DEVELOPMENT AND IMPLEMENTATION OF A FARM WATER CONSERVATION PROGRAM WITHIN THE COACHELLA VALLEY WATER DISTRICT, CALIFORNIA

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ABSTRACT

An farm water conservation program was created in May 2003 by the Coachella Valley Water District (CVWD) to reduce demand for Colorado River water following a reduction in annual supply of 109,000 acre-feet (135 MCM, 31%). JMLord, Inc. was hired to provide services to water-users within the District.

Key components of the 2003 program were water user training and field services. The program supported water user decision-making and led to reductions in farm water demand within the first 7 months.

The training program was developed to share the theory and practice of irrigation and salinity management. Weekly meetings were held from June to October, covering a wide range of topics. Activities included lectures, discussions, field demonstrations, and hands-on workshops. Water user participation was excellent.

Field services provided one-on-one interaction to implement the concepts of the training meetings. Services included irrigation scheduling, irrigation performance evaluations, salinity management, and feasibility studies for system improvements. Water users representing approximately 40% of the farmed area became involved in the program, and many identified reductions in water use.

Successful long-term conservation programs must focus on both achieving water savings and on verifying that the savings occur. The key to supporting water users in conserving water is developing trust by protecting trade secrets and by demonstrating the effectiveness of scientific management techniques.

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INTRODUCTION

The purpose of this paper is to provide a discussion of the extensive farm water conservation program developed and implemented by the Coachella Valley Water District, California (CVWD) during the last 7 months of 2003. A description of CVWD is provided, as well as a description of the factors leading to the creation of the program. Key components of the program are highlighted, and observations of the effectiveness of the program in promoting and realizing conservation are included.

BACKGROUND

The agricultural service area of CVWD is located at the north end of the Salton Sea, in Eastern Riverside County, California. The District is surrounded by the San Jacinto and Santa Rosa Mountains on the west and by the San Bernadino and Little San Bernadino Mountains on the north and east. The agricultural water service area, Improvement District No. 1 (ID1), encompasses 136,000 acres (55,000 ha), 103,000 acres (41,700 ha) of which are irrigable. Approximately 72,000 acres (29,100 ha) are irrigated annually[5]. Farmers in CVWD produce a diverse variety of crops including table grapes (17.7%), citrus (11.4%), dates (9.4%), lettuce (6.5%), bell peppers (4.7%), sweet corn (4.4%), and carrots (4.1%).

Irrigation water supplies from the Colorado River are supplemented by irrigation wells owned and operated by the water users. Annual canal water deliveries for irrigation are approximately 280,000 acre-feet (346 MCM), and annual groundwater pumpage for irrigation is approximately 90,000 acre-feet (111 MCM)[6].

Irrigation technologies and agricultural water management practices have changed significantly in CVWD since Colorado River water was first imported in 1949. As of 2002, Coachella Valley farmers have converted over 63% of irrigated lands to drip or sprinkler systems[7].

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[5] Levy, Tom (2000 – 2001) and Robbins, Steve (2002), 2000 – 2002 Annual Reviews, Coachella Valley Water District. P.O. Box 1058, Coachella, California 92236.

[6] Water Advisory Committee (WAC). March 2004. Water Management within Improvement District No. 1 of the Coachella Valley Water District. P.O. Box 1058, Coachella, California 92236. Unreleased Draft.

[7] Water Advisory Committee (WAC). March 2004. Water Management within Improvement District No. 1 of the Coachella Valley Water District. P.O. Box 1058, Coachella, California 92236. Unreleased Draft.

For many years, California has used more than it's legal entitlement of 4.4 million acre-feet (4.4 BCM) of Colorado River Water annually. Several agencies receiving the water including CVWD, Imperial Irrigation District (IID), and the Metropolitan Water District of Southern California (MWD) have been working for years to reach an agreement to reduce the State's demand on the Colorado. An important milestone of the negotiation process was December 31, 2002. Failure to reach an agreement by that time resulted in an instantaneous cut by the Bureau of Reclamation (BOR) of 800,000 acre-feet (990 MCM) to immediately curb California's annual use to the legal entitlement. If the milestone were met and an agreement forged by the end of 2002, deliveries would have been decreased gradually over 15 years, softening the reduction in water supply.

When December 31 came and passed and an agreement had not been signed, BOR enforced it's earlier warning and immediately reduced California's Colorado River supply. In order to allocate the reduced supplies among California contractors, BOR cut IID's 2003 water order of 3.1 million acre-feet (3.8 MCM) by 205,000 acre-feet (253 MCM). This cut was stopped by an injunction upheld by the U.S. District Court in April 2003, pending an analysis of IID's beneficial use of water by BOR under the Federal Part 417 process. The impact of this ruling on CVWD was a 109,000 acre-foot (135 MCM) reduction in water supply for 2003. The cut represented approximately 31% of the annual water order or 50% of the remaining supply for the year.

In response, CVWD adopted several measures in May to minimize adverse impacts on water users. The following measures were adopted:

- Temporary $15 per acre-foot surcharge for Colorado River water to increase the agricultural irrigation rate to $30.50 per acre foot.
- Requirement of non-agricultural users to convert to groundwater sources.
- Suspension of the water availability assessment until January 1, 2004.
- Encouragement of farmers to switch from canal water to private well water, where possible.
- Retention of JMLord, Inc. to provide training, fields services, computer software, and other farm water conservation support.

As an added measure, the District sought additional supplies from Palo Verde Irrigation District (PVID), another California contractor on the river. A temporary fallowing program was developed and implemented to transfer up to 80,000 acre-feet (99 MCM) from PVID to CVWD at a cost of $12 million.

Almost a decade of heated debate and intense negotiations resulted in the realization of the Quantification Settlement Agreement (QSA), signed by Secretary of the Interior Gale Norton October 16, 2003. This agreement will result in the largest transfer of water in United States history. The need for water conservation has not abated as a result of this agreement, however. In fact, the

need continues to increase as supplies dwindle and demand increases. The events of 2003 served as a catalyst for the development of a farm water conservation program in CVWD, but the importance and value of the program has not diminished with the signing of the QSA and restoration of Colorado River water supplies. The program has been renewed for 2004 and is expected to continue at some level into the future. Water conservation is a critical component of CVWD's role as a public service agency.

TRAINING PROGRAM

A primary component of CVWD's 2003 conservation program was water user training. The objective of the training program was to provide explanation and demonstration of scientific and technical methods of farm water management to water users to allow continued independent operation following participation in the program. The following specific goals were identified at the outset:

- Provide a thorough understanding of the need to schedule irrigation frequencies and amounts to satisfy crop water needs.
- Provide a thorough understanding of techniques, both manual and computer, used to schedule irrigations based upon the relative capital and manpower available to the participant.
- Discuss and demonstrate the advantages of irrigation scheduling to enhance yield and crop quality.
- Discuss and demonstrate the impacts of irrigation scheduling on timing of harvest and the implications regarding better control and regulation of the time crops are put on the market.
- Discuss and demonstrate the optimization of fertilizer application by minimizing losses and the optimization of soil salinity levels through adequate leaching.
- Discuss and demonstrate the necessary scheduling adjustments that must occur for cultural reasons such as: seedbed preparation, germination, transplanting, and climate modification.

A sequence of educational meetings was scheduled and curriculum developed to meet the specific goals of the training program. The specific courses held are listed in Table 1 on the following page.

A total of twenty courses were held as part of the 2003 training program. Attendance for the meetings was excellent. On average, 3 CVWD personnel, 4 JMLord personnel, and 13 water users attended each meeting. The courses provided an excellent opportunity for water users to interact with the District and to communicate regarding District operations, water supply status, and factors influencing farm water use. Through the training meetings, water users representing approximately 25,000 acres (10,000 ha, 35%) of the farmed acreage in the District opted to become involved in field services offered under the

program. Water conservation achievement awards were presented to 18 water users attending 5 or more meetings.

The 2003 program has provided insights into opportunities and constraints to improve farm water management practices in CVWD. Moreover, the implementation of an education program by the District has yielded insights into opportunities to provide a valuable, effective water management program that benefits all water users, both agricultural and urban. The following observations have been made regarding the training program:

- Many participants expressed interest in attending future courses.
- More courses should be taught in Spanish, or a translator should be present.
- Classes should focus on hands-on activities with a minimum of time in the classroom.
- A course catalog should be provided well in advance to allow the participants to plan to attend courses that relate to their operations directly.

Table 1. Schedule of Courses

Date	Meeting Topic
June 18, 2003	Introduction to CVWD Water Conservation Program
June 25, 2003	Irrigation Scheduling Concepts
July 2, 2003	Irrigation Scheduling Strategies
July 9, 2003	Soil Moisture Measurement
July 16, 2003	Crop Water Use I
July 23, 2003	Crop Water Use II
July 30, 2003	Translating Crop Water Use into an Irrigation Schedule
August 6, 2003	Manual Methods of Scheduling I
August 13, 2003	Manual Methods of Scheduling II
August 20, 2003	Computer Methods of Scheduling I
August 27, 2003	Computer Methods of Scheduling II
September 3, 2003	Soil Moisture Measurement by the Feel Method (Field Activity)
September 10, 2003	Soil Moisture Measurement Using Tensiometers (Field Activity)
September 17, 2003	Salinity Monitoring and Reclamation (Field Activity)
September 24, 2003	Distribution Uniformity Evaluation (Field Activity)
September 25, 2003	Distribution Uniformity Evaluation (Spanish, Field Activity)
October 1, 2003	Irrigation System Maintenance (Field Activity)
October 2, 2003	Irrigation System Maintenance (Spanish, Field Activity)
October 8, 2003	Irrigation Timers and Controllers
October 15, 2003	Other Methods of Determining Moisture and Stress

FIELD SERVICES

Another key component of the conservation program was water management field services. One-on-one interaction between the water user and the consultant served to reinforce topics covered in the training program. Numerous specific services were provided, allowing the participants to evaluate and utilize those applicable to their specific operation. Demonstration of the effectiveness of scientific management techniques and promotion of independent adoption by the water user were emphasized. The following services were offered:

- Soil Moisture Monitoring
- Crop Evapotranspiration Calculations
- Irrigation Recommendations
- Irrigation Performance Evaluations
- Salinity and Drainage Monitoring
- Leaching Recommendations
- Feasibility Studies for System Improvements

Irrigation scheduling (soil moisture monitoring, crop evapotranspiration calculations, and irrigation recommendations), irrigation performance evaluations, and salinity management activities (salinity monitoring and leaching recommendations) were the most popular services among program participants. Irrigation scheduling was implemented on approximately 3980 acres (1610 ha) including row crops, dates, table grapes, and citrus. Irrigation performance evaluations were performed on approximately 780 acres (320 ha) including microirrigation systems and sprinklers. Salinity management was implemented on approximately 4120 acres (1670 ha) including composite sampling, grid sampling, EM38 "Salt Sniffer" surveys, and bed/row scale sampling throughout the wetted pattern of the irrigation system. A feasibility study was conducted for a 270-acre (109 ha) ranch producing row crops with furrow irrigation.

The following observations were made regarding the irrigation scheduling services under the program:

- Most participants were interested in implementing irrigation scheduling if assistance was provided.
- Some participants were concerned about the confidentiality of their practices.
- Some participants felt that it is not feasible to implement frequent soil moisture monitoring independent of the program.
- The high level of irrigation technology present in CVWD increases the potential to optimize water use.

The following observations were made regarding the irrigation performance evaluation services under the program:

- Most microirrigation systems in the Coachella Valley were designed well to minimize pressure differences and maximize distribution uniformity.
- Distribution uniformity for most systems is dependant on maintenance including regular flushing, filter setup and maintenance, and chemical injection to prevent bacteria and algae.
- In many cases, nonuniformity occurs due to low system pressures, where small differences in hose pressures lead to significant differences in flow.
- In many cases, there are opportunities to run fewer blocks simultaneously to maintain system pressures.

The following observations were made regarding salinity management services under the program:

- Soils in the Coachella Valley are highly variable. Soils may vary significantly in texture, compaction, and related hydraulic properties both across the field and through the profile.
- Lack of adequate drainage can seriously hinder the ability to leach salts effectively.
- There are opportunities to target high salinity areas in many fields, removing the maximum quantity of salt per unit of water applied.

The following observations were made regarding feasibility studies under the program:

- Areas receiving water from the end of CVWD laterals may experience fluctuations in delivery flows that reduce the ability to irrigate uniformly and efficiently.
- Fluctuations in delivery flows can result in inordinately high water and labor costs.
- Improvements to District and/or farm irrigation systems may be feasible and could greatly improve flexibility in water management by water users.

WATER SAVINGS

The catalyst of this program was a critical need to reduce canal water demand to survive a water supply shortage. The success of the program was demonstrated by the ability of the agricultural economy to reduce water demands and survive the shortage. Accordingly, the focus of the program was to implement conservation practices and achieve real water savings as quickly as possible.

The feasibility of continuing the program depends upon the ability to quantify the amount of water conserved through each of the field services provided and

through the education program. The effort to quantify water savings may require an equal or greater amount of energy than the effort to actually achieve savings. Verification of water savings resulting from specific practices provides the necessary accounting to establish conservation incentives and drive water savings using market forces. These incentives may come from District cost savings, farm cost savings, and urban cost savings.

On average, growers participating in the field services reported water savings of 0.7 acre-feet per acre (21 cm). Applied to the 9140 acres (3700 ha) for which field services were provided, total savings are estimated to be 6400 acre-feet (7.9 MCM). If growers applied the same management practices to their entire acreage, total savings could be as great as 17,500 acre-feet (21.6 MCM). These values provide a rough estimate of savings, and future efforts must provide more detailed verification of actual water savings resulting from specific conservation practices.

Recorded Colorado river diversions for 2003 were 28,600 acre-feet (35.4 MCM) below the average annual diversions from 1990 – 1999. Three causes for decreased diversions have been identified. The three causes are:

- Farm Water Conservation
- Increased Groundwater Pumping
- $15 Per Acre-Foot Increase

The causes of decreased diversions are interrelated. For example, an increase in agricultural water rates may have served as an incentive to implement conservation practices otherwise not feasible. Likewise, the increased rate likely caused some water users to pump groundwater in lieu of canal water.

CONCLUSIONS

Educational programs coupled with one-on-one field services provide a valuable mechanism to foster communication and interaction between the District and it's agricultural water users. The key to supporting water users in conserving water is developing trust by protecting trade secrets and by demonstrating the effectiveness and feasibility of scientific management techniques.

Real opportunities to save water at the farm level exist. Incentives may be required to implement conservation practices where the cost savings to the water user alone are not sufficient. Cost savings to the District, urban water users, and other agricultural water users may provide the market forces needed to implement conservation practices.

Successful long-term conservation programs must focus on both achieving water savings and on verifying that the savings occur. Verification of water savings is a necessary condition to establish mechanisms that use market forces to drive

agricultural water conservation. Verification of water savings may require an equal or greater amount of energy than the effort to achieve actual savings.