

Findings and Recommendations

Well Replacement and Repair of Existing Wells

The well evaluation project has identified 18 wells that need repairs in order to improve their performance to an acceptable level. This includes 11 Modesto Irrigation District (MID) wells and 7 Oakdale Irrigation District (OID) wells. It is recommended that OID and MID schedule and budget repair of these wells as soon as possible. The specific work that must be performed is identified by well in the evaluation report.

The well evaluation project also identified six wells that must be replaced, including one OID well and five MID wells. The existing wells should be decommissioned and properly destroyed and new wells should be drilled and developed. It is also recommended that the districts budget and schedule a well replacement program for these wells.

Implement Phase II of the Well Field Optimization Program

This phase of the program expands the Well Field Optimization to include service areas of other water purveyors in the Basin. This will include expanding the well evaluations, DMS, and DSS. The DMS will also be modified to become web-based to provide access by all Association member agencies.

Implement Phase III of the Well Field Optimization Program

This phase will fully automate the DSS and conjunctive management operations, which will include:

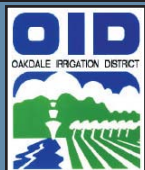
- Using remote sensing to collect real-time groundwater level and water quality data as well as water quantities and quality in the agencies' main laterals and pipelines
- Establishing a process to assess the water requirement in each lateral
- Installing a SCADA system to monitor, control, manage, and optimize groundwater pumping, surface water quantities in the laterals, groundwater levels, and operational outflows



Typical Pumping Plant

Financial Plan

A financial plan should be developed to facilitate orderly development and implementation of the recommendations listed above, including identification of potential grant funding.



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Well Field Optimization Project

Final Report: EXECUTIVE SUMMARY – May 2007



Stanislaus and
Tuolumne Rivers
Groundwater Basin
Association



Executive Summary

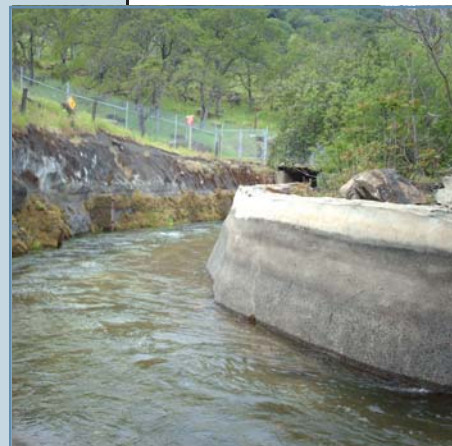
The Stanislaus and Tuolumne River Basin Groundwater Association (Association) was formed in 1994 by six agencies interested in improving the management of the Modesto Groundwater Subbasin (Basin). Notable among the Association's accomplishments is the preparation of the *Integrated Regional Groundwater Management Plan for the Modesto Subbasin* (IRGMP) in 2005. The current project, the Well Field Optimization Project (Project), is also notable because it is the first IRGMP recommendation funded for implementation. The goal of the Project is to improve understanding of the groundwater system and its infrastructure and to develop tools for optimizing operations of the well field in conjunction with the surface water resources of the Basin.

The Project is the first of a three-phase Well Optimization Program (Program). Objectives of the Program are to:

- Operate wells to meet water supply demands of the districts
- Lower power costs per unit of water pumped by prioritizing well usage by cost of operations
- Maintain groundwater levels that satisfy the Basin Management Objectives (BMOs) established in the Groundwater Management Plan
- Manage the water quality of groundwater discharged into the surface water delivery system
- Increase the effectiveness of shallow groundwater management



Pumping plant similar to the one shown above pumps groundwater and discharges it to the District's conveyance system.



Surface water is conveyed through canals to the MID and OID service areas for delivery to farmers.

In the current phase, the Project was completed for Modesto and Oakdale Irrigation Districts. Implementation of future phases (depending on funding availability) will automate the system for real-time conjunctive use management and will expand to the other Association member agencies' service areas. The Project includes a Data Management System (DMS) and a Decision Support System (DSS). Districts' facilities and wells are inventoried and data collected are stored in the database. Using the data stored in the DMS, the DSS optimizes well field operations according to pumping energy costs, water quality objectives, and/or water conservation. The DSS provides operational flexibility to the districts for conjunctively managing surface and groundwater resources on a real-time basis.

The Project can be broken down into four major components as listed below.

- 1) Facilities Inventory and Mapping
- 2) Production Well Evaluations
- 3) Database Management System
- 4) Decision Support System

A summary of each component follows.

(1) Facilities Inventory and Mapping and (2) Well Evaluations

Existing district facilities, wells and laterals, were inventoried and mapped. First steps of the inventory and mapping included gathering all available data and assessing the quality of the data for use in the Well Performance Evaluations, DMS, and DSS. Next, data gaps were identified and prioritized for field surveys. Finally, all available and newly collected data were entered in the DMS and/or Geographic Information System (GIS) for use in the DSS and performance evaluations.

Well evaluations were completed to rank district wells and identify wells with acceptable efficiency and performance. This information was also used in the DSS. Recommendations for repairs or replacements of non-efficient wells were prepared and prioritized and associated cost estimates provided to the districts.

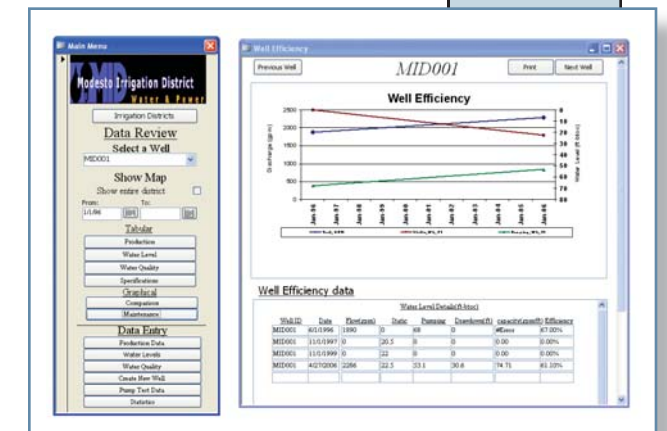
(3) Database Management System

A Database Management System (DMS) was developed for storage, retrieval, and evaluation of groundwater data. The DMS is a Microsoft Access® database with a custom interface for entering well data into a database, viewing data, and generating reports. For example, the DMS can be used for storage and retrieval of production data as well as water level and water quality data collected by Association member agencies' monitoring programs. The DMS also interacts with the DSS, supplying well data used in the DSS decision algorithm and logging well operation status as orders are placed.

(4) Decision Support System

The Decision Support System (DSS) was developed to optimize the conjunctive use of surface and groundwater resources to meet objectives developed for each district. The DSS is a custom tool within Microsoft Access® that interacts with the DMS, retrieving data and updating well operation status as orders are placed.

The main function of the DSS is to automate the decision process for system operators in selecting wells to meet deliveries. The DSS optimizes well selection based on criteria input by the operator, including location, time of delivery, flow rate, efficiency, cost of energy for pumping the water, and water quality. DSS output includes a list of available wells that meet the selection criteria. The user can select from among the eligible wells to satisfy the order.



The Well Field Optimization program was developed to combine data evaluation capabilities of the DMS with the decision support capabilities of the DSS into a single, easy to use interface.