

CHAPTER 11: TECHNICAL ANALYSIS

CONTENTS

11.1	Proposition 84 and 50 IRWM Grants - Technical Studies	2
11.1.1	Aromas and Purisima Groundwater Basin Management Study	2
11.1.2	Santa Margarita Groundwater Model Update.....	4
11.1.3	Conjunctive Use and Water Transfers - Phase II.....	4
11.1.4	Watsonville Sloughs Hydrologic Study.....	4
11.1.5	Additional Technical Studies	5
11.2	Local Plans, Assessments, and Technical Studies	6
11.2.1	Land Use Plans	7
11.2.2	Water Resource Management Plans	7
11.2.3	Water Quality Plans	8
11.2.4	Resource Stewardship Plans	9
11.2.5	Climate Change Planning	9
11.3	Data Gaps.....	19

TABLES

Table 11 - 1	Water Supply.....	11
Table 11 - 2	Land Use and Demographics.....	13
Table 11 - 3	Climate Change	14
Table 11 - 4	Watershed and Natural Resources	15
Table 11 - 5	Stormwater and Flood Management Plans	16
Table 11 - 6	Water Quality.....	17

The intent of this chapter is to document that the IRWM Plan is based on sound technical information and analyses. The following sections provide a description of the plans, studies, and methodologies used to shape the Regional Water Management Group (RWMG) and Steering Committee's understanding of water management in the Santa Cruz IRWM Region.

The Santa Cruz IRWM Plan was developed through collaborative discussions regarding regional needs, proposed projects, and teaming for regional effectiveness. The basis for many of these discussions were numerous studies, assessments, and planning documents prepared for the various stakeholders in the Region. As the stakeholders shared their needs and objectives, similarities and opportunities for collaboration were identified. During the IRWM Plan preparation and development, particularly through the development of the Plan's conceptual framework (see more below), data and water management strategies were collected from a number of existing local and/or sub-regional planning documents, and were integrated into the regional strategies presented in this document. Examples of local planning documents reviewed during the IRWM Plan development and update include urban water management plans, water supply master plans, capital improvement plans, recycled water master plans, project environmental impact reports/environmental impact statements, and grant applications for other state and federal programs. The specific plans, studies, and key reports used in the preparation of this IRWM Plan are listed at the end of this chapter.

The IRWM Plan is not intended to supersede local planning documents; rather the intent of the IRWM Plan is to provide a regional context from these studies and to support stakeholders in the IRWM process.

11.1 PROPOSITION 84 AND 50 IRWM GRANTS - TECHNICAL STUDIES

Several technical studies specifically carried out with IRWM funding were used in the development of this IRWM Plan. The California Department of Water Resources awarded \$999,750 in Proposition 84 IRWM Grant funds to the Regional Water Management Foundation to support the Santa Cruz Region's work updating the IRWM Plan and to complete key technical studies to guide water resources management. These technical studies provided critical data to evaluate resource management strategies to address the water resource challenges facing the Region. The studies include:

11.1.1 AROMAS AND PURISIMA GROUNDWATER BASIN MANAGEMENT STUDY

This planning and feasibility analysis examined the potential for redistribution of groundwater pumping in mid-county between the Aromas and Purisima Formations near the boundary of the Central Water District and Soquel Creek Water District. Groundwater from both aquifers is currently the sole source of water supply for both Districts. The Aromas is subject to seawater intrusion, elevated levels of hexavalent chromium (Cr-6), and groundwater overdraft. Currently, CWD pumps approximately 96% of its water supply from the Aromas area and 4% from the Purisima area. This study evaluated the potential to shift pumping from the Aromas to inland portions of the Purisima to balance the pumping and potential treatment costs for Cr-6 removal.

As part of the study, CWD's existing wells in the Purisima area on Cox Road were evaluated for their ability to increase pumping. Tests evaluated well condition, well production performance, dry season

well capacity, aquifer response to pumping and properties, and vertical flow and water quality profiles. Based on the age of the wells and documented degradation of well performance, it is recommended that existing wells be taken out of production and replaced with a single modern-designed production well. A new well would likely have a discharge capacity of 300 to 400 gpm and it was estimated that dry season production of approximately 160 acre-feet can be sustained.

In order to evaluate the sustainable yield for redistributing pumping to the Purisima, CWD's groundwater model was updated. The model was originally developed as a steady state model for use in CWD's Drinking Water Source Assessments.¹ The model was updated to simulated transient conditions from 1984-2009 for calibration to available groundwater level data and simulation of long-term groundwater level changes due to shifting pumping. Model inputs including pumping for private wells and some small water systems and return flow recharge were based on a spatial analysis of water use. Rainfall recharge and flow from upgradient watersheds were based on results from a watershed model using the Precipitation-Runoff Modeling System.² The western and eastern boundary conditions were based on groundwater level data from Soquel Creek Water District and Pajaro Valley Water Management Agency.

The updated groundwater model was calibrated to groundwater levels for 1984-2009 so that the model can be defensibly used to evaluate redistribution of pumping from the Aromas area to the Purisima area. Model calibration consisted of modifying the distribution and magnitude of horizontal hydraulic conductivity, vertical hydraulic conductivity, specific storage, and specific yield values. The updated groundwater model was used to simulate three groundwater management scenarios for comparison with a baseline simulation.

Simulation results showed that the strategy to redistribute pumping to a new Cox well is within the sustainable yield of the Purisima Formation that supplies the Cox well field. Shifting pumping from the Aromas area to the Purisima area will also reduce system Chromium VI concentrations while increasing CWD's reliability by diversifying its supply. Finally, CWD's increased inland pumping capacity potentially facilitates regional basin management if water in excess of CWD's demand can be used to help non-CWD pumpers reduce pumping closer to the coast to address seawater intrusion risk. The primary environmental effect of the strategy that may need further evaluation is the effect of predicted lower groundwater levels on the supply of private wells near the Cox well field. Cost estimates for constructing and developing the new well and destroying two of the existing wells were provided.

The study concluded that the strategy of shifting pumping from the Aromas area to Purisima area is beneficial for CWD and regional basin management. Replacing the aging wells at the Cox well field with a new well and treating the groundwater for iron and manganese will improve CWD's system reliability and water quality. Increasing inland pumping capacity has the potential to facilitate regional partnerships that help non-CWD pumpers reduce pumping near the coast to address seawater intrusion risk. The estimated capital cost of the well replacement and treatment system installation is \$2.7 million.

This study was completed in March 2014; the final report is available at the Santa Cruz IRWM website.

¹ Johnson, Nicholas M. Drinking Water Source Assessments (DWSAPs). Prepared for Central Water District, Aptos, California. March 2009.

² HydroMetrics WRI, 2011

11.1.2 SANTA MARGARITA GROUNDWATER MODEL UPDATE

Groundwater levels in portions of the Santa Margarita Groundwater Basin, which underlies the City of Scotts Valley, have declined over 200 feet in the past 30 years. The District relies upon a groundwater model and other monitoring data to inform its groundwater management. SVWD is still in the process of updating, calibrating, and improving the existing groundwater basin model to more accurately evaluate groundwater-surface water interactions. This will inform the District's efforts to restore groundwater levels and increase stream baseflow. This will also support other regional efforts and help to evaluate the expected effectiveness of conjunctive use projects for restoring groundwater levels and restoring stream baseflow. This study will be completed in fall 2014.

11.1.3 CONJUNCTIVE USE AND WATER TRANSFERS - PHASE II

Phase I technical studies (2008-11) evaluated the feasibility of water transfers and aquifer recharge to mitigate the water management problems in the Scotts Valley area. Phase II builds upon Phase I to estimate potential yields for various options of diverting San Lorenzo River winter flows, assess benefits of delivering water to reduce pumping from both overdrafted groundwater basins in Scotts Valley and Soquel, evaluate fish habitat needs to better characterize potential yields, identify infrastructure needs, preliminary designs and cost estimates; and, evaluate water rights options and other legal issues. Implementation of water transfers and exchanges has the potential to reduce groundwater pumping, recover groundwater levels and increase summer stream baseflow. It has the potential in the long term to provide for groundwater banking and some drought relief for the City of Santa Cruz. This study will be completed in fall 2014.

11.1.4 WATSONVILLE SLOUGHS HYDROLOGIC STUDY

The Watsonville Sloughs are a highly valued and unique freshwater wetland resource on the Central Coast. The Slough wetland complex has been modified significantly over the last 100 years, both in size and function. Agriculture and urban uses have encroached on wetland boundaries, portions of the system have been drained to allow farming, and urban development encircles the upper watersheds of three principal sloughs in the six-slough system. There are significant draws of deep groundwater to support these activities and there are subsurface drainage structures that discharge shallow groundwater back to the sloughs.

Many hydrologic control structures have been installed on surface waters throughout the watershed, including pumps, gates, culverts, bridges, and road crossings. Many of these structures modify the rate at which water flows through various portions of the system, dewatering habitat in some areas while contributing flooding in others. In addition to these control structures and extensive upstream/upland development, recent conversion of highly erodible rangelands to strawberry production has led to further modifications of the hydrologic system with elevated erosion rates resulting in deposition of fine sediments into the sloughs and drainage systems.

With these changes, and because of the system's hydrologic complexity, local planners, policymakers, and conservationists have been seeking a means to better understand the hydrologic function and the potential effects of possible future modifications in and around the sloughs. Funded by grants from the California Department of Water Resources and the State Coastal Conservancy, the RCD and its partners recently completed an extensive hydrologic study of the Sloughs, with technical and oversight support

from a steering team composed of local stakeholders and academics with a history of engagement in resource management and data collection in the Watsonville Sloughs watershed.

RCD consultant Balance Hydrologics used existing monitoring equipment and historic measurement records, and installed 11 new measurement gauges in the Sloughs and monitored how the Sloughs responded to rainfall and other movement of water over two water years (2011-2012 and 2012-2013) to develop extensive hydraulic and hydrologic models of the entire slough system. The models provide a means to better understand many questions, including:

- Understanding the overall function of the Sloughs;
- Providing data to support restoration and conservation planning and permitting of restoration projects;
- Understanding how the system might be better managed for water supply and recharge;
- Determining whether land is subsiding in sloughs and if so, by how much; and
- Understanding how water moving through the sloughs may provide opportunities to enhance habitat, water supply and quality, and flood management.

The complete final report was issued in February 2014 and includes the results and conclusions from the study, as well as recommendations for future work to refine the models and better understand the functioning of the Sloughs. The report can be found on the Santa Cruz IRWM and the RCD websites. Both the RCD and the Pajaro Valley Water Management Agency will retain electronic copies of the models for future use by local agencies, partners, and planners for projects including enhancement of water supply, flood management, ecosystem restoration, water quality, and recreational opportunities. This was an interregional study that also benefits the neighboring Pajaro River Watershed IRWM Region.

11.1.5 ADDITIONAL TECHNICAL STUDIES

Additionally, several technical studies were conducted with partial funding from the Region's 2008 Proposition 50 IRWM grant. These include:

Conjunctive Use Phase 1

The Santa Margarita Groundwater Basin is situated in the lower San Lorenzo River watershed. The increasing use of groundwater from the early 1980s through the early 2000s and the loss of infiltration and natural aquifer recharge caused by development resulted in precipitous decline in groundwater levels. Groundwater levels in some parts of the Scotts Valley area have declined as much as 200 feet over the past 25 years. The impacts from the aquifer overdraft include the drying up of wells in the region and a significant decline in groundwater quality. Local stream baseflow and water quality have been impacted by the groundwater decline. Eight technical studies were carried out that analyzed physical, environmental, and regulatory aspects of potential conjunctive use projects. Three preferred alternative project types were identified in the final report:

1. Enhanced stormwater recharge in the Scotts Valley area using low impact design (LID);
2. Inter-district exchange of water for in-lieu recharge of aquifers, and
3. Surface water diversion at Felton for groundwater recharge in the Hanson Quarry area.

Desalination Intake Study

A challenging aspect of the selection of an efficient and environmentally appropriate method to bring seawater into a small coastal desalination facility is gathering sufficient information and data to understand how each proposed intake concept would function at a specific site and at full capacity. The IRWM grant funded technical investigations that met the gaps in data that existed for furthering the conceptual designs of open-ocean and sub-seafloor intakes capable of providing 6.3 mgd of seawater to the proposed 2.5 mgd desalination facility.

Drainage Master Plan

The County prepared a drainage master plan for the Aptos Creek watershed and adjoining urban and coastal areas (Flood Control and Water Conservation District Zones 5 and 6). This includes the urban areas of Soquel Creek, Noble Gulch, Rodeo Gulch, and Arana Gulch. Work included field verification of drainage infrastructure and condition, evaluations of the drainage systems, and analysis of the watershed and the proposed improvements. The master plan assesses stormwater flows and facilitates development of policies and projects to manage flooding, reduce channel erosion, promote groundwater recharge, and improve stormwater quality.

Climate Change Impacts on Water Resources

The US Geological Survey (USGS) prepared an assessment of potential climate change impacts on water resources in the Santa Cruz region, including potential impacts on temperature, water demand, rainfall patterns, runoff and groundwater recharge. Global climate models were downscaled and use to run hydrologic models at the local watershed scale to assess impacts under different scenarios. This work, which is further described in Chapter 15, has greatly helped inform the development of the conceptual framework described below, as well as policies and projects for the region.

11.2 LOCAL PLANS, ASSESSMENTS, AND TECHNICAL STUDIES

This IRWM Plan was informed by a conceptual framework developed over a year-long planning process in close collaboration with a diverse and representative group of regional stakeholders. The framework is comprised of conceptual models for each of the four functional areas of the Plan - water supply, water quality, aquatic ecosystems, and flood and stormwater management - and serves as a tool to prioritize regional management strategies for implementation. Each conceptual model represents a hypothesis of cause and effect between components of the system and management strategies. Within each model, a climate change vulnerability assessment was completed with best available projections of future climatic conditions and used to identify strategies with climate change adaptation benefits. The conceptual framework identifies quantifiable metrics and condition targets (Chapter 9, Plan Performance and Monitoring) to be used to track progress of IRWM Plan implementation and the Plan's progress towards achieving objectives.

A wide variety of plans, assessments, and technical studies were used to support development of the conceptual models and therefore of this IRWM Plan. The IRWM Plan builds upon these existing efforts by integrating them into a water resources document with a regional focus. The manner in which the local plans inform this document is described in various chapters, including Chapter 4, Goals and Objectives, Chapter 13, Relation to Local Water and Land Use Planning, and Chapter 5, Resource Management Strategies. The following sections provide a general description of the types of documents used in the preparation of this IRWM Plan, and Tables 11-1 through 11-6 at the end of this chapter list the specific documents used, as well as the chapters of this IRWM Plan that they have informed.

11.2.1 LAND USE PLANS

Land use plans provide for the scientific, aesthetic, and orderly disposition of land, resources, facilities, and services for 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. In California, general plans have seven mandatory elements and may include any number of optional elements, e.g., a water element. Most local general planning documents generally have identified water resource management 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 (see below).

11.2.2 WATER RESOURCE MANAGEMENT PLANS

Various water resources 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. Plans such as groundwater management plans focus mainly on resource management, whereas urban water management plans and similar documents focus more on addressing water supply and demand and forecasting future needs.

Various regulatory and statutory responsibilities require agencies to prepare and implement groundwater management plans. Throughout the state, some agencies are special act districts that have groundwater management authority. However local districts, including Scotts Valley, Soquel Creek, and Central Water Districts have adopted 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 forms of regulation. AB 3030 lays out a procedure for development of a groundwater management plan. The act also specifies 12 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. The groundwater management plans prepared by local districts informed various chapters of this IRWM Plan, including Chapter 3, Region Description, and Chapter 9, Plan Performance and Monitoring.



Loch Lomond (photo courtesy: SCWD)

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 (UWMP), which is submitted to DWR in years ending in five and zero (e.g., 2005, 2010, and 2015). All of the local water supply agencies, with the exception of Central Water District, are subject to the Urban Water Management Planning Act. Each, with the exception of the San Lorenzo Valley Water District, have prepared and submitted their 2010 UWMPs to DWR for approval.

At the local level, general plans (see Chapter 13, Relation to Local Water and Land Use Planning) and municipal services reviews (MSRs) conducted throughout the region present analysis of land use, development plans, and population trends. 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 resources plans (IRPs), groundwater management plans, and stormwater management plans. Water master plans and IRPs 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 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.

Finally, the information developed in the project-specific plans serve as the foundation for development of IRWM Plan projects and programs. Perhaps because the Region relies on a locally derived water supply, there have been numerous studies and plans developed over the last decade related to water supply planning; these documents are listed in Tables 11-1 through 11-6.

11.2.3 WATER QUALITY PLANS

The Central Coast Regional Water Quality Control Board Basin Plan is the overriding water quality document that encompasses the region. Each of the nine hydrologic units of the state have a basin plan that 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 Water Board and Regional Water 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. As the basis for water quality regulation, the Central Coast Basin Plan is the driver for many of the water quality strategies outlined in this IRWM Plan.

The Santa Cruz Region is relatively free from large point sources of water pollution. Instead, the main water quality impact comes from non-point source pollution in the form of urban, agricultural, and rural runoff. Various stormwater management plans and related water quality control plans formed the basis for the strategies in the water quality functional area. These plans are described in Tables 11-1 to 11-6 at the end of this chapter. Finally, drainage master plans identify infrastructure necessary for effective stormwater management and implementation of best management practices (BMP). The strategies presented in these documents, together, provided the basis for development of the Santa Cruz IRWM Plan's water quality and stormwater management strategies.

11.2.4 RESOURCE STEWARDSHIP PLANS

Resource stewardship plans are those watershed, river, and conservation plans that analyze the natural, biological, recreational, and historical resources of a particular watershed, subregion, or the Santa Cruz Region as a whole. The Santa Cruz Region has a long history of developing watershed plans and assessments, many of which were initially developed in the 1990s to early 2000s and formed the basis for the Integrated Watershed Restoration Program (IWRP).

Beginning in the late 1970s, eight watershed restoration plans and a number of other related assessments were undertaken for seven watersheds in Santa Cruz County. Over the next few years, the focus shifted to ways to effectively implement these plan recommendations. Unfortunately, there were various barriers to implementing the plans, including inefficient competition for limited funding and costly and time-consuming regulatory processes, among others.

Staff from the Santa Cruz County Resource Conservation District (RCD), Coastal Conservancy, California Department of Fish and Game (CDFG), Coastal Watershed Council, and the City and County of Santa Cruz developed the concept for the Integrated Watershed Restoration Program (IWRP) for Santa Cruz County in 2002 to address these stumbling blocks. IWRP is a voluntary framework, put into place to coordinate resources, funding, and permitting agencies to reduce staff time and help ensure that critical projects are identified, funded, and permitted. IWRP also provides resources to local watershed partners for developing projects.

IWRP has been heralded as a model for collaborative, integrated watershed stewardship by local partners, key funders, as well as state and federal partners. Due to the program's success in identifying, developing, and implementing high priority restoration projects, the staff and management at the National Marine Fisheries Service, US Fish and Wildlife Service, and the California Department of Fish and Game requested that the State Coastal Conservancy expand IWRP and its associated funding to cover the neighboring counties of San Mateo and Monterey. Since IWRP's inception, the RCD and its partners have been able to design, permit, and construct over 80 water quality improvement and habitat restoration projects throughout the County. More than 40 of these projects were implemented with partial funding from the Region's 2008 IWRM Implementation Grant.



Laguna Creek Floodplain Restoration

11.2.5 CLIMATE CHANGE PLANNING

Projected climate changes are expected to have a number of negative impacts on the natural and socioeconomic systems throughout the world. Recently developed regional downscaling approaches have increased the usability of climate change projection information for regional decision makers. Climate change model predictions specific to California and the Santa Cruz region have been reviewed and incorporated into the IRWM conceptual framework in a format that is intended to be accessible and useful for regional decision makers. The potential impacts of these future climatic and hydrologic

changes have been evaluated in the context of each of the IRWM functional areas to identify opportunities for adaptation to reduce the vulnerability of water supply, water quality, aquatic ecosystems, and flood hazards in the region.

The tables below present the technical sources and methodologies used in developing this IRWM Plan, along with a brief explanation of how the local plans were used in the IRWM Plan.

Table 11 - 1 Water Supply

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
City of Santa Cruz 2010 Urban Water Management Plan (December 2011)	City of Santa Cruz	Population based water demand projections based on historical use and recent trends and climate projections	Water demand projections; water supply availability under future conditions	Used as basis for determining water supply and demand projections incorporated into Region Description
Water Supply Assessment General Plan 2030 (March 2011)	City of Santa Cruz	Population based water demand projections based on historical use and recent trends and climate projections	Projected water demands associated with General Plan projections, total water demand and supply for 20 year planning horizon	Water supply and demand projections, supplemental supply alternatives incorporated into Region Description and Resource Management Strategies chapters
Proposed scwd ² Regional Seawater Desalination Project Draft EIR (May 2013)	City of Santa Cruz / Soquel Creek Water District	Analyses of impacts and benefits, alternatives, and technical feasibility. Region description, water supply and demand trends	Updated supply and demand projections, description of study area, description of water supply operations and constraints, description of impacts and mitigations	Water supply and demand, supplemental supply alternatives, agency/district descriptions incorporated into Region Description and Resource Management Strategies chapters
City of Santa Cruz Habitat Conservation Plan: Conservation Strategy for Steelhead and Coho Salmon. Draft Report (August 2011)	City of Santa Cruz	Water system and stream habitat modeling, statistical analysis	Relationship between water diversions and streamflow, habitat assessments, streamflow targets	Draft stream flow requirements incorporated into Region Description and Monitoring chapters
City of Watsonville 2010 Urban Water Management Plan	City of Watsonville	Population based water demand projections based on historical use and recent trends and climate projections	Water demand projections; water supply availability under future conditions	Water supply and demand forecasts incorporated into Region Description chapter
Revised 2010 Urban Water Management Plan (2011)	Scotts Valley Water District	Population based water demand projections based on historical use and recent trends and climate projections	Water demand projections; water supply availability under future conditions	Water supply and demand projections incorporated into Region Description chapter

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Urban Water Management Plan 2010 (2011)	Soquel Creek Water District	Population based water demand projections based on historical use and recent trends and climate projections	Water demand projections; water supply availability under future conditions	Water supply and demand projections incorporated into Region Description chapter
San Lorenzo Valley Water District Water Supply Master Plan (2009)	San Lorenzo Valley Water District	Population based water demand projections based on historical use and recent trends and climate projections	Water demand projections; water supply availability under future conditions	Water supply and demand projections incorporated into Region Description chapter
Annual State of the Basin Report, Water Year 2011 (May 2012)	Soquel Creek Water District	Groundwater elevation monitoring, basin modeling	Status and trends of groundwater basin	Groundwater status and trends incorporated into Region Description and Monitoring chapters
2012 Integrated Resources Plan Update (September 2012)	Soquel Creek Water District	Assessment of basin conditions, demand projections based on use and projected population	Water demand projections; water supply availability under future conditions	Updated water supply and demand projections, water supply alternatives and conservation incorporated into Region Description and Resource Management Strategies chapters
Annual Groundwater Report, 2011 Water Year (June 2012)	Scotts Valley Water District	Groundwater elevation monitoring, basin modeling	Status and trends of groundwater basin	Groundwater status and trends incorporated into Region Description and Monitoring chapters
Integrated Water Plan (June 2003)	City of Santa Cruz	Confluence® model, supply and demand projections	Water demand projections; water supply availability under future conditions	Identified potential resource management strategies and supported development of the Region Description chapter

Table 11 - 2 Land Use and Demographics

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Santa Cruz County General Plan and Local Coastal Program (December 1994)	County of Santa Cruz	Population projections	Population estimates; resource protection goals and objectives	Supporting information for the Region Description chapter
City of Santa Cruz General Plan 2030 and Local Coastal Program (June 2012)	City of Santa Cruz	Population projections	Population estimates; resource protection goals and objectives	Supporting information for the Region Description chapter
City of Capitola General Plan and Local Coastal Program (Public Draft Review December 2013)	City of Capitola	Population projections	Population estimates; resource protection goals and objectives	Supporting information for the Region Description chapter
City of Scotts Valley General Plan and Local Coastal Program (1994)	City of Scotts Valley	Population projections	Population estimates; resource protection goals and objectives	Supporting information for the Region Description chapter
Watsonville Vista 2030 General Plan (January 2013)	City of Watsonville	Population projections	Population estimates; resource protection goals and objectives	Supporting information for the Region Description chapter
2035 Metropolitan Transportation Plan / Sustainable Communities Strategy (Draft, February 2014)	Santa Cruz County Regional Transportation Commission	Transportation modeling; vehicle use summaries; land use descriptions	Land use information; planned infrastructure improvements	Supporting information for the Region Description chapter
State of the Region (2012)	AMBAG	Population projections; summary of conditions	Population estimates, land use trends	Supporting information for the Region Description chapter
Community Assessment Project 2013 (2013)	United Way of Santa Cruz County	Statistical analysis, phone surveys	Assessment of social and economic conditions; summary of opinions regarding environment and other concerns	Supporting information for the Region Description chapter

Table 11 - 3 Climate Change

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Simulation of Climate Change in San Francisco Bay Basins, California: Case Studies in the Russian River Valley and Santa Cruz Mountains (2012)	Lorraine E. Flint and Alan L. Flint - USGS	Downscaled climate change models; statistical analysis; runoff model	Assessment of future temperature, rainfall, runoff and recharge under climate change	Climate change impacts on rainfall, runoff, and recharge incorporated into Region Description and Climate Change chapters
City of Santa Cruz Climate Change Vulnerability Assessment (2011)	Gary Griggs and Brent Haddad	Literature review; compilation of GHG and other data	Vulnerabilities and potential adaptation strategies for climate change response	Climate change vulnerability assessment incorporated into Region Description and Climate Change chapters
City of Santa Cruz Climate Action Plan (June 2012)	City of Santa Cruz	Literature review; compilation of GHG and other data	Vulnerabilities and potential adaptation strategies for climate change response	GHG emissions inventory incorporated into Climate Change and Resource Management Strategies chapters
City of Watsonville Climate Action Plan (2014)	City of Watsonville	Literature review; compilation of GHG and other data	Vulnerabilities and potential adaptation strategies for climate change response	GHG emissions inventory incorporated into Climate Change and Resource Management Strategies chapters
County of Santa Cruz Climate action Strategy (2013)	County of Santa Cruz	Literature review; compilation of GHG and other data	Vulnerabilities and potential mitigation and adaptation strategies for climate change response	GHG emissions inventory incorporated into Climate Change and Resource Management Strategies chapters

Table 11 - 4 Watershed and Natural Resources

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Watsonville Sloughs Watershed Resource Conservation & Enhancement Plan (January 2003)	County of Santa Cruz	Biological surveys, habitat assessments	Resource descriptions, potential management strategies	Watershed study with recommended restoration actions informing Region Description and Resource Management Strategies chapters
Watsonville Sloughs Hydrologic Study (February 2014)	Resource Conservation District of Santa Cruz County	HEC modeling; water surface elevation monitoring; flow monitoring	Updated condition assessment and hydrologic information	Base hydraulic and hydrologic data for potential restoration projects informing Region Description and Resource Management Strategies chapters
San Lorenzo River Salmonid Enhancement Plan (March 2004)	Santa Cruz County	Biological surveys, habitat assessments	Resource descriptions, potential management strategies	Restoration projects for salmonid enhancement informing Resource Management Strategies chapters
A Conservation Blueprint (May 2011)	Land Trust of Santa Cruz County	GIS analysis; surveys; literature review	Resource descriptions; GIS layers; maps	Biotic and other supporting data and information for the Region Description chapter
Aptos Creek Watershed Enhancement Plan (April 2003)	Coastal Watershed Council	Biological surveys, habitat assessments	Resource descriptions, potential management strategies	Biotic and other supporting data and information for the Region Description chapter as well as Resource Management Strategies
Soquel Creek Watershed Assessment and Enhancement Project Plan (November 2003)	Resource Conservation District of Santa Cruz County	Biological surveys, habitat assessments	Resource descriptions, potential management strategies	Biotic and other supporting data and information for the Region Description chapter as well as Resource Management Strategies
San Lorenzo River Watershed Management Plan (1979, updated 2001)	County of Santa Cruz	Biological surveys, habitat assessments, water quality and sediment source assessments	Resource descriptions, potential management strategies	Water quality , hydrologic data, and other supporting data for the Region Description chapter
San Vicente Creek - Plan for Salmonid Recovery (February 2014)	Resource Conservation District of Santa Cruz County	Biological surveys, habitat assessments	Resource descriptions, potential management strategies	Biotic and other supporting data and information for the Region Description chapter as well as Resource Management Strategies

Table 11 - 5 Stormwater and Flood Management Plans

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Storm Water Management Program (November 2010)	Santa Cruz County, City of Capitola	Water quality data analysis; literature review	Strategies to address water quality issues / concerns	Management actions to address stormwater pollution informing Region Description and Resource Management Strategies chapters
Storm Water Management Plan (Revised March 2010)	City of Santa Cruz	Water quality data analysis; literature review	Strategies to address water quality issues / concerns	Management actions to address stormwater pollution informing Region Description and Resource Management Strategies chapters
Storm Drain Master Plan Santa Cruz County, CA, Zones 5 and 6 (August 2013)	County of Santa Cruz	Hydraulic modeling	Condition assessment; strategy descriptions	Overview of flooding/drainage system and management options informing Region Description and Resource Management Strategies chapters

Table 11 - 6 Water Quality

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Water Quality Control Plan for the Central Coast Basin (June 2011)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality targets	Water quality status and sources of pollution; management recommendations informing Region Description and Resource Management Strategies chapters
Assessment of Sources of Bacterial Contamination at Santa Cruz County Beaches, 2006 (March 2006)	County of Santa Cruz	Water quality sampling, bacterial ribotyping, statistical analysis, epidemiological studies	Water quality conditions, related human health impacts	Water quality status and sources of pollution; management recommendations informing Region Description and Resource Management Strategies chapters
San Lorenzo River Watershed Management Plan Update (December 2001)	County of Santa Cruz	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Watershed conditions and project implementation status informing Region Description and Resource Management Strategies chapters
Wastewater Management Plan for the San Lorenzo River Watershed (1995)	County of Santa Cruz	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Watershed condition and management recommendations informing Region Description, Resource Management Strategies, and Monitoring chapters
San Lorenzo River Total Maximum Daily Load for Sediment (September 20, 2002)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Load allocation, management actions and monitoring recommendations informing Region Description, Resource Management Strategies, and Monitoring chapters
San Lorenzo River Watershed Nitrate Total Maximum Daily Load for Santa Cruz, CA (September 2000)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Load allocation, management actions and monitoring recommendations informing Region Description, Resource Management Strategies, and Monitoring chapters
Total Maximum Daily Load for Pathogens in San Lorenzo River Watershed Waters (including tributaries) (May 8, 2009)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Load allocation, management actions, and monitoring recommendations informing Region Description, Resource Management Strategies, and Monitoring chapters

Document Title or Description (Date)	Lead Agencies	Technical Analysis or Method Used	Results/ Derived Information	Use in IRWM Plan
Total Maximum Daily Load for Pathogens in Aptos Creek, Valencia Creek and Trout Gulch, Santa Cruz County, CA (May 8, 2009)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Load allocation, management actions, and monitoring recommendations informing Region Description, Resource Management Strategies and Monitoring chapters
Total Maximum Daily Load for Fecal Coliform in Soquel Lagoon, Soquel Creek and Noble Gulch, Santa Cruz County, CA (May 8, 2009)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Load allocation, management actions, and monitoring recommendations informing Region Description, Resource Management Strategies, and Monitoring chapters
Total Maximum Daily Load for Pathogens in Watsonville Slough, Santa Cruz County, CA (December 16, 2005)	Central Coast Regional Water Quality Control Board	Summary of conditions; water quality analysis	Water quality status and trends, management recommendations	Load allocation, management actions, and monitoring recommendations informing Region Description, Resource Management Strategies, and Monitoring chapters

11.3 DATA GAPS

Each technical information source that has been used in the development of this IRWM Plan represents the latest or most currently available information available for that source. Each source is broadly considered to be a reliable and acceptable source of information by water resource managers and related professionals in the field. Thus, the information and data that have been used are considered to be representative and adequate for the development of this IRWM Plan. However, some of the data is being further developed and refined and some data gaps do exist:

- Regional climate, including projections of microclimatic change and fog
- Groundwater model for the Soquel-Aptos basin
- More precise data on sea level rise, and impact on coastal river and stream flooding
- Weather variability, and how will projected changes in climatic water deficit match reality
- Drought measurement of stream baseflow to determine which portions of the watershed are gaining or losing reaches
- Benefits of managed aquifer recharge projects in terms of water supply and basin recharge
- Effectiveness of demand offset programs in terms of providing real water savings
- Assessment of impacts on fish habitat and establishment of workable baseflow regimes for habitat protection and restoration

Note that all of the data and information contained in this IRWM Plan will be reviewed and updated approximately every five years, depending on available funds, as part of the formal IRWM Plan update. Some data will be reviewed on a more frequent basis; for example, MHI data will be reviewed prior to every Proposition 84 Implementation Grant solicitation, using the ACS five-year survey estimates, in order to determine the status of DACs in the region.