CHAPTER 7
ALTERNATIVE WATER SUPPLIES

7.1 OVERVIEW

Evaluating available alternative water supplies is part of a comprehensive water resources strategy that allows for long-term development and uses in the Chino Basin. The goal for alternative water supplies is to meet the region's water quality goals and provide IEUA's local retail agencies with a reliable and affordable water supply over the next twenty years. As discussed previously, a large program costing several hundred million dollars is currently being implemented to increase local groundwater storage, increase recycled water use and recover groundwater through advanced treatment (i.e. Chino Basin Desalters 1 and 2 and well head treatment). This chapter discusses possible new water supplies that may be implemented which would enhance local supply reliability and enhance water quality management of the Chino Basin.

Present Water Management Strategies

IEUA's water management goals are as follows:

- Implement an effective-innovative water conservation program that will maximize efficient water use and reuse in the service area by:
    - Water conservation with conversion to low-water-use dishwaters, toilets, shower heads and use of swimming pool covers, etc. Evaluate programs such as turf removal. These conservation efforts to achieve water savings of 28,500 AFY by 2010.

- Continue development of a groundwater recovery program by:
    - Pumping and treating plumes of contaminated water to a potable water quality and distribute the water for beneficial purposes
    - Continuing to implement brackish groundwater recovery of 24,000 AFY by 2010 by Desalters 1 and 2.

- Achieve maximum reuse of all available recycled water (104,000 AFY by 2025).

- Increase the safe storage capacity of the Chino Groundwater Basin by 100,000 acre-feet and implement a cooperative conjunctive use groundwater management program that provides dry year water supplies for the Chino Basin and parts of the Santa Ana River Watershed: (complete by 2008).
    - Expand and improve groundwater storage capabilities.
        - Develop new groundwater recharge basins
        - Injection & retrieval wells with wellhead treatment

- Achieve maximum capture, recharge, and use of all available stormwater;
    - Establish programs for total containment of on-site stormwater with pretreatment facilities at multiple sites, i.e., schools, parks, golf courses; parking lots, plus receive storm water from upgradient sites.
    - Research all available sites for new surface recharge basins.

All of the above concepts have been discussed in previous chapters and all help to minimize dependence upon imported water supplies. By emphasizing local water supply development within the service area, it is estimated that over 80,000 AFY of additional imported water can be saved through current programs by 2025.

Other programs under consideration, but not under development at this time include:

- Additional groundwater recovery projects, Desalter 2 expansion (10,000 AFY), and Desalter 3 (16,000 AFY)

- Expand water recycling beyond 104,000 AFY; (46,000 AFY).

- Additional groundwater replenishment through more efficient stormwater management (20,000 AFY); and

- Development of new water supplies such as gray water recovery, (10,000 AFY).

Through these additional programs, it is expected that local supplies can be expanded by an additional 1000,000 AFY.

7.2 GROUNDWATER RECOVERY

The projected ultimate development of the Chino Basin Desalter Program will produce 51,800 AFY of potable water; and extract an estimate 54,000 tons of salt from the Chino Basin annually. As a result, the program will clean up the area's groundwater while helping to meet the increased potable water demands in the lower Chino Basin.

Desalter No. 2 is presently under construction and is due to come on line in January 2006. The eight wells for Desalter No. 2 will pump 12 MGD of brackish groundwater and Desalter No. 2 will produce 10 MGD of potable product water for distribution but is expandable to 20 MGD. Table 7-1 lists the respective phases of the Chino Basin Desalter Program showing the ultimate development of the program. Eventually, the expanded program will recover 51,800 AFY of groundwater for potable use from the Chino Basin.[1]

[1] Chino Basin Optimum Basin Management Program, State of the Basin Report 2004 (July 2005)

Table 7-1
Chino Basin Desalter Projected Expansion to Ultimate Production
AFY of Product Water

Desalter No.	Year Constructed	2005	2006*	2010	2015	2020	2025
Desalter* No. 1 & Expansion	2000	8,960	15,900	15,900	15,900	15,900	15,900
Desalter No. 2	2006		11,200	20000	20000	20,000	20000
Dealter No. 3	2010 – 2015			0	10,000	12,900	15,900
Total		**8,960**	**27,100**	**35900**	**45900**	**48,800**	**51,800**

*Denotes date of Desalter No. 1 expansion with the addition of ion exchange unit

Chino Desalter No. 3

As shown in Table 7-1, Chino Basin Desalter No. 3 (Desalter No. 3) is planned for future construction possibility in the years 2010 to 2015; initial capacity of this facility is 10,000 AFY with future expansion to 15,900 AFY. Desalter No. 3 might be an expansion of Desalter No. 2.

Wellhead Treatment of Impaired Groundwater

Some purveyor owned wells in the Chino Basin have been impacted by migration of contaminants to the level that the water from these wells can no longer be used for potable purposes. Under the MWD Dry Year Yield Conjunctive Use Program, impacted wells in the cities of Chino, Chino Hills, Ontario and Upland, plus, the special service districts of Cucamonga Valley Water District (CVWD), and Monte Vista Water District (MVWD) will have ion exchange wellhead treatment installed. These projects will improve yield and increase water quality in the groundwater basin especially during dry years. This program is in progress. Brine from the wellhead treatment processes will be transported ultimately to the Pacific Ocean via the NRW.

Pumping and Treatment of Plumes of Contaminated Water

In the Chino Basin, there are five identified plumes of contaminated groundwater from past industrial operations: the GE Flatiron Facility Plume, and GE Test Cell Facility Plume, the Ontario Airport VOC Plume; the Kaiser Steel Corporation Plume; the Milliken Landfill Plume, and the Chino Airport Plume. Pumping and treatment and treating of contaminated water from two of these plumes is underway; namely the GE Flatiron Facility Plume; and GE Test Cell Facility Plume.

The GE Flatiron Facility Plume and GE Test Cell Facility Plume are being treated using reverse osmosis. The treated water is then discharged to a local storm drain which flows to the Ely Basins 1, 2, & 3, where this water is recharged to the

Chino Basin aquifer. This treated water is of very high quality. The CBWM, IEUA and GE are studying the possibility of pumping this water into the IEUA Regional Recycled Water Distribution system for use by industries for cooling towers, and other industrial process. Public entitles could profit by using this water for schools, parks, park strips, etc.

The other plumes are being studied by the responsible parties as to how best to treat the contaminated water and possible reuses of the reclaimed product.

7.3 TAKING RECYCLED WATER TO THE NEXT LEVEL

Recycled water is a natural resource that has been overlooked in the past century of development in the Chino Basin. As an alternate water supply, the recycled water produced by the IEUA Recycled Water Reclamation Facilities if equivalent to most water supplies used for potable sources. As is discussed in Chapter 5, the Agency's recycled water meets all requirements for Title 22; permitting this valuable resources to be used for row crops, irrigation of parks and water features where human contact is likely; full human contact is permitted; but the recycled water is not allowed for potable uses. Beyond the current recycled water described in Chapter 5, the following recycled water applications are being contemplated.

Dual Plumbing

For the purpose of this subsection of this report, the referenced sections of the State CCR, Title 22 Requirements for Dual Plumbed Systems are defined in Sections: 60301.250. Dual plumbed systems, 60313; General requirements and operational requirements, 60316.

Section: 60301.250, provides the definition of "dual plumbed system" or "dual plumbed: as meeting a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:

1. To serve plumbing outlets (i.e., in restrooms or water features) (excluding fire suppression systems) within a building, or
2. Outdoor landscape irrigation at individual residences.

Both applications are viable future uses of recycled water within IEUA.

Increased Use of Recycled Water for Groundwater Replenishment

Current planning for recycled water use in Chapter 5 calls for 35,000 AFY of recycled water replenishment. The 35,000 AFY value represents a maximum 20 percent blend of recycled water with stormwater and imported water. In the future, it is expected that future replenishment permits will allow a higher percentage level either because of successful operating experience at 20 percent level or through the use of additional treatment.

By 2025, it is expected that overall recycled water use will increase by 50,000 AFY.

7.4 EXPANDED GROUNDWATER STORAGE

The Chino Basin Watermaster was formed under the 1978 Judgment of the Superior Court of the State of California for the County of San Bernardino. Under the Judgment, the CBWM was charged to develop an Optimum Basin Management Plan (OBMP) that in future years would govern the operations of the groundwater basin.

Program Element No. 8 and 9 of the OBMP were to develop and implement a groundwater storage and conjunction use program. They have taken the form of the Dry Year Yield Program described earlier.

The CBWM, TVMWD and IEUA entered into an agreement with MWD for a "2003 Dry Year Conjunctive Use program" wherein MWD would store up to 100,000 acre-feet of imported water and be able to "call" for a 33,000 AFY reduction in imported water deliveries during a 12 month period. Recharge of the imported water will enhance the overall quality of groundwater stored in the Chino Basin aquifer. The Dry Year Yield (DYY) Program is scheduled to be operational in 2008.

The initial MWD program is expected to be the initial phase of a conjunctive use program that will increase to 500,000 AF of storage (reference CBWM Peace Agreement and IEUA PEIR, July 2000).

Expand and Improve Groundwater Recharge Facilities
The groundwater recharge program is always being enhanced and ever-expanding to meet the needs of the population of the Chino Basin. Several groundwater recharge basins in the Chino Basin complex will be expanded and improved beyond that of the Chino Basin Facilities Improvement Project (CBFIP). In the immediate future, improvements will be made to the present design, by adding hardened spillways to the internal berms; adding ridges and furrows to the flow-through basins to enhance the percolation rate; adding silt setting / debris catchments basins; and SCADA systems. Also, several new groundwater recharge basin sites are presently being evaluated and will have geophysical studies performed to determine their feasibility for future development.

Integration of San Antonio Dam in the Groundwater Management Project
Present practices by the U. S. Army Corps of Engineers (Corps) (who owns and operates the San Antonio Dam in conjunction with three water purveyors; Cucamonga Valley Water District, the San Antonio Water Company, and the City of Upland), is to capture and recharge water behind the San Antonio Dam into the Claremont Heights Groundwater Basin aquifer. During the exceptional rainy season of 2004-2005, water that could not be recharged to the Claremont Heights Basin was released from the dam into the San Antonio Channel, thereby

allowing it to flow to the Santa Ana River and downstream to Orange County. Due to the exceptional water year, a significant portion of this water flowed to the Pacific Ocean.

The CBFIP improved three sets of basins along the San Antonio Channel, namely the College Height Basins, the Upland Basin, the Montclair Basins 1, 2, 3, & 4, and the Brooks Basin. With better coordination in the future between the GRCC and the Corps, much of the water released from the San Antonio Dam can be captured and recharged in these newly improved basins. With the new SCADA system, continual monitoring of the channel flows and the water within the recharge basins, will allow for capture of excess flows in the channel thereby maximizing the recharge efforts in accord to with the OBMP.

Groundwater Extraction Enhancement with Monte Vista Water District
As is mentioned above in the Dry Year Yield Conjunctive Use Program, one of the limiting issues facing the Chino Basin Water Master and its entities is the region's ability to meet its drought proofing / groundwater recharge capacity goals within the Chino Groundwater Basin. The MVWD has implemented the Aquifer Storage and Recovery Program (ASR) using existing wells whose water quality has been impacted by high nitrates. MVWD has constructed two new ASR wells and modified several existing facilities, thereby enabling the MVWD to cost-effectively combine these groundwater management practices into a single coordinated operation. The injection & retrieval wells with wellhead treatment have the ability to provide up to 4,500 AFY of additional recharge capacity with MZ-1 (Management Zone 1) of the Chino Basin.

The project specifically targets nitrate contaminated groundwater for injection with high quality SWP supplies. The injection process provides for basin blending during low demand periods and for subsequent production during high demand periods without the need of treatment. By way of comparison, project-related groundwater modeling results indicate that this portion of the basin would not see water quality improvements through traditional surface recharge at existing and planned recharge basins located within MZ-1 of the Chino Basin until after 2020.

7.5 ENHANCED STORM WATER MANAGEMENT

As described in Chapter 6 previously, Program Element No. 2 of the OBMP was set forth to development and implement a comprehensive recharge program. A key part thereof is the establishment of a well coordinated storm water management program to capture the maximum amount of storm water. More efficient stormwater capture can be accomplished with the Chino Basin Facilities Improvement Project (described in Chapter 6) and enhancements to that project. In addition, there are a number of non-traditional stormwater management techniques that, if implemented, could significantly improve water management in the Chino Basin.

Principles for Stormwater Management

Stormwater runoff can be beneficially used to recharge groundwater systems and relieve pressure on stormwater infrastructure. Often perceived as a problem in the past due to the costs of controlling storm flows and pollutants; stormwater present an opportunity for groundwater recharge and other beneficial uses. The guiding principle of this approach is to initiate the containment and use of this valuable resource with management of each drop of precipitation as close to where it falls as is technically possible and economically feasible. This means examining the options available at the regional and local levels, i.e., parks; public and private golf courses; public and private schools; city and county streets and park strips; plus, public and privately owned buildings and their parking facilities; new subdivision developments and older neighborhood yards. Some of these measures include:

- Tree plantings. Studies have shown that tree foliage can hold and absorb up to 35% of the rain falling annually on the diameter of the tree canopy[3].

- Turf management. Aeration and other techniques can increase the infiltration rate of lawns. When mowing lawns, leave higher turf as this helps to hold water on-site longer, allowing for more percolation and reduce evaporation during hot months. Certain grass species (by virtue of denser, deeper roots) can further improve infiltration.

- Roof Leader disconnects. Appropriate redirection of the leaders, re-grading of the landscape around a building, use of dry wells with perforated lateral piping (constructed infiltration chambers), and other techniques can infiltrate roof runoff and enhance subsurface irrigation of trees and shrubs, plus perennials .

- Cisterns. Some roof runoff can be captured in rain barrels or other cisterns. Stormwater captured in such a manner, can either be used for yard and garden watering, or released to dry wells or other infiltration systems once the storm passes.

- Surface infiltration basins. In some yards and many commercial landscapes, ponds, temporal “water gardens,” and other basins can be designed to gather site runoff and hold/infiltrate it over varying periods of time.

- Driveway and parking lot “cuts.” Modifying driveways to increase previous area can be done in many ways.

- Street narrowing. Common now in new developments, narrow streets calm traffic, increase green space, improve property values, and reduce imperious area. Some American communities are narrowing existing streets for the multiple benefits created. Portland, Oregon refers to their efforts as the “Skinny Streets” program.

- Parking lot redesign. Creative layout can incorporate “infiltration islands,” filter strips, and other storm water management features with no or little impact on the number of parking spaces.

- Porous pavements. The porous pavement techniques are well-developed and the performance well-tested. As streets and parking areas are re-paved in coming decades, porous paving options should be given strong consideration.

- Major on-site storm water pretreatment & containment facilities. The major on-site storm water pretreatment and containment facilities could be sized to capture on-site flows and treat other runoff water from upgradient properties.

- Minor total containment with subsurface detention/infiltration chambers. Made of gravel or manufactured components, varying depths and capacities of chambers can be installed under lawns and parking lots to hold large volumes of site runoff during a storm and infiltrate that water to the subsoil in the following hours or days.

The IEUA Administration complex is an excellent example of on-site containment of stormwater. All stormwater falling onto the IEUA site is held on-site to enhance recharge to the aquifer. Schools, parks, and golf courses, plus numerous parking lots are excellent sites for better management of stormwater.

Chino Basin Green is a model home project that encourages environmental friendly design. It includes a example “design center” where home buyers can evaluate environmental friendly designs such as California friendly landscaping, drip irrigation, high efficiency heating, cooling and appliances, solar heating, and solar energy.

7.6 DUAL PLUMBING FOR GRAY WATER SYSETMS

An additional source of recycled water is the use of “gray water,” (household water from sinks, showers, bathtubs and clothes washing machines.

In addition to the standard sewer pipes that send wastewater (or black water) to the sewer collection and treatment system, a second set of plumbing pipes would direct cleaner water (gray water) from the washing machine, bathtub or shower onto the landscaping. Using the gray water would:

1. save water by reusing this water for irrigation;
2. conserve needed capacity in future Water Treatment Facilities;
3. conserve needed capacity in future Water Reclamation Facilities; and
4. cut back on water bills for outside irrigation.

Implementation of such a practice would need to be initiated in newly constructed homes and businesses. Estimated cost for dual plumbing in a new home would be from $1,500 to $2,000. Builders could offer the gray water system as an option.

The City of Phoenix Arizona is considering the gray water option. It is a matter of convincing the general public to use this source of recycled water. After considering the subject the City decided that gray water would cut down on the infrastructure needed for all water and wastewater systems.[2]

Estimated daily savings per household for gray water uses is presented in Table 7-2. Weekly savings would be 1,470 gallons, enough to irrigate shrubs and most present day lawns. Irrigation of vegetable and flower gardens are a real possibility after convincing the public to use this source of water.

Table 7-2
Gray Water Reuse for Landscape Irrigation (gallons per housing unit per day)
Without Conservation

Year	Showers	Bathtubs & Whirlpools	Bathroom Sinks	Kitchen Faucets	Clothes Washing Machines	Total Gray Water Available
2000	77.0	13.9	20.7	31.0	67.4	**210.0**
2005	76.2	13.7	20.5	30.7	67.7	**208.8**
2010	75.0	13.6	20.3	30.5	68.5	**207.9**
2015	75.7	13.6	20.3	30.4	69.8	**209.8**
2020	75.4	13.5	20.1	30.1	69.2	**208.3**

With Conservation

Year	Showers	Bathtubs & Whirlpools	Bathroom Sinks	Kitchen Faucets	Clothes Washing Machines	Total Gray Water Available
2000	70.0	13.9	20.1	30.1	67.3	**201.4**
2005	67.2	13.7	19.3	29.0	67.5	**196.7**
2010	65.4	13.6	18.8	28.1	68.4	**194.3**
2015	64.3	13.6	18.4	27.6	69.7	**193.6**
2020	63.1	13.5	18.0	27.0	69.1	**190.7**

Source MWD – Main Model, Section 5: End-Use Model Output – End Use Factors (2004)

[2] Arizona Republic Newspaper, May 30, 2005.