San Francisco Bay Area
Integrated Regional Water Management Plan

October 2019

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Chapter 1: Governance

This chapter of the 2019 San Francisco Bay Area Integrated Regional Water Management Plan (IRWMP or Plan) Update describes the Regional Water Management Group (RWMG), stakeholders, and the IRWMP governance structure. This chapter also covers the evolution of the structure and function of the governance since 2004 through the current Plan update process.

1.1 Background

The IRWMP is an outgrowth of a collaborative process that began in 2004, when regional and local associations, agencies, groups, and organizations in the San Francisco Bay Area signed a Letter of Mutual Understandings (LOMU) to develop an IRWMP for the nine-county San Francisco Bay Area. To facilitate development of the 2006 Integrated Regional Water Management Plan (2006 Plan), the participants agreed to organize into four Functional Areas (FA):

- Water Supply & Water Quality,
- Wastewater & Recycled Water,
- Flood Protection & Stormwater Management, and
- Watershed Management & Habitat Protection and Restoration.

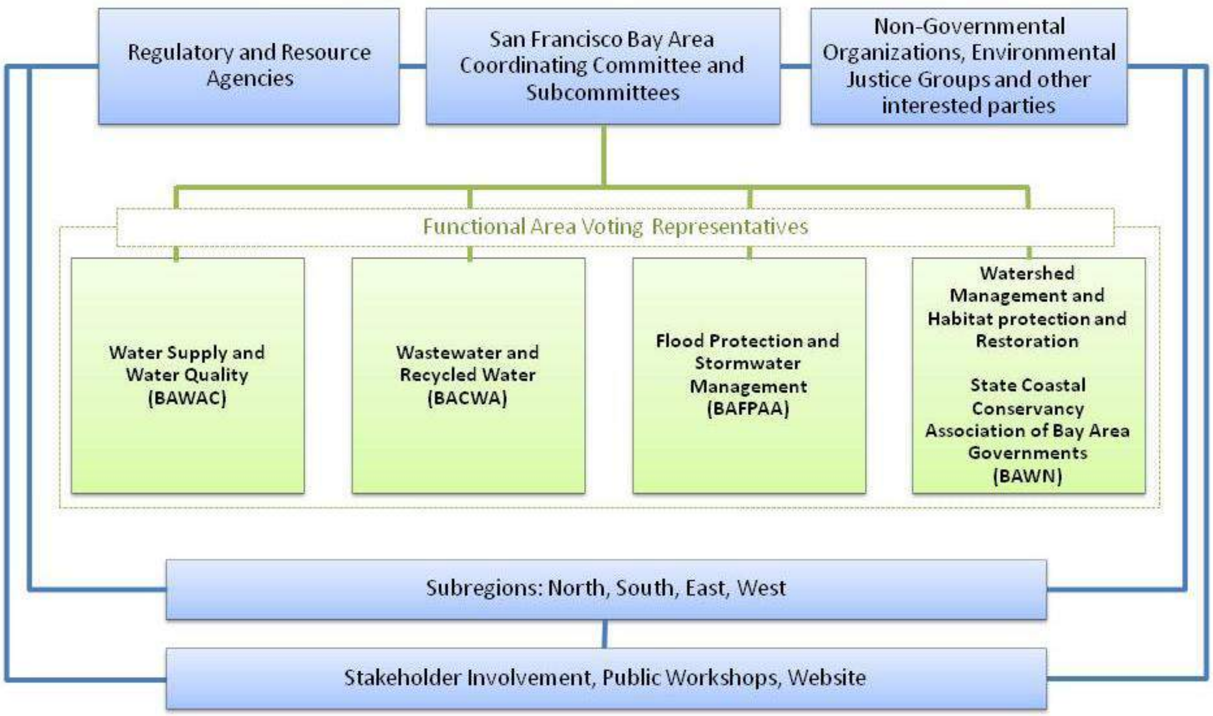
Representatives from agencies that represented the FAs formed a Technical Coordinating Committee which served as the original governing body and provided oversight for the IRWMP process. In January 2007, following completion of 2006 Plan, this group became known as the San Francisco Bay Area IRWMP Coordinating Committee (CC).

During the development of the Region Acceptance Process (RAP) in 2009, the CC developed an additional organizational structure based on demographic and geographic divisions in order to address the challenges of integrated management at the scale of the San Francisco Bay Area IRWM Region (Bay Area Region or Region). Four Subregions were defined: East, West, South, and North. The Subregions have subsequently become the focal points for outreach and project solicitation and integration in the IRWMP. The CC still includes representatives from the FAs and the FAs continue to address IRWM issues as needed.

1.2 Governance Team and Structure

This section describes roles and responsibilities of the IRWMP participants. As Figure 1 illustrates, regulatory agencies, non-governmental organizations, environmental groups, business groups, the public and other interested parties participated in the development of the IRWMP, serving in an advisory role at the CC and Subregion levels. The participants and their roles are described in the following sections.

Figure 1-1: IRWMP Governance Structure



1.2.1 Coordinating Committee

The CC is the “RWMG” for the IRWMP. The role of the CC is to provide leadership, oversight and administrative support for the San Francisco Bay Area IRWM process. The CC is composed of representatives from Bay Area water supply agencies, wastewater agencies, flood control agencies, ecosystem management and restoration agencies, regulatory agencies, non-governmental organizations (NGOs), and members of the public. Any interested person may participate on the CC.

The CC is responsible, directly or through participating agencies, for decision-making and actions including, but not limited to, establishing IRWMP goals and objectives, prioritizing projects, identifying financing for CC and IRWMP activities, implementing Plan activities, making future revisions to the IRWMP, hiring and managing consultants, coordinating, authorizing and/or approving grant proposals and managing funding agreements. The CC has no independent fiscal responsibility or capability except via the participating organizations.

Legal actions such as contracting and submitting grant funding applications are carried out by individual participating agencies on behalf of the CC, and cost sharing agreements are developed on a case-by-case basis as necessary. Costs associated with administrative functions of the CC, IRWMP development, and Plan implementation are covered in a variety of ways, including grants, multi-agency contributions through FA associations, funds from individual project proponents, and in-kind contributions of staff time from participating entities.

The CC is composed of a Chair and Vice Chair, individuals from resource and regulatory agencies, non-governmental organizations and other interested stakeholders, including members of the public. There are 12 voting representatives made up of three representatives from each of the four FAs, many of which have statutory authority over water resources. Guidelines for the CC established in June 2007 defined two-year terms for the Chair and Vice Chair and stipulate that the Chair and Vice Chair cannot be from the same water/wastewater and flood/watershed combined FAs (see Appendix A-1: Chair and Vice Chair Roles). For more information on the CC's decision-making process, see Section 1.3.2.

The CC meets monthly. Agendas are distributed in advance via listserv (about 314 contacts as of this IRWMP) and are posted to the IRWMP website. After each meeting, summaries are posted on the IRWMP website. The listserv is open to anyone who signs up on the IRWMP website.

The following subsections identify the stakeholders that make up the full CC, which include water resource management agency and other stakeholders, LOMU signatories, FA representatives – statutory (voting) members of the CC, and subcommittees.

1.2.2 Stakeholders

The goals in promoting stakeholder engagement are to:

- Develop a broader understanding of the water resources management needs of the Bay Area Region;
- Expand the scope of the IRWMP (from the 2006 version) to define in more detail the relationship between land use planning decisions and water resources management decisions;
- Engage NGOs, resource management agencies, and other stakeholder groups in a more comprehensive manner in the IRWMP update process; and
- Identify and address the needs of disadvantaged and tribal communities.

A broad stakeholder outreach process is crucial to ensure that this IRWMP identifies local issues, reflects local needs, promotes the formation of partnerships, and encourages coordination with state and federal agencies. One of the benefits of this planning process is that it brings together a broad array of groups into a forum to discuss and better understand shared needs and opportunities. Residents of the Region are facing rapidly changing conditions, mainly related to urban growth, that create challenges in water resources management and the stewardship of environmental resources. Agencies and planning jurisdictions must work closely together in order to assure the delivery of clean, reliable water supplies while maintaining the quality of life and environmental values in the Region. If sufficient planning is not undertaken, the consequences for the Region could be significant.

The IRWMP benefits from active participation by a wide range of Stakeholders. Stakeholders are defined as any person or organization interested in or affected by provisions of the IRWMP and more broadly by water resources management decisions. Members of the CC and other Stakeholders have participated in periodic Stakeholder meetings, reviewed draft document materials, and provided collaborative input to shape the formation of this IRWMP. Stakeholder comments are recorded and the CC responds to these comments by indicating how they were reflected in the IRWMP or if not, why not. By participating in Stakeholder meetings to develop this IRWMP, participants have created opportunities for establishing and developing mutually beneficial partnerships.

All water resources management agencies in the Bay Area Region are represented in the IRWM planning process either directly or indirectly through membership in a participating association or other business relationship, such as membership in Bay Area Water Agencies Coalition (BAWAC), Bay Area Clean Water Agencies (BACWA) and Bay Area Flood Protection Agency Association (BAFPAA).

1.2.2.1 Identification of Stakeholder Types

During the development of the IRWMP, targeted stakeholder outreach activities involved a diverse group of water supply, water quality, wastewater, stormwater, flood control, watershed, municipal, environmental, and regulatory groups. These outreach activities sought to inform, educate, and engage constituents, stakeholders, and interested parties throughout the nine-county Bay Area. Targeted outreach was conducted via stakeholder workshops, Subregional and individual County/Agency outreach to stakeholders in their particular area, and a new website.

The list of IRWMP stakeholders is maintained by the CC; stakeholders for the IRWMP have been identified through the following mechanisms:

- **Development of the 2006 Plan**

  Stakeholders were initially identified during the development of the 2006 Plan through collection of information directly from water resources management agencies and through outreach efforts and public meetings. Some information about stakeholders was also collected during the development of the four Functional Area Documents (FADs) that served as a baseline to the 2006 Plan. As development of the IRWMP progressed, additional stakeholders were identified through workshops, local government meetings, the project website and several other forums. The Stakeholder database was updated to reflect additional stakeholder groups identified through the 2013 IRWMP outreach activities.

- **Development of Local Planning Documents**

  Stakeholders were also identified from the public involvement process that occurred during the development of the individual agency planning documents used to develop the FADs (e.g., General Plans, Urban Water Management Plans, Water Supply Master Plans, Wastewater Master Plans, Recycled Water Master Plans, Flood Protection Management Plans, Stormwater Management Plans, Watershed Management Plans, etc.).

- **Subregional Workshops and Regional Outreach and Meetings**

  The Subregional leads organized and facilitated community workshops using an updated listserv and other notifications to publicize the meetings. The workshops provided an overview of the value of regional water management planning, examples of successful grant applications, an overview of the update process, and highlights of the new climate change element of the Plan. Stakeholders were able to ask questions and were invited to consider local water resources management challenges that could be addressed through collaboration with partners.

- **Disadvantaged Communities**

  The 2013 IRWMP update process targeted Disadvantaged Communities (DACs) for inclusion in the development of the IRWMP and identification of potential water resources management projects. The California Department of Water Resources (DWR) defines DACs as communities in which the Median Household Income (MHI) is less than 80% of the statewide average. Using 2010 Census data, communities that fit the economic threshold were identified. Subregional leads and other CC stakeholder members identified potential regional water resources management challenges that affected these communities in particular and/or other agencies and resources that would know about water supply and water quality challenges in those communities. Subregions have targeted agencies and organizations specific to those communities and engaged in concerted outreach to make them aware of the IRWMP update process, solicit their participation, help identify water resources management problems, and offer assistance so DACs could understand their opportunities to have their needs and concerns addressed by the Plan and its list of proposed projects for state funding. The outreach and engagement team will assist Subregions to make continued progress with these DAC outreach efforts.

  In 2016, the Bay Area began its IRWM Disadvantaged Community and Tribal Involvement Program (DACTIP) process, funded through the 2014 Water Quality, Supply, and Infrastructure Improvement Act (Proposition 1) and administered by The CA Department of Water Resources. The Bay Area IRWM Coordinating Committee endorsed the Environmental Justice Coalition for Water (EJCW) to be the Grant Administrator and Program Manager for the Bay Area, who partnered with the California Indian Environmental Alliance (CIEA) to coordinate outreach, capacity building, and a needs assessment for Bay Area Tribes. The mandate of the program is to include underrepresented populations (including Disadvantaged Communities (DACs), Under-represented Communities (URCs), Economically Disadvantaged Areas (EDAs), and Tribes) into IRWM and other water-related decision making processes. The ultimate goal is to build the capacity of communities and community-based groups to develop and submit IRWM-eligible projects for implementation to address priority water issues identified through tailored outreach and needs assessment processes. EJCW originally partnered with 17 community-based groups and agencies located in DACs around the Bay Area to conduct these tailored outreach and needs assessment processes. In 2019, grant administration for the program was transferred to the San Francisco Estuary Partnership (SFEP). See Chapter 14 Section 6 and 7 for additional information on the DACTIP.

- **Native American Tribes**

  Tribal members are dispersed into the Bay Area population and in some cases do not live in Tribal-specific communities. With that as a challenge, the initial outreach and engagement team for the 2013 Plan Update worked with Tim Nelson, DWR Tribal Liaison for the North Central Region Office and the state Native American Heritage Commission to identify tribal members in the Bay Area Region. Beginning with the

Disadvantaged Communities and Tribal Involvement Program (DACTIP), the Environmental Justice Coalition for Water (EJCW), contracted with the California Indian Environmental Alliance (CIEA) to coordinate outreach and capacity-building for Bay Area Tribes. The ultimate goal of the Tribal process is to include Bay Area Tribes and Bay Area Tribal communities in the local IRWM decision-making bodies directly and for those Tribes and Tribal organizations to be prepared to submit and implement IRWM eligible projects. CIEA first conducted outreach to Tribes and Tribal organizations whose members are descended of the first people of the Bay Area. Several regional Tribes have been identified. Of these, CIEA has partnered with five Tribal Program Partners to receive support and develop their own capacity to work on water stewardship and planning in the Bay Area. Tribal Program Partners include the Amah Mutsun Tribal Band, Association of Ramaytush, Him-R^n, Indian People Organizing For Change (IPOC), and the Muwekma Ohlone. CIEA's initial effort of identifying Tribal interests involved outreach to Ohlone gatherings, reaching out to Tribal Chairmen and Chairwomen to discuss the opportunity of the DACTIP and conducting interviews with Tribal representatives about their water resources management needs, concerns, interests and ability to participate in the development of Tribal-specific projects that could be addressed through IRWM. See Chapter 14 Sections 6 & 7 for additional information on the DACTIP.

1.2.3 Letter of Mutual Understandings Signatories

The following organizations are signatories to the 2004 LOMU and continue to be involved:

1.2.3.1 Alameda County Water District

The Alameda County Water District (ACWD) is a retail water purveyor supplying drinking water to more than 320,000 people living in the Cities of Fremont, Newark and Union City. The District also provides conservation/protection of the Niles Cone Groundwater Basin, one of its sources of water supply.

1.2.3.2 Association of Bay Area Governments

The Association of Bay Area Governments (ABAG) serves as the council of governments and comprehensive planning agency for the San Francisco Bay Area. It was established in 1961 to protect local control, plan for the future, and promote cooperation on area-wide issues. ABAG's region comprises the nine Bay Area counties—Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma—and the 101 cities within those counties, serving over 7 million people in a 7,000 square mile area. ABAG committees also include representatives from the Bay Conservation and Development Commission (BCDC), Metropolitan Transportation Commission (MTC), Bay Area Economic Forum, and more. ABAG programs include conducting research and analysis and providing planning and outreach. ABAG projects range from job and population research, data analysis, earthquake preparedness research, green business strategies to on-line training classes. In addition, ABAG administers the San Francisco Estuary Partnership (SFEP).

1.2.3.3 Bay Area Clean Water Agencies

BACWA is a joint powers authority (JPA) formed in 1984 comprised of local governmental agencies that operate publicly owned treatment works (POTWs) which discharge to the waters of San Francisco Bay Estuary. Together, BACWA's members serve more than 7 million people in the nine-county Bay Area, treating all domestic and commercial wastewater and a significant amount of industrial wastewater. BACWA is governed by a five person Executive Board comprised of one representative from each of the joint powers agreement signatory agencies: Central Contra Costa Sanitary District (CCCSD), East Bay Dischargers Authority, East Bay Municipal Utility District (EBMUD), the City and County of San Francisco, and the of San Jose. BACWA and its members support committees and groups that facilitate communication about key issues affecting the municipal wastewater community, keep agency staff apprised of important regulatory and policy developments, and provide a venue for establishing regional collaboration. BACWA served as the fiscal agent for development of the Bay Area Regional Water Recycling Project Master Plan. BACWA members that are located in the Bay Area Region are listed in Table 1-1.

Table 1-1: Bay Area Clean Water Agencies (BACWA) Members[1]

Public Agencies

Table 1: Central Contra Costa Sanitary District	**Table 20:** Napa Sanitation District
Table 2: Central Marin Sanitation Agency	**Figure 8:** North San Mateo Sanitation District
Table 3: City of Belmont	**Figure 9:** Novato Sanitary District
Table 4: City of Benicia	**Figure 10:** Pinole/Hercules WPCP
Table 5: City of Brisbane Public Works	**Figure 11:** San Francisco International Airport
Table 6: City of Burlingame WWTP	**Table 21:** San Francisco Public Utilities Commission
Table 7: City of Fairfield	**Figure 12:** San Mateo County
Table 8: City of Livermore	**Figure 13:** Sanitary District of Marin County No. 1 (Ross Valley)
Table 9: City of Millbrae	**Figure 14:** Sanitary District of Marin County No. 2 (Corte Madera)
Table 10: City of Palo Alto	**Figure 15:** Sanitary District of Marin County No. 5 (Tiburon)
Figure 1: City of Petaluma	**Figure 16:** Santa Clara County Sanitation District No. 2-3
Figure 2: City of Piedmont	**Figure 17:** Sausalito/Marin City Sanitary District
Figure 3: City of Pleasanton	**Figure 18:** Sewage Agency of Southern Marin
Figure 4: City of Redwood City	**Figure 19:** Sewer Authority Mid-Coastside
Figure 5: City of Richmond WPCP	**Figure 20:** Sonoma County Water Agency
Figure 6: City of San Carlos	**Table 22:** South Bayside System Authority (South San Francisco/San Bruno WQCP, City of Belmont, City of Redwood City, City of San Carlos, West Bay Sanitary District)
Table 11: City of San Jose	**Figure 21:** Stege Sanitary District
Table 12: City of San Mateo	**Figure 22:** Tamalpais Community Services District
Figure 7: City of St. Helena	
Table 13: City of Sunnyvale	
Table 14: Delta Diablo Sanitation District	
Table 15: Dublin-San Ramon Services District	
Table 16: East Bay Dischargers (City of San Leandro, Oro Loma Sanitary District, Castro	

[1] The Sacramento Regional County Sanitation District is also a BACWA Member, but its service area falls outside of the jurisdiction of the San Francisco Regional Water Quality Control Board (it is in the Central Valley RWQCB), which defines the Bay Area region for this IRWMP.

Public Agencies

Valley Sanitary District, City of Hayward, Union Sanitary District)	**Figure 23:** Town of Yountville
Table 17: East Bay Municipal Utility District	**Table 23:** Vallejo Sanitation & Flood Control District
Table 18: Fairfield-Suisun Sewer District	**Figure 24:** West Bay Sanitary District
Table 19: Mt. View Sanitary District	**Table 24:** West County Agency
	Figure 25: West Valley Sanitation District

1.2.3.4 Bay Area Water Supply and Conservation Agency

The Bay Area Water Supply and Conservation Agency (BAWSCA) was created in 2003 to represent the interests of 26 cities and water districts, as well as two private utilities that purchase water from the San Francisco Regional Water System. BAWSCA's goals are to ensure high-quality, reliable water supply for the 1.7 million people residing in Alameda, Santa Clara, and San Mateo Counties that depend on the San Francisco Public Utilities Commission (SFPUC) regional water system. BAWSCA has the authority to coordinate water conservation, supply and recycling activities for its agencies; acquire water and make it available to other agencies on a wholesale basis; finance projects, including improvements to the regional water system; and build facilities jointly with other local public agencies or on its own to carry out the agency's purposes. BAWSCA's member agencies are listed in Table 1-2.

Table 1-2: Bay Area Water Supply and Conservation Agency (BAWSCA) Members

Cities and Water Districts

1 Alameda County Water District	• City of Millbrae
2 City of Brisbane	• City of Milpitas
3 City of Burlingame	• City of Mountain View
4 Coastside County Water District	• North Coast County Water District
5 City of Daly City	• City of Palo Alto
6 City of East Palo Alto	• Purissima Hills Water District
7 Estero Municipal Improvement District	• City of Redwood City
8 Guadalupe Valley Municipal Improvement District	• City of San Bruno
9 City of Hayward	• City of San Jose
10 Town of Hillsborough	• City of Santa Clara
11 Los Trancos County Water District	• Skyline County Water District
12 City of Menlo Park	• City of Sunnyvale
13 Mid-Peninsula Water District	• Westborough Water District

Private Utilities

• California Water Service Company	• Stanford University

1.2.3.5 Contra Costa County Flood Control and Water Conservation District

The Contra Costa County Flood Control and Water Conservation District (CCC FC&WCD) manages the flood- and stormwaters in city and county areas of Contra Costa County, develops flood control plans, and establishes and collects development fees. CCC FC&WCD is an active partner in the Contra Costa Clean Water Program, which jointly holds a National Pollutant Discharge Elimination System (NPDES) permit containing a comprehensive plan to reduce the discharge of pollutants to the maximum extent practicable.

1.2.3.6 Contra Costa Water District

Formed in 1936, the Contra Costa Water District (CCWD) is a retail and wholesale water distributor, delivering treated drinking water directly to customers in central and eastern Contra Costa County. In addition, wholesale treated water is provided to the City of Antioch, the Golden state Water Company in Bay Point, the Diablo Water District in Oakley, and the City of Brentwood. CCWD provides raw (untreated) water to the Cities of Antioch, Martinez and Pittsburg, as well as to industrial and irrigation customers. CCWD serves approximately 500,000 people and is one of the larger urban water districts in northern California and a leader in the protection of the Sacramento-San Joaquin Delta. CCWD serves as the contract administrator for the East Contra Costa County IRWMP.

1.2.3.7 East Bay Municipal Utility District

Formed in 1923, EBMUD provides water for approximately 1.3 million people in a 331-sq-mile area in Contra Costa and Alameda counties, extending from Crockett on the north, southward to San Lorenzo (encompassing the major cities of Oakland and Berkeley), eastward from San Francisco to Walnut Creek, and south through the San Ramon Valley. EBMUD's wastewater system serves approximately 685,000people in an 88-sq-mile area in Contra Costa and Alameda counties along the Bay's east shore, extending from Richmond on the north, southward to San Leandro.

1.2.3.8 Marin Municipal Water District

The Marin Municipal Water District (MMWD) has been providing drinking water to residents in Marin County since 1912. MMWD currently serves approximately 190,000 people in a 147 square mile area of Marin County.

1.2.3.9 City of Napa

The City of Napa has been operating a municipal drinking water system since 1922. Located at the northeast end of San Pablo Bay in the lower Napa Valley, the City currently serves more than 86,000 people in and around the City limits and Upvalley along the Conn Transmission Main. The City also provides treat-and-wheel service of State Water Project (SWP) supplies to the Cities of American Canyon and Calistoga, and makes retail water available for the Town of Yountville and the City of St. Helena. Within the City of Napa's service territory, recycled water is supplied by the Napa Sanitation District.

Steelhead and Chinook in the Napa River

1.2.3.10 North Bay Watershed Association

The North Bay Watershed Association (NBWA) is a partnership of 16 public agencies in Marin, Sonoma, and Napa counties dedicated to facilitating projects and activities across political boundaries to promote the stewardship of the San Pablo Bay watershed. Agencies participate in the NBWA to discuss issues of common interest, explore ways to work collaboratively on water resources projects of regional concern, and share information about projects, regulations, and technical issues. The partner agencies of the NBWA are listed in Table 1-3.

Table 1-3: North Bay Watershed Association (NBWA) Agencies

Partner Agencies	
• Bel Marin Keys Community Services District • Central Marin Sanitation Agency • City of Petaluma • City of San Rafael • City of Sonoma • County of Marin • County of Sonoma • Las Gallinas Valley Sanitary District • Marin County Stormwater Pollution Prevention Program	1. Marin Municipal Water District 2. Napa County Flood Control and Water Conservation District 3. Napa Sanitation District 4. North Marin Water District 5. Novato Sanitary District 6. Sonoma County Water Agency 7. Sonoma Valley County Sanitation District
Associate and Group Associate Members	
• City of Mill Valley • Sewerage Agency of Southern Marin 8. City of Novato	9. The Bay Institute 10. Tomales Bay Watershed Council

1.2.3.11 City of Palo Alto

The City of Palo Alto operates city-owned utility services that include electric, fiber optic, natural gas, water and wastewater services. The City of Palo Alto provides water supply for approximately 60,000 people living in the City of Palo Alto and has received all of its potable water supply from the SFPUC since 1962. The City of Palo Alto is a member of BAWSCA, and works through BAWSCA to manage its SFPUC contract and to interact with the SFPUC. In addition to water supply, the City of Palo Alto provides wastewater and recycled water services for over 200,000 residents of Palo Alto and its surrounding areas. The Palo Alto Regional Water Quality Control Plant treats wastewater from the East Palo Alto Sanitary District, Los Altos, Los Altos Hills, Mountain View, Palo Alto, and Stanford.

1.2.3.12 San Francisco Public Utilities Commission

The SFPUC provides retail water, wastewater service and municipal power to the City and County of San Francisco. The SFPUC also owns and operates the Hetch Hetchy Regional Water System that delivers water to 28 wholesale customers. The SFPUC serves approximately 2.5 million residential, commercial, and industrial customers in the Bay Area. Approximately one-third of the water deliveries go to retail customers in San Francisco, while wholesale deliveries to agencies in Alameda, Santa Clara, and San Mateo counties comprise the other two-thirds. The SFPUC is currently implementing an extensive capital improvement program to repair, replace, and seismically upgrade the water system's aging infrastructure to ensure reliable delivery of its water supply. BAWSCA member agencies are served wholly or in part by the SFPUC's Hetch Hetchy Water System.

1.2.3.13 City of San Jose

The City of San Jose's Environmental Services Department provides drinking water supply, wastewater treatment, water pollution prevention, and recycled water supply services to local residents. Created in 1961, the San Jose Municipal Water System serves four different neighborhoods in the City of San Jose: North San Jose/Alviso, Evergreen, Edenvale and Coyote. The San Jose/Santa Clara Water Pollution Control Plant is one of the largest advanced wastewater treatment facilities in California. It treats and cleans the wastewater of over 1,500,000 in the 300-square mile area encompassing San Jose, Santa Clara, Milpitas, Campbell, Cupertino, Los Gatos, Saratoga, and Monte Sereno. About 10 percent of the treated water is recycled through South Bay Water Recycling pipelines for landscaping, agricultural irrigation, and industrial needs around the South Bay.

1.2.3.14 Santa Clara Basin Watershed Management Initiative

The Santa Clara Basin Watershed Management Initiative (SCBWMI) was formed in 1996 as a collaborative effort of representatives from Santa Clara County and South Bay. Its members include representatives from businesses and industrial sectors; professional and trade organizations; civic, environmental, resource conservation, and agricultural groups; regional and local public agencies; and the general public.

The SCBWMI addresses issues in water rights and water supply reliability, flood management, regulatory compliance, land use, and public awareness and involvement. Table 1-4 provides a list of member organizations are SCBWMI signatories.

Table 1-4: Santa Clara Basin Watershed Management Initiative (SCBWMI) Signatories

Public Agencies	
1. California Department of Fish & Game 2. City of Cupertino 3. City of Palo Alto 4. City of San Jose 5. City of Santa Clara 6. City of Sunnyvale 7. Guadalupe-Coyote Resource Conservation District 8. San Francisco Bay Regional Water Quality Control Board 9. San Francisquito Creek Joint Powers Authority	1. Santa Clara County 2. Santa Clara County Open Space Authority 3. Santa Clara Valley Transportation Authority 4. Santa Clara Valley Urban Runoff Pollution Prevention Program 5. Santa Clara Valley Water District 6. US Army Corps of Engineers 7. US Environmental Protection Agency 8. USDA Natural Resource Conservation Service
Business and Trade Associations	
1. California Restaurant Association/Dairy Belle Freeze 2. Home Builders Association of Northern California 3. San Jose Silicon Valley Chamber of Commerce	● Santa Clara Cattlemen's Association ● Santa Clara County Farm Bureau ● Silicon Valley Manufacturing Group
Environmental and Civic Groups	
● CLEAN South Bay ● Greenbelt Alliance ● Leagues of Women Voters of Santa Clara County ● Salmon and Steelhead Restoration Group ● San Francisco Bay Bird Observatory	● San Francisquito Watershed Council ● Santa Clara Valley Audubon Society ● Sierra Club Loma Prieta Chapter ● Silicon Valley Toxics Coalition ● Stevens and Permanente Creeks Watershed Council ● Western Waters Canoe Club

1.2.3.15 Santa Clara Valley Water District

The Santa Clara Valley Water District (SCVWD) manages an integrated water resources system that includes the supply of clean, safe water, flood protection and stewardship of streams on behalf of Santa Clara County's 1.8 million residents in 1,300 square miles. SCVWD effectively manages 10 dams and surface water reservoirs, three water treatment plants, a state-of-the-art water quality laboratory, nearly 400 acres of groundwater recharge ponds and more than 275 miles of streams. SCVWD also provides wholesale water and groundwater management services to local municipalities and private water retailers who deliver drinking water directly to homes and businesses in Santa Clara County.

1.2.3.16 Solano County Water Agency

Rinconada Water Treatment Plan, SCVWD

Formed in 1951, the Solano County Water Agency (Solano CWA) provides water supply and flood control services for cities and irrigation districts in Solano County and parts of Yolo County. Solano CWA leads efforts to protect rights to existing sources of water and works to secure new sources of water for water supply reliability and future growth. In addition to its irrigation customers, Solano CWA delivers untreated water to its wholesale customers, who serve more than 400,000 residents. These wholesale customers include:

- City of Benicia
- City of Fairfield
- Maine Prairie Water District
- Solano Irrigation District
- City of Suisun City
- City of Vacaville
- City of Vallejo

1.2.3.17 Sonoma County Water Agency

Created in 1949, the Sonoma County Water Agency (Sonoma CWA) is a water wholesaler that provides drinking water to approximately 570,000 residents of Sonoma and Marin counties. In addition, Sonoma CWA provides sanitation and flood control services to residents of Sonoma County. Sonoma CWA wholesales water to the following agencies:

- City of Cotati
- City of Petaluma
- City of Rohnert Park
- City of Santa Rosa
- City of Sonoma
- Town of Windsor
- North Marin Water District
- Valley of the Moon Water District
- Forestville Water District
- MMWD

1.2.3.18 State Coastal Conservancy

The State Coastal Conservancy (SCC), established in 1976, is a non-regulatory state agency whose goal is to purchase, protect, restore, and enhance coastal resources, and to provide access to the shore. The legislature created the SCC as a unique entity with flexible powers to serve as an intermediary among governmental agencies, NGOs, citizens, and the private sector in recognition that creative approaches would be needed to preserve California's coast and San Francisco Bay lands for future generations. The San Francisco Bay Area Conservancy

Program, administered by the SCC, was established in 1998 to address the natural resource and recreational goals of the nine-county Bay Area in a coordinated and comprehensive way.

1.2.3.19 Zone 7 Water Agency

The Zone 7 Water Agency (Zone 7) was formed in 1957 to manage groundwater, flood control, and water supplies for the Livermore-Amador Valley. Zone 7's service area includes the cities of Dublin, Livermore, Pleasanton, and the surrounding unincorporated areas, providing roughly 215,000 residents with a reliable supply of high quality water. Zone 7 also supplies water supplies to the Dougherty Valley area of Contra Costa County. By pursuing multiple water supply strategies and state-of-the-art technologies, Zone 7 is committed to ensuring the needs of its customers are met, even in times of drought. Zone 7's wholesale customers include:

- Dublin San Ramon Services District
- City of Pleasanton
- City of Livermore
- California Water Service Company

1.2.4 Functional Areas

The 2006 Plan included four FADs whose purpose was to (1) identify specific needs and challenges relating to the specific FA; (2) describe water management strategies and approaches to address these needs; and (3) develop a list of potential strategies and implementation projects that would maximize benefits and enhance opportunities for regional cooperation within a given FA. Each FA has responsibility for a particular type of regional water management, and responsibilities extending beyond IRWM planning activities.

The IRWMP maintains the four FAs and the three purposes described above.

The four FAs are:

- **Water Supply & Water Quality**. The Water Supply-Water Quality (WS-WQ) FA addresses water supply and water quality opportunities and challenges throughout the Region and is led by BAWAC and its member agencies.

- **Wastewater & Recycled Water.** The Wastewater-Recycled Water (WW-RW) FA addresses wastewater treatment and discharge and recycled water treatment and distribution within the Bay Area, and is led by BACWA.

- **Flood Protection & Stormwater Management.** The Flood Protection-Stormwater Management (FP-SM) FA addresses regional issues in management of flood- and stormwaters, led by BAFPAA and coordinated with BASMAA.

- **Watershed Management-Habitat Protection & Restoration.** The Watershed Management-Habitat Protection and Restoration (WM-HPR) FA addresses management of hydrologic systems with emphasis on habitat protection and enhancement and is led by the SCC, in partnership with SFEP, Bay Area Watershed Network (BAWN) and NBWA.

The four FAs are represented in the CC by three designated individuals, or their alternates, and are considered the "voting representatives." Voting representatives are appointed by their respective FA groups and may change over time. If the CC is not able to reach consensus on an item that needs a decision, the Chair or Vice Chair may ask for a vote from this body. However, this situation has yet to arise and the group has been successful in achieving consensus in all cases.

The CC's FA representatives receive direction from their corresponding FA agencies and interests. For example, the three voting representatives of the Flood Protection and Stormwater Management FA receive direction from BAFPAA. BAFPAA policy is reflective of policies adopted by elected officials related to BAFPAA members such as County Supervisors or Boards of Directors. For some other participants, policy direction is aligned with elected officials (e.g., Water District Boards, Sanitary District Boards, City Councils, Agency Boards, County Supervisors, etc.) or NGOs.

FA representatives also take into consideration the interests of other stakeholders and the public. The FA representatives, or their designated alternates, are responsible for attending all CC meetings, reviewing matters in advance for discussion at the meetings, helping give direction to consultants, participating in CC subcommittees, and reporting back to their FAs, agencies and constituents.

1.2.5 Subregions

A "Subregional" approach was developed to facilitate truly integrated projects with smaller geographical areas and better address the diversity of needs and ideas across the Bay Area Region, and provide better local access to the IRWM process. Between submittal of the IRWMP in 2006 and the RAP in 2009, the CC evaluated five different scenarios seeking to balance populations and areas and decided on a Subregional approach which established four geographic Subregions – North, East, South and West (Figure 1-2). In contrast to FAs that function across the IRWM Region, Subregional activities are focused on a local scale.

The Subregional approach has the following benefits:

- Facilitate project integration;
- Local governmental entities and NGOs are more aware of their own constituents' concerns regarding water management issues and can better represent the needs of their particular DACs;
- Projects can be better identified from smaller organizations, citizens' groups and DACs whose projects might otherwise not be recognized by a larger regional body;
- Using a designated Subregion lead, the IRWMP information can be disseminated to local groups who might not otherwise travel outside their geographic area to voice their concerns, needs, or ideas; and
- The system attempts to provide for equitable distribution of funding for projects.

The four Subregions were established, in part, to ensure local participation and ownership of the outcomes from the process. Each of these Subregions is essentially several DWR detailed analysis units (DAUs), or small watersheds. Once the DAUs were identified, political boundaries were used to adjust the Subregion boundaries to maintain the integrity of counties and agencies within a Subregion. This Subregional approach, focused on more localized issues and outreach, was designed to increase the participation of stakeholders who had not previously been involved in the IRWM process, and facilitated the development of integrated projects. Stakeholders who may be better able to engage at the Subregional level include NGOs, watershed and conservation groups, representatives of DACs, community-based organizations, environmental justice groups and communities, industry and agricultural organizations, park districts, educational institutions, and local general governments where many land-use decisions are made.

Calculations of area and population within each Subregion were used to establish ‘Target Allocations’ for funding. Areas and population were weighted as follows:

- 50% distribution based on number of Subregions (4)
- 25% distribution based on population in each Subregion
- 25% distributed based on area of each Subregion

Based on these calculations the following allocation targets were established:

- North Bay 25%
- East Bay 29%
- South Bay 25%
- West Bay 22%

Subregion groups meet regularly and each establishes its own schedule for meetings and other activities. Information on Subregions and materials for stakeholders can be found on the IRWMP website (http://bayareairwmp.org/). While the Subregional approach will bring new parties into the IRWM process, final decisions concerning IRWMP plans, priorities and funding continue to occur at the regional level.

While much of the Plan development effort is now at the Subregional level, regional efforts may include, but may not be limited to:

- Regional discussion and actions concerning water supply and imports;

- Actions and policies to improve the water quality of San Francisco Bay;

- Oversight and integration of Subregional processes;

- Coordination of grant proposals for regional scale activities;

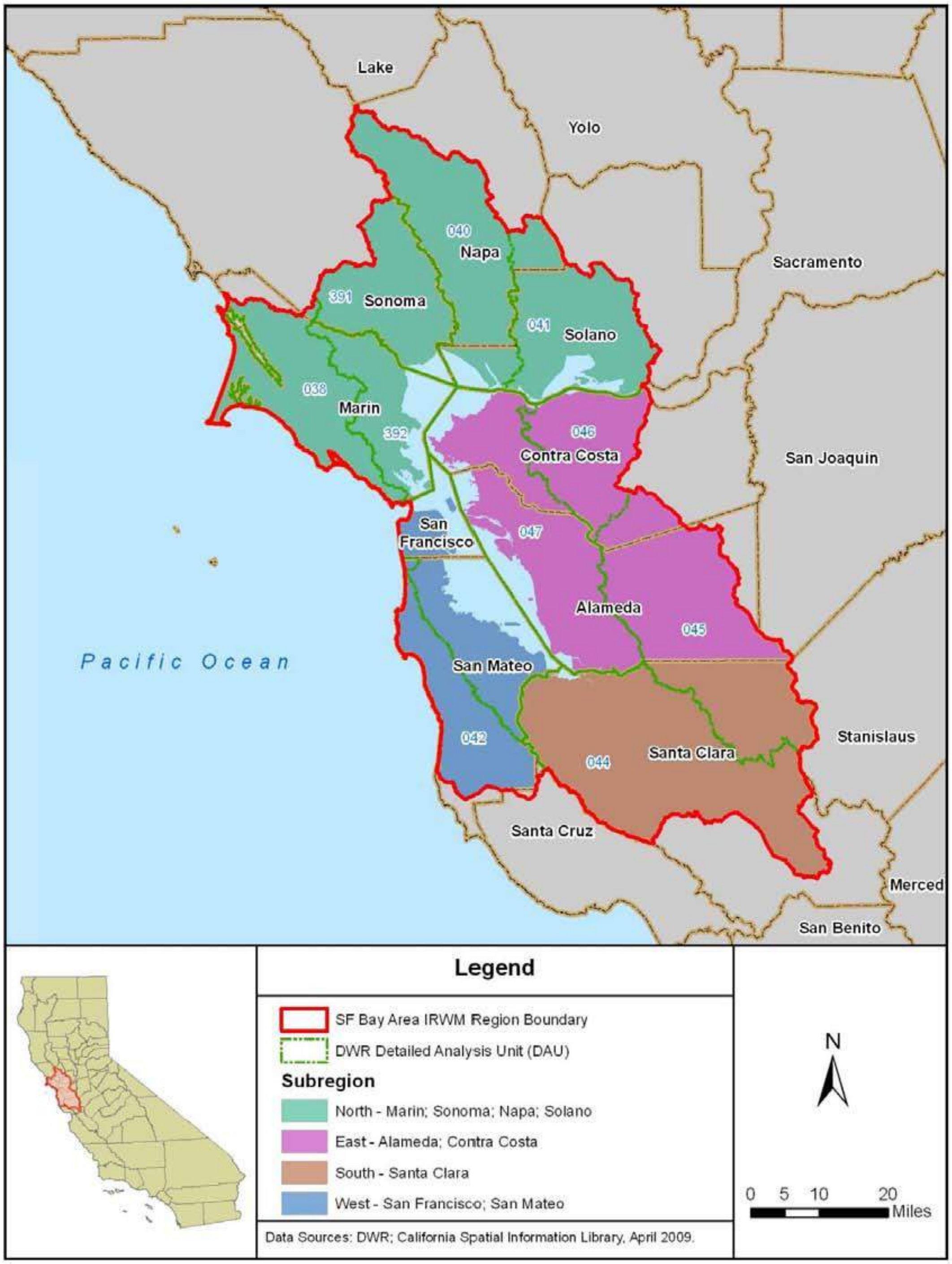
- Efforts to address impacts of climate change, such as sea level rise;

- Actions to address regional flood protection, including with National Oceanic and Atmospheric Administration (NOAA) weather prediction programs and the sediment reduction/transport effort; and

- Regional habitat protection for tidal, riparian and estuarine habitats

The Subregions are described below.

Figure 1-2: IRWM Subregions



1.2.5.1 North Subregion

Napa River Watershed

The North Subregion consists of portions of Sonoma, Napa, and Solano Counties and the majority of Marin County. These counties have the smallest populations in the Bay Area Region, the largest land area, the most individual counties, and are projected to grow the least (ABAG 2009). Solano County has the largest projected growth and contains the largest number of DACs within the North Subregion.

The Lead for the North Subregion is the NBWA. Meetings held within the Subregion are Joint County meetings and county-specific stakeholder meetings organized by the County lead. County lead meetings are conducted to update stakeholder lists and develop preliminary lists of projects, with subsequent input review.

1.2.5.2 East Subregion

The East Subregion consists of the majority of Alameda and Contra Costa Counties which includes a large continuous urban area from Richmond to Fremont, making up one of the major metropolitan areas in the Bay Area Region. This Subregion makes up over 35% of the total population and has among the highest growth rates in the Bay Area Region. DACs are primarily concentrated within the continuous urban area that spans the two counties. This Subregion includes an overlap area with the East Contra Costa County IRWM region.

The East Subregion is led by at least one representative from each county, which makes up an informal executive committee that presides over Subregional meetings, coordinates outreach efforts, and represents the Subregion at CC meetings. Each county representative is responsible for disseminating information on upcoming grant rounds and other Subregional activities and for conducting regular outreach to all stakeholders across FAs for inclusion in the IRWMP process. Outreach mechanisms in this Subregion include County Watershed Forums that include members from various watershed groups, state and local agencies and private citizens. Additionally, water supply agencies coordinate fairly regularly with their customers and with each other on their common objectives, and with landowners for flood protection.

1.2.5.3 South Subregion

The South Subregion consists of the portion of Santa Clara County that drains to the San Francisco Bay. This Subregion includes the City of San Jose, one of the three major metropolitan areas in the Bay Area Region, as well as 13 other cities and towns. Santa Clara County has the highest population of all the counties included in the Bay Area Region, with a high growth rate, and clusters of DACs in areas of high urban concentrations.

SCVWD serves as the lead for the South Subregion. SCVWD conducts its own regular outreach to all stakeholders across FAs. Outreach mechanisms include IRWM-specific workshops to solicit input on projects and priorities, participation in the Countywide stormwater management program, joint planning efforts with water recyclers, ongoing collaboration with water retailers, extensive on-going newsletter outreach and coordination with cities on flood protection projects and environmental stewardship activities. SCVWD also has its own functional master plans and grant programs. For each, it provides outreach to the community and interested parties.

1.2.5.4 West Subregion

The West Subregion consists of the County of San Francisco and the majority of San Mateo County. The City of San Francisco, which coincides with the County boundaries, is one of the three major metropolitan areas in the Bay Area Region. The two Counties in this Subregion have populations and growth rates in the mid-range, compared to other Counties within the Bay Area Region. Both San Francisco and the portion of San Mateo County within the Bay Area Region include clusters of DACs.

1.2.6 Other Stakeholders

In addition to the LOMU signatories, many organizations and agencies with roles in water resources planning and/or management in the Bay Area previously participated in development of the FADs and/or the IRWMP. These entities included:

- Environmental Water Caucus
- Clean Water Action
- The Bay Institute
- Sierra Club
- Environmental Justice Coalition for Water
- U.S. Army Corps of Engineers (USACE)
- Napa County Resource Conservation District
- San Francisco Bay Conservation and Development Commission
- League of Women Voters
- San Francisco Bay Regional Water Quality Control Board (SF RWQB)

In addition, representatives of small areas within the San Francisco Bay Area that have been engaged in their own concurrent planning efforts also attend CC meetings for the Bay Area IRWMP. These include East Contra Costa County which is participating in the East Contra Costa IRWMP and Napa County, which is participating in the Westside Sacramento IRWMP.

All members of the CC contribute to reaching decisions at CC meetings, serve on subcommittees, participate in Subregional activities, identify and evaluate projects for inclusion in the Plan and grant applications, assist in drafting documents, and participate in various meetings and workshops at the state level. Stakeholder activities and the CC's role in coordinating with other stakeholders during the IRWMP development are discussed in greater detail in Chapter 14: *Stakeholder Involvement*. These stakeholders include the following state and federal agencies:

- SCC
- DWR
- State Water Resources Control Board (SWRCB)
- SF RWQB
- BCDC

- SFEP (SFEP has an Implementation Committee that meets four times a year and which includes many listed regulatory and resource agencies. IRWMP updates are provided at these meetings.)
- California Natural Resources Agency (CNRA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Environmental Protection Agency (US EPA)
- USACE
- NOAA's National Marine Fisheries Service (NMFS)
- California Environmental Protection Agency (CALEPA)
- California Department of Fish and Wildlife (CDFW)
- California Department of Transportation (DOT)

Additional discussion on coordination with state and federal agencies, and effective communication and coordination, both internal and external to the Bay Area Region, can be found in Chapter 15: *Coordination*.

1.2.7 Subcommittees

Subcommittees are work groups established by the CC as needed in order to accomplish specific tasks on behalf of the CC and the Region. The subcommittees are used to frame the issues, develop options and make recommendations through a collaborative process, which are then forwarded to the full CC for discussion and resolution.

The following subcommittees are active for the IRWMP:

Plan Update Team (PUT). The PUT subcommittee includes various FA representatives and Subregion leads, and is a subset of the CC, committed to the day-to-day managing of the IRWMP update process. The PUT subcommittee currently serves as the primary "work group" for the IRWMP, addressing tasks as requested by the CC and bringing forward material for discussion and decision. CC Chair and Vice Chair participate as needed.

Project Screening Committee (PSC). The PSC was established to facilitate the process of incorporating new project ideas and processing/updating existing projects, as well as making recommendations to the CC, for the IRWMP and future funding applications, such as the Round 2 IRWM Implementation Grant. The PSC works with Subregions to receive and organize project proposals, identify synergies and encourage collaboration, review projects and ensure that projects are in accordance with DWR IRWM Grant Program Guidelines and the parameters of specific funding opportunities.

Website. The Website Subcommittee is tasked with ensuring that the website provides a reasonable communication and information tool, and is appropriately updated.

Planning and Process. The Planning and Process subcommittee was established to analyze issues, perform specific work tasks as needed, and recommend potential actions to the CC.

As noted above, these subcommittee work groups have been established by the CC as needed in order to accomplish specific tasks on behalf of the CC and the region. As such, they will remain active, become re-activated, or additional subcommittees will be established as needed during Plan implementation.

1.3 Procedures for IRWMP Development

The following sections describe the IRWMP development process.

1.3.1 Public Outreach and Involvement Process

A broad stakeholder outreach process is crucial to ensure that the IRWMP identifies local issues, reflects local needs, promotes the formation of partnerships, and encourages coordination with state and federal agencies. One of the benefits of a regional planning process is that it brings together a broad array of groups into a forum to discuss and better understand shared needs and opportunities.

The IRWMP process invites active public participation of all interested stakeholders. The main forum for IRWM planning, discussion and decisions is the CC. Anyone who wants to participate in the monthly meetings can do so.

Because the CC meetings encourage broad participation, non-voting attendees usually outnumber voting participants. These "non-voting" members include: (1) Chair and Vice Chair of the CC, (2) additional individuals representing agencies involved in one or more FAs, (3) staff of resources and regulatory agencies, (4) representatives of nongovernmental organizations, and (5) individuals representing other interested organizations or simply themselves. Many of these stakeholders are listed in Sections 1.2.2 and 1.2.6, above.

Participants in the CC collaborate in a number of ways:

- **Subcommittees:** Agencies, non-governmental organizations, regional planning organizations, and other stakeholders serve on subcommittees where policies and other recommendations are developed and forwarded to the full CC for consideration and discussion.

- **Functional Area group:** This collaboration is particularly the case between two of the FAs – Flood Protection and Stormwater Management and Watershed Management and Habitat Protection and Restoration (here, for example, stakeholders with specific interests in environmental issues contribute significantly to the development of multi-purpose projects). The Water Supply and Water Quality and Wastewater and Recycled Water FAs also routinely collaborate.

- **Subregional activities:** Participants work together at the local level to reach out to local organizations and encourage and enable their participation in the IRWMP process. They work with local communities to help identify and evaluate projects for inclusion in the Plan and for grant applications, may assist in drafting documents.

- **Representation at the state level:** The CC is the venue where representatives of the Bay Area are selected to represent the region in various meetings and workshops at the state level.

The public involvement process is built upon the success of the collaborative efforts within the region and with the surrounding IRWMP regions. Stakeholders were identified through their involvement or interest in water, environment, and similar projects in the past; interviews and brainstorming sessions were used to identify potential stakeholders and their interests. These entities were contacted and invited to participate in the IRWMP and to identify other potentially interested groups. By this process, a varied and broad group was encouraged to become stakeholder participants, including entities that were not necessarily involved with any past efforts.

Past and potential stakeholders were identified as environmental groups, conservancy groups, DACs, water suppliers, municipalities, sanitation districts, flood control districts, Native American tribes and their representatives, developers, landowners, adjacent IRWM areas, state agencies, elected representatives, and interested individuals. Methods used to do outreach include direct emails, mailings, face-to-face interaction, event participation, flyers, notices, surveys, notices in organization newsletters and presentations. Outreach also takes place at the local agency level during California Environmental Quality Act (CEQA) and other project approval processes.

With the involvement of the stakeholders, facilitation of meetings to ensure inclusive processes, tracking of stakeholder comments, and efforts to incorporate those comments into the Plan document, the IRWMP has been able to consider and utilize a broad range of inputs and ideas. Every stakeholder was and continues to be able to add projects to the list of candidate projects for implementation of the IRWMP, projects that pertain to water resources management and contribute to the goals and objectives of the Plan.

During the development of the IRWMP, outreach efforts included:

- Conducting interviews with IRWMP participants — public agencies and NGOs — to document their experiences in developing the 2006 Plan, expectations and desires with regards to project outreach, including obtaining their recommendations on the best methods for communicating with their constituencies to ensure awareness and involvement.

- Updating the website (http://www.bairwmp.org/) to provide information to the IRWMP participants, as well as a broader public audience. The website provides access to documents, project forms, IRWMP chapters, and documents for review, and notices about opportunities to review them.

Stakeholder Workshop

- Stakeholder workshops and meetings were conducted at key milestones during the IRWMP development to ensure an inclusive and transparent planning process, promote open communication between participating entities and other stakeholders, identify stakeholder interests and concerns, and incorporate stakeholder comments into the IRWMP.
- Stakeholder workshop notices were distributed via email using the IRWMP database consisting of approximately 2,000 contacts.
- Notices were also posted on the IRWMP website and distributed to local newspapers in advance of the scheduled meeting time.
- Meetings were held in different parts of the San Francisco Bay Area to encourage participation throughout the Region.

Specific outreach activities since Plan completion in 2006:

- Updated website to allow for easier maintenance, document sharing, access to and submittal of forms and review process.
- Listserv email access to allow public to sign up for update emails.
- Continued monthly CC meetings, open to all interested parties.
- Created Subregional planning level to facilitate better access for smaller or local organizations.
- Created BAFPAA.
- Created subcommittee for Planning and Process to accomplish specific tasks on behalf of the CC, including writing the RAP document, and proposing a process for inclusion of future projects.
- Created the PSC.
- Created the PUT for purposes of managing the IRWMP update process.

- Created the Website Subcommittee for purposes of managing updates to the IRWMP website.
- Created BAWN.
- DAC and tribal outreach associated with the DAC Involvement Program.

1.3.2 Decision-Making Process

The CC is a consensus-based organization that strives to get the consent, not necessarily the total agreement, of the members for direction and decisions and attempts to resolve conflicts before proceeding.

The CC's decision-making process typically follows these steps:

- Frames the issue.
- Develops facts and options. Usually the CC delegates research and development tasks to a working subcommittee with broad representation.
- Develops criteria to evaluate options consistent with IRWMP goals and objectives. This role is usually delegated to the same working subcommittee with broad representation.
- Presents the subcommittee analysis and evaluation for consideration by the CC.
- For major issues, seeks additional input from regional FA groups that also provide broad geographic representation.
- Delegates next steps back to the subcommittee.
- Finalizes decisions, work efforts, or direction.

The CC operates through consensus-based decision making and has succeeded in reaching consensus on all decisions during the past. If an issue needing a firm decision cannot be resolved via consensus, the Chair or Vice Chair of the CC shall call for a vote (See Appendix A-2: Voting Principles[2]).

1.3.3 Document Review Process

The document review process was designed to promote efficiency and maximize stakeholder and public involvement. Reviews are performed and drafts are released as they are developed. Drafts remain on the website and are available for public review for the duration of the IRWMP update process.

The process, which applies to all chapters, is as follows:

DRAFT #1: Review to identify major issues and errors.

[2] The Voting Principles were drafted in 2009

Reviewers: PUT, CC chair, CC vice-chair, FA reps and Subregion leads.

- Consultant team updates 2006 IRWMP materials with RAP and other new information.
- Documents are made available to the reviewers.
- Review occurs through process of simultaneous collaboration.
- Consultant goes through final document from reviewers, creates list of conflict areas to be resolved, tracks substantive changes or comments to reflect origin and works with PUT to determine how to incorporate comments.
- If a significant rewrite is required, the PUT will review the document again before it goes to the next stage of review.
- Reviewers provide recommendations for additional reviewers with particular interests in the draft that are not on the targeted reviewers list.
- Consultant incorporates comments into Draft #2.

DRAFT #2: Targeted Review to solicit comments from select agency and organization staff on adequacy of the draft.

Reviewers: Draft #1 Reviewers, agency and stakeholder representatives who have been identified to review IRWMP materials, key people in FAs, Subregions and other stakeholder groups who want to review the draft and recommended reviewers from Draft #1 review process.

- Document is sent to Targeted Reviewers.
- Reviewers provide comments.
- Consultant processes all comments.
  - Consultant team compiles consensus comments and incorporates into Draft #3.
  - Consultant team consolidates substantive comments, tracks substantive changes or comments to reflect origin and creates a list of any conflict areas to be resolved.
- PUT+ provides resolution of conflict areas as direction for inclusion in Draft #3

DRAFT #3: Public Review.

Reviewers: All interested parties, organizations and individuals.

- Document, in PDF, will be available for download through the website and at physical locations. The draft will be available until such time as all sections are compiled into draft IRWMP document.
- Reviewers will provide comments via form or letter.

- Consultant processes all comments.
  - Consultant team compiles consensus comments and incorporates into Final
  - Consultant team consolidates substantive comments, tracks substantive changes or comments to reflect origin and creates a list of any conflict areas to be resolved.
- PUT+ provides resolution of conflict areas, with support from Consultant team, as direction for inclusion in the Final document.

Throughout the review process, notifications of opportunity to review the documents along with instructions on comment submissions were disseminated via website notice, email to the listserv and via media release.

1.4 Balanced Access and Opportunities

CC meeting participants include a broad and balanced representation of community sectors and environmental and water resources interests. In addition to representatives from water supply, recycled water and wastewater agencies, flood control and stormwater-related agencies, and watershed and habitat protection organizations, participants in CC meetings include staff from regional planning agencies such as SFEP, regulatory agencies such as DWR, and representatives from NGOs such as the San Francisco Estuary Institute (SFEI).

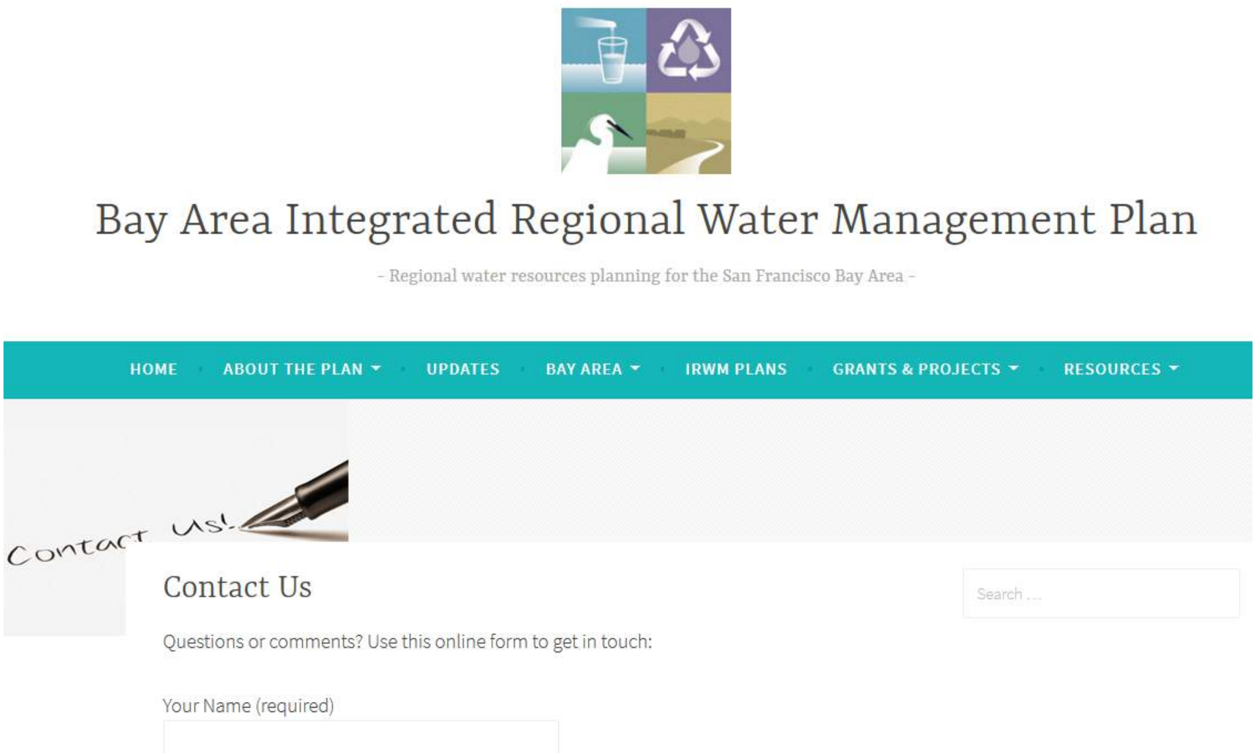
Participation in the IRWMP process is inclusive. There are no requirements for participation in the CC and monthly meetings are open to all stakeholders and members of the public. Meeting notices are posted on the IRWMP website prior to each meeting, as are agenda materials, monthly CC meeting notes and associated announcements. Agenda packages are also sent via e-mail to the CC IRWMP email notification list, which is open and inclusive. Individuals may subscribe to receive emails notifying them of postings to the website via the website (http://www.bairwmp.org/).

1.4.1 Effective Communication with Stakeholders and the Public

The IRWMP update process utilizes regularly agendized meetings of public agencies and NGOs in the Bay Area Region's four Subregions, as well as its monthly, public CC meetings, as well as updates to its website, to inform the public about IRWMP efforts and the opportunity to affect the content of the document as well as identify potential projects for funding. The website allows for members of the public to track upcoming and recent meetings, review draft chapters and provide comment, sign up for email updates, contact the administrator, find a contact list of CC representatives, and submit project ideas and/or proposals via the secure web portal. Regular email updates on upcoming and recent CC meetings are sent to all subscribers of the IRWMP listserv. The website also serves as a key vehicle for communication among the CC.

Meeting agenda and information is posted on the website at least one week in advance of the CC meetings. Meeting notes are generated from each monthly CC meeting to record comments, decisions, agreements and action items. Draft and Final CC meeting minutes are distributed to attendees and are published on the Plan website. In addition, each Subregion has a page on the BAIRWMP website to post presentations, meeting agendas, minutes, and local contacts.

The “listserv” function allows members of the public and other stakeholders to sign up for email updates regarding IRWMP activities. In addition direct emails, the stakeholder outreach and engagement efforts will include mailings, face-to-face interaction, event participation, classroom instruction, flyers, notices, surveys, and presentations to communicate with the public and stakeholders. Members of the public may also contact their local CC representative through the email contact information listed in the website for questions regarding regional water management efforts or IRWM planning and implementation in the Bay Area Region.



IRWMP Website, Contact Page

The public has access to the IRWMP process through several avenues including:

- http://www.bairwmp.org
- Monthly CC meetings
- Subregional meetings
- Press releases regarding IRWMP updates
- Agendized meetings of various associations and coalitions throughout the Bay Area, including:

  a. ABAG
  b. BAWN
  c. BAFPAA

d. BACWA
e. BAWAC
f. BASMAA
g. BAWSCA

For members of the public who may not have web access, local outreach is conducted by each Subregion through local water resources management agencies and other local organizations who can reach customers and constituents. This ensures that smaller stakeholder groups and the public at-large have an opportunity to learn about the IRWM process close to home and in a forum designed to initiate new participants in the IRWMP process. This Subregional outreach includes efforts to bring local NGOs, municipalities, and any other member of the public. The outreach efforts were conducted prior to project list updates to allow time for the identification and integration of new and existing projects on the Subregional level. All projects identified on the Subregional level were screened for potential integration and regionalization. Subregional meetings began as early as 2010 to alert the public about the IRWMP update process, the project list, and future grant opportunities for project implementation.

1.4.2 Outreach to Disadvantaged Communities and Native American Tribes

Outreach to these specifically identified stakeholders is addressed in Section1.2.2 and Chapter 14.6 & 4.7.

1.4.3 Coordination with Neighboring IRWM Efforts and State and Federal Agencies

The Bay Area Region is adjacent to five planning regions that are currently in the process of developing or updating IRWMPs (See Chapter 2, Figure 2-23). These consist of North Coast, Westside Sacramento, East Contra Costa County, Pajaro River Watershed and Santa Cruz County.

During the RAP the Bay Area Region CC directly contacted and coordinated efforts with water supply, wastewater, flood protection, watershed, and habitat restoration agencies in adjacent and overlapping IRWM regions. After initial contact and as appropriate, adjacent regions were given the opportunity to consider partnering and integrating with the Bay Area Region. For more information on the region description and neighboring IRWM efforts, see Chapter 2.

The collective efforts of these interconnected IRWMPs will not only benefit their respective regions, but each other and the watersheds of northern California as a whole. The efforts are coordinated in the following ways:

- Attending CC meetings
- Inclusion of interested parties in listserv for email updates
- Information available on the IRWMP website
- Items on participating agency agendas
- Updates to interested organizations and agencies

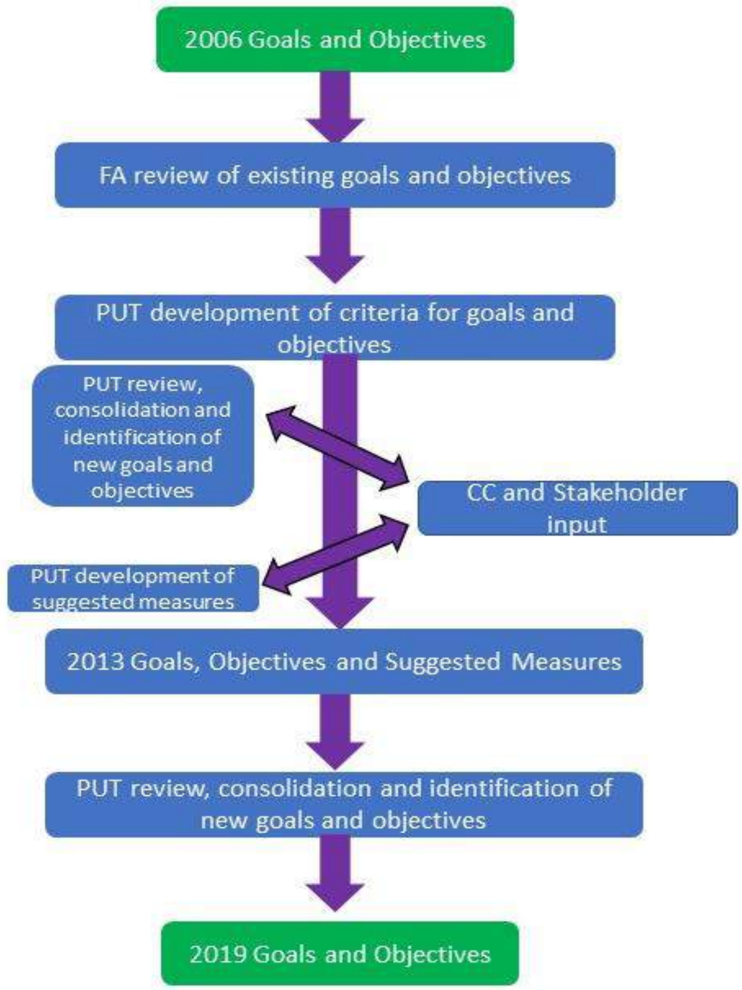
The Region also participates in the statewide "Roundtable of Regions" that shares information and often meets with DWR to give a more generalized and broad-based view of IRWM-related issues.

1.5 Collaboration Process Used to Establish Plan Objectives

Development of objectives for the IRWMP was an iterative and consensus-based process. Led by the PUT, the process also included review by the FAs and the CC. Stakeholder outreach and involvement, discussed in Chapter 14: *Stakeholder Involvement* was critical to this process. Proposed goals, objectives and suggested measures for the IRWMP were discussed at the first Workshop where stakeholders were given opportunity to provide input. At the workshop, the PUT members described the development process for the goals and objectives, and provided a list of deleted objectives, as well as opportunity for stakeholders to submit comments. Based on discussion at the workshop and stakeholder input, the PUT refined and finalized the list of goals and objectives, which were approved by the CC

This open and transparent decision-making process was important to ensure that all perspectives within the Region were considered in the IRWMP. Additionally, many of the local planning documents that serve as the basis for this IRWMP involved extensive stakeholder involvement as well. Figure 1-3 shows the steps in the goals and objectives development process.

Figure 1-3: Development of Regional Goals, Objectives and Suggested Measures



1.6 Long-term implementation of the Plan

Participants are planning to adopt the IRWMP by the end of 2019. Following adoption, the Plan will be implemented through execution of projects by their respective project proponents. Progress toward attaining the regional goals and objectives will be reviewed periodically and additional work will be completed on the IRWMP as needed through an adaptive management framework.

The IRWMP governance structure supports IRWMP implementation into the future. The CC, as the institutional structure for overseeing IRWMP development, will continue to be responsible for the IRWM planning and Plan management. The CC will continue to meet on a regular, as needed, basis to:

- Review the IRWMP with DWR to ensure DWR standards are met
- Receive updates on regional efforts relevant to IRWMP implementation

- Oversee the evaluation and prioritization of projects for future grant rounds
- Communicate on behalf of the CC to others including DWR, other IRWM Regions, DACs and tribes, other water resource management programs of interest (e.g., US EPA and other federal and state programs).

The CC will also oversee Website Development and Data Management. The website (bayareairwmp.org) will continue to be used to support the IRWMP in a variety of ways including making the Plan, CC meeting materials, project descriptions and progress reports for projects funded via Prop 1 IRWM grants accessible to the public as well as a library of Bay Area Climate Change and other resources. Additionally, web tools, such as collaborative mapping, information collection tools and more, may be developed for collaboration and project development.

In addition to the CC, the subcommittees will meet as needed. For more information on Plan implementation, monitoring and adaptive management, see Chapter 8: *Performance and Monitoring*.

1.7 Interim and Formal Changes to the Plan and Plan Updates

The planning horizon of this IRWMP will be 20 years from initial adoption. Formal re-assessment which will require readoption of the Plan will occur every five years within that 20-year timeframe, provided IRWM planning funds are available, unless one of the following events triggers an assessment prior to the scheduled five -year interval:

- Significant change in conditions as defined by the CC with input from the Stakeholders
- Achievement of an objective which necessitates setting a revised or replacement regional objective
- The need, as determined by the CC with Stakeholder input, to set new regional objectives
- Availability of new information, which may be particularly relevant with respect to the Climate Change Chapter.

Since its development, interim updates have occurred. For example, the 2006 Plan was updated to include additional projects for funding. The added projects were placed in Appendices, approved by consensus after project proponents filled out the template and some presented their projects in more detail at the CC meeting. Additionally, the Chair/Vice Chair Roles, Subregions, and Voting Principles were all developed between the 2006 the 2013 Plans and approved at the CC. The 2019 Plan Update is in response to the 2016 IRWM guidelines. The update also includes more substantive information on Disadvantaged Communities and Tribal communities through the Proposition 1 Disadvantaged and Tribal Communities Involvement Program.Addressing interim changes will continue through the term of the Plan by the CC, subject to available resources.

Further details on IRWMP implementation, including long-term implementation and adaptive management, are found in Chapter 8: *Performance and Monitoring*.

1.8 Plan Adoption

Upon the completion of the IRWMP, the CC will publish a notice of intention to adopt the Plan in accordance with §6066 of the Government Code and shall adopt the Plan in a public meeting of the CC. The governing bodies of each agency that is part of the CC will formally adopt the IRWMP. Additionally, each project proponent named in an IRWM Grant application will also adopt the IRWMP.

For purposes of Plan adoption, the CC consists of the Chair, Vice Chair, and FA representatives (formal members). The formal members of the CC, along with all project proponents included in grant funding agreements and applications, will bring the IRWMP and future IRWMP updates to their governing bodies for adoption. Currently, the following agencies and organizations have formal members in the CC:

- ABAG – Most members are local agencies
- BACWA – Local agency
- CCC FC&WCD – Local agency with statutory authority over water supply or water management
- CCWD – Local agency with statutory authority over water supply or water management
- EBMUD – Local agency with statutory authority over water supply or water management
- MMWD – Local agency with statutory authority over water supply or water management
- NBWA – Most members are local agencies
- SFEP – Includes local agencies, some with statutory authority of water supply or water management
- SFPUC – Local agency with statutory authority over water supply or water management
- SCVWD – Local agency with statutory authority over water supply or water management
- Sonoma CWA – Local agency with statutory authority over water supply or water management
- SCC – State agency with statutory authority over water management
- Zone 7 – Local agency with statutory authority over water supply or water management

All the agencies listed above have signed the LOMU.

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Chapter 2: San Francisco Bay Area Region Description

This chapter describes the physical, environmental and hydrologic features of San Francisco Bay Area Integrated Regional Water Management Region (Bay Area Region or Region), it's social and demographic characteristics and provides an overview of the Region's water system.

2.1 Bay Area Region Description

The Bay Area Region was approved as an Integrated Regional Water Management (IRWM) region by DWR in 2009 through the Region Acceptance Process (RAP) to maximize opportunities to integrate local water management activities and promote partnerships and multi-objective projects that benefit local communities and the natural environment.

2.1.1 Region Boundaries

While the overall contributing watershed of the San Francisco Bay (Bay) extends far into the interior of California, the Bay Area Region boundary corresponds to the Bay watershed as defined by the SF Regional Water Quality Control Board (SF RWQCB), Region 2. The watershed functions as the sole drainage outlet for waters of the Central Valley, conveying the flows of the Sacramento and San Joaquin rivers that enter the Bay system through the Delta at the eastern end of Suisun Bay (Figure 2-1). Coastal regions that drain to the Pacific Ocean range from Marin County's Stempel Creek in the north to San Mateo County's Pescadero-Butano Creek Watershed in the south. The Sacramento and San Joaquin River Delta is excluded from the Bay Area Region; it is managed by other IRWM regions and independent multi-purpose programs. The Bay Area Region's relationship to the Delta is further discussed in Section 2.1.4.

Rainbow in Bay Area Region

The Bay Area Region includes all or portions of the nine counties which surround San Francisco Bay (known as the Bay Area), including Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara, Marin, Napa, Solano and Sonoma counties. Many counties are divided between the Bay Area Region and other IRWM regions to better coincide with natural watershed boundaries. The East Contra Costa County IRWM region is the only neighboring IRWM planning region that overlaps with the Bay Area Region boundaries. It is also the only area within the Bay Area Region where the organizational and physical infrastructure boundaries are not consistent with the state-defined hydrologic basin boundaries, as discussed further in Section 2.8. The Region includes three major metropolitan cities—San Francisco, San Jose, and Oakland— and a total of approximately 100 smaller cities and towns (Figure 2-2).

Figure 2-1: RWQCB Region 2 Boundary and Bay Area Region Counties

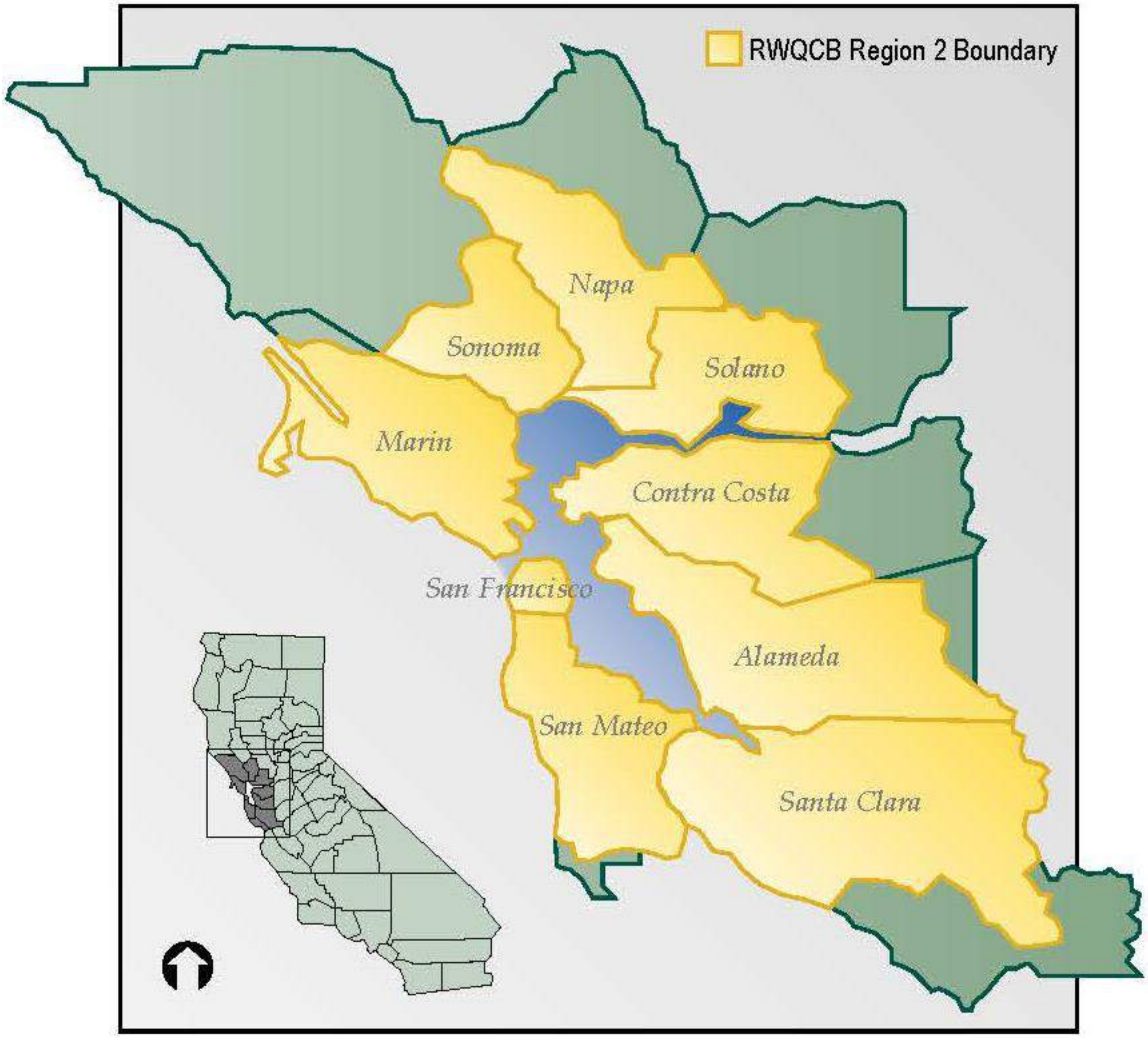
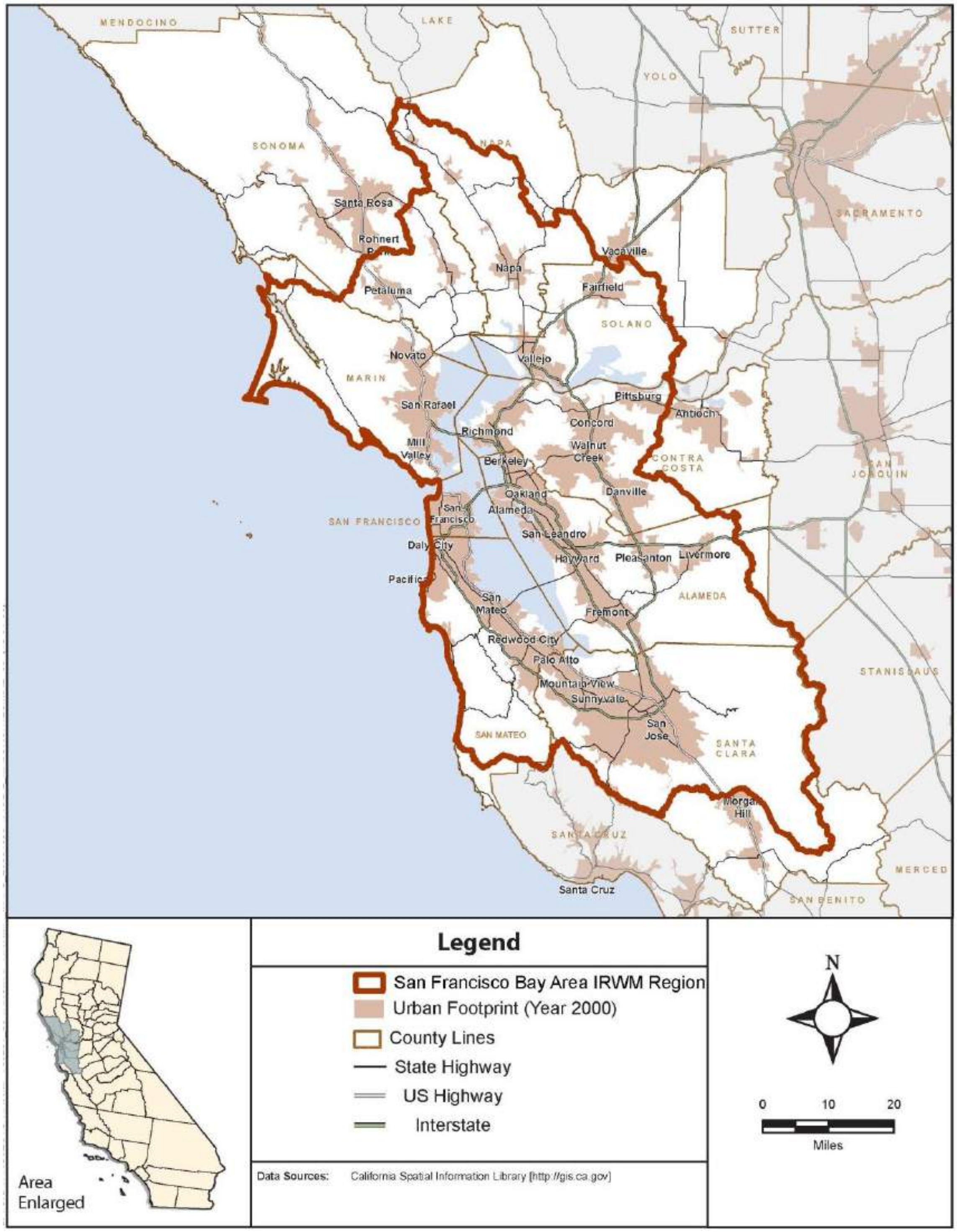


Figure 2-2: Major Cities of the Bay Area Region



2.1.2 Region Watersheds

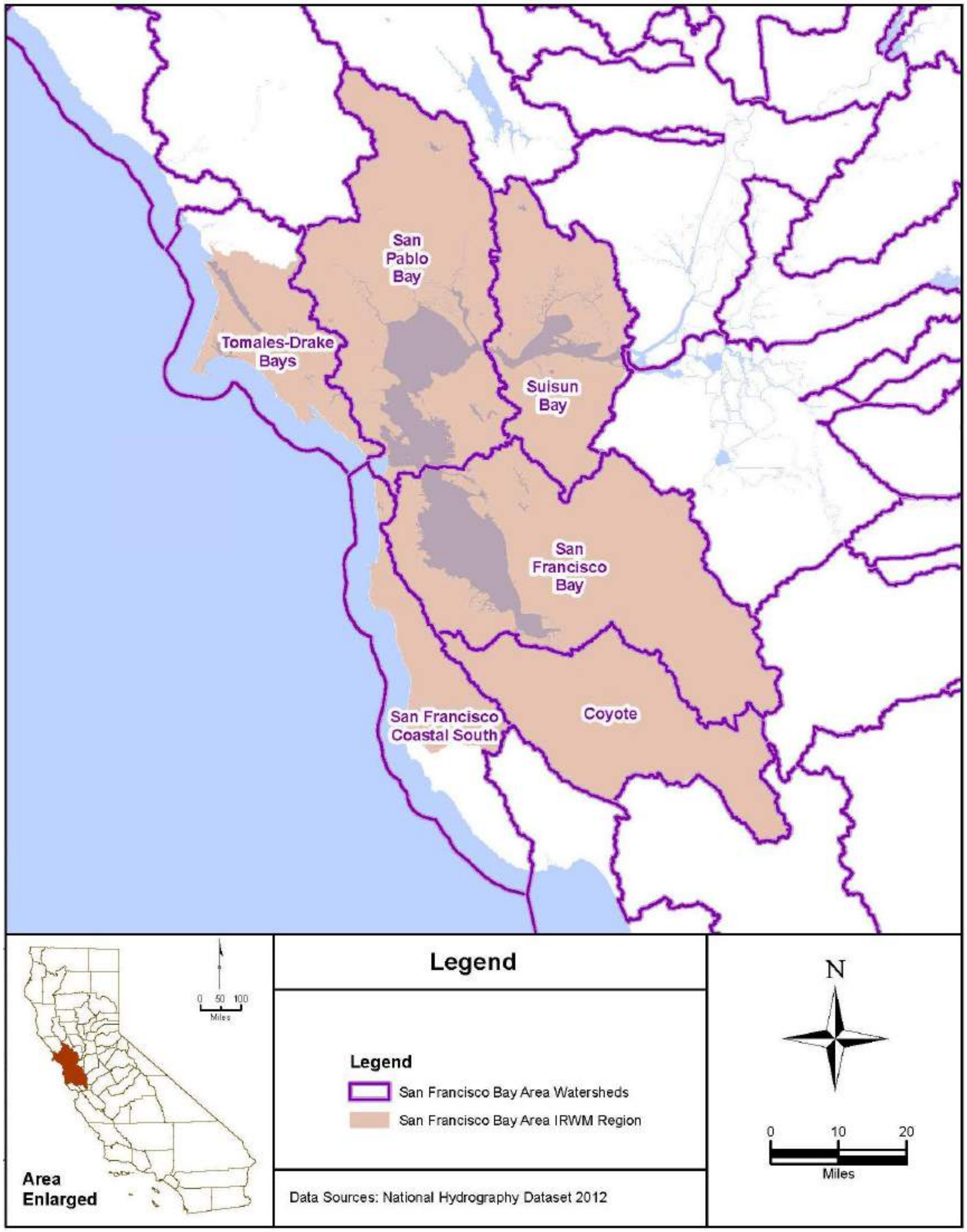
The San Francisco Bay Area is a complex network of watersheds, marshes, rivers, creeks, reservoirs, and bays predominantly draining into the San Francisco Bay and Pacific Ocean. The largest bodies of water in the Bay Area Region are the San Francisco Bay, San Pablo Bay, and Suisun Bay. The San Francisco Bay is one of the largest bays in the world. Many inlets on the edges of the three major bays are designated as bays in their own right, such as Richardson Bay, San Rafael Bay, Grizzly Bay, and San Leandro Bay. Nearby bays along the Pacific Coast include Bodega Bay, Tomales Bay, Drakes Bay, Bolinas Bay, and Half Moon Bay.

The largest rivers are the Sacramento and San Joaquin Rivers which drain into the Sacramento-San Joaquin River Delta and thence to Suisun Bay. Other major rivers of the North Bay are the Napa River, the Petaluma River, the Gualala River, and the Russian River; the former two drain into San Pablo Bay, the latter two into the Pacific Ocean.

The Bay Area has a broad network of streams, creeks, and arroyos. Due to low rainfall in the summer months (May–October), many Bay Area creeks are intermittent, flowing above ground only during part of the year.

Resulting from this extensive network of waterways, the Bay Area Region covers numerous watersheds ranging in size from a few square miles to several hundred square miles. Figure 2-3 depicts the principal watersheds in the Bay Area Region based on the 8-digit Hydrologic Unit Code (HUC) of the U.S. Geological Survey (USGS) standardized hydrologic unit system. This system delineates watersheds based on surface hydrologic features and generally single outlet drainage points.

Figure 2-3: Watersheds of the Bay Area Region



2.1.3 Region Service Agencies

The Bay Area Region includes all, or part of the service areas of all water agencies, flood protection agencies, and wastewater agencies in the Bay Area. These agencies conduct the full range of water resources management activities, including supplying water, protecting and enhancing water quality, flood protection, and environmental stewardship. They work together through regional associations such as Bay Area Water Agencies Coalition (BAWAC), Bay Area Clean Water Agencies (BACWA), Bay Area Flood Protection Agency Association (BAFPAA), Bay Area Watershed Network (BAWN) and Association of Bay Area Governments (ABAG). In addition, they work in partnership with watershed groups, state agencies and federal agencies, such as the California Department of Water Resources (DWR), North Bay Watershed Association (NBWA), SF RWQCB, San Francisco Estuary Partnership (SFEP), State Coastal Conservancy (SCC), Tomales Bay Watershed Council, U.S. Army Corps of Engineers (USACE), and U.S. Bureau of Reclamation (USBR).

2.1.3.1 Water Agencies

The following water agencies serve the majority of the water demands in the Bay Area Region:

- Alameda County Water District (ACWD)
- Bay Area Water Supply and Conservation Agency[3] (BAWSCA)
- Contra Costa Water District (CCWD)
- East Bay Municipal Utility District (EBMUD)
- Marin Municipal Water District (MMWD)
- City of Napa
- San Francisco Public Utilities Commission (SFPUC)
- Santa Clara Valley Water District (SCVWD)
- Solano County Water Agency (Solano CWA)
- Sonoma County Water Agency (Sonoma CW)
- Zone 7 Water Agency (Zone 7)

The service area boundaries of these agencies are illustrated in Figure 2-4. Several of these agencies have service area boundaries that extend outside the Bay Area Region but only the service area within the Region is included. The portions of the service areas outside the Bay Area Region boundary are included in other IRWM regions and/or water management efforts (described in Section 2.8).

The San Francisco Bay Area water supply agencies have a history of working together on water resource management issues through BAWAC. Regional efforts enable Bay Area water agencies to capitalize on collective resources, expertise, and knowledge in order to achieve

[3] BAWSCA member agencies include the SFPUC regional system customers and are served wholly or in part by the SFPUC regional system.

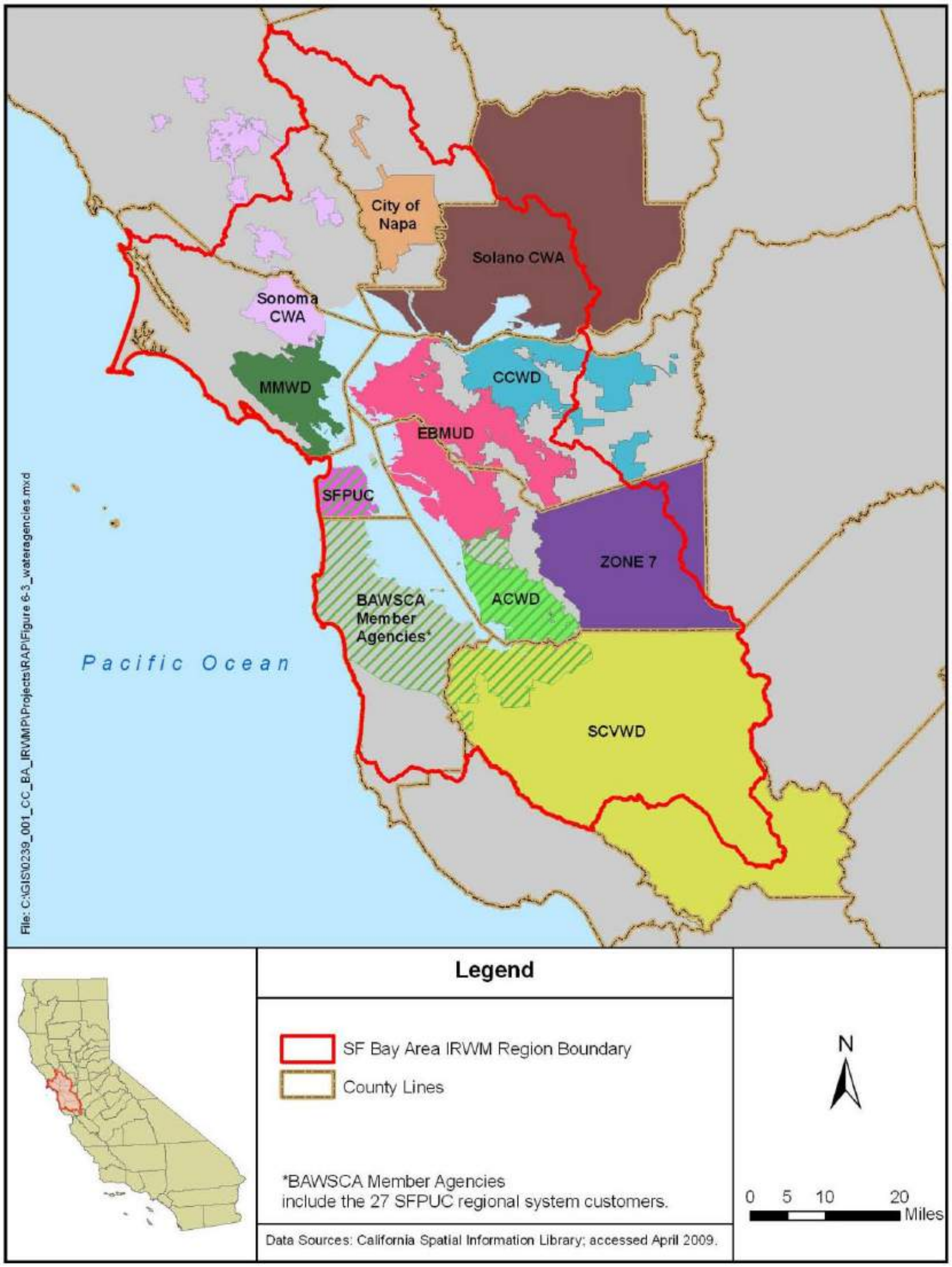
water quality and supply reliability goals. Additional information on these agencies is included in Chapter 1.

2.1.3.2 Wastewater Agencies

There are numerous wastewater management agencies in the Bay Area Region, including cities, sanitation districts, community services districts, water agencies, counties, and other local agencies. Like water supply agencies, wastewater agencies have recognized the value in regional cooperation and collaboration as means of advancing shared interests and resolving common issues. While not every wastewater management agency actively participates in the IRWM effort, their service areas are included within the Region. Many wastewater agencies are represented by BACWA, which has a long history of providing a forum for coordination on region-wide wastewater management issues. Wastewater agencies represented in this effort through participation in BACWA are listed in Chapter 1.

Sonoma Valley Wastewater Treatment Plant, Clarifier

Figure 2-4: Major Water Agencies of the Bay Area Region



2.1.3.3 Flood Protection Agencies

In California, flood protection is provided by various government entities, including USACE, DWR, the State Reclamation Board, the Natural Resources Conservation Service (NRCS), counties, cities, special districts (such as flood control and water districts), and local Resource Conservation Districts (RCDs). In the Bay Area Region, flood protection primarily is provided by countywide flood control districts. These agencies create standards, rules, ideas, and concepts that are developed into comprehensive countywide flood control plans and design and construct projects to improve flood protection.

The Bay Area flood protection agencies have a history of working together on water resource management issues, largely through BAFPAA, which promotes the sharing of ideas, technologies, experiences, legislative approaches and funding strategies. BAFPAA also provides a forum for regional coordination and collaboration with state and federal regulatory and resource agencies. The ten Bay Area agencies that are signatories to BAFPAA include the Alameda, Contra Costa, Marin, Napa and San Mateo Counties Flood Control and Water Conservation Districts (FCWCD), the City and County of San Francisco Department of Public Works, SCVWD, Solano CWA, Sonoma CWA, and Zone 7. As shown in Figure 2-5, most of the flood district boundaries coincide with County boundaries and extend outside the Bay Area Region.

2.1.3.4 Land Use Agencies

Land use planning in the Bay Area Region typically takes place through local city and county governments, as well as the following regional planning organizations:

- **Association of Bay Area Governments**: ABAG is the primary regional land use planning agency for the Bay Area representing nearly all of the region’s population. ABAG strives to enhance cooperation and coordination between local governments to reach regional planning goals.

- **Metropolitan Transportation Commission:** The Metropolitan Transportation Commission (MTC) is the transportation planning, coordinating and financing agency for the Bay Area Rapid Transit (BART) and other major Bay Area transit systems (MTC, 2012).

- **Joint Policy Committee:** The Joint Policy Committee (JPC) coordinates the regional planning efforts of ABAG, Bay Area Air Quality Management District (BAAQMD), San Francisco Bay Conservation and Development Commission (BCDC) and MTC, and pursues implementation of the Bay Area's Smart Growth Vision as expressed in the Smart Growth Preamble and Policies and the Smart Growth Strategy / Regional Livability Footprint Project.

Chapter 13 provides detail on the relationship between land use planning and IRWM planning.

2.1.4 Importance of the Bay Area Region and IRWM Planning

The Bay Area Region is an appropriate area for IRWM planning for many reasons. The Region boundary is consistent with the RWQCB Region 2 boundary and water resource management agencies within the Region have longstanding relationships and have historically coordinated planning efforts to varying degrees. Establishing the Bay Area IRWM Region builds upon these existing historical efforts and provides context for increased integration and coordination.

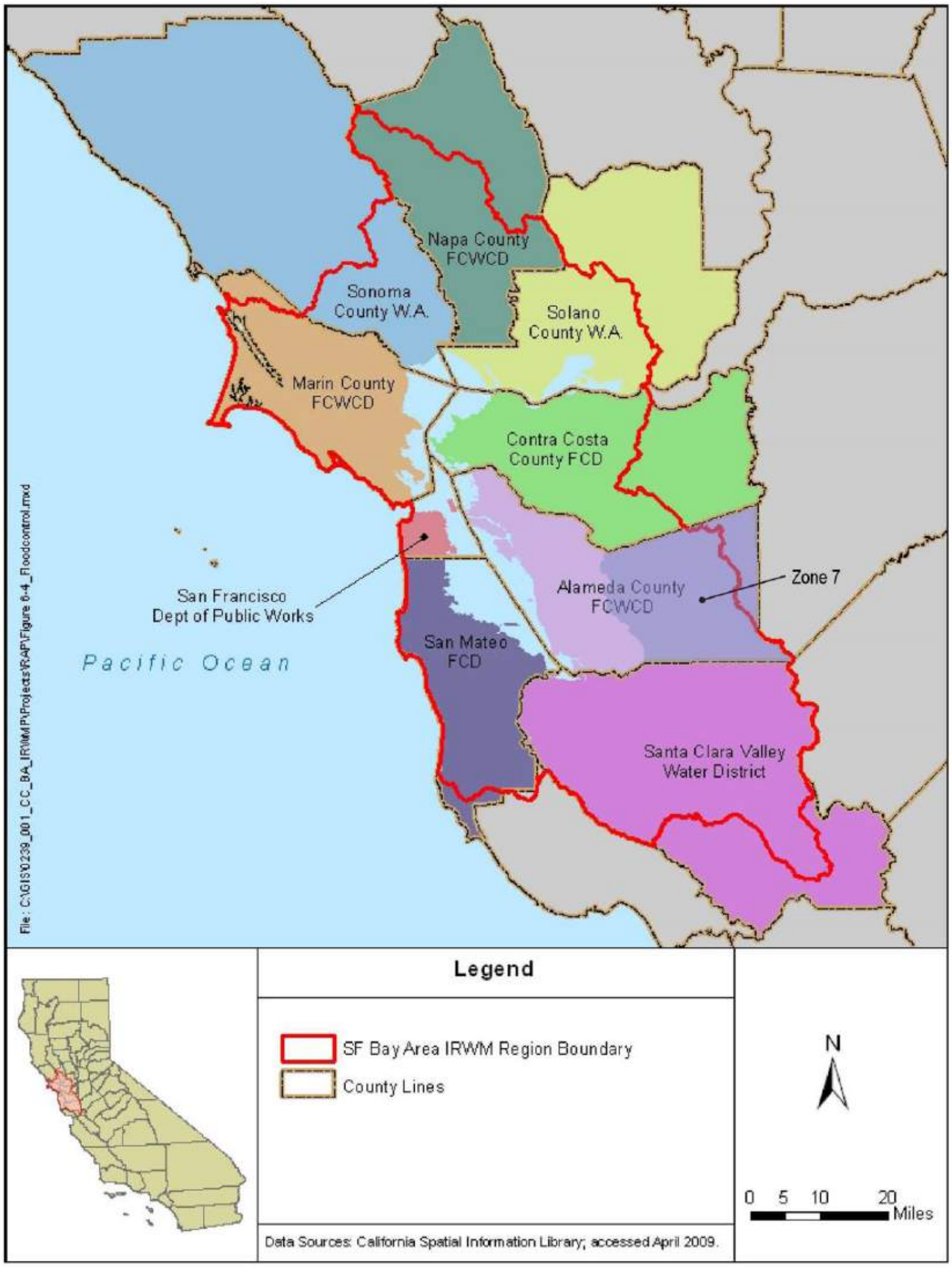
The San Francisco Bay is an important ecological, recreational, and commercial resource. The San Francisco Bay is located at the downstream end of the Sacramento-San Joaquin River Delta, which is the largest estuary on the west coast (and second in the nation), conveying nearly 40 percent of the state's surface water from the Sierra Nevada and the Central Valley to the Pacific Ocean. The Delta is both a rich and diverse ecological habitat and a major water supply source for the entire state. Precipitation falling in the Sierra Nevada flows downriver to the Delta where it is pumped into the State Water Project (SWP) and the Central Valley Project (CVP) to supply 25 million Californians with drinking water and irrigate 750,000 acres of farmland.

Two-thirds of the state's salmon pass through the Bay and Delta each year, as do an estimated half of the waterfowl and shorebirds migrating along the Pacific Flyway (SFRWQCB, 2004). This extensive watershed (60,000 sq. miles) drains nearly half the area of inland California to the Bay, which also is the receiving water for the many local drainage basins of the Bay Area Region.

In addition to its ecological importance, the San Francisco Bay is an important recreational and commercial resource. Sailing and other boating, windsurfing and kite surfing, kayaking, and fishing are popular sporting activities in the bay. The San Francisco Bay serves as a major international shipping port, with major facilities including the Ports of Oakland and Richmond, as well as smaller facilities that include the Ports of San Francisco and Redwood City. Salt is harvested in evaporation ponds and commercially sold to food companies and other industries.

The San Francisco Bay and Golden Gate Bridge

Figure 2-5: Major Flood District Boundaries in the Bay Area Region



In addition to the hydrologic connection of the Bay Area Region, several other features help to create a unique regional connection:

Distinctive Identity. The Bay Area has a strong regional identity, tied together by connections to the Bay, interdependent economies, shared natural resources, and common cultural experiences.

Ecologic Connection. The Bay estuary and its supporting local watersheds host a distinct natural environment and ecology that includes many important habitats for significant species.

Nationally and Internationally Renowned. The Bay Area is a nationally and internationally recognized region. It is a global center for innovation and technology, home to more Fortune 500 companies than almost any other region in the United States, and is the fifth largest metropolitan region in the United States. The San Francisco Bay itself is a famous water body.

History of Regional Planning. Water management agencies throughout the Bay Area have a long history of regional cooperation and planning through groups such as BAWAC, BACWA and Bay Area Stormwater Management Agencies Association (BASMAA). The ABAG, MTC, and BART also have regional planning programs in the Bay Area. The SF RWQCB and San Francisco Bay Conservation and BCDC have regulatory purview over most of the Bay Area Region. Through these programs and others, Bay Area Region water resources management agencies have been collaborating for years to develop regional solutions to water resources issues throughout the region.

The Bay Area Region IRWM planning efforts are crucial to preserving the unique characteristics of the Bay Area. The following sections provide a more detailed description of Bay Area Region's characteristics and water supply.

2.2 Region Characteristics

2.2.1 Climate

Climate is the basic driver of stream flow and other hydrologic factors, and determines the ecology of the Bay Area Region. Climatic conditions are generally characterized as Mediterranean with moist, mild winters and hot, dry summers. The Region's varied topography creates numerous microclimates dependent upon elevation, proximity to the Bay or coast, orientation with respect to the ocean, and wind patterns. The microclimates of the Bay Area Region also cause differences in rainfall amounts and evapotranspiration rates across the region and contribute to varied vegetation and habitats.

Like most of Northern California, the Bay Area Region is largely governed by weather patterns originating in the Pacific Ocean. In the winter, the southern descent of the Polar Jet Stream brings mid-latitude cyclonic storms. Over 90 percent of the Bay Area Region's precipitation falls between November and April, delivering an annual rainfall of between 15 and 20 inches in the South Bay and between 20 and 25 inches in the North Bay. Higher elevations in the Region, particularly along the north or west facing slopes of the North Bay, may receive over 40 inches of rain per year. In the summer, the Hawaiian High Pressure cell over the northern Pacific creates mild and dry weather for inland areas of the region. Conversely, coastal and bay areas often are covered by a thick marine fog layer, which forms off the coast and moves eastward through gaps and passes into the bay.

Watersheds in the northern part of the Bay Area Region receive the highest amount of precipitation, primarily due to topographic effects of Mt. Tamalpais and proximity of the marine layer. The Suisun Bay area watersheds are influenced by pressure systems in the Central Valley and the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) system; high winds develop in the summer as warm low pressure systems in the Central Valley draw cooler marine air from the Bay eastward through the Carquinez Straits. Areas east of the East Bay Hills receive less precipitation and have higher temperatures than areas west of the hills. Similarly, southern Alameda County and the Santa Clara Valley experience drier and warmer climatic conditions since they are further removed from marine influences than the North Bay. The Santa Cruz Mountains create a rain shadow effect over the South Bay, resulting in the lowest annual precipitation rates in the Bay Area Region. Temperature and precipitation on the Peninsula are influenced by wind patterns associated with the east and west sides of the Coast Ranges and Santa Cruz Mountains. Gaps in the mountains allow marine air and fog to cool temperatures in some locations, particularly in San Bruno and Redwood City.

Evapotranspiration rates in the Bay Area Region are influenced by the distribution, type, and percent cover of vegetation, as well as factors such as temperature and humidity. Evapotranspiration rates in the South Bay, for example, are higher than in the North Bay due to lower precipitation, less vegetative cover, and higher temperatures.

Fog in Napa County

2.2.2 Geography and Topography

The Bay Area Region is located in the central Coast Range mountains and is distinct in California as the only location where streams interior to the Coast Range drain directly to the coast. The Bay is the tidal estuary of the Sacramento-San Joaquin River Delta system. Figure 2-6 illustrates the topographic variation within the region.

2.2.3 Flood Plains and Flood Zones

Bay Area Region watersheds typically are characterized by urbanized valleys and bayside alluvial plains that are surrounded by steep, less developed uplands. Valley flooding tends to occur when large, widespread storms follow several days of rainfall. The most widespread flood damages occur in urbanized, low-gradient, low elevation areas when the capacity of natural or engineered channels is exceeded and floodwaters spread through urban neighborhoods. In low-lying areas near the Bay, flooding may be exacerbated by high tides and storm surges that back up riverine flows.

Figure 2-7 illustrates the 100-year and 500-year flood zones mapped by the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program. The 100-year flood zone represents the area with at least 1 percent chance of flooding in any year. The 500-year flood zone illustrates urbanized valleys and Bay plains with the potential for shallow, overland flooding of less than 1 foot, or that are protected from the 100-year flood zone by levees.

Local flooding may occur following intense, short-duration storm bursts that can cause storm drain surcharges. Because of the topography of alluvial plains, floodwaters escaping some stream channels may flow away from the flooding stream, crossing open areas or flowing through city streets until reaching an adjacent watercourse. This type of flooding compounds and exacerbates local flooding that occurs when storm drains and small channels become blocked or surcharged during storms.

Figure 2-6: Bay Area Region Topography

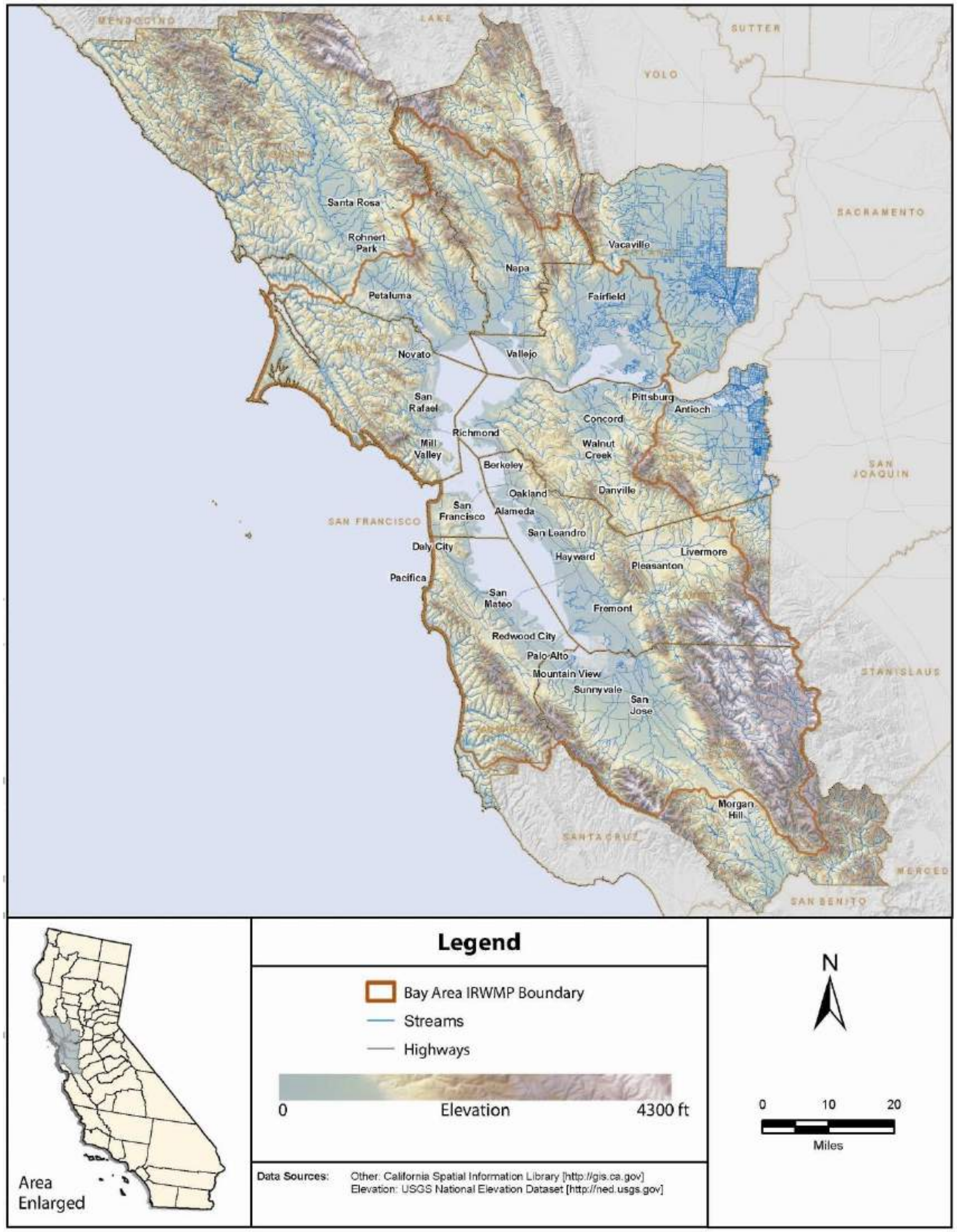
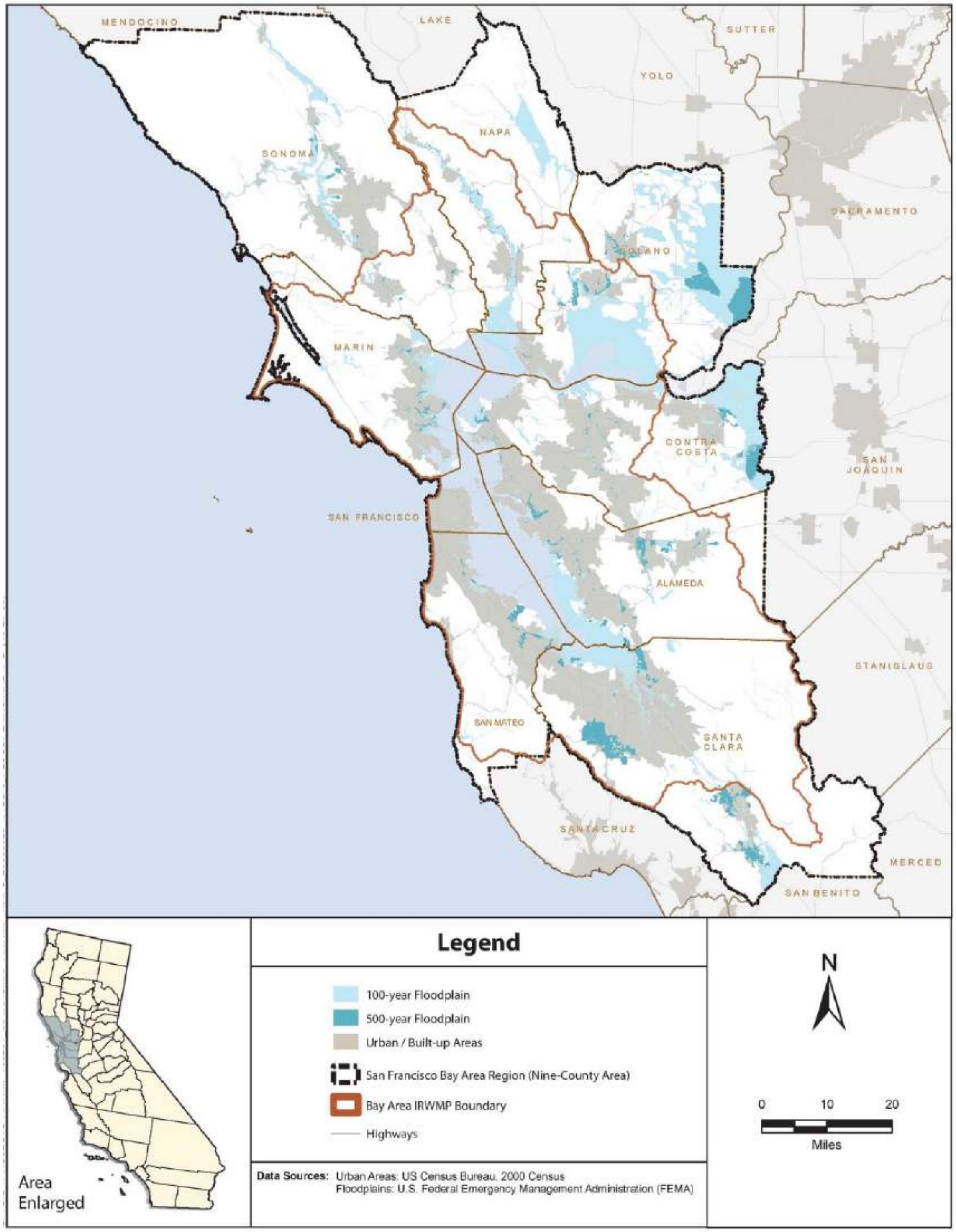


Figure 2-7: 100 and 500-year Flood Zones



2.2.4 Geologic Setting

Identifying a watershed's general location and placement within the overall Bay Area Region in relation to basic structural features is important to understanding watershed function, sediment delivery, watershed hydrology, water quality, and resulting habitat opportunities.

The San Francisco Bay lies in a basin that extends from the Santa Clara Valley in the south to the Napa, Sonoma, and Petaluma valleys in the north. The Bay is generally oriented northwest/southeast between the San Andreas Fault zone to the west and the Hayward and Calaveras Fault zones to the east. The Bay is a relatively recent feature (estimated to be approximately 10,000 years old) that was inundated by sea-level rise associated with the end of the Last Glacial Maximum.

The Bay is relatively shallow, with 85 percent of its area less than 30 feet deep. Much of the perimeter of the Bay is occupied by shallow tidal mud flats, tidal marshes, diked or leveed agricultural areas, and salt ponds. These tidal baylands support important aquatic and wetland habitats and have been the focus of many restoration activities over the past 30 years. In the future, the physical extent of the Bay will depend on the balance between the continually rising sea level, the rate of sediment delivery to the Bay, and potential tectonic subsidence (or uplift) that may affect the depth of the Bay.

In the North Bay, the Petaluma River, Sonoma Creek, and Napa River watersheds are generally north/south oriented, somewhat elongated basins that are aligned in parallel with the dominant tectonic structure. In these watersheds, central trunk streams collect flows and sediment from east/west oriented tributaries emerging from adjacent uplands, fans, and canyons. Similarly, in the South Bay, the Coyote Creek and Guadalupe River watersheds are generally north/south aligned systems parallel to the strike of the tectonic structure. Central trunk streams assimilate smaller local tributaries that emerge from the Santa Cruz Mountains to the west of the Santa Clara Valley or the Mt. Hamilton segment of the Diablo Range to the east of the Santa Clara Valley. The central lowland valleys of these watersheds house the region's important alluvial aquifers.

Several other Bay Area Region watersheds are oriented perpendicular to the generally northwest/southeast alignment of Bay faults and geologic structure. This is observed in watersheds of the East Bay and Peninsula whose headwaters originate in the hills above the Bay and whose major tributaries flow generally east or west out of the steeper headwaters, across a transitional alluvial fan zone, and across a more gently sloping bay plain before reaching the Bay.

2.2.5 Hydrology and Geomorphology

The San Francisco Bay watershed and its sub-basins are complex hydrologic systems with multiple and concurrent water inputs and outputs. In addition to the San Francisco Bay itself, surface water bodies located in the Bay Area Region include:

- Ocean bays and lagoons, such as Bolinas Bay and Lagoon, Half Moon Bay, and Tomales Bay
- Urban lakes, such as Lake Merced and Lake Merritt

- Large lakes and reservoirs, such as Anderson Reservoir, Briones Reservoir, Calaveras Reservoir, Crystal Springs Reservoir, Kent Lake, Lake Chabot, Lake Hennessey, Nicasio Reservoir, San Andreas Lake, San Antonio Reservoir, San Pablo Reservoir, Upper San Leandro Reservoir, Lake Del Valle
- Numerous smaller lakes and reservoirs
- Rivers and creeks (listed by watershed in Table 2-1 and by CCA in Table 2-3)

Due to local topography and geology, surface runoff can cause a range of geomorphic functions – including erosion, transport, or deposition – throughout the Bay watershed. Tectonic, faulting, and structural controls are of particular importance, as they often influence the relative distribution of sediment source, transport, or depositional areas in the region.


Campbell Creek, Napa County

The majority of human impacts to watershed systems are linked to land use or land cover alterations, as well as channelization and alteration of waterways. Land use and channel modifications alter the fundamental hydrologic cycle by impacting infiltration rates and capacity. Land development that uses impermeable surfaces reduces infiltration, resulting in increased surface runoff.

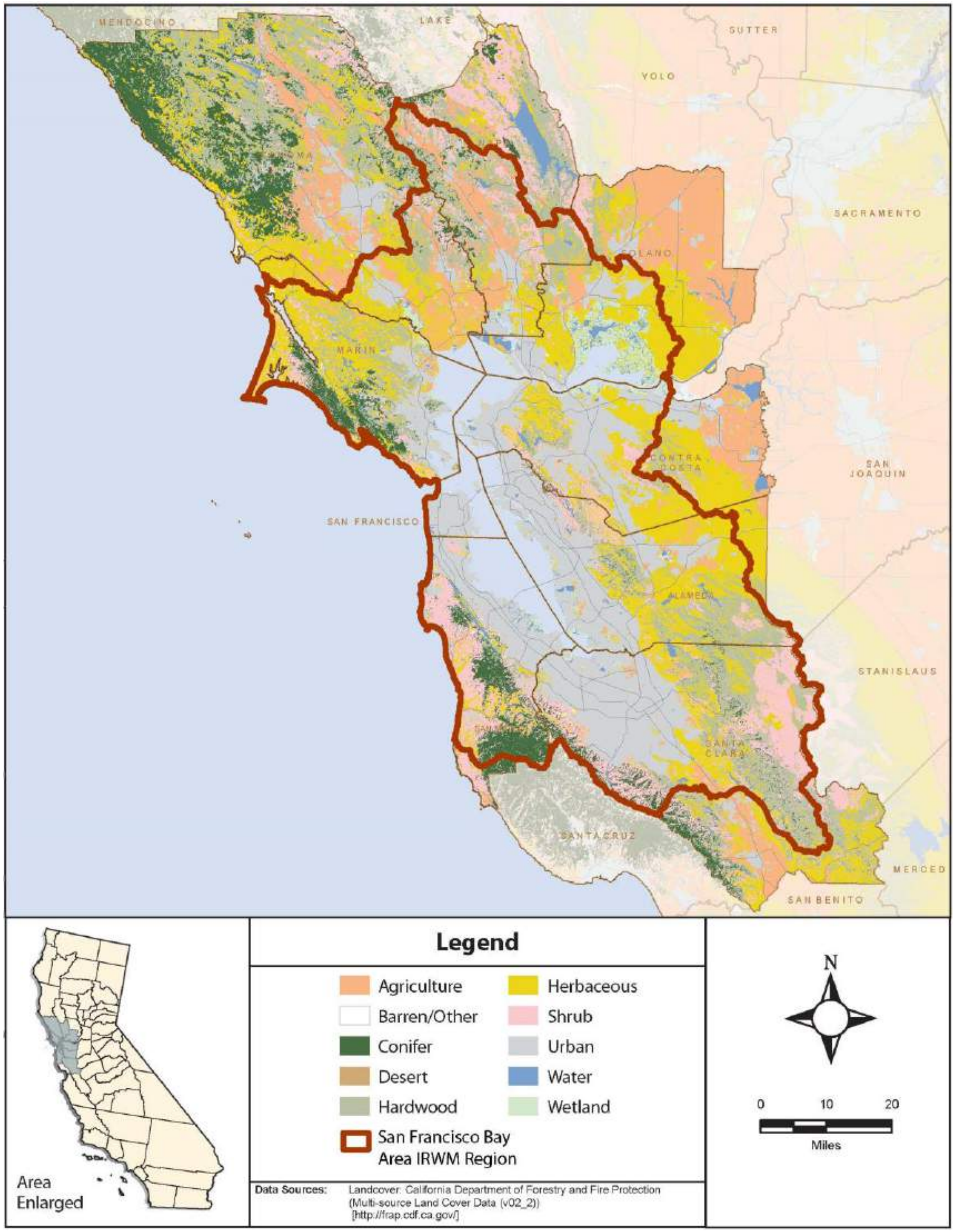
Surface runoff from some disturbed upland and urbanized areas collects and transports pollutants and organic materials into Bay Area Region streams and wetlands. Surface runoff carries a variety of dissolved materials including: minerals dissolved from bedrock deposits (calcium carbonate); metals derived from bedrock (iron and aluminum) or human activities (zinc and lead); pesticides, herbicides, toxic pollutants, and industrial waste materials; phosphorus and nitrogen; and oxygen (Holdren, 2001). Concentration of these surface pollutants can degrade water bodies until they are no longer able to serve beneficial purposes.

The hydrologic function of Bay Area Region watersheds has been greatly affected through surface land cover and land practice alterations. As shown in Figure 2-8, a broad band of urbanization surrounds the Bay, covering much of the gently sloping bay plain terrain. In the last few decades, urbanization has extended beyond the immediate Bay plain to the interior valleys and foothills of the North Bay, East Bay, and South Bay.

Increased stream flows that have resulted from Bay Area Region urbanization have been associated with increased bed and bank erosion and potential for increased downstream sediment transport and deposition. Geomorphic effects of urbanization can be less obvious since urbanization includes construction of reservoirs, stormwater management systems, and channel engineering which mitigate some direct impacts. However, such systems often introduce secondary geomorphic impacts, such as the "hungry stream" effect associated with reduced sediment source areas and streams that have increased erosive competence. The hungry stream effect results in a reduction in sediment delivery to the Bay and coastal areas and shoreline erosion.

Ranching practices, most notably cattle and sheep grazing, also have impacted watersheds and have resulted in soil compaction and the replacement of a wide variety of native grasses with lower coverage non-natives. These changes increased surface runoff, gullying, channel incision and the severe destabilization of creek banks and beds from direct animal activity. Effects of grazing in several sub-basins of the Bay watershed are still evident today.

Figure 2-8: Bay Area Region Vegetation Land Cover



2.2.6 Groundwater Basin Boundaries

The Bay Area Region has 28 identified groundwater basins, which underlie approximately 30 percent of the region (California's Groundwater, 2003) as shown in Figure 2-9. Groundwater is an important part of the water supply for several parts of the Bay Area Region. The major groundwater basins used for supply are described below:

Santa Clara Valley Groundwater Basin: The Santa Clara Valley basin runs parallel to the Coast Ranges and is bounded by the Diablo Range to the east and the Santa Cruz Mountains to the west. The basin contains a large inland valley drained by tributaries to San Francisco Bay including Coyote Creek, the Guadalupe River, and Los Gatos Creek. The Santa Clara Groundwater Basin includes four sub-basins – the East Bay Plain, San Mateo Plain, Santa Clara, and the Niles Cone.

Napa-Sonoma Valley Groundwater Basin: The Napa-Sonoma Valley basin consists of the Sonoma Valley and Napa-Sonoma Lowlands sub-basins. The Sonoma Valley Sub-basin is located in the southeastern corner of Sonoma County and extends over an area of 70 square miles. The cities of Sonoma, Schellville, and Valley of the Moon are located in the recharge area of the sub-basin. The Napa-Sonoma Lowlands Sub-basin covers 65 square miles located north of San Pablo Bay. The sub-basin consists of two main water-bearing formations: Recent and Pleistocene Alluvial Deposits and the Pleistocene Huichica Formation.

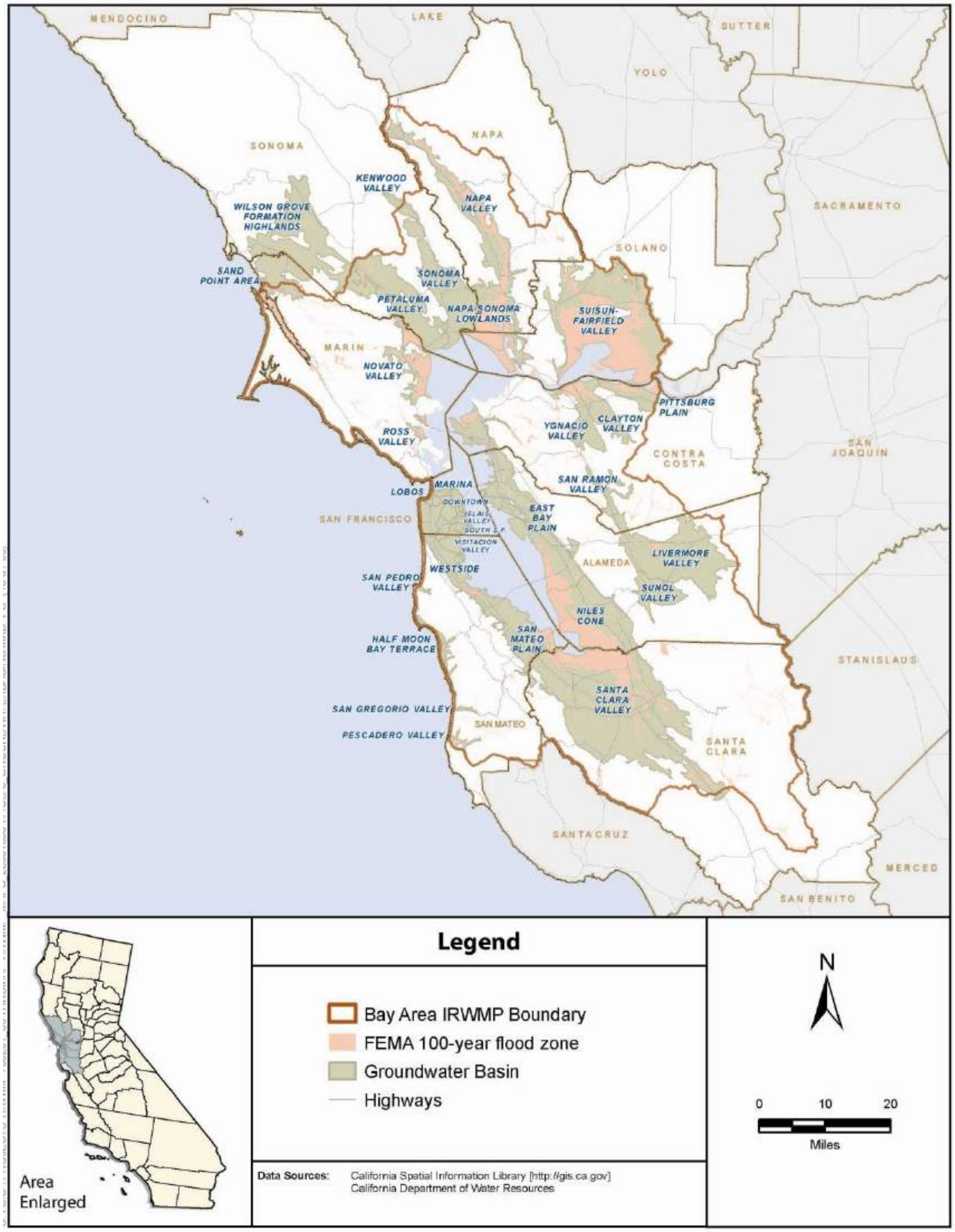
Petaluma Valley Groundwater Basin: The Petaluma Valley Groundwater Basin, located south of Rohnert Park, drains to the southeast towards San Francisco Bay. Alluvial-fan deposits and stream-valley alluvium compose the major part of the aquifer. Estuarine deposits of sand beneath are an important local source of ground water (USGS, 2006).

Livermore Valley Groundwater Basin: The Livermore Valley groundwater basin is located in the Livermore-Amador Valley. It extends from the Pleasanton Ridge east to the Altamont Hills and from the Livermore Upland north to the Orinda Upland. Principal streams draining the Livermore Valley include Arroyo Valle, Arroyo Mocho, and Arroyo Las Positas; minor streams include Alamo Creek, South San Ramon Creek, and Tassajara Creek. These streams converge on the west side of the basin to form Arroyo de la Laguna, which flows south and joins Alameda Creek in Sunol Valley (DPLA2, 2006).

Westside Groundwater Basin: The Westside Basin is the largest groundwater basin on the San Francisco Peninsula, bounded by Golden Gate Park to the north, the San Bruno mountains to the east, the San Andreas Fault and Pacific Ocean to the west, and the San Mateo Plain groundwater basin to the south. The basin is comprised of unconsolidated sediments of the Colma formation of Pleistocene age and the Merced Formation of Pleistocene/Pliocene age.

As described in Section 2.5, in general, groundwater in the Bay Area Region is of good quality and suitable for most purposes, with some locally high concentrations of certain constituents.

Figure 2-9: Significant Bay Area Region Groundwater Basins



2.2.7 Biodiversity and Protected Lands

The Bay Area is an internationally recognized biodiversity hotpot, nationally one of the six most important. It is recognized for its abundance of birds, plants, insects and other species, and known for a high diversity of endemic species which thrive in the Mediterranean-type climate. The metropolitan nature of the region and continuing urban sprawl, have prompted major efforts to conserve this biodiversity.

The Bay Area is a leader in open space protection with 1.2 million acres currently under permanent protection and habitat conservation plans that cover the entire Bay Area. There were three significant milestones in this effort:

1. The Baylands Ecosystem Habitat Goals Project (1999) featured a consortium of public agencies and focused on the conservation of historic tidelands. This Project became a model for subsequent habitat protection efforts.

2. The Bay Area Open Space Council initiated the first regional plan for conserving the Bay Area's biological diversity in 2004, with development of the San Francisco Bay Area Upland Habitat Goals Project. This study established the Conservation Lands Network and outlined actions needed to sustain the diversity and health of the ecological community in the nine county Bay Area.

3. The San Francisco Bay Subtidal Habitat Goals Project, completed in 2011 developed a framework for the protection and restoration of submerged habitats in the San Francisco Bay. The network of protected lands and more information can be found on the Conservation Lands Network website at http://www.bayarealands.org/.

In addition, the Bay Area acknowledges that the relationship between Tribes and their land and natural resources is complex, extending from time immemorial to the present day and beyond. Tribal governments demonstrate excellence in caring for their lands and natural resources with respect and minimal financial resources. Tribes look to their land and natural resources to provide and support essential elements of Native life and culture—from subsistence hunting, fishing, and gathering, to sources of economic development and Tribal sacred places.

2.2.8 Biologic and Aquatic Resources

The Bay estuary is the largest estuary of the West Coast and one of North America's most important. It is an environmentally sensitive and biologically diverse ecosystem made up of freshwater streams, tidelands, marshlands, wetlands, mudflats, farmland and other unique systems. Bay Area watersheds and their associated habitats provide a myriad of water resource and ecological benefits to both humans and wildlife.

Napa Marshlands

Watersheds provide freshwater sources for humans and wildlife; floodplains and wetlands can reduce flood impacts and improve water quality and groundwater resources; diverse habitats allow wildlife to flourish; and vegetation can reduce water temperatures and minimize erosion and sedimentation. Native habitats include:

Riparian: Montane riparian areas in the region are associated with lakes, ponds, seeps, bogs and meadows, as well as rivers, streams and springs. In these systems water may be permanent or ephemeral. Valley foothill riparian habitats are found in valleys bordered by sloping alluvial fans, slightly dissected terraces, lower foothills, and coastal plains. They are generally associated with low velocity flows, flood plains, and gentle topography.

Lacustrine: Lacustrine habitats are inland depressions or dammed river channels containing standing water. Typical Bay Area lacustrine habitats include permanently flooded lakes and reservoirs, intermittent lakes, and shallow ponds (including vernal pools) in which rooted plants can grow. Additionally, relic or maintained stock ponds often provide important wetlands habitats in many parts of the East Bay, South Bay, and Peninsula. Most permanent lacustrine systems support fish life, while intermittent types usually do not.

Wetlands: Freshwater wetlands in the region occur in tidal areas with low salinity due to mixing and are populated by trees, shrubs, persistent emergents, emergent mosses or lichens. Tidal wetlands are characterized as salt or brackish marshes consisting mostly of perennial graminoids and forbs, along with algal mats on moist soils and at the base of vascular plant stems.

California Clapper Rail

The Bay Area is home to over 90 animal and plant species that have been designated by state and federal agencies as threatened or endangered (Center for Biological Diversity 2012), including the ones listed in Table 2-1. The Bay Area provides an important wintering site for migratory waterfowl along the Pacific Flyway, as well as a spawning area for anadromous fish. Two-thirds of the state’s salmon population passes through the Bay and Delta each year, however populations continue to undergo significant decline and are the focus of ongoing recovery efforts. In September 2012, the National Marine Fisheries Service (NMFS) released the final Recovery Plan for the Central California Coast Coho Salmon Evolutionary Significant Unit, which focuses on the recovery of populations from Punta Gorda in northern California to Aptos Creek in Santa Cruz County, including the San Francisco Bay estuary and its tributaries. Several streams in the Bay Area have been identified for recovery actions, including Pescadero Creek and Lagunitas Creek where focus populations for recovery exist. Persistence of Lagunitas Creek coho populations is due in large part to long-term dedicated coordination and action among local citizens and agencies (NMFS 2012).

Table 2-1: Threatened and Endangered Species in the Bay-Delta

Classification	Species
Mammals	San Joaquin kit fox, Salt-marsh harvest mouse, Southern sea otter
Birds	California least tern, California Ridgway's rail, Western snowy plover, Marbled Murrelet, Northern spotted owl
Reptiles	Giant garter snake, Alameda whipsnake, Green sea turtle, Leatherback sea turtle, Olive ridley sea turtle, San Francisco garter snake
Fish	Chinook salmon, Coho salmon, Steelhead trout, Delta smelt, Tidewater goby
Amphibian	California red-legged frog, California tiger salamander
Crustaceans	California freshwater shrimp, Conservancy fairy shrimp, Longhorn fairy shrimp, Vernal pool tadpole shrimp, black abalone
Insects	Callippe silverspot butterfly, Delta green ground beetle, Lange's metalmark butterfly, Mission blue butterfly, Myrtle's silverspot butterfly, San Bruno elfin butterfly, Bay checkerspot butterfly, Smith's blue butterfly, Ohlone tiger beetle, Zayante band-winged grasshopper,
Plants	Antioch Dunes evening-primrose, Baker's larkspur, Beach layia, Calistoga allocarya, Clara Hunt's milk-vetch, Clousa grass, Contra Costa wallflower, Coyote ceanothus, Few-flowered naverretia, Fountain thistle, Keck's Checker-mallow, Lake County stonecrop, Loch Lomond coyote thistle, Many-flowered navarretia, Marin dwarf-flax, Metcalf Canyon jewelflower, Bapa bluegrass, Pallid Manzanita, Palmate-braced bird's beak, Pennel's bird's beak, Pitkin Marsh lily, Presidio clarkia, Presidio Manzanita, San Francisco lessingia, San Joaquin Orcutt grass, San Mateo thornmint, San Mateo woolly sunflower, Santa Clara Valley dudleya, Sebastapol meadowfoam, Soft bird's-beak, Solano grass, Sonoma alopecurus, Sonoma spineflower, Sonoma sunshine, Suisun thistle, Tiburon jewelflower, Tiburon mariposa lily, Tiburon paintbrush, Vine Hill clarkia, White sedge, White-rayed pentachaeta, Yellow larkspur

Source: USFWS 2012, sfbaywildlife.info 2012.

Female Chinook Salmon in the Napa River

Given the setting of the Bay Area Region, the areas adjacent to the coast and Bay are extensive and have high ecological significance. Critical Coastal Areas (CCAs) are specially designated land areas of the California coast where state, federal and local government agencies and other stakeholders have agreed to improve degraded water quality or protect exceptional coastal water quality from the impact or threat of nonpoint source pollution by coordinating expertise and resources. The SF RWQCB jurisdiction has a total of 32 designated CCAs, including several that have been proposed as high priority CCA planning and implementation areas. Table 2-2 lists each of the Bay Area CCAs and describes each one's importance. The CCAs span across seven Bay Area regions, as shown in

Figure 2-10. More information on the listed CCAs can be found on the California Coastal Commission website by following the individual hyperlinks in the table.

Table 2-2: Bay Area Critical Coastal Areas

CCA Name	Description
Walker Creek	The Walker Creek watershed covers 73 square miles in West Marin County, an area of rolling hills to steep gullies. The majority of the watershed is private property, and the major land uses are livestock ranching and dairies. The creek is a protected habitat for coho salmon (the native run is generally extirpated, but CDFW has recently reintroduced coho on an experimental basis), steelhead trout, and California freshwater shrimp. Major tributaries are Chileno Creek and Keys Creek.
Tomales Bay	Tomales Bay, a 28-km^2 bay on the west coast of Marin County, is one of the major estuaries on the Pacific Coast of California, supporting abundant wildlife, including marine mammals and migratory wildfowl. It is a very popular recreation area for kayaking, fishing, hiking, and sightseeing, and the Bay is one of four commercial oyster-growing areas in the state. Tomales Bay Ecological Reserve is located in the Bay.
Lagunitas Creek	The 103 square mile Lagunitas Creek watershed is the largest watershed in Marin County. Primary tributaries are San Geronimo, Devil's Gulch, Nicasio Creek, and Olema Creek. A large part of the watershed is within state and federal parklands; the largest landowner is the National Park Service. The second largest landowner is Marin Municipal Water District, and Marin County Open Space District holds about 2,000 acres in the watershed. There are a number of small towns along the San Geronimo Creek tributary.
Bird Rock	The remote 'Bird Rock' Area of Special Biological Significance (ASBS) has only 0.3 miles of coastline. The National Park Service manages the wilderness shoreline of this CCA (Point Reyes National Seashore), and a portion of the ASBS lies in the Gulf of the Farallones National Marine Sanctuary.
Point Reyes Headlands Reserve and Extension	'Point Reyes Headlands' ASBS in Marin County has 4.8 miles of coastline. This ASBS lies within the Gulf of the Farallones National Marine Sanctuary; the National Park Service (Point Reyes National Seashore) manages the shoreline. Offshore of this CCA is the Point Reyes Headlands State Marine Conservation Area and Extension. On the peninsula leading to the headland are historical working dairy ranches, but these do not drain directly into the ASBS. A road follows the entire ASBS, but the slope of the headland is such that any road run-off also flows away from the ASBS.
Double Point	'Double Point' State ASBS, located in Marin County, has only 0.7 miles of coastline; a portion of the ASBS lies in the Gulf of the Farallones

CCA Name	Description
	National Marine Sanctuary. This area is in a rural part of the Point Reyes National Seashore, and the National Park Service manages the shoreline of this CCA. The area surrounding Double Point is accessible only to hikers, and has primitive trail camps to the north and east of this ASBS.
Duxbury Reef Reserve and Extension	‘Duxbury Reef’ ASBS in Marin County has 3.4 miles of coastline. This ASBS lies entirely within the Gulf of the Farallones National Marine Sanctuary. Offshore of this CCA is the Duxbury Reef State Marine Conservation Area and Extension, which is managed by CDFW.
James V. Fitzgerald Marine Reserve	This watershed flows into the ‘James V. Fitzgerald’ ASBS in San Mateo County, which has 5.5 miles of coastline. Offshore of this CCA is the James V. Fitzgerald State Marine Park. San Mateo County manages the Marine Park, which was preserved for its unique underwater habitat and extensive tide pools. This ASBS lies entirely within the Monterey Bay National Marine Sanctuary.
San Gregorio Creek	San Gregorio Creek and its tributaries are impaired by accelerated rates of erosion and sedimentation resulting from natural geologic and climatic processes, augmented by human land use practices. The largest anthropogenic sources of sediment are believed to be active and abandoned roads on unstable slopes near stream channels; and hillside gullies on agricultural and range lands in the lower watershed, formed primarily as a result of hillside row-cropping in the 1930s.
Pescadero Creek	With an extensively wooded upper watershed, willow-alder riparian corridors, and a large estuarine marsh, this 80 square mile watershed supports one of the largest remaining runs of steelhead within the San Francisco Bay region. It also supported a large coho salmon run as recently as the late 1960s, although few if any coho have returned to spawn in recent years. Pescadero Marsh is the largest wetland habitat between San Francisco Bay and Elkhorn Slough.
Butano Creek	With an extensively wooded upper watershed, willow-alder riparian corridors, and a large estuarine marsh, this 80 square mile watershed supports one of the largest remaining runs of steelhead within the San Francisco Bay region. It also supported a large coho salmon run as recently as the late 1960s, although few if any coho have returned to spawn in recent years. Pescadero Marsh is the largest wetland habitat between San Francisco Bay and Elkhorn Slough.
Alameda Creek and Flood Control Channel	Alameda Creek drains the largest watershed in the Southern San Francisco Bay Region, about 700 square miles. The creek historically supported anadromous fisheries of steelhead trout, coho salmon, and Pacific and river lamprey, and still supports one of the best native stream fish assemblages in the San Francisco Bay Region. Although dammed in a number of locations, much of Alameda Creek remains natural, with the exception of a large earthen channel Army Corps project in the lower end of the creek. Alameda Creek is a high quality creek with the potential to support significant anadromous fish populations, if restored.

CCA Name	Description
Calabazas Creek	Calabazas Creek extends approximately 13.3 miles from the confluence with the Guadalupe Slough to the Saratoga foothills. The watershed drains approximately 21 square miles within the cities of Sunnyvale, Cupertino, San Jose, Santa Clara, and Saratoga. Three major tributaries include Regnart Creek, Rodeo Creek, and Prospect Creek. The creek channel has been significantly modified, yet retains large sections of natural channel. Fish are rare due to limited habitat, extreme stormwater flows, and barriers associated with the modified channel. There are many road crossings, including stormwater outfalls that likely contribute to extreme stormwater flows in the creek. High stormwater flows have contributed to a high level of channel instability and stream bank scour that has created a sediment problem in the stream channel.
Corte Madera Creek	The Corte Madera Creek watershed is a 28 square mile watershed in central eastern Marin County. The creek, which has a number of tributaries including Cascade Creek, San Anselmo Creek, Larkspur Creek, and Ross Creek, flows from open space headwater areas through a highly urbanized area to San Francisco Bay. The watershed supports a number of aquatic species including steelhead trout, and has significant salt marsh wetlands at the mouth of the creek where it flows into the Bay, at the Corte Madera Marsh State Marine Park.
Coyote Creek (Santa Clara Co.)	Sixteen major creeks drain this 322-square-mile watershed. The county's largest watershed, it extends from the urbanized valley floor upward to the vast natural areas of the Mt. Hamilton range. The watershed's main waterway, Coyote Creek, is the longest creek in the county. The watershed is home to over 1,000,000 people and provides aquatic and riparian habitat for plants and animals, including threatened or endangered species such as the California red-legged frog, bank swallow, steelhead, and Chinook salmon.
Gallinas Creek	Gallinas Creek runs from the upper slopes of San Rafael open space areas in an open channelized stretch through an urban residential area, then winds through the Santa Margherita Island and Santa Venetia preserves, and discharges into San Pablo Bay.
Guadalupe River	The Guadalupe River is surrounded by dense urban development, and passes through the heart of the City of San Jose. This river supports an important anadromous fishery, and is used for recharge of public water supply aquifers. The lower river reach flows into the former Cargil Salt Ponds, which are in the process of wetland restoration.
Lake Merritt	Lake Merritt, also known as the jewel of Oakland, is a 140-acre tidal estuary in the City of Oakland. With an average depth of eight to ten feet and 3.4 miles of shoreline, it is home to migratory waterfowl, aquatic life, and is a significant public recreation resource for Oakland.
Matadero Creek	Matadero Creek originates near the town of Los Altos Hills and flows in a northeasterly direction through the residential, commercial, and industrial areas of the City of Palo Alto and unincorporated areas of Santa Clara County. Downstream of the Bayshore Freeway (U.S. Highway 101), Matadero Creek discharges into the Palo Alto Flood Basin, which outfalls into the Bay. Matadero Creek has a total watershed area of about 14 square miles, of which approximately 11

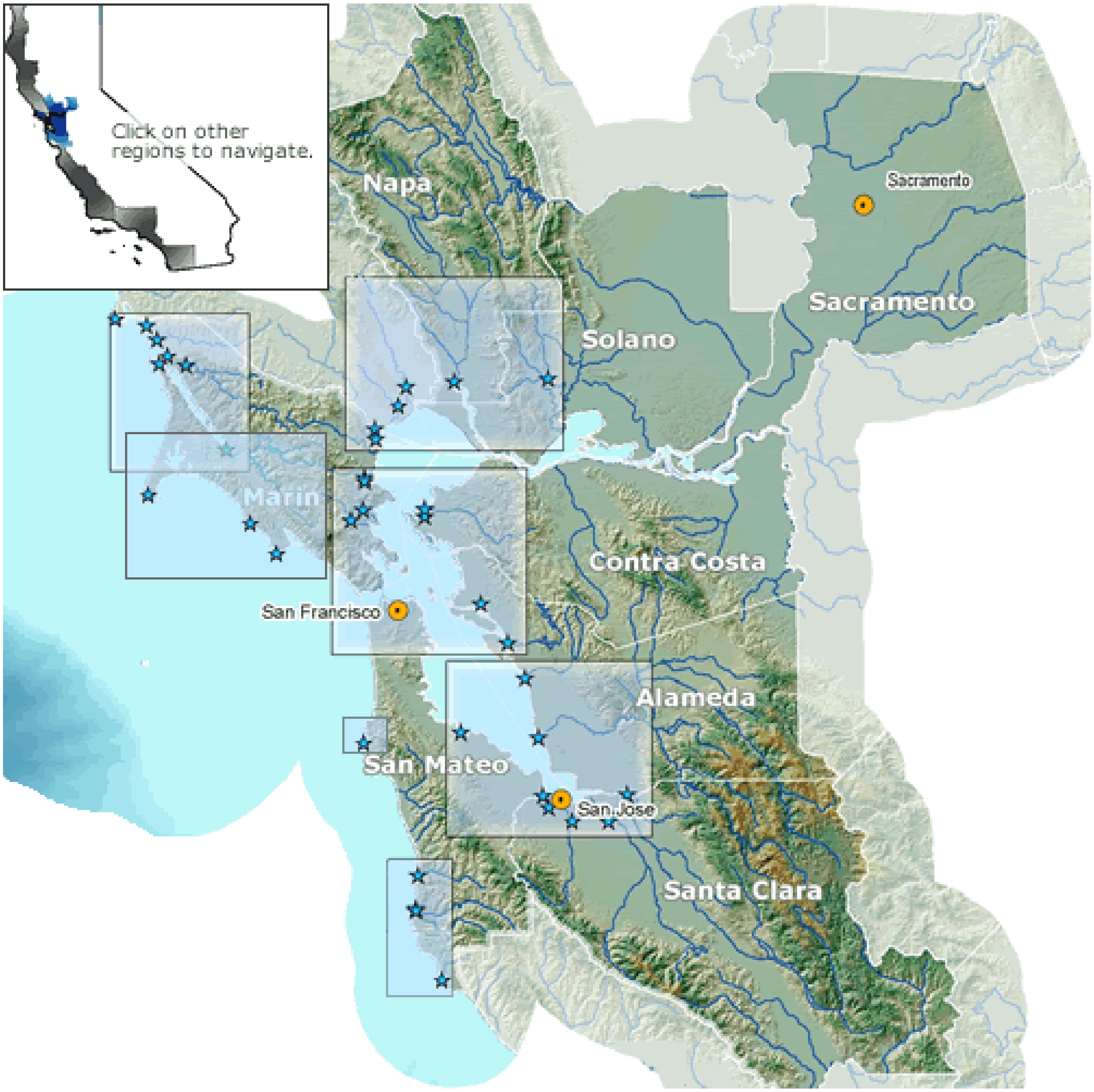
CCA Name	Description
	square miles are mountainous land, and 3 square miles are gently sloping valley floor.
Miller Creek	Miller Creek runs east from Big Rock Ridge in central Marin County through the Las Gallinas Valley and into San Pablo Bay. The Miller Creek watershed has been grazed continuously since the 1800s, and the creek has experienced severe widening and down-cutting as a result. The creek maintains more of its natural channel than other eastern Marin County streams, and supports a variety of native fish. The majority of the creek is in agricultural uses in the upper and lower reaches, with suburban residential areas in the middle reaches.
Napa River	The Napa River watershed encompasses an area of approximately 426 square miles at the northern end of San Pablo Bay in the San Francisco Estuary. The Napa River and its tributaries support an unusually diverse community of native fishes including two salmonid species: steelhead and Chinook Salmon. The Napa River basin has been identified as an “anchor watershed” with the highest potential for maintaining and restoring current and historic salmonid populations in the San Francisco Bay Area and it appears to support the largest remaining run of steelhead in the streams that discharge directly to San Francisco Bay.
Novato Creek	Novato Creek is a perennial stream that extends about 17 miles from its headwaters at Stafford Dam to San Pablo Bay. Areas near the Bay are largely salt marsh and leveed wetlands. The stream system supports steelhead and other native fishes.
Petaluma River	The Petaluma River, located in southern Sonoma and Northern Marin counties, drains an area of approximately 146 square miles into San Pablo Bay. The river is tidally influenced in the lower 11 miles, up to downtown City of Petaluma, and it is used for navigation by commercial and recreational vessels. Considerable open space remains in the watershed, and the watershed supports an unusually diverse community of native fish and wildlife species in its stream, riparian, and wetland habitats.
San Francisquito Creek	The San Francisquito Creek Watershed is approximately 42 square miles, extending from Skyline Boulevard at the top of the Santa Cruz Mountains to the San Francisco Bay. The watershed includes public lands and numerous private landowners in the cities of East Palo Alto, Menlo Park, Palo Alto, Portola Valley and Woodside, unincorporated land areas of San Mateo and Santa Clara counties, and Stanford University. San Francisquito Creek and Los Trancos (a large tributary) represent the boundary between the two stated counties. Stanford University is the largest landowner in the watershed owning over 8,000 acres in both counties.
San Leandro Creek	San Leandro Creek is a significant East San Francisco Bay creek. Its headwaters are in watershed and public parklands, and include drinking water reservoirs; downstream, it flows through urban areas. San Leandro Creek supports a diverse range of fish, native and non-native vegetation, and recreational opportunities. With good restoration, San Leandro Creek has the potential for reintroducing fish spawning.

CCA Name	Description
San Lorenzo Creek	The lower portion of the 48-square mile San Lorenzo Creek watershed is urbanized, and the headwaters are located in rural, agricultural, and low-density residential areas. San Lorenzo Creek supports diverse wildlife, including anadromous fish, although a concrete-lined creek section and other barriers block fish passage. Two shallow reservoirs (Cull and Don Castro) are also in this system.
San Mateo Creek	San Mateo Creek flows from the Peninsula watershed through the Lower Crystal Springs Reservoir at Crystal Springs Dam, through Hillsborough and San Mateo out to San Francisco Bay. The watershed provides wildlife habitat and fish spawning habitat, including preservation of rare and endangered species. The Crystal Springs Reservoir is used for municipal and domestic water supply.
San Pablo Creek	The San Pablo Creek Watershed covers 27,640 acres and includes approximately 109 miles of creek channel. The headwaters of San Pablo Creek run through the City of Orinda before entering drinking water reservoirs (San Pablo and Briones) managed by the EBMUD. The lands in the upper watershed are largely undeveloped watershed and parklands managed by the East Bay Regional Park District and EBMUD. As water leaves San Pablo Reservoir, it flows through the heavily urbanized, residential, and commercial areas of the cities of Richmond and San Pablo before reaching salt marshes adjacent to San Pablo Bay.
San Rafael Creek	San Rafael Creek in eastern Marin County is fed by several small creeks that run through a primarily urban residential area, then through industrial areas where the creek is channelized into a canal, and thence into San Francisco Bay. The canal area is heavily impacted by urban Nonpoint Source runoff, including from several marinas and light industry.
Sonoma Creek	Sonoma Creek drains a 170-square mile area from the Sonoma and Mayacamas Mountains into the Valley. Land cover in the watershed as of 2000 was as follows: 12 percent urban (concentrated along Highway 12 in the central part of the watershed), 2 percent other paved area, 14 percent vineyard, 15 percent other agricultural (primarily hayfields and pasture), and 56 percent non-agricultural, undeveloped open space. About 18 percent of the watershed was protected open space, generally in upland State Parks and private conservation easements.

CCA Name	Description
Suisun Slough	Suisun Slough flows through Suisun Marsh, the largest contiguous brackish water marsh on the west coast. It is a resting and feeding ground for waterfowl migrating on the Pacific Flyway, and provides essential habitat for many bird, mammal, amphibian, and fish species, as well as endemic plants. Marsh management influences salt water intrusion into the San Joaquin/Sacramento Delta.
Wildcat Creek	The Wildcat Creek watershed covers 6,848 acres and includes approximately 22 miles of creek channel. The upper watershed in contained in Wildcat Canyon, and the land use is parkland. Wildcat Regional Park and Tilden Regional Park, both managed by the East Bay Regional Park District, cover the upper watershed. In the lower reaches, Wildcat Creek flows through the heavily urbanized, residential, and commercial areas of the cities of Richmond and San Pablo before reaching salt marshes adjacent to San Pablo Bay.

Source: California's Critical Coastal Areas website (http://www.coastal.ca.gov/nps/cca-nps.html).

Figure 2-10: Critical Coastal Areas in the Bay Area



Source: http://www.coastal.ca.gov/nps/Web/cca_sfbay1.htm

In addition to CCAs, some areas of the coast are considered to be Marine Protected Areas (MPAs), in which human activity is restricted to protect the sensitive area. The MPAs are listed in Table 2-3.

Table 2-3: Bay Area Marine Protected Areas

MPA Name	Limitations
Double Point/Stormy Stack Special Closure	Closed to the public.
Drakes Estero State Marine Conservation Area (SMCA)	Take of all living marine resources is prohibited, with the exception of limited clam harvesting and permitted shellfish operations.
Duxbury Reef SMCA	Take of all living marine resources is prohibited except the recreational take of finfish from shore and abalone.
Egg (Devil's Slide) Rock to Devil's Slide Special Closure	Transit in between the rock and the mainland between these points is prohibited at any time. Closed to the public.
Estero de Limantour State Marine Reserve (SMR)	Take of all living marine resources is prohibited.
Montara SMR	Take of all living marine resources is prohibited.
Pillar Point SMCA	Take of all living marine resources is prohibited, with the exception of limited fishing and seafood harvesting.
Point Resistance Rock Special Closure	Closed to the public.
Point Reyes SMR and SMCA	Take of all living marine resources is prohibited, with the exception of limited fishing and crabbing.
Point Reyes Special Closure	Transit on the south side of Point Reyes headlands in between the mean high tide line to a distance of 1,000 feet seaward of the mean lower low tide line is prohibited at any time. Closed to the public.

2.2.9 Land Use

Rangeland, forest land and agriculture combined occupy almost 70 percent of the Bay Area Region's 4.7 million acres (Table 2-4 and Figure 2-11). Land use patterns within the Region are illustrated in Figure 2-12 and described below.[4]

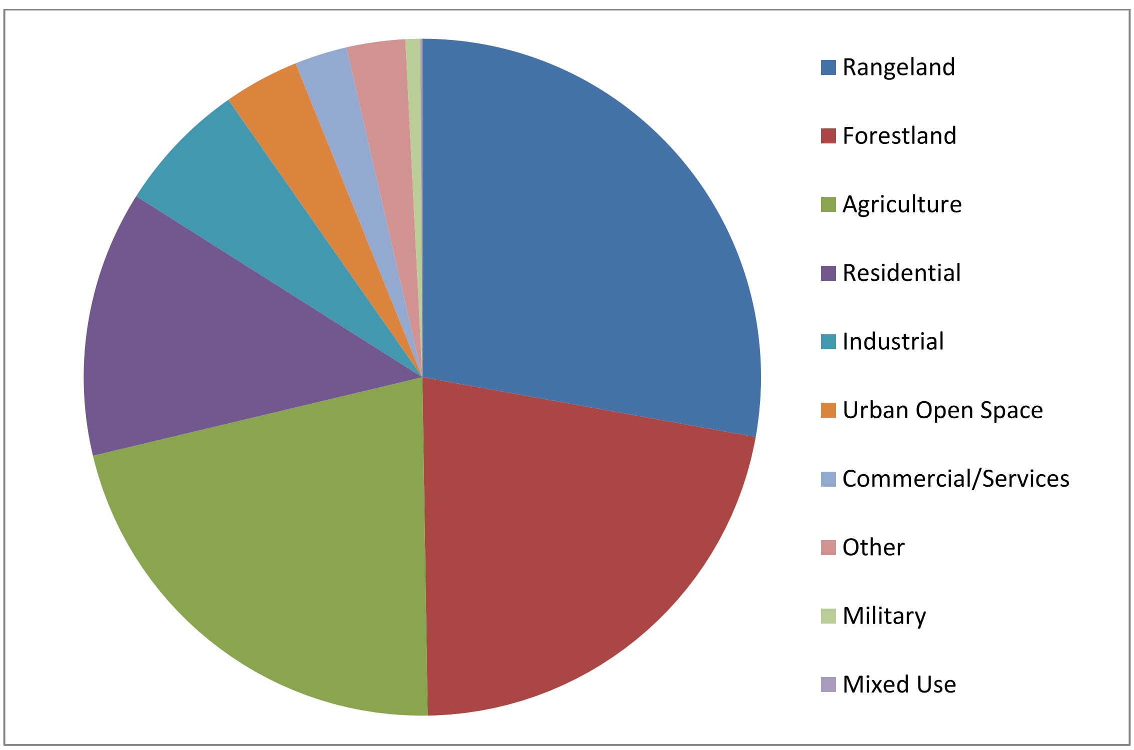
[4] While the Bay Area region is defined by the boundaries of RWQCB Region 2 for this IRWMP, the land use data presented here is based on data available for the entire nine-county region, due to difficulty isolating data for the hydrologic region.

Table 2-4: San Francisco Bay Area Land Use Distribution

Land Use	Acreage	Percent of Total
Rangeland	1,222,236	27.8%
Forestland	963,464	21.9%
Agriculture	943,100	21.5%
Residential	555,620[(a)]	12.7%
Industrial[(b)]	278,451	6.3%
Urban Open Space	159,881	3.6%
Commercial/services	110,778	2.5%
Other[(c)]	122,735	2.8%
Military	30,581	0.7%
Mixed Use[(d)]	5,122	0.1%
Total	4,391,968	100%

Notes:
(a) More recent estimates indicate 618,000 acres (ABAG 2009).
(b) Includes industrial and major infrastructure.
(c) Includes sparsely vegetated and wetlands.
(d) Includes residential/commercial and commercial/industrial.
Source: Association of Bay Area Governments. 2006. Existing Land Use 2005.

Figure 2-11: San Francisco Bay Area Land Use Distribution



Rangeland: Rangeland includes herbaceous, shrub and brush, and mixed rangeland areas and is prominent on Coast Range foothills throughout the region. Southeastern Santa Clara County contains the highest proportion of rangeland in the Bay Area (24 percent). Much of the remaining rangeland is distributed among the rolling grasslands of Alameda (15 percent), Contra Costa (13 percent), Marin (13 percent), and Sonoma Counties (14 percent).

Forest Land: Forest lands include deciduous, evergreen, and mixed forested areas. Nearly one third of the Bay Area Region's forested lands are located in the Santa Cruz Mountains in southwestern Santa Clara County. An additional 20 percent of the region's forested lands are in northern Napa County, while 18 percent are located in northern Sonoma County.

Agriculture: Agriculture includes croplands, vineyards, orchards, nurseries, confined feeding areas, and farmsteads. Agricultural areas in Solano (31 percent) and Sonoma (46 percent) counties make up the majority of active cropland in the region. Agricultural areas are also concentrated in Napa County and the southern edge of Contra Costa County.

Residential: Residential land includes rural and single family homes, mobile homes, apartments and multifamily residential and group quarters. The counties with the region's highest concentration of residential areas include Sonoma (25 percent) and Santa Clara (18 percent), likely due to rural and semi-rural development patterns. Other concentrations of the region's residentially developed land are located in the counties of Alameda (13 percent), Contra Costa (15 percent), and San Mateo (10 percent).

Industrial: Industrial includes light and heavy industrial land uses, as well as major infrastructure, such as roads, airports, power facilities, municipal wastewater and water supply facilities, communication facilities and other land uses. Santa Clara County (22 percent) and Alameda County (18 percent) have the highest industrial land use acreage of the region.

Urban Open Space: Urban open space includes areas that have been affected by urban development but contain minimal paving and buildings. These areas include golf courses, racetracks, campgrounds, cemeteries, urban parks, and vacant lands. Alameda (18 percent), Contra Costa (19 percent), and Santa Clara (17 percent) counties contain the majority of urban open space within the Region.

Alameda County Vineyard and Golf Course

Commercial/Services: This land use classification includes retail and wholesale, educational facilities, hospitals and health centers, prisons, local government and other public facilities, offices, research centers and emergency services. In addition to the three major metropolitan centers, smaller urban centers and vast highway corridors lined with commercial and services land uses occur throughout the region. Santa Clara

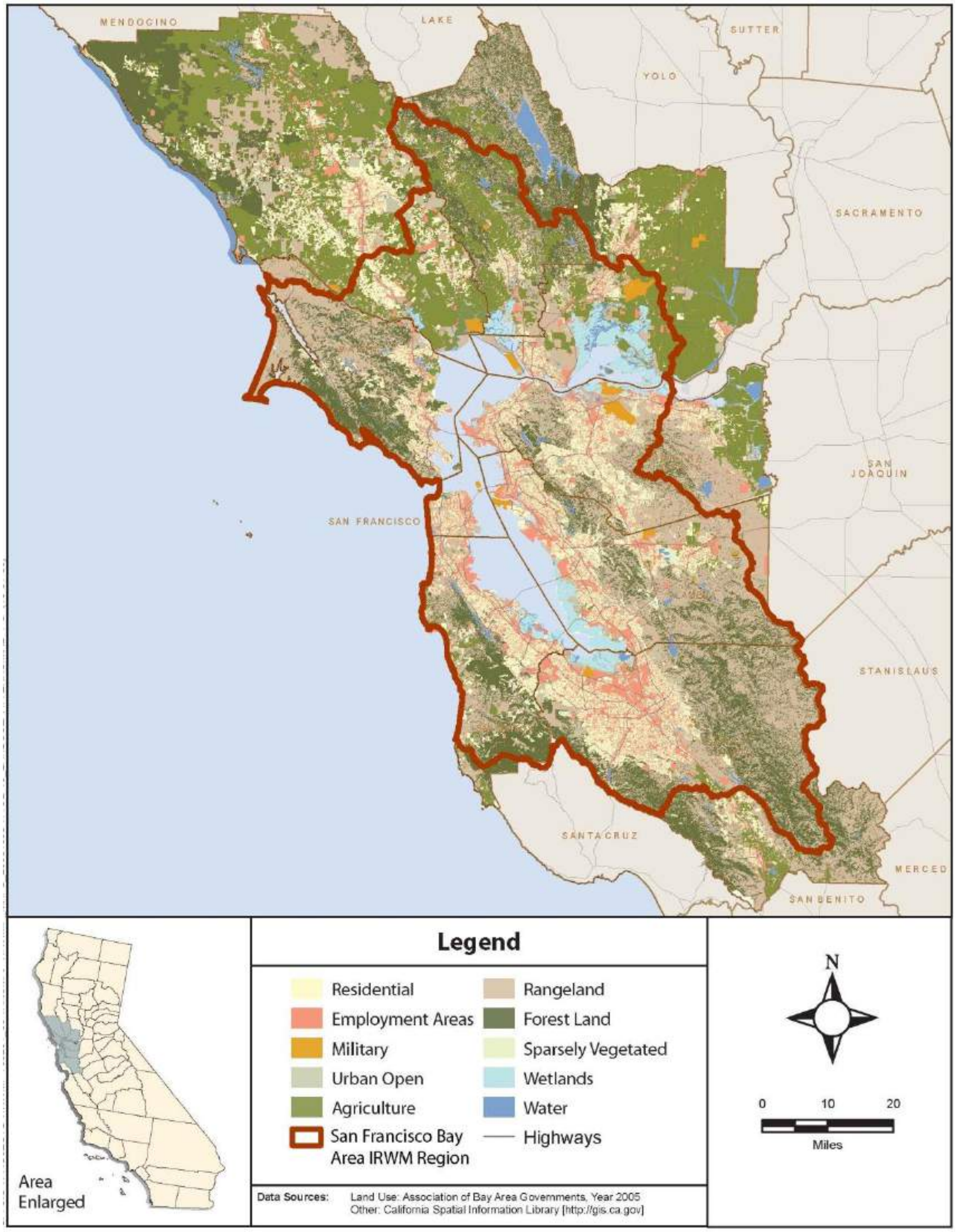
County, home of Silicon Valley, contains the highest percentage of this land use (23 percent), followed by Alameda County (18 percent).

Other: The Other land use classification includes the sparsely vegetated and wetland acreages reported by ABAG, though this "other" land use classification is not comprehensive for these features. The Bay Area Region is home to several thousand acres (more than included in the ABAG "other" land class) of wetland habitats, including tidal marsh, freshwater marsh, riparian, seeps, pools, springs, and others.

Military: After major closures occurred in the 1990s, the major active duty military installations that remain in the Region are the Travis Air Force Base in Solano County and Coast Guard Island in Alameda County.

Mixed Use: Mixed use describes urban centers that contain a diverse mix of residential, commercial, and industrial uses. The counties with the region's highest concentrations of mixed use include Alameda (29 percent), San Francisco (19 percent), and San Mateo (33 percent).

Figure 2-12: Bay Area Region Land Use Patterns



2.2.10 Social and Cultural Makeup

The San Francisco Bay Area consists of 9 counties (whole and partial), 101 municipalities, 2.6 million households and a population of 7.15 million (Bay Area Census, 2010), making the metropolitan region the second largest in California (U.S. Census Bureau, 2011). Table 2-5 provides an overview of key Bay Area demographic characteristics. Note that as mentioned in Section 2.1.1, some counties are divided between the Bay Area Region and other IRWM regions to better coincide with natural watershed boundaries; census information cited is, however, only available to describe the larger Bay Area.

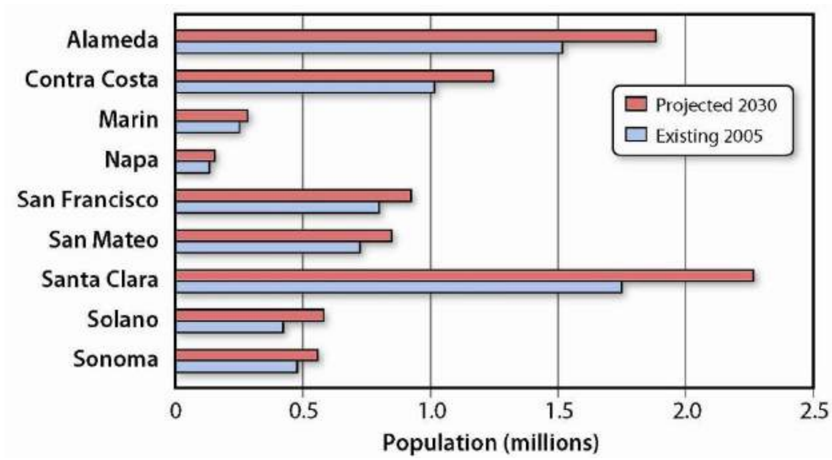
Table 2-5: Demographic Characteristics for the San Francisco Bay Area

	Existing 2010 [(a)]	Projected 2030 [(b)]	Percent Change
Total Population	7,150,739	8,719,300	18%
Total Households	2,608,023	3,171,940	18%
Residential Acreage[(c)]	618,302	646,376	5%
Average Residential Density	4.22	4.91	16%
Median Household Income	$ 102,000	$ 126,400	19%

Notes:
(a) Bay Area Census, 2010.
(b) ABAG projections, 2009.
(c) The projected 2030 residential acreage is less than projected in the 2006 Bay Area IRWMP, likely in response to the economic downturn.

Growth projections show a continuation of existing trends. Currently, almost half of the region's population resides in Santa Clara and Alameda counties, which continue to grow at the fastest rates. Despite large proportions of residential areas compared with other land use types, North Bay counties, including Marin, Sonoma, and Napa, have the lowest population densities and are also projected to change the least. Figure 2-13 shows existing and projected populations in each of the Bay Area counties.

Figure 2-13: Population Growth in Bay Area Counties[5]



Source: ABAG, Census 2010, ABAG 2012.

A significant shift in the age distribution of Bay Area residents is anticipated to occur over the next 20 years (Table 2-6). The population of working-age residents is expected to drop from about 62 percent to 57 percent of total, while the proportion of seniors is expected to increase from about 14 percent in 2010 to 21 percent by 2030.

Table 2-6: Current and Projected Age Distribution for the San Francisco Bay Area

	Existing 2010[(a)]	Projected 2030	Percent Change
0-4 years	455,384	543,296	19%
5-19 years	1,349,783	1,459,408	8%
20-44 years	2,587,300	2,979,078	15%
45-64 years	1,930,198	1,948,310	1%
65+ years	1,018,994	1,789,187	76%

Note: (a) ABAG 2009.

The Bay Area is a racially diverse region. Approximately 58 percent of the Region's population was of a race other than white. Hispanics/Latinos and Asians make up the two large minority groups in the Region at 24 percent and 23 percent, respectively, and African Americans represent approximately 6 percent of the population (ABAG, 2010). The Native American population in the Bay Area according to the 2010 census is 48,493 or 0.7 percent of the total population.

[5] The One Bay Area / Sustainable Communities Strategies projections have been identified as a "preferred alternative" but have not yet been adopted. This is expected to occur in 2012. They are included because they may better reflect the impact of current economic conditions.

2.2.11 Economic Conditions and Trends

The Bay Area is among the largest metropolitan areas in the United States and the second-largest in California. With a Gross Domestic Product (GDP) of $535 billion, the Bay Area is the 19th largest economy in the world. On a per capita basis, it has the highest GDP in the United States at $74,815 (Bay Area Economic Forum, 2012). The region is at the cutting edge of global technology and is a leader in many key indicators of regional, national and global competitiveness. Water supply reliability and water quality have a tremendous effect on the continuing success of the Bay Area's economy.

The Bay Area's productivity stems from a variety of factors, including a concentration in high value-added activities, a well-educated workforce, and a spirit of innovation. The Bay Area leads most other U.S. metropolitan regions in its employed share of management, technology, and engineering occupations. The Bay Area also plays a leading role in delivering innovation to the U.S. economy, with more than one third of the nation's overall venture capital investments occurring here and the highest economic productivity of the nation. The Bay itself is an important economic resource, providing commercial and sport fishing, and other tourist and recreational economic opportunities. Table 2-7 lists current and projected employment characteristics for the Bay Area.

Table 2-7: Current and Projected Employment Characteristics for the Bay Area

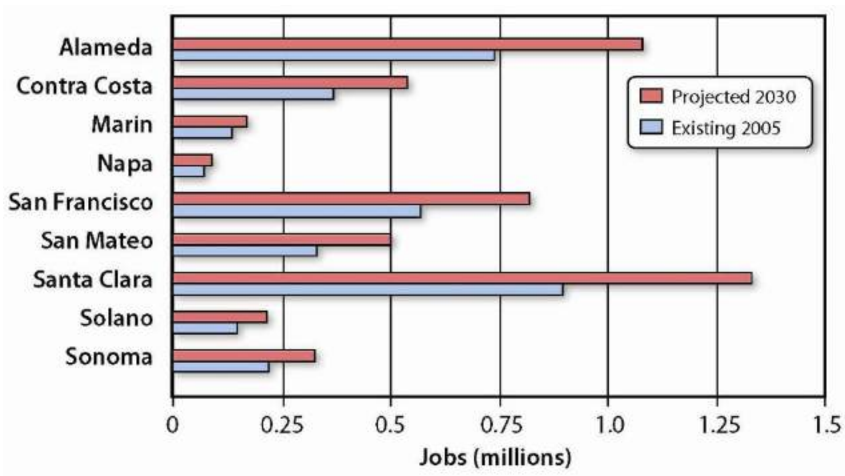
	Existing 2010	Projected 2030[6]	Percent Change
Total Jobs[(a)]	3,385,294	4,738730	36%
Commercial/Industrial Acreage	231,777	248,415	7%
Average Employment Density	14.6	19.1	31%

Notes:
(a) Projections for employment have been adjusted downward by about 8 percent from the 2006 Bay Area IRWMP plan, likely in response to the economic downturn.
Source: ABAG, 2010.

Almost half of the region's jobs are located in Santa Clara and Alameda counties (27 percent and 21 percent, respectively), which together provide 1.62 million jobs. Employment densities in North Bay counties are relatively low, with Marin, Sonoma, Solano and Napa collectively hosting 15 percent of the region's jobs. ABAG's growth projections estimate significant job growth, particularly in Solano and Sonoma counties which currently have lower employment densities (Figure 2-14).

[6] These values are from ABAG's 2009 projections. The Sustainable Communities Strategies (SCS) preferred alternative has a lower 2030 jobs projection of 4,195,567 (a 24% increase). However, the SCS projections have not yet been adopted.

Figure 2-14: Job Growth in Bay Area Counties



2.2.12 Disadvantaged and Environmental Justice Communities

The environmental justice movement began with the struggles of minority populations against the location of toxic waste dumps and waste facility sitings within their communities, but it has since expanded to encompass equal access to clean water supplies, protection from flooding hazards, and provision of open spaces and recreation opportunities (Liu, 2001). Certain environmental hazards may disproportionately affect communities of color and low-income neighborhoods and are increasingly being linked to a range of conditions such as asthma, cancer, and birth defects (CBE 2012, Environmental Justice Coalition for Water, 2005).

An understanding of the location of disadvantaged and environmental justice communities can help the region to identify water resources management projects that improve water quality, open space and recreation opportunities, and flood protection within these neighborhoods. Additionally, because restoration of rivers and waterfronts is a recognized catalyst for community revitalization, watershed projects can contribute to sound community development in disadvantaged areas.

The placement of water infrastructure in or near these communities also can cause concern. From the environmental justice perspective, sewage treatment plants, desalination facilities, and recycling plants – while providing benefit to the community as a whole – can serve to add to the cumulative environmental burden of nearby communities due to odors, effluent, sewage backups, and industrial buildings. Identifying these communities will allow agencies to ascertain the impact of their operations and to work with the community to mitigate problems or more appropriately locate proposed new facilities.

California legislation AB1747 (2003) defines disadvantaged communities (DACs) as those with a Median Household Income (MHI) less than 80 percent of the state MHI. As of 2010, 80 percent of the state of California's MHI was $48,314 (Table 2-8). Within census tracts that fall under that 80 percent limit, there are a wide range of income levels, from very poor to more moderate. To capture these differences, Table 2-8 also lists other poverty metrics. Figure 2-15 illustrates the distribution of DACs in the Bay Area.

Table 2-8: Definition of Disadvantaged Communities by Income Factor[(a)]

	Income Limit
State Median Household Income (2006-2010)[(a)]	$60,883
80% of State MHI	$48,706
60% of State MHI	$36,530
Federal Poverty Level, 2006[(b)]	$19,091
CPUC's Universal Lifeline Telephone Service threshold[(c)]	$28,200

Notes:

(a) State MHI is based on 2010 U.S. Census data. http://quickfacts.census.gov/qfd/states/06000.html

(b) Threshold for 3 persons in family or household for 2011 http://www.census.gov/hhes/www/poverty/data/threshld/index.html; California has average household size of 2.89 http://quickfacts.census.gov/qfd/states/06000.html.

(c) California Public Utilities Commission. 2006. Universal Lifeline Telephone Service. *Effective from 06/01/09 to 05/31/*12 http://www.cpuc.ca.gov/puc/telco/public+programs/ults.html.

Environmental justice communities are defined as low-income communities and communities of color that have been disproportionately impacted by programs, policies, or activities that have resulted in adverse health or environmental impacts. President Bill Clinton's Executive Order 12898 (1994) specifically directed federal agencies to address these situations. Figure 2-16 illustrates census tracts that contain greater than 30 percent of one minority population (Asian, black or African-American, or Hispanic origin), as well as those census tracts with greater than 30 percent in multiple categories.

To begin to understand the environmental burden these communities may endure, the locations of wastewater treatment facilities and flood-prone areas are examined in Figure 2-17. Mapping the locations of environmental justice communities and environmental burdens can assist water and flood agencies to identify water resources management projects that may reduce or relieve potential water-related adverse impacts to these communities.

Efforts to effectively involve and collaborate with disadvantaged and environmental justice communities are discussed in Chapters 12 and 14.

Figure 2-15: Disadvantaged Communities

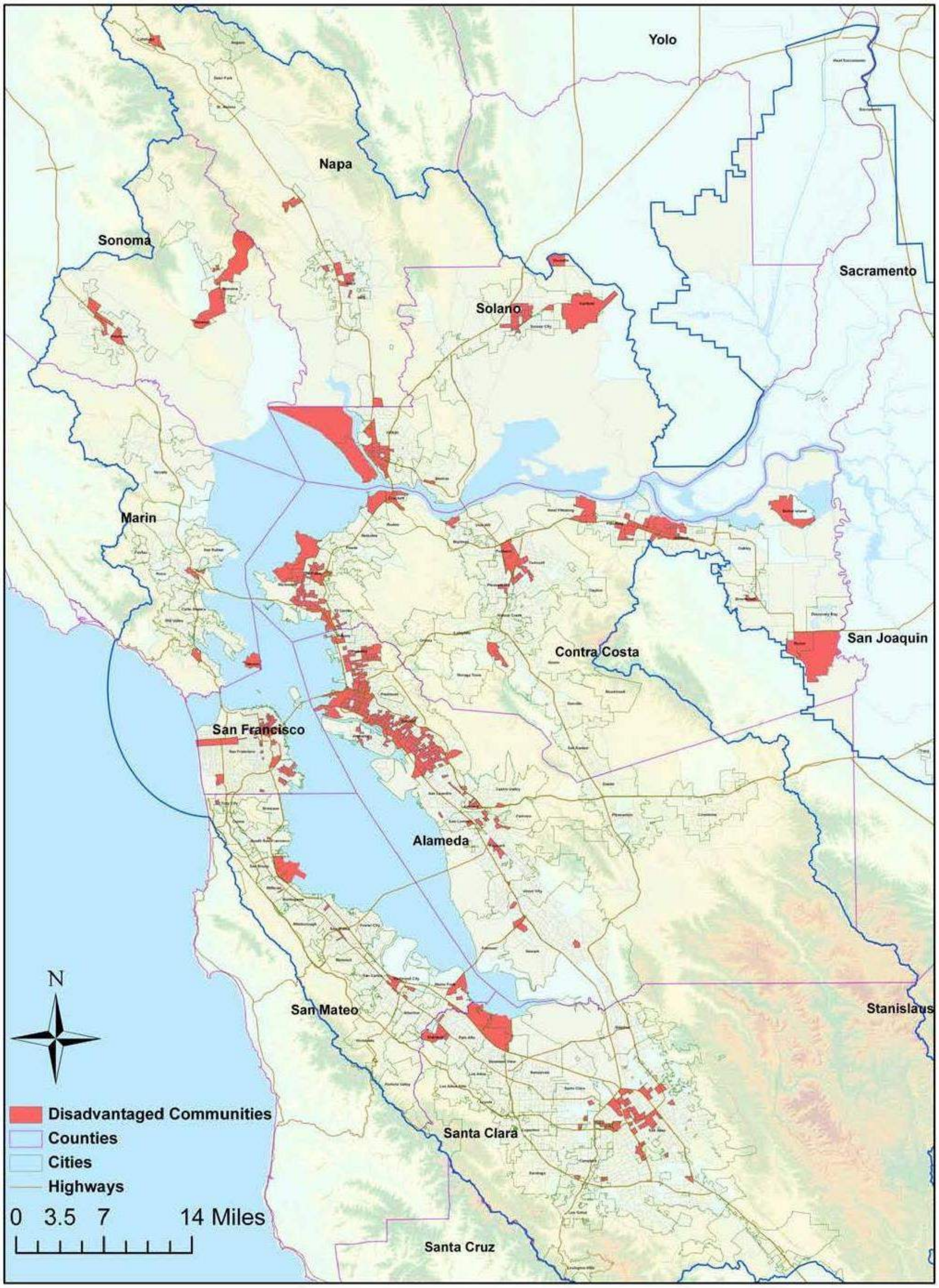


Figure 2-16: Concentration of Minority Populations

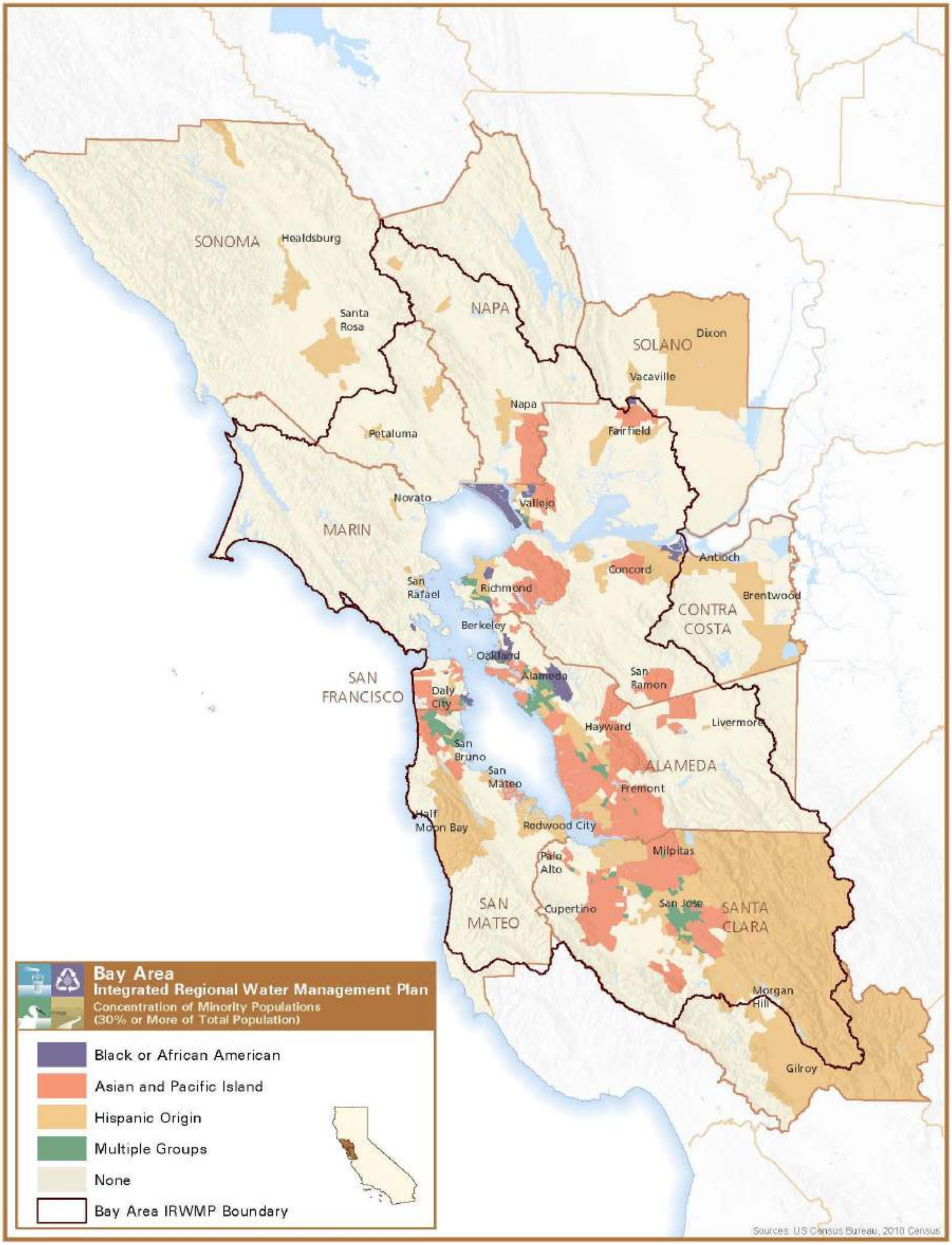
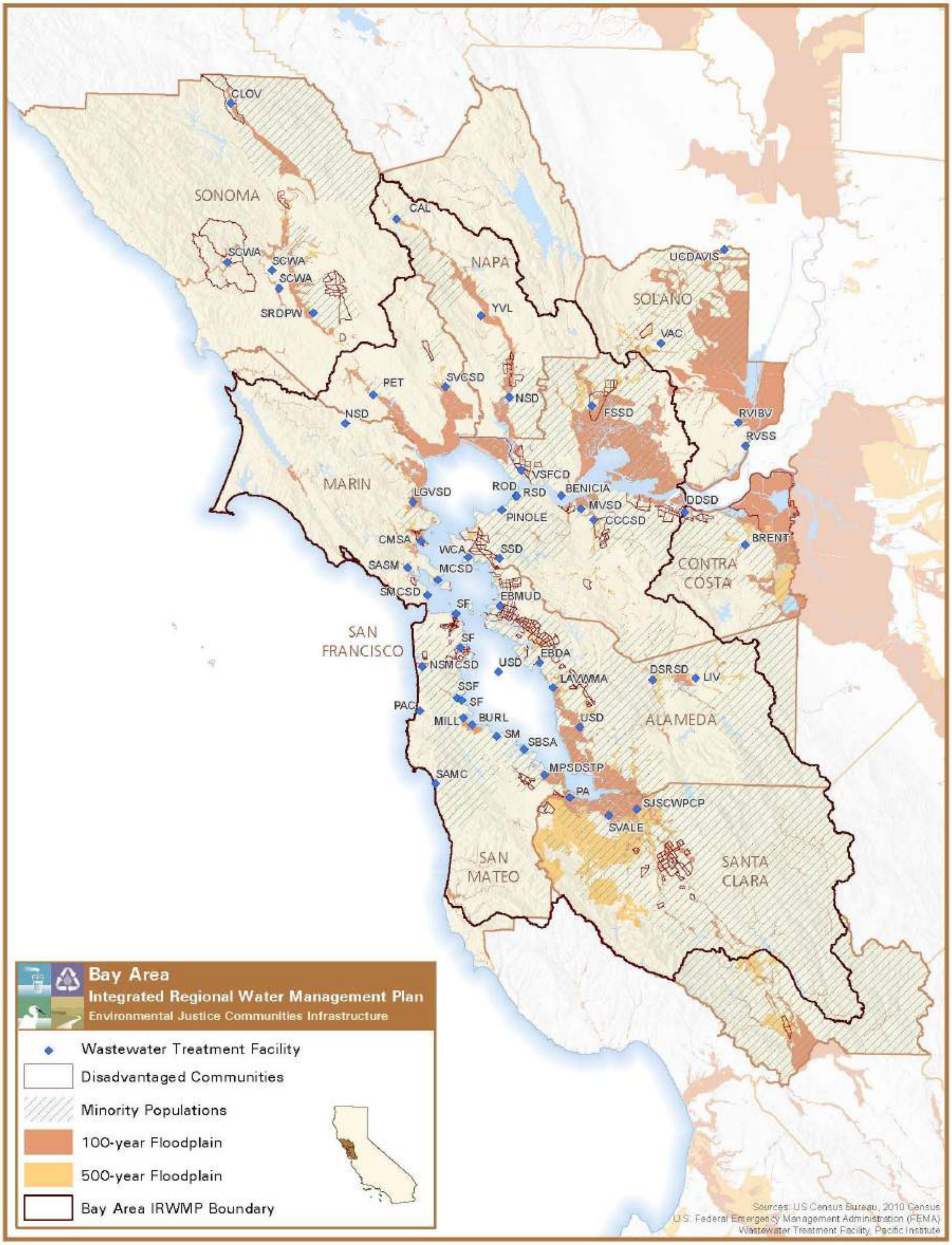


Figure 2-17: Environmental Justice Communities and Infrastructure



2.2.13 Native American Tribal Communities

According to the 2000 census, the American Indians and Alaska Native population in the Bay Area was 43,000, making it the 3rd largest urban American Indian population in the US. According to the Pew Foundation, in 2013 Native American women married outside of their race at the highest percentage, accounting for 58 percent of mixed race marriages in the United States within the 12 month period. This suggests that the Native American Population may be statistically higher in the Bay Area.

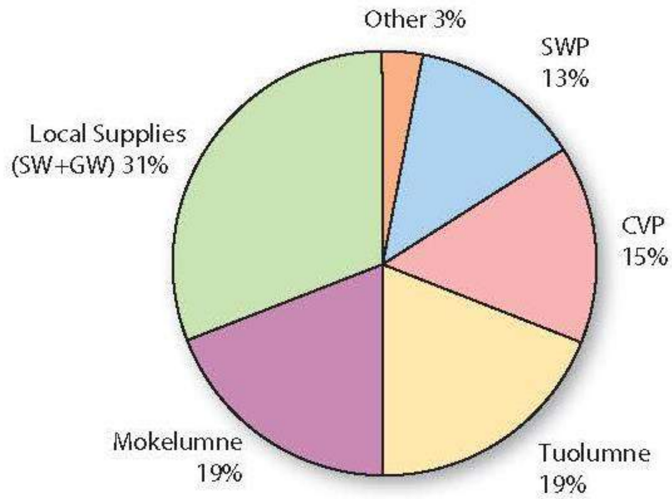
This Bay Area Native community also includes California Indians from nearby reservations and tribal communities, and those who have relocated to the Bay Area from around the United States as part of the Indian Diaspora into the Bay, which can be traced to forced assimilation including termination and Indian relocation policies of the 1950s-60s. Tribal members are dispersed into the Bay Area population and do not live in Tribal-specific communities. Bay Area Tribal families for whom the Bay is their historical homeland have often been displaced outside of the Bay due to housing costs and other economic pressures. However, deep connections remain along with a continued responsibility to steward traditional territory and cultural resources. Although this presents a challenge for outreach and engagement, efforts to effectively involve and collaborate with Native American Tribal Members are discussed in Chapters 12 and 14.

2.3 Overview of Bay Area Region Water Supplies

The Bay Area’s prosperity and continued leadership in economic development and environmental protection, rely on continued delivery of high quality, reliable water supplies. Bay Area water agencies continue to seek to protect the reliability and quality of existing supplies through innovative water management strategies and regional cooperation. The following sections outline current and projected quantity and quality of water resources throughout the Bay Area Region, and introduce some of the challenges facing water in the future.

Bay Area Region water agencies manage a diverse portfolio of water supplies, including imported surface water (SWP, CVP, Tuolumne, Mokelumne), local supplies, and other types of supplies (Figure 2-18).

Figure 2-18: Bay Area Water Use by Supply Source



2.3.1 Imported Water Supplies

Approximately two-thirds of the Bay Area Region's water supply is imported from Sierra Nevada and Delta sources through various federal, state and local projects. Nearly all Bay Area Region water agencies depend on imported water as an important component of their water portfolios.

2.3.1.1 Mokelumne River Watershed

Over 600 square mile watershed of the Mokelumne River, located on the west slope of the Sierra Nevada, provides EBMUD with approximately 90 percent of its water supply. EBMUD has water rights and facilities to divert up to 325 million gallons per day (mgd) from the Mokelumne River. Snowmelt that feeds the upper Mokelumne River is collected and stored in the Pardee Reservoir (located near Valley Springs) and Camanche Reservoir (10 miles downstream from Pardee). In addition to storage, Pardee and Camanche Reservoirs provide recreation opportunities, power generation, flood control and irrigation, and supplies for fisheries and riparian plants and wildlife (EBMUD, 2010).

2.3.1.2 Tuolumne River Watershed

The SFPUC owns and operates the Hetch Hetchy Regional Water System that conveys water from the Tuolumne River watershed in Yosemite National Park on the western slope of the Sierra Nevada. The watershed, which provides approximately 85 percent of SFPUC's supply, serves customers in San Francisco and 28 wholesale customers located in Alameda, Santa Clara, and San Mateo counties (represented by BAWSCA). The Hetch Hetchy Regional Water System provides up to two thirds of the BAWSCA service area water supply and up to 19 percent of ACWD and SCVWD's service area supplies.

Three major reservoirs collect runoff: Hetch Hetchy Reservoir, Lake Lloyd, and Lake Eleanor.[7] Water is diverted from the Hetch Hetchy Reservoir into a series of tunnels, aqueducts and pipelines that cross the San Joaquin Valley to facilities located in Alameda County. Conveyance facilities then deliver water to wholesale customers and San Francisco.

2.3.1.3 State Water Project

South Bay Aqueduct

The SWP originates in northern California and conveys water over 500 miles to the Bay Area, and central and southern California through a system of reservoirs, aqueducts and pump stations. Initially constructed starting in the late 1950's, the SWP is the largest state-built, multi-purpose water project in the country, consisting of 34 storage facilities, reservoirs and lakes, 20 pumping plants, four pumping-generating plants, five hydro-electric plants and approximately 700 miles of aqueducts and pipelines. The primary water source for the SWP is the Feather River, which is a tributary of the Sacramento River. Water released from Oroville Dam flows down natural river channels to the Sacramento-San Joaquin River Delta. Bay Area supplies are pumped from the Delta into the North Bay and South Bay Aqueducts (NBA and SBA), from which water is delivered to ACWD (27 percent of total supplies), the City of Napa (39 percent of total supplies), SCVWD (15 percent of total supplies), Solano CWA (13 percent of total supplies), and Zone 7 (82 percent of total supplies).

2.3.1.4 Federal Water Projects

Several Bay Area Region agencies receive Delta water through the CVP, which is operated by USBR. The CVP extends from the Cascade Range in the north to the plains along the Kern River in the south, with a major part of water flowing through the Delta and pumped at Jones Pumping Plant. Initially, the project protected the Central Valley from water shortages and floods, but now serves farms, homes, and industry in the Central Valley and Bay Area. CVP also produces electric power and provides flood protection, navigation, recreation, and water quality benefits, and is the primary source of water for much of California's wetlands. In fact, over 400,000 acre-feet per year (AFY) of CVP supplies are dedicated to state and federal wildlife refuges and wetlands (USBR 2011). CVP supplies water to CCWD (over 75 percent of total agency supplies) and SCVWD (almost 30 percent of total agency supplies).

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[7] Releases from Lake Eleanor and Lake Lloyd are used to satisfy in-stream flow requirements, downstream obligations, and to produce hydroelectric power. Neither of these reservoirs is permitted for potable use.

The Solano Project, also operated by USBR, stores water in Lake Berryessa in Napa County and provides Solano CWA with approximately 87 percent of its water supplies.

2.3.1.5 Russian River Watershed

The Russian River drains an area of 1,485 square miles in Sonoma and Mendocino counties and provides approximately 4 percent of the total water supplied to the Bay Area (DWR, 2009). Sonoma CWA operates the water conveyance facilities along this river, which makes up its primary source of water supply.

2.3.2 Local Water Supplies

Local Surface Water: Local watersheds provide an important source of supply to several Bay Area Region water agencies. For MMWD, the City of Napa and the Sonoma CWA, local surface water provides over 60 percent of total supplies. For other agencies, local surface water supplies contribute a small but important part of their diverse water supply portfolios. For example, CCWD uses water supplies from Mallard Slough and the San Joaquin River; EBMUD's secondary water supply source comes from runoff originating in local watersheds of the East Bay area; and the Alameda and Peninsula watersheds produce about 15 percent of the total water supply for SFPUC.

Groundwater: Groundwater is another important local supply source for many Bay Area Region agencies, including ACWD, BAWSCA member agencies, SCVWD, SFPUC, and Sonoma CWA.

2.3.3 Other Water Supplies

Recycled water, desalination, transfers and interties, and groundwater banking are used by many Bay Area Region agencies to supplement their water supplies.

2.3.3.1 Recycled Water

The development of recycled water is a critical element of the region's water supply portfolio. Recycled water provides a reliable and sustainable local water supply, in addition to environmental restoration and enhancement, surface water protection, preservation of drinking water, improvement of water quality, and reduction of wastewater discharges. Many Bay Area Region water agencies produce and use recycled water to supplement to supplement local water supplies. Over 30 agencies in the Bay Area Region have developed recycled water programs to provide recycled water to their customers for a variety of uses including irrigation, commercial, industrial, agricultural, municipal and residential.

The Bay Area has a long history of regional recycled water planning, including the development of the Bay Area Regional Water Recycling Program (BARWRP) Master Plan and the North Bay Regional Water Recycling Feasibility Study and Program. These planning efforts have occurred through the regional collaboration of various government agencies and partnerships in the Bay Area, including but not limited to BACWA, the Western Recycled Water Coalition (WRWC, formerly the San Francisco Bay Area Recycled Water Coalition), the North Bay Water Reuse Authority (NBWRA), and BAWSCA.

In 2015, the Bay Area recycled approximately 58,000 AFY, almost 10 percent of the wastewater effluent generated, and supply is expected to more than double over the next 20 years (BACWA 2018 Recycled Water Survey).

Table 2-9 provides a list of the recycled water programs in the Bay Area. Funding for recycled water projects in the Region has come from Propositions 50 and 84, State Water Resources Control Board (SWRCB) programs, Title XVI Water Resources Development Act, in addition to agency funding. Individual agencies can apply for state and federal funding as well as establish partnerships to pursue funding.

Sonoma Valley Recycled Water Reservoir under Construction

Table 2-9: Bay Area Recycled Water Programs

- City of American Canyon
- Central Contra Costa Sanitary District (CCCSD)
- Contra Costa Water District
- Delta Diablo Sanitation District (DDSD)
- Dublin San Ramon Services District (DSRSD)
- DERWA (DSRSD-EBMUD Recycled Water Authority)
- East Bay Municipal Utility District
- City of San Leandro
- Fairfield Suisun Sewer District (FSSD)
- City of Livermore
- Las Gallinas Valley Sanitation District
- Marin Municipal Water District
- Mt. View Sanitation District
- City of Mountain View
- City of Napa
- County of Napa
- Napa Sanitation District
- North San Mateo County Sanitation District/Daly City
- Novato Sanitary District
- North Marin Water District
- Oro Loma Sanitary District
- San Francisco Public Utilities Commission
- City of Palo Alto
- City of Petaluma
- Redwood City/South Bayside System Authority
- Santa Clara Valley Water District
- Sewerage Agency of Southern Marin
- South Bay Water Recycling
- South County Regional Wastewater Authority (SCRWA, member of the Western Recycled Water Coalition, but they are not in the Bay Area Region)
- Sonoma County Water Agency/Sonoma Valley County Sanitation District
- South County Regional Wastewater Authority
- City of Sunnyvale
- Union Sanitary District
- Vallejo Sanitation and Flood Control District
- Town of Yountville

An example of a partnership established to pursue funding is the WRWC. In an effort to study recycled water use opportunities and secure federal funding for identified projects, 22 water and wastewater agencies from northern and central California are members of the WRWC[8]. Since 2009, WRWC projects have been awarded over $38 million in federal funding. For more information go to http://barwc.org/.

Partnering agencies continue to collaborate on a regional scale to promote legislation to authorize federal funding for recycled water projects. In February of 2012, the Bay Area Regional Water Recycling Program Expansion Act of 2012 (H.R. 3910) was introduced, which would facilitate implementation of recycled water projects, expecting to yield approximately

[8] Bay Area Clean Water Agencies, Central Contra Costa Sanitary District, City of Hayward, City of Mountain View, City of Palo Alto, City of Redwood City, City of San Jose, South Bay Water Recycling, City of Sunnyvale, Delta Diablo Sanitation District, Dublin San Ramon Services District, Ironhouse Sanitary District, Santa Clara Valley Water District, San Jose Water Company, Zone 7 Water Agency

35,000 AFY of recycled water in the near-term and over 70,000 AFY in the future (BARWC, 2012). Additional recycled water projects are discussed in Chapters 4 and 12.

BACWA actively promotes and develops recycled water through its Recycled Water Committee in an effort to protect the environment and increase water supply reliability in the region. In addition to promoting the development of regional partnerships, the Committee monitors and provides input on legislative and regulatory issues that affect the Bay Area, collaborates to secure state and/or federal funding for Bay Area recycled water projects, and develops regional informational pieces to Increase public awareness of recycled water and its use in the Bay Area. For more information, go to http://bacwa.org/committees/water-recycling. In addition, BAWSCA encourages enhanced recycled water use through participation in BACWA. Various BAWSCA agencies participate in local recycled water programs and have developed projects to achieve recycled water goals set for the Bay Area. For more information on BAWSCA agencies' recycled water projects see http://bawsca.org/water-conservation/recycled-water/.

NBWRA promotes water reuse through the North Bay Water Reuse Program, which is a coordinated regional effort among various water and sanitation agencies[9] in Sonoma, Marin and Napa Counties. Currently Phase 1 of the Reuse Program is being implemented, consisting of six recycled projects throughout the three program counties. Final design and construction of these projects is anticipated to be completed by 2019, allowing production of up to 5,500 AFY of recycled water. In addition, a Phase 2 Scoping Study is underway to identify potential new projects and additional member agencies (NBWRA, 2012). For more information go to http://nbwra.org/index.htm.

2.3.3.2 Desalinated Water

As a high-quality, drought-proof local supply, desalination is an increasingly competitive water supply alternative for Bay Area Region water agencies. Desalination projects currently being pursued by Bay Area Region agencies include:

- CCWD, EBMUD, SFPUC, SCVWD and Zone 7 are currently collaborating on the Bay Area Regional Desalination Project, which is anticipated to produce between 10 to 50 mgd. Pilot testing was completed in 2009, site specific analyses are scheduled to be completed by 2013 if implemented, and construction is scheduled to begin in 2018.

- ACWD is currently using brackish groundwater desalination at its Newark Desalination Facility to supplement water supplies.

- MMWD investigated desalination and built a successful 1 mgd pilot plant, although a larger project is not currently being pursued.

- BAWSCA member agencies have several projects to investigate desalination that are in stages of feasibility planning, evaluation and pilot testing.

Additional projects are discussed in Chapter 12.

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[9] Members of NBWRA include: Las Gallinas Valley Sanitary District, Napa County, Napa Sanitation District, Novato Sanitary District, North Marin Water District and Napa County, Sonoma County Water Agency, Sonoma Valley County Sanitation District.

2.3.3.3 Water Transfers and Interties

Several Bay Area Region water agencies (including ACWD, CCWD, EBMUD, SCVWD, SFPUC, Solano CWA and Zone 7) have participated in various types of water transfers to supplement their existing water supplies. These transfers and interties are important to help water agencies manage excess water and aid neighboring agencies in drought or other emergencies.

Examples of water transfer and intertie arrangements are described in Chapter 4.

2.3.3.4 Groundwater Banking

Many Bay Area Region agencies (including ACWD, SCVWD, Zone 7, and Solano CWA) participate in offsite groundwater banking programs for increased supply reliability. Typically, offsite groundwater banking allows storage of excess supplies in wet years for use in dry years. Examples of local groundwater banking programs are described in Chapter 4.

2.3.4 Water Supply Reliability

Although water supply and demand is unique to each agency, all Bay Area Region agencies face similar challenges relating to water supply reliability. Many challenges, including threats to baseline supplies, increasing demands, hydrologic variations, and infrastructure vulnerability, are facing the Region and will need to be understood and addressed by IRWMP projects. These water supply reliability challenges are described in more detail in Chapter 4.

2.4 Water Demand and Conservation

Although the Bay Area Region water agencies are all located in the same hydrologic region, water demand characteristics for the Bay Area vary greatly due to the following factors:

- **Source of Supply** - Since the availability, reliability and quality of water supplies depends on the source, each agency has unique challenges in meeting its water demands.

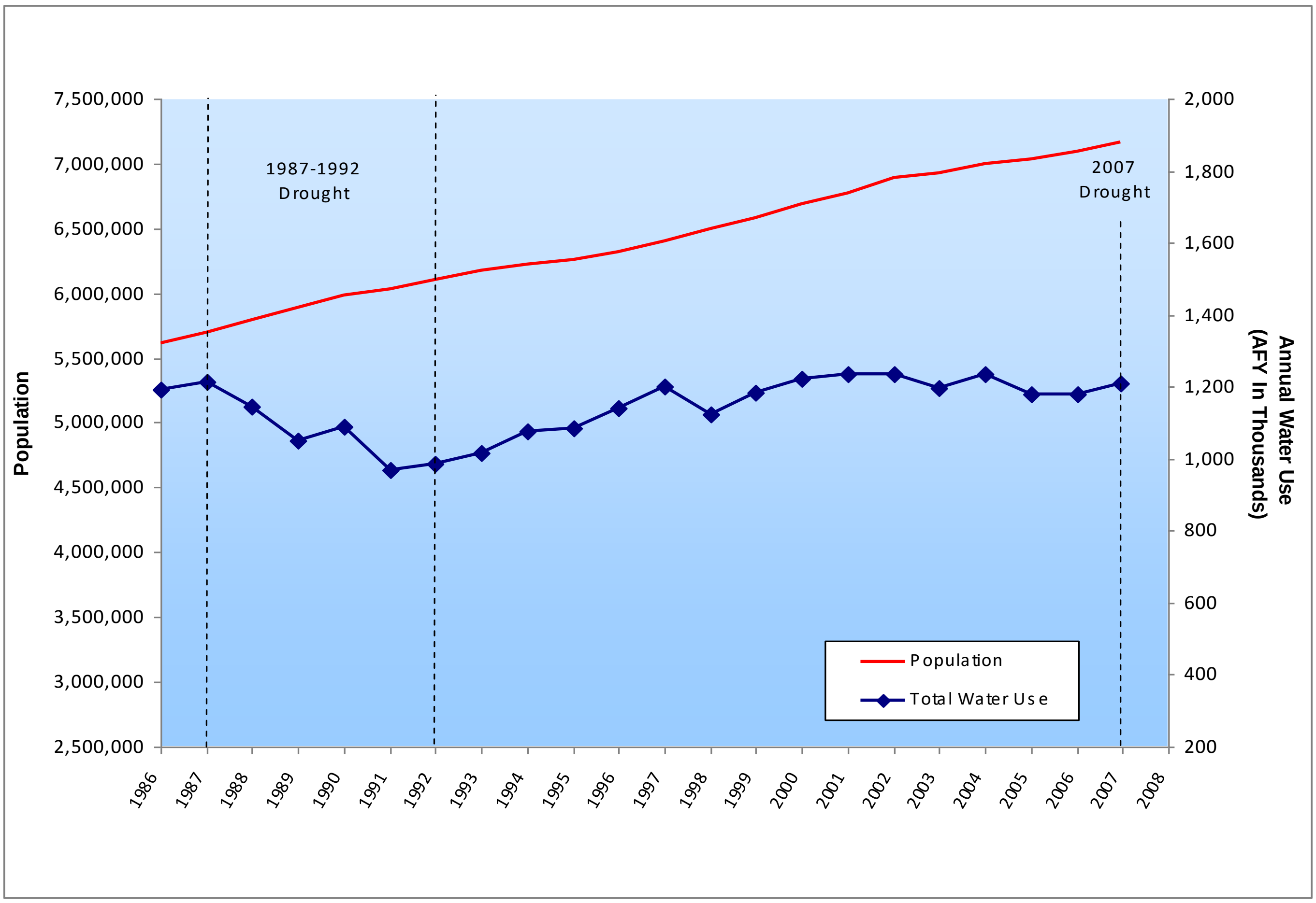
- **Bay Area Climate Variations** – Wide variation in local climates results in a corresponding variation in outdoor water use across the region and sometimes within the service area of agencies. Agencies closer to the San Francisco Bay tend to have cooler climates and higher precipitation (and thus a lower water demand) than areas further inland.

- **Population Density** - Higher density, urban areas such as San Francisco tend to have less outdoor landscaping and lower outdoor water demand than more suburban areas in Alameda, Contra Costa and Santa Clara counties.

- **Type of Users** - Water use demand patterns vary by user type—residential, commercial, industrial or agricultural—and are unique to each agency. Agencies, such as Zone 7 and Solano CWA, with significant agricultural or landscape use have distinct seasonal use patterns with peak water demand in the hottest, driest months. Agencies with large industrial or residential customers, such as SFPUC, are likely to have a more constant and predictable water demand pattern.

Historically, the Bay Area has experienced a significant increase in population with a minimal associated change in total water use. This trend can be seen in Figure 2-19 which shows the regional summary of population versus water use. The Water Conservation Bill of 2009, or SBX7-7, provides the regulatory framework to support the statewide reduction in urban per capita water use. Each water retailer must determine and report its existing baseline water consumption and establish an interim target in their 2015 Urban Water Management Plan (UWMP) and a 2020 water use target in gallons per capita per day (gpcd). Although water wholesalers are not required to meet the targets outlined in SBX7-7, many Bay Area wholesalers implement conservation programs and policies in partnership with and/or on behalf of their water retail agencies. This not only helps to ensure compliance with SBX7-7, it also helps to ensure long-term water supply reliability goals are met.

Figure 2-19: Historical Population and Water Use in the Bay Area



It is expected that the demand management measures, combined with alternative resources and strategies, and regulatory requirements will allow Bay Area Region water agencies to continue to meet projected demand through 2035 in average years. Normal year shortfall are not projected, however in dry years all but 4 major agencies—MMWD, City of Napa, SFPUC and Zone 7 —project a shortfall. Without strong local and regional planning, most Bay Area

Region water agencies could experience future supply shortfalls in severe droughts. Supplies and demands of the Bay Area Region are summarized in Table 2-10 and show that supplies are adequate through 2035 except in dry year scenarios where a shortfall is projected. Supply and demand data for each major Bay Area Region water supply agency are provided in the following sections, and water conservation strategies are further discussed in Chapter 4.

Table 2-10: Summary of Bay Area Region Water Supply and Demand

		Projected				
	Current	Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case
Population[a]	7,331,716	8,231,905	9,186,676	8,231,905	9,186,676	
Supply (AFY)	1,475,595	1,719,535	1,793,699	1,522,959	1,563,757	1,073,975
Demand (AFY)	1,278,480	1,534,534	1,680,963	1,517,778	1,666,870	1,197,143
Difference (AFY)	197,115	185,001	112,736	5,181	-103,113	-123,168

Note: (a) Does not include Sonoma CWA.

2.4.1 ACWD

ACWD's current and projected population, water supply and water demand are presented in Table 2-11. Shortfalls are projected for dry years and are expected to be offset in part by local and off-site groundwater storage.

Table 2-11: ACWD Water Supply and Demand

		Projected				
	Current	Normal Year[a]		Single Dry Year[b]		Multiple Dry Year[c]
	2015	2030	2040	2030	2040	Worst Case
Population[d]	344,300	382,500	415,600	382,500	415,600	NA
Supply (AFY)	77,900	76,600	76,000	56,100	56,800	58,400
Demand (AFY)	52,600	68,600	69,800	65,800	67,000	63,300
Difference (AFY)	25,300	8000	6,200	-9,700	-10,200	-4,900

Notes:
(a) Table 9-2.
(b) Table 9-3.
(c) Based on maximum shortage projected from 2015 UWMP, Table 9-8.
(d) 2015 UWMP, Table 1-3;

2.4.2 BAWSCA

BAWSCA member agencies collectively purchase approximately two-thirds of their water supply from the SFPUC to serve a residential population of nearly 1.8 million people in a 468-square mile area. BAWSCA members utilize local surface water, groundwater, SWP and CVP water, recycled water and water conservation measures to meet their remaining water supply demands. Current and projected population, water supply and water demand for the BAWSCA agencies are presented in Table 2-12. By 2035, the population served by BAWSCA member agencies is expected to increase by about 378,000, a 22 percent increase over current levels. Even with current and planned water conservation activities, future water demands are projected to exceed available supplies after 2018. It is estimated that by 2035 up to 25 mgd in normal years and up to 76 mgd in drought years will be needed to meet BAWSCA demands (BAWSCA, May 2010).[10]

Table 2-12: BAWSCA Water Supply and Demand

	Current[a]	Projected[b][d]			
		Normal Year		Drought Conditions	
	2015	2030	2040	2030	2040
Population	1,781,530	1,870,393	2,122,507	1,870,393	2,122,507
Supply (AFY)	196,666	315,001	330,695	258,951	272,403
Demand (AFY)	196,666	315,001	358,720	315,001	358,720
Difference (AFY)	0	0	-28,025	-56,050	-85,196

Source: BAWSCA. Annual Survey, FY 2015-16

2.4.3 CCWD

CCWD's current and projected population, water supply and water demand are presented in Table 2-13. The District has planned purchases of 7,200 AFY in 2035 in single and multiple dry year scenarios. CCWD can meet demands with existing supplies in normal and single dry years until 2035 at which point it projects a shortfall.

Table 2-13: CCWD Water Supply and Demand

	Current	Projected				
		Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case (2040)
Population	477,480	543,850	605,600	543,850	605,600	605,600
Supply (AFY)	213,700	247,000	249,800	194,000	196,000	161,500
Demand (AFY)	148,000	177,600	191,000	177,600	191,000	191,000
Difference (AFY)	65,700	69,400	58,800	17,000	5,000	-29,500

2.4.4 EBMUD

EBMUD's current and projected population, water supply and water demand are presented Table 2-14. Supply deficits are projected in dry years.

[10] BAWSCA projections has some overlap with the supply and demand projection for ACWD and SCVWD.

Table 2-14: EBMUD Water Supply and Demand

	Current	Projected				
		Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case (Year 2040, Year 3)
Population	1.39 M	1.58 M	1.72 M	1.58 M	1.72 M	NA
Supply (AFY)	183,000	249,000	258,000	234,000	241,000	163,000
Demand (AFY)[a]	183,000	249,000	258,000	233,000	240,000	206,000
Difference (AFY)	0	0	0	1,000	1,000	-43,000

Source: EBMUD 2015 UWMP and EBMUD O&M FY15 Statistical Report

Notes:

(a) "Demand" is reported as 'Planning Level of Demand' – adjusted demand for planning purposes after applying cumulative conservation and cumulative recycled water savings. In single and multiple dry years, demand is further reduced by customer rationing, ~7% in single dry year and ~20% in year 3 of multiple dry years. "Supply" includes actual and projected available CVP supplies and Bayside Project is on line in Year 3 of the multiple dry years.

2.4.5 MMWD

MMWD's current and projected population, water supply and water demand are presented in Table 2-15. MMWD expects to be able to meet its demands in both normal and dry year scenarios through 2035.

Table 2-15: MMWD Water Supply and Demand

	Current	Projected				
		Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case
Population	189,000	199,800	210,400	199,800	210,400	-
Supply (AFY)	39,452	152,794	152,794	60,442	60,442	60,442
Demand (AFY)	38,866	41,685[(a)]	42,109[(a)]	41,685[a)]	42,109[(a)]	42,109[(a)]
Difference (AFY)	586	111,109	110,685	18,757	18,333	18,333

Note: (a) Based on assumptions, including effective implementation of aggressive conservation program.

2.4.6 City of Napa

The City of Napa's current and projected population, water supply and water demand are presented in Table 2-16. In 2020, demand is projected to outpace supply in single dry years but increases in supply after 2020 are expected to correct that imbalance.

Table 2-16: City of Napa Water Supply and Demand

		Projected				
	Current	Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2035	2030	2035	Worst Case (2035)
Population	87,615	96,219	98,819	96,219	98,819	93,723
Supply (AFY)	29,150	32,873	32,873	17,962	17,962	19,896
Demand (AFY)	13,442	16,151	16,536	16,151	16,536	16,536
Difference (AFY)	15,708	16,722	16,337	1,811	1,426	3,360

While the City of Napa is the largest water agency in Napa County, more than 6,000 AFY in additional municipal demands are met by the cities of American Canyon, St. Helena, and Calistoga and the Town of Yountville. Each has its own water supply portfolio including local reservoirs, groundwater, retail purchases, or State Water Project entitlements. The City of Napa has a water relationship with these four nearby agencies, such as providing SWP treat-and-wheel service (American Canyon, Calistoga), retail sales (St. Helena), and emergency supply and water conservation assistance (Yountville). In the unincorporated areas of Napa County, demand is met primarily via local groundwater basins.

2.4.7 SFPUC

The current and projected population, water supply and water demand for SFPUC's retail and wholesale water system are presented in Table 2-17. Demands are projected to be met in every scenario.

Table 2-17: SFPUC Water Supply and Demand – Retail and Wholesale Water System

		Projected Retail				
	Current	Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case
Population	847,370	983,568	1,087,468	983,568	1,087,468	
Supply (AFY)	87,024	92,248	100,767	92,248	100,767	100,655
Demand (AFY)	87,024	92,248	100,767	92,248	100,767	100,767
Difference (AFY)	0	0	0	0	0	0

		Projected Wholesale				
	Current	Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case
Population	1,800,897	2,062,427	2,242,606	2,062,427	2,242,606	
Supply (AFY)	167,440	206,243	206,243	171,047	171,047	148,517
Demand (AFY)	167,440	206,243	206,243	206,243	206,243	206,243
Difference (AFY)	0	0	0	-35,196	-35,196	-57,726

Source: SFPUC 2015 UWMP.

2.4.8 Valley Water

Valley Water's current and projected population, water supply and water demand are presented in

Table 2-18. Supplies are projected to meet demands in all scenarios except for a multiple dry year worst case scenario in 2040. In dry years, Valley Water plans to meet demands using reserves and carryover.

Table 2-18: Valley Water Supply and Demand

		Projected				
	Current	**Normal Year**		**Single Dry Year**		**Multiple Dry Year**
	2015	**2030**	**2040**	**2030**	**2040**	**Worst Case**
Population	1,877,700	2,188,500	2,423,500	2,188,500	2,423,500	2,423,500
Supply (AFY)[a,b,c]	260,000	435,800	441,900	370,700	408,500	256,800
Demand (AFY)	285,000	408,600	435,100	370,600	434,300	434,100
Difference (AFY)	-25,000	27,200	6,800	100	-25,800	-177,300

Notes:
(a) Supply projections based on full implementation of the 2012 Water Supply and Infrastructure Master Plan
(b) Average water supplies during an extended drought (with 2035 demands) are 419,396 AFY.
(c) Supplies in the single dry and multiple dry include use of reserves and carryover.

2.4.9 Solano CWA

Solano CWA's current and projected population, water supply and water demand are presented Table 2-19. This table represents the part of Solano County that is in the Bay Area IRWMP and includes the cities of Fairfield, Benicia, Suisun City and Vallejo Supplies are projected to meet demands in all scenarios.

Landscape Water Conservation in San Francisco

Table 2-19: Solano CWA Water Supply and Demand[a]

	Current	Projected				
		Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2035	2030	2040	Worst Case
Population	280,128	312,560	350,069	312,560	350,069	350,069
Supply (AFY)	182,605	205,825	205,825	204,051	204,051	184,887
Demand (AFY)	182,194	207,350	207,350	207,350	207,350	207,350
Difference (AFY)	411	-1,525	-1,525	-3,299	-3,299	-22,463

Note: (a) Includes Fairfield, Benicia, Suisun City and Vallejo.

2.4.10 Sonoma CWA

Sonoma CWA's current and projected population, water supply and water demand are presented in Table 2-20.

Table 2-20: Sonoma CWA Water Supply and Demand

	Current	Projected				
		Normal Year		Single Dry Year		Multiple Dry Year
	2015	2030	2040	2030	2040	Worst Case (2040)
Population	614,196	698,824	742,040	698,824	742,040	NA[a]
Supply (AFY)	42,254	73,011	75,987	60,696	61,837	75,987
Demand (AFY)	42,254	73,011	75,987	73,011	75,897	75,897
Difference (AFY)	0	0	0	-12,315	-14,150	0

2.4.11 Zone 7

Zone 7's current and projected population, water supply and water demand are presented in Table 2-21. Zone 7 projects to be able to meet demand in all water year types through 2035.

Table 2-21: Zone 7 Water Supply and Demand

	Current	Projected				
		Normal Year[b]		Single Dry Year[c]		Multiple Dry Year[d]
	2015	2030	2035	2030	2035	Worst Case
Population[a]	238,600	285,300	285,300	285,300	285,300	291,000
Supply (AFY)	47,900	99,500	99,500	78,200	78,200	73,950
Demand (AFY)	47,900	89,500	92,800	48,500	49,900	58,600
Difference (AFY)	0	10,000	6,700	29,700	28,300	15,350

Notes:

(a) Population (2010, 2020): UWMP, Table 2-2; Population (2035): 2011 Water Supply Evaluation Report, Figure 2-2.
(b) Normal Year Supply and Demand: UWMP, Table 16-1; 2035 assumed to be the same as 2030.
(c) Single Dry Year Supply and Demand: UWMP, Table 16-2; 2035 assumed to be the same as 2030.
(d) Multiple Dry Year Supply and Demand: UWMP, Table 16-3(d), worst case assumed to be the same as 2030.

2.5 Water Quality

2.5.1 General Bay Area Region Water Quality Issues

Water quality issues facing the Bay Area Region include:

- **Microbes.** Potential microbial contamination, particularly by *Cryptosporidium* and *Giardia*, is a water quality issue of concern for Bay Area surface water supplies. *Cryptosporidium* and *Giardia* have caused large waterborne disease outbreaks throughout the United States and are of particular concern for immunocompromised individuals. Surface water is generally more exposed to and impacted by microbial contaminants than groundwater.

- **Total Organic Carbon (TOC), Bromide and Disinfection Byproducts.** Many of the Bay Area's supplies, particularly from the Delta, contain high levels of TOC and bromide. These constituents are precursors to disinfection byproducts (DBPs), which are potential carcinogens. Bromide concentrations are primarily dependent on the amount of seawater mixing with freshwater in the Delta and can be challenging to reduce through treatment.

- In 2002, the **CALFED Record of Decision (ROD)** set target Delta source water concentrations for TOC and bromide at 3.0 mg/L and 50 µg/L, respectively, in an attempt to mitigate the potential formation of DBPs. The ROD also indicated that, should source water quality targets not be met, an equivalent level of public health protection (ELPH) should be achieved through treatment. This would involve use of treatment technologies specifically tailored to mitigate production of potentially harmful byproducts of disinfection and treatment. DBP production can be mitigated by innovative treatment strategies, but the process is difficult and expensive. Water quality at the Delta drinking water intakes is above the 3.0 mg/L target for organic carbon and, at most intakes, is several times the 50 µg/L bromide target (CALFED, 2007).

- **Total Dissolved Solids.** Many Bay Area Region water sources contain high levels of total dissolved solids (TDS), particularly groundwater, recycled water, and Delta supplies (Delta supply's TDS concentrations and salinity are variable depending on the time and type of year as well as pumping patterns). TDS is a common water quality parameter used to measure salinity of water supplies. The secondary drinking water standard for TDS is 500 mg/L,

Water Quality Testing

above which problems with taste, odor and color may occur.

- **Nuisance algae.** Nuisance algae is a major concern for many local and imported Bay Area Region surface water supplies. Agencies typically spend a significant amount of money to control algae, mitigate related taste and odor problems, and address filter clogging at water treatment plants.

- **Toxic pollutants.** Major pollution challenges in the Bay Area Region are associated with legacy and emerging toxic pollutants. Legacy pollutants result from past human activities, including mining, military, pesticide manufacture and use and industrial activities. Emerging pollutants and sources of other toxic compounds include urban and rural runoff and other past and ongoing discharges. Pollutants of specific concern include mercury, polychlorinated biphenyls (PCBs), pesticides, flame retardants, solvents and pharmaceuticals. Mercury contamination is of particular concern for the many minority communities practicing subsistence fishing in the region.

- **Lead**. Elevated levels of lead often are due to lead piping in the water distribution system and/or household plumbing, commonly in older housing developments and in DACs.

- **Urban Runoff.** Urban and roadway runoff is a significant source of toxic pollutants such as mercury, PCBs, copper, nickel, and pesticides. In an effort to address this source of pollution, the RWQCB has developed more stringent regulations for stormwater permits. Whereas previous permits had required stormwater treatment where practicable, the new provisions require that runoff from projects that create or replace an acre or more of impervious surface must incorporate source control, site design measures, and stormwater treatment of runoff before discharge from the site.

- **Trash Control.** Trash is transported into creeks through storm drains, by wind, and directly from adjacent roads and pedestrian areas. This can often be a problem in DACs located near industrial areas, where trash can create a neighborhood eyesore. In 2001, the RWQCB considered adding trash to the list of pollutants impairing Bay Area creeks. However, the listing was not made because of the lack of a consistent methodology to assess impairment from trash. Instead, all urban creeks, lakes, and shorelines were placed on a “monitoring” list. Municipalities are expected to assess trash impairments in their jurisdictions and to report their findings in their annual reports.

- **Grazing and Agriculture.** Grazing and agricultural practices, when not properly managed can contribute water quality degradation. Agricultural uses may contribute fertilizers, pesticides, and other pollutants to surface water through irrigation runoff and impact groundwater quality by concentrating nitrates from irrigated agriculture and confined animal facilities. Trampling and direct consumption of stream and wetlands vegetation by improperly managed cattle may cause erosion and reduces biodiversity. Cattle also contribute nutrients and pathogens to surface runoff.

Agencies throughout the Bay Area are actively addressing water quality issues in their service areas. In order to provide uniformly high quality water to all customers and to reduce treatment costs, many agencies blend higher quality supplies with lesser quality water. In addition, agencies are working to manage salts, dissolved solids and other constituents of concern through several measures, including source water assessment, watershed protection, collaborative work groups, and advanced treatment technologies.

Water quality protection and improvement are discussed further in Chapter 4.

2.5.2 Specific Source Water Quality Issues

Bay Area Region water quality is dependent upon source of supply. Table 2-22 illustrates how select water quality parameters can vary significantly between major Bay Area sources.

Table 2-22: Water Quality Constituent Concentrations for Major Bay Area Supplies[a]

Parameter	Sierra Nevada Supplies[b]	Delta Supplies[c]	Russian River Supplies[d]	Livermore Valley Groundwater[e]
TDS (mg/L)	27-230	330	130 – 180	608-1,146
Hardness (mg/L as $CaCO_3$)	8-140	119	40-141	413-613
TOC (mg/L)	2.4-3.2	3.1	0.6	0.2 – 0.5
Chloride (mg/L)	3-16	90	0.12	95-193

Notes:
(a) Water quality concentrations vary significantly by location, season, and hydrologic year type. Values presented here represent ranges measured at specific locations.
(b) Data shown for Sierra Nevada Supplies include ranges found for both Tuolumne and Mokelumne Rivers sources, from the following documents: SFPUC. Annual Water Quality Report 2010; EBMUD. Annual Water Quality Report 2010.
(c) Santa Clara Valley Water District April 2012 Water Quality Report http://www.valleywater.org/services/WaterQualityReports.aspx
(d) TDS and Hardness values from the City of Petaluma, Department of Water Resource and Conservation. Annual Water Quality Report 2010. TOC and Chloride values from Water Quality Data from Russian River Basin, Mendocino and Sonoma Counties 2005-2010. http://pubs.usgs.gov/ds/610/pdf/ds610.pdf
(e) TDS, hardness, and chloride reported values for Mocho Wellfield as reported in Zone 7's 2010 Consumer Confidence Report http://www.zone7water.com/images/pdf_docs/water_quality/2010-ccr-web.pdf. TOC values from Pam John et al. Feasibility Level Design of Recycled Water Facilities for Santa Clara County, presented at the 2005 Water Reuse Annual Conference (http://www.watereuse.org/ca/ 2005conf/papers/B1_pgittens.pdf).

2.5.2.1 Surface Water Quality

Delta water supplies typically contain organic carbon, bromide, pathogens, salinity, nutrients, and algae. Salinity contributes to taste problems, limits recycling and groundwater recharge opportunities, and is closely linked to bromide concentration. Although seawater is the primary source of salinity, agricultural and urban discharges in the watershed also contribute to the salt load. Nutrients (primarily nitrogen and phosphorus) lead to algal growth in reservoirs and conveyance structures. Algae cause tastes and odor problems and clog filters or otherwise interfere with water treatment. Additional water quality issues and objectives for Delta source water are discussed in Chapter 12.

Supplies originating in the Sierra Nevada Mountains typically have the best water quality with very low salts and organic matter, since the water originates from snowmelt on granite peaks that allows few avenues for infiltration of salts and solids.

Russian River water supplies, like many other local water supplies, typically are of very good quality, with low levels of total dissolved solids and total organic carbon. As water flows to the Russian River aquifer, it flows through a thick layer of gravel and sand that acts as a filter, eliminating many regulated constituents.

2.5.2.2 Groundwater Quality

Bay Area groundwater supplies are generally high quality. AB 1249 requires IRWM plans to include information as available on certain constituents if present in groundwater, specifically nitrates, arsenic, perchlorate, and Cr-VI. It should be noted that some of these constituents are naturally occurring in Bay Area groundwater basins, and not all Bay Area groundwater basins are currently used for water supply. Groundwater in many areas does not require treatment. In others, water utilities treat or blend the groundwater used for water supply to ensure that they meet all drinking water standards. Further information on water quality for each utility can be found in their respective Urban Water Management Plans. The Livermore Valley Basin is reporting the presence of nitrates, arsenic, and Cr-VI. The Napa Valley and Napa-Sonoma Valley Lowlands Basins also report nitrates, arsenic, perchlorates, and Cr-VI. San Francisco is reporting the presence of nitrates and Cr-VI for the Westside Basin. Zone 7 Water Agency, the agency managing the Livermore Valley Basin, has taken one of its wells out of service and added treatment processes to other wells in order to address nitrates and other constituents. Zone 7 has also developed Salt and Nutrient Management Plans and constructed and operates a groundwater demineralization facility to remove TDS and other contamination. Napa County, the agency managing the Napa Valley and Napa-Sonoma Valley Lowlands, reports that since the contaminants are naturally occurring and not widespread, there are minimal impacts on the groundwater quality. San Francisco meets water quality standards through blending. Many agencies are in the process of setting up further monitoring as required by their Groundwater Sustainability Plan (GSP). Data may not be readily available for groundwater basins that are not used for water supply.

Testing conducted by the Groundwater Ambient Monitoring and Assessment (GAMA) Program showed that most constituents of concern generally were below health-based thresholds. Pharmaceutical compounds were not detected in any of the tested wells. Seawater intrusion has affected some aquifers along the Bay, contributing high concentrations of chloride and other dissolved minerals to the groundwater, but reduced withdrawals and more effective groundwater management have alleviated impacts to many groundwater basins (further described in Chapter 4).

2.5.2.3 Recycled Water Quality

Quality of recycled water supplies is a function of influent water quality and treatment. All recycled water in use in the Bay Area Region complies with applicable Title 22 water quality standards, which specify treatment and use requirements for various recycled water uses (including landscape irrigation, agricultural irrigation, cooling towers and other industrial uses, and toilet and urinal flushing). Some recycled water quality issues that can impact existing habitat and sensitive species include the amount of total dissolved solids and nitrates.

The salinity of recycled water, which is generally 150 to 400 mg/L above potable levels (Tanji et al. 2008), is an important parameter in determining its suitability for irrigation and other uses. Depending on salinity levels, it may be unsuitable for irrigation of more salt sensitive plants or for industrial purposes requiring higher quality water. This issue can often be addressed during project design, planning, and monitoring and would be considered on a project-by-project basis for IRWM planning. For examples, SCVWD, in partnership with the City of San Jose, is constructing the Silicon Valley Advanced Water Purification Center to help address salinity levels through the production of highly purified recycled water.

2.5.2.4 Desalinated Water Quality

The overall quality of desalinated water is comparable to other high quality drinking water sources. Results from the MMWD Seawater Desalination Pilot Program showed that desalinated water met or exceeded all state and federal drinking water standards.

2.5.3 Water Quality Regulations

2.5.3.1 TMDLs

The U.S. Environmental Protection Agency (US EPA), SWRCB, and RWQCBs have permitting, enforcement, remediation, monitoring, and watershed-based programs to prevent or manage pollution.

The Federal Clean Water Act (CWA) contains two strategies for managing water quality including, (1) a technology-based approach that envisions requirements to maintain a minimum level of pollutant management using the best available technology; and (2) a water quality-based approach that relies on evaluating the condition of surface waters and setting limitations on the amount of pollution that the water can be exposed to without adversely affecting the beneficial uses of those waters.

Section 303(d) of the CWA bridges these two strategies. Section 303(d) requires that the states make a list of waters that are not attaining standards after the technology-based limits are put into place. For waters on this list (and where the US EPA administrator deems they are appropriate), the states are required to develop total maximum daily loads (TMDL) — a number that represents the assimilative capacity of receiving water to absorb a pollutant—to control both point and nonpoint source pollution and must account for all sources of the pollutants that caused the water to be listed.

Lagunitas Creek

In the Bay Area Region, surface water and groundwater quality is regulated by the SF RWQCB. The SF RWQCB classifies the San Francisco Bay and many of its tributaries as impaired for various water quality constituents. The SF RWQCB staff is currently developing more than 30 TMDL projects to address the impaired water bodies. Table 2-23 shows TMDL projects that have been completed and that are currently in development in the Bay Area Region. Chapters 4 and 12 provide additional discussion and examples of non-point source pollution control TMDL project development in the Bay Area Region. Additional information on TMDLs and 303(d) listings can be found on the SWRCB website, including the Integrated Report (https://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/impaired_waters_list/).

One of the main regulatory planning documents for water quality is the San Francisco Bay Basin Plan, administered by the SF RWQCB. It designates beneficial uses and water quality objectives for surface and groundwater and includes implementation programs to achieve those objectives.

Another local entity is the Clean Estuary Partnership (CEP), which is an innovative collaboration of the BACWA, the BASMAA, and the RWQCB designed to improve water quality in San Francisco Bay. Other key participants include the San Francisco Estuary Institute, the Clean Water Fund, San Francisco Bay Keeper, the Port of Oakland, and the Western States Petroleum Association. The CEP works with RWQCB staff to fund and conduct technical research and analysis to support TMDL development and to conduct stakeholder outreach activities.[11]

[11] For more information on the Basin Planning Process go to: http://www.swrcb.ca.gov/rwqcb2/water_issues/programs/TMDLs/mainpagegraphics/basin_planning_fs.pdf

Table 2-23: TMDL Projects – Completed and in Development

Completed TMDL Projects	TMDL Projects in Development
• Guadalupe River Watershed Mercury • Lagunitas Creek Sediment • Muir Beach Bacteria (proposed de-listing) • Napa River Pathogens • Napa River Nutrients (proposed de-listing) • Napa River Sediment • North San Francisco Bay Selenium • Pescadero and Butano Creeks Sediment • Richardson Bay Pathogens • San Francisco Bay Beaches Bacteria • San Francisco Bay Mercury • San Francisco Bay PCBs • San Vicente Creek and Fitzgerald Marine Reserve Bacteria • San Pedro Creek and Pacifica State Beach Bacteria • Sonoma Creek Nutrients (proposed de-listing) • Sonoma Creek Pathogens • Sonoma Creek Sediment • Suisun Marsh Mercury and Dissolved Oxygen • Tomales Bay Mercury • Tomales Bay Pathogens • Urban Creeks Pesticide Toxicity • Walker Creek Mercury	• Kiteboard Beach and Oyster Point Beach Bacteria • Permanente Creek Selenium • Petaluma River Bacteria • Pillar Point Harbor & Venice Beach Bacteria • San Francisquito Creek Sediment • San Gregorio Creek Sediment • Stevens Creek Toxicity •

Source: SFRWQCB 2019.

2.5.3.2 Salt and Nutrient Management

High salinity has become a particular constituent of concern for water planning. The rate at which salts accumulate in soils is an important factor in determining acceptable TDS levels for irrigation. In addition, the salinity and potential toxicity to plant foliage and roots from other specific constituents are potential concerns.

Some groundwater basins contain salts and nutrients that exceed or threaten to exceed water quality objectives established in the applicable Water Quality Control Plans. These conditions can be caused by natural soils/conditions, discharges of waste, irrigation using surface water, groundwater or recycled water and water supply augmentation using surface or recycled water.

In 2009, the SWRCB adopted a statewide Recycled Water Policy (Policy) to establish uniform requirements for the use of recycled water. The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources in a manner that implements state and federal water quality laws. The Policy states that salts and nutrients from all sources, including recycled water, should be managed on a basin wide or watershed wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses.

The SWRCB determined that the appropriate way to address salt and nutrient issues is through the development of regional or sub-regional salt and nutrient management plans rather than through imposing requirements solely on individual recycled water projects. Salt and nutrient plans must include a basin/sub basin wide monitoring plan that specifies an appropriate network of monitoring locations. The monitoring plan should be site specific and must be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives. For more information see Chapter 5.

2.5.3.3 Drinking Water

The California State Board Water Boards (SWB) Drinking Water Program (DWP) regulates public drinking water systems.

DWP consists of three branches: (1) the Northern California Field Operations Branch, (2) the Southern California Field Operations Branch, and (3) the Program Management Branch.

The Field Operations Branches (FOBs) are responsible for the enforcement of the federal and California Safe Drinking Water Acts (SDWAs) and the regulatory oversight of about 7,500 public water systems to assure the delivery of safe drinking water to all Californians. In this capacity, FOB staff perform field inspections, issue operating permits, review plans and specifications for new facilities, take enforcement actions for non-compliance with laws and regulations, review water quality monitoring results, and support and promote water system security. In addition, FOB staff are involved in funding infrastructure improvements, conducting source water assessments, evaluating projects utilizing recycled treated wastewater, and promoting and assisting public water systems in drought preparation and water conservation.

FOB staff work with the US EPA, the SWRCB, RWQCBs, and a wide variety of other parties interested in the protection of drinking water supplies. On the local level, FOB staff work with county health departments, planning departments, and boards of supervisors. Primacy has been delegated by CDPH to certain county health departments for regulatory oversight of small water systems, and FOB staff provide oversight, technical assistance, and training for the local primacy agency personnel.

2.5.3.4 The Technical Programs Branch consists of the Quality Assurance Section, the Environmental Laboratory Accreditation Program Section, and the Technical Operations Section. Recycled Water

The DWP establishes regulations and criteria for water recycling to protect public health. The RWQCB issues permits for water recycling to ensure groundwater and surface water quality are protected and to implement DWP recommendations for protecting public health.

2.6 Major Water Related Infrastructure

The following sections list the major water-related infrastructure for the Region.

2.6.1 Drinking Water Infrastructure

Bay Area Region water agencies rely upon a diverse network of water related infrastructure that includes major aqueducts that convey water supplies from the Sierra Nevada Mountains and the Delta. Major transmission facilities throughout the region include:

- **Contra Costa Canal:** The 48-mile long Contra Costa Canal comprises the backbone of the CCWD transmission system for CVP. It originates at Rock Slough in East Contra Costa County and ends and ends at the Shortcut Pipeline near the Bollman Water Treatment Plant, delivering water to CCWD's treatment facilities and raw water customers.

- **Hetch Hetchy Aqueduct:** The 156-mile Hetch Hetchy Aqueduct conveys water from the Tuolumne River through the Hetch Hetchy Reservoir to the San Francisco Bay Area. In Fremont, the aqueduct splits into four pipelines , all of which cross the Hayward fault. Pipelines 1 and 2 cross the San Francisco Bay to the south of the Dumbarton Bridge and Pipelines 3 and 4 run to the south.

- **Mokelumne Aqueducts:** Three aqueducts form the Mokelumne Aqueduct System and convey most of EBMUD's supply 84 miles from Pardee Reservoir on the Mokelumne River westward to Walnut Creek.

- **North Bay Aqueduct:** The North Bay Aqueduct (NBA) is an underground pipeline operated remotely by DWR that conveys water from the Sacramento-San Joaquin Delta. The NBA extends from Barker Slough in the Delta to Cordelia Forebay, outside of Vallejo. From the Cordelia Forebay water is conveyed via the NBA to Napa County, Vallejo and Benicia. Solano CWA and the Napa County FCWCD, which contracts for water supply on behalf of the cities and towns in Napa County, receive Delta supplies through the NBA.

- **Russian River Transmission Facilities**: Sonoma CWA operates diversion facilities at the Russian River and an aqueduct system comprised of pipelines, pumps, and storage tanks. Three major reservoir projects provide water supply for the Russian River watershed: Lake Pillsbury on the Eel River, Lake Mendocino on the East Fork of the Russian River, and Lake Sonoma on Dry Creek. Lake Mendocino and Lake Sonoma provide water for agriculture, municipal and industrial (M&I) uses, in addition to maintaining the minimum stream flows required by water rights permits. Most of the streamflow in the Russian River during the summer is provided by water imported from the Eel River. Streamflows are augmented by releases from Lake Mendocino and Lake Sonoma.

- **San Felipe Division:** The San Felipe Division is comprised of pipelines and pumps that convey CVP water from San Luis Reservoir (a joint SWP CVP facility) to Santa Clara and San Benito Counties. In Santa Clara County, the San Felipe Division terminates at Coyote Pumping Plant, where it connects with SCVWD's Cross-Valley Pipeline. The

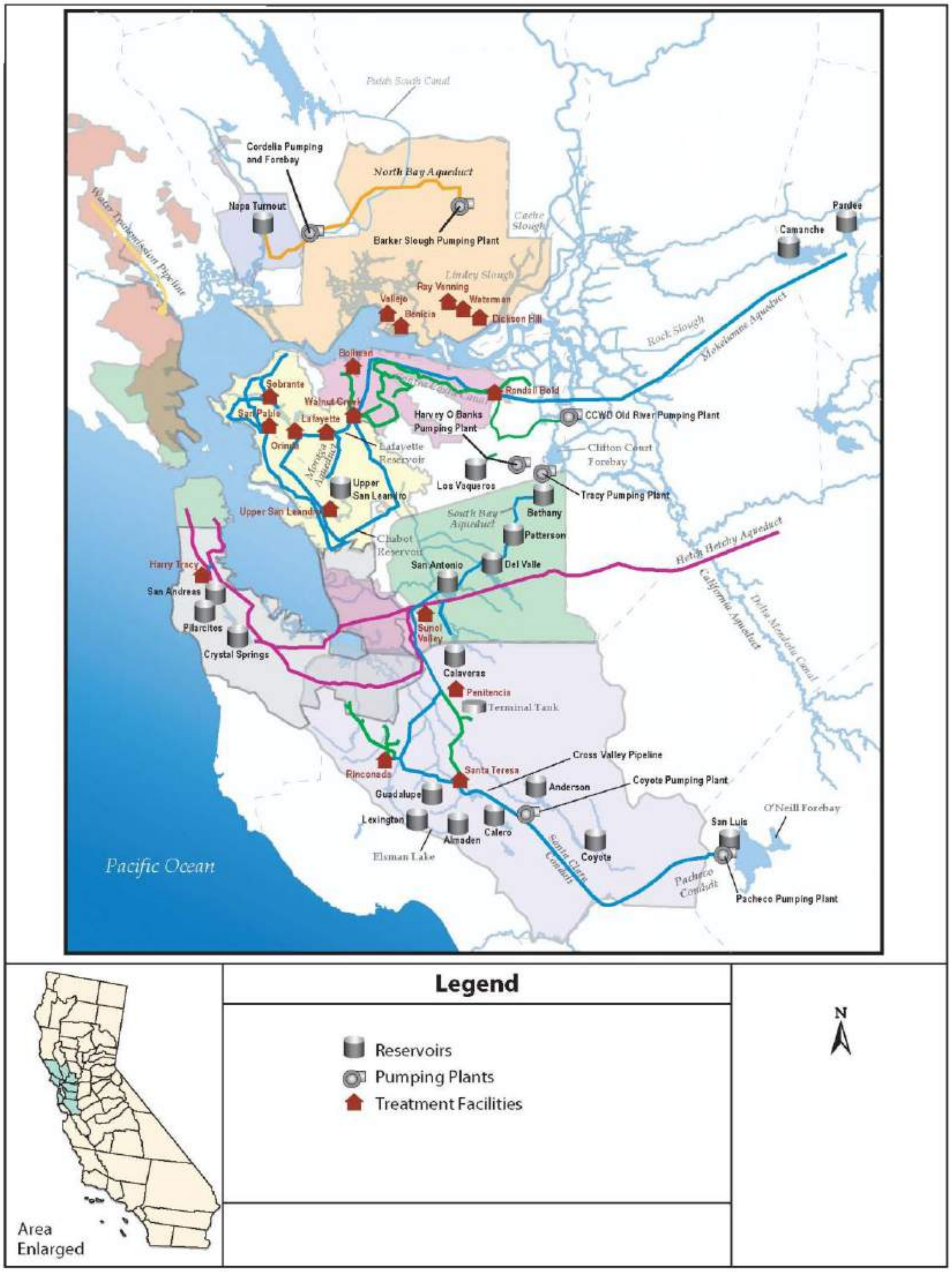
Cross Valley Pipeline is a source of supply for drinking water treatment plants, recharge ponds, and irrigation customers.

- **South Bay Aqueduct:** The South Bay Aqueduct (SBA) conveys water from the Sacramento-San Joaquin Delta through over forty miles of pipelines and canals. Beginning at Bethany Reservoir, water is pumped through two parallel pipelines to the eastern ridge of the Diablo Range. From there, water flows by gravity to Patterson Reservoir, where some water is released for delivery to Livermore Valley. Water is then conveyed to a junction point where a portion is diverted into Lake Del Valle. Beyond Lake Del Valle, water flows south past Sunol and through the hills overlooking San Francisco Bay, terminating in a steel tank east of downtown San Jose. ACWD, Zone 7, and SCVWD receive SWP supplies conveyed through the SBA (South Bay Aque, 2006).


Lake Del Valle

A schematic of these facilities and major rivers located in and around the Bay Area Region is presented in Figure 2-20. In addition to pipelines and aqueducts, each water agency has its own extensive network of surface water storage reservoirs, groundwater extraction wells, water treatment plants, and distribution pipelines.

Figure 2-20: Major Water Infrastructure Serving the Bay Area Region



2.6.2 Major Wastewater Infrastructure

Most of the nine counties that surround San Francisco Bay and discharge effluent into the Bay are urbanized and sewered. Wastewater is discharged to publicly owned sewers and transported to publicly owned treatment works (POTWs). In the San Francisco Bay region, POTWs are public agencies, governed by elected officials and funded with sewer user fees paid for by the users of the sewerage systems. Each of the POTWs in the San Francisco Bay Area Region has received National Pollution Discharge Elimination System (NPDES) permits from the SF RWQCB. Major Bay Area Region wastewater facilities are illustrated in Figure 2-21.

2.6.3 Flood Protection Infrastructure

The natural physical setting of the Bay Area and the increase in impervious surfaces due to urban development puts many areas in the Bay Area Region at risk for flooding. In order to manage stormwater and prevent damages from flooding, flood protection infrastructure has been developed throughout the region. In addition to storm drain systems that are common throughout the Bay Area Region, major Bay Area flood protection infrastructure projects have been constructed along the following waterways:

- **Alameda Creek.** Twelve miles of Alameda Creek has been straightened, widened and rip-rapped and levee protection is provided for almost the entire length of the channel. In addition, the Arroyo del Valle reservoir in the Livermore-Amador Valley was constructed to regulate flows along this creek.

- **Corte Madera Creek.** County Flood Control Zone Nine began a flood control project in the late 1960s which was originally intended to extend 6.5 miles through Larkspur, Kentfield, Ross, San Anselmo, and Fairfax. Construction at the downstream end created a trapezoidal earthen channel and, further upstream, a rectangular concrete channel part way through Ross. In 2011, DWR awarded Proposition 1E funding for the Phoenix Lake retrofit project, a component of the Ross Valley flood control projects, which will temporarily store stormwater runoff from watershed to lower flows in Ross Creek and Corte Madera Creek (Marin County 2011).

- **Guadalupe River.** Two major flood protection projects were recently completed to provide 1 percent flood protection to the Guadalupe River. These projects included a large underground bypass about 2,700 feet long, twenty feet high and sixty feet wide to convey flood flows and allow the existing channel to be left in its natural condition so that critical steelhead salmon runs would not be adversely impacted. Currently, construction on the Upper Guadalupe Flood Protection Project is underway with completion scheduled for 2015. This project constitutes the last section of the larger Guadalupe river project.

Guadalupe River Flood Protection Project

- **Napa River.** Currently under construction is a flood control project on the Napa River to protect developed areas from flooding. The $400 million project includes raising several bridges, adding floodplain terraces, and a large restored wetland.

- **Novato Creek.** Flood control improvements sufficient to prevent flooding during storms up to the 50-year recurrence interval are currently being developed.

- **Petaluma River.** New floodwalls—part of a nearly complete $41 million flood control project—protected residents in the Payran neighborhood during the 2006 New Year's flood.

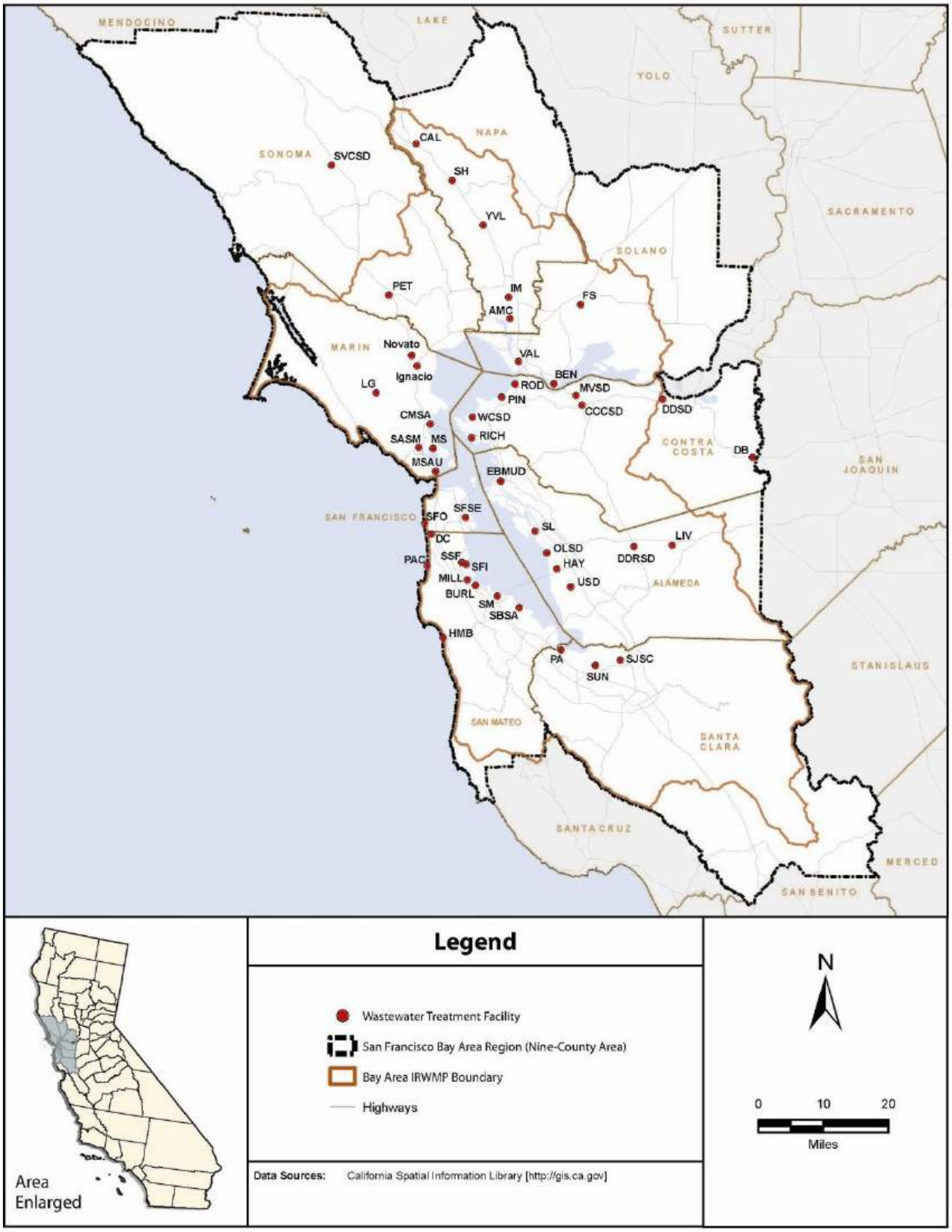
- **San Francisquito Creek.** In 2002, SCVWD completed a multi-agency project that provided interim flood protection to the communities of East Palo Alto and Palo Alto. The effort was a critical measure in protecting homes and businesses from the danger of flooding. The San Francisquito Creek Joint Powers Authority (JPA) continues implementation of projects to stabilize, restore and maintain the channel, which include ongoing capital projects within the 100-year floodplain. Since then, the JPA has received Proposition 1E and Proposition 84 grant awards for construction in support of this program..

Many DACs are located in floodplain areas where much of this flood protection infrastructure is located. These communities have the potential to be negatively impacted by flood control projects.

2.6.4 Infrastructure Reliability

Maintaining and upgrading water resources infrastructure is crucial to successful water resources planning. Infrastructure in the Bay Area Region is vulnerable to effects from events such as seismic activity, levy failures, sedimentation, climate change impacts and system security breaches. A discussion of these issues and examples of mitigation strategies is presented in Chapters 4 and 12.

Figure 2-21: Major Bay Area Region Wastewater Facilities



2.7 Regional Issues, Needs and Challenges

The key issues, needs, challenges, and priorities for the Bay Area Region with respect to water resource management are described in the following sections.

2.7.1 Regulatory Compliance Challenges

Challenges to achieving and maintaining compliance with applicable regulatory requirements may include:

- **Compliance with Environmental Mandates:** Depending upon the extent and jurisdiction of a water management project, water agencies must comply with some or all of the following regulations and agencies:
  - California Environmental Quality Act
  - National Environmental Policy Act (if a Federal interest exists)
  - California Department of Fish and Wildlife
  - U.S. Army Corps of Engineers
  - San Francisco Bay RWQCB
  - San Francisco Bay Conservation and Development Commission
  - U.S. Fish and Wildlife Service and National Marine Fisheries Service
  - California Department of Public Health

  Bay Area Region water resources management entities have observed problems imposed by severe funding and staffing limitations at the resource protection agencies, including long delays in permitting and the inability to commit sufficient resources to guiding and assisting applicants during the planning and decision-making phases of projects. IRWM planning, therefore, must be creative, flexible, and be well-planned to overcome environmental planning challenges. Open and ongoing discussions with the above agencies can be critical to project success. Additional discussion of agency coordination is provided in Chapter 15.

- **Compliance with Stormwater Requirements:** Stormwater compliance presents a variety of challenges to both municipalities and stormwater management agencies. Local planning and plan review staff generally lack expertise in NPDES permit compliance and in stormwater treatment requirements. Guidelines that call for stormwater infiltration can be challenging to meet in the Bay Area Region, which has wide prevalence of low-permeability clay soils and high groundwater. In addition, stormwater NPDES programs have responsibility for defining their standards as well as for meeting those standards, so municipal stormwater program staff spends a significant proportion of their time and resources preparing regulatory compliance reports. Stormwater capture and management strategies are discussed in Chapter 4.

- **Compliance with Flood Protection Permitting:** Environmental permits from the Corps, SF RWQCB, and the NMFS are typically required to construct flood protection or stream restoration projects and maintain existing facilities, even for routine maintenance of channels, including dredging, bank repair, and vegetation management. Flood protection agencies must also cooperate with efforts by Federal and state wildlife agencies and non-governmental organizations (NGOs) to maintain and restore critical habitat and assist species recovery. In each case, the local flood protection agency must evaluate and mitigate, if necessary, the effects of these projects on conveyance of flood flows. The time and cost associated with obtaining these permits are a considerable burden on the local agencies.

2.7.2 Flood Protection Challenges

Flood protection agencies throughout the region face challenges related to permitting, floodplain management, and stream ownership and maintenance responsibility.

Flooding along Berryessa Creek

2.7.2.1 Floodplain Management

Development in upper elevations and steep hillside areas exacerbate problems of stream instability, erosion, and flooding. On lower elevations and flatter gradients, high land values are a disincentive to retaining riparian setbacks where natural geomorphic and ecologic processes such as flooding and minor erosion could occur without affecting structures. Floodplain and riparian management concerns include the following:

- **Development in Stream Corridors***.* During the 1940s through the 1970s, the "golden age of stream channelization" coincided with the most rapid urban development in the region. Stream restoration projects typically require reconfiguring channel cross-sections to accommodate increased flows and restore sediment equilibrium; development near streams constrains options for implementing these projects.

- **Accommodating Recreational Needs and Public Access.** As the Bay Area's population increases and urban development intensifies, there is increasing need for parks, trails and open space. Needs include active recreation areas such as playing fields and courts in addition to trails where residents can obtain access to nature. Many Bay Area riparian areas are used by homeless people for refuge and camping. This damages riparian areas and exacerbates problems with trash and potential water-borne pathogens.

- **Development in Areas Susceptible to Tidal Flooding.** Although many portions of the Bay shoreline are protected from development or are in the process of restoration, there is significant ongoing development on the Bay-ward side of the freeways ringing the Bay. DACs are often located in low-lying flood-prone areas. The Bay is subject to El Niño episodes, which bring about a dangerous combination of severe storms and heightened seas, and resulting tidal flooding impacts.
  - Flood management strategies are discussed further in Chapter 4.
  - Recreation and public access are discussed further in Chapter 4.

- State floodplain management task force recommendations are presented in Chapter 12.

2.7.2.2 Stream Ownership and Maintenance

Ownership of Bay Area streams is a patchwork of public title, public easements, and private ownership. Flood protection agencies have adopted different policies with regard to jurisdiction over, or maintenance responsibility for, urban streams. Many Bay Area stream reaches have, in fact, no established public jurisdiction or established maintenance responsibility. As infrastructure ages and deteriorates, and as incised channels erode and evolve, resulting property damage and flooding threats often lead to claims and counterclaims among public agencies and private property owners. Stream maintenance can be managed through ecosystem restoration, a water management practice that is further discussed in Chapter 4.

2.7.3 Financial and Funding Challenges

Water resources management entities in the Bay Area Region face several financial and funding challenges for regional projects, including:

- Competing costs between existing operating costs and improvement projects
- Lack of funding to maintain or replace aging infrastructure
- Lack of funding to comply with stormwater permit obligations

Chapter 11 discusses financial and funding issues for IRWM projects.

2.7.4 Environmental and Watershed Challenges

The Bay Area Region watershed has numerous and significant water resource management and environmental stewardship challenges. These often occur when resources are managed for conflicting uses, such as instream flows and municipal water supplies or land use development and habitat conservation.

Bay Area Region water agencies are tasked with balancing the water needs of sensitive environmental areas with the water needs of their customers, and ensuring that natural resources and habitats are shielded from potential adverse impacts associated with water resource management. Environmental water demands (including the quantity, timing, duration, and frequency of flows required by plants, wildlife, and fisheries) frequently conflict with water supply demands for agricultural irrigation and/or urban development. For example, diversions of water from streams and reservoir fluctuations can limit survival rates for aquatic and riparian species. Opportunities exist for water managers to evaluate their delivery schedules, reservoir ramping rates, and other flow requirements and find “windows” for providing flow for environmental and habitat support. Water management strategies to address environmental and watershed concerns are further discussed in Chapter 4.

Effective management of the Region’s water resources also requires effective ongoing communication and collaboration between land and water resource managers and stewards. These relationships are further discussed in Chapters 12 and 13.

2.7.5 Dependence on the Sacramento-San Joaquin Delta

Many Bay Area Region water agencies purchase imported water that flows through the Sacramento-San Joaquin Delta, such as the SWP and CVP. Some agencies (such as CCWD and Zone 7) rely on the Delta to transport over 75 percent of their water supply. However, the long-term reliability of this water supply is unknown because of a variety of issues including infrastructure reliability, endangered species, water quality, sea level rise, ecosystem restoration, political interests and more.

Approximately 1,600 miles of levees that are part of the California Central Valley Flood Control System, and another 1,000 miles of local levees, protect the Central Valley and Delta regions from flooding (DWR Flood Warnings, 2005) and protect Delta water supplies. In the event of a massive failure of these levees, the quality of Delta water could be severely compromised as salt water rushed in from the Bay to equalize water pressure. This would immediately affect the water supplies, since the CVP and SWP pumping plants would need to be shut down to prevent further saltwater intrusion. The Mokelumne Aqueducts that serve EBMUD customers, which cross the Delta and are protected by levees, could also be damaged by a major flooding event.

Many groups within the state are pushing to improve the Delta but have conflicting visions of how to resolve the many issues surrounding the Delta. Because of the Bay Area's dependence on the Delta as a critical water supply, the uncertainty of the Delta's future is a significant concern for the Bay Area Region that must be addressed by water agencies and considered in the integrated planning process.

2.7.5.1 Reducing Dependence on the Delta

The Bay Area – through both regional and individual agency programs and projects - has a long-standing commitment to efficient water use and development of local supplies that will result in reduced dependence on water exported from the Delta. Robust conservation programs have led per capita use in the Bay Area to decrease steadily since the 1980s (fig 2.19). There are also over 35 recycled water programs in the Bay Area (Table 2-9) and capacity is expected to more than double over the next 20 years (BACWA 2011 Recycled Water Survey). Agencies are expanding conjunctive use and considering projects such as groundwater banking to minimize impacts to the Delta during dry years. Agencies are also considering projects to develop alternative supplies (e.g., desalination) and optimize existing supplies (e.g., water transfers and interties) (Section 2.3.3). Regional and individual agency programs and projects advancing these strategies and others are included in this IRWMP, and will contribute to reduced Bay Area Region dependence on water exported from the Delta in future years.

2.7.6 Interagency Coordination Challenges

Inter-jurisdictional coordination is a major challenge facing water resource management. Municipal boundaries, water supply service areas, and the boundaries of county flood protection agencies rarely coincide with watershed boundaries and can impede implementation of projects. As environmental protection initiatives, such as sediment TMDLs and habitat restoration, continue to adopt a watershed approach, the need for interagency coordination is increasing. However, regulatory guidance and permitting decisions are not made on a watershed basis, but on a project-by-project basis.

Although the Bay Area Region seeks to overcome regional conflicts and challenges toward integrated water resources planning and management, not all regional goals and objectives will be met exclusively through IRWMP implementation. Individual agencies and organizations also contribute to regional goals when addressing local challenges and implementing local programs. The IRWMP provides a regional lens and opportunity for collaboration on activities that are already being pursued by individual agencies to meet their local mandates.

Effective management of water resources requires a collaborative approach to maximize resources while minimizing costs. Additional discussion and examples of regional cooperation is provided in Chapters 4 and 15.

2.7.7 Challenges to Expanding Recycled Water Use

Expanding recycling water use is important for meeting future demands and it provides an all-weather local supply that helps adapt to climate change and other risks. However, several challenges may limit recycled water expansion. Some of the challenges include increasing salinity in recycled water supplies and the cost per acre-foot of water for expanding non-potable distribution systems. Potable reuse is another option for expanding recycled water, but requires extensive public engagement and regulatory support.

2.7.8 Climate Change

Climate change is driven by increasing concentrations of carbon dioxide and other greenhouse gases that cause an increase in temperature and stress natural systems, such as oceans and the hydrologic cycle. Climate changes that may affect Bay Area Region water resources include:

- **Higher temperatures and heat waves** that increase demand for water, especially for agricultural and residential irrigation uses. The eastern and southern portions of the region are likely to see more pronounced warming than the coastal, northern and central Bay regions.

- **Water Uncertainty**: A projected overall decrease in precipitation levels coupled with more intense individual storm events may lead to increased flooding. Higher temperatures that may cause more precipitation to fall as rain rather than snow, hasten snowmelt and increase runoff will affect water storage planning. Increased evaporation will create a generally drier climate, with wildfires likely to increase and groundwater basins likely to receive less replenishment.

- **Sea level rise,** which is estimated to rise an average of 14 inches by 2050 (Cayan et al. 2009), will likely affect low lying infrastructure of all types, including many of the Bay Area Region’s wastewater treatment plants.

Chapter 16 describes potential effects of climate change on Bay Area Region agencies and IRWM planning in more detail.

2.8 Relationship to Other Regional Water Management Efforts

The sections below describe the Bay Area Region’s connections and coordination efforts with adjacent IRWM regions (Figure 2-22). For more information on

Incorporation of Tomales Bay: In the 2006 IRWMP, the Tomales Bay watershed area in Marin County was covered under a separate Tomales Bay Watershed Integrated Coastal Water Management Plan but subsequent discussions have led to incorporation of the Tomales Bay area into the Bay Area IRWMP.

Westside Sacramento River IRWMP: Napa County is split between the Bay Area and Westside Sacramento River IRWMPs. The Bay Area Region generally covers the western part of Napa County and focuses on the Napa River and Suisun Creek watersheds. The Westside Sacramento River Region, which is part of the larger Sacramento River Funding Area delineated by DWR, generally covers the eastern part of Napa County and focuses on the Putah Creek/Lake Berryessa watershed. Depending upon their location within the county, projects will be incorporated into the appropriate IRWMP. Representatives from Solano County Water Agency and Napa County FCWCD provide a linkage between the Bay Area and Westside Sacramento IRWMPs, enabling information sharing and communication between the two planning efforts.

North Coast IRWMP: Sonoma and Marin Counties lie within both the North Coast IRWM Region and Bay Area Region. Marin County, which only has a small portion in the North Coast region, participates in the Bay Area IRWMP and pursues planning and project implementation in the North Coast Region, as do stakeholders in Sonoma County. The Sonoma County Water Agency provides a linkage between the Bay Area and North Coast IRWMPs, enabling strong information sharing and communication between the two planning efforts.

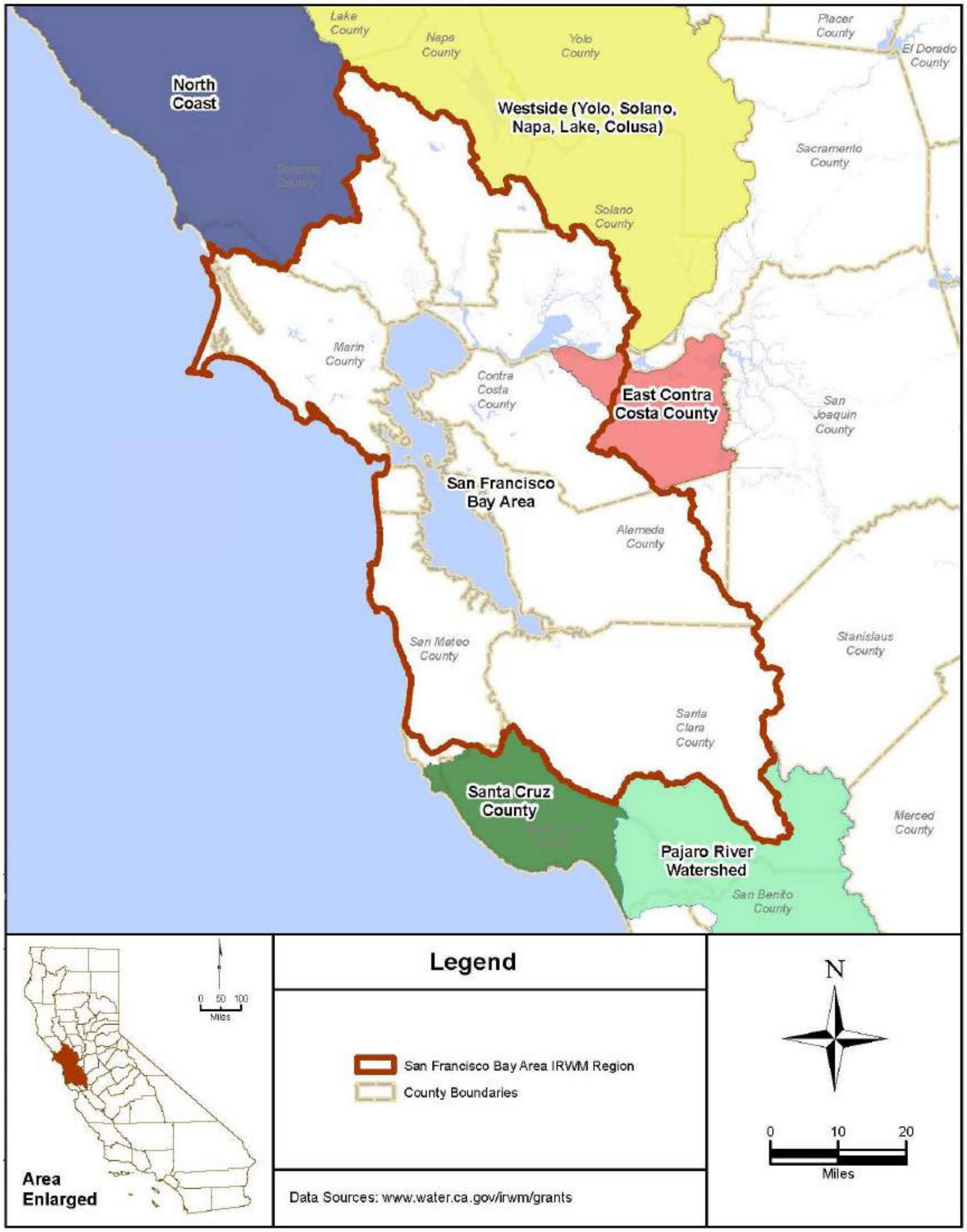
East Contra Costa County IRWMP: The East Contra Costa County IRWM region is the only IRWM planning region with boundaries that overlap the Bay Area Region boundaries, straddling the Bay Area hydrologic region and the San Joaquin River hydrologic region. The overlap area contains two watersheds that drain to the east of the Mt. Diablo hydrologic divide (Willow Creek and Kirker Creek). These two watersheds are included in the Bay Area Region, resulting from the defined boundaries of the San Francisco Funding Area and RWQCB Region 2, and within the East Contra Costa County IRWM region, whose boundaries are defined by the hydrologic divide created by the ridgeline. East Contra Costa County attends Bay Area IRWM Coordinating Committee meetings and participated in the planning and prioritization processes for projects that are within the Bay Area regional boundary.

Solano County Water Agency: Although originally a separate IRWMP, the Solano CWA area has been absorbed into neighboring regions. The southwestern portion of Solano County has been integrated into the Bay Area Region and the rest of the original IRWM region is coordinating with the Westside Sacramento River area.

Pajaro River Watershed IRWMP: SCVWD is participating in both the Bay Area and the Pajaro River Watershed IRWMPs. The southern portion of its service area is part of the Pajaro River Watershed and drains to Monterey Bay, while the northern portion is part of the Bay Area and drains to the Bay.

Santa Cruz IRWMP: The Santa Cruz IRWMP encompasses most of Santa Cruz County. Coordination between the Santa Cruz County and Bay Area Regions has focused on efforts to minimize the area not covered by a planning region in the Central Coast Funding Area in San Mateo County. As a result, the northern boundary of the Santa Cruz IRWM region was adjusted in 2009 to encompass additional portions of small watersheds of Año Nuevo, reducing, yet not eliminating the gap (Regional Water Management Foundation, April 2009).

Figure 2-22: Surrounding IRWM Regions



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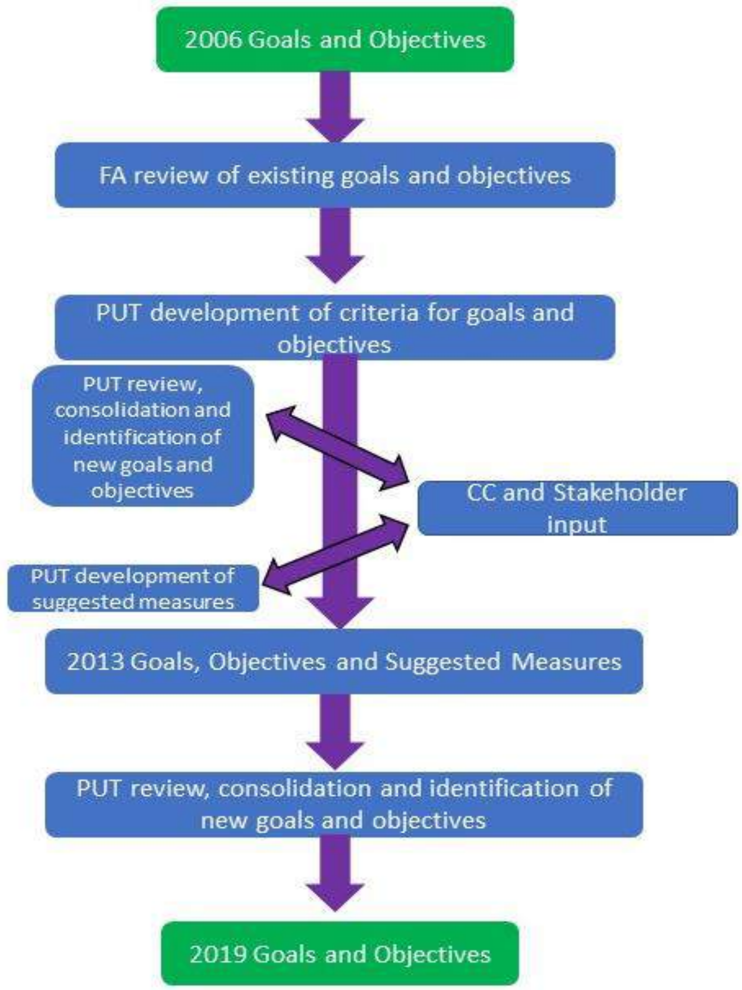
Chapter 3: Goals and Objectives

This chapter presents the goals and objectives for the Integrated Regional Water Management Plan (IRWMP or Plan), representing what the stakeholders and the Coordinating Committee (CC) have determined they would like the IRWMP to accomplish when implemented. This chapter also describes how the goals and objectives were developed. To the extent feasible, measures of success have been suggested for IRWMP objectives in order to be able to evaluate progress of IRWMP implementation.

The Bay Area Region has developed both goals and objectives for the IRWMP. No IRWMP standard exists to define “goals”, nor are they required by the California Department of Water Resources (DWR). The Bay Area Region, however, has chosen to use goals as an additional layer for organizing and defining the objectives, due to the complexity of water management issues in the Region.

Development of objectives for the IRWMP was an iterative and consensus-based process. Led by the Plan Update Team (PUT), the process also included review by the Functional Areas (FAs) and the CC. Stakeholder outreach and involvement, discussed in Chapter 14: *Stakeholder Involvement* was critical to this process. Proposed goals, objectives and suggested measures for the Bay Area IRWMP were discussed at the first Workshop on 7/23/2012 where stakeholders were given opportunity to provide input. This open and transparent decision-making process was important to ensure that all perspectives within the Region were considered in the IRWMP. Additionally, many of the local planning documents that serve as the basis for this IRWMP involved extensive stakeholder involvement as well. Figure 3-1 shows the steps in the goals and objectives development process.

Figure 3-1: Development of Regional Goals, Objectives and Suggested Measures



The following sections describe each step in more detail and identify what evaluation criteria were considered.

3.1 Background

The process for developing the goals and objectives for IRWMP began with a review of the goals and objectives identified in the 2006 Plan. For the 2006 Plan, the goals and objectives were developed for each FA independently. Each FA outlined regional goals and objectives based on geographic integration of established local agency plans, projects, and programs. The process involved the following steps:

- Compilation of the issues, conflicts and challenges from each FA, and definition of common water resource management interests
- Compilation of the various goals and objectives identified in each FA to address water management challenges, and identification of overarching goals that transcend all functional areas of water resource management

- Revision of overarching goals and objectives based on stakeholder input and feedback, and development of a vision to guide implementation of the IRWMP

- Discussion of proposed goals and objectives at stakeholder workshops

The 2006 Plan identified six goals and 68 objectives generated by the four FAs. The effort did not include development of measures. The processes for establishing regional goals and objectives, as well as the goals and objectives identified by each functional area, are described in detail in the 2006 Plan.

3.2 Development of 2013 Goals, Objectives and Suggested Measures

3.2.1 Requirements

The approach to developing the 2013 goals and objectives, while still considering the FAs, focused on priority elements for the entire Bay Area and emphasized regional collaboration. The approach also incorporated 2012 DWR guidelines that a Regional Water Management Group (RWMG) must consider overarching goals that apply to their region, including:

- Basin Plan objectives

- 20x2020 water efficiency goals

- Requirements of California Water Code (CWC) Section §10540(c) (identified in Table 3-24 below)

DWR also specifies that:

- Objectives must address major water-related issues and conflicts

- Objectives must be measurable by some practical means, quantitatively or qualitatively

- Objectives may be prioritized

3.2.2 Development Process

Development of the goals and objectives was a two step process:

Step 1: Revisit and confirm, or modify the goals and objectives from the 2006 IRWMP with iterative input from the PUT, FAs, the CC and Stakeholders.

Step 2: Determine how to best articulate the manner in which the objectives can be measured, either quantitatively or qualitatively.

To start the process, the 2006 goals and objectives were distributed to the FA leads for review. Since the FAs were the authors of the original objectives, their initial review would ensure that the rationale driving the process and decisions could be maintained.

The FAs were instructed to consider the following items in their review:

1. Are the goals and objectives from the 2006 Plan still the most relevant?
2. Should any goals or objectives be eliminated or added?
3. What is the best way to articulate each objective so that it can be measured?

With this guidance, the four FAs solicited input from their members and provided their recommendations to delete, add, or modify objectives to the PUT.

After receiving the recommendations by the FAs, the PUT conducted a rigorous, iterative review of every goal and objective over the course of multiple meetings and calls. The PUT considered the following evaluation criteria for each goal and objective in the update process:

- Does it address a major issue in the Region?
- Is it already addressed by other objective(s)?
- Does it address an outcome (as opposed to addressing a process)?
- Is it consistent with 2012 Guidelines?
- Is it measurable?

Objectives were deleted if they were already addressed by another objective, could be merged with another objective(s), did not reflect 2012 Guidelines, or were not clear.

The PUT presented this initial evaluation to the CC, which provided the PUT with direction for finalizing the proposed goals and objectives. Based on that input, the PUT prepared a final draft. The final draft included the following changes to the 2006 list:

- The number of goals were reduced from 6 to 5
- The number of objectives were reduced from 65 to 35
- Objectives that address climate change and integration were added

Once the recommended list of goals and objectives was developed, suggested measures for each objective were identified to provide a framework for measuring project outcomes and, ultimately, to gauge successful implementation of the IRWMP projects. The intent of these suggested measures is to allow project proponents to relate their individual project outcomes to the overall Plan objectives. Project proponents are encouraged to use these suggested measures.

The suggested measures in Table 3.2 fall into two broad categories: (1) those that can be used when a specific project is implemented such as megawatt or kilowatt reduction in energy use, and (2) those that are better measured at a regional level by existing monitoring programs or by enhancing regional monitoring programs such as measuring reliability of supplies of appropriate quality. The measures were developed by the PUT as tools the Region can use to determine if the goals and objectives are being met as projects included in the Plan are implemented. For more information see Chapter 8: Plan Performance and Monitoring, which contains performance measures and monitoring methods to ensure the objectives of the Plan are met.

Although the PUT identified what the group determined to be the most appropriate measures for a given objective, the suggested measures do not encompass the entire universe of possible ways to measure success in meeting the Plan goals and objectives. Project proponents are encouraged to provide this information by quantifying the changes and benefits that will result from implementation of their proposed project(s). When this is not possible, qualitative descriptions may be provided, as allowed by the 2012 Guidelines.

The proposed list of goals, objectives and measures was approved for stakeholder review by the CC and presented to stakeholders at the first workshop in July 2012 (for more information see Chapter 14). At the workshop, the PUT members described the development process for the goals and objectives, and provided a list of deleted objectives, as well as opportunity for stakeholders to submit comments. Each participant received a handout of the goals, objectives and measures that included space for comments, as well as an opportunity to submit comments via email. Based on discussion at the workshop and stakeholder input, the PUT refined and finalized the list of goals and objectives, which were approved by the CC at their August meeting.

3.2.3 Results: Goals, Objectives and Measures

The five overarching goals of the Bay Area IRWMP are to:

1. Promote environmental, economic and social sustainability
2. Improve water supply reliability and quality
3. Protect and improve watershed health and function and Bay water quality
4. Improve regional flood management
5. Create, protect, enhance, and maintain environmental resources and habitats

As previously described, the 2012 Guidelines require IRWMP goals and objectives to address and consider, at a minimum, applicable Basin Plan objectives, 20x2020 water efficiency goals, and the requirements of CWC §10540(c). Table 3-24 lists which of the Bay Area goals address each of the required water management areas. Note that Table 3-24 illustrates how the Bay Area is meeting DWR's minimum requirements, however the Region has developed a number of additional goals and objectives to meet overall watershed health including stormwater, flood protection, climate change and more (Table 3-25).

Table 3-24: IRWMP Goals and DWR Requirements

DWR Requirements	IRWMP Goals: Promote environmental, economic and social sustainability	IRWMP Goals: Improve water supply reliability and quality	IRWMP Goals: Protect and improve watershed health and function and Bay water quality	IRWMP Goals: Improve regional flood management	IRWMP Goals: Create, protect, enhance, and maintain environmental resources and habitats
Requirements of CWC §10540					
Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water use efficiency strategies.		✓			
Identification and consideration of the drinking water quality of communities within the area of the Plan.	✓	✓			
Protection and improvement of water quality within the area of the Plan consistent with relevant basin plan.		✓			
Identification of any significant threats to groundwater resources from overdrafting.		✓			
Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region.	✓		✓		✓
Protection of groundwater resources from contamination.		✓			
Identification and consideration of water-related needs of disadvantaged communities in the area within the boundaries of the Plan.	✓				
Basin Plan objectives		✓	✓		
20x2020 water efficiency goals		✓			

Objectives for the Bay Area Region were developed to support the goals and are categorized accordingly. The objectives generally apply to the Region as a whole and are meant to focus attention on the primary needs of the Region. Chapter 5: *Integration* describes the value of integrating water management strategies to achieve these regional goals.

3.2.3.1 Prioritizing the Objectives

The PUT discussed and suggested various approaches to prioritize or organize the IRWMP goals and objectives, including sequential ranking and sorting as "high, medium, and low." Ultimately, the consensus was that the goals should not be prioritized since all are equally important.

There were two reasons for this decision. The first is that there was no scientific framework or justification for prioritizing the objectives. Secondly, the Bay Area Region is a broad geographic area made up of a very diverse group of stakeholders, which is reflected in the CC. The CC has aimed to be as inclusive as possible of all stakeholders in the Region, encouraging their active participation in the IRWM planning process. The 35 objectives included in the Plan were based on the issues that exist throughout the Region, as defined by different groups of stakeholders. The CC therefore recognized that each of the objectives is significant for at least some groups of stakeholders and that prioritizing some objectives over others implied prioritizing the needs of certain stakeholders over others.

In order to maintain inclusivity, transparency and to avoid the possibility of alienating certain groups of stakeholders or discouraging their participation in the IRWM planning process, the CC has therefore decided not to prioritize objectives. Instead, the objectives are listed under each goal from most general to most specific.

After attempting a sequential ranking of the objectives, it was agreed that there was no compelling reason to prioritize the objectives under each goal since the proposed project review process did not require prioritized objectives, and because prioritization would be very challenging given the diverse views in the Bay Area Region. Instead, the PUT agreed to list the objectives under each goal from most general to most specific.

The CC approved this approach during their August 2012 meeting. Table 3-25 presents the goals, objectives and suggested measures for the Region.

Table 3-25: Goals, Objectives and Suggested Measures for Meeting Regional Goals

	Objectives	Suggested Measures
Goal 1: Promote Environmental, Economic and Social Sustainability		
1.1	Work with local land, water, wastewater and stormwater agencies, project proponents and other stakeholders to develop policies, ordinances and programs that promote IRWM goals, and to determine areas of integration among projects	Number of local policies, ordinances, incentives and other programs that promote integrated planning and development of Low Impact Development (LID) projects; number of integrated projects
1.2	Encourage implementation of integrated, multi-benefit projects	Examples of collaboration between government and regulatory agencies, project proponents and stakeholders; number of integrated projects; number of benefits/partners/FAs

	Objectives	Suggested Measures
1.3	Plan for and adapt to more frequent extreme climate events	Number of projects that include climate change planning efforts; number of local efforts; number of projects that include climate adaptation strategies; number of projects that address adapting to changes in the amount, intensity, timing, quality and variability of runoff
1.4	Reduce energy use and/or use renewable resources where appropriate	Megawatt or kilowatt reduction in energy use; megawatts of renewable power sources; number of projects with an energy reduction component; number of projects that incorporate strategies in CARB's AB 32 Scoping Plan
1.5	Plan for and adapt to sea level rise	Number of projects that plan for and adapt to sea level rise, including keeping important infrastructure out of hazard zone; considering range of sea level projections when evaluating proposed water management projects practice and promote integrated flood management; Acre-feet (AF) water storage and conjunctive management of surface and groundwater resources; water resources management strategies that restore and enhance ecosystem services; avoiding significant new development in areas that cannot be adequately protected from flooding or erosion
1.6	Secure adequate support, funding and partnerships to effectively implement plan	Process to successfully respond to funding opportunities; dollars of grant funding; long-term project viability; number of projects implemented under new partnerships
1.7	Avoid disproportionate impacts to disadvantaged communities	Community support for local projects; amount reduction in risk to Disadvantaged Communities (DACs); inclusion of DACTIP Needs Assessment work in regional planning efforts
1.8	Promote community education, involvement and stewardship	Number of informational brochures, workshops, educational and technical assistance events that address water reliability, watershed health, flood risks, flood protection and other IRWM goals; educational curricula for K-12
1.9	Support data management for climate change vulnerabilities	Number of projects that provide climate change vulnerability data; number of monitoring stations; number of links and items in Bay Area IRWMP website climate change library (in development at this time); climate change vulnerability assessments completed

	Objectives	Suggested Measures
1.10	Enhance monitoring network and information sharing to support proper management of watersheds	Number of monitoring stations, number of monitoring plans; number of watersheds with trends measured using indicators; number of links and material on Bay Area Watershed Network (BAWN) website (in development at this time)
1.11	Minimize health impacts associated with polluted water	Compliance with all applicable water quality standards; number of customer complaints
1.12	Protect cultural resources	Project-specific cultural resources survey and monitoring results; acres of culturally valuable area and/or resource acquired or preserved through conservation easements or other means; number of projects implemented with cultural resources surveys/monitoring; work in collaboration with Bay Area Tribes and Tribal communities for whom the Bay Area is their homeland to apply traditional ecological knowledge and traditional management strategies
1.13	Increase water resources related recreational opportunities	Miles of trails, acres of parklands and/or access added; number of amenities, visitor days added; miles of upgrades to trails and acres of upgrades to parklands
Goal 2: Improve water supply reliability and quality		
2.1	Provide adequate water supplies to meet demands	Reliability of supplies of appropriate quality
2.2	Provide clean, safe, reliable drinking water	Compliance with drinking water standards; acceptable levels of constituents of concern in drinking water at point of delivery
2.3	Minimize vulnerability of infrastructure to catastrophes and security breaches	Number of vulnerability assessments; number of efforts to address vulnerabilities
2.4	Implement water use efficiency to meet or exceed state and federal requirements	Progress toward SBX7-7 goals, number of water conservation measures adopted; annual per capita water use; acre feet of annual savings
2.5	Increase recycled water use	Acre-feet per year (AFY) of potable water use replaced by non-potable supply; AFY recycled water delivered to customers
2.6	Expand water storage and conjunctive management of surface and groundwater	AF of water storage; number of conjunctive management projects developed; AFY of reduced water dependency on the Delta; AFY of reduced dependency on imported water supplies

	Objectives	Suggested Measures
2.7	Provide for groundwater recharge while protecting groundwater resources from overdraft	AFY artificial groundwater recharge; number of projects that address changes in the amount, intensity, timing, quality and variability of recharge.
2.8	Protection of groundwater resources from contamination	Migration of contaminant plumes; recharge area protection; degree to which groundwater quality meets basin plan objectives; monitoring of groundwater quality trends for nitrate concentrations and salinity; number of adopted groundwater management plans; number of SNMP activities implemented according to plan
Goal 3: Protect and improve watershed health and function and Bay water quality		
3.1	Protect, restore, and rehabilitate watershed and bay processes	Miles of natural streams restored and/or rehabilitated; acres of wetlands protected and/or restored; acres of fee simple or conservation easements acquired.
3.2	Maintain health of watershed vegetation, land cover, natural stream buffers and floodplains, to improve filtration of point and nonpoint source pollutants	Acres of enhanced or reconnected floodplains; acres of created treatment wetlands; acres of uplands enhanced through best management practices, revegetation, sediment reduction or other measures; number of Low-Impact Development stormwater projects
3.3	Minimize point-source and non-point-source pollution	Implementation of delivery reduction practices; number of LID projects that store and infiltrate stormwater runoff; AFY stormwater capture; progress toward meeting established water quality objectives, Total Maximum Daily Loads (TMDLs) and National Pollutant Discharge Elimination System (NPDES); acreage managed with approved Best Management Practice (BMP) techniques.
3.4	Control excessive erosion and manage sedimentation	Progress toward meeting established water quality objectives, sediment TMDLs and NPDES; number of sediment management or biotechnical bank stabilization projects; acres of uplands enhanced through best management practices, revegetation, sediment reduction or other measures
3.5	Improve floodplain connectivity	Acres of floodplain reconnected and preserved in 100-year floodplains; number of projects that reconnect former floodplains or create floodplain enhancements
3.6	Improve infiltration capacity	Miles of natural streams restored and/or rehabilitated; acres of uplands enhanced through best management practices, revegetation, runoff reduction or other measures; miles of streams

	Objectives	Suggested Measures
		de-channelized; LID projects implemented that include bioswales to increase perviousness; AFY stormwater capture; acres of created or enhanced floodplains
3.7	Control pollutants of concern	Progress toward meeting established water quality objectives, TMDLs and NPDES; number of projects that benefit water quality of 303(d) listed stream parameters
Goal 4: Improve regional flood management		
4.1	Manage floodplains to reduce flood damages to homes, businesses, schools, and transportation	Annual flood damages in dollars; frequency and extent of flooding; number of innovative flood management projects; AFY annual flood flows
4.2	Achieve effective floodplain management that incorporates land use planning and minimizes risks to health, safety and property by encouraging wise use and management of flood-prone areas	Policies and programs that encourage LID in new and rehabilitated development
4.3	Identify and promote integrated flood management projects to protect vulnerable areas	Number of integrated flood management projects including elements such as sediment management, fisheries enhancement, natural channel function improvement, riparian habitat enhancement, ground water recharge, etc.
Goal 5: Create, protect, enhance, and maintain environmental resources and habitats		
5.1	Protect, restore, and rehabilitate habitat for species protection	Acres of habitat protected, restored and/or rehabilitated for species protection; number of at-risk species addressed; miles of wildlife corridors protected; acres of upland, riparian and bayland habitat restored and/or protected
5.2	Enhance wildlife populations and biodiversity (species richness)	Number of species delisted; number of species addressed; population numbers targeted and/or improved; acres of expanded and/or enhanced habitat; number of species re-introduced
5.3	Protect and recover fisheries (natural habitat and harvesting)	Number of species delisted; number of listed species addressed; creek miles of increased spawning habitat for fish; number of projects that improve passage
5.4	Reduce geographic extent and spread of pests and invasive species	Acres of invasive species cover; invasive species numbers and/or targets reached; number of projects that map or monitor invasive species; acres of reduced impact from presence of pests and invasive species

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Chapter 4: Resource Management Strategies

A resource management strategy (RMS) is a project, program, or policy that helps local agencies manage their water and related resources. The intent of the RMS standard is to encourage diversification of water management approaches as a way to mitigate for future uncertainties, including the effects of climate change. The 2016 Guidelines require that the IRWMP document the range of RMS considered to meet the IRWM objectives and identify which RMS were incorporated into the IRWMP. The effects of climate change on the IRWM region must be factored into the consideration of RMS. RMS to be considered must include, but are not limited to, the RMS found in Volume 3 of the California Water Plan (CWP) Update 2013.

Accordingly, this chapter describes how the Bay Area Coordinating Committee (CC) and its subcommittees developed an updated set of RMS for the IRWMP based on both the strategies included in the 2006 plan and the latest set of statewide water management goals and RMS developed by DWR as part of the CWP Update 2013. As was the case with the 2006 Plan, the IRWMP incorporates an extensive range of RMS that includes most of the RMS on DWR's latest list along with some additional Bay Area-specific RMS developed for the 2006 Plan. The chapter provides a brief description of each RMS along with examples of how these strategies are being implemented in the Bay Area.

4.1 Resource Management Strategies Identification and Selection

Table 4-1 presents the RMS list from the CWP Update 2013. DWR identifies a set of 30 RMS organized into eight main categories.

Table 4-1: RMS in CWP 2013 Update[(a)]

Category	Resource Management Strategies
Reduce Demand	• Agricultural Water Use Efficiency • Urban Water Use Efficiency
Improve Operational Efficiency	• Conveyance – Delta • Conveyance – Regional/Local • System Reoperation • Water Transfers
Increase Water Supply	• Conjunctive Management & Groundwater • Desalination – Brackish and Seawater • Precipitation Enhancement (drop) • Recycled Municipal Water • Surface Storage – CALFED • Surface Storage – Regional/Local
Improve Flood Management	• Integrated Flood Management

Table 4-1: RMS in CWP 2013 Update[(a)]

Category	Resource Management Strategies
Improve Water Quality	• Drinking Water Treatment and Distribution • Groundwater / Aquifer Remediation • Matching Quality to Use • Pollution Prevention • Salt and Salinity Management • Urban Stormwater Runoff Management
Practice Resources Stewardship	• Agricultural Land Stewardship • Ecosystem Restoration • Forest Management (drop) • Land Use Planning and Management • Recharge Area Protection • Sediment Management • Watershed Management
People and Water	• Economic Incentives (Loans, Grants & Water Pricing) • Outreach and Engagement • Water and Culture • Water-Dependent Recreation
Other (drop all)	• Crop Idling for Water Transfers • Dewvaporation or Atmospheric Pressure Desalination • Fog Collection • Irrigated Land Retirement • Rainfed Agriculture • Waterbag Transport / Storage Technology

Notes:
(a) RMS highlighted in grey were dropped from further consideration in the IRWMP update and are discussed in Section 4.3.

The CC reviewed and considered DWR's 2013 RMS in light of the strategies adopted in the 2006 Plan along with current activities being implemented and/or proposed by participating agencies in the Bay Area and the potential effects of climate change. Most of the RMS on the DWR 2013 list are the same or similar to those that were included in the 2006 plan and are being implemented in the Bay Area. Most of these were carried forward for inclusion in the 2013 plan update. RMS highlighted in grey on Table 4-1 were dropped by the CC from further consideration; these are mostly strategies from the "other" category that, in general, have limited application in the Bay Area region. Section 4.3 indicates the reasons that these RMS were not carried forward.

Table 4-2 lists the 26 water management strategies included in the 2006 Plan. These strategies were reviewed by the CC in comparison to DWR's RMS list from the CWP Update 2013 to determine which strategies were the same or similar on both lists and which strategies from the 2006 Plan were different and should be kept on the RMS list in addition to those already reflected on DWR's 2013 list. The right-hand column in Table 4-2 summarizes the decisions regarding whether to keep, replace, or drop each of the 26 water management strategies from the 2006 Plan. A strategy was identified for replacement if it was the similar to one on DWR's

2013 RMS list in order to reflect DWR's more current RMS terminology. Section 4.2 describes all of the strategies marked as Keep or Replace in more detail.

As shown in Table 4-2, two strategies from the 2006 Plan were dropped from further consideration. The Water Supply Reliability Strategy was dropped because it was redundant with numerous other RMS (e.g., urban water use efficiency, infrastructure reliability, surface storage). The Wetlands Enhancement and Creation Strategy was also dropped as a separate RMS because it is covered by DWR's broader RMS for Ecosystem Restoration. However, the CC requested that the description of the Ecosystem Restoration RMS indicate that wetland creation and enhancement is the chief target of restoration efforts within the Bay Region.

Table 4-3 presents the 37 resource management strategies selected for the IRWMP, organized by the seven categories that DWR has identified in the 2013 CWP.

Many RMS were included because they reflect current practices. Other RMS provide new opportunities to address regional issues (as described in Chapter 2 Region Description). Consistent with the decision making structure and process established in Chapter 1: Governance, recommendations were considered, modifications were made, and ultimately there was concurrence with the final list of RMS to include in this chapter. Each of the selected RMS addresses the Regional Goals and associated objectives as presented in Table 4-4. In addition, per the 2012 Guidelines, note that numerous RMS adopted by the CC were selected, in part, for their potential to address climate change. Examples of adopted RMS that address issues related to climate change include Urban Water Use Efficiency, Water Recycling, Desalination – Brackish and Seawater, Surface Storage – Regional/Local, Integrated Flood Management, Ecosystem Restoration and Regional Cooperation, among others. More information about how the RMS address climate change vulnerabilities can be found in Chapter 16.

Table 4-2: Disposition of 2006 Bay Area IRWMP – Water Management Strategies

2006 IRWMP Water Management Strategy	Disposition in 2013 Plan Update
Water Conservation	Replace with CWP 2013 Update RMS for Agricultural Water Use Efficiency and Urban Water Use Efficiency
Flood Management	Replace with CWP 2013 Update RMS for Integrated Flood Management
Water Supply Reliability	DROP since many other RMS help address this overarching goal
Groundwater Management	Replace with CWP 2013 Update RMS for Conjunctive Management and Groundwater
Stormwater Capture and Management	KEEP – Stormwater Capture and Management
Water Recycling	KEEP this broader term "Water Recycling" rather than CWP Update 2013 RMS of Recycled Municipal Water in order to capture both municipal reuse and greywater reuse
Conjunctive Use	Replace with CWP 2013 Update RMS for Conjunctive Management and Groundwater

Table 4-2: Disposition of 2006 Bay Area IRWMP – Water Management Strategies

2006 IRWMP Water Management Strategy	Disposition in 2013 Plan Update
Desalination	Replace with CWP 2013 Update RMS for Desalination – Brackish and Seawater
Imported Water	KEEP - Imported Water
Surface Storage	Replace with two CWP 2013 Update RMS for Surface Storage – CALFED and Surface Storage – Regional/Local
Water Transfers	KEEP – same as CWP Update 2013 RMS – Water Transfers
Interties	Replace with CWP 2013 Update RMS for Conveyance – Regional / Local
Infrastructure Reliability	KEEP – Infrastructure Reliability
Groundwater Banking	Replace with CWP 2013 Update RMS for Conjunctive Management and Groundwater
Water Quality Protection and Improvement	KEEP – Water Quality Protection and Improvement
Non-point source (NPS) Pollution Control	Replace with CWP 2013 Update RMS for Pollution Prevention and Urban Stormwater Runoff Management
Water and Wastewater Treatment	KEEP Wastewater Treatment and replace “Water Treatment” with CWP 2013 Update RMS for Drinking Water Treatment and Distribution
Monitoring and Modeling	KEEP – Monitoring and Modeling
Ecosystem Restoration	KEEP – same as CWP 2013 Update
Environmental and Habitat Protection and Improvement	KEEP – not covered by CWP 2013 Update RMS. Addresses protection of existing habitats
Wetlands Enhancement and Creation	DROP as separate RMS but emphasize as the chief focus in the Bay Area under Ecosystem Restoration RMS
Watershed Planning	Replace with CWP 2013 Update RMS for Watershed Management
Land Use Planning	Replace with CWP 2013 Update RMS for Land Use Planning and Management
Recreation and Public Access	KEEP – Recreation and Public Access
Regional Cooperation	KEEP – Regional Cooperation Water Conservation Incentives
Education and Outreach	KEEP – same as CWP Update 2013 RMS for Outreach and Engagement

Table 4-3: Selected 2013 Bay Area IRWMP Resource Management Strategies[(a)]

Reduce Water Demand

- Agricultural Water Use Efficiency
- Urban Water Use Efficiency

Improve Operational Efficiency

- Conveyance – Delta
- Conveyance – Regional/Local
- System Reoperation
- Water Transfers
- Imported Water*
- Infrastructure Reliability*

Increase Water Supply

- Conjunctive Management and Groundwater
- Water Recycling
- Surface Storage – CALFED
- Surface Storage – Regional / Local
- Stormwater Capture and Management*

Improve Flood Management

- Integrated Flood Management

Improve Water Quality

- Drinking Water Treatment/Distribution
- Groundwater and Aquifer Remediation
- Matching Quality to Use
- Pollution Prevention
- Salt and Salinity Management
- Urban Stormwater Runoff Management
- Water Quality Protection and Improvement*
- Monitoring and Modeling*
- Wastewater Treatment*

Practice Resources Stewardship

- Agricultural Lands Stewardship
- Ecosystem Restoration
- Land Use Planning and Management
- Recharge Areas Protection
- Sediment Management
- Watershed Management
- Environmental and Habitat Protection and Improvement*

People and Water

- Economic Incentives
- Outreach and Engagement
- Water and Culture
- Water-dependent Recreation
- Regional Cooperation*
- Recreation and Public Access*

Note: (a) The Selected RMS are from DWR California Water Plan Update 2013 except those marked by the "*", which were carried forward from the 2006 Bay Area IRWMP.

Table 4-4: Selected Resource Management Strategies that Address Regional Goals

Selected Resource Management Strategies – Organized by Statewide Common Goals	IRWMP Regional Goals: Promote Environmental, Economic and Social Sustainability	Improve water supply reliability and quality	Protect and improve watershed health and function and Bay water quality	Improve Regional Flood Management	Create, protect, enhance, and maintain environmental resources and habitats
Strategies to Reduce Water Demand					
Agricultural Water Use Efficiency	✓	✓	✓		✓
Urban Water Use Efficiency	✓	✓	✓		✓
Strategies to Improve Operational Efficiency					
Conveyance – Delta	✓	✓	✓	✓	✓
Conveyance – Regional/Local	✓	✓	✓	✓	✓
Imported Water	✓	✓			
Infrastructure Reliability	✓	✓			
System Reoperation	✓	✓	✓	✓	✓
Strategies to Increase Water Supply					
Conjunctive Use and Groundwater Management	✓	✓	✓	✓	✓
Water Recycling	✓	✓	✓		✓
Desalination – Brackish and Seawater	✓	✓			
Surface Storage – CALFED	✓	✓	✓	✓	

Selected Resource Management Strategies – Organized by Statewide Common Goals	IRWMP Regional Goals: Promote Environmental, Economic and Social Sustainability	Improve water supply reliability and quality	Protect and improve watershed health and function and Bay water quality	Improve Regional Flood Management	Create, protect, enhance, and maintain environmental resources and habitats
Strategies to Increase Water Supply (Continued)					
Surface Storage – Regional	✓	✓	✓	✓	✓
Water Transfers	✓	✓			
Stormwater Capture and Management	✓	✓	✓	✓	
Strategies to Improve Water Quality					
Pollution Prevention	✓	✓	✓		✓
Urban Runoff Management	✓	✓	✓	✓	✓
Water Quality Protection and Improvement	✓	✓	✓		✓
Salt and Salinity Management	✓	✓	✓		✓
Groundwater and Aquifer Remediation	✓	✓	✓		✓
Monitoring and Modeling	✓				
Drinking Water Treatment/Distribution	✓	✓			
Matching Water Quality to Use	✓	✓	✓		✓
Wastewater Treatment	✓	✓	✓		✓

Selected Resource Management Strategies – Organized by Statewide Common Goals	IRWMP Regional Goals: Promote Environmental, Economic and Social Sustainability	Improve water supply reliability and quality	Protect and improve watershed health and function and Bay water quality	Improve Regional Flood Management	Create, protect, enhance, and maintain environmental resources and habitats
Strategies to Improve Flood Management					
Integrated Flood Management	✓	✓	✓	✓	✓
Strategies for Resource Stewardship Practice					
Environmental and Habitat Protection and Improvement	✓	✓	✓	✓	✓
Environmental and Habitat Protection and Improvement	✓	✓	✓	✓	✓
Ecosystem Restoration	✓	✓	✓	✓	✓
Sediment Management	✓	✓	✓	✓	✓
Recharge Areas Protection	✓	✓	✓	✓	✓
Agricultural Lands Stewardship	✓	✓	✓	✓	✓
Watershed Management and Planning	✓	✓	✓	✓	✓
Watershed Management and Planning	✓	✓	✓	✓	✓
Land Use Planning and Management	✓	✓	✓	✓	✓

Selected Resource Management Strategies – Organized by Statewide Common Goals	IRWMP Regional Goals: Promote Environmental, Economic and Social Sustainability	Improve water supply reliability and quality	Protect and improve watershed health and function and Bay water quality	Improve Regional Flood Management	Create, protect, enhance, and maintain environmental resources and habitats
Strategies for People and Water					
Economic Incentives	✓	✓	✓		✓
Outreach and Education	✓	✓	✓	✓	✓
Regional Cooperation	✓	✓	✓	✓	✓
Recreation and Public Access	✓				
Water-dependent Recreation	✓			✓	✓
Water-dependent Cultural Resources	✓				✓

4.2 Selected Resource Management Strategies

This section provides a brief description of each of the 37 RMS Selected for the IRWMP (Table 4-3) based on DWR's RMS descriptions in the CWP Update 2013, the 2006 Plan, and input from the CC. Following this are just a few examples, where applicable, of existing Bay Area efforts that apply to each strategy. In most cases, there are many more examples throughout the Bay Area region where these strategies are being implemented. As is evident from these examples, a broad range of resource management strategies are already being implemented throughout the Bay Area region. The RMS descriptions are organized by the seven categories DWR presents in the CWP Update 2013.

Note that RMS can, in some circumstances, be incongruent. For example, a shoreline trail (Public Access RMS) could potentially be incompatible with the Ecosystem Restoration RMS if the trail were sited through a sensitive habitat area. There are a variety of ways in which agencies consult that provide a means to resolve such incompatibilities. In this example, resource agencies would place restrictions on trail location and operation to preclude adverse impacts on the species or resources under their jurisdiction. Refer to Chapters 12 and 13 for descriptions of consultation among agencies.

4.2.1 Strategies to Reduce Water Demand

These two management strategies address water conservation or efforts to reduce the amount of water that is used for both agricultural activities and urban use including residential, commercial, and industrial uses.

4.2.1.1 Agricultural Water Use Efficiency

RMS Description

The agricultural water use efficiency management strategy involves improvements in the technology and management of water, both on-farm and within the water delivery system, that provide water supply, water quality and environmental benefits. There are opportunities for implementation of agricultural water management efficiencies primarily from three activities:

- Hardware: Improving on-farm irrigation systems and water supplier delivery systems;
- Water management: Improving management of on-farm irrigation and water supplier delivery systems; and
- Crop water consumption: Reducing non-beneficial evapotranspiration.

The agricultural water use efficiency strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Improving efficiency of agricultural irrigation can result in substantial demand offset.

As described in Chapter 2 – Region Description, about 21.5 percent of land in the Bay Area region is in agricultural production, which includes a wide variety of crops as well as grazing. In 2010/11, the agricultural industry contributed an estimated $1.8 billon[12] to the Bay Area economy. The majority of cropland within the Bay Area region occurs within Sonoma and Solano Counties.

In recent years, the Sonoma County Water Agency has targeted wine growers with demonstrations of how to conserve water and reduce energy usage for crop irrigation and cooling. In Solano County, the Agricultural Water Conservation Committee of the Solano Water Advisory Committee assists growers with water use efficiency and is responsible for activities including:

[12] Includes gross value of agricultural products in the nine Bay Area Counties and accounts for all agricultural products, including crops, nursery products, livestock, and grazing (various sources: County Crops Reports 2010).

- Operation of automated weather stations throughout Solano County for use by irrigators in irrigation scheduling.
- The Irrigation Hotline, a telephone service providing user-friendly data from 4 local weather stations; and The Irrigator, a newsletter for irrigators of urban turf and other crops.
- Weathernews Website for Solano County growers to distribute information such as reference evapotranspiration, phenology models, degree days, temperatures, and precipitation.
- Workshops on irrigation scheduling and management and irrigation system evaluations.

About 25 percent of the county's farmers participate in the Committee's programs (Solano CWA, 2012).

In Napa County, agricultural industry groups, local government agencies, and non-profit organizations partner to promote water use efficiency. Wine grapes are the dominant agricultural crop and growers routinely use deficit irrigation practices[13] to improve wine quality and to conserve water. Growers in Napa County utilize local weather stations (CIMIS or individually owned weather stations) and many growers monitor soil moisture to further refine irrigation schedules to meet plant needs while efficiently applying irrigation water. Agricultural irrigation audits and water assessments are available commercially and through Napa County Resource Conservation District. In Alameda County, Zone 7 Water Agency provides untreated water to agricultural (e.g., vineyards) customers in the Livermore Valley to reduce the use of treated potable water for irrigation.

Agricultural water use efficiency strategies are implemented in other counties within the Bay Area region as well, and this strategy will remain active in the IRWMP.

4.2.1.2 Urban Water Use Efficiency

RMS Description

The urban water use efficiency management strategy involves technology improvements as well as behavioral changes related to indoor and outdoor residential, commercial, and industrial water use that lower total demand, lower per capita use, and result in benefits to water supply, water quality and the environment. This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect,

Example of BMP 5, Maloney Waterwise Demonstration Garden, City of Sonoma. Photo by Sonoma County Master Gardeners, 2012.

13 Deficit irrigation is a watering strategy that limits water application to drought-sensitive growth stages of the crop.

enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

There is widespread implementation of this management strategy throughout the Bay Area. Over the last twenty plus years, the population in the Bay Area has increased significantly while water use has remained relatively constant, due in part to increases in urban water use efficiency (refer to Section 2.4, Chapter 2). An analysis of statewide and regional water consumption estimated that the Bay Area's per capita water use was among the lowest in the state, at 64 gallons per capita per day (LAO 2017).

Most Bay Area water agencies are members of the California Urban Water Conservation Council (CUWCC) and have committed to implementing Best Management Practices (BMPs) to reduce California's long-term urban water demands. In 2009 the CUWCC adopted changes to the list of BMPs to provide more flexibility in achieving water conservation while identifying BMPs all members are expected to implement ("Foundational BMPs") as a matter of their regular course of business, including Utility Operations (metering, water loss control, pricing, use of a conservation coordinator, wholesale agency assistance programs and water waste ordinances) and Education (public information and school education programs).

Additionally, as described in Section 2.4, the Water Conservation Bill of 2009 requires progress towards a statewide 20 percent reduction in per capita water use by 2020, and mandated that each urban retail supplier establish a water use target in the 2010 UWMPs. The legislation further requires that retailers report an interim 2015 water use target, their baseline daily per capita use, and 2020 compliance daily per capita use, along with the basis for determining those estimates.

Conservation programs being implemented by Bay Area water agencies, often in partnership with land use agencies, include:

- Residential Water Surveys
- Residential Plumbing Retrofits
- High Efficiency Toilet (HET) Rebates
- System Water Audits
- Metering
- Large Landscape Programs
- Washing Machine Rebates
- Public Information Programs
- School Education Programs
- Regional Water Campaigns
- Commercial, Industrial, Institutional Programs
- Wholesale Assistance
- Conservation Pricing
- Conservation Coordinator
- Water Waste Prohibitions
- Replacement
- Weather-based Irrigation Controller
- Bay Friendly Landscape Program

4.2.2 Strategies to Improve Operational Efficiency

This set of management strategies targets improvements in the efficiency, reliability and effectiveness of water supply storage and delivery systems to provide multiple benefits associated with water supply reliability, flood hazard management, environmental resource protection, and, in some cases, public access and recreation.

4.2.2.1 Conveyance – Delta

RMS Description

Conveyance provides for the movement of water from its source to the area of use. Conveyance involves use of natural channels as well as manmade facilities (e.g., constructed channels, pipes and tunnels). The Sacramento-San Joaquin Delta (Delta) is a major source of supply for the Bay Area region. Thus, Delta conveyance facilities are an important element of the region's water supply system. Management strategies to maintain and improve both the overall Delta and the regional Delta conveyance system are integral to the Bay Area's water supply reliability.

DWR South Bay Aqueduct

The Delta conveyance "system" includes a highly developed network of natural streams and sloughs as well as constructed channels through the Delta bordered by levees to prevent flooding of adjacent islands. This system of through-Delta conveyance is connected to the diversion structures, canals, aqueducts, pumps, and reservoirs that comprise the State's SWP and the federal CVP water systems and deliver water into the Bay Area region and other regions in the state.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

As described in Chapter 2 and shown on Figure 2-17, almost 30 percent of the Bay Area's water supply is conveyed through and diverted from the Delta. Section 2.3.1.3 summarizes the Bay Area agencies that receive water from the SWP system via either the North Bay Aqueduct or the South Bay Aqueduct. Over the past several years, Zone 7 and DWR have implemented projects to improve and expand the 16-mile South Bay Aqueduct. These projects improve Delta supply conveyance for the Bay Area users and provide Zone 7 with 130 cfs of expanded conveyance capacity to move additional water supply it secured through water transfers.

The Bay Area water agencies that are SWP and/or CVP contractors are actively participating in ongoing efforts to implement the State's dual goals to restore the Delta ecosystem and improve water supply reliability from and through the Delta, including the proposed Bay Delta Conservation Plan (BDCP), which includes wetland/habitat restoration in the Delta coupled with new water conveyance facilities to better move water supplies through the Delta for export.

4.2.2.2 Conveyance – Regional/Local

RMS Description

Conveyance provides for the movement of water from its source to the area of use. Within the Bay Area region water conveyance is provided by both natural and manmade facilities. Water conveyance supports several objectives including water supply delivery, flood management, in-stream habitat uses, water quality protection, and recreation. Section 2.6.1 in Chapter 2, Regional Description, provides a discussion of the major local and regional water transmission facilities in the Bay Area.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

The list of recent and planned regional and local conveyance projects in the Bay Area is quite long. Water agencies throughout the Bay Area are continually investing in their conveyance systems to maintain integrity, expand capacity, include redundancy and reliability, protect water quality, and improve energy efficiency. In addition, several agencies have implemented interties between their conveyance systems to improve water delivery flexibility and emergency response. A few selected projects are highlighted below.

Conveyance Projects

- **SFPUC Water System Improvement Program.** The SFPUC has implemented conveyance projects as part of its $4.3 billion capital improvement program for the regional water system that service more than 2.5 million customers in the Bay Area. Projects include repair and replacement of several major conveyance pipelines including those that bring Hetch Hetchy water, through upgrades to the Irvington Tunnel, and around and across the southern end of the San Francisco Bay, as shown below. Specific conveyance facility projects include: Bay Division Pipeline Reliability Upgrade, Crystal Springs / San Andreas Transmission Upgrade, Crystal Springs Pipeline No. 2 Replacement, New Irvington Tunnel, Peninsula Pipeline Seismic Upgrade, San Antonio Back-up Pipeline, and San Joaquin Pipeline System.

Interties

- **BAWSCA Member Agencies' Interties.** BAWSCA member agencies maintain vital local emergency interconnections throughout their individual systems. There are 25 BAWSCA member agencies that have interconnected systems.

Regional efforts to help increase water supply reliability include regional interties.

- **EBMUD – CCWD Interties.** EBMUD currently has an one-way raw water intertie (from EBMUD to CCWD) and a small treated water intertie with CCWD. In 2007, EBMUD and CCWD completed construction of intertie facilities, including a 170 foot pipeline, linking CCWD's Los Vaqueros Pipeline with EBMUD's Mokelumne Aqueduct. These facilities can pass up to 100 mgd from EBMUD to CCWD and up to 60 mgd from CCWD to EBMUD. EBMUD and CCWD each own and maintain their separate portions of the intertie facilities and coordinate operations when needed.

- **MMWD – NMWD Interties.** The current Intertie Agreement between NMWD and MMWD was executed in March 1993. The agreement provides a mechanism for MMWD and NMWD to utilize their respective water systems' surplus water and surplus system capacity in a coordinated manner which respects that each district must first meet the needs of its water users, and permits the optimum use of same for the benefit of the customers of both districts (NMWD, 1993). The term of the current agreement expires in 2014. The two agencies are currently in negotiation to revise and extend the agreement.

- **SCVWD – SFPUC Intertie.** SCVWD currently has an existing intertie with SFPUC (located in Milpitas), which allows both agencies to convey up to 40 mgd of water in the event of a natural disaster or planned outage.

4.2.2.3 System Reoperation

RMS Description

System reoperation means changing existing operation and management procedures for existing reservoirs and conveyance facilities to increase water related benefits, including water supply reliability, flood hazard reduction, ecosystem protection and restoration, and water quality improvement. There are three basic purposes of reoperation: (1) to address specific existing needs; (2) to improve operational efficiency and water supply reliability; and (3) to anticipate and adapt to future changes. System reoperation is a tool for project owners to willingly make changes in how their systems operate to best meet their changing needs. Reoperation of existing reservoirs and conveyance facilities can help integrate surface and groundwater supplies, facilitate water transfers, improve instream flows, and provide integrated water supply, flood management, ecosystem and water quality benefits.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

In the Bay Area, reoperation efforts in progress have focused on improving supply reliability, and ecosystem conditions (instream flows), and in some cases protecting water quality. Select programs and projects that include system reoperation are highlighted below.

- **CCWD Los Vaqueros Reservoir Expansion.** The Contra Costa Water District, in conjunction with the Department of Water Resources (DWR) and the U.S. Department of the Interior, Bureau of Reclamation developed the Los Vaqueros Reservoir Expansion to expand the Los Vaqueros Reservoir from 100,000 acre-feet potentially up to 250,000 acre-feet. Project objectives are to improve Bay Area drinking water quality and reliability; reduce the effects of Delta water diversions on aquatic resources and enhance the Delta and tributary environment. The expanded reservoir storage capacity provides valuable flexibility to adjust the timing of water diversion from the Delta to minimize impacts on sensitive fishery resources and maximize supply reliability and water quality.

At the same time, given the strategic location of the Los Vaqueros Reservoir near the State Water Project system facilities, water supply can be delivered to Bay Area water customers via the South Bay Aqueduct without using the existing state or federal system Delta pump, neither of which provide effective fish screening protections. CCWD has completed reservoir expansion to 160,000 acre-feet to provide water supply reliability and water quality benefits to its customers while improving Delta ecosystem conditions. The District continues to study further reservoir expansion with Reclamation and other Bay Area water agencies to allow further reoperation flexibility for Delta diversions that can achieve additional integrated benefits.

4.2.2.4 Water Transfers

RMS Description

Water transfers involve the voluntary sharing of water supplies on a short or long-term basis. The California Water Code defines a water transfer as a temporary or long-term change in the point of diversion, place of use, or purpose of use due to a transfer, sale, lease, or exchange of water or water rights. A temporary water transfer is defined as occurring for one year or less (Water Code Section 1725), while a long-term water transfers has a duration of more than one year (Water Code Section 1728). Transfers can occur between neighboring agencies or across the state, provided there is either a means to physically convey and/or store the water or a way to account for an in lieu supply exchange. Water transfers can be a temporary or permanent sale of water or a water right by the water right holder; a lease of the right to use water from the water right holder; or a sale or lease of a contractual right to water supply. Water transfers can also take the form of long-term contracts for the purpose of improving long-term supply reliability. In combination, water transfers can serve as one element of flexible system reoperation and can be linked to many other water management strategies including surface water and groundwater storage, conjunctive management, conveyance efficiency, water use efficiency, water quality improvements, and ecosystem protection and enhancement. These linkages often result in increased beneficial use and reuse of water overall and are among the most valuable aspects of water transfers.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; and improve water supply reliability and quality.

Existing Bay Area Efforts

Through collaborative water transfers, Bay Area agencies are making the most of available water supplies. Historic and existing water transfer arrangements in place in the region include the following:

- **CCWD Long-Term and Short-Term Water Transfers.** CCWD has long-term agreements that enable it to purchase up to 12,200 AFY from East Contra Costa Irrigation District (ECCID) during droughts.

- **SFPUC Water Transfers.** The SFPUC participated in the DWR Drought Bank to help meet demands during the 1987-1992 drought, and has also purchased water from the Kern County Water Bank. SFPUC is also investigating the possibility of a dry-year water transfer in the Tuolumne River basin with Modesto Irrigation District/Turlock Irrigation District for 2 mgd.

- **SCVWD Short-Term Water Transfers.** SCVWD participates in water transfers and exchanges on a routine basis. For example, in 2003 when CVP and SWP allocations initially were low, SCVWD purchased about 28,000 AF through six separate transactions.

- **Solano CWA Water Contractors Water Transfer Agreements.** There are currently several agreements for water transfers within the group of Solano CWA water contractors, including the Solano Irrigation District City Agreements, the Solano Project Drought Measures Agreement, and the Vallejo Agreements.

- **Zone 7 Agriculture-to-Urban Water Transfers.** Long-term agriculture-to-urban water transfers have enabled Zone 7 to increase its SWP entitlement from 46,000 to 80,619 AFY. Zone 7 also has a 15-year contract (renewable for another 15 years at Zone 7's option) with Byron Bethany Irrigation District (BBID) to acquire up to 5,000 AFY of additional supply.

4.2.2.5 Imported Water

RMS Description

As described in Chapter 2, Regional Setting, a substantial amount of the Bay Area's water supply is imported, coming to the Bay Area region from Sierra Rivers, the Delta, or the Russian and Eel Rivers. Because imported water constitutes such an important component of many agencies' baseline supplies, this RMS involves active participation in appropriate efforts to protect and ensure the delivery and viability of imported supplies.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; and improve water supply reliability and quality.

Existing Bay Area Efforts

For Bay Area water agencies the most significant current program addressing Delta imported water is the Bay Delta Conservation Plan (BDCP). The BDCP program is a collaborative effort to restore the Delta's ecosystem and protect water supplies. It is a multi-agency effort of local, regional, state and federal agencies to implement a combination of ecosystem restoration and management efforts and water system infrastructure projects that will provide for both ecosystem improvement and improved water supply reliability. Many Bay Area agencies participate in the process.

The Sonoma County Water Agency has a Water Supply Strategies Action Plan, currently being updated for 2013, that identifies near-term and long-term actions needed to increase the reliability, resiliency and efficient use of its water supply imported from the Eel River and the Russian River upstream of Sonoma County in Mendocino and Lake Counties. The Eel River facilities are owned and operated by PG&E; SCWA is taking an active role in protecting its imported water supply; for example the agency will be conducting studies needed for PG&E's future Potter Valley Project relicensing process, pending in 2022.

4.2.2.6 Infrastructure Reliability

RMS Description

Bay Area agencies recognize the importance of maintaining and upgrading their water supply, wastewater, stormwater, and flood control infrastructure to improve service and reliability of water supplies. Bay Area agencies will continue to implement improvement projects to ensure the reliability of their systems.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; and improve water supply reliability and quality.


The Bay Area is home to aging water, wastewater, stormwater, and flood protection infrastructure.

Existing Bay Area Efforts

Agencies throughout the region continually strive to enhance the reliability of existing infrastructure. In addition to the conveyance projects highlighted above in Section 4.2.2.2, a few examples of the types of Infrastructure Reliability projects in place throughout the region are provided below.

- **CCWD's CIP Projects.** CCWD's CIP for fiscal years 2012-2021 identifies approximately $147.2 million for untreated water supply and transport projects to improve seismic reliability, water conveyance, pipelines and canals.

- **SCVWD's 2012 Water Supply and Infrastructure Master Plan.** Adopted in October 2012, the 2012 Water Supply and Infrastructure Master Plan is the District's strategy for providing a reliable and sustainable future water supply for Santa Clara County. The strategy has three key elements: (1) secure existing supplies and infrastructure, (2) optimize the use of existing supplies and infrastructure, and (3) increase recycling and conservation. One of the approved activities is to update the District's Infrastructure Reliability Plan that addresses recovery from short-term outages and infrastructure system robustness.

- **Solano CWA's Highline Canal Study and North Bay Aqueduct Improvements.** Solano CWA is evaluating the potential to expand its infrastructure reliability through the Highline Canal Study, and North Bay Aqueduct Improvements. The Highline Canal Study is evaluating whether a connection from the NBA to SID's Highline Canal would improve reliability of local water supplies. The project facilities would include a pump station, a connection to the NBA and a connection to the Highline Canal.

- **Zone 7's Infrastructure Projects.** Zone 7's 2005 Well Master Plan proposes to increase well production/recovery capacity by up to 42 mgd to increase reliability and redundancy of the water system. Zone 7 is also working on the SBA Enlargement Project, which will increase the SBA and South Bay Pumping Plant capacity from 300 to 430 cfs; and Altamont WTP construction, which will provide up to 42 mgd of additional surface water treatment capacity.

4.2.3 Strategies to Increase Water Supply

Most water agencies in the Bay Area implement a diverse portfolio of water management strategies to increase water supply. A sample of the specific projects and programs currently being implemented is presented in subsequent sections.

4.2.3.1 Conjunctive Use and Groundwater Management

RMS Description

ACWD and many other Bay Area water agencies currently implement conjunctive use programs.

Conjunctive management is coordinated and planned use of both surface water and groundwater resources to maximize the availability and reliability of water supplies to meet various management objectives. Water is stored in the groundwater basin for later use by intentionally recharging the basin when excess water supply is available such as during years of above-average surface water supply or through the use of recycled water. Conjunctive use also includes in-lieu groundwater recharge through the provision of treated surface water and acquisition of supplemental water supplies. Effective conjunctive management not only increases the reliability and the overall amount of water supply in a region, but may provide other benefits such as flood management, environmental water use, and water quality improvement.

Aquifer recharge can increase groundwater storage by directing surface water (when available) into the aquifer through injection wells, spreading the water on permeable ground surfaces, or introducing the water into streams that are connected to the aquifer through permeable streambeds. The stored water in the aquifer can then be withdrawn at a later time when surface water is less available. Groundwater banking improves operational flexibility and efficiency, provides additional dry year supply reliability, and helps manage water levels in the groundwater basin. Methods include in lieu recharge, direct recharge or injection wells (aquifer storage and recovery).

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Active groundwater management programs are in place for Bay Area groundwater supplies and in many cases include conjunctive use. In addition, several Bay Area agencies are currently participating in interregional groundwater banking programs with Semitropic Water Storage District and Mojave Water Agency (MWA). Nearly all Bay Area water agencies are investigating groundwater banking options for the future. Select examples of conjunctive use programs in the Bay Area are noted below.

- **ACWD Niles Cone Groundwater Basin Conjunctive Use.** ACWD optimizes the use of imported SFPUC and SWP surface water supplies, using the local groundwater basin to store these supplies in the Niles Cone Groundwater Basin, which underlies the ACWD service area. ACWD makes use of a series of former quarry pits to recharge the local groundwater basin with the imported surface water supplies.

- **SCVWD Conjunctive Use Program.** SCVWD has implemented an active conjunctive use program for more than 80 years. SCVWD's integrated water system includes 10 reservoirs, 17 miles of canals, four water supply diversion dams, almost 300 acres of recharge ponds, 91 miles of controlled in-stream recharge, 142 miles of pipelines, three drinking water treatment plants, three pump stations, recycled water facilities, and imported supplies from the SWP and CVP.

- **Solano Irrigation District Conjunctive Use Wells.** SID uses groundwater conjunctively with surface water supplies. SID groundwater well network consists of 29 wells ranging from 400 to 1,000 feet below the surface. Groundwater is primarily used to supplement irrigation demands in areas constrained by conveyance capacity for surface water deliveries. The historical yield of the groundwater system is 15,000 AFY (Solano County LAFCO, 2009).

- **Westside Groundwater Basin Conjunctive Use Project.** SFPUC is currently conducting a pilot program with the cities of Daly City and San Bruno and Cal Water (South San Francisco) for the Westside Groundwater Basin Conjunctive Use Project, involving the use of SFPUC surface water in-lieu of pumping groundwater during normal and wet years.

- **Zone 7 Groundwater Banking Program.** Zone 7 supplements its local groundwater storage capacity with off-site storage capacity in groundwater banking programs, including 65,000 AF of storage capacity in the Semitropic Water Storage District and 120,000 AF of storage capacity in the Cawelo Water District, located in Kern County.

4.2.3.2 Desalination – Brackish and Seawater

RMS Description

Desalination utilizes various water treatment processes to remove salt from water for beneficial uses. Desalination is applied to both seawater and brackish water (low salinity water). The principal method for desalination used in California is reverse osmosis. This process can be used to remove salt as well as specific contaminants in water such as disinfection byproducts, volatile organic compounds, nitrates and pathogens.

The 5-MGD Newark Desalination Facility uses reverse osmosis for groundwater desalination.

Desalination offers many potential benefits, including the following:

- A new source of potable water supply
- High quality water, even during periods of drought
- Local supply under local control
- Reduced dependence on imported supplies

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; and improve water supply reliability and quality.

Existing Bay Area Efforts

A large number of Bay Area agencies have pursued or are considering desalination projects to contribute to their future water supply portfolios. Please refer to Section 2.3.3.2 in Chapter 2, Regional Description, for a description of several example projects.

4.2.3.3 Water Recycling

RMS Description

The CWP Update 2013 identifies a Recycled Municipal Water RMS that focuses specifically on treatment and reuse of municipal wastewater; it does not include commercial, industrial or institution water reuse that may result from “internal” onsite or process reuse prior to discharge to a municipal system and it does not include grey water reuse. The Bay Area CC decided to include a broader Water Recycling RMS that includes municipal reuse along with these other approaches to water recycling. Water recycling is a strategy that increases the usefulness of water by reusing a portion of the existing waste stream that would be discharged to the environment, by redirecting the water to another local application. This action does not necessarily increase the amount of water in the water supply, but it enables conserving higher quality water for appropriate uses.

Recycled water is a drought-resistant supply that can contribute to improved supply reliability.

Recycled water is integrated into the water supply for potable or non-potable uses. Non-potable reuse includes any application not involving drinking water for human consumption, such as landscape or agricultural irrigation, commercial applications like car washes or dual-plumbed office buildings, or industrial process such as oil refineries or cooling towers. Potable reuse results in augmentation to drinking water supplies, and it can be either direct or indirect. Indirect potable reuse is using highly purified recycled water for groundwater recharge or surface water reservoir augmentation. Currently, recycled water is only used for non-potable uses in the Bay Area.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Bay Area Clean Water Agencies (BACWA) includes the largest wastewater agencies in the Bay Area. In 2010 BACWA surveyed member agencies to develop recycled water projections for the Bay Area, presented in Figure 4-1. Based on survey results, the following conclusions were established:

- In 2010 the Bay Area recycled almost 10 percent of the effluent generated.
- The State Water Resources Control Board estimated that 29,100 AFY were produced in the Bay Area in the year 2000. The 2010 production was nearly 60,000 AFY, which is almost twice that amount.

- Recycled water production is expected to more than double over the next twenty years to 120,000 AFY.

- The current and future predominate uses of recycled water are for landscape irrigation and industrial facilities (including boiler washdown and cooling by oil refineries).

Figure 4-1: Projected Recycled Water Use in the Bay Area[14]

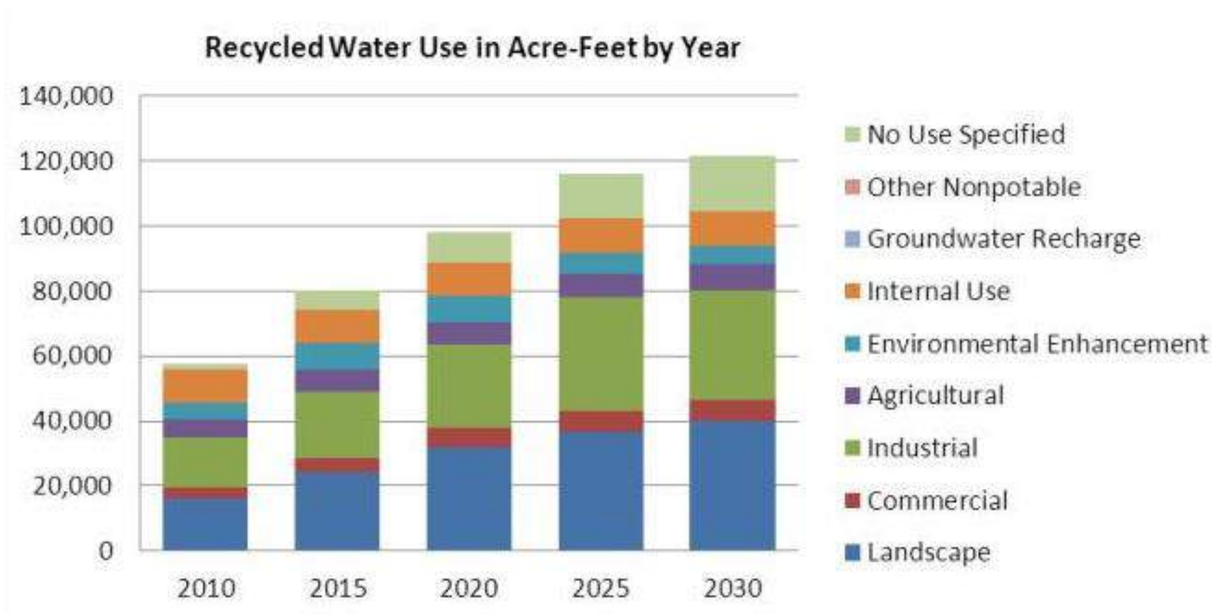

Table 2-9 in Chapter 2 lists recycled water programs in the Bay Area and describes regional recycling initiatives such as the North Bay Water Reuse Program. A few selected examples of the numerous water recycling programs currently in the Bay Area include:

South Subregion

- **Santa Clara County Recycling Partnerships and the Silicon Valley Advanced Water Purification Center.** SCVWD has entered into recycling partnerships with three recycled water producers in Santa Clara County: the South Bay Water Recycling Program; the Sunnyvale Water Pollution Control Plant; and the South County Regional Wastewater Authority. About 18,000 acre-feet of recycled water was used in Santa Clara County in 2012. In 2010 the SCVWD Board of Directors approved agreements with the City of San José to build an advanced water treatment facility (to be completed in summer of 2013) that will produce up to 10 million gallons per day of highly purified recycled water. This near distilled-quality water will be blended into existing recycled water provided by the Santa Clara/San Jose Water Pollution Control Plant's recycled water producer, South Bay Water Recycling, which will improve overall non-potable recycled water quality so that the water can be used for a wider variety of irrigation and industrial purposes. SCVWD will also use the Silicon Valley Advanced Water Purification Center to engage stakeholders and demonstrate the effectiveness of the advanced

14 BACWA, Recycled Water Survey Results, November 2011.

treatment technologies, which helps set the stage for future decisions regarding potable reuse. SCVWD's 2012 Water Supply and Infrastructure Master Plan specifies actions that support making decisions in 2016 about how to proceed with potable reuse in Santa Clara County.

East Subregion

- **DSRSD EBMUD San Ramon Valley Recycled Water Program.** In 1994, DSRSD and EBMUD entered into an agreement to facilitate the development of a joint water recycling program. The San Ramon Valley Recycled Water Program is a multi-phase project designed to supply recycled water to DSRSD and EBMUD. Transmission and distribution lines have been completed and currently serve 56 DSRSD customers at 205 sites and 10 EBMUD customers at 41 sites. When completed, the San Ramon Valley Recycled Water Program will serve about 3.3 mgd of recycled water to DSRSD and 2.4 mgd of recycled water to EBMUD.

North Subregion

- **The California Coastal Conservancy, U.S. Army Corps of Engineers, and California Department of Fish and Wildlife** have proposed and are implementing a salinity reduction and habitat restoration project for the 9,460-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area. The Napa River Unit is located at the northeast edge of San Pablo Bay, adjacent to the Napa River. The purpose of the Napa River Salt Marsh Restoration Project is to restore a mosaic of habitats, including tidal habitats and managed ponds, and provide for better management of ponds in the Napa River Unit to support populations of fish and wildlife. This project includes the annual delivery of approximately 3,000 AF of tertiary recycled water from the SVCSD as an ongoing supply of non-saline water for restoration, with subsequent agricultural use.

West Subregion

- **Regional Efforts.** The SFPUC, the Cities of South San Francisco and San Bruno, and California Water Service Company (Bayshore District) are jointly pursuing a project to produce and distribute recycled water in the South San Francisco and San Bruno areas. Recycled water for the project will be produced at the South San Francisco/San Bruno Water Quality Control Plant jointly operated by the Cities of South San Francisco and San Bruno (SFPUC, 2011).

4.2.3.4 Surface Storage – CALFED

RMS Description

The CALFED Record of Decision (2000) identified five potential surface storage reservoir projects for further investigation by federal, state and local interests. Implementation of one or more of these projects was included in the adopted CALFED long-term comprehensive program to restore ecological health and improve water management of the Bay-Delta. The five storage reservoir projects include:

- In-Delta Storage Project – the Delta Wetlands Project, proposed by a privately owned entity, is proceeding through the environmental permitting process.
- Los Vaqueros Reservoir Expansion – CCWD completed reservoir expansion to 160 TAF in 2012.
- North-of-the Delta Offstream Storage – Sites Reservoir proposal.
- Shasta Lake Water Sources Investigation (expansion of Shasta Reservoir) – studies are in progress lead by Reclamation.
- Upper San Joaquin River Basin Storage Investigation – studies for the Temperance Flat Reservoir in progress lead by Reclamation.

Los Vaqueros Reservoir is an important surface storage reservoir in Contra Costa County.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and improve regional flood management.

Existing Bay Area Efforts

As discussed in subsection 4.2.2.5 System Reoperation, CCWD in conjunction with DWR and Reclamation developed the Los Vaqueros Reservoir Expansion Project to expand the Los Vaqueros Reservoir from 100,000 acre-feet potentially up to 250,000 acre-feet. CCWD proceeded with reservoir expansion to 160,000 acre-feet and completed construction in mid-2012. The District continues to study further reservoir expansion with DWR, Reclamation and potential Bay Area partners. As studies on the other CALFED surface storage project concepts are completed, Bay Area water agencies participating in the federal and state water systems will be engaged in decisions regarding whether to fund and proceed with these additional storage projects.

4.2.3.5 Surface Storage – Regional/Local

RMS Description

Surface storage is the use of reservoirs to collect water for later release and use. Given California's natural hydrology pattern, characterized annually by a long dry season and a shorter

”wet” season, and including cyclic droughts that can extend for multiple years, surface water reservoirs play an important role in capturing surface water supply when it is available and holding it until it is needed for use. Reservoirs are an important strategic facility for responding to emergencies and for adapting to projected climate change effects on precipitation. Most water agencies in the state and in the Bay Area rely on surface water reservoirs as a key part of their water supply systems.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

The Bay Area is currently exploring a variety of surface storage projects for potential water supply reliability and water quality benefits. A few examples of projects underway throughout the Bay Area region include the following:

- **SCVWD Anderson Dam.** SCVWD has dam safety operating restrictions on five of its 10 reservoirs, including Anderson Reservoir. Anderson Reservoir is the District’s largest reservoir and has more capacity than the remaining reservoirs combined. The Anderson Dam Seismic Retrofit Project will restore the reservoir capacity from 61,810 acre-feet to 90,373 acre-feet, providing important storage and operational flexibility.

- **SFPUC Restoration of Calaveras Reservoir capacity.** The adopted WSIP includes the Calaveras Dam Replacement Project, which will result in construction of a new seismically sound dam, allowing the reservoir to be returned to its full capacity of 96,850 acre-feet and restoring about 60,000 acre feet of reservoir storage to the SFPUC water system. The restored capacity provides storage for emergency and drought water supplies, providing up to 7 mgd over the SFPUC design drought. In general, a restored Calaveras Reservoir provides 40 percent of the SFPUC’s local system storage capacity.

4.2.3.6 Stormwater Capture and Management

RMS Description

This RMS is not on DWR’s list but has been retained by the Bay Area CC from the 2006 Plan and given an updated definition and focus. In the 2006 Plan, this RMS focused on efforts to protect water quality and maintain flood protection; however, these objectives are addressed by other RMS including Urban Runoff Management (4.2.4.2) and Integrated Flood Management (4.2.5.1). For this 2013 plan update, this RMS is refocused on efforts to capture stormwater primarily for water supply purposes, while acknowledging that doing so also has potential associated water quality, flood management and ecosystem benefits. Stormwater capture and management may include rainwater harvesting systems that serve individual properties, or local or regional efforts to capture and store stormwater in cisterns or surface reservoirs or to recharge the groundwater.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and improve regional flood management.

Existing Bay Area Efforts

While many Bay Area agencies already use their local reservoirs to capture stormwater runoff in local watersheds, existing efforts to capture and use stormwater runoff from developed urban areas is more limited. An example of a stormwater capture program underway in the Bay Area Region is provided below:

- **San Francisco Public Utilities Commission Rainwater Harvesting Program.** The purpose of this program is to raise awareness regarding rainwater harvesting and to promote installation of rainwater harvesting systems throughout San Francisco. The program includes information on rainwater harvesting, permitting guidance and rainbarrel/cistern subsidies.

4.2.4 Strategies to Improve Flood Management

Watershed runoff generated in Bay Area headwaters is rapidly augmented by runoff from relatively impervious urban areas in the lower watersheds. The Mediterranean climate of the region also concentrates the storm season. Annual precipitation varies greatly, within any given season, and spatially across the region. For example, average annual rainfall in San José is 15 inches, whereas average annual rainfall in San Rafael is 36 inches. Taken together, the regional geography, development patterns, and climate promote an important need for regional and local flood management strategies. Many creeks in the Bay Area can flood within 30 to 60 minutes of a particularly powerful storm burst, causing millions of dollars in damages and catching businesses and residents off guard.

Flood risk management projects protect communities and properties from flooding hazards through improved conveyance, detention, and retention techniques as well as flood emergency preparedness and flood recovery support.

4.2.4.1 Integrated Flood Risk Management

RMS Description

This strategy includes efforts to assist individuals and communities to manage flood flows, reduce flooding risk, and prepare for, respond to and recover from a flood. Integrated Flood Management is recognized as an approach to flood management[15] and strives to achieve multiple objectives and enhanced outcomes. Integrated flood risk management utilizes watershed management to achieve additional runoff reductions through source area control, improved infiltration, and use of naturally existing surface detention features to reduce or delay peak flows. Carefully integrated flood risk management projects provide opportunities for water supply increases and for ecosystem and habitat protection, restoration, and enhancement.

Flood Risk Management projects and programs can be generally grouped into three categories: Disaster Preparedness, Response, and Recovery (Education, Emergency response, Flood Insurance, Post flood recovery); Land Use Management (Floodplain restoration and regulation,

[15] Draft California Water Plan Update 2013, Chapter 28 Flood Management.

Building codes); Structural Approaches (Dams, Levees, Floodwalls, Channelization, Maintenance).

Integrated Flood Management provides an overall flood management strategy for long-term economic stability, public safety, and enhancement of environmental stewardship. There are six basic strategies for incorporating flood management into Integrated Water Management:

11. **Integrated Flood Management and Land Use** - Incorporates flood management into land use planning recognizing that both can impact flood magnitudes and flood risks. Land use planning can reduce flood risks by limiting development within floodplains.

12. **Leverage Natural Watershed Features –** Enhances natural watershed features to reduce the intensity, duration or impacts of flooding. Undeveloped floodplains can store and slowly release floodwaters and wetlands can filter runoff for groundwater infiltration.

13. **Adopt a "Best Mix" of Structural and Nonstructural Approaches –** Compares the available structural and nonstructural approaches and selects a strategy or a combination of strategies that is most appropriate for management objectives.

14. **Implement Regional Flood Management at a System Scale** - Opportunities and impacts of flooding and management are evaluated at a regional scale, across geographic and agency boundaries to achieve sustainable outcomes, informed decisions, and prioritized investment.

15. **Promote Multiple Benefits** - Focuses on implementing projects with multiple benefits. Management of floodwaters and stormwaters could be a resource for water supply, pollution prevention and source control, as well as ecosystem restoration.

16. **Implement Multiple -Hazard Management** - Incorporates flood risks induced by other hazards, into a multiple hazard approach to planning.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Napa River Flood Control Project

Existing Bay Area Efforts

Bay Area Flood Protection Agencies Association (BAFPAA) promotes integrated approaches to overcome challenges facing flood risk management in the region. Under a MOU with nine counties, BAFPA member agencies address the major flood protection and stormwater management objectives and issues for the watersheds in the region. BAFPAA's approach is described below. Refer to Section 2.6.3 in Chapter 2, Regional Description, for a description of major Bay Area flood protection projects.

1. **Employ Collaborative Approaches.** Bay Area flood protection agencies actively pursue collaborative approaches to planning and designing projects. This approach brings together the interests of health and safety and environmental resource protection into the planning and design phases, where objectives can be coordinated and integrated. Flood protection agencies facilitate consensus at each stage of project development and implementation.

2. **Innovative Multi-Benefit Projects**. Bay Area agencies have developed regional approaches to address sea level rise and coastal flooding, combining flood control and tidal marsh enhancement. Inland areas in a common watershed are transitioning to flood control projects that function simultaneously as habitat restoration projects.

3. **Managing Floodplains and Riparian Areas.** To participate in the National Flood Insurance Program (NFIP), managed by FEMA, municipalities must engage in minimum levels of floodplain management. Nearly all Bay Area municipalities have floodplain management ordinances based on the FEMA model. Over the past two decades, riparian protection policies have also been developed in several Bay Area municipalities.

4. **Providing Stream Maintenance Outreach and Education.** Many Bay Area flood protection agencies have "jurisdiction" over streams within their boundaries, but the streams themselves are very often in private ownership. Lack of continuous access to streams hampers agencies' ability to maintain stream stability and capacity. To address maintenance in these areas, the agencies seek to assist property owners through outreach and education programs.

5. **Obtaining Voter Approval for Flood Protection Funding.** Bay Area flood protection agencies have, in some situations, obtained the required two-thirds voter approval of taxes or fees to fund their activities.

6. **Coordinating among Jurisdictions.** In some areas, Bay Area flood protection agencies have formalized cooperative arrangements to manage watersheds.

7. **Infrastructure Maintenance.** Repair and upgrades to existing aging infrastructure is a general responsibility of flood managers. Targeting high profile (i.e. critical public services) and at risk infrastructure (i.e. located in floodplains or coastal zone) enables flood managers to prioritize projects and leverage available budgets to maximize benefits.

8. **Education/Outreach and Flood Issues and NFIP**. Development in the Bay Area is concentrated around major waterbodies (i.e., San Francisco Bay, Napa River, Alameda Creek, Novato Creek), and coastal areas. As noted above, there are challenges for flood managers relative to private property. Education for land owners is critical in engaging the community to purchase flood insurance and plan for flood risk.

9. **Controlling Invasive Species.** Bay Area flood control agencies discourage or prohibit planting of invasive species in areas where they have ownership or easement. Several Bay Area agencies have prepared streamside planting guides which are available free to help guide appropriate plant selection.

10. **Emergency Response and Disaster Preparedness.** Flood damage can incur high costs of life and property. Bay Area agencies recognize the importance of proactive emergency planning to prepare for flood events and post flood recovery. There are a variety of mechanisms, including public outreach, local emergency notification broadcasting, and information centers.

4.2.5 Strategies to Improve Water Quality

Water quality protection and improvement includes efforts to protect existing good water quality, prevent pollution, and clean up and improve areas of poorer or degraded water quality. Nine RMS have been identified to address water quality.

4.2.5.1 Drinking Water Treatment/Distribution

RMS Description

The goal of the public water systems throughout the state of California is to provide a reliable supply of safe drinking water to the public. Water treatment and distribution are the two key components which provide for delivery of safe, high quality drinking water. Drinking water treatment includes physical, biological, and chemical processes to make water suitable for potable use. Distribution includes storage, pumping, and pipe systems to protect and deliver water to customers.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; and improve water supply reliability and quality.

Existing Bay Area Efforts

Throughout the Bay Area, water agencies strive to provide uniformly high quality water to all customers. Water treatment plants play a key role in insuring high quality water for customer delivery and in managing multiple supply sources with varying source qualities. Bay Area agencies routinely expand and improve their treatment facilities as one strategy in managing overall delivered water quality. Interrelated strategies to protect and improve drinking water supplies include pollution prevention, water quality protection and improvement, groundwater and aquifer remediation, and watershed management. Select examples of Bay Area projects include:

- **SCVWD Water Treatment Plant Upgrades.** SCVWD completed multi-million dollar projects to upgrade two of its three water treatment plants (Penitencia and Santa Teresa), including installation of new chemical facilities, conversion from chlorine to ozone in order to effectively combat taste and odor compounds and reduce the potential for forming THMs, and improved plant recycled water filtering, washing and clarifying systems. The Rinconada Water Treatment Plant Reliability Improvement Project is currently in the design phase with construction scheduled to begin in 2016.

- **Organic Carbon Removal Technology Testing.** Solano CWA received a CALFED grant to test organic carbon removal technologies for drinking water supplies and is working with cities to consider implementation.

4.2.5.2 Groundwater and Aquifer Remediation

RMS Description

Groundwater contamination can and has resulted from several sources, both naturally occurring, such as arsenic, or manmade, such as leaking underground storage tanks. The groundwater and aquifer remediation strategy employs several approaches to treat and reuse contaminated groundwater either in place or through extraction, treatment, and discharge or reuse. It also involves efforts to limit and contain contamination within an aquifer and clean-up these aquifers so that they may be used for water storage for beneficial use.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

A few select examples of groundwater and aquifer remediation projects within the Bay Area include:

- **Alameda County Water District Underground Injection Control Project.** ACWD with the USEPA identify aquifer remediation wells within the Niles Cone Groundwater Basin to inject fluids to enhance the remediation of a cleanup site (ACWD, 2012).
- **San Mateo County Health System Underground Storage Tank Program.** This program ensures regulations are followed and inspected as well as to educate business on how to maintain their underground storage tank (San Mateo County, 2012).

4.2.5.3 Matching Water Quality to Use

RMS Description

Not all water uses require the same quality of water or level of water treatment. Potable water should be reserved for those uses that require potable water standards (e.g., drinking water supplies), while other uses that do not require potable water (industrial, construction, landscape and agricultural irrigation) can use lesser quality or recycled water. Various laws are in place to ensure water quality matches use, including Title 22, Chapter 4 of the California Code of Regulations (Title 22). Recycled water can also be treated to a wide range of purities that can be matched to different uses. Under Title 22, DPH has set bacteriological water quality standards on the basis of the expected degree of public contact with recycled water. Title 22 identifies several levels of recycled water based on level of treatment and disinfection, including: Disinfected Tertiary Recycled Water; Disinfected Secondary-23 Recycled Water; Disinfected Secondary-2.2 Recycled Water; and Undisinfected Secondary Recycled Water. Title 22 further identifies allowable uses for each of these different levels of recycled water based on the potential impacts to public health.

Existing Bay Area Efforts

Section 4.2.3.2, Water Recycling, provides numerous examples of recycled water projects in the Bay Area that produce various qualities of recycled water. Below are two examples of projects that produce very high quality recycled water for industrial and other uses, as well as one example of on-site wastewater recycling for sanitary uses.

- **Silicon Valley Advanced Water Purification Center.** As described under Section 4.2.3.2, this facility is capable of producing high-purity water for blending with tertiary effluent to produce a blended recycled water with low total dissolved solids (total dissolved solids concentrations target is 500 milligrams per liter). By providing high-purity recycled water, the facility will increase the marketability of the water, allowing SCVWD to expand recycled water service to uses with more stringent water quality requirements.

- **EBMUD Richmond Advanced Recycled Water Expansion Project (RARE).** EBMUD's program demonstrates innovation and achieves real water savings by recycling effluent from West County Wastewater District. Helping to meets its goal of delivering 20 million gallons per day of recycled water by the year 2040, the district completed a water treatment plant that treats secondary effluent from a local wastewater district for use by the Richmond Chevron oil refinery. Using microfiltration and reverse osmosis, the project delivers 3.5 million gallons per day of highly purified water to the refinery, reducing demand for potable water by the same amount. By redirecting flows from the wastewater district, the project will reduce wastewater and pollutant discharges into the San Francisco Bay for part of each year.

- **525 Golden Gate "Living Machine."** The SFPUC headquarters building at 525 Golden Gate includes a wide array of green building features including several systems that reduce potable water consumption by matching water quality to use. Gray and blackwater generated by the building is treated onsite and re-used to satisfy 100 percent of the water demand for the building's low-flow toilets and urinals, reducing per person water consumption from 12 gallons to 5 gallons. In addition, building's rainwater harvesting system can capture and store up to 250,000 gallons of water per year for use in exterior irrigation systems, replacing use of potable water for irrigation. By utilizing these systems, 525 Golden Gate consumes 60 percent less water than similarly sized buildings.

4.2.5.4 Pollution Prevention

RMS Description

The pollution prevention strategy aims to protect water quality at its source and prevent contamination and degradation. This preserves water quality, reduces the need and cost of other water management and treatment strategies. Pollution prevention efforts throughout a watershed help support beneficial use and reuse of water for a broader number and type of downstream water uses. Improving water quality by protecting source water is consistent with and reinforces a watershed-based approach to water resource management. This RMS is interrelated to strategies for Urban Runoff Management (4.2.4.2), Water Quality Protection and Improvement (4.2.4.3), Wastewater Treatment (4.2.4.9), and Watershed Management and Planning (4.2.6.6.).

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Bay Area stormwater managers are undertaking a variety of efforts to reduce pollutants of concern and prevent pollution of local and regional waters. Select efforts from among many being implemented throughout the Bay Region are highlighted below:

- **Countywide Cleanwater Programs.** In many counties in the Bay Area, agencies responsible for stormwater management have joined together to form countywide cleanwater programs aimed at facilitating compliance with regional stormwater regulations, supporting regional stormwater quality efforts and providing public outreach and education regarding stormwater pollution. Examples of countywide programs in the Bay Area include the Alameda Countywide Clean Water Program, the Contra Costa Clean Water Program, Marin County STOPPP, the Napa Countywide Stormwater Pollution Prevention Program, San Mateo Countywide STOPPP, Santa Clara Valley Urban Runoff Pollution Prevention Program.

- **The Bay Area Pollution Prevention Group**. As part of BACWA, this group leverages limited resources to develop and carry out innovative regional pollution prevention projects that help member agencies comply with permit requirements and educate the public regarding pollution prevention practices.

4.2.5.5 Salt and Salinity Management

RMS Description

Salinity refers to the level of dissolved minerals in the water. With the exception of freshly fallen snow, salt is present to some degree in virtually all natural water supplies as soluble salts in rocks and soil begin to dissolve as soon as water reaches them. While these minerals can be beneficial, higher concentrations of salts can pose problems for various beneficial uses from causing scaling in industrial process, or irrigated crop and landscape vegetation impacts to taste effects in drinking water or even possible health effects. Salt sources are naturally occurring and may affect local surface and groundwater. In addition, water reuse, water softeners, and agricultural irrigation are among the practices that can increase salinity in surface and groundwater. Salt and salinity management contributes to improving water supplies and reducing salt loads through prevention, treatment, disposal, storage and aiming to achieve a sustainable salt balance.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Several Bay Area agencies are pursuing salt management activities within their service areas as well as participating in regional efforts to address salinity management. Some of those efforts are highlighted below.

- **Contra Costa Water District Evaluation of Historic Salinity Conditions.** The Contra Costa Water District's report "Historical Fresh Water and Salinity Conditions in the Western Sacramento-San Joaquin Delta and Suisun Bay" provides a review of more than 100 years of studies, monitoring data, scientific reports, and modeling analyses that establish the historical salinity conditions in the Western Delta and Suisun Bay (CCWD, 2009). The report findings provide a historic baseline to inform management approaches, including a better understanding of intrusion, salinity levels, and sources.

- **Northern California Salinity Coalition (NCSC).** NCSC, dedicated to protecting the region's water supplies from salt contamination, is comprised of eight Bay Area water agencies: ACWD, CCWD, EBMUD, SFPUC, SCVWD, Solano CWA, Sonoma CWA, and Zone 7 Water Agency. The Northern California Salinity Coalition is focusing its efforts in the following areas: seawater desalination, brackish groundwater desalination, salinity increases in groundwater basins and the impact on water supplies, seawater intrusion, control of salinity in wastewater to improve recycling options for irrigation or industrial use, and other related issues. The NCSC has endorsed 26 regional and local salinity related projects. The NCSC has developed the following strategic objectives:

  - Regional Leadership
  - Legislative Coordination
  - Coalition Membership
  - Education and Outreach
  - Regulations and Collaboration

- **Sonoma County Water Agency Salt and Nutrient Management Plan.** Sonoma CWA and USGS identified salinity issues in the southern part of the Sonoma Valley groundwater basin. Numeric modeling could be conducted to evaluate data gaps and simulate future conditions. Sonoma CWA has developed a salt and nutrient management plan for the Sonoma Valley County Sanitation District (SCWA, 2012a). The approach included a series of workshops to identify sources; develop a draft monitoring plan; assimilate capacity, fate, and transport; anti-degradation analysis; and implementation measures.

4.2.5.6 Urban Stormwater Runoff Management

An interior roof drain discharges to a vegetated swale in Emeryville, CA. This is an example of an "approved alternate location" for stormwater discharge.
From SFPUC, 2009.

RMS Description

Urban runoff management addresses both stormwater and dry-weather runoff. Dry-weather runoff most commonly results from excess landscape irrigation that flows to the storm drains. A watershed approach to runoff management consists of a series of best management practices (BMPs) designed to reduce the pollutant loading and reduce the volumes and velocities of urban runoff discharged to surface waters. These BMPs may include facilities to capture, treat, and recharge groundwater with urban runoff, public education campaigns to inform the public about stormwater pollution, technical assistance and stormwater pollution prevention training. This strategy also includes promotion of low impact development (LID) that minimizes hydromodification within the watershed. Interrelated strategies include RMS for Pollution Prevention, Integrated Flood Management, and Urban Water Use Efficiency.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

- **BASMAA Design Guidance Manual.** BASMAA has developed a Design Guidance Manual for Stormwater Quality Protection "Start at the Source", which is intended to assist members[16] in efforts to address stormwater management.

- **Fairfield-Suisun Urban Runoff Management Program.** Fairfield-Suisun Sewer District initiated the Urban Runoff Management Program to reduce or eliminate pollutants discharges from urban areas into storm drainages, local creeks, and Suisun Marsh. Key components of the URMP include industrial and commercial inspections, education outreach to schools and the general public, monitoring municipal maintenance activities, and ensuring that local residential and commercial construction sites do not contribute to pollution in our local waterways (FSSD, 2012).

- **Napa County Flood Control and Water Conservation District Rainwater Harvesting Program.** Napa County Flood Control and Water Conservation District offers cash

[16] BASMAA members include the Alameda Countywide Clean Water Program, Contra Costa Clean Water Program, Fairfield-Suisun Urban Runoff Management Program, Marin County Stormwater Pollution Prevention Program, San Mateo Countywide Water Pollution Prevention Program, Santa Clara Valley Urban Runoff Pollution Prevention Program, Sonoma County Water Agency and Vallejo Sanitation District.

rebates to residents of the Napa River watershed who install rain gardens and rain barrels/cisterns to treat and capture stormwater.

- **San Pablo Avenue Green Stormwater Spine**. The San Francisco Estuary Partnership initiated this as a pilot project and model for Bay Area municipalities implementing “green” infrastructure projects as part of their stormwater management efforts. The Spine Project will design, build, and monitor an array of LID projects distributed along 12.5 miles of San Pablo Avenue, a major thoroughfare passing through a number of East Bay cities.

4.2.5.7 Water Quality Protection and Improvement

RMS Description

This strategy is not on DWR’s RMS list but has been retained by the Bay Area CC. This strategy focuses on efforts to protect water quality throughout all stages of its life cycle. Water protection must start at the source, whether that is a remote or local watershed or a groundwater basin. Source to tap protection should be provided, preserving the quality of water supplies as they are transported to the end users. In addition, protecting and restoring ecosystems associated with receiving waters will also enhance water quality since water quality is not only a function of the pollutants in the water body, but also the ability of that water body to sustain aquatic life across the food web. Interrelated strategies include RMS for Pollution Prevention, Urban Runoff Management, Drinking Water Treatment and Distribution, Ecosystem Restoration, Agricultural Lands Stewardship, Watershed Management and Planning, and Salt and Salinity Management.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

The examples listed above under the Pollution Prevention RMS (Countywide Cleanwater Programs and the Bay Area Pollution Prevention Group) also have elements that address this RMS. A few additional examples focused on protecting water quality at its source include:

- **CCWD Middle River Intake**. CCWD seeks to protect drinking water supplies from degrading and variable Delta water quality. This project relocates the drinking water intake further east in the Delta, allowing for diversion of higher quality water.

- **Lake Berryessa Watershed Partnership.** Lake Berryessa provides drinking water for nearly 500,000 people and provides year-round recreation opportunities for more than a million people each year. Lake Berryessa water also serves farmers and businesses downstream. Solano County Water Agency participates in this voluntary program facilitated by the Solano Resource Conservation District along with many other local and regional agencies and other stakeholder groups. The program works to educate boaters, campers, day visitors and other lake users about the importance of water quality and good personal stewardship practices.

- **Santa Clara Valley Water District Groundwater Management Plan.** This plan was used to develop strategies and methods to protect groundwater quality and to manage groundwater supply reliability. Strategies related to water quality protection in the plan include minimizing salt water intrusion, and working with regulatory and land use agencies to protect recharge areas, promote natural recharge and prevent groundwater contamination. An example of a specific program from the plan that is underway to protect groundwater quality is the SCVWD Well Ordinance Program. Under this program, SCVWD permits and inspects well construction, maintenance and destruction to ensure that these activities will not allow transport of contaminants into drinking water aquifers.

- **Solano CWA Land Use BMP Program.** High dissolved oxygen content and turbidity concentrations in SWP water from the NBA encourage blue-green algae during winter months, which affect water taste and odor. Solano CWA is implementing land use BMPs in the watershed to reduce organic carbon and turbidity loading, and encouraging upper watershed protection and grazing practices (Solano County Water Agency, 2010).

- **Tuolumne River Watershed Protection.** The SFPUC has formed partnerships with the National Park Service, the California Department of Forestry, and several other agencies to protect the Tuolumne River watershed, which is the source water for the SFPUC's drinking water supply to over 2.5 million people in the Bay Area. The effort includes detailed monitoring of Hetch Hetchy Reservoir conditions, water turbidity levels, microbial contaminants, and aqueduct disinfection levels, as well as visual inspections, research on land uses within the watershed, and meeting with other agencies and stakeholders to discuss watershed activities and promote awareness of water quality issues.

- **Ettie Street Pump Station Urban Runoff Diversion to EBMUD.** Since 2017, EBMUD's Main Wastewater Treatment Plant (MWWTP) accepts and treats up to 0.5 MGD of urban runoff flow captured during dry weather at the Ettie Street Pump Station owned by the Alameda County Flood Control & Water Conservation District. This project provides a significant environmental benefit by treating the pollutant-laden flows which were previously directly discharged to the San Francisco Bay.

4.2.5.8 Monitoring and Modeling

RMS Description

Monitoring and modeling projects track and predict water quantity and quality affecting water supplies, and local watershed conditions. Water quality monitoring measures source water protection and stormwater pollution reduction strategies. Watershed modeling projects address surface runoff and channel flows, sediment loading and transport, and flood management. While monitoring and modeling are often an element of implementing other RMS strategies, the Bay Area CC also elected to retain this as a separate strategy. The Bay Area has implemented some important regional and subregional monitoring programs that help inform the development and implementation of actions under other RMS. These modeling and monitoring programs, in some cases stand-alone efforts, provide valuable input for project development and feedback on project effectiveness. These types of efforts will also play an increasingly important role in climate adaptation response to support adaptive management strategies that rely on routine continual monitoring and adjustments as needed.

This strategy addresses the following IRWMP Regional Goal: Promote environmental, economic and social sustainability.

Existing Bay Area Efforts

A few examples of the great number of monitoring and modeling projects and programs in the Bay Area include:

- **Alameda Countywide Clean Water Program.** Alameda County has developed a Multi-year Monitoring Plan to manage urban stormwater and protect natural aquatic resources of Alameda County and San Francisco Bay (ACCWP, 2003).

- **BACWA Annual Monitoring.** BACWA works to ensure that water quality information is fully utilized to promote the health and needed protection of the San Francisco Bay. BACWA supports its public utility members— the clean water agencies of the San Francisco Bay region—to promote understanding of the water quality needs and requirements of the region and to make water quality protection and enhancement a priority in regional communities.

- **BASMAA Regional Monitoring Strategy and the Regional Monitoring and Assessment Strategy (RWQCB, 1999).** BASMAA cooperated with the Regional Water Quality Control Board to adopt the Regional Monitoring Strategy. The Regional Board's most recent conceptual strategy is based on the design of its Surface Water Ambient Monitoring Program efforts and uses several categories depending on the spatial extent, type of pollutant or stressor and level of detail and data quality required. Participants are involved in the Regional Monitoring Program for Water Quality in the San Francisco Estuary. The Regional Monitoring Program performs regular Status and Trends monitoring throughout the Bay, and also sponsors special studies to strategically address specific water quality problems and information gaps.

- **Estimating Tidal and Residual Circulation in San Francisco Bay and the Sacramento-San Joaquin Delta.** The objective of this project is to determine the magnitude and location of variations in hydrodynamics (water currents and salinity) within San Francisco Bay which result from changes in freshwater inflows from the Sacramento-San Joaquin River Delta, to measure tidal flows in the Delta, and to distinguish between natural variations of flow and variations of flow caused by state and federal water projects.

- **Santa Clara Valley Groundwater Modeling.** SCVWD's groundwater management program includes development and implementation of groundwater modeling to support operational decisions and long-term planning. SCVWD has developed calibrated flow models for the Santa Clara, Coyote Valley, and Llagas subbasins, which are used to evaluate groundwater storage and levels under various operational and hydrologic conditions. Maintaining calibrated models that can be used to forecast groundwater conditions is a critical part of SCVWD's groundwater management strategy.

- **San Francisco Bay Regional Monitoring Program (RMP).** This program, managed by the San Francisco Estuary Institute, monitors contamination in the SF Bay-Delta Estuary, including pilot efforts in its watersheds. It has a world-class dataset on estuarine contaminants providing long-term trends through sampling of water, sediment, bivalves, bird eggs, and fish. Data collected under this program are combined with data from other sources to provide for comprehensive assessment of chemical contamination in the Bay. In 2011, 17 high priority watersheds were identified for stormwater sampling to meet the new requirements of the Municipal Regional Permit (MRP) for additional information on the loads of sediment and contaminants.

4.2.5.9 Wastewater Treatment

RMS Description

Wastewater treatment is not on DWR's RMS list but the Bay Area CC decided to retain this as a separate strategy, distinct from the broader Water Quality Protection and Improvement RMS because of the substantial role that these treatment plants play in managing water quality.

Wastewater treatment plays important roles in protecting public health and environmental resources within the Bay Area. Regulatory requirements for treated water quality are becoming more stringent and many Bay Area agencies are turning to innovative treatment technologies to help maintain regulatory compliance and protect the health of end users. Several Bay Area wastewater entities are upgrading to tertiary treatment in order to maximize recycled water opportunities and provide additional protection to receiving water bodies.

For most of the nine Bay Area counties, residential wastewater, consisting of all waste flushed or washed down sinks and drains of residences and commercial establishments, is collected in sewers and flows to secondary or advanced wastewater treatment facilities across the Bay Area. Much of the industrial wastewater produced throughout the region, following pretreatment, is also discharged to publicly owned sewers and subsequently transported to these treatment plants. Harmful pollutants such as bacteria, suspended solids, heavy metals, and toxic chemicals are removed, and treated effluent is discharged to the Bay.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

A few examples of continual investment in Bay Area wastewater treatment facilities and capabilities include:

- **EBMUD Integrated Master Plan for Wastewater Treatment Plant (MWWTP).** The EBMUD MWWTP was originally constructed in 1951. Despite the addition of new treatment processes and completion of major capital improvements since that time; aging infrastructure, along with increasingly stringent water quality and environmental regulations have made it necessary to identify options for maintaining and enhancing the wastewater treatment facilities in the future. Currently, EBMUD is developing an Integrated Master Plan for its MWWTP. The development of this integrated master plan will consider all the competing priorities of aging infrastructure needs, seismic vulnerabilities, regulatory changes, service area growth, Resource Recovery (R2) Program strategies, climate change impacts, recycled water needs, and operational improvements for the MWWTP as well as recommendations for future improvements.

EBMUD's Main Wastewater Treatment Plant

- **San José/Santa Clara WPCP Master Plan.** The San José/Santa Clara Water Pollution Control Plant (WPCP) is the largest advanced wastewater treatment facility in the western United States, with a permitted average dry weather flow of 167 mgd. The WPCP is facing many of the same issues as other wastewater plants in the Bay Area: aging infrastructure, anticipated changes in water quality regulations and sea level rise. The WPCP is located on a 2,680-acre site that includes biosolids lagoons, drying beds and bufferlands between Plant operations and neighboring land uses, including an 850-acre former salt pond and the lower reach Coyote Creek. The Plant Master Plan identifies projects needed to address aging infrastructure, reduce odors, accommodate projected population growth in the Plant's service area, add nutrient removal, enhance filtration and disinfection capabilities, and promote restoration and resource recovery; and develops a land use plan for the entire site.

- **Sunnyvale Water Pollution Control Plant Master Plan and Primary Treatment Facility Design.** The City of Sunnyvale has initiated a master planning process to renovate its existing Water Pollution Control Plant, which currently has an average dry weather flow rate of 14 mgd. The Plant was originally constructed in 1950 and is in need of rehabilitation to address critical aging infrastructure. The master plan will include overall rehabilitation as well as new processes and facilities for some portions of the existing Plant. The project also includes design and construction of a new primary treatment facility.

- **San Francisco Public Utilities Program Sewer System Improvement Program (SSIP)**. This multi-billion dollar program will upgrade San Francisco's sewer system to address aging infrastructure, seismic vulnerability and climate change impacts. The SFPUC has developed a series of goals and levels of service to guide improvements at all three of the City's wastewater treatment plants and systems throughout the City. Phase 1 of the SSIP consists of critical repairs to solids processing and energy recovery facilities, as well as construction of green infrastructure projects. Phase II of the SSIP will consist of upgrades to additional facilities, including seismic and system reliability upgrades to pump stations and treatment facilities, as well as green infrastructure projects.

- **Napa Sanitation District Wastewater Treatment Plant Master Plan.** The Master Plan, competed in April 2011, was prepared to determine the capacity of existing facilities, estimate future wastewater loads and regulatory impacts and develop a recommended plan for upgrading existing facilities to optimize operation and expand capacity of the wastewater treatment plant. The recommended project developed by the master plan would expand existing WWTP facilities to increase treatment capacity, satisfy regulatory requirements and produce up to 12 mgd of recycled water. The master plan also developed three projects that could be implemented in the future to increase recycled water production, address changing effluent ammonia concentration regulations, and enhance the WWTP's maintenance facilities.

4.2.6 Strategies to Practice Resource Stewardship

4.2.6.1 Agricultural Lands Stewardship

RMS Description

In the draft CWP Update 2013 DWR describes agricultural land stewardship as broadly meaning the conservation of natural resources and protection of the environment. Land managers practice stewardship by conserving and improving land for food, fiber and biofuels production, watershed functions, soil, air, energy, plant and animal and other conservation purposes. Agricultural land stewardship also protects open space and the traditional characteristics of rural communities, as well as open space within urban areas. Moreover, support for public benefits from stewardship activities helps landowners maintain their farms and ranches rather than being forced to sell their land because of pressure from urban development. Agricultural lands will increasingly be relied on for flood management and water storage and conservation, as well as to provide critical habitat at key locations and sequester carbon, while maintaining ongoing primary productivity of food and fiber.

Agricultural lands stewardship includes the following practices and strategies:

- Croplands management to reduce streambank erosion or stormwater runoff
- Assistance in identifying suitable crops and management of them
- Technical help on wildlife-friendly farming techniques for wildlife and aquatic ecosystem
- Cover soil, water, and habitat conservation planning

Agricultural land stewardship has been practiced and encouraged by California Department of Conservation's programs, local RCDs, the US Department of Agriculture's Natural Resource Conservation Service, and various non-governmental entities for many years.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Although it is not practical to list every existing agricultural lands stewardship project within the region, a few select examples are noted below.

- **Marin County Pine Gulch Creek Watershed Enhancement Project.** Pine Gulch Creek Watershed Enhancement Project located in Marin was a voluntary cooperative effort on the part of the local farmers. The project modified existing water operations to support sustainable agriculture and enhance aquatic habitat supporting coho salmon and steelhead trout. The project included irrigation diversion, limited riparian withdrawals and storage that would accommodate water needs for the growing season between July and December (California Coastal Conservancy, 2012).

- **Napa River Rutherford Reach Restoration Project.** The Rutherford Reach Restoration Project is a voluntary cooperative project initiated by the Rutherford Dust Society and agricultural landowners in 2002 with a goal of restoring a 4.5-mile reach of the Napa River. The project is a public-private partnership being led by Napa County and involving several additional public agencies and 25 riverside property owners, many of whom have dedicated productive agricultural lands to expand the riparian forest by 18 acres along the Napa River. The project improves water quality, enhances wildlife habitat, and attenuates flood waters. Similar efforts are being planned for an additional 9-mile reach of the Napa River through the cooperative efforts of Napa County and private agricultural landowners.

- **Natural Resources Trust of Contra Costa County.** The Natural Resources Trust has conserved approximately 3,000 acres of land in Contra Costa County. The Trust lands include Clayton Ranch, Roddy Ranch, Fuss Property, and Vaquero Farms. In addition to managing these properties the trust collaborates with willing landowners interested in seeing their land protected in perpetuity (Natural Resources Trust, 2012).

- **Sonoma County Agricultural Preservation and Open Space District.** Sonoma County Agricultural Preservation and Open Space District Stewardship Program manages easement properties and protects and manages District-owned agricultural land. Management practices include: building and maintaining constructive relationships with easement landowners; maintaining a clear understanding of the condition of our easement sites through periodic monitoring visits; documenting features of the land through photographs, written reports and maps; enforcing conservation easements if the need arises; and protecting the conservation values of the property (Sonoma County Agricultural and Open Space District, 2012).

4.2.6.2 Ecosystem Restoration

RMS Description

Ecosystem restoration seeks to repair past damage to ecosystem processes and functions and improve the condition of our modified natural landscapes and biological resources to provide for their resilience and sustainability. Under this strategy efforts are focused on rehabilitation of important elements of ecosystem structure and function. Enabling the return of the physical and biological processes that shape the landscape can be instrumental in improving upland, wetland, and riparian habitat conditions and restoring watershed function.

Successful restoration increases the diversity of native species and biological communities and the abundance of habitats and connections between them. This can include rehabilitating upland areas, reproducing natural flows in streams and rivers, curtailing the discharge of waste and toxic contaminants into water bodies, controlling non-native invasive plant and animal species, restoring riparian canopy cover, removing barriers to fish migration in rivers and streams, and recovering wetlands so that they can store floodwater, recharge aquifers, filter pollutants, and provide habitat.

Restoration of aquatic, riparian and floodplain ecosystems is important because these systems are directly affected by water and flood management actions, and are particularly vulnerable to the impacts of climate change. Further, these habitats will play an important role in responding to the effects of climate change related to sea level rise and changes in precipitation runoff patterns that are predicted to result in more frequent and larger flood events.


The South Bay Salt Ponds project aims to restore 15,100 acres of former salt ponds to tidal wetlands.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Ecosystem restoration is occurring throughout the Bay Area. In 1999, in the Baylands Ecosystem Habitat Goals scientists determined that 100,000 acres of tidal wetlands is necessary for a healthy and sustainable Bay, from the 44,000 acres of healthy tidal marsh that existed at the time. Approximately 32,000 acres of restorable shoreline areas have been acquired and are in the process of being restored. The Bay Area continues to work towards protection of an additional 24,000 acres of restorable wetlands (Save the Bay, 2012). Similarly, the San Francisco Bay Area Upland Habitat Goals Project released a report in 2011 which identifies types, amount and distribution of upland habitats within the Bay Area and identifies research needs as well as management approaches to protect and restore Bay Area habitats. A few selected examples of specific restoration efforts are noted below.

- **The Peralta Creek Restoration Project.** The project converted a flood channel back into natural habitat providing flood protection and creating a sustainable wildlife habitat. Alameda County Public Works Agency received the 2009 American Public Works Association Environmental Project of the Year and the 2009 Association of Bay Area Governments Growing Smarter - Preserving and Protecting the Environment Award for the Peralta Creek Restoration Project (Alameda County Sustainability, 2012).

- **Santa Clara Valley Habitat Conservation Plan (Habitat Plan).** The Habitat Plan was developed in association with the U.S. Fish and Wildlife Service, and the California

Department of Fish and Wildlife, in consultation with stakeholder groups and the general public. The purpose of the Habitat Plan is to protect, enhance, and restore natural resources in specific areas of Santa Clara County and to contribute to the recovery of endangered species. The Habitat Plan evaluates natural-resource impacts and mitigation requirements comprehensively in a way that is more efficient and effective for sensitive species and habitats and provides a mechanism to streamline permitting for development and maintenance activities. The Habitat Plan allows the County of Santa Clara, the Santa Clara Valley Water District, the Santa Clara Valley Transportation Authority and the cities of Gilroy, Morgan Hill, and San José to receive endangered-species permits for activities and projects they conduct and those under their jurisdiction.

- **Sonoma Baylands and Sears Point. The Sonoma Baylands Wetland Demonstratio**n Project (Sonoma Baylands) is located on 348 acres of formerly diked farmland. The design approach for Sonoma Baylands was to create the appropriate conditions whereby a marsh would evolve in response to natural processes occurring at the site. The adjacent 2,327-acre Sears Point was acquired in 2005 to restore tidal, seasonal, and riparian wetlands, streams, and upland habitats for a wide range of native plants and animals, to protect open space, and to develop public access and educational opportunities, including extending the San Francisco Bay Trail.

- **South Bay Salt Pond Restoration Project.** The largest wetland restoration project on the West Coast, the South Bay Salt Pond Restoration Project is a multi-agency effort to restore 15,100 acres of salt production ponds to tidal wetlands ecosystem. The goals of the program are ecosystem and habitat restoration, public access and flood management for the South Bay (SCVWD, 2011). See Chapter 13 (Section 13.2.1.4) for a detailed description of the project.

- **Yosemite Slough Wetlands Restoration, Candlestick Point State Recreation Area.** This project has allowed youth in the surrounding area to become involved with the restoration effort. The project has not only involved the community, but offered an example of tidal marsh restoration in an urbanized watershed, and improved stormwater quality. Upon completion of the project it would result in more transitional habitat, and a reduction in invasive plants. This unique project would be the largest contiguous wetland area in the City and County of San Francisco (San Francisco Estuary Partnership, 2012).

4.2.6.3 Land Use Planning and Management

RMS Description

Integrating land use and water management involves planning for the housing and economic development needs of a growing population while providing for the efficient use of water, water quality, energy and other resources and for the effective protection and sustainable management of natural resources. Land use policy and planning is one of the most effective methods of reducing hydrologic and ecologic impacts associated with detrimental changes in land cover. Land use planning can improve the siting of potential developments to reduce adverse impacts. Planning projects can restore floodplain connectivity, protect stream buffers, reduce urban stormwater pollution, and enhance habitats. Land use policies and ordinances can also reduce flood hazards and damages, as well as result in water conservation as human use and irrigation demands are reduced. Land use planning and policy activities may include the following actions:

- Development of water and/or watershed elements for local city or county general plan updates;
- Adoption of policies linking land use, water demands, and watershed protection;
- Development of creek setback ordinances to protect riparian corridors for wildlife habitat and flood protection;
- Development of stream corridor enhancement measures for use during recreation and trails design
- Implementation of best management practices (BMPs) to address post-development peak discharge rate, volume, and pollutant loadings to receiving waters.
- Mandatory recycled water use ordinances

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

A few examples of this resource management strategy include:

- **Alameda Countywide Clean Water Program.** The Alameda Countywide Clean Water Program is effort between local government and the community, working together to protect creeks, wetlands, and the San Francisco Bay. Member agencies include several cities and water agencies throughout Alameda County (Alameda County Sustainability, 2012).
- **ABAG-MTC Joint Policy Committee and Plan Bay Area.** Under the coordination of the Joint Policy Committee, ABAG and MTC, in partnership with BAAQMD and BCDC, are leading an initiative, "OneBayArea," to coordinate efforts among the region's counties and cities to "create a more sustainable future". A major effort of OneBayArea is the development of *Plan Bay Area*: the region's long-range plan for sustainable land use, transportation, and housing. Refer to Section 13.1.1.2 in Chapter 13, Relationship to Local Land Use Planning for more detail on these efforts.
- **Focusing Our Vision.** A state supported regional planning initiative to develop a vision for housing the projected population of the Bay Area (8.75 million people by 2030) while protecting the character and uniqueness of the region. Unlike prior attempts to develop regional growth solutions, this project was organized from the start around the precept that widespread support was essential. In addition to a high level of commitment from the private sector and local and regional government agencies, the involvement of local communities is a key ingredient.

- **Lower Sonoma Creek Flood Management and Enhancement Project.** The Southern Sonoma RCD, the Coastal Conservancy, and the Sonoma County Water Agency are undertaking the Lower Sonoma Creek Flood Management and Enhancement Project to address flooding issues in the Schellville Area. The greatest flood hazard reduction opportunities identified involved the conversion of existing land uses and runoff reduction in the watershed. Significant opportunities for tidal wetland restoration and sea level rise adaptation were also identified, including opportunities on lands that are presently flood-prone. Having substantial undeveloped and agricultural lands and lands already committed for habitat purposes, Lower Sonoma Creek offers tremendous potential for the creation of a large, contiguous habitat corridor in a tidal zone where adaptation to rising sea levels will be dictating significant change in the years to come.

- **Regional Open Space Visioning Task Force.** Sponsored by the Bay Area Open Space Council and Greenbelt Alliance, this task force is evaluating regional data and land use policies, creating maps, and developing strategies for how to fully protect 2 million acres in the Bay Area. The goal is to protect 1 million of these acres through land use policy and programs.

4.2.6.4 Recharge Areas Protection

RMS Description

Recharge areas are those areas that provide the primary means of replenishing groundwater. Natural recharge occurs where surface water is able to percolate through the sediment into the underlying aquifer areas containing the groundwater. This strategy focuses on protecting these groundwater recharge areas from being paved over or otherwise developed or used in a manner that would interfere with groundwater recharge. It also includes protecting these areas from contamination to protect groundwater quality. Efforts include both physical protection of these areas as well as education to insure that the public and private land owners and managers protect these areas.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

A few examples of agencies that manage groundwater recharge areas throughout the Bay Area region include:

- **Santa Clara Valley Water District.** The Santa Clara Valley Water District maintains and operates 18 recharge systems. The District's recharge program uses both in-stream and off-stream facilities for their efforts. To protect recharge areas, the District reviews land use plans and encourages the preservation of natural infiltration and reduction of imperious surfaces in recharge areas, conducts vulnerability studies to assess the vulnerability of groundwater to different land uses, assisting with drinking water source assessments, reviews land use plans to identify threats to groundwater, and works with local agencies on guidelines and model ordinances for such issues as graywater systems (SCVWD, 2012).

- **Solano County Ground Water Management Plan.** Several agencies overlying the groundwater basin in Solano County established a groundwater management plan. In addition to the plans the Solano County Water Agency prepares biannual reports on the groundwater levels for the area (Solano County Water Agency, 2012).

- **Sonoma Valley Groundwater Management Program and Plan.** The plan was adopted in 2007 by the Sonoma County Water Agency, City of Sonoma, Valley of the Moon Water District, and the Sonoma Valley County Sanitation District (SCWA, 2012b). In Fall 2010, Sonoma CWA initiated watershed scoping studies for flood control and groundwater recharge projects in the Laguna de Santa Rosa, Petaluma, and Sonoma Valley watersheds. The goal of the studies is to evaluate the feasibility of implementing multi-benefit projects that will provide stormwater detention and groundwater recharge, while maximizing opportunities for flood control, water quality enhancement, and potential open space benefits.

4.2.6.5 Sediment Management

RMS Description

Sediment moving across the landscape is an essential watershed process. Within our modified watersheds and developed landscapes, sediment management remains critical, beginning with the headwaters and continuing into the coastal shores; it is integral to managing surface water systems for water supply, ecosystem health, flood management and public access and enjoyment. This strategy involves projects and actions that work to preserve natural sediment processes, reduce nuisance sediment loads, and add sediment to sediment-depleted systems. The Long-Term Management Strategy (LTMS) for Placement of Dredged Material in the San Francisco Bay Region has identified categories as generally appropriate for beneficial reuse of dredged materials as including tidal wetland restoration, landfill cover, levee rehabilitation, beach nourishment, etc. Agencies such as the San Francisco BCDC and organizations such the San Francisco Bay Joint Venture are currently developing management tools to facilitate beneficial reuse of sediment for wetlands restoration projects. Sediment management is often integrated into broader actions under resource management strategies for watershed management, environmental and habitat protection and improvement, restoration and integrated flood management.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Relevant examples of sediment management actions being implemented in the Bay Area region are summarized above under the Integrated Flood Management RMS. Additional examples include:

- **Local ordinances in Sonoma and Napa Counties** require development and implementation of erosion and sediment control plans for a variety of agricultural developments to protect water quality and soil health.

- **Marin County's Devil's Gulch Culvert Modification** that involved removing two degraded culverts, bank armoring and revegetation to decrease erosion and stream sedimentation, decrease road density, improve fish passage, increase native plant species composition, and increase shading.

- **Flood Control 2.0 (San Francisco Estuary Partnership)** is a grant funded project to improve flood control channel design to restore wetland habitat, water quality, and shoreline resilience at three creek mouths- San Francisquito, Lower Novato, and Lower Walnut creeks. The redesign takes sediment clogging local flood control channels and redistributes it in areas where wetlands can be restored.

- **San Francisco Littoral Cell Coastal Regional Sediment Management Plan.** This effort is being led by the California Sediment Management Workgroup, a collaborative effort by federal and state agencies chaired by the U.S. Army Corps of Engineers and the California Natural Resources Agency, in partnership with ABAG and the San Francisco Estuary Partnership. The objective of the plan is to assist coastal government entities, municipalities, stakeholders, and communities in developing strategies for beneficial reuse of sediments to address coastal erosion and storm damage. The Plan will provide sufficient information for local and regional coastal decision makers to develop policies and execute management sub-plans for the future vitality of beaches and shoreline areas throughout the littoral cell.

- **Implementing Sonoma Creek and Napa River Sediment TMDLs**. Local entities are implementing practice based on sediment TMDLs in both watersheds to improve water quality and enhance aquatic habitat by reducing excess erosion and sedimentation caused by a wide range of activities including roads, agriculture and stream bank failure.

4.2.6.6 Watershed Management

RMS Description

The primary objective of Watershed Management is to increase and sustain a watershed's functions and its ability to provide for the diverse needs of the communities. The watershed is an appropriate and effective scale at which to coordinate and integrate management of numerous physical, chemical and biological processes that make up a drainage basin ecosystem. Using a watershed approach is beneficial because it addresses problem-solving in a holistic manner with all appropriate stakeholders actively involved. Watershed Management and Planning necessarily involves evaluation of existing watershed conditions, identification of issues and opportunities, and development of strategies, policies, and projects that contribute to healthy watershed functioning.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

In the Bay Area, many local watersheds have created (or are proposing to create) watershed plans to balance water supply, wastewater treatment, flood management, and habitat protection needs. Watershed management contributes to coordinated protection, restoration, and improvement of hydrologic, geomorphic, and biologic functions of the San Francisco Bay drainage basin. There are a large number of Watershed Management and Planning projects and programs underway throughout the Bay Area. A few select examples are listed below.

- **EBMUD Watershed Improvement and Protection Program.** EBMUD's 1996 East Bay Watershed Master Plan included development and implementation of a range management program, which won the Association of California Water Agencies' Theodore Roosevelt Environmental Award. The Plan was updated in 2018 and continues to provide clear guidance regarding the sustainable management of East Bay watershed lands.

- **Marin County Watersheds Program.** The Watershed Program began in spring 2008, is staffed by the County Flood Control division and is supported by a grant from DWR. The Program focuses on watersheds within County flood zones areas that have support and agreement from City councils and local agencies. Watershed planning efforts are under way in Ross Valley and San Geronimo Valley. The Program develops frameworks to integrate flood protection, creek and wetland restoration, fish passage and water quality improvements with public and private partners to protect and enhance Marin's watersheds.

  Watershed master plans are also in process in Arroyo Corte Madera del Presidio and Coyote Creek (Mill Valley) and planning is underway in Easkoot Creek (Stinson Beach), Novato, Gallinas and Miller Creek watersheds. Ballot measures would be considered to generate funds to construct the identified improvements (Marin County DPW, 2012).

- **Napa County Watershed Management Plans.** The Napa County RCD works with land managers and other interested stakeholders to develop management plans for local watersheds. Plans have been developed for the Carneros Creek, Sulphur Creek, and Dry Creek watersheds. Management plans provide an assessment of watershed conditions, the natural resource goals of land managers, and best management practices to achieve conservation goals. The RCD works with individuals and groups of land managers in each of the watersheds to implement priority projects such as fish barrier removal, riparian restoration, and sediment source reduction projects.

- **Pilarcitos Integrated Watershed Management Plan.** The Pilarcitos watershed in San Mateo County drains 28 square miles, including old-growth forests, farm land and the City of Half Moon Bay. In addition to providing water supply to the City of San Francisco, rural San Mateo County and the City of Half Moon Bay, the watershed supports several threatened species, including steelhead trout. Loss of habitat from channelization, water diversions, sedimentation, non-native vegetation and fish passage barriers, has resulted in a strains on steelhead and other species. An Integrated Watershed Management Plan was developed to address steps to restore the watershed and protect and recover steelhead trout and other native species. Other goals of the IWMP included developing cost-effective water supply and water recycling projects, restoring stream channels, removing and controlling non-native vegetation and ensuring water quality for both human and biotic uses. (San Mateo County Resources Conservation District, 2008).

- **SFPUC Peninsula and Alameda Watershed Management Plans.** The SFPUC developed the comprehensive management plans for the Peninsula and Alameda Watersheds in an effort to provide the optimal environment for the production, collection, and storage of the highest quality water for the City and County of San Francisco and suburban customers. The management plans were designed to protect water quality and the broad assemblage of the watershed's natural and cultural resources, while balancing concerns for public access and revenue generation. Primary issues included impacts of grazing on natural resources, control of invasive vegetation and fire hazards, and protection of special status species.

The San Mateo County RCD developed the Pilarcitos Creek Watershed Management Plan as an integrated approach to drinking water quality and sensitive species protection.

- **San Mateo County – San Gregorio Creek Watershed Management Plan.** State and federal agencies assisted in the development of this plan. This project's purpose is to direct future planning and restoration implementation in the watershed (Natural Heritage Institute San Gregorio, 2010).

- **Santa Clara Basin WMI Action Plan.** Santa Clara Basin WMI developed the Action Plan. The Action Plan includes strategic objectives that incorporate watershed management into general plans, encourage drainage systems that detain and retain runoff, advocates integrates planning process for floodplains and riparian corridors across cities and counties general plans, encourages expanding the Don Edwards National Wildlife Refuge, develops integrated, multi-objective planning and adaptive management, and encourages development of TMDLs and water quality assessments.

- **Sonoma County – Upper Mark West Watershed Management Plan. T**he Sotoyome RCD developed this Plan to provide tools, resources and guidance for stakeholders to protect the natural environment in the upper Mark West Creek watershed. The plan includes efforts to restore and enhance altered landscapes, and to steward the land in perpetuity (Sotoyome RCD, 2008).

4.2.6.7 Environmental and Habitat Protection and Improvement

RMS Description

This strategy, retained by the Bay Area CC from the 2006 plan, seeks to protect, preserve and restore important wildlife habitat and ecosystem functions. This strategy emphasizes protecting important remaining open space lands to preserve existing environmental and habitat values and protect these areas from impact. Conservation easements, strategic acquisitions and other protections of watershed lands are important mechanisms to implement this strategy. From an integrated water resource management perspective, protection of headwaters and sensitive habitats can reduce pollutant loading and improve water quality by reducing stormwater flows into local drinking water reservoirs. Protection of watershed lands also conserves habitat linkages for wildlife and avian species dependent on wetlands and water bodies. Watershed improvement is also part of this strategy and includes land management strategies such as invasive species control, erosion control, and vegetation management that enhance and preserve habitat and environmental benefits. Related strategies include the Ecosystem Restoration RMS and the Watershed Management and Planning RMS.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Numerous public and non-governmental organizations are actively planning and implementing projects that protect watershed lands through acquisition of easements and fee title. Protected Bay Area lands increased by 27 percent between 2000, from 794,000 acres to 1,007,200 acres in 2005.[17] Protected lands are tracked by the Bay Area Open Space Council and Greenbelt Alliance and can be found at www.bayarealands.org. Acquisition programs take a large range of forms, via federal and state agencies and funding programs (USFWS, EPA, National Park Service, California Dept. of Fish and Wildlife, Department of Parks and Recreation, California Coastal Conservancy, Wildlife Conservation Board), cities and counties, local public districts (Resource Conservation Districts, Water Agencies, Open Space Districts, Park Districts), and private land trusts (Sonoma Land Trust, Peninsula Open Space Trust, Marin Agricultural Land Trust, Land Trust of Napa County, Save Mt. Diablo, Save the Redwoods League, Sempervirens Fund, etc.). Many examples of this strategy's implementation include cooperative efforts between entities, such as the Solano Land Trust and California Coastal Conservancy, with a grant from the Wildlife Conservation Board, to acquire approximately 1,165 acres of land north of Cordelia Junction, to protect significant natural landscapes and wildlife corridors (CDFG, 2012). Various examples of habitat protection and improvement are list below under the Ecosystem Restoration RMS and Watershed Management and Planning RMS.

4.2.7 Strategies Related to People and Water

4.2.7.1 Economic Incentives

RMS Description

Economic incentives include financial assistance and pricing policies intended to influence water resource management. Economic incentive mechanisms can include low-interest loans, grants, pricing of water, sewer, flood protection services, and tax rebates. Government financial assistance can provide incentives for integrated resource plans by regional and local agencies and help water agencies make subsides available to their water users for a specific purpose.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; and create, protect, enhance, and maintain environmental resources and habitats.

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17 Greenbelt Alliance: Protected Lands Data Base.

Existing Bay Area Efforts

In addition to the water conservation efforts described in Section 4.2.1.2, a few examples of economic incentives programs influencing water resources management throughout the Bay Area region include:

- **Water Conservation Incentives Programs.** Many water agencies in the Bay Area utilize financial incentives (e.g., rebates, grant programs, or subsidies) to encourage conservation measures such as turfgrass replacement, ultra low-flush toilets, high efficiency appliance retrofits, rainwater harvesting, and irrigation audits.

- **Measure B, SCVWD's Safe, Clean Water and Natural Flood Protection special tax.** Measure B, passed in November 2012 in Santa Clara County, offers a continuation of the prior Clean Safe Creeks program. The measure establishes 15 years of funding for five priorities and several projects that use grants and partnerships as a means to achieve identified goals and objectives. These grants and partnerships include opportunities to prevent and remove contaminants in surface and groundwater; provide outreach, education and support of creekside clean-ups; enhance creek and bay ecosystems, study and pilot test new water conservation programs, provide drinking water dispensers for students, and remove excess nitrate from drinking water. Funding from these projects supports the community and includes substantial outreach to local municipalities, non-profits, and schools.

- **EBMUD Recycled Water Pricing.** EBMUD uses a variety of economic incentives to encourage use of recycled water. EBMUD's primary incentives are in the form of subsidized costs and reduced rates for recycled water. For example, EBMUD offers new recycled water customers a 20 percent volumetric rate discount for recycled water as compared to potable water rates. EBMUD also funds cost-effective site retrofits and training for existing potable water customers to accommodate recycled water use.

4.2.7.2 Outreach and Education

RMS Description

This strategy reflects the importance of outreach and education to increase awareness, influence behavior, build support, and affect public and stakeholder actions related to watershed management, water and natural resource protection, conservation and stewardship.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Many of the programs and projects highlighted throughout this chapter under the other resource management strategies involve a notable outreach and education component. See in particular, examples described under water quality protection and improvement, watershed management and planning, land use planning, agricultural stewardship and water use efficiency.

4.2.7.3 Regional Cooperation

RMS Description

This strategy, retained by the Bay Area CC from the 2006 Plan, recognizes the importance and benefit of regional coordination in effective integrated water management. This strategy includes the development and continuation of regional forums to plan and implement effective integrated water resource management programs.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve water supply reliability and quality; protect and improve watershed health and function and Bay water quality; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

A variety of cooperative regional planning efforts, coalitions and forums, in addition to this IRWMP, are currently being undertaken by Bay Area agencies. These include the following:

- Bay Area Clean Water Agencies (BACWA)
- BAFPAA
- Bay Area Stormwater Management Agencies Association (BASMAA)
- Bay Area Water Agencies Coalition (BAWAC)
- Bay Area Water Supply and Conservation Agency (BAWSCA)
- ABAG
- San Francisco Bay Joint Venture (SFJV)
- Bay Area Ecosystems Climate Change Consortium (BAECCC)
- Bay Area Watershed Network (BAWN)
- California Association of RCDs (CARCD) Bay-Delta and Central Coast Regions, including RCDs in the Bay Area counties of Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo.
- North Bay Water Reuse Authority (NBWRA)
- North Bay Watershed Association (NBWA)
- Northern California Salinity Coalition (NCSC)
- San Francisco Estuary Partnership (SFEP)

As a regional planning effort, all of the proposed IRWM projects and programs will employ Regional Cooperation as a water management strategy.

4.2.7.4 Recreation and Public Access

RMS Description

This strategy recognizes that construction and maintenance of public trails and other public access points along water bodies can increase social enjoyment, awareness and investment in protection of water resources. Interpretive signage, facilities, and trails within watersheds and along water bodies, provide the opportunity to educate people about the water resources and management needs. Access to watersheds and water bodies increases the public's connection to and awareness and appreciation of water resources.

This strategy addresses the following IRWMP Regional Goal: Promote environmental, economic and social sustainability.

Existing Bay Area Efforts

The Bay Area region enjoys substantial open space resources that provide public access and recreation opportunities within the regions watersheds. There are numerous public trail systems and interpretive facilities, numerous county and city-wide trail master plans, and the following regional efforts:

- **San Francisco Bay Trail**. The project seeks to complete development of a 500-mile long hiking and bicycling trail that encircles the shoreline of San Francisco Bay, connects to parks, and links to transportation facilities.

- **Bay Area Ridge Trail**. Project that aims to complete a second 500-mile trail ring around the Bay Area region along the ridgeline; when completed this will include many trails across protected watershed areas.

- **San Francisco Bay Area Water Trail**. The Water Trail program is an ongoing effort led by the Coastal Conservancy, ABAG, BCDC and the Department of Boating and Waterways to create a network of launch and landing sites, for human-powered boats and beachable sail craft access San Francisco Bay. This trail links the nine Bay Area counties and also joins to three other regional trail systems.

- **California Coastal Trail**. The California Coastal Trail, which was initiated by Proposition 20 in 1972, is a network of public trials that run along California's coastline. The trail passes through Sonoma, Marin, San Francisco and San Mateo counties.

Several individual open space districts throughout the Bay Area partner with these regional efforts and also work to provide additional public access and recreation opportunities in their local communities. In addition, several local organizations have provided funding to prevent certain state parks in the Bay Area from being closed to public use due to state budget cuts. For example, the Sempervirens Fund, a non-profit group in Los Altos, provided funding to keep Castle Rock State Park open and the Coe Park Preservation Fund, another nonprofit group, provided funding to keep Henry W. Coe State Park open.

4.2.7.5 Water-dependent Recreation

RMS Description

Water-dependent recreation includes a wide variety of outdoor activities that occur on or in the water, such as swimming, boating, fishing and rafting. This also includes activities that are enhanced by water features but do not require actual use of water, such as hiking, birding or other wildlife viewing, camping and picnicking. This strategy focuses on development and maintenance of water-dependent recreation access and opportunities within the Bay Area.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; improve regional flood management; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

A few examples of water dependent recreation projects and programs underway throughout the Bay Area region include the following:

- **Alameda Creek Regional Trail.** This 12 mile multi-use trail in southern Alameda County provides access to Coyote Hills Regional Park (EBRPD, 2012a).
- **Contra Loma Resource Management Plan.** The U.S. Bureau of Reclamation is preparing a Resource Management Plan to guide the future land and water resources management of the Contra Loma Reservoir and Recreation Area (EBRPD, 2012c). Contra Loma Reservoir offers boating, fishing and swimming.
- **Crystal Springs Regional Trail.** This planned 17.5 mile trail will extend from San Bruno to Woodside incorporating existing trails along the Crystal Springs Reservoirs. The trail connects with a number of San Mateo County Parks including Junipero Serra Park, Edgewood Park, and Huddart Park (County of San Mateo, 2012).
- **Future Use and Operation of Lake Berryessa, Napa County, California.** This comprehensive plan was established for the redevelopment and management of visitor services to support traditional, short-term, and diverse outdoor recreation opportunities such as boating, fishing and swimming at Lake Berryessa. This document builds on the analysis from the 1992 Lake Berryessa Environmental Impact Statement (United States Department of the Interior, 2012). While Lake Berryessa is not within the IRWM planning region, redevelopment of the lake will provide improved access and services to the population throughout the region.
- **Guadalupe River Trail and Lake Almaden.** The goal of the City of San José trail project in San José is to create a trail from the Bay (connecting to the Bay Trail) to Lake Almaden Park, over 10 miles of trail. Maintaining a recreational component at the lake where a mercury remediation and cold water fisheries improvement project is under consideration.
- **Napa Valley Vine Trail / River Trail.** Led by the Napa Valley Vine Trail Coalition, the trail will extend 47 miles from the Vallejo Ferry to the City of Calistoga. The trail will be level, paved, and family-friendly. The Vine Trail will include the Napa River Trail, which

provides several miles of recreational activities for hikers, fisherman, joggers, bicyclists, and boaters, as well as a setting for wildlife observation and environmental education.

4.2.7.6 Water-dependent Cultural Resources

RMS Description

This strategy recognizes that there are resources associated with the cultural history of the Bay Area that are water-dependent and require awareness and protection to be preserved. These may range from ceremonial practices to historic water infrastructure to water based landscapes to heritage practices dependent on water.

This strategy addresses the following IRWMP Regional Goals: Promote environmental, economic and social sustainability; and create, protect, enhance, and maintain environmental resources and habitats.

Existing Bay Area Efforts

Examples of efforts to protect and preserve water-dependent cultural resources include the following:

- **Turtleback Trail Interpretive Tour, China Camp State Park**. China Camp State Park preserves the site of one of the many Chinese shrimp-fishing villages that thrived along the Bay shoreline in the late 1800s. The Turtleback Trail Interpretive Tour provides educational panels and an audio tour to inform park visitors of the cultural and natural history of the area.

- **Angel Island State Park Interpretation Master Plan**. Angel Island has rich and varied cultural history, having served at different times as a seasonal hunting and gathering grounds for the Coast Miwok, a harbor and supply stop for Spanish explorers, a U.S. immigration station, a U.S. military station and a cattle ranch. The Interpretation Master Plan, developed by California State Parks and the Angel Island Conservancy, is a comprehensive roadmap for developing new and improved educational programs, facilities, and recreational opportunities at the park.

- **Port of San Francisco History Tour**. To celebrate its 150th anniversary, the Port of San Francisco developed a tour to showcase the history of San Francisco's waterfront. The Port of San Francisco installed twenty pylons along the waterfront that contain historical photos and educational information regarding history of each particular location. The tour is also available online and in mobile format.

4.3 Strategies Considered but Not Carried Forward

The CC considered RMS included in the 2006 Plan as well as RMS presented in CWP Updates for 2009 and 2013. Seven potential RMS presented on Table 4-1 were not carried forward to Table 4-3 due to consideration of their potential efficacy and applicability in the Bay Area region. In some cases, the strategy may partially meet the Regional goals and objectives, but may not be technically feasible, is limited in capacity to strategically address regional water planning needs, or may likely result in trade-offs that do not maximize the potential benefit. When the potential RMS is not applicable or feasible, or is not anticipated to provide substantial benefit relative to existing land uses and water programs, the strategy is identified below, and not discussed further. As time progresses and strategies advance, these may become more applicable to the Bay Area.

4.3.1 Precipitation Enhancement or Fog Collection

Precipitation enhancement, commonly called "cloud seeding," artificially stimulates clouds to produce more rainfall or snowfall than they would naturally. Cloud seeding injects special substances into the clouds that enable snowflakes and raindrops to form more easily. This technology is still evolving relative to California water issues and is not considered by the Bay Area as a reliable long-term solution. Fog collection is not used in California as a management technique but does occur naturally within coastal vegetation.

4.3.2 Crop Idling for Water Transfers

Crop idling is removal of lands from irrigation with the aim of returning the lands to irrigation at a later time. Crop idling is done to make water available for temporary water transfers. However, crop idling to support water transfers implies some land use trade-offs. For example, land removed from agricultural production may limit the productiveness of the agricultural industry in the region, create disproportionate impacts on low income and disadvantaged groups, and have cumulative impacts on habitat, water quality, and wildlife. In areas that may be eligible for crop idling, this strategy may be implemented on a small scale; however it is anticipated that Agricultural Water Use Efficiency RMS, described in Section 4.2, above, will be more effective in addressing water management.

4.3.3 Dewvaporation/Atmospheric Pressure Desalination

Dewvaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall. The energy needed for evaporation is supplied by the energy released from dew formation. This is an emerging technology with several limitations including lack of proven science, potential capital costs and affordability, and secondary effects such as brine disposal. Although this technology could allow for small-scale reclamation of salt water, the Bay Area has determined that focusing on traditional desalination, as described in Section 4.2, would be more technically feasible to address long-term reliability.

4.3.4 Irrigated Land Retirement

Irrigated land retirement is the permanent cessation and removal of farmland from irrigated agricultural production to support water transfer or for solving drainage-related problems. While irrigated land retirement can potentially provide water supply, water quality, and habitat benefits, it also can also have several adverse impacts. Adverse impacts include potential urban growth inducement, socioeconomic impacts to local communities that can be environmental justice issues, and inconsistency with federal, state, and local land use policies. The potential water supply benefits of irrigated land retirement can be achieved with strategies that are more consistent with Bay Area IRWM Plan goals. Drainage-related problems have not been identified as a significant water management issue in the Bay Area.

4.3.5 Rainfed Agriculture

Rainfed agriculture is when all crop consumptive water use is provided directly by rainfall on a real time basis. Due to unpredictability of rainfall frequency, duration, and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture. It is anticipated that combining rainfed agriculture as one component of broader, larger strategies, including Agricultural Water Use Efficiency or Agricultural Lands Stewardship, will be more effective in addressing water management needs within the Bay Area.

4.3.6 Waterbag Transport/Storage Technology

The use of waterbag transport/storage technology involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region. This strategy does not directly address regional water management issues, and it is unknown at this time if it would be technically feasible.

4.3.7 Forest Management

Forest management activities can affect water quantity and quality. However, in most of the Bay Area forests are not generally managed for production. In the majority of the Bay Area, forests are managed primarily as watershed lands and open space for recreation. As such forest resource management strategies are captured under watershed management and planning, ecosystem restoration and water-dependent recreation resource management strategies.

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Chapter 5: Integration of Supporting Activities

5.1 Optional IRWM Supporting Activities

This chapter presents some potential activities that may be undertaken in support of Integrated Regional Water Management (IRWM) in the Bay Area. The supporting activities described here have been grouped in two broad categories: (1) Planning; and (2) Policies. The activities described in this chapter are presented such that individual agencies or other participants within the region can choose to use them if desired. The added value and benefits associated with implementing these supporting activities are discussed in this chapter, with further supporting material provided in Appendices B-1 through B-4.

5.2 Planning Activities

5.2.1 Developing Salt and Nutrient Management Plans

Example: Sonoma Valley Salt and Nutrient Management Plan

The Sonoma Valley Groundwater Subbasin is located in southern Sonoma County, California bordering San Pablo Bay. The overlying community includes both urban areas as well as a significant amount of rural and agricultural land. Groundwater is an important resource to the area, which could be impacted by agriculture fertilizer use, stream diversions, groundwater pumping, and irrigation with recycled and potable water.

In recognition of the importance of recycled water projects and their growing significance in meeting state-wide water demands, the State adopted the Recycled Water Policy in 2009. The Recycled Water Policy requires that Salt and Nutrient Management Plans (SNMPs) be developed to manage salts and nutrients on a watershed- or basin-wide basis. As the primary local distributor of recycled water, the Sonoma Valley County Sanitation District is leading the development of the Sonoma Valley SNMP in conjunction with other stakeholders within the basin area.

Preparation of the Sonoma Valley SNMP began in 2012 and progressed through an 18-month collaborative development process using an existing stakeholder infrastructure created through the voluntary Sonoma Valley Groundwater Management Program. Development of the Sonoma Valley SNMP was a stakeholders-based collaborative effort that held workshops to present information when key milestones were reached.

Data gathered through technical analysis completed for the Sonoma Valley basin found that, in general, relatively low salinity and nitrate concentrations are found throughout most of the Inland Area of the subbasin, and concentration trends for salinity and nitrate over time are flat or stable. The average total dissolved solids and nitrate concentrations in the Inland Area are below basin plan objectives, and there is available assimilative capacity. Given that water quality concentration trends are relatively flat over time, and below water quality objectives, no new management measures were recommended for implementation as part of the Sonoma Valley SNMP. Existing best management practices in the basin will continue and new data will become available through the groundwater monitoring program that was developed as part of the Sonoma Valley SNMP. The Sonoma Valley SNMP is included in Appendix B-2, and the most recent Sonoma Valley SNMP documents can be found on the following website: www.scwa.ca.gov/svgroundwater/

5.2.1.1 Guidance for Developing Salt and Nutrient Management Plans in the Region

The *Guidance Document for Salt and Nutrient Management Plans for the San Francisco Bay Region* may be found in Appendix B-1, and was developed as part of the Sonoma Valley Salt and Nutrient Management Plan (SNMP) preparation effort described above. The Sonoma Valley SNMP received partial funding through the Bay Area's Proposition 84 Planning Grant for their SNMP preparation and development of a guidance document to assist other Bay Area agencies wanting to undergo a similar process in developing their SNMPs.

The purpose of the *Guidance Document* is to describe common steps that may be taken by Bay Area agencies, entities and stakeholders to prepare a SNMP. The San Francisco Bay Regional Water Quality Control Board is expected to consider the size, complexity, level of activity, and site-specific factors within a basin in reviewing the level of detail and the specific tasks required for each SNMP.

In addition to Sonoma Valley County Sanitation District, Zone 7 Water Agency and the Santa Clara Valley Water District have developed or are developing SNMPs for other local groundwater basins/sub-basins in the San Francisco Bay Region.

5.3 Policies Supporting IRWM

This section discusses potential policy language that could be customized and adopted by agencies' governing bodies in order to demonstrate institutional alignment with specific strategies, objectives, and priorities described in this Integrated Regional Water Management Plan. The language could be tailored for each participating entity and could be more specific or directive. It is up to each agency to decide whether to adopt the IRWM Plan with or without reference to additional policy language.

5.3.1 Integration Policy

The BAIRWMP Coordinating Committee (CC) has emphasized "integration" in the Plan update, and included the following objective: *Encourage implementation of integrated, multi-benefit projects,* under the broad goal: *Promote Environmental, Economic and Social Sustainability*.

As part of the outreach effort seeking new projects for inclusion in the Plan update, the sub-regions encouraged the development of integrated projects. In ranking projects for the 2013 Plan, the CC placed the heaviest emphasis on projects that met the most objectives across the Plan goals, and the highest scoring projects were those that met objectives in multiple Functional Areas. The most integrated projects scored highest. In ranking projects for the 2019 Proposition 1 Round 1 funding, projects were given a point if the project achieved multiple benefits. Qualitative discussions on multiple benefits and regional priorities were held to determine ranking if projects scored similarly.

The CC has deliberated including a policy statement supporting integrated projects and elaborating upon the integration objective in the Plan Update.

5.3.2 Example Integration Policies

Examples of integration policies already in place throughout the region are presented below.

Example: North Bay Watershed Association

The North Bay Watershed Association (NBWA) has endorsed a policy on "Integrated /Multi-Benefit Water Management Projects" and encouraged member agencies to adopt the policy or an equivalent. Both Marin Municipal Water District and North Marin Water District have adopted such a policy. The MMWD Policy statement adopted on May 3, 2012 states "*It is the policy of the Marin Municipal Water District to achieve multiple benefits in the planning and implementation of its water management projects, where appropriate, and to coordinate these projects with other agencies, to realize the maximum number of benefits from a project. It is the intent of this policy to encourage collaboration within and among MMWD and other agencies to conduct integrated water management planning and achieve multiple benefits on water management projects that provide appropriate opportunities. These may be water supply, stormwater management, flood control, public access, recreation, watershed resource management, and/or wastewater management projects, where more than one benefit may be achieved*". Other NBWA member agencies have identified equivalent existing policies. Sonoma County Water Agency has adopted an equivalent policy statement on "Multi-Benefit and Integrated Water Resource Projects". Napa County Flood Control and Water Conservation District has an equivalent ordinance – Ordinance No.1 –that includes "…*an integrated approach that applies to all the Napa County watersheds"*. The Marin County Board of Supervisors has approved a Watershed Program that: " *provides a framework to integrate flood protection, creek and wetland restoration, fish passage and water quality improvements with public and private partners to protect and enhance Marin's watersheds*."

Example: East Bay Municipal Utility District

East Bay MUD has adopted a Sustainability and Resilience Policy[18] to guide the use of resources (economic, environmental, and human) in a responsible manner to meet the needs of today without compromising the ability of future generations to meet the needs of tomorrow. The Policy calls for EBMUD to maintain strong working relationships with local regulatory agencies, industry and public interest organizations, other water and wastewater agencies, cities and counties to develop sustainable environmental guidelines and communicate the environmental significance of EBMUD's current and future operations and activities.

Example: San Francisco Public Utilities Commission

San Francisco PUC's Sewer System Improvement Program (SSIP) is a 20-year, multi-billion dollar citywide investment required to upgrade San Francisco's aging sewer infrastructure to ensure a reliable and seismically safe sewer system. In developing the SSIP, the SFPUC endorsed specific, measureable goals and objectives that will guide project selection and will be used to evaluate program implementation and success. A number of the goals and objectives stress integration:

[18] EBMUD Policy 7.05, Effective 26 June 18.

- **Integrate Green and Grey Infrastructure to Manage Stormwater and Minimize Flooding.** The use of innovative green stormwater projects together with upgrades to sewer pipelines (grey) will minimize stormwater impacts on neighborhoods and the sewer system.

- **Provide Benefits to Impacted Communities**. SSIP projects will provide both economic and job benefits to the communities it serves.

- **Modify the System to Adapt to Climate Change**. New facilities will be built using a climate change design criterion so that the sewer system will be better able to respond to rising sea levels and other impacts.

- **Achieve Economic and Environmental Sustainability.** The SFPUC will beneficially reuse and conserve the by-products of our wastewater and stormwater treatment systems.

Example: Santa Clara Valley Water District

The Santa Clara Valley Water District has adopted the following policy on integration:

- E-1.1. An integrated and balanced approach in managing a sustainable water supply, effective natural flood protection and healthy watersheds is essential to prepare for the future.

Strategies that support this policy include:

- S 2.2. Develop, maintain, and implement in an integrated and balanced manner long-term master plans, asset management plans and capital improvement plans to support water utility operations, protect infrastructure, and optimize investment.

- S 2.3. Coordinate with the development of a 20-year integrated watershed master plan which incorporates groundwater recharge areas, sea level rise, and updated hydrologic analysis to identify potential future project that promote natural stream condition in the watershed.

- S 2.1.2.5. Work with the wildlife agencies to address the impact of district water supply operations on fish.

- S 3.2. and S 4.2. Coordinate preparation of a 20-year integrated watershed master plan which incorporates best available stream condition data, riparian corridors, sea level rise, countywide trails master plan, and updated hydrologic analyses to identify potential future projects that reduce flooding and sedimentation, improve water quality, and promote a more nature stream condition within the watershed.

- S 4.1.2.2. Identify and incorporate enhancement opportunities into capital projects and operations.

Example integration policy or equivalent documents described above are provided in Appendix B-3. These examples may be useful to other Bay Area agencies considering adopting a policy supporting integration or development of integrated projects.

5.3.3 Climate Change Adaptation Policy and Principles

The BAIRWMP Coordinating Committee (CC) has established Climate Change as an overarching theme. This Plan includes a chapter on Climate Change which is based upon understandings derived from the most current science available for the region, and was developed in accordance with *Climate Change Handbook for Regional Water Planning* dated November 2011 (Schwarz et al 2011), which identifies Sea Level Rise, Flooding, and Water Supply as the most vulnerable categories for the Bay Area.

The California Water Plan 2013 Update states that California is already seeing the effects of climate change on hydrology (snowpack, river flows), storm intensity, temperature, winds, and sea levels, and that planning for and adapting to these changes will be among the most significant challenges facing water and flood managers this century. Climate change will affect both sea level and the temporal and spatial distribution of runoff in California, affecting the reliability of water supplies and operations of California's water supply system.

In support of local agency efforts to consider, plan for and adapt to Climate Change affects, a template Climate Change adaptation policy statement is included in Appendix B-4, which includes the following general principles:

Project Specific Risk Assessments: Consider the effects of climate change on existing and proposed projects to evaluate project merit. A risk assessment should identify all types of potential impacts, degrees of uncertainty, consequences of failure, likelihood of failure, and risks to existing resources. Consider how foreseeable climate impacts may affect project success and incorporate anticipated impacts into project planning and design. Avoid investing in projects that are likely to be undermined by climate-related changes.

Co-Objectives of Climate Mitigation and Adaptation: Develop a planning process that supports comprehensive climate response, aligning greenhouse gas mitigation strategies with adaptation actions. Strategies and projects should minimize energy use and greenhouse gas emissions, and sustain the natural ability of ecosystems to cycle and sequester carbon and other greenhouse gases.

Forward-Looking Goals and Progressive Time-Scales: Focus goals on future climatic and ecological conditions rather than those of the past. Develop strategies for near-term and long-term timescales, as well as transitional strategies. For sectors where there is uncertainty in the timing and/or severity of climate change impacts, planners should include climate change factors in decision support analyses (scenario planning) in order to enable the development and implementation of appropriate adaptation options.

Agile and Informed Management: Employ an adaptive management decision making framework that is flexible and responsive to changes in climate, ecology and economics. Resource planning and management is capable of continuous learning and dynamic adjustment to accommodate uncertainty, take advantage of new knowledge, and cope with rapid shifts in climatic, ecological, and socio-economic conditions. Planners should consider preserving and developing adaptation options that can be implemented in the future when more is known about the timing and/or magnitude of actual impacts. This process would include assessing/testing the adaptive capacity for operational adjustment of the existing system as well as re-engineering of water systems in tandem with making investments in infrastructure renewal and replacement. Utilities should also consider enhancing their existing data monitoring programs to include new information that would help identify triggers for when climate adaptation options should be implemented.

Robust in an Uncertain Future: Adaptation strategies and actions should provide benefit across a range of possible future conditions to account for uncertainties in future climatic conditions, and in ecological and human responses to climate shifts. Prioritize actions based on their risks and benefits, as well as the likelihood that they will reduce the vulnerability of built and natural environments. High priority actions include those that have a high probability of producing beneficial adaptation outcomes, improve the capacity of highly vulnerable systems to adapt to climate change impacts, and/or that produce the greatest combination of benefits under a range of possible future climate scenarios.

Ecosystem Enhancement: Employ strategies that enhance the capacity of human communities to adapt to extreme, climate change driven events by implementing ecosystem-based solutions that also benefit fish, wildlife, and habitat. Prioritize activities that provide co-benefits for people, habitat, and the economy.

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Chapter 6: Project Review Process

The Integrated Regional Water Management Plan (IRWMP) will be implemented through the specific studies, actions, projects, and programs proposed by the Region's stakeholders and participants. This chapter describes the process that was used for submitting, reviewing and scoring projects and provides the final, prioritized list of projects. Recognizing that regional priorities evolve over time, the Coordinating Committee (CC) will periodically review this IRWMP and the project listings herein, depending on changing conditions and availability of funds to perform future work, and make adjustments as necessary to respond to changes throughout the Region.

6.1 Background

The 2006 Plan was adopted with 127 projects, which were sorted based on consistency with project assessment criteria. Subsequent to the adoption of the 2006 Plan, additional projects were added as appendices.

The 2006 Bay Area project prioritization process involved the following steps:

- Screen Projects for Inclusion in the IRWMP.
- Assemble IRWMP Projects into Cohorts.
- Identify Prioritization Criteria.
- Assess Projects with Respect to Criteria.

The screening method and criteria used for inclusion in the IRWMP varied by each of the four Functional Areas (FAs); the cohorts were based on "readiness to proceed;" and the categories of assessment criteria were: IRWMP Goals, Bay Area Regional Criteria, Proposition 50 Program Preferences, and Proposition 50 Statewide Priorities.

The project assessment conducted for the 2006 Plan did not assign scores or rank the project list. The prioritization process was developed and implemented during the Plan development. Based on input from the Department of Water Resources (DWR) and the 2012 Guidelines, the IRWMP project assessment criteria have been expanded beyond "readiness to proceed" to reflect factors identified by DWR, and the projects have been scored and ranked accordingly. The following sections describe the process.

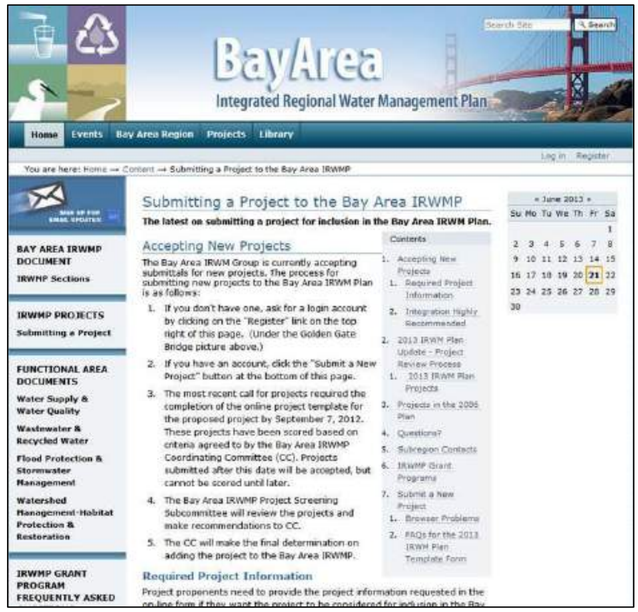
6.2 Summary

The project prioritization process involved the following steps:

- Assembling a Master list of projects (Section 6.4.1)
- Conducting a preliminary Subregional review to determine project eligibility (Section 6.4.2)

- Identifying prioritization criteria and weighting (Section 6.3.3)
- Scoring projects (Section 6.5)

To identify potential projects that support IRWMP implementation and promote its goals and objectives, the CC held an open "call for projects," which gave stakeholders the opportunity to submit their projects and project concepts for consideration. Stakeholders were encouraged to submit projects through a variety of channels, including Subregional meetings, public workshops, email correspondence solicitations, and the IRWMP website. The solicitation yielded 332 projects submitted for inclusion in the Plan. Full project descriptions can be found in Appendix F.bayareairwmp.org/projects



Bay Area IRWMP Website

The review and ranking process was developed by the Plan Update Team (PUT) and approved by the CC. The goal was to develop a process, from submittal through prioritization, which was transparent, replicable and consistent. Stakeholders were presented with the proposed process at the first public workshop on July 23 and given an opportunity to provide comments.

The CC developed a scoring methodology that assigns projects into three tiers. The prioritization of projects is based upon a detailed two phase screening process consisting of an initial screening by the Subregion leads, followed by project evaluation and ranking. The process encouraged Subregional integration while ranking at a regional level. The review and scoring process was available on the website so that project proponents were well informed about the process and how the projects would be ranked, as they completed their templates (see Section 6.3.1). All projects submitted are maintained on a Master List, and the list will be updated as projects are developed through time and re-prioritized.

A discussion of how each proposed project is related to resource management strategies selected for use in the IRWMP is found in Chapter 4: Resource Management Strategies.

6.3 Procedures for Submitting a Project

To facilitate the project review, the PUT developed the following process and materials:

6.3.1 Project Template

In order to be eligible for review, all proponents were required to complete and submit the project template (Appendix C) or input project information directly into a web-based form based upon the project template. In developing the template, the PUT attempted to balance the level of effort and resources required by the project proponent to complete it, with the information needed in order to assess and rank the project. The PUT also framed the template to encourage submittal of projects that were at a more conceptual stage rather than just ready-to-proceed projects.

To support the submittal of projects at various stages of readiness, proponents were instructed to complete as much of the template as possible, but that all projects would be reviewed regardless of completeness. The template also outlined the cost/benefit information that would be required at a further stage for inclusion in a grant proposal. This allowed proponents to understand the level of detail that would be required to participate in a grant application, without yet requiring them to provide it.

The project template was approved by the CC in March 2012. A new project template was used in 2019 for the Proposition 1 Implementation funding round and utilized an online format to streamline the collection process.

6.3.2 Call for Projects

The CC launched an open call for projects in June 2012 via electronic notification The notification provided a link to the Project Template on the website and indicated the submittal due date — originally September 1, later moved to September 7— offered a “Frequently Asked Questions” (FAQs) section, and provided other relevant information.

Stakeholders were informed of the project submittal deadline and process in a number of venues and communications. Meetings included Workshop #1 which was attended by 80 people and at which project criteria and online project submittal instructions were presented in detail. Additional meetings at which the criteria, deadline and process were described included Subregional meetings, water and land use-related meetings and workshops, local government meetings, regular meetings of water associations and other meetings at which CC members were present.

The communications avenues that explained the submittal process and deadline included the website notice and instructions, four emails to the 1,500-person master list that were related to Workshop #1, and separate email notices to the Subregional lists.

In all the communications, stakeholders were encouraged to submit projects, by the deadline, in any stage of development, including concepts or ideas. The Subregion process provided an opportunity to move the concepts towards more developed implementation projects by providing guidance on project criteria, framing of the project in the context of being a multi-benefit, integrated project, and, in some cases, suggestions about potential partners. More information about the Subregion outreach process is provided in Chapter 14: Stakeholder Engagement.

Project proponents of both new and existing projects were instructed to complete the online project template. In order to facilitate this process, the CC did the following:

- Created a new online interface that allowed project proponents to easily update existing projects and enter new projects.
- Created basic instructions to help people input project data in the interface.

- Contacted project proponents of existing projects, including Disadvantaged Community (DAC)-serving projects, and gave them accounts to access the site and website rights to update their own projects.
- Invited other stakeholders to submit projects.
- Provided guidance regarding the template to stakeholders at Workshop #1, including the opportunity to participate in a hands-on, step-by-step support session, though none of the participants requested that level of assistance at the workshop.

With a few minor exceptions, the online project template provided an efficient and relatively easy way to submit and collect project proposals.

For the Proposition 1 Implementation funding, the CC launched an optional call for short form project proposals in November 2018, to gauge regional interest in projects and understand what types of projects would be submitted. The formal call for projects occurred in May 2019.

More information on the stakeholder outreach for project submittal is presented in Chapter 14.

6.3.2.1 Targeted Assistance for DAC Project Proponents

An effort was made to assist organizations, agencies, communities and Tribes with limited technical and time capacities to participate in the process and submit projects, particularly for projects serving DACs and Tribes. The State of California's Proposition 1 Disadvantaged Communities Involvement Program was developed to ensure the involvement of DACs, Economically Distressed Areas (EDAs), and Underrepresented Communities (URCs). The Bay Area Disadvantaged Communities and Tribal Involvement Program (DACTIP), begun in 2016, includes a Needs Assessment conducted through outreach partner organizations located in DACs and capacity building activities designed to aid in project development and support future access to funding. In addition, a minimum 10% of the Bay Area Funding Region's allocation is designated for projects benefitting Disadvantaged Communities. The following organizations and Tribes participated in the DACTIP:

- California Indian Environmental Alliance
- Amah Mutsun Tribal Band
- Association of Ramaytush
- Him-R^n
- Indian People Organizing For Change (IPOC)
- Muwekma Ohlone
- All Positives Possible
- Greenaction for Environmental Justice and Health

- The Resilient Communities Initiative
- Sonoma Ecology Center & Daily Acts
- Shore Up Marin
- Marin County Community Development Agency
- The Watershed Project
- Friends of Sausal Creek
- Ronald V. Dellums Institute for Sustainable Policy Studies and Action
- Keep Coyote Creek Beautiful
- Nuestra Casa
- Youth United for Community Action
- Contra Costa Resource Conservation District
- City of Hayward

See Chapter 14 Section 6 & 7 for additional information on the DACTIP partners, goals and process.

6.3.3 Review Matrix

The PUT focused significant effort in developing a matrix to outline the project scoring methodology (Table 6-1: 2019 Proposition 1 Scoring Methodology

Criteria- Directly from Prop 1 Guidelines	Point Value
Does the project address the critical needs and/or priorities of the IRWM region as identified in the IRWM plan?	1
Is the project sufficiently justified by the description given in the narrative of Section D.1? Does the narrative include requisite referenced supporting documentation such as models, studies, engineering reports, etc.? Does the narrative include other information that supports the justification for the proposed project, including how the project can achieve the claimed level of benefits?	3
Does the project address and/or adapt to the effects of climate change? Does the project address the climate change vulnerabilities assessed in the IRWM Plan?	2
Does the Work Plan include a complete description of all tasks necessary to result in a completed project? Are all necessary and reasonable deliverables identified?	3

Collectively, are the Work Plan, Schedule, and Budget thorough, reasonable, and justified; and consistent with each other? (see scoring criteria document for considerations)	4
Continue from Column H: 1.Does the project clearly and concisely address all required topics listed in sectionC.1 of the PIF, including summarizing the major components, objectives and intended outcomes/benefits of the project? 2. Are the tasks shown in the Work Plan, Schedule and Budget consistent? 3. Are the costs presented in the budget backed up by and consistent with supporting justification and/or documentation? 4. Is the Schedule reasonable considering the tasks presented in the Work Plan?	
Does the project sponsor have legal access rights, easements, or other access capabilities, to the property to implement the project? If not, does the project sponsor provide a clear and concise narrative and schedule to obtain the necessary access?	2
Does the budget leverage funds with other private, Federal, or local fund sources?	1
Is the primary benefit* claimed in Table 3 of the Project Information Form logical and reasonable given the information provided in the Work Plan? *For Decision Support Tools, non-physical benefits will be considered.	2
Does the project provide multiple (more than one) benefits?	1
Does the project provide benefits to more than one IRWM region and/or Funding Area?	1
If the proposed project addresses contamination per the requirements ofAB1249, does the project provide safe drinking water to a small disadvantaged community?	1
Does the proposed project employ new or innovative technology or practices?	1
Does the project provide a benefit(s) to a DAC, EDA and/or Tribe (minimum 75%)?	1
Did the applicant provide a narrative on cost considerations that is fully explained based on information requested in the Project Information Form?	2

Table 6-). The intent was to develop a methodology that reflected DWR guidelines, limited ambiguity, and was replicable and transparent to participants and stakeholders.

The scoring methodology reflects the criteria of the Guidelines as well as the Bay Area IRWMP Goals and Objectives. The criteria include:

- Addressing Multiple Goals
- Integrating Multiple Resource Management Strategies
- Strategic Considerations for IRWM Plan implementation (regionalism, partnerships and integration)
- Project Status

- Technical Feasibility
- Benefits to DAC Water Issues
- Benefits to Native American Tribal Community Water Issues
- Environmental Justice Considerations
- Project Costs and Financing
- Economic Feasibility
- Climate Change Adaptation
- Reducing Greenhouse Gas (GHG) Emissions
- Reducing Dependence on the Delta

Development of the assessment methodology and scoring was an iterative process. First the PUT began with the "review factors" identified in the 2012 Guidelines and used that to finalize the scoring metrics, and assessment methodology, identifying what to score and how to score it. Where appropriate, the Guidelines were also consulted for direction regarding the assessment methodology and weighting of the review factors.

The PUT weighted the review factors indicating most important to least important from the perspective of identifying projects to include in the Plan. Certain criteria, such as benefits to disadvantaged communities (DAC) water issues and reducing dependence on the Delta, did not receive points, but instead were assigned a Yes/No scoring so they could be identified and sorted by this factor. The scoring methodology was approved by the CC in August 2012.

In developing a project review process, the CC did not consider any specific grant program-related selection criteria. The purpose of identifying projects in the IRWM Plan is to understand the needed actions to meet the IRWM Plan objectives and therefore not prioritize projects based on any specific grant program. The CC will apply grant criteria when moving projects from the scored list in the IRWMP to a specific grant proposal list.

Table 6-1: 2019 Proposition 1 Scoring Methodology

Criteria- Directly from Prop 1 Guidelines	Point Value
Does the project address the critical needs and/or priorities of the IRWM region as identified in the IRWM plan?	1
Is the project sufficiently justified by the description given in the narrative of Section D.1? Does the narrative include requisite referenced supporting documentation such as models, studies, engineering reports, etc.? Does the narrative include other information that supports the justification for the proposed project, including how the project can achieve the claimed level of benefits?	3
Does the project address and/or adapt to the effects of climate change? Does the project address the climate change vulnerabilities assessed in the IRWM Plan?	2
Does the Work Plan include a complete description of all tasks necessary to result in a completed project? Are all necessary and reasonable deliverables identified?	3
Collectively, are the Work Plan, Schedule, and Budget thorough, reasonable, and justified; and consistent with each other? (see scoring criteria document for considerations)	4
Continue from Column H: 1.Does the project clearly and concisely address all required topics listed in sectionC.1 of the PIF, including summarizing the major components, objectives and intended outcomes/benefits of the project? 2. Are the tasks shown in the Work Plan, Schedule and Budget consistent? 3. Are the costs presented in the budget backed up by and consistent with supporting justification and/or documentation? 4. Is the Schedule reasonable considering the tasks presented in the Work Plan?	
Does the project sponsor have legal access rights, easements, or other access capabilities, to the property to implement the project? If not, does the project sponsor provide a clear and concise narrative and schedule to obtain the necessary access?	2
Does the budget leverage funds with other private, Federal, or local fund sources?	1

Is the primary benefit* claimed in Table 3 of the Project Information Form logical and reasonable given the information provided in the Work Plan? *For Decision Support Tools, non-physical benefits will be considered.	2
Does the project provide multiple (more than one) benefits?	1
Does the project provide benefits to more than one IRWM region and/or Funding Area?	1
If the proposed project addresses contamination per the requirements ofAB1249, does the project provide safe drinking water to a small disadvantaged community?	1
Does the proposed project employ new or innovative technology or practices?	1
Does the project provide a benefit(s) to a DAC, EDA and/or Tribe (minimum 75%)?	1
Did the applicant provide a narrative on cost considerations that is fully explained based on information requested in the Project Information Form?	2

Table 6-2: Prop 84 Project Scoring Methodology

Yellow Shading = Directly From Prop 84 Guidelines REVIEW FACTORS

Scoring Criteria	Scoring Objective	Scoring Metric(s)	Assessment Methodology & Scoring	Max Score	Weighting
Addresses Multiple Goals	How the project contributes to the IRWM Plan Objectives	Number of goals and objectives the project addresses	Total of 200 points allocated among the 5 goals; 10 points per objective until 40 points maximum per goal (for Flood goal, 40 points if all objectives addressed)	200	27%
Integrates Multiple Resource Management Strategies	How the project is related to resource management strategies	Address multiple RMS (CWP Management Outcomes)	20 points per each of the six CWP Management Outcomes met	120	16%

Yellow Shading = Directly From Prop 84 Guidelines REVIEW FACTORS

Scoring Criteria	Scoring Objective	Scoring Metric(s)	Assessment Methodology & Scoring	Max Score	Weighting
Strategic Considerations for IRWM Plan implementation		Regionalism: How much of the Bay Area Region does this project benefit?	50 points: project provides direct benefits to 1) 2 or more of the Bay Area Sub-Regions; or 2) at least three counties (portions within Region); or 2) six or more of the 20 Bay Area watershed areas as illustrated in Figure B-6 and listed in Table B-1 from 2006 IRWMP. 25 points: provides direct benefits to 1) at least two counties (portions with Region); or 2) at least three of the 20 Bay Area watershed areas as illustrated in Figure B-6 and listed in Table B-1 from 2006 IRWMP. 15 points: project provides direct benefits to one of the 20 Bay Area watershed areas as illustrated in Figure B-6 and listed in Table B-1 from 2006 IRWMP, AND at least one county (portions within Region). 5 points: project provides direct benefits to more than one watershed of smaller scale than the 20 Bay Area watershed areas as illustrated in Figure B-6 and listed in Table B-1 from 2006 IRWMP.	50	7%
		Partnership: How many entities are partnering to implement this project?	30 points if project involves three or more partners that include both government agencies and NGOs 20 points if project involves three or more partners. 10 points if project involves two partners. 0 points if Project involves only one entity.	30	4%
		Integration with land use planning	20 points: Project increases coordination between water resources agencies and land use planning agencies	20	3%
Project Status			2 points for each criterion met:	10	1%

Yellow Shading = Directly From Prop 84 Guidelines REVIEW FACTORS

Scoring Criteria	Scoring Objective	Scoring Metric(s)	Assessment Methodology & Scoring	Max Score	Weighting
	Considers the project's readiness to proceed	What is the current status of the project (with respect to the criteria listed in the scoring)?	Construction Drawings		
			Land acquisition/easements complete		
			CEQA/NEPA complete		
			Preliminary Design complete		
			Conceptual Plans complete		
Technical Feasibility	Technical feasibility of the project. Accesses the availability and quality of technical information in supporting project plan and results	Is this a common and widely accepted technology with well documented results?	75 points: Technical feasibility has been well documented and based on similar, successful studies and/or projects or established literature; the project is using a technology or processes that meet industry standards; the project includes pilot study results and/or an agency's own operational results to estimate benefits; project site conditions are known (soils, hydrology, ecology)	75	10%
		Is there enough known about the geologic conditions, hydrology, ecology or other aspect of the system where the project is located	35 points: the project has not been done before but the project proponents provide adequate documentation related to the feasibility of the proposed process and project site conditions are known (soils, hydrology, ecology)		
			0 points: the project has not been done before, does not use industry standard processes, and/ or the project's projected benefits exceed those of similar studies with no supporting documentation provided.		

Yellow Shading = Directly From Prop 84 Guidelines REVIEW FACTORS					
Scoring Criteria	**Scoring Objective**	**Scoring Metric(s)**	**Assessment Methodology & Scoring**	**Max Score**	**Weighting**
Benefits to DAC Water Issues	Considers if project provides specific benefits to critical water issues for disadvantaged communities and/or increases DAC participation.	Does the proposed project provide specific benefits to critical DAC water issues	Yes/No	Yes/No	Yes/No
Benefits to Native American Tribal Community Water Issues	Considers if project provides specific benefits to critical water issues for Native American tribal communities and/or increases tribal participation.	Does the proposed project provide specific benefits to critical Native American tribal community water issues?	Yes: 15points	15	2%
Environmental Justice Considerations	Considers if project addresses inequitable distribution of environmental burdens.	Does the proposed project redress inequitable distribution of environmental burdens and/or improve access to environmental goods?	Yes: 15points	15	2%
Project Costs and Financing	Identifies if project costs and financing have been assessed.	Has a project cost estimate been prepared and documented in Section 3 of the Project Template?	Yes: 25 points	25	3%
		Does project have identified sources at least 25% match funding?	Yes: 25 points	25	3%

Yellow Shading = Directly From Prop 84 Guidelines REVIEW FACTORS

Scoring Criteria	Scoring Objective	Scoring Metric(s)	Assessment Methodology & Scoring	Max Score	Weighting
Economic Feasibility	Benefits, monetized or non-monetized can be estimated (consistent with DWR Guidelines.)	Does the response to Section 3, Table A indicate proponent would be able to provide necessary data for an economic analysis, for a potential grant application?	50 points if primarily "yes"	50	7%
Climate Change Adaptation	Contribution of the project in adapting to the effects of climate change.	Will the project contribute to regional adaptation to projected climate change impacts?	5 points per strategy, up to 50 points	50	7%
Reducing GHG Emissions	Considers a project's ability to reduce regional GHG emissions, as compared to project alternatives. Considerations include energy efficiency and reduction of GHG emissions when choosing between project alternatives.	Compared to project alternatives, does the project reduce regional GHG emissions OR improve energy efficiency?	5 points per strategy, up to 50 points	50	7%
	Reducing dependence on the Delta		Yes/No	Yes/No	Yes/No
			Total	**735**	**100%**

(white)	Yes/No question
(dark green)	High point value
(light green)	

Yellow Shading = Directly From Prop 84 Guidelines REVIEW FACTORS					
Scoring Criteria	**Scoring Objective**	**Scoring Metric(s)**	**Assessment Methodology & Scoring**	**Max Score**	**Weighting**
	Medium point value				

6.4 Procedures for Reviewing Projects

6.4.1 IRWMP Project Lists

The projects were grouped into two project lists: a Master List and an Active List. The Master List contains all submitted projects, and the Active List contains projects that are moving forward for evaluation. The rules that govern the lists are as follows:

6.4.1.1 Master List

The IRWMP Master Project List is a non-scored list of projects that includes all projects that have ever been submitted for inclusion in the Plan, including project concepts. The Master List is composed of all projects from the 2006 Plan, projects in the appendices to the 2006 Plan, projects that were subsequently added to the list by the CC and all projects submitted to the Plan during the update process. This list is located at: http://bayareairwmp.org/grants-projects/projects/.

Any IRWMP stakeholder may submit a project for inclusion on the Master List by completing the Project Template (Section 6.3.1).

In advance of a review process, the CC sends an email to the list serve and posts to the website asking the project proponents of all projects on the Master List to confirm that the project is still active and that they want their project ranked. If the project proponent fails to confirm their involvement, the project will not move forward to the Active Project List.

Unless a project has been removed by the project proponent, it will remain on the Master List.

Projects may be added to or removed from the Master Project List at any time; however this must be done by the project proponent(s).

- To remove a project, the project proponent must submit a written request for removal to the CC. The request for removal must include: the project title, consent to remove the project from all project lists and the reason for removal of the project.
- In the event of multi-entity projects, all entities must agree to a project's removal.
- It is the project proponent's responsibility to notify, and get consent from, any and all partnering entities of the removal of the project from the IRWMP Master List.
- In the case of multi-entity projects the "project proponent" refers to the lead entity.

The CC may commence a call for new projects. The confirmed projects and new projects will comprise the IRWMP Active List.

6.4.1.2 Active List

The Active List is a subset of the Master List and includes all projects that will be evaluated in the Project Review Process. (Section 6.4.2)

It is the project proponent's responsibility to:

- Complete the Project Template (as described in Section 6.3.1)
- Ensure that project information is up to date
- Respond to CC requests for information

Project(s) can be removed from the Active List by the CC if the project proponent does not meet its responsibilities. Projects removed from the Active List are maintained in the Master List until removed by the project proponent(s).

Subsequent to the 2013 Project Review Process, updates to the Project lists will be added to the Plan as appendices. The process is described in Section 6.6.

6.4.2 Project Review

Projects are reviewed by the Project Screening Committee (PSC). The PSC is a volunteer body composed of members active on the Bay Area Integration Regional Water Management (IRWM) Coordinating Committee (CC) and representing local public agencies, tribes, disadvantaged communities (DACs) and Economically Distressed Areas (EDAs), and other stakeholder organizations. For the 2019 review process, the PSC embraced the concept of the regional Proposal representing each Functional Area and each Subregion in the Funding Area, as defined in the 2013 Bay Area IRWM Plan, if such projects could be considered competitive, and also elevating projects that provided benefits to Tribes/DACs/EDAs, either through the 10% minimum reserved for Tribes/DACs/EDAs or through the General Implementation Project funding.

Project Scoring and Selection Process

For the 2019 Round 1 Implementation Project review, the PSC followed the following process:

Quantitative Review Process:

- PSC agreed to use the Department of Water Resources (DWR) Round 1 Grant Implementation Proposal Solicitation Package (PSP) Project Level Evaluation scoring criteria to evaluate all project submittals (25 point scale).
- Point totals were compiled for each project and averaged (Method 1). A second method compiled each project by rank and then averaged the rank, thus avoiding skew and outliers to provide all scorers equal voice (Method 2). Both Method 1 and Method 2 identified the same top 10 projects, just in a slightly different order.

Qualitative Review Process:

- PSC referenced the 2013 Bay Area IRWM Plan, the PSP, and the 2019 IRWM Grant Program Guidelines for guidance. The PSC removed any projects that the group agreed were not as competitive as other highly-ranked projects given the principles of the Bay Area IRWM and/or the statewide IRWM guidelines – i.e., projects that needed to better articulate claimed benefits or only provided benefits to a very limited geographical area in comparison to other projects.

• PSC reviewed the updated highest-ranked projects for Functional Area representation.

• PSC reviewed the updated highest-ranked projects for Subregion representation.

• PSC reviewed the updated highest-ranked projects for Tribal/DAC/EDA representation.

Managing Conflict of Interest

To ensure the scoring and selection process was fair and equitable, PSC members representing agencies or organizations did not score their own projects. In addition, the accepted ground rules for the July 15th, 2019 in-person 'Scoring Review and Project Selection' meeting included an agreement by all present not to lobby the group or advocate on behalf of their project, and to only provide additional information about a project if requested. Lastly, no member of the PSC received any additional information on how to put together a competitive project application compared to other applicants: the quantitative review process mirrored DWR's 2019 PSP scoring criteria exactly and the qualitative review process was based on IRWM principles in the 2013 Bay Area IRWM Plan, the 2019 PSP, and the 2019 IRWM Grant Program Guidelines. In addition, qualitative selection goals such as Functional Area representation, Subregion representation, and Tribal/DAC/EDA representation were discussed at public CC meetings leading up to the project application deadline.

6.5 Results

The Master List includes 690 projects, 332 of which were submitted (or re-submitted) in the 2012 call for projects and went through the two-phase project review process. The Master List includes the following subcategories for projects submitted during the 2012 call for projects:

Number of projects on the Active List: 315

Number of regional projects: 30

Number of projects indicating benefits to DAC: 123

Number of projects that did not pass Subregion review: 17

Of the 332 projects submitted, the Subregion screening process identified 17 projects that were deemed ineligible because they did not meet the minimum criteria. Project proponents were provided a notice that the project did not advance to the ranking phase and were given an opportunity to address the CC at its monthly meeting. These projects remain on the Master List.

The remaining 315 projects that were included in the Active List continued to Phase 2 for scoring and ranking based on the methodology described in Section 6.3.3. The results of the project scoring are shown in **Error! Reference source not found.**.

6.5.1 Procedure for Communicating the List of Selected Projects

Once the Active List projects were ranked, draft scores were posted on the Bay Area IRWM website. The PSC also contacted project proponents by email to announce the draft scores, the criteria used to score each project, and the Project Review Process guidance. Proponents were informed that the scored list would be published in the Plan and the project information would be used to update the Plan and describe the efforts to develop regional, integrated, and multi-benefit solutions for our water resources.

Project proponents were then given an opportunity to address errors identified in the project review process. Examples of errors the PSC would consider correcting included errors made by the scoring team or errors due to technical issues from the website and project information not being properly captured. Project proponents were requested to provide an explanation of the error and a proposed solution. Proponents were given two weeks to provide this information, which was submitted electronically. The PSC re-scored 17 projects.

6.6 Adaptive Management Process

The water management issues facing the Bay Area will change over time as regulations become more stringent, environmental conditions change, and new regional interests and goals emerge. As these issues evolve over time, the type of projects considered as regional priorities for implementation will change. Further, as projects are implemented and additional studies are completed, their readiness-to-proceed will change.

Recognizing that goals, objectives, and regional priorities evolve over time, the CC will review the Plan periodically, depending on changing conditions and availability of funds as future work is performed, and make adjustments as necessary to respond to changes throughout the region. This review will be informed by assessments performed by project proponents at the project level and by the CC at the Plan level (refer to Chapter 8: Plan Performance and Monitoring). Information collected through this review process will be used to inform decisions regarding IRWMP project sequencing, as well as updates to the regional goals, objectives, and priorities. This process of continual review and update will optimize the effectiveness of IRWMP implementation.

The IRWMP Project Review Process will generally take place on a schedule that anticipates an IRWMP update, a Proposal Solicitation Package, or as determined necessary by the CC. Subsequent to the completion of the Project Review Process in the IRWMP update, projects to be added to the IRWMP will be reviewed and ranked by the PSC, subject to the approval of the CC, and a new list of Plan Projects generated. To the extent allowable under State IRWM guidelines and criteria, a new project submitted after adoption of the Plan will be considered by the appropriate functional area(s) to evaluate whether that project should be forwarded to the IRWMP CC as a high priority project to consider when the next available funding proposal is developed. The schedule and process for each functional area may vary. Updates to the Project lists will be added to the Plan as appendices.

Table 6-3: Proposition 1 Round 1 Project Scoring Results

Project Title	Sponsor	Subregion	Functional Area	Prop 1 Grant Request	Rank by Ave Score
RD1 System Fish Passage Improvements	Alameda County Water District (ACWD) Leonard Ash	East	Watershed-Habitat	$ 4,000,000	1
Lower Walnut Creek Restoration	Contra Costa County Flood Control and Water Conservation District	East	Watershed	$ 1,500,000	2
River Oaks Stormwater Capture Project	City of San José, Jeff Sinclair	South	Flood Protection-Stormwater	$ 4,350,000	3
NBWRP Phase 2	North Bay Water Reuse Authority - Jake Spaulding	North	Wastewater-Recycled Water	$ 5,246,931	4
Calistoga Water and Habitat Project	City of Calistoga and Napa County Resource Conservation District, Derek Rayner	North	Disadvantaged Communities	$ 2,121,555	5
San Francisquito Creek Flood Protection, Ecosystem Restoration, and Recreation Project, Upstream of Highway 101	San Francisquito Creek Joint Powers Authority	West	Flood Protection-Stormwater	$ 3,100,000	6
Bay Area Regional Water Conservation	East Bay Municipal Utility District	Multiple	Water Supply-Water Quality	$ 8,415,400	6
San Francisco Zoo Recycled Water Pipeline Project	San Francisco Public Utilities Commission	West	Wastewater-Recycled Water	$ 562,648	8
McCosker Creek Restoration	East Bay Regional Park District, Tiffany Margulici	East	Water Supply-Water QualityWatershedDisadvantaged Communities	$ 910,500	9
Palo Alto Flood Basin Tide Gates Improvements	Santa Clara Valley Water District	South-West	Flood Protection-Stormwater	$ 6,500,000	10
OLSD Sewer Pipeline Replacement Project	Oro Loma Sanitary District	South	Wastewater-Recycled Water	$ 1,000,000	11
Sutter Urban Flood Reduction	City of San Pablo; Amanda Booth	East	Flood Protection-Stormwater	$ 4,000,000	12
Implementing BMPs on Rural Lands	Sonoma Resource Conservation District, Valerie Quinto	North	Watershed	$ 1,193,047	12

San Mateo Water Resources Program	San Mateo Resource Conservation District	West	Water Supply-Water Quality	$ 2,955,000	14
BART Hayward Maintenance Complex Rainwater Catchment, Bio-Retention Basin, and Solar Thermal project	BART	East	Flood Protection-Stormwater	$ 5,441,180	14
Bayfront/Atherton Flood Protection Project	County of San Mateo, Erika Powell	South	Flood Protection-Stormwater	$ 3,216,484	16
Belmont Creek Watershed Restoration Project	County of San Mateo	West	Flood Protection-Stormwater	$ 10,680,548	16
Hayward Recycled Water Project Phase-2	City of Hayward; Jan Lee	East	Wastewater-Recycled Water	$ 3,980,000	18
Bayfront Recycled Water and SLR Protection	West Bay Sanitary District, Phil Scott, Manager	West	Wastewater-Recycled Water	$ 15,000,000	19
Graywater Direct Installation Program for Underserved Communities	Ecology Action	Multiple	Water Supply-Water Quality	$ 338,387	20
Athlone Terrace Pump Station Upgrade	County of San Mateo Dept of Public Works. Joe LoCoco (jlococo@smcgov.org)	West	Flood Protection-Stormwater	$ 3,750,000	20
Walnut/Angus pump stations upgrades	San Mateo County Flood Control District. Mark Chow (mchow@smcgov.org)	West	Flood Protection-Stormwater	$ 2,181,450	22
Aging Concrete-Lined Channels	Zone 7 Water Agency	East	Flood Protection-Stormwater	$ 10,375,000	23
Bluff Erosion Protection Preservation Esplanade	City of Pacifica, Louis Sun	West	Flood Protection-Stormwater	$ 1,700,000	24
Beach Boulevard South Seawall Replacement	City of Pacifica, Louis Sun	West	Flood Protection-Stormwater	$ 9,000,000	25
Chain of Lakes Pipeline	Zone 7 Water Agency	East	Flood Protection-Stormwater	$ 33,000,000	26
Retional Upstream Detention Improvements	Zone 7 Water Agency	East	Flood Protection-Stormwater	$ 7,625,000	27

Selected Project

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Chapter 7: Impacts and Benefits

This chapter contains a discussion of potential impacts and benefits of implementation of the IRWMP, including those within and between regions, and those potentially affecting disadvantaged, environmental justice concerns and Native American Tribal communities. Consistent with DWR requirements as described in the 2016 Guidelines, the discussion is not exhaustive but rather provides a screening level analysis to help any reader of the IRWMP generally understand the impacts and benefits of implementing the IRWMP. This overview of impacts and benefits will serve as a benchmark to help the IRWM planners assess whether the anticipated benefits of the IRWMP have been realized and/or unanticipated impacts have occurred.

Impacts and benefits will be analyzed in more detail prior to implementation of specific projects. As appropriate, as project concepts are further developed and advanced for approval, detailed environmental impact assessment will be conducted in accordance with the California Environmental Quality Act (CEQA) and, if applicable, the National Environmental Policy Act (NEPA). The status of CEQA/NEPA review varies by project and was collected and recorded during the project review process (see Section 6.3.3 in Chapter 6 for further information on the project review process). Project information is available online at the Bay Area IRWMP website.

7.1 Introduction

For the purposes of characterizing potential impacts and benefits of IRWMP implementation, a list of potential project types was developed. The list reflects DWR's latest set of primary management objectives for the 2013 Update of the California Water Plan, this IRWMP's set of Resource Management Strategies presented in Chapter 4, and the current list of projects submitted for consideration as part of this IRWMP update process. Table 7-5 presents the list of project types evaluated in this chapter and shows how this project list relates to DWR's most recent set of broad management priorities as laid out in the 2013 CWP Update.

Sections 7.2 through 7.10 address each project category, and describe the potential environmental impacts, benefits, and interregional effects that could result from implementation. With respect to impacts, four areas of impact are considered: short-term site development or construction-related impacts (e.g., traffic, dust and noise associated with earthwork and/or construction activity); facility "footprint" impacts associated with disturbance of resources at and near the project site; facility/project operations impacts (e.g., energy use, air and GHG emissions, traffic associated with project operations and maintenance); and growth inducement potential (e.g., potentially associated with expanded service capability) leading to secondary effects of growth (e.g., increased land development, traffic, and service demands associated with growth). Sections 7.11 and 7.12 address potential impacts and benefits to Bay Area disadvantaged communities and Native American Tribal communities or resources, respectively.

Table 7-5: Project Categories and Types Evaluated in This Chapter

CWP 2013 Update Management Objectives	Project Categories and Types
Reduce Water Demand	**Water Conservation and Demand Management** • Agricultural Water Use Efficiency • Urban Water Use Efficiency
Increase Water Supply Improve Operational Efficiency	**Water Supply Enhancement** • Infrastructure Reliability • Surface Water Supply • Groundwater Management • Water Reuse • Stormwater Capture • Desalination
Improve Water Quality	**Water Quality Protection and Improvement** • Water, Wastewater Treatment Facilities • Pollution Prevention and Runoff Management • Aquifer Remediation • Salt and Salinity Management
Practice Resource Stewardship	**Watershed Management** • Watershed Erosion Control, Land Stewardship **Habitat Protection and Restoration** • Habitat Protection and Improvement • Ecosystem Restoration and Wetland Creation
Improve Flood Management	**Flood and Sea Level Rise (SLR) Hazard Management** • Flood Management Facilities, Floodplain Protection • SLR Hazard Management
People and Water	**Public Access, Recreation and Use** **Planning, Modeling and Monitoring Tools** **Education, Outreach and Incentives**

Table 7-6 and the text in Sections 7.2 through 7.10 summarize typical impacts associated with each project type. Actual impacts of specific projects would vary depending on site-specific conditions, such as the sensitivity of on-site and nearby resources, as well as project design and operation details. Two of the project types, shown corresponding to DWR's People and Water objective – Planning, Modeling and Monitoring Tools, as well as Education, Outreach and Incentives – are not expected to result in physical impacts and thus they are not addressed in Table 7-6.

Table 7-7 summarizes potential benefits of IRWMP implementation by project type. The list of benefits shown in the table was developed to reflect both the statewide priorities presented in the latest CWP and IRWMP goals and objectives and reflected in the project descriptions submitted as part of the planning process.

This chapter will be reviewed and updated during normal plan management activities as part of the regular Plan re-assessment and readoption process, which occurs on a five-year cycle. See Section Chapter 1, Governance, for a description of the Plan update process.

7.2 Water Conservation and Demand Management

Water Conservation and Demand Management includes both agricultural and urban water use efficiency projects. Projects in this category can include rebate programs to accelerate plumbing retrofits or landscape changes, tiered rates and other financial incentive programs that influence customer behavior to reduce water use, and projects targeting agricultural conservation such as canal relining, irrigation improvements, crop changes, or other use reduction measures. The Bay Area has made significant strides in urban water use efficiency by reducing per capita water use; DWR studies indicate that per capita water use in the San Francisco Bay hydrologic region is among the lowest in the state (DWR et al, 2010). *Water Conservation and Demand Management* projects proposed as part of the IRWMP may include conversion to drought tolerant landscapes to promotion of BMPs for both urban and agricultural irrigation efficiency, among others.

High efficiency clothes washers can help reduce urban water use.

Potential Impacts

In general, urban *Water Conservation and Demand Management* projects do not result in appreciable physical impacts as they often do not require new or modified facilities or other types of major land disturbance or new operations; rather, these projects involve behavioral changes and/or indoor/outdoor device and plumbing changes. Some irrigation improvements may involve land disruption to install new irrigation equipment but this would most likely occur within areas already subject to regular maintenance, resulting in little “new” environmental impact. Agricultural *Water Conservation and Demand Management* projects could include lining agricultural water canals to reduce water loss through canal seepage. This practice reduces water losses, but may also have unintended consequences to nearby groundwater supplies, adjacent habitats and wetlands supported by or benefiting from the canal seepage.

Table 7-6: Potential IRWMP Environmental Impacts by Project Types

	Impact Category															
	Land Use						Water Resources				Biological Resources		Air and Energy			
Project Categories and Type	Agriculture	Land Use Compatibility	Recreation	Hazardous Materials	Cultural Resources	Growth Inducement Potential	Surface Water	Groundwater	Water Quality	Flooding	Aquatic Resources	Terrestrial Resources	Pollutant Emissions	Greenhouse Gas Emissions	Energy Use	Delta water and biological resources
Water Conservation and Demand Management																
Agricultural and Urban Water Use Efficiency								✓			✓					
Water Supply Enhancement																
Infrastructure Reliability		✓			✓	✓	✓		✓					✓	✓	✓
Surface Water Supply	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
Groundwater Management	✓	✓			✓	✓	✓		✓	✓	✓	✓		✓	✓	
Water Reuse		✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Stormwater Capture		✓			✓		✓	✓	✓	✓	✓	✓				
Desalination		✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Water Quality Protection and Improvement																
Water, Wastewater Treatment Facilities		✓		✓	✓	✓	✓		✓		✓		✓	✓	✓	
Pollution Prevention and Runoff Management	✓	✓					✓		✓	✓	✓	✓				
Aquifer Remediation				✓		✓	✓	✓	✓		✓		✓	✓	✓	
Salt and Salinity Management		✓					✓	✓	✓		✓		✓	✓	✓	
Watershed Management																

Project Categories and Type	Impact Category															
	Land Use						Water Resources				Biological Resources		Air and Energy			
	Agriculture	Land Use Compatibility	Recreation	Hazardous Materials	Cultural Resources	Growth Inducement Potential	Surface Water	Groundwater	Water Quality	Flooding	Aquatic Resources	Terrestrial Resources	Pollutant Emissions	Greenhouse Gas Emissions	Energy Use	Delta water and biological resources
Watershed Erosion Control, Land Stewardship		✓	✓		✓		✓		✓		✓	✓				✓
Habitat Protection and Restoration																
Habitat Protection and Improvement		✓	✓		✓		✓	✓	✓	✓	✓	✓		✓		✓
Ecosystem Restoration and Wetland Creation	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓				✓
Flood and SLR Hazard Management																
Flood Hazard Management		✓	✓		✓		✓	✓	✓	✓	✓	✓				
SLR Hazard Management	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓				✓
Public Access, Recreation and Uses																
Water Dependent Recreation, Trails, etc.	✓	✓	✓		✓		✓		✓		✓	✓				

Table 7-7: Potential IRWMP Benefits by Project Type

Project Categories and Type	Benefit Category																															
	Water Supply Reliability						Water Quality					Integrated Flood Management						Climate Change Response					Environmental Stewardship					Community Involvement and Public Use				
	Reduce total water demand through water use efficiency	Reduce potable water demand	Expand use of recycled water	Expand stormwater reuse	Diversity regional water management portfolio	Increase storage or conveyance capacity	Increase aquifer recharge	Protect or improve surface water quality	Protect or improve groundwater quality	Improve drinking water quality	Improve wastewater treatment	Improve stormwater quality	Respond to salinity issues	Prevent nutrient loading	Reduce risk of flooding	Restore floodplains	Improve flood ctrl through wetland restoration, protection	Reduce stormwater runoff through improved infiltration	Reduce energy consumption and GHG emissions	Prepare for sea level rise, higher tidal surges	Prepare for extreme climate events, and drought	Contribute to carbon sequestration	Protect existing high quality habitat	Restore impaired habitat	Promote recovery of threatened and endangered	Provide water for aquatic habitat	Manage pests and invasive species	Promote energy efficiency, use of renewable energy	Potential to benefit a disadvantaged community	Protect cultural resources	Promote community outreach, education and stewardship	Promote public access, water-oriented recreation
Water Conservation and Demand Management																																
Agricultural and urban use efficiency	✓	✓			✓		✓	✓	✓					✓					✓		✓		✓	✓	✓	✓		✓	✓		✓	✓
Water Supply Enhancement																																
Infrastructure Reliability	✓			✓		✓	✓			✓									✓	✓	✓							✓	✓			
Surface Water Supply					✓	✓	✓			✓											✓								✓			✓
Groundwater Management	✓		✓	✓	✓	✓	✓		✓	✓		✓	✓		✓			✓		✓	✓		✓	✓	✓	✓			✓			
Water Reuse		✓	✓		✓	✓	✓	✓					✓						✓		✓		✓	✓	✓	✓			✓	✓	✓	
Stormwater Capture	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓			✓		✓	✓
Desalination					✓					✓			✓								✓				✓	✓			✓			
Water Quality Protection and Improvement																																
Water, Wastewater Treatment Facilities		✓	✓				✓	✓	✓	✓	✓	✓	✓		✓				✓	✓	✓			✓	✓	✓		✓	✓		✓	✓
Pollution Prevention and Runoff Management				✓			✓	✓	✓		✓	✓		✓	✓		✓	✓					✓	✓	✓	✓			✓	✓	✓	
Aquifer remediation					✓	✓	✓		✓	✓			✓	✓										✓		✓			✓			
Salt and salinity management		✓	✓				✓	✓	✓	✓	✓		✓											✓		✓			✓			
Watershed Management																																
Watershed protection, sediment management, erosion control, land stewardship				✓			✓	✓	✓	✓		✓		✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Habitat Protection and Restoration																																
Existing Habitat Protection and Improvement								✓	✓			✓		✓	✓		✓	✓		✓		✓	✓		✓	✓			✓	✓		✓
Ecosystem Restoration				✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓		✓	✓		✓
Flood and SLR Hazard Management																																
Flood management facilities, floodplain protection				✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓		✓		✓		✓	✓	✓			✓		✓	✓
SLR hazard management			✓	✓					✓		✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
Public Access, Recreation and Use																																
Trails, water-based recreation, water-dependent cultural uses (fisheries)				✓	✓															✓				✓					✓	✓	✓	✓

Project Categories and Type	Benefit Category																															
	Water Supply Reliability						Water Quality					Integrated Flood Management					Climate Change Response					Environmental Stewardship						Community Involvement and Public Use				
	Reduce total water demand through water use efficiency	Reduce potable water demand	Expand use of recycled water	Expand stormwater reuse	Diversity regional water management portfolio	Increase storage or conveyance capacity	Increase aquifer recharge	Protect or improve surface water quality	Protect or improve groundwater quality	Improve drinking water quality	Improve wastewater treatment	Improve stormwater quality	Respond to salinity issues	Prevent nutrient loading	Reduce risk of flooding	Restore floodplains	Improve flood ctrl through wetland restoration, protection	Reduce stormwater runoff through improved infiltration	Reduce energy consumption and GHG emissions	Prepare for sea level rise, higher tidal surges	Prepare for extreme climate events, and drought	Contribute to carbon sequestration	Protect existing high quality habitat	Restore impaired habitat	Promote recovery of threatened and endangered	Provide water for aquatic habitat	Manage pests and invasive species	Promote energy efficiency, use of renewable energy	Potential to benefit a disadvantaged community	Protect cultural resources	Promote community outreach, education and stewardship	Promote public access, water-oriented recreation
Modeling and Monitoring Tools																																
Decision support systems (DSS) and technical data collection					✓		✓	✓				✓			✓	✓				✓			✓	✓				✓	✓		✓	
Education, Outreach, and Incentives																																
Student and community programs, school projects, financing programs					✓			✓				✓						✓			✓		✓	✓					✓	✓	✓	

Potential Benefits

The substantial benefits of *Water Conservation and Demand Management* include reductions in total water demand and reductions in potable water demand, expanding the regional water management portfolio and netting additional supply reliability throughout the system without any of the construction-related impacts associated with a “new” or supplemental supply project. Further, these projects have the benefit of reducing demands on imported water supplies such as the Sierra supplies delivered to the Bay Area by SWP and CVP, which convey water through the Delta, or by the SFPUC’s Hetch Hetchy system or EBMUD’s Mokelumne systems, thereby lessening pressure of competing demands on a limited resource and improving surface and groundwater water quality in water source areas. Improved water quality and quantity in these areas aids in recovery of aquatic habitats and supports sensitive species. Reduced water consumption also aids in drought preparedness by conserving water supplies. Reducing average annual water deliveries reduces energy use associated with water conveyance and treatment, which in turn reduces air and GHG emissions. Reducing water demands provides in-lieu groundwater recharge. Improved water use efficiency can reduce nutrient leaching and prevent nutrient loading. Water conservation programs also provide community outreach and education benefits.

Interregional Effects

There are multiple interregional benefits of *Water Conservation and Demand Management* including better drought preparedness and reduced reliance on imported water. Reduced energy consumption and associated reductions in air emissions would benefit the Bay Area and Central Valley air basins. In addition, reductions in energy use due to reduced water transport and consumption also decreases contribution to greenhouse gas emissions, a global concern.

7.3 Water Supply Enhancement

7.3.1 Infrastructure Reliability

Infrastructure Reliability projects can include facility repair, replacement, improvement or expansion at any point in the water supply system including conveyance, storage, treatment or distribution. Projects in this category may also include interties within or between systems to improve delivery flexibility and redundancy. The improvement and expansion of the South Bay Aqueduct element of the SWP executed by DWR and Zone 7 Water Agency are an example of this type of project. Examples of *Infrastructure Reliability* projects currently included in the IRWMP include system interties, reconstruction of aging storage tanks and pipelines, dam seismic retrofits and rehabilitations, and SCADA system upgrades.

Potential Impacts

Infrastructure Reliability projects often involve modifying or improving existing facilities, resulting in fewer construction and footprint-related impacts than would occur with construction of new facilities. Nonetheless, facility modifications and/or the addition of new facilities, such as conveyance interties or additional system storage could result in construction, footprint and possibly operational impacts that may affect adjacent developed land uses, or natural resources and cultural resources if undeveloped open space areas are affected. Improvements involving capacity expansion may lead to the potential for growth inducement and consequently, an increase in overall energy use and associated greenhouse gas emissions.

Potential Benefits

The benefits of *Infrastructure Reliability* projects can include improved water supply and supply reliability, improved operational efficiency, increased energy efficiency (from replacement of outmoded equipment), reduced risk of outages under normal or emergency operations (e.g., following a major earthquake), and improved drinking water quality (e.g., from replacement of aging treated water storage facilities).

Interregional Effects

Projects designed to improve the reliability of existing conveyance systems that import water to the Bay Area may result in both impacts and benefits to the source water regions, such as the Delta, Sierra foothills or upper Russian River watershed, where water diversion, storage and conveyance facilities originate. Projects in these areas may result in construction and footprint impacts at facility sites as well as off-site water resource, hydrologic and aquatic resource impacts. Benefits to these areas could include facilities that better conserve water and are more energy efficient, reducing interregional operational impacts. Regional system interties can provide regional and interregional benefits by improving water supply capabilities during an emergency or extended drought.

7.3.2 Surface Water Supply

Surface Water Supply projects include water transfers, or improvements to existing water supply systems tapping sources both within and outside of the San Francisco Bay Area hydrologic region, including changes in water diversions (from local, Delta, Sierra, Russian River or Eel River sources), interties, and/or surface water storage augmentation. Examples of *Surface Water Supply* projects currently included in the IRWMP include pilot projects for water transfers between major water agencies within the Bay Area and projects to restore operating capacity at dams.

Potential Impacts

Potential impacts of improved *Surface Water Supply* vary by activity, but can include adverse effects on surrounding land uses including agriculture, aquatic resources, water quality and other beneficial uses such as recreation (for potential increases in surface water diversions), cultural resources (e.g., archeological resources near waterways affected by facility construction or operation), growth-inducing impacts, increases in air pollutant and GHG emissions (to the extent that the project increases energy use from fossil fuels), and third party impacts (e.g., when State Water Project contractors have more [or less] water to sell to other water supply agencies). Storage facilities, such as reservoirs, can have large footprints and may be located in rural areas adjacent to agriculture and/or sensitive habitats (e.g., riparian woodland). Reservoir construction can adversely affect habitat and resident threatened and endangered species. Although currently there are limited Surface Water Supply projects included in the IRWMP that would be expected to adversely affect Delta resources, the Bay Area does rely on the Delta for a portion of its water supplies and such projects may be proposed in the future. Proposition 1 prioritizes projects that help increase regional self-reliance for those areas that receive water from the Delta watershed.

Potential Benefits

Potential benefits of Surface *Water Supply* projects include improved water supply reliability under normal and emergency conditions (through, for example, diversifying an agency's or region's water supply, conveyance and storage portfolio), improved system resilience to extreme climate events, increased operational flexibility, and support of beneficial uses defined in the San Francisco Bay Basin Plan (e.g., industrial and municipal water supplies).

Interregional Effects

Expanding local water supplies increases water supply options for the Bay Area and increases supply delivery flexibility. Improving and supplementing the water supply portfolio for Bay Area water providers may allow a reduction in the use of water from sources outside the hydrologic region, which could reduce impacts on source watersheds and may provide better flexibility to divert water at times when it results in less adverse environmental effect to water and aquatic resources.

7.3.3 Groundwater Management

Specific G*roundwater Management* project types include conjunctive use, groundwater recharge, groundwater banking and recharge area protection. Examples of Groundwater projects in the IRWMP include groundwater recharge and groundwater banking projects in the North Bay, and a multi-county water reuse program that utilizes portions of recycled water for groundwater recharge. In other areas, rubber dams are used to encourage groundwater recharge (these projects often include fish ladders around those dams to improve fish access to upper habitats in the watershed). Many projects also identify conjunctive use or protection of recharge areas as a secondary benefit.

Potential Impacts

Groundwater Management may include recharge pond projects, which tend to be land intensive with site development impacts that could extend broadly into existing and surrounding land uses, including agriculture, open space, and natural resource areas. In riparian areas, construction of recharge ponds could impact aquatic and terrestrial species, for example, by reducing the frequency of local flooding/inundation which is typically beneficial for wetland areas. Conjunctive use projects may result in water quality impacts due to the interaction of surface and groundwater. Operational effects include potential additional energy use (associated with water conveyance, injection and pumping) and associated air and greenhouse gas emissions. Increased in water availability could lead to the potential for growth inducement.

Potential Benefits

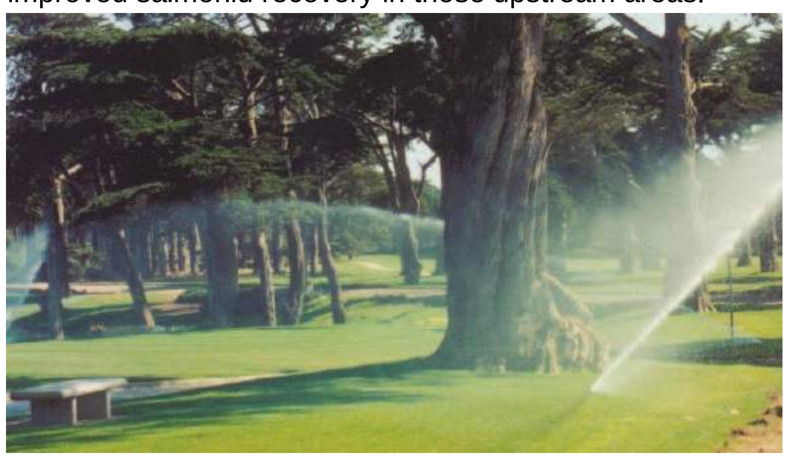
Benefits of G*roundwater Management* projects may include reduced reliance on imported water through expansion of local water supplies, or increased storage capacity to allow for better timing of water imports to avoid upstream environmental impacts. Expanded local management and protection of water supplies may allow for reduced exposure to surface pollutants. Rain capture and storage of stormwater in groundwater basins could reduce flooding by minimizing peak runoff volumes in local streams. Stormwater or recycled water could be used to recharge overdrafted groundwater basins and also prevent saltwater intrusion associated with sea level rise (SLR) near San Francisco Bay. Groundwater may also be a source of water for existing high quality and restored habitats that could be managed or preserved to benefit sensitive species and improve water quality and supply. Capturing available local water supplies and recharging groundwater basins for future use is a form of green infrastructure management that supports local water demand and diversifies the local water management portfolio.

Interregional Effects

Interregional effects are common with *Groundwater Management,* specifically conjunctive use projects because of the relationship to surface water supplies. For example, local groundwater banking programs could store waters originating from other regions. Local storage would enable water to be diverted during less sensitive high flow periods and stored for use during dry weather periods. Depending on timing and compliance with upstream flow requirements, this could have the benefit of recharging some local groundwater basins, where there may be overdraft or salinity issues.

A separate interregional effect could occur when local demand for imported water is reduced, for example through recycling, which would free source supplies for other beneficial uses such as groundwater recharge programs in those source areas. Interregional benefits could include enhanced summer stream flows and improved salmonid recovery in those upstream areas.

7.3.4 Water Reuse



Using recycled water for landscape irrigation can help offset use of potable water supplies.

Water Reuse (non-potable, indirect and direct potable, and matching quality to use) projects involve development of treatment, storage, and conveyance facilities to serve appropriate water uses including landscape irrigation (e.g., business parks, roadway medians and golf courses), crop irrigation (e.g., vineyards in Sonoma and Napa Counties), industrial uses (e.g., oil refinery cooling in Contra Costa County), indoor uses (e.g., toilet flushing), groundwater recharge, and wetland/habitat creation. Examples of *Water Reuse* projects submitted for consideration as part of the IRWMP include multiple recycling projects throughout the Bay Area and potable reuse studies.

Potential Impacts

Water Reuse projects typically include modifications to wastewater treatment facilities, installation or expansion of recycled water distribution pipelines, pump stations, and system storage. Modification of existing discharges from wastewater treatment facilities as well as the use of recycled water has the potential to adversely affect surface water hydrology, surface water and groundwater quality, and groundwater. Installation of treatment facilities, pump stations, pipelines, and storage can impact existing land uses, and may have temporary impacts to habitat and water quality. The operation of treatment processes to support water reuse requires additional energy with commensurate air and GHG emissions.

Potential Benefits

By making recycled water available to more customers, *Water Reuse* projects reduce the use of imported and local surface water and groundwater supplies, diversify the local and regional water portfolio, increase reliability, and provide a drought resistant water supply. *Water Reuse* projects often increase storage and conveyance capacity by constructing new pipelines and storage facilities. *Water Reuse* projects provide opportunities to match water quality to use (e.g., using recycled water instead of potable water for irrigation purposes) and preserve the highest quality water for potable use. As indicated in Chapter 2 (Section 2.3.3.1), the Bay Area recycled approximately 60,000 acre feet of supply in 2010, and recycled water supply is expected to double over the next 20 years (BACWA 2011 Recycled Water Survey). Water reuse projects help to improve water quality in San Francisco Bay and Pacific Ocean by reducing wastewater discharges and can also support recovery of threatened and endangered species by reducing demand on local surface waters. Recycled water can also be used to support habitat restoration projects (e.g., wetlands creation), thereby providing local and regional habitat benefits. Non-potable water recycling processes can have lower energy requirements than other water sources (e.g., imported water) and therefore may help to lower or offset GHG emissions if used in place of more energy intensive water supplies. Finally, promotion of successful water reuse projects helps to educate the community about water issues and environmental stewardship.

Interregional Effects

Many of the benefits of *Water Reuse* projects are interregional, such as reduced reliance on imported water from the Delta and Eel River systems. Additional water in these systems reduces many of the documented environmental stressors that result from water diversion away from those ecosystems. Additional water flows in the Eel River would also benefit the Bear River, Wiyot, and Blue Lake Native American tribes there, for whom the river and the fishery are water dependent cultural resources.

7.3.5 Stormwater Capture

Stormwater Capture projects include use of detention basins, roof gardens, rain barrels/cisterns, biofiltration and other technologies to capture, manage, and infiltrate stormwater onsite. Examples of Stormwater Capture projects included in the IRWMP include Low Impact Design (LID) projects at schools, in disadvantaged communities (DACs), and in Priority Development Areas (PDAs). In some cases, stormwater capture projects are linked to other project categories such as *Groundwater Management* and *Education and Outreach*.

Potential Impacts

Stormwater Capture projects are often responsive to, and dependent on, surrounding land uses, which generate stormwater for capture. Capturing stormwater is a generally passive activity that does not typically require treatment and therefore has few energy related impacts. Capturing stormwater however, may have impacts on downstream hydrology and water quality, potentially affecting aquatic and terrestrial biological resources. Land use impacts could result from siting large facilities, such as detention basins, in constrained urban areas. These detention basins could affect flooding frequency and may also concentrate surface water pollutants, which would require long-term maintenance and funding.

Potential Benefits

Stormwater Capture systems, such as detention basins incorporated into the design of a new development, can result in beneficial management of the storm hydrograph. By detaining peak flows generated from new impervious surfaces, Stormwater Capture and Management projects reduce disruption of natural flow cycles by storing stormwater and minimizing potential downstream flooding impacts. These projects may also provide a wide range of benefits related to water supply, water quality, ecosystem restoration, recreation, and public health. Increasingly, new urban development projects utilize detention basins, roof gardens, or cisterns to capture and manage stormwater on-site. These actions may provide recreational opportunities by incorporating dual-acting design features such as detention basins that are used as playing fields or parks during summer months, or left to function as year-round wetlands. Design components such as wetlands can also address other watershed scale issues. For example, filtering runoff through vegetation reduces subsequent pollutant loading in receiving water bodies benefiting salmonid habitats. Implementation of Stormwater capture projects may support several beneficial water uses as defined by the San Francisco Bay Basin Plan including, but not limited to: groundwater recharge, marine habitat, and water contact recreation.

Interregional Effects

Stormwater Capture can be used to augment local water supplies and could reduce the need to import water from other regions. Stormwater capture programs in the urbanized Bay Area could reduce urban runoff pollutants, particularly during ‘first flush’ events entering San Francisco Bay and marine environments of the Pacific Ocean.

7.3.6 Desalination

Desalination projects include projects designed to provide a new source of potable water supply by removing salts and dissolved solids from brackish or saline water. The IRWMP includes a regional desalination project that has been proposed by multiple Bay Area water agencies as well as a project that will investigate the feasibility of developing brackish groundwater aquifers for water supply.

Potential Impacts

Potential impacts from *Desalination* projects include impacts to surrounding land uses associated with siting a new treatment facility. Diversion of brackish or saltwater from the Bay has the potential to impact to aquatic resources as a result of entrapment and entrainment by intake structures. Disposal of brine generated during treatment operations could impact air and water quality. Desalination projects are often located to take advantage of operational efficiencies derived from using brackish water and therefore could impact estuarine habitat and other sensitive biological resources in the Bay and Delta. The desalination process remains relatively energy intensive and thus would increase energy use along with air and greenhouse gas emissions, and could have growth-inducing impacts as it would represent a new water supply source.

Potential Benefits

Potential benefits of *Desalination* include diversification of the region's water supply portfolio by providing a new high quality source of supply that is not weather-dependent and would be available during periods of drought, reducing reliance on imported supplies. Implementation of *Desalination* projects may also support several beneficial water uses as defined by the San Francisco Bay Basin Plan including, but not limited to, industrial service supply, and municipal and domestic water supply.

Interregional Effects

Using *Desalination* to meet local water demand could improve short-term drought resistance and decrease drought effects in source watersheds. However, the increase in energy use and associated increase in air and greenhouse gas emissions associated with desalination could contribute to impacts on the regional and global climate.

7.4 Water Quality Protection and Improvement

There are many strategies to protect and improve surface and groundwater water quality, ranging from pollutant source control measures to active treatment technologies. Four methods are discussed below.

7.4.1 Water/Wastewater Treatment Facilities

Water/Wastewater Treatment Facilities projects include projects that would build or upgrade water or wastewater treatment plants and/or technology. Examples of Water/Wastewater Treatment Facilities projects included in the IRWMP include pretreatment facilities to treat water obtained from regional transfers and interties. Some of these projects include use of renewable energy.

Wastewater treatment plant aeration basin.

Potential Impacts

Water and Wastewater Treatment facilities require energy for treatment processes and, as a result, new or reconstructed facilities could increase energy use and associated air and greenhouse gas emissions. Wastewater treatment facilities often result in land use conflicts due to the potential for air quality, noise, odor, and visual effects impacts on adjacent land uses. Changes in discharge patterns may affect downstream hydrology and water quality, resulting in impacts to aquatic and terrestrial biological resources.

Potential Benefits

Water and Wastewater Treatment projects protect and improve surface water and groundwater quality, which benefits both human and ecosystem health. Improved water quality benefits contact and non-contact recreational water activities such as fishing, swimming and boating. Improved water quality also protects riparian and aquatic habitats which often support rare, threatened and endangered species. Implementation of new water treatment processes supports the ability to meet drinking water standards and wastewater effluent requirements. New and upgraded treatment facilities are generally more energy efficient than older facilities and therefore may reduce energy use and associated air pollutant and greenhouse gas emissions. Implementation of *Water and Wastewater Treatment* projects may also support beneficial water uses defined in the *San Francisco Bay Basin Plan* including, but not limited to industrial service supply, and municipal and domestic water supply.

Interregional Effects

Reducing air pollutant and greenhouse gas emissions through the implementation of new, energy efficient treatment technologies provides regional, interregional and global benefits. As described above under *Water Reuse,* modifying and improving wastewater treatment facilities to support recycled water production reduces the need for water imports and improves drought preparedness. Improvements to wastewater treatment facilities in other regions can provide water quality benefits to the Bay Area region and vice versa. Improvements to pretreatment processes could supp ort use of raw water from varying sources, thereby increasing treatment flexibility, supporting regional transfers, expanding existing water distribution infrastructure and encouraging interties between agencies.

7.4.2 Pollution Prevention and Runoff Management

Pollution Prevention and Runoff Management includes both urban and agricultural projects aimed at reducing runoff and improving water quality through the implementation of site design, source control and treatment control best management practices. *Pollution Prevention and Runoff Management* projects could range from end-of-pipe capital improvements on existing stormwater systems, to development of a regional approach for reducing pollution in urban or agricultural runoff. Examples of *Pollution Prevention and Runoff Management* projects currently included in the IRWMP include efforts to reduce trash in urban waterways, efforts to reduce and control agricultural runoff, and efforts to install exclusion fencing to protect riparian areas from livestock.

Potential Impacts

Impacts resulting from implementation of *Pollution Prevention and Runoff Management* projects are highly varied depending on the nature of the management approaches that are employed. *Pollution Prevention and Runoff Management* projects may have impacts associated with facility siting, since they would typically be near a riparian area that could impact surface water and water quality, and could also affect local flooding due to slowing and filtering of runoff. Implementation of agricultural runoff BMPs, such as silt fencing along riparian buffers could reduce land available for agriculture and affect terrestrial animal migration patterns near fenced stream corridors. With modified stream flows, aquatic resources could also be affected by runoff management.

Pollution prevention activities can benefit aquatic species such as steelhead trout.

Potential Benefits

Non-point source pollution is a leading source of water quality degradation and contributes largely to the degraded health of lakes, streams, San Francisco Bay and the Pacific Ocean. Therefore, benefits resulting from implementation of *Pollution Prevention and Runoff Management* projects would directly benefit surface and groundwater water quality and would support nearly all beneficial water uses as defined by the San Francisco Bay Basin Plan, including provision of water for aquatic habitats and the recovery of threatened and endangered species. *Pollution Prevention and Runoff Management* also reduces stormwater runoff through improved infiltration, sometimes through the restoration of wetlands and can reduce the risk of local flooding. Agricultural runoff management can improve groundwater quality and prevent nutrient loading in receiving waters which in turn could reduce related GHG emissions. *Pollution Prevention and Runoff Management* improves water quality for wildlife, aquatic species, water contact recreation, and human consumption. Cleaner water would promote community stewardship and would yield benefits to all communities.

Interregional Effects

Pollution Prevention and Runoff Management programs in upstream regions such as Sacramento and other parts of the Central Valley would improve water quality flowing into San Francisco Bay. Within the Bay Area urban runoff pollutants could be reduced and water quality would be improved before entering marine environments of the Pacific Ocean.

7.4.3 Aquifer Remediation

Aquifer Remediation projects include projects that identify and clean contaminated groundwater through long-term groundwater injection, treatment processes and flow monitoring. There are salinity reduction projects underway in Alameda County (as discussed in the next section), however at this time, the IRWMP does not include any Aquifer Remediation projects.

Potential Impacts

Aquifer Remediation projects could have impacts associated with long-term energy use for filtration and pumping, causing air and greenhouse gas emissions. Discharges from Aquifer Remediation projects, if left untreated, could affect local water quality in surface waters and other groundwater basins. Clean up activities may require use of hazardous materials to counteract poor groundwater chemistry.

Potential Benefits

Aquifer Remediation projects include removal of contamination from otherwise usable groundwater storage areas. Once clean, these aquifers can be recharged and returned to beneficial use, including provision of additional safe water and groundwater storage capacity that could aid in diversifying the regional water management portfolio. *Aquifer Remediation* projects also reduce drinking water treatment costs and protect human and environmental health.

Interregional Effects

Aquifer Remediation projects improve groundwater quality in selected aquifers and could allow for broader use of groundwater when remediation is complete. Maximizing use and quality of available groundwater storage enables regions to better manage water supplies and improve drought resistance. In some cases this may reduce the need for imported water from other regions, in other cases additional storage could allow for transfer of water at more ecologically opportune times to avoid environmental impacts associated with supply diversion and conveyance.

7.4.4 Salt and Salinity Management

Salt and Salinity Management projects include use of membrane or distillation treatment to reduce salinity loads in wastewater or brackish or briny water sources, use of groundwater demineralization techniques to mitigate salt loading to groundwater basins and restoration of areas impacted by high salinity resulting from use of Delta imports or industrial operations and discharges. Examples of *Salt and Salinity Management* projects included in the IRWMP include expansion of an advanced recycled water purification center to manage salinity in non-potable recycled water. Several Bay Area groundwater management programs were formed in part to address salt and salinity management issues.

Potential Impacts

Impacts of *Salt and Salinity Management* projects, such as groundwater demineralization efforts, include disposal of the waste brine, which could affect aquatic habitat as well as surface and groundwater water quality. Treatment facilities required for these projects range in size from individual wellhead treatment units to larger centralized water treatment facilities; development of these facilities would result in both construction-related and footprint impacts affecting developed land use or open space/natural resources, depending on site location. Long-term water treatment requires energy and would result in air pollutant and GHG emissions.

Potential Benefits

The benefits of implementing *Salt and Salinity Management* projects include improved groundwater quality in areas where demineralization techniques are employed. Some imported and recycled water is high in salts and salinity reduction benefits water purveyors via lower treatment costs. Agriculture would benefit with higher crop yields, and could potentially create a stronger and more diversified market for available recycled water.

Interregional Effects

Salt and Salinity Management in Delta watersheds would improve water quality in downstream receiving waters including San Francisco Bay and would improve imported water quality. Some coastal groundwater basins have shown significant improvements with salinity management efforts to prevent sea water intrusion.

7.5 Watershed Management

Watershed Management includes resource stewardship activities to benefit the watershed, such as sediment management, erosion control on roads and trails, stream crossing improvements (bridges and fish passage projects) and other land management projects such as the restoration of sloughs, wetlands or shorelines. Watershed planning may also include evaluating, modeling and monitoring these activities, and is discussed below. Examples of *Watershed Management* in the IRWMP include implementation of high priority projects in Pilarcitos Watershed of San Mateo County, as well as improvements in the Napa, Sonoma, Petaluma, Corte Madera, Lagunitas, Mill Valley, Berkeley (five creeks), San Francisquito Creek and other watersheds.

Potential Impacts

The impacts of W*atershed Management* projects include short-term construction impacts, such as those associated with erosion control projects that are site specific in nature. Occasionally there are larger watershed-scale programs, such as sediment TMDL programs (in Napa and Sonoma Counties) or restoration projects which are designed for long-term watershed improvement by reducing impacts caused by previous land use and development patterns. These larger scale programs could cause impacts to existing land use and to recreational use of streamside trails and possibly water dependent recreation uses. Streamside improvements could impact surface waters and water quality of aquatic habitats while broader watershed programs could also affect upland terrestrial habitats.

Potential Benefits

The benefits of *Watershed Management* include diversification of upland forest and rangeland habitat, improved soil structure, reduced erosion, and retention of water for aquifer recharge. Public access in Bay Area uplands and watershed lands continues to provide recreation and health benefits to the entire Bay Area population. There are many opportunities in urban watersheds to incorporate LID, fish passage, flood control, public access, habitat and vegetation management projects into the urban fabric to further improve urban riparian corridors with multiple benefits for stormwater quality and flood control. At the Bay margins are shorelines, levees, creek mouths, fresh water and tidal marshes that could be managed as a unit to provide habitat diversity and respond to increased flooding from the uplands while adapting to higher tidal surges and SLR generated by climate change. Watershed Management provides synchronization between related projects to provide multi-beneficial improvements for flood control, habitat diversity, and public access benefits.

Interregional Effects

Watershed Management efforts could improve water quality and fish habitat to ultimately support fishery recovery efforts targeting steelhead and salmon in the Bay-Delta system, which, in turn would benefit other coastal regions.

7.6 Habitat Protection, Improvement and Restoration

This category is divided into two sections. Habitat Protection and Improvement applies to acquisition and protection of existing high quality habitats for the characteristics they possess, such as biological diversity or preservation of important ecosystem services. Habitat Restoration applies to activities to restore degraded natural areas and habitats that would benefit from focused efforts to improve selected ecosystem services, such as creation of wetlands to improve water quality.

7.6.1 Habitat Protection and Improvement

Habitat Protection and Improvement projects include protection of high quality habitats and environmental resources. Examples of *Habitat Protection and Improvement* projects included in the IRWMP include land acquisition, resource management and mitigation banking. Many of the projects involve work within or adjacent to sensitive habitats such as streams, rivers, lakes, wetlands, and marine environments. Habitat protection is often integral to the success of with projects focusing on water quantity and quality.

Potential Impacts

Impacts related to implementation of *Habitat Protection and Improvement* projects often include construction related impacts, changes in or loss of sensitive habitat areas due to habitat conversion, changes to the hydrologic makeup of a site including effects to surface water, groundwater, and water quality, and effects on land use planning, including floodway protection and effects on agricultural land availability and local land values. In general, projects involving work within or adjacent to sensitive habitats would incur certain unavoidable impacts such as temporary disturbance to native species in sensitive aquatic and terrestrial habitats, temporary dewatering and disturbance of soils and bottom sediments. With disturbance of riparian soils also comes the possibility of disturbing cultural resources which are likely to be near streams and are of particular importance to local Native American Tribes. Protection of watershed lands or specific resource areas could result in modifications of available space for other uses including development and lands for public recreation.

Potential Benefits

Benefits of *Habitat Protection and Improvement* projects include retention of existing high quality biological habitats that would typically support hydrologic and geomorphic functions, such as intact riparian corridors and floodplains. Benefits of such projects may include retention of improvements to flow conveyance, maintenance of channel and bed form, sediment transport and deposition, and filtration of stormwater pollutants. In agricultural areas, protection of riparian habitats can prevent nutrient loading in downstream waters and improve stormwater infiltration.

Protection and improvement of tidal wetlands can improve shoreline resilience to sea level rise and can prevent substantial greenhouse gas emissions from large carbon stores associated with shoreline disturbance of tidal marshes and/or lowland agriculture that leads to land subsidence. Protected habitats may include areas for rare, threatened or endangered species, which on San Francisco Bay shorelines include California Clapper Rail and Salt Marsh Harvest Mouse. Mitigation banks extend these benefits to preserve large high quality habitats to mitigate for habitat losses in other areas. Protected areas provide cover, nesting, and forage areas; improvement to soil quality; increase in the diversity of native vegetation and habitat structure; and the protection or improvement of wildlife corridors.

Increase of Tribal cultural resources and awareness is an additional potential benefit to watershed management. The value of Indigenous stewardship and management practices informed by traditional management and Traditional Ecological Knowledge allows for Indigenous Peoples to take care of watershed, soil, forest and grassland, and the replanting of Native plants and vegetation. These methods help the improvement of cultural resources and ensure cultural continuance by teaching the next generation to maintain the traditional ties that Indigenous Peoples have to their heritage and stewardship responsibilities.

Interregional Effects

Habitat Protection and Improvement is particularly beneficial on an interregional scale when animal migration corridors can be preserved or improved. As climate change modifies habitats both animals and plants will migrate in search of suitable habitats and corridors to facilitate that migration will become increasingly important.

7.6.2 Habitat Restoration and Wetland Creation

Habitat Restoration and Wetland Creation projects include restoration of important biological habitats, and specifically wetlands because of their species diversity and importance to surface water management. Examples of *Habitat Restoration* projects included in the IRWMP include restoration of former industrial salt ponds to provide enhanced wetlands habitat, public access and recreational opportunities, fish passage and aquatic habitat restoration projects, creek daylighting, and multiple stream restoration projects.

Potential Impacts

Potential impacts resulting from *Ecosystem Restoration* are similar to those impacts described above for Habitat Protection and Improvement projects. Long-term impacts for Ecosystem Restoration however may also include changes in the distribution of aquatic and riparian vegetation species, depending upon the restoration targets. Changes in the physical characteristics of instream and floodplain habitats can lead to associated changes in local species composition and diversity, as the new conditions may favor a different suite of species. Riparian habitat restoration projects often require wider floodplains which could encroach upon existing adjacent land uses including agricultural lands. Removal of levees during salt pond restoration could result in modified tidal influence, possibly affecting local flood control facilities.

Potential Benefits

An example of a fish ladder installed as to aid fish passage on a Bay Area stream.

Benefits *of Habitat Restoration and Wetland Creation* may include expansion of critical habitats for local rare, threatened or endangered species such as Coho Salmon, Steelhead Trout, Red legged Frog, and California Tiger Salamander. Habitat quality is often an indicator of watershed health and improvement of these habitats also tends to benefit natural physical processes, such as creek migration or floodplain recruitment. Expansion of riparian or wetland habitats can slow or delay peak flood flows, reduce localized flooding, and improve stormwater management and overall water quality which indirectly provide public health and safety benefits. Improvements to local ecosystems may result in enhancements to several beneficial water uses as defined by the San Francisco Bay Basin Plan including, but not limited to: freshwater habitat, estuarine habitat, preservation of rare and endangered species, fish migration, and fish spawning. Habitat restoration projects may also include provisions for recreation, groundwater recharge, and water quality. Restoration of tidal wetlands would provide resilience to storm surges and sea level rise, thereby enhancing and protecting human development.

Stream restoration projects can improve access to historic salmon and steelhead spawning and rearing habitats (improving habitat for salmonids can also contribute to restoring cultural practices as Tribal communities regain opportunities to engage with these resources); improve conditions for movement by juveniles; increase the diversity of benthic taxa; and lower water temperature along the bank. Benefits may also extend to improved water supply quality and reliability. Improved water quality ensures the health and well being of terrestrial and aquatic species by providing clean water for all stages of the lifecycle.

Interregional Effects

Habitat Protection, Improvement and Restoration projects can improve the resilience of shoreline and upland ecosystems to withstand the effects of climate change. Upland ecosystems are subject to changes in temperature and soil moisture, which in turn could affect environmental water demands. Restoration projects that anticipate these effects and can help shoreline and upland ecosystems adapt to changing environmental conditions would have interregional benefits.

7.7 Flood and Sea Level Rise Hazard Management

Flood Hazard Management and Sea Level Rise Hazard Management are separate discussions since multi-objective flood management projects in the upland and urbanized settings of the Bay Area are quite different from shoreline conditions at the interface of fluvial and tidal environments. Shorelines are affected by sea level rise, while urban conditions present their own set of special circumstances, yet both are closely related, as sea level rise will increasingly affect flood management in the Bay Area.

7.7.1 Flood Management Facilities, Floodplain Protection

Flood Management Facilities and Floodplain Protection projects may include construction of new or improved floodwater conveyance, detention and retention facilities as well as restoration of floodplains to reduce peak flows. Examples of *Flood Management Facilities and Floodplain Protection* projects included in the IRWMP include a regional effort to facilitate identification of flood protection projects in the Bay Area Region as well as several projects in the North Bay and East Bay that include floodplain and habitat restoration, erosion control, and construction of storage basins to provide floodwater detention and increased infiltration.

Potential Impacts

Potential impacts resulting from implementation of *Flood Management and Floodplain Protection* projects could include impacts to surface waters, groundwater and water quality of the subject stream channel. Multi-objective approaches to flood control tend to emphasize low impact development techniques, naturalized channel systems and restoration of floodplain connectivity. Multi-objective approaches to flood management often require more land area and an expanded footprint to accommodate broader floodplains, detention basins and possibly trails as compared to traditional flood control techniques. These projects may result in impacts to cultural resources from disturbing soils and land use compatibility issues. In floodways constrained by existing development land use compatibility may require installation of “harder” flood management infrastructure that could impact existing, and often constrained, riparian and aquatic habitat zones. Floodplain restoration may result in habitat conversion that could impact aquatic and terrestrial biological resources. Operation of these projects may result in changes in the frequency, duration, and magnitude of storm flows and flooding, as well as changes in the timing/seasonality of flows. Such hydrologic effects may potentially decrease the health and vigor of established floodplain vegetation, and eventually alter the distribution of floodplain habitats.

Potential Benefits

Potential benefits realized through implementation of *Flood Management and Floodplain Protection* projects include improved public safety through the management of stream flow volumes and peak flood events. Reduction of peak flows protects downstream properties and regional infrastructure from flood damage. Retention of floodwaters over aquifer recharge areas maximizes infiltration into the groundwater basin for water to be available for later use. This practice diversifies the local water portfolio and can reduce use of imported water.

Multi-objective approaches to flood management can help to minimize or reverse past impacts to environmental resources (e.g., hydrology, sediment transport, and water quality, channel aesthetics,) caused by traditional approaches to flood control such as stream channelization and bank hardening. Increased use of floodplains for flood water storage and retention allows for overbank flows to spread out along the floodplain, providing habitat and ground water recharge benefits. Restoration of natural flooding events in stream systems helps to restore natural disturbance cycles, increasing species diversity and improving stream channel structure. Restoring floodplain connectivity can also lead to improved water quality by increasing opportunities for biofiltration.

Multi-objective approaches to flood management aim to reduce the impacts of traditional channelized flood control infrastructure (above) by restoring creeks to provide both flood control and habitat benefits (below).

The benefits of integrated flood control projects include reduced risk of flooding, minimized vulnerability to sea level rise, improved carbon sequestration (through minimization of subsidence and minimization of construction within wetlands and tidal marshes), and protection or restoration of habitats that could promote recovery of threatened and endangered species. With public access these projects could also improve recreation opportunities and promote community education and stewardship.

Interregional Effects

Integrated *Flood Management Facilities and Floodplain Protection* projects begin within the region and end at the Bay or the coastal shoreline, and therefore have little environmental effect on other upland regions. The Pacific Ocean however will exert significant influence on flood management in all sections of coastal California, including the Bay Area and the Delta. Integrated projects, particularly those near the shoreline and at the mouths of streams will become increasingly important to manage or adapt to changing flood level baselines, undersized levees, modified habitat zones and changing shoreline conditions.

7.7.2 Sea Level Rise (SLR) Hazard Management

SLR Hazard Management projects include evaluation of SLR exposure, development of SLR adaptation and management strategies and development of structural or natural flood control facilities. Examples of *SLR Hazard Management* projects included in the IRWMP include regional and local efforts to identify inundation areas and develop SLR adaptation strategies including habitat management, land use planning, managed retreat, engineered shoreline protection and natural shoreline treatment alternatives.

Potential Impacts

Potential impacts resulting from implementation of *SLR Hazard Management* projects would generally include impacts to surface water, groundwater, water quality and biological resources which typically would be within sensitive shoreline habitat zones. Control and mitigation of impacts within these sensitive zones would necessarily become part of proposed SLR projects. Projects in this category could also involve land use changes such as restoring bay-front habitats to form a buffer against tidal flooding, restricting land uses in waterfront zones, accommodating SLR with larger bridges and modified levees where needed, and employing managed retreat strategies to accommodate SLR. These strategies may result in land use conversion or land use compatibility issues (e.g., restricted development in waterfront areas, conversion of developed areas to habitat, impacts to agricultural lands). Habitat restoration may result in habitat conversion that could impact aquatic and terrestrial biological resources as well as other impacts described above in sections 7.6 Habitat Protection and Restoration.

Potential Benefits

Potential benefits realized through implementation of *SLR Hazard Management* projects include the protection of public safety through development and implementation of multiple SLR adaptation strategies. Construction of waterfront wetland buffers and implementation of land use restrictions in some areas subject to increased flooding and exposure to higher tidal surges could allow for slow accretion of sediments in tidal marshes to help protect existing infrastructure and reduce damage from SLR. Expanded or restored freshwater and tidal marshes in these buffers could also expand the tidal prism and help to lower flood elevations in certain areas. Use of recycled water to irrigate freshwater wetlands upland of tidal marshes would increase the biological diversity of San Francisco Bay shorelines and would also reduce wastewater discharges into the Bay. Maximizing fresh water recharge into low lying aquifers could also slow increases in groundwater salinity associated with SLR.

Restoration of waterfront wetlands and marshes could produce more resilient aquatic and terrestrial habitats to protect existing human development and may also provide increased public access and opportunities for recreation. Benefits of habitat restoration and public access activities are further described under sections 7.6 Habitat Protection and Restoration and 7.8 Public Access, Recreation and Use.

Interregional Effects

Implementation of SLR projects in the Bay Area could benefit regionally important infrastructure such wastewater treatment plants, by providing critical flood protection. SLR projects that include green infrastructure or habitat restoration could support regional efforts to restore sensitive bayland habitats needed to support healthy communities of fish and wildlife in the Bay Area. In addition, SLR projects involving restoration of natural shoreline areas could provide water-related recreational opportunities for the greater Bay Area (e.g., hiking, boating, wildlife observation etc.)

7.8 Public Access, Recreation and Use

Public Access, Recreation and Use projects include efforts to increase opportunities for public access to natural areas through creation or expansion of watershed lands, natural parks, trails and specific facilities for water oriented recreation. These types of facilities are often included as components of larger multi-benefit water management and flood control projects that also include habitat restoration and preservation. The IRWMP currently includes a beach restoration project in San Francisco Bay and conversion of some waterfront recreation facilities to accommodate landside access to the San Francisco Bay Water Trail. Many other multiple benefit projects include components aimed at increasing opportunities for public access and recreation including improved trails and interpretive signage.

Potential Impacts

Impacts resulting from implementation of *Public Access, Recreation and Use* projects could include temporary impacts to water quality and biological resources, and possible discovery of cultural resources during construction phases. Depending on the location and availability of visitor services, operation of *Public Access, Recreation and Use* projects may also cause longer term impacts to surrounding land uses due to recreation attracting additional people to the resource, potentially impacting neighborhoods, or possibly surrounding agriculture, as well as impacts to surface water and water quality (e.g., through possible increased litter, erosion, etc.) and increased disturbance to aquatic and terrestrial biological resources. Recreation and Public Access projects are often included as a component of Habitat Protection, Enhancement and Creation and Flood and SLR Hazard Management projects and could also result in similar impacts and benefits as described above in sections 7.6 Habitat Protection and Restoration and 7.7 Flood and Sea Level Rise Hazard Management.

Potential Benefits

Development of *Public Access, Recreation and Use* projects provide multiple health benefits for local and regional populations. Restoration of natural areas and creation of new trails and shoreline activities provides expanded recreation opportunities, encouraging people get out-of-doors to walk, hike and exercise. Increased use of water-based recreational facilities can also provide economic benefits to the local community. Spending more time in local or regional parks may provide education opportunities through docent-guided tours or interpretive signage or direct observation. Education and connection to the natural environment may increase social investment in protection of local natural resources. Appropriate site selection and design of new open spaces may also provide or improve habitat or movement corridors to help sustain healthy populations of wildlife. Associated site improvements and habitat restoration may reduce pollutant loading, such as sediment from eroded stream banks. Proper incorporation of visitor facilities helps to realize human benefits while reducing impacts associated with human use.

A new streamside trail in Alameda County provides access to natural lands and serves as an important transportation link for bicyclists. Photo: Zone 7 Water Agency.

Interregional Effects

There are several interregional trails within the Bay Area that connect to neighboring regions. The statewide Coastal Trail with connections to the North Coast and Central Coast is nearly complete in the Bay Area. The newly developed San Francisco Bay Water Trail could provide eastern connections to the Delta. The Bay Area Ridge Trail and the Bay Trail stay within the Bay Area, and provide outdoor recreation opportunities to all Californians (and world travelers) that chose to participate. Several IRWMP projects are proposed along these routes and would help to develop portions of, or connectors to these trails as well as other recreation opportunities.

7.9 Planning, Modeling and Monitoring Tools

Planning, Modeling and Monitoring provides important tools for science based water resource and watershed management decisions. General project types in this program include technical data collection, watershed evaluations, hydraulic and hydrologic modeling and development of decision support systems. Examples of these project types included in the IRWMP include historic ecology baselines, technical mapping, effects of lea level rise on hydrologic baselines, decision support systems for future land use modeling (such as for sea level rise or floodplain management), mapping for improved habitat management in a changing climate and improved precipitation prediction and recording.

Potential Impacts

Planning, Modeling and Monitoring projects are generally strategic in nature or involve data collection and analysis using various software programs and have few, if any, physical impacts.

Planning, modeling and monitoring projects tend to focus on water and resource management strategies designed to improve overall watershed health. Impacts may result from field access and observations but would be minimal and temporary. Possible impacts resulting from implementing recommendations would be separate from the effects of any planning, modeling or monitoring process, and would be evaluated on a project by project basis prior to implementation.

Fish monitoring in Napa County.

Potential Benefits

Planning, Modeling and Monitoring do not in themselves generate physical benefits, however they do inform management actions and help accrue benefits through improved understanding of environmental issues, constraints and opportunities and/or the development of collaborative planning strategies regarding water management. Planning projects provide means for agencies and organizations to understand water and environmental management tradeoffs, to prioritize solutions based on chosen criteria or objectives, and to take measured actions to achieve intended results. These planning processes facilitate efficient selection and integration of solutions to create projects that maximize societal and environmental benefits that respond to Statewide Common Goals as addressed in Table 7-5 in the introduction of this chapter.

Interregional Effects

Planning, Modeling and Monitoring can have multiple interregional benefits from the communication that supports them and from the sharing of information derived from these planning efforts.

7.10 Education, Outreach and Incentives

Education, Outreach and Incentives include a variety of efforts to provide the public with information regarding water-related issues and to involve communities in reducing water demand and improving stewardship of water resources. Examples of these project types included in the IRWMP include providing training to residents regarding low water use landscaping, offering rebates for water efficient plumbing fixtures, irrigation and landscaping retrofits, providing opportunities for students to participate in watershed restoration projects, implementing classroom education programs regarding stormwater quality and developing LID demonstration projects at local schools.

Potential Impacts

Education, Outreach and Incentive programs are not likely to result in physical impacts. Projects that include on-the-ground actions such as habitat restoration or installation of low impact development features may result in temporary construction and footprint related impacts, as discussed in Sections 7.6 and 7.7.

Potential Benefits

Education, Outreach and Incentive programs teach and encourage new social habits that can encourage water awareness in daily decisions to reduce consumption and encourage watershed health. Education programs have shown significant results in stretching scarce water supplies and have been essential components of conservation and overall demand management programs. Benefits derived from education, outreach and incentives programs also may support community stewardship and social investment in watershed health. Direct benefits of education based projects may lead to improvement in regional water quality as individual actions compound to implement broader goals to reduce water use, and minimize pollution. Direct benefits of habitat restoration and other volunteer activities include improvements to local aquatic and riparian habitats and improved water quality.

Water-wise gardening is just one of many ways to involve the local community in water conservation.

Interregional Effects

There are multiple interregional benefits of *Education, Outreach and Incentive* programs; most notable is a general statewide reduction of water consumption benefitting virtually all aspects of water management. Few other strategies can claim such success. Education and outreach to the public will continue to be important in managing supply demand and increasing awareness of climatic effects on water supplies and personal adaptation strategies.

7.11 Environmental Justice and Effects on Disadvantaged Communities

Environmental justice is a concept that looks at the distribution of environmental benefits (e.g., clean air, water and open space) and burdens (e.g., pollution, noise, toxic hazards) among communities. Environmental justice often applies to disadvantaged communities (DACs) (communities with a Median Household Income of less than 80 percent of the State Median Household Income) that have been affected by adverse health or environmental impacts linked to programs, policies, or activities that disproportionately affect those neighborhoods. See Section 2.2.12 for a more detailed discussion of environmental justice and DACs. The 2012 Guidelines require identification and consideration of water-related needs of disadvantaged communities and evaluation of the impacts and benefits of IRWMP implementation on these communities.

7.11.1 DACs in the Bay Area Region

Figures 2-15 and 2-16, in Chapter 2, show the location of DACs/Tribes and minority populations in the Bay Area region. DACs/Tribes tend to be located in urban areas at the lower ends of watersheds. Due to their location, these communities may also bear the environmental burden of proximity to infrastructure such as wastewater treatment plants, which provide benefits to the broader community, but can negatively affect those communities that are closer to the direct impacts of such facilities (such as noise, odors, etc.). In some instances, Tribes may not be connected to water systems, which can lead to unreliable sources of water and/or drinkable water. Figure 2-17, shows the location of wastewater treatment facilities in relation to DACs/Tribes in the Bay Area Region.

7.11.2 Development and Identification of DAC Projects

A priority for the IRWMP has been to include DACs in consideration of related water resource projects. To encourage inclusion of DAC related projects, targeted outreach was provided to DAC project proponents and project scoring included consideration of a project's ability to provide DAC benefits. Section 14.6 in Chapter 14, Stakeholder Engagement, provides more detail on the steps taken to involve DACs in the IRWMP process.

7.11.3 Current Projects in DACs

The IRWMP currently includes 123 projects that were identified by project proponents as providing DAC benefits. Six of these projects were identified during the IRWMP project review process as providing environmental justice benefits. A majority (approximately 52 percent) of these projects are located in the East Bay Subregion. Approximately 20 percent of the DAC projects are located in the North Bay Subregion, while the South and West Bay Subregions contain less than 10 percent each. Approximately 20 percent of DAC projects are regional projects or are located in more than one Subregion.

A majority of projects identified as providing DAC benefits are aimed at implementing low impact design features to control stormwater, improving levees and other flood control facilities, developing climate change adaptation strategies, restoring habitat or providing education and outreach to involve the community (including DACs) in watershed stewardship and protection efforts. In addition, a considerable number of wastewater treatment and recycled water projects were identified during the review process as providing DAC benefits.

Examples of projects that would provide environmental justice and DAC benefits include:

- Retrofit streets in DACs with low impact development features to control stormwater
- Conduct outreach to involve DAC communities in watershed stewardship activities
- Install stormwater retention and groundwater recharge facilities to improve flood protection
- Fund trash capture infrastructure and tracking tools for DACs
- Create seasonal wetlands to provide habitat and flood control benefits to a DAC

- Improve water supply reliability through the development of local groundwater and recycled water supplies
- Restoring Native American cultural resources and accessibility for Tribal cultural continuance

7.11.4 Potential Effects of IRWMP Implementation on DACs

A majority of impacts resulting from implementation of DAC projects would likely consist of short-term impacts related to construction activities at specific sites. In some cases, implementation of projects that involve construction of new facilities (i.e., recycled water or wastewater treatment plants) could result in impacts such as altered visual character, increased noise or increased air emissions from facility operations. However, most of these projects are aimed at upgrading outdated facilities, and are expected to reduce negative environmental effects of facility operation.

Potential Benefits

Potential benefits of projects in DACs include improved water quality and reliability, improved flood protection, increased protection from risks associated with climate change, increased awareness regarding water related issues, social investment in watershed health, and increased access to open space and water oriented recreational opportunities. Potential benefits from implementation of wastewater treatment and recycled water projects are the same for disadvantaged communities as they are for other communities in the Bay Area and include reduced wastewater discharge, improved effluent quality, improved water supply reliability and drought protection.

7.12 Effects on Native American Tribal Communities

There are several Tribes with traditional territories in the San Francisco Bay Area whose territories overlap with adjacent IRWM regions including Amah Mutsun Tribal Band, Federated Indians of Graton Rancheria, Kashia Band of Pomo Indians of Stewarts Point Rancheria, Federated Villages of Lisjan, Him-R^n , the Muwekma Ohlone Tribe, and the Association of Ramaytush.
The Amah Mutsun Tribal Band's traditional territories extend into the southern portion of the SF Bay IRWM region and into the adjacent Santa Cruz and Pajaro River Watershed IRWM regions.

The Federated Indians of Graton Rancheria are a federally recognized Tribe in the North Bay Area with designated territories in Marin County and southern Sonoma County. The Tribes has expressed concern about potential impacts to cultural resources from project activities. The Tribe participated with the Sonoma CWA in development of their Stream Maintenance Program, which identifies soil disturbing activities as the primary source of impacts to cultural sites and identify mitigation measures to protect those sites near streams. Federated Indians Graton Rancheria is also concerned about sea level rise and are investigating how it affects cultural sites, which include Angel Island and the San Rafael islands, among many other coastal areas. Tidal marsh restoration has been identified as an adaptation strategy in response to sea level rise. Creek mouths are of particular interest because of the interchange between tidal and fluvial systems, and these locations are typically where artifacts and cultural sites may be located.

The traditional territories of the Muwekma Ohlone Tribe includes the following counties: San Francisco, San Mateo, most of Santa Clara, Alameda, Contra Costa and portions of Napa, Santa Cruz, Solano and San Joaquin.

The Lytton Rancheria Tribe operates the San Pablo Lytton Casino in the East Bay even though it is outside of their territory, which is north of Santa Rosa, and consequently outside of the Bay Area region.

Potential Benefits

The main potential benefit for the inclusion of Tribes in the Bay Area IRWM is increased awareness of regional activities for Tribal communities. Allowing Tribes to be a part of the decision-making process from the start rather than towards the end of conversations will prove to make a difference in meaningful relationship-building between governments. Projects that improved water quality and reliability, improved flood protection, increased protection from risks associated with climate change, increased awareness regarding water-related issues, social investment in watershed health, and increased access to open space and water-oriented recreational opportunities are some of the traditional ecological knowledges that Tribes will be more familiar with, since they have been stewarding these lands for hundreds of years. Like all other communities of the Bay Area, Tribes will benefit from the implementation of wastewater treatment and recycled water projects, reduced wastewater discharge, improved effluent quality, improved water supply reliability, and drought protection.

7.13 References

BACWA Water Survey Results, November 2011.

California Department of Water Resources (DWR), State Water Resources Control Board, California Bay-Delta Authority, California Energy Commission, California Department of Public Health, California Public Utilities Commission, California Air Resources Board, 2010. 20x2020 Water Conservation Plan, February 2010.

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Chapter 8: Performance and Monitoring

The Integrated Regional Water Management Plan (IRWMP) is a dynamic document and its success is related to how well its goals and objectives are accomplished, at both the Plan and project levels. This chapter presents the approach to implementing the IRWMP: the institutional structure and parties responsible for plan implementation and monitoring, ongoing data management, and how performance data will be used to improve future versions of the Plan. The intent is to ensure:

- Progress is being made towards meeting the objectives in the Plan.
- Projects listed in the Plan are being implemented
- Projects are monitored to comply with all applicable rules, laws, and permit requirements.

IRWMP objectives and regional priorities will continue to be reviewed for relevance and modified as needed to ensure the Plan reflects changing regional needs and continues to be effective. Additionally, the list of projects will be reviewed and evaluated every five years, or as needed, to ensure that Plan objectives will be met, that the Plan projects offer the greatest benefit possible and that the list of Plan projects continues to address IRWMP objectives as well as state and regional priorities. This ongoing review and update will allow the plan to evolve in response to changing conditions and as better data is developed. IRWMP revisions will result in:

(1) An updated evaluation of information and data related to watershed conditions

(2) An evaluation of projects/actions and their contribution to meeting IRWMP objectives

(3) Revised objectives, strategies, and projects based on new conditions and past project successes

8.1 Overview of Bay Area IRWMP Implementation Approach

Participants are planning to adopt the IRWMP by the end of 2019. Following adoption, the Plan will be implemented through execution of projects by their respective project proponents. Progress toward attaining the regional goals and objectives will be reviewed periodically and additional work will be completed on the IRWMP as needed through an adaptive management framework.

IRWMP updates and subsequent re-adoption by the parties responsible for development and implementation of the Plan will occur as appropriate in response to significant material change to the IRWMP or events such as:

- Significant change in environmental and/or economic conditions as defined by the Coordinating Committee (CC) with input from the Stakeholders.

- The need, as determined by the CC with Stakeholder input, to revise or establish new regional objectives and/or strategies.

8.2 Institutional Structure and Responsibilities

8.2.1 Role of the CC

The institutional structure for overseeing IRWMP development is the CC and the CC will continue to be responsible for the Bay Area IRWM planning and plan management. This body includes participation by agencies with a broad range of water management interests, including: water supply, water quality, wastewater, recycled water, flood protection, stormwater management, watershed management, habitat protection and restoration, and land use planning. In addition, resource and regulatory agencies, non-governmental organizations (NGOs), environmental groups, business groups, the public, and other interested parties serve in an advisory role. Responsibilities of the CC include overseeing the Plan development process, participating in and facilitating outreach activities, reviewing and directing assessment methodologies, and making day-to-day decisions necessary to guide IRWMP development and implementation. The roles and responsibilities of the various participants envisioned to carry out the broad purposes of the governance structure have been described in Chapter 1: *Governance*.

Since development of the original plan, the CC has demonstrated the ability to:

- Work together and reach consensus on key decision points, despite the large geographic scope of the Region, the diverse water resource management interests represented, and the short timeframe for Plan development;
- Foster coordination, collaboration and communication across a diverse array of water resources management entities throughout the Region;
- Provide a forum for involvement by resource agencies, environmental justice groups and other interested parties though targeted outreach efforts and public workshops throughout development of the Plan;
- Develop and promote a unifying vision that reflects the water resources needs for the Bay Area Region, and guide the development of goals and objectives, integrated water management strategies, and priorities for the Bay Area Region;
- Manage the entirety of the Plan development process including: contract compliance for the planning grant; management and oversight of a consultant team; web site development; development of a data management system (DMS); and the writing, editing, and production of the IRWMP;

BAFPAA Conference, 2013

- Encourage development of new coalitions and associations (ex: Bay Area Flood Protection Agency Association [BAFPAA] and Bay Area Watershed Network [BAWN]); and

- Develop a process to identify and prioritize projects for grant submittal.

Based on the accomplishments of the CC described above, this organizational structure, or an equivalent structure, will continue to serve as the decision-making and management body of the Plan.

The role of the CC in implementing the IRWMP is described below. The level of effort in each area may depend on the amount of funding and staff resources available.

1. The CC will continue to follow the current structure for coordination and collaboration on implementation issues and provide focused leadership for implementing and updating the IRWMP. Through the ongoing meetings the CC will:
    a. Foster partnerships and facilitate participation by a broad range of water resource management stakeholders, including environmental justice groups, resource agencies, public agencies, environmental groups, and the general public.
    b. Provide a regional forum for cross-jurisdictional coordination.
    c. Oversee continued outreach and data dissemination to stakeholders.
    d. Provide decision-making authority for further development and/or implementation of the Plan.
    e. Define the process of implementation where coordination and collaboration are needed, including IRWMP performance tracking, monitoring and updating, and other mutually agreeable implementation activities.
    f. Periodically review the ongoing institutional structure and discuss whether improvements are needed and propose options for improvements to best serve IRWMP implementation needs effectively and meet the needs of the participating organizations.
    g. Review the information captured in the DMS.
    h. Oversee preparation of the state implementation grant applications.
    i. Review and update the project list as necessary
2. The CC will oversee maintenance of the DMS and provide links to regional and state data systems. The intent of the DMS is to ensure efficient use of available data, stakeholder access to data, and to ensure the data generated by IRWMP implementation activities can be integrated into existing state databases. For more information, see Chapter 9: Data Management.
3. The CC will survey proponents of all the projects identified in the Plan, which will include, both, projects that have been funded through the State grant process and those that have not. The annual or biannual surveys will explore project status, challenges and more and will reflect DWR reporting requirements for funded projects. The CC will identify a subcommittee who will create/review questions for the survey and direct the appropriate persons or consultants to administer the survey and collect results. The results will be presented to the CC and posted on the website.

4. The CC will organize a biannual workshop that includes stakeholders, project proponents and the public, to engage a broader discussion of Plan and project implementation and provide a mechanism for dialogue between the parties. The workshop will also provide a forum to review regional efforts that overlap with BAIRWMP objectives. To the extent possible, other existing efforts, such as the State of the Estuary Conference or other regional water forums will be leveraged to enhance dialogue.
5. The CC will be responsible for monitoring progress toward meeting IRWMP objectives and monitoring project proponents' progress in implementing projects.

The CC will not be responsible for carrying out individual projects or programs in the IRWMP. In addition to the CC, the other subset of the Stakeholder Group critical for Plan implementation is the project proponent, as described below.

8.2.2 Project Proponents' Roles and Responsibilities

Project proponents are those IRWMP Stakeholder agencies or entities that have projects included in the Plan. Information on each of the IRWMP Projects and a summary list of all IRWMP Projects is maintained in a database at http://bairwmp.org/projects. It is envisioned that project proponents will have the roles and responsibilities described below (note that while all project proponents are encouraged to update the CC on their projects, these tasks are aimed at projects receiving funding).

1. Prepare project-specific monitoring plans prior to the start of project construction or implementation.
2. Conduct project-specific monitoring activities in accordance with the project-specific monitoring plan.
3. Seek opportunities to integrate, where possible and practical, IRWMP Projects in order to most-efficiently achieve the regional objectives. This process may be facilitated at regional, Subregional and/or Stakeholder meetings (including the biannual meetings initiated by the CC) as well as the project review process, but project proponents are also encouraged to seek these opportunities outside of that forum.
4. Provide updated project-specific information for the project database as necessary to reflect major project milestones (e.g., California Environmental Quality Act (CEQA) completion, 100% design, construction underway, construction complete, and project completion). Although this particular role is not a requirement, it is in the best interest of the project proponents to keep the database current, so the most updated information is used to evaluate projects as outside funding sources become available. Furthermore, projects that have received funding will not be included in subsequent grant proposals unless updates have been completed.
5. Identify a point person for each project who will provide in a timely manner to the CC and/or consultant, requested information for projects selected for inclusion in a grant application.
6. Identify a point person for each project who will provide in a timely manner to the Grantee and/or consultant, requested information for projects selected for funding through a funding agency.

7. Comply with grant requirements, as identified by the funding agency, in order to qualify for grant funding.

8.3 Monitoring Performance

IRWMP performance will be assessed at two levels: the project level and the Plan level. The Plan is framed around regional goals and objectives that all contribute to the overall vision of sustainable water resources management within the Bay Area (see Chapter 3: Objectives). Assessment of plan performance is necessary to evaluate how effectively the Plan is achieving these regional goals and objectives. Progress toward achieving these objectives or the need to modify priorities in response to regional changes will be assessed periodically, as availability of funding allows. The methods to be used in assessing Plan and project performance are described below.

8.3.1 Monitoring Plan Performance

As described in previous sections, and assuming sufficient funding and resources are available, future work on IRWM planning and implementation will be completed with guidance from the IRWMP CC. The water management issues facing the Bay Area Region will change over time as environmental conditions change, and new regional interests and goals emerge. Recognizing that goals, objectives, and regional priorities evolve over time, the CC will review this Plan periodically, depending on changing conditions as future work is performed, and make adjustments as necessary to respond to changes throughout the Region. As part of this process, the CC will collect the information gathered by a variety of sources to assess IRWMP performance in contributing to regional goals, objectives, and IRWMP vision. As discussed in Chapter 3, the CC developed suggested measures to guide project proponents, to allow progress of the individual projects to be measured and to gauge the impact of the overall IRWMP. The CC will use the measures in Chapter 3 to evaluate progress toward achieving the IRWMP goals and objectives.

SFEI Sediment Study

It is anticipated that plan performance will be evaluated every two years, based on the information collected in the DMS, by assessments performed by project proponents at the project level, surveys, and other relevant documents and stakeholder input.

In addition, there are a variety of ongoing monitoring programs currently in place in the Bay Area that the IRWMP CC may leverage to support the assessment of plan performance. Table 8-8 lists several of the existing Bay Area monitoring programs that the CC may elect to use in support of its assessment of progress toward the IRWMP regional goals as future work is completed.

Table 8-8 does not represent a comprehensive listing of water resources monitoring programs throughout the Region. Recognizing that the status of IRWMP project implementation will evolve with Plan implementation and the type of monitoring best suited for assessing Plan performance will change accordingly. The CC will evaluate the utility of various ongoing monitoring efforts for assessing Plan performance over time. It is anticipated that the CC will use a subset of the programs presented in Table 8-8 in conjunction with other monitoring programs not included in this table to assess the Region's progress toward achieving its goals and objectives as appropriate.

Besides data collected by agencies in their resource management roles, as part of the IRWMP, stakeholders are invited to provide data, reports, or studies to benefit information contained in the IRWMP.

Table 8-8: Existing Monitoring Efforts

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
Local Policy Survey	Association of Bay Area Governments (ABAG)	Availability of vacant land, timing of future development, type of future development, density of development, transportation, land use policy and other land use related factors that could affect development.	ABAG, Local governments	Ongoing
The San Francisco Estuary Institute Regional Monitoring Program	SFEI	Monitors contamination in the Estuary. Determines spatial patterns and long-term trends in contamination through sampling of water, sediment, bivalves, bird eggs, and fish, and evaluates toxic effects on sensitive organisms and chemical loading to the Bay. The Program combines RMP data with data from other sources to provide for comprehensive assessment of chemical contamination in the Bay. http://www.sfei.org.	SFEI	Annual
The State of San Francisco Bay Report	ABAG	Science-based assessment of the health of San Francisco Bay, focusing on the water, habitats, living resources, ecological processes, and stewardship. http://www.sfestuary.org/	San Francisco Estuary Partnership (SFEP)	every five years
Air Quality Monitoring	Bay Area Air Quality Management District	Regional monitoring for a variety of weather elements:	BAAQMD, ARB	Ongoing

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
	(BAAQMD), California Air Resources Board (ARB)	Wind, Rainfall, Air Quality, Air Temperature, etc.		
Bay Area Protected Lands Database	Bay Area Open Space Council	Maps of protected public and private open space lands throughout the Bay Area.	Bay Area Open Space Council	Ongoing
Watershed Sanitary Surveys	California Department of Public Health (CDPH)	Agency specific documents which assess existing water quality within a watershed and identify specific water treatment processes for the source waters for the purposes of human consumption.	Water supply agencies	Updated every 5 years
San Francisco Estuary Invasive Spartina Project	CALFED, U.S. Fish and Wildlife Service (USFWS) Coastal Program, National Fish and Wildlife Foundation, State Coastal Conservancy (SCC)	Conducts monitoring and regional mapping of spartina in order to perform eradication activities.	CALFED, USFWS Coastal Program, National Fish and Wildlife Foundation, SCC	Ongoing
California Partners In Flight (CalPIF) Study Area Database	CalPIF	Standard bird monitoring sites and provides a repository for species breeding status information for the entire state.	CalPIF, Point Reyes Bird Observatory	Ongoing
Drinking Water Source Assessment and Protection Program (DWSAP)	CDPH	Monitors and assesses the quality of surface and groundwater sources according to federal and state standards for drinking water. Identifies potential contaminating activities within the source watershed.	Water supply agencies	Updated when deemed necessary by CDPH
California Natural Diversity Database (CNDDB)	California Department of Fish and Wildlife (CDFW)	Data repository for endangered/native species sightings and population locations, but no	CDFW	Ongoing

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
		comprehensive monitoring program.		
CalFish.org	CDFW	CDFW maintains a database with fish range and habitat information, but no comprehensive monitoring program.	CDFW	Ongoing
California Statewide Groundwater Elevation Monitoring (CASGEM)	DWR	Groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins.	Local Monitoring Entities	Every five years beginning in 2015
Flood Control Facilities	Flood control agencies	Monitoring of catch basins and storm drains near the urban/wildland interface during storms; Debris monitoring and monitoring activities, erosion repair activities, removal of excessive vegetation and reshaping of stream banks for improved flow in rivers and streams.	Flood control agencies	Ongoing
Monitoring Avian Productivity and Survivorship (MAPS) Program	Institute for Bird Populations	Assesses and monitors the vital rates and population dynamics of over 120 species of North American land birds.	Institute for Bird Populations	Ongoing
Bird Counts	National Audubon Society	Christmas Bird Count, Great Backyard Bird Count, and the Feederwatch Bird Count.	National Audubon Society	Ongoing
Songbird Populations	Point Reyes Bird Observatory	Long-term monitoring of songbird populations for the past 30 years.	Point Reyes Bird Observatory	Ongoing
National Pollutant Discharge Elimination	Regional Water Quality Control Board (RWQCB)	Wastewater Treatment Plants/Publicly Owned	POTWs	Ongoing

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
System (NPDES), Waste Discharge Requirements (WDRs)		Treatment Works (POTWs) are required to monitor for the following: Carbonaceous Biochemical Oxygen Demand (CBOD), total suspended solids, oil and grease, chlorine residue, pH, fecal coliform, and toxicity in effluent discharged. Annual Self-Monitoring reports are required.		
Regional Wetlands Monitoring Program	SCC	Utilize GIS mapping of wetland projects, the California Rapid Assessment Method of wetland conditions, and other tools to monitor wetlands on a regional scale.	U.S. Environmental Protection Agency (US EPA), SCC, San Francisco Estuary Institute (SFEI)	As funding allows
Groundwater Ambient Monitoring and Assessment (GAMA) Program	State Water Resources Control Board (SWRCB)	Statewide groundwater quality monitoring and assessment program mandated by the Groundwater Quality Monitoring Act of 2001. Participation by private drinking well operators is encouraged through the Voluntary Domestic Well Assessment Project. The San Francisco Bay Region is assessed in two hydrogeologic provinces.	SWRCB, U.S Geological Survey (USGS), voluntary local participation	Regional Assessments every 10 years, trend monitoring every 3 years
NPDES, Municipal Stormwater Permits	SWRCB	Issued to countywide collaboratives for management plan-based approach to implementing	Local municipalities and agencies	Permits are renewed every 5 years

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
		stormwater pollution prevention BMPs. The permit conditions require monitoring of BMPs.		
Nonpoint Source (NPS) Control Program-Tracking and Monitoring Council	SWRCB	Monitors NPS pollutant trends and impairments in the Bay Area. Evaluates effectiveness and success of projects and programs funded by the NPS program that are designed to protect and restore water quality. Coordinates with the SWAMP program.	SWRCB, RWQCBs, SCC, USEPA, National Oceanic and Atmospheric Administration (NOAA)	Ongoing
Surface Water Ambient Monitoring Program (SWAMP)	SWRCB	Statewide monitoring effort designed to assess the conditions of surface waters in streams, rivers, lakes, and estuaries throughout the state. Monitoring efforts vary by RWQCB. However, sampling methods are standardized across the State.	RWQCB	As funding allows
Regional Monitoring Program for Trace Substances for San Francisco Bay	SWRCB	Monitoring of contaminant concentrations and toxicity levels in water and aquatic species of the San Francisco Bay.	SFEI, RWQCB	Ongoing
Bay Area Macroinvertebrate Bioassessment Information Network (BAMBI)	SWRCB	Currently being developed to utilize rapid bioassessment techniques in order to determine the distribution and population counts for macroinvertebrates in the Bay Area.	SWRCB, Municipalities	Under development

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
Bird Breeding Survey	USGS Patuxent Wildlife Center	Population data and population trend analyses on more than 400 bird species.	USGS Patuxent Wildlife Center	Ongoing
Habitat Conservation Plans	Various agencies and organizations	Conservation planning for special-status species in a defined geographic area; Contains mitigation to offset development and monitoring requirements to measure success of restored and protected areas.	Various agencies and organizations	Varies
Annual Self-Monitoring Recycled Water Reports	Wastewater/water/recycled water agencies	Reports on recycled water analysis, recycled water used, list of users, total daily deliveries, site inspections, effluent violations and corrective actions, updates to future plans to expand recycled water program and any special studies or projects.	Permitted wastewater/water/ recycled water agencies	Annual, due March 15
Source water quality monitoring	Water supply agencies	Monitoring for contaminants such as radionuclides, organic chemicals, inorganics, and microbes in source and treated supplies	Water supply agencies	Varies/ongoing
Treated water quality monitoring	Water supply agencies	Monitoring for contaminants such as radionuclides, organic chemicals, inorganics, microbes, disinfectants, and disinfection byproducts in treated supplies	Water supply agencies	Varies/ongoing

8.3.2 Monitoring Project Performance

As part of the IRWMP performance assessment, the projects will be evaluated with respect to stated performance measures. Assuming adequate funding and resources are available, the agencies identified as proponents of priority projects will be responsible for implementing the project as well as project-specific monitoring strategies. As shown in Table 8-9, project proponents will be responsible for collecting project information, including project implementation status, throughout implementation. In addition, the project proponents will assess project performance with respect to the stated performance metrics for the project on a quarterly basis, or as dictated by the reporting requirements associated with the funding source. Projects that are included in the Plan, but are not funded will be encouraged to follow a similar monitoring and reporting plan. Project proponents will be asked to provide monitoring and reporting information on their projects on an annual or bi-annual basis, through survey requests associated with the projects database (DMS) housed on the IRWMP website.

The CC will utilize the performance measures identified by the project proponents in the monitoring plans to measure progress. Project specific monitoring plans shall reflect the DWR requirements identified in the 2016 Guidelines which include the following:

1. A description of what is being monitored/performance measures. Examples include:
   - Number of innovative flood management projects
   - Number of projects that benefit water quality of 303(d) listed stream parameters
   - Miles of natural streams restored and/or rehabilitated
   - Increase in local water supplies (in Acre-feet per year [AFY])
   - Acres of invasive species cover
   - AF water storage and conjunctive management of surface and groundwater resources
   - Megawatt or kilowatt reduction in energy use,
   - Climate mitigation and adaptation strategies such as reduction in greenhouse gas emissions
2. A description of measures to remedy problems encountered during monitoring.
3. A description of the location of monitoring and monitoring frequency.
4. A description of monitoring protocols and methodologies, and assignment of the responsibility for monitoring.
5. A description of what data will be shared with the IRWMP Stakeholders and with what frequency. Identification of what state databases information will be provided to, and requirements for data submittal.
6. Resources and procedures to ensure the monitoring schedule will be maintained (e.g., identify responsible parties and alternates and funding for monitoring).

Napa River Fish Monitoring

Metrics are intended to serve as measurable benchmarks for establishing success of projects following implementation. A sample of potential metrics that are being used in measuring project implementation performance are presented in Table 8-9. These IRWMP projects are complete and reflect specific project goals. Each project implemented will include its own set of metrics and monitoring strategies and as projects become further developed, metrics may evolve to better capture the performance of projects with respect to meeting project objectives.

Table 8-9: Sample Project Performance Measures and Monitoring Strategies

Project Name	Targets	Performance Metrics	Monitoring Strategy
Bay Area Regional Conservation and Education Program	• Replace 2,250 high-water using toilets with high-efficiency Toilets, and achieve total 38 AF water savings • Install 51,000 high-efficiency washers and achieve a total of 1,400 AF. • Hold 20 water-efficient gardening events, 10 professional training courses • Distribute 2,000 water-saving pocket guides • Install 400 weather-based irrigation controllers and achieve 50 AF water savings	• Number of Rebates issued over course of the program • Actual demand reductions/water savings achieved • Customer satisfaction with program • Increased public awareness about efficient landscaping practices • Number of informational materials issued	• Track number of rebates issued and associated water savings. • Monitor water demands to track reductions over time. • Survey program participants • Track number of events held, participants, and education materials distributed
East Bayshore Recycled Water Project Phase 1A (Emeryville)	• Offset potable water use by 2,800 AFY with recycled water	• Reduced potable water demand • Flow measured at treatment plant	• Flow meter monitoring at treatment plant • Water use monitoring/meter readings at customer sites
Lagunitas Creek Watershed Sediment Reduction and Management Project	• Replace existing undersized, failing culverts with culverts sized for 100-year storm event • Reestablished engineered fills to support transmission line • Reestablish and stabilize trail road surface to engineered specifications for travel • Allow upstream and downstream passage for salmonids • Increase channel capacity at stream crossing	• Integrity of trail at improved stream crossing and ability to pass at 100 year storm flows • Improved reliability of water conveyance through transmission line • Improved integrity of trail surface for use by recreational uses • Passage of salmonids at improved crossings • Hydrologic capacity of streams at improved crossings	• Site inspections and photo monitoring • Streambed monitoring surveys • Evaluate records of conveyance of water through secured transmission line • Salmonid surveys and monitoring • Pre- and post-construction photographic and video documentation of hydrology

Project Name	Targets	Performance Metrics	Monitoring Strategy
Marin/Sonoma Conserving Our Watersheds: Agricultural BMP Projects	• 50-75% reduction in fine sediment delivery from fencing and revegetation practices • 60-90% reduction in nutrient and pathogen loading • Survival of at least 80% for revegetation projects • Increase native riparian tree & shrub cover by 65% for revegetation projects • Increase woody plant species richness in the riparian zone by 50% for revegetation projects	• Number of management practices completed • Miles of stream fenced • Linear feet of streambank repaired • Reduction in fine sediment delivery • Increase in percent bank stability • Number and survival of planted trees. • Increase native tree and shrub cover, and diversity.	• Monitoring conducted based on CDFW Salmonid Stream Habitat Restoration Manual, USDA NRCS Technical Office Field Guide, and Marin Resources Conservation District Riparian Zone Monitoring Plan
Napa County Milliken Creek Flood Damage Reduction, Fish Passage Barrier Removal and Habitat Restoration Project	• Successful fish passage to spawning and rearing grounds in the upper watershed. • Safely convey the 100-year flood. • Protect structures from the 100-year flood.	• Evidence of steelhead spawning activity in reach above former dam location (i.e. presence of redds/nests). • Presence of rearing/foraging juvenile salmonids in reach above former dam site. • Lowered water surface elevation. • Stable longitudinal and cross sectional stream channel profile.	• Steelhead spawner surveys. • Steelhead snorkel surveys. • Photographic documentation. • Site specific water surface and channel field surveys. • Post flood flow high water survey.

Project Name	Targets	Performance Metrics	Monitoring Strategy
City of Oakland Sausal Creek Restoration Project	• Plant 84 native trees within the project area to mitigate for 33 native trees to be removed as part of the project. • Increase population of resident native rainbow trout by 25% at the end of 5 years. • 80% survival rate of newly planted species at end of five years. • Improve diversity of resident and migrating native bird species in project area. • Widen creek corridor to 1.5 times wider than existing channel width.	• Ensure >90% of the preserved native trees survive in the first 5 years. • 5% increase in trout population per year over 5 years. • Survival rate of plants meeting project goals. • Increase diversity of native bird species by 20% at end of 5 years. • Floodprone width.	• Survey retained and newly planted trees for health and survival rates to comply with the City of Oakland Tree Permit. • Fish surveys • Annual plant monitoring through transect counts. • Quarterly bird monitoring. • Annual geomorphic surveys and cross-sections.
Pescadero Water Supply and Sustainability Project	• Supply water for 100 customers for 38+ years. • Improved warning system for pump failure and low tank volume. • 120 toilet/urinal replacements. • 80 washer replacements • High community attendance at workshops or surveys.	• Available drawdown at the new well is at least 90 feet. • Pumping rate is at least 150 gpm to meet the design criteria for the well. • Alarms are activated during pump failure or when water level in tank reaches the low level set point. • 3 AFY reductions in water demand. • Installations are completed and devices are functional.	• Measure drawdown after well installation. • Measure water level in well annually. • Test alarm system monthly. • Track the number of installed high efficiency devices. • Track and compare water meter records from before high efficiency devices are installed to after devices are installed.

Project Name	Targets	Performance Metrics	Monitoring Strategy
Petaluma Flood Reduction, Water & Habitat Quality, and Recreation Project for Capri Creek	• Peak flow reduction to existing out-of-bank flows of 60, 194, and 254 cubic feet per second in 10-year, 50-year, 100-year storms, respectively • Capture and removal of 15-20 cubic yards of debris annually, providing for sediment placement on flood terrace. • Provide 5 acres of enhanced habitat. • Surrounding residents participate in stewardship programs	• Flood impacts to identified land uses • Debris and sediment removed from flood terrace rather than having debris travel downstream to Petaluma River and toward the Bay. • Use of the restored site by various species. • Citizen participation in monitoring, maintenance, and enjoyment of the creek corridor.	• Observe stream at headwall during storm events. • Track out-of-bank flows and surface flood depths during storm events. • Field surveys and sampling following construction and during a 5-year monitoring period. • Track and record the number of citizens participating in annual maintenance day(s) and other outreach events.
City of Redwood City Bayfront Canal Flood Management and Habitat Restoration Project	• Prevent 250 homes from being flooded • Treat 62 acre-feet of runoff during 1-yr storm, 106 acre-feet of runoff during 5-yr storm, 182 ac-ft of runoff during 25-yr storm • Provide 62 acre-feet of stormwater runoff for habitat enhancement of ponds	• Flood impacts along the Bayfront Canal and Atherton Channel	• Track out-of-bank flows and surface flood depths during storm events.
Regional Groundwater Storage and Recovery Project Phase 1A - South Westside Basin, Northern San Mateo County	• Store 35,000 acre-feet by 2017 for drought supply.	• Amount of stored water in aquifer • Quality of groundwater	• Track elevation of groundwater • Monitor Water Quality

Project Name	Targets	Performance Metrics	Monitoring Strategy
Richmond Breuner Marsh Restoration Project	• Create, restore or enhance approximately 60 acres of wetlands and 90 acres of coastal prairie upland habitat. • Increased public access for recreation and public education	• Increase in presence of marine, intertidal, and upland species. • Acres created or restored • Vegetation Cover and Type • Increased hydrologic capacity/function • Public use for recreation • Participation in educational events	• Annual surveys of Sediment Stakes, Staff Gages, Tidal Prism • Track public visitation • Track participation in educational events
Roseview Heights Infrastructure Upgrades for Water Supply and Quality Improvement, Santa Clara County	• Replace unengineered redwood water tanks with seismically engineered bolted steel tanks. • Eliminate water leakage (300,000 gallons/month) from tanks • Increase useful life of galvanized water mains. • Reduction of chlorine levels to 0.2 chlorine residual throughout entire system	• New tanks constructed. • Source meter reading (San Jose Water) closely matches meter readings per individual customer usage. • Water clarity and chlorine residuals at the farthest end of the distribution system.	• Track meter readings monthly at the source • Track customer meter reading quarterly • Perform annual tank maintenance and valve exercise plans • Standard monthly water testing • Test TTHM and HAAS annually
San Francisco Bay Climate Change Pilot Projects Combining Ecosystem Adaptation, Flood Risk Management and Wastewater Effluent Polishing	• Develop capacity to store up to 8 million gallons of secondary treated wastewater for up to 6 hours. • Capacity for more frequent peak flows – up to 5 MG of wastewater for up to 6 hours for 3 to 5 events per year. • Increase acceptance for ecotone slopes	• Equalization facility built. • Storage availability/capacity as required. • Generation of peer reviewed journal papers • Conceptual design of 2 additional pilot projects which incorporate lessons learned from this project • Presentation of results to BACWA and other regional entities	• Monitoring plan to be developed Sign off by OLSD following project completion • OLSD report on facility functionality • Outreach document in quarterly reports and papers and posted on the website

Project Name	Targets	Performance Metrics	Monitoring Strategy
San Francisco International Airport Industrial Waste Treatment Plant and Reclaimed Water Facility	• Upgrade facilities to treat 1.6 MGD of industrial wastewater and first flush storm water to a higher quality. • Use 100% recycled water for all non-potable water demands. • Reduce occurrence of illicit discharges by upgrading IW infrastructure.	• Increase in effluent quality entering the Bay. • Percent decrease in quantity of effluent being sent to the Bay. • Percentage decrease in annual potable water use. • Percentage increase in annual recycled water use for non-potable purposes. • Annual reduction in infrastructure breakdowns and violations for the IW treatment plant.	• Water quality testing of effluent • Water metering to measure reduction in effluent being sent to the bay, reduction in potable water use, and increased amount of recycled water use. • Survey of work order and history logbooks
San José Green Streets & Alleys Demonstration Projects	• Reduce impervious surfaces by over 55,000 square feet and create up to 32,500 square feet of biorention rain gardens to treat runoff. • Install 5,000 square feet of permeable pavers. • Capture and infiltrate 334 pounds of Total Suspended Solids (TSS) per year. • Infiltration trenches and dry wells will be designed to capture, store, and infiltrate 80% of the annual runoff from the alleys and tributary areas of adjoining properties	• Decrease in Total Suspended Solids (TSS) using the Spreadsheet Method (CPSWQ, Inc). • Significant pollutant load reductions.	• Track pollutant loads • Bay Friendly certification maintenance methods • Pre- and Post-construction water quality monitoring • Final report discussing findings

Project Name	Targets	Performance Metrics	Monitoring Strategy
San Pablo Rheem Creek Wetlands Restoration Project	• Create and establish up to 4.82 acres of seasonal wetlands on an approximately 10 acre site adjacent to Rheem Creek. • Preserve 5.2 acres of upland watershed. • Confirm that created seasonal wetlands have been established within 5 years. • Wetlands will accommodate Rheem Creek overtopping during storm events.	• Seasonally flooding: soils will pond and/or saturate for long (>7 days) to very long (>30 days) continuous durations. • The frequency of inundation and/or saturation of the restored wetlands shall be a minimum of 18.25 continuous days per year. • Vegetative cover will consist predominantly of native wetland plant species or other wetland species. • Total average wetlands vegetation cover ≥ 60% of reference wetlands by monitoring Year 3 and ≥ 70% by monitoring Year 5. • Improved water quality from Rheem Creek into San Pablo Bay.	• Annual reports according to USACE and SF RWQCB Mitigation Monitoring and Reporting Plan (MMRP) • Evaluate amount, character and quality of wetlands through Aerial photography, Field surveys, GIS analysis • Monitor water quality and flood management • Track large storm events in annual reports.

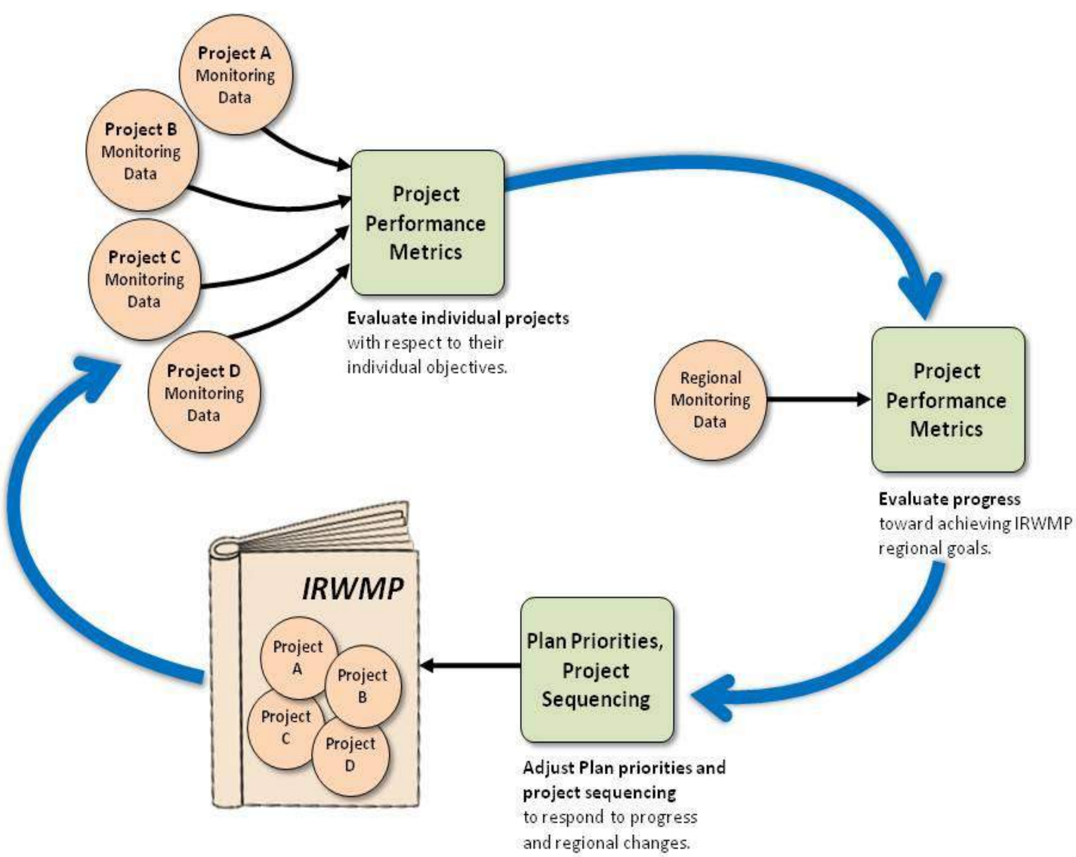
Project Name	Targets	Performance Metrics	Monitoring Strategy
St. Helena Upper York Creek Dam Removal and Ecosystem Restoration Project	• Provide upstream passage to 1.7 miles of spawning and rearing habitat for steelhead and habitat connectivity for both anadromous and resident fish and other aquatic and riparian species • Restore approximately 2 acres of degraded riparian and aquatic habitat within the existing upper dam and reservoir area. • Natural transport of gravel materials and organisms downstream. • Reduce downstream fine sediment releases.	• Noticeable trout and salmon in the creek. • Revegetated ecosystem with plant, animal and fish life. • Reduction of dead fish along stream banks • Minimization of downstream fine sediment delivery resulting in mortality of aquatic organisms • Riparian, aquatic and habitat regrowth in the project area. • Terrestrial wildlife reintroduction.	• Visually inspect the area three times per year for the first three years following the project completion
Students and Teachers Restoring a Watershed (STRAW) Project—North and East Bay Watersheds	• Restore a minimum of 15,000 linear feet of wetland/riparian habitat • After 5 years, restoration sites will have achieved a riparian bird index (RBI) that rates as "good" or "excellent." • Achieve a minimum of 75% survival rate for planted native vegetation • 3,500 volunteers annually. • 80% increase of participants' environmental knowledge, skills and attitudes through STRAW workshops, classroom activities and restoration projects.	• Linear feet of each project/increased density of native vegetation • Planted native vegetation percent survival and vigor. • Number of people participating in various STRAW activities. • Percent of participants who indicate a positive change in their environmental knowledge, skills and attitudes after participation in a STRAW activity.	• On ground measurements/ photomonitoring • Area search surveys will be conducted on plots that are 0.5-1.5 hectares in area. • Monitor plant survival rate and vigor by species • Track number of participants that participate in STRAW activities. • Survey a subset of participants through written and on-site assessments.

8.4 Mechanism for Adapting Project Operations

Water resources management issues facing the Bay Area Region evolve over time in response to continually changing regulations and other emerging issues. Projects were identified as top priorities for regional implementation based on their ability to address goals and objectives. As the Region's goals and objectives evolve over time, the ability of projects to address these goals and objectives will similarly change. In addition, project performance will be periodically assessed with respect to established performance measures. Maintaining flexible project operations will allow projects to adapt to the changing needs of the Region while performing well with respect to performance measures.

Figure 8-2 presents the circular relationship between the data collection at the project and the regional level and how these results are used to modify the IRWMP priorities and project sequencing, which then in turn could change the monitoring program.

Figure 8-2: Adaptive Management Cycle



Each project identified in this IRWMP has a lead project proponent that has agreed to oversee project implementation. The project proponent will be responsible for ensuring that project operations are adjusted as appropriate based on the changing needs of the Region. As future work is completed, the CC will recommend whether changes to the Region's goals, objectives, and needs should be considered. In response to the CC assessment, and considering the project's performance with respect to its performance measures, project proponents will be responsible for identifying and adjusting project operations as appropriate and feasible. The relationships between project performance, Plan performance, and adjustments to the regional goals are illustrated in Figure 8-2.

Additionally, as future work is completed, the CC may recommend revisions to project priorities and sequencing based on past performance. For example, should certain San Francisco Bay Total Maximum Daily Loads (TMDLs) be achieved and water quality improved in certain watersheds, the IRWMP CC may recommend that projects addressing those TMDLs no longer be considered the highest priority projects for regional implementation. Regional implementation priorities will evolve as regional goals and objectives change over time, and as the Region progresses toward attainment of those goals and objectives.

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Chapter 9: Data Management

9.1 Overview of the Data Needs within the Bay Area Region

As part of IRWMP implementation, data will be collected to support assessment of project and Plan performance.

A primary data need within the Bay Area IRWM Region is to collect and maintain accurate, reliable, and current data about the projects that are included and have received IRWM grant funding under the IRWM Plan. Data will be gathered at the project level to assess the performance of projects in meeting their objectives, and to gauge the region's progress toward achieving its goals.

Project overviews are routinely developed to allow stakeholders to quickly familiarize themselves with each project. Metadata collected for each project includes things like keywords, location data, participating organizations, budget, status, etc. In order to develop a robust metadata ontology[19], standards including FGDC and CERES have been consulted and cross-referenced. The CC will make periodic calls for project proponents to update their information. This will help to ensure that the project information is current. As the data needs of the Region continue to evolve, the project metadata schema can be updated by appending new fields to the existing ontology. It is also necessary to be able to browse and search projects based on a variety of criteria including keyword, location, Functional Area, participating people and organizations. By addressing these needs, the CC will ensure that the projects directory provides a useful platform for the future planning needs of the region.

It is also necessary to gather and manage contact information for the BAIRWMP stakeholders, with an easy way to search and browse the directories of key people and organizations active in the Region. This contact information will also be organized into email lists for use in updating stakeholders, agency representatives, and project proponents regarding ongoing activities in the region as well as important opportunities and deadlines.

The Region's data management system also needs to document the planning process and all of its associated meetings and workshops. The contacts directory and lists described above are necessary for organizing and coordinating these events. Meetings and workshops must be announced on the website and presented in context with their related meeting materials. For example, when viewing an event, it should be possible to view the agenda and meeting minutes. It should also be possible to download any handouts and presentations from the meeting, as well as have links to any other online resources that were discussed at the event. These materials should be archived so that they can be organized and accessed as needed after the event.

The Region will also curate topical information libraries or "specialty collections", such as climate change, in a virtual library. This library will hold climate change information, resources,

[19] A metadata ontology is effectively a conceptual "world view" for the information. The BAIRWMP data management system includes fields such as Projects, People, Organizations, Documents, Locations; the ontology is the model of the relationships between those things and how individual metadata fields are managed.

and lists of other sources, which can be added to over time as new material is developed and becomes available. In the future other specialty collections can be added.

In addition to project-specific data generated through project implementation, data collected as part of region-wide monitoring programs is available to support IRWMP assessment at the Plan level. Various local and regional monitoring programs are currently underway throughout the region. Several of these programs are described in Chapter 8 – *Performance and Monitoring,* and are listed in Table 9-2.

The process for managing and disseminating this information to stakeholders is discussed below. In addition, opportunities for data collection have been identified and a process for integrating collected information into statewide programs is described.

Apart from those containing sensitive information, publicly funded data and materials are made available to the public via the BAIRWMP website (www.bairwmp.org) in an easily accessible and searchable format. A sustainable strategy will be adopted to ensure that these documents remain available over time, and are not subject to any particular funding round or consultant's tenure. The formats for resource URLs will be designed to be technology-neutral (e.g., no jsp, asp, php extensions that have remnant proprietary elements). Whenever content is reorganized on the site, redirects will be used to preserve the functionality of existing links that have already been bookmarked or circulated in emails and documents (e.g., PDFs, reports, and meeting minutes).

9.2 Data Collection Techniques

One of the primary methods for gathering data is outreach to the project leads. Periodically the IRWMP CC will contact the project proponents and request that they enter or update their information in the site. Each project proponent will have a personal login for the site that will be used to control access, enforce permissions, and ensure that they have access to the correct content and areas of the site. The Website Subcommittee will be able to modify these permissions and grant additional access as necessary.

Meeting materials will be posted and updated by the meeting organizers and participants. Meeting~~s~~ organizers will enter the metadata for their events including title, description, location, date/time, presenters, etc. They will then be able to upload agendas and minutes. Participants will also be able to upload their handouts and presentation files.

The content for specialty libraries will be gathered via a call to the stakeholders. There may also be some high-level planning undertaken by CC subcommittees to identify potential source documents. These materials will then be cataloged into the BAIRWMP website. The files will be uploaded and metadata will be entered for each resource. This work can be done either by designated members of the consultant team~~,~~ or by the document contributors themselves.

9.3 Approach to Data Management and Dissemination

A variety of steps will be required for IRWMP implementation, including adoption, implementation of priority projects, and updated approaches to data management as needs evolve. Successful completion of each of these steps will require effective data management and dissemination, as described below.

Information will be collected and compiled at several levels as appropriate, including the project level, the Functional Area level, the sub-regional level, and the IRWMP level. At each of these levels, effective data management and dissemination contributes to successful IRWMP implementation. Table 9-10 identifies the types of activities that will be undertaken as part of IRWMP implementation. The level of effort for each activity may vary depending on its need and upon the amount of funding and resources available.

Table 9-10: IRWMP Data Management Responsibilities(a)

Responsible Party	Data Management and Dissemination Task	Frequency
Project Proponents	• Compile and maintain project implementation information through monitoring program implementation • Disseminate project implementation information, as necessary, to meet applicable reporting requirements • Disseminate project implementation information, as appropriate, to Functional Area stakeholder group	• Quarterly, or as dictated by grant reporting requirements. • Annually or bi-annually, in response to FA or CC requests.
Functional Areas	• As appropriate or as requested by CC, consolidate and present regional information, including detailed analysis of one or more water resource management areas	• Periodically
Sub-regions	• As appropriate, consolidate and present information on priority projects and needs within each of the four geographic sub-regions.	• Periodically
IRWMP CC	• Compile information prepared by Project Proponents, Functional Areas, or Sub-regions into regional outlook • Present project-specific information submitted to Bay Area website database by Project Proponents • Disseminate regional outlook to stakeholders	• Periodically

<u>Note</u>: (a) Tasks, frequency, and responsible parties assume adequate funding and other resources are available.

Compiling or reviewing this information on a regional scale will enable the IRWMP CC to communicate effectively about the contribution of IRWMP projects to the region's goals, objectives, and vision.

The type, level, and frequency of data management and dissemination activities and the parties responsible for implementing those activities may change as the IRWMP CC periodically reviews the effectiveness of the ongoing institutional structure. As much as possible, the design of the BAIRWMP website favors a self-service model of data update, where individual project leads and committee members can upload their own data without going through a webmaster or utilizing specialized technology skills. This removes bottlenecks and restrictions from the content-creation process, while still preserving review and permissions structure to ensure quality data and oversight.

9.4 Data Management and Dissemination

A large quantity of information will be developed and collected as part of IRWMP implementation and performance assessment. This information will range from water supply and demand information to recycled water usage, water quality data, floodplain reduction project information, stormwater runoff quality and quantity, and habitat mapping information. Chapter 8 – *Performance and Monitoring*, lists examples of existing Bay Area monitoring efforts, and provides examples of performance metrics and the variety and types of information to be gathered at the project level.

As shown in Table 9-1, data will be collected at the project level, reported and compiled on the website, and then reviewed and disseminated through the website. The data on the website may be further disseminated through other means. Data management and dissemination responsibilities at each level are described below.

The BAIRWMP Coordinating Committee (CC) has prioritized the use of open source software tools for supporting its data management needs. This choice brings several advantages. With open source software, the group has free reign to customize the software as it sees fit and is not locked in to any one vendor. Also, some software tools are being developed by multiple IRWMPs as well as several of the Fish and Wildlife Service's (FWS) Landscape Conservation Cooperatives (LCCs). This approach enables these organizations to share the cost of developing common tools and benefit from the advancements that are externally funded.

The existing BAIRWMP website is based on a metadata-driven Content Management System (CMS), which is a web-based software system concerned with enabling non-technical users to manage web content which is also designed and built around a carefully thought-out metadata schema in order to support effective querying from an increasingly complex body of information. This ensures that even as the site grows to hold a large volume of material, it will still be easily accessible via search and browse tools. The site will include a search engine that automatically indexes all content in the site, including deep-search within Microsoft Office and PDF documents. The group will also carefully design an organizing and navigation system to make it as easy as possible to browse the materials. This will also support visitors who want to learn more about the BAIRWMP and the IRWMP process without looking for a particular resource.

9.4.1 Project-Level Data Management and Dissemination

At the project level, project proponents will be responsible for submitting information on project implementation status as well as evaluating project performance with respect to the performance measures identified for each project, potential examples of which are presented Chapter 3 – *Objectives*, and in Chapter 8: *Performance and Monitoring*.

The BAIRWMP website has been customized with reporting tools for projects funded under Proposition 1, Proposition 84, and Proposition 50. These tools provide an easy-to-use engine for project leads to provide the required reporting information, including financial tracking data as well as narrative reporting based on predefined fields and criteria. The reporting tools provide a means to organize this information for compilation into aggregate reports.

For projects funded through IRWM, quarterly reporting (or intervals as stipulated in grant agreements) is required through the website's reporting tools. Reporting data will be compiled on the website, monitored for completeness, and provided to the state by the agency administering the Implementation Grant or other funding agreement. Proponents of other implemented projects are similarly encouraged to track this information through the website on a regular basis.

The BAIRWMP website will feature a profile in the CMS for each project. These project profiles will be adapted over time to meet the information gathering needs of the CC. They will also function as workspaces where project proponents can upload materials including work plans, budgets, reports, documents, datasets, and more. The workspaces can also be configured as mini-sites for the projects. As many of these projects may not have their own websites outside of the BAIRWMP website, these homepages, or mini-sites, will provide valuable functionality to the project leads. They will enable project proponents to share their successes and tell their stories in ways that are both visually impactful and supported by knowledge-management and other CMS features. Because these sites are nested inside, and powered by, the main BAIRWMP website, the content-generation activity of the project leads will also generate valuable content in the BAIRWMP site.

9.4.2 Functional Area and Sub-region-Level Data Management

Assuming sufficient funding and resources are available, the FA and sub-region groups may each collect data for use in assessing the region's progress toward goals and objectives on an annual basis. FAs may track the following kinds of information:

- WS-WQ Functional Area: Regional water use, water conservation, and population throughout the region.
- WW-RW Functional Area: Amount of recycled water use throughout the region, type of uses of the recycled water, cost of recycled water and new projects.
- FP-SM Functional Area: Number of acres within FEMA flood zone and number of floods and reported damages throughout region.
- HP-WM&R Functional Area: Amounts and quality of habitats conserved, enhanced and restored, status of wildlife populations, land use practices developed and/or implemented.

This data will be indexed and viewable based on Functional Area tagging, and will be disseminated to the Bay Area IRWMP CC to support its periodic IRWMP information update and assessment process. In addition, data will be used in conjunction with the project-level data compiled and managed by the project proponents to assess the region's progress toward achieving its goals in each Functional Area.

The BAIRWMP CMS will feature metadata tags for the functional areas, making it possible to easily browse and search resources by Functional Area. This will become especially important as the content of the site grows in volume. The Functional Area meta-tags will ensure that searching and browsing by Functional Area remains easy and meaningful with a minimum of overhead and human input.

The East, South, West, and North sub-regions may also collect and compile data pertaining to their respective geographic areas on a variety of subjects from time to time, as needed or as requested by the CC. Information collected at the sub-region level may include project-related data such as needs assessments and sub-region priorities, implementation project lists, reporting on project implementation outcomes, monitoring efforts, etc.

9.4.3 Plan-Level Data Management and Dissemination

As described in previous sections, and assuming sufficient funding and other resources are available, future work will be guided by the CC. As part of this process, the CC will collect the information gathered by the Functional Areas and Sub-regions to assess IRWMP performance in contributing to regional goals, objectives, and IRWMP vision. The CC can compile and manage this information, and ultimately disseminate the data to the public.

As future work is completed, the FAs and Sub-regions will provide data to the CC in electronic format. Existing regional data collection sources (such as those identified in Table 8-8) may also be reviewed for their applicability in assessing Plan performance, as resources and funds permit. As appropriate, this data will be maintained, along with project-specific data and information compiled by the Functional Areas, on the BAIRWMP website.

The IRWMP data will be publicly accessible from the IRWMP web portal. While every effort will be made to ensure open, public access to data used in the Plan performance assessment, confidentiality agreements may be required to obtain a portion of the data used to support Plan assessment. In these limited cases, data availability will be managed in a manner consistent with the terms of individual confidentiality agreements.

IRWMP stakeholders and the general public will be informed of the process and online data availability through email announcements and postings on the BAIRWMP website home page. In addition, it is anticipated that future work will include public outreach aimed at encouraging stakeholder participation. Outreach will be used as a forum for generating public awareness and disseminating the information in the data library.

Meeting materials and information on activities of the IRWMP CC will be made available online in a transparent manner. Meeting announcements will be featured prominently and synchronized with email announcements. An archive of past meetings will be kept on the website along with meeting materials such as agendas, minutes, presentations, and handouts. These materials will be archived by year and committee and will be searchable through the site's search functionality. For additional information on anticipated stakeholder involvement during Plan implementation, please refer to Section 14: *Stakeholder Engagement*.

9.5 Existing Data Collection and Monitoring Efforts

Within the Bay Area, several regional, local, and state-sponsored monitoring programs currently exist that monitor the conditions of the Plan's four Functional Areas. The table below shows the programs and responsible parties collecting data. Implementing agencies lead the effort to collect and disseminate monitoring data. The responsible agencies listed below generate the data at the local level. Examples of these existing monitoring efforts are presented in Table 8-1, Chapter 8: *Performance and Monitoring,* and below in Table 8-8. It may be possible to utilize these existing programs to support Plan performance assessment.

Table 9-11: Example Existing Monitoring Efforts

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
Local Policy Survey	ABAG	Availability of vacant land, timing of future development, type of future development, density of development, transportation, land use policy and other land use related factors that could affect development.	ABAG, Local governments	Ongoing
The State of San Francisco Bay Report	ABAG	Science-based assessment of the health of San Francisco Bay, focusing on the water, habitats, living resources, ecological processes, and stewardship. http://www.sfestuary.org/	SFEP	Updated every five years
Air Quality Monitoring	Bay Area Air Quality Management District (BAAQMD), California Air Resources Board (ARB)	Regional monitoring for a variety of weather elements: Wind, Rainfall, Air Quality, Air Temperature, etc.	Bay Area Air Quality Management District, ARB	Ongoing
Bay Area Protected Lands Database	Bay Area Open Space Council	Tracking of protected public and private open space lands throughout the Bay Area.	Bay Area Open Space Council	Ongoing
Watershed Sanitary Surveys	CA Department of Public Health (CDPH)	Agency specific documents which assess existing water quality within a watershed and identify specific water treatment processes for the source waters for the	Water supply agencies	Updated every 5 years

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
		purposes of human consumption.		
San Francisco Estuary Invasive Spartina Project	CALFED, USFWS Coastal Program, National Fish and Wildlife Foundation, SCC	Conducts monitoring and regional mapping of spartina in order to perform eradication activities.	CALFED, USFWS Coastal Program, National Fish and Wildlife Foundation, SCC	Ongoing
California Partners In Flight (CalPIF) Study Area Database	California Partners in Flight	Standard bird monitoring sites and provides a repository for species breeding status information for the entire state.	California Partners in Flight, Point Reyes Bird Observatory	Ongoing
Drinking Water Source Assessment and Protection Program (DWSAP)	CDPH	Monitors and assesses the quality of surface and groundwater sources according to federal and state standards for drinking water. Identifies potential contaminating activities within the source watershed.	Water supply agencies	Updated when deemed necessary by DHS
California Natural Diversity Database (CNDDB)	CDFW	Data repository for endangered/native species sightings and population locations, but no comprehensive monitoring program.	CDFW	Ongoing
CalFish.org	CDFW	DFG maintains a database with fish range and habitat information, but no comprehensive monitoring program.	CDFW	Ongoing
Urban Water Management Plan (UWMP)	DWR	Monitors urban water supply and demand. UWMP and updates approved and deemed complete by DWR.	Water supply agencies	Urban Water Management Plan updates required every five years.
California Statewide Groundwater Elevation	DWR	Groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in	Local Monitoring Entities	Every five years beginning in 2015

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
Monitoring (CASGEM)		California's groundwater basins.		
Flood Control Facilities	Flood control agencies	Monitoring of catch basins and storm drains near the urban/wildland interface during storms; Debris monitoring and monitoring activities, erosion repair activities, removal of excessive vegetation and reshaping of stream banks for improved flow in rivers and streams.	Flood control agencies	Ongoing
Monitoring Avian Productivity and Survivorship (MAPS) Program	Institute for Bird Populations	Assesses and monitors the vital rates and population dynamics of over 120 species of North American land birds.	Institute for Bird Populations	Ongoing
Bird Counts	National Audubon Society	Christmas Bird Count, Great Backyard Bird Count, and the Feederwatch Bird Count.	National Audubon Society	Ongoing
Songbird Populations	Point Reyes Bird Observatory	Long-term monitoring of songbird populations for the past 30 years.	Point Reyes Bird Observatory	Ongoing
NPDES, Waste Discharge Requirements (WDRs)	RWQCB	Wastewater Treatment Plants/Publicly Owned Treatment Works (POTWs) are required to monitor for many constituents including the following: Carbonaceous Biochemical Oxygen Demand (CBOD), total suspended solids, oil and grease, chlorine residue, pH, fecal coliform, and toxicity in effluent discharged. Annual Self-Monitoring reports are required.	Publicly Owned Treatment Works (POTWs)	Annually, Ongoing
Regional Wetlands Monitoring Program	SCC, SFJV	Utilize GIS mapping of wetland projects, the California Rapid Assessment Method of wetland conditions, and other tools to monitor wetlands on a regional scale.	USEPA, SCC, SFJV, SFEI	As funding allows

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
Groundwater Ambient Monitoring and Assessment (GAMA) Program	SWRCB	Statewide groundwater quality monitoring and assessment program mandated by the Groundwater Quality Monitoring Act of 2001. Participation by private drinking well operators is encouraged through the Voluntary Domestic Well Assessment Project. The San Francisco Bay Region is assessed in two hydrogeologic provinces.	SWRCB, USGS, voluntary local participation	Regional Assessments every 10 years, trend monitoring every 3 years
NPDES, Municipal Stormwater Permits	SWRCB	Issued to countywide collaboratives for management plan-based approach to implementing stormwater pollution prevention BMPs. The permit conditions require monitoring of BMPs.	Local municipalities and agencies	Permits are renewed every 5 years
NPS Control Program-Tracking and Monitoring Council	SWRCB	Monitors NPS pollutant trends and impairments in the Bay Area. Evaluates effectiveness and success of projects and programs funded by the NPS program that are designed to protect and restore water quality. Coordinates with the SWAMP program.	SWRCB, RWQCBs, SCC, U.S. Environmental Protection Agency (USEPA), NOAA	Ongoing
Surface Water Ambient Monitoring Program (SWAMP)	SWRCB	Statewide monitoring effort designed to assess the conditions of surface waters in streams, rivers, lakes, and estuaries throughout the state. Monitoring efforts vary by RWQCB. However, sampling methods are standardized across the State.	RWQCB	As funding allows
Regional Monitoring Program for San Francisco Bay	Regulated dischargers	Monitoring of contaminant concentrations and toxicity levels in water and aquatic species of the San Francisco Bay.	SFEI, RWQCB	Ongoing

Program Title	Implementing Agency	Details	Responsible Agency	Update / Sampling Frequency
Bay Area Macroinverte-brate Bioassessment Information Network (BAMBI)	SWRCB	Currently being developed to utilize rapid bioassessment techniques in order to determine the distribution and population counts for macroinvertebrates in the Bay Area.	SWRCB, Municipalities	Under development
Bird Breeding Survey	USGS Patuxent Wildlife Center	Population data and population trend analyses on more than 400 bird species.	USGS Patuxent Wildlife Center	Ongoing
Habitat Conservation Plans	Various agencies and organizations	Conservation planning for special-status species in a defined geographic area; Contains mitigation to offset development and monitoring requirements to measure success of restored and protected areas.	Various agencies and organizations	Varies
Annual Self-Monitoring Recycled Water Reports	Wastewater/water/recycled water agencies	Reports on recycled water analysis, recycled water used, list of users, total daily deliveries, site inspections, effluent violations and corrective actions, updates to future plans to expand recycled water program and any special studies or projects.	Permitted wastewater/water/recycled water agencies	Annual, due March 15
Source water quality monitoring	Water supply agencies	Monitoring for contaminants such as radionuclides, organic chemicals, inorganics, and microbes in source and treated supplies	Water supply agencies	Varies/ ongoing
Treated water quality monitoring	Water supply agencies	Monitoring for contaminants such as radionuclides, organic chemicals, inorganics, microbes, disinfectants, and disinfection byproducts in treated supplies	Water supply agencies	Varies/ ongoing

9.6 Data Gaps and Potential New Data Collection Programs

While extensive water resources monitoring is ongoing in the region, additional opportunities exist for data gathering to fill gaps and expand knowledge about the region's remaining water resources. Some potential additional data gathering opportunities, to fill perceived gaps, are illustrated inTable 9-12. Additional data gathering will occur as time and funding allows.

Table 9-12: Data Gaps and Potential Regional Data Sharing Opportunities

Data Gap	Program Type	Potential Implementing Agency	Program Description
Water Supply-Water Quality			
Regional Groundwater Information	Regional Groundwater Monitoring Program	Groundwater basin managers.	Compile local groundwater monitoring data from throughout the region to conduct an assessment of groundwater quantity and quality for basins within the region. Regional groundwater assessments should be conducted every 5 years.
Wastewater and Recycled Water			
Compilation of Regional Recycled Water Information	Regional Recycled Water Reporting	RWQCB	Regional compilation of quantity and quality of recycled water produced and used within the region. This system would track and encourage utilization of recycled water to conserve potable supplies. Information is already provided to RWQCB.
Flood Protection and Stormwater Management			
Compilation of Regional Impervious Surface Information	Regional Monitoring of Impervious Surfaces	RWQCB	Regional monitoring of trends in urbanization through tracking the extent of impervious surfaces and undeveloped lands with the use of GIS mapping. This information can be utilized when designing restoration efforts and to examine the effects of altered hydrology on streams, and habitats. Additionally, this information will be useful for stormwater and flood control management agencies to assess application of appropriate BMPs and management measures according to the extent of imperviousness in the region.
Compilation of Regional Storm Drainage Information	Regional Storm Drainage Mapping	RWQCB	Collaborative effort to develop a regional map showing locations of creeks, underground culverts, storm drains, and flood control channels. Use the Oakland Museum Creek Maps as an example for a region-wide effort to map storm drainage networks. This information will improve regional efforts for habitat restoration, flood control, and water-quality monitoring.

Data Gap	Program Type	Potential Implementing Agency	Program Description
Non-Point Source Pollution Data	Nonpoint Source Pollution Control Program	SWRCB	The State Water Resources Control Board is developing the Nonpoint Source Pollution Control Program to track and monitor nonpoint source pollution in the Bay Area, but it is not yet effective. The Program could be expanded to compile both runoff quantity and quality information.
Emerging Contaminants Monitoring	Regional Monitoring of Emerging Contaminants	SWRCB	Conduct regional monitoring of emerging contaminants, such as endocrine disrupting compounds, in water, sediment, and aquatic species. Expand upon the existing Regional Monitoring Program for Trace Substances to include emerging contaminants. Extend the Regional Monitoring Program (RMP) to include monitoring of the quality of urban creeks in addition to sites within the San Francisco Bay.
Floodplain Management Information	Regional Monitoring of Floodplains	BAFPAA	Regional mapping and monitoring of floodplains, including acreage protected, connectivity, and management techniques. Monitoring information would facilitate planning, design, and execution of flood-protection projects.
Watershed Management, Habitat Protection, and Restoration			
Regional Stream Channel Maps	Regional Monitoring of Stream Channel Functioning	CDFW	Regional mapping and monitoring of channel bed and bank conditions, including extent of functioning riparian corridors. Regional mapping and monitoring of sediment source, transport, and depositional areas. This information will be useful to monitor the success of creek restoration projects, assess the need for future restoration efforts, and track habitat conditions for wildlife and aquatic habitat. Due to the extent of urbanization in the region, these data should be gathered in conjunction with local flood control and stormwater management agencies.

Data Gap	Program Type	Potential Implementing Agency	Program Description
Regional In-Stream Habitat Information	Regional Monitoring of In-Stream Habitat Conditions	USEPA-Office of Research and Development, CDFW	Expand upon the Western Pilot Environmental Monitoring and Assessment Program (WEMAP) to implement standardized monitoring of in-stream habitat conditions (water quality, fish populations, benthic populations) within the region. Establish protocols and baseline data to assess urbanized habitat conditions.
Regional Wildlife Corridor, Population, and Biodiversity Information	Regional Monitoring of Wildlife Corridors, Populations, and Biodiversity	CDFW	Establish a regional monitoring system for wildlife corridors, populations, and species richness (for amphibians, birds, and mammals). This could expand upon the CNDDB, focusing solely on population monitoring within the region.
Regional Invasive Species Information	Regional Monitoring of Invasive Species	CDFW, USFWS	Regional monitoring program for presence and absence of invasive plant species. The program would provide information to target eradication and restoration activities.
Regional At-Risk Native Species Monitoring	Regional Monitoring of Native At-Risk and Special Status Species	CDFW, USFWS	Regional program to track presence and absence of at-risk native and special status species in the Bay Area.

Due to resource limitations, there are few ongoing efforts that collect and compile data continuously at the regional level. While establishment of regional data collection and management programs such as those described above would provide deeper understanding of the challenges facing the region as it strives to achieve the goals of the IRWMP, the CC has not yet determined if that is best accomplished by better coordination with existing efforts, enhanced where feasible, versus creating any new regional monitoring effort directly under the IRWM Plan.

While such a regional data integration approach may be valuable in concept, it is important to consider the potential costs and administrative/management commitments such an effort would entail. Table 9-12 lists potential implementing agencies for each potential program. Potential implementing agencies were identified based on their wide jurisdiction and access to the data needed to develop the recommended compilations and reports. Implementation of these monitoring and reporting programs would require resources beyond those of the IRWMP CC.

Whether or not the IRWM Plan is the appropriate venue to fill gaps in regional monitoring is a subject that will continue to be explored as the Plan is implemented. Stakeholders, project proponents, regional organizations, DWR, and the public will be invited to engage in a broader discussion of Plan and regional monitoring efforts and needs. This will also provide a forum to review regional efforts that overlap with BAIRWMP Objectives. To the extent possible, other existing efforts, such as the State of the Estuary Conference or other regional water forums will be leveraged to enhance dialogue. After this discussion, Bay Area IRWM Plan participants will be in a better position to determine whether IRWM is the optimal venue to address some of the gaps identified.

9.7 Validation and QA/QC Measures

The data cataloged into the Bay Area IRWM portal will be reviewed by the CC through the Website Committee as it comes online. If the Website Committee members find issues with the uploaded data, they can easily contact the document contributor or original author for corrections or clarifications. Additionally, the gathered data will be subject to ongoing review and correction by the BAIRWMP stakeholders. By providing prominent links to contact the document authors and Website Committee, the Region will encourage the crowd-sourcing of these data corrections. These measures will ensure the review of the gathered data and expedite the process of identifying and correcting any errors or inaccuracies.

9.8 Supporting Statewide Data Needs

As described in Table 8-8, a wealth of information is collected by individual Bay Area agencies and water resource programs. While a limited number of programs compile and assess water resources data for the Bay Area region, it is not clear whether new regional assessments versus more efficient coordination of existing efforts would lead to more useful regional information. As future work is completed, the Bay Area's data library of relevant water resources information and data that have been collected by projects funded through IRWM grants will grow. Whether the library can become a more comprehensive resource throughout the region has yet to be determined. As such, the process represents an important first step toward developing a regional perspective on water resources management information.

The data and conclusions developed through the Bay Area IRWMP assessment process may be used by state agencies for developing regional fact sheets and determining regional funding priorities. In addition, DWR may use the information developed through future work to support updates to the California Water Plan. The California State Water Plan is updated on a five-year cycle. Periodic information updates could be coordinated with the State Water Plan update. Another opportunity for data coordination may be found with the San Francisco Bay RWQCB. The RWQCBs are currently reviewing new data standardization and data provision requirements to accompany 401-certification permits. If this program becomes formalized, additional opportunities for regional data integration may arise. Such requirements and standards would provide data at the project-scale that could then be aggregated for a regional interpretation. Coordination with the San Francisco Bay RWQCB will continue with implementation of the Bay Area IRWM Plan.

In addition to compiling water resources data and information about Bay Area IRWM Projects, the Bay Area data will support statewide data activities by retaining data collected to support project performance assessment in a manner consistent with continuing statewide data collection programs. Consistency with statewide monitoring programs is critical to ensure that regional projects contribute to efficient, uniform, and comprehensive study design and data collection. Data collected as part of IRWMP project implementation is expected to be compatible with applicable statewide data collection programs such as the Surface Water

Ambient Monitoring Program (SWAMP) and the Groundwater Ambient Monitoring and Assessment (GAMA) programs, and the California Environmental Data Exchange Network (CEDEN). Upon completion of the IRWMP performance assessment, project-specific data, along with the associated quality assurance/quality control information, will be available in a format that can easily be integrated into statewide data collection and tracking programs. As appropriate, the CC will also encourage project proponents to contribute data to the California Environmental Resources Evaluation System (CERES), an information system developed by the California Resources Agency to facilitate access to natural resource data. The CMS that powers the BAIRWMP includes built-in support for exporting project metadata to CERES using the FGDC-XML metadata standard. Resources cataloged in the site can be easily exported in a format that is consumable by the CERES information clearinghouse.

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Chapter 10: Financing

Securing adequate funding for program planning and implementation is one of the biggest challenges facing integrated planning efforts. Successful Integrated Regional Water Management Plan (IRWMP) implementation requires both capital and/or planning costs associated with project implementation as well as ongoing funding to support their continued operation, maintenance and administration.

Table 10-1, at the end of this Chapter, provides a summary of funding opportunities by local, state, and federal funding sources. Table 10-2, also located at the end of this Chapter, documents previous, ongoing, and near-term funding for the IRWMP.

The total cost for projects included in the Plan is about $4.1 billion, ranging from $27,500 to $292 million and averaging $13.9 million.

The following sections identify various funding sources, their associated requirements and guidelines to assist with implementation of Plan Projects.

10.1 Local Funding Opportunities

There are opportunities for grant funding available to the stakeholders in the Region which are well suited to many candidate projects. Many of these grant opportunities require that the Local Project Sponsor provide matching funds ("local match") and funds for operations and maintenance once a project or program is constructed or implemented. The source of the local match and funds for operations and maintenance may include water and wastewater general funds; capital improvement funds; development impact fees; and general funds from local cities, county departments, other local agencies, private organizations, member dues, etc. Local taxpayers may also fund these projects through rate increases, bond measures, and tax increases.

In the past, local entities have planned, implemented, and funded construction and operation of water-related projects. These funds may be available to fund Plan Projects or to provide the local match.

10.1.1 Capital Improvements Program Funding (Revenue Bonds, Certificates of Participation)

Water districts, as well as other government entities (e.g., counties and cities), can raise funds by issuing municipal bonds or certificates of participation. Bonds and certificates of participation are governed by an extensive system of laws and regulations. Under these systems, investors provide immediate funding for the promise of later repayment. Generally, bonds and certificates of participation are used for capital improvement projects. In the case of a water district, bonds and certificates are secured by revenues from the water system and by property taxes received by the agency.

10.1.2 Property Tax Assessment (Assessed Valuation)

Property taxes can be used for general expenditures, capital improvements, and to service bond and certificate debt. While this is a large and important source of funding for local agencies, in some cases, the State of California can divert these funds, thus rendering them unavailable. In addition, revenue from property taxes can fluctuate with the real estate market.

10.1.3 User Fees

Funding for construction and operation and maintenance of water-related projects often comes from user fees, which are charges for water delivered to a home or business, or charges for wholesale water supplies. In addition to these fees, many agencies also charge "hook-up" or "connection" fees – charges for providing facilities to provide water or wastewater services to new development. These fees are also known as "facility capacity fees." Facility capacity fee revenue is difficult to forecast due to the unpredictable timing of development activity. Development activity depends on real estate demands, the regional economy, and land use planning activity. Revenue from user fees and water charges can also fluctuate with the regional economy, short-term water use reductions or restrictions, and precipitation.

10.1.4 Innovative Local Funding Mechanisms

Organizations across the Region have been developing innovative mechanisms to fund local programs. Some examples are presented below.

10.1.4.1 Tamalpais Lands Collaborative

Established in March 2014, the Tamalpais Lands Collaborative (TLC) brings together the resources, talents, and philanthropy of the four agencies responsible for the management of Mt. Tamalpais (National Park Service, California State Parks, Marin Municipal Water District (MMWD), Marin County Parks) and the conservation nonprofit Golden Gate National Parks Conservancy. The partnership grew out of a history of public stewardship of Mt. Tamalpais and earlier collaborative efforts, including a plan by MMWD to create a nonprofit "Friends" organization for the Mt. Tamalpais Watershed. The collaborative supports conservation, stewardship, and public enjoyment of the nearly 10 square miles of local, state, and national parklands that encompass the Mt. Tamalpais region.

10.1.4.2 Napa County, Measure A

Napa County voters passed Measure A in 1998, a 20 year 1/2 cent sales tax to generate revenue for watershed improvements and flood control. The tax was proposed by a coalition of stakeholders ("Community Coalition") to generate funds for the $450 million Napa River/Napa Creek Flood Protection Project. The Community Coalition included representatives from local, state and federal government, local business and environmental groups, and resource agencies. The Community Coalition developed the Living River Guidelines, which are written into the tax ordinance and require projects funded by Measure A to follow geomorphically sound design principles. A Joint Powers Authority (JPA) agreement was written that sets forth the expenditure plan for the County and its five cities. Each entity has projects designed to protect and enhance the Napa River, its tributaries and local watersheds.

10.1.4.3 Ross Valley Storm Drainage Fee

The Health and Safety Code allows the County of Marin to charge a fee for acquiring, constructing, reconstructing, maintaining, and operating storm drainage facilities. In July 2007, the Marin County Board of Supervisors approved the levy of a storm drainage fee against those parcels that drain into the Ross Valley Watershed. The fee is to pay a portion of the annual costs for the flood protection and storm drainage improvement programs. The fee for each property is related to how much stormwater runoff it generates. The duration of the storm drainage fee is for fifteen years, terminating with fiscal 2026/27.

For more information on efforts funded by the program see: http://marinwatersheds.org/rossvalleywatershed-org/documents/RossValleyWatershedAnnualReport2012_000.pdf

10.1.4.4 Santa Clara Valley Water District, Measure B

In November 2012, Santa Clara County voters approved the renewal of Santa Clara Valley Water District's Measure B—Safe, Clean Water and Natural Flood Protection Program—with over 73 percent public approval. Taxes will be used to:

- Ensure safe, reliable water supply;
- Reduce toxins, hazards and contaminants in waterways;
- Protect water supply and dams from earthquakes and natural disasters;
- Restore wildlife habitat and provide open space;
- Provide flood protection to homes, schools and businesses; and
- Provide safe, clean water in creeks and bays.

Projects include a dam seismic retrofit, impaired water bodies improvement, fish habitat and passage improvement, creek restoration and stabilization, vegetation control and sediment removal for flood protection, and flood protection projects. More information on the Safe, Clean Water Program is available at: http://safecleanwater.org/.

10.1.4.5 Santa Clara Valley Water District, Grant Program

Since 2001, the Santa Clara Valley Water District has awarded $16.4 million in grant funding to 86 projects in its three grant programs which include: Environmental Enhancement Grant, Trail and Open Space Grant, and Watershed Stewardship Grant. The grant funding is from the voter-approved Clean, Safe Creeks and Natural Flood Protection Plan of 2000 (Clean, Safe Creeks), and the funded projects help achieve objectives included in the plan. Projects focus on: pollution prevention, educational outreach, non-native exotic plant removal, native plant revegetation, endangered species protection and fish barrier removal.

There have been eight grant cycles to date, over 594 acres of tidal and riparian habitat created or restored and over 70 miles of recreational trails already opened for public access. Government agencies, non-profit organizations and schools are among the entities eligible to apply for funding. This funding source allows smaller organizations to implement smaller projects. The district's completion of and support for environmental enhancement and trail projects through the Clean, Safe Creeks program has surpassed the original established goals. It is anticipated that between 2014 and 2028 grant cycles will be biennial and funded by the 2012 Safe, Clean Water and Natural Flood Protection Program with a focus on pollution prevention, stewardship, restoration, and trails.

10.1.4.6 Alameda County Watershed Projects

The San Francisco Public Utilities Commission (SFPUC) and the Alameda County Resources Conservation District (ACRCD) work cooperatively to implement watershed resources management projects within the lands associated with the operation of the SFPUC's water system. A Memorandum of Understanding between the agencies allows the SFPUC to provide funds to ACRCD to implement projects associated with water quality protection, fire management, grazing operations, riparian/wetland enhancement through, aquatic and upland habitat enhancement, public outreach and education and integrated watershed resources management.

10.1.4.7 Zone 7 Water Agency, Stanley Reach Project

Zone 7 Water Agency (Zone 7) has been working to find creative ways to fund fish passage and habitat enhancement projects. The Stanley Reach project is using external mitigation revenue to fund portions of the project, which modifies and plants an existing trapezoidal channel with concrete structures that are barriers to fish passage. Mitigation funds are available from public and private sources and are associated with environmental impacts from other development based projects. Mitigation funds are often required to be spent within the watershed where the environmental impact occurs. Although this limits the availability and timing of these funds, projects that are 'shelf-ready' are often the same ones that seek grant funding, so this is a means to offset the need for grant funding altogether or to augment grants with another source of local match. Zone 7 plans to also use portions of the project to mitigate for environmental impacts from other projects built through the Capital Improvement Program, where possible. The regulatory agencies have been supportive of this effort and have encouraged potential mitigation partners to participate in the conversation. The use of mitigation funds provides a means to augment or fund environmental projects, but these are limited in scope and timing. This project is funded by Property taxes (83%) and Development Impact fees (17%).

10.1.4.8 Potential Spending Offset Projects

In addition to revenue-generating initiatives, some local entities have developed initiatives that offset maintenance spending or could go to constructing other projects. Examples include:

- The City of Livermore "Adopt-a-Creek-Spot" program that helps pair local volunteers with stretches of creek that need specific attention (trash and weed removal, etc.). Creek spots are located on property owned by the City of Livermore, Zone 7, Livermore Area Recreation and Park District and along the Arroyo Mocho, Arroyo Las Positas and Arroyo Seco. This Program helps offset maintenance costs with its use of volunteers and grant funds to purchase clean-up supplies and website, etc. Additional information about the ongoing Adopt-a-Creek Spot Program is available at www.trivalleycreeks.org.

- Sonoma County Water Agency (SCWA) Youth Work Program, where volunteers help perform summer maintenance of their channels.

10.1.4.9 Investor Owner Utility Investments

Investor owner utility (IOU) investments, can also support the goals and objectives of the Bay Area IRWM Plan. For example, the California Public Utilities Commission (CPUC), which regulates IOUs, is formalizing their process and developing a policy framework to guide the regulation of recycled water development, production, and sales. IOUs may have significant incentives to expand recycled water when offered a favorable rate of return on their investments.

10.1.4.10 Resources Identified by Stakeholders

Other funding mechanisms that Region stakeholders have used and/or have found to be effective to fund water resource projects include:

- The California Financing Coordinating Committee hosts regular Funding Fairs that are open to the public and very helpful. The fairs provide opportunities for project proponents to obtain information about currently available infrastructure grant, loan and bond financing programs and options. For more information, visit: http://www.cfcc.ca.gov/funding_fairs.htm.

- Estate planning for land trusts has allowed a number of conservation projects to take place. This is a strategy that can be further explored.

- Several local foundations fund watershed, wetlands and riparian projects.

- The San Francisco Bay Joint Venture funding database is a helpful resource that identifies federal, state and local agency funding sources as well as private sources such as foundations and educational institutions. For more information, visit: http://www.sfbayjv.org/funding-list.php

- Utilizing teams of volunteers to staff watershed projects has been a highly successful practice for local non-profit organizations.

10.1.4.11 Measure AA

On June 7th, 2016, residents of the nine-county San Francisco Bay Area voted with a 70% majority to pass Measure AA, the San Francisco Bay Clean Water, Pollution Prevention and Habitat Restoration Measure. This measure is a parcel tax of $12 per year, raising approximately $25 million annually for twenty years to fund shoreline projects that would protect and restore San Francisco Bay. The San Francisco Bay Restoration Authority, created by the California Legislature in 2008, is a regional agency created to fund shoreline projects that will protect, restore, and enhance San Francisco Bay through the allocation of funds raised by the Measure AA parcel tax. These funds are available for wetland and habitat restoration, flood protection features, and public access improvements along the San Francisco Bay shoreline.

10.2 State Funding

Potential funding for IRWMP implementation may be available through various state programs, which have included Propositions 1, 84, 1E, and 50. The discussion below and Table 10-1 provide information on state funding opportunities.

CURRENT & PAST STATE FUNDING SOURCES FOR IRWMP IMPLEMENTATION:

- Proposition 1
- Proposition 84
- Proposition 1E
- Proposition 50
- Other (Pending Legislation, State Revolving Fund)

10.2.1 Proposition 1

Passed in 2014, the Water Quality, Supply, and Infrastructure Improvement Act (Prop 1) authorized $7.545 billion in general obligation bonds to fund ecosystems and watershed protection and restoration, water supply infrastructure projects, including surface and groundwater storage, and drinking water protection. Of the $7.5 billion, Prop 1 authorized $510 million in IRWM funding throughout the state, which is allocated to 12 hydrologic region-based Funding Areas. The San Francisco Bay Funding Area was allocated $65 million under Prop 1 for IRWM funding.

10.2.2 Proposition 84

The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Act of 2006 (Public Resources Code § 75001, et seq.), was passed by California voters in the November 2006 general election and provided $5.388 billion to support various water resource needs in the State, including IRWM, groundwater, and stormwater projects. Funding under this program is fully expended.

10.2.3 Proposition 1E

Proposition 1E, the Disaster Preparedness and Flood Protection Bond Act, encouraged new investments for flood protection and storm water management programs. It included the Stormwater Flood Management Program and the Early Implementation Program. The Stormwater Flood Management Program provided grants of up to $30 million per project to local entities for storm water flood management projects. The Early Implementation Program provided funding to rehabilitate, reconstruct, or replace levees, weirs, bypasses, and facilities of the State Plan of Flood Control; or to improve or add to facilities of the State Plan of Flood Control to increase flood protection levels for urban areas. Funding under this program is fully expended.

10.2.4 Proposition 50

The Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, Water Code §79500, et seq., was passed by California voters in the November 2002 general election. Proposition 50 authorized $3.44 billion in general obligation bonds, to be repaid from the State's General Fund, to fund a variety of water projects such as: specified CALFED Bay-Delta Program projects including urban and agricultural WUE projects; grants and loans to reduce Colorado River water use; purchasing, protecting and restoring coastal wetlands near urban areas; competitive grants for water management and water quality improvement projects;

development of river parkways; improved security for state, local and regional water systems; and grants for desalination and drinking water disinfecting projects. Funding under this program is fully expended.

10.2.5 Proposition 68

Passed by California voters in June 2018, the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of (Proposition 68) authorized $4 billion for parks, trails, environmental restoration, climate change adaptation and outdoor recreation. The State Coastal Conservancy's San Francisco Bay Area Conservancy Program received $21 million for protection of and public access to the Bay Area's public open space, $14 million for climate adaptation grants, and $20 million for grants consistent with San Francisco Bay Restoration Authority Act purposes. These funds are available for wetland and habitat restoration, flood protection features, and public access improvements along the San Francisco Bay shoreline.

10.2.6 Other State Funding

10.2.6.1 State Revolving Fund

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 authorized the creation of a revolving fund program for public water system infrastructure needs specific to drinking water. There is similar state legislation and the Safe Drinking Water State Revolving Fund reflects the intent of federal and state laws to provide grant funding or low-interest loans to correct deficiencies in public water systems based on a prioritized system. There are three different entities that provide loans and/or grants under the State Revolving Fund (SRF).

10.2.6.2 Safe Drinking Water SRF

Under this SRF program, CDPH provides loans to assist public water systems in achieving and maintaining compliance with the SDWA. Up to $20 million is available per project. Disadvantaged community systems can obtain a zero interest loan and may be eligible for partial grant funding. All applications to this program are initially made for loans, however financial review may determine if grant funds apply.

10.2.6.3 Infrastructure SRF

The California Infrastructure and Economic Development Bank, also known as I-Bank, provides financing to local municipal entities for construction and/or repair of publicly owned water supply, treatment and distribution systems, and drainage, and flood control facilities. In addition to water-related projects, loans are available for public infrastructure projects that include parks and recreational facilities and environmental mitigation.

10.2.6.4 Clean Water SRF

SWRCB also provides financing for wastewater treatment facility construction projects and expanded use projects that include nonpoint source and estuary projects. Funding options are available to public agencies, as well as non-profit organizations and Native American tribes, for up to $50 million per year.

10.2.6.5 State Water Resources Control Board – Federal 319 Program

This program, administered by the SWRCB, is a nonpoint source pollution control program that is focused on controlling activities that impair beneficial uses and on limiting pollutant effects caused by those activities. The program is federally funded on an annual basis. Project proposals that address Total Maximum Daily Load (TMDL) implementation and those that address problems in impaired waters are favored in the selection process. There is also a focus on implementing management activities that reduce and/or prevent release of pollutants that impair surface and ground waters. Nonprofit organizations, local government agencies including special districts, tribes, and educational institutions qualify. State or federal agencies may qualify if they are collaborating with local entities and are involved in watershed management or proposing a statewide project.

10.2.6.6 State Water Resources Control Board – Water Recycling Funding Program

This is a long-term program operated by the SWRCB that offers grants and low-interest loans for the planning, design and construction of water recycling facilities. Grants are provided for facilities planning studies to determine the feasibility of using recycled water to offset the use of fresh/potable water from state and/or local supplies. Pollution control studies, in which water recycling is an alternative, are not eligible. Planning grants are limited to 50 percent of eligible costs, up to $75,000. Construction grants are limited to 25 percent of project costs or $5,000,000, whichever is less. Only public agencies are eligible. The Water Recycling Funding Program receives funding from various sources, including Proposition 50 and the SRF. Due to the varying funding sources, preferences for funding can vary. For example, funding from Proposition 50 gives preference to those recycling projects that result in benefits to the Delta.

10.2.6.7 Department of Housing and Community Development – Community Development Block Grant

The California Department of Housing and Community Development provides grants to cities and counties with a program emphasis on creating or retaining jobs for low-income workers in rural communities. Activities may include housing rehabilitation and public improvements, which may involve among other things, water, wastewater and other infrastructure projects as well as feasibility studies.

10.2.6.8 California Energy Commission (CEC) – Energy Conservation Assistance Act

The California Energy Commission provides loan financing for water and wastewater utilities for energy efficiency projects, feasibility studies, and implementing energy-saving and renewable energy measures. Eligible uses include, but are not limited to, lighting, motors or variable frequency drives, pumps, insulation, HVAC, energy generation and cogeneration. There are two loan programs under this Act for energy efficient and energy generation projects. One program has a zero-interest, while the other has an interest rate of 1 percent.

Sonoma Valley Wastewater Treatment Plant Solar Panels

10.3 Federal Funding

This section includes a discussion of funds available through various federal programs and specifies eligibility requirements. A summary of potential federal funding sources is also provided in Table 10-1.

10.3.1 Environmental Protection Agency, Source Reduction Assistance

The purpose of this program is to prevent the generation of pollutants at the source and ultimately provide an overall benefit to the environment. This program seeks projects that support source reduction, pollution prevention, and/or source conservation practices. Source reduction activities include: modifying equipment or technology; modifying processes or procedures; reformulating or redesigning products; substituting raw materials; and generating improvements in housekeeping, maintenance, training, or inventory control. Pollution prevention activities reduce or eliminate the creation of pollutants via such procedures as: using raw materials, energy, water or other resources more efficiently; protecting natural resources through conservation; preventing pollution; and promoting the re-use of materials and/or conservation of energy and materials. Eligible organizations include units of state, local, and tribal government; independent school district governments; private or public colleges and universities; nonprofit organizations; and community-based grassroots organizations.

10.3.2 Environmental Protection Agency, San Francisco Bay Water Quality Improvement Fund (SFBWQIF)

This program began in 2008 to support projects to protect and restore San Francisco Bay. The SFBWQIF has invested over $58 million in 49 grant awards. These projects include over 80 partners who are contributing an additional $168 million to restore wetlands and watersheds, and reduce polluted runoff. For more information see: http://www2.epa.gov/sfbay-delta/bay-area-water-projects.

10.3.3 Environmental Protection Agency, Wetlands Program Development Grants

This program seeks projects that promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. The US EPA has identified three priority areas: (1) the development of a comprehensive monitoring and assessment program; (2) the improvement of the effectiveness of compensatory mitigation; and (3) the refinement of the protection of vulnerable wetlands and aquatic resources. A 25 percent match is required. Eligible entities include states, tribes, local governments, interstate associations, intertribal consortia, and national non-profit, non-governmental organizations.

10.3.4 Environmental Protection Agency, Five Star Restoration Program

This program is a partnership among various entities, including the US EPA, U.S. Forest Service, National Association of Counties and National Fish and Wildlife Foundation. This program provides grants, technical support and opportunities for information exchange to develop community capacity to sustain local natural resources for future generations. Projects focus on elements, including on the ground restoration, meaningful environmental education, diverse partnerships, and measurable ecological and educational/social benefits. Average grant awards range from $25,000 to $35,000 and require fifty percent match.

10.3.5 Water Resources Development Act

The Water Resources Development Act is federal legislation, first passed in 1974, that enables authorization of U.S. Army Corps of Engineers (USACE) projects, including levee repair, beach management, aquatic ecosystems, flood emergency and water infrastructure projects. The Act has traditionally been reauthorized every two years, but was last enacted in 2007. Steps towards developing a Water Resources Development Act for the 112th Congress are currently underway. After the Act is passed, Congress will appropriate funding for projects in one of the annual Energy and Water Development appropriation bills.

10.3.6 National Marine Fisheries Service (NMFS), NOAA Coastal and Marine Habitat Restoration

This program provides funding for restoration projects that use a habitat-based approach to foster species recovery and increase fish production. The funding opportunity focuses on coastal habitat restoration projects that aid in recovering listed species and rebuilding sustainable fish populations or their prey. Roughly $20 million could potentially be available over the next three years (starting in 2013) to maintain selected projects, dependent upon the level of funding made available by Congress. Typical awards are anticipated to range from $500,000 to $5 million over three years. For more information see: http://www.habitat.noaa.gov/funding/coastalrestoration.html.

10.3.7 National Park Service (NPS), Rivers, Trails, and Conservation Assistance (RTCA) Program

The purpose of this program is to conserve rivers, preserve open space, and develop trails and greenways. The program provides staff assistance, but not funding, to meet this intent. Projects are evaluated on how successfully they meet the following criteria: (1) a clear anticipated outcome leading to on-the-ground success; (2) commitment, cooperation, and cost-sharing by interested public agencies and non-profit organizations; (3) opportunity for significant public involvement; (4) protection of significant natural and/or cultural resources and enhancement of outdoor recreational opportunities; and (5) consistency with the NPS mission. Eligible organizations include non-profits, community groups, tribes or tribal governments, and state or local government agencies.

10.3.8 U.S. Department of Agriculture (USDA) – Rural Development, Water and Waste Disposal Program

The Water and Waste Disposal Program provides financial assistance in the form of grants and loans for the development and rehabilitation of water, wastewater, and storm drain systems within rural communities. Funds may be used for costs associated with planning, design, and construction of new or existing water, wastewater, and storm drain systems. Eligible projects include storage, distribution systems, and water source development. There are no funding limits, but the average project size is between $3 and $5 million. Projects must benefit cities, towns, public bodies, and census-designated places with a population less than 10,000 persons. The intent of the program is to improve rural economic development and improve public health and safety.

10.3.9 U.S. Bureau of Reclamation (USBR), WaterSMART Grant Programs

This grant program is intended to fund collaborative local projects that improve water conservation and management through advanced technology and conservation markets. Through this program, federal funding is provided to irrigation and water districts for up to 50 percent of the cost of projects involving conservation, efficiency and water marketing. Eligible applicants include irrigation and water districts and state governmental entities with water management authority. Applicants must be located in the western U.S. (California is an eligible area). Applicants do not have to be part of a USBR project but proposals with a connection to USBR will receive more weight in the evaluation process. Past and proposed programs have included Water and Energy Efficiency Grants, Advanced Water Treatment Pilot and Demonstration Projects, and Grants to Develop Climate Analysis Tools, and Title XVI – Water Reclamation and Reuse. Funding opportunities vary depending on available program funding.

10.3.10 U.S. Fish and Wildlife Service (USFWS), North American Wetlands Conservation Act Grant

This grant program provides funds for projects that provide long-term protection of wetlands, and the fish and wildlife that depend upon wetlands. Applicants must provide local match equal to that requested. The Small Grants Program provides up to $75,000 in funding and the

Standard Grants Programs averages $40 million annually for the whole U.S. and is applicable to projects exceeding $75,000. Entities that are eligible include organizations and individuals who have developed partnerships to carry out wetlands conservation projects in the U.S., Canada, and Mexico. Small Grants only apply to the U.S. Applications are continuously accepted by the USFWS for this grant.

In addition to the programs listed above, specific congressional authorizations and funding may be obtained to study, build, and construct specific projects in the Region. Potential sources include legislation and funding associated with renewal of the Clean Water Act (CWA), SDWA, and appropriations for specific agencies, such as the USACE and the US EPA.

The Water Resources Development Act (WRDA) authorizes projects and policies of the Civil Works program of the USACE. The USACE is a federal agency in the Department of Defense with military and civilian responsibilities. At the direction of Congress, USACE plans, builds, operates, and maintains a wide range of water resources facilities in U.S. states and territories. The agency's traditional civil responsibilities have been creating and maintaining navigable channels and controlling floods. However, in the last two decades, Congress has increased USACE's responsibilities in ecosystem restoration, municipal water and wastewater infrastructure, disaster relief, and other activities. WRDA often includes specific authorizations for federal, regional, and local projects. Inclusion in WRDA authorizes a given project but does not guarantee funding for a specific project.

Local projects can also receive authorization and federal funding as part of appropriations for the US EPA. The US EPA will enter into assistance agreements with local agencies to fund studies and projects associated with: (1) various environmental requirements (e.g., wastewater treatment); (2) identifying, developing, and/or demonstrating necessary pollution control techniques to prevent, reduce, and eliminate pollution; and/or (3) evaluating the economic and social consequences of alternative strategies and mechanisms for use by those in economic, social, governmental, and environmental management positions.

10.4 IRWM Project Funding

Securing funding for Plan Projects is a significant issue for IRWMP implementation. The Bay Area Region has had success in moving projects identified in the 2006 Plan towards implementation by securing funding through a variety of sources. Funding opportunities are typically focused on a specific resource management strategy or policy issue, so those projects that may rank highest in importance or priority to stakeholders may or may not be the first to be funded. The Coordinating Committee (CC), project proponents and stakeholders understand that it is important to be flexible and responsive to funding opportunities as they arise. **Error! Reference source not found.** documents a sample of previous, ongoing and near-term funding for the IRWMP. The projects described are a subset of the project list and are meant to convey breadth of funding sources, representing efforts in each of the Functional Areas.

Project funding information for individual projects in the Plan is included with the project templates (http://bairwmp.org/projects). Not all project descriptions include financing details. As described in Chapter 6, candidate projects were evaluated for basic eligibility for inclusion in the Plan and then ranked for based on the criteria identified by the Project Update Team (PUT). The criteria included the completeness of the financial information presented, but projects were evaluated regardless of whether this information was provided. Proponents were encouraged to submit conceptual projects or those that did not yet have full information available.

During the preparation of applications for the various funding opportunities, the financing elements and certainty of the proposed funding will be evaluated in more detail for potential eligible projects. For each funding source identified, suitable projects on the Plan Projects list will be put forward in an application. A summary of funding needs and the funding status for each Plan Project will be prepared after project selection has taken place. This summary will include estimates of outside funding assistance, amount of matching funds, type of matching funds, and whether the matching funds have been secured. For example, the CC is currently working on a DWR Prop 84 IRWM Implementation grant application (Round 2) and gathering this information for 20 projects, for a total request of up to $20 million.

Funding for the 2013 IRWMP update was provided by DWR through a Proposition 84 planning grant and supported by the member agencies. This 2019 update was funded by in-kind service from CC members. It is currently expected that implementation of the IRWMP will continue to rely upon in-kind services; however, at some point in the future, additional grant funds may be required to offset the costs associated with IRWMP administration.

10.5 IRWM Plan Administration Funding

In addition to funding individual projects the IRWMP must address the need for ongoing funding of the planning and administration of the Plan. In 2007 and 2010, funding agreements were developed with the Functional Areas (FAs) to identify funding for planning and administration needs. These funds were largely used to support the 2013 Plan Update as well as website development. The Region is currently self-funded, as needed, for any IRWM Plan administration through CC member in-kind services.

Table 10-1: Funding Opportunities

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Proposition 1*						
Water Use Efficiency	DWR	CalConserve Water Use Efficiency Revolving Loan	Loans to local agencies to fund specific types of water conservation and water use efficiency projects and programs to achieve urban water use targets.	Total of $10 million available. Projects should allow local agencies to provide no-cost efficiency upgrades to residents or aid customers in financing repair of expensive customer leaks.	Local Agencies	Solicitation is available on a first-come, first-served basis until funds are exhausted.
Resource Stewardship	Sacramento-San Joaquin Delta Conservancy	Ecosystem, Watershed Protection and Restoration Grant Program	Competitive grants for multi-benefit ecosystem and watershed protection and restoration projects in accordance with statewide priorities.	Emphasis on projects using public lands and those that maximize voluntary landowner participation. No match requirement.	Public agencies, nonprofits, tribes, public utilities, mutual water companies	Four cycles conducted so far, next cycle TBD.
Resource Stewardship	San Joaquin River Conservancy	Multi-Benefit Water Quality, Water Supply, and Watershed Protection and Restoration	Competitive grants for projects that contribute to the protection or restoration of the San Joaquin River watershed between Friant Dam and State Route 99.	No per-project funding limit, no match requirement.	Public agencies, nonprofits, public utilities, tribes, mutual water companies	Solicitations typically annual, last solicitation closed December 2018.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Resource Stewardship	Secretary for Natural Resources	Ocean Protection Council: Ecosystem, Watershed Protection and Restoration	Competitive grants. Priority issues are marine managed areas, coastal and ocean water quality impacts, fisheries, and climate change.	Minimum project budget $250,000 (DAC exceptions).	Public agencies, public universities, nonprofits, public utilities, tribes, mutual water companies	TBD, most recent solicitation closed March 2019.
Resource Stewardship	Sierra Nevada Conservancy	Sierra Nevada Watershed Improvement Program	Competitive grants focused on forest health projects that result in multiple watershed benefits. Projects should be located within a forested area of the Sierra Nevada Region.	Maximum award $1 million for implementation projects (including fee title acquisition) and up to $100,000 for project development activities.	Public agencies, nonprofits, tribes.	TBD, most recent pre-applications were due August 2019. Solicitations occur roughly annually.
Resource Stewardship	State Coastal Conservancy	Ecosystem, Watershed Protection and Restoration	Grants funding multi-benefit ecosystem and watershed protection and restoration projects.	Matching funds not required, but encouraged.	Public agencies, nonprofits, tribes, public utilities, mutual water companies.	No current solicitations.
Flood Management	DWR	Coastal Watershed Flood Risk Reduction	Grants funding projects in coastal areas that focus on multi-benefit flood risk reduction,	Projects in Delta are excluded. Maximum award unknown.	Public agencies, nonprofits, tribes, public utilities, mutual water	Program Guidelines public comment period closed in September 2019. Final guidelines and proposal solicitation to follow.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			including addressing flood risk and public safety, enhancing coastal ecosystems, and promoting natural resources stewardship and public access corridors.		companies.	
Water Supply	DWR	Groundwater Plans and Projects	Funding for projects that develop and implement groundwater plans and projects consistent with sustainable groundwater planning	50% match requirement.	Public agencies, nonprofits, tribes, public utilities, mutual water companies.	No future solicitations anticipated.
Water Supply	SWRCB	Groundwater Sustainability	Funds projects that prevent or cleanup the contamination of groundwater that serves or has served as a source of drinking water.	Planning projects between $100,000 and $2 million. Implementation projects between $500,000 and $50 million. 50% match required. The project must be identified as a high priority by the applicable state or federal regulatory agencies.	Public agencies, nonprofits, tribes, public utilities, mutual water companies.	Unknown if additional rounds will occur.
Water Supply, Water	DWR	Integrated Regional Water	Multi-benefit projects including	Project must be included in an Integrated	Public agencies, nonprofits,	Round 1: Fall 2019

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Quality, Resource Stewardship		Management – San Francisco Bay	water reuse, efficiency, conservation, groundwater, stormwater, conveyance, desalination, water quality improvement, and decisions support tools.	Regional Water Management Plan. CEQA must be complete in 12 months after final grant award (exceptions for DACs). $52 million available across two rounds of funding.	public utilities, federally recognized and California State Native American tribes and mutual water companies.	
Stormwater	SWRCB	Storm Water Grant Program	Multi-benefit stormwater management projects including green infrastructure, rainwater and storm water capture projects and storm water treatment facilities.	Stormwater Resource Plan required to apply. Award size has ranged from $250,000 to $1 million.	Public agencies, nonprofits, public utilities, federally recognized Native American tribes, state Native American tribes listed on Native American Heritage Commission's California Tribal Consultation List, and mutual water companies.	Early 2020
Water Quality	SWRCB	Clean Water State Revolving Fund	Low-interest loans and other financing mechanisms	Max $50M per agency per year, with a max financing	Public Agencies, non-profit organizations,	Applications are accepted on a continuing basis.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			(principal forgiveness) are available for wastewater treatment facility construction projects and expanded use projects that include nonpoint source and estuary projects.	term of 20 years.	Native American tribes	
Resource Stewardship	Wildlife Conservation Board	Streamflow Enhancement	Noncompetitive grants that fund projects that enhance stream flows and are consistent with the objectives and actions outlined in the California Water Action Plan, with the primary focus on enhancing flow in streams that support anadromous fish; support special-status, threatened, endangered, or at-risk species; or provide resilience to climate change	No match requirement. No maximum award amount, total funding anticipated to be $64 million.	Public agencies, nonprofits, tribes, public utilities, mutual water companies.	July 2020

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Water Supply	DWR	Water Desalination Grant Program	Funds planning, design, and construction of potable water desalination facilities for both brackish and ocean water. Also provides grants for pilot, demonstration, and research projects.	Up to $10 million for construction projects, lower amounts for other project types.	Public agencies, nonprofits, public utilities, federally recognized and California State Native American tribes and mutual water companies.	Continuous application process is currently closed. May reopen late 2019.
Water Supply	SWRCB	Water Recycling	Grants and loans for planning and construction projects that offset the use of fresh/potable water from state and/or local supplies.	Planning projects – 50% match is required, maximum grant award is $75,000 Construction projects – 50% match is required, maximum grant award is 35% of the total project cost or $15 million	Public agencies, nonprofits, public utilities, federally recognized and California State Native American tribes and mutual water companies.	Applications accepted on rolling basis
Water Supply	California Water Commission	Water Storage Investment Program	Water storage projects	Applications no longer being accepted.	Program closed.	No future solicitations anticipated.
Water Supply	SWRCB	Water System Infrastructure Improvements – Safe Drinking Water	Grants and loans. Funds/finances drinking water improvements to publicly and privately owned	Interest rate is 50% of general obligation bond rate. Maximum repayment term 20 years	Publicly and privately owned community water systems and nonprofit,	No application deadline.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			community water systems and nonprofit, non-community water systems.		non-community water systems	
Resource Stewardship	California Department of Fish and Wildlife	Watershed Restoration & Delta Water Quality and Ecosystem Restoration	Projects should address watershed priorities that may include wildfire recovery response and prevention, headwaters management, meadow ecosystem restoration, coastal wetlands protection, and others.	Minimum or maximum grant amount unknown, anticipated total available funding this solicitation approximately $37 million.	Public agencies, nonprofits, tribes, public utilities, mutual water companies.	Deadline TBD. Proposal solicitation package being finalized as of September 2019.
Resource Stewardship	Secretary for Natural Resources	Watersheds and Urban Rivers	Grants funding multi-benefit watershed and urban rivers enhancement projects in urban watersheds that increase regional and local water self-sufficiency.	No minimum or maximum grant amount. Approximately $9.3 million available in each cycle.	Public agencies, nonprofits, tribes, public utilities, mutual water companies.	No future solicitations anticipated.
Proposition 84						
Funds are fully expended						
Proposition 1E						
Funds are fully expended						

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Proposition 50						
Funds are fully expended						
Other						
Water Supply	HUD	Community Development Block Grant Program	Grants are available with a program emphasis on creating or retaining jobs for low income workers in rural communities.	Grants of up to $2.5M are available, whereby award limits are typically $1.5M.	City with less than 50,000 residents and County jurisdictions with less than 200,000 residents in unincorporated areas.	Notices of funding availability scheduled for release in January each year. Applications are invited by an annually and are continuously received and reviewed throughout the year. Awards are made on an ongoing basis.
Water Supply	DWR	New Local Water Supply Construction Loans	Eligible projects include a canal, dam reservoir, desalination facility, groundwater extraction facility, or other construction or improvement, including rehabilitation of a dam for water supply purposes by a local public agency for the diversion, storage, or distribution of water which will remedy existing	Loans: $5M max per construction project, $500,000 max per feasibility project. The interest rate is equal to the rate that the State pays on the general obligation bonds sold to finance the program.	Local Public Agencies	Continuously accepting applications.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			water supply problems.			
Energy Efficiency	CEC	Energy Financing Program	Low interest loan financing for water and wastewater utilities for energy efficiency projects, feasibility studies, and implementing energy-saving and renewable energy measures.	Max loan amount is $3M per application or 12 times the annual energy savings, whichever is less. 3% interest rate.	Publicly owned water and wastewater treatment facilities, cities, counties, special districts, or other non-profit entities.	Applications are available on the CEC website
Water Quality	SWRCB, SWRCB, I-Bank	State Revolving Fund	Provides low-interest loans and/or grants to assist public agencies in correcting deficiencies in water infrastructure	Grants and loans can be combined with other funding sources.	Publicly owned treatment works, local public agencies, non-profit organizations, and private parties	Applications vary depending on type of project and agency from which funds requested. Applications are accepted on a continuing basis.
Water Quality	SWRCB	Safe Drinking Water State Revolving Fund	Provides low interest loans or grants to assist public water systems in achieving or maintaining compliance with the SDWA. Project include water	Up to $500,000 per planning study; $20M per project and a max of $30M per entity	Public Water System	Pre-application invitations annually. Disadvantaged system can obtain a zero interest loan. Applications are for loans; financial review determines if grant funds apply.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			treatment facilities, replace aging infrastructure, planning studies, consolidation of water systems, source water protection, etc. Projects must be needed to comply with SDWA.			
Water Quality	I-Bank	Infrastructure State Revolving Fund Program	The California Infrastructure and Economic Development Bank provides loans for construction and/or repair of publicly owned water supply, treatment and distribution systems, and drainage, and flood control facilities. Loans are also available for public infrastructure, such as solid waste collection and disposal, environmental mitigation, as well as	Loan: $10M per project ($2M max per environmental mitigation project per year, $2M max per project for parks and recreation facilities) and $20M per jurisdiction per fiscal year.	Local Municipal Entity	Preliminary applications are at ibank.ca.gov

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			projects such as parks and recreational facilities and public safety facilities.			
Water Quality	SWRCB	Clean Water State Revolving Fund	Low-interest loans and other financing mechanisms are available for wastewater treatment facility construction projects and expanded use projects that include nonpoint source and estuary projects.	Max $50M per agency per year, with a max financing term of 20 years.	Public Agencies, non-profit organizations, Native American tribes	Applications are accepted on a continuing basis.
Water Quality	SWRCB	Federal CWA 319(h) Program (Nonpoint source grant program)	Funding to support projects throughout the State to restore impaired surface waters through the control of nonpoint source pollution	Project Funding: $250,000-$1 million. 25% local match required but waived for Disadvantaged Communities and small water systems. For 2012, funding for planning/assessment projects ranges between $75,000 and $125,000 and funding for implementation projects ranges	Public agencies, public colleges, 501(c)(3) non-profit organizations, tribes, state and federal entities	Applications accepted in periodic application cycles. During the project solicitation process, applicants submit a brief concept proposal via FAAST. Applicants with the highest-ranking concept proposals will be invited to submit a full proposal.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
				between $250,000 and $750,000.		
Water Supply	SWRCB	Water Recycling Funding Program	Grants are provided for facilities planning studies to determine the feasibility of using recycled water to offset the use of fresh/potable water from state and/or local supplies. Water recycling construction projects that meet objectives of the CALFED Bay-Delta Program are eligible to compete for Proposition 50 grant funds.	Grants for planning studies will cover 50% of eligible costs, up to $75,000. Grants for construction will cover up to 25% of costs or $5M (whichever is less). Construction projects not eligible for grants may also apply for loans are under the SRF loan program.	Public agencies	Applications accepted on continuous basis.
Water Quality	SWRCB	Cleanup and Abatement Account	This account generally provides public agencies with grants for emergency	Use of funds are limited to activities specified by the State Water Board and include among other	Public agencies with authority to cleanup or abate a waste.	Requestors must first contact the State Water Board or submit an online application using FAAST. Requests can be

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			cleanup or abatement of conditions of pollution where no viable responsible parties are available to undertake the work.	things, waste cleanup and abatement of effects of a waste, and remedying a significant water pollution problem.		made on an ongoing basis.
Water Quality	SWRCB	Agricultural Drainage Loan Program	This program provides loans, from the Water Conservation and Water Quality Bond Law of 1986, to fund treatment, storage, conveyance, or disposal of agricultural drainage water.	Funding cap is $20 million for implementation projects and $100,000 for feasibility studies. Rates are set at 1/2 of the State's General Obligation bond rate	City, county, district, joint powers authority or other political subdivision of the State involved with water management	Applications are accepted on a continuous basis.
Water Quality	SWRCB	Agricultural Drainage Management Loan Program	This program provides loans, from Proposition 204, to fund treatment, storage, conveyance, or disposal of agricultural drainage water.	Funding cap is $5 million for implementation projects and $100,000 for feasibility studies. Rates are set at 1/2 of the State's General Obligation bond rate	City, county, district, joint powers authority or other political subdivision of the State involved with water management	Applications are accepted on a continuous basis.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Water Quality	SWRCB	Underground Storage Tank Cleanup Fund	Funds are available to provide a means for petroleum underground storage tank (UST) owners and operators to meet the federal and state requirements. The Fund also assists a large number of small businesses and individuals by providing reimbursement for unexpected and catastrophic expenses associated with the cleanup of leaking petroleum USTs.	Loans are available in amounts up to $1.5 million, depending on project and special program.	Various entities depending on special program.	Applications are accepted on a continuous basis.
Water Quality, Water Supply	SWRCB	Supplemental Environmental Projects	The SWRCB or Regional Boards may allow Supplemental Environmental Projects to be implemented or funded to partially satisfy a monetary assessment made in an	Generally, projects with a value of at least $50,000 will be considered under this program.	Projects may either be performed by the discharger or third parties paid by the discharger.	Sign up forms for the project proponent list are available on the SWRCB website.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			administrative civil liability order. Projects must directly benefit or study groundwater or surface water quality or quantity.			
FEDERAL						
Water Quality	US EPA	Source Reduction Assistance	This program supports source reduction/pollution prevention projects that provide an overall benefit to the environment by preventing pollutants at the source.	Award amounts typically range from $25,000 - $75,000.	Units of State, local, and tribal government; independent school district governments; private or public colleges and universities; nonprofit organizations; and community-based grassroots organizations.	Applications accepted in periodic application cycles.
Water Quality	US EPA	San Francisco Bay Water Quality Improvement Fund	This program supports projects to protect and restore San Francisco Bay, including through water quality and habitat improvement, wetlands	Award amounts have recently ranged between $500,000 - $2 million. 50% match required.	State, local government agencies, districts, and councils, regional water pollution control agencies	Applications accepted on an annual cycle.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			and watersheds restoration, and polluted runoff reduction.		and entities, state coastal zone management agencies, public and private universities, and colleges, and public or private non-governmental, non-profit institutions.	
Water Quality and Resource Stewardship	US EPA	EPA Wetlands Program Development Grants	Projects that promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution	Three priority areas identified by the US EPA: Developing a comprehensive monitoring and assessment program; improving the effectiveness of compensatory mitigation; and refining the protection of vulnerable wetlands and aquatic resources Awards for 2012 were anticipated to range from $50,000 to $350,000. 25% match required.	States, tribes, local governments, interstate associations, intertribal consortia, and national non-profit, non-governmental organizations are eligible to apply.	Applications accepted in periodic application cycles.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Resource Stewardship	US EPA and other partners	Five Star and Urban Waters Restoration Program	This program provides challenge grants, technical support and opportunities for information exchange to facilitate community-based wetland, riparian and coastal habitat restoration projects. Project sites may be public or private land.	Key project elements include on the ground restoration, environmental education, partnerships and measurable results.	Schools, youth groups, public, private or corporate landowners, local, state and federal government agencies, local non-profit organizations, etc.	Applications generally open in late fall, with award notification in late spring.
Resource Stewardship	NMFS	NOAA Coastal and Marine Habitat Restoration	This program provides funding for restoration projects that use a habitat-based approach to foster species recovery and increase fish production, with a focus on coastal habitat restoration projects.	Typical awards are anticipated to range from $500,000 to $5 million over three years	Institutions of higher education, non-profits, commercial organizations, U.S. territories, and state, local and Native American tribal governments.	Applications accepted upon issuance of Funding Opportunity Announcement.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
Resource Stewardship	NPS	Rivers, Trails, and Conservation Assistance Program	The program provides technical and staff assistance to conserve rivers, preserve open space, and develop trails and greenways. Note: RTCA does not provide monetary grants or loans.	Projects will be evaluated on how they meet the following criteria: 1) A clear outcome leading to on the ground success; 2) Commitment, cooperation, and cost-sharing by applicant; 3) Opportunity for significant public involvement; 4) Protection of significant natural and/or cultural resources and enhancement of outdoor recreational opportunities; and 5) Consistency with the NPS mission.	Nonprofits, community groups, tribes, or tribal governments; and state or local government agencies.	Applications are generally due in the summer for assistance during the next fiscal year. http://www.nps.gov/rtca/
Resource Stewardship	NRCS	Watershed Protection and Flood Prevention	Funding for activities that promote soil conservation and the preservation of the watersheds of rivers and streams throughout the U.S.	Matching funds are not required: applicants must generally provide matching ranging from 0%-50% in cash or in-kind resources depending on such factors as project type and the kinds of structural measures a project proposes.	States, local governments, and other political subdivisions; soil or water conservation districts; flood prevention or control districts and tribes. Potential applicants	Not currently soliciting applications.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
					must be able to obtain all appropriate land and water rights and permits to successfully implement proposed projects.	
Water Quality	USDA Rural Development	Water and Waste Disposal Program	Program that provides financial assistance (loans and grants) for community water, wastewater, and drainage systems in rural areas	Funds may be used for planning, design, and construction of new or existing systems; eligible projects include storage, distribution, source development; no funding limits, but average project size is $~~1.8~~3-5 million. Greater funding share provided for low-income communities. Grants may be made for up to 75% of eligible project costs.	Cities, towns, public bodies, and census designated places with populations less than 10,000. Must demonstrate financial need.	Applications accepted on a continuous basis.
Water Supply	USBR	WaterSMART Challenge Grant Programs	Reclamation provides 50/50 cost share funding to irrigation and water districts and states for	Matching funds are required. Applicants must provide a minimum 50% of project costs in non-federal cash or in-kind resources.	Eligible applicants include irrigation and water districts, state governmental	Funding opportunities vary depending on available program funding.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			projects focused on water conservation, efficiency, and water marketing. Past and proposed programs have included Water and Energy Efficiency Grants, Advanced Water Treatment Pilot and Demonstration Projects, Grants to Develop Climate Analysis Tools.		entities with water management authority. Projects must be located in Western United States.	
Resource Stewardship	USFWS	North American Wetlands Conservation Act	The Small Grants Program provides funding, up to $75,000, for projects that provide long-term protection of wetlands and wetlands dependent fish and wildlife. Funding available under the Standard Grants Program averages $40M annually for	Partners must match the grant request at a 1 to 1 ratio.	Organizations and individuals who have developed partnerships to carry out wetlands conservation projects in the US, Canada, and Mexico. Small Grants only apply to the U.S.	Applications accepted on continuous basis. Proposals may be submitted at any time during before the fiscal year deadline.

Funding Objective	Agency	Program	Brief Description	Key Points	Eligibility	Submit Grant Application
			the whole U.S. and is provided to projects exceeding $75,000 per proposal.			

* Note that only programs relevant to the Bay Area IRWM Region have been included.

Table 10-2: IRWMP Funding: Past, Ongoing, and Near-Term Examples

Project Lead	Local Project Sponsor*	Project Title
ABAG/SFEP	ABAG/SFEP	Regional Green Infrastructure Project
ABAG/SFEP	ABAG/SFEP	Watershed Partnership Technical Assis
ABAG/SFEP	ABAG/SFEP	Watershed Program Administration
ABAG/SFEP	ABAG/SFEP	Administration
ABAG/SFEP	ABAG/SFEP	Grant Administration
Alameda County Water District	Alameda County Water District	Alameda Creek Phase 2 Fish Passage
Alameda County Water District	Solano County Water Agency	Conservation Program
Alameda County Water District	Solano County Water Agency	Bay Area Regional Conservation Progra
Alameda County Water District	Stopwaste.org	Bay Area Regional Drought Relief and
Bay Area Clean Water Agencies	Bay Area Clean Water Agencies	Administration
Bay Area Clean Water Agencies	Bay Area Clean Water Agencies	Regional Conservation Outreach Camp
Bay Area Clean Water Agencies	Bay Area Clean Water Agencies	Grant Administration
Bay Area Water Supply & Conservation Agency	Solano County Water Agency	Conservation Program
Bay Area Water Supply & Conservation Agency	Solano County Water Agency	Bay Area Regional Conservation Progra
Bay Area Water Supply & Conservation Agency	Stopwaste.org	Bay Area Regional Drought Relief and
Bay Friendly Coalition/SW	Solano County Water Agency	Conservation Program
Bay Friendly Coalition/SW	Solano County Water Agency	Bay Area Regional Conservation Progra
Center for Ecosystem Mgt & Research (CEMAR)	ABAG/SFEP	S.F. Estuary Steelhead Monitoring Prog
Central Contra Costa Sanitary Dist	Central Contra Costa Sanitary Dist	CCCSD-Concord Recycled Water Pipe
City of Calistoga	City of Calistoga	Calistoga Recycled Water Storage Faci
City of Campbell	ABAG/SFEP	Hacienda Avenue Green Street Improv
City of Napa	Solano County Water Agency	Conservation Program
City of Napa	Solano County Water Agency	Bay Area Regional Conservation Progra
City of Napa	Stopwaste.org	Bay Area Regional Drought Relief and
City of Oakland	City of Oakland	Oakland Sausal Creek Restoration Proj
City of Palo Alto	City of Palo Alto	Mt. View / Moffett Area Recycled Water
City of Petaluma	City of Petaluma	Petaluma Flood Impact Reduction, Wat Recreation, Phase IV
City of Redwood City	City of Redwood City	Redwood City Recycled Water Project

Project Lead	Local Project Sponsor*	Project Title
City of Redwood City	City of Redwood City	Redwood City Bayfront Canal Flood Ma Restoration Project
City of San Jose	City of San Jose	San José Green Streets Demonstration
City of St Helena	City of St Helena	St Helena Upper York Creek Dam Rem River Watershed
Committee for Green Foothills	ABAG/SFEP	Restoration Guidance and San Francis Restoration
Contra Costa Water District	Contra Costa Water District	CCWD-EBMUD Regional Intertie (VFD
Contra Costa Water District	Solano County Water Agency	Conservation Program
Contra Costa Water District	Contra Costa Water District	San Pablo Rheem Creek Wetlands Res
Contra Costa Water District	Solano County Water Agency	Bay Area Regional Conservation Progr
Contra Costa Water District	Stopwaste.org	Bay Area Regional Drought Relief and
DERWA	DERWA	DERWA Phase 3 Recycled Water Expa
Dublin San Ramon Services Dist	Dublin San Ramon Services Dist	Central Dublin Recycled Water Distrib.
East Bay Municipal Utility District	East Bay Municipal Utility District	New Business Guidebook Pilot Progran
East Bay Municipal Utility District	East Bay Municipal Utility District	Richmond Advanced Recycling Expans
East Bay Municipal Utility District	East Bay Municipal Utility District	California WaterStar Initiative - Bay Are
East Bay Municipal Utility District	East Bay Municipal Utility District	East Bayshore Phase 1A - Interstate 80
East Bay Municipal Utility District	Solano County Water Agency	Conservation Program
East Bay Municipal Utility District	East Bay Municipal Utility District	East Bayshore Recycled Water Project
East Bay Municipal Utility District	Solano County Water Agency	Bay Area Regional Conservation Progr
East Bay Municipal Utility District	Stopwaste.org	Bay Area Regional Drought Relief and
East Bay Regional Park District	East Bay Regional Park District	Richmond Breuner Marsh Restoration a
Las Gallinas Valley Sanitation Dist	Las Gallinas Valley Sanitation Dist	Novato South Service Area - Hamilton I
Marin Municipal Water District	Marin Municipal Water District	WaterSMART Irrigation with AMI/AMR
Marin Municipal Water District	Marin Municipal Water District	Direct Installation High Efficiency Toilet
Marin Municipal Water District	Solano County Water Agency	Conservation Program
Marin Municipal Water District	Marin Municipal Water District	Lagunitas Creek Watershed Sediment I Management Project
Marin Municipal Water District	Stopwaste.org	Bay Area Regional Drought Relief and
Marin RCD	Marin RCD	Marin/Sonoma Conserving Our Watersh
Montara Water & Sanitary District	Montara Water & Sanitary District	Groundwater Exploration Project

Project Lead	Local Project Sponsor*	Project Title
Napa Co. RCD	Solano County Water Agency	Conservation Program / Napa County F Project
Napa County	Napa County	Napa Milliken Creek Flood Damage Re Barrier Removal
Napa Sanitation District	Napa Sanitation District	Napa State Hospital Pipeline Construct
Napa Sanitation District	Napa Sanitation District	Los Carneros Water District and Millike Water Pipelines
North Coast Water District	North Coast Water District	Pacifica Recycled Water Project
North Marin Water District	North Marin Water District	North Marin Recycled Water Project
Novato Sanitary District	Novato Sanitary District	Novato North Service Area Project
Oro Loma/EBDA	ABAG/SFEP	San Francisco Bay Climate Change Pil Ecosystem Adaptation, Flood Risk Man Effluent Polishing
Point Blue	ABAG/SFEP	Stream Restoration w/ Schools in North
Point Blue	Point Blue	The Students and Teachers Restoring A Project
Roseview Heights Municipal Water Agency	Roseview Heights Municipal Water Agency	Roseview Heights Mutual Water Tanks
S.F. Estuary Institute	ABAG/SFEP	Flood Infrastructure Mapping & Commu
San Francisco Airport	San Francisco Airport	San Francisco International Airport Indu Plant and Reclaimed Water Facility
San Francisco Public Utilities Commission	San Francisco Public Utilities Commission	Harding Park Recycled Water Project
San Francisco Public Utilities Commission	Solano County Water Agency	Bay Area Regional Conservation Progra
San Francisco Public Utilities Commission	San Francisco Public Utilities Commission	Regional Groundwater Storage and Re
San Francisco Public Utilities Commission	San Francisco Public Utilities Commission	Lower Cherry Aqueduct Emergency Re
San Francisco Public Utilities Commission	Solano County Water Agency	Conservation Program
San Francisco Public Utilities Commission	Stopwaste.org	Bay Area Regional Drought Relief and V
San Mateo Co. RCD	ABAG/SFEP	Pescadero Integrated Flood Reduction Project
San Mateo County	San Mateo County	Pescadero Water Supply and Sustainal
San Mateo Resources Conservation District	San Mateo Resources Conservation District	Drought Relief for South Coast San Ma
Santa Clara Valley Water District	Santa Clara Valley Water District	South Bay Advanced RW Treatment, R

Project Lead	Local Project Sponsor*	Project Title
Santa Clara Valley Water District	Solano County Water Agency	Conservation Program
Santa Clara Valley Water District	Solano County Water Agency	Bay Area Regional Conservation Progra
Santa Clara Valley Water District	Stopwaste.org	Bay Area Regional Drought Relief and
Santa Clara Valley Water District - City of San Jose	Santa Clara Valley Water District	South Bay Advanced Recycled Water T
Santa Clara Valley Water District / City of Sunnyvale	Santa Clara Valley Water District / City of Sunnyvale	Sunnyvale Continuous Recycled Water Wolfe Road Pipeline
Solano County Water Agency	Solano County Water Agency	Conservation Program
Solano County Water Agency	Solano County Water Agency	Conservation Program Admin
Solano County Water Agency	Solano County Water Agency	Bay Area Regional Conservation Progra
Solano County Water Agency	Solano County Water Agency	Bay Area Regional Conservation Progra
Solano County Water Agency	Stopwaste.org	Bay Area Regional Drought Relief and
Sonoma County Water Agency	Solano County Water Agency	Conservation Program
Sonoma County Water Agency	Stopwaste.org	Bay Area Regional Drought Relief and
Sonoma Resource Conservation District	Solano County Water Agency	Bay Area Regional Conservation Progra
Sonoma Resource Conservation District	Solano County Water Agency	Bay Area Regional Conservation Progra
Sonoma Valley Co Sanitation Dist	Sonoma Valley Co Sanitation Dist	Napa Marsh Restoration / Recycled Wa
Sonoma Valley Co Sanitation Dist	Sonoma Valley Co Sanitation Dist	Sonoma Valley Recycled Water Project
Sonoma Valley Co Sanitation Dist	Sonoma Valley Co Sanitation Dist	North Bay Water Reuse Program -- Sor Water Project - Phase 2
State Coastal Conservancy	State Coastal Conservancy	Bair Island Restoration
State Coastal Conservancy	State Coastal Conservancy	South Bay Salt Pond 16A/17 Habitat Re
State Coastal Conservancy	State Coastal Conservancy	Sears Point Wetland and Watershed Re
Stinson Beach Water District	Stinson Beach Water District	Stinson Beach Water Supply & Drought
Stopwaste.org	Stopwaste.org	Bay Area Regional Drought Relief and Admin
Urban Tilth	ABAG/SFEP	Richmond Shoreline & San Pablo Flood
Watershed Project	ABAG/SFEP	Storm Water Improvements & Pilot Proj
Zone 7 Water Agency	Solano County Water Agency	Bay Area Regional Conservation Progra
Zone 7 Water Agency	Zone 7 Water Agency	Mocho Basin GW Demineralization Proj
Zone 7 Water Agency	Solano County Water Agency	Conservation Program
Zone 7 Water Agency	Stopwaste.org	Bay Area Regional Drought Relief & Wa
Zone 7 Water Agency	Zone 7 Water Agency	Zone 7 Water Supply Drought Preparec

* Local Project Sponsor is a grant sub-recipient that collaborates with Project Lead to implement the project

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Chapter 11: Technical Analysis

The intent of this Chapter is to document that the IRWM Plan Update is based on sound technical information, analyses, and methods. The following sections provide a description of studies, models, or other methodologies used to analyze the technical information and data sets, and explains how they have shaped the Coordinating Committee's (CC) and stakeholders' understanding of water management in the Region.

The IRWMP Update documents the results of a collaborative effort between public agencies with varying water, wastewater, flood and watershed management responsibilities and numerous other interested entities. The Bay Area IRWMP was developed using data provided in the four FA[20] Documents (FADs, see Chapter 1) as well as local and subregional planning documents and information.

The planning and analysis conducted at the local and subregional levels has been used as the basis for analysis performed at the IRWM Plan Level.

- **Local Level**. The "Local Level" refers to water resources planning that is conducted over a relatively limited geographic extent, such as an individual municipality, flood zone, or small/partial watershed. Planning and analysis occurring at the local level frequently serves as the basis for planning and analysis conducted at larger geographic scales.

- **Subregional Level**. The "Subregional Level" refers to water resources planning and analysis that is conducted across a larger geographic scale than the local level, while not encompassing the entire region. Subregional-level planning includes planning across multiple municipalities, large flood zones, or large watersheds. For example, planning conducted by water, wastewater, or flood protection agencies that serve multiple municipalities, or planning conducted by a watershed group addressing an entire large watershed or multiple watersheds would be considered subregional planning. This type of analysis and planning frequently builds upon analyses and plans developed at the local level.

- **IRWM Plan Level**. The "IRWM Plan Level" refers to the water resources planning and analysis being conducted across the entire Bay Area region, such as that being conducted through IRWMP development. This type of planning frequently incorporates and builds upon planning conducted at both the local level and the subregional level.

Typically regional efforts build on local ones. However, the Bay Area's IRWMP efforts have also influenced organizational activities as well as projects and implementation more locally. For example, flood management started as a local effort and in 2007 Bay Area Flood Protection Agencies Association (BAFPAA) was developed as an outgrowth of the IRWM planning process. BAFPAA was established to coordinate planning and implementing flood protection services amongst the flood protection agencies in the Bay Area. Since that time, flood related projects have received significant funding—$1M in Round 1for flood mapping and $2M from the

[20] The four functional areas, as listed in chapter 1 are: (1) Water Supply & Water Quality, (2) Wastewater & Recycled Water, (3) Flood Protection & Stormwater Management, and (4) Watershed Management & Habitat Protection and Restoration.

Environmental Protection Agency project to develop innovative approaches for bringing environmental benefits and cost-savings to flood protection infrastructure along the San Francisco Bay shoreline. For water conservation as well, prior to the 2006 IRWM Plan, conservation efforts in the Bay Area were implemented at the local level by utilities for their service area customers. Early regional conservation programs came from the 2006 IRWM Planning efforts. Climate change is being elevated to the regional level through the Plan update and the impact is already evidenced through the project list.

11.1 Documents Used in Plan Development

A wide variety of technical studies have been developed at the local level and the subregional level, and used in development and support of the Bay Area IRWMP. Many studies are also being conducted in parallel with IRWMP development. The Plan builds upon these existing documents, plans and programs, combining them into a comprehensive plan for water resources management throughout the region. The Plan was prepared using information and guidance provided by agencies representing all four Functional Areas (FAs) and, to varying degrees, municipalities, town councils, regulatory, environmental and land use planning entities that represent the CC and Stakeholders. The IRWMP in turn, will be used by these same entities to guide and support their future regional water resources management efforts.

Appendix D-1 provides a table with most of the key technical studies that were collected, reviewed and evaluated by the CC, as well as links to the reports where available. The following types of documents contain the baseline information used in the development of Plan:

11.1.1 Land Use Plans

Land use plans provide for the scientific, aesthetic, and orderly disposition of land, resources, facilities and services of urban and rural communities. **General plans** are a compendium of city or county policies regarding long-term development, in the form of maps and accompanying text (for more information on General Plans see Chapter 13: Relation to Land Use Planning). In California, general plans have seven mandatory elements (circulation, conservation, housing, land use, noise, open space, safety and seismic safety) and may include any number of optional elements (such as water, air quality, economic development, hazardous waste, and parks and recreation). Most local general planning documents generally have identified water management resource strategies that integrate with land use planning efforts and oftentimes reference and tie to regulatory requirements, such as water quality requirements of relevant basin plans. By law, each city and county is required to update the Housing Element of its general plan every five years and the Governor's Office of Planning and Research recommends that the remaining elements be reviewed every eight to ten years.

11.1.2 Water Resource Management Plans

Water Resource Management reports document the reliability and availability of the Region's water supplies to meet current and projected demands, in addition to identifying infrastructure needs to provide effective water resource management.

Different local agencies have different authorities to prepare and implement **Groundwater Management Plans.** Some agencies are special act districts that have groundwater management authority. Others adopt Groundwater Management Plans following the AB 3030 procedure for development of a groundwater management plan. AB 3030, the Groundwater

Management Act, authorized local agencies to prepare **Groundwater Management Plans** for groundwater basins not subject to adjudication or other form of regulation. AB 3030 lays out a procedure for development of a groundwater management plan. The act also specifies twelve technical components which can be included in a groundwater management plan, including replenishment strategy, mitigation of overdraft, mitigation of contaminated groundwater, and avoidance of saline intrusion. Zone 7 Water Agency, Santa Clara Valley Water District (SCVWD), Sonoma County Water Agency (SCWA) and Diablo Water District have developed Groundwater Management Plans. Finally, SB 1938 requires any public agency seeking State funds administered through DWR for the construction of groundwater projects or groundwater quality projects to prepare and implement a groundwater management plan with certain specified components.

The California Urban Water Management Planning Act applies to public and private municipal water suppliers with more than 3,000 connections or supplying more than 3,000 AFY. The act requires suppliers to assess the reliability of their water sources over a 20-year planning horizon considering normal, dry, and multiple dry years. Suppliers must describe and evaluate sources of water supply, water demand, water quality, water conservation goals and activities and other relevant information and programs. This information is used by the urban water supplier to develop an **Urban Water Management Plan**, which is submitted to DWR in years ending in five and zero (e.g., 2005, 2010, and 2015). About 45 of the Plan participants have filed UWMPs (See Appendix D-1).

Many water suppliers develop and update **Water Master Plans and Integrated Water Resources Plans** (IWRPs) which present data and analyses including flow projections and facility requirements for wastewater treatment at the service area level. These plans build upon the information and analysis presented in the UWMPs to identify issues, goals and objectives, as well as water supply and water quality needs, at the agency level. These plans also present potential strategies for achieving the goals and meeting the identified water supply and water quality needs of the region. Appendix D-1 provides information on Santa Clara Valley Water District's (SCVWD) Water Supply and Infrastructure Master Plan as well as Dublin San Ramon Services District's Water Master Plan.

At the local level, General Plans (see Section 11.1.1) and Municipal Services Reviews (MSR) conducted throughout the region present analysis of land use, development plans, and population trends. These data and analyses are limited in geographic scope, focusing on municipalities. Still, these planning documents provide the basis for planning at a larger geographic scope. The information and analysis presented in General Plans and MSRs is developed by water suppliers at the subregional level into UWMPs, Water Master Plans and Integrated Water Resources Plans (IWRPs), Groundwater and Stormwater Management Plans. The strategies presented in these documents, together, provide the basis for development of IRWMP water management strategies. Finally, the information developed in the project-specific plans serve as the foundation for development of IRWMP projects and programs.

11.1.3 Water Quality Plans

Water quality plans are generally designed to preserve and enhance water quality and protect beneficial uses of water.

The **Bay Area Regional Water Quality Control Board (RWQCB) Basin Plan** protects the beneficial uses of water within the Bay Area hydrologic region, designates beneficial uses for surface and ground waters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the state's anti-degradation policy, and describes implementation programs to protect all waters in the Region. In addition, the Basin Plan incorporates (by reference) all applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. As conditions change, such as the identification of new TMDLs or water quality standards, the Basin Plan is amended.

The Recycled Water Policy requires that **Salt and Nutrient Management Plans** be completed by 2014 to facilitate basin-wide management of salts and nutrients from all sources in a manner that optimizes recycled water. The plans are intended to protect groundwater from accumulating salt and nutrient concentrations that would degrade the quality of groundwater and limit its beneficial uses. The Recycled Water Policy requires stakeholders to develop implementation plans to meet these objectives for salts and nutrients which are then adopted by Regional Boards as amendments to the region's Basin Plan. Zone 7 Water Agency, SCVWD, and SCWA are is also developing a Sonoma Valley Salt and Nutrient Management Plans (http://www.scwa.ca.gov/svgroundwater/).

Storm drain master plans and other stormwater management plans identify infrastructure necessary for effective stormwater management and implementation of Best Management Practices (BMP). Contra Costa, Alameda County Counties, and Zone 7, and several cities have Stormwater Master Plans. In addition, the Bay Area Stormwater Management Agencies Association developed a Design Guidance Manual for Stormwater Quality Protection.

11.1.4 Facilities' Plans and Master Plans

A facilities plan and/or master plan is a development plan that provides the framework by which future planning decisions are made. It is an action plan for a particular resource or service such as recycled water, flood control, and wastewater, and can include planned facilities.

Additional local efforts include **Flood Insurance Rate Maps are** developed by the Federal Emergency Management Agency (FEMA) to identify 100-year floodplains for use in determining flood insurance rates. Stormwater NPDES permits require implementation of BMPs and effectiveness monitoring for pollution prevention.

At the subregional level, wastewater agencies develop **Wastewater Master Plans** which present data and analyses including flow projections and facility requirements for wastewater treatment at the service area level.

Recycled Water Master Plans provide information related to available supply and demand, wastewater disposal, public perception as well as facility requirements for recycled water at the service area planning level. At the subregional level, but on a greater scale, the 1999 Bay Area Regional Water Recycling Program (BARWRP) Recycled Water Master Plan was developed to determine the potential for using high quality recycled water to augment water supplies, to support the restoration of the Bay/Delta system and wastewater discharge management into the San Francisco Bay.[21] The BARWRP Recycled Water Master Plan built upon local agency data

[21] The BARWRP Master Plan is categorized as subregional because it did not include the North Bay.

to develop subregional issues, goals and objectives, subregional flow projections, and potential recycled water markets and associated costs. http://bacwa.org/committees/recycled-water/documents.

The North Bay Water Reuse Authority (NBWRA) is another example of a subregional approach- http://www.nbwra.org/. The North Bay Water Reuse Program (NBWRP) is a coordinated regional effort among a group of water and sanitation agencies in Sonoma, Marin and Napa Counties, organized as the North Bay Water Reuse Authority (NBWRA), to offset potable water demand by promoting water reuse for agriculture, urban and environmental uses. By using an integrated approach to recycled water applications, the NBWRA is creating a regional water reuse Program to implement projects that provide a reliable new water supply that will help meet the North Bay region's long-term needs.

11.1.5 Resource Conservation Plans

Resource conservation plans in this context are those watershed, river, and conservation plans that analyze the natural, biological, recreational, and historical resources of a particular watershed, subregion or Region.

Watershed management plans, habitat conservation plans (HCPs), and natural community conservation plans (NCCPs) are developed at the subregional level and provide a review of land use planning information, biological assessments, and limiting factors analysis to identify mitigation measures, restoration activities, and habitat protection actions that can be taken to offset potential impacts associated with development and operations and maintenance. Broader watershed monitoring projects and programs are also initiated to collect data watershed-wide, often extending into multiple watersheds. Data collected and analyzed may include water quality, wildlife populations, sediment sources and transport, and in-stream flow conditions.

Restoration plans, watershed assessments, and monitoring efforts are also developed at the subregional level to evaluate the conditions of local watersheds. These plans are generally limited in geographic scope, but serve as the basis for subregional and regional planning.

At the local level, visioning exercises, restoration plans, watershed assessments, and monitoring efforts evaluate the conditions of local watersheds. These plans are generally limited in geographic scope, but serve as the basis for subregional and regional planning.

Project-specific data and analyses are also compiled at the subregional level. Project planning documents include detailed feasibility, design, and cost information for development of watershed, habitat, and ecosystem protection and restoration projects. Analysis of restoration alternatives and description of environmental benefits accrued from project implementation are also prepared at the subregional level

Regional Habitat Goals Plans have set the planning and information base for the entire region. Three major efforts have been undertaken in the Bay Area to date, spanning the near-shore ocean and sub-tidal bay areas, the baylands, and the region's terrestrial uplands.

- The 1999 **Baylands Ecosystem Habitat Goals** report set habitat type, quality and acreage goals for wetland habitats at the bay's edge, and has become a foundational document guiding nearly 40,000 acres of habitat restoration in the region. This report is currently undergoing a major update for climate change vulnerabilities and adaptation responses led by the Coastal Conservancy in partnership with nearly 20 regional conservation, policy and regulatory bodies. http://www.sfei.org/node/2123.

- The **San Francisco Bay Subtidal Habitat Goals** Report was released in 2010, outlining a bold vision for a hidden part of the Bay Area. Led by the Coastal Conservancy with the Ocean Protection Council, Bay Conservation and Development Commission, NOAA Fisheries and Restoration Center, and the San Francisco Estuary Partnership, the 50-Year Report presents a strong, non-regulatory vision for how to move forward with science-based subtidal research, protection, and restoration. Marking the first time that comprehensive information about submerged areas in the Bay has been compiled, the report has inspired a variety of in-the-water restoration efforts, including oyster, eelgrass, and living shoreline projects that benefit aquatic fish, invertebrates, and wildlife. http://www.sfbaysubtidal.org/.

- The **Conservation Lands Network** has been developed by the Bay Area Open Space Council. Over 125 organizations and individuals came together to identify the most essential lands needed to sustain the "natural infrastructure" of our region. Over 4.3 million acres and over 1,000 variables were considered – from redwood forests to California red-legged frog habitat, from climate change to migratory routes. The Coastal Conservancy was an early and ongoing supporter and funder of this effort with several other foundations and public agencies. The *Conservation Lands Network* map, report, and interactive on-line map were released in 2011 and are available to land managers, legislators and local planners to help them make informed and integrated decisions, and regularly assess the region's progress towards these goals. www.bayarealands.org.

11.1.6 Climate Change Mitigation and Adaptation Strategies Plans

A number of planning documents representing the Bay Area Region as a whole as well as the various subregions were reviewed to identify climate mitigation and adaptation strategies. The main regional approach to climate change mitigation is being implemented through **Plan Bay Area**, an integrated long-range transportation and land-use/housing plan, developed as a joint initiative by the Association of Bay Area Governments (ABAG), Bay Area Air Quality Management District (BAAQMD), the Bay Conservation and Development Commission (BCDC) and the Metropolitan Transportation Commission (MTC).

In addition, communities throughout the Bay Area Region have adopted **Climate Action Plans** (CAPs), which contain a set of strategies intended to guide community efforts for reducing greenhouse gas emissions. As of June 2012, a total 86 local governments in the Bay Area Region have completed community emissions inventories (the first step in developing a CAP) and 30 have finalized and adopted a CAP (Institute for Local Government, 2012). Table 12-3 in Chapter 12: Relation to Local Water Use Planning identifies climate mitigation strategies included in local and regional climate action planning documents.

A vulnerability analysis was developed using DWR's *Climate Change Handbook for Regional Water Planning* guidelines and a synthesis of climate change scenarios for the San Francisco Bay Region and statewide (including the Sierra Nevada) prepared by others (see Chapter 16). Sea level rise and coastal flooding are especially important in the Bay Area Region and the

State provides guidance to help state agencies incorporate future sea-level rise impacts into planning decisions. The National Academy of Sciences report, *Sea-Level Rise for the Coasts of California, Oregon, and Washington*, was released in June 2012 and the State of California Sea-Level Rise Guidance Document was accordingly updated in March 2013. This guidance will continue to be updated as the science of climate change develops.

California produces periodic scientific assessments on the potential impacts of climate change in California and reports potential adaptation responses as required by Executive Order #S-03-05. The State's third major assessment, released in 2012, reported projected climate change impacts and provided understanding of the interactions of those potential impacts on the ground exposure, sensitivity, and response capacity of natural and human systems.

In addition there are a number of other regional efforts in the Bay to update planning documents in the light of projected climate change. These include a technical climate change update to the *San Francisco Baylands Ecosystem Habitat Goals* report to incorporate an assessment of the predicted impacts and associated adaptation strategies on the Baylands ecosystem.

There are also likely to be more focused, collaborative, cross-sector planning efforts to study vulnerability and adaptation at a sub-regional scale. An example is BCDC's *Adapting to Rising Tides* project which is focused on a portion of the Alameda County shoreline, from Emeryville to Union City. Additional information on this project can be found at: http://www.bcdc.ca.gov/planning/climate_change/climate_change.shtml.

11.2 Regional Reports and Studies

Various coordinated efforts provide data and results from regional-scale studies that assess the health of water and additional environmental resources. Important examples of these regional studies include:

The State of San Francisco Bay 2011 presents a science-based assessment of the health of San Francisco Bay. The authors reviewed available data and developed methods for evaluating the status and trends of the Bay's vital signs. By providing all interested parties with these results, the broader community can consider whether resource managers, regulators, and citizens are taking enough of the right actions to protect the Bay. With this assessment, the Estuary Partnership will begin to report on the state of the Bay approximately every five years, with the goal of educating the public and helping scientists and managers make decisions about how to best allocate resources to protect and restore the Bay. Additional information is available on their website: http://www.sfestuary.org/about-the-estuary/sotb/.

The San Francisco Estuary Institute Regional Monitoring Program (RMP) for Water Quality in the San Francisco Estuary is an innovative collaboration of the San Francisco Bay Regional Water Quality Control Board, the regulated discharger community, and the San Francisco Estuary Institute. It monitors contamination in the Estuary, information water quality regulators need to manage the Estuary effectively. SFEI generates a Regional Monitoring Report every year, accessible on their website: http://www.sfei.org.

The Bay Area Regional Reliability Program (BARR) is a consortium of the Bay Area's largest water agencies that are working togethers to develop a regional solution to improve the water supply reliability for over 6 million area residents and thousands of businesses and industries located therein. The Bay Area Regional Reliability (BARR) Partners include Alameda County Water District, Bay Area Water Supply and Conservation Agency, Contra Costa Water District, East Bay Municipal Utility District, Marin Municipal Water District, San Francisco Public Utilities Commission, Santa Clara Valley Water District, and Zone 7 Water Agency. The BARR Partners have joined forces to leverage existing facilities and, if needed, build new ones to bolster regional water supply reliability. More information is available on their website: www.bayareareliability.com.

11.3 Technical Analysis and Methods

Numerous sources of technical information formed the foundation of the Plan. Table 11-3 provides examples of these analyses performed by agencies in evaluating their water management needs.

11.4 Data Needs

During the course of the preparation of this IRWMP, data needs were identified by stakeholders and resource specialists working on the plan. Data needs identified for the Region include:

- Updated climate change projections to reflect new data, methods, and improved understanding of climate change
- Regional hydroclimate (hydrology and weather), including projections of microclimatic change and fog
- Statewide hydroclimate data on imported water supplies that show influence of climate change
- Data on sea level rise
- Weather variability (e.g., monthly averages of maximum and minimum daily air temperatures monthly precipitation and ET, etc.) in the Region and subregions
- Market saturation of water efficient fixtures
- Projections of future habitat change
- Improved projections of wetland response to sea level rise

Table 11-3: Examples of Technical Analysis Utilized in Plan Development

Data or Study	Analysis Methods	Results/Derived Information	Use in IRWM Plan	Reference or Source
Stream Management Master Plan	HEC-HMS (calibrated to stream gauge date) and HEC-RAS with Digital Elevation and Terrain Models created from LiDAR data, and updated digital soils and rainfall data	Service area hydrologic and hydraulic models and innovative techniques for stormwater management	Used to integrate flood protection, water supply, recreation, and water quality and habitat	Zone 7
Water Supply Evaluation	probability-based water supply model; key water supplies were modeled as uncertain variables – their value was determined through Monte Carlo methods.	Risk assessment of water supply shortages	Used to evaluate a diverse set of water supply options for meeting the Valley's water supply needs	Zone 7
Flood Protection Monitoring	HEC-HMS, HEC-RAS, HEC-FDA for Risk and Uncertainty (RU) analysis, GIS	Detention basin; analysis and design; stream hydraulic modeling; watershed parameters (topography, drainage); levee elevations based on the RU analysis	Watershed analysis for calculating peak design flows	Contra Costa County Flood Control and Water Conservation District
Permanente Creek Flood Protection Project	FLO-2D, HAZUS-MH FLOOD	Flood limits and depths; economic losses	Used to compare alternative flood management strategies and analyze flood damage reduction from the selected project	SCVWD

Data or Study	Analysis Methods	Results/Derived Information	Use in IRWM Plan	Reference or Source
Berryessa Creek Flood Protection Project	HEC-RAS channel and HEC-HMS watershed modeling coupled with FLO-2D for overbank modeling	Flood limits and depths	Used to compare alternative flood management strategies and analyze flood damage reduction from the selected project	US Army Corps of Engineers (USACE); SCVWD
2012 Water Supply and Infrastructure Master Plan	Water Evaluation and Planning model; Groundwater flow models	Water supply availability under different future scenarios; groundwater levels and storage under different future scenarios	Used to compare alternative water supply strategies and analyze water supply reliability with selected water supply strategy; prioritizes projects for achieving water supply objectives	SCVWD
2015 UWMP	IWRMAIN; Water Evaluation and Planning model	Water demand projections; water supply availability under future conditions	Used to compare demands and supplies for evaluating water supply reliability	SCVWD and other water agencies with UWMPs (See Appendix D-1)
Conservation Lands Network	MARXAN	Multi-factor prioritization of habitats for regional biodiversity value	Used to assess the value of lands for habitat protection and restoration efforts	Bay Area Open Space Council
Lagunitas Creek Stewardship Plan	Salmon limiting factors and recovery priorities; State Water Board directives	Prioritization of fishery restoration actions to be taken by MMWD over a ten-year period.	Used to consider and prioritize strategies, techniques and projects, for managing creek habitat for the benefit of aquatic resource populations of coho salmon, steelhead, and California	MMWD

Data or Study	Analysis Methods	Results/Derived Information	Use in IRWM Plan	Reference or Source
			freshwater shrimp.	
Wildfire Protection and Habitat Improvement Plan		Prioritized recommendations for vegetation management on 22,000 acres of watershed lands, in order to support fire hazard reduction and biodiversity with drinking water protection as the number one priority.	Used to prioritize vegetation management actions and strategies to support drinking water protection.	MMWD
Mt. Tamalpais Watershed Road and Trail Management Plan		Designation of official network of unpaved roads and trails on MMWD's Mt. Tamalpais Watershed; prioritization of work plan for restoration and decommissioning.	Used to consider and prioritize sediment reduction work on unpaved roads and trails, and restoration work on recreational and access trails.	MMWD
Lagunitas Creek Watershed Sediment Source Site Assessment	California Department of Fish and Wildlife, Salmon id Stream Habitat Restoration Manual methods	Evaluation and categorization of all unpaved roads in the Lagunitas Creek Watershed, yielding prioritized list of restoration and sediment reduction work.	Used to consider and prioritize sediment reduction work on unpaved roads downstream of Peters Dam in Lagunitas Creek watershed.	MMWD
San Francisquito Creek Flood Protection and Ecosystem Restoration Capital Improvement Project (East Bayshore Road to San Francisco Bay)	FLO-2D, which simulates channel flows and overland flows	Flood limits and depths	Used to compare alternative flood management strategies and analyze flood damage reduction from the selected project	San Francisquito Creek Joint Powers Authority

Data or Study	Analysis Methods	Results/Derived Information	Use in IRWM Plan	Reference or Source
Dam Seismic Stability Evaluations	Field and laboratory testing; statistical analyses	Dam deformation potential; fault rupture hazard to dams and outlet structures; adequacy of dam freeboard and spillway	Used to identify necessary infrastructure improvements for meeting water supply objectives	SCVWD
Upper Tuolumne Hydrology Under Climate Change Scenarios	Hydrologic modeling (HFAM), climate change scenario development	Predicted future reservoir inflows	Long-term water supply planning	SFPUC, Tuolumne Irrigation District, Hydrocomp Inc.
San Francisco Groundwater Pumping Model	Groundwater model (MODFLOW)	Constraints and potential yield of groundwater pumping in SF	Local water supply, groundwater, and environmental management	SFPUC, City of Daly City
Calaveras Forecasting During WSIP	NWS climate forecasts, Hydrologic models (statistical rainfall-runoff model, TOPMODEL, CNRFC forecasts) operations model, rule curves	Operational recommendations and flood forecasts for contractors and ACWD	Flood control	SFPUC, California Nevada River Forecast Center (CNRFC), USGS data, National Weather Service (NWS)
Supplemental Statement of Water Diversion and Use	Internal water balance and operations models	Water diversion and use	Reporting to SWRCB and water supply management	SFPUC, US Geological Survey (USGS) data
Alameda Creek Surface Water/Sunol Valley Groundwater Flow Models	Hydrologic and operational models (ASDHM, HSPF, statistical models), groundwater models	Reservoir inflows, groundwater levels, flows in environmentally sensitive reaches	Long-term water supply planning, environmental compliance, infrastructure planning	SFPUC, McBain and Trush
Pilarcitos Creek	HSPF and statistical models	Inflows to local reservoirs	Compliance with Pilarcitos IWMP	SFPUC

Data or Study	Analysis Methods	Results/Derived Information	Use in IRWM Plan	Reference or Source
Water Conservation Potential and Demand Forecast Model	Internal water conservation estimate and future demand based in population and housing projections	Estimated conservation potential and effect on future demand	Identification of potential conservation projects	SFPUC
Sewer System Improvement Program, Level of Service Model Simulations	Hydrologic and hydraulic (H&H) model simulations	Estimates volumes and frequencies of combined sewer discharge and flooding performance improvements through use of hard and green infrastructure.	Stormwater management and flood control	SFPUC, Wood

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Chapter 12: Relation to Local Water Planning

The *California Water Plan* notes that coordination in water planning at all levels is essential for the successful management of California's water system in the face of increasing challenges due to climate change, growing water demand and uncertainty regarding availability of water from the Sacramento-San Joaquin Delta. Accordingly, this chapter discusses the relationship between the IRWMP and local water planning efforts and documents the local water plans on which the IRWMP is based. The intent of coordinating the IRWMP with local water planning efforts is to ensure that the IRWMP is congruent with local water plans and reflects current, relevant elements of local water planning and water issues common within the region. The 2012 Guidelines require that this chapter describe how the IRWMP relates to local planning efforts (including how regional planning feeds back into local planning and how any inconsistencies between local and regional plans are identified and resolved) and incorporate climate mitigation and adaptation strategies from local plans into the IRWMP.

12.1 Overview of Bay Area Water Resource Planning

12.1.1 Local and Regional Water Resources Plan Inventory

Water agencies throughout the Bay Area continually engage in resource management planning and periodically prepare reports to memorialize long-range planning. In order to characterize water resources planning underway in the Bay Area, IRWMP authors first prepared a comprehensive inventory of plans reflecting the four Functional Areas (water supply and water quality, wastewater and recycled water, flood protection and stormwater management, and watershed management – habitat protection and restoration) and the four Subregions (shown in Appendix D 1-1 in Chapter 1). Sources for the inventory, presented in Appendix D, included the 2006 Plan, agency websites, project application forms, and Coordinating Committee (CC) member input. Consistent with the 2012 Guidelines, the inventory indicates the jurisdiction of each plan, when the plan is updated and relevance to the IRWMP (in terms of Bay Area water management activities and Subregion). The final inventory contains over 100 Bay Area water resources plans. The CC may use the inventory as a database that planners can consult and revise when updating the IRWMP in the future to help facilitate coordination between the IRWMP and local planning efforts.

Table 12-4 summarizes the types of local and regional plans in effect in the Bay Area, categorized by the water management activities identified in the 2012 Guidelines and by Functional Area. Section 12.1.2 describes some of these plan types.

Table 12-4: Bay Area Water Resource Plan Types by Water Management Activity and Functional Area

Water Management Activity (2012 Guidelines)[a] – General	Water Management Activity (2012 Guidelines)[a] – Specific	Corresponding Functional Area	Plans in Bay Area IRWMP Water Plan Inventory [b] Addressing these Topics	
Multi-Purpose Program Planning City and County General Planning Emergency Response, Disaster Plans	• Groundwater Management • Urban Water Management • Water Supply Assessments • Agricultural Water Management • Salt and Salinity Management	Water Supply & Water Quality	• Water Supply Management Programs • Urban Water Management Plans • Clean Water Programs • Groundwater Management Plans • Salt Management Plans • Salt/Nutrient Management Plans	• Water Supply Evaluations • Stormwater Pollution Prevention Program • Integrated Resource Management Plan • Water Supply Strategies Action Plans • Water Supply Infrastructure Master Plan
		Wastewater & Recycled Water	• Recycled Water Master and Strategic Plans • Sewer System Master Plans	• Wastewater Treatment Plant Master Plan • Water Reuse Programs
	• Flood Protection • Stormwater Management • Low Impact Development	Flood Protection & Stormwater Management	• Stormwater Management Plans • Flood Management Plans • Sediment Management Studies/Plans	• Stream Management Master Plans • Stormwater Pollution Prevention Program • Stream Maintenance Plans
	• Watershed Management	Watershed Management - Habitat Protection & Restoration	• Habitat Restoration Plans • Watershed Management and Stewardship Plans • Habitat Conservation Plans • Conservation Strategy Plans • Habitat and Species Recovery Plans • Historical Ecology Studies	• Vegetation Management Plans • Habitat Stewardship Plans • Stream Maintenance Plans • Coastal Waters Management Plans • Watershed Action Plan • Invasive Species Studies/Plans

Notes:
(a) IRWM Grant Program Guidelines - Propositions 84 and 1E (November 2012), pages 58 – 59.
(b) Appendix D presents the Bay Area IRWMP Water Plan Inventory.

12.1.2 Example Local Water Planning Documents

12.1.2.1 Urban Water Management Plans

The Urban Water Management Planning Act requires all urban water suppliers[22] to carry out long-term resource planning responsibilities through development of Urban Water Management Plans (UWMPs). UWMPs assess the reliability of the supplier's water sources over a 20-year planning horizon considering normal and drought conditions. A list of major water suppliers in the Bay Area is provided in Chapter 2, Regional Description. Appendix D lists all UWMPs within the Bay Area region.

12.1.2.2 Stormwater Management Plans

Compliance with the Bay Area Municipal Regional Stormwater National Pollution Discharge Elimination System Permit (MRP), administered by the San Francisco Bay Regional Water Quality Control Board, is the primary driver for addressing water quality in stormwater discharges in the Bay Area. Many municipalities have formed countywide "clean water" programs, some of which prepare annual work plans to define actions, responsibilities and schedules to be implemented by program members to support compliance with the MRP (e.g., Marin County Flood Control and Water Conservation District Stormwater Pollution Prevention Program Action Plan). Refer to Chapter 13 for additional information on stormwater management plans for individual land use projects.

It should be noted that Senate Bill 985 requires the development of a stormwater resource plan in order to receive grants for stormwater and dry weather runoff capture projects. Stormwater Resource Plans developed in the Region are approved by the CC and attached as addenda to this Plan. All CC approved Stormwater Resource Plans can be found in Appendix G.

12.1.2.3 Sewer System Management Plans

In 2006 the State Water Resources Control Board adopted requirements for all public sanitary sewer collection system agencies prohibiting sewer overflows that result in a discharge to waters of the United States. Under these requirements, each sewer collection system agency is required to develop a plan to provide for the proper and efficient management, operation, and maintenance of the collection system. There are eleven required elements to the plan (e.g., goals, operation and maintenance program, overflow emergency response program). The Bay Area Clean Water Agencies (BACWA) has worked with the San Francisco Regional Water Quality Control Board to develop the SSMP Development Guide to assist wastewater collection agencies in preparing SSMPs. Appendix D includes links to the plans for San Mateo County, Delta Diablo Sanitation District, and Novato Sanitary District.

12.1.2.4 Watershed Plans and Habitat Restoration Plans

In the Bay Area, many local watersheds have created (or are proposing to create) watershed plans to balance water supply, flood management, and habitat protection needs. Many watershed planning efforts are voluntary; however, in some cases, watershed or habitat plans are motivated by regulatory drivers and permitting processes (e.g., developed in association with consultation pursuant to Section 10 of the federal Endangered Species Act).

[22] A supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually.

Section 4.2.6.6 of Chapter 4, Regional Description provides several examples of watershed planning projects and programs underway throughout the Bay Area; refer to Appendix D for additional examples.

12.1.3 Regional Water Resources Planning

Although the focus of this chapter is on *local* water resources planning, a variety of regional planning efforts (in addition to the IRWMP) have been underway for many years, most of which are described in other chapters of this report. Examples include planning initiatives of the regional water management organizations described in Chapter 15 (see Section 15.2.2), regional planning by the Association of Bay Area Governments that informs long-term planning for water and wastewater services (see Section 13.1.1.1 in Chapter 13), regional planning for climate change described below in Section 12.4.2, the North Bay Watershed Association (described in Chapter 13, Section 13.2.1.4), and planning for major regional projects like South Bay Salt Ponds and South Bay Shoreline Study (described in Chapter 13, Section 13.2.1.4).

12.2 Use of Local Water Plans in IRWMP Planning

In essence, this IRWMP has combined information presented in numerous water resources plans into a single document. Rather than superseding local planning, the IRWMP uses these documents as a basis for developing a wider regional view of water supply, water quality, wastewater and recycled water, flood protection and stormwater management, and watershed management and habitat protection/restoration.

12.2.1 Development of Regional Description and Resource Management Strategies

Preparation of Chapter 2: Regional Description relied on current local and regional water resources plans as well as more up-to-date information provided by water managers and regional water resources agencies to describe (for example) the characteristics of Bay Area water supplies, groundwater basin characteristics, water demand and conservation, and major water-related infrastructure. Preparation of Chapter 4: Resource Management Strategies relied on similar inputs to characterize water use efficiency, recycled water, storage and other strategies currently being employed in the Bay Area.

12.2.2 Identification of IRWMP Projects

Many of the local plans in Appendix D identify projects and programs to implement IRWMP objectives and are the source for numerous projects that are proposed for funding. Project applications require agencies to indicate water resources plans relevant to the proposed project. In addition, IRWM projects must indicate compliance with select water resources plans and proponents must adopt the IRWMP in order to be eligible for funding.

12.3 Participation by Agency Personnel

Many IRWMP participants are directly involved in local water resources planning for their respective agencies and were involved in developing plans identified in Appendix D. Water resource managers are involved throughout the IRWMP process, serving as members of the Coordinating Committee, Subregional and Functional Area groups and other working groups, and providing input at various meetings. Their knowledge and expertise of local plans influence all aspects of the IRWMP, including development of IRWMP objectives, selection of resource management strategies to implement, the project selection process, and review of all IRWMP chapters, among other things.

12.3.1 Subregional Workshops

Subregional workgroups organize and facilitate community workshops that provide an overview of the IRWMP process, and invite stakeholders to consider ways to address local water challenges through collaborative partnerships. Refer to Chapter 14 for a description of all of the outreach efforts used to engage local water resources and other stakeholders in development of the IRWMP.

12.3.2 Briefings at Regional Planning Forums

Existing forums promoting regional planning occur through the following entities[23]:

- Association of Bay Area Governments (ABAG)
- Metropolitan Transportation Commission (MTC)
- Joint Policy Committee
- Bay Area Clean Water Agencies (BACWA)
- Bay Area Water Supply and Conservation Agency (BAWSCA)
- Bay Area Water Agencies Coalition (BAWAC)
- Bay Area Flood Protection Agencies Association (BAFPAA)
- Bay Area Watershed Network (BAWN)
- North Bay Watershed Association
- City/county councils of government
- Low Impact Development Leadership Group
- Watershed Information Center & Conservancy (WICC) of Napa County
- Santa Clara County Basin
- Watershed Management Initiative
- Bay-Delta Region of Resource Conservation Districts (RCDs)

Functional Area leads and other IRWMP participants conduct briefings at these forums (and at joint meetings between regional entities) to update participants on IRWMP planning and to solicit input on development of the Plan including review of draft chapters. Chapter 15 provides

[23] Chapters 1 and 2 describe the roles of most of these organizations, with the following exceptions: BAWN, a network of natural resource professionals and community members who work locally to protect watersheds throughout the Bay Area; WICC, an advisory committee to the Napa County Board of Supervisors and provides support for community efforts to improve the health of Napa County's watersheds; Santa Clara County Basin Watershed Management Initiative, a collaboration among regional and local agencies and non-governmental organizations to advance watershed management goals in the South Bay, and the Bay-Delta Region of RCDs, which includes RCDs from around the Bay Area working to conserve, protect and restore the watersheds of the Bay Area.

more detail regarding coordination activities undertaken with local, regional and state agencies, stakeholders and neighboring IRWM regions in developing the Plan update.

12.4 Dynamics and Coordination between Local Planning and IRWM Planning

12.4.1 Plan Consistency

12.4.1.1 Consistency and Coordination between Local Water Plan Content the IRWMP

Using current water resources plans as source material for the IRWMP, extensive participation by local and regional water resource planners, requiring adoption of the IRWMP by project proponents, and using compliance with specified local plans as eligibility criteria for proposed projects are the steps that have been implemented to preclude inconsistencies between the IRWMP and local water plans.

12.4.1.2 Considering Updates to Local Plans

The existing mechanisms to coordinate local planning efforts with IRWMP planning will continue into to the future. The CC may use the water plan inventory presented in Appendix D as a database that future planners can consult and revise when updating the IRWMP. The database can be sorted by agency, Subregion, and Functional Area to facilitate participation. Planners can capture updates to local plans and reflect these in future revisions to the IRWMP.

12.4.1.3 Resolving Inconsistencies with Local Water Plans

Any inconsistencies between plans will be addressed on a case by case basis. In the event that inconsistencies between a local water plan and the IRWMP are identified, IRWMP participants will resolve the inconsistency through direct consultation with the agency that prepared the plan.

12.4.1.4 How Regional Planning Efforts Feed Back to Local Planning Efforts

While local and regional planning forms the foundation of the IRWMP, the IRWMP provides opportunities for regional planning to inform local plans. The collaborative planning that occurs through the IRWMP process, and adoption of the IRWMP by project proponents, will inevitably feed into local planning in multiple ways (e.g., reflecting regional objectives, policies and projects in local plans; pursuit in one Subregion of successful interagency solutions achieved in another Subregion). Participation in the IRWMP process to develop regional solutions to the challenges faced by individual agencies can help each agency meet its goals and objectives, forges connections among agency personnel that persist outside the IRWMP context, and invests agency planners and decision makers in regional planning.

Climate change presents many challenges for water resources agencies that demand a regional approach. Advancements in research in this dynamic field may frequently outpace local planning. Chapter 16, Climate Change, identifies vulnerabilities for water resources and adaptation strategies (e.g., implementing multifunctional green infrastructure along rivers and the bayshore, raising and armoring flood structures, and removing critical infrastructure out of the hazard zone). That analysis will feed back to local planning efforts through briefings to the CC, the Climate Change Technical Advisory Group and the regional planning forums listed above; and commitments by IRWMP participants to incorporate information into future local planning efforts.

12.4.1.5 Mechanisms to Ensure Consistency Between IRWMP Projects and Other Plans

There are a number of mechanisms already in place to ensure consistency between IRWMP projects and other local and regional plans:

- ***Permits and Approvals***. Issuance of permits and other approvals often is contingent on consistency with applicable plans. Examples include:
  - San Francisco Regional Water Quality Control Board - *San Francisco Bay Basin (Region 2) Water Quality Control Plan*
  - San Francisco Bay Area Air Quality Management District – Clean Air Plan
  - San Francisco Bay Conservation and Development Commission – *San Francisco Bay Plan*
  - California Coastal Commission, designated local agencies - coastal management programs
- ***California Environmental Quality Act (CEQA).*** CEQA requires Environment Impact Reports to discuss inconsistencies between a project and applicable plans; some criteria for determining the significance of environmental impacts are based on plan or policy consistency, and require mitigation to resolve inconsistencies.
- ***General Plan Consistency Determinations*** by cities and counties are typically required for water resources projects, although the findings may be advisory in some cases.

12.4.2 Climate Change Mitigation and Adaptation Strategies in Local Plans

Managing risks associated with climate change requires implementation of both mitigation strategies and adaptation strategies. Climate change mitigation strategies aim to reduce climate extremes through reduction of GHG emissions, while climate change adaptation strategies manage and respond to the impacts of climate change (California Natural Resources Agency, 2009). The 2012 Guidelines require that the IRWMP consider and incorporate climate change mitigation and adaptation strategies from local plans. In response to this requirement, a number of representative plans from the Bay Area Region as a whole as well as the various Subregions were reviewed to identify climate mitigation and adaptation strategies.

12.4.2.1 Climate Change Mitigation Strategies

In the Bay Area Region, the main regional approach to climate change mitigation is being implemented through Plan Bay Area.[24] Plan Bay Area is an integrated, long-range transportation and land-use/housing plan, developed as a joint initiative by ABAG, BAAQMD, the San Francisco Bay Conservation and Development Commission (BCDC) and MTC. Under Plan Bay Area, the Bay Area Region's Sustainable Communities Strategy will be incorporated into the land use allocation in the next Regional Transportation Plan, slated for adoption in

[24] Plan Bay Area can be found at: http://onebayarea.org/regional-initiatives/plan-bay-area/draft-plan-bay-area.html.

summer 2013. The primary GHG reduction strategy employed by Plan Bay Area is to promote compact, mixed-use commercial and residential development with better access to mass transit.

In addition to the regional Sustainable Communities Strategy being developed by Plan Bay Area, communities throughout the Bay Area Region have adopted Climate Action Plans, which contain a set of strategies intended to guide community efforts for reducing greenhouse gas emissions to advance compliance with State GHG reduction targets. As of June 2012, a total 86 local governments in the Bay Area Region had completed community emissions inventories (the first step in developing a Climate Action Plan) and 30 had finalized and adopted a Climate Action Plan (Institute for Local Government, 2012). Table 12-5 identifies climate mitigation strategies included in local and regional climate action planning documents. These strategies were drawn from a selection of plans representing the four Bay Area Subregions. In terms of water management in the Bay Area, a key water management strategy employed to mitigate climate change is reducing demand via implementation of water conservation measures, which cuts energy consumption from water treatment and conveyance.

12.4.2.2 Climate Change Adaptation Strategies

Climate change adaptation strategies are included in a wide range of regional and local planning documents such as urban water management plans, habitat restoration plans, wastewater treatment master plans, watershed stewardship plans and water supply strategies. Adaptation strategies for the Bay Area are also being developed through several regional initiatives focused specifically on climate change adaptation.

Table 12-6 identifies climate change adaptation strategies included in representative regional and local plans according to corresponding Functional Areas and vulnerabilities and priorities identified in Chapter 16. The plans reviewed, listed at the bottom of the table, reflect all Functional Areas and sub regions. Note that the scope, focus, and age of the plans varied considerably; these factors undoubtedly contributed to fact that the degree to which climate change adaptation was addressed also varied considerably. A number of plans identified adaptation strategies, as shown in Table 12-6, although a strategy like “water conservation” was not always identified as a climate adaptation strategy. Several plans identified joint studies and working groups aimed at improving modeling and/or developing adaptation strategies.[25] The review confirmed that, with the exception of urban water supply[26], the approach to water resources planning *in general* varies widely across Functional Areas and among agencies. For example, with respect to sea level rise and vulnerable water resources infrastructure (e.g., wastewater treatment plants), not all local plans reviewed contained adaptation strategies. This may reflect the absence of a legal requirement for a plan rather than a lack of planning for sea level rise; some agency websites indicated that climate change planning was indeed underway.

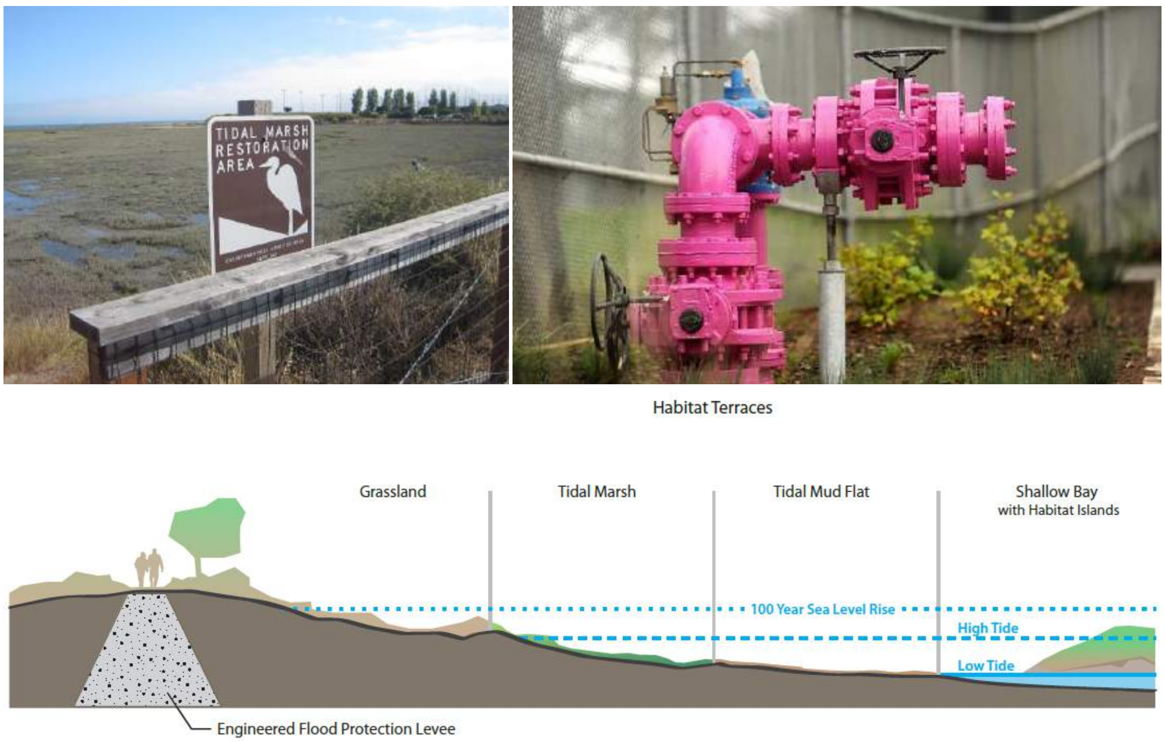
[25] Examples of joint studies and working groups identified in local plans include the Climate Ready Water Utilities Working Group, Climate Resilience Evaluation and Assessment Tool, and Piloting Utility Modeling Applications for Climate Change.

[26] The Urban Water Management Planning Act (California Water Code Section 10610 et seq.) requires every urban water supplier that provides water to 3,000 or more customers or provides over 3,000 acre-feet of water annually to prepare and adopt an urban water management plan (UWMP) for the purpose of “actively pursue[ing] the efficient use of available supplies,” and stipulates required contents of UWMPs. Consequently, UWMPs tend to include similar climate adaptation strategies.

Recognizing that flooding from sea level rise threatens the long-term viability of Bay Area neighborhoods, job centers, transportation, water and wastewater infrastructure, schools, emergency services, and vital ecosystems on which our quality of life and the regional and state economies depend, the BCDC prepared a vulnerability assessment for the San Francisco Bay shoreline. The assessment, published in 2011, focused on shoreline development, the Bay ecosystem, and governance. The report provided the basis for a subsequent amendment to the Bay Plan specifically addressing sea level rise. While the report acknowledged the limitations of BCDC's regulatory authority to ensure that sea rise is taken into consideration in project planning, it also identified a number of strategies that the agency and others can undertake to address issues identified in its vulnerability assessment, summarized in Table 12-7.

Flooding resulting from sea level rise can threaten shoreline infrastructure.

Another regional effort to address sea level rise is being led by the Joint Policy Committee, which coordinates the regional planning efforts of ABAG, the BAAQMD, the San Francisco BCDC and MTC. In September 2012, the Joint Policy Committee adopted a work plan to develop a Regional Sea Level Rise Adaptation Strategy. The objective of the project is to ensure the ongoing health and ecological viability of regional natural resources; coordinate adaptation mechanisms that transcend local jurisdictional boundaries; and share the costs of adaptation responses at a regional level. The sea level rise adaption strategy work plan focuses on developing a "bottom-up" regional strategy where the regional agencies work with local entities to assess vulnerabilities and risks, identify critical assets, explore adaptation options, and use a balanced approach to identify costs, benefits and adaptation strategies for the natural resources and ecosystem services provided by the Bay and its watersheds. The first phase of this effort includes considering sea level rise exposure in the current Plan Bay Area Sustainable Communities Strategy and its Environmental Impact Report (described above under Section 12.4.2.1). The second phase will include convening and supporting Subregional and local planning adaptation planning efforts, and incorporating lessons learned into the Bay Area's second Sustainable Communities Strategy. The third phase will include developing a regional sea level rise adaptation strategy, informed by the lessons learned in phases one and two, which will be incorporated into the third iteration of the Sustainable Communities Strategy. This effort is also proposed as an IRWMP project.



Examples of climate change adaptation strategies identified in local and regional plans include (clockwise from top) restoring shoreline habitats, increasing use of recycled water, and improving levees and flood control structures.

As acknowledged in Chapter 16, as more information becomes available on impacts of climate on water resources and adaptation strategies emerge and mature, planning at all levels will need to be updated. Existing regional planning forums provide venues to disseminate this information, and the IRWMP provides a vehicle to support regional solutions.

Table 12-5: Climate Change Mitigation Strategies Identified in Bay Area Regional and Local Plans[a]

Category of Action	Strategy/Action	
Transportation	• Establish a regional public charger network for plug-in hybrid electric vehicles • Establish vehicle buy-back and plug-in hybrid electric vehicles or battery electric vehicle purchase incentives • Expand car sharing services • Increase MTC's vanpool program incentive • Establish a clean vehicles rebate program	• Implement a Smart Driving Strategy (tire pressure rebates, in-vehicle fuel economy meter rebate program) • Implement a Commuter Benefits Ordinance • Encourage and accelerate implementation of bicycle/pedestrian plans • Consider establishing a Car-Free Sunday community event to demonstrate non-vehicular uses for streets • Adopt of low emission government vehicles
Land Use & Planning	• Support mixed-use infill and new development • Utilize Priority Development Areas in development planning • Shift parking policies to promote infill development	• Require new development to supply an adequate number of street trees and private trees • Require new sidewalks, crosswalks, and parking lots to be made of cool paving materials with a high solar reflectivity.
Energy Use	• Achieve zero net energy performance in new construction by 2020 • Enhance and lower the cost of energy efficiency services and standards for existing residential and non-residential buildings • Develop a local, clean, decentralized renewable energy supply • Use city codes, ordinances, and permitting to enhance green building, energy efficiency, and energy conservation	• Promote green building and energy efficient development for government operations and city infrastructure • Encourage existing development and require new development to utilize PG&E's SmartMeter system to facilitate energy and cost savings • Reduce carbon intensity of energy supply provided by utilities • Participate in and promote greenhouse gas emissions inventory tracking and reporting • Incentivize solar energy installation
Water/Wastewater	• Reduce community and municipal water use through building and landscape design and improvements • Increase or establish use of reclaimed/grey water systems • Encourage existing development and require new development to utilize smart water meters to facilitate water and cost savings	• Improve the efficiency of water and wastewater facilities • Increase water reuse
Waste Reduction & Recycling	• Increase recycling, organics diversion, and waste reduction associated with municipal operations • Expand the types of materials that can be recycled locally, such as certain plastics.	• Expand efforts to eliminate waste at its source • Reduce the availability or use of common materials that are not recyclable or that are not cost-effective to recycle
Habitat Conservation & Agriculture	• Initiate Priority Conservation Areas pilot program • Complete the region's three major multi-use trails	• Increase the amount of food grown and consumed locally • Develop a regional agricultural and farmland protection plan
Community Outreach & Education	• Launch a coordinated outreach and education campaign to mobilize residents, businesses, and industry • Partner with schools to promote sustainability efforts • Prepare local residents for job opportunities in the emerging green economy	• Increase awareness and action in the City government by providing training on how to increase sustainability at home and in the workplace

Note:
(a) Mitigation strategies were drawn from a selection of plans representing the region as a whole as well as the four Bay Area Subregions. Plans reviewed for mitigation strategies include Plan Bay Area: Technical Summary of Proposed Climate Policy Initiatives (May 4, 2012), Plan Bay Area: Jobs-Housing Connection Strategy (May 16, 2012), City of Berkeley Climate Action Plan (June 2009), City of Pleasanton Climate Action Plan (2012), City of Santa Rosa Climate Action Plan (2012), City of Palo Alto Climate Protection Plan (2007) and City/County Association of Governments of San Mateo County Regionally Integrated Climate Action Planning Suite (2012).

Table 12-6: Climate Change Adaptation Strategies Identified In Bay Area IRWMP and Local Plans

Vulnerabilities by Priority	Overview	Adaptation Strategies Identified in Bay Area IRWMP[a]: General	Adaptation Strategies Identified in Bay Area IRWMP[a]: Specific	Functional Area Affected	Adaptation Strategies in Local Plans[b], [c]
Sea Level Rise	Low-lying Baylands increasingly vulnerable to more frequent, longer, deeper flooding Critical infrastructure in the hazard zone, for example 22 wastewater treatment plants and 12 power plants vulnerable to 100-year coastal flood	• Incorporate climate change adaptation into relevant local and regional plans and projects. • "No Regrets" approach to address immediate or ongoing concerns while reducing future risks • Establish a climate change adaptation public outreach and education program. • Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation strategy development and regional approaches. • Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness. • Update building codes and zoning.	• Multifunctional ecosystem-based adaptation along the bayshore and rivers • Remove critical infrastructure from hazard zone • Raise, armor and maintain flood control structures that protect critical infrastructure that cannot be moved. • Excluding placement of new infrastructure in areas likely to be inundated. • Improve emergency preparedness, response, evacuation and recovery plans.	Flood Protection & Stormwater Management Wastewater and Recycled Water	• Elevated, terraced levees (South Bay) • Marsh restoration
Flooding	More intense storms leading to more frequent, longer, deeper flooding generally expected				
Water Supply and Hydropower	***Sierra Nevada Sources*** – decrease in total precipitation is possible; decrease in snowpack is expected; increased evapotranspiration is expected; shift in timing of runoff virtually certain; and timing and amount of power generation is expected to change		• Continued water conservation • Reduce reliance on imported water • Increased use of recycled water • Improve potential movement of water supplies among neighboring agencies during periods of extreme water shortage • Expand available water storage • Adopt land use ordinances that protect natural functioning of groundwater recharge areas	Water Supply & Water Quality	• Water conservation • Additional storage to take advantage of wet season water • Diversifying water supply portfolios through development of additional supplies and/or transfers • Local capture and reuse projects • Desalination • Increased use of recycled water • Additional treatment options to respond to water quality impacts
	Delta Sources – impacts from sea level rise				
	Regional Sources – continued variability in precipitation; potentially less spring precipitation; more intense storms may affect surface water runoff, storage, groundwater recharge				
Water Quality	***Sierra Nevada Supplies*** – imported water potentially vulnerable to water quality change		• Evaluate capability of surface water treatment plants to respond to extreme storm events and increased risk of wildfires. • Encourage projects that improve water quality of contaminated groundwater sources • Increase implementation of LID techniques to improve stormwater management.		
	Delta Supplies – increased salinity from sea level rise, increased turbidity from extreme storm events				
	Regional Supplies – water quality impacts from increased temperature, decreased precipitation, decreased recharge, more intense, storms, increased wildfire, risk, longer periods of low flow conditions.				

Vulnerabilities by Priority	Overview	Adaptation Strategies Identified in Bay Area IRWMP[a] General	Adaptation Strategies Identified in Bay Area IRWMP[a] Specific	Functional Area Affected	Adaptation Strategies in Local Plans [(b), (c)]
Ecosystem and Habitat	Changes in temperature and precipitation, together with increased wildfire will result in impacts to species, increased invasive species' ranges, loss of ecosystem functions, changes in growing ranges for vegetation.		• Provide or enhance connected "migration corridors" and linkages between undeveloped areas for animals and plants • Promote water resources management strategies that restore and enhance ecosystem services • Re-establish natural hydrologic connectivity between rivers and floodplains	Watershed Management – Habitat Protection and Restoration	• Incorporate sea level rise into baylands restoration planning
Water Demand	Demand likely to increase due to increases in air temperature, increased evaporation losses and longer growing season		• Continued water conservation • Implement tiered pricing to reduce water consumption and demand	Water Supply and Water Quality	• Water conservation - Commercial, industrial and residential water conservation programs - Utility demand management programs - Water-efficient landscaping programs

Notes:
(a) Refer to Chapter 16 for a discussion of climate change vulnerabilities, priorities and adaptation strategies.
(b) Includes strategies that promote adaptation, whether identified as such or not in the local plan.
(c) Plans reviewed for adaptation strategies include EBMUD's Urban Water Management Plan (UWMP, 2011) and Main Wastewater Treatment Plant Land Use Master Plan Environmental Impact Report (2011), San Francisco Public Utilities Commission's 2010 UWMP (2011), SCVWD's UWMP (2010), Contra Costa Water District's UWMP (2011), the San Jose/Santa Clara Water Pollution Control Plant Draft Master Plan (2011), South Bay Salt Ponds Restoration Project Final EIR/EIR (2007), Contra Costa Flood Control and Water Conservation District, The 50 Year Plan (2009), Napa Sanitation District Wastewater Treatment Plant Master Plan, (2011), North Bay Watershed Association, North Bay Watershed Stewardship Plan (2003), Napa County Resource Conservation District, Napa River Watershed Owner's Manual (1994), Bay Area Water Supply and Conservation Agency, Long Term Water Supply Strategy Phase IIA Final Report (2012).

Table 12-7: Summary of Sea Level Rise Adaptation Strategies Identified by the San Francisco Bay Conservation and Development Commission

Shoreline Development	***Risk Assessments.*** Conduct risk assessments for shoreline areas and larger shoreline projects. ***General Strategies*** • ***Design for the Long-Term.*** Design projects to be resilient to a mid-century sea level rise projection and adaptable to longer-term impacts. • ***Consider Impacts.*** Build projects that do not negatively impact the Bay and do not increase risks to public safety, or if projects do increase flood risks, ensure that regional public benefits outweigh the increased risk of flooding. • ***Incorporate Flood Protection.*** Protect new projects from future storm activity and sea level rise by using setbacks, elevating structures, designing structures that tolerate flooding or other effective measures. ***Public Access*** • ***Design to Avoid Impacts.*** Site, design, manage and maintain public access to avoid significant adverse impacts from sea level rise and shoreline flooding. • ***Accommodate Future Conditions.*** Design any public access to remain viable in the event of future sea level rise or flooding, or provide equivalent access to be provided nearby.	***Shoreline Protection*** • ***Locate Where Appropriate.*** Build shoreline protection only if necessary to protect existing or appropriate planned development. • ***Setbacks.*** Set aside land on the upland side of levees to allow for future levee widening to support additional levee height so that no fill is placed in the Bay. • ***Integrate with Other Protection Measures.*** Integrate shoreline protection projects with current or planned adjacent shoreline protection measures. • ***Nonstructural Protection.*** Include provisions for nonstructural shoreline protection methods such as marsh vegetation, whenever feasible. • ***Minimize Impacts.*** Avoid, reduce or mitigate adverse impacts to natural resources and public access from new shoreline protection. • ***Public Access.*** Design and construct shoreline protection to avoid blocking physical and visual public access.
Bay Ecosystem	***General Strategies*** • ***Preserve Sensitive Habitat.*** Preserve and enhance habitat in undeveloped areas that are both vulnerable to future flooding and have current or potential value for important species. • ***Incorporate Habitat into Shoreline Protection Design.*** Design shoreline protection projects to include provisions for establishing marsh and transitional upland vegetation as part of the protective structure, wherever feasible. • ***Include Buffers.*** Include a buffer, where feasible, between shoreline development and habitats to protect wildlife and provide space for marsh migration as sea level rises.	***Research and Planning*** • ***Conduct Research and Monitoring.*** Conduct comprehensive Bay sediment research and monitoring to understand sediment processes necessary to sustain and restore wetlands. • ***Update Targets to Accommodate Climate Change.*** Update regional habitat conservation and restoration targets to achieve a Bay ecosystem resilient to climate change and sea level rise.
Governance	***Regional Conservation Strategy*** • ***Adaptive Management.*** Develop a regional strategy for conservation and development of the Bay and its shoreline that incorporates adaptive management. • ***SB 375.*** Ensure that the strategy is consistent with the climate change mitigation goals of SB 375 and the principles of the California Climate Adaptation Strategy. • ***Update.*** Update the strategy regularly to reflect changing conditions and scientific information. ***Mapping*** • ***Map Vulnerable Areas.*** Include maps of shoreline areas that are vulnerable to flooding based on projections of future sea level rise and shoreline flooding. • ***Consult Authorities.*** Prepare the maps under the direction of a qualified engineer and regularly update them in consultation with government agencies with authority over flood protection	***Integration*** • ***Long-Term Planning.*** Identify and encourage the development of long-term regional flood protection strategies that may be beyond the fiscal resources of individual local agencies. • ***Incorporate Multiple Agencies.*** Develop a framework for integrating the adaptation responses of multiple government agencies. • ***Integrate with Local Processes.*** Provide information, tools, and financial resources to help local governments integrate regional climate change adaptation planning into local community design processes. • ***Environmental Justice.*** Address environmental justice and social equity issues. • ***Hazards and Emergencies.*** Integrate hazard mitigation and emergency preparedness planning with adaptation planning.

Source: Table 5.1 in San Francisco Bay Conservation and Development Commission, 2011. *Living With a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline*. October 6, 2011; adapted by ESA.

12.5 References

California Natural Resources Agency, 2009 California Climate Adaptation Strategy, 2009.

Institute for Local Government, *Track Bay Area Progress*, June 2012. Available online: http://www.ca-ilg.org/post/track-bay-area-progress, accessed February 8, 2013.

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Chapter 13: Relation to Local Land Use Planning

The intent of this chapter is to foster enhanced communication between land use managers and regional water management groups. The IRWM Plan Guidelines require that the Integrated Regional Water Management Plan (IRWMP) describe the current relationship between land use and water resources managers (e.g., how water management input is considered in land use decisions and vice versa), identify current constraints to collaboration, explore opportunities to facilitate improved collaboration, and identify plans to further a collaborative, proactive relationship between land use planners and water managers in the future.

This chapter was developed based on literature review of current planning efforts, written surveys completed by land use planning agencies, telephone surveys conducted with water resources planners, and meetings at regional planning forums. Refer to Chapter 2 for a description of the major water resource agencies in the Bay Area and to Chapter 12 for an overview of water resources planning in the region.

Many of the IRWMP objectives require coordination between land use planners and water managers; as a result, improving collaboration between land use planners and water resource managers will support accomplishment of the IRWMP objectives. Indeed, Objective 1.1 specifically calls for coordination between local land, water, wastewater and stormwater agencies to promote IRWM goals and identify areas of integration among projects. Examples of other objectives that would benefit from increased coordination include Objective 1.5 – Plan for and adapt to sea level rise; Objective 2.6 – Expand water storage and conjunctive management of surface and groundwater; Objective 3.3 – Minimize point-source and nonpoint-source pollution; Objective 4.1 – Identify and promote integrated flood management projects; and Objective 5.1 – Protect, restore and rehabilitate habitat for species protection. Refer to Chapter 3, Objectives, for further discussion of IRWMP objectives.

13.1 Land Use Planning in the Bay Area

Bay Area cities and counties typically have primary authority over land use decisions while management of water resources typically is the purview of special districts, flood control agencies, investor-owned utilities, and mutual water companies. Integrating land use and water resources decision-making is essential for meeting existing and future resource management challenges. Described below are regional and local land use planning agencies and major planning initiatives.

The San Francisco Bay Area is the ancestral territory of Bay Area Tribes. The majority of Bay Area Tribes acknowledge an inherent responsibility for managing their ancestral territories regardless of whether they currently have the capacity to do so. Therefore, Bay Area Tribes' jurisdiction goes beyond the gathering, fishing, and hunting rights, which each individual Tribal member retains. Each of the Bay Area Tribes have a land use stewardship responsibility and each Tribe conducts these activities according to their own traditional policies, laws, mandates, and capacity.

13.1.1 Regional Planning

The key agencies involved in Bay Area-wide regional land use planning include the Association of Bay Area Governments (ABAG) and the other member agencies of the Joint Policy Committee (JPC).

13.1.1.1 ABAG

ABAG coordinates planning activities within the region and carries out select state and federal statutory duties, including setting state-mandated fair-share regional housing allocations for Bay Area cities and counties. ABAG's members include the nine Bay Area counties and the 101 cities and towns within the Bay Area.[27] Formed in 1961, ABAG's mission is to strengthen cooperation and coordination among local governments. ABAG has examined regional issues such as housing, transportation, economic development, and the environment. ABAG's "Projections" series provides long-term population, housing, and economic forecasts through a series of computer models. Transportation and air quality agencies, water agencies, local governments, and others rely on ABAG's model results for planning.

Plan Bay Area encourages resource conservation and reductions in greenhouse gas emissions by advocating for compact, mixed-use re-development in existing urban areas.

13.1.1.2 Joint Policy Committee and Plan Bay Area

As mentioned in Section 2.1.3.4 in Chapter 2, the regional planning efforts of ABAG, Bay Area Air Quality Management District (BAAQMD), the San Francisco Bay Conservation and Development Commission (BCDC) and the Metropolitan Transportation Committee (MTC) are coordinated by the JPC. Formed in 2003, the JPC is composed of twenty members from these agencies, and select representatives from the State (One Bay Area, 2013). The Joint Policy Committee provides structure for coordinating the development and drafting of major planning documents for its four member agencies.

Under the coordination of the JPC, ABAG and MTC, in partnership with BAAQMD and BCDC, are leading an initiative, "OneBayArea," to coordinate efforts among the region's counties and cities to "create a more sustainable future". A major effort of OneBayArea is the development of

27 Note that ABAG includes the entirety of all nine Bay Area counties and therefore overlaps with other IRWM regions.

Plan Bay Area: the region's long-range plan for sustainable land use, transportation, and housing.

Plan Bay Area responds to Senate Bill 375, requiring California's metropolitan areas to reduce greenhouse gas emissions. SB 375 requires the adoption of a Sustainable Communities Strategy that identifies where the region's population will be housed and integrates land use planning and transportation planning via compact, mixed-use development: development patterns that advance stewardship of water resources consistent with the Ahwhanee Principles.[28] During development of Plan Bay Area, which began in 2010, the JPC engaged with local land use planning agencies and the public to identify and assess several scenarios for the region. The Draft Plan Bay Area and corresponding Draft EIR were released on April 2, 2013 for public review. The Draft Plan Bay Area features a preferred scenario that assumes a land use development pattern that concentrates future household and job growth into Priority Development Areas identified by local jurisdictions. It pairs this land development pattern with MTC's Preferred Transportation Investment Strategy, which dedicates nearly 90 percent of future revenues to operating and maintaining the existing road and transit system.

The San Francisco Bay Conservation and Development Commission regulates development along the Bay shoreline.

The JPC is also leading a regional effort to develop a Regional Sea Level Rise Adaptation Strategy by working with local entities to assess risks, identify critical assets and explore sea level rise adaptation options. The results of the effort will be incorporated into future Plan Bay Area updates. See Chapter 12, Relationship to Local Water Planning, for more detail.

13.1.1.3 San Francisco Bay Conservation and Development Commission

The BCDC is a state agency created in 1965 to protect and enhance the San Francisco Bay by regulating development along the Bay and its shoreline. BCDC has permit jurisdiction over shoreline areas subject to tidal action up to the mean high tide line and including all sloughs, tidelands, submerged lands, and marshlands lying between the mean high tide and 5 feet above mean sea level for the nine Bay Area counties with Bay frontage, and the land lying between the Bay shoreline and a line drawn parallel to, and 100 feet from, the Bay shoreline. The *San Francisco Bay Plan*, prepared in 1969 and amended in 2007 and 2011, guides the protection and use of the Bay and its shoreline and provides policy direction for BCDC's permit authority

[28] The Ahwahnee Principles for Resource-Efficient Communities, written in 1991 by the Local Government Commission, are a set of principles to intended to guide development of compact, mixed-use, walkable, transit-oriented communities. In 1995, the Ahwahnee Water Principles for Resource Efficient Land Use were created to encourage integration of water resource, planning and land use decisions.

regarding the placement of fill, extraction of materials, determination of substantial changes in use of land, water, or structures within its jurisdiction, protection of the Bay habitat and shoreline, and maximization of public access to the Bay.

13.1.1.4 LAFCOs and Municipal Service Reviews

To provide for better coordination of local land use planning, the California Legislature created Local Agency Formation Commissions (LAFCOs) within each county to discourage urban sprawl and to preserve open space and agricultural lands while meeting regional housing needs and planning for the efficient provision of public services and utilities, including water and wastewater service. LAFCOs have approval authority (with some limits) over the establishment and expansion of municipal and service district boundaries, including expansion related to a city proposing to expand its sphere of influence. LAFCOs also have responsibility to conduct Municipal Service Reviews which evaluate the provision of municipal services within each county. Municipal Service Reviews are required to include determinations regarding (among other things) infrastructure needs or deficiencies, growth and population projections for the affected area, and government structure options (including service providers).

13.1.1.5 Land Management by Federal, State and Other Non-Municipal Agencies

Several other agencies besides regional governments (described above) and municipal governments (described below) exercise land use planning authority independent of local land use planning agencies for lands or projects that fall under their control. The land use planning authority of these entities may derive from land ownership or regulatory authority over certain lands. Examples of these agencies and the lands or project types that they manage in the Bay Area include:

- National Park Service (e.g., Golden Gate National Recreation Area, Presidio of San Francisco)
- U.S. Fish and Wildlife Service (e.g., Don Edwards National Wildlife Refuge)
- National Oceanic and Atmospheric Administration (e.g., the San Francisco Bay National Estuarine Research Reserve, in partnership with San Francisco State University)
- California Fish and Wildlife (e.g., the Eden Landing pond complex of the South Bay Salt Ponds)
- Water resources agencies (e.g., for management of water bodies, watersheds, and flood control features under their control)[29]
- University and college campuses (e.g., UC Berkeley, UC San Francisco, Cal State East Bay)
- California Coastal Commission (regulating development along the coast via the California Coastal Act and review of Local Coastal Programs)

[29] Pursuant to Section 53091 *et seq* of the California Government Code, the activities of many water resource agencies are exempt from certain local land use policies.

- California Energy Commission and California Public Utilities Commission (regulating select energy and utility projects, respectively)

Some of these entities develop land use plans containing policies governing the lands that they manage. Examples include the Golden Gate National Recreation Area General Management Plan, the Presidio Trust Management Plan, the Don Edwards San Francisco Bay National Wildlife Refuge Comprehensive Conservation Plan, watershed management plans implemented by water resource agencies, and long range development plans implemented for university and college campuses.

13.1.2 Local Land Use Planning

13.1.2.1 Cities, Counties and Multipurpose Agencies

As indicated in Chapter 2 (Sections 2.1.1 and Section 2.2.9), the Bay Area includes all of San Francisco County and parts of Alameda, Contra Costa, San Mateo, Santa Clara, Marin, Napa, Sonoma and Solano counties (see Figure 2-1). There are 101 incorporated cities in the Bay Area; Figure 2-2 depicts major cities in the region.

While most land use planning in the Bay Area takes place through city and county governments[30] many are multipurpose agencies with respect to one or more water management areas, and each deals with multiple water resources agencies. The number of agencies involved in water resources and land use planning, coupled with constraints on staff resources, can impede collaboration. As an example, Table 13-8 indicates the array of agencies involved in water, wastewater, and stormwater management in one Bay Area county -- Alameda. The information in Table 13-8 is drawn from the County's Municipal Service Review (Alameda Local Agency Formation Commission, 2005). As shown, there are 16 water, wastewater, and flood control service providers; stormwater management and wastewater collection are generally within the purview of the cities and the county; and while water services are largely provided by "limited purpose" agencies, three cities and one county service area are water retailers. At the other end of the spectrum, various branches within the City and County of San Francisco manage the full scope of water resources and land use planning functions within that jurisdiction. Governance patterns within the other seven counties in the region generally trend closer to the Alameda County example.

Key local planning processes that influence, and are influenced by water resources management include general plans; specific plans, zoning ordinances and conditional use permits; water supply assessments; and stormwater management, discussed below.

13.1.2.2 General Plans

Each city and county in California is required to adopt a comprehensive, long-term general plan for the physical development of its jurisdiction. The general plan is a statement of development policies and is required to include land use, circulation, housing, conservation, open space,

30 There are exceptions to this, including the universities and colleges, and in some cases water resources agencies (e.g., for management of water bodies, watersheds, and flood control features); the California Coastal Commission (regulating development along the coast) and San Francisco Bay Conservation and Development Commission (BCDC) (regulating development close to San Francisco Bay); and the California Energy Commission and California Public Utilities Commission (regulating select energy and utility projects, respectively).

noise, and safety elements. The land use element designates the proposed general distribution, location, and extent of land uses and includes a statement of the standards of population density and building intensity recommended for lands covered by the plan.

General Plans and Development. With respect to planning development to accommodate housing growth, the State Planning and Zoning law (California Government Code 65580 et seq.) prescribes that the housing element of a general plan may not be constrained by the lack of all needed governmental services, including water service. The housing element is required to plan for the housing allocated to a given city or county pursuant to Government Code Section 65584 (in this case the Association of Bay Area Governments, ABAG, discussed below). To the extent that governmental services, like a public water supply, are not available to fully meet a city's or county's housing allocation, state law requires the city or county to "remove the governmental constraints" to the development of the housing described in the general plan. This requirement promotes the state general plan policy that "the availability of housing is of vital statewide importance, and the early attainment of decent housing and a suitable living environment for every California family is a priority of the highest order" that "requires the cooperative participation of government and the private sector in an effort to expand housing opportunities and accommodate the housing needs of Californians of all economic levels". State legislation (discussed below under Water Supply Assessments) ensures that specific housing and other development projects are not approved and constructed without a demonstrated, adequate water supply.

Table 13-8: Agencies and Providers Involved in Water, Sewer, and Stormwater Services in Alameda County

	Water														
	Wholesale					Retail			Sewer				Stormwater		
Provider	Importing	Extraction/ Wells	Ground-water Mgmt.	Treatment	Recycled Water	Potable	Raw	Recycled	Collection	Treatment	Disposal	Flood Control	Maintenance	Permitting	Preventive
"Limited Purpose" Providers															
Alameda County Flood Control and Conservation District												✓			
Alameda County Water District		✓	✓	✓		✓									
Contra Costa Water District															
Castro Valley Sanitary District									✓						
Dublin San Ramon Services District					✓	✓		✓	✓	✓					
East Bay Municipal Utility District	✓			✓	✓	✓		✓		✓	✓				
Oro Loma Sanitary District									✓	✓					
Union Sanitary District									✓	✓				✓	
Washington HCD		✓													
Zone 7 Water Agency	✓	✓	✓	✓			✓					✓			
Cal Water						✓									
San Francisco Public Utilities Commission	✓			✓		✓	✓								
State Water Project															
East Bay Dischargers Authority											✓				
Livermore-Amador Valley Wastewater Management Agency											✓				
U.S. Army Corps of Engineers												✓			

	Provider	Water								Sewer			Flood Control	Stormwater		
		Wholesale					Retail									
		Importing	Extraction/ Wells	Ground-water Mgmt.	Treatment	Recycled Water	Potable	Raw	Recycled	Collection	Treatment	Disposal		Maintenance	Permitting	Preventive
Multipurpose Agencies																
Cities	Alameda									✓			✓	✓	✓	✓
Cities	Albany									✓			✓	✓	✓	
Cities	Berkeley									✓			✓	✓	✓	✓
Cities	Dublin													✓	✓	
Cities	Emeryville									✓				✓	✓	
Cities	Fremont													✓		✓
Cities	Hayward						✓			✓	✓			✓	✓	✓
Cities	Livermore					✓	✓		✓	✓	✓			✓	✓	✓
Cities	Newark													✓	✓	✓
Cities	Oakland									✓				✓	✓	✓
Cities	Piedmont									✓			✓	✓	✓	✓
Cities	Pleasanton						✓			✓				✓	✓	✓
Cities	San Leandro									✓	✓			✓	✓	✓
Cities	Union City													✓	✓	✓
Castlewood and Five Canyons County Service Areas							✓			✓				✓		
East Bay Regional Park District				✓												
Alameda County														✓	✓	✓

Source: Table ES-2 in Final Municipal Service Review Volume II – Utility Services, Report to the Alameda Local Agency Formation Commission, 2005; adapted by ESA.

Water Resources in General Plans. Water resource topics are usually addressed in general plan conservation, public services and/or open space elements. Policies are developed which connect the management of water resources and provision of water supply infrastructure with development patterns. In 2003, the California Governor's Office of Planning and Research published general plan guidelines that encouraged jurisdictions to include an optional water element in their general plan to allow a more thorough consideration of water supply availability and subsequent development decisions. The water element of the general plan must be developed in coordination with any county-wide water agency and with all districts and city agencies that have developed, serviced, controlled, managed, or conserved water of any type for any purpose in the city or county for which the general plan is prepared. Such coordination must include the discussion and evaluation of water supply and demand information. As of May 2012, 5 counties and 18 cities in the Bay Area had adopted optional water resources elements in their general plans (Governors Office of Planning and Research 2011, Governors Office of Planning and Research 2012).

In 2007, legislation[31] was passed to facilitate coordination between land use and flood risk management agencies by updating cities' and counties' responsibilities related to local land use planning requirements. Specifically, the legislation requires cities and counties to amend their general plan land use, conservation, safety and housing elements to consider and address flood risks. Revised water resources policies are required to be developed in coordination with applicable flood management, water conservation and groundwater agencies.

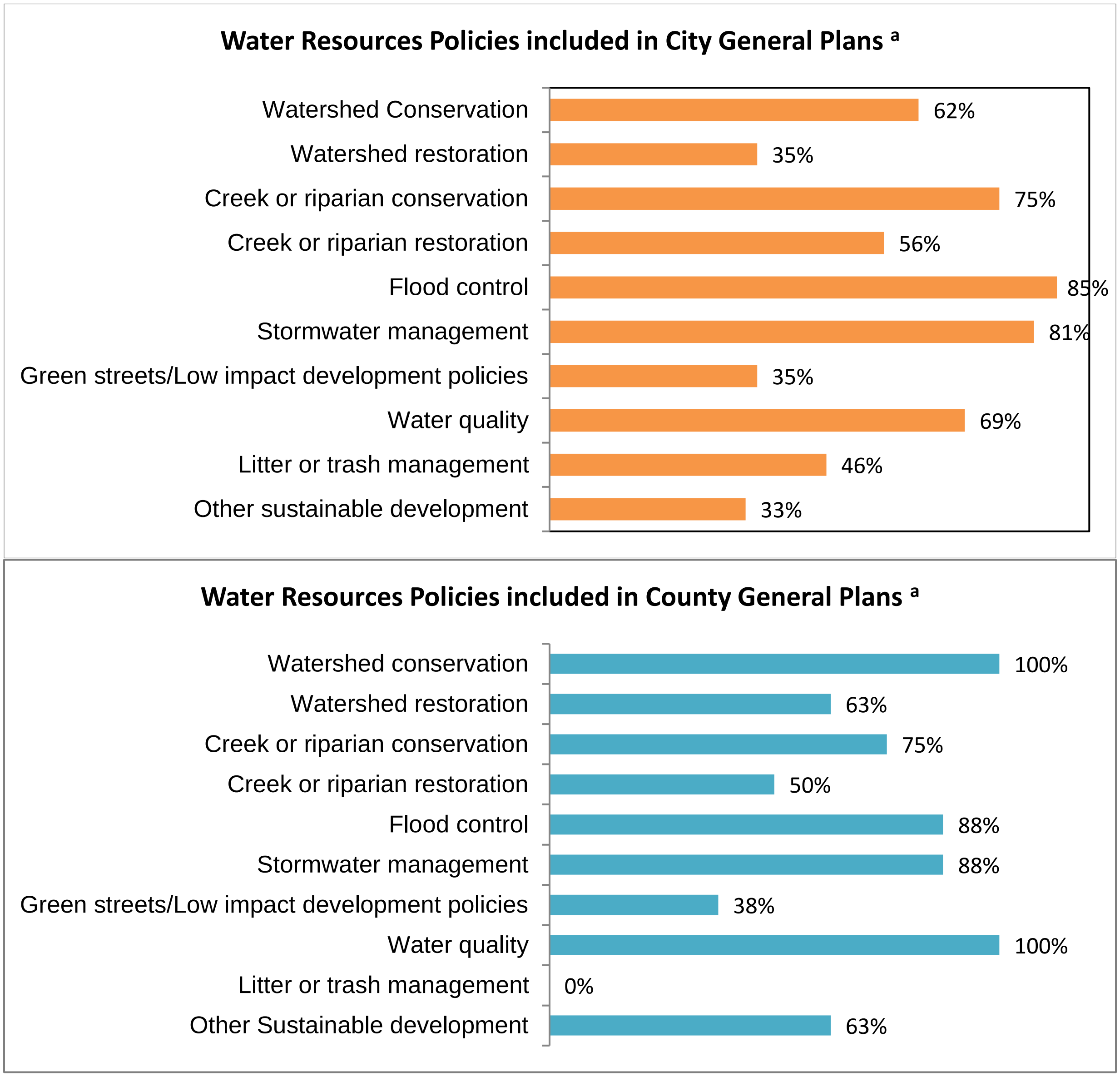
Figure 13-3 presents the results of a survey (described in Section 13.2.2) of the prevalence of water resources policies contained in city and county general plans.

13.1.2.3 Specific Plans, Zoning Ordinances, and Conditional Use Permits

City and county planning agencies also use specific plans, zoning ordinances and other development regulations (e.g., urban limit lines), and conditional use permits to implement the general plan and regulate development as well as the protection of water resources within their jurisdictions. Specific plans can be used to implement policies of a general plan "that are specific to financing infrastructure improvements and extensions [within a particular area], or cost recovery programs may be implemented by matching land uses with supporting public facilities (Governors Office of Planning and Research, 2001)." Conditional use permits (CUPs) are planning tools to impose specific requirements on a given proposed land use. In the context of water resources management, CUPs can provide opportunities to impose requirements that advance numerous policies, including low impact development (LID) features to manage stormwater run-off and reduce impervious surfaces and reduce flooding potential.

[31] AB 162, codified in Government Code Sections 65302(a), 65302(d), 65302(g), 65584.04 and 65584.06

Figure 13-3: Water Resources Policies Contained In Bay Area General Plans



Notes:
(a) "Other sustainable development" includes green building, density increase, water recycling, greenhouse gas (GHG) emissions, open space conservation, green government, climate change and sea level rise plans, complete streets, transit oriented development, and rainwater and greywater reuse.

Source: San Francisco Estuary Partnership, *Local Governments Watershed Inventory*, September 12, 2012.

13.1.2.4 Water Supply Assessments

Senate Bill (SB) 610 and SB 221 (codified primarily in the California Water Code and Public Resources Code) took effect in 2002 and require increased efforts to identify and assess the reliability of water supplies and increased levels of communication between land use planning authorities and local water suppliers. SB 610 requires that CEQA review for most large projects and smaller projects meeting certain thresholds include a water supply assessment. The water supply assessment must address whether existing water supplies will suffice to serve the project and other planned development over a 20-year period in average, dry, and multiple-dry year conditions, and must set forth a plan for finding additional supplies necessary to serve the project. Cities and counties can approve projects notwithstanding identified water supply shortfalls provided that they address such shortfalls in their findings. SB 221 (applying to similar sized projects as those addressed in SB 610) requires that cities and counties impose a new condition of tentative subdivision approval, requiring that the applicant provide a detailed, written verification from the applicable water supplier that a sufficient water supply will be available before the final subdivision map can be approved.

13.1.2.5 Stormwater Management Plans

Among the Functional Areas addressed in this IRWMP, stormwater management may reflect the highest degree of integration of water resources and land use planning. Compliance with the Bay Area Municipal Regional Stormwater National Pollution Discharge Elimination System Permit (MRP) is the primary driver for addressing water quality in stormwater discharges and a primary means of improving water quality in Bay Area receiving waters, consistent with the San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan).

Section C.3 of the MRP requires the permittees (cities, counties and special districts) to use their planning authorities to include appropriate source control, site design, and stormwater treatment measures in new development and redevelopment projects of 10,000 or more square feet to address pollutant discharges and prevent increases in runoff flows. Therefore, compliance with Section C.3 provisions requires upfront land use and site design planning to identify appropriate stormwater control measures. Municipalities generally implement the provisions of Section C.3 by requiring a stormwater control plan, describing proposed long-term stormwater control measures, to be submitted as part of the development approval process for new projects. If onsite measures are not feasible, project proponents can work with municipalities and regulatory agencies to identify regional off-site stormwater management facilities. The C.3 provisions may preclude certain land uses and/or development of certain sites if appropriate measures are not feasible.

Section C.6 of the MRP requires permittees to implement a construction site review and inspection program to avoid and minimize water quality impacts from construction activity. Prior to issuance of grading permits, permittees are required to review adequacy of stormwater and erosion control plans and verify that construction sites disturbing one acre or more of land have filed a Notice of Intent for coverage under the State General NPDES Permit for Stormwater Discharges Associated with Construction Activities (Construction General Permit). The Construction General Permit requires (among other things) preparation of a Stormwater Pollution Prevention Plan that specifies best management practices to prevent construction pollutants from contacting stormwater.

Many municipalities have formed countywide "clean water" programs to meet MRP regulations by sharing resources and collaborating on projects of mutual benefit.

Senate Bill 985 requires the development of a stormwater resource plan in order to receive grants for stormwater and dry weather runoff capture projects. Stormwater Resource Plans developed in the Region are approved by the CC and attached as addenda to this Plan. Stormwater Resource Plans can be found in Appendix G.

13.1.2.6 Flood Protection and Floodplain Management

An important driver of flood protection planning in the Bay Area is the National Flood Insurance Program (NFIP), managed by the Federal Emergency Management Agency (FEMA). The NFIP offers federally backed flood insurance to communities that develop and adopt floodplain management ordinances to regulate development in high flood risk areas. Because flood insurance is a prerequisite for obtaining a mortgage for properties within floodplains, nearly all Bay Area municipalities have floodplain management ordinances based on the FEMA model. The NFIP's Community Rating System (CRS) provides further incentive to develop floodplain management ordinances by offering reductions on flood insurance premiums to communities that undertake additional floodplain management activities. Ordinances require new residential construction or reconstruction to follow guidelines to reduce risk of flood damage and encourage a multi-objective approach to floodplain management.

13.1.2.7 Other Regulatory Drivers

There are numerous additional ways in which water resources regulations drive land use agency action, including the examples discussed below.

San Francisco Bay Basin Water Quality Control Plan (Basin Plan). The Basin Plan, developed and implemented by the San Francisco Bay Regional Water Quality Control Board (Water Board) is the central planning document governing water quality in the Bay Area. The Basin Plan provides a program of actions designed to preserve and enhance water quality and protect beneficial uses. In 1995, the Water Board adopted a watershed management approach to achieving water quality goals specified in the Basin Plan. The watershed management approach relies on water quality monitoring and stakeholder involvement, including local land use agencies, to develop watershed action plans to address high priority water quality issues.

Total Maximum Daily Load (TMDL) Programs. Section 303(d) of the Clean Water Act requires that states identify and restore water bodies that do not meet water quality standards. Once a water body is identified as impaired, a TMDL is developed to identify sources of pollutants and specify actions necessary to ensure attainment of water quality standards. TMDLs must account for all sources of a pollutant, including point and nonpoint sources. Because nonpoint source pollution is strongly related to local land use, land use management is an essential component of TMDL implementation. Examples of land use actions that may be required under a TMDL include urban and agricultural erosion control measures, agricultural fertilizer and waste management measures, riparian buffers and setbacks and urban runoff management measures. There are currently nine completed TMDLs in the Bay Area that address a range of pollutants including mercury, pathogens, sediment, PCBs and pesticide toxicity.

Senate Bill X7-7 (codified in California Water Code Sections 10608 and 10800-10853) creates a framework to reduce California's per capita water consumption 20% by 2020. The law establishes methods for urban retail water suppliers to determine their urban water use target. Methods specified include: setting a conservation target of 80 percent of their daily per capita water baseline; utilizing performance standards for indoor, landscaping, industrial and institutional uses; meeting 95 percent of the per capita water goal for their specific hydrologic region as identified by the California Department of Water Resources (DWR) and other state agencies in the *20x2020 Water Conservation Plan*; or using an alternative method developed by DWR. The bill also requires urban water suppliers to set an interim urban water use target and meet that target by December 31, 2015. SB X7-7 also requires agricultural water suppliers to implement efficient water management practices and prepare, adopt, and periodically revise agricultural water management plans to document their water conservation efforts. DWR is required to work cooperatively with the California Urban Water Conservation Council in achieving the goals of SBX7-7. Implementation of SB 7X 7 requirements is resulting in changes in local land use planning practice to encourage and require reductions in per capita consumption. For example, some Bay Area municipalities are collaborating with local water districts to incorporate water efficiency requirements into the development approval process.

13.2 Current Relationship between Land Use and Water Planning Agencies

To characterize the existing relationship between local land use agencies and water resource managers, literature review of current planning and consultation processes was conducted, and surveys and interviews were conducted with agencies throughout the region.

13.2.1 Examples of Current Collaboration

Consultation between land use planners and water resources managers occur during long-term planning, at the project level, and in association with a variety of specific initiatives and regulatory drivers. For the purposes of structuring this section, examples of interaction are presented in the following categories:

- Long-Term Planning
- Project Driven Consultation
- Other Forms of Collaboration

13.2.1.1 Long-Term Planning

General Plan Consultation. As described above, consultation, development and approval of general plans provides an opportunity for interaction between water resource managers and land use planners.

Urban Water Management Plans. A major driver of coordination between water supply managers and land use managers is the Urban Water Management Planning Act. The Act requires all urban water suppliers[32] to carry out long-term resource planning responsibilities through development of Urban Water Management Plans (UWMPs). UWMPs assess the

[32] A supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually.

reliability of the supplier's water sources over a 20-year planning horizon considering normal and drought conditions. In preparing the UWMP, the urban water supplier is required to coordinate with other appropriate agencies, including other water suppliers that share a common source, water management agencies, and relevant public agencies, including land use planning agencies. UWMPs must be provided to land use agencies following each update (i.e., every five years). When a city or county proposes to adopt or substantially amend a general plan, the water agency is required to provide the planning agency with the current adopted UWMP and other information relevant to the system's sources of water supply. Appendix 12 lists all UWMPs within the Bay Area region; 25 cities in the Bay Area region are water retailers, providing water service within their jurisdictions and preparing their own UWMPs.

Demographics, Forecasts and Resource/Facilities Planning. The projections that most Bay Area water and wastewater agencies use for demand forecasts and facilities planning usually rely to some extent on ABAG forecasts, general plan forecasts, or other inputs from cities and counties to ensure the provision of adequate services.

Flooding in Napa County.

In addition to the examples above, Appendix 12 identifies numerous other long-term planning efforts relevant to Bay Area water resources.

Flood Protection Planning. In 2007, legislation[33] was passed to encourage cities and counties to adopt a local hazard mitigation plan (LHMP) in conjunction with the revised safety element of the general plan. In 2010 ABAG adopted a multi-jurisdictional local hazard mitigation plan. The plan was developed with input from agencies with both land-use and water management authority, including city and county governments, water districts and flood control districts. The purpose of the plan is to identify and assess vulnerability to hazards in the Bay Area and to identify specific actions that can be taken to reduce risk from hazards. The plan contains a description of general land-use planning actions that can be taken within the Bay Area to mitigate flooding hazards. Examples of strategies related to flood management include providing mechanisms to ensure new development in floodplains is reviewed by local flood control districts, enforcing compliance with NFIP requirements for new construction and encouraging setbacks for developments near floodways. Participating governments and special districts in the Bay Area have also developed their own annexes to ABAG's multi-jurisdictional plan, which document each government's specific efforts to mitigate flood risk.

13.2.1.2 Project-Driven Consultation

There are numerous triggers for consultation between land use planners and water resource managers at the project level. Several water resource managers interviewed indicated that receipt of a California Environmental Quality Act (CEQA) document on a project (e.g., a Notice

[33] AB 2140, codified in Government Code Sections 65302.6 and 8685.9

of Preparation for an environmental impact report) triggered consultation with a local land use agency. Many water resource managers have consultation requirements under CEQA as responsible agencies or agencies with jurisdiction by law. Water supply managers also become involved in project consultation through Water Supply Assessment requirements described under Section 13.1.2.4. Others identified consultation driven by development permits and other steps in project review (e.g., plan reviews, issuance of tentative subdivision maps). One agency staff indicated that occasionally she learns about a project when the agency received an application for water service.

13.2.1.3 Other Forms of Collaboration

Collaboration and consultation between water managers and land use planners takes many other forms; examples include:

- Periodic and regularly scheduled multi-disciplinary meetings with planning agency staff
- Development of water- and resource-conservation based ordinances and policies (e.g., recycled water ordinances)
- Presentations to the Council of Mayors
- Routine meetings with City Managers
- Topic-specific forums such as the integration of stormwater and wastewater management
- Development of guidance documents (e.g., the Ocean Protection Council's *State of California Sea-level Rise Guidance Document*, San Mateo County's Green Streets)
- Development of education and outreach programs (e.g., the Bay Area Regional Water Conservation and Education Program, Bay Friendly Landscaping and Gardening Coalition, described in Section 4.2.1.2 of Chapter 4, Resource Management Strategies)
- Development of multi-agency habitat or watershed planning documents (e.g., the Baylands Ecosystem Habitat Goals Project, described in Section 4.2.6.2 of Chapter 4, Resource Management Strategies).
- LID Leadership Group initiatives (e.g., Bay Area Green Infrastructure Master Planning Grant; project to identify local plans, policies and programs that lead to the development of integrated water projects).
- Resource Conservation Districts (RCDs) of the Bay Area – RCDs across the Bay Area collaborate to coordinate technical, financial and educational resources to meet local and regional demands for conservation, restoration, and protection of soil, water, and related natural resources.
- San Francisco Bay Restoration Authority, a regional agency with a governing board made up of local elected officials, was created in 2008 to raise and allocate local resources for the restoration, enhancement, protection, and enjoyment of wetlands and wildlife habitat in San Francisco Bay and along its shoreline.

- Bay Area Open Space Council, a regional collaborative of land conservation and management entities working towards long-term protection of sensitive habitat and open space lands in the Bay Area.

- Adapting to Rising Tides, a collaborative planning effort to help San Francisco Bay Area communities adapt to rising sea levels, increasing the Bay Area's preparedness and resilience to sea level rise and storm events while protecting critical ecosystem and community services. Led by the San Francisco Bay Conservation and Development Commission and the National Oceanic and Atmospheric Administration Coastal Services Center; engages local, regional, state and federal agencies and organizations, as well as non-profit and private associations.

- San Francisco Littoral Cell Coastal Regional Sediment Management Plan is currently being developed to assist government entities, municipalities, stakeholders, and communities in developing strategies for beneficial reuse of sediments within the region from the Golden Gate to Pacifica to address coastal erosion.

- San Francisquito Creek JPA was conceived as a flood management program among the counties and cities of San Mateo and Santa Clara that border the creek, as well as the Santa Clara Valley Water District. With the goal of transforming San Francisquito Creek from a divisive liability into a unifying asset, the JPA plans, designs, and implements projects from the upper watershed to coastal wetlands that are of mutual interest to these jurisdictions. The JPA's multijurisdictional approach to solving problems is reflected in these projects. They serve the interrelated ecosystem, recreational, and disaster protection needs of the region, and are funded by multiple local, state, and federal partners.

- ReNewIT – Engineering Research Center for Re-inventing the Nation's Urban Water Infrastructure. ReNewIT is an interdisciplinary research center funded by the National Science Foundation whose partner institutions include Stanford University, University of California at Berkeley, Colorado School of Mines, and New Mexico State University. Some specific aims of research include incorporating resource recovery and energy production into engineered water systems, engineering natural systems to improve water quality, water quality and habitat, overcoming impediments to adopting new urban water management strategies, and providing improved decision-making tools to decision makers.

- SFEP Implementation Committee. The Committee (made up of representatives from local/state/federal agencies, business/industry, and environmental organizations) coordinates implementation of Partnership activities, helps to set work priorities, exchanges ideas and suggestions about management issues, and recommends work plans and budgets for approval.

- Bay Area Watershed Network - The Bay Area Watershed Network (BAWN) is a network of natural resource professionals and community members who work locally to protect watersheds, from headlands to the Bay, throughout our region. The BAWN provides opportunities to share information and coordinate ideas, proposals, and activities.
  San Francisco Bay Joint Venture, established under the Migratory Bird Treaty Act, brings together public and private agencies, conservation groups, development interests

and others to restore wetlands and wildlife habitat in the San Francisco Bay watersheds and along the Pacific coast of San Mateo, Marin and Sonoma counties.

- Santa Clara Basin Watershed Management Initiative Land Use Subgroup. San Mateo Green Streets Manual and Low Impact Development street and parking lot retrofits, funded by the California Department of Motor Vehicles.
- The Bay Area Ecosystems Climate Change Consortium is a regional collaborative of natural resource managers, scientists, and policy and funding entities working to secure nature's benefits for the region in the face of accelerating climate change.
- Grand Boulevard Initiative (a retrofit of El Camino Real). This initiative is a collaboration of 19 cities, counties, and local and regional agencies to improve the performance, safety, and aesthetics of El Camino Real from Daly City to San José. The project aims to include low-impact development features such as water efficient landscaping, vegetated stormwater strips and pervious pavement.

13.2.1.4 Profiles of Successful Integrated Planning

Four examples of highly collaborative planning in the Subregions are presented below. Refer also to Chapter 4, Resource Management Strategies.

North Subregion: Comprehensive, Multi-Agency Watershed Planning

The North Bay Watershed Association (NBWA) was created in 2001 to help member agencies work cooperatively on water resources issues in order to promote stewardship of the North Bay watershed.

Location. The NBWA planning area includes parts of eastern Marin and southern Sonoma and Napa counties that drain to San Francisco and San Pablo bays.

Agencies Involved. Table 13-9 identifies the agencies participating in NBWA and their respective Functional Areas.

Functional Areas Involved. Water supply and water quality; wastewater and recycled water; flood protection and stormwater management; watershed management- habitat protection and restoration.

Description. The NBWA was formed for the purpose of integrating local planning efforts related to water resources management and habitat enhancement by using a collaborative format for information exchange between and amongst water management agencies and land use planning agencies (e.g., cities and counties). The goals of the NBWA include working cooperatively to maximize effective use of resources; enhancing NBWA's influence on local, state and federal policies; increasing eligibility for watershed based funding; and educating communities about the importance of watershed stewardship. The NBWA Board of Directors is composed of primarily elected officials from North Bay cities, counties and water resource agencies and is responsible for overall governance. The NBWA watershed Council is comprised of interested stakeholders across the region and is advisory to the NBWA Board of Directors. Several technical committees comprised of staff from member agencies and the NBWA Watershed Council are responsible for meeting the goals of the association. These technical committees meet jointly and independently to coordinate activities, share information, and discuss topics of joint concern. NBWA developed the *North Bay Watershed Stewardship Plan* and, subsequently, oversaw development of the *Integrated Regional Water Management Plan* for the North Bay to provide a framework for supporting improved water resources management. Implementation of these plans includes coordinating with local land use agencies. In addition, NBWA has implemented and/or funded a variety of creek restoration, water quality monitoring, watershed stewardship, and climate adaptation projects in the North Bay. Some specific examples of successful collaborative projects initiated by NBWA include coordinating a tri-county effort to implement Total Maximum Daily Loads, funding a stormwater infiltration program for three North Bay counties and implementing a multi-county effort to develop an online tool to help North Bay communities adapt to sea level rise.

East Subregion: Rigorous Land-Use Based Water Demand Forecasting

An accurate analysis of existing and future water demands is “the foundation for comprehensive water supply planning” (Johnson, 2004), a critical intersection of land use and water resources planning, and the link between urban growth and water supply. Since 2000, the East Bay Municipal Utility District (EBMUD) has implemented a land use-based approach to estimating water demands which relies on close coordination with land use agencies within its water service area to project demand for potable supplies essentially to the parcel level.

Location. Parts of Alameda and Contra Costa Counties.

Agencies Involved. EBMUD, Alameda and Contra Costa Counties, and cities in Alameda and Contra Costa Counties.

Functional Areas Involved. Water supply and water quality; wastewater and recycled water.

Table 13-9: North Bay Watershed Association - Member Agencies And Water Resources Functions

Member Agency	Water Supply & Water Quality	Wastewater & Recycled Water	Flood Protection & Stormwater Management	Watershed Management-Habitat Protection & Restoration	Land Use Planning
Bel Marin Keys Community Services District			✓	✓	
Central Marin Sanitation Agency		✓			
City of Mill Valley (Group Associate Member)		✓	✓		✓
City of Novato (Associate Member)					✓
City of Petaluma	✓	✓	✓	✓	✓
City of San Rafael			✓		✓
City of Sonoma	✓		✓		✓
County of Marin			✓	✓	✓
County of Sonoma			✓		✓

Member Agency	Water Supply & Water Quality	Wastewater & Recycled Water	Flood Protection & Stormwater Management	Watershed Management-Habitat Protection & Restoration	Land Use Planning
Las Gallinas Valley Sanitary District		✓			
Marin County Stormwater Pollution Prevention Program			✓	✓	✓
Marin Municipal Water District	✓	✓		✓	
Napa County Flood Control and Water Conservation District			✓	✓	
Napa Sanitation District		✓			
North Marin Water District	✓			✓	
Novato Sanitary District		✓			
Sewerage Agency of Southern Marin (Group Associate Member)		✓			
Sonoma County Water Agency	✓	✓	✓	✓	
Sonoma Valley County Sanitation District		✓			
The Bay Institute (Associate Member)				✓	
Tomales Bay Watershed Council (Associate Member)				✓	

Description. EBMUD's land use based approach used geographic information system (GIS) technology to digitize polygons of similar land uses over aerial photographs to create a detailed GIS land use coverage for EBMUD's entire service area (EBMUD and Montgomery Watson, 2000). Existing (base year) water demands were determined for each land use polygon based on actual metered consumption data (normalized for weather and other factors), using another EBMUD GIS-based application. Based on water consumption and land area in each land use category, an average land use unit demand (LUD), expressed in gallons per day per acre, was generated for each land use.

To estimate future demands, land use polygons in the GIS database were updated to reflect future development based on adopted general plans and specific plans, and maps showing future land uses based on these revisions were prepared and presented to planning agencies for review. Consultation with planning agencies of the cities and counties in the EBMUD's service area was a key aspect of the EBMUD's demand study, and EBMUD staff and demand study consultants met with each of the city and county planning agencies to confirm general plan land use designations for future development, to identify redevelopment areas, and to identify phasing of future development over the demand study planning period. Future annual average demands thus calculated were then adjusted to incorporate estimated reductions in distribution system demand due to conservation and non-potable water (e.g., recycled water) use, based on EBMUD's Water Supply Management Program 2040 preferred portfolio of conservation and non-potable water programs (EBMUD et al., 2009). EBMUD updates its demand forecasting periodically.

EBMUD's forecasting methodology provides a complement to the requirements for Water Supply Assessments (described in Section 13.1.2.4). EBMUD's demand forecasting methodology incorporates land-use planning into EBMUD's water supply management program to ensure that EBMUD will have sufficient supply to meet projected demand, while Water Supply Assessments require that water management planning is incorporated into land use decisions to ensure that development will not occur without sufficient water supply.

South Subregion: Integrated Habitat Restoration and Flood Control for Local Municipalities

The South Bay Salt Pond Restoration Project and the South Bay Shoreline Study provide successful examples of projects involving collaboration among a diverse group of agencies with the goal of providing an array of benefits, such as wetlands restoration and enhancement, flood management, recreation and public access. The South Bay Salt Pond Restoration Project began in 2003 and the South Bay Shoreline Study began in 2006, both are still in progress.

Location. The South Bay Salt Pond Restoration project involves restoration of former salt ponds located in three pond complexes along the South San Francisco Bay: Eden Landing near Hayward, Ravenswood near East Palo Alto, and Alviso. The South Bay Shoreline Study will eventually provide flood protection to all Santa Clara County Baylands, from Palo Alto to Southern Alameda County, in addition to the former salt ponds within the Alviso Pond complex and adjacent properties such as areas around Moffett Field. The first reach will protect important infrastructure such as the San Jose/Santa Clara Wastewater Treatment Plant and the community of Alviso.

Agencies Involved. South Bay Salt Pond Restoration project: California State Coastal Conservancy , U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, the California Department of Fish and Wildlife, the Santa Clara Valley Water District, Alameda County Flood Control and Water Conservation District, East Bay Regional Park District, and South Bay cities and counties bordering the salt ponds (e.g., City of San Jose, City of Sunnyvale). South Bay Shoreline Study: U.S. Army Corps of Engineers, California State Coastal Conservancy, Santa Clara Valley Water District, and local sponsors and other land-owning agencies, including the U.S. Fish and Wildlife Service and the City of San Jose.

Functional Areas Involved. Flood protection and stormwater management; watershed management - habitat protection and restoration.

Description. As described in Section 4.2.6.2 of Chapter 4, Resource Management Strategies, the South Bay Salt Pond Restoration project involves restoration of 15,100 acres of former salt ponds while providing for flood management and wildlife-oriented public access and recreation. The South Bay Shoreline Study is being developed to accomplish similar goals, including flood damage reduction, ecosystem restoration and public access. Because these two projects have similar objectives and geographic scope, planning and management of the projects has been closely integrated.

Due to the nature of the proposed projects, consultation with local planning agencies is a key component of the project planning process. For example, city and county input is needed to implement project components such as habitat restoration, flood protection and public access features which all require decisions regarding land use. In order to involve local planning agencies, development of the South Bay Salt Pond Restoration project includes periodic local government forums to provide local government representatives with opportunities to exchange information and voice concerns regarding the project. Similarly, local government participation is a critical part of the planning process for the South Bay Shoreline Study, as the U.S. Army Corps of Engineers is required to collaborate with local sponsors to identify a locally preferred alternative, and in the case of Phase 1, the City of San José is an underlying landowner as well as a primary beneficiary of proposed flood control features. The nature of both of these processes provided the opportunity for water managers and land use planners to collaborate in providing a variety of needed services and benefits to the South Bay region. Thus far, this collaboration has successfully resulted in over 3,000 acres of habitat restoration and when complete, will provide 15,100 acres of habitat restoration as well as critical flood protection for the San Jose/Santa Clara Water Pollution Control Plant and the local community, including the approximately 2,000 residents of the community of Alviso.

West Subregion: Land Use and Water Resources Management under One Roof

The City and County of San Francisco integrates water resources management and land use planning through multiple city departments.

Location. City and County of San Francisco

Agencies Involved. Various departments of the City and County of San Francisco, including Planning, Public Works, Recreation and Park, Municipal Transportation Agency, Redevelopment Agency among others; and the SFPUC.

Functional Areas Involved. Water supply and water quality; wastewater and recycled water; flood protection and stormwater management; watershed management- habitat protection and restoration.

Description. The interaction between City and County of San Francisco departments having different responsibilities, priorities, and areas of expertise on common projects facilitates the integration of land use and water planning. Within San Francisco, the SFPUC provides potable water, recycled water and sewer services; and implements urban watershed planning to reduce stormwater flows to the City's combined system. The SFPUC uses the Planning Department's growth forecasts in developing projections of future water demand. The Recreation and Park Department manages remnant City-owned natural areas within San Francisco and manages other City parks and recreation areas, which provide opportunities for using recycled water for irrigation. The Department of Public Works builds, operates, and maintains City infrastructure; it coordinates construction work within public rights of way and many of its street improvement projects incorporate green stormwater management technologies endorsed by other City departments to reduce, filter, or slow stormwater runoff. The San Francisco Planning Department guides the long-term development of the City's built and natural environment, prepares and updates the City's general plan and sub area plans, and reviews projects for environmental impacts.

Collaboration among City departments occurs at numerous junctures during planning, project review, and rule-making. An example of a recent multi-departmental water resource initiative is San Francisco's Non-potable Water Program, which is a collaboration between the San Francisco Department of Building Inspection, the San Francisco Department of Public Health and the SFPUC. This program promotes on-site non-potable water reuse for commercial, multi-family and mixed-use developments by providing technical and regulatory guidance, establishing a streamlined approval process, and offering grants to help fund retrofits for non-potable reuse. The SFPUC estimates that this program has the potential to offset up to 3.4 mgd of potable water demand.

13.2.2 Bay Area IRWMP Coordination with Land Use Planning Agencies

As described in Chapter 1, development of the IRWMP is led by the Coordinating Committee (CC). The CC is responsible for providing leadership and oversight for the IRWMP process. The CC is composed of 12 voting representatives, made up of three representatives from each of the four Functional Areas as well as non-voting representatives from resource and regulatory agencies, non-governmental organizations and other interested stakeholders. Monthly CC meetings are open to all interested parties and provide an opportunity for land use planning agencies to participate in the IRWMP.

13.2.2.1 Stakeholder Involvement

In addition to the CC, the IRWMP effort draws on input from the four Functional Area workgroups, four Subregional groups, CC subcommittees (established as needed), and targeted stakeholder outreach (stakeholder workshops, sub-regional outreach and individual county/agency outreach). These workgroups and subcommittees provide opportunities for land use planning agencies to participate in and contribute to the IRWMP (e.g., through providing collaborative input or reviewing and commenting on draft document materials). Refer to Chapter 14, Stakeholder Engagement, for a detailed description of outreach conducted in support of the IRWMP.

13.2.2.2 Outreach to Cities and Counties

As part of the development of the IRWMP, the San Francisco Estuary Partnership (SFEP)[34] convened discussions on collaborations between water agencies and land use agencies and conducted a survey of local governments to establish a baseline inventory of local watershed policies and to assess the current degree of inter-agency collaboration.

As shown in Table 13-10, discussions occurred at nine sub-regional or regional meetings in the Bay Area. The goal of these meetings was to provide an overview of the IRWMP update and

[34] The San Francisco Estuary Partnership is a coalition of resource agencies, non-profits, citizens, and scientists working to protect, restore, and enhance water quality and fish and wildlife habitat in and around the San Francisco Bay Delta Estuary. Working cooperatively, SFEP shares information and resources that result in studies, projects, and programs that improve the Estuary and communicate its value and needs to the public. The Association of Bay Area Governments is the home agency for Partnership staff and finances. SFEP's offices are located at the San Francisco Regional Water Quality Control Board in Oakland.

project selection process and to initiate a dialog to identify the current status of, and ways to improve the relationship between water planning and land use planning. Discussion participants included water management, land use and regulatory agencies as well as nongovernmental organizations. Key findings of the discussions include:

- Programs, policies, and plans are in place throughout the Bay Area that encourage collaboration between water and land use agencies; however, if these are not fully funded then implementation may be difficult to achieve.

- Collaborations between agencies may lead to less expensive solutions to water and land use problems.

- Research is being conducted in the Bay Area to consider water solutions for the next 100 years. Such efforts may lead to improvements in collaborations between land use and water agencies.

Table 13-10: Bay Area IRWMP Meetings with City and County Planning Agencies

Date	Organization	Agencies in Attendance
November 2012	City/County Association of Governments of San Mateo County	Cities of Belmont, Brisbane, Burlingame, Daly City, Fc Millbrae, Pacifica, Redwood City, San Bruno, San Car and Woodside; County of San Mateo, Caltrain, San M Peninsula Corridor Joint Powers Board, Caltrans
March 2012 May 2012 September 2012 December 2012	Low Impact Development Leadership Group	Cities of Campbell, Emeryville and San José, Santa Clara Valley Water District, Zone 7 Water Agency, BCDC, ABAG, SF Bay Regional Board, Caltrans
December 2012	Santa Clara Watershed Management Initiative Land Use Subgroup	Cities of Mountain View, San José, Sunnyvale; County of Santa Clara, West Valley Clean Water Program (cities of Campbell, Saratoga, Monte Sereno, Los Gatos), CLEAN South Bay, Santa Clara Valley Water District
January 2013	North Bay Watershed Association	Counties of Marin and Sonoma; Las Gallinas Valley Sanitary District, Novato Sanitary District, Central Marin Sanitation Agency, North Marin Water District, Marin Municipal Water District, and Sonoma County Water Agency
February 2012 April 2012	Sustainable Watershed Forum	Cities of Emeryville, El Cerrito, Campbell, San Jose; Counties of Marin and San Mateo; ABAG; BAFPAA, BASMAA, BCDC, Caltrans, EBDA, EBMUD, EPA, MTC, SFEI, SFPUC, Santa Clara County Urban Runoff Program, Regional Board, Zone 7 Water Agency

Source: San Francisco Estuary Partnership, How to Improve Collaboration Between Land Use & Water Agencies: SFEP Stakeholder Outreach Findings for the Bay Area IRWM Plan Update, June 2013

In addition to convening these discussions, SFEP conducted a survey of cities and counties in the Bay Area to:

- Evaluate the extent to which local governments have implemented watershed protection policies (e.g., in general plans and other policy documents) and identify obstacles to policy development.
- Assess the degree of inter-agency coordination currently occurring between local government and resource agencies, and
- Identify obstacles to coordination.

The survey was sent to planning and public works departments in all 101 cities and 9 counties in the Bay Area; the following 56 municipalities participated in the survey:

Participating Cities[35]

Alameda	El Cerrito	Oakley	San Rafael
Albany	Emeryville	Orinda	San Ramon
American Canyon	Fairfax	Pinole	Santa Clara
Belmont	Gilroy	Pittsburg	Santa Rosa
Benicia	Hayward	Redwood City	St Helena
Brentwood	Hillsborough	Richmond	Suisun City
Calistoga	Larkspur	Rio Vista	Sunnyvale
Campbell	Milpitas	San Anselmo	Town of Colma
Cloverdale	Monte Sereno	San Carlos	Town of Los Altos Hills
Corte Madera	Mountain View	San Jose	Town of Moraga
Daly City	Newark	San Mateo	Town of Tiburon
Dixon	Oakland	San Pablo	Union City

Participating Counties

Alameda	San Francisco
Contra Costa	San Mateo
Marin	Solano
Napa	Sonoma

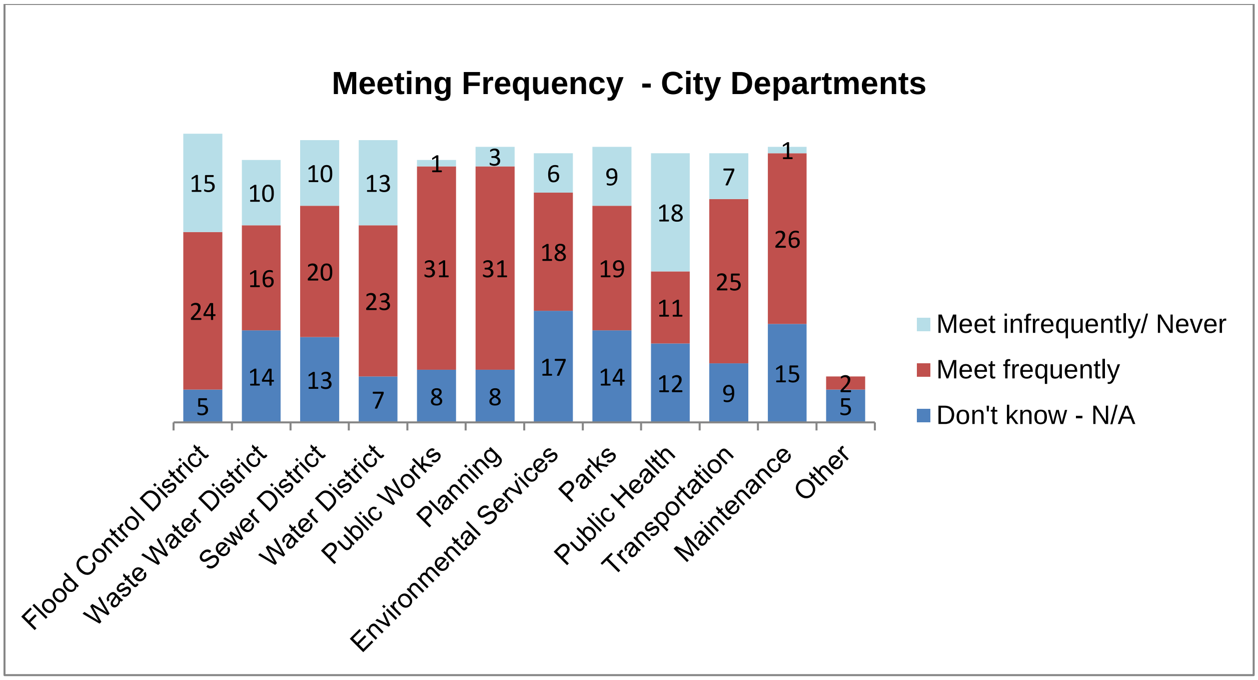
Questions in the survey included whether select water resources topics (e.g., watershed conservation and restoration, creek/riparian restoration and conservation, flood control, stormwater management green streets/LID, water quality) were addressed in general plan policies, ordinances, regulations or codes; whether the municipality has – as well as obstacles to developing and implementing -- watershed plans, creek or riparian setback ordinance, or creek restoration program; and frequency of interactions with districts and departments responsible for the municipality's surface water and groundwater resources.

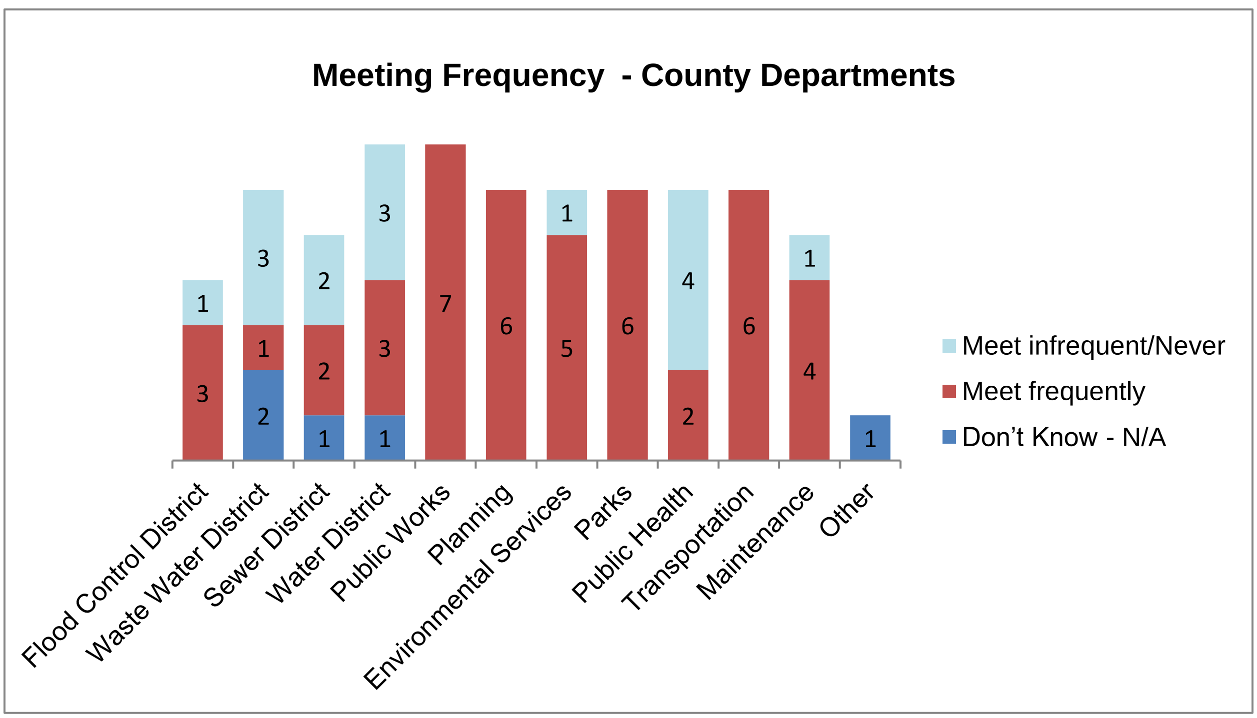
[35] One respondent did not indicate which city she or he represented.

The survey indicated that the majority of cities and counties surveyed have water quality, stormwater management, flood control, and creek/riparian conservation or restoration policies (see Figure 13-3), but that there are obstacles to implementation.

To characterize the degree of interagency collaboration regarding surface water and groundwater resources, the survey evaluated the frequency of meetings between public works and planning departments and other government departments and agencies (e.g., environmental services departments, flood control districts, water districts), regarding surface and groundwater resources. As shown in Figure 13-4, city and county governments met most frequently with flood control, public works, planning, transportation, parks and environmental services departments. City and county governments met most infrequently or never with public health, flood control, water and wastewater districts. Note that county governments have a lower overall level of coordination on water resource issues compared to city governments. These data show that there is an opportunity to improve the degree of coordination and communication at the county level and among agencies that currently meet infrequently or never regarding water resources.

Figure 13-4: Meeting Frequency between City Departments and Agencies Regarding Surface Water and Ground Water





Source: San Francisco Estuary Partnership, *Local Governments Watershed Inventory*, September 12, 2012.

13.3 Future Efforts to Improve Interactions Among Land Use and Water Resources Planning Entities

To plan for future collaboration, the CC considered input received via the discussions, surveys and interviews with land use and water resource managers and developed a plan setting forth steps to improve collaboration following completion of this IRWMP. In developing the plan, the CC considered feasibility, responsiveness to constraints and regional priorities, efficacy and ease of implementation of potential opportunities to improve collaboration.

13.3.1 Constraints Inhibiting Collaboration Among Local Land Use Planning and Water Resources Managers

Table 13-11 below summarizes obstacles to collaboration that were identified through the outreach activities through interviews with water resource managers.

Opinions varied among survey and interview participants regarding how much coordination is desirable, and whether there were constraints inhibiting collaboration, but many participants perceived of one or more obstacles to better inter-agency collaboration and the development of watershed-based resource initiatives. The most common issue identified among land use agencies was constraints on resources and funding, which likely stems in part from the effects of the recession on the staffing and budgets of many cities, counties and special districts. The recession has resulted in lay-offs, early retirement and higher staff turnover at many Bay Area municipalities, leading to lapses in collaboration. Given these staff and budget constraints, City and county managers may be less inclined to support consultation and training beyond that required by law. As indicated in Section 13.1, the number of agencies involved in water resources and land use planning – each with its specific mission, area of authority, jurisdictional boundaries, and consultation strategies -- can impede collaboration.

The root causes of many of the constraints to collaboration are largely beyond the authority or ability of the CC to surmount (e.g., flat or declining revenues, increasing regulatory requirements, and differing missions among agencies). However, the challenges common to these agencies (e.g., strained natural resources; complex, changing regulations) have already spawned numerous interregional organizations and initiatives that have thrived for years. In the future, the severity and magnitude of challenges associated with climate change will necessitate further collaboration among water and land use agencies and integrated solutions.

Table 13-11: Constraints Identified by Survey and Interview Participants that Inhibit Collaboration among Local Land Use Planning and Water Resource Managers

Category	Constraint
Resources	• **Resources.** Lack of resources (financial, human, technical) ▪ Reductions in city, county and agency staff participation in regularly scheduled meetings since economic downturn. ▪ Lack of dedicated resources for water-oriented infrastructure improvements (e.g., stormwater improvements, creek restoration/protection, green infrastructure planning and implementation). • **Turnover.** Staff turnover leading to lapses in collaboration. • **Education**. Lack of cross-training regarding land use planning and water resources management.
Priorities	• **Missions**. Differing missions, agendas and priorities among agencies. ▪ City staff thinks in terms of broad policies, goals; stormwater agencies focus on permit compliance. ▪ Divided responsibilities over water resources. • **Boundaries.** Differing boundaries between land use and water agencies' jurisdictions complicates coordination. • **Leadership.** Lack of support for integration from public officials.
Other	• Lack of communication between agencies and departments. • Complex regional regulations lead to difficult approval processes. • Project review and consultation processes occur late in the planning process. • Considerable variation in consultation among agencies (may depend on individual staff relationships). • Lack of regulatory mandate for coordination.

13.3.2 Opportunities to Improve Collaboration among Local Land Use Planning and Water Resources Managers in the Future

Table 13-12 below summarizes opportunities to improve collaboration that were identified through the outreach activities.

In general, the opportunities identified by participants fell into one of three categories: Communication, Training and Information Sharing; Leadership; and Program and Project Development. The suggestions ranged from very general (e.g., increase frequency of meetings) to more specific (e.g., develop a GIS tool to identify projects with similar goals). Several suggestions focused on climate change ("Utilize climate change as a common denominator to encourage agency collaboration for integrated solutions"; "Develop a set of climate-change-oriented integrated projects") as a basis for improving collaboration.

Some suggestions for improving collaboration are beyond the authority of CC members to implement. For example, the authority to include flood control agency staff in development review processes generally rests with land use agencies. In this case, consultation mandated under the California Environmental Quality Act (CEQA) represents an existing mechanism for consultation with responsible and trustee agencies which typically would include a flood control district. Note that under Section 15060.5 of the CEQA Guidelines, project applicants can request early, "pre-application" consultation with a lead agency (typically a city or county). The lead agency can include agencies with an interest in that type of project in the consultation. Flood control agencies – as well as other water resource agencies -- can request that lead agencies include them in any pre-application consultation occurring under Section 15060.5 for particular types of projects.

The suggestions presented in **Error! Reference source not found.** are undergoing review as part of IRWMP development and may be considered for implementation by individual participating agencies. Select strategies are being incorporated into a draft Collaboration Plan for implementation by the CC, described in the next section.

Table 13-12: Opportunities Identified by Survey and Interview Participants to Facilitate Collaboration Among Local Land Use Planning and Water Resources Managers

Category	Opportunity
Communication, Training and Information Sharing	• **Meetings**. ▪ Increase frequency of meetings with land use agencies (e.g., include water/flood agency staff in development review processes) ▪ Convene biennial summits with land use agencies ▪ Increased use of the IRWM subregional approach to involve multiple agencies in managing specific water resources to advance common goals ▪ Hold workshops on implication of land use planning on water resources ▪ The regional groups that already meet (e.g., BAWAC, BASMAA, etc.) can help promote coordination as some participating agencies focus on land use • **Tools**. Develop web-based tools (e.g., maps, processes) or social media for incorporating water resources into land use planning • **Climate Change**. Utilize climate change as a common denominator to encourage agency collaboration for integrated solutions
Leadership	• **Commitment**. ▪ Increase commitment by agency leadership for interdepartmental, interagency, interdisciplinary coordination (workload prioritization) ▪ Increase commitment by water agency leadership for staff to provide input in land use policy development (general plan, zoning) • **Champions**. Engage public officials or “local champion” to lead collaborative planning efforts • **IRWMP Participation**. Conduct outreach to land use agencies to encourage participation in the CC and its subcommittees
Projects and Program Development	• **Integrate Collaboration**. Develop policies, plans and programs that set clear environmental goals and encourage collaboration (e.g., a guide for developing integrated projects, a green infrastructure master plan for the Bay Area, a set of climate change-oriented integrated projects, a GIS tool to identify projects with similar goals) • **Partner on Projects**. Pursue multi-objective projects in partnership with land use agencies. Collaboration can lead to integrated solutions that may be less expensive than implementing separate projects

13.3.3 Planning Future Collaboration

As indicated in Chapter 14, Section 14.8, stakeholder engagement will continue following adoption of the IRWMP, and will be the vehicle for implementing the recommendations for improving collaboration between land use planning and water resources management described below.

Climate change has the potential to significantly affect a wide range of issues important to both water management and land use planning including water supply, agricultural productivity, wildfire and flood risk, and ecosystem function. Climate Change Response Action is identified as a Statewide Priority for the IRWM Grant Program; consequently, climate change response is a theme that appears throughout the 2016 Guidelines and this IRWMP. The severity and magnitude of challenges associated with climate change as well as the scope of regional adaptation strategies (described in Chapter 16) will necessitate further collaboration among water and land use agencies and the development of integrated solutions. For these reasons, development and implementation of a collaboration plan focused on climate change is recommended.

13.3.3.1 Draft Climate Change Collaboration Plan

This draft plan incorporates input and feedback of the CC and other IRWMP reviewers regarding suggestions for improving future collaboration and will be refined and finalized by the CC through the on-going monthly meetings described in Section 14.9. What follows are issues to be considered and reviewed by the CC to develop and implement the Collaboration Plan.

- The suggested goal of the draft Collaboration Plan is to support collaborative inter-agency solutions to climate change in the Bay Area by promoting a shared understanding of climate change projections, vulnerabilities and adaptation strategies.

- Consistent with the current stakeholder outreach plan, outreach to land use planning and water resources agencies will continue to be organized and implemented by subregion, which allows for consideration of local issues related to climate change and sea level rise.

- Biennial summits through existing platforms are suggested (e.g., BAFPAA meetings, Council of Mayors meetings). Consistent with the goal of the collaboration plan, the summits should focus on disseminating information presented in Chapter 16, including climate change vulnerabilities of the region's water resources (water supply, water quality, wastewater management and flood management), and recommended adaptation strategies. Examples of topics for subsequent summits include updates in climate change research, vulnerability assessments, and adaptation strategy development.

13.3.3.2 BayCAN

In 2018, the SFPUC helped launch the Bay Area Climate Adaptation Network (BayCAN), a collaborative focused on Bay Area local government adaptation response to climate change. SFPUC has served as steering committee chair since its inception in July 2018. (www.baycanadapt.com). BayCAN member agencies include other water utilities, city representatives, and environmental groups. BayCAN is part of a statewide network of collaboratives, the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA), organized under the Local Government Commission (www.arccacalifornia.org). ARCCA includes collaboratives in San Diego, Los Angeles, Central Coast, Sacramento Region, Sierra, and North Coast. BayCAN facilitates collaboration on the full range of climate adaptation issues within the Bay Area and more widely in California.

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Chapter 14: Stakeholder Engagement

14.1 Stakeholder Engagement for the IRWMP

Development of the IRWMP involved a diverse group of water supply, water quality, wastewater, stormwater, flood control, watershed, municipal, environmental, and regulatory groups whose input played a key role in defining sustainable water resources management goals and objectives, and identifying and selecting priority projects to help meet those goals and objectives.

Stakeholder engagement activities were used to inform, educate, and engage constituents, stakeholders, and interested parties throughout the nine-county Bay Area. This chapter details the stakeholder engagement process for developing the IRWMP, which is intended to identify water management goals, objectives, strategies and priorities in a collaborative regional process in accordance with both the requirements and spirit of the 2012 Guidelines.

Bay Area agencies recognize that involving stakeholders in development of an integrated approach to water resources management benefits all parties by ensuring that social, economic, environmental, and technical considerations are taken into account in the planning stages and establishment of regional priorities. The types of stakeholder engagement activities outlined in this chapter were critical to ensuring a viable and representative Plan Update with broad-based support.

14.2 Approach to Stakeholder Engagement in Plan Development

Stakeholder engagement activities were planned and implemented to ensure that the IRWMP reflects the knowledge and interests of residents, public agencies, businesses, and institutions with respect to water supply reliability, improving water quality, flood protection, and protecting natural resources. Stakeholder engagement efforts were intended to generate awareness and interest, and to help provide the opportunity for people with different levels of knowledge, interest, resources and capacities to shape the IRWMP and share in the potential benefits.

A phased approach was used to plan and implement engagement activities to inform the IRWMP. The approach was informed by reflections and lessons learned from the 2006 Plan development process, and it intended to achieve engagement goals and objectives as efficiently as possible, including leveraging existing venues and relying on a “spider-web” approach to disseminating information. The phases of stakeholder engagement (also displayed in Figure 14-1) included:

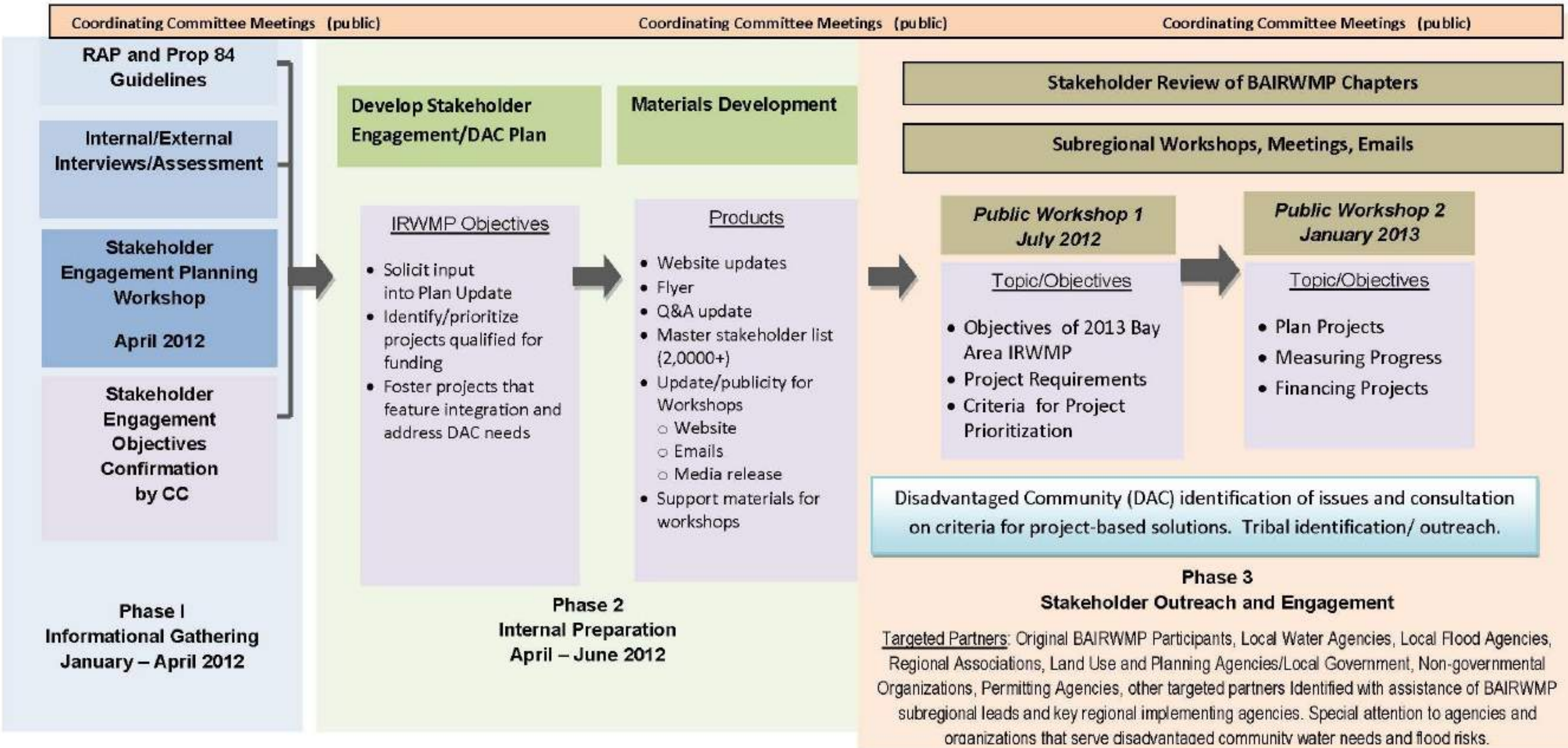
Phase 1 (January – April 2012) focused on information gathering, which consisted of conducting interviews and developing an assessment of past stakeholder engagement efforts; clarifying DWR guidelines for integrated regional water management plans generally, and projects benefitting disadvantaged communities (DACs) specifically; and consolidating and augmenting the stakeholder contact list.

Phase 2 (April – June 2012) focused on planning and preparation, which included convening a Stakeholder Engagement Planning Workshop; developing a Stakeholder Engagement Plan; producing easy-to-understand informational materials, including fact sheets, a frequently-asked-questions document, and a series of maps; preparing for public workshops; and developing a process for identifying DAC projects and providing guidance to DAC project proponents.

Phase 3 (June 2012 – August 2013) focused on the implementation of outreach and engagement activities, which included preparing for and conducting public workshops, executing the process for identifying and providing guidance for DAC-serving project submissions, and promoting stakeholder review of draft chapters of the IRWMP. See Section 14.5 for more details on these activities.

It should be noted that ongoing stakeholder engagement activities continued throughout these phases, including CC meetings, subregional meetings, county meetings within the subregions, Functional Area meetings, as well as meetings focused on the integration of water and land use planning (see Section 14.5 for descriptions of these activities).

Figure 14-1: Stakeholder-based Approach to Developing the IRWMP



14.3 Bay Area IRWMP Stakeholders

14.3.1 Identification of Stakeholders

The San Francisco Bay Area is comprised of nine counties, nearly seven million residents, 101 cities, a wide variety of interests and priorities, and a range of economic and ethnic demographics. The IRWMP stakeholder engagement approach took this diversity into account, and it provided a range of opportunities for stakeholders to get involved and share their input.

The 2006 Plan development and implementation process generated several stakeholder contact lists. In addition, contacts lists were developed and maintained by subregional leads to enable them to provide updates about upcoming meetings and share information specific to their respective geographic areas. In order to maximize efficiency, these various contact lists were consolidated into a master stakeholder list containing approximately 1,500 contacts. The list collectively represents all local and regional water resource and flood agencies, watershed organizations, a complete and current list of elected city, county and state officials, city and county land use agencies, disadvantaged community representatives, environmental and community groups, media, and Native American Tribal contacts (the master stakeholder contact list is included as Appendix E-1). Throughout the IRWMP development process, contacts in the master stakeholder list were provided with information about key milestones and deadlines, public workshops, and opportunities to review draft chapters.

14.3.2 Local and Regional Water Resource Agencies

Local and regional water resource management agencies are the most active participants in the Bay Area IRWMP, as these agencies will be implementing the vast majority of the projects included in the 2013 Plan and they are more likely to have sufficient resources to participate in the process. These agencies are collectively responsible for meeting the Bay Area's needs with respect water supply and water quality, flood protection and stormwater management, wastewater and recycled water, and watershed management-habitat protection and restoration.

14.3.3 State and Federal Resource and Regulatory Agencies

State and federal agencies play a role in the implementation of IRWMP projects via regulatory and public resource stewardship mandates. Stakeholder agencies include the State Water Resources Control Board (SWRCB), Bay Area Regional Water Quality Control Board (RWQCB), California Department of Fish and Wildlife (DFW), California Department of Water Resources (DWR), U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), National Marine Fisheries Service (NMFS), San Francisco Bay Conservation and Development Commission (BCDC), and the U.S. Fish and Wildlife Service (USFWS).

14.3.4 Non-Governmental Organizations

Non-governmental organizations (NGOs) play an important role in regional watershed management through planning and implementation of habitat protection and restoration projects, administration of monitoring efforts, and education and outreach programming. Many of these entities may have the interest but not the resources to participate actively in the Bay Area IRWMP. A number of NGOs represent the interests of disadvantaged communities (DACs) in the Bay Area. The Bay Area IRWMP team targeted NGOs representing watershed management, environmental and DAC interests for participation in workshops and ongoing communications via email announcements and the BAIRWMP website. Throughout the update process, a representative from the San Francisco Estuary Partnership (SFEP) served as a central point of contact for outreach to DACs and the organizations that represent them.

14.3.5 General Public

All Bay Area citizens depend on water and how it is managed, and interested citizens were able to access information about the IRWMP document, the update process, project criteria and submission, and meetings and workshops. Members of the public also had the opportunity to review and provide input on draft chapters of the Plan. The primary sources of information for the public were the BAIRWMP website and update emails. Through notices sent to the master mailing list, and re-distributed to partner and stakeholder lists, a significant number of people who follow water and land use issues were made aware of the update process, and were encouraged to visit the website and attend meetings and workshops.

14.4 Stakeholder Engagement Planning Process

14.4.1 Stakeholder Assessment

A stakeholder assessment was conducted in early 2012 to inform the development of the engagement strategy. The assessment was informed by interviews with thirteen Bay Area IRWMP stakeholders, including CC participants, NGO staff, and representatives of DACs and Tribal communities. The interviews focused on understanding stakeholder experiences during the development of the 2006 Plan, identifying their interests and concerns, and soliciting their ideas on how best to address their concerns for the IRWMP process. Key findings from the stakeholder assessment included:

- Stakeholder engagement goals were not clearly identified for the 2006 Plan development process. This made measuring success challenging.

- Conducting outreach through the subregional groups is effective and should be leveraged as much as possible.

- Engaging disadvantaged and Tribal communities in the Bay Area is challenging, especially since drinking water quality is not a significant concern in the Bay Area and water resource management issues are rarely a top priority. Further, DWR's criteria for DAC projects need to be clarified.

- Simple, consistent messaging should be developed and shared about the IRWMP to help stakeholders understand why they should care about it.

- It is not realistic to expect an NGO or small public agency to develop a project proposal. Most NGOs and small public agencies need to partner with a larger agency with the resources needed to develop the proposal.

The full assessment, including the list of interviewees, is included in Appendix E-2. The assessment helped to foster a common understanding of stakeholder interests and to lay the groundwork for the Stakeholder Engagement Plan.

14.4.2 Stakeholder Engagement Planning Workshop

Fifteen CC participants and consultants representing various Bay Area water resource management and government agencies participated in a half-day Stakeholder Engagement Planning Workshop on April 17, 2012. Workshop participants helped define stakeholder engagement objectives for the IRWMP, and identified priorities and strategies for engaging stakeholders in developing the IRWMP. Workshop participants discussed current and potential engagement activities (in all sub-regions and across all functional areas), and discussed where there might be gaps in engagement and how best to address them. In addition, workshop participants identified strategies to engage and identify projects in DACs and Tribal communities.

Key recommendations resulting from the Stakeholder Engagement Planning Workshop included:

- Develop a robust and continually updated contact list of Bay Area IRWMP stakeholders.
- Help stakeholders understand the IRWMP and why it is important; this will be a key part of the outreach effort.
- Keep the BAIRWMP website more current, including newsletters or e-mail updates and a calendar of upcoming activities.
- Ensure that subregional leads share information at other meetings they attend, and use outreach at those meetings to build the stakeholder contact list and encourage participation in the process.
- Some level of outreach to and engagement with DACs and Tribes is necessary and should be well documented.
- Contact current Bay Area IRWMP DAC project managers (i.e., DAC projects included in the 2006 Plan) to determine if there might be a “Phase 2” expansion of the projects benefitting DACs. This could potentially qualify as a DAC project for inclusion in the 2013 Plan Update.
- Leverage existing DAC/Tribal outreach mechanisms.
- Inquire with subregions, functional areas, and individual water resource management agencies whether there are potential DAC serving projects already under consideration.

See Appendix E-3 for the Stakeholder Engagement Planning Workshop agenda.

14.4.3 Stakeholder Engagement Plan

A Stakeholder Engagement Plan (SEP) was developed to address the interests and priorities clarified by the assessment, the April 17, 2012 engagement planning workshop, DWR guidelines, and input from the CC and Public Outreach Committee. The SEP identifies stakeholder engagement goals and objectives for the IRWMP, and outlines the strategy and specific engagement activities to be implemented. Section 14.5 describes the engagement activities identified in the SEP.

The stakeholder engagement goals and objectives described below helped guide engagement efforts to inform the development of the IRWMP, and they will be referenced to both evaluate success and to guide ongoing engagement following the completion of the Plan.

Stakeholder engagement goals (note: while goals #3 and #7 focus on plan preparation, their intent is to generate interest from and involve a broader range of stakeholders):

11. Develop a broader understanding of the water needs of the Bay Area.
12. Increase broad public awareness of regional water resource management planning.
13. Expand the scope of the IRWMP to include planning for climate change impacts and to provide for greater collaboration with land use agencies.
14. Further engage NGOs in the collaborative planning process.
15. Further engage DACs in the collaborative planning process.
16. Identify and address the needs of DACs and Tribal communities within the jurisdiction of the Bay Area IRWMP.
17. Include a significant number of multi-benefit, inter-subregional projects – including DAC-serving projects – in the IRWMP.

Stakeholder engagement objectives:

18. IRWMP Awareness
    - BAIRWMP stakeholders know the IRWMP is being updated and understand why it is important for their respective groups to be involved.
    - Stakeholders understand the opportunities for public participation in content development and review.
    - Stakeholders understand the decision-making processes associated with the IRWMP, including:
        - How, when and by whom decisions are made regarding content

- How, when and by whom decisions are made regarding potential water projects and their prioritization

19. Stakeholder Identification and Inclusion

- The CC listserv is easy to join, open to the public, and the participant list is maintained and continually expanding.
- Stakeholders are regularly identified and are invited to join the CC listserv and participate.
- Stakeholders representing DACs and Tribes are identified for targeted outreach and engagement.

20. Bay Area IRWMP Stakeholder Input and Review

- Stakeholders inform content development by providing information and data to the Plan Update Team and/or the technical consultants, including at CC meetings, subregional meetings, and workshops. Stakeholders can help frame issues, identify challenges and recommend solutions, including recommendations for policies and programs that involve collaboration and integration among organizations and agencies.
- Stakeholders are able to review and provide feedback on draft chapters of the IRWMP, which are available on the BAIRWMP website.
- Stakeholders see how their input was addressed in the IRWMP and/or are informed of why their comments are not reflected.

21. Project Identification

- The IRWMP includes projects that meet the needs of the Bay Area region and conform to DWR requirements.
- Stakeholder involvement in the IRWMP identifies projects that reflect integration among water management functions, agencies, and organizations to provide multiple benefits to communities.

22. Coordination and Collaboration

- The IRWMP process fosters coordination, collaboration and creative thinking among public agencies, non-governmental organizations, businesses and individuals to identify and address the region's water resource challenges and opportunities.
- Agencies, organizations and individuals involved in the Bay Area IRWMP are informed of the stakeholder engagement activities of other participants allowing for the effective and efficient use of resources.

The complete Stakeholder Engagement Plan is included as Appendix E-4.

14.5 Stakeholder Engagement Activities

What follows are descriptions of the stakeholder engagement activities identified in the Stakeholder Engagement Plan, and implemented to support the development of the IRWMP.

14.5.1 Subregional Outreach

The IRWMP development process emphasized a subregional outreach approach in order to promote the identification of successfully integrated projects and to provide more accessibility to the IRWMP process by stakeholders. The subregional approach allowed for improved local stakeholder access to the Bay Area IRWMP process and greater collaboration among water interests within the Subregions. Each of the Subregions has a lead (or leads) who convenes subregional outreach meetings, provides updates to stakeholders within the Subregion, reviews submitted projects, and serves as a regular point of contact. Each lead maintains a stakeholder contact list and determines outreach and engagement efforts appropriate for their geographic area. A log of subregional meetings and communications is included as Appendix E-5. In addition to the subregional meetings, the Bay Area IRWMP and its related activities are discussed at various non-IRWMP meetings that occur within the Subregions.

14.5.2 Functional Area Outreach

Some regular CC participants serve as Functional Area (FA) leads. In this capacity, the FA leads provide regular Bay Area IRWMP updates to regional water resource management membership organizations, which allows them to reach a broad audience of agencies and organizations interested in a specific functional area. Updates included information about the IRWMP development process, opportunities to review draft chapters and upcoming public workshops. FA leads also discussed the need to identify DAC projects and solicited input from participating agencies on potential projects.

FA outreach represents an efficient approach to partnering with existing groups to engage a diverse group of stakeholders. The FAs are described below:

- **Water Supply and Water Quality**

  The Bay Area Water Agencies Coalition (BAWAC) is the coordinating organization for water supply and water quality FA. BAWAC is comprised of water agencies in Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara, Solano and Sonoma counties. BAWAC meets on a monthly basis and agenda topics typically includes the Bay Area IRWMP and other topics of mutual interest.

- **Watershed Management-Habitat Protection and Restoration**

  The Bay Area program of the California State Coastal Conservancy (SCC) has served as the IRWMP CC FA lead and is responsible for coordinating the activities of the Watershed Management-Habitat Protection and Restoration FA. SCC works in partnership with watershed and open space protection groups throughout the region to advance regionally-significant conservation priorities.

  The Bay Area Watershed Network (BAWN) is a primary coordinating organization for Bay Area watershed and habitat organizations. BAWN is a collaboration of federal, state, and local agencies and non-profit organizations as well as individuals concerned with watershed planning, management and restoration. CC participants who are also BAWN members are actively seeking increased coordination and collaboration on Bay Area watershed and habitat efforts and information, particularly on the multiple benefits of watersheds. Additional efforts in which CC members have been participating on an ongoing basis include: the Watershed Management Initiative (WMI), Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), and the 2012 Silicon Valley Watershed Summit.

- **Flood Protection and Stormwater Management**

  The Bay Area Flood Protection Agencies Association (BAFPAA) is the primary coordinating organization for the Flood Protection and Stormwater Management FA. CC participants have also been leaders in BAFPAA which holds monthly meetings and/or conference calls, and an annual workshop. There is a standing Bay Area IRWMP item on the BAFPAA agenda and FA leads disseminate Bay Area IRWMP information and updates. BAFPAA coordinates with the Bay Area Stormwater Management Agencies Association (BASMAA) representatives to manage the FA.

Dog Creek Culvert

- **Wastewater and Recycled Water**

  Bay Area Clean Water Agencies (BACWA) is the primary coordinating organization for the wastewater and recycled water FA. BACWA is a joint powers agency, formed under the California Government Code by the five largest wastewater treatment agencies in the San Francisco Bay Area. Its members include the many municipalities and special districts that provide sanitary sewer services to more than 6.5 million people.

14.5.3 Participation in the Coordinating Committee

The Coordinating Committee (CC) serves as the organizing body and plenary forum for the development and implementation of the IRWMP. The CC holds monthly meetings at a regular time that are open to the public and are held at centrally located and public transportation accessible venues. CC meetings are noticed on the BAIRWMP website, and meeting agendas and materials are shared through a CC email distribution list and are also available on the BAIRWMP website. Decision-making at CC meetings is conducted by consensus, and all attendees are encouraged to participate in discussions and the decision-making process. Stakeholders can request that topics be placed on the agenda for future meetings. Stakeholders can also participate in one or more of the CC subcommittees. Tribes are working diligently to join and be a part of both these sub committees and the coordinating committee itself. CC subcommittees include:

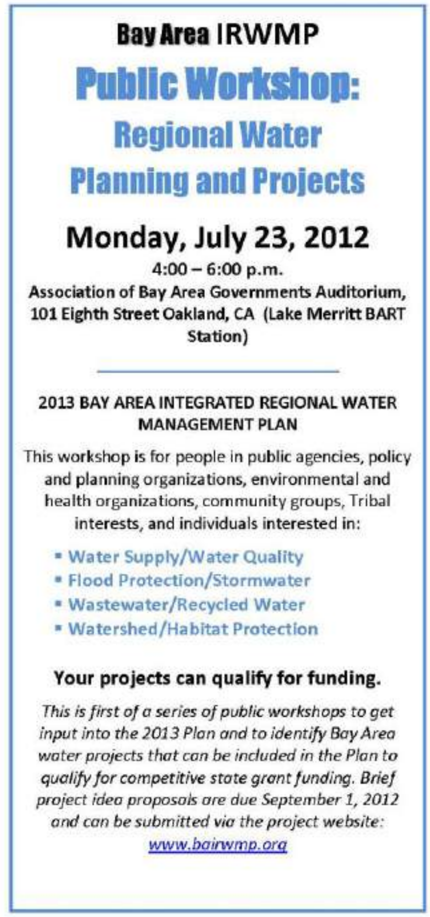
- Plan Update Team

- Project Screening Subcommittee
- Planning and Process Subcommittee
- Stakeholder Outreach and Engagement Subcommittee
- Website Subcommittee

The participation of individuals representing organizations beyond water interests in the CC and its subcommittees has increased awareness and coordination with other Bay Area planning efforts (e.g., land use and transportation) as well as environmental and community issues, e.g., coastal and bay interests, and recycling and educational efforts.

14.5.4 Public Workshops

Two public workshops were conducted to provide information and solicit input the IRWMP[36]. The CC and Stakeholder Outreach and Engagement Subcommittee helped to develop the agenda and design the format for each workshop. Broad outreach and publicity for the workshops resulted in a high level of participation both in terms of numbers and variety of participants. That outreach and publicity included:


Bay Area IRWMP

Public Workshop:

Regional Water Planning and Projects

Monday, July 23, 2012

4:00 – 6:00 p.m.

Association of Bay Area Governments Auditorium, 101 Eighth Street Oakland, CA (Lake Merritt BART Station)

2013 BAY AREA INTEGRATED REGIONAL WATER MANAGEMENT PLAN

This workshop is for people in public agencies, policy and planning organizations, environmental and health organizations, community groups, Tribal interests, and individuals interested in:

- Water Supply/Water Quality
- Flood Protection/Stormwater
- Wastewater/Recycled Water
- Watershed/Habitat Protection

Your projects can qualify for funding.

This is first of a series of public workshops to get input into the 2013 Plan and to identify Bay Area water projects that can be included in the Plan to qualify for competitive state grant funding. Brief project idea proposals are due September 1, 2012 and can be submitted via the project website: www.bairwmp.org

Public Workshop #1 Notice

- Three pre-workshop emails and one post-workshop email were sent to the master contact list for each workshop. Contacts from the master list redistributed the information to their own lists and newsletters, further extending the notification reach.
- Announcements were provided at meetings hosted and/or attended by subregional leads and CC participants.
- Subregional leads sent notification emails to their respective contact lists.
- Notices and workshops materials were posted on the BAIRWMP website, including some materials translated into Spanish.
- Media releases were distributed to local, regional, environmental and non-English media outlets.

[36] While three workshops were initially planned, holding a third workshop was not deemed critical since stakeholders were able to participate in monthly CC meetings.

The public workshops helped foster new connections and partnerships between NGOs and community organizations and water and flood agencies, and provided assistance to stakeholders in answering questions about projects and Plan content. Examples of workshop outreach materials can be found in Appendix E-7.

- **Workshop #1: July 23, 2012**

  Participants provided input on the IRWMP objectives and received guidance on DAC project criteria and the online project submittal process. Following presentations and a question-and-answer session, the workshop attendees were organized into groups according to their geographical location to promote direct interaction with subregional leads. More than 80 stakeholders attended the workshop, representing a wide range of organizations and interests; the table below includes stakeholder groups represented by categories of participants.

Table 14-1: Public Workshop #1 Participants

Participant Category	Entities Represented
Environmental Interests, Community and Environmental Justice Organizations	California Land Stewardship Institute; Conservation Corps North Bay; Daily Acts; FOLAW; Friends of Sausal Creek; Gallinas Watershed Council; Institute for Conservation Advocacy Research & Education; League of Women Voters Palo Alto; Marin Audubon Society; Mount Veeder Stewardship Council; San Francisco Bay Bird Observatory; San Francisco Estuary Partnership; Sierra Club; The Watershed Project; Trout Unlimited
Agricultural Interests	San Mateo County Farm Bureau
Water Agencies and Special Districts	Alameda County Resource Conservation District Clean Water Program; Coastside County Water District; Contra Costa County Flood Control District; Contra Costa Resource Conservation District; Corte Madera Flood Board; East Bay Municipal Utility District; East Bay Regional Parks District; Las Gallinas Valley Sanitary District; Marin Municipal Water District; Napa County Resource Conservation District; San Francisco Public Utilities Commission; San Francisquito Creek Joint Powers Authority; Santa Clara Valley Water District; Sonoma County Water Agency; Zone 7 Water Agency
State and Federal Agencies	Delta Protection Commission; USDA Natural Resources Conservation Service US Army Corps of Engineers
Local Government	Alameda County Public Works Agency; Bay Area Joint Policy Committee; City of Belmont; City of East Palo Alto; City of Hayward; City of Oakland; City of Palo Alto; City of Redwood City; Napa County; Stopwaste.org; Suffolk County Water Authority; Town of Hillsborough
Private Sector Service Providers	AECOM; Brezack & Associates Planning; Carollo Engineers; CDM Smith; ESA PWA; Horizon Water and Environment; Kliman Sales; Sloan Valve; Sound Watershed Consulting;

Participant Category	Entities Represented
	RMC Water and Environment; Whitley Burchett & Associates; Zentraal Acterra

- **Workshop #2: January 28, 2013**

  Participants received a presentation on the process for scoring and ranking projects for inclusion in the IRWMP, project criteria for DWR grant applications, and future funding rounds. Following additional presentations on funding sources and how to address potential funding challenges, a facilitated group discussion of panelists and workshop attendees took place. During this facilitated discussion, workshop attendees shared a number of successful strategies and approaches for funding water resource management projects.

Public Workshop #2

Table 14-2: Public Workshop #2 Participants

Participant Category	Entities Represented
Environmental Interests, Community and Environmental Justice Organizations	Acterra; Bay-Friendly Landscaping and Gardening Coalition; Daily Acts; Golden Gate National Parks Conservancy; ICARE; Midpeninsula Regional Open Space District; North Bay Watershed Association; San Francisco Estuary Institute; San Francisco Estuary Partnership; Sonoma Land Trust
Water Agencies and Special Districts	Alameda County Resource Conservation District; Alameda County Water District; Contra Costa County Flood Control District; Contra Costa Resource Conservation District; East Bay Dischargers; East Bay Regional Parks District; Marin Municipal Water District; North Bay Water Reuse Authority; San Francisco Bay Regional Water Quality Control Board; San Francisco Public Utilities Commission; Santa Clara Valley Urban Runoff Pollution Prevention Program; Santa Clara Valley Water District; Sonoma County Water Agency; Sonoma Valley County Sanitation District; Zone 7 Water Agency
Federal Agencies	Environmental Protection Agency
Local Government	City of Belmont; City of East Palo Alto; City of Livermore; City of Napa Stopwaste.org
Private Sector Service Providers	Arup; Balance Hydrologics; Carollo Engineers; CDM Smith; Newfields; Parsons; Stillwater Sciences; West Yost Associates

A list of attendees for each workshop is included in Appendix E-7.

14.5.5 General Outreach Materials and Distribution

Outreach materials were developed and distributed throughout the IRWMP development process to keep stakeholders informed and to encourage their participation in meeting, workshops, and the project submittal process. Materials included informational flyers, a frequently-asked-questions document, presentation materials and information on the BAIRWMP website (see Appendix E-6). Materials were distributed at CC meetings, regional public workshops, subregional meetings, other water- and land use-related meetings, and were posted on the BAIRWMP website. Materials and notices were distributed centrally to the regional stakeholder list, as well as by the subregional leads to their respective contact lists. In addition, media releases were submitted to local newspapers prior to stakeholder workshops.

The project website serves as the principal channel to educate the public about the IRWMP. The website includes background information, materials for CC meetings and public workshops, and notices of opportunities to review draft chapters. The website also provides an e-mail address (info@bayareairwmp.org) to allow public submission of comments, questions, and requests for information.

In 2012, a new system was developed to allow submission of project applications through the BAIRMWP website. Additionally, in response to a stakeholder recommendation, a "forum" section was added to allow potential applicants to post information about project partnerships wanted and/or offered. This approach was designed to serve as an online "matchmaking" portal to connect organizations and agencies with DAC-serving projects looking for partnerships.

14.5.6 Local Government Outreach

Local governments were targeted for specific outreach due to the nature of integrated regional water management and its relationship to local land use planning. Presentations and briefings were provided to local government agencies to inform them on the Bay Area IRWMP, to highlight the interrelated nature of water and land use planning and need for coordinated planning, to ensure local needs were addressed in the IRWMP, and to provide an opportunity for local governments to provide feedback on IRWMP development. Specific briefings and presentations included:

- City/County Association of Governments of San Mateo County (C/CAG) Technical Advisory Group
    - November 15, 2012
- Santa Clara County C3 Ad Hoc Task Force (Santa Clara County Cities and Water Agencies)
    - December 5, 2012
- Low-impact Development (LID) Leadership Group
    - March 7, 2012
    - May 16, 2012
    - September 23, 2012
    - December 3, 2012
    - February 8, 2013
- Bay Area Flood Protection Agencies Association (BAFPAA)/ Bay Area Stormwater Management Agencies Association (BASMAA) joint meeting in Oakland
    - December 12, 2012
- North Bay Watershed Association
    - January 24, 2012
    - April 13, 2012
    - June 13, 2012
    - July 6, 2012

- October 9, 2012
- November 2, 2012
- December 13, 2012
- January 4, 2013

- Sustainable Watershed Workshops
  - February 12, 2012
  - April 30, 2012

14.6 Engagement of Disadvantaged and Environmental Justice Communities

14.6.1 Approach to DAC Engagement

The IRWMP process found the inclusion of DACs and water resource projects that serve them a priority. The approach to engaging DACs and the organizations that represent them was informed by the review of DWR guidelines and policies in addition to a review of benchmark programs. The approach was further informed by interviews with Bay Area DAC representatives as part of the assessment process (See Appendix E-2 for a summary of findings from the interviews focusing on DACs).

Key components of this approach included:

- Inviting DAC representatives to participate in all aspects of the IRWMP process, including initial stakeholder interviews, CC and subregional outreach meetings, public workshops, and the review of draft chapters.
- Making the IRWMP process easy to understand for a broad audience, and making information easy to access through the website and non-technical outreach materials.
- Clearly identifying the location of DACs and their spatial relationship to water resource management considerations, including wastewater treatment facilities and flood-prone areas.
- Clarifying DWR's DAC project eligibility criteria and communicating this information to DAC representatives and water resource agencies.
- Conducting targeted outreach and providing hands-on guidance to support the identification and development of projects serving DACs.

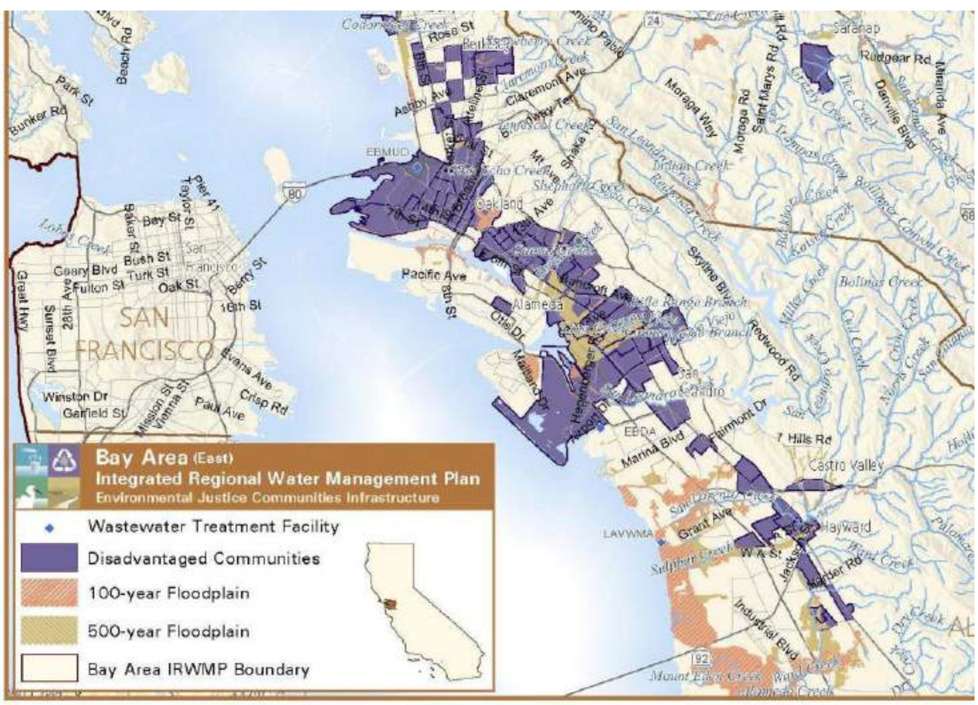
14.6.2 Identification of Disadvantaged and Environmental Justice Communities

State of California legislation AB-1747 (2003) defines disadvantaged communities as those with a Median Household Income (MHI) less than 80 percent of the State MHI, or $48,706 (2010

Census). While the MHI of each of the nine Bay Area counties is well above the 80 percent threshold for the State, there are disadvantaged communities located in each county, with the majority of these communities located in Alameda and Contra Costa counties. Chapter 2, *Regional Description*, contains additional information and maps of disadvantaged communities in the Bay Area using 2010 Census data.

Environmental justice communities are disadvantaged communities and communities of color that have been disproportionately impacted by programs, policies, or activities that have resulted in adverse health or environmental impacts. Placement of water infrastructure including sewage treatment plants, desalination facilities and recycling plants can place a burden on nearby communities due to odors, effluent, sewage back-ups and industrial buildings. Identifying the location of disadvantaged and environmental justice communities is an important step in ensuring that agencies, stakeholders and the general public can determine the impact of operations and plans on these communities.

In order to facilitate the identification of these communities, in 2013 the Bay Area IRWMP team developed a series of 2010 Census-based maps to promote the consideration of disadvantaged and environmental justice communities in IRWMP projects. In addition to developing a region-wide map, more detailed DAC subregional maps were developed identifying major streets, rivers and streams. The maps were distributed broadly to Bay Area organizations and agencies, including representatives of DACs and environmental justice communities, and were made available on the BAIRWMP website. The development and wide distribution of these maps (along with other outreach materials) proved to be helpful in generating DAC project ideas and, ultimately, having DAC projects included in the Plan.



Portion of East Subregion DAC Map

14.6.3 Clarification of DAC Project Criteria

Clarifying DWR's DAC project eligibility criteria, which was recommended in the stakeholder assessment, proved to be another valuable strategy in identifying DAC projects for the IRWMP. At the outset of the IRWMP development process, DWR guidance to the plan developers regarding DAC eligibility project criteria was that in order to qualify as a DAC project for grant funding purposes, a project needed to both benefit a community with a median household income below the DWR threshold and meet a "critical water supply or water quality need". Given that water supply and water quality are not common challenges for Bay Area communities, these criteria limited the number of projects that could meet DWR criteria for funding match waivers which are an incentive to DAC participation.

Following the release of the Proposition 84 Round 2 Draft Proposal Solicitation Package in July 2012 and subsequent exchanges with DWR staff, DWR clarified that it intended to offer a funding match waiver for any project that served a community with a median household income below the DWR threshold, meaning that a project did not necessarily have to address a critical water supply or water quality need to be considered an eligible DAC project. DWR further clarified that DAC projects meeting a critical water supply or water quality need would qualify for DAC-dedicated funding and would receive priority when projects are evaluated for funding (i.e., priority points). Additionally, DWR confirmed that flood control projects could meet a critical water quality need, making them eligible for DAC-dedicated funding in addition to the match funding waiver.

The table below illustrates the two types of DAC projects eligible for IRWM funding.

Table 14-3: DAC Criteria and Priority Funding Considerations

Project Submitted	Qualifies for Match Waiver	Qualifies for Dedicated DAC Funding	Qualifies for Priority Points
1. Serves DAC	✓		
2. Serves DAC and critical supply and/or quality	✓	✓	✓

The clarification of DAC project eligibility criteria for funding match waivers and dedicated DAC funding was conveyed broadly in communications and outreach with stakeholders. This clarification expanded the potential for Bay Area communities to submit DAC projects to be included in the IRWMP.

14.6.4 DAC-Specific Outreach Materials

A variety of materials were developed and disseminated to support outreach to disadvantaged communities and the identification of DAC water resource projects to be included in the IRWMP, including:

- DAC maps
- A DAC-specific factsheet including information on DAC project eligibility criteria, general information about Bay Area IRWMP, guidance for submitting DAC project proposals, and points-of-contact for additional questions or guidance.
- A dedicated DAC page was created on the BAIRWMP website containing information and links related to DACs, including the series of DAC maps; information on DAC project eligibility, DAC points-of-contacts, and a link to the DWR DAC mapping tool.

Select DAC outreach materials are included in Appendix E-8.

14.6.5 Targeted DAC Outreach and Engagement

The IRWMP update process in 2013 included targeted outreach to disadvantaged communities. All DAC representatives involved in the 2006 Plan were contacted to encourage their submittal of new projects to be included in the Plan Update. Agency staff from Bay Area communities containing DACs were contacted to encourage their participation in the IRWMP process, including the identification of projects for their communities. Outreach was conducted through the Functional Area groups, particularly water quality/water supply and flood protection FAs, to help identify DAC projects. In addition, all DAC contacts were included in the master contact list and received all BAIRWMP-related email notifications to ensure they were aware of upcoming events and deadlines. DAC contacts were invited to participate in broader engagement efforts, including monthly CC meetings and public workshops.

While efforts were made to reach to as many stakeholders as possible in the 2013 process, there was noticeably little Tribal and Disadvantaged Community participation. This is mainly because materials and workshops are not likely to reach Disadvantaged and Tribal communities without direct and coordinated outreach efforts by a trusted third party.

In 2016, the Bay Area began its IRWM Disadvantaged Community and Tribal Involvement Program (DACTIP). The mandate of the program is to include underrepresented populations (including DACs, URCs, EDAs, and Tribes) into IRWM and other water-related decision making processes, with an ultimate goal of building the capacity of communities and community based groups to develop and submit IRWM-eligible projects for implementation to address priority water issues identified through tailored outreach and needs assessment processes. See sections 14.6.7 & 14.7 for additional information on the DACTIP. The California Indian Environmental Alliance is conducting Tribal outreach and coordination as part of the DACTIP's outreach process. Their outreach includes attending Tribal cultural events where they hand out materials and introduce themselves to elders and first explain who they are and what their mission is. They then ask to meet another time to further explain their efforts and goals once they become more comfortable and familiar with who they are. This process has led to further Bay Area Tribal engagement in IRWM.

14.6.6 DAC Project Support and Guidance

To facilitate DAC project identification and development, the 2013 year Bay Area IRWMP team offered hands-on guidance and support to potential DAC projects proponents to ensure that the application process was clear, that their projects met DWR's eligibility criteria, and that their project development and submittal processes were progressing successfully. DAC liaisons were available in each subregion to respond to questions and requests for information, and they conducted regular check-ins with DAC project proponents by phone and email to ensure their project development processes were progressing. DAC project proponents that received targeted assistance included:

- Alameda County Flood Control Agency
- City of Berkeley
- City of Calistoga
- City of East Palo Alto
- City of Oakland
- City of Pittsburg
- Committee for Green Foothills
- Friends of Sausal Creek
- Rural Community Assistance Corporation/Town of Pescadero
- San Francisquito Creek Joint Powers Authority
- The Watershed Project

A log of DAC targeted outreach and project assistance is included in Appendix E-8.

14.6.7 Disadvantaged Community and Tribal Involvement Program

The Disadvantaged Community Involvement Program (DACIP) is a Proposition 1 (2014 Water Quality, Supply, and Infrastructure Improvement Act) funded program that was designed to ensure the involvement of disadvantaged communities (DACs), economically distressed areas (EDAs), and underrepresented communities (URCs) in IRWM planning efforts and decision-making processes. The State allowed an expanded definition of eligible participants outside of the traditional definition of Disadvantaged Community, which allowed the Bay Area to include unincorporated communities and homeless communities in programmatic engagement.

The Environmental Justice Coalition for Water (EJCW) was endorsed by the Bay Area IRWM Coordinating Committee in 2016 to be the Grant Administrator and Program Manager for the Bay Area DACIP, and EJCW partnered with the California Indian Environmental Alliance (CIEA) to conduct Tribal outreach and a needs assessment,

To implement the DAC portion of the DACTIP, EJCW partnered with organizations already working in communities that qualified as DACs throughout the Bay Area to expand outreach efforts and conduct tailored needs assessment processes to engage and build the capacity of communities to identify their own water-related issues, to participate in IRWM decision-making processes, and ultimately develop and submit IRWM-eligible projects to address priority water-related issues identified through the Needs Assessment process. Concurrently, CIEA conducted outreach to Tribes to begin a separate needs assessment process in Tribal communities. In 2019, grant administration for the program was transferred to the San Francisco Estuary Partnership (SFEP).

Outreach Partners Selected as part of the DACTIP for DACs are as follows:

- All Positives Possible (Vallejo)
- City of Hayward (Tennyson Corridor)
- Marin County Community Development Agency (Dillon Beach & Pt. Reyes Station)
- Shore Up Marin (Marin City & San Rafael Canal District)
- Sonoma Ecology Center & Daily Acts (Petaluma, Penngrove, Cotati, Rohnert Park, Rodgers Creek (Creekside Village/Temelec/Chanterelle), & The Springs)
- Greenaction for Health and Environmental Justice (Bayview-Hunters Point)
- Ronald V. Dellums Institute for Sustainable Policy Studies and Action (Sobrante Park, Columbia Gardens, & Brookfield Village)
- Nuestra Casa & Youth United for Community Action (East Palo Alto)
- Friends of Sausal Creek (Oakland Fruitvale Neighborhood)
- Contra Costa Resource Conservation District (Antioch, Pittsburg, & Bay Point)
- Keep Coyote Creek Beautiful (San Jose)
- The Watershed Project (Richmond, San Pablo, & El Sobrante)

The majority of the Outreach Partners were selected through an RFQ process by the Bay Area IRWM Region Coordinating Committee. Three of these communities (Vallejo, East Palo Alto, Antioch/Pittsburg/Bay Point) and the Outreach Partners working in them were identified through an initial "gaps analysis" of high priority DACs not covered by the initial 10 Outreach Partners selected through the RFQ process.

Phase 1 DACTIP activities being carried out by the Outreach Partners, coordinated by EJCW and then SFEP, include Outreach, Needs Assessment, Capacity Building, and Technical Assistance and Project Development. Other DACTIP activities to more meaningfully include DACs, EDAs, and URCs into IRWM processes include working to change the CC governance and voting structure to formally include DAC and Tribal representatives, investigating expanding funding to encourage DAC, EDA, and URC participation in all regional planning processes, and creating connections between communities/community groups and water-related decision-making bodies to leave behind social infrastructure to ensure continued involvement of communities and community groups in IRWM beyond the life of the DACTIP funding.

Outreach & Needs Assessment

Outreach and Needs Assessment activities are simultaneously and iteratively being carried out by Outreach Partner organizations in their respective communities, coordinated by first EJCW and subsequently SFEP. Needs Assessments were tailored to each community to account for the variation in community capacity, context, and needs, but were designed to ensure varying individual strategies resulted in information that can be used to identify capacity building and technical assistance needs, further project development, and to support continuance in DACTIP communities and Tribes to participate in the regional IRWM process after the life of the DACTI Program. A decentralized approach was chosen to leverage existing relationships and allow for greater ability to thoughtfully involve community members in water management on a local scale.

Needs Assessment activities include direct outreach and education, participation in local events to conduct broader outreach and education, website updates, meetings and presentations, as well as surveys, listening sessions, and interviews to determine needs, priorities, and strengths in these communities, as defined by community members. The Needs Assessment will inform the second phase of DACTIP work by providing insight into potential barriers to accessing funding, region-wide issues, and strategies for inclusion into regional planning efforts, and will inform future tailored outreach to communities.

Capacity Building, Technical Assistance & Project Development

In conjunction with Needs Assessment activities, Capacity Building for Outreach Partner organizations and communities is part of every stage of the DACTIP to ultimately support the development and submission of proposals to IRWM Prop 1 and other grants as applicable and to ensure communities and community groups stay engaged with these processes after the DACTIP formally concludes. Capacity Building that the Outreach Partners are being provided with includes coordination support and trainings on state processes for contracting, invoicing, and other administrative tasks, as well as outreach and needs assessment activities to build their capacities to develop solutions to issues in their communities, write grants, administer contracts and agreements, collect data, and report on their ongoing work at all levels. Other Capacity building and technical assistance will be offered to address capacity building needs identified through the needs assessment process, such as grant writing and water testing, to support project and proposal development for IRWM and other funding sources as applicable. The capacity building effort is ultimately intended to increase the capability of DACs, EDAs, and URCs to engage with and voice concerns at regional planning efforts, as well as to support water managers in understanding how to better meaningfully engage with all communities they serve.

Building on Capacity Building activities and trainings, Outreach Partners will use the findings of their Needs Assessment processes to work with Technical Assistance Providers to develop project proposals to address identified issues. The Phase 2 workplan for the DACTIP is currently being adaptively developed by SFEP in coordination with the Bay Area CC and OPs to support and further the Program’s goals. The second phase of the DACTIP involves utilizing lessons learned from Outreach, the Needs Assessment, Capacity Building, Technical Assistance, and Project Development to address identified issues and barriers.

14.7 Native American Tribe Identification and Outreach

14.7.1 Native American Tribal Identification

The Stakeholder Engagement Plan noted that outreach to Bay Area Native American Tribes and/or members would include the identification of Tribes and Tribal contacts, and initial communication with Tribal leaders. The process conducted in 2013 to identify Native American Tribes and Tribal members within the Bay Area IRWMP's jurisdiction included conducting interviews with knowledgeable contacts from NGOs and water agencies and reviewing publicly-available resources from Tribes and information provided by DWR's Tribal Liaison for the region. In 2016 the Bay Area engaged in the Disadvantaged Communities and Tribal Involvement Program (DACTIP) and the California Indian Environmental Alliance (CIEA) conducted further Tribal outreach and identification. .

In 2013, it was determined that one Tribal community – the Lytton Band of Pomo Indians – currently owned land within the Bay Area IRWMP geographic boundary and may have distinct water resource interests, needs, or challenges, though they are not originally a first land Bay Area Tribe. The Lytton Band owns and operates the San Pablo Lytton Casino in the East Bay and is served by the East Bay Municipal Utilities District. Otherwise, there are individual members of other Native American Tribes residing in the San Francisco Bay Area, but they are dispersed into the general population and do not have distinct water quality or water supply challenges. In 2019, it was determined that two other Tribes – Federated Indians of Graton Rancheria and Mishewal Wappo – also own land and manage their own water systems.

Other federally recognized Tribes in the larger Bay Area are located primarily in the North Bay/Sonoma County area, including the federally recognized Federated Indians of Graton Rancheria, Dry Creek, and Kashia Tribes. These Tribes mainly fall within the jurisdiction of the North Coast IRWMP where they are actively involved in the development of that region's IRMWP.

The Amah Mutsun Tribe participates in both the Pajaro River Watershed IRWM and the Bay Area IRWMP since it holds territory in both regions.

CIEA's outreach resulted in the identification of five Tribes for participation in the DACTIP: The Amah Mutsun Tribal Band, Association of Ramaytush, Indian People Organizing for Change, Him-R^n , and Muwekma Ohlone. Descriptions of each participating Tribal partner are provided below.

Amah Mutsun

The Amah Mutsun Tribal Band (AMTB) is comprised of the living descendants of the Mutsun and Awaswas speaking peoples whose ancestral homeland encompasses the lands and waters of Santa Cruz, San Benito, and parts of San Mateo and Santa Clara counties—the territory known to the Tribe as Popeloutchom. The Tribe's creation story describes how Creator specifically chose the Amah Mutsun to steward these lands and waters, as well as the Tribe's four-legged, winged, finned, and plant kin.

Despite a brutal history of subjugation and displacement from its ancestral territory during colonization and a loss of the Tribe's federal recognition, the AMTB maintains its community identity and its commitment to the stewardship of Popeloutchom. Honoring this commitment today requires the restoration and relearning of indigenous practices of resource management, as well as the development of new means of accessing the lands and waters from which the Tribe has been displaced.

In 2013, the AMTB established the Amah Mutsun Land Trust (AMLT)—a Native-led 501(c)(3) non-profit organization—to serve as a vehicle for the Tribe's re-engagement with its ancestral territory and stewardship role. Rather than solely pursuing direct ownership of land, AMLT focuses on cultivating partnerships with private and public landowners, including leading conservation organizations, to restore indigenous stewardship, presence, and perspectives to lands within the Tribe's ancestral territory. These efforts have led to an array of innovative and historic collaborations, including a recent partnership with the Midpeninsula Regional Open Space District to restore both Tribal and public access to the summit of Mt. Umunhum in Santa Clara County. Through the AMLT Native Stewardship Corp—a program focused on cultural relearning and the application of indigenous stewardship techniques—Tribal members are working directly to conserve natural resources and restore ecosystems in AMTB territory, including in a multi-year collaboration with California State Parks at Quiroste Valley Cultural Preserve in southern San Mateo County.

Through sustained processes of outreach, collaboration, and direct engagement in conservation, research, and education led by AMLT, the Amah Mutsun are re-establishing a vital presence as indigenous stewards of Popeloutchom. Recognizing the intrinsic links between land and water resources, AMTB and AMLT are eager to help bring an indigenous perspective to the Bay Area IRWM process and to the broader management of water throughout their ancestral territory so that indigenous knowledge and cultural values are always a part of the region's resource management practices.

Indian People Organizing for Change

"Indian People Organizing for Change (IPOC) is a community-based organization in the San Francisco Bay Area. Its members, including Lisjan-Ohlone Tribal members and conservation activists, who work together in order to preserve cultural and traditional heritage, as well as the goal to accomplish social and environmental justice within the Bay Area American Indian community."

Him-R^n
Him-R^n is an Ohlone, Plains and Bay Miwok Tribe, whose chairwoman is Ruth Orta. Ruth and members of the Tribe work alongside Coyote Regional Parks and collaborate on stewardship guidance on Native planting, materials for plant and boat making as well as basket weaving and brushes, and provides recommendations with details on how to care for the land. Coyote Regional Parks recognizes Him-R^n 's ties to their traditional lands, which include Coyote Regional Parks who keep certain areas protected with fences to only allow for Him-R^n to continue practicing their Tribal ceremonies. Ruth coordinates and hosts Ohlone gatherings, and cultural heritage trainings (plant gathering, cultural trainings, tours of the regional park, acorn making, jewelry making from abalone, etc.), and gives talks to Tribal members and non-Tribal members.

Association of Ramaytush Ohlone

The Association of Ramaytush Ohlone (ARO) is an association dedicated to researching, revitalizing, and preserving Ramaytush Ohlone history and culture. The primary objectives of the ARO are to engage in research to expand knowledge about the Ramaytush Ohlone, to enhance public awareness of the Ramaytush Ohlone in San Francisco and San Mateo counties, to support cultural revitalization efforts in the San Francisco Bay Area, and to preserve natural and archaeological resources in Ramaytush Ohlone lands. The ARO partners with local, state, and federal agencies, and other Ohlone tribes and organizations to further its objectives. The ARO is not a public non-profit 501.c.3.

Muwekma Ohlone

The present-day Muwekma Ohlone Tribe is comprised of all known surviving Native American lineages aboriginal to the San Francisco Bay region who trace their ancestry through the Missions San Jose, Santa Clara, and Dolores and the historic federally recognized Verona Band of Alameda County.

Noted anthropologists and linguists such as Alphonse Pinart, Jeremiah Curtin, Alfred L. Kroeber, C. Hart Merriam, Edwin Gifford, James Alden Mason, and John P. Harrington during the late 19th and early 20th centuries interviewed the fluent speakers of the Indian languages spoken at the Muwekma rancherias. These tribal Elders include Jose Guzman and Maria de los Angeles Colos who still employed the linguistic term “Muwekma” which means “La Gente” meaning “The People” in the Chocheño and Thámien Ohlone languages of the East Bay and Santa Clara Valley.

In 1906, BIA Special Indian Agent for California Charles E. Kelsey identified the Muwekma Tribal community as the Verona Band of Alameda County residing in Pleasanton, Niles, Sunol, Livermore, Newark and towns located around Mission San Jose. The tribe formally remained under the jurisdiction of the Indian Service Bureau as a landless tribe that was eligible for land purchase under the Congressional Homeless California Indian Acts and appropriations of 1906,1908 and later years as a result of the discovery of the 18 unratified California Treaties of 1851-52.

In 2003, the Muwekma Language Committee was established to restore the Tribe’s Ohlone Language. Silent for over 65 years, Chocheño was spoken for the first time by several Muwekma councilmembers. Monica V. Arellano**,** Vice Chairwoman/Co-Chair of the Language Committee and Gloria E. Arellano-Gomez Councilwoman have been given the authority to issue public welcoming and blessings to Muwekma’s Ancestral Homeland. Joined by Sheila Guzman-Schmidt, Councilwoman/Committee Co-Chair whose great-grandfather was Jose Guzman and who was one of the last speakers of the Delta Yokuts and Chocheño Ohlone languages until his death in 1934. All three Councilwomen are very proud to have a leadership role in the restoration and preservation of the Tribe’s Language, Culture and Heritage.

Since 1986, the Tribal leadership has been working diligently in addressing adverse impacts to their ancestral heritage cemetery and village sites. Since that time the Tribal leadership has co-authored numerous scientific and cultural publications and have presented at professional meetings on the skeletal biology and ancient DNA relative to their heritage sites.

Over the years the Tribe has established a working relationship with governmental agencies, such as Army Corps of Engineers, Caltrans, Santa Clara County VTA, City of San Jose and San Francisco Public Utilities Commission as well as many other entities.

14.7.2 Initial Tribal Outreach and Next Steps

Regardless of the limitations of geography, Tribal recognition, and resources, representatives of Bay Area Tribes are included in the Bay Area IRWMP master contact email list and each received multiple email notices about the 2013 public workshops. Efforts to involve Bay Area Native American Tribes in the 2013 Plan update process are found in Appendix E-9.

Native American Tribes are sovereign nations and as such require coordination on a government-to-government basis. CC member agencies are looking for ways to involve Native Americans living in the Bay Area in the planning and implementation of specific projects included in the IRWMP.

In its work through the DACTIP, CIEA focused on the five participating Tribal outreach partners. Through participating in the Ohlone Gathering in Fremont, CIEA reached Him-R^n , Muwekma Ohlone and other Tribes with affiliation to Bay Area Tribes. Ramaytush identified their point person. CIEA also reached out to the Federated Indians of Graton Rancheria, Kashia Band of Pomo Indians, and Lytton Rancheria. These Tribes want to be informed but will not be official Tribal Partners at this time.

While there are numerous individual members of other Native American Tribes residing in the San Francisco Bay Area, a diaspora due to cost of living has spread many Natives away from their traditional lands. CIEA is committed to representing the needs of all Native American Tribal members through the DACTIP and is working to represent their water quality or water supply challenges and needs.

14.8 Stakeholder Engagement Following Adoption of the IRWMP

Stakeholder engagement will continue following adoption of the IRWMP, and it will be essential to ensuring the successful implementation of the Plan. The Coordinating Committee will continue to serve as the organizing body and plenary forum for the Bay Area IRWMP, and discussions concerning stakeholder engagement strategies and opportunities will mainly take place at these meetings which are open to the public.

What follows are stakeholder engagement considerations that will be reviewed and discussed by the Coordinating Committee to ensure that stakeholder engagement is continuing effectively and that adjustments are made as needed.

- Stakeholder engagement goals and objectives, which are identified in the Stakeholder Engagement Plan, will be revisited annually by the Coordinating Committee to determine the level of success in achieving them. In addition, the goals and objectives will be modified as needed to ensure they are consistent with current stakeholder needs and resources available.
- Stakeholder outreach will continue to be organized and implemented by subregion, which allows for the consideration of local needs. Regional coordination across the subregions will help promote integration.
- The BAIRWMP website will serve as the effort's main resource for sharing information with stakeholders. The website will be easy to navigate. Information about opportunities to participate (Coordinating Committee meetings, subregional outreach meetings, IRWM funding rounds) will be kept up to date and posted on the website.
- The master stakeholder contact list will be maintained and continually updated.
- The Coordinating Committee will continue to look for ways to include representatives of DACs and Tribes in the Bay Area IRWMP process, including encouraging DAC and Tribal participation in future IRWMP funding rounds.
- Future outreach to Bay Area Native American Tribes will include discussions with the with the California Indian Environmental Alliance to increase participation by Tribes in the Coordinating Committee and Sub Committees.

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Chapter 15: Coordination

This chapter presents an overview of the Bay Area IRWM region's coordination with local, regional and state agencies, stakeholders and neighboring IRWM regions.

15.1 Coordination of Activities within the Region

Developing this Plan Update involved a diverse group of water supply, water quality, wastewater, stormwater, flood control, watershed, municipal, environmental, and regulatory groups whose input played a key role in defining water resources management goals and objectives, identifying and selecting priority projects to help meet those goals and objectives and coordinating IRWM related activities and efforts. A wide range of local and regional agencies and districts participated in development of the Plan and will continue to participate in IRWMP implementation. These local planning entities (see Chapters 12 and 13: Relation to Water Planning and Relation to Local Land Use Planning for more information), along with the general Stakeholder group, participated in CC meetings, Stakeholder meetings and workshops, provided updated data, reviewed and commented on IRWMP sections, sponsored projects, and participated in project review.

A master stakeholder list was developed at the start of the Plan update process. The list contains approximately 1,500 contacts representing all local and regional water resource and flood agencies, watershed organizations, a complete and current list of elected city, county and state officials, city and county land use agencies, disadvantaged community representatives, environmental and community groups, media, and Native American Tribal contacts (Appendix 14-A). Contacts in the master stakeholder list were provided with information about key milestones and deadlines, public workshops, and opportunities to review draft chapters.

All interested stakeholders and members of the public were provided access to information about the Plan, the Plan update process, project criteria and submission, and meetings and workshops. Members of the public also had the opportunity to review and provide input on draft chapters of the Plan. The primary sources of information for the public were the BAIRWMP website and update emails. Through notices sent to the master mailing list, and re-distributed to partner and stakeholder lists, a significant number of people who follow water and land use issues were made aware of the update process, and were encouraged to visit the website and attend meetings and workshops.

In addition to regional meetings and workshops, subregional meetings and workshops also provided an opportunity for project proponents and stakeholders to coordinate their IRWM related activities and efforts.

15.1.1 Coordination with Regional Entities

Water management agencies throughout the San Francisco Bay Area have a long history of regional cooperation and planning. A number of these regional water management organizations in the San Francisco Bay Area include organizations that span multiple regions. The following regional organizations play an integral role in regional and inter-regional coordination:

15.1.1.1 Bay Area Water Agencies Coalition

The Bay Area Water Agencies Coalition (BAWAC) was formed in 2002 by ACWD, BAWSCA, CCWD, EBMUD, SCVWD, SFPUC, and Zone 7 to address regional water supply and water quality issues. BAWAC membership has since been expanded to include North Bay agencies MMWD, Solano CWA, and Sonoma CWA. BAWAC is committed to advancing water conservation in the region through new technologies, refinement of existing conservation programs, and evaluation of regional opportunities in marketing, product labeling, and research. Projects carried out by these agencies include a variety of regional water conservation programs, regional interties, and a subset has been steadily working on studies for a Regional Desalination Project. BAWAC agencies are represented in the Bay Area, East Contra Costa NS Westside and Pajaro IRWM regions.

15.1.1.2 Bay Area Clean Water Agencies

The Bay Area Clean Water Agencies (BACWA) is a joint powers agency formed in 1984 by the five largest wastewater treatment agencies in the San Francisco Bay Area. Its members are local governmental agencies involved in urban water resource management and San Francisco Bay water quality stewardship. BACWA's members treat all domestic, commercial and a significant amount of industrial wastewater in the Bay Area. BACWA was formed to foster regional understanding of watershed protection and enhancement for long-term stewardship of the San Francisco Bay Estuary. BACWA also actively promotes and develops recycled water through its Recycled Water Committee which monitors and provides input on legislative and regulatory issues that affect the Bay Area, collaborates to secure funding for Bay Area recycled water projects, and develops regional informational pieces to Increase public awareness of recycled water and its use in the Bay Area (for more information, see Chapter 2). BACWA members are represented in the Bay Area, East Contra Costa, Westside and Pajaro IRWM regions.

15.1.1.3 Bay Area Stormwater Management Agencies Association

The Bay Area Stormwater Management Agencies Association (BASMAA) was formed in 1990 in response to the NPDES permitting program for stormwater. BASMAA encourages regional consistency and efficient use of public resources. BASMAA, is a consortium of the following nine San Francisco Bay Area municipal storm water programs: Alameda Countywide Clean Water Program, Contra Costa Clean Water Program, Fairfield-Suisun Urban Runoff Management Program, Marin County Stormwater Pollution Prevention Program, Napa County Stormwater Pollution Prevention Program, San Mateo Countywide Water Pollution Prevention Program, Santa Clara Valley Urban Runoff Pollution Prevention Program, Sonoma County Water Agency and the Vallejo Sanitation and Flood Control District. Other agencies, such as the California Department of Transportation (Caltrans) and the City and County of San Francisco (combined sewer system), participate in some BASMAA activities. Together, these agencies represent more than 90 agencies, including 79 cities and 6 counties, and the bulk of the watershed immediately surrounding San Francisco Bay. BASMAA agencies span the Bay Area, East Contra Costa, Westside and North Coast IRWM regions.

15.1.1.4 Bay Area Flood Protection Agencies Association

The Bay Area Flood Protection Agencies Association (BAFPAA) was formed in 2007 as a result of coordinated IRWM efforts by the regional flood protection agencies and provides a forum for regional coordination and collaboration with State and Federal regulatory and resource agencies. The nine Bay Area agencies that are signatories to BAFPAA include the Alameda, Contra Costa, Marin, Napa and San Mateo Counties Flood Control and Water Conservation Districts, SCVWD, Solano CWA, Sonoma CWA, and Zone 7. Most of the flood district boundaries coincide with County boundaries and extend outside the Bay Area Region. BAFPAA agencies span the Bay Area, Pajaro and East Contra Costa IRWM regions.

15.1.1.5 Bay Area Water Supply and Conservation District

The Bay Area Water Supply and Conservation District (BAWSCA) was enabled by AB 2058 in 2003 to represent the interests of 24 cities and water districts in Alameda, Santa Clara and San Mateo counties, and two private utilities that purchase water wholesale from the San Francisco regional water system. BAWSCA encourages water conservation and use of recycled water supplies on a regional basis. BAWSCA agencies span the Bay Area IRWM Region.

In addition to the regional organization described above, the Bay Area Air Quality Management District, Metropolitan Transportation Commission, ABAG, Bay Area Rapid Transit, and RWQCB all have regional planning programs/efforts for the nine-county Bay Area. The RWQCB and BCDC also have regulatory purview over the same nine counties.

15.1.1.6 Bay Area Watershed Network

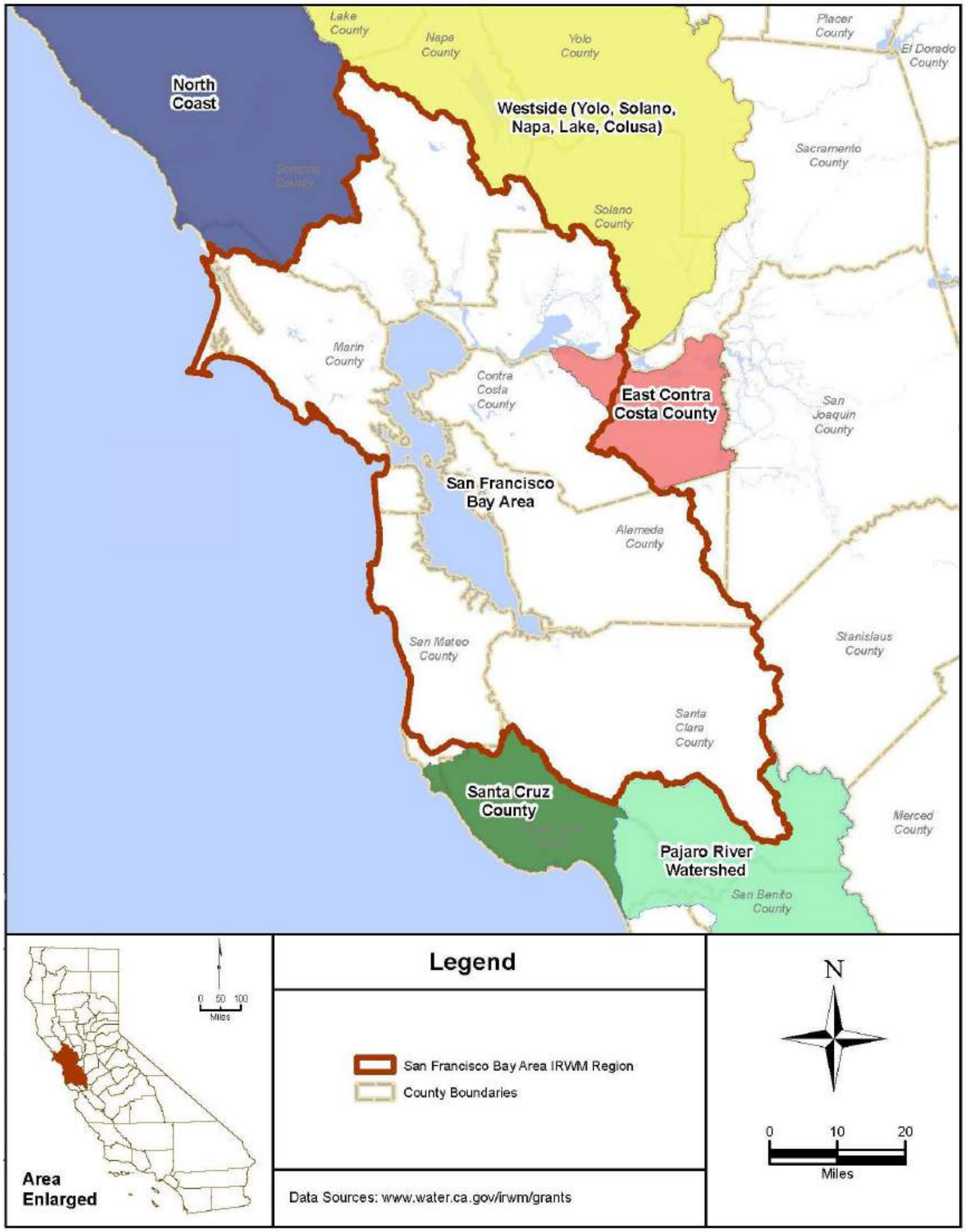
The Bay Area Watershed Network (BAWN) is a network of natural resource professionals and community members working locally to protect watersheds throughout the Bay Area. BAWN members interact and collaborate in various ways, providing opportunities to exchange information and coordinate ideas, proposals, and activities valuable to the IRWM Planning process.

15.2 Coordination of Activities outside of the Region

15.2.1 Identification and Coordination with Neighboring IRWM Regions

The Bay Area IRWM Region is adjacent to five IRWMP regions as shown in Figure 15-2 (there are no IRWM regions in San Joaquin and Stanislaus counties). When preparing the Region Acceptance Process (RAP) application in 2009, the CC contacted and coordinated efforts with water supply, wastewater, flood protection, and watershed and habitat and restoration agencies in adjacent IRWM regions. Agencies are aware of each other's efforts and projects that overlap planning regions have been identified and coordinated to the degree possible (see Section 15.2.1.3). Several of the agencies participating in the Bay Area IRWMP are also participating in these other regional planning efforts.

Figure 15-2: Surrounding IRWM Regions



Multiple IRWM planning efforts were initiated during 2005-2006 and several of these were consolidated into the San Francisco Bay Area IRWM Plan. Since the IRWM Plan was first adopted in 2006 additional consolidation and clarification has occurred. Table 15-4 summarizes the historic overlaps in the San Francisco Bay Area region that have been consolidated since the 2006 Plan

Table 15-4: Changes in Regional Boundaries since 2006 Plan

Region	Description of Previous Region Overlap	Boundary Resolution
Tomales Bay Watershed Integrated Coastal Water Management Plan	Complete overlap	The Tomales Bay Watershed Council decided not to pursue its Integrated Coastal Watershed Management Plan independently of the Bay Area IRWMP. IRWM efforts in the Tomales Bay watershed are now included in the San Francisco Bay Area IRWM effort.
East Contra Costa County (ECCC) IRWM Plan	Overlap of northwestern triangular area	Integration of northwestern portion into the Bay Area Region. Efforts with the San Joaquin IRWM region to be coordinated under East Contra Costa County region's governance
Napa-Berryessa IRWM Plan	Overlap of southwestern portion	Complete integration of southwestern portion into the Bay Area Region. The rest of their original region is coordinating with the Westside IRWM Region.
Solano IRWM Plan	Overlap of southwestern portion	Complete integration of southwestern portion into the Bay Area Region. The rest of their original region is coordinating with the Westside IRWM Region.
Sonoma County Agencies	Overlap of southeastern-portion	Integration of southeastern portion into the Bay Area Region through Sonoma County Water Agency. The rest of the county is involved in the North Coast IRWM efforts.

The San Francisco Bay Area IRWM Region Coordinating Committee (CC) and the other regions listed in Table 15-4 resolved the overlapping boundaries listed in the table through direct contact with the leaders of the other regional efforts in writing, phone conversations, and invitations for them to participate in CC meetings. The approach was for the other regions to determine for themselves if partnering and integrating with the Bay Area IRWM Plan was beneficial to them. Each reached their decision independently after visiting CC meetings and discussing the proposed mergers of the boundaries with their respective organizing committees.

Below is a brief description the neighboring IRWM regions, their water management priorities and coordination with development of the Bay Area IRWM.

15.2.1.1 Relationship with the Westside Sacramento River IRWM Region

Napa County is split between the Bay Area and Westside Sacramento River IRWMPs. The Bay Area Region generally covers the western part of Napa County and focuses on the Napa River and Suisun Creek watersheds. The Westside Sacramento River Region, which is one of eight IRWMPs within the Sacramento Valley Funding Area delineated by DWR, generally covers the eastern part of Napa County and focuses on the Putah Creek/Lake Berryessa watershed. The drainage divide between Fairfield and Vacaville is the boundary between the Bay Area and Westside Regions. During development of the RAP application, Bay Area representatives contacted and coordinated with Solano County to resolve overlap areas.

Representatives from Solano County Water Agency and Napa County Flood Control and Water Conservation District provide a linkage between the Bay Area and Westside Sacramento IRWMPs, enabling information sharing and communication between the two planning efforts as well as the potential for developing interregional projects. Both agencies are targeted reviewers for the Plan Update process and, as such, receive each draft chapter prior to public release for review and input. Both agencies are also members of the Westside IRWM coordinating committee. Depending upon their location within the Napa or Solano county, projects will be incorporated into the appropriate IRWM Plan.

15.2.1.2 Relationship with the North Coast IRWM Region

The North Coast IRWM Planning area is consistent with the North Coast RWQCB boundary. The North Coast Region is made up of watersheds that drain to the Pacific Ocean from Marin County in the south to the Oregon border in the north and includes the counties of Modoc, Siskiyou, Del Norte, Trinity, Humboldt, Mendocino and Sonoma. The major issues in this region are primarily related to timber harvesting, management and enhancement of anadromous fisheries, and protection of wild and scenic rivers. This area is much less urbanized and much wetter than the San Francisco Bay Area, and thus has fewer problems with water supply reliability, stormwater management and urban runoff, and wastewater discharges.

Sonoma and Marin Counties lie within both the North Coast IRWM and Bay Area IRWM Regions. The County of Marin, which only has a small portion in the North Coast region, participates in the Bay Area IRWMP and pursues planning and project implementation in the North Coast Region, as do stakeholders in Sonoma County. The Sonoma County Water Agency and the North Bay Watershed Association, both of which are PUT members, provide a link between the Bay Area and North Coast IRWMPs, enabling information sharing and communication between the two planning efforts. They also provide joint updates at Sonoma County Water Agency's (SCWA) quarterly water advisory committee meetings which includes all of SCWA's water contractors and members of the public including stakeholders

15.2.1.3 Relationship with the East Contra Costa County IRWM Region

The East Contra Costa County (ECCC) IRWM region is the only IRWM planning region with boundaries that overlap the Bay Area Region boundaries, straddling the Bay Area and San Joaquin River hydrologic regions. The ECCC region is isolated from the remainder of Contra Costa County and the greater Bay Area by the ridgelines of Mt. Diablo in the south and west, and by the San Joaquin and Old Rivers on the north and east. However, the boundaries of the RWQCB Region 2 (and the San Francisco Funding area) also include the Willow Creek and Kirker Creek watersheds that drain to the east of the Mt. Diablo hydrologic divide thus creating an overlap. These two watersheds are included in the Bay Area Region, resulting from the defined boundaries of the San Francisco Funding Area and RWQCB Region 2, and within the East Contra Costa County IRWM region, whose boundaries are defined by the hydrologic divide created by the ridgeline.

The entire East Contra Costa IRWM region drains to the Delta primarily through Marsh Creek, Kirker Creek, and Kellogg Creek watersheds. These watersheds encompass the jurisdictional boundaries of all of the East Contra Costa County IRWM region participating entities except for Contra Costa County and Contra Costa Water District, which serve an area broader than East Contra Costa County. The agencies in the East Contra Costa County region all fall within the jurisdiction of the Central Valley Regional Water Quality Control Board (Region 5). The dominant issues in this region are water quality in the Delta, flood control and floodplain development and endangered aquatic species protection, which are a subset of the large complement of water resources management issues in the Bay Area region as a whole.

This overlap has caused some challenges. Under the definitions of funding areas as described in the DWR grant guidelines, the overlap area is potentially eligible for funds from both the San Francisco and San Joaquin funding areas. The potential for leveraging multiple funding sources with the San Francisco Bay IRWM region is especially important as the overlap area includes a disproportionate number of Disadvantaged Community (DAC) members. At the same time, the requirements for coordination are increased.

The cities of Pittsburg and Antioch are located in an area that is contained within both the ECCC and the San Francisco Bay Area IRWM regions (**Error! Reference source not found.**). Approximately 2 percent of the City of Pittsburg is located wholly within the San Joaquin area, with the remaining 98 percent located in the overlap area. Conversely, approximately 99 percent of the City of Antioch is located wholly within the San Joaquin funding area, with only 1 percent located in the overlap area. The Bay Point Area, which sits slightly northwest of Antioch, is fully within the San Francisco Bay funding overlap area.

Both the ECCC and San Francisco Bay IRWM regions recognize the importance of implementing projects in the overlap area, particularly due to the high proportion of DACs present in this area. The two regions are currently collaborating to develop a mutually agreeable approach to determining which funding area(s) should contribute funding to support implementation of projects in the overlap area.

A representative from East Contra Costa County attends Bay Area IRWM Coordinating Committee meetings and participated in the planning and prioritization processes for projects that are within the Bay Area regional boundary.

15.2.1.4 Relationship with the Pajaro River Watershed IRWM Region

The Pajaro River is the largest coastal stream between the San Francisco Bay and the Salinas River Watershed. Due to its large size, there are diverse environments, physical features, and land uses within the watershed. The Pajaro River coastal area has been identified by the State Coastal Conservancy as a Critical Coastal Area (CCA), and the river is also a tributary to Monterey Bay, a federally protected National Marine Sanctuary administered by the National

Oceanic and Atmospheric Administration (NOAA). Many of the water supply, water quality, flood management and environmental enhancement challenges are associated with this unique mix of agriculture, small urban developments and sensitive marine habitats.

The Pajaro River Watershed and the Bay Area regions share similar interests in reducing reliance on the Delta for water supply, increasing recycled water use and water conservation, and providing high quality drinking water quality. The two regions also both have flood management goals, but the Pajaro River Watershed flood issues pertain to a single river , whereas the Bay Area surface hydrology is more complex. The two IRWM groups share interests in watershed management and environmental protection, but the land use in the Pajaro watershed, which is predominantly agriculture, is very different from the Bay Area. In addition, the Pajaro River Watershed is within the Central Coast hydrologic area.

Coordination is facilitated through Santa Clara Valley Water District (SCVWD), which is part of both the Bay Area IRWM and Pajaro River Watershed IRWM Watershed Regions. The Bay Area effort includes representatives from SCVWD on the CC, PUT and the targeted reviewer list.

15.2.1.5 Relationship with the Santa Cruz IRWM Region

The Santa Cruz County region encompasses approximately 80 percent of the population and 84.3 percent of the land area of northern Santa Cruz County. The planning region is based on watershed and jurisdictional boundaries as well as common water management issues, which are all geographically contained within the region. This area has challenges associated with limited water supplies, urban development limits associated with large portions of the region being forested, mountainous terrain, and significant precipitation.

Coordination between the Santa Cruz County and Bay Area Regions has focused on efforts to minimize the area not covered by a planning region in the Central Coast Funding Area in San Mateo County. As a result, the northern boundary of the Santa Cruz IRWM region was adjusted in 2009 to encompass additional portions of small watersheds of Año Nuevo, reducing, yet not eliminating the gap. The gap area is in the Central Coast hydrologic region.

15.3 Coordination with State and Federal Agencies

CC members have a long history of working with State and Federal agencies to address water resources management issues and are involved with implementation of the Region's priority projects. Many proposed IRWMP projects require permits from resource and regulatory agencies and directly impact the region's ability to effectively manage local water resources during the Plan implementation phase. In addition to the many state or federal regulatory decisions required, there are many opportunities for state or federal assistance with Plan implementation. Regulatory agencies can be of greater assistance in shaping plans and project as they are being developed, thereby making permit review more expedient. Resource and regulatory agencies can also contribute ongoing monitoring data to enable assessment of Plan and project performance

A number of the state and federal agencies interact with CC members in the normal course of business. Although the interaction may not necessarily be specific to the IRWMP, they may be related to specific projects. Examples of member interaction with state and federal agencies include:

- The California State Coastal Conservancy (SCC) provides guidance, funding and staff assistance to the Bay Area IRWMP through its San Francisco Bay Area Conservancy Program. SCC is a non-regulatory state agency focused on land conservation, habitat protection and restoration, urban waterfront development, agricultural conservation and public access. Conservancy staff serve on the CC, assist in the leadership of the Watersheds/Habitat Functional Area and provide access and links to statewide Conservancy programs.

- The San Francisco Estuary Partnership (SFEP) Implementation Committee which coordinates the implementation of partnership activities, helps to set priorities, exchanges ideas and suggestions about management issues, and recommends work plans and budgets. Members often bring ideas and issues before the committee for comment and consideration. The Committee is made up of representatives from local, state and federal agencies, business and industry, and environmental organizations. The committee provides (and posts) updates on IRWMP activities and progress. Regulatory agencies participating on the committee include: the Environmental Protection Agency, National Marine Fisheries Service, San Francisco Bay Regional Water Quality Control Board, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, California Department of Water Resources, Delta Protection Commission and the National Oceanic and Atmospheric Administration.

The involvement of State and Federal agencies in the development of the 2006 IRWMP began with their participation during the development of the four Functional Area Documents (FAD). Resource and regulatory agencies were invited to participate in the Watershed Plan Development Committee, an open-ended membership group that provided guidance regarding the Watershed Plan's purpose, development and application. State and Federal agencies that participated in this group included: CALFED (now the Delta Stewardship Council), the California Resources Agency, the San Francisco Bay Conservation and Development Commission (BCDC), the RWQCB and SCC. USACE, State Coastal Conservancy and SFEP were also involved early on in meetings with these agencies, forming a Resource and Regulatory Agencies Group.

State and Federal agencies were invited to participate in the development of the IRWMP Update, attend CC meetings and workshops, and comment on draft chapters. To varying degrees they:

- Participated in PUT and CC meetings,

- Reviewed and commented on IRWMP Chapters,

- Provided guidance on project ranking, and

- Partnered on Candidate Projects

On multiple occasions, DWR participated in Stakeholder meetings.

An overview of the major State and Federal agencies that have been involved in the development of the Plan and/or implementation of IRWMP projects is provided below.

15.3.1 San Francisco Bay Regional Water Quality Control Board

The mission of the San Francisco Bay Regional Water Quality Control Board (RWQCB) is to develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the state's waters, recognizing local differences in climate, topography, geology and hydrology. RWQCB staff regulates permitting for discharges of fill and dredged material, stormwater permitting, water quality certifications, and waste discharge requirements.

Representatives from the RWQCB are part of the CC and have been invited to participate in stakeholder workshops and CC meetings.

15.3.2 San Francisco Bay Conservation and Development Commission

San Francisco Bay Conservation and Development Commission (BCDC), created by the California Legislature in 1965, is dedicated to the protecting and enhancing the San Francisco Bay, and to encouraging its responsible use.[37] BCDC has planning and regulatory responsibility over development in San Francisco Bay and along the Bay's nine-county shoreline. BCDC is a federally-designated state coastal management agency for the San Francisco Bay segment of the California coastal zone. This enables BCDC to use the authority of the federal Coastal Zone Management Act to ensure that federal projects and activities are consistent with the policies of its San Francisco Bay Plan and state law.

The Commission is also responsible for administering development permits for the San Francisco Bay and Suisun Marsh. These permits must be obtained for proposed IRWMP projects affecting tidal wetlands or baylands habitats.

Representatives from BCDC were Targeted Reviewers and invited to participate in CC meetings and stakeholder workshops.

15.3.3 State Coastal Conservancy

The State Coastal Conservancy (SCC) was established in 1976 as a non-regulatory state agency that employs innovative approaches to purchase, protect, restore, and enhance coastal resources. The legislature created the SCC as a unique entity with flexible powers to serve as an intermediary among governmental agencies, NGOs, citizens, and the private sector in recognition that creative approaches would be needed to preserve California's coast and San Francisco Bay lands for future generations. The San Francisco Bay Area Conservancy Program, administered by the SCC, was established in 1998 to address the natural resource and recreational goals of the nine-county Bay Area in a coordinated and comprehensive way.

The SCC serves all Californians and state visitors who are interested in enjoying, improving, and protecting the spectacular natural resources of the California coast and San Francisco Bay. Because of its accomplishments and relationships with other agencies, NGOs, and the private sector, the SCC serves as an advisory body for the Watershed Management & Habitat Protection and Restoration FAD (WM-HPR). The SCC's work with local watershed and creeks groups allows it to serve as a representative for local watershed and habitat protection concerns throughout the Bay region.

[37] Bay Conservation and Development Commission. Accessed July 24, 2006.

The SCC, as a member of the CC and PUT, is the most active State Agency participant in Bay Area IRWM planning. The SCC participated in meetings, reviewed and commented on Chapters, provided guidance on project ranking as part of the Project Selection Committee, and currently has a project on the Active list.

15.3.4 California Department of Water Resources

The California Department of Water Resources (DWR), in cooperation with other state agencies, manages California's water resources to benefit the state's people, and to protect, restore, and enhance the natural and human environments. DWR provides dam safety and flood control services, assists local water districts in water management and conservation activities, promotes recreational opportunities, and plans for future statewide water needs. DWR also operates and maintains the State Water Project.

On multiple occasions, DWR has participated in CC meetings. DWR representatives are Targeted Reviewers, which means that they have an opportunity to review the Chapters prior to release of the Public draft (see Chapter 1: Governance).

15.3.5 State Water Resources Control Board

The mission of the State Water Resources Control Board (SWRCB) is to "preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations".[38] The SWRCB has joint authority of water allocation and water quality protection thus providing comprehensive protection for California's waters.

Representatives from the SWRCB have been invited to participate in key workshops and meetings and are on the list of targeted reviewers.

15.3.6 California Resources Agency

The mission of the California Resources Agency is to "restore, protect and manage the state's natural, historical and cultural resources for current and future generations using creative approaches and solutions based on science, collaboration and respect for all the communities and interests involved."[39]

The Resources Agency is responsible for overseeing policies, activities and budgeting for 24 departments, commissions, boards, and conservancies within the state, including California State Parks, Department of Fish and Wildlife, DWR, BCDC, SCC, and Wildlife Conservation Board, among others. The Resources Agency collaborates with the California Environmental Protection Agency (CalEPA) to provide a "California Watershed Portal" in order to identify ongoing watershed activities and provide links to planning and other tools.

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[38] State Water Resource Control Board (SWRCB). 2006. Home Page. Available: <http://www.swrcb.ca.gov/>. Accessed July 24, 2006.

[39] California Resources Agency.2006. Home Page. Available: <http://resources.ca.gov/>. Accessed: July 24, 2006.

Representatives from the Resources Agency has been invited to participate in CC meetings and stakeholder workshops.

15.3.7 California Environmental Protection Agency

Formed in 1991, the mission of the California Environmental Protection Agency (CalEPA) is to “restore, protect and enhance the environment, to ensure public health, environmental quality and economic vitality”. Representatives from CalEPA were Targeted Reviewers and invited to participate in CC meetings and stakeholder workshops held throughout the development of the Plan.

15.3.8 Department of Public Health

The Department of Public Health (DPH) regulates public water systems, including allowable treatment technologies for drinking water and the treatment and distribution of recycled water. Any Plan Projects that involve treatment of drinking water or recycled water will require coordination with DPH.

15.3.9 U.S. Fish and Wildlife Service

The mission of the U.S. Fish and Wildlife Service (USFWS) is “to provide leadership in sustaining and enhancing fish, wildlife, and their habitats for the benefit of the American people and to engage citizens in the shared stewardship of our nation’s natural resources.”[40] The USFWS is responsible for enforcing federal wildlife laws, protecting endangered spices, restoring and conserving wildlife habitat, managing migratory birds, restoring nationally significant fisheries, and helping foreign governments with their conservation efforts.

Representatives from the USFWS were Targeted Reviewers and invited to participate in CC meetings and stakeholder workshops.

15.3.10 U.S. Environmental Protection Agency

Established in 1970 in response to growing public demand, the mission of the U.S. Environmental Protection Agency (USEPA) is to protect human health and the environment. The USEPA develops and enforces regulations that implement environmental laws enacted by Congress. The USEPA is responsible for researching and setting national standards for environmental programs, and delegates to states and tribes the responsibility for issuing permits and for monitoring and enforcing compliance.[41]

The USEPA is another regulatory agent responsible for discharges in to the San Francisco Bay and surrounding wetlands through oversight of Corps administration of CWA Section 404 permitting. The USEPA also manages and administers various grants and environmental financing programs for watershed management projects. The USEPA would be involved with proposed IRWMP projects related to discharge permits.

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40 U.S. Fish & Wildlife Service (USFWS). 2006. Home Page. Available: <http://www.fws.gov/>. Accessed July 24, 2006.

41 U.S. Environmental Protection Agency (USEPA). Home Page. Available: <http://www.epa.gov/>. Accessed July 24, 2006.

Representatives from the USEPA were Targeted Reviewers and invited to participate in CC meetings and stakeholder workshops.

15.3.11 U.S. Army Corps of Engineers

The mission of the U.S. Army Corps of Engineers (Corps) is to “provide quality, responsive engineering services to the nation[42] by focusing on water resources, environment, infrastructure, and homeland security. Part of the Corps’ mission includes planning, designing, building and operating water resources and wetlands, as well as handling waterways regulation and permitting. The Corps carries out a wide array of projects that provide coastal protection, flood protection, hydropower, navigable waters and ports, recreational opportunities, and water supply.

The Corps provides regulatory authority and funding assistance for a variety of water resources management projects in the Bay Area, particularly related to flood management and habitat restoration. Representatives from the Corps participated in various workshops.

15.3.12 National Oceanic and Atmospheric Administrations National Marine Fisheries Service

National Oceanic and Atmospheric Administrations (NOAA) National Marine Fisheries Service (NMFS) is responsible for the management, conservation and protection of living marine resources of the Exclusive Economic Zone (water three to 200 miles offshore). NMFS reviews and predicts the status of fish stocks, validates compliance with fisheries regulations, and works to reduce wasteful fishing practices. Under the Marine Mammal Protection Act, the Magnuson-Stevens Fishery Conservation and Management Act, and the ESA, NMFS works toward recovery of protected marine species, sustainable fisheries, and prevention of lost economic potential associated with overfishing, declining species and degraded habitats.

Representatives from NMFS were Targeted Reviewers and invited to participate in CC meetings and stakeholder workshops.

[42] U.S. Army Corps of Engineers (Corps). Home Page. Available: <http://www.usace.army.mil/>. Accessed July 24, 2006.

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Chapter 16: Climate Change

16.1 Introduction

"Climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected climate changes include increased temperatures, sea-level rise, a reduced winter snowpack, altered precipitation patterns and more frequent storm events. These changes have the potential for a wide variety of impacts such as altered agricultural productivity, wildfire risk, water supply, public health, public safety, ecosystem function and economic continuity."[43]

"If the state were to take no action to reduce or minimize expected impacts from future climate change, the costs could be severe. A 2008 report by the University of California, Berkeley and the non-profit organization Next 10 estimated that if no such action is taken in California, damages across sectors would result in 'tens of billions of dollars per year in direct costs' and 'expose trillions of dollars of assets to collateral risk.'"[44]

"Climate change is already affecting California's water resources. Bold steps must be taken to reduce greenhouse gas emissions. However, even if emissions ended today, the accumulation of existing greenhouse gases will continue to impact climate for years to come. Warmer temperatures, altered patterns of precipitation and runoff, and rising sea levels are increasingly compromising the ability to effectively manage water supplies, floods and other natural resources. Adapting California's water management system in response to climate change presents one of the most significant challenges of this century … Water and wastewater managers and customers … can play a key role in water and energy efficiency, the reduction of greenhouse gas emissions, and stewardship of water and other natural resources."[45]

The conclusions described above make it imperative that climate change impacts and greenhouse gas emission reductions be integrated into Integrated Regional Water Management Plans (IRWMP). This climate change section was developed based on the Proposition 84 IRWMP Guidelines for integrating climate change (October 2012). Those guidelines require the IRWMP to:

- Describe, consider, and address the effects of climate change on the region and disclose, consider, and reduce where possible greenhouse gas (GHG) emissions when developing and implementing projects.
- Identify climate change impacts and address adapting to changes in the amount, intensity, duration, timing, and quality of runoff and recharge.
- Consider the effects of sea-level rise on water supply conditions and identify suitable adaptation measures.

[43] *California Climate Adaptation Planning Guide*, 2012, Executive Summary.
[44] California Adaptation Strategy, 2009, page 3.
[45] *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water*, DWR, 2008, page 2.

In addition, future updates should describe policies and procedures that promote adaptive management; and minimize risk, damage and loss due to climate change impacts.

This section is intended to focus on assessing the potential climate change vulnerabilities of the Region's water resources, identifying climate change adaptation strategies; with the overall goal of making climate change adaptation an overarching theme throughout the Plan. The recently issued *Climate Change Handbook for Regional Water Planning* dated November 2011 (Schwarz et al. 2011) was used for guidance in developing this Plan section. In addition, information in "Climate Change Impacts, Vulnerabilities, and Adaptation in the San Francisco Bay Area (CEC Report CEC-500-2012-071)" dated July 2012, prepared for the California Energy Commission's Public Interest Energy Research Program (PIER), and related documents, were reviewed and incorporated as appropriate.

16.2 Climate Change Projections Affecting the Bay Area Region

The projections used in the analysis are based on information provided in "Climate Change Scenarios for the San Francisco Region (CEC-500-2012-042)" dated July 2012 (Cayan, Tyree, and Iacobellis 2012), prepared for the PIER program.

16.2.1 Climate Change Scenarios

The Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES) provides a family of common scenarios that cover a range of plausible trends in GHG emissions over the 21st century as a result of economic, technological, and population change (IPCC 2007). The total amount of GHG emissions and the rate of accumulation of GHG emissions in the atmosphere will drive climate change impacts. The IPCC scenarios are only a sample of the potential climate outcomes; they contain a level of uncertainty, and they have no probabilities assigned to them.

Two GHG scenarios have been commonly used in recent planning documents for California. Scenario A2 (Medium–High Emissions) assumes higher GHG emissions and high growth in population and represents a more competitive world that lacks cooperation in sustainable development (similar to "business as usual"), while B1 (Lower Emissions) is a lower GHG emission scenario that represents social consensus and action for sustainable development. Generally, the B1 scenario might be most appropriately viewed as an optimistic "best case" or "policy" scenario for emissions that will require fundamental shifts in global policy, while A2 is more of a *status quo* scenario reflecting real-world conditions incorporating incremental improvements and may be the more realistic choice for decision-makers to use for climate adaptation planning. To date, actual global emissions have more closely tracked, and even exceeded, the A2 scenario put forth in 2000.

Climate change assessments are performed using the output of computer models that project future conditions utilizing GHG emission scenarios as input. These models are not predictive, but provide projections of potential future climate scenarios that can be used for planning purposes. The primary climate variables projected by global climate models (GCMs) that are important for water resources planning in California are changes in air temperature, changes in precipitation patterns, and sea-level rise. A set of six GCMs were run for the two GHG emissions scenarios, A2 and B1, and downscaled to locations in California. The six GCM models used were:

1. National Center for Atmospheric Research (NCAR) Parallel Climate Model (PCM)
2. National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluids Dynamic Laboratory (GFDL) model
3. French Centre National de Researches Meterologiques CNRM3 model
4. NCAR CCSM3 model
5. German MPI ECHAMS model
6. Japanese MIROC3.2 (medium-resolution) model

Based on historical simulations, the selected models are capable of producing a reasonable representation of California's seasonal precipitation and temperature, variability of annual precipitation, and the El Niño/Southern Oscillation (Cayan, Tyree, and Iacobellis 2012).

16.2.1.1 Statewide Climate Change Projections

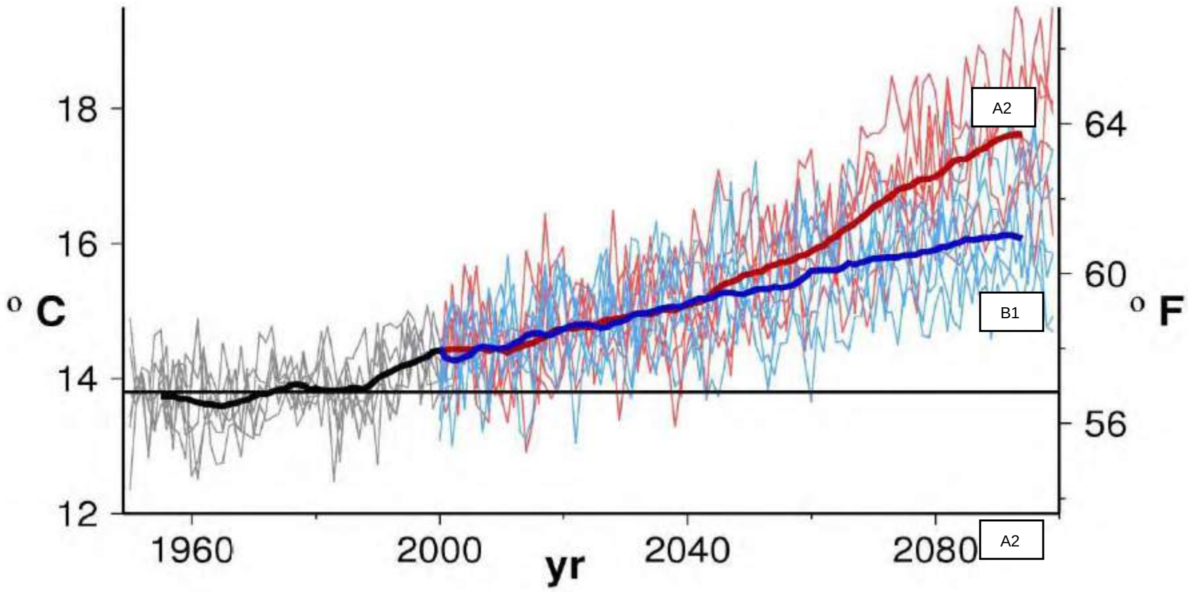
All of the models show increased warming throughout the 21st century, with average annual air temperature increasing about 2°F to 5°F by 2050. The Mediterranean seasonal precipitation pattern is expected to continue during the 21st century, with most of the precipitation occurring during winter from North Pacific storms. The hydro-climate (hydrology and weather) is expected to be influenced by the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) with alternating periods of wet and dry water years. In the Sierra Nevada Mountains, there will be some shift to more winter precipitation occurring as rain instead of snow, with a reduction in snowpack accumulation and shifts in runoff patterns, especially during the summer and fall.

16.2.1.2 Bay Area Region Climate Change Projections

The historical average annual temperature in the San Francisco Bay Area region is 56.8°F (13.8°C). Overall average air temperatures in the SF Bay Area are expected to rise 2.7°F (1.5°C) between 2000 and 2050 regardless of the GHG emissions scenario, but the A2 and B1 scenarios project increases of 10.8°F (6°C) and 3.6°F (2°C), respectively, by the end of the 21st century. Figure 16-1 shows the projected air temperature change for the GCMs averaged from 2000 through 2100, compared with the historical baseline from 1950-2000 used for the initial conditions for the models. The temperature projections begin to deviate between the A2 and B1 scenarios around mid-century, with the A2 scenario increase about twice the B1 scenario by 2100 (Cayan, Tyree, and Iacobellis 2012).

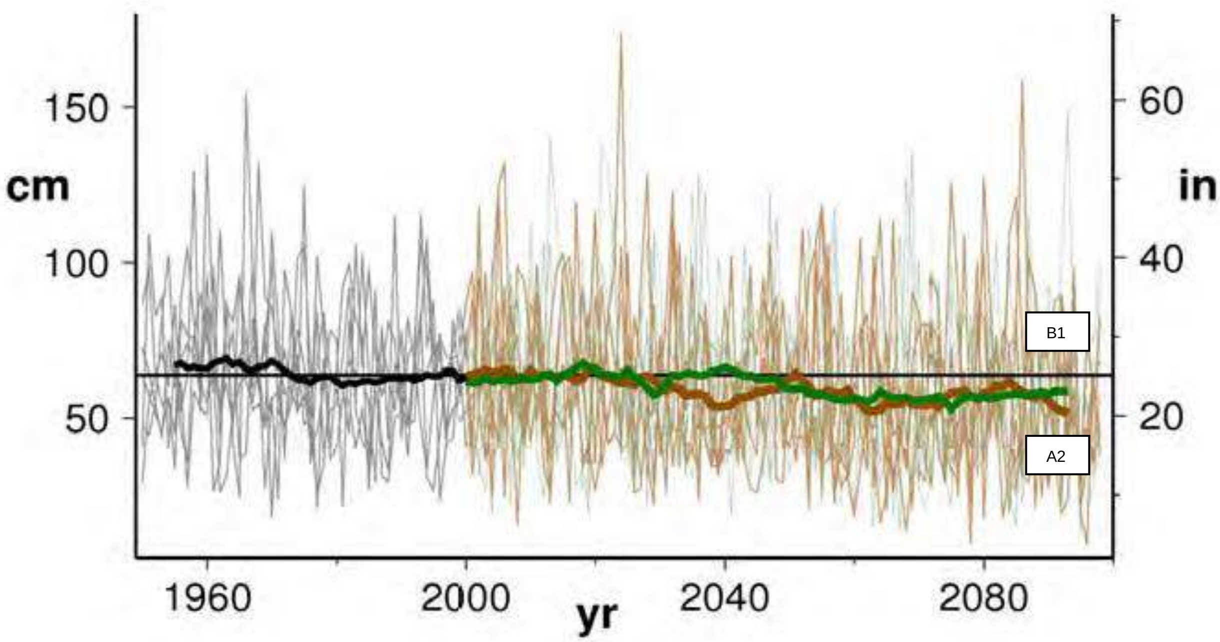
Precipitation in the Region, as shown in Figure 16-2, is essentially all due to rain, and significant shifts in the timing of precipitation are not expected to occur (Cayan, Tyree, and Iacobellis 2012). The SF Bay Area is likely to continue with a Mediterranean climate of cool wet winters and hot dry summers. Possible changes in precipitation projected by the GCMs are uncertain in part due to the highly variable precipitation that California experiences on an annual and decadal time scale. Up to the year 2050 annual precipitation changes produce mixed results; however there is an indication that conditions will be drier than the historical average in the second half of the century. Looking at averaged projections by month, it is possible to identify greater reductions in precipitation in March and April while November, December and January may remain relatively unchanged. While average conditions may be drier the expectation is that more intense downpours will occur during a somewhat shorter rainy season.

Figure 16-1: Historical and Projected Annual Average Air Temperature for the SF Bay Area Region: Average of Six GCMs for Two Emissions Scenarios



Source: Figure 3, Cayan, Tyree, and Iacobellis (2012). Black line is historical, Blue line is B1 (Lower Emission) scenario. Red line is A2 (Medimum to Higher Emissions) scenario.

Figure16-2: Projected Annual Precipitation for SF Bay Area Region: Average of Six GCMs for Two Emissions Scenarios



Source: Figure 7, Cayan, Tyree, and Iacobellis (2012). Black line is historical, Green line is B1 (Lower Emissions) scenario, Brown line is A2 (Medium to Higher Emissions) scenario.

16.2.2 Sea-Level Rise and Coastal Flooding

Sea-level rise is expected to increase the risk of coastal erosion and flooding along the California coast, and higher water levels due to sea-level rise could magnify the adverse impact of storm surges and high waves. Impacts to assets from extreme high tides in addition to net increases in sea level will likely result in increased inundation frequency, extents, and depths leading to catastrophic flooding and coastal erosion. Understanding the extent, depth and duration of inundation and the patterns of erosion will be necessary for characterizing infrastructure vulnerability in coastal areas. The picture is further complicated by the concurrent vertical movement of the land due to tectonic activity. Projections of the relative sea level, the sum of both sea level rise and vertical land movement, are therefore important in the SF Bay Area.

Sea level has been measured at the Presidio tide gauge in San Francisco since 1854, with a recorded rise in relative sea level of 7.6 inches (19.3 cm) over the last 100 years (NRC 2012). Rates of relative sea-level rise vary along the coast in relation to vertical land movement: the observed rise per century is 8.0 inches (20.3 cm) in San Diego; 3.3 inches (8.4 cm) in Los Angeles; 2.7 inches (6.9 cm) in Port San Luis and is falling in Crescent City at a rate of 2.9 inches (7.4 cm) per century (NRC 2012, Table 4.6). Present sea-level rise projections suggest that global sea levels in the 21st century can be expected to be much higher which will result from higher rates of relative sea-level rise. These projections are summarized in the *State of California Sea-Level Rise Guidance Document* (OPC 2013) and in Table 16-1 below:

Table 16-1: Sea-Level Rise Projections (NRC 2012)[4]

Time Period	North of Cape Mendocino[46]	South of Cape Mendocino
2000 - 2030	-2 to 9 in	2 to 12 in
2000 – 2050	-1 to 19 in	5 to 24 in
2000 – 2100	4 to 56 in	17 to 66 in

The National Research Council (NRC, 2012) updated the AR4 IPCC projections originally developed in 2006 by downscaling to the regional scale and by incorporating improved ice models, isostatic rebound and tectonic movement. Downscaling to the regional level increases uncertainty as does looking further into the future due to lack of understanding of physical processes, the ability to model the processes and the underlying assumptions of the scenarios. The NRC (2012) assigns high confidence to its 2030 projections but this confidence diminishes to low by 2100.

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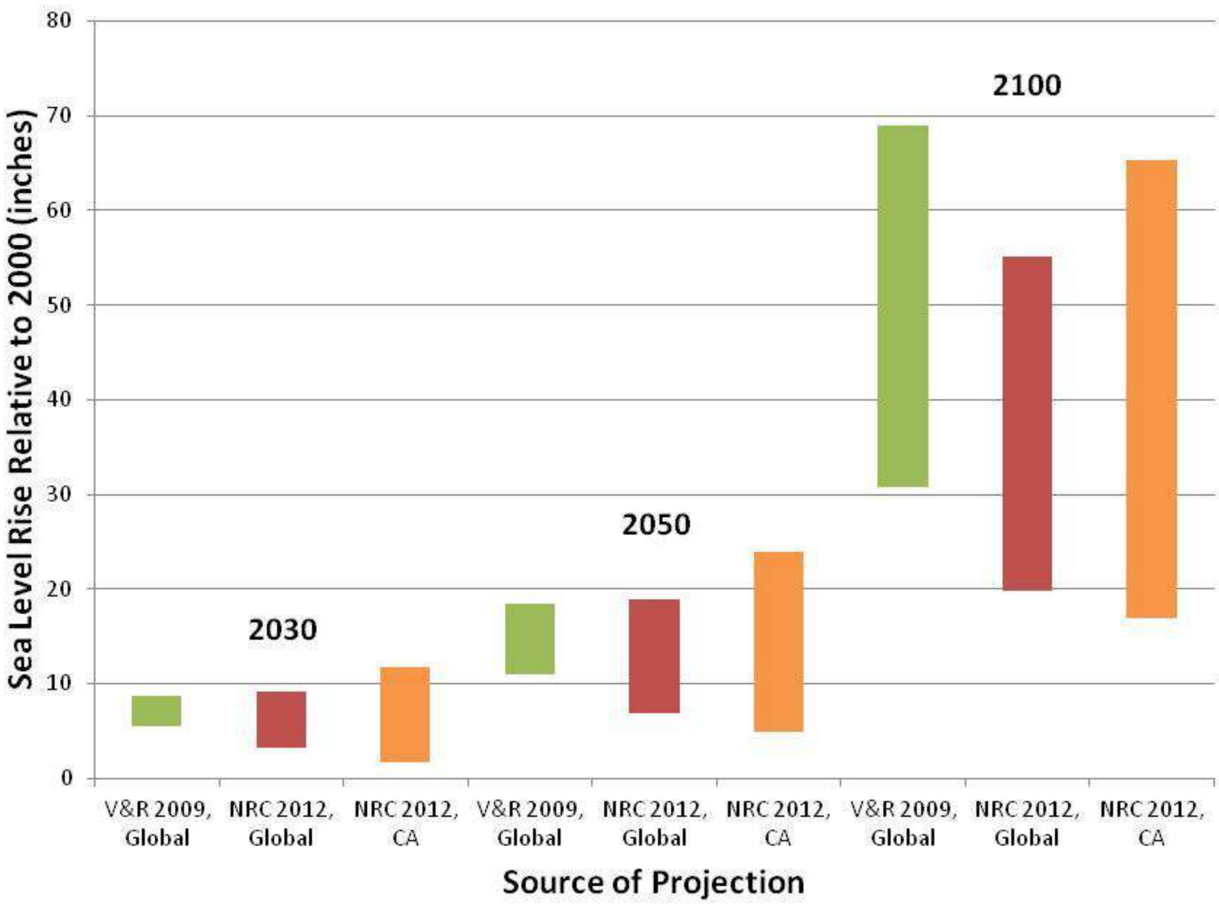
46 National Research Council, 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=13389

5 The differences in sea-level rise projections north and south of Cape Mendocino are due mainly to vertical land movement. North of Cape Mendocino, geologic forces are causing much of the land to uplift, resulting in a lower rise in sea level, relative to the land, than has been observed farther south.

Figure 16-3 shows the NRC (2012) projections for California in comparison with their projected global trend and also with the projections of Vermeer and Rahmstorf (2009) which has been widely used in guidance.

Figure 16-3: NRC (2012) Projections of Sea Level Rise



Source: Figure 5.11, NRC (2012). V& R refers to Vermeer and Rahmstorf (2009).

In addition, the NRC (2012) report provides estimates of *relative* sea-level rise for San Francisco Bay by the inclusion of regional influences on sea level such as regional tectonic movement and gravitational influences of ice caps as shown in Table 16-2. The “Range” represents the high and low estimates from the models, and the “Projection” represents the mid-range estimate with an estimate of accuracy (i.e., $\pm$2 inches).

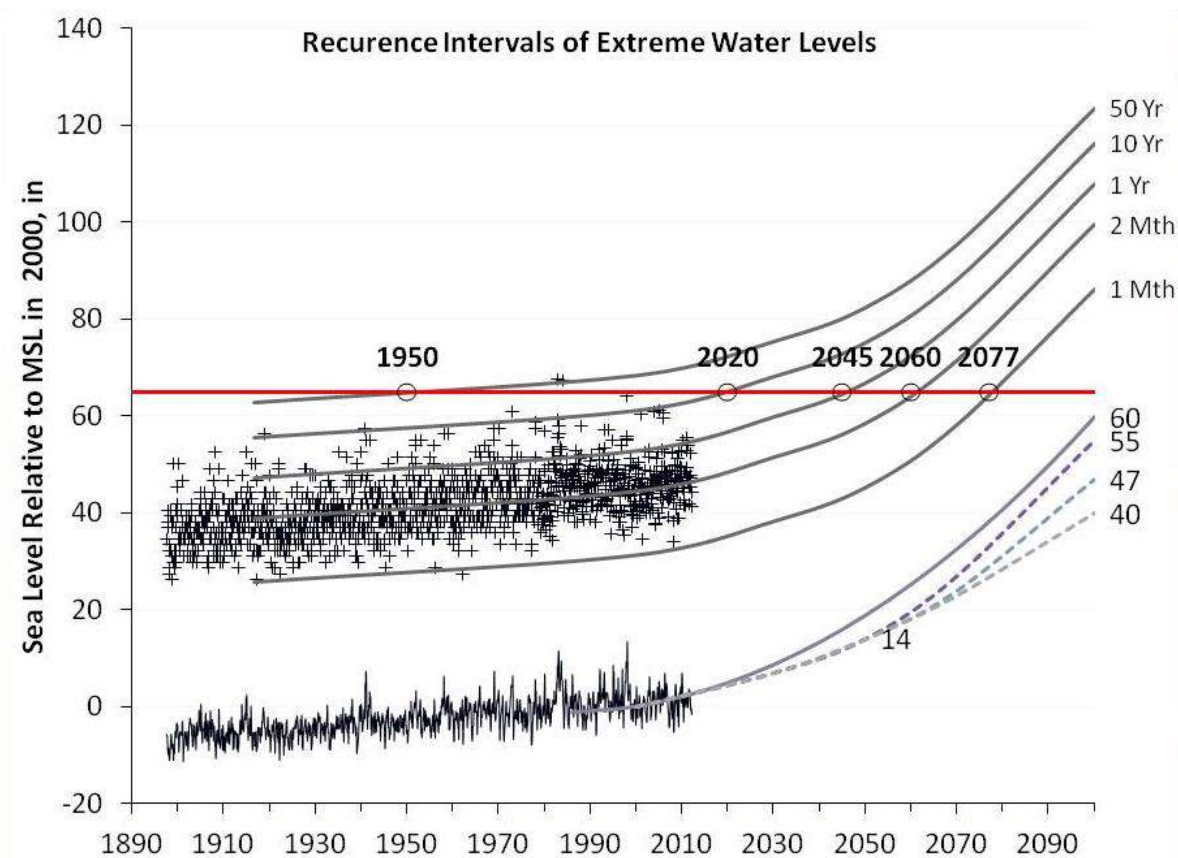
Table 16-2: Relative Sea-Level Rise Projections for San Francisco Bay (NRC 2012)

Year	Projection (in)	Range (in)
2030	6	2-12
2050	11	5-24
2100	36	17-66

Source: Table 5.3, NRC (2012)

The discussion above is in reference to mean sea level; however, the first impacts that will affect infrastructure will be from storms which generate more extreme water levels as shown in Figure 16-4 below. The figure shows that as sea-level rises (gray dotted lines) the extreme water level of a fixed recurrence event will also rise (gray solid lines). For infrastructure at a given elevation (denoted by the red line), the frequency of inundation will increase over time. In the example shown in Figure 16-4, a structure inundated with a 10 year return interval in 2020 will become inundated by a 1 year return interval by 2045. The exposure to more frequent extreme water levels will have an impact on infrastructure much earlier than mean sea level, e.g., operations will be affected more frequently well before the site is permanently inundated.

Figure 16-4: Recurrence Intervals of Extreme Water Levels



Source: Historical (solid black jagged line) and annual extreme water levels (black crosses) from Presidio tide gauge. Infrastructure at a given elevation is represented by the red line. Dotted lines indicate OPC 2011 projections. Year 2000 recurence intervals from Knowles (2010), developed from Kriebel (2011).

16.3 Vulnerability to Climate Change

This section identifies the potential climate change vulnerabilities of the Region's water resources. The climate change assessment presented in this section is at least equivalent to the checklist assessment in the Department of Water Resources' (DWR) *Climate Change Handbook for Regional Water Planning* and consistent with climate change requirements in the

Proposition 84 IRWMP Guidelines (October 2012). These vulnerabilities were also discussed with the climate change Technical Advisory Committee (TAC) formed for the Bay Area IRWMP.

16.3.1 Vulnerable Watershed Characteristics

Identification of watershed characteristics that could potentially be vulnerable to future climate change is the first step in assessing vulnerabilities of water resources in the Region. In the context of this analysis, vulnerability is defined as the degree to which a system is exposed to, susceptible to, and able to cope with or adjust to, the adverse effects of climate change, consistent with the definition in the recently issued *Climate Change Handbook for Regional Water Planning*.

Table 16-3 provides a summary list of water-related resources that are considered important in the Region and that are potentially vulnerable to future climate change. The summary table provides the main water planning categories applicable to the Region and a general overview of the qualitative assessment of each category with respect to anticipated climate change impacts. The main categories follow the climate change vulnerability checklist assessment as defined in the *Climate Change Handbook for Regional Water Planning*. These categories also reflect a combination of the IRWMP requirements and are consistent with Proposition 84 requirements.

Table 16-3 also provides a qualitative description of the anticipated climate change impacts on these identified resources. It should be noted that only those water-related resources likely to be vulnerable to climate change are considered in the analysis provided in the following subsections.

16.3.2 Vulnerability Sector Assessment

There has been extensive scientific research on climate change impacts and findings have been published in a vast collection of peer-reviewed technical literature. However, there is relatively little information that presents specific tools for how to apply impacts in the context of addressing climate change impacts on water resources. In addition, far less information is available on subregional or local geographic areas because the spatial resolution of the existing climate change models is still quite low. One additional challenge is that precipitation projections cannot be easily converted directly into surface runoff and groundwater recharge to connect changes with local water resources planning activities.

This section presents the vulnerability of each characteristic identified in Table 16-3 with respect to climate change projections given the existing tools and available data. This is an initial attempt using projections specific to the Region for the vulnerability assessment in support of the IRWMP. The outcome of this initial assessment is intended to help understand the potential impacts, to integrate climate change into long-term planning, and to improve understanding of the uncertainties associated with climate change effects. The vulnerability analysis considers projections for mid-21st century (2050); consistent with available modeling approaches to climate change. Projections through the end of the 21st century are included for perspective only.

Table 16-3: Summary of Climate Change Vulnerability Assessment

Vulnerability Areas	General Overview of Vulnerabilities
Water Demand	**Urban and Agricultural Water Demand** – Changes to hydrology in the Region as a result of climate change could lead to changes in total water demand and use patterns will change, both in quantities and patterns. Increased irrigation (outdoor landscape or agricultural) is anticipated to occur with temperature rise, increased evaporative losses due to warmer temperature, and a longer growing season. Water treatment and distribution systems are most vulnerable to increases in maximum day demand.
Water Supply	**Imported Water** – Imported water derived from the Sierra Nevada sources and Delta diversions provide 66% of the water resources available to the Region. Potential impacts on the availability of these sources resulting from climate change directly affect the amount of imported water supply delivered to the Region. **Regional Surface Water** - Although future projections suggest that small changes in total annual precipitation over the Region will not change much, there may be changes in timing with reductions in the spring and more intense rainfall in the winter. **Regional Groundwater** – Changes in local hydrology could affect natural recharge to the local groundwater aquifers and the quantity of groundwater that could be pumped sustainably over the long-term in some areas. Decreased inflow from more flashy or more intense runoff, increased evaporative losses and warmer and shorter winter seasons can alter natural recharge of groundwater. Salinity intrusion into coastal groundwater aquifers due to sea-level rise could interfere with local groundwater uses. Furthermore, additional reductions in imported water supplies would lead to less imported water available for managed recharge of local groundwater basins and potentially more groundwater pumping in lieu of imported water availability.

Vulnerability Areas	General Overview of Vulnerabilities
Water Quality	**Imported Water** – For sources derived from the Delta, sea-level rise could result in increases in chloride and bromide (a disinfection by-product (DBP) precursor that is also a component of sea water), potentially requiring changes in treatment for drinking water. Increased temperature could result in an increase in algal blooms, taste and odor events, and a general increase in DBP formation **Regional Surface Water** – Increased temperature could result in lower dissolved oxygen in streams, and prolong thermocline stratification in lakes and reservoirs forming anoxic bottom conditions and algal blooms. Decrease in annual precipitation could result in higher concentrations of contaminants in streams during droughts or in association with flushing rain events. Increased wildfire risk and flashier or more intense storms could increase turbidity loads for water treatment. **Regional Groundwater** – sea-level rise could result in increases in chlorides and bromide for some coastal groundwater basins in the Region. Water quality changes in imported water used for recharge could also impact groundwater quality.
Sea-Level Rise	Sea-level rise is additive to tidal range, storm surges, stream flows, and wind waves, which together will increase the potential for higher total water levels, overtopping, and erosion. Much of the bay shoreline is comprised of low-lying diked baylands which are already vulnerable to flooding. In addition to rising mean sea level, continued subsidence due to tectonic activity will increase the rate of relative sea-level rise. As sea-level rise increases, both the frequency and consequences of coastal storm events, and the cost of damage to the built and natural environment, will increase. Existing coastal armoring (including levees, breakwaters, and other structures) is likely to be insufficient to protect against projected sea-level rise. Crest elevations of structures will have to be raised or structures relocated to reduce hazards from higher total water levels and larger waves.
Flooding	Climate change projections are not sensitive enough to assess localized flooding, but the general expectation is that more intense storms would occur thereby leading to more frequent, longer and deeper flooding. Changes to precipitation regimes may increase flooding. Elevated Bay elevations due to sea-level rise will increase backwater effects exacerbating the effect of fluvial floods and storm drain backwater flooding.

Vulnerability Areas	General Overview of Vulnerabilities
Ecosystem and Habitat	Changes in the seasonal patterns of temperature, precipitation, and fire due to climate change can dramatically alter ecosystems that provide habitats for California's native species. These impacts can result in species loss, increased invasive species ranges, loss of ecosystem functions, and changes in vegetation growing ranges. Reduced rain and changes in the seasonal distribution of rainfall may alter timing of low flows in streams and rivers, which in turn would have consequences for aquatic ecosystems. Changes in rainfall patterns and air temperature may affect water temperatures, potentially affecting cold-water aquatic species. Bay Area ecosystems and habitat provide important ecosystem services, such as: carbon storage, enhanced water supply and quality, flood protection, food and fiber production. Climate change is expected to substantially change several of these services. The region provides substantial aquatic and habitat-related recreational opportunities, including: fishing, wildlife viewing, and wine industry tourism (a significant asset to the region) that may be at risk due to climate change effects.
Hydropower	Currently, several agencies in the Region produce or rely on hydropower produced outside of the Region for a portion of their power needs. As the hydropower is produced in the Sierra, there may be changes in the future in the timing and amount of energy produced due to changes in the timing and amount of runoff as a result of climate change. Some hydropower is also produced within the region and could also be affected by changes in the timing and amount of runoff.

16.3.3 Water Demand

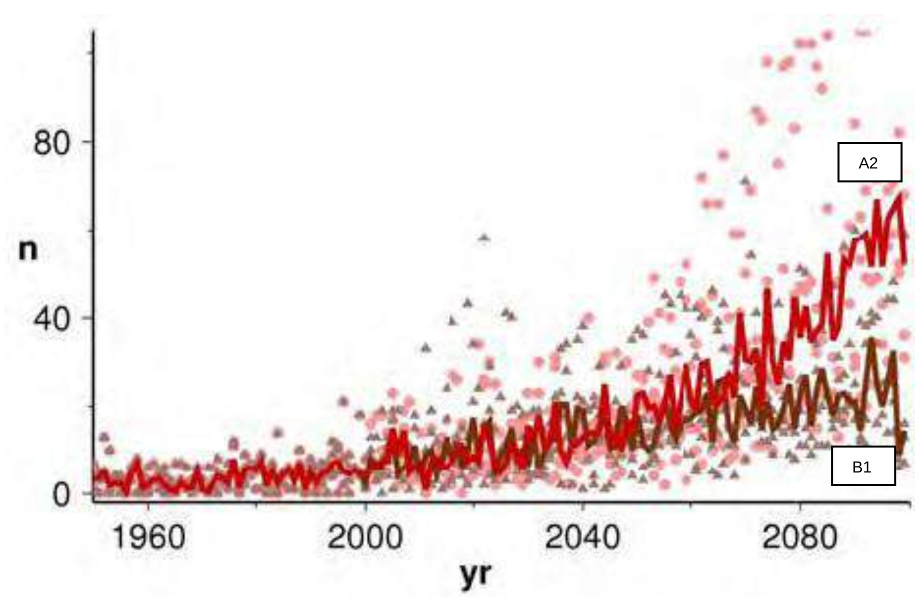
Increasing air temperature due to climate change will result in increased evaporation leading to drier soils, increased plant evapotranspiration (ET), and a longer growing season. All of these factors generally increase water demand. In addition, increased salinity due to sea-level rise, as well as increased temperature, could influence the quantity of water needed for industrial and power plant cooling (higher salinity deceases the cycles of concentration achieved in cooling towers) in some subregions.

Temperature increases are expected to be higher in the dry months than in the wet months and higher in dry water years. Total water use can vary more than 50 percent seasonally, indicating a significant monthly and seasonal variation in water use with weather conditions. Historically, extreme warm temperatures in the Bay Area have occurred in July and August, but warming due to climate change may extend this period from June through September (Ekstrom and Moser 2012).

Figure 16-5 provides an example of projected increases in extreme temperature days in the East Bay for the B1 and A2 emission scenarios. This graph shows the number of days (n), from April to October, when the maximum temperature (tmax) exceeds the 98th percentile historical (1961–1990) level of 28ºC (82.4ºF) for the East Bay grid cell from four bias-corrected or constructed analogs downscaled GCMs. The brown carrots and red dots represent the B1 and A2 emission scenarios, respectively. The thick brown (B1) and red (A2) lines show the median value from the four simulations.

Figure 16-5: Number of Days Max Temperature Exceeds the 98th Percentile

(April – October) in the East Bay



Source: From Cayan, Tyree, and Iacobellis 2012 CEC-500-2012-042)

Discussions with the TAC indicated that maximum daily temperatures were more relevant to water demand than average monthly temperatures. A land use demand study by EBMUD (2009) used average temperatures with peaking factors to account for temperature extremes.

Agricultural and outdoor landscape demands are likely to be affected by changing weather conditions. Higher temperature generally increases ET rates; but some research studies also suggest higher CO_2 levels and higher temperature increase rates of plant growth, and can shorten the time to plant maturity (Hanak and Lund, 2008). This would reduce the overall plant water uptake, partially compensating for potential reductions in agricultural water supply. Thus, the net effect on agricultural crops is still uncertain (Kiparsky and Gleick, 2005) and remains an important area of on-going research.

Qualitatively, the ET projections with climate change suggest water demand for agriculture in the Region is anticipated to increase during months where ET is high and decrease in months where ET is low. As a result of increased ET, urban water demand is anticipated to increase because of greater outdoor water use for landscape irrigation.

Several agencies have seen peak factors (e.g., maximum day to average day demand) steadily dropping for a decade, mostly from drops in residential outdoor water use caused by the economy, rainfall patterns, and conservation measures. In addition, the Bay Area Region has effective demand control measures and water conservation public information programs in effect, which help explain the decoupling of temperature and demand. This has resulted in an across the board drop in per capita and total water consumption in the Region.

16.3.3.1 Subregional Impacts

Water demand varies throughout the Region due to a number of factors including the variety of water uses (e.g., residential, commercial, industrial, and agricultural), regional micro climates, variable population densities, and changes in industrial water use. In general, ambient temperatures increase at locations more distant from the coast. Historical water use in the Region has remained rather steady even though the population has increased.

Although there is significant residential water use in the Region, there are areas where other uses are important. Water demand tends to be lower in areas close to the Bay that are cooler and have more rainfall than inland areas. In recent years, industries with heavy water demands have left the Region, resulting in a decrease in regional demand. Many of the demands are seasonal, with significantly higher demands occurring in the dry months compared with wet months.

North Subregion. The North Subregion is the least urbanized and will be particularly vulnerable to increased demands from agriculture in west Marin, Sonoma, Napa, and Solano Counties. There are significant agricultural demands in these counties, primarily for wineries and forage crops. Increased urban water demands will be impacted primarily by outside watering and landscaping during the dry season.

East Subregion. The East Subregion includes significant residential demands in Contra Costa and Alameda Counties. West of the Oakland Hills, the residential demands are primarily indoors while east of the Hills outdoor landscaping demands are significant in the dry season. In addition, there is the potential for increased water demands for heavy industrial cooling for refineries and power plants in Contra Costa County, and for agriculture demands in eastern Alameda County.

South Subregion. The South Subregion includes Santa Clara County, which has become highly residential, with decreasing agricultural activity but increasing commercial demands. A warming climate could result in increased irrigation demand for most crops and overall outdoor water use in this subregion.

West Subregion. The West Subregion includes San Mateo County, which has primarily suburban residential and commercial water demands with some agricultural activities in the southern part, and highly urbanized San Francisco County that includes predominantly residential, commercial, municipal, and some industrial uses. The subregion is primarily vulnerable to increases in outdoor landscaping demands in San Mateo County.

16.3.4 Water Supply

Coping with interannual variability has always been a challenge for long-term water supply planning in the Bay Area, and climate change may intensify variability in coming decades. With potential additional changes imposed by climate change, there will be a heightened need to evaluate and respond to increased water supply variability.

16.3.4.1 Water Supply Portfolio of the Region

In an average year, imported water delivery to the Region comprises about 66 percent of total existing water supplies projected through 2050 in the Region in normal/average years. The imported sources include 13 percent from the State Water Project (SWP), 15 percent from the Central Valley Project (CVP), 19 percent from the Tuolumne River, and 19 percent from the Mokelumne River. These imported sources derive from snowmelt in the Sierra Nevada and the Sacramento-San Joaquin Delta and are subject to climate variability outside the Bay Area Region.

Local surface water and groundwater pumping from local aquifers and additional sources from groundwater banking activities make up the remaining major water sources used to meet the Region's municipal and agricultural water demand. Recycled water is currently a small portion of water supply, but is projected to increase over time.

16.3.4.2 Vulnerability to Potential Climate Change Impacts

Climate change is expected to affect Regional imported water supplies (66%) as follows:

- Total precipitation is expected to decrease in the Sierra Nevada sources.
- Snow pack projected to decrease from less storage in the mountains.
- Precipitation projected to shift toward more rain and less snow.
- Timing of runoff is expected to shift to earlier in the year, affecting reservoir storage and hydropower generation, especially in the spring and summer months.
- Sea-level rise may impact Delta water deliveries.

Climate change is expected to affect Regional surface and groundwater supplies (31%) as follows:

- Total precipitation is not projected to change significantly, although there may be less precipitation in the spring.
- Variability in annual precipitation is expected to continue, with vulnerability to droughts.
- More intense storms anticipated that may affect surface water runoff and storage and groundwater recharge.

Because the Region relies heavily on imported supplies, any reduction or change in the timing or availability of those supplies could have negative impacts on the Region. Reductions in imported water supplies would lead to increased reliance on local groundwater, recycled water, desalination, or other sources of supplies if demand was not reduced. Changes in local hydrology could affect surface storage of water and natural recharge to the local groundwater and the quantity of groundwater that could be pumped in a sustainable manner.

DWR studies provide an example of how climate change may affect water deliveries from imported water supplies. Specifically, DWR developed projections of SWP exports by water year type (wet, above normal, average, below normal, dry, and critical for the period) that illustrate how water availability could be influenced by climate change (*2009* and *2011* DWR *Reliability Reports*). Table 16-4 shows estimated SWP “Table A” deliveries (these are the contractual deliveries to SWP contractors) by water year type under future conditions with and without climate change. The estimated SWP 2050 exports in Table 16-4 reported by DWR are based on 82 years of hydrologic data (water years 1922 to 2003) averaged according to water year type. This representation shows how the average estimated SWP exports would vary by hydrologic year types with and without climate change projections. Overall, the future conditions with climate change forecast lower deliveries under all water year types, with the largest difference for dry years. Deliveries, under future conditions with and without climate change respectively, decrease by as little as 51 thousand acre-feet (TAF) (5%) during critical years to as much as 371 TAF (20%) during dry years.

Table 16-4: Estimated SWP Exports By Water Year Type – Future Conditions With and Without Climate Change

Water Year Type	Future Conditions (2050) with Climate Change (TAF)	Future Conditions (2050) without Climate Change (TAF)	Difference, Future with and without Climate Change	
			(TAF)	(%)
Wet	2,998	3,240	-242	-8
Above Normal	2,706	2,857	-152	-6
Below Normal	2,634	2,802	-168	-6
Dry	1,817	2,188	-371	-20
Critical	1,132	1,183	-51	-5
Average of all Water Years	2,363	2,574	-211	-9

Source: Estimated SWP exports are based on the 82 years of hydrologic data (water years 1922-2003) from Draft Technical Addendum to the State Water Project Delivery Reliability Report 2011, Table 12 SWP Table A Deliveries for Future Conditions. Hydrologic data were averaged according to water year types based on DWR’s Sacramento Valley water year index (http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST).

Discussions with the TAC indicate that water agencies in the Bay Area rely on reservoirs for storing water to address annual variability in precipitation and droughts and to provide flood control. Addressing climate change is another factor that is being incorporated into reservoir management. There are other operational factors such as seismic conditions of dams and environmental releases that also influence reservoir operations.

16.3.4.3 Subregional Impacts

North Subregion. The North Subregion relies on surface water from local watersheds, the Russian River, the North Bay Aqueduct (NBA, part of the SWP), and local groundwater. This subregion is the most dependent on local water sources for its supply and will be vulnerable to extended droughts and more intense rainfall events, which impact storage requirements. For example, Marin County is dependent on precipitation within its watersheds stored in local reservoirs and withdrawals from the Russian River supply by Sonoma County Water Agency (SCWA). Some of the Russian River water is diverted to groundwater recharge and these operations are vulnerable to changes in the timing of runoff due to more intense storm events.

Agencies using imported NBA aqueduct water will be subject to reductions in SWP deliveries, especially in dry water years.

East Subregion. This subregion relies primarily on water derived directly from the Delta (CCWD), imported SWP water through the South Bay Aqueduct (Zone 7 and ACWD), imported Mokelumne River and American River water (EBMUD), as well as local watershed runoff around storage reservoirs and some local groundwater. The surface water sources are vulnerable to climate change impacts outside the Region including reduction in the snowpack storage and changes in timing of the runoff from the Sierra Nevada watersheds, as well as potential contractual restrictions on water deliveries.

The subregion is also particularly vulnerable to reduced water deliveries from the Delta that could result from sea-level rise (e.g., increased salinity) and/or from failure of Delta levees . This could trigger the need for additional water treatment (desalination) or for obtaining other supplies such as purchase of agricultural water (water transfers) and increased use of recycled water (Sicke et al. 2012). Interties between neighboring water agencies are not used at present to transfer water among Bay Area water agencies but several agencies are in the process of developing inter-agency agreements so that water can be shared among agencies using existing infrastructure in the near future.

South Subregion. About 55 percent of Santa Clara County's water supply is imported, with about 40 percent coming from sources conveyed through the Delta (CVP and SWP) and about 15 percent coming from SFPUC sources. Most of the remaining water supply is local surface water and natural groundwater recharge. Thus, the Subregion is particularly vulnerable to reductions in the snowpack in the Sierras, failure of Delta levees, and changes in the timing of runoff from the Sierra Nevada watershed.

West Subregion. In this subregion the SFPUC receives 85 percent of its supply from water imported from the Tuolumne River, with the remainder from local storage reservoirs in Alameda and San Mateo counties. BAWSCA members in the West Subregion augment their SFPUC supplies with local groundwater, local surface water, and recycled water. The SFPUC system is vulnerable to climate change impacts outside the Region including reduction in the snowpack storage and changes in timing of the runoff from the Sierra Nevada watersheds.

16.3.5 Water Quality

Improving water quality is a Plan objective that may be impacted by climate change. Studies of potential climate change impacts on water quality exist, but few trends in relationships between hydroclimate (hydrology and weather variables) have been quantified. Key climate vulnerabilities potentially important to the Region include: increasing temperature, changes in precipitation patterns, and sea-level rise. Increased wildfire risk and expansion of invasive species are other potential factors that could affect water quality in the Region. Sea-level rise in the Sacramento-San Joaquin Delta is expected to impact water quality of imported SWP and CVP water and may impact some tidal sources within the Region.

Key water quality issues for the Region include (see Section 2.5):

- Microbes
- Total organic carbon (TOC), bromide, disinfection by-products (DBPs)

- Total dissolved solids (TDS)
- Nuisance algae
- Toxic pollutants
- Lead
- Urban runoff
- Trash control
- Grazing and agriculture

Surface waters in the Region are expected to be more directly vulnerable to water quality impacts of climate change, while water quality impacts to groundwater sources would be indirect. Key surface water sources include imported and local water stored in local reservoirs and flowing water in several rivers and their tributaries.

16.3.5.1 Imported Water

Imported water used in the Region include snowmelt delivered from Sierra Nevada watersheds by pipeline aqueducts (Mokelumne and Tuolumne watersheds), SWP (SBA and NBA), and CVP (San Luis Reservoir and CCWD intakes). SWP and CVP water is vulnerable to potential effects of climate change at the source in the Delta and in storage in Regional reservoirs. Sea-level rise will increase the intrusion of salinity into the Delta and its exported water. This will increase chloride and bromide (a DBP precursor that is also a component of sea water) concentrations in the SWP and CVP imported water. In addition, decreased freshwater flows into the Delta could increase the concentration of organic matter, which contribute to potentially higher DBP formation concentrations, in the SWP and CVP water.

Imported water stored in Regional reservoirs will also be vulnerable to climate change. A prior study of potential climate change impacts on the water quality of Lake Cachuma near Santa Barbara found that water quality parameters related to rainfall runoff (turbidity and apparent color) during the wet season, winter, and/or spring could be evaluated by looking at total precipitation. Water quality parameters related to taste and odor (increasing water temperature, dissolved oxygen (DO), threshold odor number (TON), pH, and percent DO saturation) during the dry season, spring, and summer could be evaluated by looking at air temperature parameters and/or evaporation (Drago and Brekke 2005).

Extreme storm events, although rare, may be more intense due to climate change and may present treatment challenges for source water because of increased turbidity. In the past, high turbidity events in reservoirs have required modification of the treatment processes (primarily additional chemical usage) for extended periods. In addition, an intense winter rainfall event after a wildfire in a watershed that burned the prior year can result in extremely high turbidities (peak over 80 NTU) and fine organic matter in the lake water. Although most treatment plants in the region are able to treat these waters, the additional sludge production can overwhelm the solids handling equipment and require plants to be shut down or reduce their capacities for brief periods of time, or make capital investment to enlarge solids handling facilities. This combination of more intense rainfall events and increased wildfire risk is more likely under projected climate change conditions.

The warmer temperatures could also lead to increased taste and odor events triggered by algal blooms; which are characterized by water quality changes during the spring and summer such as increases in DO and DO saturation, pH, fluorescence, and TON. Many of the surface water treatment plants in the Region are designed to address taste and odor events through pre-ozonation. Although use of higher ozone dosages to control taste and odor events must also consider the need to control bromate formation (from the oxidation of bromide), which could increase due to greater bromide levels in the imported SWP and CVP water affected by climate change.

16.3.5.2 Regional Surface Waters

There are several Regional surface water supplies. Water quality impacts to surface waters due to climate change include increased temperature, more frequent heavy rainfall events, and longer periods of low natural stream flow due to decreased annual precipitation. A prior study of 43 rivers found that surface water temperatures increased 0.4 to 0.6°F for each 1°F rise in air temperature (Morrill, Bales, and Conklin 2005). Increased water temperature generally reduces dissolved oxygen and can promote algal blooms if nutrients are available in the source. The storm events can transport sediments and other pollutants along the river, while long periods of low flow can increase concentrations of pollutants from wastewater plant and non-point discharges. Increased wildfires that contribute to high erosion rates in subsequent storms may also contribute to the turbidity events.

Extreme storms and flooding may exacerbate water quality problems because urban and agricultural runoff and trash may collect in streams.

16.3.5.3 Regional Groundwater

Any water quality impacts to groundwater sources due to climate change are expected to be indirect, and primarily due to decreased natural recharge from lower precipitation and increased use of groundwater to make up loss of imported water. Decreased recharge and increased groundwater pumping may allow concentrations of groundwater contaminants such as perchlorate and volatile organic compounds to increase, in some areas of Santa Clara County, which may trigger additional treatment requirements and increase groundwater treatment costs. In addition, groundwater quality could be affected as a result of managed recharge with imported and local surface water supplies that have been impacted by climate change.

16.3.5.4 Subregional Impacts

Most of the water quality impacts discussed above will apply across all four subregions. However, there are some impacts that will be more important in individual subregions that are discussed below.

North Subregion. This subregion is heavily dependent on local water sources. Water quality will be impacted by more frequent intense storms, which can result in high turbidity that can result in water treatment plant operational challenges and in sediment transport issues in surface streams. Water stored in subregional reservoirs is vulnerable to increased taste and odor events in dry seasons due to increased temperature. Agencies depending on the North Bay Aqueduct (NBA) water may also experience increased issues with DBPs because of increased TOC in the source water.

East Subregion. This subregion contains sources that draw directly from the Delta and will be vulnerable to increased salinity as well as increased turbidity events and DBP issues. The imported EBMUD surface water sources would not be subject to the salinity increases, but are vulnerable to high turbidity events and DBP issues. Extended drought periods could increase the use of local groundwater, some of which has higher TDS than surface water and sources near the Bay in Alameda County could be influenced by future sea-level rise. Water stored in subregional reservoirs is vulnerable to increased taste and odor events due to increased temperature.

South Subregion. This subregion relies heavily on water sources that are conveyed through the Delta and are potentially vulnerable to increased salinity, DBP precursors, and turbidity. Water stored in Subregional reservoirs is vulnerable to increased algae blooms and turbidity. Changes in surface water quality can result in water treatment plant operational challenges and in sediment transport issues in surface streams. The subregion also relies on groundwater that is recharged with imported and local surface water that could be of lower quality due to climate change.

West Subregion. This subregion depends heavily on imported water provided through the SFPUC Hetch-Hetchy system. This system is an unfiltered water supply and could be vulnerable to increased turbidity resulting from changes in the timing of runoff and from more frequent intense storms and to other water quality issues due to higher temperatures (e.g., increased occurrence of microbial or nitrification issues in the SFPUC distribution systems). Extended drought periods may lead to increased groundwater use, which may lead to changes in aesthetic water quality (e.g., taste and odors, hardness, staining). Use of local surface water in San Mateo County during high turbidity events can result in water treatment plant operational challenges and in sediment transport issues in surface streams. Water stored in subregional reservoirs is vulnerable increased taste and odor events in dry seasons due to increased temperature.

16.3.6 Sea-Level Rise

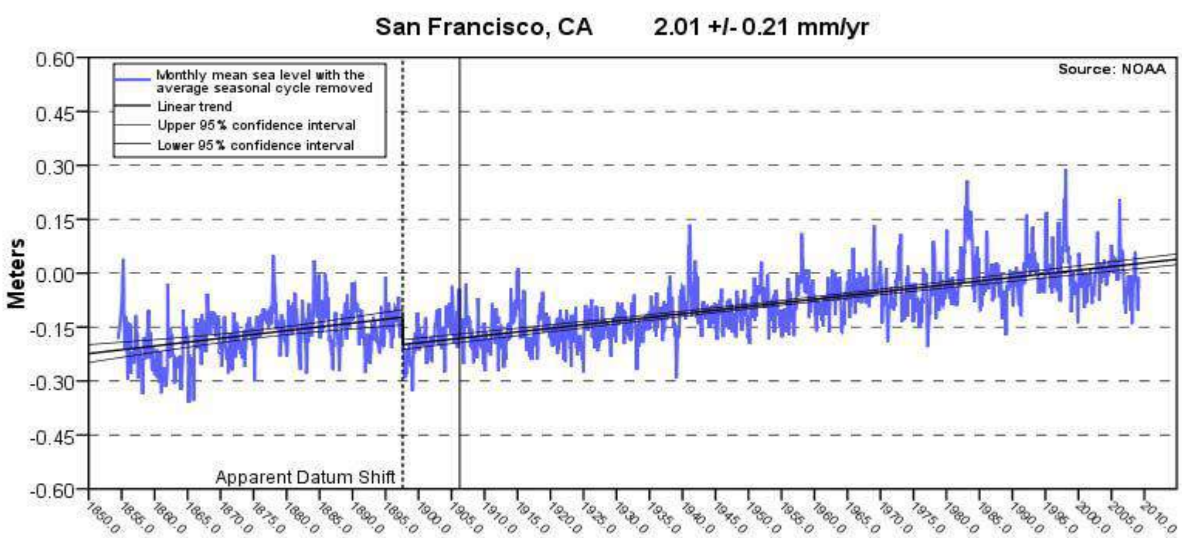
16.3.6.1 Impacts

Sea-level rise will increase tidal water surface elevation throughout the San Francisco Bay. High tides maxima will become higher, so the extent of the Bay that is regularly inundated will increase. At the same time, the low tide elevation will also increase, resulting in an upward shift of the tidal frame so that some areas that do not now experience daily tidal inundation will in the future. Changes in the water surface elevation will also increase the depth and frequency of inundation of areas already subjected to tidal inundation, and will cause some areas to become permanently subtidal.

Higher-mean water levels in the Bay may result in higher waves at the shoreline during storms if tidal marshes and flats do not keep up with sea level rise. When these higher waves reach a levee they will run up the face of the levee further and may overtop the crest, allowing water to wash over into the protected area behind the levee. The still water level is also increased by wave setup due to the transfer of wave momentum to the surf zone as waves break. At the same time these breaking waves bring more energy to the shore; and they can stir up the sediment increasing erosion of the mudflats, erosion of marsh edges and damage to structures.

In addition to wave setup increasing the still water level, low barometric pressure associated with storms will further increase water surface elevations; the combination of these effects being generally referred to as a storm surge. In addition to these storm surges, there will also be elevated water levels associated with El Niño-Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO) events. The additive effect of storm surge and ENSO/PDO events can be clearly seen in the historic tide gauge record from the Presidio in Figure 16-6, and such variability will continue to be seen into the future.

Figure 16-6: Monthly Mean Sea Level at the Presidio



Source: National Oceanic and Atmospheric Administration (NOAA) Sea Levels Online, http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=9414290

There are significant potential impacts from increases in the mean and extreme water levels. Flood risk management, wastewater discharge or stormwater conveyance structures, are generally designed for specific total water levels that have included substantially lower estimates of future sea level rise. Buildings and other infrastructure built behind levees assume that flooding will occur irregularly, if at all, and so may not be flood-proofed. They also may be sensitive to salt, and suffer from damaging corrosion if exposed to Bay waters. Structures that are not adequately protected, elevated, flood-proofed, or made corrosion resistant may be destroyed or damaged by the impacts of sea level rise. This will impact Bay Area communities due to loss of performance, need for clean up after flooding events, and increased operation and maintenance costs.

Specific Bay Area infrastructure impacted is discussed in Heberger, *et al.* (2012), and will include both private assets and critical public infrastructure and also critical facilities such as water treatment plants, energy production and transmission facilities, public transit, hospitals, and schools. These are discussed in more detail in the vulnerability section below. Low lying neighborhoods will be heavily impacted in the Bay Area; and low income communities in those areas will bear a relatively higher financial burden when having to reinforce structures, relocate, or pay additional costs related to flooding.

There will be significant impacts on Bay habitats due to sea-level rise. Tidal wetland habitats that cannot accrete rapidly enough or migrate inland may convert from marsh to mudflats. Important ecosystem services such as wave attenuation, fish and wildlife habitat, and flood protection benefits may be lost, requiring the strengthening of hard defenses at significant cost. In addition, the loss of trails, marshes, vistas and shoreline recreation areas may impact public access to the shoreline over time.

Higher Bay water levels may also lead to saltwater intrusion into coastal groundwater aquifers, and the mobilization of pollutants from landfills and contaminated sites adjacent to the Bay. Higher groundwater elevations could lead to decreased seismic stability and impacts on below-grade infrastructure such as transit tunnels, cables and pipelines depending on the aquifer depths. Historic abandoned groundwater wells can act as vertical conduits for saltwater contamination into groundwater if inundated by sea-level rise. Changes in the Bay are expected to lead to a deeper, warmer, more stratified Bay that may have significant impacts on the water column, bay water quality, and bayshore habitats.

Responding to these impacts will place greater demands on agencies. There will be a greater need to plan for, and to manage, infrastructure and resources, building codes and land use zoning will have to be updated, and governance structures involving multiple jurisdictions will have to be established to plan and finance adaptation strategies to be implemented at local, regional, and statewide scales.

16.3.6.2 Vulnerability

Heberger, *et al.* (2012), estimated that the population vulnerable to a 100-year coastal flood will increase from about 145,000 today to about 175,000 by 2050, to about 225,000 by 2080 and to about 280,000 by 2100. This includes both population along the Pacific Coast, of which the vulnerable population will increase by 30 percent by 2100, and population along the Bay, of which the vulnerable population will double.

Tables 16-5 and 16-6 show this increase of vulnerable population by county for coastal flooding along the Pacific Coast and along the San Francisco Bay, respectively.

Table 16-5: Population Vulnerable to a 100-Year Flood Along the Pacific Coast

County	Population Currently at Risk	Population at Risk with 55 inch Sea-Level Rise
Marin	530	630
San Francisco	4,800	6,500
San Mateo	4,700	5,900
Sonoma	580	700
Regional Total	**10,610**	**13,730**

Source: Heberger, *et al.* 2009, Table 8; No estimates were made for 2050.

Table 16-6: Population Vulnerable to a 100-Year Flood Along the San Francisco Bay

County	Population Currently at Risk	Population at Risk with Sea-Level Rise		
		2050	2080	2100
Alameda	12,000	22,000	43,000	66,000
Contra Costa	840	1,600	3,400	5,800
Marin	25,000	29,000	34,000	39,000
Napa	760	830	970	1,500
San Francisco	190	600	1,600	3,800
San Mateo	80,000	88,000	99,000	110,000
Santa Clara	13,000	17,000	24,000	31,000
Solano	3,700	5,500	8,800	12,000
Sonoma	250	300	420	540
Total	**135,740**	**164,830**	**215,190**	**269,640**

Source: Heberger, *et al.* 2012, Table 3.

Heberger *et al.* (2012) also noted the vulnerability of wastewater treatment and power generation much of whose infrastructure are located at the toe of watersheds, in low lying lands close to the Bay. There are 10 wastewater treatment plants representing almost 350 MGD of treatment capacity, as well as 11 power plants representing about 1,700 MW of generation capacity, that would be vulnerable to a 100-year coastal flood by 2100 (see Figure 16-7).[47] This vulnerable 1,700 MW accounts for 18 percent of all installed electricity generation capacity region-wide (CEC, 2012a).

Threats to the electrical grid increase the vulnerability of water and wastewater treatment plants and other types of water infrastructure that require electrical power to function. Many facilities have backup or emergency power supplies on-site that could be vulnerable to inundation by sea-level rise-induced flooding and to damage from storm surges.

The Heberger *et al.* report (2012) estimates that the combined replacement value of buildings and their contents at risk from flooding along the Pacific coast and San Francisco Bay shoreline by 2050 in the nine Bay Area counties is about $36 billion compared to the current value of at-risk assets of $29 billion. Of this $36 billion, $18 billion is in San Mateo County alone. Alameda, Marin and Santa Clara Counties all have replacement values at risk of about $5 billion.

16.3.6.3 Subregional Impacts

North Subregion. The North Subregion will experience effects along both the Pacific Coast and San Francisco Bay. As shown in Table 16-7, a sea-level rise of by 2050 will increase the population vulnerable to a 100-year flood by 5400 people region-wide, with the greatest at-risk population in Marin County, and the greatest percentage increase in Solano County.

[47] The Hunters Point Power Plant, shown in Figure 16-7, closed in 2006 and is not considered in the analysis by Heberger *et al.* (2012).

Table 16-7: North Subregion Population Vulnerable to a 100-Year Flood Along the Pacific Coast and San Francisco Bay

County	Population Currently at Risk	Population at Risk with Sea-Level Rise 2050
Marin	25,530	29,000
Napa	760	830
Sonoma	830	880
Solano	3,700	5,500
Subregional Total	**30,820**	**36,210**

Also in the North Subregion, there are six wastewater treatment plants representing 31 MGD of treatment capacity, as well as two power plants representing just 3.15 MW of generation capacity, that would be vulnerable to a 100-year coastal flood under the 55-inch sea-level rise scenario (see Figure 16-7 below). The vulnerable power plants account for less than 0.2 percent of all capacity in the North Subregion (California Energy Commission, 2012a).

Other vulnerable infrastructure may include one or more substations along the San Francisco Bay shore, such as the Sausalito Substation (CEC, 2012b).

East Subregion. The counties of the Eastern Subregion have no coastal shoreline, only the Bay water elevation poses a risk to near-shore populations, as summarized in Table 16-8. In both counties, the increase in vulnerable population due to sea-level rise is four to five times the population currently at risk.

Table 16-8: East Subregion Population Vulnerable to a 100-Year Flood Along the San Francisco Bay

County	Population Currently at Risk	Population at Risk with Sea-Level Rise
Alameda	12,000	66,000
Contra Costa	840	5,800
Subregional Total	**12,840**	**71,800**

The East Subregion has six wastewater treatment plants representing 118 MGD of treatment capacity, as well as five power plants representing 1615 MW of generation capacity, that would be vulnerable to a 100-year coastal flood under the 55-inch sea-level rise scenario (see Figure 16-7). The vulnerable power plants account for over 80 percent of the vulnerable power plant capacity region-wide, and 27 percent of all capacity in the East Subregion (CEC, 2012a).

PG&E and other owners have numerous electrical substations in the Pittsburg, Martinez, Hayward, and Newark areas that could be at risk of flooding with 55-inch sea-level rise and could introduce vulnerability to the local transmission grid (CEC, 2012b).

South Subregion. The South Subregion consists of Santa Clara County alone, which has no coastal shoreline. As shown in Table 16-6 above, the increase in population vulnerable to a 100-year flood along the San Francisco Bay would be 4000 people by 2050.

The South Subregion has three wastewater treatment plants representing 155 MGD of treatment capacity, as well as three power plants representing 60 MW of generation capacity, that would be vulnerable to a 100-year coastal flood under the 55-inch sea-level rise scenario (see Figure 16-7). The vulnerable power plants account for just 5 percent of all capacity in the South Subregion, though the wastewater treatment plants account for 100 percent of the subregion's wastewater treatment capacity.

Some, but not many electrical substations in South Region could be at risk of flooding with 55-inch sea-level rise and could introduce vulnerability to the local transmission grid (CEC, 2012b).

West Subregion. As shown in Table 16-9, San Mateo County has the largest population in the Region vulnerable to flooding along the Bay shore, both currently and under each sea-level rise scenario shown, and will experience a 10 percent increase in vulnerable population by 2050.

Table 16-9: West Subregion Population Vulnerable to a 100-Year Flood along the Pacific Coast and San Francisco Bay

County	Population Currently at Risk	Population at Risk with Sea-Level Rise 2050
San Mateo	84,700	92,700
San Francisco	4,990	5,400
Subregional Total	**89,690**	**98,100**

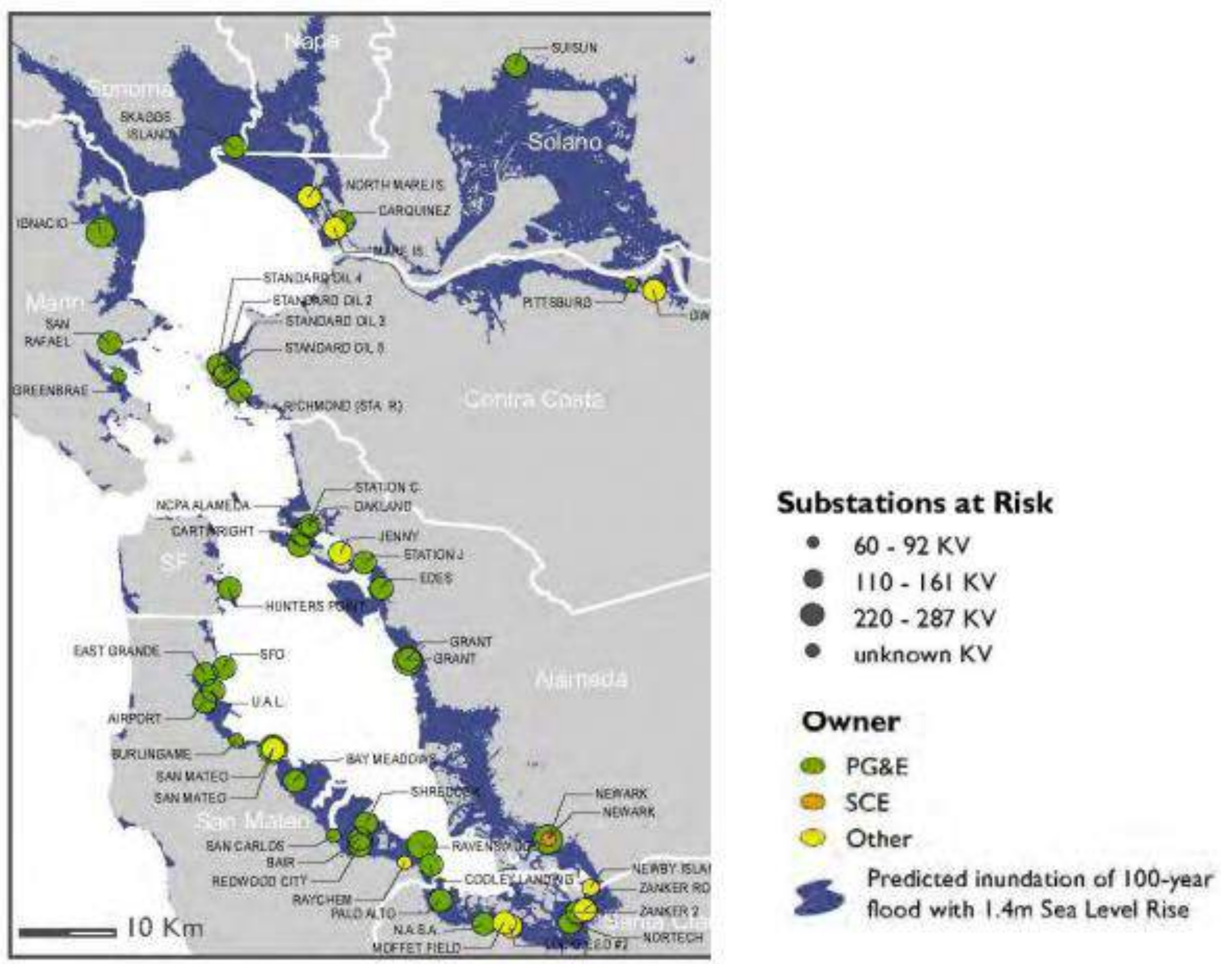
The West Subregion has six wastewater treatment plants representing 58 MGD of treatment capacity, as well as one power plant representing 31 MW of generation capacity, that would be vulnerable to a 100-year coastal flood under the 55-inch sea-level rise scenario (see Figure 16-7). The single vulnerable power plant accounts for half of all electricity generation capacity in the West Subregion (CEC 2012).

Several electrical substations in Millbrae, Foster City, Redwood Shores, and the Ravenswood areas may currently be at risk of flooding and would see greater risk with 55-inch sea-level rise that could introduce vulnerability to the local transmission grid (CEC, 2012b).

Figure 16-7: Wastewater Treatment Plants and Power Plants on the San Francisco Bay Vulnerable to a 100-Year Flood by 2050

<u>Source</u>: Heberger *et al.* (2012) (Chart modified).
<u>Note</u>: The Hunters Point Power Plant closed permanently in 2006. Central Contra Costa Sanitary District plant which has an outfall near Martinez and has a capacity of 54 MGD, and the.16.5 MGD Delta Diablo Sanitation District plant in Antioch but is in the process of expanding to 22 MGD, are not included in Figure 16-7.

Figure 16-8: Electrical Transmission and Transmission Infrastructure in the San Francisco Bay Area



Source: Sathaye *et al*, 2012.

Additional coastal and shoreline infrastructure that would be vulnerable to a 100-year flood with sea-level rise include major transportation corridors, schools, healthcare facilities, fire stations and training facilities, and police stations. Several of these facilities are currently at risk from a 100-year flood, but their numbers are expected to double by 2050 (Heberger, *et al.* 2012, Tables 8 and 9). Table 16-10 lists the highway, road, and railway miles by county that are vulnerable to coastal flooding currently and in 2050.

Table 16-10: Miles of Roads and Railways Vulnerable To a 100-Year Flood Along the Pacific and San Francisco Bay Coasts - 2050

County	Highways (miles)		Roads (miles)		Railways (miles)	
	Current Risk	Risk with Sea-Level Rise 2050	Current Risk	Risk with Sea-Level Rise 2050	Current Risk	Risk with Sea-Level Rise 2050
Alameda	1.1	4.8	76	160	9.1	17
Contra Costa	2.4	2.7	20	42	10	17
Marin	16	20	110	150	12	15
Napa	0.7	0.7	7.0	9.0	6.0	7.0
San Francisco	0.3	0.6	3.4	11	0.26	0.56
San Mateo	27	49	300	360	3.7	5.2
Santa Clara	9.4	12	110	150	5.9	7.2
Solano	5.7	14	53	78	9.3	12
Sonoma	11	12	53	57	11	14
Regional Total	**72**	**120**	**810**	**1,000**	**68**	**94**

Source: Heberger, *et al.* 2012, Table 8 and 9.

Also at risk are sites containing hazardous materials, which if flooded could result in the release of hazardous materials from the site. The report found 94 such sites in Bay Area counties that are currently at risk from a 100-year flood; an additional 47 sites throughout the region would become vulnerable by 2050. Most of these sites are located in San Mateo County (Heberger, *et al.* 2012, Table 7).

Heberger, *et al.* (2009) estimated the capital costs of coastal armoring to protect against coastal flooding by 2100 to be approximately $5.27 billion (in year 2000 dollars) throughout the region. Table 16-11 shows the estimated lengths of armoring types needed and cost by county.

Table 16-11: Estimated Length and Capital Cost of Coastal Armoring in Bay Area Counties

County	Raised Levee (miles)	New Levee (miles)	New Sea Wall (miles)	Total (miles)	Capital Cost ($million, 2000 dollars)	Operation and Maintenance Costs ($million/yr, 2000 dollars)
Alameda	45	49	16	110	950	95
Contra Costa	26	29	8	63	520	52
Marin	43	77	7.7	130	930	93
Napa	2.8	62	0	64	490	49
San Francisco	0	10	21	31	680	68
San Mateo	35	29	9.2	73	580	58
Santa Clara	47	4.0	0	51	160	16
Solano	2.7	63	8	73	720	72
Sonoma	30	15	1.3	47	240	24
Regional Total	**231.5**	**338**	**71.2**	**642**	**5,270**	**527**

Source: Heberger, *et al.* 2009, Table 23.

16.3.7 Flooding

Flooding can be an extremely costly and destructive natural disaster; the California's *Flood Future Highlights* identifies structures valued at $130 billion that are located within a 500-year floodplain in the Bay Area. Additionally, over one million Bay Area residents live within a 500-year floodplain, and these numbers are likely to increase due to expected growth in population and development in the Region (DWR, 2012b). Thus, a change in flood risk is a potential significant effect of climate change that could have great implications for the Region.

Flood risks along creeks from storm events may increase due to the more frequent extreme high sea level events leading to backwater effects along flood-prone areas. During extreme water level events the head of tide will move further inland up the creeks and, during storm events, the higher tidal levels will reduce flow capacity in the creeks and increase the risk of flooding. The gravity systems that drain stormwater from urban areas will also become less effective as bay water levels rise. Stormwater discharges and pipes may allow backflow and serve as conduits for flood water. Flap gates that prevent the back flow of flood waters will remain closed for longer, resulting in ponding of water in local drainage systems. The potential impacts are great if flood conveyance channels and storm drains are overwhelmed, as this which will lead to the increased of flooding in low-lying areas.

In addition, the duration of flooding events is likely to increase as extreme Bay water levels increase and if precipitation and storm surge events become more intense. More intense storms would produce higher peak flows in urbanized areas, resulting in increased in-channel erosion as sediment is scoured and vegetation washed out. Increased frequency of landslides and sediment erosion into flood control channels and creeks may be expected. The projections of increased wildfire during the extended dry periods may also increase erosion potential that further reduces channel capacity. Increased storm intensity may also increase landslides and sediment transport into creeks.

The increased bay elevations and reduction in capacity of flood channels suggest that pumping and dredging costs to maintain flow conveyance will increase. New pumping systems may have to be installed to drain areas that previously relied on gravity. In addition, existing pumps may have to be run for longer periods. As the head of the tide moves up the creeks piping and pumping systems will be exposed to more saline water which requires different standards of materials.

Damage from flooding is expected to increase in the same way as described in the section above on sea-level rise. DWR found that region-wide, 119 flood management projects are proposed, but not completed, and many may not currently have a funding source (DWR, 2012b). Of these, many are necessary to maintain the functionality of existing flood control systems, and may not be sufficient, even if built, to protect against increased flood risk due to climate change. More frequent flooding may disrupt key services and facilities, and could impact areas beyond the immediate flood zone such as would be caused by contamination from sewage distribution and treatment systems which may adversely affect human health in different areas. More frequent flooding would have economic impacts from lost wages and lower productivity in the aftermath of floods. In the longer term there would be more losses, claims and higher insurance rates due to greater risks. Deeper and longer duration flooding would increase the cost of repair after flood event and disrupt access to goods and services for longer.

It would also increase shoreline erosion, damage to flood risk management levees, and increase the risk of releasing legacy contaminants.

The combination of increased flood flows and higher water levels will result in raising levees and flood walls in many places. This may increase the risk to communities and infrastructure as they become lower relative to the crest of the flood protection structure. If the structure does fail then the depth of water, and the consequent damage, may be greater. Changes may also be made higher up in the watershed to alleviate some of the combined flooding issues that may occur more frequently. For instance, flood-plain restoration and reconnection, off-line detention higher up in the system and the increased use of pumping may alleviate some of these issues, all approaches which will require increased coordination between different jurisdictions.

In some ways, risk of flood from climate change could be more problematic than for water supply. Water supply issues usually arise over a period of months to years, allowing time to respond to changes. In contrast, while large floods are relatively rare, they are swift and devastating if preparations are insufficient. There is no window to prepare for a flood once the flood waters arrive; floods must be addressed through advance preparation and quick response in the course of an event. Greater flood risk should be considered when evaluating new development in the floodplain.

16.3.8 Ecological Health and Habitat

The Bay Area is a biodiversity hotspot of national significance, serves as a major stop over on the pacific flyway, and sustains some of the state's most important fisheries; ecosystem health and habitat protection are key to the Region's economy and quality of life. Increased temperature, changes in precipitation patterns, shifts in species distributions, and increased wildfire risk projected for potential climate change scenarios are potential stressors to ecosystems and habitat in the Region.

16.3.8.1 Bay Area Ecosystem Assets

Bay Area water resources include freshwater streams, tidelands, marshlands, and rivers, providing diverse habitat types including riparian, lacustrine, and wetland habitats. There are approximately 400 square miles of coastal wetlands in the region (Heberger, *et al.* 2009, see Figure 26). Terrestrial habitat types generally consist of coniferous forests, oak woodlands, shrublands, and grasslands. The Bay Area is home to over 25 major native vegetation types, 3,000 native plant taxa, and 50 locally unique species (Ackerly *et al.* 2012). San Francisco Bay Area Region Description (Table 2-2 in Section 2), lists threatened and endangered species in the Bay Area. Of these, 279 species occur within a 500-year floodplain within the Region.

Ackerly *et al.* (2012) describes the 32 Critical Coastal Areas (CCAs) and lists the nine Marine Protected Areas (MPAs) in the Bay Area (Tables 2-3, 2-4). Additionally, the Bay and its Delta connections form a part of one of the Endangered Species Coalitions' "Top 10 Places to Save for Endangered Species in a Warming World" (2011).

16.3.8.2 Recent Studies and Findings

Ackerly *et al.* (2012) summarizes existing research on the relationship between climate and biodiversity and how changes in climate historically have and will in the future impact habitat. In terrestrial systems, the impacts of rising temperature and changing precipitation patterns have the largest effect and that in estuarine and intertidal areas, sea-level rise results in the most important direct impact. These habitats may be affected directly by habitat loss through erosion, or indirectly via human responses such as coastal armoring (e.g., construction of sea walls) and other infrastructural changes.

Bay Area habitat are highly specific to climate gradients and the biodiversity of the region will be highly susceptible to climate change because shifts in climate could make existing habitats unsuitable for native species and restrict the possibility of re-establishment elsewhere (Ackerly *et al.* 2012). In addition, existing urban development and habitat fragmentation are constraints to species' ability to move (The Conservation Lands Network, 2011).

Cornwell *et al.* (2012) modeled climate change impacts on vegetation in the Bay Area and found that change is likely to occur in "small patches" throughout the region, dominated by a change from forest to shrub vegetation types. The model results showed that over 50% of the forecast transitions in vegetation type that will require about half a mile of movement for the newly establishing vegetation, because transitions will favor vegetation types that are already established nearby. Areas populated by vegetation communities that are stabilized by positive feedback mechanisms (such as redwoods collecting fog and depositing moisture onto the soils below) could transition rapidly to different habitat types if these mechanisms are disrupted by changes in climate, and re-establishment would be difficult because in the absence of this feedback, soil moisture and other necessary conditions could change significantly (Cornwell *et al.* 2012).

Vegetation habitat in open space watersheds provides ecosystem services by improving the watershed's ability to store and filter runoff. Changes in watershed habitat could reduce this ability, creating the need for greater manmade storage, groundwater recharge, and treatment options to achieve conditions similar to what currently exists.

Climate change-related effects on the quantity, timing, duration, and frequency of precipitation events and freshwater flows will affect species' ranges. Changes in freshwater flows will restrict riverine habitat, both in flow volumes and water temperatures, potentially making the passage of fish from the Pacific to up-river spawning grounds more difficult. Increases in temperature due to climate change are likely to reduce soil moisture levels due to increased evapotranspiration, resulting in shifting vegetation types.

Tidal marshes provide numerous important services, including: flood control, water filtration, air cooling effects, carbon sequestration, fish and wildlife habitat, and recreation. Later century sea-level rise is expected to inundate some tidal marshes more quickly than they can re-establish, or where coastal infrastructure may prevent the movement of marshes, except perhaps in those areas with higher suspended sediment concentrations.

These projected habitat changes to a more *dynamic* landscape may well create tensions with the historic *static* view of the landscape that has formed a lot of thinking up to now. For example, maintaining artificial habitats that formed around water infrastructure may hinder natural habitat formation and maintenance. Changes to habitat provided by mitigation lands and the need to fulfill ongoing mitigation obligations will create future challenges for regulatory agencies.

16.3.9 Hydropower

Several water agencies in the Region produce or receive power produced in high elevation hydropower plants in the Sierra Nevada range and locally. In general, the reservoirs associated with projects are relatively small and have little operational flexibility and are thus vulnerable to reduced snowpack and timing of runoff. This is expected to result in reduced hydropower production, especially in the summer months when peak electric power demands occur (Guegan, Madani and Uvo, 2012). This vulnerability was discussed with climate change TAC participants who indicated that projected hydropower reductions represented less than 10 percent of their electric power revenues, and that while lost revenues from hydropower generation would need to be offset; they believed that adequate electric power resources would be available.

DWR's climate change modeling analysis indicates increased temperature, decreased water availability with reduced Sierra Nevada snowpack, early snow melt, and a rise in sea level (DWR 2012a).

16.4 Vulnerability Prioritization

This section discusses a list of prioritized vulnerability areas based on the vulnerability assessment presented in the earlier subsections. The main categories follow the climate change vulnerability checklist assessment as defined in the *Climate Change Handbook for Regional Water Planning*. The watershed vulnerability assessment identifies the vulnerability areas for each sector most vulnerable to potential climate change projections. These sector vulnerabilities were discussed with the Climate Change TAC to help develop adaptive strategies that respond to potential climate change impacts. Based on a survey of the TAC members, the prioritization of vulnerability areas is as follows:

1. Sea-Level Rise
2. Flooding
3. Water Supply and Hydropower
4. Water Quality
5. Ecosystem and Habitat
6. Water Demand

Table 16-12: Climate Change Vulnerability Prioritization

Vulnerability Area	High	Medium	Low	Total Score
Sea-Level Rise	11	2	0	37
Flooding	8	5	0	34
Water Supply & Hydropower	5	7	1	30
Water Quality	5	4	4	27
Ecosystem & Habitat	3	6	4	25
Water Demand	0	10	3	23

Table 16-12 summarizes the climate change vulnerability area rankings based on the results of the vulnerability area TAC survey. Each first place vote was multiplied by 3, each second place vote multiplied by 2, and each third place vote was multiplied by one to derive the Total Score. The vulnerability assessment and prioritization was conducted based on data currently available and inputs from the TAC involved in the preparation of this study for the Region. This assessment can be improved in the future with further data gathering and analyzing of the prioritized vulnerabilities.

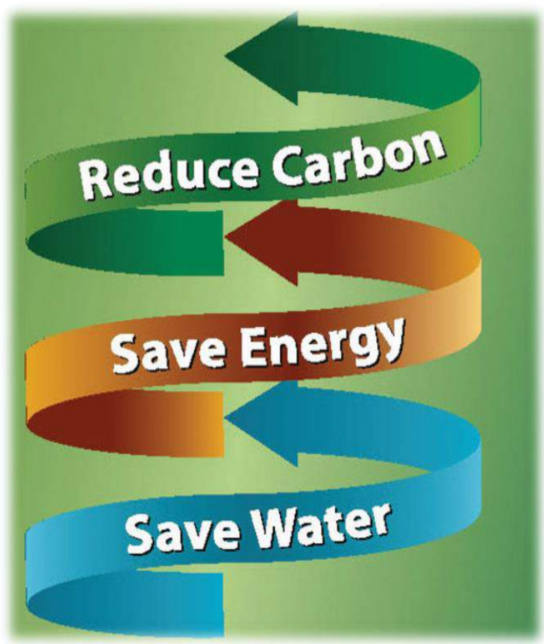
The vulnerability prioritization is intended to identify the high priority vulnerability areas (sea-level rise and flooding), medium priority areas (water supply & hydropower), and low priority areas (water quality, ecosystem & habitat, and water demand). The prioritization is used to order the following discussion about adaptation strategies.

16.5 Addressing Prioritized Climate Change Vulnerabilities

There are two main strategies to deal with climate change – mitigation strategies and adaptation strategies. Mitigation strategies combat climate change by directly reducing GHG emissions or minimize increases in GHG emissions; while adaptation strategies generally refer to efforts that deal with the impacts of climate change. The Bay Area Region and the Coordinating Committee have several ways in which the prioritized climate change vulnerabilities discussed above can be addressed, including statewide mitigation and adaptation strategies, resource management strategies (RMS), and regional adaptation strategies. Each of these options, including how they can address the prioritized climate change vulnerabilities, are discussed in more detail below.

16.5.1 Statewide Mitigation Strategies

Typically mitigation or GHG reductions measures are accomplished by implementing specific energy efficiency programs or projects, developing renewable energy projects, implementing waste-to-energy projects at wastewater treatment plants, promoting carbon sequestration, and conducting water efficiency and demand reduction programs. All of these measures either directly create carbon-free energy or reduce the need for generation of electricity from fossil fuel-fired electric plants.



The AB 32 Scoping Plan (2008) contains the main strategies California will use to reduce GHG emissions that cause climate change. The scoping plan has a range of GHG reduction actions that include: direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.

http://www.arb.ca.gov/cc/scopingplan/document/adopted_scoping_plan.pdf

Section 17 of the Scoping Plan discusses the mitigation measures or strategies for the Water sector. The table below shows the five areas from which specific GHG reduction measures will be identified and implemented.

Table 16-13: AB 32 Scoping Plan Water Sector Mitigation Measures

Measure Description	GHG Reduction by 2020 ($MMTCO_2$)
Water Use Efficiency	1.4
Water Recycling	0.3
Water System Energy Efficiency	2.0
Reuse Urban Runoff	0.2
Increase Renewable Energy Production	0.9
Total GHG Reductions	**4.8**

Energy and GHG Master Plans by individual water and wastewater agencies are a good way of identifying a specific portfolio of projects that reduce energy use and GHG emissions, while lowering the agencies operating cost.

16.5.2 Statewide Adaptation Strategies for the Water Sector

The goal of adaptation is to minimize risks associated with anticipated impacts and take advantage of beneficial opportunities that may arise from climate change. Adaptation strategies are developed in conjunction with GHG mitigation strategies, which may overlap. For example, promoting water and energy efficiency are both GHG mitigation and climate change adaptation strategies. Adaptation strategies discussed in this section provide the Region with guidance related to projects that will enhance the Region's preparedness to plan and react to these potential impacts.

In 2009, California adopted a statewide *Climate Adaptation Strategy* (CAS) that summarizes climate change impacts and recommends adaptation strategies across seven sectors: Public Health, Biodiversity and Habitat, Oceans and Coastal Resources, Water, Agriculture, Forestry, and Transportation and Energy. The 2009 CAS was the first of its kind in the usage of downscaled climate models to more accurately assess statewide climate impacts as a basis for providing guidance for establishing actions that prepare, prevent, and respond to the effects of climate change.

http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf

Specific adaptive water management strategies for the water sector were developed by the Department of Water Resources (DWR). DWR is addressing climate change impacts through mitigation and adaptation measures to ensure that Californians have an adequate water supply, reliable flood control, and healthy ecosystems now and in the future. In 2008 DWR adopted the Climate Change Adaptation Strategy.

http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf

DWR developed the following 10 statewide adaptation strategies for the Water Management Sector:

Strategy 1: Provide sustainable funding for statewide and integrated regional water management

Strategy 2: Fully develop the potential of integrated regional water management

Strategy 3: Aggressively increase water use efficiency

Strategy 4: Practice and promote integrated flood management

Strategy 5: Enhance and sustain ecosystems

Strategy 6: Expand water storage and conjunctive management of surface and groundwater resources

Strategy 7: Fix Delta water supply, quality, and ecosystem conditions

Strategy 8: Preserve, upgrade and increase monitoring, data analysis and management

Strategy 9: Plan for, and adapt to, sea-level rise

Strategy 10: Identify and fund focused climate change impacts and adaptation research and analysis

These statewide strategies provide guidance specifically aimed at addressing the impacts of climate change. Some of DWR's strategies can be directly applied to Regional Management Strategies, while others are supportive of Regional efforts that are discussed in the following section.

16.5.3 Resource Management Strategies

Discussed in detail in Chapter 4, resource management strategies (RMS) are projects, programs, or policies that help local agencies manage their water and related resources. Implementing RMS is one way that the Region can address priority climate change vulnerabilities. The RMS relevant to the Region can help address these regional climate change vulnerabilities as indicated in Table 16-14.

Table 16-14: Addressing Regional Climate Change Vulnerabilities with Resource Management Strategies

Resource Management Strategies	Bay Area IRWM Region Climate Change Vulnerabilities						
	Sea Level Rise	Flooding	Water Supply	Water Quality	Ecosystem & Habitat	Water Demand	Hydropower
Reduce Water Demand							
Agricultural Water Use Efficiency			✓		✓	✓	✓
Urban Water Use Efficiency			✓		✓	✓	✓
Improve Operational Efficiencies and Transfers							
Conveyance – Delta			✓	✓	✓		
Conveyance – Regional/Local		✓	✓	✓			
System Reoperation	✓	✓	✓				✓
Water Transfers			✓				
Imported Water			✓				
Infrastructure Reliability	✓		✓			✓	
Increase Water Supply							
Conjunctive Management & Groundwater Storage		✓	✓	✓	✓		
Desalination			✓				
Water Recycling			✓				
Surface Storage – CALFED		✓	✓				
Surface Storage – Regional/Local		✓	✓				✓
Stormwater Capture and Management		✓	✓	✓			
Improve Flood Management							
Flood Risk Management	✓	✓	✓		✓		

Resource Management Strategies	Bay Area IRWM Region Climate Change Vulnerabilities						
	Sea Level Rise	Flooding	Water Supply	Water Quality	Ecosystem & Habitat	Water Demand	Hydropower
Improve Water Quality							
Drinking Water Treatment and Distribution			✓	✓			
Groundwater/Aquifer Remediation			✓	✓			
Matching Quality to Use			✓	✓		✓	
Pollution Prevention			✓	✓	✓		
Salt and Salinity Management			✓	✓	✓		
Urban Stormwater Runoff Management		✓	✓	✓	✓		
Water Quality Protection and Improvement		✓	✓	✓	✓		
Monitoring and Modeling		✓	✓	✓	✓		
Wastewater Treatment		✓	✓	✓	✓	✓	
Practice Resource Stewardship							
Agricultural Lands Stewardship			✓	✓	✓	✓	
Ecosystem Restoration	✓	✓	✓	✓	✓		✓
Land Use Planning and Management	✓	✓	✓	✓	✓	✓	✓
Recharge Areas Protection		✓	✓	✓	✓		
Sediment Management			✓	✓	✓		
Watershed Management		✓	✓	✓	✓		✓
Environmental and Habitat Protection and Improvement	✓	✓		✓	✓		
People and Water							

	Bay Area IRWM Region Climate Change Vulnerabilities						
Resource Management Strategies	**Sea Level Rise**	**Flooding**	**Water Supply**	**Water Quality**	**Ecosystem & Habitat**	**Water Demand**	**Hydropower**
Economic Incentives (Loan, Grants, and Water Pricing)	✓	✓	✓	✓	✓	✓	✓
Outreach and Engagement	✓	✓	✓	✓	✓	✓	✓
Water and Culture	✓	✓	✓	✓	✓	✓	✓
Water-Dependent Recreation		✓		✓	✓		✓
Regional Cooperation	✓	✓	✓	✓	✓	✓	✓
Recreation and Public Access		✓		✓	✓		

16.5.4 Regional Adaptation Strategies

The 2012 California Climate Adaptation Planning Guide (APG) provides guidance to support regional and local communities in proactively addressing the unavoidable consequences of climate change. The APG provides a step-by-step process for local and regional climate vulnerability assessment and adaptation strategy development.

http://resources.ca.gov/climate_adaptation/local_government/adaptation_policy_guide.html

The Bay Area Joint Policy Committee (JPC) supports climate change adaptation efforts for the Region such as the Bay Area Climate and Energy Resilience Project. Additional information can be found at:

http://www.cakex.org/directory/organizations/bay-area-joint-policy-committee

In the following analysis, potential adaptation strategies have been identified for each watershed characteristic, starting with the highest priorities developed in the climate change vulnerability area analysis. This list of potential strategies will allow the Regional Management Coordinating Committee and other stakeholders to incorporate climate change adaptation in projects developed and evaluated as part of the IRWMP process. The applicable IRWM objectives from Chapter 3 are listed in parentheses following each strategy.

16.5.4.1 General

- Large water and wastewater agencies should conduct Energy and GHG Master Plans to assess their energy and carbon footprints, and create an Action Plan of strategies for greater energy efficiency and GHG emission reductions. Fully exploring the Water-Energy-Carbon nexus can identify opportunities for energy savings and GHG emission reductions through water operations, programs, and projects. A good example is investigation and efforts by the Sonoma County Water Agency's in developing its Carbon Free Water program (IRWM Objective 1.4).

- Incorporate climate change adaptation into relevant local and regional plans and projects (IRWM Objective 1.3, 1.5).

- Establish a climate change adaptation public outreach and education program (IRWM Objective 1.8).

- Build collaborative relationships between regional entities and neighboring communities to promote complementary adaptation strategy development and regional approaches (IRWM Objective 1.1, 1.2).

- Establish an ongoing monitoring program to track local and regional climate impacts and adaptation strategy effectiveness (IRWM Objectives 1.9, 1.10).

16.5.4.2 Sea-Level Rise

Climate change projections suggest sea-level rise from a low estimate of 5 inches to a high estimate of 24 inches by 2050 (Table 16-2). Regional adaptation strategies to address potential impacts from sea-level rise include the following:

- Evaluate the differences around the Bay with regard to the natural shore and habitats, urban development and likely future bayland evolution. Use existing frameworks (e.g., Baylands Ecosystem Habitat Goals Update) to support this evaluation and to develop strategies appropriate for distinct natural regions within the Bay (IRWM Objectives 1.3, 1.5).

- Develop an implementation framework that considers the amount of sea-level rise that is expected as well as a temporal planning horizon. As strategies are likely to have a limited life in terms of the amount of sea-level rise they can accommodate it is likely that over time different strategies will have to be implemented (IRWM Objectives 1.3, 1.5).

- Consider relocating critical infrastructure out of the hazard zone (IRWM Objective 4.1).

- Increase the resiliency of existing infrastructure by retrofitting with waterproof or corrosion resistant materials, elevating sensitive components. CCWD's Contra Costa Canal Levee Elimination and Flood Protection Project will remove aging earthen embankments of the unlined portion of the Contra Costa Canal that are prone to failure during extreme storm and rain events (IRWM Objective 4.2).

- Support policies that prevent inappropriate development in areas likely to be inundated (IRWM Objective 4.1).

- Bolster existing coastal armoring (i.e., levees, seawalls, breakwaters, and other structures) in locations that are appropriate, (e.g., along urban areas where mudflats and marshes are no longer present (IRWM Objective 4.3)). Where marshes and mudflats are present, 'holding the line' against sea-level rise by using such structures may result in their loss as they are squeezed against the fixed structures as they attempt to move landward in response to sea-level rise. Modifications could be made to existing levees, such as grading flatter slopes to allow marshes space to migrate landward. In the long term, realignment of fixed structures may prove to be most economic. An example of a study that is considering a combination of improved coastal armoring and improvements to marsh land is the South San Francisco Bay Shoreline Feasibility Study. The study is being conducted by the U.S. Army Corps of Engineers, the Santa Clara Valley Water District, and the California State Coastal Conservancy. The goal of the study is to find cost-effective ways to reduce coastal flood risk in the South San Francisco Bay, which will be made worse by sea-level rise, and to identify opportunities to improve the environment by creating tidal marsh and other habitats.

- Consider ways to enhance existing wetlands to allow them to accommodate higher rates of sea-level rise (IRWM Objectives 3.1, 3.4, 4.3, 5.1). For example, providing more space for lateral migration, and increasing the local sediment supply to allow marshes and mudflats to accrete more rapidly and keep up with accelerated sea level rise. Consider ways to reuse fine sediment dredged from navigation and storm water channels to create gentle upland slopes landward of tidal marshes. Methods for placing fine material on marshes and mudflats in such a way to emulate natural accretion processes and rates should be investigated. Sediment recharge should be focused in areas where natural processes will rework sediment and allow it to be deposited on marshes.

- Consider the use of coarser sediment, particularly in the creation of beaches, to protect areas from erosion. The Aramburu beach project in Marin County (built in 2011/2012) is an example of using coarse-grained sediment in a constructed beach to combat wind-wave erosion and sea-level rise.

- Develop sediment management plans that link regular dredging activities to local sites on a programmatic basis so that the sediment size, frequency and volume of placement can be matched to that generated by dredging. Where possible look for ecosystem-based adaptation strategies that allow the ecological values of the Baylands to be maintained while continuing to provide ecosystem services such as wave attenuation (IRWM Objectives 3.1, 4.3). For example, support multifunctional “green infrastructure” or “living shorelines” which take advantage of wetlands and mudflats along the bayshore and rivers to absorb floods, slow erosion, increase infiltration, slow runoff, improve water quality and storage, and provide habitat (e.g., the Oro Loma Ecotone Project – horizontal levee).

- Prioritize low-impact development (LID) stormwater practices in areas where storm sewers may be impaired by high water due to sea-level rise or flood waters (IRWM Objective 4.2).

- Support DWR strategies that minimize the impact of sea-level rise on salinity intrusion into the Delta, and protect levees in the Delta from the potential effects of projected sea-level rise (IRWM Objective 1.5).

16.5.4.3 Flooding

Climate change projections are not precise enough to indicate the likely location of extreme downpours that lead to flooding. However, it is projected that such intense storms will occur more frequently in the future, leading to more frequent and deeper flooding that may last longer if drainage is impaired.

Suggested Regional adaptation strategies to address potential increases in flood risk include:

- Improve emergency preparedness, response, evacuation and recovery plans in anticipation of potential increases in extreme events.

- Practice and promote coordinated and integrated flood management among water and flood management agencies (IRWM Objective 4.3). For example, flood management should be integrated with watershed management on open space, agricultural, wildlife areas, and other low-density lands to better utilize natural floodplain processes.

- Encourage policies that promote low impact development (LID) to maintain or restore historical hydrological characteristics (IRWM Objective 4.2).

- Consider policies or incentives to relocate infrastructure that is damaged or destroyed due to flooding to low-risk areas (IRWM Objective 4.1).

- Develop coordinated multi-agency/multi-jurisdiction plans to mitigate future risks of flooding, landslide, and related impacts through concurrent adoption of updated plans and policies (IRWM Objective 4.1).

- Implement National Flood Insurance Program (NFIP) activities to minimize and avoid new infrastructure or capital improvements in flood hazard areas (IRWM Objective 4.1).

- Restore, maintain and improve existing flood control and riparian corridors (IRWM Objective 4.1).

- Implement plans and policies aimed at restricting development in floodplains and landslide hazard areas (IRWM Objective 4.1).

16.5.4.4 Water Supply

Climate change projections suggest continued highly variable annual precipitation with slightly drier climate in the Sierra Nevada Mountains by mid-century. The overall impact will include reductions in imported water from the SWP, the CVP, Tuolumne River, and Mokelumne River and greater reliance on local supplies, recycled water, water conservation, and possibly desalination.

Suggested Regional adaptation strategies to address potential reductions in water supply (not in priority order) include the following:

- Continue aggressive water conservation and efficiency programs, including pooling regional resources where appropriate (IRWM Objective 2.4).

- Increase the use of recycled water for appropriate uses as a drought-proof water supply (IRWM Objective 2.5).

- Coordinate public outreach efforts to increase public acceptance of recycled water (IRWM Objective 1.8).

- Maximize conjunctive use, the coordinated management of surface water and groundwater supplies (IRWM Objectives 2.6 and 2.7).

- Integrate water supply and floodplain management (IRWM Objectives 2.6 and 4.3).

- Use conservative estimates of sea level rise in the Delta as design criteria whenever possible.

- Enhance the development and use of other local water sources, such as desalination, graywater, and rainwater/stormwater (when available) (IRWMP Objective 2.1).

- Develop local supplies (IRWM Objective 2.1)

- Reduce reliance on imported water, which depends on the Sierra snowpack for water supply (IRWM Objective 2.1).

- Consider implementation of regional desalination project(s) to improve water supply reliability (IRWM Objective 2.1).

- Enhance practices of water exchanges and water banking outside the Region to supplement water supply during dry years (IRWM Objective 2.1).

- Consider evaluation of existing intertie structural and policy constraints to improve potential movement of water supplies among neighboring agencies during periods of extreme water shortage (IRWM Objective 2.1).

- Increase “above-the-dam” regional natural water storage systems (WM 9) (IRWM Objective 2.6).

- Expand available water storage including both surface and groundwater storage projects (e.g., Contra Costa Water District’s Los Vaqueros Reservoir expansion). (IRWM Objective 2.6).

- Encourage local agencies to develop and implement Groundwater Management Plans, where appropriate, as a fundamental component of the IRWM plan (IRWM Objective 2.7).

- Adopt land use ordinances that protect natural functioning of groundwater recharge areas (IRWM Objectives 2.7 and 2.8).

16.5.4.5 Water Quality

Climate change projections suggest increased temperature and continued highly variable annual precipitation with a slightly drier climate by mid-century that could degrade water quality.

Suggested Regional adaptation strategies to address potential water quality impacts include the following:

- Support DWR and Reclamation strategies that protect or enhance the water quality of delivered by Delta-conveyed sources (IRWM Objective 2.2).

- Consider coordination with stakeholders to improve water quality in storage reservoirs through lake aeration practices where appropriate (IRWM Objective 2.2).

- Continue to control nutrient inputs to reservoirs from grazing, agriculture, septic systems, and runoff (IRWM Objectives 2.2 and 3.3);

  - Work with Resource Conservation Districts (RCDs) and ranchers to minimize grazing impacts around reservoirs and watersheds, such as fencing and alternative livestock water supplies.

  - Discourage residential and commercial development around drinking water reservoirs and watersheds;

  - Promote regional and local ordinances to protect drinking water reservoirs and watersheds with low impact land use and protective buffers;

  - Educate people on existing septic system regulations, system construction, maintenance, and replacement.

- Promote low risk land use practices such as open space, forest land parks, conservation easements, and land trusts around drinking water reservoirs and in watersheds and groundwater recharge areas (IRWM Objective 3.2).

- Consider potential water quality improvements associated with water transfers and water banking on Regional water supply (IRWM Objectives 2.1 and 2.2).

- Consider riparian forest projects that provide cooling for habitat (see Ecosystem and Habitat) (IRWM Objective 3.2).

- Evaluate capability of surface water treatment plants within the region to respond to increased turbidity from extreme storm events and increased risk of wildfires that affect source water quality (IRWM Objective 2.2).

- Evaluate surface water treatment plant technology and processes that may be required in the future to reduce DBPs, as well as taste and odor problems associated with increased algal blooms (IRWM Objective 2.2).

- Increase capacity for recharging groundwater with high quality water

- Encourage projects that clean up and improve the water quality of contaminated groundwater sources (IRWM Objective 2.8).

- Increase implementation of low impact development (LID) techniques to improve stormwater management (IRWM Objective 3.3).

- Continue to comply with NPDES permits to ensure water quality protection (IRWM Objectives 3.3 and 3.7).

- Control sediment loading and erosion with BMPs (IRWM Objective 3.4).

- Work with CalFire, FireSafe Councils, landowners, and stakeholders to develop Community Wildfire Protection Plan with actions to minimize risk and impact of wildfires and that include post fire actions to control erosion and runoff, and revegetation. Such as the Lexington Hills Community Wildfire Protection Plan, Santa Clara County FireSafe Council (IRWMP Objectives 2.2, 3.2, and 3.3).

16.5.4.6 Ecosystem and Habitat

Climate change projections of increasing average, minimum and maximum temperature suggest potential environmental stressors that may affect the sustainability of existing ecosystems and habitat. Regional adaptation strategies to address potential Ecosystem Health and Habitat impacts include the following:

- Provide or enhance connected “migration corridors” and linkages between undeveloped areas for animals and plants to promote increased biodiversity, and allow the plants and animals to migration and move to more suitable habitats to avoid serious impacts (IRWM Objectives 5.1 and 5.2).

- Improve passage and habitat for anadromous fish (IRWM Objective 5.3).

- Promote water resources management strategies that restore and enhance ecosystem services and the resiliency or adaptability of the habitats to climatic shifts (IRWM Objectives 3.1 and 3.2).
- Use purchase of development (PDR) or conservation easements to protect climate-vulnerable habitats (IRWM Objectives 5.1,and 5.2).
- Re-establish natural hydrologic connectivity between rivers and floodplains (IRWM Objective 3.5).
- Consider projects that provide seasonal aquatic habitat in streams and support corridors of native riparian forests that create shaded riverine and terrestrial habitat (IRWM Objective 5.1).
- Promote floodplain corridor vegetation projects (IRWM Objective 3.1).
- Identify and strategically prioritize for protection lands at the boundaries of the Bay that will provide the habitat range for tidal wetlands to adapt to sea-level rise (IRWM Objectives 5.1 and 5.2) such as the Shoreline Study which is being planned in San Jose which is integrated with the South Bay Salt Pond Restoration Program.
- Consider action to protect, enhance and restore upper watershed forests and meadow systems that act as natural water and snowpack storage (IRWM Objective 3.1).
- Support development of a Regional Sediment Management Plan for the Bay that will help to restore, protect and enhance tidal wetlands (IRWM Objective 3.1).

16.5.4.7 Water Demand

Climate change projections suggest increases in average annual air temperature as well as maximum and minimum daily temperatures by 2050 and increased evaporative losses are expected to increase outdoor urban, industrial cooling, and agricultural water demands.

Suggested Regional adaptation strategies to address potential increases in water demand include the following:

- Aggressively increase water use efficiency by encouraging water conservation beyond use efficiency and 20x2020 goals (IRWM Objective 2.4).
- Encourage agricultural and landscape water users to adopt all feasible Efficient Water Management Practices (EWMPs). (IRWM Objective 2.4)
- Support advancement and use of alternative irrigation techniques (e.g., subsurface drip irrigation) to reduce water use (IRWM Objectives 2.1 and 2.4).
- Implement tiered pricing to reduce water consumption and demand (IRWM Objectives 2.1 and 2.4).

16.5.4.8 Hydropower

Climate change projections suggest continued highly variable annual precipitation with slightly drier climate by mid-century, affecting hydropower generation. Strategies to address potential reductions in hydropower generated by the SWP and other Sierra Nevada hydropower projects that agencies participate in include the following:

- Support DWR, Bureau of Reclamation, and other hydropower project strategies to maximize hydropower in SWP, CVP, and other stakeholder facilities (IRWM Objective 1.4).
- Consider expanding available water storage at existing hydropower facilities (IRWM Objectives 1.4 and 2.1).
- Encourage reoperations that maintain water supply reliability and hydropower generation

Table 16-14 summarizes the vulnerabilities of each Watershed Characteristic, suggests an appropriate level of response to the vulnerabilities, and identifies future performance metrics that should be developed.

Table 16-15: Climate Change Vulnerability Assessment Responses and Performance Metrics

Vulnerability Areas by Ranked Order	General Overview of Responses and Performance Metrics
1. Sea-Level Rise	**Potential Climate Change Vulnerability** – Low lying baylands will become increasingly vulnerable to more frequent, longer and deeper flooding. **Sector Response in Context of Regional Planning** Existing coastal armoring (including levees, breakwaters, and other structures) is likely to be insufficient to protect against projected sea-level rise. Crest elevations of structures will have to be raised and armoring of structures increased to account for higher total water levels and larger waves. More use should be made of multifunctional green infrastructure along rivers and the bayshore. Consideration needs to be given to removing critical infrastructure out of the hazard zone. In the meanwhile, upgrade existing infrastructure to be water and salt resistant. **IRWMP Goal Impacted** – #1: Promote Environmental, Economic, and Social Sustainability. #2: Improve water supply reliability and quality, #3: Protect and improve watershed health and function and Bay water quality, #4: Improve regional flood management, and #5: Create, protect, enhance, and maintain environmental resources and habitats. **Performance Metric Development** – Based on reduction in population, and type and value of vulnerable infrastructure in the in hazard zone.

Vulnerability Areas by Ranked Order	General Overview of Responses and Performance Metrics
2. Flooding	**Potential Climate Change Vulnerability** – Climate change projections are not sensitive enough to assess short-term extreme events such as flooding; but the general expectation is that more intense storms would occur leading to more frequent, longer and deeper flooding. This could present larger areas susceptible to flooding and increase the risk of direct flood damage in the Region. There is the potential for increased river flooding due to rising sea level in the Bay. **Sector Response in Context of Regional Planning** Improve emergency preparedness, response, evacuation and recovery plans in anticipation of potential increases in extreme events. Practice and promote integrated flood management among water and flood management agencies, e.g., with watershed management on open space, agricultural, wildlife areas, and other low-density lands to better utilize natural floodplain processes. Agencies should implement plans and policies that decrease flood risk, and avoid significant new infrastructure or capital investment in areas that cannot be adequately protected from flooding. Encourage policies that promote or use low impact development LID practices to maintain or restore historical hydrological characteristics. **IRWMP Goal Impacted** – #4: Improve Regional Flood Management. **Performance Metric Development –** Reduction in critical infrastructure within the 500 year (or 200 year, if defined) floodplain. Reduction in value of vulnerable infrastructure in hazard zone. Number of local governments with plans, policies or programs to promote LID/Green Infrastructure and/or to otherwise decrease flood risk.

Vulnerability Areas by Ranked Order	General Overview of Responses and Performance Metrics
3a. Water Supply	**Potential Climate Change Vulnerability** – Climate change projections suggest continued highly variable annual precipitation with a slightly drier climate by mid-century. The overall impact on imported surface waters and groundwater supplies could be significant and could affect water supply availability. **Sector Response in Context of Regional Planning** **Imported Water** - Agencies relying on imported water sources will need to address shifts in runoff due more precipitation occurring as rain, decreasing Sierra Nevada snowpack, and less water availability due to droughts and reduced allocations from SWP and CVP deliveries. Future planned projects need to address changes in storage to accommodate changes in the timing and availability of these supplies. In addition, consider (or support efforts by DWR and federal agencies) investing in improving source water supplies through watershed improvements (e.g., meadow restoration and fuel management) and infrastructure improvements like system reoperation, delta conveyance, and (brackish) drought-resistant supplies such as recycled water. **Local Water Sources –** Some agencies rely on local watersheds and groundwater subbasins for their supply and are adversely affected by droughts. Future planned projects need to meet the water demand to accommodate the effects of climate change on water demand and water supplies. Consider improving groundwater recharge, , increasing local storage capacity, increasing the development and use of other water sources such as recycled water, graywater, rainwater/stormwater, desalination, as well as water use efficiency (WUE) measures. **IRWMP Goal Impacted** – #2: Improve Water Supply Reliability and Quality. **Performance Metric Development** – Based on State Water Project (SWP) and Central Valley project (CVP) deliveries, runoff patterns from Sierra Nevada snowpack, groundwater operation range limitations, quantities of drought-resistant new supply development (recycled water, water banking, desalination, etc.), and reliance on imported water.

Vulnerability Areas by Ranked Order	General Overview of Responses and Performance Metrics
3b. Hydropower	**Potential Climate Change Vulnerability** – Climate change projections suggest continued highly variable annual precipitation with slightly drier climate by mid-century, potentially changing the timing and amount of generation. **Sector Response in Context of Regional Planning -** Several water agencies in the Region depend on hydropower produced outside the Region. Any decreases in hydropower production could result in higher energy costs to the Region. Consider reoperations, diversifying energy portfolios, Water Usage Efficiency programs, and conservation measures to reduce energy usage. **IRWMP Goal Potentially Impacted –** #1: Promote Environmental, Economic, and Social Sustainability. **Performance Metric Development –** Based on energy charges incurred by water agencies relying on hydropower, and possibly a reduction in GHG emissions from energy portfolios.

Vulnerability Areas by Ranked Order	General Overview of Responses and Performance Metrics
4. Water Quality	**Potential Climate Change Vulnerability** – Climate change projections suggest continued highly variable annual precipitation with slightly drier climate and increased sea level rise in the delta by mid-century. There will be potential vulnerability for increased salinity in delta supplies, increased potential for algae and turbidity in imported and local water, and concentrated runoff in rivers and creeks. **Sector Response in Context of Regional Planning** **Imported Water** – Alternatives for managing imported water quality challenges include reoperations to change the timing of imported water deliveries or to blend imported supplies with other higher quality supplies, additional storage to provide time for natural processes to improve water quality (e.g., turbidity reduction) or facilitate reoperations, additional treatment, and treatment process modifications. **Regional Surface Water** – Opportunities to respond to water quality in regional surface water include fuel management to reduce wildfire risk, fire recovery plans to rehabilitate burn areas and reduce runoff, and habitat restoration for temperature moderation and for natural filtering. Additional surface water storage can also provide time for natural processes to improve water quality and facilitate reoperations. Additional treatment and treatment process modification may also response to water quality vulnerabilities, including turbidity excursions from extreme flooding events. **Regional Groundwater** – Responses to groundwater quality vulnerabilities include: increasing groundwater recharge capacity so that high quality water can be recharged when it is available, groundwater cleanup projects, developing local drought-resistant supplies to maintain groundwater levels, and avoid sea water intrusion. **IRWMP Goals Impacted** – #2: Improve Water Supply Reliability and Quality, and #3: Protect and Improve Watershed Health and Function and Bay Water Quality. **Performance Metric Development –** Based on source water quality exceedances (e.g., consecutive days with turbidity exceeding a trigger value, frequency of algal blooms, salinity and nitrate concentrations).

Vulnerability Areas by Ranked Order	General Overview of Responses and Performance Metrics
5. Ecosystem and Habitat	**Potential Climate Change Vulnerability** – Changes in the seasonal patterns of temperature, precipitation, and fire due to climate change can dramatically alter ecosystems that provide habitats for California's native species **Sector Response in Context of Regional Planning -** Climate change may result in species loss, increased invasive species' ranges, loss of ecosystem functions, and changes in growing ranges for vegetation. Other ideas may include habitat restoration and multi-benefit projects that incorporate ecosystem components (i.e., in supply, water treatment, and flood management projects). Increase the space available for habitats to adapt in a more dynamic landscape. Creation of habitat linkages, restoration design and planning responsive to climate vulnerabilities. Restoration of energy, water and sediment pathways in the landscape. **IRWMP Goal Impacted** – #5: Create, Protect, Enhance, and Maintain Environmental Resources and Habitats. **Performance Metric Development –** Amount of habitat created and/or maintained, habitat linkages species stability or recovery, acreage of invasive plant removal, and sediment accumulation (are wetlands keeping pace).
6. Water Demand	**Potential Climate Change Vulnerability** – Projected increase in average annual air temperature by mid-century and increased evaporative losses are expected to increase both urban and agricultural water demand. **Sector Response in Context of Regional Planning** **Urban Water Demand** – To respond to increases in irrigation demands, water managers should aggressively implement water conservation programs to achieve water savings beyond 20X2020 goals. Water conservation landscape programs include comparing site-specific irrigation budgets to actual water use as well as providing incentives for landscape conversion and upgrading to efficient irrigation equipment. **Agricultural Water Demand –** Water managers can support agricultural water conservation by supporting the improvements in irrigation efficiency through equipment and operations, as well as provide technical tools and data to support improvements. **IRWMP Goal Impacted** – #2: Improve Water Supply Reliability and Quality. **Performance Metric Development –** It is unclear that sufficient information is available to develop performance metrics unless a correlation between air temperature and water demand for the Region can be developed. One metric could be per capita water use.

16.6 Next Steps

16.6.1 Updates on Climate Change Research

Research on the climate change impacts on water resources is ongoing and continues to evolve with further analysis and more refined methodologies. During the preparation of this Plan update, key literature resources on climate change have been reviewed. New scientific findings should be reviewed periodically and incorporated into the climate change vulnerability assessment, especially the findings pertinent to the sectors most vulnerable to climate change in the Region. Consideration should be given to forming a Regional user's forum to facilitate networking among water resources planners to exchange ideas on how to incorporate latest tools or science into local planning.

16.6.2 Climate Change Models and Scenarios

The Climate Change Center of the California Energy Commission prepares periodic reports on climate model simulations for California and some specific Regions such as the San Francisco Bay Area. It also maintains the Cal-Adapt site and updates the modeling tools as new climate change modeling results, based on more refined data, become available from the IPCC. In addition, some agencies in the Region have prepared their own climate change analyses for their watersheds and have used these studies to develop scenarios for vulnerability and adaptation assessments. Agencies within the Region should explore ways where existing and updated climate models, and other available climate change tools and projections for the Region, can be used for future vulnerability assessments updated in future versions of the Plan.

16.6.3 Vulnerability Assessment Update

The intent of future data gathering is to address gaps in the current vulnerability assessment, to improve the understanding of climate change impacts and vulnerabilities, and to enable more quantitative analyses. Future data gathering efforts should include data that facilitate more quantitative analysis of the vulnerability, as described in the following sections. Data gathering efforts should be also be considered in the context of the current and proposed projects and funding available. Consideration should be given to coordinated multi-agency funding of more localized modeling, projections, and more rigorous vulnerability analysis of the more critical areas.

16.6.3.1 Sea-Level Rise

New projections of sea-level rise are being developed; each increasingly sophisticated and with higher resolution. These new projections should be incorporated into State guidance in a practical and systematic manner that allows resource managers to incorporate them into projects in a consistent manner. While the new projections will include decadal estimates and include greater regional variations, there will always be range of projections based upon future GHG emissions and guidance on how to incorporate this uncertainty should be made clear.

Future data gathering efforts to address the potential climate change effects on sea-level rise include the following:

- Create data packages that provide resource managers all the information they need in one place (e.g., tidal data, storm surge and waves, sea-level rise projections, vertical land movement, topography, and bathymetry).
- Develop guidance for the inclusion of vertical land movement at a project site; for example, sources of vertical land movement information that can be used to calculate relative sea-level rise.
- Regional monitoring of the geomorphological and ecological response of marshes and mudflats to observed sea-level rise.
- Develop regional adaptation strategies that incorporate both evolution of the natural shorelines and the protection of the built environment.
- Identify opportunities for the realignment of existing flood risk management levees that would create more resilient shorelines.
- Develop demonstration projects of shorelines that incorporate “green infrastructure” or “living shorelines” principles.

16.6.3.2 Flooding

A quantitative assessment of the potential impacts of climate change on flooding cannot be performed as climate projections are not detailed enough to project short-term extreme events such as flooding (flooding from sea level rise can be looked at more quantitatively). Rather, the 100-year and 500-year floodplains were used to define flooding risk zones that should be considered in location of water infrastructure.

Future data gathering efforts to address the potential climate change effects on flooding include the following:

- Perform an inventory of runoff monitoring stations in the Region to see if a more robust runoff record can be developed. Those data may allow an analysis of historical storm events correlated with precipitation events as well as annual precipitation to provide a better understanding of conditions that may lead to more extreme flooding conditions. This could also support a more robust flood warning system.
- Future work should focus on gathering the 200-year floodplain maps for the Region after DWR develops them. Currently, the 100-year and 500-year floodplain maps are available from the Federal Emergency Management Agency (FEMA).
- Promote better understanding of value of open space, riparian corridor, wetlands or natural habitats among land use decision makers.
- Coordinate with the Region stakeholders for advanced flood preparation and quick response and document the protocol(s).
- Perform an inventory of critical infrastructure located in floodplains and level of vulnerability to flooding.

- Update the projections of runoff with climate change as updates from the California Climate Change Center and the ICCC become available.
- Work with local flood plain managers and/or equivalent to determine areas of concern.

16.6.3.3 Water Supply

Future data gathering efforts to quantify the climate change effects on water supply include the following:

- Continue to monitor updates on surface water supply projections from the SWP and CVP to assess the effects of future climate change on Regional water supply.
- Update information on projections of changes in surface water runoff to Regional local water storage facilities for future climate change scenarios.
- Update available groundwater supply projections for each basin and sub-basin. Groundwater production in a given year varies depending on hydrologic conditions; pumping fluctuations due to demands and reductions on other sources, and changes in local hydrology and natural and artificial recharge are anticipated to have a direct impact on available groundwater storage and may affect current safe operating ranges to prevent overdrafts. Updates on trends in groundwater safe operating ranges will be needed when further assessments of water supply vulnerability to climate change are performed for future Plan updates.
- Evaluate the effects of reduction in precipitation from climate change on natural groundwater recharge. Further analysis is suggested to refine and to quantify the potential reduction in groundwater supply due to potential reduction in precipitation from climate change.

16.6.3.4 Water Quality

The assessment of the vulnerability of water quality to potential climate change impacts is qualitative due to the limited Regional monthly and seasonal weather information related to air temperature and precipitation over long time periods and limited access to long-term water quality data. The vulnerability assessment instead relied on California Climate Change Center model outputs for annual air temperature increases and precipitation changes and prior studies of how water quality in the Region may be affected by these climate change impacts. Key water quality changes identified for the Region include potential increases in the salinity of imported water, taste and odor events due to increased likelihood of algal blooms, and short-term high turbidity events due to storms, especially following wildfires. Collection of historical water quality data within the Region would greatly improve the understanding of Regional water quality and how it may be impacted by climate change.

Future data gathering efforts to quantify the climate change effects on water quality include:

- Monitor and collect historical water quality data within each sub-region during storm events.

- Collect long-term weather records associated with air temperature, precipitation, and ET to assess potential correlations with seasonal water quality.

- Continue to monitor groundwater levels and groundwater storage. Changes in groundwater recharge and/or pumping as a result of climate change could lead to overdraft and subsidence if they are not managed.

16.6.3.5 Ecosystem & Habitat

Adaptive management strategies need to be developed that can accommodate changing climatic conditions. This may require new management goals as it may not be possible to restore historical systems. Water resource managers are subject to regulatory requirements based on certain hydrology and other species related criteria (i.e. temperature). With climate change it may become more difficult for agencies to abide by the regulatory requirements they have committed to and more importantly, be able to achieve the ecosystem mitigations and enhancements that they are trying to accomplish. There needs to be an adaptive component to the regulatory requirements to acknowledge that the natural environment will be altered as a result of climate change. The efforts taken through projects, operations and mitigations may not be able to fully achieve their intended environmental outcomes, through no fault of their own, with respect to improvements in the natural environment. Goals may have to be set based on anticipated future conditions.

Future data gathering efforts to address the potential climate change effects on ecosystem and habitat include the following:

- Regional monitoring of the geomorphological and ecological response of marshes and mudflats to observed sea-level rise.

- Regional monitoring of the geographic range shifts of plants and animals to inform discussions on potential managed relocation.

- Vulnerability analysis of how climate change may affect specific habitats and inform future open space or buffer acquisition programs.

- Identify open space or buffer that would be critical to allow existing systems to evolve.

- Identify optimal genotypes for future conditions either by modeling future climates and patterns of adaptive variation across the range of a species or by experimental plantings and observing natural selection.

16.6.3.6 Water Demand

Future data gathering efforts to quantify the climate change effects on municipal and agricultural water demand include the following (note these efforts will require coordination among water purveyors who use different data collection systems):

- Collect and analyze historical monthly records of water demand data and weather (e.g., air temperature, ET, and precipitation) for each sub-region to quantify the weather effects on water use and seasonal variations in response to changes in historical temperature.

- Collect and analyze historical monthly records of water demand data for each purveyor in each sub-region to demonstrate purveyor-specific patterns in response to changes in climate.
- Based on the water demand and temperature data, develop regression analyses correlating water demand to temperature on a maximum day, monthly, and seasonal bases for each sub-region and each purveyor. The historical responses can be used to infer future response with the projected changes in temperature with climate change.
- Characterize the variations in indoor and outdoor water use, both for each sub-region and each purveyor. Future data gathering should focus on the seasonal and monthly patterns both in indoor and outdoor usage to evaluate the effects of weather conditions on each use category.
- Collect and analyze historical agricultural water demand to quantity the weather effects on water use and seasonal variations in response to changes in historical temperature.
- Identify the major industries in the Region that require cooling and/or process water. As water temperature increases, cooling water needs may also increase.

16.6.3.7 Hydropower

The Region relies on hydropower produced outside the Region, as well as locally, as a portion of its energy portfolio.

Future data gathering or assessment efforts to quantify the potential impacts of climate change on hydropower include:

- Agencies relying on hydropower for a portion of their energy supply may need to consider how reductions in hydropower availability can be replaced by other energy sources and how those sources impact their GHG footprints.
- Agencies that operate their own hydropower facilities should consider opportunities to modify their reservoir operations to optimize both water supply and hydropower production under future climate change scenarios.
- Agencies that are stakeholders in hydropower facilities operated by others should support efforts to modify reservoir operations to optimize both water supply and hydropower production.

16.6.4 Create a GHG Baseline

Each agency involved in the IRWMP should create an agency-specific comprehensive GHG inventory. A comprehensive inventory would use a well established protocol to calculate all of the GHG emissions created by each agency. It is recommended that each agency eventually conduct a GHG inventory, and numerous agencies in the Region have already done GHG inventories. However, in the absence of agency specific GHG inventories, gross GHG emissions can be calculated by developing agency-specific GHG intensity factors. An agency-specific GHG intensity factor calculates the estimated metric tons of CO_2 per acre foot of water delivered or million gallons of wastewater treated by the agency (MT CO_2/AF). Knowing this will enable an estimation of the GHG emission baseline for a particular agency and the Region. It will also allow for the estimation of the GHG emission reductions associated with an individual project or strategy that reduces water demand.

For each of the RWMGCC water or wastewater entities data will need to be collected for actual annual electricity, natural and fleet fuel used, as well as the amount of imported water from DWR and other suppliers. Using known GHG intensity factors for DWR water supplies, electrical supplies, natural gas and fleet fuel and applying these factors to the amount an agency uses, GHG emissions (MT CO_2/year) can be estimated for each agency. By dividing the total emissions by the total AF of water delivered or the million gallons of wastewater treated, agency-specific GHG intensity factors (MT CO_2/AF) can be developed. The calculation should use data from the same year. While not as precise and accurate as a comprehensive GHG inventory, a GHG intensity factor will create an estimated baseline of GHG emissions for each agency and the Region.

16.6.5 Quantify Adaption and Mitigation Strategies at the Project Level

In developing the project review process The PUT developed a scoring methodology that reflects the criteria of the 2012 Guidelines as well as the Bay Area IRWMP Goals and Objectives. The scoring criteria now consider and awards points for “Climate Change Adaptation” and “Reducing GHG Emissions” (Section 6.3.3).

the climate change impacts of specific projects proposed for implementation are being considered by a rough qualitative assessment of whether or not certain adaptation strategies apply or if a project reduces GHG emissions. No quantitative performance measurements are used to score the projects. Future Plan updates may have the data available to further quantify climate change adaptation and mitigation strategies and apply them at the project level. For each proposed project it may be desirable to identify GHG emissions and to identify and evaluate GHG reduction amounts. Proposed projects could be evaluated against the project GHG Baseline and evaluated for their ability to reduce agency-specific GHG intensity factors.

16.6.6 Develop Performance Metrics

As discussed in Section 3 Goals and Objectives, suggested measures (performance metrics) have been developed for individual IRWM objectives (see Table 3-2), The Region should develop climate change performance metrics specific to all projects and climate change (see Table 16-14 for examples). Proposed IRWMP projects would be evaluated against these metrics and these metrics would provide a measure of Plan performance.

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