Chino Basin Watermaster
Status Report No. 16

(Covering October 2005 through December 2005)

January 2006

OPTIMUM BASIN MANAGEMENT PROGRAM

In its Order of September 28, 2000, extending the term of the nine-member Watermaster Board, the Court ordered Watermaster to provide semiannual reports regarding the progress of OBMP implementation. These semiannual reports were subsequently modified to include quarterly status letters. By an Order of October 17, 2002, the Court added additional reporting items to the quarterly status report. Beginning with the first quarter of FY 2005-06, Watermaster filed Quarterly Status Letter No. 1 which updated the court on actions taken from July-September 2005. This Status Report 16 is filed pursuant to these earlier modifications and reports on the activities from October 1 through December 31, 2005.

PROGRAM ELEMENT 1 – DEVELOP AND IMPLEMENT COMPREHENSIVE MONITORING PROGRAM

Groundwater-Level Monitoring

BACK-GROUND

Watermaster has three active groundwater-level monitoring programs operating in the Chino Basin – a semiannual basin-wide well monitoring program; a key well monitoring program associated with the Chino I / II Desalter well fields and the Hydraulic Control Monitoring Program (HCMP); and a piezometric monitoring program associated with land subsidence and ground fissuring (see Land Surface Monitoring below) in Management Zone 1 (MZ1).

THIS PERIOD

For the semiannual program, Watermaster staff manually measures water levels in approximately 480 agricultural wells twice per year. In conjunction with the basin-wide monitoring program, Watermaster staff manually measures water levels at about 107 key wells in the southern portion of the Basin and around the Chino I / II Desalter well fields once per month. Pressure transducers/data loggers were installed in 19 of these key wells to automatically record water levels once every 15 minutes. For the MZ-1 program, Watermaster consultants collect groundwater level data at 35 wells in the southern portion of MZ1. Data are collected manually once every two months, and automatically once every 15 minutes using pressure transducers/data loggers installed at each well.

These Groundwater-level programs also rely on municipal producers, other government agencies, and private entities to supply their groundwater level measurements on a cooperative basis. Watermaster digitizes all these measurements and combines them into a relational database maintained at Watermaster's office.

TO COME

During FY 2005-06, Watermaster staff is expanding the use of pressure transducers/data loggers. Watermaster staff purchased and installed 18 additional pressure transducers/data loggers at HCMP wells recently completed. In addition, Watermaster staff is purchasing and installing about 20 additional pressure transducers/data loggers at key wells and at selected wells in the northern portions of Chino Basin where highly-detailed groundwater level data are scarce.

Groundwater-Quality Monitoring

BACK-GROUND

Watermaster developed a streamlined, key-well water quality monitoring program in which approximately 114 private "key wells" are sampled bi-annually (i.e. once every two years) in the southern portion of the Chino Basin. Therefore, approximately 57 wells are sampled on an annual basis. These wells are typically sampled from the late spring to early fall. The steps taken in determining the key wells were:

- The basin was divided into a grid, with each grid cell being 2000 square meters (m^2).
- For each grid cell, the average TDS and NO_3 values were calculated (using the last five years of available data).
- The water quality data of each individual well were examined. Wells most closely matching the average constituent concentrations were chosen as representative. One to two wells in each grid square were retained (the wells not chosen in the key well program, but still matching these criteria, are the alternate wells for each grid cell). Preference was given to wells with the following characteristics:
  - Known construction;
  - Choice as a groundwater level key well;
  - Likelihood of surviving regional land development.
- Basin-wide TDS and NO_3 arithmetic averages were recalculated using just the key wells and compared to the total basin arithmetic averages. New maps were made representing the water quality conditions of the key wells and qualitatively compared to the original basin maps.

Watermaster continues a comprehensive water quality program whereby water quality data from other sources are routinely collected, quality-control checked and loaded into Watermaster's database. Data sources include:

- Appropriators
- Department of Health Services (DHS) – these data are currently downloaded from DHS annually
- Department of Toxic Substance Control (DTSC) for the Stringfellow Superfund Site
- Regional Water Quality Control Board (RWQCB) for water quality data associated with sites under Cleanup and Abatement Orders (CAOs').

THIS PERIOD

Watermaster is working closely with the Appropriative Pool members and their state-certified contract laboratories in order to obtain water quality data as an electronic data deliverable (EDD). These data are transmitted either directly from the laboratory or from the Appropriators, after their QA/QC check of the laboratory data. The EDDs will enhance the quality and timeliness of the Watermaster's database.

With respect to the recharge of recycled water, Watermaster and IEUA are constructing a number of monitoring wells at recharge basins (Banana/Hickory, RP-3, DeClez, Turner 1&4, Eighth St and Ely) to monitor the influence of recharge on groundwater levels in general, and to

monitor the water quality resulting from the blend of supplemental and storm waters. At least one monitoring well will be installed downgradient of each recharge facility that receives recycled water. Construction should be completed in FY 2006-07.

Groundwater-Production Monitoring

BACK - GROUND

Monitoring of Agricultural Production Wells. Initially, production monitoring involved the installation of meters on wells operated by members of the Agricultural Pool or the use of a "water duty" method to estimate agricultural production. As of December 2005, Watermaster counted about 430 active agricultural wells and equipped 349 of these wells with operating meters. The other 81 wells will become inactive within 6-12 months because of urban development in the south Chino area and hence are not metered.

THIS PERIOD

All Producing Wells Are Monitored Quarterly. Watermaster staff reads the newly installed and/or rehabilitated meters on the agricultural wells quarterly. These data are entered into Watermaster's database.

Need For Water Use/Disposal Form Eliminated. The OBMP Implementation Plan includes a provision that requires the producers to submit a water use/disposal form describing the sources of water used by each producer and how that water is disposed of after each use. Watermaster never implemented filling out the water use and disposal forms nor reporting the results. Watermaster conducted discussions on the need for this form with the Water Quality Committee and determined that accurate salt budget estimates could now be made without the forms because all agricultural wells having a discharge line greater than ¾ inch in diameter are now metered and the key wells discussed above (Groundwater Quality Monitoring) provided the needed data on nitrate and TDS levels.

Surface-Water Monitoring

BACK-GROUND

Measure Water Quality and Water Levels In Recharge Basins. Watermaster conducts a surface water monitoring program to characterize the water quality of storm and supplemental water entering the recharge basins. In addition, newly installed pressure transducers or staff gages are used to measure water levels during recharge operations. The purposes of these measurements are to estimate the volume and quality of recharge from three major sources: imported water from MWD, recycled water from IEUA, or stormwater from the 8 major flood control channels. This information is used to estimate the "new yield" to the Basin from recharge operations and to insure adequate dilution of recycled water entering the recharge basins.

THIS PERIOD

Currently, Watermaster monitors the water quality in 8 major channels (San Antonio, West Cucamonga, Cucamonga, Deer Creek, Day Creek, San Sevaine, West Fontana, and DeClez) usually after a major storm event. Water qualities for recycled water are provided by IEUA for their RP1 and RP4 treatment plants; water qualities for State Project Water are provided by MWD. Combining the measured flow data with the water qualities enables the calculation of the blended water quality in each recharge basin.

BACK-GROUND

Surface Water Monitoring for Santa Ana River. One of the goals of the OBMP is to maximize Chino Basin yield. A key component in maximizing yield is to minimize groundwater discharge into the Santa Ana River (SAR). Watermaster developed a surface water monitoring program for the SAR that, in conjunction with Watermaster groundwater monitoring programs, is used to

characterize those reaches of the SAR that are gaining water from the Basin, and to determine if significant discharge of Chino Basin groundwater to the SAR is occurring. A conceptual monitoring plan involving IEUA, OCWD, the RWQCB, and Watermaster was finalized. These agencies developed a detailed work plan to implement a surface water and groundwater monitoring program in June 2003, and year-round water quality sampling and flow monitoring in the SAR began.

THIS PERIOD

Watermaster now measures the SAR flow and selected water quality parameters as key elements of the HCMP. Watermaster collects water quality samples and measures flow at four SAR stations (Van Buren, Etiwanda, Hamner, and River Road) plus another eight locations on tributaries, year round on a bi-weekly basis. In addition, Watermaster obtains discharge data from permanent USGS and OCWD stream gauge locations on the SAR and its tributaries. Discharge and water quality data from publicly owned treatment works (POTWs) that discharge to the SAR in this reach are obtained from the POTWs. These data are used in the management of the basin including the quality of water available for recharge, groundwater modeling investigations, and assessment of the state of hydraulic control.

Land-Surface Monitoring

BACK-GROUND

Multifaceted Approach. Watermaster staff developed a multifaceted land surface monitoring program to develop data for a long-term management plan for land subsidence in Management Zone 1 (MZ1). The monitoring program consists of three main elements:

1. An aquifer system monitoring facility is located in the southern portion of MZ1, an area that has experienced concentrated and differential land subsidence and ground fissuring. A major component of the aquifer system monitoring facility is a cluster of multiple depth piezometers that measure water level and pressure changes at 11 different depths. Another major component is a dual borehole extensometer that measures deformation within the aquifer system at deep and shallow levels. Together, the two components correlate the hydraulic and mechanical responses of the aquifer system to different aquifer stresses, such as pumping at wells.

2. Synthetic aperture radar interferometry (InSAR) measures land surface deformation across the entire Chino Basin using remote sensing techniques.

3. Benchmark surveys along selected profiles of the Chino Basin. The benchmark surveys (1) establish a datum from which to measure future land surface deformation, (2) “ground-truth” the InSAR data, (3) allow determination of historical subsidence at any historical benchmarks that can be recovered, and (4) evaluate the effectiveness of the long-term management plan.

THIS PERIOD

Depth Specific Data. Permanent transducers and data logging equipment are recording depth specific groundwater level data at the Ayala Park piezometers. Transducers also are recording groundwater level data at wells owned by the cities of Chino and Chino Hills and the California Institution for Men (CIM). These transducers record groundwater levels at all wells once every 15 minutes, and also record “on/off” pumping cycles at the active production wells.

Deep Aquifer-System Stress Test. Controlled aquifer-system stress (pumping) tests in October 2003 and April 2004 provided piezometric and aquifer-system deformation response data that revealed that:

BACK-GROUND

- at least two distinct aquifer systems exist beneath the southern portions of MZ-1: a shallow system (100-300' bgs), a confining layer (300-400' bgs), and a deep system (>400' bgs).

- a groundwater barrier potentially exists within the sediments below about 300 ft-bgs. This barrier is evidenced by a lack of water level response in well CH-18 (east of the fissure zone) due to pumping at CH-19 (west of fissure zone). Image-well analysis of pumping-test responses indicates that this barrier approximately coincides with the location of the historic zone of ground fissuring. This spatial coincidence suggests a cause-and-effect relationship between the barrier, the steep gradient of subsidence across the barrier as indicated by InSAR, ground level surveys and the ground fissuring.

- currently, mainly elastic deformation is occurring within in the aquifer-system.

Starting on September 1, 2004, Watermaster began a controlled deep aquifer-system stress test. In summary, the test provided constant discharge from two wells owned by the City of Chino Hills (CH-15B and CH-19); while most other wells in the area remain off. These wells have similar perforated intervals from about 300-1,100 ft-bgs and primarily influence water levels in the deep aquifer system – deeper than about 300 ft-bgs. The pumping test ended on October 6, 2004.

The primary objective of this test was to transition the deformation of aquifer-system sediments from elastic compression to inelastic compaction. If successful, it would provide "threshold" piezometric heads at the extensometer location that should not be approached in the future if permanent (inelastic) compaction within the aquifer-system is to be avoided. This would also define a key parameter required for estimating the maximum elastic storage capacity of the confined aquifer-system.

Inelastic compaction was potentially identified late in the pumping test through analysis of stress-strain diagrams, and the pumping test ceased. The aquifer-system transitioned from elastic compression to inelastic compaction when the water level in at the Ayala Park PA-7 piezometer exceeded 250 ft-bgs. Water levels have since recovered, and inelastic compaction of about 0.01 foot has been recorded.

Other objectives of the pumping test that were successfully accomplished were to (1) estimate key aquifer-system parameters that could be used in later modeling efforts, and (2) confirm and elucidate the existence of a groundwater barrier within the sediments below about 300 ft-bgs.

BACK-GROUND

InSAR. The objective of this task is to characterize ground surface deformation in Chino Basin using Synthetic Aperture Radar Interferometry (InSAR). This analysis was performed for a historical period (1992-2003) and will be updated periodically. The advantage of InSAR is that it provides a continuous representation of land surface deformation. These data are used to: (1) characterize the time history of land surface deformation in greater spatial and temporal detail than can be accomplished from the available historical ground level survey data, (2) calibrate

computer simulation models of subsidence and groundwater flow, and (3) assist in the evaluation of the effectiveness of the long term management plan.

Vexcel Corporation of Boulder, Colorado – a company that specializes in remote sensing and radar technologies - conducted a "proof of concept" study of historical synthetic aperture radar data that was acquired over the MZ-1 area. The objective of this study was to generate cumulative displacement maps over relatively short time steps (April to November 1993). The MZ-1 Technical Group deemed the study successful, and approved follow-up study by Vexcel to perform a comprehensive analysis of all historical synthetic aperture radar data (1992-2003) to characterize in detail the time history of subsidence in MZ-1. This work was completed during the first quarter of CY 2005. David Cohen of Vexcel presented the InSAR results by to the MZ-1 Technical Committee in March 2005.

The InSAR results were generally consistent with the ground level survey data collected over a similar period with respect to the areal extent and magnitude of historical subsidence. The InSAR data show:

- The rate of subsidence in the southern portion of MZ-1 has declined over the time history, particularly since about 1995.

- Currently, the aquifer system is experiencing mainly elastic compression and expansion in southern MZ-1.

- Central areas of MZ-1 are displaying greater rates of subsidence than near Ayala Park. This subsidence may be related to aquifer system compaction, but pumping and water level data have not yet been analyzed in the central regions of MZ-1 that would reveal this relationship.

- A steep gradient of subsidence across the fissure zone. The steep gradient extends north of the fissure zone to about Francis Street. The InSAR data show that the gradient of subsidence is steeper across fissure zone than has been shown by survey data, which further supports the potential link between the subsidence and the fissuring. The existence of this steep gradient across the fissure zone also supports and reveals the existence and extent of the groundwater barrier.

THIS PERIOD

The MZ-1 Technical Committee has recommended that InSAR data be collected twice per year for the next two years (during the Spring and Fall of each year). The InSAR data results will be compared against the ground level survey data (see below), and a new monitoring plan will then be recommended to monitor ground surface displacement as part of the long-term plan.

BACK-GROUND

Benchmark Surveys. The Interim Monitoring Program (IMP) work plan called for the deep extensometer, which is anchored in sedimentary bedrock at about 1,400 ft bgs, to be used as the "starting benchmark" for all survey loops. To accomplish this, a Class-A benchmark was constructed outside the extensometer building to serve as the practical (*i.e.* actual) starting benchmark. To link this benchmark to the deep extensometer pipe, each survey event is begun by referencing the benchmark to a marked spot on one of the piers that supports the extensometer instrument platform. These piers and the instrument platform represent a stable ground surface datum that is used to measure relative vertical displacement between the

ground surface and the deep extensometer pipe (recorded every 15 minutes). The vertical displacement recorded at the deep extensometer between survey events, in addition to any vertical displacement measured between the starting benchmark and the pier, is then used to calculate the elevation at the starting benchmark outside the extensometer building. Then, relative vertical displacement between benchmarks is measured across the entire work to obtain current elevations. These comprehensive surveys are planned to be repeated twice per year for the next two years (during the spring and fall of each year).

A key element of the MZ-1 benchmark network is the array of closely spaced benchmarks that have been established across the historic fissure zone in the immediate vicinity of the Ayala Park extensometers (Ayala Park array). At this array, located along Edison and Eucalyptus Avenues, the IMP work plan calls for the semiannual measuring of both vertical and horizontal displacements. These horizontal and vertical displacements are expected to define two-dimensional profiles of land surface deformation that can be related to the vertical distribution of aquifer system compaction and expansion that is being recorded continuously at the extensometers. These surveys are repeated semi-annually during the late spring and early fall-periods of highest and lowest water levels – in an attempt to monitor fissure movement that may be associated with elastic and/or inelastic aquifer deformation.

In June and October 2005, AE performed the semiannual survey events across the entire network of benchmark monuments, including the measurements of horizontal displacements at the Ayala Park Array of monuments. The results of these surveys are currently being processed. The next survey of the entire monument network is planned fro Spring 2006.

BACK-GROUND

The MZ-1 Technical Committee has recommended that the entire network be surveyed twice per year for the next two years (during the Spring and Fall of each year). The ground level survey data will be compared against the InSAR data (see above), and a new monitoring plan would then be recommended to monitor ground surface displacement as part of the long-term plan. The horizontal surveys will also be extended to the north over this two year period to include monuments along Schaefer Avenue. AE investigated the quantity and quality of pre-1987 subsidence data in MZ-1 and found that very little existed in the records. The data available related to the northern portions of the Chino Basin.

Aquifer-System Modeling. The objectives of aquifer-system modeling in MZ-1 are:

BACK-GROUND

- To evaluate fluid withdrawal as the mechanism of historical land subsidence (forensic tool)
- To predict the effects of potential basin management practices on groundwater levels and land subsidence (forecasting tool)

In other words, if a model can be constructed that simulates past drawdown and associated land subsidence, then the model represents an additional line of evidence that fluid withdrawal was the mechanism of historical and land subsidence. In addition, the model can be used to predict future drawdown and associated land subsidence that would result from potential basin management practices.

Three distinct modeling efforts will take place in sequence:

1. Inverse analytical modeling. This type of modeling will use groundwater level and production data collected as part of the aquifer-system stress testing (pumping tests) that were conducted in 2003 and 2004. The objectives are to determine the hydraulic and mechanical parameters of the aquifer-system and reveal XY-anisotropy. The results will be used in subsequent numerical modeling efforts.

TO COME

2. One-dimensional compaction modeling. This type of modeling will use groundwater level and aquifer-system deformation data collected at the Ayala Park Extensometer facility. The objective is to determine the aquitard properties in the vicinity of Ayala Park. Areal extrapolation of aquitard properties will be based on geology and InSAR data, and the results will be used in the three-dimensional numerical modeling efforts (below).

3. Three-dimensional groundwater flow and subsidence modeling. This type of modeling will use groundwater level and production data at all wells in the area, and historical land subsidence data from ground level surveys and InSAR. Again, this model will serve as a forensic and forecasting tool for MZ-1.

Development of Long-Term Management Plan. The objective of the long-term management plan is to minimize or abate permanent land subsidence and ground fissuring in MZ-1. The modeling efforts described above will be key to the development and evaluation of this plan.

The OBMP implementation plan called for the development of the long-term management plan for MZ-1 by June 2005. Because the modeling efforts were just begun this quarter, the Special Referee was notified, and he has indicated that the IMP progress and current activities are sufficient to warrant a delay in the development of the long-term management plan for MZ-1.

A workshop was held May 25, 2005 to update the Special Referee on IMP progress. Subsequent to the workshop, the Special Referee issued a report to the Court requesting that Watermaster produce a MZ-1 Summary Report that describes the IMP results and conclusions to date, and provides MZ-1 producers with “guidance criteria” in an effort to minimize the potential for future subsidence and fissuring until the completion of the long-term plan. The summary report was delivered to the Special Referee in October 2005.

Included in the October 2005 MZ-1 Summary Report were a set of guidance criteria to minimize subsidence and fissuring. These guidance criteria were discussed with the MZ-1 Technical Committee in their meeting of January 15, 2006; and in conjunction with modeling exercises over the next 6 months, will be revised by the committee. In June 2006, after the MZ-1 meetings and the modeling exercises, Watermaster will release an expanded second draft of the guidance criteria, which will be defined as the official long-term plan for MZ-1.

Well Construction, Abandonment, and Destruction Monitoring

BACK-GROUND

Watermaster staff monitors the condition of wells on a regular basis. Wells that may be improperly abandoned/destroyed are reported to Riverside and San Bernardino Counties as they are discovered.

Watermaster staff inspected 150 suspect wells during a 2002-03 field inspection and determined that 113 of these wells were properly abandoned and 37 wells will require some modification to meet the standard for a properly abandoned well. A well repair/abandonment

program was prepared and approved by Watermaster. Watermaster continues to develop a wellhead protection program and makes recommendations on closure of abandoned wells. Ongoing land development will require continued well abandonment activity by Watermaster.

PROGRAM ELEMENT 2 – DEVELOP AND IMPLEMENT COMPREHENSIVE RECHARGE PROGRAM

A centerpiece of the OBMP is enhancement of the Basin recharge capacity, so that high quality storm water and available recycled water can be retained in the Basin.

Recharge Facilities Improvement Project (Seven Bid Packages)

BACK-GROUND

Construction work on all 7 Bid Packages which constituted the Chino Basin Facilities Improvement Project (CBFIP) was completed by December 31, 2005. Work on this program was funded by a $19M Grant from SWRCB, using Proposition 13 Funds, and matching funds of $19M provided jointly by IEUA and CBWM. A final report on the CBFIP construction activities is being prepared by IEUA, and will be attached to the Quarterly Status Letter of April 2006.

T

THIS PERIOD

Emphasis this quarter shifted to repairing damages to the basins which resulted from the heavy storms of FY 2004-05, using a FEMA Grant of $1.2M. By the end of the quarter, renovation work on all the basins had been completed, and the basins were ready to receive both storm and supplemental water to the extent envisioned by the CBFIP.

During this quarter, IEUA/CBWM prioritized spending on four projects that supplement completed work on the CBFIP. The projects will be funded through a $5.3M grant from DWR, with matching funds from IEUA and CBWM. The four projects to be completed under this grant over the next two years are:

Phase 2A: Monitoring Wells, Lysimeters, and Recycled Water Connections

Phase 2B: SCADA System Expansion

Phase 2C: MWD Turnout to 8th St Basin

Phase 2D: MWD Turnout to Victoria Basin, Berm Heightening and Hardening

Phases 2A and 2B will be completed on a design-build basis, whereas Phases 2C and 2D will follow the traditional consultant design – contractor build procedure.

Groundwater Recharge Coordinating Committee (GRCC)

The GRCC meets biweekly to focus on facility operations and maintenance, redesign of facility shortcomings, and planning new facilities. The final Recharge Facilities Operation Procedures Manual was completed, and 12,000 AF of "New Yield" storm water were captured during the FY 2004-05 storm season. For the first 6 months of FY 2005-06, 3,000 AF of storm water, 16,000 of imported water, and 1,000 AF of recycled water were captured in the renovated basins. The quantities captured are in accordance with the annual Storm and Supplemental Water Recharge Master Plan.

During the first 6 months of FY 2005-06, recycled water was introduced into the reconditioned Banana, Hickory, Ely and Turner Basins. With the completion of the summer maintenance program, Chino Basin has the capacity to recharge over 5,000 AF/mo of supplemental (recycled and imported) water.

PROGRAM ELEMENT 3 – DEVELOP AND IMPLEMENT WATER SUPPLY PLAN FOR THE IMPAIRED AREAS OF THE BASIN; AND

PROGRAM ELEMENT 5 – DEVELOP AND IMPLEMENT REGIONAL SUPPLEMENTAL WATER PROGRAM

These program elements focus on the shift of production in the southern end of the Basin away from agricultural uses and toward urban uses. Without the OBMP, this land use conversion would result in a decrease in production in the southern end of the Basin, ultimately leading to rising water levels. If groundwater levels in the southern end of the Basin rise too high, then water may "spill" out of the Basin into the Santa Ana River. Such uncontrolled spillage caps the overall Safe Yield of the Basin. The Basin can be managed to avoid this possibility.

Directly tied to the threat of rising water levels in the southern area is the diminished desire of appropriators to pump water because of impaired water quality. The ability to balance the loss of agricultural production with increased appropriative production is inhibited because of these water quality concerns. Greater appropriative production in this area therefore requires water treatment, an issue addressed through the construction of desalter facilities.

The Chino I/II Desalters

BACK-GROUND

The Chino I Desalter was originally constructed by SAWPA to provide 8.1 million gallons per day (MGD) of product water using reverse osmosis treatment. The project also included extraction wells, raw water pipeline, and product water pipelines and pump stations.

Chino I Expansion/Chino II Desalter. This expansion includes the construction of an additional 4.9 MGD of parallel treatment capacity (nitrate removal via ion exchange) at Chino I and 10 MGD of similar ion exchange at the Chino II Desalter. Construction contracts were signed and construction is underway with completion scheduled for February 2006. Watermaster staff reviewed the proposed well construction for the new wells for Desalter II and determined that the location and construction were consistent with the OBMP Implementation Plan

THIS PERIOD

Chino I Desalter Other Improvements. Facilities under construction include three new extraction wells (construction completed), a raw water pipeline (construction completed), a Chino Hills pump station and product water pipeline (construction 98% completed), an Archibald Av. product water pipeline and pump station (construction 75% completed) and ion exchange treatment facilities (construction completed) .

THIS PERIOD

Chino II Desalter Other Improvements. Facilities under construction include eight new extraction wells (construction completed), three raw water pipeline packages (construction completed), two product water pipelines (one completed , one 75% completed), and site improvements (construction completed)

All the projects underway to expand the Chino I/II Desalters should be completed by February 2006. Application has been made for Prop. 50 funds ($1,600,000) to add 8 MGD of ion exchange capacity to the Chino ll Desalter.

PROGRAM ELEMENT 4 – DEVELOP AND IMPLEMENT COMPREHENSIVE GROUNDWATER MANAGEMENT PLAN FOR MANAGEMENT ZONE 1

Program Element 4 details the steps undertaken by Watermaster to reduce or abate subsidence and fissuring in Management Zone 1.

THIS PERIOD

The MZ1 Technical Committee. During this quarter, Watermaster consultants completed the MZ-1 Summary Report which was provided to technical committee members for their review. The next meeting of the technical committee is scheduled for January 12, 2006.

Voluntary Forbearance. The City of Chino and the City of Chino Hills submitted certifications documenting their respective voluntary participation in forbearance of groundwater production. Through the end of November 2005, the City of Chino submitted documentation of pumping reductions of 520 acre-feet toward its forbearance goal of 1,500 acre-feet for 2005/2006. The City of Chino Hills submitted documentation of forbearance of 750 acre-feet through December 2005.

Agency	Forbearance through December 2005	Forbearance Goal 2004/2005
City Of Chino	520 acre-feet	1,500 acre-feet
City Of Chino Hills	750 acre-feet	1,500 acre-feet

Pending Legal Actions Regarding Subsidence. In its October 17, 2002 Order, the Court ordered Watermaster to keep the Court apprised of any legal actions that could question the Court's jurisdiction over subsidence. Watermaster is not aware at this time of any such actions. The hearing regarding the City of Chino's Paragraph 15 Motion concerning subsidence was continued by the court until September, 2005.

PROGRAM ELEMENT 6 – DEVELOP AND IMPLEMENT COOPERATIVE PROGRAMS WITH THE REGIONAL WATER QUALITY CONTROL BOARD, SANTA ANA REGION (REGIONAL BOARD) AND OTHER AGENCIES TO IMPROVE BASIN MANAGEMENT; AND

PROGRAM ELEMENT 7 –
DEVELOP AND IMPLEMENT SALT MANAGEMENT PROGRAM

The "water quality committee" as envisioned in the OBMP Implementation Plan has been formally constituted. Since the development of the OBMP, Watermaster has worked closely with the Regional Water Quality Control Board, the Department of Toxic Substances Control, and others to define water quality challenges and to refine the water quality management criteria in the Chino Basin. Watermaster continues to review water quality conditions in the Basin and to consider future water quality management activities beyond the Chino Basin desalting program.

BACK-GROUND

Water Quality Management. In response to the results of RWQCB and Watermaster's groundwater quality monitoring programs (Program Element 1) Watermaster has refined its water quality monitoring to focus on the following key areas:

- Watermaster is identifying and characterizing water quality anomalies, such as the VOC anomalies south of the Ontario International (OIA) and the Chino Airports. Status Reports on each of the anomalies were developed by Watermaster and were presented to the Water Quality Committee for their review.
- Watermaster staff receives and reviews all reports that are produced by dischargers that are conducting investigations under orders by the RWQCB and the Department of Toxic Substances Control (DTSC).
- Watermaster staff assisted the RWQCB with research, monitoring, and the crafting of investigative, and cleanup and abatement orders for potential dischargers involved with the OIA.
- Watermaster staff continues to participate in the process of developing TMDLs for Reach 3 of the Santa Ana River and other water bodies in the lower Chino Basin. No progress has been made during the last quarter because of the State budget crisis and staffing issues at the RWQCB.

Water Quality Committee

BACK-GROUND

Watermaster staff and consultants continue to update our understanding of the contaminants of concern in the various plumes, and the extent of their migration and remediation. In addition, Wildermuth Environmental continued their analysis of the environmental records search performed by EDR. This consisted of a query of state and federal databases of known users and dischargers of potentially hazardous chemicals. Watermaster is analyzing the relationship of potential sources of perchlorate with down gradient impacted production wells.

THIS PERIOD

With respect to the VOC plume at OIA, Wildermuth Environmental completed their data gathering effort at the RWQCB and prepared five draft Letters of Notification/Cleanup and Abatement Orders for review by the RWQCB prior to their mailing to identified potential responsible parties (PRPs). On August 30, 2005, the initial meeting with the PRPs was held in RWQCB's headquarters to present our understanding of the extent of the TCE plume originating from the prior discharges at OIA. In addition, a first cut estimate was presented as to the capital and O&M costs associated with the remediation of the plume. All the PRPs were present at this briefing, and agreed to review the data presented. A second meeting was held with the PRPs on December 5, 2005, at which time Watermaster indicated that consolidation of the TCE plume

remediation with expansion of the Chino Desalters offered the possibility of a mutually beneficial solution. The PRPs indicated that they had selected a consultant to review the available data on the TCE contamination, and Watermaster agreed to secure release of these data from the primarily private producers located south of the OIA. The data should be available for release by late January 2006.

THIS PERIOD

At the Chino Airport VOC plume, Watermaster obtained permission from private well owners to release VOC water quality data to the RWQCB. Tetra Tech, a consulting engineering firm performing quarterly groundwater monitoring of the VOC plume immediately southwest of the airport property, in turn obtained these data from the RWQCB to assist in their efforts to model plume movement. Tetra Tech is under contract to the County of San Bernardino, Department of Architecture and Engineering, the owner and operator of Chino Airport, and is attempting to determine the sources of the VOC plume. This quarter Tetra Tech reported on the quarterly monitoring of the 9 monitoring wells now installed to track plume origination and movement. The plume appears to originate in the northwest quadrant of the airport, where paint stripping and engine renovation activities were known to have occurred in the past. In addition to the groundwater monitoring, Tetra Tech has performed soil gas surveys in an effort to help locate the origin of the TCE plume. In the first quarter 2006, Watermaster will work with the RWQCB and San Bernardino County to determine if enough information is now available to proceed with outlining appropriate remedial actions for the plume, which now impacts Desalter I production wells.

BACK-GROUND

With respect to perchlorate in MZ-3, a number of wells in the Fontana area of Chino Basin have been impacted and shut down because of relatively low levels of perchlorate (but above the State Action Level of 6 µg/l). Some parties in the Chino Basin believe that significant perchlorate sources near the Mid-Valley Landfill (Goodrich, Aerojet, Quickset, Emhart Industries, Denova Environmental, Pyro Spectacular, Rialto Ammunition Storage Point, et al.) in the Rialto-Colton basin may also be sources of perchlorate in Chino Basin. The proposed transport pathway is leakage across the Rialto-Colton Fault. Members of the WQC proposed that Watermaster perform a hydrogeologic investigation of that area to better understand cross basin transport. The investigation may be prohibitively expensive, given the complexity of the fault system and aquifer heterogeneity.

In a related study, the RWQCB has done an extensive historical perchlorate usage literature review and has produced a sizable volume of circumstantial evidence that large quantities of Chilean fertilizer may have been used for citrus in the Fontana area.

THIS PERIOC

At the Water Quality Committee Meeting on August 22, 2005, two major items were discussed: First, the initial sampling of wells in MZ-3 was completed (including the renovated wells MP2 and KOFS), and based on the analytical results, tentative locations were identified for two new monitoring wells. A second round of sampling of these wells was conducted on September 26-27, 2005; and negotiations were initiated with the City of Ontario to locate two new monitoring wells in their street right-of-way. The purpose of this investigation is to identify the current location of the Kaiser Plume, and its direction of movement. The concern is that the plume, last monitored in 1993, could be approaching either Ontario or Jurupa wells. Second, the draft Cleanup and Abatement Orders (CAOs) for the Ontario Airport VOC plume were completed, and provided to the RWQCB for their final review and mailing. Wildermuth Environmental prepared several scenarios for remediation of this plume, and developed approximate costs for implementing the remediation.

TO COME

Neil Sturchio, Professor and Head of the Earth and Environmental Sciences at the University of Illinois at Chicago, has developed a technique for using stable isotope ratios of oxygen and chloride to distinguish the origin of perchlorate (man-made or Chilean fertilizer). Natural perchlorate carries a unique ^{18}O and ^{37}Cl signature – very robust parameters that can be used to distinguish between man-made and natural sources of perchlorate. Professor Sturchio has tested several samples of leachate from fertilizer nitrogen (from the Atacama Desert in Chile) and rocket fuel sources. One of the innovations that Professor Sturchio has developed is the use of a flow-through column with a bi-functional anion-exchange resin. This is required to concentrate the typically low levels of perchlorate in groundwater so that the perchlorate can be analyzed isotopically.

Watermaster intends to utilize this isotopic perchlorate analysis to determine if source of the perchlorate in groundwater MZ-3 is anthropogenic or from Chilean fertilizer.

Watermaster and Regional Board Propose TDS and Nitrogen Objectives to Promote Maximum Benefit of Waters Available to the Chino Basin

BACK-GROUND

Watermaster staff worked with the Total Dissolved Solids (TDS)/ Nitrogen (N) Task Force to revise the sub-basin boundaries, and the TDS and N objectives for the Chino Basin to promote maximum beneficial use of waters in the Basin (as opposed to the Regional Board's current, more rigid anti-degradation based objectives). The maximum beneficial use approach will increase water supplies and lower costs over time while meeting water quality requirements. In December 2002, Watermaster proposed specific water-quality management zone boundaries, and N and TDS objectives for the Chino Basin to the RWQCB. The TDS/N Task Force and the RWQCB incorporated Watermaster recommendations in the TDS/N Basin Plan Amendment dated November 21, 2003.

The Basin Plan Amendment incorporating the sub-basin boundaries and maximum beneficial use concept was adopted by the RWQCB on January 24, 2004 (RWQCB Basin Plan Amendment, and Attachment to Resolution No. R8-2004-001). Watermaster staff immediately developed and submitted surface water and groundwater monitoring programs to the RWQCB on February 21, 2004. These monitoring programs measure the progress of CBWM and IEUA in achieving the "maximum benefit" goal for TDS/N in the Chino and Cucamonga Basins. The Basin Plan amendment was reviewed and approved by the State Water Resources Control Board (SWRCB) on September 8, 2004, and by the Office of Administrative Law (OAL) and U.S. Environmental Protection Agency (USEPA).

BACK-GROUND

Cooperative Effort to Determine State of Hydraulic Control. One remaining issue regarding the Basin Plan changes was to develop a monitoring plan to evaluate the state of hydraulic control in the southern end of the Basin. Hydraulic control is one tool that can be used to maximize the safe yield of the Basin. Watermaster staff developed a monitoring program for OBMP purposes and described this effort in the Initial State of the Basin Report (October 2002). The execution of this monitoring program is included in Program Element 1. Watermaster and IEUA have collaborated with OCWD and the RWQCB to select existing wells and to site nine

new multi-piezometer wells that will be used to monitor and assess the state of hydraulic control.

In addition to being a core element of the OBMP, hydraulic control is a requirement of the Basin Plan Amendment. Watermaster, OCWD, and RWQCB staffs developed a conceptual monitoring program in June 2003 to assess the state of hydraulic control and to provide information to Watermaster to manage future production and recharge. The final work plan for the Hydraulic Control Monitoring Program was completed in May 2004, and implementation is now occurring. This program will change over time as new information is developed and will last for several years. The coordination and review of the hydraulic control monitoring data and the development of management programs to maintain hydraulic control have been added to Program Elements 6 and 7.

THIS PERIOD

Watermaster, IEUA, OCWD, and the Regional Board agreed to construct nine new monitoring wells as part of the piezometric monitoring element of the HCMP. These monitoring wells are necessary because existing well locations and well construction are not sufficient to measure the extent of hydraulic control in the vicinity of the Desalter well fields and because of the loss of monitoring use of agricultural wells as these wells are destroyed in land conversion from agricultural to urban uses. These new wells will document the creation of a regional depression in the piezometric surface, for both the shallow and deep aquifer systems, as a result of Desalter pumping. These 9 new wells were installed and instrumented by the end of this quarter. Hereafter, sampling will be on a quarterly basis.

Formatted: All caps

Salt Budget Tool To Establish TDS Objectives

BACK-GROUND

Watermaster has developed a salt budget tool to estimate the current and future salt loads to the Basin and the salt benefits of the OBMP. This tool was used to establish TDS objectives for the northern part of the Basin based on maximum beneficial use of water available to the region. These projections were based on the water supply plan in the Implementation Plan and include alternative recycled water and State Project water recharge scenarios. Watermaster consultants prepared a letter report (February 20, 2004) describing the salt budget and the Chino Basin Maximum Benefit Commitment. The commitments require Watermaster and IEUA to take specific actions triggered by ambient water quality and other time-certain conditions. An implementation schedule is specified, with the RWQCB responsible for overseeing compliance.

PROGRAM ELEMENT 8 – DEVELOP AND IMPLEMENT GROUNDWATER STORAGE MANAGEMENT PROGRAM; AND

PROGRAM ELEMENT 9 – DEVELOP AND IMPLEMENT STORAGE AND RECOVERY PROGRAM

This section summarizes the work accomplished to date and the work planned over the next few months for the Chino Basin Dry Year Yield (DYY) and Storage and Recovery Programs. The DYY Program is a conjunctive use program between the Metropolitan

Water District of Southern California (MWDSC) and several Basin appropriators, which would develop a maximum of 100,000 acre-feet of storage. These Programs also explore the potential for using up to 500,000 acre-feet of storage capacity.

BACK-GROUND

Completed Preliminary Design Report. The first draft of the DYY Preliminary Design Report was completed in July 2003 and submitted to Watermaster. The DYY Program documentation is organized into four volumes: Volumes I and II, prepared by Black & Veatch, comprise the Preliminary Design Report (PDR). Volume I describes the background information and design objectives of the Program, while Volume II describes the facilities to be designed to help the agencies meet their shift obligation. Volume III presents the groundwater modeling report developed by Wildermuth Environmental, Inc., and Volume IV contains the CEQA Findings of Consistency environmental documentation prepared by Tom Dodson and Associates.

DYY Shift Obligation. Participants in the DYY Program will be required to reduce (shift) their imported water usage by a predetermined amount during a dry year. Each participating agency will have a specific shift obligation that, when added together, will provide MWDSC with 33,000 acre-feet of dry year yield. The shift obligations were determined through meetings and correspondence among IEUA, Watermaster, Black & Veatch, and representatives from each participating agency.

The eight participating agencies are as follows:

• City of Chino	• Monte Vista Water District (MVWD)
• City of Chino Hills	• City of Ontario
• Cucamonga Valley Water District (CVWD)	• City of Pomona
• Jurupa Community Services District (JCSD)	• City of Upland

Facility Requirements and Site Selection. A preliminary screening of potential sites identified the most feasible locations for the DYY Program facilities. The information was presented to the agencies and a final selection was made. The Program facilities consist of five new ion exchange (IX) facilities, expansion of two existing IX facilities, construction of seven new non-water quality impaired wells, and two new perchlorate wellhead treatment facilities. The new wellhead IX facilities will contribute approximately 18,000 acre-feet of dry year yield, while the new well facilities will contribute approximately 15,000 acre-feet of additional yield. The total capital cost for the facilities is estimated to be $38 million. MWDSC will contribute approximately $27.5 million. The Groundwater Storage Program Funding Agreement between MWDSC, IEUA, Three Valleys Municipal Water District (TVMWD), and Watermaster was signed in July 2003.

ON GOING

Design of PDR Facilities. While some of the designs for the facilities outlined in the PDR are completed (Upland IX design, MVWD ASR well design , Pomona - JCSD Teagarden IX expansion design, CVWD North Central IX, and Pomona West IX), others such as the well designs for MVWD and Ontario are still underway. These later designs should be completed in 2006.

BACK-GROUND

Final Approval of DYY Storage Account. Pursuant to Article X of Watermaster's Rules and Regulations, IEUA submitted an Application to enter into a Storage and Recovery Agreement. This Application was approved unanimously by all Pools and received unanimous approval from the Advisory Committee and Board on October 23, 2003. Watermaster and IEUA developed a storage agreement pursuant to the Application and processed that agreement through the Watermaster approval process in March 2004. The agreement was submitted to the Court for approval. Prior to Court approval, MWDSC is utilizing its existing Trust Storage Account with the intention of transferring its water from the Trust Account into the DYY account upon approval of the Storage Agreement.

BACK-GROUND

Groundwater Modeling. The Chino Basin groundwater model was completed and the draft modeling report was submitted to Watermaster in July 2003. In addition to evaluating the effects of the DYY program on the Basin, the model was used to:

- Develop draft future replenishment and wet water recharge criteria based on requirements described in the Section 7.1b of the Watermaster Rules and Regulations regarding the balance of recharge and discharge. (See Wildermuth, Analysis of Supplemental Water Recharge Pursuant to the Peace Agreement. To be filed with the Court.)
- Evaluate the cumulative effects of transfers among the Parties as described in Section 9.3 of the Watermaster Rules and Regulations. (See Wildermuth, Evaluation of the Cumulative Effects of Transfers Pursuant to the Peace Agreement. To be filed with the Court.)
- Describe pumping patterns in Management Zone 1 that will not reduce piezometric levels below current conditions.

These management criteria were incorporated into the DYY program. The results of this work were presented to the Pool Committees, Advisory Committee, and the Watermaster Board in June and August 2003, and the final report was submitted in September 2003.

BACK-GROUND

Engineering Review and Determination of the Operational Storage Requirement and Safe Storage. The Operational Storage Requirement was defined in the Peace Agreement as part of the storage in the Chino Basin "necessary to maintain the safe yield" of the Basin (Peace Agreement, Exhibit B – Implementation Plan, page 37). Safe storage is the maximum storage in the Basin that can occur without significant water quality and high groundwater related problems. The draft results of this work were presented to the Pool Committees, Advisory Committee, and the Watermaster Board in August 2003.

ON-GOING

Other Uses of the Groundwater Model in the OBMP Implementation. The groundwater model is currently being used to investigate alternative management strategies including reduced storage in the eastern part of the basin, expanded storage and recovery programs, and assessing hydraulic control with various appropriator proposed pumping alternatives in the southern Chino Basin. A draft report documenting the modeling effort and related investigations will be submitted to Watermaster during the next reporting period.

CONCLUSION

THIS PERIOD

This has been an active reporting period for Watermaster, with major activities on a number of issues:

- Construction on all 7 Bid Packages of the CBFIP is complete, and planning is now underway on a series of basin enhancement projects with an estimated capital cost of $10.6M to be expended in FY 2006-07.
- The groundwater level and quality monitoring programs have been reorganized to better support new initiatives, such as MZ1, HCMP, Nitrogen Loss, and Desalter Expansion. Selected wells were equipped with automatic measuring and recording devices to continually collect water level data at wells at frequent intervals. Field sampling and laboratory analyses used in FY 2003-04 have transitioned to the new monitoring program for FY 2005-06.
- Construction of nine new HCMP monitoring wells was completed, with the first sampling done in July 2005.
- Data from the Ayala Park Extensometer indicated that deformation within the aquifer system sediments has been primarily elastic compression and expansion during the 2004 pumping season. These data were supplemented by ground surveys and InSAR observations, which together have provided a comprehensive picture of the effects of pumping the deep aquifer (>300') on ground subsidence and fissuring.
- Draft Cleanup and Abatement Orders (CAOs) were prepared for five industrial firms which discharged volatile organic compounds from their activities at Ontario Airport. These orders were discussed with the PRPs, and now groundwater data from the area south of OIA are being released to the consultant selected by the PRPs.
- The TCE detected in the Desalter wells south of the Chino Airport has now been linked to the TCE plume found to originate from the northwest quadrant of the airport. Possible remedial actions will be discussed with the RWQCB and San Bernardino County, the owner of Chino Airport.