

EXAMPLE OF PARTIAL SCENARIOS

Excerpted from the “California Water Plan Update 2005”
California Department of Water Resources (DWR)
(Volume 1, Chapter 4 – Planning for an Uncertain Future)

<http://www.waterplan.water.ca.gov/previous/cwpu2005/index.cfm>

The Planning Process

...We typically craft responses based on what we expect to change, the likelihood of that change occurring, and the risk we face if the change occurs and we are not prepared. Water managers must routinely decide how many resources to spend today to protect against future uncertainties, especially extreme events like multiple dry years. There are often multiple responses available to satisfy a given objective, so it is prudent to consider several alternatives to find responses that balance costs, benefits, and tradeoffs effectively and efficiently.

Partial Application of Scenario Approach

The introduction of scenarios is a major difference between the approach used in previous updates and the new approach. The goal is to compare and contrast performance of possible management responses against plausible future conditions. As used in *California Water Plan Update 2005*, scenarios represent baseline conditions that we could reasonably expect to face in the year 2030, based on what we know to be true today. DWR has developed three scenarios, each describing a different baseline for 2030. These scenarios are possible pictures of the future that depend on many assumptions. They are not predictions and do not include new water agency-sponsored conservation programs or climate change effects. The water community would use each scenario to compare the performance of possible management responses. Having multiple future scenarios can help identify management responses that perform well when compared across a wide array of baseline conditions that could occur in the future.

The scenarios presented in update 2005 are only part of the story of California’s water future. The scenarios represent different baseline conditions for 2030 that could affect water demands and supplies, but that the water community has little or no control over. The other part of the story is the alternative management strategies (called response packages in Update 2005) that still need to be considered to prepare for the potential changes described in the scenarios. The next California water plan update will present quantitative information on the whole story—the baseline conditions water managers may face and the alternative strategies needed to address these conditions.

Baseline Scenarios to Describe Future Conditions

Although multiple future scenarios will be used in the quantitative work for the next California water plan update, DWR has not yet developed the analytical tools to quantify both scenarios and response packages. Three baseline scenarios in this section demonstrate how scenarios can be used to better understand the implications of future conditions on water management decisions. These scenarios are referred to as baseline because they represent changes that are reasonably likely to occur without additional management intervention beyond those currently planned. The narrative descriptions of these scenarios were developed by water plan staff and the advisory committee.

Previous water plan updates based planning assumptions on a single likely future condition. The use of multiple future scenarios provides decision-makers, water managers, and planners much more information about what they might expect in the

future and how different management actions might perform across a range of possible futures. The scenarios are created by varying important assumptions about water and other resource conditions in order to highlight important categories of uncertainties.

The primary reason to use multiple scenarios is that different assumptions about the future can significantly affect the nature and outcome of various mixes of management strategies. Some management strategies may be effective and economical regardless of the future scenario. Other strategies may only be suited if specific conditions develop in the future.

Developing quantitative estimates of water demands and supplies for multiple future scenarios and management responses requires using available data and assumed relationships. DWR and stakeholders considered numerous factors that could vary in the future and developed three preliminary narrative future scenarios that can be used to begin the analysis for the next California water plan update. However, DWR and stakeholders may develop other scenarios as work progresses.

Table 4-1 (Scenario factors affecting regional and statewide water demands and supplies) shows factors that were considered in developing the scenario narratives. These factors may vary across scenarios, and each factor must be quantified. The availability and resolution of data vary widely. Key factors have been identified, but much work remains before reaching agreement on the relationships between the factors and the methods that will be used to quantify them.

As work moves forward on the next California water plan update, DWR and stakeholders may add or eliminate factors to help answer questions about future scenarios. Although all the factors in Table 4-1 are needed to define the strategies, DWR began analysis by varying only the factors primarily related to land and water use patterns over which the water community has little control (those listed in the upper portion of Table 4-1). Other factors also may be varied to help us gain insight into specific questions. Following are brief descriptions of each example scenario.

Three Baseline Scenarios for 2030

This section describes some of the key assumptions used to develop the following three baseline scenarios for 2030.

- **Scenario 1—Current Trends.** Recent trends continue for the following: population growth and development patterns, agricultural and industrial production, environmental water dedication, and naturally occurring conservation (like plumbing code changes, natural replacement, actions water users implement on their own, etc.).
- **Scenario 2—Less Resource Intensive.** Recent trends for population growth, higher agricultural and industrial production, more environmental water dedication, and higher naturally occurring conservation than Current Trends (but less than full implementation of all cost-effective conservation measures currently available).
- **Scenario 3—More Resource Intensive.** Higher population growth rate, higher agricultural and industrial production, no additional environmental water dedication (year 2000 level), and lower naturally occurring conservation than Current Trends.

All three scenarios include assumptions for two kinds of water use efficiency actions: (1) those that water users take on their own (called naturally occurring conservation) and (2) those encouraged by water agency programs, policies, and requirements. Only naturally occurring conservation was varied among the scenarios; and all scenarios include the same continued implementation of cost-effective actions by water agencies.

Table 4-1 Scenario factors affecting regional and statewide water demands and supplies

FACTOR 1	SCENARIO 1 CURRENT TRENDS	SCENARIO 2 LESS RESOURCE INTENSIVE	SCENARIO 3 MORE RESOURCE INTENSIVE
Total Population	DOF	DOF	Higher than DOF
Population Density	DOF	Higher than DOF	Lower than DOF
Population Distribution	DOF	DOF	Higher Inland & Southern; Lower Coastal & Northern
Total Commercial Activity	Current Trend	Increase in Trend	Increase in Trend (Same as Scenario 2)
Commercial Activity Mix	Current Trend	Decrease in High Water Using Activities	Increase in High Water Using Activities
Total Industrial Activity	Current Trend	Increase in Trend	(Same as Scenario 2) Increase in Trend
Industrial Activity Mix	Current Trend	Decrease in High Water Using Activities	Increase in High Water Using Activities
Irrigated Crop Area (Includes Irrigated Land Area and Multi-cropped area)	Current Trend	Level Out at Current Crop Area	Level Out at Current Crop Area
Crop Unit Water Use	Current Trend	Decrease in Crop Unit Water Use	Increase in Crop Unit Water Use
Environmental Water-Flow Based	Current Trend	High Environmental Protection	Year 2000 Level of Use
Environmental Water-Land Based	Current Trend	High Environmental Protection	Year 2000 Level of Use
Naturally Occurring Conservation ²	NOC Trend in MOUs	Higher than NOC Trend in MOUs	Lower Than NOC Trend in MOUs
Urban Water Use Efficiency	All Cost Effective BMP's in Existing MOU's Implemented by Current Signatories (present commitments)		
Ag Water Use Efficiency	All Cost Effective EWMP's in Existing MOU's Implemented by Current Signatories (present commitments)		
Per Capita Income	Current Trends		
Ratio of Seasonal to Permanent Crop Mix	Current Trends		
Irrigated Land Retirement	Currently Planned		
Hydrology	Essentially a Repeat of History		
Climate Change	Essentially a Repeat of History		
Colorado River Supply	Equal to 4.4 Plan		
Existing Inter-Regional Import Projects	Current Conditions		
Flood Management	Current capacities, management practices and operations		
Energy Costs	As Projected From Current Trends		
Ambient Water Quality	Current Conditions		
Drinking Water Standards	Current and Planned		
Ag Discharge Requirements	Current and Planned		
Urban Runoff Mgmt.	Current Level of Use		
Recreation	Present Demand Trends Continued		
Desalting	Current Level + Permitted/Financed		
Recycled Water	Current Level + Permitted/Financed		
Water Transfers Within Regions	Currently Approved Transfers		
Water Transfers Between Regions	Currently Approved Transfers		
Conjunctive Use and Groundwater Management	Current Level + Permitted/Financed		
Surface Water Storage	Current Level + Permitted/Financed		
Conveyance Facilities	Current Level + Permitted/Financed		
Rate Structure	Current Practices - pricing constrained to cost recovery		

(1) Factors should be considered as an initial list that will be modified, as needed, as analyses proceed for next Water Plan Update.

(2) Naturally Occurring Conservation is the amount of background conservation (changes in plumbing codes, etc.) occurring independently from the BMP and EWMP programs.

Scenario 1: Current Trends

- **Population and Land Use:** The population of California meets Department of Finance (DOF) estimates of 48.1 million in 2030 with increasing population pressure in the Central Valley and on the coast. Expanding metropolitan areas continue to dominate urban growth.
- **Commercial and Industrial:** Driven to reduce costs in the face of competition, industry becomes more efficient in water use. Due to cost efficiencies, businesses have been reducing water use over time, primarily by replacing old or broken-down equipment with high-efficiency machines.

- **Agriculture:** Farmers are increasingly using sprinklers and drip irrigation, moving away from flooding and furrows. Farmers produce more “crop per drop” through a variety of means, including changes in irrigation methods, although more improvement is possible. Increased cost of land is shrinking agricultural land availability. Irrigated crop area (including multicropping) is slightly less than in 2000. Multicropping area increases significantly from the 2000 level.
- **Environment:** Environmental flows reach half way to the levels needed to meet the objectives of CALFED’s Ecosystem Restoration Program and the objectives in the Anadromous Fisheries Restoration Program. Water dedicated to wet lands reaches half way to “Level 4” supplemental water supplies for National Wildlife Refuges cited in Central Valley Project Improvement Act (CVPIA) sections 3405 and 3406(b). Urban development continues to encroach on functioning floodplains in some areas.
- **Naturally Occurring Conservation:** The background conservation that will occur as a result of emerging conditions (ongoing changes in plumbing codes, etc.) results in some increase in efficiency in all sectors.
- **Other Factors:** Other factors remain unchanged (see Table 4-1 Scenario factors affecting regional and statewide water demands and supplies).

Scenario 2: Less Resource Intensive

- **Population and Land Use:** Population in 2030 is 48.1 million. Californians live in mixed use developments with native vegetation requiring little or no irrigation. An increase in population density means infill in existing urban areas and less development of new urban land. This compact development has reduced impervious surfaces, which benefits open space, reduces runoff, increases groundwater recharge, and affects other related issues. The cost of land is shrinking the availability of housing in Southern California.
- **Commercial and Industrial:** Due to market conditions, industry has shifted from water-intensive processing to dry product assembly, reducing water use. Businesses have dramatically reduced water demand and have moved to machines with high-efficiency water use to accomplish standard tasks. Potential financial gains have accelerated the move to machines with high-efficiency water use to accomplish standard tasks. Urban areas have a high degree of commercial and industrial productivity. Also, California has emerged as a leading industrial producer of environmental products and continues as a force in producing hardware for the technology industry.
- **Agriculture:** Irrigated crop area is at the same level as in 2000. Land area removed from agriculture must be replaced by a combination of new land coming into production and increased multicropping. Improved water management is increasing water efficiency. A healthy, efficient agricultural sector produces more per acre and decreases applied water per irrigated crop acre.
- **Environment:** Projects are designed to achieve multiple benefits integrating ecosystem restoration with water supply reliability. Management actions are oriented toward the sustainability, restoration, and improvement of the natural infrastructure. Water dedicated to instream use and aquatic life enhancement is yielding increased populations. Environmental flows reach the levels needed to meet the objectives of CALFED’s Ecosystem Restoration Program and the objectives in the Anadromous Fisheries Restoration Program. Water dedicated to wetlands reach the “Level 4” supplemental water supplies for National Wildlife Refuges cited in CVPIA sections 3405 and 3406(b).
- **Naturally Occurring Conservation:** The background conservation that will occur as a result of emerging conditions is higher in the agricultural and urban sectors than under Scenario 1. Business and agriculture apply efficiency measures for reasons other than reducing water

demand or water-related costs. Current plumbing codes and other existing policies have increased efficiency greater than in scenarios 1 and 3.

- Other Factors: Other factors remain unchanged from Scenario 1.

Scenario 3: More Resource Intensive

- Population and Land Use: Population in 2030 is 52.3 million and is dispersed regionally. Expanding urban areas are commonplace. The Central Valley is experiencing air and water quality problems due to the stress of the large population. The population is more widely distributed, resulting in more outdoor residential water use (for example, larger residential lot size). Individuals tend to drive long distances to the workplace.
- Commercial and Industrial: California has emerged as a leading industrial producer of environmental products and continues as a force in producing hardware for the technology industry. California's leadership in high tech hardware places constraints on its water resources because this industry is a high water user that has not advanced efficiency technology to limit its water use. The industry continues to rely on high water-using processes based on market conditions.
- Agriculture: Irrigated crop area is at the same level as in 2000. The healthy agricultural sector maintains past levels of food and fiber production. Low-density urban development expands onto prime farmland, but harvested acreage remains about the same due to increased multicropping and new lands coming into production. The annual volume of applied water per crop is high due to the changing nature of crops and the movement of agricultural production to lands with poorer soil quality.
- Environment: Environmental flows remain at year 2000 levels. Thus, the flow objectives of CALFED's Ecosystem Restoration Program and the Anadromous Fisheries Restoration Program remain unmet. Water dedicated to wetlands remain at year 2000 levels, and the "Level 4" supplemental water supplies for National Wildlife Refuges cited in CVPIA sections 3405 and 3406(b) are not achieved. Californians recognize the link between the environment and their health and personal well being, but there is less water made available to accomplish environmental objectives.
- Naturally Occurring Conservation: The background conservation that will occur as a result of emerging conditions in the agricultural and commercial and industrial sectors is lower than current trends.
- Other Factors: Other factors remain unchanged from scenarios 1 and 2.