rising sea levels have three potential impacts to the City: inundation of Bay water onto City lands, increased flood hazard risk in areas not inundated, and impacts to the operation and performance of City storm drain facilities. Each of these impacts is discussed in more detail in subsequent sections of this report.

Planning for Uncertainty

When discussing projects to mitigate the impacts of sea level rise, there are several important points to keep in mind. As described above, there is not currently and unlikely to ever be a true consensus regarding predictions of sea level rise, particularly a consensus on a projection 100 years into the future. A planning horizon of 100 years is not only far beyond most planning timelines typical to public agencies, but it is also beyond the typical useful life of structural flood protection elements. In other words, even if it were financially feasible to construct a project today to protect for a sea level rise scenario in 2100, it may not be advisable to do so, since that project could be structurally unsound by the time it was needed. Finally, it should be noted that although currently the year 2100 is the most common projection date, sea levels are expected to continue to rise beyond the year 2100.

Other Climate Change Impacts

Climate change has many potential impacts in addition to sea level rise. Below, other climate change impacts which may adversely affect flooding risk of the City of San José are described. These impacts are: storm surge, wave runup, and precipitation.

Storm Surge

Coastal flooding is often the result of storm surges, which are caused by high winds and pressure differentials associated with storms. During storm events, ocean water increases in elevation due to low barometric surface pressure. This phenomenon is called storm surge. Pronounced multi-year fluctuations of San Francisco water levels above tidal elevations non-tidal residuals are evidenced in historical records for non-tidal residuals (NTRs). NTRs in San Francisco Bay are primarily from storm surge and wind driven waves. Historical records show no significant changes in the mean monthly positive NTRs between 1858 and 2000. However when considering only the highest two percent of extreme winter NTRs there has been a significant increasing trend in these extreme water elevations since about 1950.[12] This increased 'storminess' may be part of a larger cycle, but it suggests a relationship between global climate warming and overall storminess on the west coast.

The current FEMA one-percent (100-year) storm surge for San Francisco Bay at San José is 12 feet NAVD, compared to a mean high-high tide of 8.2 feet NAVD.[13] This represents a one-percent surge of almost four feet. It is *likely* that the incidence of extreme high sea level has increased at a broad range of sites worldwide since 1975.

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[12] Bromirski, 2002

[13] NOAA Vertical Datams Transformation Tool 2.2.4, Lat 37.43, Lon 121.98

Extreme high sea level is defined as the highest one percent of hourly values of observed sea level at a station for a given reference period.[14] 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 particularly 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.[15]

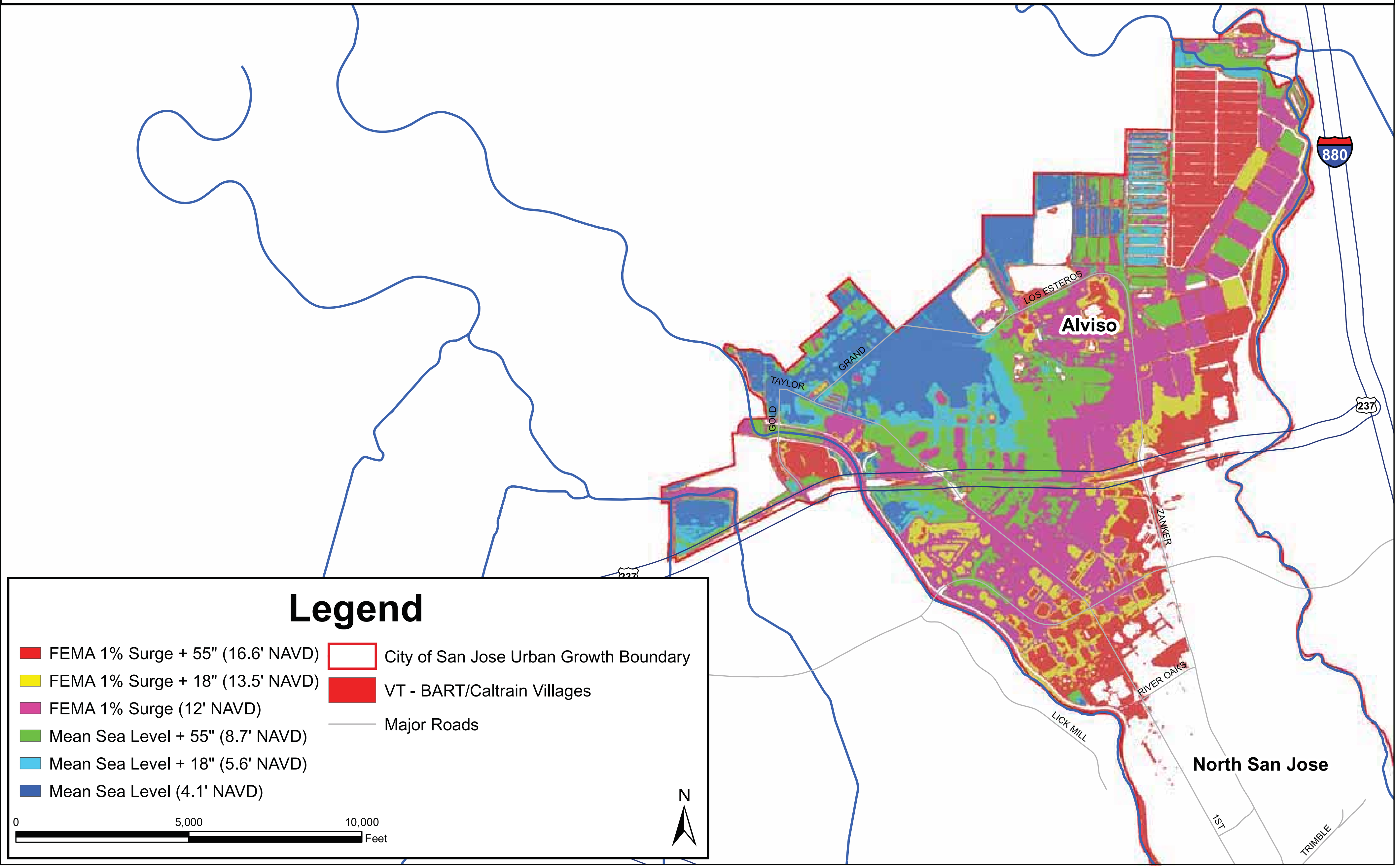
In short it is expected that as sea levels rise, not only will the occurrence of high sea level, or surge, events increase, but so may the amount of surge itself (currently about 4 feet above mean high high water in San José). This increased storm surge elevation may impact flood risk, backwater conditions and storm drainage infrastructure such as pump station operation; however quantitative estimates for the increased storm surge have not been made, and are unlikely to be determined in the near future.

Figure 1 shows the existing mean sea level and the existing FEMA storm surge elevations with both the 18-inch and 55-inch sea level rise scenarios in the absence of protective systems such as levees along the San Francisco Bay shoreline. These areas would be considered those with the potential for regulatory floodplains in the event of sea level rise with the absence of levee certification. This figure was created using the 2006 LiDAR topography, a mean sea level of 4.1 feet NAVD, and a FEMA storm surge elevation of 12 feet NAVD.

Note that Figure 1 shows the impact of sea level rise estimates on existing surge elevations – as stated previously, no estimates for climate change impacts to storm surge in the San Francisco Bay currently exist. As such, Figure 1 assumes that storm surge itself (i.e. almost 4 feet) is unaffected by climate change. Barring existing or future flood protection structures, areas shown in blue or green may be fully inundated by rising sea levels, while areas in red, yellow and pink will experience greater flood risk, and potentially, occurrence, as a result of rising sea levels. Note that the existing MHHW elevation of 8.2 feet (NAVD) is only six inches below the MSL + 55" sea level rise scenario (8.7 feet NAVD), and is 2.6 feet above the MSL + 18" sea level rise scenario (5.6 feet NAVD).

[14] Synthesis, 2007
[15] Cayan, 2007

Figure 1: Existing and Projected Mean Sea Level and FEMA 1% Storm Surge with Sea Level Rise Scenarios within the City of San José Urban Growth Boundary



In other words, 18 inches of sea level rise creates a new mean sea level that is within the current tidal prism. As such, the impact of sea level rise to flood risk exposure during extreme tide events is much greater than the impact of sea level rise to inundation from the rising mean sea level itself.

As shown on Figure 1, currently projected sea level rise and storm surge could affect areas of Alviso and North San José by 2050 and 2100. This time period is within the anticipated useful lifetime of existing or new development and infrastructure in the Alviso Specific Plan Area and the North San José Employment Lands Area. The hydraulic performance of pumps and creeks that discharge to the Bay could experience significant impacts due to rising sea levels. In addition to both public and private pumping facilities, the San José-Santa Clara Water Pollution Control Plant, which treats wastewater for over 1,500,000 people in San José and surrounding communities, is also located in the Alviso area. The Water Pollution Control Plant discharges to the South San Francisco Bay via an outfall weir/channel, Artesian Slough and Coyote Creek. Portions of the Plant are already below sea level[16], and much of the Plant is within the area currently subject to FEMA 1% Surge (12 feet NAVD). The Water Pollution Control Plant is currently protected by existing levees. As such, it is feasible that 55” of sea level rise would not inundate the Plant on an annual basis, however future storm surges could significantly impact the flood risk to the Plant, and levee failure may result in inundation of the majority of the Water Pollution Control site[17]. In addition to flood risk, rising sea levels could impact the hydraulic performance of the outfall weir of the Plant.

Wave Runup

Wave runup is the elevation wind-driven waves will reach as waves break on land and may be affected by global warming. However, these impacts are not particularly well understood at this time. A review of recently published literature finds that different published studies come to different, and at times directly opposing, conclusions regarding likely climate change impacts to wave energy. Wave heights are greatly influenced by local conditions, likely a major cause for the differing results found in the available literature. Some general trends are well understood, such as that 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.[18]

[16] City of San Jose, 2010
[17] Ibid.
[18] Cayan, 2007

Wave runup is a function of water depth, wind speed and direction, and the features of the land on which the wave is breaking (slope, roughness, etc.). In some parts of San Francisco Bay, including the San José area, rising sea levels may inundate low lying marshes, creating broad, but shallow, flooded areas. In this scenario, wave runup may decrease, as broad shallow water tends to dampen wave heights.

Published literature has found that when short term sea level is highest (i.e. during storm surge events), wave energy has an increased likelihood of reaching very high levels. The peak likely significant wave height (the average height of the one third highest waves) increases by 2.5 meters in one scenario where the surge value increased from 4 centimeters (cm) to 30 cm.[19] Thus in that particular scenario, as the storm surge increases, so does wave energy and height, which in turn may increase wave runup. That said, recent downscaled models have also indicated that the incidence of large coastal storms will lessen as part of the overall drying trend (discussed in more detail in the precipitation section below), resulting in a marginal decrease in the wind wave energy reaching California's coast as well as a decreasing trend for significant wave heights.[20] So although climate change is expected to impact storm surge and wave runup, these impacts (or even the trend of impacts) is not well understood at this time, but these impacts are expected to be less substantial than those of increasing mean sea level.

Precipitation

The IPCC states that it is *likely* that the frequency of heavy precipitation events (or proportion of total rainfall from heavy storms) has increased over most areas.[21] Global analyses of precipitation from 1901-2005 do not show statistically significant trends due to many discrepancies between data sets and the variability of precipitation in both space and time.[22] Likewise, there is no consensus among regional climate models as to how mean annual precipitation totals might change in the United States,[23] although most recent global and regional models predict that total mean precipitation will modestly decrease (5-20%) in the latter half of the next century.[24] 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.[25]

[19] Ibid
[20] Cayan, 2009
[21] Synthesis, 2007
[22] Bates, 2008
[23] Dettinger, 2004
[24] Hayhoe, 2004; Cayan, 2007
[25] DWR, 2006

While the total mean annual precipitation is not predicted to change significantly, the timing and intensity of storm events may change. Several published reports predict a tendency in California for a modest increase in the number and magnitude of large precipitation events, with longer dry periods between events,[26] however a more recent CCCC publication states that the occurrence of significant storms is expected to decline at least marginally and that the occurrence of high daily precipitation events is expected to generally remain about the same through 2100 as it does in historical projections.[27] It should be noted that this conclusion is markedly different from previous conclusions by the same authors, and that most CCCC reports reviewed for this report state the conclusion that was previously presented: that there is a modest tendency for increases in the numbers and magnitudes of large precipitation events.

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.[28] These shifts in precipitation timing and intensity may have impacts on flooding and water supply.

Water Supply

Residents and businesses in San José receive their water from one of three water retailers: Great Oaks Water Company, San José Water Company, or San José Municipal Water. Wholesale water supply sources include groundwater, recycled water, the Santa Clara Valley Water District (SCVWD), and the San Francisco Public Utilities Commission (SFPUC). Indirectly through SCVWD and SFPUC, San José receives water from snowmelt delivered to the Hetch Hetchy Reservoir via the Tuolumne River, local Bay Area runoff, and imported water from the State Water (SWP) and Central Valley Projects (CVP).

Imported water from the SWP and CVP originates in northern California watersheds and is delivered to SCVWD via the Sacramento-San Joaquin Delta. The runoff in these watersheds includes precipitation and snowmelt. Water from both the CVP and the SWP is stored in the Sacramento–San Joaquin Delta. From the Delta water is pumped to various pipes, aqueducts, and channels for delivery east and southward. Many of the pump stations and conveyance facilities of the SWP and CVP could be inundated by rising sea levels. Rising sea levels may increase the salinity of water in the Sacramento–San Joaquin Delta, affecting water supply storage and operations.

[26] Bates, 2008; Cayan 2007
[27] Cayan, 2009
[28] Dettinger, 2004; Cayan 2007; DWR 2006

Through its potable water suppliers via both SCVWD and SFPUC, San José indirectly utilizes the storage of water in snow pack as a potable water source. Rising temperatures due to global warming is expected to have significant impacts to snow pack[29], which may result in decreased water supply to San José from those suppliers who rely on snow pack as a water source.

Groundwater supplies are dependant on artificial recharge and rainfall. As described previously, a consensus on climate change impacts to mean annual precipitation does not exist. Portions of the SCVWD water supply, some of which is used for artificial groundwater recharge, originates as snow pack, and decreased water supply from snow pack due to climate change is anticipated. Meanwhile, rising sea levels may create the potential for salt water intrusion into groundwater basins. Both of these impacts, however, may be naturally offset by increased mean annual precipitation as a result of climate change, the likelihood of which is unknown. Thus, at this time the only impact to groundwater quality or groundwater supply as a result of climate change that may be anticipated with any certainty are changes in the artificial recharge operations.

Current Status of Regulations Pertaining to Climate Change

As described in the 'Tidally Influenced Areas' section of this report, climate change impacts, particularly sea level rise, may have various impacts to the City. The current status of potential regulations pertaining to climate change is explored below. Research and regulations regarding climate change are regularly, and sometimes rapidly, updated and modified; thus this section should be considered representative at its time of preparation, and may not represent a complete list of current or pending regulations.

Federal

At a Federal level there are currently very few recommendations or guidelines for incorporating the risks of sea level rise into project planning, and virtually no required measures. It should be noted, however, that with the administration change of 2009, based on President Obama's statements that global warming is a priority of the new administration, relatively rapid changes in the Federal government's involvement in global warming analyses and impacts may be forthcoming. Thus far it appears that those changes will be focused on emission standards as opposed to impact mitigation.

Flood Programs - Federal Emergency Management Agency

Although the Federal Emergency Management Agency (FEMA) has issued several statements in the last decade pertaining to climate change and the risks of global warming, at this time

[29] IPCC, 2007

FEMA policy has not changed to reflect these risks or impacts. Sea level rise is not directly considered in the National Flood Insurance Program (NFIP). In 2001 FEMA published a report on the projected impact of relative sea level rise on the NFIP, which concluded that the NFIP would not be significantly impacted by sea level rises under one foot by the year 2100, and the gradual timeframe of sea level rise provides ample opportunity for the NFIP to consider alternatives and implement them. The report recommended that FEMA should continue to monitor analyses and predictions of sea level rise and strengthen the Community Rating System (CRS) by encouraging measures that would mitigate the impacts of sea level rise (FEMA, 1991).

In March 2007 the United States Government Accountability Office published a report on the financial risks to federal and private insurers as a result of climate change, and recommended that the NFIP analyze the potential long-term fiscal implications of climate change and report these findings to Congress (GAO-07-285, March 2007). It is foreseeable that when this analysis takes place, changes to the NFIP will be made to lessen the financial risk to the insurers. Potential policy changes may include increased freeboard requirements for bay or riverfront levees and/or some consideration or discussion of sea level change in floodplain analyses, but when or if any policy changes will occur is unknown.

Sea Level Rise - United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) Planning Guidance Notebook offers some guidance on incorporating sea level rise into projects. This notebook recommends that relative sea level change should be considered in every coastal and estuarine feasibility study that the Corps undertakes; that planning should consider what impact a higher relative sea level rise rate would have on the design based on the historical rate; that sensitivity analysis should be conducted to determine what effect changes in sea level would have on plan evaluation and selections; and finally that if the plan selection is sensitive to sea level rise, then design considerations could allow for future modification when the impacts of future sea level rise can be confirmed.[30] These analyses and considerations are recommendations and not requirements.

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.[31] While incorporation of these guidelines is only required for USACE civil works projects, and as such does not directly affect the City, it may be a useful tool in the analysis of future projects.

[30] United States Army Corps of Engineers, 2000

[31] United States Army Corps of Engineers, 2009

Research on Climate Change - National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) is the federal agency that appears to have taken the lead in analyses of the impacts of global warming to the United States of America. NOAA is primarily a scientific research and reporting agency, with little regulatory power. (Recent budget proposals from President Obama suggest that this responsibility may shift from NOAA to NASA in the near future.) From the NOAA webpage:

> "NOAA is charged with helping society understand, plan for, and respond to climate variability and change. This is achieved through the development and delivery of climate information services, the implementation of a global observing system, and focused research and modeling to understand key climate processes. The NOAA climate mission is an end-to-end endeavor focused on providing a predictive understanding of the global climate system so the public can incorporate the information and products into their decisions."

National Environmental Policy Act

The Council on Environmental Quality (CEQ) provided a draft guidance memorandum on the ways in which Federal agencies can improve their consideration of the effects of greenhouse gas emissions (GHG) and climate change in their evaluation of proposals for Federal actions under the National Environmental Policy Act (NEPA).[32] The draft guidance establishes a 'trigger' for when consideration of GHG emissions should be evaluations (25,000 metric tons or more of CO_2^- equivalent GHG on an annual basis), as well as consideration of the current projection of effects from climate change on proposals. CRQ proposes that agencies should determine whether climate change considerations warrant emphasis or de-emphasis through scoping of an environmental document. If climate change effects warrant consideration, the agency may assess the extent that the effects of the proposal or its alternatives will add to, modify, or mitigate those effects. Such effects may include, but are not limited to, effects on the environment, on public health and safety, and on vulnerable populations who are more likely to be adversely affected by climate change. The level of detail in the analysis and NEPA documentation of these effects will vary among affected resource values.

State

California has been on the leading edge of creating legislation to mitigate both greenhouse gas emissions and the impacts of climate change. At this time, several concrete steps have been taken to reduce greenhouse gas emissions in the state, while specific impact mitigation strategies have been recommended but not fully developed.

[32] Council on Environmental Quality, 2010

California Environmental Quality Act

Amendments to the CEQA Guidelines which incorporate analyses and mitigation of Greenhouse Gas Emissions (GHG) went into effect in March 2010. Additions to the CEQA Guidelines Relevant to climate change include:[33]

- Lead agencies are directed to make a good-faith effort to describe, calculate, or estimate the significant of impacts from greenhouse gas emissions resulting from a particular project (15064.4 – Determining the Significance of Greenhouse Gas Emissions)).
- The EIR must discuss any inconsistencies between the proposed project and applicable general plans, specific plans and regional plans including plans for the reduction of greenhouse gas emissions (15125 – Environmental Setting).
- The lead agency is directed to consider feasible means or mitigating significant effects of greenhouse gas emissions. (15126.4 – Consideration and Discussion of Mitigation Measures Proposed to Minimize Significant Effects). Note that CEQA does not define a threshold of significance for greenhouse gas emissions.
- EIRs should include in discussion of cumulative impacts and consistency with development policies any requirements for reducing greenhouse gas emissions as set forth in adopted land use plans, policies, or regulations (15130 – Discussion of Cumulative Impacts and 15183 – Projects Consistent with a Community Plan, General Plan, or Zoning).
- The CEQA guidelines present the requirements for analyzing greenhouse gas emissions on a programmatic level such that later, project-specific environmental documents may tier from and/or incorporate by reference the programmatic review. A plan for the reduction of greenhouse gas emissions, once adopted, may be used in the cumulative impacts analysis of later projects. (15183.5 – Tiering and Streamlining the Analysis of Greenhouse Gas Emissions)
- An EIR should include evaluation of potential significant impacts of locating development in areas susceptible to hazardous conditions (such as floodplains and coastlines) as identified in authoritative hazard maps, risk assessments or in land use plans should be evaluated in an environmental impact report (EIR). (Section 15126.1 – Consideration and Discussion of Significant Environmental Impacts) Although not explicitly stated in the CEQA guidelines, this evaluation requirement may apply to local effects of climate change, such as sea level rise and increased tidal flooding.

[33] California Natural Resources Agency CEQA Guidelines Amendments (Adopted December 30, 2009, Effective March 18,2010)

California Natural Resources Agency

In November 2008, Governor Schwarzenegger signed Executive Order S-13-08 (EO), which called for the development of California's first statewide climate change adaptation strategy, to assess the state's expected climate change impacts, vulnerabilities, and recommend climate adaptation policies. This is the first legislative action to initiate active planning for the impacts of global warming in the state of California. In addition to the climate change adaptation strategy, the EO also requests that the National Academy of Science establishes an expert panel to report on sea level rise impacts in California, issues interim guidance to state agencies for how to plan for sea level rise in designated coastal and floodplain areas for new projects, and initiates a report on critical infrastructure (planned and existing) vulnerable to sea level rise.

Working with other state agencies, including the California Department of Water Resources, the California Natural Resources Agency published the *California Climate Adaptation Strategy* Report in 2009.[34] The Adaptation Strategy Report calls for integrating land use and climate adaptation planning through community general planning efforts. Recommendations in the report that apply to the City of San José's General Plan update process include:

- Consider project alternatives that avoid significant new development in areas that cannot be adequately protected from flooding, wildfire and erosion due to climate change. However, vulnerable shoreline areas containing existing development may have to be protected, and in-fill development in these areas may be accommodated.
- Communities with General Plans and Local Coastal Plans should begin, when possible, to amend their plans to assess climate change impacts, identify areas most vulnerable to these impacts, and develop reasonable and rational risk reduction strategies using the Climate Adaptation Strategy Report as guidance.
- All state agencies responsible for the management and regulation of public health, infrastructure, or habitat subject to significant climate change should prepare agency-specific adaptation plans, guidance, or criteria.

Assembly Bill 32

The California Global Warming Solution Act, also known at Assembly Bill 32 (AB32), was signed into law by Governor Schwarzenegger in 2006. AB32 requires the California Air Resources Board (CARB) to:

- Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions by January 1, 2008.

[34] California Natural Resources Agency, 2009

- Adopt mandatory reporting rules for significant sources of greenhouse gases by January 1, 2009.
- Adopt a plan by January 1, 2009 indicating how emission reductions will be achieved from significant greenhouse gas sources via regulations, market mechanisms and other actions.
- Adopt regulations by January 1, 2011 to achieve the maximum technologically feasible and cost-effective reductions in greenhouse gas, including provisions for using both market mechanisms and alternative compliance mechanisms.
- Convene an Environmental Justice Advisory Committee and an Economic and Technology Advancement Advisory Committee to advise CARB.
- Ensure public notice and opportunity for comment for all CARB actions.
- Prior to imposing any mandates or authorizing market mechanisms, CARB must evaluate several factors, including but not limited to impacts on California's economy, the environment and public health; equity between regulated entities; electricity reliability, conformance with other environmental laws and ensure that the rules do not disproportionately impact low-income communities.

In September 2008, Governor Schwarzenegger signed Senate Bill 375, which builds on AB32 by requiring the CARB to develop regional greenhouse gas emission reduction targets to be achieved from the automobile and light truck sectors for 2020 and 2035. Both AB32 and Senate Bill 375 focus on reducing greenhouse gas emissions, as opposed to predicting or mitigating climate change impacts in California.

AB 32 Scoping Plan

The AB 32 Scoping Plan contains the main strategies California will use to reduce greenhouse gases (GHG) that cause climate change. The Scoping Plan has a range of GHG reduction actions which include direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, market-based mechanisms such as a cap-and-trade system, and an administrative fee to fund the program. The Scoping Plan was approved at the Air Resources Board hearing on December 11, 2008. Six greenhouse gas emission reduction measures are proposed for the water sector. They address water use efficiency, water recycling, water system energy efficiency, reuse of urban runoff, increased renewable energy production and public goods charges for funding investments that improve water and energy efficiency.[35]

[35]California Air Resources Board, October 2008: *Climate Change Proposed Scoping Plan; A framework for Change.*

California Climate Action Team

The California Climate Action Team (CAT) was established by Governor Schwarzenegger under an Executive Order on June 1, 2005. The purpose of the CAT is to coordinate state-level actions relating to Climate Change. The Team is led by the Secretary of the California Environmental Protection Agency and includes the Secretary of the Business, Transportation and Housing Agency, Secretary of the Department of Food and Agriculture, Secretary of the Resources Agency, Chairperson of the Air Resources Board, Chairperson of the Energy Commission and President of the Public Utilities Commission. The Climate Action Team is charged with implementing global warming emission reduction programs and reporting on the progress made toward meeting the statewide greenhouse gas targets that were established in the AB32. Reports published by the CAT offer a comprehensive summary of the understanding of climate change impacts to California on a biennial basis. The most recent Climate Action Team Biennial Report was completed in April, 2010. It is unclear if this report is finalized or still in Draft form.

California Water Plan

Following the passage of AB 32 in 2006 which called for a reduction in greenhouse gas emissions, DWR voluntarily joined the California Climate Action Registry. DWR addresses climate change in its California Water Plan, updated every five years, that provides a framework for water managers, legislators, and the public to consider options and make decisions regarding California's water future. In July 2008, DWR published a technical memorandum report on the progress of incorporating climate change into the management of California’s water resources. The focus of this report was the impact of global warming to California’s water supply, although increased flood risks were presented in brief. In October 2008, the Department released a climate change white paper that proposes a series of adaptation strategies for state and local water managers to improve their capacity to handle change. On a regional level these strategies include integrated water management and increased water use efficiency.

Senate Bill X7 7 / 20x2020 Water Conservation Plan

The *20x2020 Water Conservation Plan (20x2020 Plan)*, finalized in February 2010, describes a plan to achieve a 20% reduction in urban water demand by 2020. A draft version of this plan served as the basis for California Senate Bill X7 7, which was passed in November, 2009. Senate Bill X7 7 establishes a statewide water conservation program aimed at reducing per capita statewide urban water use by 10% by 2015 and 20% by 2020. The *20x2020 Plan* sets forth the range of activities designed to meet this goal. The baseline statewide use set forth in the 20x2020 Plan is 192 gallons per capita per day (GPCD), with corresponding statewide targets of 173 GPCD by

2015 and 154 GPCD by 2020. San Francisco Bay Region, the California Department of Water Resources Hydrologic Region 2, has a baseline of 157 GPCD for 2005 with corresponding targets of 144 GPCD for 2015 and 131 GPCD for 2020.

Methods to achieve these water reduction goals that may impact the City of San José include: mandating the landscape irrigation Best Management Practices (BMPs), accelerate installation of water meters, encourage or mandate conservation water pricing, provide grants, loans, and rebates to wholesale and retail water suppliers and customers, require implementation of water conservation as a condition to receive stat financial assistance, and increase the use of recycled water and non-traditional sources of water.

Decreased water use mitigates neither the causes nor affects of climate change; however it may decrease the impact of decreased water supply to the City. As described previously, quantitative estimates for how climate change will impact City water retailers is unknown. As such, the mitigation significance of a 20% decrease in water demand is also unknown.

Local and Regional

San Francisco Bay Conservation and Development Commission

The San Francisco Bay Conservation and Development Commission (BCDC) was created in 1965 by the McAteer-Petris act, and mandated to study, prepared, and submit a report of its finding to the California Legislature. BCDC completed and adopted the San Francisco Bay Plan in 1968, and transmitted it to the California legislature in 1969, thereby completing its original charge. The San Francisco Bay Plan presents policies to guide future uses of the Bay and shoreline, and maps that apply these policies to the present Bay and shoreline.

In August 2008, Assembly Bill 2094 was passed.[36] This legislation affects BCDC in two ways: first, it authorizes BCDC to join an existing joint policy committee to coordinate and improve the quality of land use, transportation, and air quality planning in the Bay Area, and second, it allows BCDC (in consultation with local and regional governments) to develop regional strategies, as needed, to address the impacts of and adapting to the effects of sea level rise and other impacts of global climate change on the San Francisco Bay and affected shoreline areas.

Regional strategies may include, but are not limited to: identification of areas that may be subject to impacts from sea level rise and climate change, economic and environmental benefit cost analyses of protecting areas likely to be impacted, and a plan that describes how to mitigate and adapt to projected sea level rise impacts on the bay and shoreline.

[36] http://info.sen.ca.gov/pub/07-08/bill/asm/ab_2051-2100/ab_2094_cfa_20080411_192102_asm_comm.html

In summary, AB 2094 increased the authority of BCDC to analyze, participate in, and develop regional strategies related to climate change and sea level rise, but does not appear to affect BCDC's jurisdictional area.

BCDC is in the process of amending the Bay Plan to include consideration of climate change. The justification for these policy changes consistent with the McAteer-Petris Act is that public access is vulnerable due to flooding from sea level rise, and that public access needs to be maintained and guaranteed for the life of the project (hence the inclusion of predictive sea level rise scenarios). This process has included public workshops and hearings. 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 that may be relevant to the City include the following:[37]

- "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 protect 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 engineered 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

[37] 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.

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 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 and 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 City's approach to development, planning, and design of both flood control projects and new or re-development within portions of the City. Providing no significant changes are made to the publicly presented amendments, these changes could be adopted by BCDC at any time.

San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is a department of the City and County of San Francisco that provides water, wastewater, and municipal power services to San Francisco. Under contractual agreement with 28 wholesale water agencies, the SFPUC also supplies water to 1.6 million additional customers within three Bay Area counties, including customers in San José. SFPUC has made recent efforts to expand and diversify its water supply portfolio. A technical memorandum developed various diversified portfolios, including water conservation, groundwater, recycled water, and desalination.[38] In May 2008 the SPFUC passed a resolution calling for further steps to develop and expand recycled water as a water source.[39]

Santa Clara Valley Water District

The SCVWD is the primary wholesale water supplier in Santa Clara County, and acts as a steward for water resources in the County. The District owns and manages 10 local surface reservoirs and associated creeks and recharge facilities, manages the county's groundwater sub-basins and three water treatment plants, imports water from the Central Valley Project and the State Water Project and delivers recycled water to parts of the county.

The SCVWD manages the water resources within the County of Santa Clara including surface reservoirs, creeks and recharge facilities, groundwater sub-basins and water treatment plants, recycled water and water imports. The SCVWD's water supply relies on groundwater, imported water from the State Water and Central Valley Projects, the SFPUC Hetch Hetchy system, recycled water, and local surface water. Local and imported water is used to recharge the groundwater basin and delivered to potable water treatment plants. Treated water is subsequently delivered to retailers.

The largest supply of water to the District is groundwater (~45%), followed by treated delivered water, which makes up about one third of total District supplies. "Treated water" refers to water delivered by the California Department of Water Resources (DWR) or U.S. Bureau of Reclamation (USBR) to SCVWD facilities and treated either on site or prior to delivery. Imported water comes to the county from Northern California watersheds via the Sacramento-San Joaquin Delta.

Conclusion

Regulations regarding climate change are currently in a state of rapid development and fluctuation. At this time, the most significant existing regulations potentially affecting the City are those contained in the City Local Action Plan.

That the global climate is currently experiencing a warming trend is undisputable. This warming trend will have impacts to water resources in San José, although quantitative estimates of those impacts offer a range at best, with many impacts not understood except in general trend or qualitative terms. Projections of climate change and its impacts are strongly scenario-dependent and model-dependent, and the range of impacts grows broader the farther into the future those impacts are projected.

[38] SFPUC Water Resources Planning, 2007
[39] SFPUC CAC June 16, 2008

In addition to sea level rise, both storm surge and wave height, and therefore wave runup, are expected to increase by 2100 due to climate change, although quantitative estimates for storm surge and wave height impacts are not available. Although precipitation is expected to shift in timing and intensity, mean annual precipitation is not predicted to change significantly. The increase in precipitation may be offset by additional drying time between storms, and impacts to watershed runoff can not be made at this time. Thus, the only quantifiable flood risk impact to San José due to climate change are the impacts associated with an increase in sea level rise, and a wide range, with no assigned certainties or upper bounds to that range, is projected. Projected sea level rise could affect existing infrastructure and development in the Alviso Planning Area and the northern most area of North San José Employment Lands. Under CEQA, future development in these areas will need to consider the likelihood of sea level rise or flooding impacts and adaptive strategies to reduce adverse effects. The nature of identified impacts and adaptations are likely to change as sea level and climate change impacts are monitored and adaptation strategies further developed at the local, state, and federal level.

The most 'common sense' mitigation project for rising sea levels is the construction of regional bayfront levees. There are two key elements to consideration of structural projects to mitigate rising sea levels: coordination with neighboring communities, and uncertainty in sea level rise projections. At this time, San José may take concrete steps toward the long term goal of sea level rise mitigation, including conducting preliminary feasibility analyses for levee locations, and coordinating efforts with neighboring communities and the US Army Corps of Engineers. It must be noted that the construction of new bayfront levees, or significant modification of existing levees, may have significant environmental impacts.

Through its potable water suppliers, San José is indirectly dependant on the storage of water in snowpack. Climate Change is expected to have significant impacts to snowpack, resulting in decreased water supply. San José may take steps to lessen its reliance on snowpack-provided drinking water through increased water efficiency, and exploring, encouraging, or increasing various alternative water supply sources such as rainwater harvesting, recycled water utilization, groundwater, or desalinization.

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