

CHAPTER 5: RESOURCE MANAGEMENT STRATEGIES

CONTENTS

5.2	Selection of Santa Cruz Region Resource Management Strategies.....	2
5.3	California Water Plan Resource Management Strategies.....	9
5.2.1	Reduce Water Demand.....	9
5.2.2	Operational Efficiency and Transfers.....	10
5.2.3	Increase Water Supply.....	11
5.2.4	Improve Water Quality.....	12
5.2.5	Practice Resources Stewardship.....	13
5.2.6	Improve Flood Management.....	15
5.2.7	Other.....	15

TABLES

Table 5 - 1	Priority Santa Cruz IRWM Strategies.....	5
Table 5 - 2	Selected Water Plan 2009 Resource Management Strategies.....	9
Table 5 - 3	Number of Projects Addressing Each Resource Management Strategies.....	25
Table 5 - 4	Relationship between SC IRWM Strategies and California Water Plan Resource Management Strategies.....	17

The Proposition 84/1E Integrated Regional Water Management (IRWM) Grant Program Guidelines require regional water management groups (RWMGs) to evaluate and include in IRWM Plans, as applicable, various resource management strategies, including those listed in the *California Water Plan Update 2009*. The intent of this standard is to encourage an integrated and diversified approach to resource management that is more resilient and mitigates for uncertain future circumstances, such as climate change. The following sections describe the process by which strategies were prioritized for the Santa Cruz IRWM region, how the California Water Plan resource management strategies were evaluated, and the degree to which they are being implemented within the Santa Cruz IRWM region.

5.1 SELECTION OF SANTA CRUZ REGION RESOURCE MANAGEMENT STRATEGIES

The original IRWM Plan for the Santa Cruz Region was prepared in response to the Proposition 50, Chapter 8 IRWM Guidelines¹ and adopted by the Partner Agencies in 2005. As part of that Plan's development, the Santa Cruz IRWM Steering Committee identified and prioritized a list of 55 projects derived from numerous water and water resource related plans and studies conducted throughout the region. The projects were prioritized by evaluating each against a set of planning objectives created for the region. The plan also related those planning objectives to the original 20 water management strategies described in the IRWM Guidelines. A limitation of this planning effort was that the project prioritization was weighted towards the project's grant competitiveness, and did not necessarily evaluate the degree to which each project would help achieve plan objectives. This limitation was addressed by the Santa Cruz IRWM Steering Committee through the 2014 plan update process. To identify strategies based on their ability to achieve objectives, the Steering Committee used funding from a Proposition 84 Planning Grant administered by the Department of Water Resources to develop a conceptual framework for the Santa Cruz IRWM Plan. Conceptual frameworks are planning constructs that have been employed in other regions of the state to assist resource managers in filtering strategies to those that will have the greatest ability to achieve objectives. To accomplish this, a work group consisting of representatives of the Regional Water Management Group (RWMG) and stakeholders was formed in early 2012, and this group developed the framework over the course of a year and several meetings. The conceptual framework is comprised of models, developed by subcommittees of the work group, for each of the four functional areas of the IRWM plan - water supply, water quality, flood/stormwater management, and watershed resources. Each model is a hypothesis of the cause and effect between strategies and management objectives. Explicitly stated within each conceptual model is the hypothesis that effective implementation of particular strategies will ultimately result in achievement of IRWM objectives, as observed through monitoring of specific indicators. The strategies have been prioritized into "high," "moderate," and "low" according to their perceived ability to help achieve the IRWM Plan objectives. Each conceptual model includes goals, objectives, diagrams, and tables that guide effective strategy implementation. The following summarizes the priority strategies for the Santa Cruz IRWM region.

Water Supply: Water supply is not sustainable within the Santa Cruz IRWM region in normal years, a situation that is exacerbated when below average water years occur. Surface water supply is highly

¹ State Water Resources Control Board. November 2004. Integrated Regional Water Management Grant Program Guidelines.

dependent upon local precipitation, timing, and available storage capacity. A greater volume of water is extracted annually from regional groundwater aquifers than is naturally recharged. Increased flexibility in regional water management and increased groundwater recharge are necessary to improve regional water supply reliability and improve resource conditions. The achievement of a reliable and sustainable local water supply will require increased supply or reduced demand or a combination of both. The regional water supply management strategies include:

- increasing conservation measures through such measures as rebates, conservation pricing, and, implementing policies to minimize additional demand from new growth;
- investigating the feasibility of the development of alternative/supplemental sources of water to meet supply needs including the infrastructure necessary to facilitate inter-district transfers or the use of recycled water;
- increasing production from existing sources including increased ability to capture, store, and transfer greater winter storm volumes.

Annual tracking of aquifer water surface elevations and stream flow conditions relative to desired sustainable targets will serve as the measurable indicator of benefit from these strategies.

Water Quality: Water quality impairments caused by elevated bacteria and sediment levels are among the most pressing water quality concerns in the region. Elevated bacteria levels in surface waters can limit recreational activities and create human health threats. An important and controllable regional source of bacteria and nitrate to streams and the near shore is the dense and aging sewage system networks in urban and rural areas. Upgrades and maintenance to rural residential septic systems, as well as urban sewer lines and laterals, to reduce leakage, spills, and failures are priority IRWM strategies. A reducing trend of dry season bacteria levels in regional surface water may demonstrate future progress of reducing bacteria sources.

The supply of sand-sized sediment to streams significantly degrades aquatic habitat quality, resulting in negative ecosystem impacts that particularly affect the spawning and rearing habitat of sensitive salmonid species. Implementation of effective erosion control actions to reduce sediment generated from rural road networks, timber harvest activities, development activities, and agricultural lands are priority IRWM strategies. Simple methods to measure the relative risk of rural road sediment generation are being developed and could be used to track effective IRWM-supported efforts, including improvements and maintenance, on public and private roads over time.

Aquatic Ecosystems: Strategies aimed to acquire, enhance, and protect the riparian zones throughout the region are expected to contribute to all of the Santa Cruz IRWM functional goals and reduce the region's vulnerability to climate change impacts. Significant opportunities exist to widen riparian corridors; increase riparian vegetation distribution and complexity; restore morphologic function; and improve overall riparian condition in watersheds throughout the region. Effective riparian enhancement strategies will vary by stream type, location, and adjacent land uses. Riparian zone acquisitions and easements or compensation for parcels within the floodplain could allow future land use changes, potential improvements in flood conveyance and an associated reduction of flood hazards. Many of the regional flood-prone urban areas are located near the coast, where effective riparian enhancement actions would increase the habitat quality and quantity of tidal wetlands, which are critical habitat for rearing salmonids. Functional riparian zones have access to their floodplains, a well-established vegetation canopy, an energy balanced morphology, and a complex physical structure. All of these attributes support natural fluvial processes that improve water quality and remove pollutants through

deposition, filtering, and sorting. A riparian zone in good condition can flush fine sediment from the channel bed, thereby improving salmonid spawning habitat quality as well benthic invertebrate abundance and diversity. Given the dependence on local water for potable supply, improved riparian conditions will reduce water treatment requirements, increase local recharge and retention of water volumes on the landscape, and contribute to the goal of providing a sustainable water supply.

Flood & Stormwater Management: Strategies to reduce the impact of impervious surfaces on the hydrologic function of regional watersheds were identified in each of the four functional areas. Regional opportunities to increase the fraction of rainfall that is infiltrated can be realized by disconnecting impervious surfaces; increasing localized parcel-based infiltration through low impact development (LID) on both private and public lands; the construction and maintenance of recharge basins; and the prevention and/or removal of impervious surfaces in known recharge zones. In order to have a measurable impact on the amount of water lost as runoff in developed areas, these strategies would have to be implemented on a vast spatial scale throughout the impervious areas within the region. Effective implementation of these strategies is collectively intended to restore the natural storm hydrograph in local tributaries and increase groundwater recharge. Increasing infiltration opportunities will retain greater annual volumes on the landscape and mitigate several projected climate change impacts, including a longer, warmer dry season and increased drought frequency. Note that development of the conceptual models took into consideration the effects of climate change on the region, including the effects of sea level rise and potential impacts on water supply. The strategies identified through the conceptual framework encourage and promote projects that implement climate change mitigation and adaptation measures, including water use efficiency, energy efficiency, water recycling, and reuse of urban runoff.

Table 5-1 summarizes the objectives, drivers, and strategies identified through the conceptual framework planning process. Drivers are the natural or man-made influences on the objectives that define each objective. For example, the amount of potable water that can be produced (production capacity) is a key driver for ensuring a sustainable water supply. Inclusion of the drivers provides an example of the mechanisms through which the strategy will achieve the objective. It should be noted that some strategies are repeated in this table because they are associated with more than one driver and objective.

Table 5 - 1 Priority Strategies by Objective

Objective	Driver	Santa Cruz IRWM Strategy
Ensure a reliable and sustainable local water supply through strategies that diversify the supply portfolio, develop production from alternative/supplemental sources, protect and enhance surface and ground water, protect against seawater intrusion, and maximize efficient delivery and use.	Production capacity	Develop production from alternative/supplemental sources
		Increase production from existing resources
	Water supply reliability	Implement system inerties
	Pipe and facility condition	Update/replace aging infrastructure
	Groundwater aquifer storage	Construct and maintain groundwater recharge facilities
		Prevent/remove impervious coverage in recharge zones; reduce directly connected impervious area (DCIA)
		Shift groundwater pumping from coastal zone
		Support low impact development (LID)/redevelopment

High priority strategies in bold; Moderate priority

Objective	Driver	Santa Cruz IRWM Strategy
Reduce water demand as technically and economically feasible, particularly in relation to the cost of additional sources.	Water price	Utilize tiered rates/conservation pricing
	Water demand; Usage efficiency	Conduct education/outreach on conservation
	Water demand; Usage efficiency	Implement policies to minimize additional demand from new growth
	Usage efficiency	Implement groundwater management that includes non-municipal pumpers, to promote sustainable groundwater use
	Usage efficiency	Utilize temporary use restrictions as needed during critical supply shortages
	Usage efficiency	Utilize rebate/retrofit programs
	Usage efficiency	Conduct Irrigation management and water conservation

High priority strategies in bold; Moderate priority

Objective	Driver	Santa Cruz IRWM Strategy
Reduce the sources of harmful pollutants (i.e., sediment, bacteria, nitrate, persistent organics, toxic constituents) and impacts on aquatic resources.	Roads	Perform rural road improvements and maintenance
	Timberlands	Implement BMPs related to timber harvest activities
		Implement erosion control measures
	Riparian corridor health	Riparian acquisition or restoration
	Row crops Vineyards/Orchards	Develop and implement Farm Plans that include effective nutrient, sediment and irrigation measures
	Septic systems	Implement septic system upgrades, provide incentives and/or maintenance
	Sewer systems	Perform sewer system upgrades and maintenance
		Promote/implement private property sewer lateral upgrades and maintenance
	Encampments	Removal of encampments from riparian zones
	Urban non point sources	Conduct street sweeping
		Conduct regular infrastructure cleaning and maintenance
Livestock	Implement riparian exclusions for livestock	
	Implement livestock waste management BMPs	

High priority strategies in bold; Moderate priority

Objective	Driver	Santa Cruz IRWM Strategy
Increase the habitat quality and quantity of critical aquatic ecosystems (i.e. streams, tidal wetlands and fresh water wetlands).	Hydrologic barriers, Pool Depth and Channel Complexity	Reduce stream withdrawals and increase base flow at critical times to achieve streamflow targets
		Identify and eliminate illegal diversions
		Restore stream form and function
	Riparian corridor width Floodplain connectivity	Riparian zone acquisition/easements
		Reduce riparian encroachment
	Substrate grain size	Reduce erosion and sedimentation from public and private roads, unpermitted grading, and other sources.
	Large woody debris (LWD)	Preserve and enhance large woody debris (LWD) in streams and riparian zone
	Riparian corridor canopy cover; Riparian vegetation composition	Remove non-native species
		Conduct riparian revegetation
		Reduce riparian encroachment
	Constructed fish passage barriers	Remove or retrofit fish passage barriers
	Habitat complexity Edge condition Width to depth ratio	Increase/enhance physical structure and biotic habitat complexity
	Bar dynamics	Promote natural sand bar function
	Habitat complexity	Non-native species eradication
	Hydrology	Improve wetland hydrology to support desired biota
	Community Stewardship	Support education/outreach/technical training programs
		Support volunteer stewardship programs
Support school programs		
Reduce illegal dumping		
Reduce illegal diversions		
Water temperature	Riparian corridor acquisition/protection	
	Riparian vegetation protection and enhancement	
	Restore stream hydro-geomorphic function	

High priority strategies in bold; Moderate priority

Objective	Driver	Santa Cruz IRWM Strategy
Implement integrated flood management strategies that reduce hazards and impacts from floods and, where feasible, provide multi-benefits (e.g., improve stormwater quality, ecosystem benefits, Low Impact Development (LID) / redevelopment and groundwater recharge).	Riparian land use	Utilize riparian zones for flood management through acquisition or easement
		Increase riparian setbacks
		Reduce riparian encroachment
	Stream conveyance	Maintain/improve levees for flood management and environmental quality
		Geomorphic modifications
		Increase channel width and floodplain function
		Remove channel constrictions
		Conduct vegetation management
	Stormwater infrastructure	Maintain storm drain conveyance efficiency
		Implement infrastructure improvements and maintenance
	Hydromodification	Reduce directly connected impervious areas
		Implement low impact development/redevelopment
	Community Stewardship	Conduct education and outreach on flood and stormwater issues

High priority strategies in bold; Moderate priority

5.2 CALIFORNIA WATER PLAN RESOURCE MANAGEMENT STRATEGIES

The Proposition 84 Guidelines list 29 resource management strategies from the *California Water Plan Update 2009*. During the conceptual framework process (described above), the working group considered each of the *California Water Plan* resource management strategies for its potential to help achieve IRWM Plan objectives, with the intention of diversifying, to the maximum extent possible, the Region’s portfolio of strategies. Many of these strategies are currently being implemented in the Santa Cruz IRWM region. The following briefly describes each resource management strategy and its level of implementation in the Santa Cruz IRWM Plan. Table 5-2 lists the selected resource management strategies for the Region.

Table 5-2 Selected Water Plan 2009 Resource Management Strategies

<p><u>Reduce Water Demand</u></p> <ul style="list-style-type: none"> · Agricultural Water Use Efficiency · Urban Water Use Efficiency <p><u>Operational Efficiency and Transfers</u></p> <ul style="list-style-type: none"> · Conveyance – Regional/Local · System Re-operation · Water Transfers <p><u>Increase Water Supply</u></p> <ul style="list-style-type: none"> · Conjunctive Mgmt. and Groundwater Storage · Desalination · Recycled Municipal Water · Surface Storage – Regional/Local <p><u>Improve Water Quality</u></p> <ul style="list-style-type: none"> · Drinking Water Treatment and Distribution · Groundwater Remediation/Aquifer Remediation · Matching Water Quality to Use · Pollution Prevention · Salt and Salinity Management · Urban Runoff Management 	<p><u>Practice Resources Stewardship</u></p> <ul style="list-style-type: none"> · Agricultural Lands Stewardship · Economic Incentives · Ecosystem Restoration · Forest Management · Land Use Planning and Management · Recharge Area Protection · Water-Dependent Recreation · Watershed Management/Planning <p><u>Improve Flood Management</u></p> <ul style="list-style-type: none"> · Flood Risk Management <p><i>Not selected for the Region:</i></p> <ul style="list-style-type: none"> · Conveyance–Delta · Precipitation Enhancement · Surface Storage–CALFED · Crop Idling for Water Transfers · Dewvaporation/Atmospheric Pressure Desal. · Fog Collection · Irrigation Land Retirement · Rainfed Agriculture · Waterbag Transport/Storage Technology
---	---

The descriptions of the resource management strategies are paraphrased from the *California Water Plan Update, 2009, Volume 2*.

5.2.1 REDUCE WATER DEMAND

Agricultural Water Use Efficiency: Agricultural water use efficiency describes the use and application of a scientific process to control agricultural water delivery and achieve a beneficial outcome. Water use

efficiency and conservation measures serve to reduce water use, reduce energy consumption and therefore emissions of pollutants and greenhouse gasses, reduce wastewater and potentially polluted runoff, and reduce the economic and environmental costs associated with water use and water treatment. This strategy is reflected in several Santa Cruz IRWM strategies, including irrigation and nutrient management, reducing dependence on groundwater, and the development of farm plans, among others.

Urban Water Use Efficiency: Urban water use efficiency is considered an important strategy for the region. Residents in the Santa Cruz IRWM region have some of the lowest per-capita water use in California, if not the nation. Conservation is a key feature of the Santa Cruz IRWM Plan, and urban water use efficiency is reflected in several priority strategies, including for example replacing aging infrastructure, implementation of conservation pricing for water, and education, among others.

5.2.2 OPERATIONAL EFFICIENCY AND TRANSFERS

Conveyance–Delta: The Santa Cruz IRWM Region does not rely upon imported water, and as such, this strategy is not applicable to the Region.

Conveyance – Regional/Local: Conveyance provides for the efficient and effective movement of water, and conveyance infrastructure includes natural water courses as well as constructed facilities like canals and pipelines. Although the Santa Cruz region does not import water from outside of the region, conveyance nevertheless is an important strategy reflected in the plan. The need to maintain and/or improve conveyance is reflected in strategies such as investigating the feasibility of development of water produced from alternative sources, which if pursued, would necessitate improved connections between different water districts.

System Re-operation: System re-operation entails changing existing operation and management procedures for reservoirs and conveyance facilities in order to increase benefits from these facilities. Priority strategies such as those associated with investigating the feasibility of development of water produced from alternative sources and maximizing production from existing sources are associated with this strategy. Such strategies may involve upgrading the ability to treat source water or otherwise manage the water delivery system to maximize benefits.

Water Transfers: A water transfer is a temporary or long-term change in the point of diversion, place of use, or purpose of use. Water transfers typically occur in five ways (though not all of these are practiced in the Santa Cruz region): 1) transferring water from storage that would otherwise have been carried over to the following year; 2) pumping groundwater instead of using surface water delivery and transferring the surface water rights; 3) transferring previously banked groundwater either by directly pumping and transferring groundwater or by pumping groundwater for local use and transferring surface water rights; 4) making water available by reducing the existing consumptive use through crop idling or crop shifting or by implementing water use efficiency measures; or 5) making water available by reducing return flows or seepage from conveyance systems that would otherwise be irrecoverable.

Water transfer is reflected in strategies related to improving the water production in the Santa Cruz region in that the strategy might require changes to place of use.

5.2.3 INCREASE WATER SUPPLY

Conjunctive Management and Groundwater Storage: Conjunctive management is the coordinated use of surface water and groundwater to maximize water use in order to meet various management objectives. In the Santa Cruz IRWM region, conjunctive management is related to the water transfer strategy in that implementation would likely include exchange of groundwater for surface water use, which may require the temporary or long-term change to existing water rights.

Desalination: Desalination refers to any of several processes that remove some amount of salt and other minerals from saline water as a means of providing a supplemental water supply. Desalination is similar to conjunctive management in that it is one strategy of many that falls into the category of developing production from alternative sources. Desalination was identified as a potential supplemental supply to further evaluate. In 2007, the City of Santa Cruz and Soquel Creek Water District joined together to address their different needs and share the costs associated with evaluating seawater desalination. A regional seawater desalination project was in the environmental review process in 2013 when the Santa Cruz City Council decided to pursue a more thorough evaluation of water supply strategies through a formal public advisory committee process.

Precipitation Enhancement: Precipitation enhancement, commonly referred to as cloud seeding, utilizes various methods to derive more precipitation from storm events than would naturally occur without manipulation. Cloud seeding injects specific substances, typically silver iodide, into the clouds to enable raindrops to form more easily. Cloud seeding has been practiced for some time throughout California; however this strategy was not considered appropriate for the Santa Cruz IRWM Region.

Recycled Municipal Water: Recycled water is water derived from wastewater through an enhanced treatment process. Currently, recycled water cannot be used for potable use, but is commonly utilized for landscape or crop irrigation. Recycled water is already being utilized in the Santa Cruz region, and like conjunctive management, is a priority strategy for improving supply production. The City of Santa Cruz and the Soquel Creek Water District are proposing to conduct a feasibility study of recycled water.

Surface Storage—CALFED: The Santa Cruz IRWM region does not rely upon imported water, and as such, this strategy is not applicable to the region.

Surface Storage – Regional/Local: Surface storage is an existing, critical component of the Santa Cruz Water Department’s system. However, considering that other methods of ensuring adequate supply exist that do not have the level of impacts associated with on-stream surface storage, it is not identified as a priority strategy going forward for the region. However, there may be opportunities within implementation of a conjunctive use project for off-stream storage, though such a project is not currently being pursued.

5.2.4 IMPROVE WATER QUALITY

Drinking Water Treatment and Distribution: Providing a safe and reliable supply of drinking water is the primary goal of public water systems in the region. Source water protection, sufficient treatment, and efficient delivery systems are all critical to achieving this goal. This strategy is a high priority, ongoing element of the Santa Cruz IRWM Plan reflected in several strategies outlined in the conceptual framework.

Groundwater Remediation/Aquifer Remediation: Groundwater remediation removes contaminants that affect beneficial uses of groundwater. Passive groundwater remediation allows contaminants to biologically or chemically degrade or disperse in situ over time, while active groundwater remediation involves either treating contaminated groundwater in situ or extracting contaminated groundwater from the aquifer and treating it. Fortunately for the Santa Cruz IRWM region, groundwater remediation is not a priority strategy because the region's aquifers are in generally good condition, although remediation of locally contaminated sites is ongoing.

Matching Water Quality to Use: An example of matching water quality to use is a water supplier choosing to use a deeper, cleaner aquifer for municipal water, which requires less treatment before delivery, over a more shallow, more contaminated aquifer or over a surface supply. Benefits would include a reduced need for treatment and potentially fewer disinfection byproducts for the water user. Recycled water can also be treated to a wide range of purities that can be matched to different uses. This strategy is currently being implemented in the Santa Cruz Region with use of recycled water for landscape irrigation, and is reflected in several proposed projects in the IRWM Plan.

Pollution Prevention: Pollution prevention protects water at its source and therefore reduces the need and cost for other water management and treatment options. An important pollution prevention strategy is implementation of proper land use management practices to prevent sediment and pollutants from entering the source water. Pollution prevention supports several Santa Cruz IRWM objectives and goals, including ensuring a safe and reliable water supply and supporting watershed function. Pollution prevention is reflected in numerous Santa Cruz IRWM strategies.

Salt and Salinity Management: Salts are materials that originate from dissolution or weathering of the rocks and soil, including dissolution of lime, gypsum and other slowly dissolved soil minerals. Salinity describes a condition where dissolved minerals of either natural or anthropogenic origin and carrying an electrical charge (ions) are present. Most salts provide some benefit to living organisms when present in low concentrations; however salinity very quickly becomes a problem when salts become concentrated. Salt management is a persistent concern in the Santa Cruz Region because much of our water supply is derived from groundwater aquifers adjacent to the ocean, and this concern is reflected in several priority strategies that either directly or indirectly address salt management. Inland basins in the region are not impacted by salts.

Urban Runoff Management: Urban development drastically alters natural hydrology and impacts water quality. Urban runoff management is a broad series of activities designed to preserve, mimic, or restore the natural hydrologic cycle that is altered by urbanization. The watershed approach 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, conducting public education campaigns to

inform the public about stormwater pollution and the proper use and disposal of household chemicals, and providing technical assistance and stormwater pollution prevention training. Urban runoff management is common practice in municipalities in the region, and is reflected in several priority strategies in this plan.

5.2.5 PRACTICE RESOURCES STEWARDSHIP

Agricultural Lands Stewardship: Agricultural lands stewardship means farm and ranch landowners – the stewards of the state’s agricultural lands – producing public environmental benefits in conjunction with the food and fiber they have historically provided while keeping land in private ownership.² Agricultural lands stewardship also protects open space and the traditional characteristics of rural communities. Agricultural lands stewardship is reflected in several priority Santa Cruz IRWM strategies including irrigation and nutrient management, rural road maintenance, and others related to maintaining and improving water quality.

Economic Incentives: Economic incentives include financial assistance, water pricing, and water market policies intended to influence water management. Examples of economic incentives practiced in the Santa Cruz IRWM region include conservation pricing and tiered rates and rebates. Economic incentives, such as plumbing retrofits, turf rebates, washing machine rebates, and residential ultra low-flush toilet replacement programs, have been used and continue to be used at different times by water suppliers in the region. Economic incentives have long been implemented in the Santa Cruz region, and will continue to play an important role in reducing water demand, one of the Santa Cruz IRWM objectives.

Ecosystem Restoration: Ecosystem restoration improves the condition of our modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations. This strategy focuses on restoration of aquatic, riparian, and floodplain ecosystems because they are the natural systems most directly affected by water and flood management actions, and are likely to be affected by climate change. Significant ecosystem restoration has been practiced in the Santa Cruz region, and many strategies in this IRWM Plan are directly related to this resource management strategy, and several others indirectly related, through such measures as increasing streamflow or improving groundwater recharge. See also the related watershed management strategy regarding the Integrated Watershed Restoration Program (IWRP) for the Santa Cruz Region, which played a key role in significant ecosystem restoration efforts.

Forest Management: Significant portions of the Santa Cruz IRWM region consist of forested land, which are used for sustainable production of resources such as water, timber, native vegetation, fish, wildlife and livestock, as well as source water protection, carbon sequestration, and recreation. Strategies include, among others, meadow restoration (for increased groundwater storage), riparian forest restoration, fuels/fire management, and road management. Climate change is expected to directly affect forests through increased drought stress, and a study conducted by the U.S. Geological Survey (USGS) for the Santa Cruz IRWM region suggested that it may have a dramatic impact on the amount of

² California Water Plan Update 2005, Agricultural Land RMS

suitable habitat for redwoods in the region.³ Forest management is reflected in several priority strategies in this IRWM Plan.

Land Use Planning and Management: Integrating land use and water management consists of 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. The way in which we use land - the pattern and type of land use and transportation and the level of intensity - has a direct relationship to water supply and quality, flood management, and other water issues. This strategy calls for more sustainable land use practices, including intelligent site design, source control, and land use decision making that aims to both reduce and mitigate flood loss and the potential impacts of climate change. Land use planning that considers impacts to natural resources and encourages conservation is a hallmark of the Santa Cruz region, and is reflected in several priority Santa Cruz IRWM strategies.

Recharge Area Protection: The goals of recharge area protection are to 1) ensure that areas suitable for recharge continue to be capable of adequate recharge rather than covered by urban infrastructure, such as buildings and roads; and 2) prevent pollutants from entering groundwater in order to avoid expensive treatment that may be needed prior to potable, agricultural, or industrial beneficial uses. Primary groundwater recharge zones have been protected since the 1970s in the Santa Cruz region. This has been done by limiting development in areas in the County outside of the urban services line where soil and geological conditions are appropriate and conducive to infiltration and percolation of rainfall and runoff into groundwater basins. In these areas, development is limited to one unit per 10 acres. Recharge protection is a cross-cutting strategy that supports several IRWM Plan objectives.

Water-Dependent Recreation: California offers a variety of water-dependent recreation opportunities, such as fishing and swimming. Other recreation activities that are not water-dependent but are enhanced by water include wildlife viewing, picnicking, camping, and hiking. Surfing and other ocean-related water-dependent activities are of principal importance to the Santa Cruz region. In addition, several of the region's surface water storage facilities allow varying levels of recreational opportunities. Providing for water-dependent recreation in water projects is part of California law and also part of the Public Trust Doctrine (California State Lands Commission), and is of primary importance to the region. In the Santa Cruz IRWM Region, providing for water-dependent recreation is less about incorporating the concept into water projects, but rather is reflected in the need to ensure that water quality supports recreational beneficial uses.

Watershed Management/Planning: Watershed management is the process of creating and implementing plans, programs, projects, and activities to restore, sustain, and enhance watershed functions. Beginning in the late 1970s, eight watershed restoration plans and a number of other related assessments were developed for seven watersheds in Santa Cruz County. Anticipating the completion of the plans, several RWMG members and other stakeholders turned their focus to ways to effectively implement the recommended projects and programs. Recognizing that watershed restoration would be more effective as a coordinated countywide effort, they developed a program called the Integrated

³ Flint, L.E., and Flint, A.L. 2012. Simulation of climate change in San Francisco Bay Basins, California: Case studies in the Russian River Valley and Santa Cruz Mountains: U.S. Geological Survey Scientific Investigations Report 2012–5132, 55 p.

³Ibid.

Watershed Restoration Program (IWRP). The goal of IWRP is to support local watershed partners in developing projects and to coordinate agencies that provide technical assistance, permits, and funds. Such coordination reduces the staff time required while helping to ensure that critical projects are identified, funded, and permitted. Over 43 projects have been implemented to date through the IWRP program, and it continues to be a primary focus for the Santa Cruz region supporting nearly all of the IRWM objectives.

5.2.6 IMPROVE FLOOD MANAGEMENT

Flood Risk Management: Flood risk management is a strategy specifically intended to enhance flood protection. It includes projects and programs that assist individuals and communities to manage flood flows and to prepare for, respond to, and recover from a flood. Within the Santa Cruz Region, priority strategies supporting flood risk management seek to maximize the benefits of floodplains, minimize or mitigate development in the floodplain, minimize the loss of life and damage to property from flooding, and recognize the benefits to ecosystems from periodic flood events.

5.2.7 OTHER

Crop Idling for Water Transfers: Crop idling refers to the removal of lands from irrigation with the aim of returning the lands to irrigation at a later time. Crop idling for water transfers is done to make water available for transfer, or in certain cases to solve drainage and drainage-related problems. Crop idling has not been specifically identified in the Santa Cruz IRWM region as a strategy for use – primarily because most of the agricultural operations rely upon groundwater for irrigation, so there is limited potential benefit and the strategy would also face practical issues such as limited infrastructure through which to transfer water. Some idling has occurred on the north coast area of the region, due present lack of legal water supplies, and there are some potential benefits of further crop idling either to reduce groundwater overdraft or to make available for municipal use water that is presently used by agriculture.

Dewvaporation or 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. Heat sources can be combustible fuel, solar, or waste heat. The technology of dewvaporation is still being developed, and thus far the basic laboratory test unit is capable of producing up to 150 gallons per day. Despite this, it is not a viable strategy for the Santa Cruz Region at this time.

Fog Collection: There has been some interest in fog collection for domestic water supply in some of the dry areas of the world near the ocean where fog is frequent. Some experimental projects have been built in Chile, including the El Tofo project which yielded about 10,600 liters per day from about 3,500 square meters of collection net (i.e., about 3 liters per day per square meter of net). Because of its relatively small production, fog collection is limited to producing domestic water where little other viable water sources are available. The Santa Cruz Region's coastal location is ideally suited for fog collection; however, as long as other viable water sources exist, fog collection is not considered to be a practical option for the region.

Irrigation Land Retirement: Irrigated land retirement is the removal of farmland from irrigated agriculture. Permanent land retirement is perpetual cessation of irrigation of lands from agricultural production, which is done for water transfer for solving drainage-related problems. This strategy is not considered to be a priority as long as other viable water sources exist.

Rainfed Agriculture: Rainfed agriculture is when all crop consumptive water use is provided directly by rainfall on a real time basis. Rainfed agriculture has both water supply and water quality benefits. Due to unpredictability of rainfall frequency, duration, intensity, and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture. This is especially true in the Santa Cruz region, where high land values and production costs require sufficient returns in order for agricultural operations to be viable. As such, this is not a viable strategy for the Santa Cruz IRWM Region.

Waterbag Transport/Storage Technology: The Steering Committee determined that this is neither a realistic nor a feasible option for the region.



North Coast stream (photo courtesy: SCWD)

Table 5-3 below shows the overlap between the California Water Plan Update 2009 resource management strategies listed above and the priority strategies identified through the conceptual framework process to implement IRWM Plan objectives, thereby illustrating which of the resource management strategies will be implemented to achieve IRWM Plan objectives.

Table 5-3 Relationship between SC IRWM Strategies and California Water Plan Resource Management Strategies

State Water Plan 2009 Resource Management Strategy	Reduce Water Demand		Operational Efficiency and Transfers				Increase Water Supply				Practice Resources Stewardship						Improve Water Quality				Flood Mgmt							
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Crop Idling for Water Transfers	Irrigated Land Retirement	Conveyance - Regional / Local	System Reoperation	Water Transfers	Conjunctive Mgmt. & Groundwater Storage	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - Region/ Local	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Land Use Planning and Mgmt.	Recharge Area Protection	Watershed management	Water-Dependent Recreation	Drinking Water Treatment and Distribution	Groundwater / Aquifer Remediation	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Flood Risk Management	
Santa Cruz IRWM Strategy																												
Water Supply																												
<i>Develop production from alternative/supplemental sources</i>							X	X		X													X		X			
<i>Increase production from existing resources</i>						X	X																					
<i>Implement system inerties</i>																					X							
Update/replace aging infrastructure																					X							
<i>Construct and maintain groundwater recharge facilities</i>																	X											
Prevent/remove impervious coverage in recharge zones; reduce directly connected impervious area (DCIA)																	X											
<i>Shift groundwater pumping from coastal zone</i>																	X											
Support low impact development (LID)/redevelopment																	X											

State Water Plan 2009 Resource Management Strategy	Reduce Water Demand		Operational Efficiency and Transfers				Increase Water Supply					Practice Resources Stewardship						Improve Water Quality					Flood Mgmt					
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Crop Idling for Water Transfers	Irrigated Land Retirement	Conveyance - Regional / Local	System Reoperation	Water Transfers	Conjunctive Mgmt. & Groundwater Storage	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - Region/ Local	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Land Use Planning and Mgmt.	Recharge Area Protection	Watershed management	Water-Dependent Recreation	Drinking Water Treatment and Distribution	Groundwater / Aquifer Remediation	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Flood Risk Management	
Santa Cruz IRWM Strategy																												
Water Demand																												
<i>Utilize tiered rates/conservation pricing</i>		X												X														
<i>Conduct education/outreach on conservation</i>		X																										
<i>Implement policies to minimize additional demand from new growth</i>		X																										
Implement groundwater mgmt. that includes non-municipal pumpers, to promote sustainable groundwater use	X	X																										
Utilize temporary use restrictions as needed during critical supply shortages		X																										
Utilize rebate/retrofit programs													X															
<i>Conduct irrigation management and water conservation</i>	X																											

State Water Plan 2009 Resource Management Strategy	Reduce Water Demand		Operational Efficiency and Transfers				Increase Water Supply					Practice Resources Stewardship						Improve Water Quality					Flood Mgmt				
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Crop Idling for Water Transfers	Irrigated Land Retirement	Conveyance - Regional / Local	System Reoperation	Water Transfers	Conjunctive Mgmt. & Groundwater Storage	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - Region/ Local	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Land Use Planning and Mgmt.	Recharge Area Protection	Watershed management	Water-Dependent Recreation	Drinking Water Treatment and Distribution	Groundwater / Aquifer Remediation	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Flood Risk Management
Santa Cruz IRWM Strategy																											
Watersheds/Aquatic Ecosystems																											
<i>Reduce stream withdrawals and increase base flow at critical times to achieve streamflow targets</i>		X																									
<i>Identify and eliminate illegal diversions</i>																		X									
<i>Restore stream form and hydro-geomorphic function</i>														X													
<i>Riparian zone acquisition/easements</i>													X			X											
<i>Reduce riparian encroachment</i>													X			X											
<i>Reduce erosion and sedimentation from public and private roads, unpermitted grading, and other sources.</i>														X	X												
Preserve/enhance large woody debris (LWD) in streams and riparian zone														X	X												
Remove non-native species														X		X											
Revegetation efforts														X													
Reduce riparian encroachment														X													
Fish passage barrier removal or retrofit														X													

State Water Plan 2009 Resource Management Strategy	Reduce Water Demand		Operational Efficiency and Transfers				Increase Water Supply					Practice Resources Stewardship					Improve Water Quality					Flood Mgmt					
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Crop Idling for Water Transfers	Irrigated Land Retirement	Conveyance - Regional / Local	System Reoperation	Water Transfers	Conjunctive Mgmt. & Groundwater Storage	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - Region/ Local	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Land Use Planning and Mgmt.	Recharge Area Protection	Watershed management	Water-Dependent Recreation	Drinking Water Treatment and Distribution	Groundwater / Aquifer Remediation	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Flood Risk Management
Santa Cruz IRWM Strategy																											
<i>Watersheds/Aquatic Ecosystems, cont.</i>																											
Increase/enhance physical structure and biotic habitat complexity														X													
Promote natural sand bar function														X													
Remove non-native species														X													
Improve wetland hydrology to support desired biota														X													
Support education/outreach/technical training programs																		X									
Support volunteer stewardship prog.																		X									
Support school programs																		X									
Reduce illegal dumping																							X				
Reduce illegal diversions																							X				
Riparian corridor acquisition/protection														X													
Riparian vegetation protection and enhancement														X													
Restore hydro-geomorphic function														X													

State Water Plan 2009 Resource Management Strategy	Reduce Water Demand		Operational Efficiency and Transfers				Increase Water Supply					Practice Resources Stewardship						Improve Water Quality					Flood Mgmt				
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Crop Idling for Water Transfers	Irrigated Land Retirement	Conveyance - Regional / Local	System Reoperation	Water Transfers	Conjunctive Mgmt. & Groundwater Storage	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - Region/ Local	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Land Use Planning and Mgmt.	Recharge Area Protection	Watershed management	Water-Dependent Recreation	Drinking Water Treatment and Distribution	Groundwater / Aquifer Remediation	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Flood Risk Management
Santa Cruz IRWM Strategy																											
Flood and Stormwater Management																											
<i>Utilize riparian zones for flood management through acquisition or easement</i>													X				X										X
Increase riparian setbacks																	X										
Reduce riparian encroachment																	X										
<i>Maintain/improve levees for flood management and environmental quality</i>																											X
<i>Geomorphic modifications</i>																											X
<i>Increase channel width and floodplain function</i>																											X
<i>Remove channel constrictions</i>					X																						X
Conduct vegetation management																											X

State Water Plan 2009 Resource Management Strategy	Reduce Water Demand		Operational Efficiency and Transfers				Increase Water Supply					Practice Resources Stewardship						Improve Water Quality					Flood Mgmt					
	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Crop Idling for Water Transfers	Irrigated Land Retirement	Conveyance - Regional / Local	System Reoperation	Water Transfers	Conjunctive Mgmt. & Groundwater Storage	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - Region/ Local	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Land Use Planning and Mgmt.	Recharge Area Protection	Watershed management	Water-Dependent Recreation	Drinking Water Treatment and Distribution	Groundwater / Aquifer Remediation	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Flood Risk Management	
Santa Cruz IRWM Strategy																												
<i>Flood and Stormwater Management, cont.</i>																												
Maintain storm drain conveyance efficiency																											X	X
Implement infrastructure improvements and maintenance																											X	X
Reduce directly connected impervious areas																											X	X
Implement low impact development/redevelopment																											X	X
Conduct education and outreach on flood and stormwater issues																												
Count:	2	5	0	0	1	1	1	1	1	0	1	0	1	6	18	4	7	4	4	0	2	0	2	11	2	9	10	

High priority strategies in bold; Moderate priority

As part of the project review process each of the 76 projects in the 2014 IRWM Plan were reviewed to assess their use of Resource Management Strategies in the 2009 Plan. A summary is presented in Table 5-4.

Table 5-4 Number of Projects Addressing Each Resource Management Strategies

Resource Management Strategy (RMS)	Number of projects in 2014 IRWMP Plan employing RMS
Reduce Water Demand	
Agricultural Water Use Efficiency	10
Urban Water Use Efficiency	22
Operational Efficiency and Transfers	
Conveyance – Regional/Local	16
System Reoperation	3
Water Transfers	10
Increase Water Supply	
Conjunctive Management & Groundwater Banking	17
Desalination	0
Recycled Municipal Water	7
Surface Storage – Regional/Local	8
Improve Water Quality	
Drinking Water Treatment and Distribution	13
Groundwater Remediation/Aquifer Remediation	3
Matching Water Quality to Use	13
Pollution Prevention	36
Salt and Salinity Management	10
Urban Runoff Management	33
Practice Resources Stewardship	
Agricultural Lands Stewardship	9
Economic Incentives	14
Ecosystem Restoration	38
Forest Management	5
Improve Flood Management	0
Land Use Planning and Management	20
Recharge Area Protection	11
Water-Dependent Recreation	12
Watershed Management/Planning	38
Improve Flood Management	
Flood Risk Management	20