

ASSUMPTIONS

&

ESTIMATES



# ASSUMPTIONS

## Organization of A&E Report Brochure

|  |    |
|--|----|
| Introduction. ....   | 3  |
| On CD and Internet. ....   | 3  |
| Water Code Requirements .....  | 5  |
| Water Plan Activities. ....  | 5  |
| Develop Multiple Future Scenarios.....   | 5  |
| Incorporate Climate Change in Water Plan Scenarios. ....                             | 7  |
| Update the Regional Reports.....   | 8  |
| Update the 25 Resource Management Strategies.....                                    | 9  |
| Estimate and Present Actual Water Uses, Supplies, and Quality. ....                  | 10 |
| Improve Information Exchange & Data Integration, Data, and Analytical<br>Tools. .... | 11 |
| Organizing a Response .....  | 11 |
| Promoting Collaboration through the Statewide Water Analysis<br>Network. ....        | 12 |
| Improving the Institutional Setting for Quantitative Work .....                      | 12 |
| Partnering on Near-term Studies .....  | 12 |
| Shared Vision Planning .....   | 13 |
| Facilitating Information Exchange.....   | 13 |
| Improving Numbers for the California Water Plan. ....                                | 13 |
| Use Companion State Strategic Plans.....   | 14 |
| Key Water Supply and Use Definitions.....  | 14 |
| Drill down to Data and Data sources.....   | 15 |
| Geographic Coverage.....   | 15 |
| Documentation for Assumptions and Estimates .....                                    | 16 |

## Tables

|  |    |
|--|----|
| Table 1 Mapping Water Plan activities to quantitative deliverables .....         | 3  |
| Table 2 Major categories of information required by the Water Code .....         | 5  |
| Table 3 Scenario factors affecting regional and statewide water management ..... | 7  |
| Table 4 Resource management strategies and their related goals and objectives..  | 9  |
| Table 5 A&E Report Water Portfolio content .....                                 | 10 |

## California Water Plan Update 2009 Assumptions and Estimates Report *Working Draft*

### Introduction

The purpose of this brochure is to summarize the content contained in the Assumptions and Estimates (A&E) Report for California Water Plan Update 2009 (Water Plan). It also provides background on the measures we are taking to improve data and analytical tools used to develop the Water Plan. The A&E Report describes the most significant data and data sources that will be used to prepare Water Plan Update 2009. California Water Code (Section 10004.6) requires that DWR publish the assumptions and estimates for the California Water Plan one year prior to the plan's publication. This is a draft A&E Report for Update 2009. We will publish the final A&E Report in December 2008.

In this brochure, we discuss seven of the eight Water Plan activities and summarize the assumptions and estimates used to develop them. All eight activities are described on the following page. Although the first activity, which is the Water Plan's strategic plan, is not discussed in the A&E Report, results from the assumption and estimates will influence recommendations and other aspects of the final strategic plan.

#### On CD and Internet

Data, data sources, and other technical information are presented electronically in the CD inserted in this brochure and also online at <INSERT URL>. The A&E Report data are presented in a drill down fashion geographically and according to the major quantitative deliverables—water portfolios, future scenarios, and response packages--developed for the Water Plan.

**Table 1**  
**Mapping Water Plan activities to quantitative deliverables**

| Activities  | Quantitative deliverables |                  |                   |
|---|---------------------------|------------------|-------------------|
|   | Water portfolios          | Future scenarios | Response packages |
| Water Plan vision, mission, goals, and principles             | √                         | √                | √                 |
| Develop multiple future scenarios                             |                           | √                | √                 |
| Incorporate climate change                                    |                           | √                | √                 |
| Update Regional Reports                                       | √                         |                  |                   |
| Update Resource Management Strategies                         |                           |                  | √                 |
| Estimate and present actual water uses, supplies, and quality | √                         |                  |                   |
| Improve data and analytical tools                             | √                         | √                | √                 |
| Use companion State strategic plans                           | √                         | √                | √                 |

# ASSUMPTIONS

## Water Plan Activities

### Activity #1

*The A&E Report discusses only seven of the eight Water Plan activities. Although Activity #1, the Strategic Plan, is not discussed in this report, the recommendations of Water Plan Update 2009 will be influenced by the findings of our data and analysis.*

1. **Review and revise the Water Plan vision, mission, goals, and principles;** and update its initiatives, recommendations, and implementation plan. This includes: (a) reporting progress on actions associated with Update 2005's 14 recommendations, (b) addressing "Parking Lot" topics from the Update 2005 Advisory Committee, (c) incorporating issues and initiatives from Steering Committee members, and (d) updating the Water Plan stakeholder/customer survey.
2. **Develop multiple scenarios** of future California water conditions, and use scenarios to evaluate different combinations of resource management strategies (called response packages) for a range of water demand and supply assumptions plus climate change.
3. **Incorporate climate change in Water Plan scenarios** to evaluate impacts on California's water resources and water systems, and to identify and recommend statewide and regional adaptation strategies.
4. **Update the Regional Reports** for the 10 Hydrologic Regions and for the Sacramento-San Joaquin Delta and Mountain Counties as areas of special concern. Use information from the regional outreach process to describe critical issues, key initiatives, effectiveness of regional planning efforts, and region-specific response strategies.
5. **Update the 25 Resource Management Strategies** with current research and information. Expand strategy narratives to describe their suitability for integrated flood management and their current and future implementation in various regions.
6. **Estimate and present actual water uses, supplies, and quality** (Water Portfolios) for water years 1998 through 2005. Improve methods for representing consumptive and non-consumptive environmental water, and where reuse of water is occurring.
7. **Improve information exchange and data integration, data, and analytical tools** to inform all Water Plan activities and decisions and to assist California water planners and managers.
8. **Incorporate findings and recommendations** from companion State strategic plans.

## Water Code Requirements

California Water Code (Section 10004.6) lists the minimum information that is required for the A&E report. Table 2 highlights the major categories of information required by the Water Code. In some cases, information required by the Water Code is not currently used in the development of the Water Plan due to lack of information or resource limitations. However, estimates are included for all items required by the Water Code where possible.

**Table 2 Major categories of information required by the Water Code**

|  |   |
|--|---|
| Basin hydrology  | Current and projected water use   |
| Groundwater supplies   | Evapotranspiration rates for major crops  |
| Current and projected water supplies provided by water recycling and reuse | Current and projected adoption of urban and agricultural water conservation practices |
| Environmental water needs  | Current and projected land use patterns   |
| Current and projected population   |   |

## Water Plan Activities

### Develop Multiple Future Scenarios

California Water Plan Update 2005 introduced a new analytical approach to evaluating future water management conditions: multiple future scenarios and alternative response packages. The scenarios are not meant to be forecasts of the future, but represent alternatively plausible conditions for the future. They are explained here. Response packages comprise selected resource management strategies, which are explained in a later section.

Scenarios are shaped by factors considered to be beyond the control of water managers. Each scenario considers alternative values for some factors such as population growth and land use. We use scenarios to explore questions about the future, for example, what will the year 2050 be like if California’s population continues to grow at the rate it has over the past several years, and what if the rate increases over the next 10, 20, or more years? How will shifting land use influence future water demands for agriculture or municipalities?

### Activity #2

*Develop multiple scenarios of future California water conditions, and use scenarios to evaluate different combinations of resource management strategies (called response packages) for a range of water demand and supply assumptions plus climate change.*

# ASSUMPTIONS

Update 2009 is using 2050 as the planning horizon for developing scenarios. And because the California Water Plan considers climate change, some studies may reach into the 22nd century. Table 3 shows factors that will be considered in developing scenario narratives for Update 2009 based on preliminary discussion through Water Plan public outreach.

*WEAP = Water Evaluation and Planning, a modeling tool used to simulate and evaluate more refined integrated water management scenarios.*

For Update 2009, DWR is pursuing a joint proposal by Montgomery-Watson-Harza, the Stockholm Environment Institute, the National Center for Atmospheric Research, and the RAND Corporation to quantify scenarios and evaluate potential future water management responses. DWR has already begun developing information on regional demand and supply for California's 10 hydrologic regions in the modeling platform WEAP (Water Evaluation and Planning). The joint proposal would complete and then build upon this work and other studies and employ the WEAP modeling tool to simulate and evaluate more refined integrated water management scenarios for Water Plan Update 2009. The joint proposal would quantify a small set of hand-crafted narrative scenarios developed by the Water Plan staff and advisory committee; it also would generate a larger ensemble of plausible scenarios to systematically evaluate the performance of various regional water management response packages in the face of a number of critical uncertainties, including climate change and others. Work would be undertaken in pursuit of the following specific objectives:

1. Develop an integrated scenario analysis modeling framework.
2. Use this framework to assess the full spectrum of uncertainties that confront water planning in California, including global climate change, land use and demographic changes, and others.
3. Evaluate the results of these analyses against an appropriate set of performance metrics, introducing the notions of robustness and risk as part of the evaluation process.
4. Develop a strategy to evaluate the most promising regional water management responses.

**Table 3 Scenario factors affecting regional and statewide water management**

|   |   |
|---|---|
| Total population                        | Urban runoff regulations                    |
| Per capita income                       | Ag Discharge Requirements                   |
| Commercial activity & mix               | Regulation of Delta exports                 |
| Industrial activity & mix               | Colorado River agreements                   |
| Energy costs                            | Air temperature variability & trends        |
| Irrigated land area                     | Precipitation variability & trends          |
| Multi-cropped land area                 | Snowpack/melt                               |
| Permanent crop land area                | Sea-level rise                              |
| Seasonal crop land area                 | Colorado River flows                        |
| Funding availability                    | Resilience of endangered aquatic species    |
| Population density                      | Membrane technology innovation              |
| Population distribution                 | Groundwater injection technology innovation |
| Passive conservation                    | Water use technology innovation             |
| Drinking water standards                | Flood system integrity                      |
| Irrigation technology use               | Infrastructure performance                  |
| Water price - Rate structure            | Demand for water-based recreation           |
| Water price - Cost recovery             | Extended droughts (> than recent history)   |
| Managed wetlands - Irrigated land area  | Earthquakes                                 |
| Private wetlands - Irrigated land area  | Infrastructure sabotage                     |
| Instream flow requirements / objectives | Wildfire events                             |
| Endangered species listing              | Levee failure                               |
| Floodplain development                  | Chemical spills                             |
| Flood threat recognition                | Facility malfunction                        |
| Flood requirements                      |   |

### **Incorporate Climate Change in Water Plan Scenarios**

Update 2009 will make use of studies performed by the California Climate Change Center to help develop recommendations for how California can adapt to long-term climate change. The Climate Change Center was created at the Scripps Institute by the California Energy Commission in 2003 to implement the commission’s long-term climate change research plan. Of particular interest to the Water Plan are studies from the 2006 and upcoming 2008 Biennial Climate Reports required by Executive Order # S-3-05 signed by Governor Schwarzenegger on June 1, 2005.

In addition to the Climate Change Center studies, DWR is pursuing a proposal to use the WEAP model (described earlier) to quantify future scenarios and to evaluate potential management responses. All the regions represented in the WEAP modeling would incorporate plausible sequences of future weather (reflecting historical variability and possible trends in precipitation and temperature due to climate change) and use these sequences of weather to drive outdoor urban and agricultural irrigation demand requirements, groundwater basin recharge, and local surface flows. Climate change scenarios used in the WEAP modeling will be consistent with scenarios developed by the Climate Change Center.

### *Activity #3*

*Incorporate climate change in Water Plan scenarios to evaluate impacts on California’s water resources and water systems, and to identify and recommend statewide and regional adaptation strategies.*

# ASSUMPTIONS

## Activity #4

*Update the Regional Reports for the 10 Hydrologic Regions and for the Sacramento-San Joaquin Delta and Mountain Counties as areas of special concern. Use information from the regional outreach process to describe critical issues, key initiatives, effectiveness of regional planning efforts, and region-specific response strategies.*

## Update the Regional Reports

The Water Plan contains 10 reports summarizing California's hydrologic regions. Two additional reports are included—the Mountain Counties region and the Sacramento-San Joaquin Delta region. The latter two describe areas with significant water issues that overlay parts of the other hydrologic regions. These 12 regional reports provide information on the current water supplies and uses in each area, as well as a discussion of the water issues, accomplishments, and challenges that are specific to each region of California.



## Update the 25 Resource Management Strategies

A resource management strategy is a project, program, or policy that helps manage water and related resources. The Water Plan describes a broad range of resource management strategies. Different strategies can be used to accomplish different objectives and goals of water management: reducing water demand, improving operational efficiency and transfers, increasing water supplies, improving water quality, and practicing resource stewardship.

The strategies are intended to guide development of Integrated Regional Water Management plans. By selecting a mix of resource management strategies aimed at meeting its water management objectives, a region develops management response packages. By analyzing how different response packages might perform across a range of future scenarios, decision-makers, water managers, and planners can reduce uncertainty in water planning.

The A&E Report describes the key assumptions and estimates for each of the resource management strategies described in the Water Plan. Table 4 groups 25 resource management strategies under the objective or goal each is intended to accomplish. The number of water resource strategies may increase as new techniques are learned and new technology is developed.

### Activity #5

*Update the 25 Resource Management Strategies with current research and information. Expand strategy narratives to describe their suitability for integrated flood management and their current and future implementation in various regions.*

**Table 4 Resource management strategies and their related goals and objectives**

|  |   |  |
|--|---|--|
|  | <b>Reduce Water Demand</b>                            |  |
| Agricultural water use efficiency                  | Urban water use efficiency                            |  |
|  | <b>Improve Operational Efficiency &amp; Transfers</b> |  |
| Conveyance   | System reoperation                                    | Water transfers                        |
|  | <b>Increase Water Supply</b>                          |  |
| Surface storage – CALFED                           | Conjunctive management and groundwater storage        | Ocean and brackish water desalination  |
| Surface storage – regional / local                 | Precipitation enhancement                             | Recycled municipal water               |
|  | <b>Improve Water Quality</b>                          |  |
| Drinking water treatment and distribution          | Matching water quality to water use                   | Groundwater / aquifer remediation      |
| Pollution prevention                               | Urban runoff management                               |  |
|  | <b>Practice Resource Stewardship</b>                  |  |
| Agricultural lands stewardship                     | Recharge area protection                              | Economic incentives                    |
| Ecosystem restoration                              | Floodplain management                                 | Water-dependent recreation             |
| Urban land use management                          | Watershed management                                  |  |
|  | <b>Other Strategies</b>                               |  |
| Crop idling for water transfers                    | Irrigated land retirement                             | Rainfed agriculture                    |
| Dewvaporation or atmospheric pressure desalination | Fog collection  | Water bag transport/storage technology |

# ASSUMPTIONS

## Activity #6

*Estimate and present actual water uses, supplies, and quality (Water Portfolios) for water years 1998 through 2005. Improve methods for representing consumptive and non-consumptive environmental water, and where reuse of water is occurring.*

*See the full, electronic A&E Report for a complete description of Water Portfolio data categories.*

In the Water Plan, data for Water Portfolios are presented in tables, flow diagrams, and in illustrations like this one. Here key components of the flow diagrams are shown as characteristic elements of the hydrologic cycle.

## Estimate and Present Actual Water Uses, Supplies, and Quality

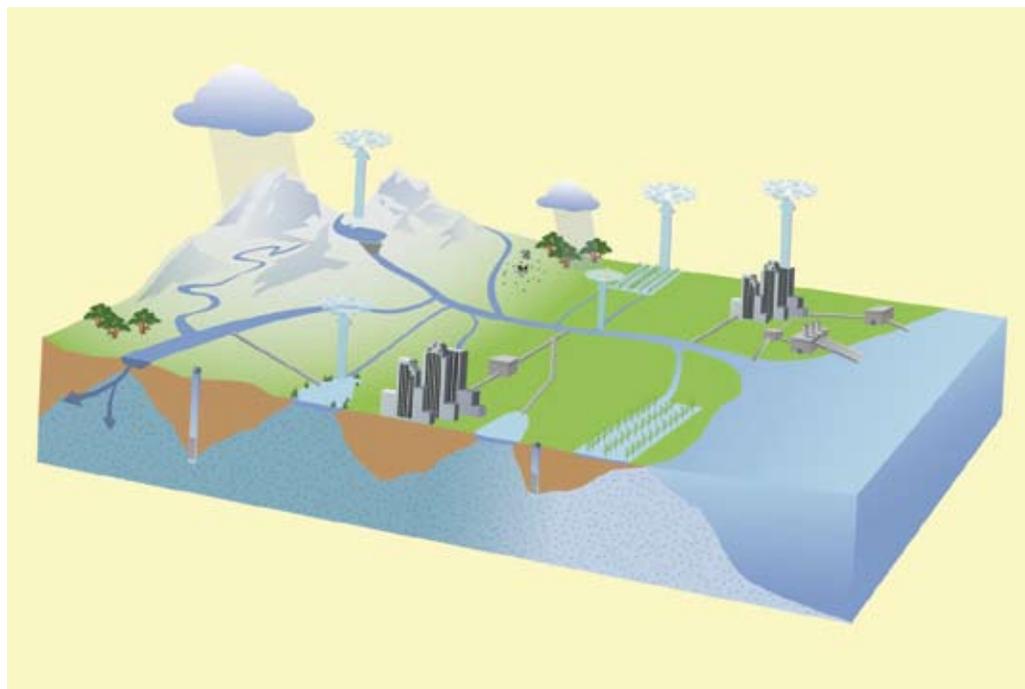
The Water Plan presents information about recent statewide and regional water conditions through Water Portfolios. Water Portfolios describe the distribution of water throughout the hydrologic cycle, how the water is used by the urban and agricultural sectors, and water in the environment. This information is necessary for Integrated Regional Water Management. Regions then have data needed to develop and pursue relevant and achievable water management objectives.

Update 2009 will include Water Portfolio information for water years 1998 through 2005. It will be part of the Water Plan's regional reports.

Table 5 shows the major categories that are included in the A&E Report.

**Table 5 A&E Report Water Portfolio content**

|                                   |  |   |
|-----------------------------------|--|---|
| Local deliveries                  | Residential interior and exterior water use  | Large landscape water use                         |
| Local imported deliveries         | Commercial and industrial water use          | Reuse of water                                    |
| Colorado River deliveries         | Large landscape water use                    | Recycled water                                    |
| Central Valley Project deliveries | Evaporation of applied water for agriculture | Evaporation of applied water for managed wetlands |
| Other federal deliveries          | Groundwater recharge                         | Required instream flow                            |
| State Water Project deliveries    | Deep percolation to a salt sink              | Required Delta outflow                            |
| Groundwater extraction            | Conveyance system losses                     | Wild and Scenic flows                             |



## Improve Information Exchange & Data Integration, Data, and Analytical Tools

Several factors have caused DWR to rethink how it evaluates California's future water conditions. Policy-makers and the public need more detailed quantitative information about the costs, benefits, and tradeoffs associated with different water management strategies. But data, analytical tool development, and data management have not kept pace with growing public awareness of the complex interactions among water-related resources. Additionally, California lacks a consistent framework and standards for collecting, managing, and providing access to data and information on water and environmental resources essential for integrated regional water management. More accurate data and analytical tools and better information management can reduce many uncertainties about the state's current and future water resources: how water supplies, demands, and quality change in response to different resource management strategies; how ecosystem health and restoration can succeed; and how we can adapt our water system to reduce controversy and conflicts.

### Organizing a Response

DWR, through California Water Plan Update 2009, has taken the lead in organizing a response to the limitations described above. DWR has identified three broad activities that must be initiated and conducted simultaneously to improve analytical capabilities in support of the Water Plan. The context and next steps for implementing the three activities are described below. Implementing a response requires significant participation by many entities that either generate information used by the Water Plan or use information in the Water Plan to make decisions. The critical activities are:

- Promoting Collaboration Through the Statewide Water Analysis Network
- Facilitating Information Exchange
- Improving Numbers for the California Water Plan

### *Activity #7*

*Improve information exchange and data integration, data, and analytical tools to inform all Water Plan activities and decisions and to assist California water planners and managers.*

# ASSUMPTIONS

*SWAN = Statewide Water Analysis Network, a technical advisory group formed by the California Department of Water Resources*

Promoting Collaboration through the Statewide Water Analysis Network

Update 2009 promotes technical collaboration through the Statewide Water Analysis Network (SWAN), which is a technical advisory group formed by DWR. There are many reasons to promote collaboration:

- Integrated Regional Water Management requires multi-disciplinary information, and no single entity has the expertise or other resources required to develop all of the analytical tools and data needed to answer these broad questions.
- People want to improve the shared understanding and access to useful information across the state at an appropriate resolution.

Through SWAN, DWR will endeavor to improve the institutional setting for analysis performed for the Water Plan, partner with others on near-term analytical studies, and use Shared Vision Planning techniques to increase technical collaboration.

*California Water and Environmental Modeling Forum (CWEMF) issued the report, "Strategic Analysis Framework for Managing Water in California"*

*Improving the Institutional Setting for Quantitative Work*

Perhaps one of the most critical activities for the near future is to engage interested parties throughout the state to leverage available resources and improve the shared quantitative capability involving California's water management system. Effectively meeting today's needs for quantitative information will require considerable networking, collaboration, and information sharing between federal, State, local, and regional entities. The September 2005 report prepared by the California Water and Environmental Modeling Forum (CWEMF) titled "Strategic Analysis Framework for Managing Water in California" presents a wide array of possible institutional arrangements that could improve the institutional setting for developing and applying qualitative capability over the long-term.

*Partnering on Near-term Studies*

To prepare Update 2005, DWR established some mutually beneficial partnerships with entities engaged in research or studies of interest to the Water Plan. DWR will continue to form these partnerships as a way of infusing new ideas and to maximize the benefit of outside expertise and funding.

## *Shared Vision Planning*

DWR is collaborating with the US Army Corps of Engineers' Institute for Water Resources to apply Shared Vision Planning methods to develop water resources planning decisions in an open and accessible way. Shared Vision Planning is an approach specifically designed to address difficult conflicts between stakeholders within a complex water management problem. The essence of Shared Vision Planning is to create a planning process capable of building a mutual understanding of the facts involved in a problem for the ultimate purpose of focusing decision-participants' attention, debate, and resolution on values.

## *Facilitating Information Exchange*

In Update 2005, DWR committed to implementing "the Water Plan Information Exchange (Water PIE) for collecting and sharing data and networking existing databases and Web sites; using GIS software to improve analytical capabilities; and developing timely surveys of statewide land use, water use, and estimates of future implementation of resource management strategies." Implementing Water PIE requires both short-term and long-term phases. The short-term phase will likely include showing linkages and providing easy access to information used by the CALFED Bay-Delta Program and the California Water Plan to assess current and future water management conditions. This will help promote transparency and build confidence among stakeholders that related statewide planning efforts are sufficiently coordinated. The goal of the long-term phase is to develop an interactive data management system to promote integrated regional water management. Water PIE will require protocols for managing data, including a common definition of terms and data quality control.

*Water PIE =  
Water Plan  
Information  
Exchange*

## *Improving Numbers for the California Water Plan*

Water Plan Update 2005 outlined three primary sets of quantitative deliverables:

- Water Portfolios
- Future Scenarios
- Alternative Response Packages

The information provided from these quantitative deliverables will be in the form of reporting metrics. Reporting metrics are quantitative numbers that represent something measurable. These numbers are reported prior to a judgment of the adequacy or desirability of the numbers with respect to specific objectives.

# ASSUMPTIONS

DWR wants to build better understanding about how the California water management system works and how it responds to change. Improved communication and collaboration help us to reach important agreements. To achieve this, we must engage in a process that simultaneously improves the conceptual understanding of California's water management system and its representation in the analytical tools we use. The Water Plan team has committed to the following:

- Take a fresh look at our collective understanding of how the water management system works.
- Interact with experts to make sure we capture the latest thinking.
- Document our collective understanding of the water management system in an archival manner that can evolve over time.

## Activity #8

*Incorporate findings and recommendations from companion State strategic plans.*

### Use Companion State Strategic Plans

<<Our list of state strategic plans has grown to more than 100. From that list, we will identify those that are most pertinent to the Water Plan. From the companion state strategic plans, we will review their data, data sources, and analysis and scenarios and compare with our own.>>

### Key Water Supply and Use Definitions

**Applied Water.** The amount of water from any source needed to meet the demand of the user. For instream use, applied water is quantified as the amount of stream flow dedicated to instream purposes (or reserved under federal or State wild and scenic rivers legislation.) It also is the amount of stream flow required for maintaining flow and water quality in the Sacramento-San Joaquin Delta per SWRCB Decision 1630 or previous standards.

**Evapotranspiration.** ET is the amount of water transpired (given off), retained in plant tissues, and evaporated into the atmosphere from plant tissues and the surrounding soil surfaces.

**Evapotranspiration of Applied Water.** ETAW is the portion of total ET that was provided from the applied irrigation water.

**Depletion.** The amount of water consumed within a service area that is no longer available as a source of supply. For agricultural and environmental wetlands water use, depletion is the sum of irrecoverable water and the ETAW due to crops, wetlands vegetation, and flooded water surfaces. For urban water use, depletion is the ETAW due to landscaping, wastewater outflow to a salt sink, and incidental ET. For instream flow, depletion is the amount of dedicated flow that proceeds to a salt sink.

*For more definitions, see Glossary on CD and online*

**Irrecoverable Water.** The amount of water that flows to a salt sink, is used by plants (evapotranspiration), or evaporates from a conveyance facility or drainage canal.

**Net Water.** The amount of water needed in a water service area to meet all demands. It is the sum of several components including (1) evapotranspiration of applied water within an area, (2) the irrevocable water from the distribution system, and (3) the agricultural return flow or treated urban wastewater leaving the area.

## *Drill down to Data and Data sources*

### **Geographic Coverage**

Water Plan Update 2005 promoted Integrated Regional Water Management as an effective approach to helping communities and regions incorporate sustainable actions into water management. Regional planning recognizes that place plays a significant role when planning and managing water supply. Therefore, electronically, assumptions and estimates data for this report are accessed in a drill down fashion geographically for the following areas:

- the entire state,
- each of 10 hydrologic regions,
- the Sacramento-San Joaquin Delta including Suisun Bay and Marsh, and
- the Mountain Counties Area, which includes foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range.

# ASSUMPTIONS

## **Documentation for Assumptions and Estimates**

The A&E Report includes the following documentation to describe the data and how the information is generated and used by the Water Plan:

- **Estimate** – The value of data items to be used in Update 2009 (estimates are only available for the underlying Water Plan assumptions, and not for data items that will be calculated during development of the Water Plan.)
- **Definition** – The definition of the data item.
- **Source** – The source of information or reference that DWR used to obtain the estimate.
- **Process diagram** – A flow chart, which describes the process DWR uses to develop the estimate for the data item.
- **Water Code reference** – Describes data items that are required to be included in the A&E Report.
- **Data recommendation** – Recommendations by DWR staff or the public to improve the accuracy of the data item.