Chapter 4, part H. WATER USE EFFICIENCY

(Conservation and Water Recycling)

I. CONSERVATION

This CALFED Program addresses four categories of Bay-Delta problems--ecosystem quality, water quality, water-supply reliability, and system integrity. Water-use efficiency is clearly related to the goal of improving water-supply reliability and can help achieve other program objectives by improving water quality or enhancing ecosystem health. CALFED has based its Water Use Efficiency Common Program (WUECP) for conservation on improved urban and agricultural water management planning, technical and financial assistance, and the resultant implementation of cost-effective urban Best Management Practices (BMP) and agricultural Efficient Water Management Practices (EWMP).

AGRICULTURAL WATER USE AND CONSERVATION

The monitoring objectives for agriculture must address questions that show WUECP is succeeding well enough to assure various stakeholders of its effectiveness. To determine the WUECP's effectiveness, the following questions need to be answered for the agricultural sector in the CALFED solution area:

1. How many endorsed agricultural water-management plans exist in the CALFED solution area, how many are completed but not endorsed, and how many acres do they represent?
2. Which EWMPs are being implemented and what is the magnitude of their implementation?
3. Have the EWMP's achieved permanent reductions in growing-season-applied water or depletions for crops, and are sufficient mechanisms in place to maintain their effectiveness?
4. What is the relationship of the water applied to crops and their actual needs, defined as evapotranspiration (ET) of applied water/potential irrigation efficiency at the farm, district and regional levels?
5. Are increased planning and assistance programs reducing applied water and depletions beyond the projections in State and local plans?
6. Has the reduction in applied water had positive, negative, or neutral effects on third parties and the environment?

In general, the measurement needs for determining agricultural water use efficiency within the CALFED Solution Area include:

1. Land-use surveys every five years of all agricultural counties with more than 50,000 irrigated acres, to be consistent with updates of the California Water Plan. These land-use surveys must include water source and irrigation method, by crop.
2. Annual land, soil, and water-use survey of the Delta including real-time ET data for the Delta lowlands.
3. Data of water applied on agricultural fields are needed for all irrigation, for a number of irrigation seasons, and for surface- and ground-water sources. Estimation of the distribution uniformity of individual irrigation, and seasonal application efficiency are needed to estimate the optimization of on-farm water use, on an annual basis.
4. Estimates of the reuse of surface and subsurface drainage water and ground water to quantify the relationship of on-farm efficiencies to higher district and regional efficiencies. Initial data gathering should be completed over a three-year period and updated every five years thereafter.
5. Annual update of acreage using various irrigation methods including estimates of their efficiency based on a standardized set of assumptions and formulas.
6. Annual review and update of crop coefficients for estimating crop water

use to be used in annual water balances by planning sub-areas.
7. Length of all canals and laterals (lined and unlined) linked with areas being irrigated by various irrigation methods, using GIS and GPS technology to be used in the determination of evaporation and seepage.
8. Documentation of EWMPs to be implemented from agricultural water-management plans, with particular attention to those practices related to improving water delivery, measurement, and pricing.
9. Documentation of environmental and third-party effects of conservation measures from the implementation of EWMPs.
10. Annual documentation of crop rotation and fallowing sequences because of agronomic practices or government programs.

Major gaps in knowledge of irrigation efficiency and crop water use should be filled to help CALFED and CALFED agencies reach their objectives. The priorities for such research are:

1. Develop a complete and improved set of crop coefficients (Kc) for all 250 California crops,
2. Determine the feasibility of attaining distribution uniformities (DU) greater than 80 percent for re-designed and manufactured irrigation equipment,
3. Evaluate improved agronomic practices that would increase yields while reducing resource inputs and improve sustainability, and
4. Develop new crop varieties that would have the same effects as #3 above.

URBAN WATER USE AND CONSERVATION

The objectives for the monitoring program in the urban sector need to assure stakeholders of the effectiveness of the WUECP. Similar questions to those posed above for agriculture apply to the urban sector in the CALFED solution area. Additional monitoring is required to determine:

1. How many certified urban water management plans exist in the CALFED solution area and how many remain uncertified?
2. Are BMPs being effectively implemented and are they being implemented within the criteria established by the California Urban Water Conservation Council (CUWCC)?
3. Have the BMPs achieved permanent reductions in applied water or depletions and are sufficient mechanisms in place to maintain their effectiveness?
4. What is the relationship to the theoretical need (or efficiency on a per-capita water use basis)?
5. Are increased planning and assistance programs reducing applied water and depletions beyond the projections in state and local plans?
6. Has the reduction in applied water had positive, negative or neutral effects on third parties and the environment?

In general, the measurement needs for determining urban water use efficiency within the CALFED Solution Area include:

1. Annual landscape surveys of all irrigated landscape acreage within agencies having more the 3,000 connections.
2. Annual estimate of ET data for surveyed landscapes using appropriate landscape coefficients and applied water data for landscape to determine the efficiency of landscape irrigation.
3. Annual consolidation of existing data; improvement of data quality and quantity from water audits and leak detection to assess reductions in unaccounted water.
4. Annual consolidation of existing data; improvement of data quality and quantity from Commercial, Industrial and Institutional (CII) customers, including surface and groundwater users.

5. Annual detail of interior water-use data to evaluate changes in single family and multi-family water use.
6. Annual updates of water-use data for all customer classes and gross per-capita water use; chart trends.
7. Annual estimates of seasonal and peak water use from water agency data; evaluate trends in seasonal and peak water use versus baseline water use values.
8. Assess the implementation of 14 BMPs and estimate their costs and benefits from biennial reports provided to CUWCC.
9. Assess the quality of urban water management plans and those that have exemplary planning elements and/or BMP implementation.

The major knowledge gaps in the urban sector are related to water budget irrigation scheduling of landscapes using the California Irrigation Management Information System (CIMIS) and estimates of water savings from new technologies in the residential and CII categories.

1. Investigate whether urban landscape irrigation water budgeting can be improved by expanding CIMIS into urban areas and developing landscape evapotranspiration coefficients for the various mixtures of plants in urban landscapes.
2. Conduct interior residential water end-use studies (faucets, showers, landscapes, etc.) similar to the national study and evaluate water savings from use of new technologies and conservation measures.
3. Conduct interior commercial water use efficiency studies and evaluate water savings from use of new technologies and conservation measures.

II. WATER RECYCLING

MONITORING OBJECTIVES AND RESEARCH NEEDS

The CMARP monitoring objectives for water recycling are based on the goals of CALFED's Water Use Efficiency (WUE) common program, which estimates a potential for recycling between 1.4 to 2 million acre-feet a year by 2020. (For more details and a description of laws and regulations governing water recycling in California, see the Water Use Efficiency Technical Appendix to the Programmatic EIS/EIR.) The policy framework for implementing CALFED's preferred program alternative states that Stage 1 of implementation will be a 7-year period that starts when the Programmatic EIS/EIR is certified. During this period, information about the effects of CALFED's WUE common program will be gathered and analyzed as the program is implemented. Findings from the analyses will be used to determine the performance of CALFED WUE program actions and change program management to improve performance if necessary.

The role of CALFED agencies in carrying out the Water Use Efficiency Program is to encourage and build upon local and regional implementation of efficiency measures. CALFED agencies are to: (1) offer support and incentives through expanded planning, technical, and financial assistance; and (2) provide assurance that cost-effective efficiency measures are implemented. With regard to water recycling, the Water Use Efficiency Program includes the following actions to encourage water recycling statewide:

- Help local and regional agencies comply with the water recycling provisions in the Urban Water Management Planning Act.
- Expand state and federal recycling programs in order to provide sharply increased levels of planning, technical, and financing assistance, and develop

new ways of providing assistance in the most effective manner.
- Provide regional planning assistance that can increase opportunities for use of recycled water.

These actions are expected to reduce demand for Delta exports, increase availability of water for transfer to other users or for environmental flows, and improve water quality in the Delta and its tributaries. In addition, they should help California reach the water recycling goals adopted in Water Code Section 13142.5(e): 700,000 acre-feet/year by 2000 and 1 million acre-feet/year by 2010. To assess the extent of the above actions in reducing demand and improving water quality, more accurate data are needed about the following:

- quality of the source water available for recycling,
- amounts of water available for recycling (amounts of wastewater being generated),
- amounts and quality of recycled water produced by treatment plants,
- costs of producing and delivering the recycled water,
- amounts of recycled water actually used and distribution of those uses, and
- benefits derived from uses of recycled water.

In addition, financial and cost data for existing water recycling projects would allow CALFED to forecast financial assistance that may be needed to achieve the estimated water recycling potential.

GOALS AND OBJECTIVES OF THE MONITORING AND RESEARCH PLAN FOR WATER RECYCLING

Monitoring Goals. To assess local agencies' responses to CALFED water recycling program actions, monitoring and data gathering during years 1 through 5 of Stage 1 implementation will focus on the following key indicators:

- quantities of wastewater collected and treated,
- amounts and quality of recycled water produced by treatment plants,
- quantities of recycled water delivered to various uses (agriculture, municipal and industrial, landscape irrigation, habitat restoration or enhancement, or stream flow augmentation),
- the effects of water quality on the amounts of recycled water produced and on the end uses of the recycled water,
- the capital outlay and other costs of producing and distributing the recycled water, and
- the prices charged for delivery of recycled water to water retailers.

Analyses of data about the above indicators will allow CALFED agencies to determine the cost-effectiveness of water recycling projects and the quantities and quality of water actually delivered and used. These determinations will allow CALFED to: (1) better determine the effects of water recycling on water supply reliability and water quality; (2) assess where and when its planning, technical, and financial assistance are most effective; and (3) refine and target future CALFED water recycling assistance.

Research Objectives. Several interests have argued that the ranges of future recycled water production in CALFED's PEIS/PEIR will not be attained unless certain actions are taken and additional incentives are provided to local agencies. Comments on the draft PEIS/PEIR described an array of hurdles to project development and implementation, and comment letters suggested the following actions for resolving some of the implementation issues:

- More closely coordinate actions taken by the Department of Health Services, the State Water Resources Control Board, the Regional Water Quality Control Boards, and the California

Plumbing Standards Commission. Resolve any differences that may exist between requirements set forth in the Uniform Plumbing Code and DHS policy regarding recycled water and potable water pipelines.

- Provide incentives for local water and wastewater agencies to coordinate their water recycling efforts.
- Remove the institutional hurdles to efficient sale and transfer of recycled water among water and wastewater agencies.
- Provide clear, concise guidance on and assistance with accounting for all benefits of proposed recycled water projects in cost-benefit analyses and other planning studies required by state and federal regulatory agencies.
- Conduct a statewide economic evaluation of water recycling that quantifies the pollution prevention, hydrologic, economic, and environmental effects of reductions in water diversions stemming from increased water recycling.
- Assess the potential for water recycling to help achieve water supply augmentation, reliability, and water quality and ecosystem health objectives of CALFED and evaluate these potential benefits.
- Provide ongoing public outreach and communication about the high value of recycled water, and improve public understanding of the water quality goals in Title 22 of the California Code of Regulations.

To address these suggestions and help assure effective implementation of the CALFED Water Use Efficiency Common Program, CMARP research could investigate:

- Interactions among and program policies or regulations of DHS, SWRCB, the Regional Water Quality Control Boards, and the California Plumbing Standards Commission.
- The economics of water recycling.
- Existing statewide infrastructure available for the treatment, transport, and storage of recycled water.
- Effects of source water quality on the costs of producing recycled water.
- Public perception and acceptance of recycled water for various uses.

See the technical appendix *VII.E* for further research needed to encourage the beneficial use of recycled water.

LINKAGES

A major factor in the production, distribution, and use of recycled water is water quality. The quality of water entering treatment plants directly affects the levels and amount of treatment necessary. The quality of the recycled water produced affects the types and amount of beneficial reuse. Therefore, a link between CMARP's water use efficiency and water quality elements is necessary. Water quality monitoring and research data useful for refining CALFED's water recycling program management include:

- A comprehensive assessment of salinity sources in wastewater collection systems.
- Impacts of salt accumulation on agricultural products and sensitive turf areas.
- Fate and transport of salts, organics, disinfection byproducts, viruses, protozoa, and bacteria in ground and surface waters.
- Effectiveness of using constructed wetlands to remove nitrogen.
- Toxicity and disposal of brines resulting from use of membrane technologies.
- Impacts of recycled water on valves, seals, and O-rings.
- Information about the levels and amount of treatment required to lower the risk of adverse health effects stemming from disinfection byproducts, viruses, protozoa, and bacteria in water and wastewater.

- Adequacy and refinement of microbiological risk assessment methodologies.
- Real-time pathogen monitoring techniques.
- Adequacy of treatment in the vadose zone (groundwater recharge systems).
- Evaluation of sources of recycled water other than urban wastewater (for example, process rinse water).