
Report

Redding Basin Water Resources Management Plan

Phase 2B Report

Prepared for

Redding Area Water Council

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Prepared by

CH2MHILL

Acknowledgement

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Executive Summary

A More Reliable Water Supply is Essential to the Economic Health of the Redding Basin

The Redding area accommodates a wide variety of lifestyles and a mix of urban, commercial, agricultural, industrial, and recreational land uses. To sustain the area's quality of life and improve its economic vitality, each of these land uses must have a reliable water supply. Without it, shifts in existing land uses will be triggered and economic growth will be limited in many areas of the Redding Basin. As the state's water supply reliability continues to decline, this is a very real and imminent threat. With the pending renegotiation of the Central Valley Project (CVP) Water Supply Contracts and the Sacramento River Water Rights Settlement Contracts, now is the time to develop plans to secure a more reliable water supply for the future.

Redding Basin Water Resources Planning Efforts

This report is the most recent step in a long-term water supply planning effort being undertaken by the Redding Area Water Council (RAWC). The RAWC is a consortium of water purveyors, industries, and private interests. RAWC was formed in June 1993 as a forum to address the severe local impacts to water supplies during the 1986 to 1992 drought. In 1996, the RAWC initiated a long-term water resources planning effort for the Redding Basin. The planning effort has been broken into three major Phases. Phase 1, which was completed in October 1997, developed current and projected land uses and water needs through the year 2030, and documented findings in a report titled *Current and Future Water Needs*. Phase 2 work has included the development and adoption of a Groundwater Management Plan, development of a detailed regional groundwater model of the basin, evaluation of existing water supply reliability, and screening evaluation of short- and long-term actions for improving regional water supplies. This report presents the findings and recommendations from this most recent Phase 2 work, and provides a framework within which potential actions can be identified to improve regional water supply reliability.

Future Phase 2 work will develop and evaluate a range of comprehensive water management alternatives to meet the Redding Basin's water needs through 2030, and will initiate the environmental study and documentation work for a preferred long-term plan. During Phase 3, a detailed implementation plan will be developed for the long-term water supply actions.

Regional Plan Goals

The regional plan goals were developed during Phase 2B in conjunction with members of RAWC. The goals were presented in public information meetings in September and October 2000, and comments, concerns, and questions were solicited from attendees. Presentations also were made to state and federal legislators representing the Redding Basin. Comments received from the RAWC members, the public, and the legislators were considered prior to

issuance of the draft report. A draft of the Phase 2B report was distributed to the governing boards of the study sponsors and to other interested members of the public to solicit further comments prior to finalizing the document.

Following are the long-term goals for the Water Resources Management Plan:

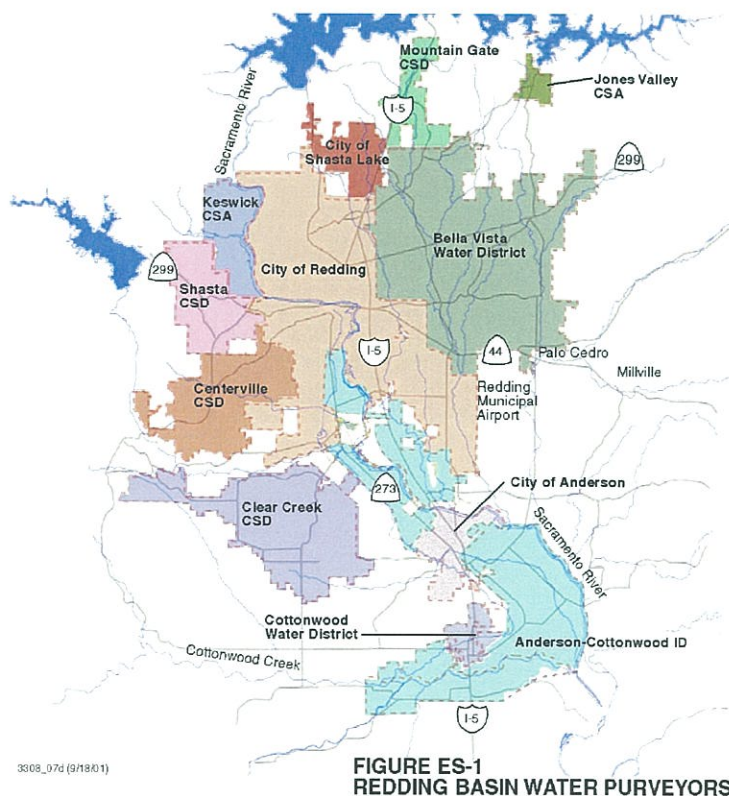
- Provide affordable, high-quality water supplies to support a diversified and stable economy, and preserve environmental values in the Redding Basin
- Improve basinwide water supply reliability under dry-year hydrologic conditions and extended droughts
- Improve local and regional control of water resources in the basin
- Increase flexibility to use alternative sources of supply during droughts or emergencies
- Preserve the autonomy of existing water purveyors to set user rates and establish policies that are appropriate for their respective service areas
- Develop regional guidelines to encourage efficient water use
- Provide a planning framework and analytical tools to help facilitate ongoing regional water management decisions

These goals will help RAWC develop and evaluate specific actions within the regional planning framework.

Existing Water Sources

Figure ES-1 is a map showing the study area and the service areas of the Redding Basin water purveyors. Figure ES-2 shows the sources of water that are currently available to basin's water purveyors.

Eleven members of the RAWC have water supply contracts with the U.S. Bureau of Reclamation (Bureau of Reclamation), which owns and operates the CVP. The CVP distributes water to about two-thirds of the State of California. CVP Water Supply Contracts are the sole water supply source for the Clear Creek Community Services District, the Keswick County Service Area, the City of Shasta Lake, and the Shasta Community Services District. CVP



contracts are a primary source of supply to six other purveyors. Purveyors that rely on CVP contracts as a primary source of supply include Bella Vista Water District, Centerville Community Services District, Jones Valley County Service Area, Mountain Gate Community Services District, and the City of Redding. The Shasta County Water Agency (SCWA) also holds a CVP Water Supply Contract. SCWA is a wholesaler and does not distribute water directly to individual water users. As shown on Figure ES-2, a few of the CVP contractors have direct access to other significant sources of supply, but most do not.

	Settlement Contract (Pre-1914 Water Right)	Post-1914 Water Right	CVP Water Supply Contract	Groundwater
City of Anderson				●
Anderson-Cottonwood Irrigation District	●		○	
Bella Vista Water District		○ ^a	● ^b	○
Centerville Community Services District	●		●	
Clear Creek Community Services District			● ^{b,c}	
Cottonwood Water District				●
Jones Valley County Service Area		●	●	
Keswick County Service Area			●	
Mountain Gate Community Services District			●	●
City of Redding	●		●	●
City of Shasta Lake			●	
Shasta Community Services District			●	
The McConnell Foundation	● ^d			
Large Industrial (SPI, Shasta Paper Mill, Wheelabrator)				● ^e

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Legend: ● Sole Source ● Primary Source ○ Minor Source

Notes: ^a Privately held water rights.

^b CVP contract includes provisions for municipal and industrial and agricultural uses.

^c Clear Creek Community Services District has two wells, but they may only be used for emergencies.

^d Privately held CVP exchange contract-water may be used within existing CVP service areas in Shasta County.

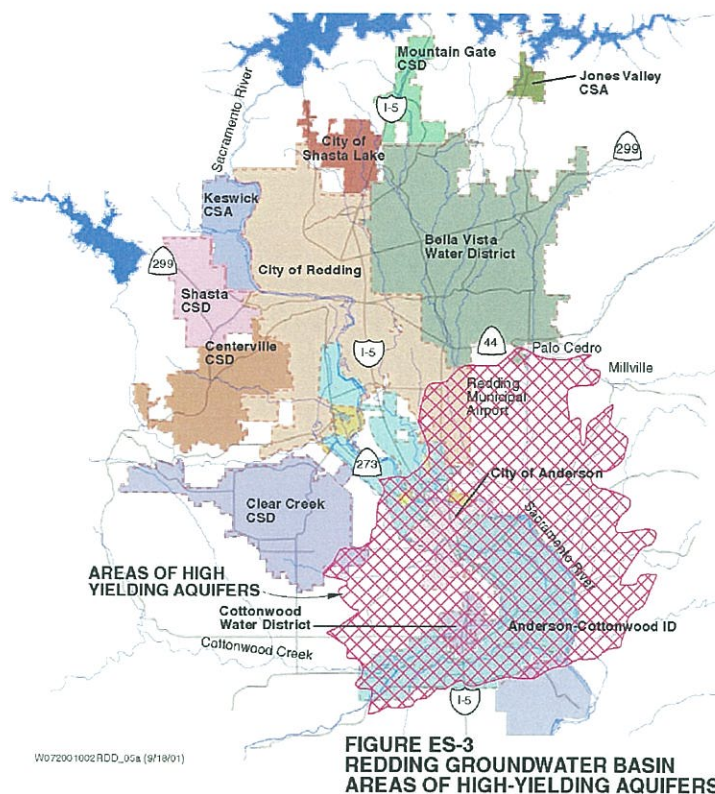
^e Anderson-Cottonwood Irrigation District supplies a small portion of industrial demands.

**FIGURE ES-2
REDDING BASIN PURVEYORS'
SOURCES OF SUPPLY**

ACID, Centerville Community Services District, and the City of Redding have pre-1914 appropriative water rights. Private landowners within Bella Vista Water District also hold post-1914 appropriative rights. Appropriative rights have a higher reliability than the CVP Water Supply Contracts because cutbacks are not as large during dry years.

A large volume of groundwater is stored in aquifers of the Redding Basin. Areas of high-yielding aquifers are illustrated by the hatchmarks on Figure ES-3. The City of Anderson and the Cottonwood Water District use groundwater as their sole source of domestic water supply. Other purveyors that use groundwater include Bella Vista Water District, Mountain Gate Community Services District, and the City of Redding. Several large industrial water users in the Anderson area also rely on groundwater for large-volume industrial water uses. Groundwater users are not currently subject to the types of supply limitations that the CVP contractors are subject to.

Although some of the Redding Basin purveyors do not have direct access to high-yielding aquifers of the Redding Basin, groundwater offers tremendous potential to increase water supply reliability throughout the basin.



**FIGURE ES-3
REDDING GROUNDWATER BASIN
AREAS OF HIGH-YIELDING AQUIFERS**

Water Needs and Supplies

Table ES-1 shows the projected water needs and critical dry-year water supplies for 12 of the Redding Basin purveyors for the years 2005 and 2030. The information in the table quantifies the water supply reliability problems facing some Redding Basin purveyors. The water needs are based on a combination of population and land use projections through 2030, and reflect long-term average conditions. Existing supplies shown are based 1995 data, including 1995 groundwater pumping levels. “Critical dry year” supplies reflect cutbacks in CVP contract supplies that occur when the CVP’s reservoir levels and river inflows reach critical low levels. Critical dry year cutbacks are projected to occur on a 1-in-10 year average frequency, with reductions of 40 percent for M&I contract supplies and no water delivery for agricultural supplies.

Cutbacks in CVP supplies are initiated by the Bureau of Reclamation based on a combination of reservoir storage conditions and hydrologic conditions, which are used to estimate the ability of the overall CVP water system to meet its supply and other operating targets in the near term (i.e., 6 months or longer). Five basic “year types” are commonly used in evaluating CVP operations under a range of hydrologic conditions. In order of decreasing supply, these five year types are wet, above normal, below normal, dry, and critical dry. Contractual language in the CVP supply contracts typically specifies a range of reductions in supply depending on the year type. In the work done for the Redding Basin Water Resources Management Plan, the critical dry-year condition and associated supply cutbacks

was used as the worst-case planning condition to determine the impacts on water supply from CVP cutbacks.

TABLE ES-1

Projected Water Needs and Supplies for M&I and Agricultural Purveyors with Critical Dry-year Cutbacks
2005 and 2030 (all values in acre-feet)

	2005				2030			
	Water Need	Existing Water Supply	Deficit	Surplus	Water Need	Existing Water Supply	Deficit	Surplus
City of Anderson	2,900	2,100	-800		5,400	2,100	-3,300	
Anderson-Cottonwood ID ^a	92,700	108,800		+16,100	92,700	108,800		+16,100
Bella Vista WD ^b	23,700	11,420	-12,280		26,700	11,420	-15,280	
Centerville CSD	1,500	2,600		+1,100	2,200	2,600		+400
Clear Creek CSD ^c	9,400	3,990	-5,410		10,600	3,990	-6,610	
Cottonwood WD	800	600	-200		1,100	600	-500	
Jones Valley CSA	260	400		+140	400	400		
Keswick CSA	210	300		+90	300	300		
Mountain Gate CSD	1,270	1,270		0	1,900	1,270	-630	
City of Redding ^d	35,600	23,400	-12,200		62,000	23,400	-38,600	
City of Shasta Lake	3,440	1,730	-1,710		6,300	1,730	-4,570	
Shasta CSD ^e	670	660	-10		1,000	660	-340	
	172,450	157,270	-32,610	+17,430	210,600	157,270	-69,830	+16,500

^aExcludes Tehama County portion of Anderson-Cottonwood Irrigation District (ACID) service area.

^b70 percent agriculture, 30 percent M&I. Based on 18,800 ac-ft supply in interim contract. Contract renewal may increase total CVP supply to 24,000 ac-ft.

^c60 percent M&I, 40 percent agriculture.

^dCity of Redding is expected to have up to 2 new wells on line by the end of 2001, increasing the existing supply by approximately 2,000 ac-ft per year.

^eShasta CSD's water demand actually exceeded 2005 projections during 2000, at 762 ac-ft

The SCWA and the Townsend Flat Ditch Company are not shown because SCWA is a wholesaler and has no service area of its own and the Townsend Flat Ditch Company has exchanged its pre-1914 water rights for the Bureau of Reclamation contracts held by the shareholders. SCWA has a CVP water service contract for 2,100 ac-ft, which it wholesales to individual purveyors. In 2000, the Bureau of Reclamation negotiated with the Townsend Flat Ditch Company shareholders to remove Saeltzer Dam and replace the ditch company's pre-1914 water rights with exchange contracts. The McConnell Foundation now has an exchange contract for 5,100 ac-ft per year and Centerville CSD has an exchange contract for 900 ac-ft per year. The water under these contracts may be used within any existing CVP contractor's service area in Shasta County.

In critically dry years beyond the year 2005 (with the water supply systems in place when this study was commissioned), more than half of the purveyors in the basin will need additional water supplies to meet the needs of their customers. Purveyors that rely on CVP Water Supply Contracts and do not have access to other supplies are particularly vulnerable to supply shortfalls. Those with access to high-yielding aquifers of the Redding Basin can rely on groundwater to meet their growing demands, but most of the purveyors do not have this option.

Impacts of CVPIA On Water Supply

The challenge of providing a reliable water supply has become more difficult since the Central Valley Project Improvement Act (CVPIA) was signed into law in 1992. Recent proposals by the federal government for renewing CVP Water Supply Contracts have added to this challenge. CVPIA and the new water supply contracts will have a dramatic and lasting effect on the availability and cost of water for CVP contractors.

CVPIA made significant changes to the CVP's legislative authorization. Use of CVP surface-water supplies for fish and wildlife mitigation and restoration is now recognized as being on par with M&I and agricultural water uses. CVPIA dedicated more than 1 million acre-feet of surface water to statewide environmental restoration programs. This water must come from the state's already inadequate water supply systems.

CVPIA also provided the framework for renegotiating long-term CVP Water Supply Contracts, which is scheduled to occur within the next 5 years. These contracts will incorporate new provisions for reducing water diversions to CVP water contractors during dry years. During critical dry-year conditions, estimated to occur in 1 in every 10 years, contractors will be subjected to severe cutbacks in their CVP contract allocations. Cutbacks will occur more frequently than in the past. M&I suppliers will receive full contract allocations only about half the time. Under critical dry-year conditions, CVP agricultural contractors will not receive any water from CVP facilities.

Under the new Water Supply Contracts, the cost of water supplied through the CVP facilities will rise to accelerate the repayment of the capital cost of the CVP facilities and to cover rising operations and maintenance costs and the cost of environmental restoration programs. To encourage conservation and efficient water use, the draft water supply contracts contain tiered pricing provisions. If implemented as proposed, the draft contracts will require water purveyors to pay higher costs for water used beyond 80 percent of their contract allocations. These pricing provisions would significantly increase the cost of water to the affected water purveyors, who would then need to pass these costs on to their customers. Table ES-2 lists current and proposed rates for local CVP contractors. Bella Vista Water District and Clear Creek Community Services District are affected more than others because they rely on water delivery facilities owned by Bureau of Reclamation, which will have a significant impact on the cost of their CVP contract supplies under the proposed contract pricing provisions. Energy cost, treatment costs to comply with emerging water quality standards, and local operations and maintenance costs, will also cause the cost of water to increase significantly in the future.

Regional Cooperation is Critical to Improving Basinwide Water Supply Reliability

A regional water resources management program is needed to improve the reliability of water supplies throughout the Redding Basin. A regional program will increase the area's ability to coordinate the development of groundwater and surface-water resources for regional benefit while preserving local water rights. This type of program can be implemented without undermining the autonomy of the individual water purveyors and their policymaking authority within their respective

service areas. In fact, a proactive regional approach will likely help preserve local decision making authority better than piecemeal solutions developed in reaction to mandates from afar.

Without regional cooperation, it will be difficult and costly for many water purveyors to meet their customers' future needs for economical, high-quality water supplies. Without regional cooperation, the reliability of the area's water supply is in jeopardy for many Redding area water users.

TABLE ES-2

Impact of Proposed Tiered Pricing on Redding Basin CVP Contractors (cost per acre-foot)

	1999 Published Rates			Proposed Rates		
	Contract Rate (\$)	Cost-of-service Rate (\$)	Full-cost Rate (\$)	Contract Rate (First 80% of Allocation) (\$)	Cost-of-service Rate (80 to 90% of Allocation) (\$)	Full-cost Rate (90 to 100% of Allocation) (\$)
Bella Vista Water District						
M&I	57.62	57.62	73.50	74.37	74.37	95.89
Agricultural	13.05	22.89	53.32	13.06	32.02	75.67
Clear Creek Community Services District						
M&I	42.01	42.01	59.88	137.59	137.59	193.22
Agricultural	9.24	18.21	32.20	9.24	21.68	38.66
Keswick County Service Area	9.00	23.60	32.16	9.00	35.09	48.71
Mountain Gate Community Services District	9.00	17.38	21.50	9.00	17.72	22.03
City of Redding						
Sacramento River	21.77	21.77	28.61	23.41	23.41	31.08
Whiskeytown Lake	20.14	20.14	26.70	21.21	21.21	28.05
City of Shasta Lake	15.00	15.00	15.00	15.00	15.00	15.00
Shasta Community Services District	9.00	20.37	26.77	9.00	24.57	33.23
Shasta County Water Agency ^a	9.00	29.77	39.78	9.00	37.78	48.66

^aShasta County Water Agency is a wholesaler of water to water purveyors throughout the Redding Basin.

While CVPIA implementation and CVP contract renegotiation have presented some challenges for the future, potential opportunities have also emerged. CALFED, an \$8.6 billion program being advanced by state and federal agencies, is providing funding for regional water management initiatives. State and federal agencies have recognized the importance of regional cooperation in meeting future water supply needs, and have provided a framework to help facilitate regional problem solving by incorporating common interests at a basin level. Regional water management programs that can also provide statewide benefits are favored in the evaluation of competing water resources development funding proposals. Basinwide groundwater management plans (accommodated under Assembly Bill [AB] 3030) are another mechanism by which regional cooperation is encouraged. With its longstanding interest in working together to resolve local water supply issues, the RAWC is positioned to capitalize on these opportunities.

In 1998, a regional groundwater management plan was developed and adopted by the RAWC. The groundwater management plan provides a starting point for regional

cooperation in managing local groundwater resources, but further opportunities remain. A Memorandum of Understanding was also developed, outlining future steps in the regional planning process and establishing the intent of the participants to prepare, adopt, and implement an integrated water resources management plan.

Some Redding Basin purveyors have made joint efforts to improve the reliability of their water supplies through water transfers, groundwater development, and jointly sponsored capital improvement projects. In some instances these efforts have been successful, but in many cases they have not. Because some purveyors rely heavily on CVP Water Supply Contracts, current efforts have done little to improve long-term water supply reliability when the CVP contract allocations are cut back. Some interconnections between neighboring purveyors exist to provide more economical service to customers at the common boundary of two neighboring purveyors, but may not provide a remedy for water supply reliability problems if long-term supplemental supplies are not available.

A regional water management program can provide much greater flexibility to meet the projected critical dry-year deficiencies of all purveyors while preserving the autonomy of each purveyor to set rates and policies that are appropriate within their service area. Go-it-alone efforts by Redding Basin purveyors will likely not achieve a reliable basinwide water supply and sustain a stable regional economy. Major shifts in land use could occur in many areas of the basin because of the lack of a reliable water supply or prohibitive water costs. Broader basinwide cooperation can enhance current efforts by neighboring purveyors and demonstrate basinwide commitment to a more universal course of action. This type of basinwide planning is being encouraged under the CALFED program and provides the opportunity to help meet basinwide and statewide water supply needs.

Without a regional solution, purveyors that rely heavily on CVP Water Supply Contracts have few options. Their lack of direct access to high-yielding groundwater aquifers, institutional impediments to complete water transfers, and inability to develop additional surface-water supplies make them especially vulnerable to water-supply shortages. A regional solution offers greater potential to alleviate these shortages and provide for a more reliable water supply for all purveyors within the basin. Regional cooperation can also provide workable solutions for purveyors facing longer term water supply shortfalls resulting from projected growth.

Solidarity among the Redding Basin water purveyors and their governing bodies will help to promote regionwide solutions and gain support for regional plans by the affected state and federal agencies. Advocacy by state and federal legislators will also be essential to advance regional solutions that are beneficial throughout the basin.

Five Core Elements Provide the Framework for Developing a Regional Solution

Water supply planning in California is a dynamic process. When the area's water supply systems were being developed, water was plentiful and water supplies could generally be increased by constructing new infrastructure, such as pumps, pipelines, and other water supply facilities. Today, flexibility is required to meet ever-changing hydrologic conditions and increasingly complex water regulations and policies. Because of uncertainties associated with some potential actions, it is

important that purveyors have a menu of actions that they can pursue to meet long-term needs. This menu of actions must be consistent with an overall basinwide planning framework. It is not possible to foresee the future, so it is important that alternative courses of action be considered and accommodated as the planning process continues. Maintaining a mix of options will provide flexibility to respond to changing regulatory requirements and hydrologic, economic, social, and technological factors.

The following five core solution elements are essential to successful and economical resolution of the Redding Basin's water supply problems:

- Additional groundwater pumping
- Transfers and exchanges between Redding Basin Purveyors
- Conjunctive management of surface water and groundwater
- Use of nonpotable supplies (untreated surface water and reclaimed wastewater)
- Conservation

Figure ES-4 shows the degree to which each of the five core elements may be applicable to each of the water purveyors. This matrix provides a framework for each purveyor to take future actions that are consistent with a regional planning structure.

Figure ES-4 substantiates the concept that a regional water management plan is necessary for all purveyors to reliably meet the needs of their customers. Transfers, exchanges, and conjunctive management are shown to be significant elements in a regional plan, and these elements would require cooperative regional actions. In some cases, these cooperative actions can be implemented by neighboring purveyors, but broader, basinwide cooperation will be necessary to achieve a reliable basinwide water supply. For example, the full benefit of transfers could be best realized by forming a single coordinating entity to facilitate intra-basin transfers.

Other types of solutions (e.g., development of local storage reservoirs) are possible, but they may face significant implementation hurdles or could have significant impacts on the cost of new water supplies, system connections, and customer rates. The five core elements provide the framework necessary to meet the goals of this regional planning effort to provide a reliable, affordable water supply throughout the basin.

The volume of water that can be provided through implementation of each of the core elements is uncertain because of inherent technical, institutional, environmental, social, or cost issues. These issues affect different purveyors in different ways and they are constantly evolving because of California's dynamic water supply planning framework. However, the fact that these issues cannot be quickly resolved or the benefits of actions cannot be readily quantified does not mean that issues should be ignored or a potential solution elements should be discarded. In fact, the feasibility of some plan elements may be enhanced when they are considered in combination with other elements. As a result, all of the core elements should be retained as part of a dynamic, long-term resource mix. The recommendations provided later in this report provide a framework for clarifying and resolving the issues through a cooperative problem-solving process. Following is an example that illustrates how one element can be integrated with another to provide a workable solution that might not otherwise be achievable.

	Transfers/ Exchanges	Conjunctive Management	Conservation	Increased Groundwater Pumping	Use of Nonpotable Supplies
City of Anderson					
Anderson-Cottonwood ID					^a
Bella Vista WD					
Centerville CSD					
Clear Creek CSD					
Cottonwood WD					
Jones Valley CSA					
Keswick CSA					
Mountain Gate CSD					
City of Redding					
Shasta CSD					
City of Shasta Lake					

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^a = Potential exists as a supplier of nonpotable water

- Element is proven through existing application or has high probability for success, has a reasonable comparative cost, and may provide significant new supply without detrimental impacts.
- Some promise of net benefit, but may require further study and/or hinges on decisions of third parties or a court ruling on a key issue. Other factors may need resolution prior to proceeding. Outside funding or incentives may be needed for future consideration.
- Little or no potential benefit, substantial implementation issues, prohibitive costs, and not likely to be pursued, even with outside funding.

FIGURE ES-4
POTENTIAL PURVEYOR ACTIONS TO SUPPORT
REGIONAL WATER MANAGEMENT CONCEPTS

Preliminary analysis of the basin water budget indicates that it may be possible to develop a sufficient volume of groundwater to address the projected basinwide critical dry-year deficiencies in the year 2030. However, most of the purveyors with projected deficiencies do not overlie the high-yielding portions of the groundwater basin. To avoid large capital expenditures (e.g., pipelines), some form of water transfers would be needed to achieve the benefits of additional groundwater pumping in areas where the water is needed. A purveyor with access to both surface water and groundwater could forego a portion of its surface-water entitlement and transfer it to another purveyor, while increasing groundwater pumping to make up the difference. Methods to fairly apportion costs and benefits of such actions will be required.

Immediate action is needed to solidify or resolve some of the assumptions made in formulating the menu of potential actions for each purveyor. For example, all potential issues associated with water transfers must be identified and resolutions developed and accepted by the purveyors and the state and federal resource management agencies. Through these efforts, specific issues and potential resolutions can be explored, and future courses of action will become more clear.

The integrated groundwater/surface-water model developed during this phase of the regional planning effort is a useful tool for evaluating the effects of potential actions in the future. Continued development of the groundwater/surface-water model will enhance its usefulness as an analytical tool. Data should continue to be collected, and the model should be updated to incorporate new data as it becomes available.

Groundwater will become a larger component of the regional water supply. Measures to protect groundwater quality will need to be included in future phases of the regional planning effort. Potential impacts to private groundwater pumpers will also be a significant issue with increased groundwater development in the Redding Basin.

Conjunctive management of groundwater and surface-water resources will require development of measures to fairly apportion the benefits and costs of facilities necessary to implement such a program. Other elements of a regional solution may also require similar evaluations.

Use of non-potable supplies (untreated surface water or reclaimed water) could help extend available surface-water and groundwater resources. Examples of potential actions include converting large industrial users and municipal irrigators from using treated water to using Anderson-Cottonwood Irrigation District (ACID) canal water or other untreated water supply. Use of reclaimed water could be supported with upgrades to the Redding, Anderson, and Cottonwood wastewater treatment facilities, and would require distribution systems to convey the water to users. The City of Shasta Lake's existing water reuse program demonstrates the viability of reuse under appropriate circumstances.

Water conservation measures improve the efficiency of beneficial water uses for municipal, industrial, and irrigation uses. Demand management involves changing the timing and quantity of use to help match supply capacity with the quantity and timing of water demands. These two measures can help extend the available water supplies and defer the need for capital improvements. Conservation and demands management will also improve each purveyor's ability to deal effectively with future supply cutbacks. State and federal laws also require water conservation planning as a condition of receiving funding assistance under many water-related programs such as CALFED. Finally, tiered pricing under future CVP contracts will provide a strong incentive to use supplies efficiently and minimize the need to use the full contracted supplies.

Recommendations

Resolutions by Governing Boards and City Councils

Acceptance of Findings and Recommendations. The governing board or city council for each purveyor should pass a resolution accepting the core elements as the framework for future water supply planning by their respective staffs. Such action would not commit the purveyors to specific courses of action, but would demonstrate an acceptance that water supply reliability is a problem that is best addressed through regional planning.

Target Reliability Factors. Each governing board or city council should also consider adopting a resolution to establish target water supply reliability factors for critical dry year conditions within their respective service areas. A target reliability factor is a goal for the

percentage of a full water supply that will be delivered in critically dry years. These targets would reflect the fact that the availability of some water supplies may be affected during critically dry years and it may not be economically feasible for the purveyors to provide a 100 percent reliable water supply under all hydrologic conditions. The reliability factors would provide a framework for evaluating the menu of potential actions to develop supplemental supplies to meet a reliability target. Selection of a target reliability factor provides basic direction for updating capital improvement programs and other staff activities.

Workshops

Governing Boards and City Councils

Workshops should be held with the governing board or city council of each RAWC participant to discuss their menu of potential actions, answer questions, and identify specific issues of concern. This interactive discussion can help establish priorities for the staff of each entity regarding these potential actions.

Issues and Concerns. Specific purveyor issues and concerns identified in the workshops should be documented and carried forward for analysis in the next phase of the planing effort. Potential means of addressing these issues will be identified in evaluating regional solutions and possible implementing authorities.

Presentation of the Integrated Groundwater/Surface-Water Model. The model should be presented at the workshops. The presentation will provide an opportunity for the participants to understand the intended application of the model, how it was developed, recommendations for continued operation and maintenance of the model, and its application in future planning efforts.

Public Outreach

Support for regional solutions should be solicited from local stakeholder groups. Public workshops should be held to discuss water supply reliability issues, answer questions, and identify specific issues of concern. Feedback from these sessions should be carried forward in future planning efforts.

Policy Advisory Committee

RAWC should be expanded to include a Policy Advisory Committee. A representative to the proposed Policy Advisory Committee should also be designated by each purveyor. The Policy Advisory Committee should include a member of the governing board or council of each of the participants. The Policy Advisory Committee would strengthen the awareness and involvement of elected representatives and help secure their active participation in the development of regional solutions. Areas of suggested involvement include the following:

- **Political Outreach.** Meetings with elected state and federal representatives of the Redding area should be continued. Local elected officials should assume a greater role in political outreach efforts, through their participation on the Policy Advisory Committee, to provide solidarity and ensure consistency with other local policies and initiatives.

- **Agency Outreach.** RAWC, through the Policy Advisory Committee, should seek the input of the state and federal resource agencies regarding the planning concepts and assumptions and the core actions identified in this study. This input would better define the criteria for further development of the core elements and specific actions for each purveyor. These discussions would help identify specific issues that may affect the feasibility of potential solutions to achieve regional management goals.

Support Activities by Purveyor Staff

Cost Analysis. If they have not already done so, the staff of each participating agency should conduct a detailed cost analysis to assess the impacts of the proposed CVP Water Supply Contracts on the cost of water to various categories of water users. Other factors affecting the cost of water (e.g., power costs) should also be evaluated. This information should be provided to SCWA staff as input to future phases of the regional planning effort to help evaluate the feasibility and cost of various water supply options for each purveyor.

Interties and Interagency Agreements. Some current interconnections between neighboring purveyors are useful to provide economical service to customers at a common boundary, but may not provide a reliable long-term remedy for water supply reliability problems. Existing distribution system interties and interagency agreements between neighboring purveyors should be reviewed to assess their long-term viability with the shortage criteria and projected cutbacks under the provisions of the CVPIA. Through this process, potential changes in the interagency agreements may be identified, and possible influences on future planning activities and capital improvements can be identified.

Specific Plans of Action. Development and implementation of specific plans of action should be initiated as soon as possible, and applications for outside funding support for these activities should be authorized. Information regarding specific plans of action should be shared with other RAWC representatives to coordinate activities, as appropriate.

Future Planning Activities

Groundwater Monitoring. Groundwater will become a larger and more important component of the regional water supply. Measures to protect groundwater quality will need to be included in future phases of planning. Potential impacts to private groundwater pumpers will also be a significant issue with increased groundwater development in the Redding Basin. To address these issues, the SCWA should implement the groundwater monitoring programs identified in the Groundwater Management Plan that was developed during Phase 2A. Data obtained from these programs should be input to the integrated groundwater/surface-water model.

Groundwater Quality Protection. Means to protect groundwater quality from potential adverse effects of increased pumping or potential sources of contamination need to be included as part of the further development and implementation of the Groundwater Management Plan.

Water Conservation Guidelines. Guidelines for water conservation should be updated for the basin's water purveyors. These guidelines will not be prescriptive, but will establish a menu of potential actions that can be employed by each participant to reduce water use.

Development and Adoption of a Regional Plan. RAWC should initiate Phase 2C of the regional planning process. This phase should include the following actions:

- Final development of combined actions
- Model runs to help assess the effects of the combined actions
- Costs/benefits analyses for each purveyor
- A public information program
- Preparation of impact analyses
- Development of a detailed implementation plan, including an institutional framework and a financing plan. This work would culminate in the preparation of CEQA/NEPA documentation and the Basinwide Water Resources Management Plan.

Cost/Benefit Analyses. The detailed evaluation of regional solutions should specifically consider cost/benefit issues within the service areas of each participant. Alternative methods for apportioning the costs and benefits should be specifically identified and presented as part of the regional plan.

Funding. The RAWC should explore options for funding future phases of the regional planning efforts through the California Department of Water Resources, the Bureau of Reclamation, CALFED, or a special state or federal appropriation. Both the Department of Water Resources and Bureau of Reclamation have demonstrated an interest in RAWC's planning efforts and a willingness to participate in future activities, including financial participation.

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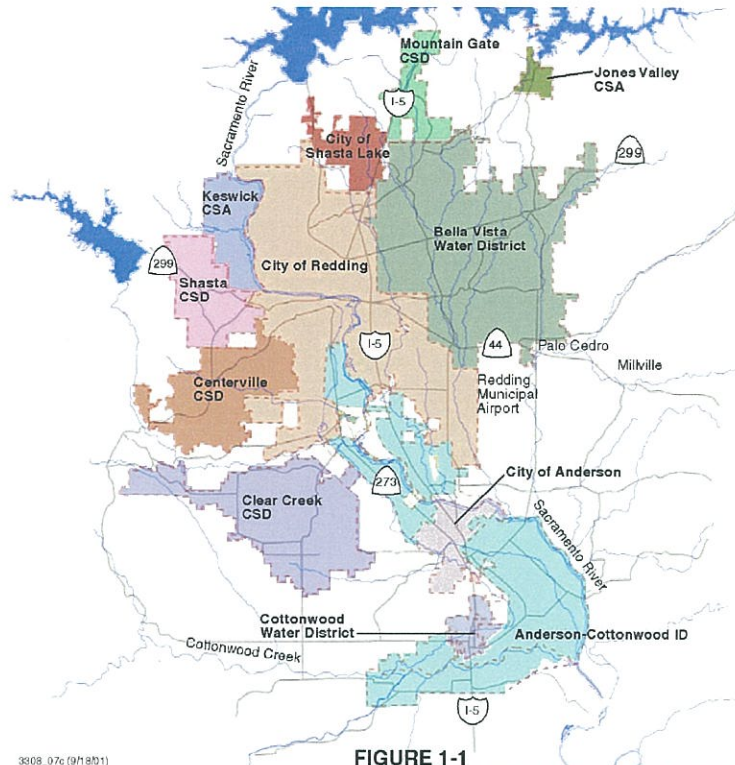
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SECTION 1

Background and Problem Statement

Study Area

The study area for this report is the Redding Basin, which is bounded on the north by Shasta Lake, on the south by the southerly boundary of the Anderson-Cottonwood Irrigation District (ACID), on the west by Whiskeytown Lake, and on the east by the Millville Plains area. This area includes the cities of Redding, Anderson, and Shasta Lake, the Town of Cottonwood, and surrounding unincorporated areas. The basin has a population of about 150,000 people and encompasses approximately 275,000 acres and includes the service areas of the water purveyors shown on Figure 1-1.



**FIGURE 1-1
REDDING BASIN WATER PURVEYORS**

Current Conditions

Redding Basin water purveyors supply water for a variety of municipal and industrial (M&I), agricultural, and recreational water uses. Various physical, legal, economic, and institutional factors affect the availability and reliability of surface-water and groundwater supplies. These factors affect different purveyors in different ways and to different degrees. Some purveyors have access to multiple supply sources through different surface-water diversions or multiple surface-water or groundwater pumping facilities. The current water sources of the Redding Basin water purveyors are shown on Figure 1-2.

Only three of the Redding Basin purveyors currently supply both surface water and groundwater to their customers. Overall, the Redding Basin is heavily dependent on Central Valley Project (CVP) Water Supply Contracts. Nine purveyors rely in whole or in part on CVP contracts for their water supply. The Shasta County Water Agency (SCWA) also has a CVP Water Supply Contract and serves as a wholesaler to other purveyors. With increasing competition for dwindling water supplies, CVP contractors are subject to cutbacks from their contract allocations during times of shortage. These cutbacks can have negative impacts on purveyors that do not have access to alternative sources.

	Settlement Contract (Pre-1914 Water Right)	Post-1914 Water Right	CVP Water Supply Contract	Groundwater
City of Anderson				●
Anderson-Cottonwood Irrigation District	●		○	
Bella Vista Water District		○ ^a	● ^b	○
Centerville Community Services District	●		●	
Clear Creek Community Services District			● ^{b,c}	
Cottonwood Water District				●
Jones Valley County Service Area		●	●	
Keswick County Service Area			●	
Mountain Gate Community Services District			●	●
City of Redding	●		●	●
City of Shasta Lake			●	
Shasta Community Services District			●	
The McConnell Foundation	● ^d			
Large Industrial (SPI, Shasta Paper Mill, Wheelabrator)				● ^e

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Legend: ● Sole Source ● Primary Source ○ Minor Source

Notes: ^a Privately held water rights.

^b CVP contract includes provisions for municipal and industrial and agricultural uses.

^c Clear Creek CSD has two wells, but they may only be used for emergencies.

^d Privately held CVP exchange contract-water may be used within existing CVP service areas in Shasta County.

^e ACID supplies a small portion of industrial demands.

**FIGURE 1-2
REDDING BASIN PURVEYORS'
SOURCES OF SUPPLY**

Current water supplies are inadequate to meet the needs of some purveyors during critical dry-year conditions. Some purveyors' water supplies are adequate to meet current needs, but additional supplies will be needed in the future. Cumulative shortages of 26,500 acre-feet were experienced as a result of CVP supply cutbacks during 1995 (an average runoff year). Basinwide shortages of 69,830 acre-feet are anticipated for the cumulative water needs projected for 2030 with critical dry-year cutbacks projected under the terms of the CVPIA. Until additional water supplies are made available, the affected purveyors will be subject to more frequent and more severe cutbacks in the future.

The lack of reliability and flexibility of existing supply sources will affect most of the water purveyors in the Redding Basin over the planning period for this study. General issues associated with the reliability and cost of surface-water and groundwater supplies for Redding Basin water purveyors are described in the following paragraphs.

Surface-water Supply Issues

Water Rights Overview

Surface water is diverted from lakes, rivers, and streams in accordance with the water rights held by local landowners or water purveyors, or under the terms of CVP contracts with the U.S. Bureau of Reclamation (Bureau of Reclamation).

The State of California has a dual system of surface-water rights: riparian and appropriative. Riparian rights are associated with ownership of land that is located adjacent to a water-course. Riparian rights are not lost if unused or unquantified, but they are not transferable to other water users. Riparian rights may only be exercised on lands within the watershed of the source from which the water is taken. Only about 10 percent of the rights to use surface water in California are riparian rights. Private landowners within some of the Redding Basin purveyors' service areas hold riparian rights. Riparian rights are typically recognized as superior to appropriative rights.

Appropriative water rights are entitlements to a specific amount of water. Appropriative rights have a specific assigned priority, which stems from the principle of "first in time, first in right" (the earliest appropriative rights receive priority over subsequent rights when there is not enough water to satisfy all claims). Appropriative rights can be lost if not continuously used. Water purveyors in the Redding Basin that hold appropriative water rights include ACID and the City of Redding. These rights were established prior to 1914 and are subject to less regulation by the State Water Resources Control Board than post-1914 water rights. Pre-1914 water rights holders may transfer water by changing the place of use, purpose of use, or point of diversion, so long as no injury is caused to an intervening diverter. Additional limitations are placed such transfers if the water to be transferred is to be conveyed through facilities owned or operated by the Bureau of Reclamation.

Area of Origin Laws

California's area-of-origin laws serve to assign an overall water right priority to areas of the state where water originates, such as the Redding Basin. Water Code Section 10505 defines the county-of-origin provisions. Water Code Section 11460 prohibits the Department of Water Resources from depriving an area of origin of the "prior right to all of the water reasonably required to adequately supply the beneficial needs of the watershed area, or any of the inhabitants or property owners therein." Known as the Watershed Protection Act, Section 11460 applies only to those units of the state's water supply system authorized by the California legislature. Water Code Section 11128 provides that the United States shall be bound by the provisions of Water Code sections 11460 and 11463, which address the transfer of water from one watershed to another. In *California v. United States* (1978), the U.S. Supreme Court held that the United States, in the construction and operation of projects by the Bureau of Reclamation, was bound by state law. This ruling encompasses the law of prior appropriation and the area-of-origin provisions of state law.

In 1939, the State of California assigned water rights for water to be stored in Lake Shasta to the Bureau of Reclamation. A numerical reservation of 700,000 acre-feet per year, but not to exceed 4.5 million acre-feet in any 10-year period, was made for the county of origin in water rights permits granted to the Bureau of Reclamation. Under this reservation, water

purveyors in Shasta County could file for a water right under the area-of-origin protections for a portion of this reserved supply and receive priority over other water rights holders that supply water users in export areas.

Westlands Water District (WD) recently filed for water rights under an area-of-origin claim associated with the San Joaquin River. Westlands asserted its rights as an area of origin to water that is now used by irrigators in the San Luis Unit under CVP Water Supply Contracts. Affected parties, including the Bureau of Reclamation and the affected export interests, protested this filing, and a negotiated settlement is being developed.

A water rights application based on an area-of-origin reservation, would involve considerable costs for processing the water rights claim and defending it in the inevitable legal proceedings. However, the area-of-origin protections may be useful as a negotiation tool to secure the support of the resources agency for a regionwide water resources management strategy.

CVP Water Supplies

The Bureau of Reclamation holds permits associated with CVP storage reservoirs (including Shasta Lake) to store water for delivery throughout much of the state. Water users that established beneficial uses of water from the Sacramento River and its tributaries before the construction of Shasta Dam hold water rights that are considered "senior" to the Bureau of Reclamation's permits and diversions by subsequent diverters. These senior water rights holders are guaranteed a more reliable supply than later diverters. A majority of the surface-water diverters in the Redding Basin were formed after Shasta Dam was constructed. As a result, most of these purveyors do not hold their own water rights and must rely on CVP Water Supply Contracts as their principal source of surface water.

The annual volume of surface water available to CVP contractors is limited by the terms of their contracts with the federal government. The contracts do not obligate the federal government to provide the full amount of water specified in the contract, or to increase the contract allocations to meet growing demands. The contracts specify the maximum amount of water each purveyor is allowed to divert and include provisions for limiting diversions during times of shortage. Limits on these reductions are not specified in the contracts.

Cutbacks in CVP supplies are initiated by the Bureau of Reclamation based on a combination of reservoir storage conditions and hydrologic conditions, which are used to estimate the ability of the overall CVP water system to meet its supply and other operating targets in the near term (i.e., 6 months or longer). Five basic "year types" are commonly used in evaluating CVP operations under a range of hydrologic conditions. In order of decreasing supply, these five year types are wet, above normal, below normal, dry, and critical dry. In the work done for the Redding Basin Water Resources Management Plan, the critical dry-year condition and associated supply cutbacks was used as the worst-case planning condition to determine the impacts on water supply from CVP cutbacks.

Increasing water demands from a growing statewide population and reallocation of water supplies pursuant to the Central Valley Project Improvement Act (CVPIA) have further reduced the reliability of the CVP Water Supply Contracts during years of below-normal runoff. Implementation of the CVPIA compounded existing water supply reliability problems by dedicating more than 1 million acre-feet of the CVP yield to restore fish and

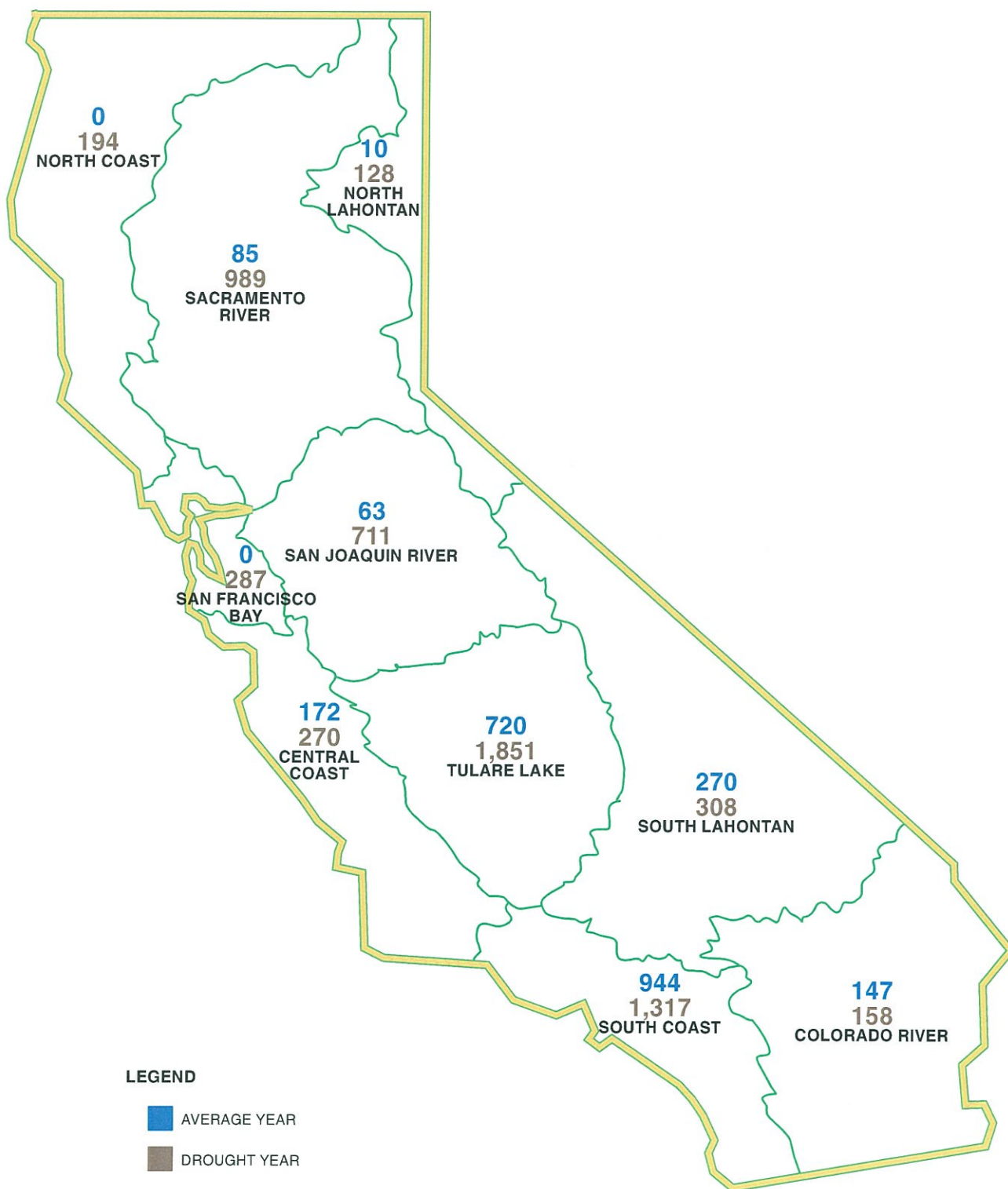
wildlife populations in the Central Valley and the Sacramento/San Joaquin Delta. Statewide water supply deficits for the year 2020, as projected by the California Department of Water Resources in the California Water Plan (Bulletin 160-98), are shown on Figure 1-3. Projected cutbacks in CVP allocations under CVPIA shortage criteria for M&I and agricultural contractors in the Redding Basin are shown on Figure 1-4.

When CVP contract supplies are cut back, agricultural contractors are subject to larger cutbacks than M&I contractors. Some water rights holders are also subject to cutbacks, but not as large as those imposed on the CVP contractors. The Sacramento River Water Rights Settlement Contracts incorporate provisions for cutbacks of 25 percent during a critical dry year, as defined by specific inflows to Shasta Lake. In 1992, the sixth year of the 7-year drought, the Water Rights Settlement Contractors received 75 percent of their normal water deliveries, while some CVP Water Supply Contractors received only 25 percent of their contract supply. During this drought, cutbacks in CVP allocations caused Redding Basin purveyors to implement voluntary water conservation measures or mandatory rationing if they could not access additional surface-water or groundwater supplies.

Under the proposed terms of future CVP Water Supply Contracts, surface water will become more costly to Redding Basin CVP contractors. The cost provisions and the tiered pricing policies set forth in the CVPIA will result in significant cost increases for both M&I and agricultural supplies. Figure 1-5 provides a general representation of how the CVPIA tiered pricing structure would affect water costs to the purveyors. The example shown is for an assumed contract for 1,000 acre-feet per year. The contractor would pay the CVP capital repayment and operations and maintenance (O&M) costs per acre-foot for the first 800 acre-feet, and would pay full per acre-foot cost (CVP capital repayment cost plus interest plus O&M) for the last 100 acre-feet. The middle 100 acre-foot increment would cost the per acre-foot cost of the first 800 acre-feet plus the per acre-foot cost of the last increment divided by two.

Table 1-1 shows the impact of the proposed tiered pricing on Redding Basin CVP contractors. The proposed pricing policies are intended to accelerate the repayment of the cost of constructing the CVP facilities. The cost of ongoing O&M and the cost of the environmental restoration activities being undertaken within the Delta and its tributaries are also included. The proposed rates are intended to encourage conservation by charging progressively higher rates for each acre-foot of water used beyond 80 percent of each purveyor's contract allocation. These increased costs will ultimately be passed on to the consumer.

The draft CVP Water Supply Contracts also contain provisions for reclassifying land uses that have traditionally qualified for lower agricultural rates to an M&I classification. The draft contract language stipulates that "M&I Water shall include water used for purposes such as watering of landscaping or pasture for animals (e.g., horses) which are kept for personal enjoyment or water delivered to land holdings operated in units of less than 5 acres unless the Contractor establishes to the satisfaction of the Contracting Officer that the use of water delivered to any such landholding is a use described in subdivision *n* of this Article." Bella Vista WD and Clear Creek Community Services District (CSD) receive a portion of their water supply at agricultural rates under their CVP Water Supply Contracts. These two districts may be subject to these new restrictions. The increased cost of these



Note: All numbers are per thousand acre-feet
Source: *The California Water Plan Update, bulletin 160-98*

FIGURE 1-3
STATEWIDE WATER SUPPLY DEFICITS
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN
CH2MHILL

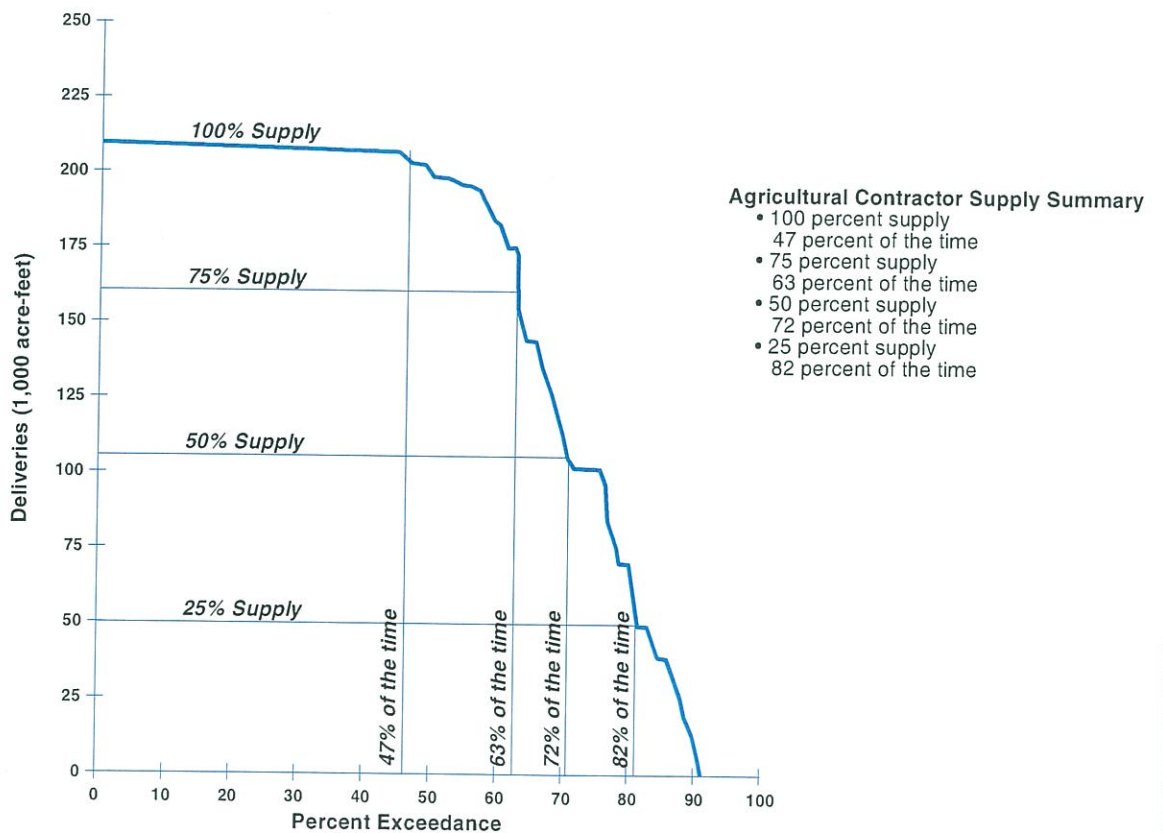
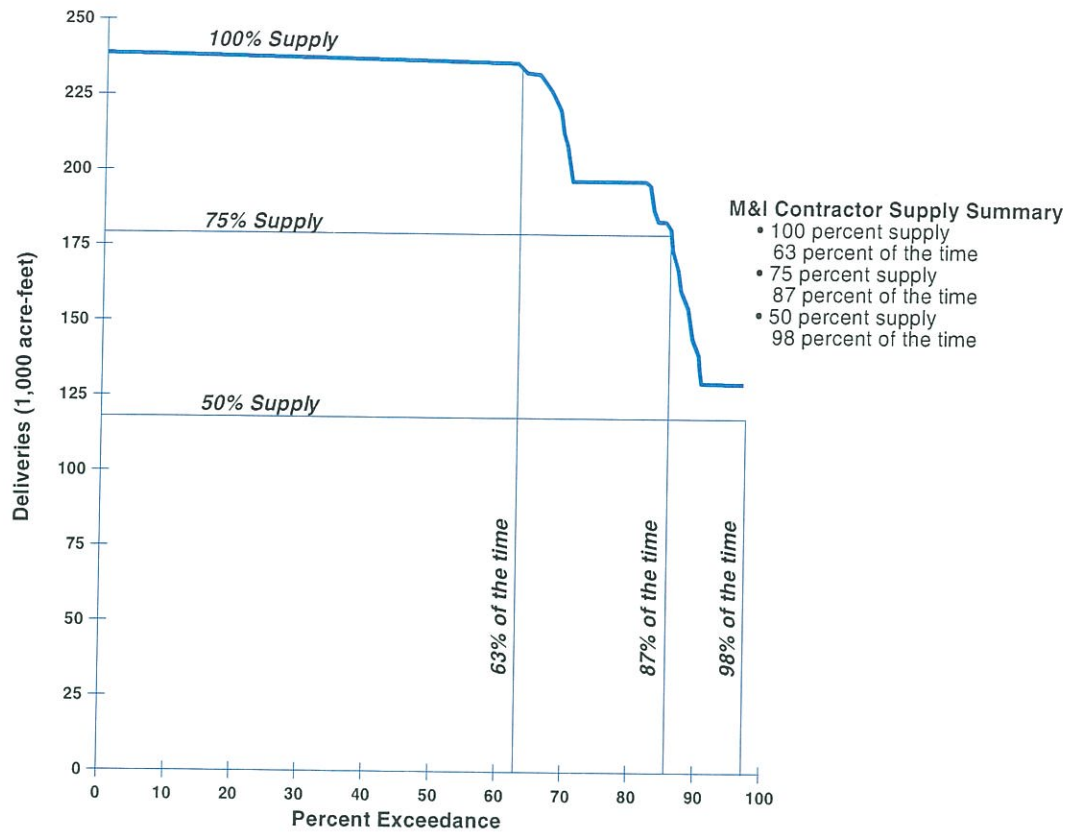
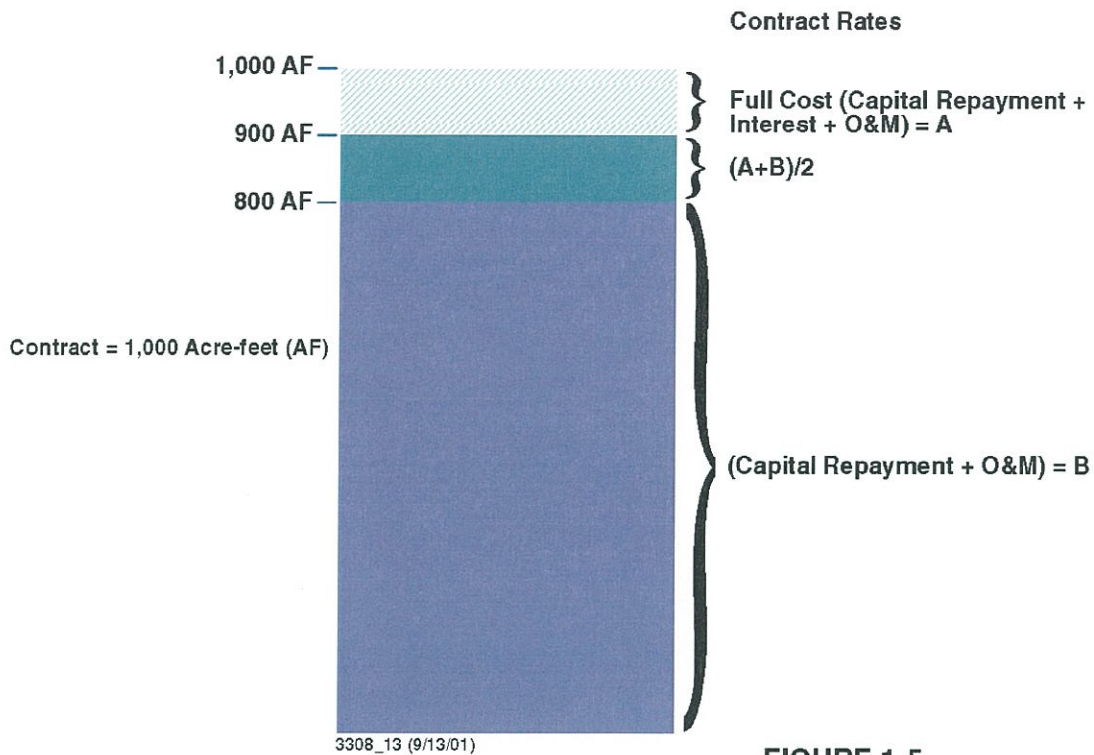


FIGURE 1-4
SIMULATED DELIVERIES FOR CVP M&I
CONTRACTORS AND CVP AGRICULTURAL
CONTRACTORS NORTH OF THE DELTA
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN



**FIGURE 1-5
CVPIA TIERED PRICING**

supplies will impact the cost of water to these districts and the rates that they must charge their affected customers and other agencies with whom they have interagency interconnecting agreements.

Groundwater Supply Issues

In California, the right to pump groundwater is an extension of the rights of landowners whose land lies over the groundwater basin. Landowners have the right to pump groundwater underlying their property for reasonable beneficial use on their land. There is no permit process associated with groundwater pumping, but state law requires that groundwater use be "reasonable." Groundwater rights are analogous to riparian rights and are not quantifiable unless the groundwater basin is adjudicated to establish the rights of the affected parties. The rights of owners of land overlying the resource are superior to groundwater appropriators, so only surplus water is available for appropriation and use outside of the groundwater basin.

TABLE 1-1
Impact of Proposed Tiered Pricing on Redding Basin CVP Contractors

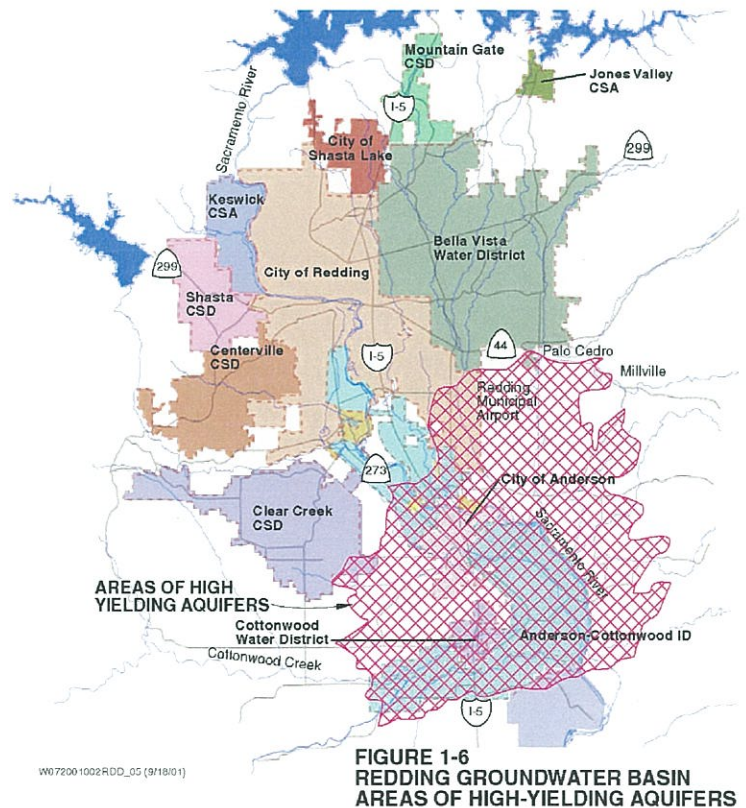
	1999 Published Rates				Proposed Rates		
	Total Allocation (acre-feet)	Contract Rate (\$)	Cost-of- service Rate (\$)	Full-cost Rate (\$)	Contract Rate (first 80% of allocation) (\$)	Cost-of- service Rate (80 to 90% of allocation) (\$)	Full-cost Rate (90 to 100% of allocation) (\$)
Bella Vista Water District M&I Ag	18,800 (total M&I and Ag)	57.62 13.05	57.62 22.89	73.50 53.32	74.37 13.06	74.37 32.02	95.89 75.67
Clear Creek Community Services District M&I Ag	15,300 (total M&I and Ag)	42.01 9.24	42.01 18.21	59.88 32.20	137.59 9.24	137.59 21.68	193.22 38.66
Keswick County Service Area	500	9.00	23.60	32.16	9.00	35.09	48.71
Mountain Gate Community Services District	350	9.00	17.38	21.50	9.00	17.72	22.03
City of Redding Sacramento River Whiskeytown Lake	2,895 6,140	21.77 20.14	21.77 20.14	28.61 26.70	23.41 21.21	23.41 21.21	31.08 28.05
City of Shasta Lake	2,750	15.00	15.00	15.00	15.00	15.00	15.00
Shasta Community Services District	1,000	9.00	20.37	26.77	9.00	24.57	33.23
Shasta County Water Agency ^a	5,000	9.00	29.77	39.78	9.00	37.78	48.66

^a Shasta County Water Agency is a wholesaler of water to water purveyors throughout the Redding Basin.

Under Assembly Bill (AB) 3030, local agencies have been authorized by the state to develop regional plans for managing and protecting groundwater resources within their jurisdiction. The Redding Area Water Council (RAWC) adopted a groundwater management plan for the Redding Basin in November 1998. RAWC was directed to prepare this plan in a Memorandum of Understanding that was adopted by the governing board of directors or city council of each of the RAWC members. The groundwater management plan was subsequently prepared and adopted by RAWC. This plan contains provisions to preserve local control and beneficial uses of groundwater resources.

During the 1986 to 1992 drought, water purveyors or individuals from throughout the north state sold surface water to the Department of Water Resources' drought water bank, substituting groundwater to replace the transferred surface water. These transfers were controversial and subject to intense public scrutiny because of concerns about aquifer drawdown and potential impacts on adjacent landowners. State law allows these types of transfers, but the groundwater pumping must be consistent with a local groundwater management plan (if one exists), or otherwise approved by the local water purveyor. If surface water is sold, it cannot be replaced with groundwater if the substitution would cause or contribute to a long-term decline in groundwater levels.

Groundwater resources in the Redding Basin represent a large potential source of supply. With more than 3 million acre-feet of groundwater stored in the basin and an average volume of groundwater recharge of 350,000 to 700,000 acre-feet per year, a much greater level of groundwater pumping can be safely accommodated (note: total estimated groundwater pumping in the Redding Basin in 1995 was only about 37,000 acre-feet). Groundwater can be developed to increase the reliability of the area's water supply during dry and critical dry periods and meet the needs for future growth. Groundwater could also be used directly, and some surface water could be sold to generate a revenue stream to finance regional actions and capital improvements that may be beyond the capability of the local purveyors. Many institutional and regulatory issues would need to be addressed before such courses of action were pursued. One issue is the seasonal impacts to private groundwater pumpers as a result of increased levels of pumping. As evidenced in other locations throughout the state, obtaining concurrence on such regional management programs and fairly apportioning the costs and benefits of such a program would be a major undertaking.



Purveyors in the central and southern portions of the Redding Basin (City of Redding, City of Anderson, and Town of Cottonwood) have direct access to groundwater from high-yielding aquifers that underlie more than one-third of the basin. In general, these areas are underlain by a considerable (greater than 500 feet) thickness of permeable alluvial material (sands and gravels) (see Figure 1-6). Wells drilled in these locations have yielded 1,500 to 3,000 gallons per minute for sustained periods. Several major industries have also developed groundwater as their sole water supply or as a supplemental source. Purveyors and industries at the north and west perimeters of the Redding Basin do not have direct access to these high-yielding aquifers and typically must rely on CVP Water Supply Contracts. Groundwater development in these areas is typically limited to wells that serve individual properties.

In 1995, groundwater pumping was used to meet only about 13 percent of the total needs in the Redding Basin. More than 80 percent of current groundwater pumping is in the central and southern areas of the basin. Much of the groundwater is pumped by large industrial users.

Without direct access to large quantities of groundwater, Bella Vista WD, Mountain Gate CSD, Jones Valley County Service Area (CSA), Keswick CSA, Shasta CSD, Centerville CSD, and Clear Creek CSD have been particularly hard hit by cutbacks in their surface-water supplies. These purveyors have limited potential to develop groundwater supplies to provide a supplemental supply during critical dry periods and to meet future water needs of their customers. Each has significant incentives to expand and diversify its sources of supply, but options for doing so are limited without a cooperative regional effort.

SECTION 2

Overview of the Regional Planning Process

RAWC is a consortium of water purveyors, industries, and other private interests, which was formed in June 1993. RAWC was an outgrowth of the Redding Area Groundwater Committee, which had been established several years earlier. RAWC provided a forum for local water interests to address water supply planning issues as the 1986 to 1992 drought continued and serious impacts were being experienced by local water users. RAWC representatives provide input to their governing boards or city councils, but RAWC is not legally authorized to take action on behalf of these governing entities. The following members of RAWC have participated in the regional planning efforts to date:

- City of Anderson
- Anderson-Cottonwood Irrigation District
- Bella Vista WD
- Centerville CSD
- Clear Creek CSD
- Cottonwood Water District
- Jones Valley CSA
- Keswick CSA
- Mountain Gate CSD
- McConnell Foundation
- City of Redding
- Shasta CSD
- Shasta County Water Agency
- City of Shasta Lake
- Sierra Pacific Industries
- Shasta Paper Mill
- Wheelabrator Shasta Energy Company

RAWC's governing entities initiated a long-term regional water resources planning effort for the Redding Basin in June 1996. The SCWA was the lead agency for this effort, providing staff time to coordinate the effort and support specific activities. The overall planning process for the basinwide water resources management plan is shown on Figure 2-1. Following is a description of each phase of the planning process.

Phase 1

Phase 1 of the planning process was initiated in September 1996 and was completed in October 1997. Phase 1 documented the current land uses within Shasta County and the Redding Basin, current water supplies, and current and projected land uses and associated water needs through the year 2030. The Phase 1 Report—*Current and Future Water Needs*—documented the results of Phase 1.

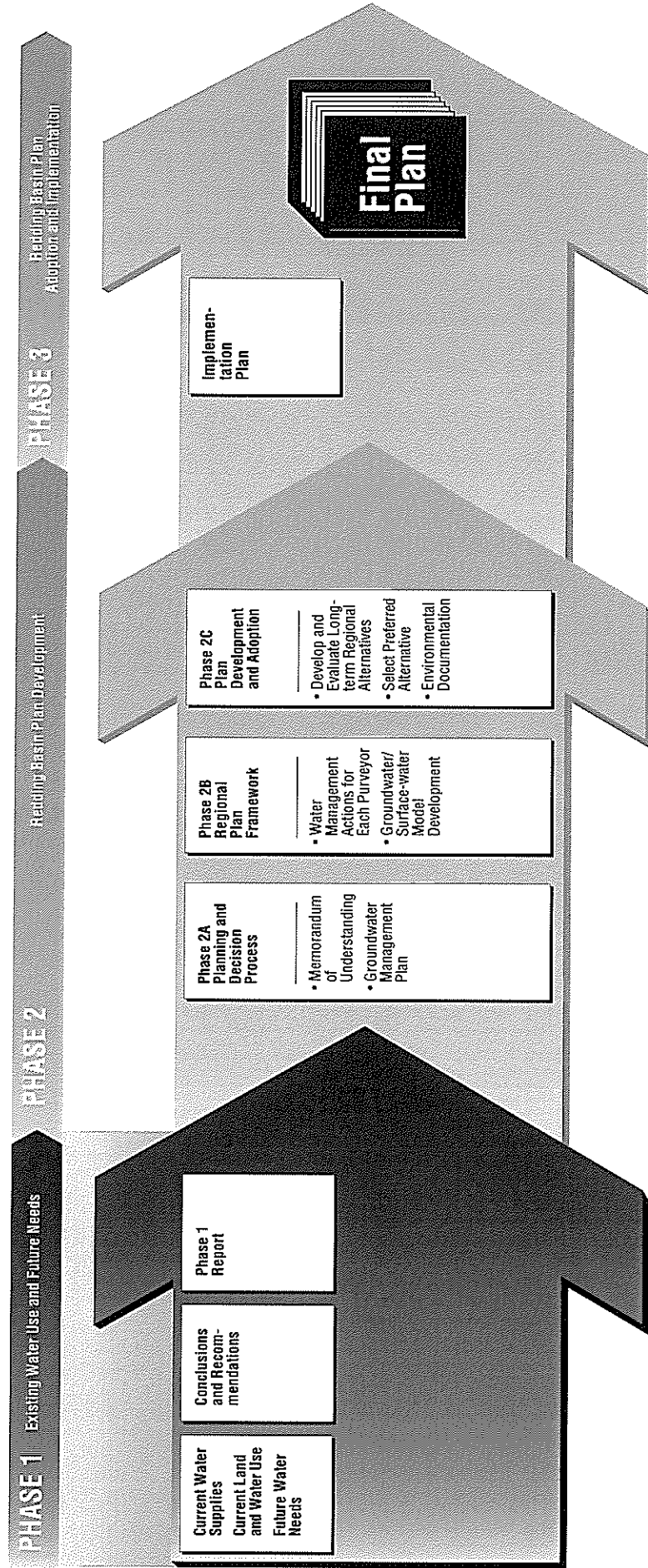


FIGURE 2-1
PLANNING PROCESS
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN
CH2MHILL

Land uses for 1995 were identified from the aerial photographs and geographic information system (GIS) database from the Department of Water Resources office in Red Bluff. Mapping provided by the Department of Water Resources was reviewed with the water purveyors, and minor adjustments were made to reflect actual land uses for the period of analysis. Projections of future population and land uses were developed from State Department of Finance projections and the applicable general plans of the local agencies, respectively.

The Phase 1 report documented 55,300 acres of land using water in the basin for the year 1995 (the base year for the report). Land uses were distributed as follows: 42.1 percent for agricultural uses, 41.2 percent for urban uses, 9.1 percent for recreational and environmental uses, and 7.6 percent for commercial and industrial uses. A total of 280,460 ac-ft of water was diverted in 1995 (surface water and groundwater) to meet these needs.

The estimated population of the Redding Basin in 1995 was 130,225, and this population was projected to grow to 261,275 by 2030. The projected water need for the year 2030 was 342,350 ac-ft, an increase of about 62,000 ac-ft over the total diversions in 1995. The predominant changes in land use projected for the future involve a continuing conversion of non-water-using lands and some agricultural lands to urban, commercial, and industrial uses. Growth in commercial and industrial water use was assumed to increase at about the same rate as basinwide population growth (3 percent per year).

In Phase 1, it was concluded that current water supplies are inadequate to meet the existing water needs of some purveyors during critical dry-year conditions. Some that have adequate supplies now will need new supplies to fully meet the future needs of a growing population. The Phase 1 report indicated that by the year 2030 more than 81,000 ac-ft of supplemental supplies would be needed to meet local needs during a critical dry year. It is likely that CVP contractors may face more frequent cutbacks than were accounted for in developing these projections, so the impact of supply shortfalls may be even greater than was originally projected.

The Phase 1 report provided recommendations for potential interim actions to help address the current and projected supply shortfalls. It was also recommended that development and evaluation of alternative concepts for basinwide water management solutions be completed.

Phase 2

Phase 2 of the planning process was initiated in October 1998. Initial elements of Phase 2 (Phase 2A) included forming committees to guide the study efforts, identifying water supply problems and opportunities for each purveyor, setting preliminary goals, listing environmental and institutional concerns, establishing an approach for developing an integrated groundwater/surface-water model of the Redding Basin, developing a Memorandum of Understanding among the participants, developing a Groundwater Management Plan, and developing a work plan for future activities. A public information component was also developed to inform and obtain input from the affected agencies and the public.

The Redding Basin Groundwater Management Plan developed in Phase 2A was adopted by RAWC in November 1998. The agencies that signed to the Memorandum of Understanding

provided input during the development and review of the plan. The purposes of the plan were to:

- Avoid or minimize conditions that adversely affect groundwater availability and quality within the basin.
- Develop a monitoring and data collection program to help protect local beneficial use of the groundwater resources of the Redding Basin.
- Implement the elements of the Groundwater Management Plan by achieving basinwide consensus, whenever possible.

The Groundwater Management Plan was developed because of the vital role that groundwater will play in meeting the basin's water supply needs for the future. The plan is effective within the jurisdictional boundaries of the participating public entities. It includes sections addressing data development, groundwater monitoring, public entity coordination and monitoring, public information and education, export limitations, water quality, well-head protection, land use, conjunctive use operations, groundwater management facilities, and groundwater overdraft and well interference. The plan is intended to provide a starting point for regional cooperation in managing local groundwater resources. The Groundwater Management Plan will be updated as specific actions are defined under the regional plan.

Phase 2B was initiated in March 1999. The scope of work for this phase included establishing goals for the Water Resources Management Plan and identifying and screening potential actions to increase the reliability of water supplies within the Redding Basin. These elements are described in detail in later sections of this report. It also included the development of an integrated water resources model for the basin. Numerous public outreach activities were also conducted during this phase of the work. This report documents the results of the Phase 2B activities.

It is beyond the scope of this planning effort to address specific capital improvements and staff additions necessary to implement the core elements described herein. Planning and implementation of capital improvements (e.g., diversion works, wells, pipelines, and pumping plants) is the function of capital improvement planning by each of the purveyors. It is also beyond the scope of this phase to develop a specific approach for apportioning the costs and benefits of the regional water resources master plan among the participants and their water users. The purpose of this planning document is to identify a recommended framework within which potential projects can be identified to improve regional water supply reliability.

The development of the integrated water resources model was a major element of the work in Phase 2B. The model is a useful tool to help evaluate the seasonal and long-term impacts of future water management plans within the basin. Examples of the types of impacts that can be evaluated using the model are changes in groundwater levels and streamflows, and availability of water during droughts.

The model was developed to readily facilitate future updates, as additional information is collected as part of the monitoring program included in the Groundwater Management Plan. The model includes separate land use, water conveyance, surface hydrology, and sub-surface hydrology modules.

The land use data were input to a GIS. The GIS database includes the boundaries of purveyor service areas, sources of water supply, wastewater service areas, consumptive use factors for each land use, specific geographic units by which to assess groundwater conditions, and surface-water drainage areas. The GIS database is linked to an Access database that is used to compute the monthly water demand for each geographic area of the basin, determine the water supply source that would be used to meet that demand, determine the fate of the delivered water, estimate the groundwater recharge for each model node, compute the water demand for each purveyor, and compute the return flow for each surface-water drainage area of the basin.

The water conveyance module includes the major conveyance facilities in the basin. This module will be used to evaluate how water could be conveyed throughout the basin as part of a regional water resources management plan.

The surface hydrology module will be used to assess flow in surface streams and canals on a monthly basis. The surface-water drainage network was divided into different reaches of the major creeks, canals and drains, and the Sacramento River. The water budget for each reach will be computed by summing various inflows and outflows so that reasonable estimates of the linkage between surface water and groundwater can be developed.

The subsurface hydrology module consists of a four-layer groundwater flow model that incorporates information on hydraulic conductivity, aquifer thickness, streambed permeability, and aquifer storativity. This module computes groundwater levels throughout the basin using water budget information developed for the other modules.

Land use and hydrologic information was developed for 4 years: 1969, 1976, 1982, and 1995. This provided a representative range of land use and hydrologic conditions by which to calibrate the model to known conditions. The model was successfully calibrated and is ready for use in evaluating the effects of various water management options.

Phase 2C will include more detailed evaluations of the combinations of actions identified during Phase 2B. The integrated groundwater/surface-water model will be used to help facilitate the evaluations and decisionmaking regarding the selection of a recommended regional plan. Environmental documentation will be prepared to support the selection of a preferred alternative and the existing groundwater management plan will be modified, if necessary. Related public information activities will be included. The recommended plan will be presented in public forums and in a project report.

Phase 3

Phase 3 will include development of an implementation plan for the selected alternative and initial tasks to support plan implementation. The implementation plan will include a recommendation concerning the institutional framework and a methodology to allocate costs and benefits to the participants.

Regional Plan Goals

The regional plan goals were developed during Phase 2B in conjunction with members of RAWC. The goals were presented in public information meetings in September and October 2000, and comments, concerns, and questions were solicited from attendees. Presentations also were made to state and federal legislators representing the Redding Basin. Comments received from the RAWC members, the public, and the legislators were considered prior to issuance of the draft report. A draft of the Phase 2B report was distributed to the governing boards of the study sponsors and to other interested members of the public to solicit further comments prior to finalizing the document.

Following are the goals for the Water Resources Management Plan:

- Provide affordable, high-quality water supplies to support a diversified and stable economy and preserve environmental values in the Redding Basin
- Improve basinwide water supply reliability under dry-year hydrologic conditions and extended droughts
- Improve local and regional control of water resources in the basin
- Increase flexibility to use alternative sources of supply during droughts or emergencies
- Preserve the autonomy of existing water purveyors to set user rates and establish policies that are appropriate for their respective service areas
- Develop regional guidelines to encourage efficient water use
- Provide a planning framework and analytical tools to help facilitate ongoing regional water management decisions

These goals will help RAWC develop and evaluate specific actions within the regional planning framework.

SECTION 3

Current Conditions and Operating Practices

This section provides a discussion of the current water supply sources and operating practices of each of the study sponsors. Operating practices are described for years of normal precipitation and runoff; means available to address periods of below-normal precipitation and runoff are described as applicable. Each purveyor's water deliveries during 1995 (the base year for this planning effort) are described to provide an understanding of their water operations. Purveyors that operate wastewater treatment facilities are noted because these treatment plants are a potential source of reclaimed water for irrigation or industrial uses. In Section 6, potential actions to increase water supply reliability will be evaluated in the context of the impacts on these existing facilities and practices.

The water purveyors draw upon their accessible surface-water and/or groundwater sources to meet changing customer water demands, restrictions in the availability of water from specific supply sources, and operational constraints throughout the year. Having the flexibility to draw on multiple sources of supply is becoming increasingly important, particularly when surface-water diversions are restricted during years of below-normal runoff or extended droughts. Flexibility to draw on other sources is also important when surface-water sources have high turbidity for extended periods, or if a source of supply is affected by contaminants.

Under normal hydrologic conditions, purveyors can generally rely on their primary sources of supply to meet customer needs. However, cutbacks of allocations under the CVP Water Supply Contracts make it necessary for purveyors without other sources of supply to request voluntary reductions in customer water use or impose mandatory water rationing. Most attempts at securing short-term water transfers from the water sources of neighboring purveyors have not been successful because of contractual limitations or institutional obstacles.

Typical demand reduction measures exercised by the water purveyors in times of shortage include limiting watering of yards, gardens, small pasture areas, and commercial agricultural uses, and other voluntary conservation measures. Such measures can have negative economic effects if they continue over an extended period because of continuing drought conditions. If water use is severely limited or mandatory rationing is instituted, purveyors may also have to reduce the extent of their O&M programs or charge higher rates to offset their revenue shortfalls because of reduced water sales.

The discussion of each purveyor's water supplies, facilities, and operations is provided in the remainder of this section. The purveyors are discussed in alphabetical order.

City of Anderson

In 1995, the City of Anderson had an estimated population of 8,865, and the city's 2,250 service connections were delivered 1,900 ac-ft of water. Anderson relies solely on groundwater

to serve its M&I water users. Most of the limited agricultural land uses within the city are served surface water through the ACID canal system, or groundwater from individual onsite wells. The ACID canal system provides a major source of recharge to replenish groundwater pumped by the city.

Anderson currently has eight wells, and two storage tanks provide a total storage capacity of 3.5 million gallons. The distribution system is divided into six pressure zones, most of which are served by individual wells. Additional wells and storage reservoirs will be added as the city's population grows. Anderson also has an intertie with the City of Redding, which can supply up to 2 million gallons per day (mgd). To address specific requests for service, agreements have been executed for the neighboring system to serve specific users at or near the common boundary of the two cities. This situation is indicative of how pipeline interconnections can be of benefit to neighboring purveyors and their customers.

The city currently has little operational flexibility because of its reliance on groundwater and the lack of interconnections between pressure zones. However, its groundwater sources are located in an area of the Redding Basin that yields large volumes of good-quality water, so the reliability of the source is not affected significantly during dry periods.

Anderson operates a municipal wastewater treatment facility. Treated wastewater is discharged to the Sacramento River. With modifications to its treatment process, this treatment facility could provide water of suitable quality to accommodate irrigation of landscaped areas within the city that are currently served by wells. Reclaimed water could also be used instead of groundwater for industrial purposes. However, the cost of constructing a reclaimed water distribution system and upgrading the treatment facility would likely exceed the cost of developing additional groundwater supplies for most areas of the city.

Anderson-Cottonwood Irrigation District

ACID's boundary encompasses about 35,000 acres of land, about 7,000 acres of which are served by the district. ACID serves approximately 900 customers, most of whom are agricultural users, and some limited industrial uses. ACID operates only during the irrigation season, generally from April through October, and does not deliver water for direct domestic consumption. Redding, Anderson, and Cottonwood service areas overlay a portion of ACID's service area. About three-quarters of the service area is within Shasta County, with the remainder in northern Tehama County.

ACID was formed in 1914 and is the oldest district of its kind in the Sacramento Valley. ACID's water supply consists of 165,000 ac-ft per year of pre-1914 natural flow rights to the Sacramento River (referred to as Base Supply), plus 10,000 ac-ft of CVP Project Water. ACID's water supply is obtained through a Sacramento River Water Rights Settlement Contract with the Bureau of Reclamation. In recent years, ACID's annual diversions have been about 106,000 ac-ft per year. About 20,000 ac-ft is distributed to ACID customers in Tehama County. ACID has typically relied on its Base Supply to meet customer needs.

ACID's pre-1914 water rights are among the most senior rights on the river, so the reliability of this supply is considered good. Because the district has a Water Rights Settlement Contract with the Bureau of Reclamation, ACID's water supply reductions are not as severe

during times of drought as are other CVP agricultural contractors (ACID is subject to a maximum 25 percent reduction in its Base and Project Water supplies). Availability of Project Water enhances the reliability of the pre-1914 water supply during drought periods. The district has transferred CVP Project Water to other water purveyors when the district does not need it. These transfers generate revenues to cover the cost of the Project Water and to help offset other district costs. Such transfers are considered a beneficial use of the water, so they have not led to reductions of ACID's allocation of CVP Project Water. However, ACID's customer base has been steadily declining as irrigated lands served by the district have been converted to residential use. Because ACID does not deliver water for potable use, these residential uses must be accommodated by a purveyor that can provide treated water.

The majority of the district's water supply is diverted by gravity flow from the Sacramento River at Lake Redding. The Churn Creek Bottom area is served through a pumping plant located near the South Bonnyview Bridge in Redding.

Most of ACID's distribution system consists of earth-lined canals, and the district's main canal represents a major source of seasonal groundwater recharge to the middle and southern portions of the Redding Basin. ACID recently received CALFED grant funding to implement a groundwater monitoring program. This is an initial step in assessing the feasibility of recapturing a portion of the estimated 44,000 ac-ft of seepage along its canals. Such a conjunctive use program could help provide greater reliability to other Redding Basin water purveyors during dry periods by reducing ACID's diversions from the river, potentially making additional surface water available to other purveyors in the basin.

Because ACID's distribution system operates primarily under gravity flow through open canals, reliability of mechanical equipment is not as significant a concern as it is for purveyors who rely on pumped diversions. The district is exploring the possibility of constructing a gravity-flow siphon under the river to enhance the reliability of service to the Churn Creek Bottom, avoid pumping costs associated with its South Bonnyview pump station, and reduce seepage losses. If this project were implemented, all of the district's water supply would be diverted by gravity flow from the Lake Redding gravity diversion. With the recently completed improvements to fish passage facilities at the district's main diversion, concerns regarding adverse impacts to migration of state and federally listed endangered or threatened fish species should be mitigated, thus further increasing system reliability.

ACID does not own or operate any wastewater treatment facilities.

Bella Vista Water District

Bella Vista WD serves water for M&I and agricultural uses within an area encompassing about 34,000 acres. The district's service area is located generally north and east of Redding and south of Shasta Lake. In 1995, the population of the district was estimated at about 12,000. Residential connections outnumber agricultural connections by a factor of nearly eight. However, agricultural use represents between 70 and 80 percent of the district's total water use. About 7,000 acres are typically irrigated for agricultural land uses, although the irrigated acreage varies from year to year. The district's allocation of agricultural and M&I

supplies is determined annually to reflect the anticipated acreage of agricultural production. Bella Vista WD does not have zoning powers, so the district has no ability to control land uses within its boundary.

The majority of the district's water supply is derived from the Sacramento River through a CVP Water Supply Contract with the Bureau of Reclamation. Bella Vista's contract provides for 24,000 ac-ft of water for municipal and agricultural uses. However, the Bureau of Reclamation has limited deliveries to a maximum of 18,800 ac-ft pending completion of environmental documentation. Several private landowners within the district hold post-1914 water rights totaling 3,000 ac-ft.

The district's CVP supply has been subjected to cutbacks of up to 75 percent of its agricultural allocation and 25 percent of its M&I allocation in recent years. Coupled with the reduction in its CVP Project Water allocation, the district is limited in its ability to meet growing demands and critical dry-year water needs.

The district has contracted for annual purchases of up to 579 ac-ft of additional CVP Project Water from the SCWA. The district has also constructed five wells near its southern boundary to supplement its surface-water supply. All wells are equipped with treatment units for removal of iron and manganese. The wells account for only about 10 percent of the supply that has historically been available from the river, and about 15 to 20 percent of the reduced supply when maximum cutbacks in CVP supplies have been instituted. The wells have limited capacity because they are located at the northern limits of the groundwater basin. The aquifers in this area are not as thick and do not yield as much water as areas farther south. However, the wells provide much needed reliability and flexibility during times of shortage or system outages.

The district has established distribution system interconnections with the City of Redding, Mountain Gate CSD, and the City of Shasta Lake. The connection with the City of Redding provides the capability to supply areas of the district during system outages or when the district is subjected to cutbacks in its CVP Project Water supply. Bella Vista WD is also exploring the possibility of participating in a project to construct a well and distribution pipeline to jointly serve City of Redding and Bella Vista WD customers near their common boundary. These interconnections are intended to provide better reliability in responding to emergency conditions and to help meet the district's growing water demand.

Bella Vista WD experiences very high seasonal water demands because of the influence of high-volume agricultural uses during the summer. Summer demands are as much as 15 times the typical winter demands. Because the district serves both municipal and agricultural customers through a common distribution system, all water must be treated to potable standards, and the distribution system must be sized to meet the much higher demands during the irrigation season. A major challenge for the district is to achieve mandated water quality standards for domestic uses, while maintaining water rates that are affordable for higher volume agricultural uses.

Bella Vista WD does not own or operate wastewater treatment facilities.

Centerville Community Services District

Centerville CSD supplies water for municipal uses on about 8,000 acres of land located west of and adjacent to the City of Redding. The district has approximately 1,000 service connections. Centerville CSD has historically obtained surface water from Whiskeytown Lake through a contract with SCWA for 2,900 ac-ft of annual CVP supply. The district now contracts directly with the Bureau of Reclamation for this supply. As a result of its purchase of shares in the Townsend Flat Water Ditch Company, Centerville CSD also has an exchange contract with the Bureau of Reclamation for 900 ac-ft annually. The district does not have access to reliable groundwater supplies.

The district's water supplies are delivered through the Muletown Conduit, which was constructed in the early 1960s and is owned by the Bureau of Reclamation. The conduit is located in a steep canyon that is difficult to access for maintenance and is subject to landslides. Cutbacks in CVP supplies and reliability concerns associated with the Muletown Conduit are significant issues facing the district. Centerville CSD has experienced cutbacks of up to 25 percent of its CVP contract allocation during times of shortage.

Centerville CSD has two interties with the City of Redding system, which provide backup supplies in case of system outages or other emergencies. Attempts to develop groundwater supplies have not been successful because of the limited capacity of the aquifer underlying the district.

Centerville does not own or operate wastewater treatment facilities.

Clear Creek Community Services District

Clear Creek CSD is located southwest of Redding and west of Anderson and serves approximately 2,400 service connections, including just over 700 agricultural connections. The district's service area presently encompasses about 17,800 acres. In 1995, the population within the service area was about 7,000, and about 9,000 ac-ft of CVP water was delivered to meet the district's water needs.

The district delivers surface water for both M&I and agricultural water uses. The district's water supply is derived from Whiskeytown Lake under an annual CVP allocation of 15,300 ac-ft. Residential connections currently outnumber agricultural connections by about two to one. Historical agricultural uses have been declining as the larger land holdings have been subdivided for residential growth. However, the district still accounts for about one-third of the total acreage of permanent crops in the Redding Basin. Clear Creek CSD has no zoning powers, so the district has no ability to control land uses within its boundary.

Although the district's distribution system was originally constructed for irrigation, the generally poor soils and the lack of large contiguous parcels of land have not allowed the levels of agricultural development forecast in the 1960s. As a result, the development has primarily been rural residential, with 2.5- to 5-acre parcels providing pasture for domestic animals and space for small truck farms or family gardening. Like Bella Vista WD, Clear Creek CSD also serves both agricultural and domestic uses through the same distribution system. This increases the challenges of maintaining affordable user rates for the agri-

cultural land uses in the area while providing the mandated level of treatment for domestic uses.

Clear Creek CSD's water supply is derived from Whiskeytown Lake via the Muletown Conduit, which is owned by the Bureau of Reclamation. Reliability of the CVP Project Water supply and the Muletown Conduit are also of concern to Clear Creek CSD. Clear Creek CSD has been subjected to cutbacks of 25 percent in its M&I contract allocation during periods of shortage. The district has constructed three wells in an area south of the district boundary, near Cottonwood Creek. This supply may only be used during emergency conditions and not as a supplemental supply during dry periods. Clear Creek CSD has 5.24 million gallons of storage within the distribution system to meet customer water needs during peak demand periods.

Clear Creek CSD does not own or operate wastewater treatment facilities.

Cottonwood Water District

Cottonwood WD serves residential water uses for about 870 service connections in the Town of Cottonwood. In 1995, the district delivered about 600 ac-ft of water to an estimated population of 2,400 people. Agricultural uses in the district are generally served by ACID or by individual privately owned wells. Private wells also serve some of the residential uses in the district. Cottonwood WD's water supply system consists of five wells and storage and distribution facilities. Direct access to the high-yielding aquifers of the Redding Basin enhances the reliability of its supply source and reduces its susceptibility to supply shortfalls during dry periods. Lack of adequate reserve storage capacity is a concern however. Growing water demands are met by adding wells and augmenting the existing distribution system.

The Town of Cottonwood is served by a municipal wastewater treatment system, which discharges to Cottonwood Creek at the Tehama County boundary. With modifications, this plant would be capable of producing reclaimed water that would meet state standards for irrigation of landscaped areas and certain agricultural crops. This represents a potential source of water for some of the land uses in the district. However, the cost of constructing a reclaimed water distribution system and upgrading the treatment facility would likely exceed the cost of constructing additional wells.

Jones Valley County Service Area

The Jones Valley CSA is located northeast of Redding, serving about 360 connections. Total water use in 1995 was about 200 ac-ft. Land uses are exclusively residential.

Water systems for the Silverthorn and Jones Valley areas were constructed in 1950 and 1964, respectively. Both systems originally obtained water from onsite wells, but population growth in the area and later annexations to the service areas exceeded the production capacity of the wells. As a result, the Jones Valley CSA was formed, the two water systems were combined, and construction of major improvements was completed, enabling a switch to Shasta Lake water in 1980. The system obtains its water supply under an appropriate water right for 400 ac-ft from September 1 through June 15, and replacement water is

purchased from the SCWA during July and August. Groundwater has limited potential as a supplemental source for the number of connections and the geographic area presently served by the Jones Valley CSA.

The Jones Valley CSA does not own or operate wastewater treatment facilities.

Keswick County Service Area

Keswick CSA is located west of Redding and is the successor of the Keswick CSD, which was formed in the early 1960s. The Keswick CSA currently serves about 195 connections, which are exclusively residential. Total 1995 water use was about 200 ac-ft. The Keswick CSA was formed in 1990 and supplies water in the Town of Keswick and adjacent developed areas. The Keswick CSA's water supply is derived from Whiskeytown Lake via a turnout on the Spring Creek Conduit. The Keswick CSA's CVP Water Supply Contract provides for deliveries of up to 500 ac-ft annually. These deliveries are subject to cutbacks during times of shortage. Two storage tanks provide total storage of 0.2 million gallons. The Keswick CSA does not have access to a reliable groundwater source.

Keswick CSA does not own or operate wastewater treatment facilities.

Mountain Gate CSD

Mountain Gate CSD is located north of the City of Shasta Lake and provides water service to about 600 connections within an area of about 2 square miles. The total 1995 water use was about 1,000 ac-ft. The primary land uses are ranchettes, urban, industrial, and fire protection. The district derives about half of its water supply from Shasta Lake. The district's contract with the Bureau of Reclamation is for a maximum of 350 ac-ft per year. This amount is supplemented by an additional 1,000 ac-ft via a contract for CVP water supplies with the SCWA. Both of these contracts are subject to cutbacks in critical dry years. The district also operates three wells within a small, low-yielding aquifer. The wells supply approximately half of Mountain Gate CSD's needs annually. The district has no storage. The available supply from wells is subject to limitations during extended dry periods. Lack of storage limits the reliability of the system during outages of system components.

Mountain Gate CSD does not own or operate wastewater treatment facilities.

City of Redding

The City of Redding is the largest city in Shasta County with an estimated 1995 population of 78,490. It is also the fastest growing community in the Redding Basin. The total 1995 water demand was about 25,000 ac-ft. State Department of Finance population projections indicate the city's population will increase to about 150,000 in the year 2030. The city provides service to more than 25,000 connections, with urban land uses dominating. The limited agricultural uses are served by ACID or from individual onsite wells.

Currently, a majority of the city's water supply is derived from surface water from the Sacramento River and Whiskeytown Lake. Under the terms of a 1966 Water Rights Settlement Contract with the Bureau of Reclamation, Redding has both a Base Supply (pre-1914

water rights) and a Project Water supply from the Sacramento River. The terms of the 1966 contract call for a Base Supply of 15,385 ac-ft per year, increasing by 255 ac-ft per year. The Project Water supply was 2,715 ac-ft in 1995 and increases by 45 ac-ft per year. The total entitlement (pre-1914 water and CVP Project Water) in 1996 was 18,400 ac-ft. These entitlements are subject to reductions in "Critical Water Years," as defined in the contract. The maximum historical reduction occurred in 1992, when Redding's supply was reduced by 25 percent.

In 1967, the city assumed ownership of the Buckeye County Water District and the District's 1964 water supply contract with the Bureau of Reclamation. A new contract was executed in 1971. This contract allows the city to obtain up to 6,140 ac-ft per year from the Spring Creek Conduit. This Project Water supply is subject to cutbacks in times of shortage.

The city operates two surface-water treatment plants. Sacramento River water is treated at the 24-mgd Foothill plant, and Whiskeytown Lake water is treated at the 7-mgd Buckeye plant. Sacramento River water is pumped to the Foothill plant, and the Buckeye plant is served by a gravity flow diversion from the Spring Creek Conduit.

Redding supplements its surface-water supplies with well production capacity within the Redding Basin. The city currently has 14 operational wells providing a total capacity of up to 12 mgd. In 1995, 6,800 ac-ft was supplied from wells, about one-third of the city's total 1995 water need. The wells are located in the Cascade area and near the Redding Municipal Airport. Two new wells in the Enterprise area adjacent to the airport are expected to come into service by late 2001, increasing the City's potential groundwater supply by approximately 2,000 ac-ft per year. Additional new wells in the Enterprise area are planned for installation between 2002 and 2005. These wells and the two sources of surface-water supply provide the city with greater supply flexibility to meet customer demands than other purveyors in the Redding Basin.

The city operates two municipal wastewater treatment facilities that discharge treated effluent to the Sacramento River. Both facilities employ treatment processes that can be modified to meet California water reclamation and reuse standards for irrigation of turf areas and some agricultural crops, as well as potential industrial uses. These treatment facilities represent potential sources of water that could be used to meet these kinds of demands in areas near the treatment facilities. However, both plants are located at the edge of the currently urbanized area, so the cost of providing additional treatment and conveying the treated effluent to the point of use may be prohibitive. Future industrial developments near the Redding Airport may make reclaimed water more attractive for uses that do not require potable-quality water.

City of Shasta Lake

The City of Shasta Lake was incorporated in 1993, and the estimated 1995 population was 9,500. The city provides water for domestic and industrial uses within an area formerly served by the Shasta Dam Area Public Utility District and the Summit City Public Utility District. The city currently serves about 3,500 connections, and the total water demand in 1995 was about 2,300 ac-ft. The city obtains its water supply exclusively from Shasta Lake via a pump station at Shasta Dam, which is owned by the Bureau of Reclamation. The city

also serves the visitor facilities at the dam. Shasta Lake has distribution system interties at its common boundaries with the City of Redding and the Bella Vista WD.

The city's maximum diversion rate from the lake through its CVP Water Supply Contract is 5.0 mgd. An interim contract with the Bureau of Reclamation provides a maximum allocation of 2,750 ac-ft per year from the lake. The city was subjected to a cutback of 25 percent in its allocations from the lake in 1992. Population growth and a lack of alternative supplies have heightened concerns about the city's ability to meet future demands, especially in critical dry years. Groundwater supplies are very limited. Well yields are low and unreliable, so groundwater is not a viable source to supplement available surface-water supplies. The City has recently entered into a 1-year purchase agreement with the McConnell Foundation for 1,000 ac-ft of surface water. See the discussion under Townsend Flat Ditch Water Company for details on the McConnell Foundation's exchange contract supplies.

The city recently upgraded its wastewater treatment plant to provide reclaimed water that is suitable for landscape irrigation and industrial uses. As water use grows, reclaimed water can be used for appropriate nonpotable uses to help offset growing demands for potable water supplies.

Shasta Community Services District

Shasta CSD was formed in 1959 to supply water for domestic use and fire protection in the community of Shasta and adjacent developed areas. The district serves more than 630 connections, virtually all of which are residential (ranchettes). The total 1995 water demand was approximately 540 ac-ft.

The district's water supply is derived from Whiskeytown Lake via the Spring Creek Conduit. The district contracts with the Bureau of Reclamation for up to 1,000 ac-ft annually under a CVP Water Supply Contract. Groundwater is not viable as a supplemental source of supply because the district is located outside of the high-yielding areas of the Redding Basin. Shasta CSD has historically been subject to cutbacks in supply under its CVP Water Supply Contract. During the 1986-1993 drought, the district's allotment was reduced by up to 75 percent, to 250 ac-ft per year. With its lack of flexibility to switch to another source of supply, these cutbacks resulted in a prohibition of outside watering and other mandatory provisions to conserve water.

Shasta CSD has experienced a sharp increase in water demand in the last several years. The projected 2005 water demand for Shasta CSD was 670 ac-ft per year according to work done under the Phase 2A Report. However, this level of demand was actually exceeded in 2000 with actual demands of 762 ac-ft. Shasta CSD also has more than 80 currently inactive water service connections, and eventual activation of these services will place additional demands on the system. This relatively large difference between projected and actual demands highlights the limitations of projecting demands for relatively small water systems, since the addition of a few new homes or changes in water use patterns can have large relative impacts.

Shasta County Water Agency

The SCWA was created in 1957 as an outgrowth of the county's Department of Water Resources. SCWA's purpose is to control and conserve water resources for the beneficial use and protection of life and property of the people of Shasta County. SCWA actively promotes the creation of public water and sewer systems and was instrumental in the creation of Bella Vista WD, Centerville CSD, Clear Creek CSD, and Shasta CSD, as well as six county service areas for water. The water agency does not distribute water directly to individual customers.

In 1967, SCWA negotiated a 37-year contract with the Bureau of Reclamation for 5,000 ac-ft of CVP Project Water, which it wholesales to subcontractors throughout the county. A total of 2,900 ac-ft of SCWA's contact supplies has been relinquished to Centerville CSD, which now contracts directly with the Bureau of Reclamation for this supply. SCWA has not developed additional water supplies to supplement the surface-water supplies available to its customers.

SCWA was also instrumental in developing the Redding Basin Groundwater Management Plan. As the lead agency for implementation of the plan, SCWA is responsible for monitoring groundwater levels, preserving and protecting local groundwater resources for local beneficial use, and adding to the database that was developed in association with the Redding Basin Groundwater Model.

SCWA does not own or operate any wastewater facilities.

Townsend Flat Ditch Company

The Townsend Flat Ditch Company formerly diverted water from Clear Creek at Saeltzer Dam to irrigate pastureland straddling the City of Redding's southern city limit. Shares in the ditch company are owned by the McConnell Foundation, a philanthropic organization in Redding, and the Centerville CSD.

In 2000, the Bureau of Reclamation negotiated with the ditch company shareholders to remove Saeltzer Dam and replace the ditch company's pre-1914 water rights with exchange contracts. The McConnell Foundation now has an exchange contract for 5,100 ac-ft per year and Centerville CSD has an exchange contract for 900 ac-ft per year. The water under these contracts may be used within any existing CVP contractor's service area in Shasta County.

The ditch company no longer diverts or delivers any water to its shareholders.

Large Industrial Water Users

Several large industrial water users pump groundwater to supply their operations in the middle and southern portions of the Redding Basin. These include Sierra Pacific Industries, the Wheelabrator Shasta Energy Company cogeneration plant, and the Shasta Paper Mill. Their location over high-yielding aquifers of the Redding Basin assures a reliable supply for their high-volume uses. In 1995, total water use of these three facilities was more than 12 mgd. Pumped groundwater is used for industrial processes, including papermaking,

SECTION 4

Future Water Supply Needs

Future water supply needs for all of Shasta County were projected in the *Shasta County Water Resources Master Plan Phase 1 Report-Current and Future Water Needs* (Phase 1 report). The Phase 1 report presents background and details on the methodology used to develop the water need projections, including key long-term planning assumptions for the different water use categories. The Phase 1 report estimated year 2030 water supply needs for all of Shasta County of approximately 672,000 ac-ft per year. The Redding Basin water supply needs in 2030 were projected to be approximately 342,000 ac-ft per year, or about 50 percent of the total Shasta County needs. The Redding Basin contains approximately 75 percent of the total current county population, and it is anticipated that most of the future population growth in Shasta County will occur within the Redding Basin. This section summarizes the methodology for projecting future water needs that was used in the Phase 1 report. Water need projections are presented for specific types of use and by purveyor service area, through 2030. The water needs for the purveyors are then compared with currently available water supplies to determine the adequacy of the supplies and highlight the major long-term planning issues facing the Redding Basin water purveyors.

Estimating Future Water Supply Needs

Water needs are defined in the Phase 1 report as the quantity of water that must be diverted from the supply source (i.e., a river or groundwater well) to meet water demands at the point of use. Water needs include conveyance losses that occur between the point of diversion and the point of use. "Baseline conditions" were established using Department of Water Resources land use data for 1995 combined with water use data from purveyors and estimated diversions for private water users. These two data sources were analyzed to define general relationships between land use (e.g., housing, commercial, industrial, agricultural) and water use. Future water demands were then estimated for 2005 and 2030 using a combination of population and land use projections. For smaller purveyors, these projections are more sensitive to short-term changes in actual water demand caused by a relatively smaller number of new water service connections. For example, the addition of just one new sub-division with 20 homes can have a relatively significant impact on a water purveyor with only 200 water service connections. Therefore the projections should be viewed as indicating long-term average conditions and not specific conditions for any actual year. This is illustrated by the water demand growth in Shasta CSD's service area. During 2000, the actual demand exceeded the projected 2005 demand due to addition of new homes in the service area.

Several key assumptions regarding long-term land and water use trends were made to support the water demand projections, as follows:

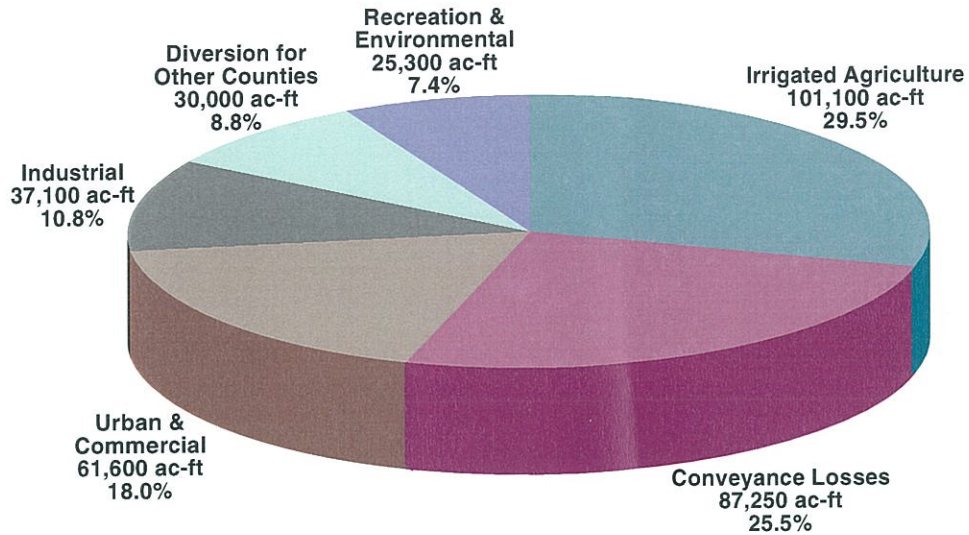
- **Agricultural Water Use-** It is anticipated that agricultural water use within the Redding Basin will remain flat through 2030. Some undeveloped lands not currently used for agriculture may be developed, but existing agricultural lands in other areas will be con-

verted to urban, commercial, and industrial uses. It is estimated that the net effect will be relatively constant total agricultural land use in the basin through 2030.

- **Urban Water Use-** Water needs for urban uses (i.e., housing and commercial) were projected using population growth trends for the Redding Basin, assuming relatively constant per capita water use. Population projections were developed using California State Department of Finance data. The average annual population growth, and the associated total urban and commercial water use, are projected to be 3 percent per year.
- **Industrial Water Use-** Industrial water use in the Redding Basin averages about 11 percent of the total current needs and about 35 percent of the urban water needs. This compares to a statewide average of about 1 percent and 9 percent for total use and urban use, respectively. This trend is expected to continue as local communities strive to attract and retain industrial employers. Accordingly, future industrial water supply needs are projected to grow at approximately the same rate as the overall basin population, at about 3 percent per year, resulting in a doubling of industrial water demands between today and 2030. Most of the existing major industrial water users use groundwater as their primary supply. It is assumed that future major industrial users will do the same because the groundwater supply in the central area of the basin is an economical and reliable water source, relative to available surface-water supplies.
- **Conveyance Losses-** Conveyance losses were estimated using either the methods consistent with state and federal resource agency practices or actual recorded values where available. The majority of the conveyance losses in the Redding Basin are associated with seepage from ACID's open-channel conveyance system.
- **Recreation and Environmental Water Needs-** Future water needs to maintain and possibly increase existing environmental and recreational water uses associated with the major water supply reservoirs were not accounted for in Phase 2B of this study. However, the Phase 1 report notes that the manner in which local reservoirs, such as Shasta and Whiskeytown, are managed has a significant impact in terms of water levels and associated recreational use levels. The recreational use levels in turn have a direct impact in terms of the tourism portion of the Redding area economy.

Redding Basin Water Needs

The estimated year 2030 water need for the Redding Basin is approximately 210,600 ac-ft per year. Figure 4-1 shows the future water needs by use type, including existing transfers to Tehama County and conveyance losses (leakage from enclosed pipelines or open channels as the water is conveyed to the point of use) for all diversions. Table 4-1 subdivides the water needs geographically by the main purveyor service areas, industrial users, and unincorporated areas. Note that the "conveyance losses" figure shown on Figure 4-1 represents the total losses for all use types in the basin, and is accounted for in Table 4-1 within the various individual water need values. The combined water needs of the purveyors, industrial users, and unincorporated areas represents approximately 82 percent of the total Redding Basin water needs in year 2030. Most of the population of the Redding Basin is currently served by the 12 purveyors listed in Table 4-1. Each purveyor will need to address significant long-term water supply planning issues as they take steps to meet the projected 2030 water needs.



TOTAL YEAR 2030 WATER NEEDS = 342,350 AC-FT

**FIGURE 4-1
REDDING BASIN
FUTURE WATER NEEDS (2030)**

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TABLE 4-1
Water Needs for Redding Basin, 2005 and 2030

	2005 Water Need (ac-ft)	2030 Water Need (ac-ft)
City of Anderson	2,900	5,400
Anderson-Cottonwood Id ^a	92,700	92,700
Bella Vista WD ^b	23,700	26,800
Centerville CSD	1,500	2,200
Clear Creek CSD ^c	9,400	10,600
Cottonwood WD	800	1,100
Jones Valley CSA	260	400
Keswick CSA	210	300
Mountain Gate CSD	1,270	1,900
City of Redding	35,600	62,000
City of Shasta Lake	3,440	6,200
Shasta CSD ^d	670	1,000
Purveyor Subtotal	172,450	210,600
Unincorporated Areas	27,100	32,700
Industrial Users	17,100	37,100
Other (Recreation, Environmental, Tehama County Diversion)	63,810	61,950
TOTAL	280,460	342,350

^aExcludes Tehama County portion of ACID service area. The 18,000 ac-ft for Tehama County is included under "other"

^b56 percent agriculture, 44 percent M&I, CVP Contract Supply.

^c29 percent M&I, 71 percent agriculture, CVP Contract Supply.

^dShasta CSD exceeded its projected 2005 water need during 2000, with actual demand of 726 ac-ft

Long-term Issues for Purveyors

As part of the Phase 2 report process, Redding Basin water purveyors provided input on their primary long-range concerns in meeting future water needs. All of the purveyors who rely on CVP contracts expressed concern regarding the declining reliability of these supplies, and the impact of future actions related to resolution of the Bay-Delta and Trinity River issues. For those purveyors who use CVP-owned facilities as a critical part of their system, such as pump stations and pipelines, there is concern about the age, capacity, and reliability of these facilities to meet future needs. Many purveyors also have concerns regarding the adequacy of revenue and funding to support the needed replacement, repair, and expansion of existing water supply and distribution infrastructure. The types of capital facility improvements anticipated include fish protection facilities on river diversions, pump stations, storage reservoirs, water treatment plants, and conveyance/distribution pipe systems.

Concerns related to CVP supply cutbacks are among the most critical issues facing the purveyors. Figure 1-4 showed "exceedance curves" for the anticipated supply cutback levels and frequency under CVPIA. To provide a uniform basis for comparing future needs and available supplies, and evaluating the resulting reliability of future water supplies, this report evaluates three assumed supply cutback conditions: 1 in 2 years, 1 in 4 years, and 1 in 10 years. Table 4-2 shows the resulting contract supply reductions. For example, Table 4-2 shows that on average, once in every 4 years CVP M&I supplies will be reduced to 83 percent of the contract quantity.

TABLE 4-2
Range of CVP Supply Cutbacks- Frequency and Magnitude

Frequency (average occurrence of cutbacks)	Percent of Full M&I Contract Supply Provided	Percent of Full Agricultural Contract Supply Provided	Notes
1 in 2 years	100	100	Full supply received on average 50% of the time
1 in 4 years	83	52	
1 in 10 years	60	0	Settlement Contracts receive 75% of their total contract supply

Comparison of Water Needs and Supply Reliability

An analysis was completed for each of the Redding Basin purveyors to determine the reliability of their 1995 water supplies in meeting future water needs. To provide a uniform basis for comparison, each purveyor's need and supply balance was evaluated using the range of CVP supply cutback conditions shown in Table 4-2. Short-term conditions were considered for 2005, and long-term conditions for 2030. The results are presented on Figures 4-2 through 4-16. Each figure shows the current (2005) and projected (2030) water needs, and the supply provided by each of the purveyor's 1995 water supply sources. Groundwater supplies were held constant at existing (1995) levels for those purveyors

currently pumping groundwater. This was done to illustrate the potential increases in future groundwater pumping required to meet increases in water demands. The results of the analysis show that the reliability of water supply in the basin varies widely among the purveyors, from minor shortages under only the most severe 1-in-10-year cutbacks, to significant shortages for some purveyors occurring every 2 to 4 years as early as 2005.

Changes to the CVP supply contracts (increased frequency and severity of cutbacks, increasing costs) are expected to have significant and wide-ranging impacts on management decisions and actions needed to meet future increases in water needs for all 12 of the Redding Basin water purveyors. Each purveyor's management will need to evaluate alternative supply strategies incorporating individual factors such as the major types of water use in the service area, the availability of non-CVP supplies, costs for developing new supplies, and the level of revenue (water rates) or funding sources to support needed capital facility improvements. These factors will need to be balanced with a management decision to achieve a targeted level of water supply reliability under the full range of future water supply cutback conditions. For example, a purveyor may select long-term planning criteria to have a water supply reliability that can meet 100 percent of projected water needs under a 1-in-10-year CVP cutback condition. Alternatively, other purveyors may determine that they cannot reasonably afford this level of reliability, and select supply reliability criteria to meet 90 percent of normal peak demands under a 1-in-10-year cutback condition. With this target reliability, conservation and demand management strategies would be necessary to reduce normal peak demands by 10 percent.

Selecting appropriate long-range water supply reliability criteria is a fundamental element in developing and evaluating long-term water supply alternatives for each purveyor. Once planning criteria have been established, a range of potential supply alternatives can be developed and evaluated. The supply alternatives would typically build off of some mix of the individual actions described in Section 5. From the evaluation results, the planning criteria can be iteratively adjusted to achieve a viable and economical long-term water supply plan for each purveyor and the Redding Basin as a whole.

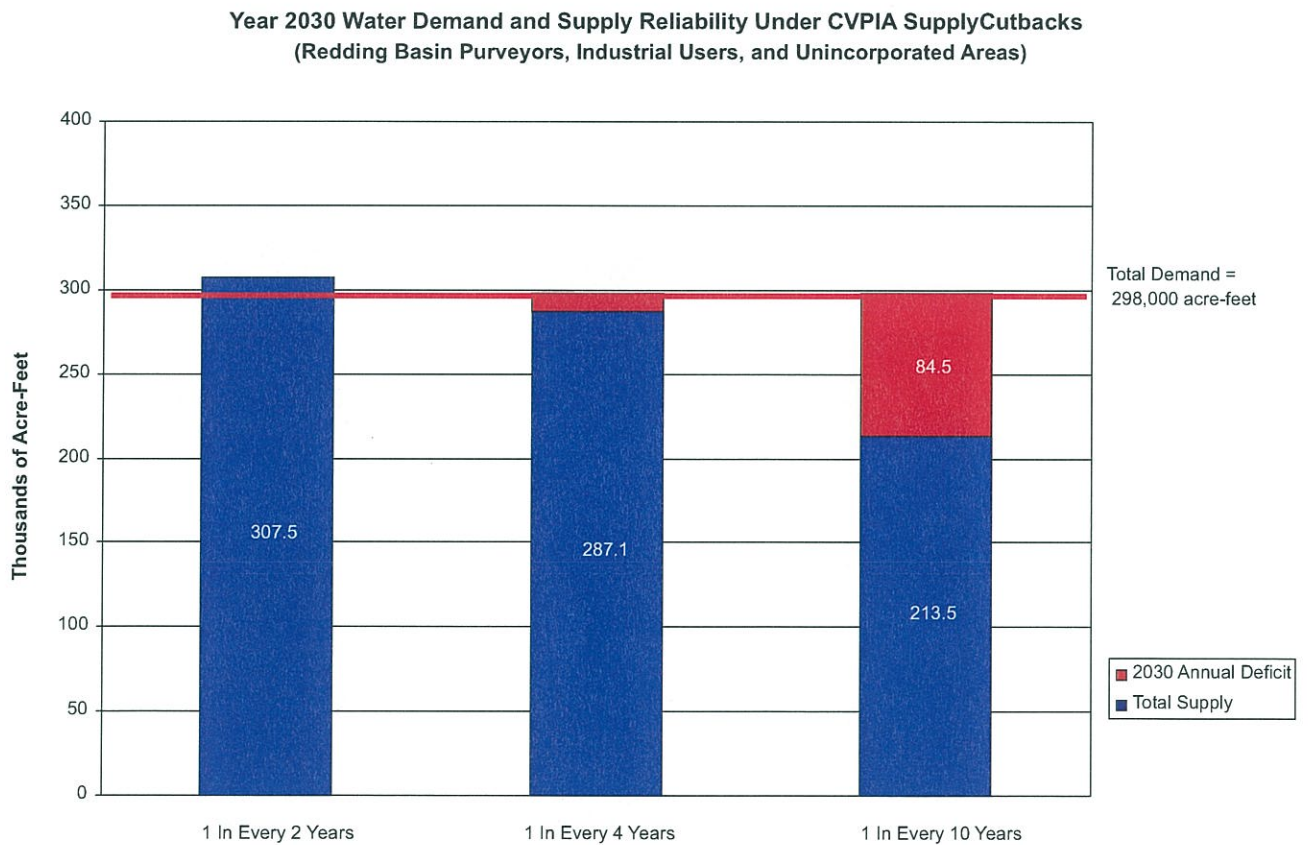
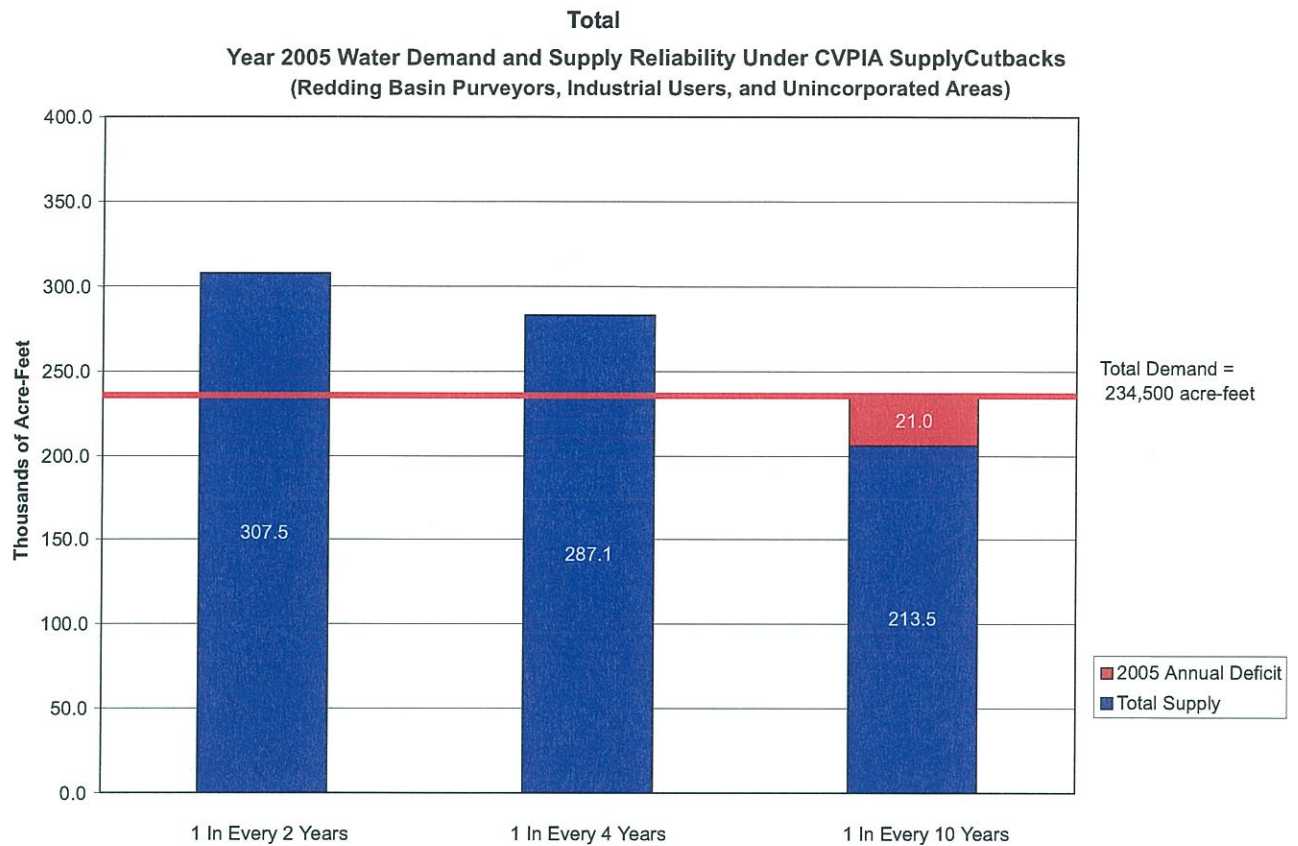
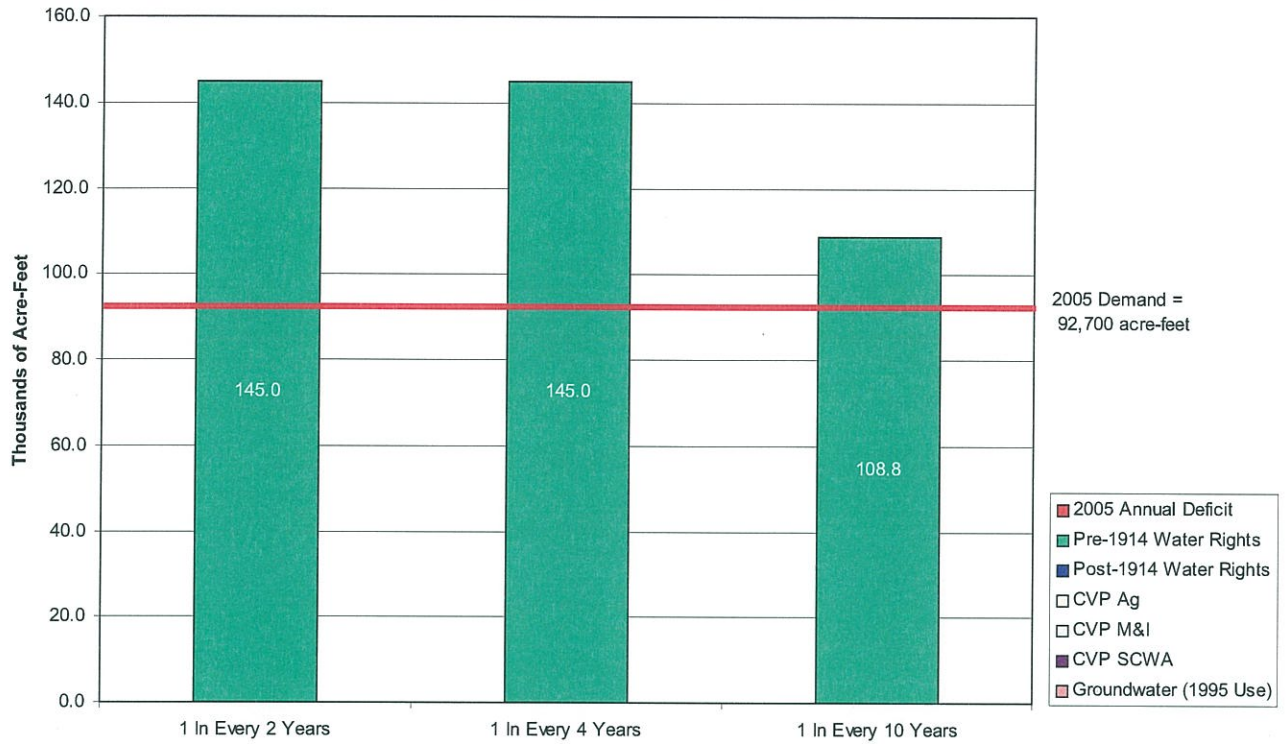
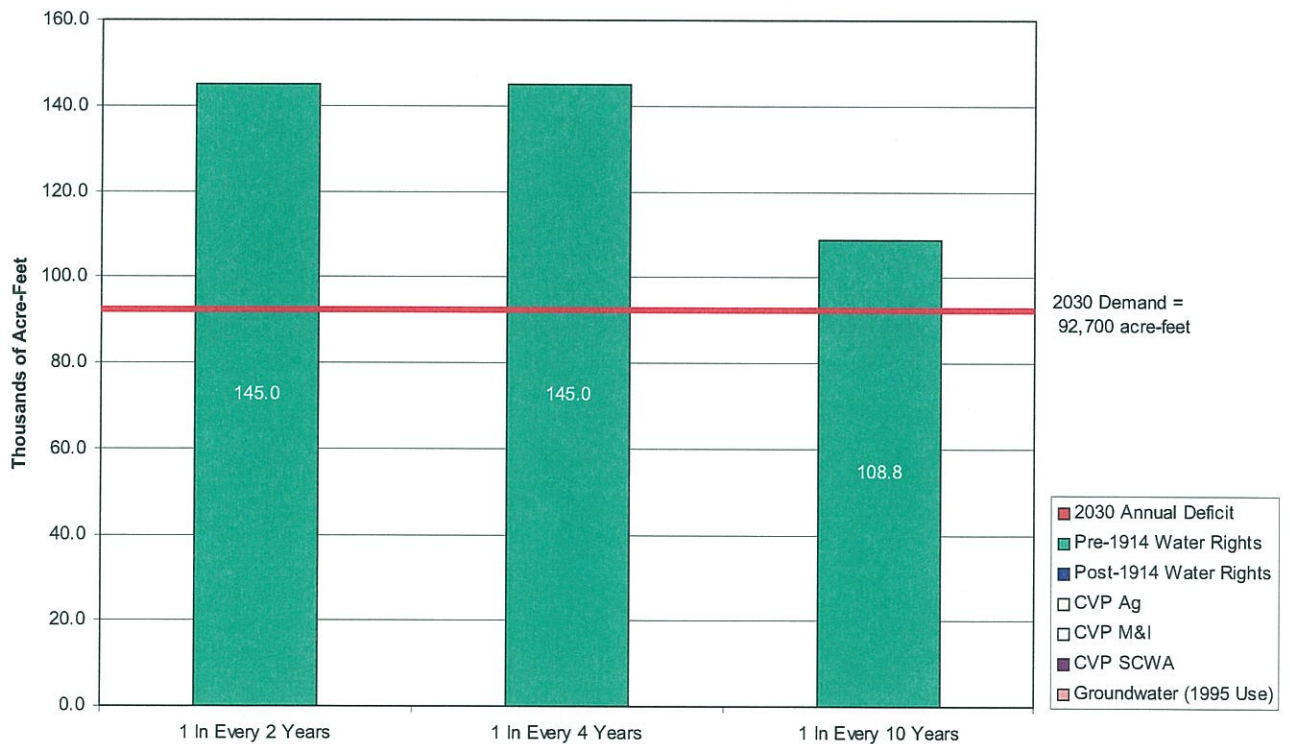


FIGURE 4-2
REDDING BASIN-SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

**Anderson-Cottonwood Irrigation District-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)**

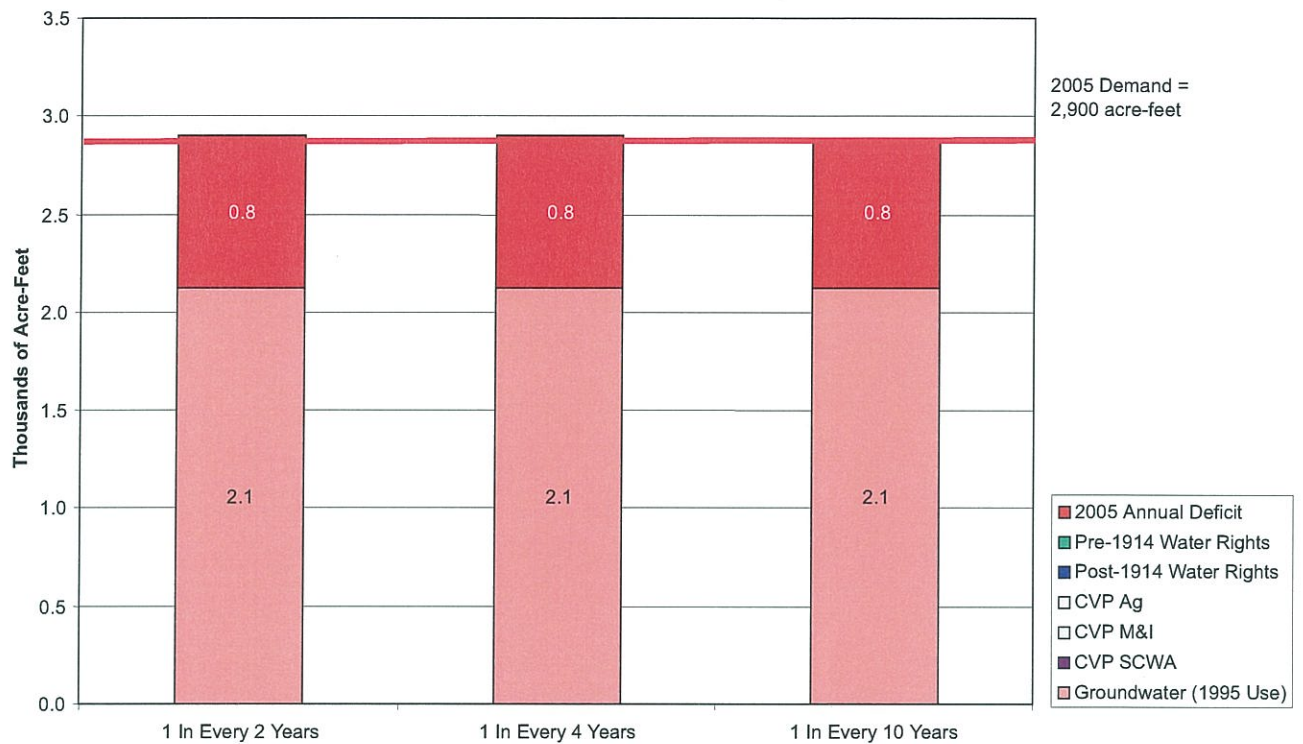


**Anderson-Cottonwood Irrigation District-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)**



**FIGURE 4-3
ACID SUMMARY OF SUPPLY AND DEMAND
REDDING BASIN WATER RESOURCES MANAGEMENT PLAN**

Anderson-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)



Anderson-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)

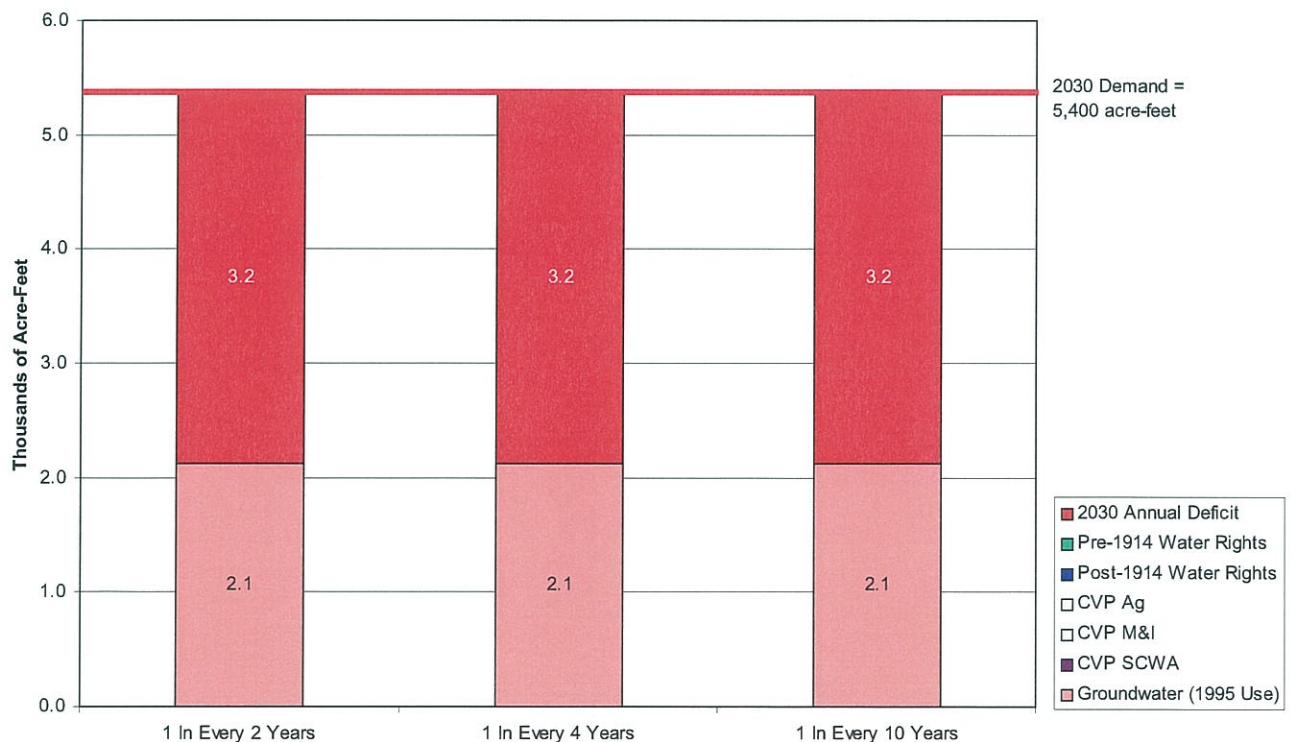
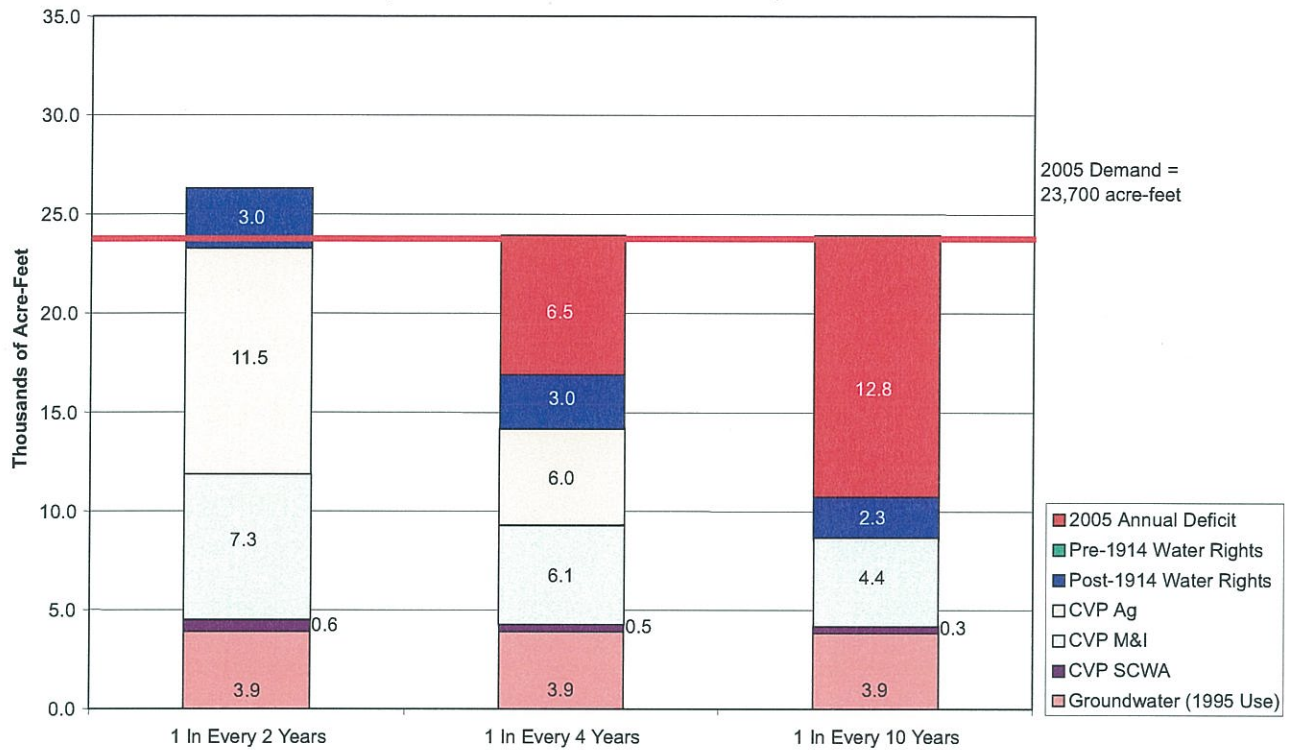
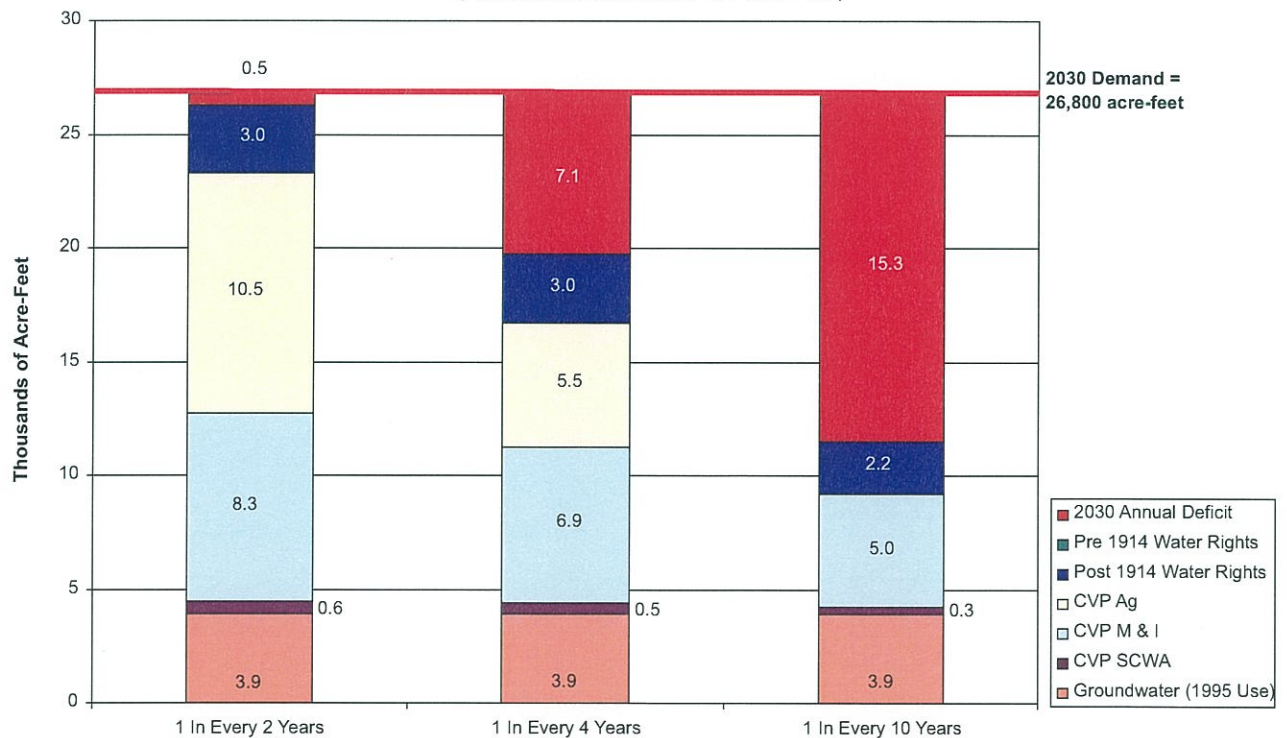


FIGURE 4-4
ANDERSON SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Bella Vista-Year 2005
Summary of Demand, Supply, Reliability, and Deficit
 (All Numbers in 1000s of Acre-Feet)



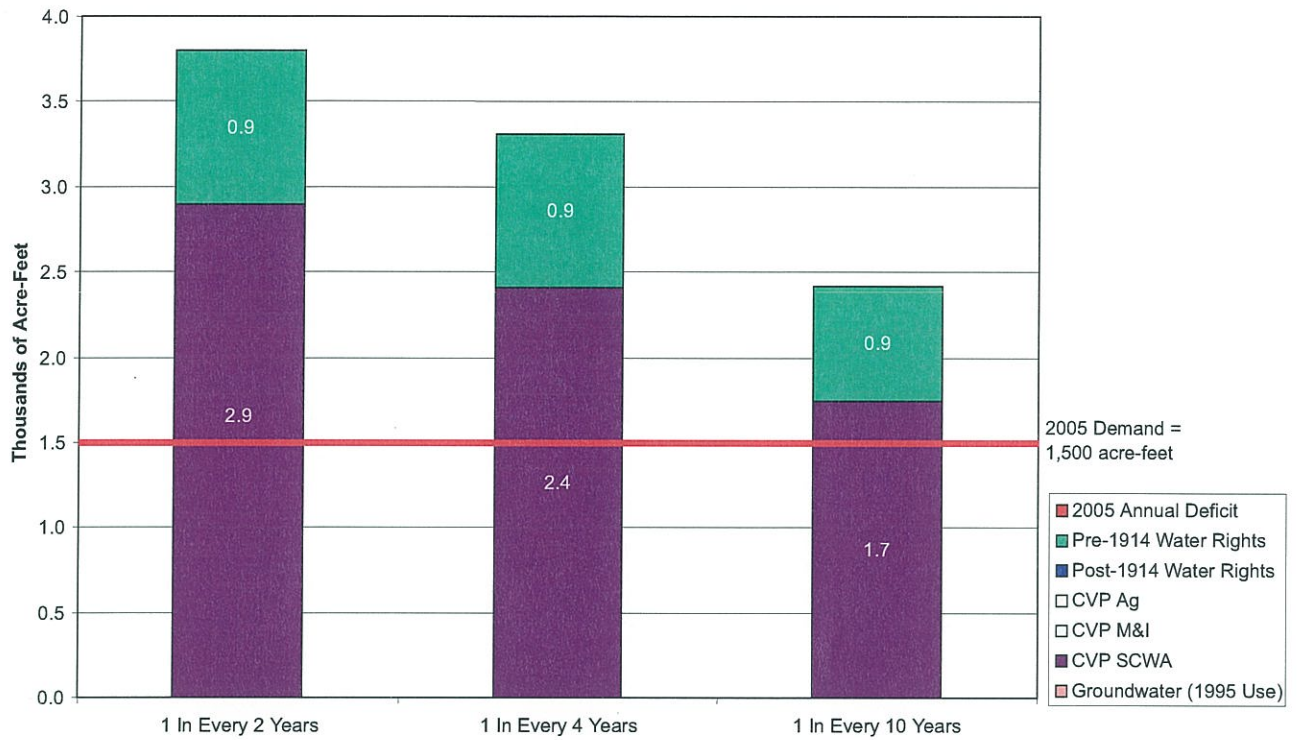
Bella Vista-Year 2030
Summary of Demand, Supply, Reliability, and Deficit
 (All Numbers in 1000's of Acre-Feet)



NOTE: REFLECTS 1994 AG/M&I CVPIA SUPPLY SPLIT

FIGURE 4-5
BELLA VISTA SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Centerville-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Centerville-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

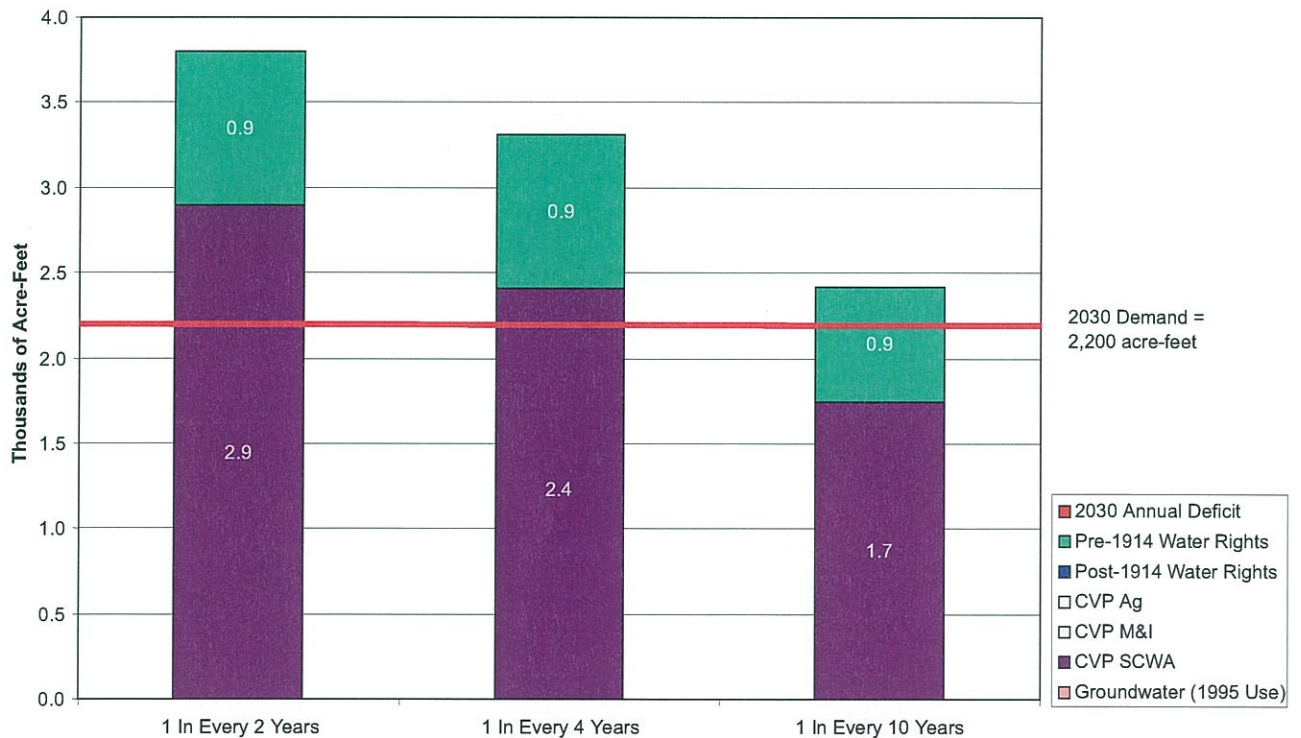
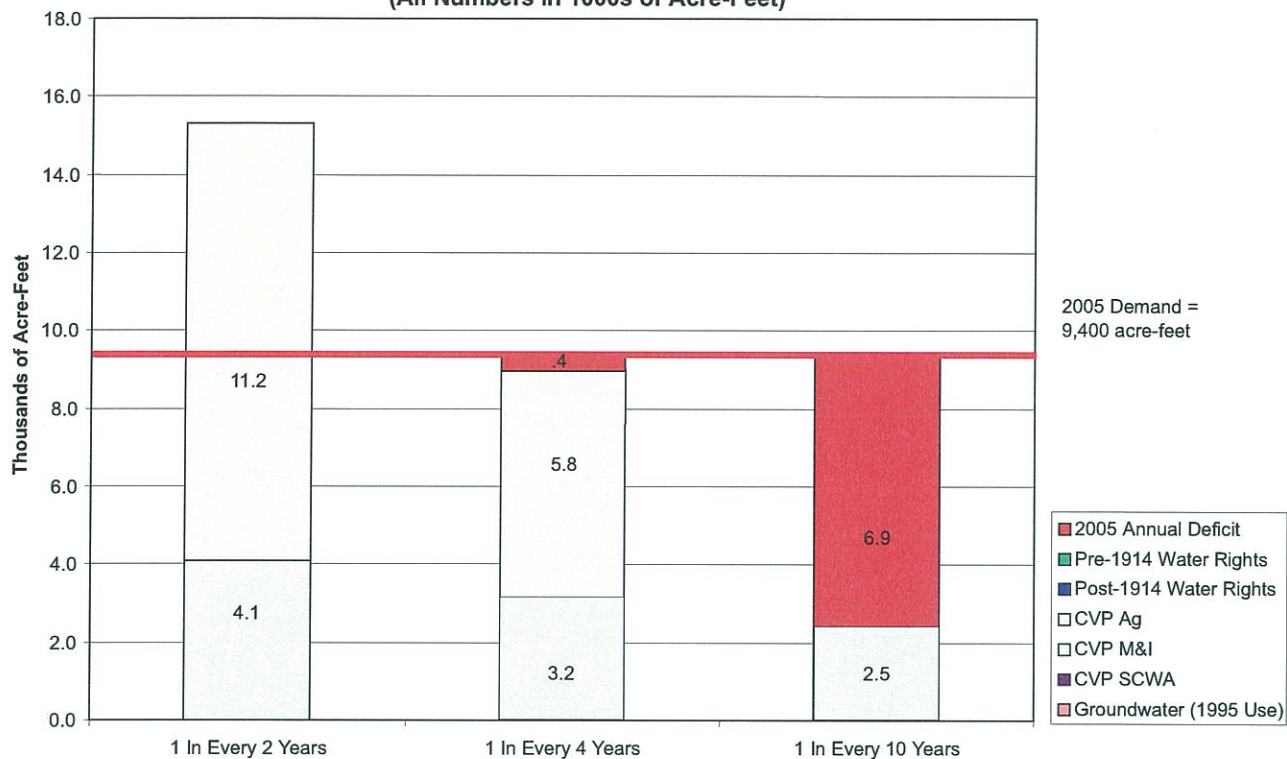


FIGURE 4-6
CENTERVILLE SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Clear Creek-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Clear Creek-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

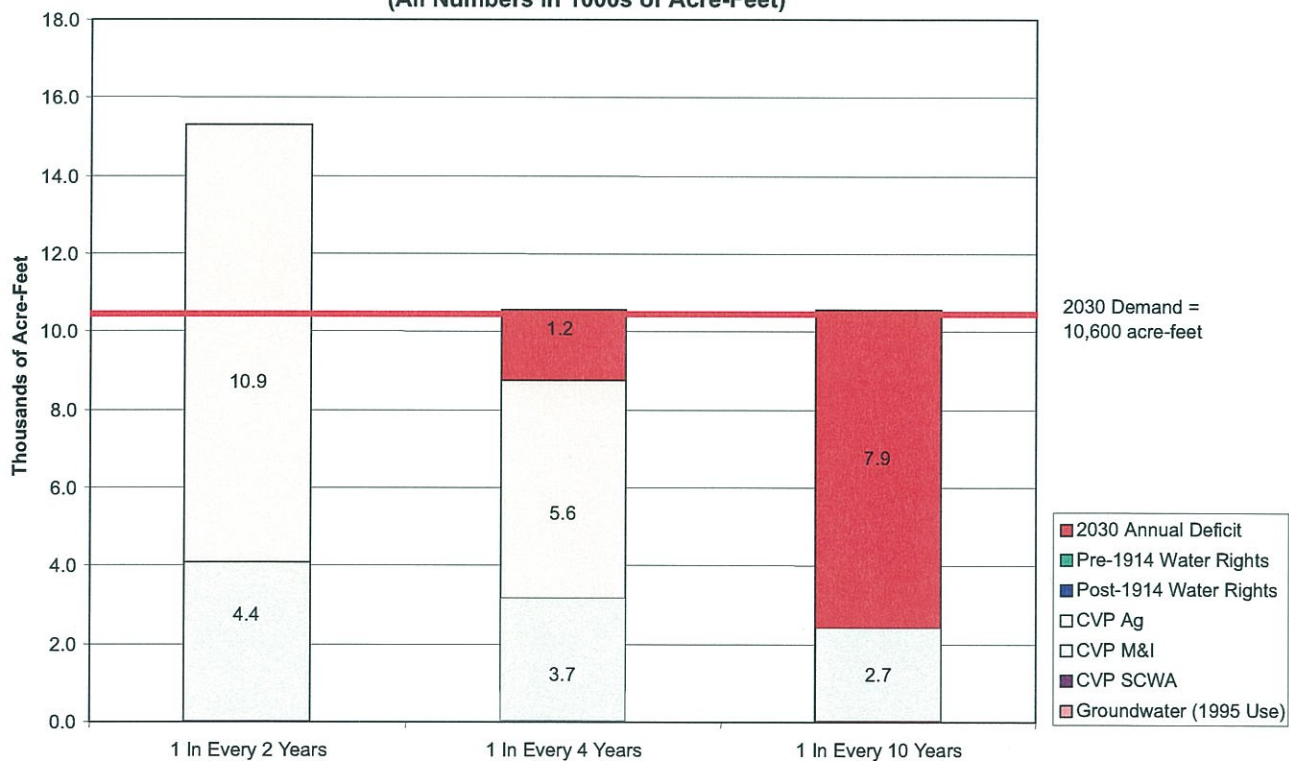
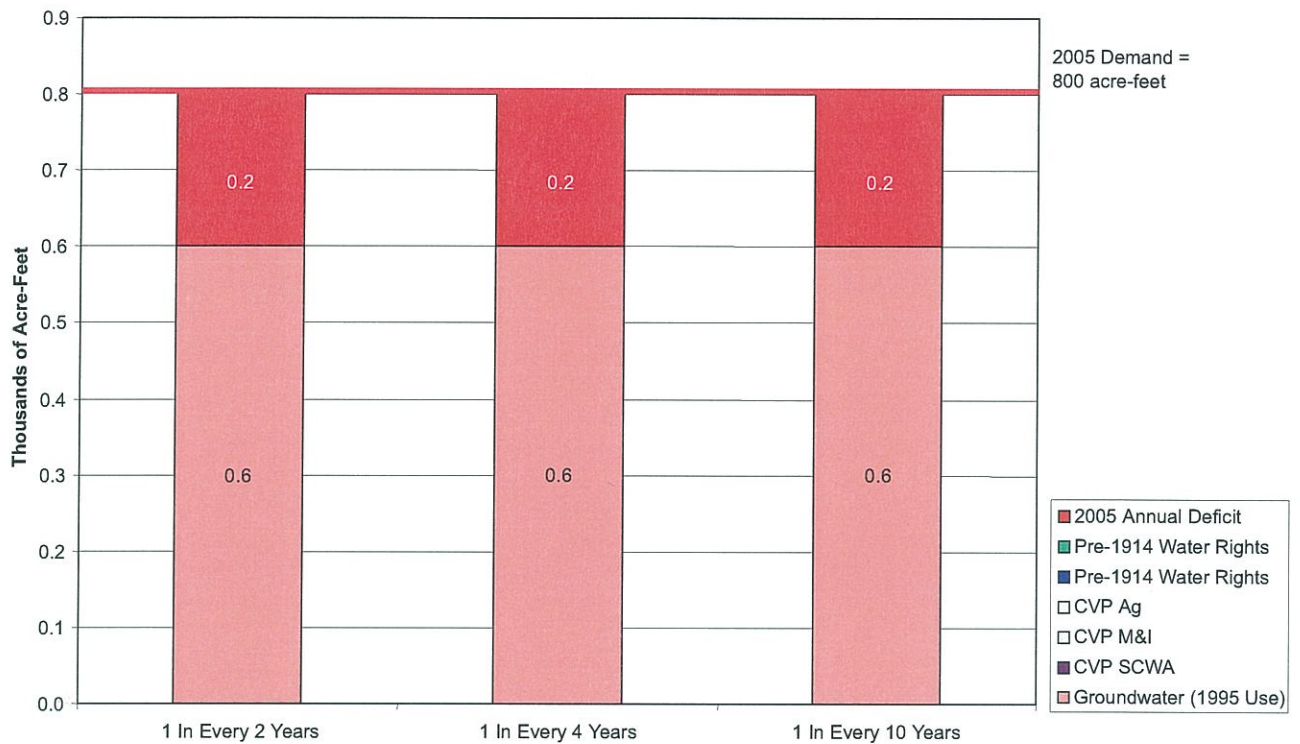


FIGURE 4-7
CLEAR CREEK SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Cottonwood-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)



Cottonwood-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)

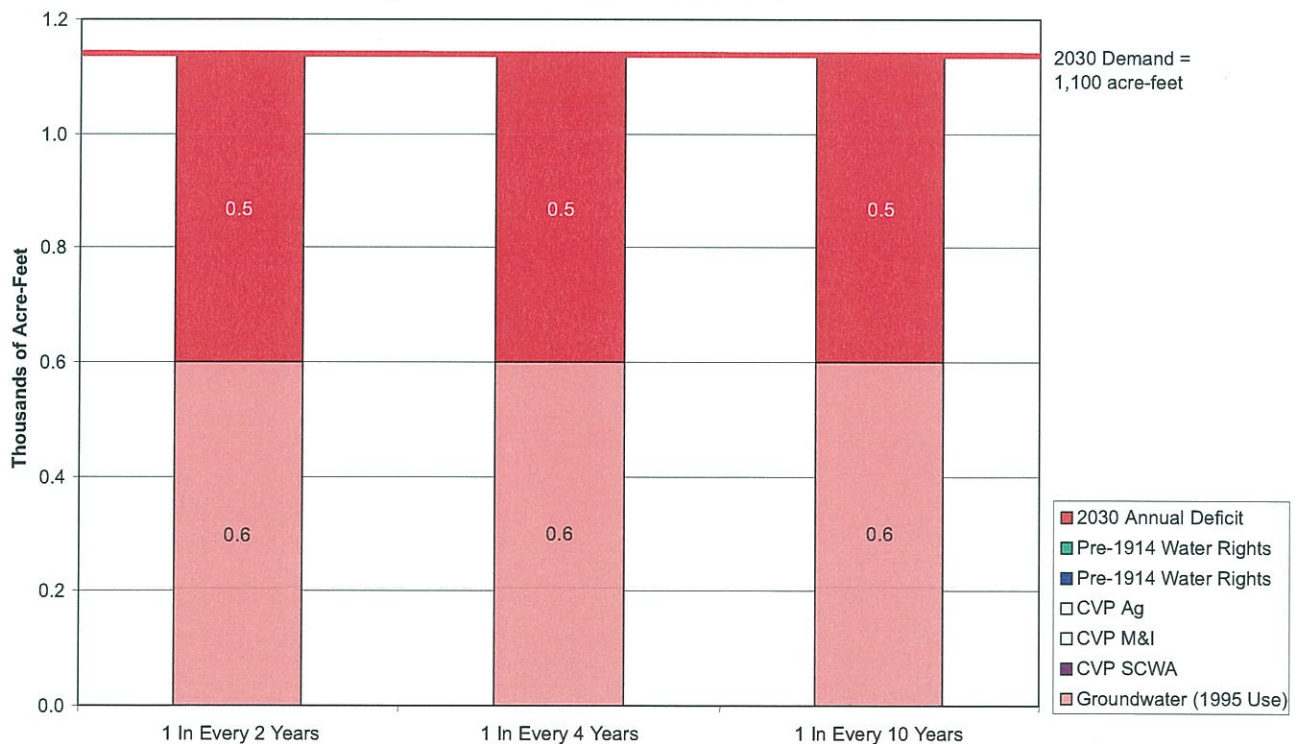
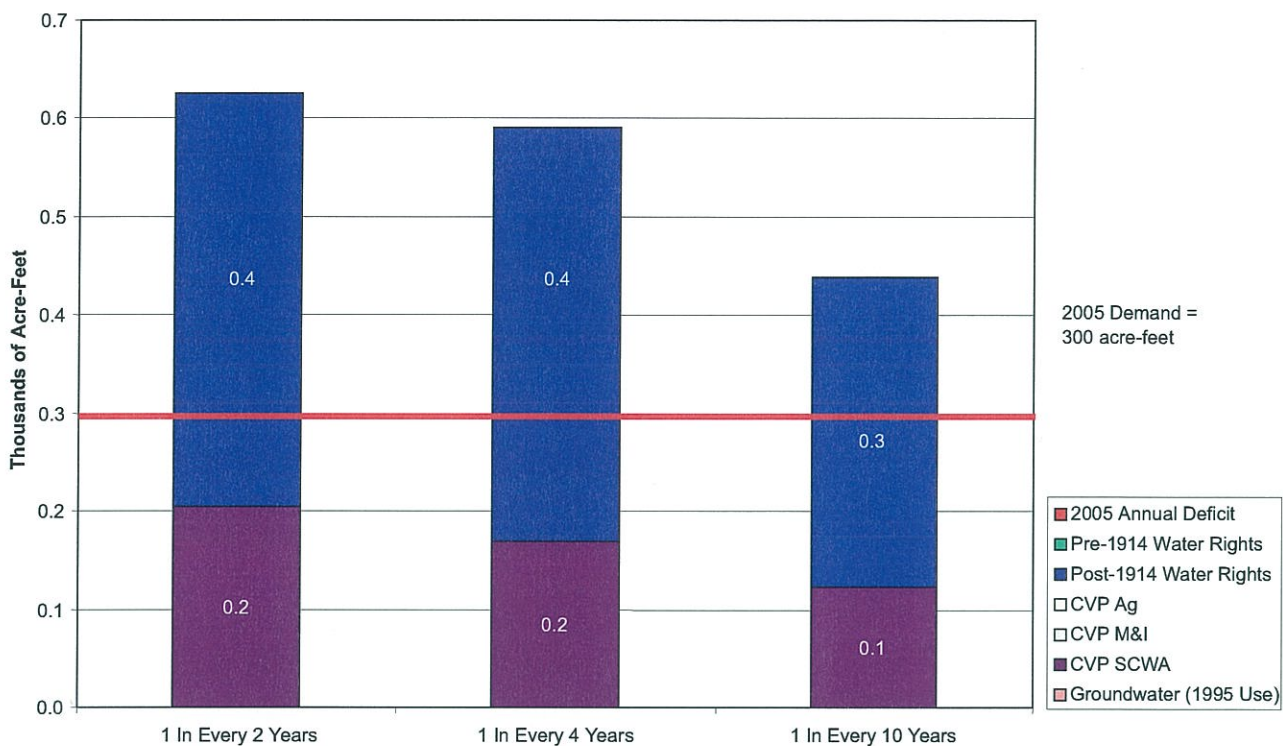


FIGURE 4-8
COTTONWOOD SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Jones Valley-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Jones Valley-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

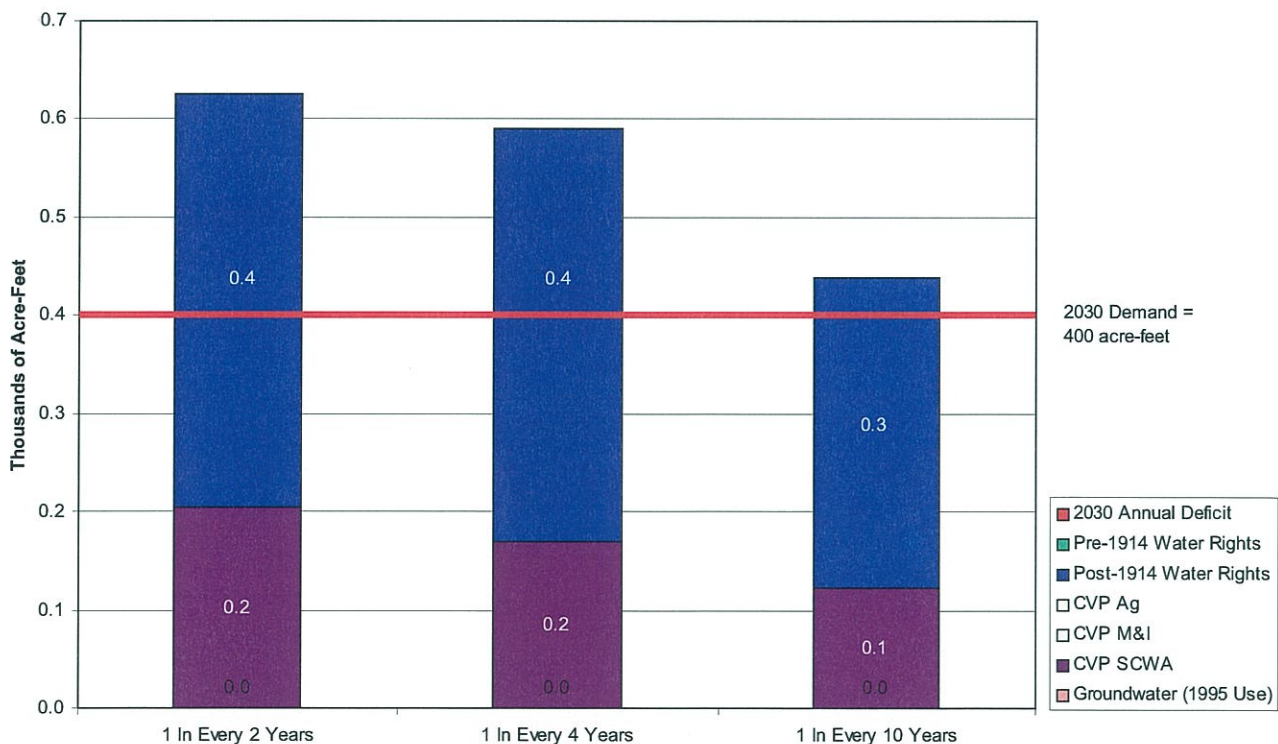
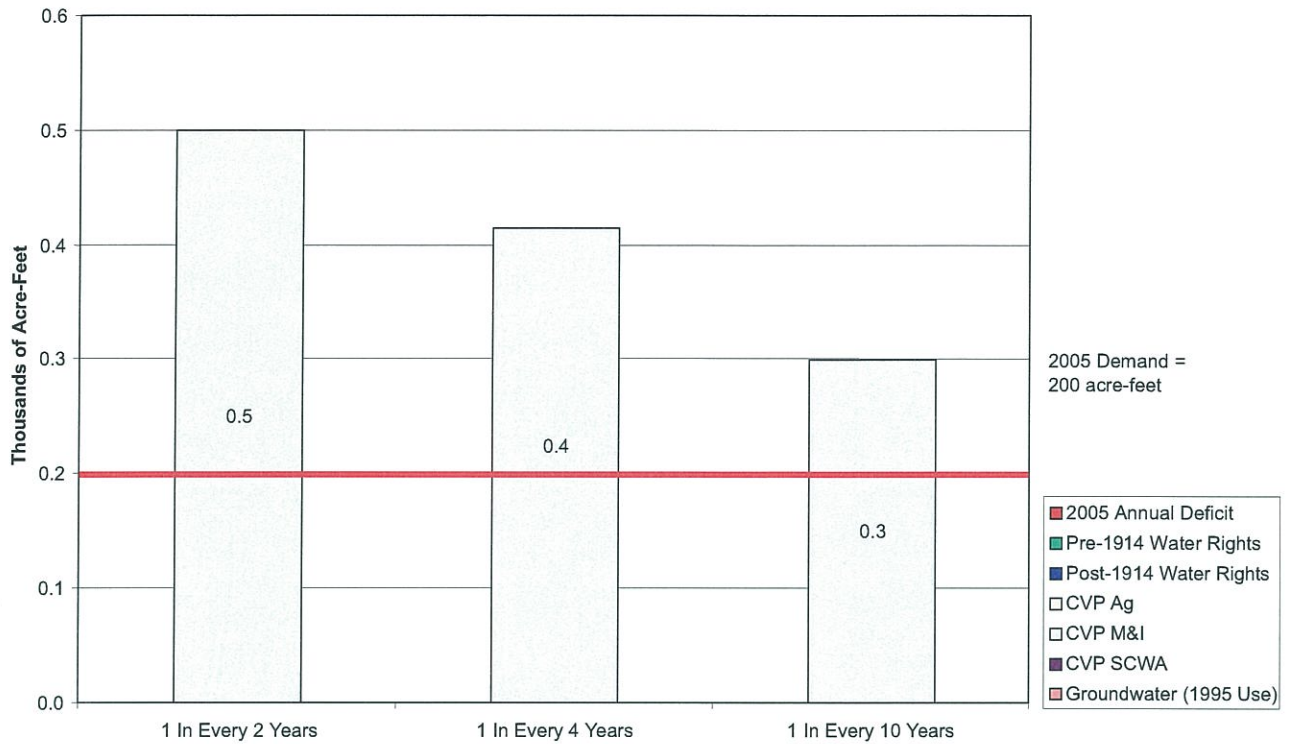


FIGURE 4-9
JONES VALLEY SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Keswick-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Keswick-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

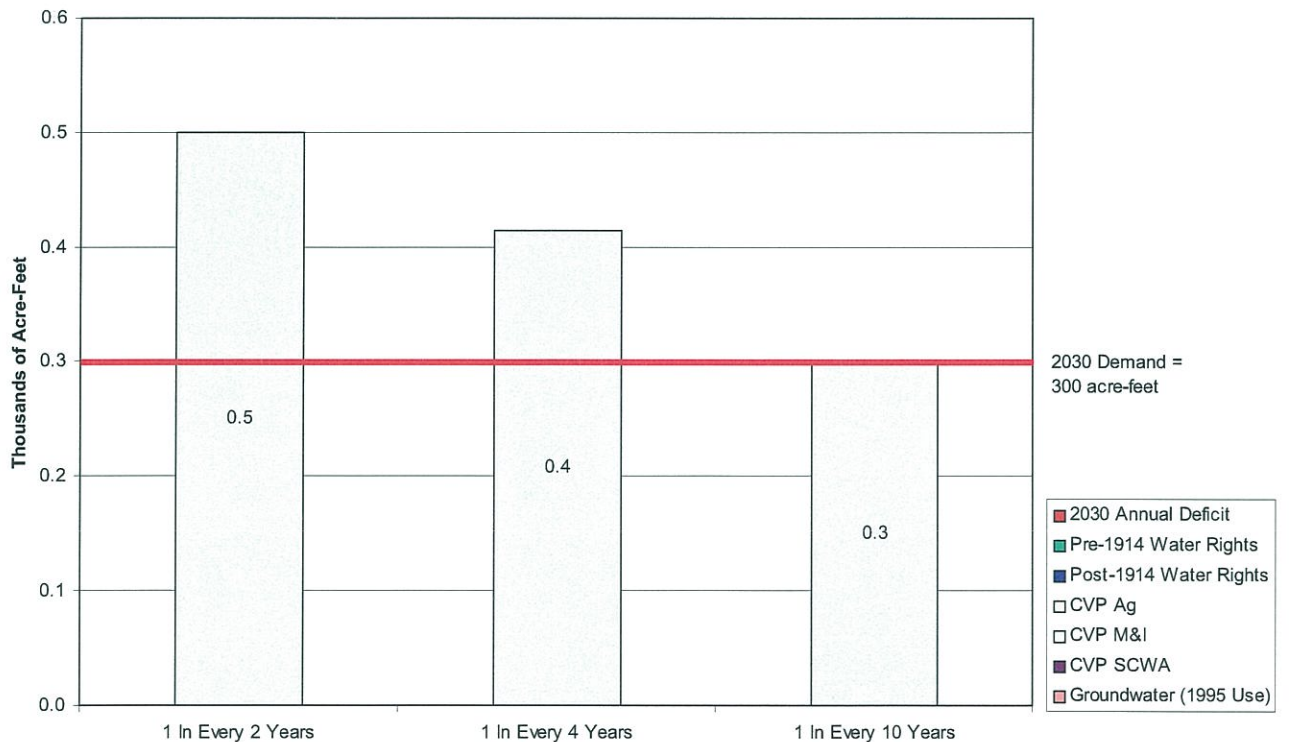
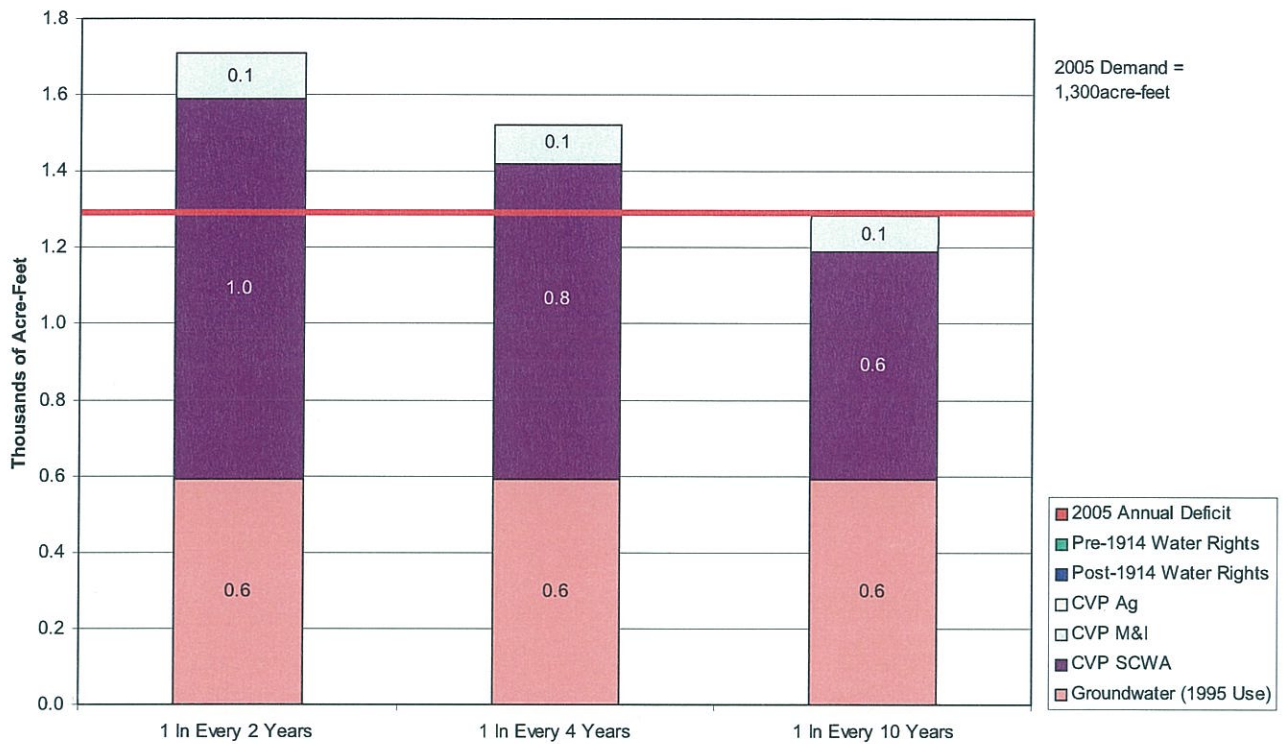


FIGURE 4-10
KESWICK SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Mountain Gate-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Mountain Gate-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

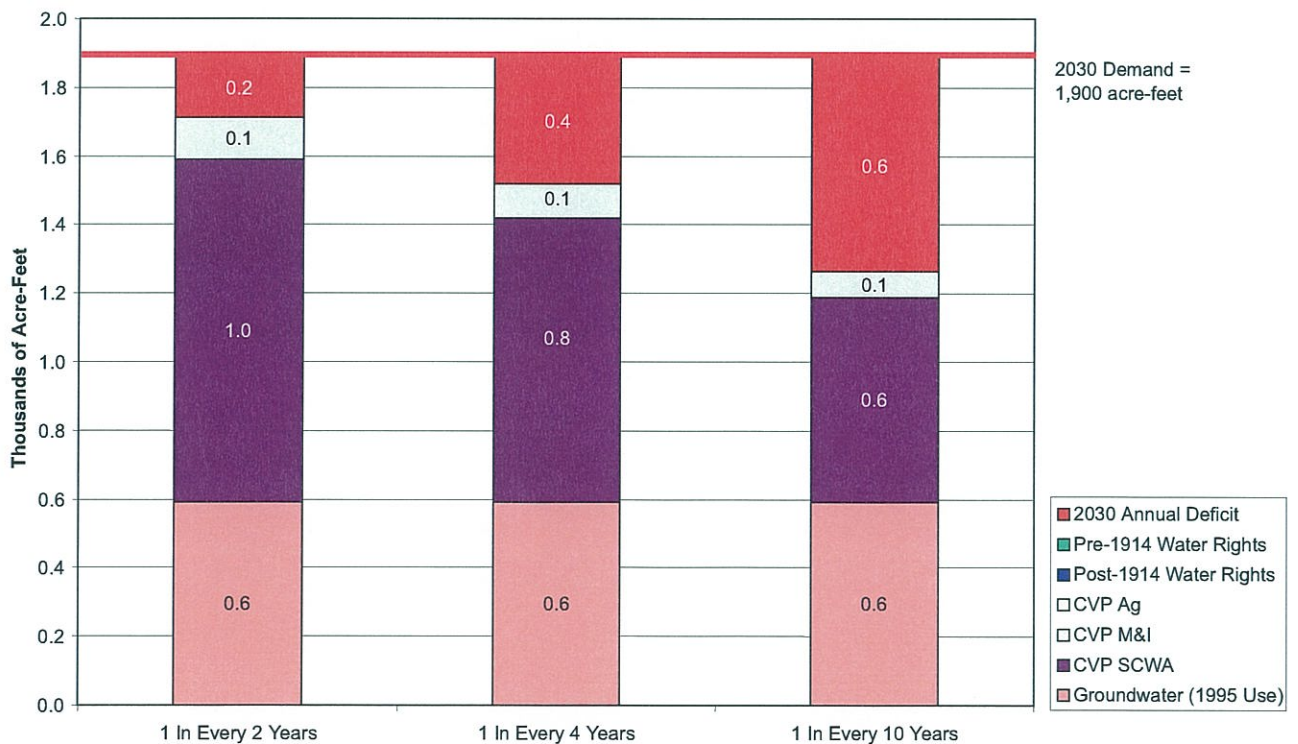
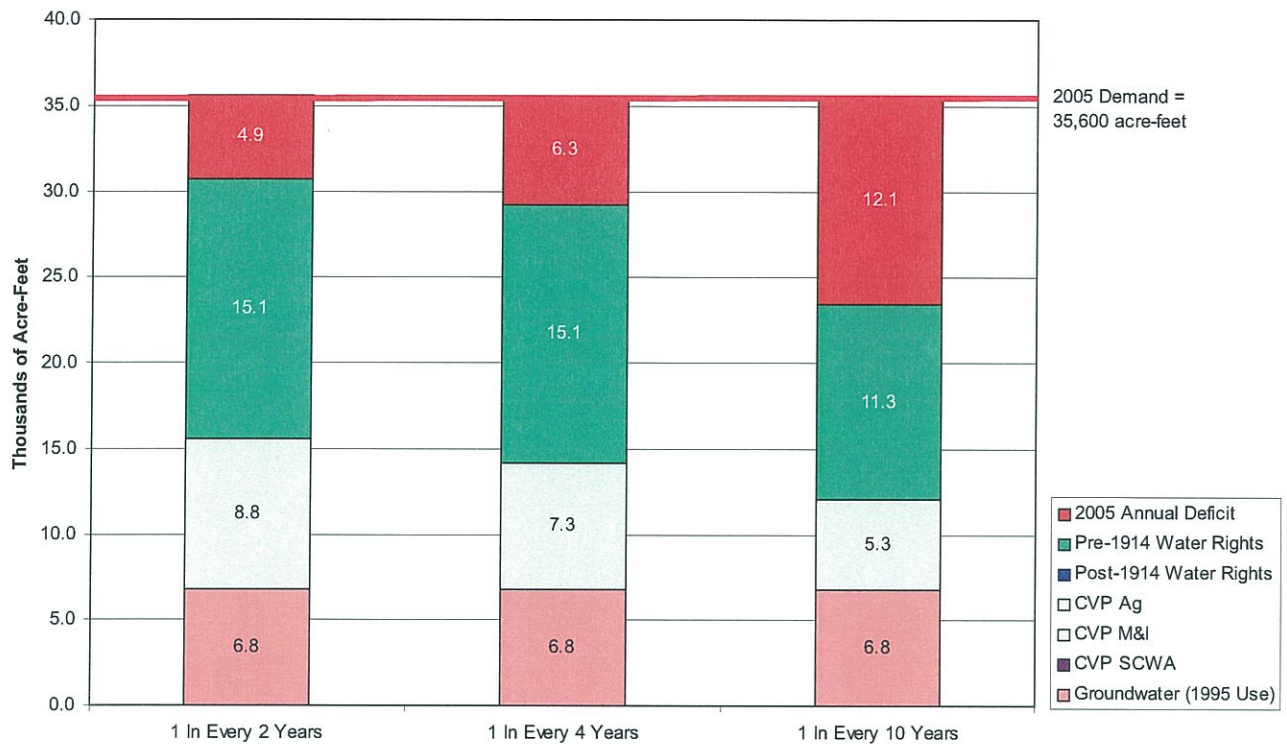


FIGURE 4-11
MOUNTAIN GATE SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Redding-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Redding-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

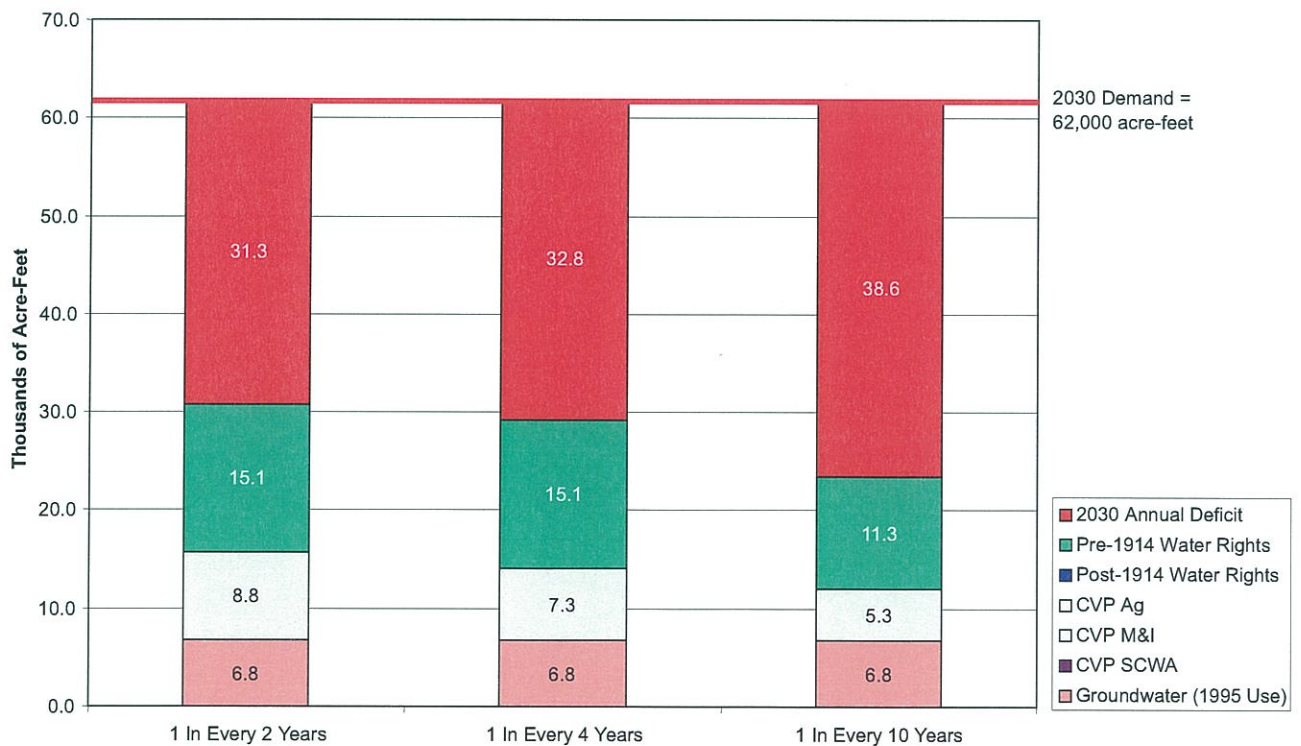
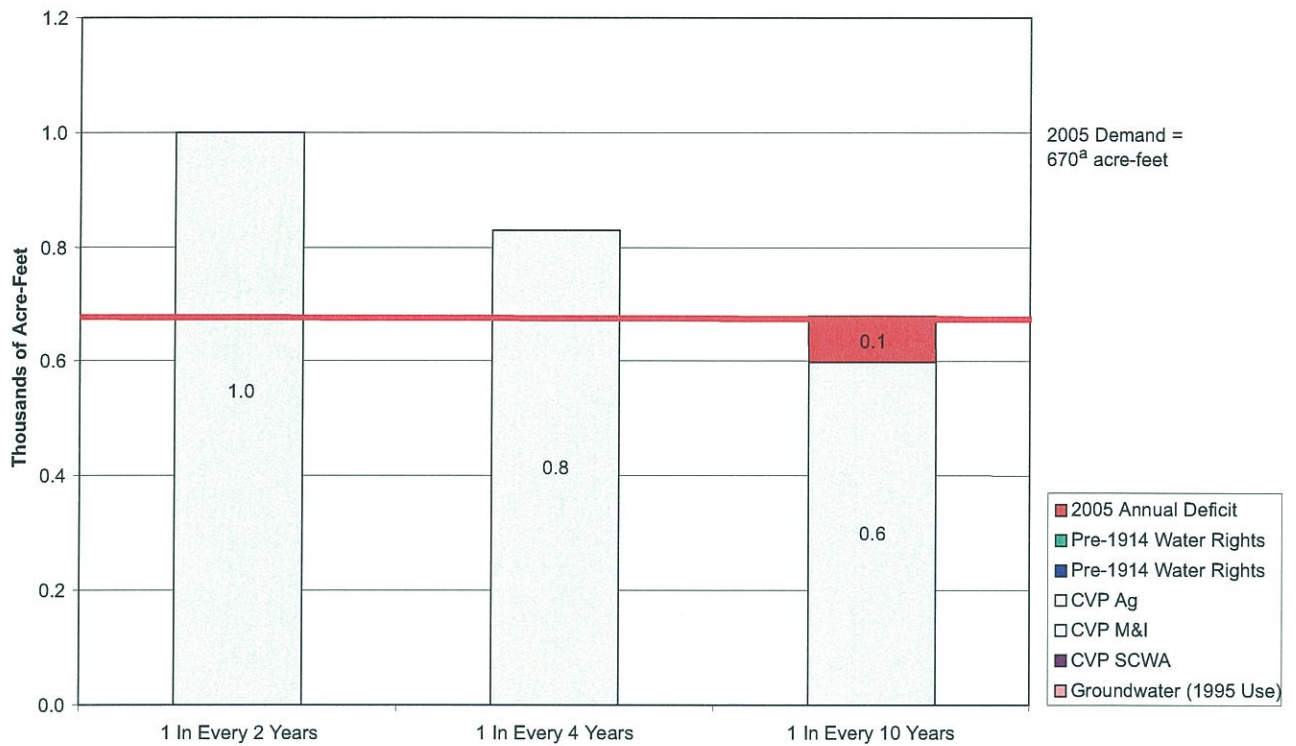


FIGURE 4-12
REDDING SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Shasta CSD-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Shasta CSD-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

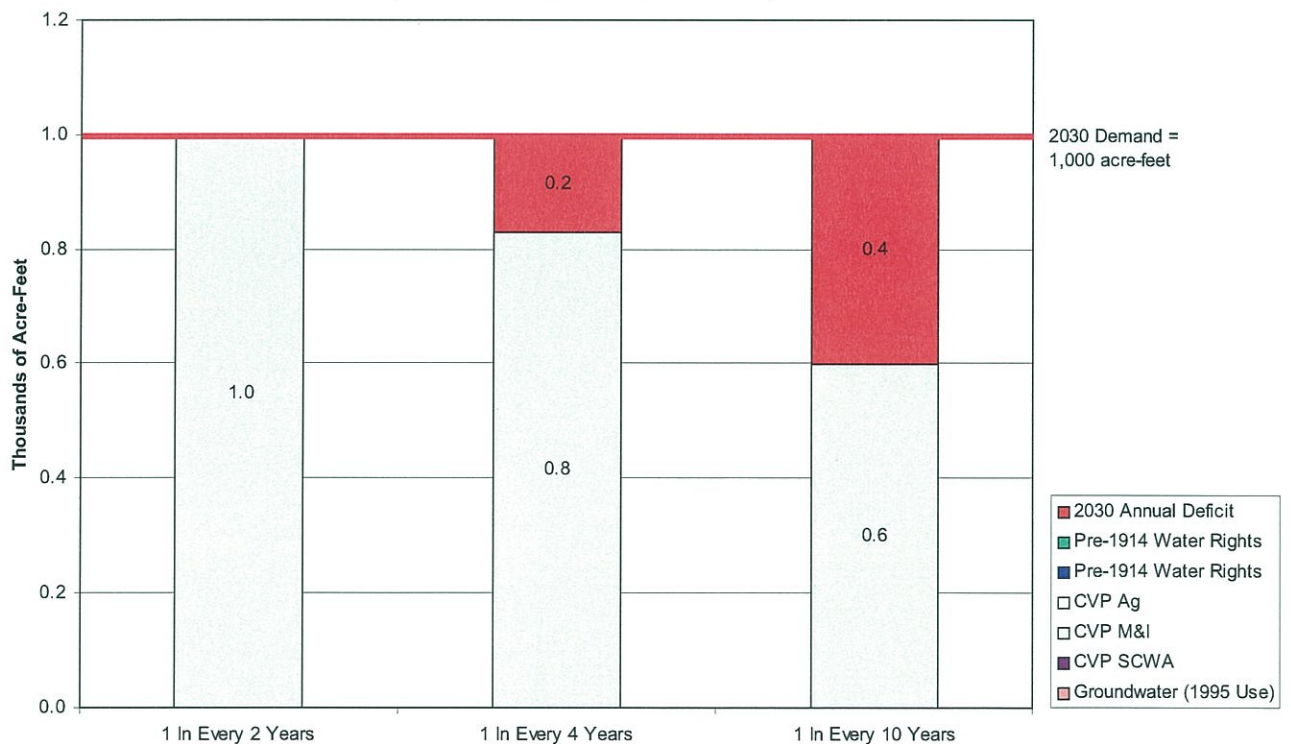
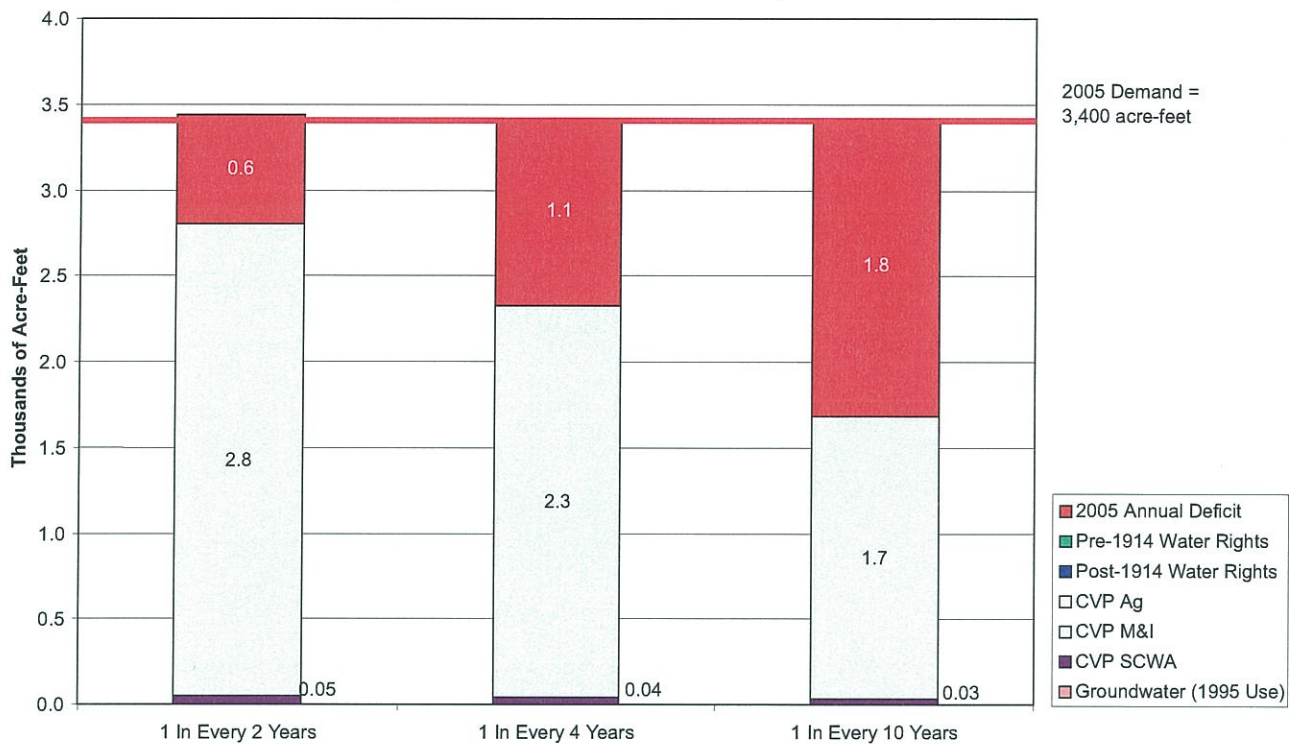


FIGURE 4-13
SHASTA CSD SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Shasta Lake-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Shasta Lake-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

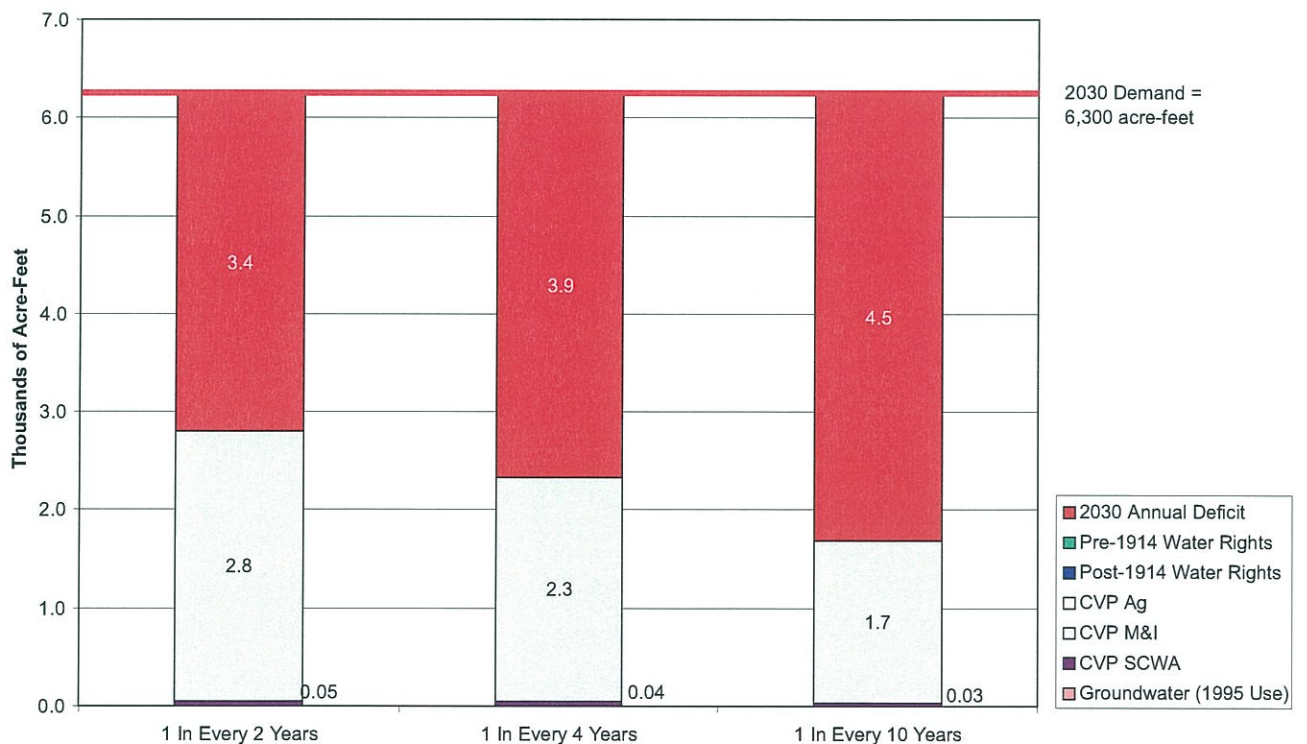
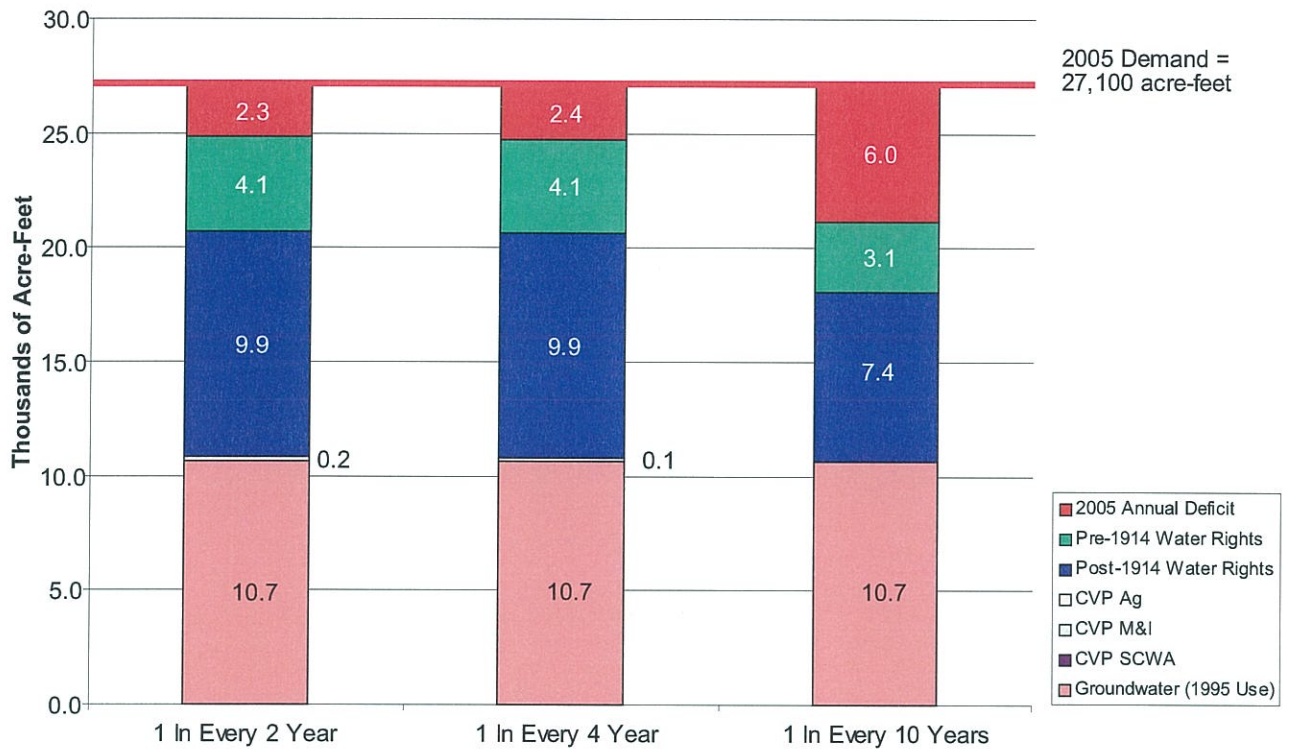


FIGURE 4-14
SHASTA LAKE SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Unincorporated-Year 2005
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)



Unincorporated-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
 (All Numbers in 1000s of Acre-Feet)

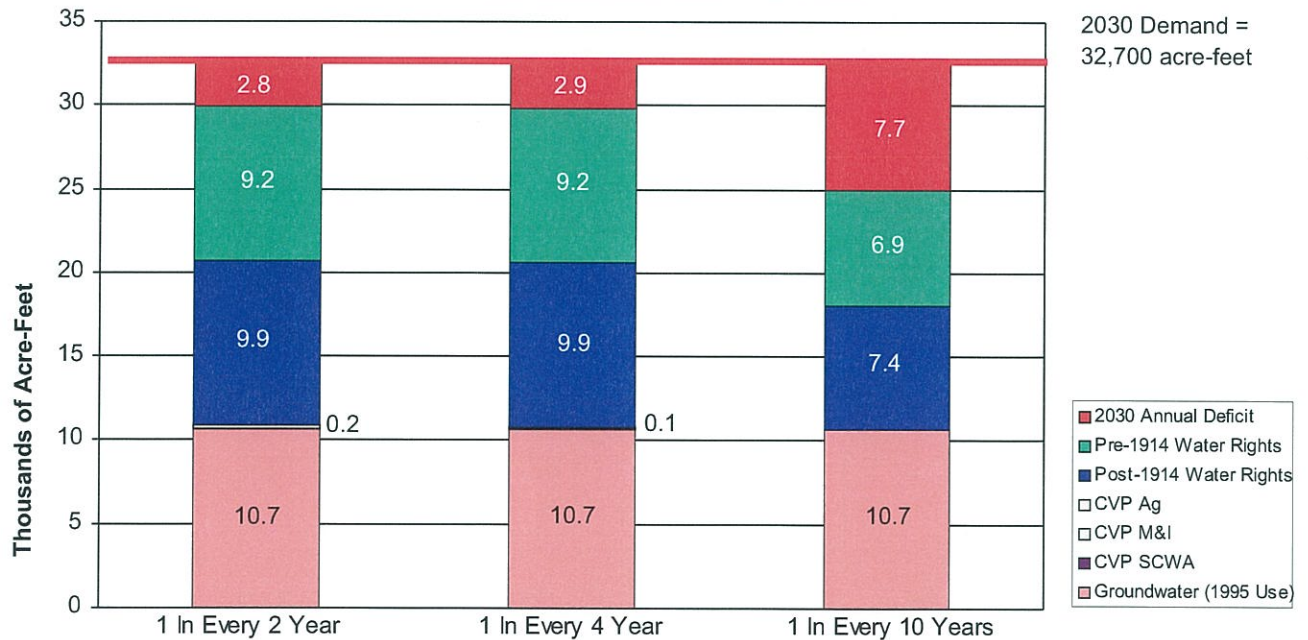
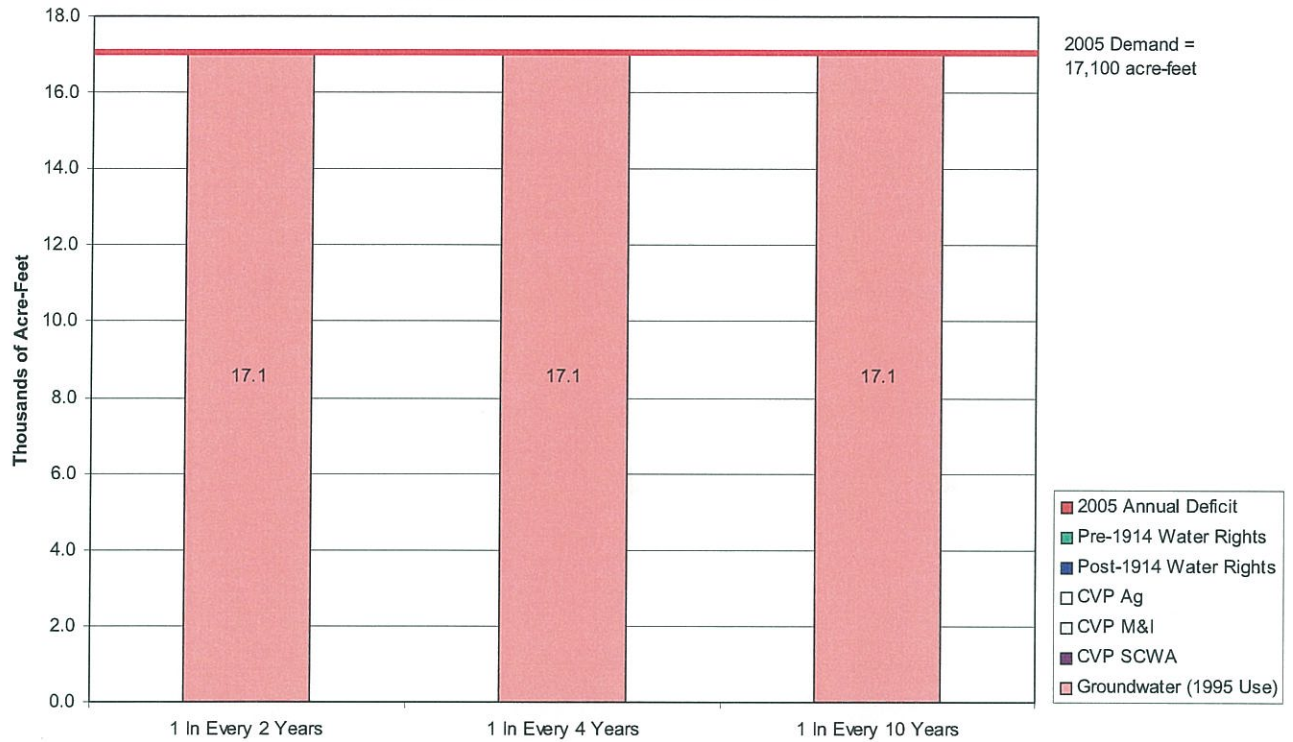


FIGURE 4-15
UNINCORPORATED SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

Heavy Industrial-Year2005
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000s of Acre-Feet)



Heavy Industrial-Year 2030
Summary of Demand, Supply, Reliability, and Deficits
(All Numbers in 1000's of Acre-Feet)

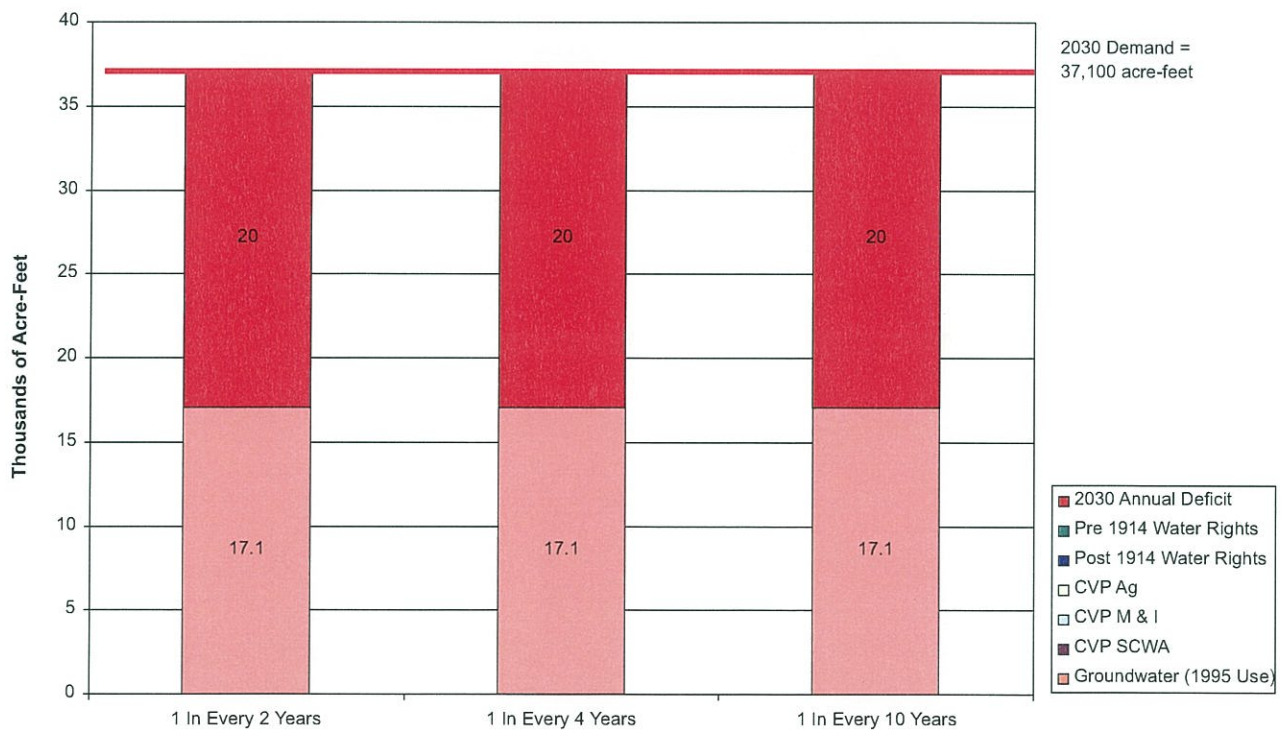


FIGURE 4-16
HEAVY INDUSTRIAL SUMMARY OF SUPPLY AND DEMAND
 REDDING BASIN WATER RESOURCES MANAGEMENT PLAN

SECTION 5

Potential Actions to Meet Future Needs

Development of Potential Actions

Section 4 identified the short-term and long-term water supply needs for the Redding Basin. These needs were compared to existing water supplies to forecast where and when available supplies or deficits may exist. The results show that most purveyors face significant deficits over the next 5 years and beyond.

As part of this planning process, a range of potential actions to address these deficits were identified, discussed with RAWC members, and screened at a conceptual level. This section provides an overview of this process and discusses each general action. The actions were developed and evaluated in conjunction with the RAWC Technical Advisory Committee (TAC). It is anticipated that some combination of these actions will provide the foundation for a long-term water management strategy to meet the future water needs of the Redding Basin.

Water supply shortages experienced by Redding Basin purveyors in the 1990s prompted a variety of actions to improve their water supply reliability. Some of these actions were successful, and various opportunities for further actions and regional cooperation were identified. Examples of further opportunities for regional cooperation include short-term and long-term transfers of available water from one purveyor to another, construction of interties between service areas, and shared development of groundwater supplies.

The potential actions to meet future water needs include the following water supply development and management/institutional actions:

- Increase groundwater pumping to develop available groundwater resources
- Conjunctively manage surface water and groundwater supplies to increase overall water supply reliability during the full range of hydrologic conditions
- Use non-potable water (reclaimed water and untreated surface water) for irrigation and industrial uses
- Develop new in-basin surface storage
- Implement water transfers and establish a common pool of CVP contract supplies
- Implement additional water conservation and demand management measures
- Take additional steps to preserve and protect existing water rights

These actions were evaluated at a very general "screening" or "feasibility" level. The evaluation addressed potential benefits of improved water supply or management capability, potential fatal flaws, and how each action may be implemented or supported by each of the Redding Basin purveyors. Specific capital improvements such as pipelines and

well fields, and related capital and operating costs, were not developed at this stage of the planning process. In the next phase of the planning process, these actions will be combined into a range of comprehensive long-term plans, including capital facilities, specific operational concepts, and costs.

Table 5-1 presents the evaluation criteria that were developed to evaluate the potential actions. These criteria will also be used to develop alternatives for the comprehensive long-term plan.

TABLE 5-1
Evaluation Criteria for Potential Actions

Evaluation Criteria	Factors to Consider
Legal Acceptability	Is the action consistent with applicable state and federal laws, and existing CVP contract provisions?
Institutional Acceptability	Does the action adversely affect the autonomy of the existing water purveyors in the basin? Is the action consistent with the goals of major federal and state water management programs such as CALFED?
Protection of Water Rights	Does the action help preserve and protect water rights held by local water purveyors? Will the action put those water rights at risk?
Capital Costs	Can the costs of constructing any necessary water supply facilities be repaid by the water users, or are other sources of funding available to reduce the costs to the water users?
Operations and Maintenance Costs	Are the ongoing operations and maintenance costs affordable?
Impact on Water Rates and Ability to Pay	Is the action affordable to the ratepayers or the users? Are costs fairly apportioned to the beneficiaries?
Reliability	Does the action help address the reliability criteria established by the water purveyors?
Public Acceptance	Is the action acceptable to the water users and the public at large?
Environmental Impacts	Will the action result in adverse environmental impacts that are not feasible to mitigate?
Timing of Implementation	Can the action be implemented so that benefits are realized in the desired timeframe?
Sustainability	Does the action represent a long-term sustainable approach to providing a reliable water supply?

Increased Groundwater Pumping

Groundwater represents a significant source of additional water supply in the Redding Basin. Current annual groundwater pumpage is less than 40,000 acre-feet per year. This represents less than 2 percent of the amount of groundwater in storage in the basin, and less than the estimated annual recharge of 303,000 acre-feet. Portions of the Redding Basin are underlain by aquifers suitable for large-scale groundwater development. Increased groundwater pumping could be particularly beneficial during drought periods when ample surface water may not be available.

Areas of the Redding Basin that are generally suitable for large-scale development of groundwater lie in the central and southern portions of the basin, where more than 500 feet of permeable alluvial materials have been deposited. In the central parts of the basin, well yields can be above 3,000 gallons per minute. However, around the perimeter of the basin, where permeable materials are thin or non-existent, well yields are small and generally suitable only for a single-family dwelling. Another limitation on the availability of groundwater around the perimeter of the basin is the occurrence of saline groundwater within the Chico Formation, which underlies the more permeable alluvial materials.

Preliminary evaluation of the groundwater basin's response to increased pumping indicates that a significant volume of additional groundwater could be extracted from the high-yielding areas of the basin without inducing long-term progressive drawdown of groundwater levels. Temporary impacts would result from increased pumping rates, but the magnitude and timing of such impacts is dependent on the details of the wellfield design and the timing and rate of pumping. A detailed analysis of such impacts should be part of any plan to significantly increase pumping in the Redding Basin. These impacts may include some or all of the following:

- Removal of groundwater from storage causing a temporary, localized decline in groundwater levels
- Temporary reduction in the rate of groundwater discharge to surface streams
- Temporary reduction in evapotranspiration in areas of shallow groundwater
- Temporary increase in the rate of seepage from surface streams and other surface-water sources

Because of geographic variations in groundwater availability throughout the basin, some water purveyors have the ability to develop large quantities of groundwater while others have very limited groundwater resources within their respective service areas. The purveyors with the best opportunities to develop large quantities of supplemental groundwater are ACID, the City of Redding, the City of Anderson, and the Cottonwood WD. Purveyors with moderate potential to develop additional groundwater supplies include the Bella Vista WD and the Clear Creek CSD. The other purveyors in the basin have very limited potential to develop additional groundwater supplies within their respective service areas. Therefore, any plan to increase basinwide reliability through groundwater development should include provisions for conveyance and/or transfer of water supplies throughout the basin so that all purveyors can achieve some improvement in water supply reliability.

Conjunctive Management of Groundwater and Surface-water Supplies

Conjunctive management involves operating a groundwater basin in combination with a surface-water storage and conveyance system to provide greater flexibility to meet demands under all hydrologic conditions. The groundwater basin can act as a "reservoir," similar to a large surface-water reservoir such as Lake Shasta. During periods of reduced surface-water

supply, the groundwater reservoir can be drawn down to provide the needed supply. The groundwater reservoir is then refilled during wet periods. The recharging of the groundwater is typically achieved through a combination of natural recharge, induced recharge through shallow infiltration basins or injection wells, or "in-lieu recharge" (reducing groundwater pumping).

The potential for a conjunctive management program is very favorable in the Redding Basin. In the deep part of the basin the aquifer is thick and permeable, so high-yielding wells can be drilled. Also, it appears that the volume of natural recharge to the aquifer is so large that construction of facilities to increase recharge may not be needed. The estimated volume of recharge to the groundwater basin currently exceeds the local use by a factor of about eight. If the groundwater basin were operated conjunctively with the available surface-water resources, the total yield from the two sources could be increased without significant effects on other water users or the environment.

Redding Basin water purveyors currently pump less than 40,000 acre-feet of groundwater per year. About 35 percent of this groundwater is used for agriculture and 65 percent for urban and industrial uses. It is used as a sole source of supply by the City of Anderson, the Town of Cottonwood, and large industrial water users including the Shasta Paper Mill, Wheelabrator Shasta Energy Company, and Sierra Pacific Industries. Groundwater is a supplemental supply for the City of Redding, Bella Vista WD, and the Mountain Gate CSD. The Clear Creek CSD has also constructed wells outside the district boundary, but they may be used only under emergency conditions. Other basin water users do not have ready access to large quantities of groundwater because their service areas lie at the edges of the basin, where well yields are much lower.

Increased Use of Nonpotable Water

Use of nonpotable water (untreated surface water or reclaimed water) could help extend the available surface-water and groundwater resources of the basin, potentially deferring the need for new water supply infrastructure. Examples of potential actions include converting large municipal irrigation and industrial users from treated water to ACID canal water or other untreated surface-water sources. Using untreated surface water for these purposes would also help preserve beneficial use of ACID's pre-1914 water supply. Use of reclaimed water could be supported by upgrades to the Redding, Anderson, and Cottonwood wastewater treatment facilities, along with construction of a separate distribution system for reclaimed water. Large capital expenditures would be required to serve reclaimed water users located remotely from the source of the reclaimed water. The City of Shasta Lake's current water reuse program demonstrates the viability of this action under the appropriate conditions. By drawing on the wastewater supplies of growing communities, reclaimed water is also the only potential source of supply that is certain to grow in the future.

New Surface-water Storage

Potential for New Surface Storage

The average surface-water inflow into the Redding Basin is about 8.5 million acre-feet per year. This inflow includes flow in the Sacramento River, Cow Creek, Bear Creek, Cottonwood Creek, Clear Creek, Battle Creek, and ungaged minor streams that enter the basin. This inflow also includes about 1 million acre-feet of flow that has historically been diverted into the basin from the Trinity River. The average surface-water outflow from the basin is about 9.2 million acre-feet, so the Redding Basin “generates” about 700,000 acre-feet of water in a year of average runoff.

New surface storage reservoirs such as the proposed Sites Reservoir could help increase the reliability of the water supply available to purveyors within the Redding Basin. Reservoirs could be located within or in proximity to the basin, in other areas of the Sacramento Valley, or elsewhere in the state. Surface reservoirs would provide carryover storage to help meet water demands during dry periods when CVP contractors are subject to supply cutbacks. In wet years, surplus water within the CVP system could be stored in surface reservoirs for use during dry years.

Implementation Issues for Surface Storage

The feasibility of implementing local surface storage or securing water supplies from storage reservoirs located elsewhere is affected by several factors. First, the sources of water that could be available to fill a surface storage reservoir are limited. Flows in streams tributary to Lake Shasta are covered by water rights held by the Bureau of Reclamation. Water rights for extreme flood flows are available, but unless area-of-origin priority is granted, these rights would be junior to all other water rights holdings. Also, water rights filings by Redding Basin purveyors would certainly draw protests from elsewhere in the state because the state’s water supply is already overappropriated.

A second factor affecting the feasibility of implementing new surface storage is public and institutional acceptance. Within the CALFED process, surface storage originally was not included among the core actions to be implemented in the first 7 years of the program. Instead, technical studies were authorized and trigger mechanisms were defined that would bring surface storage into the phased implementation of the CALFED solution. These trigger mechanisms were developed in response to concerns by environmental groups that the state needs to encourage conservation, reclamation and reuse, conjunctive use, and other water supply solutions before additional surface storage reservoirs are considered. However, studies associated with several alternatives to augment existing surface storage are included in the first stage of the CALFED program, such as raising Shasta Dam and constructing Sites Reservoir west of Colusa. Redding Basin purveyors should capitalize on these storage projects, leveraging their status under the area-of-origin protections.

A third factor affecting the feasibility of new surface storage is the time required for implementation relative to the need for additional supplies by local purveyors. The time required for site feasibility studies, environmental approvals, securing permits, design, and filling a large-scale reservoir could easily extend beyond the period when additional water supplies are needed by local purveyors. Current projections indicate that most Redding Basin

reliability of the supply and flexibility to use the water within existing CVP service areas of Shasta County.

Other attempted transfers have been blocked by third parties because of water rights issues such as proposed changes in the point of diversion, or the need to use federally owned facilities to accommodate the proposed transfer.

The degree of difficulty involved in obtaining approval for and completing a transfer is a function of the many factors considered under current law. These factors include the relative location of the parties involved in the proposed transfer, the source of water and type of water right held by the supplying party, determination of whether the transferred supply is "real water" or "paper water," changes in the point of diversion by the receiving party, the duration of the transfer, and the magnitude of impacts to other water users. These factors are considered in detail in the State Water Resources Control Board's draft publication *A Guide to Water Transfers*, dated July 1999. This guidance document is intended to help parties understand the processes involved and the information needed to complete water transfers. It was developed with the recognition that water transfers will play an increasingly important role in meeting future statewide water needs. The intent of the guide was to gain resource agency consensus on new transfer policies that would reduce impediments to transfers and help alleviate water supply shortages.

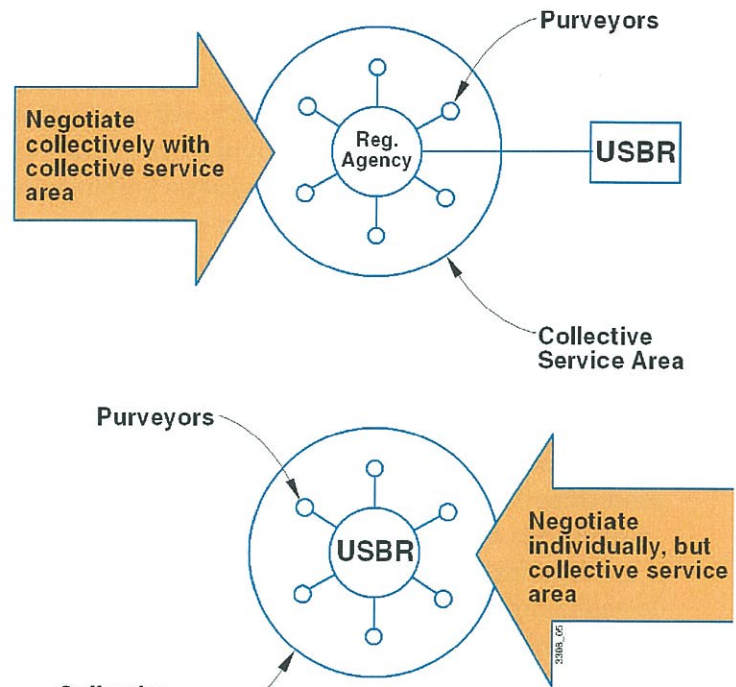
The document summarizes current regulations governing transfers as follows: "You can transfer water if it is your water and not somebody else's water, provided the transfer does not injure another water right holder or unreasonably affect instream beneficial uses." Problems encountered by Redding Basin purveyors attempting to transfer water have resulted from interpretations of terms such as "water rights holder," "injury," and others. Other limitations have been associated with transferring a specific source of water and use of federally owned facilities to convey the transferred water. The guide provides a decision tree that outlines the considerations and approval mechanisms that may be involved in securing approvals for a proposed water transfer. An important acknowledgement contained in the guide is that "The parties that contributed to this effort may not necessarily agree with the conclusions reached in this *Guide to Water Transfers*." This acknowledgement is indicative of the lack of clear, universally agreed upon policies governing water transfers in California. Because water transfers are such an integral element of the CALFED solution, there is increasing urgency to effect changes that will reduce these historical impediments.

Options for Facilitating Future Redding Basin Water Transfers

The basic goals for facilitating water transfers in the Redding Basin should be to provide flexibility to use available water supplies, maximize the use of in-basin water supplies to meet in-basin water needs before any out-of-basin transfers are considered, and minimize the impact of regulatory hurdles on the transfer process. The first option is to continue the current approach of each purveyor acting independently and facing the full brunt of the regulatory hurdles each time a transfer is attempted. Recent failed attempts demonstrate the drawbacks to this approach. The key for facilitating transfers in the future is for the Redding Basin to be viewed as a single coordinated management unit, both by state and federal resource management agencies and the Redding Basin water purveyors. With this management approach, a common pool of water resources could be managed to meet

regional water needs. This can be achieved in one of two frameworks: a regional water supply agency, and a “common pool” arrangement. Both of these options are supported by successful local precedent. Figure 5-1 illustrates the basic concept for each of these options.

Under the regional water supply agency framework, an agency, similar to the SCWA, would be formed having no specific service area. The agency could function as a wholesaler to existing water suppliers, who would retain their autonomy to establish policies, set rates, and perform O&M for their respective service areas. The agency would act as the lead party in securing and coordinating the use of the CVP contract supplies and apportioning the Project Water to local water purveyors as-needed. Such an arrangement could provide greater reliability and flexibility than the individual purveyors can provide on their own. The current cooperative efforts by neighboring purveyors can be viewed as a small step in this direction. Significant issues, such as sustaining the autonomy of the individual purveyors and the need to develop capital facilities to move available water supplies throughout the basin, are important considerations in implementing such a regional management approach.



**FIGURE 5-1
COMMON POOL CONCEPTS**

Under the common pool framework, the Redding Basin purveyors with CVP contract supplies would form a common coordinating agency to interface with the Bureau of Reclamation on in-basin transfer issues. This agency would act as a clearinghouse to efficiently match available contract supplies with the needs of each purveyor. The Sacramento River agricultural water users, as the SRWCA, have successfully implemented a similar framework. The SRWCA pool was formed in 1974 to facilitate optimum use of CVP contract supplies. Each year, participating members have the option to identify a portion of their CVP contract supply that they will make available to the Pool, based on their assessment of their specific supply and demand picture for the year. The water supply committed to the Pool is then available for use by other participating members, who pay the CVP contract costs incurred by the party supplying the water. A small administrative fee is included to cover the cost of administering the Pool. The transfers are short-term, driven by specific local needs and hydrologic conditions. A similar Redding Basin association could facilitate annual transfers of CVP water to purveyors who face shortages and have no alternative supplies, while those purveyors that can draw on other supplies such as groundwater, could make a portion of their CVP supply available to the Pool.

SECTION 6

Purveyor Actions

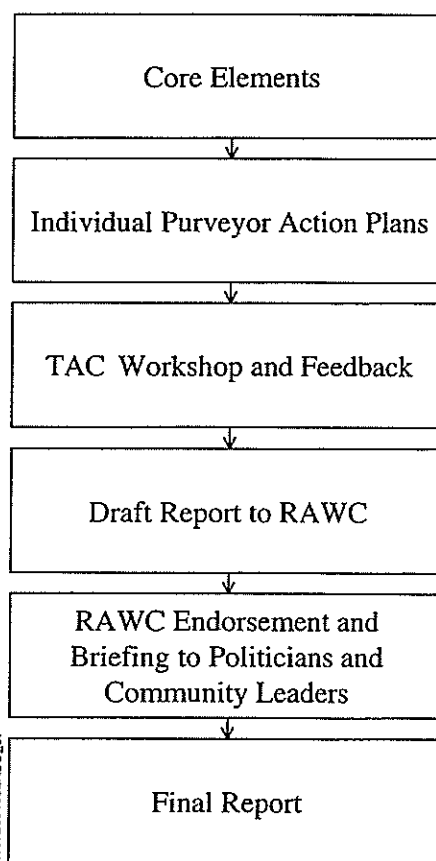
Beginning with the potential actions described earlier, a menu of individual purveyor actions was identified for two planning horizons: actions through the year 2005, and actions beginning in 2005 and extending through the year 2030. The year 2005 was selected because of the ongoing renegotiation of the CVP Water Supply Contracts, which are scheduled to conclude in 2004 or 2005, and because this period typically coincides with the planning period for capital improvement programs for cities and publicly owned utilities.

Potential actions that each purveyor can take were identified and discussed at a meeting of the RAWC. Prior to developing this list of possible actions, it was necessary to develop a list of key assumptions. These assumptions and the lists of potential actions for each purveyor are presented in this section. The process used to define a menu of actions for each purveyor is shown on Figure 6-1.

Once the menu of individual purveyor actions was developed and reviewed, the results were made available to the governing boards and city councils of the participants through the issuance of the draft report. Comments were received and incorporated into the final report text.

Assumptions

To develop a menu of possible water supply and management options for each purveyor, it was necessary to develop a set of key assumptions. These assumptions provide a framework for defining appropriate actions by each purveyor on the basis of currently available information, projected availability of various sources of supply under various hydrologic conditions, possible policies of the resource management agencies to meet the intent of the CALFED Record of Decision, and other factors. Some of these assumptions are subject to uncertainties because of the dynamic nature of water supply planning in California, the evolving contract renewal terms for CVP Water Supply Contracts, and other factors that are as yet unknown. As a result, the future conditions that each purveyor must operate within may vary from those described in the assumptions presented below. However, it is important that these assumptions be noted so that each purveyor can make appropriate choices as these items are validated or as changes are defined.



**FIGURE 6-1
PROCESS FOR IDENTIFYING
AND SCREENING PURVEYOR
ACTIONS**

Available Water Supply, Transfers, and Wheeling

- CVP Water Supply Contract dry year contract allocation reduction (percent cutback) and frequency were projected per CVPIA programmatic EIR.
- CVP Water Supply Contracts will be renewed at same *quantity* as current contracts, for each purveyor. Price and other terms are uncertain. It was assumed that the contracts will be written to allow transfers of contract supplies between in-basin contractors without restriction, subject only to the terms and conditions set by the parties involved in the transfer.
- All pre-1914 water rights supplies will be maintained at existing Settlement Contract quantities. Renewal terms on Sacramento River Water Rights Settlement Contracts will allow transfers within the Redding Basin, without restriction as to place of use or type of use. Time of use will be in accordance with Settlement Contract terms.
- Sacramento River Water Rights Settlement Contracts supply quantities will be reduced by a maximum of 25 percent.
- Basin groundwater supplies, within the identified high-yield areas of the basin, will not be significantly diminished and will at least remain steady at current pumping levels. New groundwater development of up to 40,000 acre-feet per year is assumed possible, with higher yield subject to analysis of local impacts through modeling and subsequent monitoring. Groundwater levels may fluctuate seasonally under these pumping rates, but the yield will remain steady.
- All existing facilities (public and private) will be available for wheeling of water without restriction, other than physical capacity limits and the terms agreed upon by the parties to the wheeling agreement.
- Use of reclaimed wastewater will not impact existing or future water contract quantities, provided the wastewater is diverted for use prior to discharge back into the Sacramento River.

Water Supply Needs

- Supply needs considered for each purveyor are *average annual needs*, with no adjustment (increase or decrease) for critical/dry-year conditions. Future water needs are estimated using the methodology in the Phase 1 Report, including current water conservation measures.

Water Supply Reliability Targets

- Future supply and management alternatives will provide at least 90 percent of the *average annual M&I demand* and 75 percent of the *average annual agricultural demands* for each purveyor, under a 1-in-10 year *supply* cutback condition.
- During critical dry years, the remaining 10 percent of M&I needs will be addressed through additional demand reduction actions such as tiered pricing. The remaining 25 percent reduction in agricultural needs will be achieved through crop changes, fallowing, or other demand reduction methods. The specific actions to achieve these

City of Anderson

Table 6-1 lists actions that could be taken by the City of Anderson between now and 2005 and from 2005 to 2030. Because the City of Anderson has access to large quantities of good-quality, unregulated groundwater, there is little to be gained by implementing other water supply strategies in the short term. So, under any plausible scenario, Anderson would increase groundwater pumping to meet short-term future domestic needs. Irrigation of greenbelt lands or large-scale industrial uses near the ACID canal could be accommodated from the ACID system, or these uses could be served reclaimed water from the city's wastewater treatment facility. Where appropriate, interconnections with adjacent water purveyors could continue to be pursued to increase water supply reliability by providing an alternate supply source during emergencies.

Beyond the short-term planning horizon (2005), Anderson could play a significant role in a regional conjunctive use program. Its potential participation is a function of its location in the area of high-yielding aquifers within the Redding Basin. As an example, groundwater could be pumped into the ACID canal from areas of high groundwater adjacent to the canal but within the Anderson city limits. By pumping groundwater into the canal, ACID could reduce the quantity of water diverted from the Sacramento River, potentially making this water available to other purveyors who do not have direct access to other sources of supply. Agricultural users within Anderson's city limits could also convert to groundwater instead of surface-water supplies from ACID, thereby allowing the surface water to be used elsewhere. Both of these options would require some means to equitably apportion the benefits and costs of such a program.

TABLE 6-1
List of Purveyor Actions—Anderson

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Increase groundwater pumping	1	1	1	1	
2030					
Increase groundwater pumping	1	1	1	1	
Conjunctive use					
ACID conjunctive use	2	1	2	1	• Institutional arrangement • Cost/benefit allocation
Convert from ACID to city	2	1	2	1	• Institutional arrangement • Cost/benefit allocation
Reclamation/reuse	2/3	1	1	1	• Relative cost • Public acceptance • Cost/benefit allocation

Notes:

1 = Favorable

2 = Conditional

3 = Negative

Anderson-Cottonwood Irrigation District

Table 6-2 lists actions that could be taken by ACID between now and 2005 and between 2005 and 2030. ACID can have a significant role in increasing the reliability of water supplies in

the Redding Basin under a regional resource management plan. ACID's 165,000 acre-feet of pre-1914 water rights represents the largest and oldest water right in the basin. The district also has a contractual entitlement to 10,000 acre-feet of CVP Project Water that it has rarely used and has transferred to others in prior years. A majority of the purveyors in the basin that rely on CVP contracts have attempted to complete short-term or long-term transfers from ACID to improve the reliability of their water supply. Most of these attempts have been unsuccessful because of the institutional or legal restrictions described previously.

TABLE 6-2
List of Purveyor Actions—ACID

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Conjunctive use and transfers	2/3	1 (seasonal)	2	2	• Funding potential high • Wet water • Cost/benefit allocation • Institutional arrangement
Supply untreated water to M&I irrigation users	2	1	1	1	• Institutional arrangement • Cost/benefit allocation
Firm up pre-1914 rights (transfers of type of use)	2	1	2	N/A	• Institutional arrangement • Public acceptance
Transfers and water marketing	1	1	2	1	• Timing policies • Wet water
Conservation (canal lining or piping) and transfer	2/3	1 (seasonal)	2	2	• Timing to Sacramento River • Funding potential
Market water to overlapping service areas	1/2	1 (seasonal)	1	1	
2030					
Conjunctive use and transfers	2/3	1	1	1	
Supply untreated water to M&I uses	1	1	1	1	

Notes:

- 1 = Favorable
2 = Conditional
3 = Negative

As district lands continue to be converted to urban land uses, ACID will continue its efforts to maintain beneficial use of its pre-1914 and CVP Project Water supplies. Preserving ACID's water right is of prime importance to all Redding Basin water users to enhance the basin's water supply reliability. Urbanization continues to encroach on ACID's service area, and although the district has been successful in bringing new agricultural and industrial users online, district lands may be converted to urban uses faster than new users are added. To preserve its water right, ACID has actively pursued potential transfers or agreements with other water purveyors to serve untreated surface water for irrigation uses. Such actions would enable ACID to deliver water to other water purveyors in the basin. This water could then be treated for potable use or used directly to irrigate landscaped areas that are currently being served potable water. These efforts should continue in tandem with pursuit of a collective service area designation and other solution elements that could help remove past impediments to transfers from ACID.

ACID is currently pursuing renegotiation of its CVP Sacramento River Water Rights Settlement Contract. There are several alternative strategies that ACID could employ in renegotiations to help meet the needs of other purveyors in the Redding Basin. For example, ACID could forego a portion of its CVP Project Water in return for incentives from the Bureau of Reclamation or from other purveyors in the basin.

Many other actions are also possible. For example, documenting and securing changes in the point of use and/or point of diversion that have occurred as ACID's service area has urbanized over the last 5 years could also help facilitate long-term transfers and maintain the basin's cumulative pre-1914 water rights.

ACID not only represents a potential source of surface-water supply for other purveyors, but the district also represents a significant source of recharge that helps replenish groundwater that is pumped in the central and southern portions of the Redding Basin. Annual seepage from ACID's canal system was estimated at about 44,000 acre-feet in Phase 1 of this master planning effort, whereas 1995 groundwater pumping in the high-yielding portions of the basin was only about 38,400 acre-feet. Preserving ACID's water rights and CVP contract entitlements and maximizing diversions into ACID's canal system would help maintain this important source of recharge, which would benefit groundwater users as groundwater pumping increases in the future.

Looking at this situation from the opposite perspective, portions of the ACID main canal could be lined to reduce seepage from the canal and groundwater recharge. This could enable ACID to reduce its diversions from the river. It is possible that water not diverted by ACID could be transferred to other purveyors in the basin, although such a proposal would be subject to institutional interpretations on the definition of "conserved water."

ACID could have a significant role in enabling better conjunctive management of available groundwater and surface-water resources. ACID recently secured a grant to perform groundwater-monitoring studies along its main canal. This study will generate information to help assess the feasibility of salvaging canal seepage with interceptor wells, lining canals to reduce seepage, or other means to reduce diversions so that equivalent quantities of water can be transferred to other users. These possible actions will require favorable resolution of the definition of "conserved water" in the context of the district's water supply contract. Other actions may also be required to enable conserved water to be transferred to other water purveyors in the basin.

ACID has been very successful in securing funding assistance from state and federal agencies. These grants have enabled the district to achieve environmental protection goals in concert with needed system improvements. These efforts have helped to solidify the reliability of the district's water supply for the future. Additional actions by the district and other purveyors within the basin can help achieve similar benefits throughout the basin.

Bella Vista Water District

Table 6-3 lists actions that could be taken by Bella Vista WD between now and 2005 and between 2005 and 2030. Bella Vista WD has actively sought to augment its CVP contract supply and its groundwater supply to more reliably meet the existing and future needs of its customers. However, because it relies heavily on its CVP contract supply, the district is still vulnerable during times of shortage or extended droughts.

TABLE 6-3
List of Purveyor Actions—Bella Vista WD

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Cooperative groundwater development with City of Redding	2	1	1/2	1	• Cooperative agreements
Intrabasin transfer to Wintu Pump Station	1	1/2	2/3	1	• Wet water
Reclassification of land from agriculture to M&I	3	2	2	2	
Limit agricultural use during times of shortages	1	3	1	3	
Renegotiate CVP contract with more favorable terms	2	3	3	1	
Purchase of water from the McConnell Foundation	1	1		1	• Effects on CVP contract supplies • Conveyance through Bureau of Reclamation facilities
2030					
Groundwater development in unincorporated areas	2	1	1	1	• Public acceptance
Intrabasin transfers to Wintu Pump Station	1	1/2	2/3	1	• Wet water
Transfer and cooperative transmission outside service area	3	1	2/3	2	
Reclamation/reuse via Shasta Lake	2	1	1	1	• Public acceptance
Expand cooperative groundwater development outside service area	2	2	2	1	
Area-of-origin water rights filing	3	2	3	3	• Cost of filing and legal expenses
Limit agricultural use during times of shortages	1	3	1	3	
Renegotiate CVP contract with more favorable terms	2	3	3	1	

Notes:

1 = Favorable

2 = Conditional

3 = Negative

Bella Vista WD should continue its efforts to secure additional water through actions such as transfers, optimizing district groundwater pumping, and implementing the planned well and intertie with the City of Redding or other cooperative projects outside of the district's boundaries. Assuming ownership of facilities constructed by the Bureau of Reclamation could help remove barriers to future water transfers.

Bella Vista WD should continue to aggressively seek to restore its full CVP allocation and renegotiate CVP water supply contracts for future needs. The district could also seek to limit high-volume agricultural uses to extend available supplies during seasonal peak demand periods. Limiting agricultural uses during times of shortage could be achieved by negotiating agreements with specific high-volume agricultural water users. It may also be possible to negotiate provisions in its CVP contract to provide a higher reliability factor for a lesser contract allocation, thereby making the district less susceptible to supply cutbacks.

Centerville Community Services District

Table 6-4 lists actions that could be taken by Centerville Community Services District between now and 2005 and between 2005 and 2030. Centerville CSD has taken a significant step in securing a more reliable future water supply with its purchase of 900 acre-feet of water from the pre-1914 water right held by the Townsend Flat Ditch Company. With this supply in place, Centerville's water supply will be much more reliable, except for possible interruptions in deliveries due to system maintenance or outages of the Muletown Conduit. This conduit is the main delivery pipeline to the district, and unless adequate quantities of surface water could be delivered from another point of diversion (e.g., the City of Redding), Centerville is subject to potential water supply interruptions associated with maintenance operations or failures along the conduit.

With the purchase of this additional supply, Centerville may be able to transfer water to other purveyors until its demand exceeds its currently available CVP contract supply and purchased water.

TABLE 6-4
List of Purveyor Actions—Centerville CSD

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Transfer Project Water to others, if available	1	2	2	1	
2030					
Increase reliability of Muletown Conduit	3	2	2	2	
Abandon Muletown and develop cooperative agreement to wheel water through City of Redding system	2/3	2	2/3	1	
Secure Whiskeytown water from City of Redding and convey through Muletown Conduit	2/3	2/3	2/3	2	

Notes:

1 = Favorable

2 = Conditional

3 = Negative

Beyond 2005, transfers to Centerville from other agencies are possible, but the fact that the Muletown Conduit is owned by the Bureau of Reclamation has precluded the district from completing proposed water transfers.

Because the district does not have local access to significant volumes of groundwater, its role as a participant in a conjunctive use program would likely be as the recipient of water transferred as a result of a conjunctive use program elsewhere in the basin.

Clear Creek Community Services District

Table 6-5 lists actions that could be taken by Clear Creek CSD between now and 2005 and between 2005 and 2030. Clear Creek CSD's prior attempts to secure additional supplies through water transfers have been unsuccessful. The district is totally dependent on its CVP contract and has limited flexibility because it does not have access to large volumes of groundwater within district boundaries. The district may only use the wells that it has drilled outside of its boundaries for emergency purposes, so this supply is of no value during periods of shortage.

TABLE 6-5
List of Purveyor Actions—Clear Creek CSD

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Seek permit to increase existing groundwater pumping (outside district)	2	1	3	1	• Public acceptance
Transfer from Centerville CSD	2	3	2/3	1	• Effects on CVP contract supplies • Conveyance through Bureau of Reclamation facilities
Purchase of water from the McConnell Foundation	1	1	2	1	
Transfer/wheel/pump from ACID	2/3	2 (seasonal)	2	1	
Convert agriculture use to M&I contract category	3	2	2	1	• Public acceptance • Quality of life
(2 nd tier) Limit agricultural use	1	1	1	2	
Increase groundwater pumping (inside)	1/2	2	1	1	
Limit agricultural use during times of shortage	1	3	1	3	
Renegotiate CVP contract with more favorable terms	2	3	3	1	
2030					
Transfer—pump/new pipeline from ACID canal	2/3	2 (seasonal)	2	1	
Increase groundwater/conjunctive use program— pump from ACID area	2/3	1	2	2	
Increase reliability of Muletown	3	2	2	2	
(2 nd tier) Limit agricultural use	1	1	1	1	
Rainbow Lake	3	2	1	2	
Limit agricultural use during times of shortage	1	3	1	3	
Renegotiate CVP contract with more favorable terms	2	3	3	1	

Notes:

1 = Favorable

2 = Conditional

3 = Negative

Clear Creek CSD does not use its full allocation of CVP contract water, but under the proposed CVPIA cutback criteria, its full allocation will be available only about half the time.

So, the district needs some means to augment its available supply, or it will be forced to limit high-volume agricultural uses during dry periods. As shown earlier, the cost of the district's CVP contract supply is also a major issue. Large increases in the proposed contract rates may have an impact on existing land uses in the district.

The district's options are to renegotiate more favorable terms in its CVP water supply contract or pursue transfers from other contractors or water rights holders. In either case, the reliability of the Muletown Conduit will be important to ensure that these supplies can be reliably conveyed to the district's users. Because of the large seasonal variations in water use and the presence of high-volume agricultural uses, development of a separate water supply source to serve the remaining large volume agricultural uses may help relieve heavy seasonal demands on the existing water supply infrastructure. Two possibilities are pumping from the ACID canal near the district boundary and use of reclaimed water from the City of Redding's Clear Creek Wastewater Treatment Facility. Transfers from other water users face some institutional hurdles because the Bureau of Reclamation owns the Muletown Conduit.

The district may also have some capability to develop shallow groundwater underlying district boundaries. Because the shallow aquifers have limited production capacity and are largely sustained by irrigation with surface water, groundwater development probably has limited potential unless another more reliable source of irrigation water is secured. Water quality is also a concern in some areas because of the presence of iron and manganese.

Cottonwood Water District

Table 6-6 lists actions that could be taken by Cottonwood Water District between now and 2005 and between 2005 and 2030. The Cottonwood Water District relies solely on groundwater, similar to the City of Anderson. As such, its options are much the same as Anderson's. With the small volume of water use and ready access to high-yielding aquifers, there is little to be gained by implementing a new water supply strategy, at least for the short term. Increasing groundwater pumping is certainly the least cost and easiest to implement alternative. Irrigation of landscaped areas or large-scale industrial uses could be served from the ACID canal or by reclaimed water from the Cottonwood wastewater treatment facility. The district could also be a participant in a regionwide conjunctive use program, as described earlier for the City of Anderson.

Jones Valley County Service Area

Table 6-7 lists actions that could be taken by the Jones Valley CSA between now and 2005 and between 2005 and 2030. The Jones Valley CSA water supply appears to be adequate to meet the water needs throughout the planning period of this study. The area would continue to receive water through its appropriative water right on Lake Shasta, with replacement water provided under contract to the SCWA or through a direct contract with Bureau of Reclamation. The contract with Shasta County or directly with the Bureau of Reclamation would have to be renegotiated to maintain status quo conditions.

TABLE 6-6
List of Purveyor Actions—Cottonwood Water District

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Purchase of water from the McConnell Foundation	1	1	2	1	• Effects on CVP contract supplies • Conveyance through Bureau of Reclamation facilities
Increase groundwater pumping	1	1	1	1	
2030					
Increase groundwater pumping	1	1	1	1	
Conjunctive use					
ACID conjunctive use	2	1	2	1	• Institutional arrangement • Cost/benefit allocation
Convert from ACID to city	2	1	2	1	• Institutional arrangement • Cost/benefit allocation
Reclamation/reuse	2/3	1	1	1	• Relative cost • Public acceptance • Cost/benefit allocation

Notes:

1 = Favorable

2 = Conditional

3 = Negative

If future conditions indicate that more water is needed, the Jones Valley CSA could possibly negotiate an intra-basin transfer from ACID or another purveyor. Such a transfer would accommodate a diversion at the Lake Shasta pump station in lieu of its CVP contract supply. This change in the point of diversion could be more costly because of the foregone power that would not be generated at Shasta and Keswick dams if the water were diverted upstream of the dams.

TABLE 6-7
List of Purveyor Actions—Jones Valley CSD

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
No Action					
2030					
Negotiate intra-basin transfer	2/3	2	2/3	2	

Notes:

1 = Favorable

2 = Conditional

3 = Negative

Keswick County Service Area

Table 6-8 lists actions that could be taken by the Keswick CSA between now and 2005 and between 2005 and 2030. Securing a transfer from the Sacramento River to Whiskeytown Lake will be costly and difficult to achieve, but could be accomplished in connection with other basinwide management options that provide some advantages to the Bureau of Reclamation. The Keswick CSA's options are to receive a transfer from one of the other purveyors that draws water from the Spring Creek Conduit (City of Redding, Shasta CSD) or from Whiskeytown Lake (Centerville CSD, Clear Creek CSD), or secure a transfer from the Sacramento River to Whiskeytown Lake. The City of Redding has an existing turnout on its 30-inch water main that could be a source of supply for Keswick CSA.

Because of the limited demands in the service area, Keswick CSA could merely establish an interconnection with one of the other diverters from the Spring Creek Conduit.

TABLE 6-8
List of Purveyor Actions—Keswick CSA

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
No Action					
2030					
Negotiate intra-basin transfer	2/3	2	2/3	2	
Interconnection with neighboring purveyor	2	2/3	2	1	

Notes:

1 = Favorable

2 = Conditional

3 = Negative

Mountain Gate Community Services District

Table 6-9 lists actions that could be taken by the Mountain Gate CSD between now and 2005 and between 2005 and 2030. Without a transfer of water from another supplier, Mountain Gate CSD would likely experience supply shortfalls throughout the planning period. Efforts to continue to optimize the use of groundwater within district boundaries would also be required. Gaining approval for a change in the point of diversion from below Shasta Dam to above the dam will likely present some significant cost and institutional issues.

City of Redding

Table 6-10 lists actions that could be taken by the City of Redding between now and 2005 and between 2005 and 2030. The City of Redding is less susceptible to supply cutbacks than most other purveyors in the Redding Basin because it has three sources of supply to draw from. Having multiple sources and surface water supplies that are less susceptible to cutbacks provides greater reliability and flexibility in meeting current demands. However, the city will experience significant growth in demands over the planning period, and additional sources of supply will be necessary to meet the growing water demand of city residents. Integrating these new sources of supply into the city's existing water system will also present significant challenges.

TABLE 6-9
List of Purveyor Actions—Mountain Gate CSD

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Transfer (in)	2	2	2/3	2	
Purchase of water from the McConnell Foundation	1	1	2	1	• Effects on CVP contract supplies • Conveyance through Bureau of Reclamation facilities
Limited groundwater development increase	2	2/3	1	1	
2030					
Transfer (in)	2	2	2/3	2	
Limited groundwater development increase	2	2/3	1	1	

Notes:

- 1 = Favorable
2 = Conditional
3 = Negative

TABLE 6-10
List of Purveyor Actions—City of Redding

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Increase groundwater pumping	1	1	1	1	• Impacts to private pumpers
Increase surface-water diversion up to max of contract	1	2	1	1	
ACID irrigation of city customers (nonpotable)	2	2 (seasonal)	2	1	• Cost/benefit allocation
2030					
Increase groundwater/ regional conjunctive use	1	1	1	1	
Transfer surface water to expanded FHWTP BWTP NEW WTP?	2	1	2	2	• Wet water • What source
Nonpotable use of ACID water	2	2	1	1	
Reclaimed water	3	1	1	1	• Public acceptance
Buy ACID water and treat	2/3	2 (seasonal)	1	1	

Notes:

- 1 = Favorable
2 = Conditional
3 = Negative

The city should strive to renegotiate its existing CVP water supply contract for the Buckeye area, add additional wells and optimize the use of groundwater, and continue present efforts to secure additional supplies through transfers and groundwater exchanges.

The city's future options also include negotiating agreements with ACID to serve irrigation uses along the ACID canal, developing and implementing a wastewater reclamation and reuse plan for effluent from the Clear Creek and Stillwater wastewater treatment plants, negotiating an intra-basin transfer with ACID (potentially in lieu of CVP contract water supplies), and negotiating a combined service area for the city's CVP contract and water rights supplies (so that a greater area can be served under gravity pressure from the Buckeye Water Treatment Plant).

Shasta Community Services District

Table 6-11 lists actions that could be taken by the Shasta CSD between now and 2005 and between 2005 and 2030. Shasta CSD is totally dependent on CVP contract supplies and does not have access to groundwater in sufficient quantities to meaningfully improve its water supply reliability. Therefore, Shasta CSD will likely continue to depend on its CVP contract for all or a portion of its water supply. Greater reliability could be achieved by securing agreements to transfer and wheel water through neighboring water systems. The district could engage in cooperative efforts with other agencies that divert from the Spring Creek Conduit to increase supply reliability.

TABLE 6-11
List of Purveyor Actions—Shasta CSD

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Transfer (in)	2	2	2/3	2	
Purchase of water from the McConnell Foundation	1	1	2	1	• Effects on CVP contract supplies • Conveyance through Bureau of Reclamation facilities
Interconnection with neighboring purveyor	2	2/3	2	1	
2030					
Develop cooperative agreement to wheel water through City of Redding system	3	2/3	2/3	1	

Notes:

- 1 = Favorable
2 = Conditional
3 = Negative

City of Shasta Lake

Table 6-12 lists actions that could be taken by the City of Shasta Lake between now and 2005 and between 2005 and 2030. The City of Shasta Lake currently depends solely on its CVP

contract for potable water supplies. The city operates a water reclamation facility that produces water for irrigation and industrial uses. This facility helps reduce potable water needs by preserving these supplies for uses requiring water of the highest quality.

The city should continue to attempt to expand and diversify its supply sources by negotiating water transfers and other agreements with its neighbors to supplement its CVP contract entitlement. The city's reliance on the Bureau of Reclamation's pump station at the dam could be a barrier to securing additional supplies through the present delivery system. Changing the point of diversion from below Shasta Dam to above the dam may present cost and institutional barriers to potential water transfers. The limitation regarding the pumping plant at the dam also applies in this situation.

TABLE 6-12
List of Purveyor Actions—City of Shasta Lake

Actions	Cost	Quantity/ Reliability	Institutional Acceptability	Environment	Other Issues
2005					
Increase reuse	2	1	2	1	
Purchase of water from the McConnell Foundation	1	1	2	1	• Effects on CVP contract supplies • Conveyance through Bureau of Reclamation facilities
Transfer groundwater from Bella Vista/City of Redding	2/3	2	1	1	
Distribution system improvements	3	1	1	1	• Grant dollars?
Other transfers (in)	2/3	2	2/3	2	
2030					
Increase reuse	2	1	1	1	
Distribution system improvements	3	1	1	1	
Transfers (in)—increase existing pump station capacity	2/3	2/3	3	1	
City of Redding intertie	2	2/3	2/3	1	
Bella Vista WD intertie	2/3	3	2/3	1	
Cooperative agreement for groundwater and/or surface water	3	1/2	1/2	1/2	

Notes:

- 1 = Favorable
2 = Conditional
3 = Negative

Current efforts to expand the number of reclaimed water users should continue, particularly for industrial users that are current or prospective users of potable water.

Unincorporated Areas

Unincorporated areas outside of the spheres of influence of the major entities currently rely on pre- and post-1914 water rights, groundwater pumping, and a small amount of CVP water received from the SCWA.

Under any scenario, it is assumed the present water supply sources would be maintained. Groundwater use is likely to increase, although these areas could be participants in a conjunctive use program. As time passes, some of these areas will likely be annexed into other jurisdictions and the water supplies attendant to the land would also come under the jurisdiction of the new water supply agency.

Heavy Industrial

Existing heavy industrial users would continue to pump groundwater. New heavy industrial users would either pump groundwater, be connected to the water system of an existing purveyor, or be served reclaimed water from one of the wastewater treatment plants, depending on the regional strategy that is ultimately adopted.

Recommendations

Resolutions by Governing Boards and City Councils

Acceptance of Findings and Recommendations. The governing board or city council for each purveyor should pass a resolution accepting the core elements as the framework for future water supply planning by their respective staffs. Such action would not commit the purveyors to specific courses of action, but would demonstrate an acceptance that water supply reliability is a problem that is best addressed through regional planning.

Target Reliability Factors. Each governing board or city council should also consider adopting a resolution to establish target water supply reliability factors for critical dry year conditions within their respective service areas. A target reliability factor is a goal for the percentage of a full water supply that will be delivered in critically dry years. These targets would reflect the fact that the availability of some water supplies may be affected during critically dry years and it may not be economically feasible for the purveyors to provide a 100 percent reliable water supply under all hydrologic conditions. The reliability factors would provide a framework for evaluating the menu of potential actions to develop supplemental supplies to meet a reliability target. Selection of a target reliability factor provides basic direction for updating capital improvement programs and other staff activities.

Workshops

Governing Boards and City Councils

Workshops should be held with the governing board or city council of each RAWC participant to discuss their menu of potential actions, answer questions, and identify specific issues of concern. This interactive discussion can help establish priorities for the staff of each entity regarding these potential actions.

Issues and Concerns. Specific purveyor issues and concerns identified in the workshops should be documented and carried forward for analysis in the next phase of the planning effort. Potential means of addressing these issues will be identified in evaluating regional solutions and possible implementing authorities.

Presentation of the Integrated Groundwater/Surface-Water Model. The model should be presented at the workshops. The presentation will provide an opportunity for the participants to understand the intended application of the model, how it was developed, recommendations for continued operation and maintenance of the model, and its application in future planning efforts.

Public Outreach

Support for regional solutions should be solicited from local stakeholder groups. Public workshops should be held to discuss water supply reliability issues, answer questions, and

identify specific issues of concern. Feedback from these sessions should be carried forward in future planning efforts.

Policy Advisory Committee

RAWC should be expanded to include a Policy Advisory Committee. A representative to the proposed Policy Advisory Committee should also be designated by each purveyor. The Policy Advisory Committee should include a member of the governing board or council of each of the participants. The Policy Advisory Committee would strengthen the awareness and involvement of elected representatives and help secure their active participation in the development of regional solutions. Areas of suggested involvement include the following:

- **Political Outreach.** Meetings with elected state and federal representatives of the Redding area should be continued. Local elected officials should assume a greater role in political outreach efforts, through their participation on the Policy Advisory Committee, to provide solidarity and ensure consistency with other local policies and initiatives.
- **Agency Outreach.** RAWC, through the Policy Advisory Committee, should seek the input of the state and federal resource agencies regarding the planning concepts and assumptions and the core actions identified in this study. This input would better define the criteria for further development of the core elements and specific actions for each purveyor. These discussions would help identify specific issues that may affect the feasibility of potential solutions to achieve regional management goals.

Support Activities by Purveyor Staff

Cost Analysis. If they have not already done so, the staff of each participating agency should conduct a detailed cost analysis to assess the impacts of the proposed CVP Water Supply Contracts on the cost of water to various categories of water users. Other factors affecting the cost of water (e.g., power costs) should also be evaluated. This information should be provided to SCWA staff as input to future phases of the regional planning effort to help evaluate the feasibility and cost of various water supply options for each purveyor.

Interties and Interagency Agreements. Some current interconnections between neighboring purveyors are useful to provide economical service to customers at a common boundary, but may not provide a reliable long-term remedy for water supply reliability problems. Existing distribution system interties and interagency agreements between neighboring purveyors should be reviewed to assess their long-term viability with the shortage criteria under various hydrologic conditions and projected cutbacks under the provisions of the CVPIA. Through this process, potential changes in the interagency agreements may be identified, and possible influences on future planning activities and capital improvements can be identified.

Specific Plans of Action. Development and implementation of specific plans of action should be initiated as soon as possible, and applications for outside funding support for these activities should be authorized. Information regarding specific plans of action should be shared with other RAWC representatives to coordinate activities, as appropriate.

Future Planning Activities

Groundwater Monitoring. Groundwater will certainly become a larger and more important component of the regional water supply. Measures to protect groundwater quality will need to be included in future phases of planning. Potential impacts to private groundwater pumpers will also be a significant issue with increased groundwater development in the Redding Basin. To address these issues, the SCWA should implement the groundwater monitoring programs identified in the Groundwater Management Plan that was developed during Phase 2A. Data obtained from these programs should be input to the integrated groundwater/surface-water model.

Groundwater Quality Protection. Means to protect groundwater quality from potential adverse effects of increased pumping or potential sources of contamination need to be included as part of the further development and implementation of the Groundwater Management Plan.

Water Conservation Guidelines. Guidelines for water conservation should be updated for the basin's water purveyors. These guidelines will not be prescriptive, but will establish a menu of potential actions that can be employed by each participant to reduce water use.

Development and Adoption of a Regional Plan. RAWC should initiate Phase 2C of the regional planning process. This phase should include the following actions:

- A review and modification of basinwide operations philosophies
- Final development of combined actions
- Model runs to help assess the effects of the combined actions
- Costs/benefits analyses for each purveyor
- A public information program
- Preparation of impact analyses
- Development of a detailed implementation plan, including an institutional framework and a financing plan. This work would culminate in the preparation of CEQA/NEPA documentation and the Basinwide Water Resources Management Plan.

Cost/Benefit Analyses. The detailed evaluation of regional solutions should specifically consider cost/benefit issues within the service areas of each participant. Alternative methods for apportioning the costs and benefits should be specifically identified and presented as part of the regional plan.

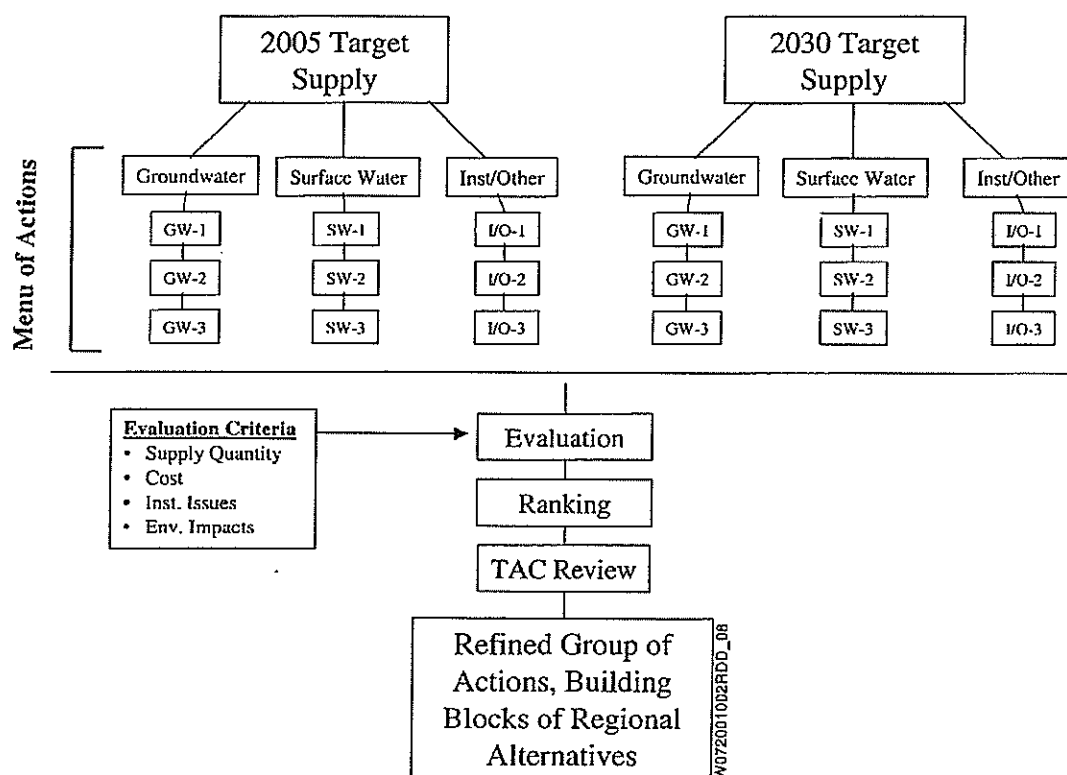
Funding. The RAWC should explore options for funding future phases of the regional planning efforts through the California Department of Water Resources, the Bureau of Reclamation, (CALFED) or a special state or federal appropriation. Both the Department of Water Resources and Bureau of Reclamation have demonstrated an interest in RAWC's planning efforts and a willingness to participate in future activities, including financial participation.

demand reductions will be selected and implemented by each purveyor, in accordance with their individual supply and demand factors and management policies.

These level-of-service reliability targets serve as initial planning targets. If the targets cannot be met without unreasonable costs or impacts, then specific management choices will be made by each purveyor to implement additional conservation measures, select a lower acceptable level of reliability, and/or plan for the related supply shortage impacts accordingly.

Purveyor Actions in Support of Regional Management Concepts

The process used to evaluate and rank the potential actions for individual purveyors is shown on Figure 6-2. First, potential actions described in Section 5 were identified for year 2005 and 2030 projected water demands. These actions were then evaluated and scored according to criteria addressing supply quantity, institutional acceptability, environmental impacts, and other issues. The scoring criteria were 1=favorable, 2=conditional, and 3=negative. By applying these scoring criteria to each action, preliminary preferred actions were identified. Where appropriate, other factors outside of the categories of evaluation criteria listed above were also noted. The resulting rankings were then reviewed with the RAWC, and modifications were made as appropriate. Further review and input was accommodated through comments received on the draft report.



**FIGURE 6-2
PROCESS FOR RANKING
PURVEYOR ACTIONS**

The intent of the ranking process is to provide a menu of actions that individual purveyors may pursue prior to the development and adoption of a more formal regional water resources management program.

Core Actions Common to All Purveyors

Greater flexibility to transfer water throughout the basin is needed. All purveyors should encourage the State Water Resources Control Board and CALFED to help remove obstacles that have historically prevented potential intra-basin transfers. Intra-basin transfers and local solutions are consistent with the CALFED tenets of encouraging regionally based solutions whenever possible.

A combined service area contracting authority has value to all Redding Basin purveyors under any planning scenario. Perhaps no other action can do more to increase water supply reliability than having the flexibility to move surface water and conjunctively manage groundwater throughout the basin. Key considerations in identifying an appropriate governance model for such an authority include:

- Principles for operation and decisionmaking, and decisionmaking authority
- Maintaining autonomy of individual purveyors to develop policies and rates, and carry out O&M functions as appropriate for their respective entities
- Structure (e.g., Joint Powers Authority, Memorandum of Understanding) and composition of governing board or committee

New regionwide water conservation guidelines should be prepared for agricultural, municipal, and industrial uses. With regionwide conservation guidelines in place, individual purveyors would then review and update their existing water conservation and peak demand management plans. Currently, water conservation is treated as a demand management tool to be exercised during times of shortage or emergency conditions. Without significant public acceptance of a continuing need to conserve under all hydrologic conditions, water conservation guidelines or ordinances will have limited effectiveness. More aggressive conservation measures will be a prerequisite for CVP contractors as part of the upcoming contract renegotiations, and a stronger conservation ethic among all Redding Basin purveyors could enhance the basin's bargaining position for other potential actions that require approvals by state and federal agencies or the courts.

Water conservation plays another important role in regional water resources management. Without an effective conservation program in place, water utilities must make large capital investments so their water systems are capable of meeting peak demand requirements for only a few months of the year. With more aggressive conservation and peak demand reduction programs in place, costly water system expansions can often be deferred. Moreover, with California's existing statewide water supply deficiencies, Redding Basin water utilities can no longer expect to merely increase the supply to match demand. As economics and ability to pay increasingly drive water supply reliability, land uses in the Redding Basin do not generate economic returns as high as other areas in the state. Under a free market system and without area-of-origin protections, the purveyors in the Redding Basin would soon not be able to afford the next needed increment of water supply.