ORANGE COUNTY WATER DISTRICT

2001-2002 Engineer's Report

On Groundwater Conditions, Water Supply and Basin Utilization in the Orange County Water District

2001-2002

ENGINEER'S REPORT ON

GROUNDWATER CONDITIONS,

WATER SUPPLY AND BASIN UTILIZATION

IN THE

ORANGE COUNTY WATER DISTRICT

FEBRUARY 2003

ORANGE COUNTY WATER DISTRICT

Orange County's Groundwater Authority

February 12, 2003

Ms. Virginia Grebbien
General Manager
Orange County Water District
Post Office Box 8300
Fountain Valley, CA 92728-8300

Dear Ms. Grebbien:

In accordance with Section 26 of the District Act, the 2001-2002 Engineer's Report is hereby submitted.

Precipitation for the water year July 1, 2001 through June 30, 2002 was 31% of normal (total of 4.2 inches), which is the driest year in 41 years. Santa Ana River flow past Prado Dam was 18% below the 30-year average, totaling 173,730 acre-feet for the water year. Flow past the District's spreading grounds that was lost to the ocean totaled 930 acre-feet.

Total water demand within the District for the water year was 512,154 acre-feet, which is an increase of approximately 1.5% from the prior year. Imported water received in 2001-02 for groundwater replenishment totaled 48,154 acre-feet (excludes In-lieu water). Groundwater production within the basin totaled 371,585 acre-feet (includes In-lieu water) for the water year, which is a slight increase from the prior year.

Accumnlated basin overdraft increased from 328,000 acre-feet on June 30, 2001 to 406,000 acre-feet on June 30, 2002, an increase of 77,620 acre-feet. The current accumulated basin overdraft is approximately 58% of the maximum overdraft (i.e., estimated to have been approximately 700,000 acre-feet) experienced in the 1950s.

Given the conditions of the groundwater basin, the portion of the 2003-04 Replenishment Assessment allocated for District replenishment water purchases could equal the amount necessary to purchase up to 120,000 acre-feet.

Very truly yours,

Steven R. Conklin, P.E.
Director of Engineering

REGISTERED PROFESSIONAL ENGINEER
STEVEN R. CONKLIN
C 24633
Exp. 12-31-05
CIVIL
STATE OF CALIFORNIA

Charles Z. Steinbergs, P.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
Charles Z. Steinbergs
No. 32225
Exp. 12-31-04
CIVIL
STATE OF CALIFORNIA

P.O. Box 8300, Fountain Valley, CA 92728-8300 • 10500 Ellis Avenue, Fountain Valley, CA 92708
Telephone (714) 378-3200 Fax (714) 378-3373 Web Page www.ocwd.com

EXECUTIVE SUMMARY

Total water demand within Orange County Water District (OCWD) was 512,154 acre-feet for the 2001-02 water year (beginning July 1, 2001 and ending June 30, 2002), an approximate 1.5 percent increase from the previous year's total demand of 504,144 acre-feet. Groundwater production (including In-Lieu Program water, but excluding OCWD well production used for the Talbert Barrier) for the water year totaled 363,009 acre-feet, a slight increase over the previous year's total of 359,988 acre-feet. For the water year, a total of 48,154 acre-feet was purchased for groundwater replenishment.

For the water year, which ended June 30, 2002, it is estimated that the basin storage decreased by 77,620 acre-feet when compared to the same time one year earlier. On November 1, 2002, the basin storage had decreased by 44,413 acre-feet when compared to one year earlier. Precipitation within the basin was only 31 percent of normal during the water year, totaling 4.2 inches (the driest year in 41 years).

Based on the groundwater basin conditions for the water year ending June 30, 2002, OCWD may purchase up to 120,000 acre-feet for groundwater basin replenishment during the ensuing water year, beginning July 1, 2003, pursuant to the District Act.

ACKNOWLEDGMENTS

A number of public and private agencies contributed data used in this report, including:

City of Anaheim
City of Buena Park
East Orange County Water District
City of Fountain Valley
City of Fullerton
City of Garden Grove
City of Huntington Beach
The Irvine Company
Irvine Ranch Water District
City of La Palma
Mesa Consolidated Water District
Metropolitan Water District of Southern California
Municipal Water District of Orange County
City of Newport Beach
City of Orange
Orange County Public Facilities & Resources Department
Orange County Sanitation District
Orange Park Acres Mutual Water Company
San Bernardino Valley Municipal Water District
City of Santa Ana
Santa Ana Watershed Project Authority
City of Seal Beach
Serrano Water District
Southern California Water Company
City of Tustin
United States Geological Survey
Western Municipal Water District
City of Westminster
Yorba Linda Water District

The cooperation received from all agencies is gratefully acknowledged.

This report is based on the 2001-02 Basic Data Report, which is placed on file in the District office.

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GLOSSARY OF ACRONYMS

AF	acre-feet
BEA	Basin Equity Assessment
BPP	Basin Production Percentage
CBMWD	Central Basin Municipal Water District
CM	Connection Maintenance (MWD)
CR	Capacity Reservation (MWD)
GAP	Green Acres Project
IRWD	Irvine Ranch Water District
MCWD	Mesa Consolidated Water District
ILP	Irvine Lake Pipeline
mg/L	milligrams per liter
MWD	Metropolitan Water District of Southern California
MWD of OC	Municipal Water District of Orange County
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
RA	Replenishment Assessment
RTS	Readiness to Serve (MWD)
SAR	Santa Ana River
SARI	Santa Ana River Interceptor
SAWPA	Santa Ana Watershed Project Authority
SBVMWD	San Bernardino Valley Municipal Water District
SWP	State Water Project
TDS	total dissolved solids
WMWD	Western Municipal Water District
WF-21	Water Factory 21

PART I: GROUNDWATER CONDITIONS

Section 25 of the Orange County Water District (OCWD) Act requires that OCWD order an annual investigation to report on the groundwater conditions within the District's boundaries. A summary of the groundwater conditions for the July 1, 2001 to June 30, 2002 water year are as follows:

GROUNDWATER CONDITIONS
2001-02 SUMMARY OF FINDINGS

1. Groundwater production totaled 352,113 acre-feet for the 2001-02 water year.

2. Groundwater stored in OCWD's basin decreased by 77,620 acre-feet for the 2001-02 water year.

3. Accumulated overdraft on June 30th of the 2001-02 water year was 406,000 acre-feet.[1]

4. Annual overdraft for the 2001-02 water year was 149,000 acre-feet.

5. Average annual overdraft for the immediate past five water years (1997-98 to 2001-02) was 99,500 acre-feet.

6. Estimated annual overdraft for the current 2002-03 water year is 160,000 acre-feet.

7. Estimated annual overdraft for the ensuing 2003-04 water year is 59,000 acre-feet.

8. Estimated accumulated overdraft on June 30 of the current 2002-03 water year is 414,000 acre-feet.

9. Under the provisions of Section 27 of the District Act, a portion of the 2003-04 Replenishment Assessment (RA) could be equal to an amount necessary to purchase a maximum 120,000 acre-feet of replenishment water.[2]

[1] *Basin Water Supply Management Program water was included as part of the total stored water in determining the basin's accumulated overdraft for 2001-02. Engineer's Reports previous to 1992 have used November groundwater conditions to determine accumulated overdraft. This report's findings estimate accumulated overdraft as of June 30, 2002. Prior to 1992, the monthly data was not available to make the adjustment to June basin conditions.*

[2] *The limit is determined by adding the five-year annual average overdraft (99,500 acre-feet) to one-tenth of the difference between the accumulated overdraft (406,000 acre-feet) and the "target" dewatered basin storage (200,000 acre-feet), which results in the following: 99,500 acre-feet + [(406,000 – 200,000 acre-feet) x 0.10] = 120,100 acre-feet (or 120,000 acre-feet when rounded). The target dewatered basin storage factor is explained in the subsequent section titled, "Groundwater Basin Overdraft."*

BASIN HYDROLOGY

Groundwater conditions in the Orange County groundwater basin are influenced by the natural hydrologic conditions of rainfall, groundwater seepage and stream flow. The basin is also influenced by groundwater extraction and injection through wells, use of imported water for groundwater replenishment, and water conservation practices throughout OCWD.

The water year beginning July 1, 2001 yielded 4.2 inches of rainfall on average within OCWD, which is 31 percent of normal rainfall (i.e., 13.4 inches) and the driest year since the 1960-61 water year. Stream flow in the Santa Ana River was 18 percent below normal for the water year, totaling 173,730 acre-feet of flow through Prado Dam, which is a decrease of 37,220 acre-feet below the 30-year average of 210,950 acre-feet.

GROUNDWATER PRODUCTION

Groundwater production from wells within OCWD for the 2001-02 water year totaled 352,113 acre-feet: 342,313 acre-feet for non-irrigation uses (all exempt uses are included) and 9,800 acre-feet for irrigation uses. This year's groundwater production increased one-half percent from the previous year's total of 350,385 acre-feet. The non-irrigation category of use for groundwater production remained unchanged from the previous water year's total, while the irrigation use showed a 20 percent increase.

OCWD's In-Lieu Program, which replaces quantities of groundwater with imported water to reduce groundwater pumping, was in effect this year with an amount totaling 19,473 acre-feet (includes water from the Basin Water Supply Management Program from the Metropolitan Water District of Southern California). The In-Lieu Program has served as an efficient groundwater replenishment method since the 1970s.

Groundwater production and in-lieu quantities within OCWD for the period 1959-1960 through 2001-02 are presented in Figure 1 and Table 1. Without the In-Lieu Program, groundwater production would have reached 371,586 acre-feet for the 2001-02 water year.

2001-02 groundwater production for producers that produce more than 25 acre-feet per year for non-irrigation and irrigation purposes, are listed in Appendices 2 and 3, respectively.

FIGURE 1. Groundwater Production

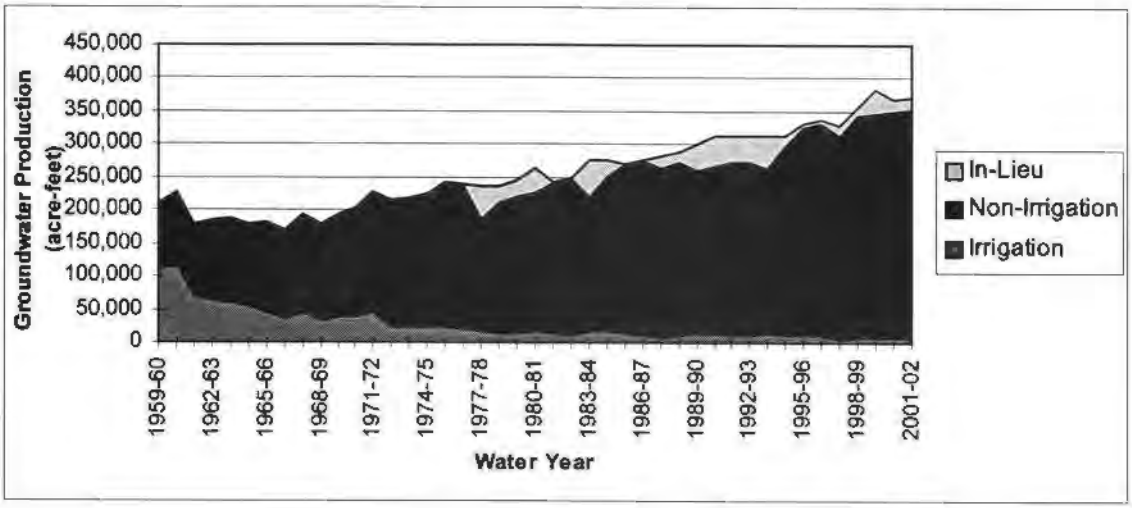


TABLE 1. Historical Groundwater Production Within Orange County Water District

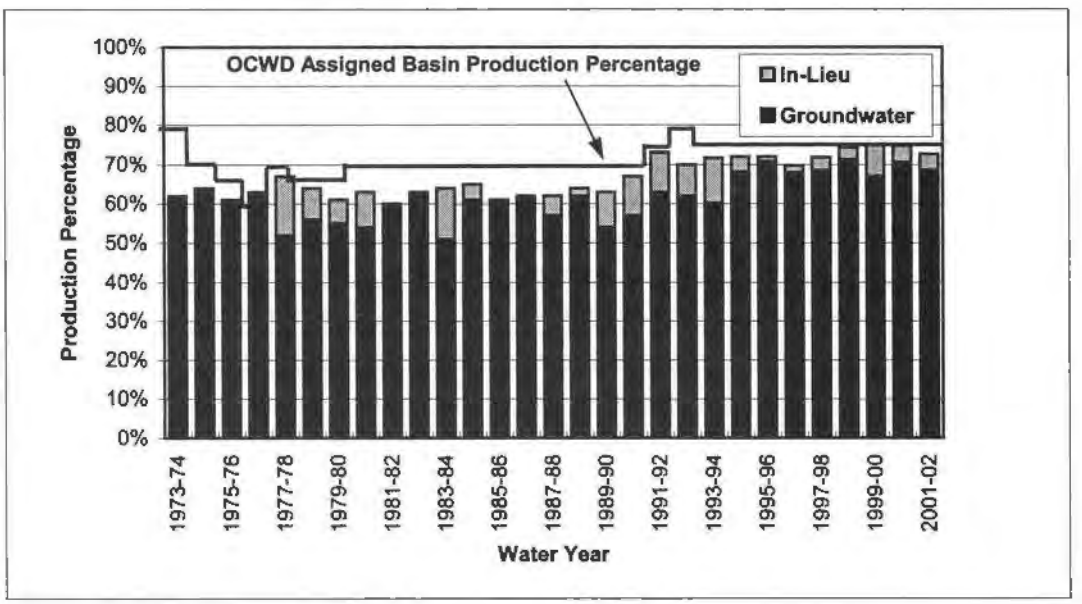
Water Year Jul 1-Jun 30	Groundwater Production (AF)	In-Lieu Program (AF)	Water Year Jul 1-Jun 30	Groundwater Production (AF)	In-Lieu Program (AF)
1959-60	207,448	-	1981-82	244,184	-
1960-61	226,025	-	1982-83	249,548	-
1961-62	177,172	-	1983-84	223,207	52,822
1962-63	186,093	-	1984-85	252,070	25,198
1963-64	188,603	-	1985-86	270,932	-
1964-65	179,798	-	1986-87	276,354	-
1965-66	182,172	-	1987-88	265,226	18,856
1966-67	169,375	-	1988-89	275,077	15,022
1967-68	193,656	-	1989-90	261,190	38,961
1968-69	178,798	-	1990-91	266,745	44,588
1969-70	194,379	-	1991-92	271,224	39,789
1970-71	203,923	-	1992-93	273,587	38,900
1971-72	229,048	-	1993-94	264,159	48,134
1972-73	214,983	-	1994-95	298,217	15,622
1973-74	218,863	-	1995-96	324,111	5,542
1974-75	225,597	-	1996-97	331,406	7,883
1975-76	245,456	-	1997-98	313,805	15,096
1976-77	243,511	-	1998-99	342,823	13,352
1977-78	188,407	48,290	1999-00	345,362	38,007
1978-79	213,290	23,792	2000-01	350,385	18,640
1979-80	221,453	24,861	2001-02	352,113	19,473
1980-81	228,943	36,373			

BASIN PRODUCTION PERCENTAGE

The Basin Production Percentage (BPP) is defined in the District Act as "the ratio that all water to be produced from groundwater supplies within the District bears to all water to be produced by persons and operators within the District from supplemental sources as well as from groundwater within the District." The BPP applies only to water producers that utilize more than 25 acre-feet of groundwater per water year. Water producers that use 25 acre-feet or less from the groundwater basin are excluded from the production percentage limitation.

The BPP for the 2001-02 water year was established at 75 percent by the OCWD Board of Directors in April 2001. The actual 2001-02 BPP achieved by the District's major groundwater producers, including In-Lieu Program deliveries, was 72.7 percent. The actual production percentage achieved by each major producer is presented in Appendix 1. Historical assigned and achieved BPPs are presented in Figure 2.

FIGURE 2. Groundwater Basin Production Percentage



GROUNDWATER LEVELS

Groundwater levels in the Orange County groundwater basin are shown on Plate 1. Groundwater level data used to prepare this plate were collected during October and November 2002 from more than 300 production and monitoring wells screened within the principal aquifers (approximately 200 to 1,200 feet deep). The groundwater elevation plate shows pumping depressions generally ranging from 50 to 70 feet below sea level in coastal and western areas of the basin. A general indicator of changing

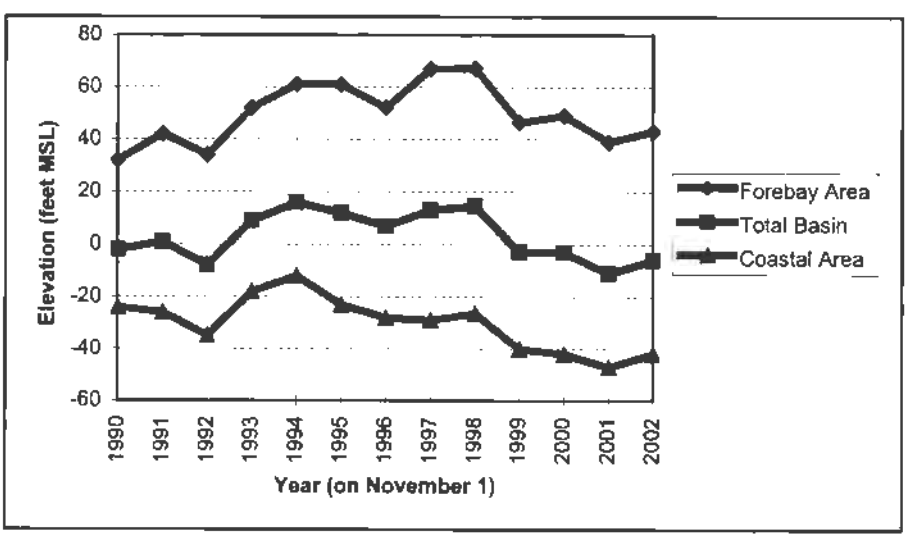
basin levels is the zero (0) mean sea level elevation contour line. The "zero contour line" shifted approximately 1 mile seaward in the vicinity of the cities of Anaheim and Orange, but remained relatively stable in other areas when compared to its alignment in the prior year.

A review of the Change in Water Levels between November 2001 and 2002 map (Plate 2) shows that water levels throughout the majority of the central and coastal portions of the basin were approximately 10 feet higher in November 2002 due in part to the substantial In-Lieu Program begun in October 2002. Water levels also increased approximately 10 feet in much of the Anaheim forebay area, with the exception of a notable decrease of 20-30 feet in the vicinity of Warner Basin (an explanation for the decrease is not readily apparent). Santiago Creek area water levels showed declines ranging from 10 to 60 feet, with the largest declines in the vicinity of the Santiago Pits (the pits were drained for several months while a dewatering pump installation project was being completed). The Irvine-area water level changes varied geographically, with some areas showing increases of 0 to 10 feet while others showed a decrease of 0 to 10 feet. The overall net result of the water level changes in the basin was an estimated decrease of 44,413 acre-feet in the amount of groundwater stored in the basin as of November 1, 2002.

Water level hydrographs for four monitoring wells located in different areas of the basin are shown on Plate 3. The hydrographs span the years between 1970 (shortly after the basin was considered full) and 2002.

Based on Figure 3, during the five-year period of November 1, 1997 to November 1, 2002, average water levels in the District's forebay (intake) area decreased

FIGURE 3. Average Piezometric Elevations



24 feet and average water levels in the pressure (coastal) area decreased 13 feet. For this five-year period, the overall average water level for the whole basin decreased 19 feet.

COASTAL GROUNDWATER CONDITIONS

The coastal portion of the groundwater basin, essentially that area within five miles of the coast, is sensitive to lower groundwater levels due to seawater intrusion potential and seasonal effects on production well capacity. Coastal groundwater levels are affected by groundwater production, overall groundwater storage in the basin, and, to a lesser extent, injection at the Talbert and Alamitos Barriers. For the year ending June 30, 2002, groundwater production from the cities of Fountain Valley, Huntington Beach, Newport Beach, Seal Beach and Westminster as well as Irvine Ranch Water District (IRWD), Mesa Consolidated Water District (MCWD) and OCWD totaled approximately 110,000 acre-feet, an increase of approximately 17 percent from the previous year. The increase was due primarily to Huntington Beach bringing on line both an existing well that had been down for repairs and two newly constructed wells; IRWD bringing on line their Deep Aquifer Treatment System (DATS) that treats colored groundwater; MCWD bringing on line its Colored Water Treatment Facility (CWTF) that treats colored water and MCWD having participated in the Seasonal Storage Program (i.e., taking imported water in-lieu of pumping groundwater) in 2000-01 but not in 2001-02.

The Talbert and Alamitos Barriers injection totaled approximately 16,300 acre-feet (includes all sources of water) for the 2001-02 water year, which was a 30 percent increase over the prior year. This increase was mainly due to increased injection capacity at the Alamitos Barrier (due to completion of two new injection wells) and the addition of supplemental water from the City of Fountain Valley to WF-21 (which supplies the Talbert Barrier).

Coastal groundwater levels typically reach their lowest point during the period of August through September. Minimum water levels in summer 2002 were generally plus or minus 5 feet from the minimum levels of the prior year's summer.

GROUNDWATER BASIN OVERDRAFT

Annual groundwater basin overdraft, as defined in the District Act, is the quantity by which production of groundwater supplies exceeds natural replenishment of groundwater supplies during a water year. This difference between extraction and replenishment can be estimated by determining the change in volume of groundwater in storage that would have occurred had supplemental water not been used for any groundwater recharge purpose, including seawater intrusion protection, water reclamation and the In-Lieu Program.

For the 2001-02 water year, it is estimated that the volume of groundwater in storage decreased by 77,620 acre-feet. In addition, approximately 72,000 acre-feet was percolated or injected to replenish groundwater supplies with imported water from Colorado River and State Water Project, In-Lieu Program, Water Factory 21 recycled water (excluding deep well water) San Bernardino Valley Municipal Water District (SBVMWD), Western Municipal Water District (WMWD) and Arlington Desalter water. The annual overdraft for the 2001-02 water year is 149,000 acre-feet (equals the decrease in storage plus the imported water used for percolation or injection). During the five years from July 1, 1997 to June 30, 2002, an annual average of 61,900 acre-feet of supplemental water and recycled water was percolated or injected into the underground basin for replenishment, or used directly in lieu of pumping groundwater. The average annual overdraft during this five-year period was approximately 99,500 acre-feet. Average seasonal rainfall in the OCWD service area during this five-year period was 12.9 inches, which is slightly less than the historical average of 13.4 inches.

The accumulated overdraft, as defined in the District Act, is the quantity of water needed at OCWD's intake area in order to prevent landward movement of ocean water into the fresh groundwater body. Landward movement of ocean water can only be prevented if groundwater levels near the coast are several feet above sea level. Groundwater levels along the coast are related to the volume of water stored in the intake area, water pumped from the entire basin, and the pattern or location of pumping. However, seawater intrusion control projects have been constructed and others are under construction or planned that together will be effective in preventing landward movement of ocean water into the fresh groundwater body. These facilities will allow greater utilization of the storage capacity of the basin. Based on these opportunities, a "target" dewatered storage of 200,000 acre-feet has been implemented for the past several years as the appropriate accumulated overdraft level for the basin. This level allows OCWD the flexibility to fully utilize supply opportunities even when the groundwater basin is considered "full" at the target dewatered storage of 200,000 acre-feet. OCWD is dedicated to maximizing its replenishment capabilities by actively negotiating with the U.S. Army Corps of Engineers to increase OCWD's water conservation program behind Prado Dam and creating a recharge facility development plan to evaluate cost-effective improvements to OCWD's groundwater recharge capabilities.

For the purpose of estimating accumulated overdraft, groundwater levels as measured on November 1, 1969 were assumed to represent full basin conditions (a condition under which seawater intrusion would not occur). Using this 1969 reference year, the groundwater levels as of November 1, 2002 show an accumulated overdraft of approximately 426,000 acre-feet, as shown in Figure 4. For the 2001-02 water year, which ended June 30, it is estimated (by means of back-calculating from November 1, 2002 to June 30, 2002) that the accumulated overdraft totaled 406,000 acre-

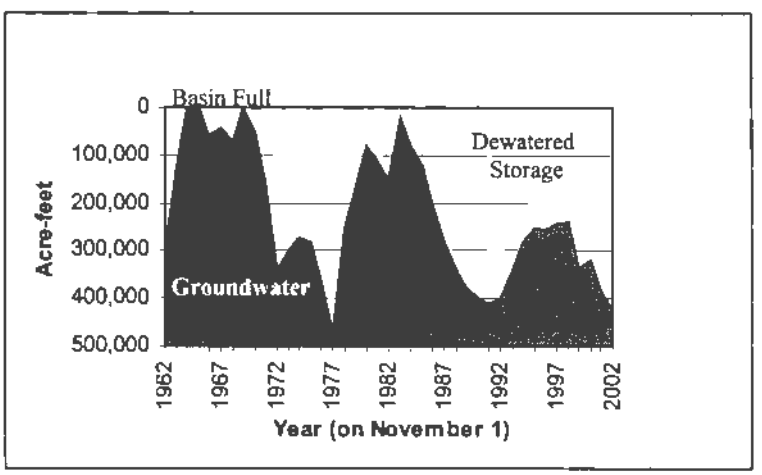
feet. Projected accumulated overdraft for the current water year (2002-03) ending June 30 is estimated to be 414,000 acre-feet.

Projected annual overdraft for the current water year is estimated to be 160,000 acre-feet. This estimate is based on the assumption that annual groundwater production for the current water year will total 380,000 acre-feet (including In-Lieu Program water) and that natural replenishment will total 220,000 acre-feet.

Projected annual overdraft for the ensuing water year (2003-04) is estimated to be 59,000 acre-feet. This estimate is based on the assumption that annual groundwater production for the ensuing water year will total 324,000 acre-feet, based upon an assumed BPP of 66 percent (discussed further in the subsequent section, "Recommended BPP") and that natural replenishment (captured Santa Ana River base and storm flows and local recharge) will total 265,000 acre-feet.

On September 1, 1997, OCWD and MWD entered into a water supply management agreement, which allows MWD to pre-deliver replenishment water to the groundwater basin (called the Basin Water Supply Management Program). As of June 30, 2002, MWD had pre-delivered a total of 61,757 acre-feet to the groundwater basin. Of this quantity, OCWD had purchased a total of 10,000 acre-feet as of June 30, 2002.

FIGURE 4. Accumulated Basin Overdraft



REPLENISHMENT RECOMMENDATION

Section 27(b) of the District Act states the following:

"The total of the replenishment assessment levied in any year shall not exceed an amount of money found to be necessary to purchase sufficient water to replenish the average annual overdraft for the immediate past five water years plus an additional amount of water sufficient to

eliminate over a period of not less than 10 years nor more than 20 years, the accumulated overdraft, plus an amount of money to pay the costs of initiating, carrying on, and completing any of the powers, projects, and purposes for which this district is organized."

Based upon the previously cited Section 27(b), that portion of the Replenishment Assessment (RA) that is used for water purchases for the ensuing water year 2003-04 is limited to the amount needed to purchase 120,000 acre-feet, as calculated below:

Five-year (7/1/97 through 6/30/02) Average Annual Overdraft	= 99,500 acre-feet
Water Year 2001-02 Accumulated Overdraft	= 406,000 acre-feet
Target Accumulated Overdraft for Basin	= 200,000 acre-feet
Assumed time period to eliminate accumulated overdraft (10 years is selected since it is the most aggressive time period allowed)	= 10 years
Potential Water Purchase Amount:	
99,500 af + [(406,000 af - 200,000 af)/10 years]	= 120,000 acre-feet

Table 2 presents the proposed 2003-04 budget for water purchases, which shows the proposed quantity of purchased water (75,000 acre-feet) being less than the amount of 120,000 acre-feet calculated under the provisions of the Section 27(b) of the District Act.

TABLE 2. 2003-04 Budget for Water Purchases

Water Source	Acre-Feet	Rate ($/AF)	Total Cost
Alamitos Barrier	2,000	$418[1]	$ 836,000
Arlington Desalter	5,000	$233	$ 1,165,000
City of Fountain Valley (for WF-21)	4,000	$380[2]	$ 1,520,000
City of Huntington Beach (for WF-21)	4,000	$426[3]	$ 1,704,000
In-Lieu Water	30,000	$295	$ 8,850,000
MWD Untreated Water	30,000	$233	$16,543,000
WATER PURCHASES	75,000	—	—
Applicable Surcharges	**Acre-Feet**	**Rate ($/AF)**	**Total Cost**
MWD of OC Surcharge	35,000[4]	$ 5.50	$ 192,500
MWD RTS Charge	8,000	$20.00	$ 160,000
MWD CR Charge	8,000	$13.00	$ 104,000
WATER COST	—	—	$21,681,500
TOTAL	75,000	—	$21,681,500

[1] *Equals Metropolitan Water District (MWD) Tier 1 treated non-interruptible water rate plus City of Long Beach surcharge.*
[2] *Equals melded rate using MWD rate, City of Fountain Valley's groundwater rate and other City charges.*
[3] *Equals melded rate using MWD Tier 1 and Tier 2 rates.*
[4] *Based on 8-year running average.*

RECOMMENDED BASIN PRODUCTION PERCENTAGE (BPP)

In December 2002, the Board approved a new basin management approach for determining the BPP for future water years. The new management approach is based upon developing a base amount of groundwater production the basin can annually sustain utilizing dependable water supplies the District can count on receiving.

For the 2003-04 water year, a BPP of 66 percent is recommended, predicated on the following two conditions. The first condition is that the District will recharge at least 380,000 acre-feet in the current water year (2002-03), which equals the current estimate of annual groundwater production. This condition would prevent the further increase of the accumulated overdraft, which should be avoided given the current inadequacy of the Talbert seawater barrier to prevent seawater intrusion. The second condition is that the dependable basin water supplies for the 2003-04 water year will total at least 344,000 acre-feet, including 205,000 acre-feet captured river flows, 60,000 acre-feet incidental recharge, 14,000 acre-feet seawater barrier injection, 5,000 acre-feet Arlington Desalter flows, and 60,000 acre-feet of available MWD replenishment water. A BPP of 66 percent corresponds to approximately 324,000 acre-feet of production from the basin, which may reduce the basin accumulated overdraft by up to 20,000 acre-feet provided that 344,000 acre-feet of total replenishment occurs.

Thus, in April 2003, staff will apprise the Board on the status of these two conditions, with particular emphasis on the availability of at least 60,000 acre-feet of MWD replenishment water for the ensuing year. If the estimates of basin supplies in the current or ensuing year are less than those contained in the respective two conditions, then a BPP of 62 percent or less would be recommended. Alternatively, if the basin replenishment estimates exceed the condition in the 2002-03 water year, then a BPP above 66 percent may be recommended.

In order to achieve water quality objectives in the groundwater basin, it is recommended for the water year 2003-04 that additional production (above the BBP) be allowed for the cities of Garden Grove, Tustin, and Mesa Consolidated Water District (MCWD) and IRWD. These agencies need the additional pumping allowance in order to accommodate groundwater remediation projects. As in prior years, the production from these projects would be partially or fully exempt from the Basin Equity Assessment (BEA) as a result of poor-quality well water being produced and treated to domestic standards in amounts that exceed the BPP.

In addition, it is further recommended that for 2003-04, the cities of Anaheim and Orange, and MCWD be encouraged to continue participating in the Demonstration Coastal Pumping Program. The purpose of the program is to transfer coastal pumping inland by modifying the BEA and BPP for the participants. The program provides incentives for the two cities to increase their groundwater production above the BPP and for MCWD to limit its groundwater production to below the BPP. In addition, the cities of Buena Park, Fullerton, Newport Beach and Santa Ana are recommended to begin participation in the program.

PART II: WATER SUPPLY AND BASIN UTILIZATION

Section 31.5 of the District Act requires an investigation and annual report setting forth the following information related to water supply and basin utilization within the OCWD service area, together with other information as OCWD may desire:

WATER SUPPLY AND BASIN UTILIZATION 2001-02 SUMMARY OF FINDINGS

1. Water usage from all supplemental sources totaled 205,315 acre-feet for the 2001-02 water year.

2. Water usage from other sources for the 2001-02 water year totaled 2,055 acre-feet.

3. Water served through the In-Lieu Program totaled 19,473 acre-feet for the 2001-02 water year.

4. Water demand within OCWD totaled 512,154 acre-feet for the 2001-02 water year.

5. Estimated demand for imported water for the ensuing 2003-04 water year is 176,000 acre-feet.

6. Quantity of supplemental water available in the ensuing 2003-04 water year for groundwater recharge and In-Lieu is unknown as of February 2003. MWD needs to complete its water supply analysis (April 2003) before a determination can be made.

SUPPLEMENTAL WATER

Supplemental water is used by water agencies throughout OCWD to augment groundwater supply and to recharge the groundwater basin. Supplemental water, as defined in the District Act, is any water that originates from outside District boundaries, including the Santiago Creek watershed above Villa Park Dam. Sources of supplemental water include deliveries from MWD and flow diversions from Santiago Creek (including water from Irvine Lake/Santiago Reservoir and Villa Park Dam) that are conveyed to users within OCWD boundaries. MWD deliveries originate from either the Colorado River or the State Water Project. As a result, this water is sometimes referred to as "nonlocal water." Water agencies utilizing supplemental water are listed in Appendix 1.

During the 2001-02 water year, use of supplemental water in the OCWD service area totaled 205,315 acre-feet: 137,688 acre-feet used directly by water agencies and 67,627 acre-feet (including In-Lieu water) used for groundwater replenishment purposes. Water agencies' uses included 126,997 acre-feet for municipal and industrial use and 10,691 acre-feet for agricultural purposes; groundwater replenishment included 19,473 acre-feet for the In-Lieu Program. Historical supplemental water usage for the 2001-02 water year and earlier is shown in Figure 5, and supplemental water usage is detailed in Table 3. A breakdown of supplemental water purchases by OCWD for the water years 1990-91 through 2001-02 is presented in Appendix 7.

Groundwater replenishment quantities include deliveries to OCWD's forebay recharge facilities, Alamitos Barrier, Talbert Barrier, In-Lieu Program and water purchased from the Arlington Desalter, SBVMWD and WMWD for groundwater recharge.

FIGURE 5. Historical Supplemental Water Usage

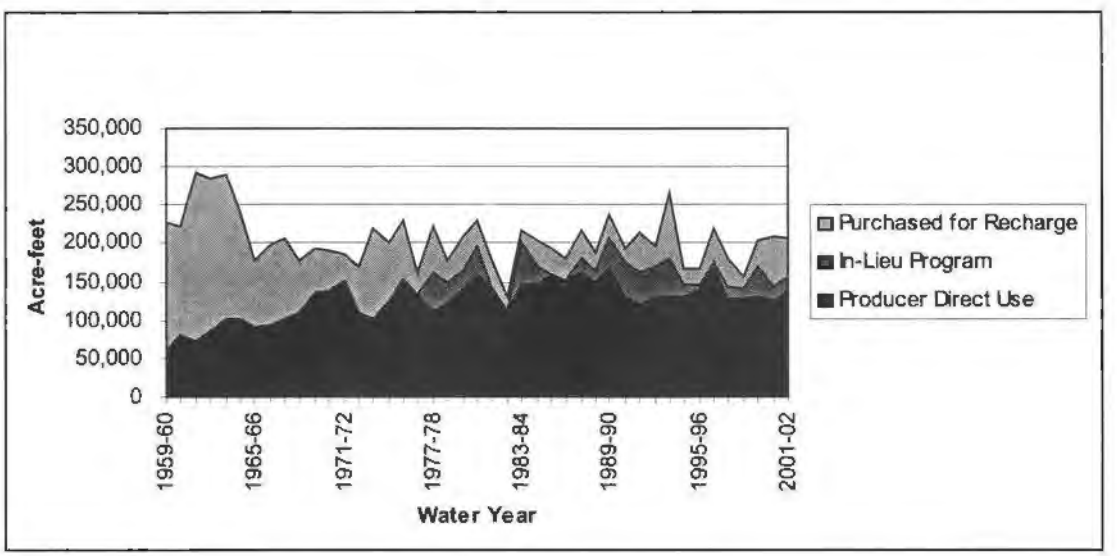


TABLE 3. 2001-02 Supplemental Water Usage

Direct Agency Use	Acre-feet
Agencies	135,633
Other Sources	2,055
Subtotal	137,688
Groundwater Replenishment	
In-Lieu Program	19,473
Forebay Recharge	30,093
Arlington Desalter	5,820
San Bernardino MWD	4,296[1]
Western MWD	2,990
Alamitos Barrier	2,282
Talbert Barrier	2,673
Subtotal	67,627
TOTAL	205,315

[1] *This quantity agrees with the Santa Ana River Watermaster's determination made at its February 2003 monthly meeting. Furthermore, the quantity of SBVMWD water received by OCWD for the water years 1998-99 through 2000-01 was determined after release of the 2000-01 Engineer's Report. The water received is as follows: zero in 1998-99; zero in 1999-2000; 2,788 acre-feet in 2000-01. These quantities are shown in Appendix 7.*

For the 2001-02 water year, the OCWD Board of Directors approved the continuation of the In-Lieu Program, previously sanctioned by MWD. The cost of the In-Lieu Program water to OCWD is the difference between the MWD Seasonal Storage rate and the cost to produce groundwater. OCWD pays this difference to participating agencies. In-Lieu Program water deliveries totaled 19,473 acre-feet for the 2001-02 water year, as shown in Table 4.

TABLE 4. In-Lieu Program 2001-02 Water Deliveries

Agency	Acre-feet
City of Garden Grove	3,306
City of Santa Ana	9,238
Irvine Ranch Water District	6,929
TOTAL	19,473

AVAILABILITY OF SUPPLEMENTAL REPLENISHMENT WATER

For the ensuing 2003-04 water year, replenishment water would primarily be supplied from MWD's Colorado River and State Water Project water sources. MWD is uncertain as to the availability of replenishment water until it completes its water supply analysis (the earliest date would be April 2003).

WASTEWATER RECLAMATION

Historically, only groundwater, supplemental water, and local surface water have been a source of water within OCWD. Wastewater reclamation is becoming an increasingly significant source of additional water. Wastewater is recycled at OCWD's Green Acres Project (GAP) and at IRWD for non-irrigation and industrial use. Purified wastewater is also produced at OCWD's WF-21 for use in the Talbert Barrier (plant production and seawater intrusion barrier quantities are reported in Appendix 6) and for use in supplementing GAP.

GAP and IRWD serve recycled wastewater for landscape irrigation and industrial use in Fountain Valley, Costa Mesa, Huntington Beach, Newport Beach, Santa Ana and the IRWD service area. For the 2001-02 water year, GAP and IRWD produced 11,456 acre-feet of recycled wastewater as detailed in Appendix 5.

In October 2002, OCWD and the Orange County Sanitation District signed a Joint Exercise of Powers Agreement for the planned Groundwater Replenishment (GWR) System. This project will treat and deliver 70,000 acre-feet per year of wastewater purified to drinking water standards (microfiltration followed by reverse osmosis and UV disinfection) for direct injection into a seawater barrier and percolation into the OCWD groundwater basin. The project is currently in the latter stages of final design. Construction is scheduled to begin in spring 2003. The project is scheduled to be on line in late 2007.

The Water Replenishment District of Southern California is nearing completion of the Leo J. Vander Lans 3 million gallons per day (mgd) advanced wastewater treatment facility. When brought on line (scheduled for summer 2003), the plant will supply the Alamitos Barrier with 50 percent recycled wastewater (the remaining 50% to be supplied with potable water from MWD).

WATER DEMANDS AND USAGE

During the 2001-02 water year, total water demands within OCWD's service area totaled 512,153 acre-feet, which is a 3 percent increase over the previous year's demand of 495,109 acre-feet. Total demand includes the use of groundwater, imported water, water from other sources and reclaimed wastewater. Total demand excludes groundwater and supplemental water used by OCWD for groundwater recharge (but includes In-Lieu water) and water credits given for water conservation.

Total water usage (i.e., quantity of water for all categories of use) for the 2001-02 water year was 564,467 acre-feet. Total water usage includes "total water demand" (from above) plus supplemental water purchased for groundwater replenishment plus recycled water used for groundwater injection (i.e., WF-21 production).

2001-02 water demands and projected water demands for 2002-03 and 2003-04 are shown in Table 5. 2002-03 (current year) water demands were determined by assessing current year data that is available and projecting that data to develop annual totals for the current year. 2003-04 (ensuing year) water demands are based on projections provided by the District's retail water producers. Long-term projections are shown in Figure 6.

TABLE 5. Water Demands Within Orange County Water District

	Ground-water[1]	Imported Water[2,3]	Other Water[3]	Recycled Water[4]	Total
2001-02					
Non-Irrigation	353,209	124,943	2,055	11,456	491,663
Irrigation	9,800	10,691	-	-	20,491
Total	363,009	135,634	2,055	11,456	512,154
2002-03 (Current Year)[5]					
Non-Irrigation	371,000	106,000	4,000	12,000	493,000
Irrigation	9,000	10,000	3,000	-	22,000
Total	380,000	116,000	7,000	12,000	515,000
2003-04 (Ensuing Year)[5]					
Non-Irrigation	315,000	166,000	4,000	13,000	498,000
Irrigation	9,000	10,000	3,000	-	22,000
Total	324,000	176,000	7,000	13,000	520,000

[1] *Includes In-Lieu Program water and excludes OCWD's use of groundwater for seawater barrier.*
[2] *Excludes water conservation credits and imported water used for groundwater replenishment.*
[3] *"Imported Water" and "Other Water" are both counted as supplemental water elsewhere in this report.*
[4] *Excludes recycled water injected into the groundwater basin for seawater intrusion protection (i.e., WF-21). Includes OCWD's Green Acres Project (excluding OCSD usage) and IRWD's reclaimed water production.*
[5] *Demands are estimated by OCWD.*

WATER QUALITY

When blended together by the major agencies within the OCWD service area, the blended groundwater (without treatment) and treated supplemental water is determined to have a flow-weighted average of 476 milligrams per liter (mg/L) of total dissolved solids (TDS). The average groundwater TDS concentration for the basin was 462 mg/L, ranging from a low of 226 mg/L in the coastal areas to greater than 600 mg/L in certain inland areas. The average TDS concentration for the basin has shown an increase over time.

Average concentrations of TDS, nitrates and hardness for groundwater and groundwater combined with supplemental water supplied by agencies within OCWD's service area during the 2001-02 water year are shown in Table 6. These concentrations

were determined from groundwater and supplemental water analyses and from production reports submitted to and filed with OCWD by each agency. The cities of Garden Grove and Tustin, and MCWD have active groundwater treatment projects that help to reduce certain constituents in their groundwater supply prior to it being served to customers (see note 6 in Table 6).

WATER RESOURCES DATA

A summary of water resources data within OCWD for the 2001-02 water year and the previous year (2000-01) is shown in Appendix 6.

WATER CONSERVATION

On September 20, 1995 OCWD approved an innovative program to encourage water conservation among groundwater producing agencies within the OCWD service area. The objective of the program is to encourage the installation of ultra low-flush (ULF) toilets and low-flow showerheads by creating an incentive (opportunity to reduce the purchase of supplemental water) for participating agencies. For 2001-02, a total of 2,183 acre-feet of water (i.e., water conservation credits) were conserved through this program. From the inception of this first program through June 30, 2002, a total of 11,661 acre-feet of water has been conserved.

A second water conservation program, which operates in parallel with the first program, was implemented in October 1999 to encourage greater participation in replacing inefficient toilets. Under this program, MWD, OCWD and OCSD pre-purchase ULF toilets and then make them available at no cost to area residents (in exchange for their old toilet). The program is administered by the Municipal Water District of Orange County (MWD of OC). For the 2001-02 water year, a total of 41,739 ULF toilets were given out with an estimated annual water savings of 1,337 acre-feet. From the inception of this second program through June 30, 2002, a total of 3,620 acre-feet of water has been conserved.

Combining both programs, the water savings for 2001-02 is 3,520 acre-feet. Since the start of both programs, the combined water savings is approximately 15,000 acre-feet.

TABLE 6. 2001-02 Water Quality Summary

City/Agency	Groundwater[1,6,7]			Delivered Blend[1,2,6,7]		
	TDS[3]	NO_3-N[4]	Hardness[5]	TDS[3]	NO_3-N[4]	Hardness[5]
Anaheim	620	3.7	340	596	3.0	319
Buena Park	334	0.6	190	401	0.5	210
East Orange County Water District	582	4.7	335	555	3.1	300
Fountain Valley	338	0.9	222	381	0.8	227
Fullerton	604	3.7	318	580	2.8	298
Garden Grove[6]	518	4.5*	298	517	3.9*	290
Huntington Beach	323	0.5	169	380	0.4	191
Irvine Ranch Water District	267	0.2	152	357	0.2	185
La Palma	298	0.0	135	333	0.1	153
Mesa Consolidated Water District	315	0.1	143	369	0.2	171
Newport Beach	410	1.3	225	438	1.0	230
Orange	471	2.3	271	480	1.8	264
Orange Park Acres Mutual Water Co.	664	3.9	351	531	0.8	257
Santa Ana	339	2.4	293	392	1.7	277
Seal Beach	226	0.0	74	319	0.1	129
Serrano Water District	595	1.6	378	625[2]	1.3[2]	364[2]
Southern California Water Co.	452	2.0	256	472	1.4	251
Tustin[6]	673*	7.2*	336*	622*	5.0*	307*
Westminster	366	1.4	230	401	1.1	233
Yorba Linda WD	620	3.8	318	573	2.3	285
Weighted Average (based upon water usage) for OCWD Service Area[7]	462	2.4	262	476	1.8	257

[1] *All groundwater results (alone or as a blend) are for untreated groundwater (see note 6 below). Units are reported in mg/L.*

[2] *Delivered blend includes untreated groundwater and treated imported MWD water (i.e., blend of Colorado River water and State Project water as measured at the MWD Diemer Plant), except Serrano Water District, which blends with treated Santiago Reservoir water. Units are reported in mg/L. Annual average water qualities for MWD and Santiago Reservoir (Irvine Lake) for 2001-02 are as follows:*

MWD Water Quality			Santiago Reservoir Water Quality		
TDS	=	510 mg/L	TDS	=	712 mg/L
NO_3-N	=	0.3 mg/L	NO_3-N	=	0.3 mg/L
Hardness (as $CaCO_3$)	=	242 mg/L	Hardness (as $CaCO_3$)	=	322 mg/L

[3] *Secondary Drinking Water Standards for total dissolved solids (TDS) are as follows:*

500 mg/L	=	recommended limit
1,000 mg/L	=	upper limit

[4] *Primary Drinking Water Standard for nitrate NO_3-N (i.e., nitrate expressed as nitrogen) is 10 mg/L.*

[5] *Hardness is reported as mg/L of $CaCO_3$. General ranges of hard and soft water are as follows:*

0-75 mg/L	=	soft	150-300 mg/L	=	hard
75-150 mg/L	=	moderately hard	300-up mg/L	=	very hard

[6] *Agencies with active groundwater quality improvement projects that treat for one or more of the constituents listed in the table. The results shown herein for "groundwater" and "delivered blend" reflect results from untreated groundwater. Water quality constituents that are marked with an asterisk (*) are reduced prior to delivery to customers.*

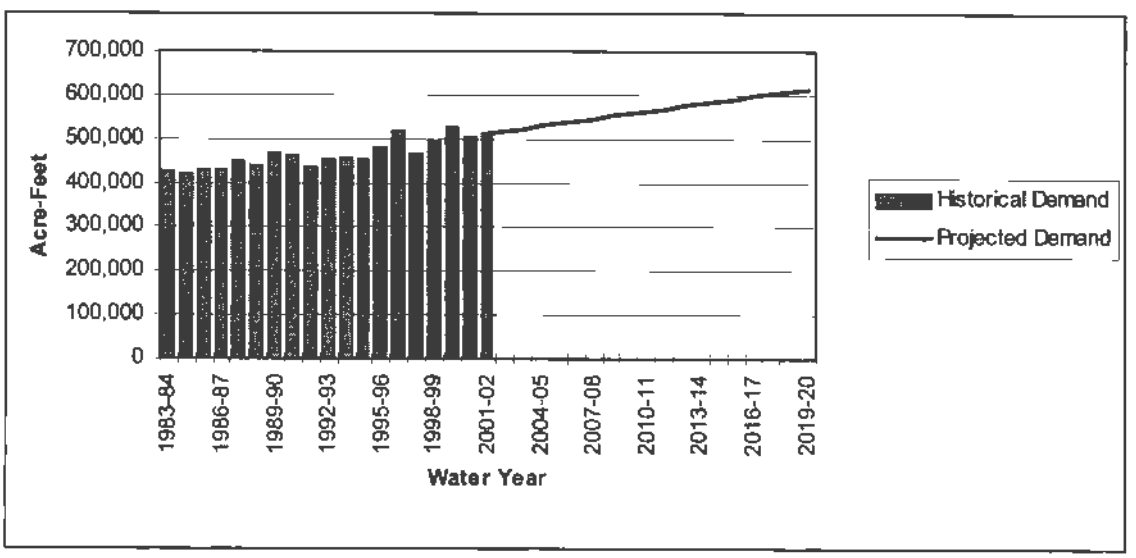
[7] *All water quality results are flow-weighted averages based on groundwater produced and imported water delivered to each entity.*

WATER DEMAND FORECAST

During the past year, OCWD has participated with MWD of OC and retail groundwater producers to predict future demands in the OCWD service area. Each producer projected its total water demands to the year 2020. These projections include the effect of local water conservation measures. Figure 6 illustrates historical and projected water demands for the OCWD service area to the year 2020.

Population within OCWD's service area is expected to increase from 2.2 million currently to 2.6 million people by the year 2020 (based on information from OCWD's major water agencies). This growth in population is expected to increase water demands from the current 512,000 acre-feet per year to 615,000 acre-feet per year in 2020. With these future demands, groundwater production levels will increase from 363,000 acre-feet per year to 465,000 acre-feet per year during the next 20 years (if the BPP were to be maintained at 75%). To support the projected future levels of groundwater production, OCWD must continue to purchase imported supplies for groundwater recharge, capture Santa Ana River flows, develop local recycled water supplies for replenishment purposes, expand recharge facilities and improve the In-Lieu Program.

FIGURE 6. Water Demand Projections



PART III: WATER PRODUCTION COSTS FOR ENSUING YEAR (2003-04)

Section 31.5 of the District Act requires that the costs of producing groundwater and obtaining supplemental water be evaluated annually. The cost of producing groundwater and supplemental water varies for each producer, depending on many factors. Although these variations in cost are recognized, it is necessary for the purpose of this report to arrive at figures representing the average cost of producing groundwater and purchasing supplemental water for irrigation and non-irrigation use. A summary of water production costs for the ensuing year (2003-04) is as follows:

ENSUING YEAR WATER PRODUCTION COSTS SUMMARY OF FINDINGS

1. Production cost for groundwater (i.e., well energy cost plus the proposed Replenishment Assessment) for non-irrigation use in the 2003-04 water year is estimated to be $203 per acre-foot.

2. Groundwater production cost (i.e., energy cost plus the proposed Replenishment Assessment) for irrigation use in the 2003-04 water year is estimated to be $153.50 per acre-foot.

3. Estimated cost of MWD water (i.e., treated, non-interruptible rate) for non-irrigation use in the 2003-04 water year is $462.50 per acre-foot.

4. Estimated cost of MWD water (i.e., untreated, interruptible rate) for groundwater replenishment use in the 2003-04 water year is $239 per acre-foot.

GROUNDWATER PRODUCTION COSTS FOR NON-IRRIGATION USE

The "production cost" for groundwater, which consists of the energy cost for a well to pump groundwater plus the proposed OCWD Replenishment Assessment (RA), for non-irrigation use for the ensuing 2003-04 water year is estimated to equal $203 per acre-foot. This cost along with other estimated costs for groundwater production are detailed in Table 7. Energy costs for the production of an acre-foot of groundwater for each of the major producers for the water year 2001-02 are shown in Appendix 1. A survey of the major water agencies was conducted to determine characteristics of representative groundwater extraction facilities for irrigation and non-irrigation class producers and the associated annualized capital costs. The findings of the survey are presented in Appendix 4.

Significant components included in the cost to producers for non-irrigation use are energy, operation and maintenance requirements. Based on responses to the November 2002 agency survey, energy costs range from $32.62 per acre-foot to $80.56 per acre-foot, and operation and maintenance costs range from $8.31 per acre-foot to $347.80 per acre-foot. Elements that influence these costs include load factors and variations in groundwater levels. Recently drilled wells are generally deeper (1,100-foot depth for a typical well) than those drilled decades ago. The average load factor, which indicates the percent-of-use of an extraction facility, was 63 percent for the major water agencies within OCWD. Groundwater production costs should continue to remain lower than supplemental water costs for this type of producer.

GROUNDWATER PRODUCTION COSTS FOR IRRIGATION USE

Groundwater production costs for irrigation use are determined for producers that have the ability to receive supplemental water and for producers that do not have the ability to receive supplemental water. Total costs to both types of producers are shown in Table 7. Costs shown are based on a representative irrigation facility; characteristics of such a facility are presented in Appendix 4.

Groundwater production costs for irrigation use for the ensuing 2003-04 water year are expected to total $153.50 per acre-foot. This total is the sum of the energy cost and the proposed 2002-03 Replenishment Assessment. Total costs to producers are based on an annual production of 415 acre-feet and an average load factor of 30 percent. Energy costs average $79.00 per acre-foot for this type of producer, which reflects the need to double pump groundwater (pumping from the groundwater basin to a reservoir and then pumping from the reservoir to delivery system pressure).

TABLE 7. 2003-04 Groundwater Production Costs

Item	Non-irrigation		Irrigation with Supplemental Connection		Irrigation without Supplemental Connection	
	Annual $	$/AF[1]	Annual $	$/AF[2]	Annual $	$/AF[3]
Production Costs						
Energy	61,452	54.00[4]	32,785	79.00	14,773	79.00
Proposed Replenishment Assessment	169,562	149.00[5]	30,918	74.50[5]	13,932	74.50[5]
Total Groundwater Production Costs	231,014	203.00	63,703	153.50	28,705	153.50
Other Costs to Producers						
Capital Costs	78,511	68.99[4]	34,545[6]	83.24	34,544[6]	184.73
Operation & Maintenance	77,475	68.08[4]	21,891	52.75	9,864	52.75
Total Other Costs to Producers	155,986	137.07	56,436	135.99	44,408	237.48
Total Cost to Producers	387,000	340.07	120,139	289.49	73,113	390.98

[1] *Based on an estimated 60 percent load factor, 1,138 acre-feet/year, and an average lift of 280 feet.*
[2] *Based on an estimated 30 percent load factor, 415 acre-feet/year, and an average lift of 123 feet.*
[3] *Based on an estimated 30 percent load factor, 187 acre-feet/year, and an average lift of 123 feet.*
[4] *Based on survey of major agencies within OCWD, non-irrigation groundwater users.*
[5] *Proposed for 2003-04.*
[6] *Based on current construction costs for well facilities only (land excluded) amortized over 30 years at 6 percent interest.*

COST OF SUPPLEMENTAL WATER

Supplemental water is supplied to the OCWD service area by MWD. MWD delivers both treated and untreated water as either a non-interruptible supply or an interruptible supply. As a result, there are several categories of water that are available from MWD. The categories most applicable for purposes of this report are 1) uninterruptible (i.e., firm) treated water, which is referred to as "full service water," 2) interruptible treated water, which is referred to as "in-lieu water," and 3) interruptible untreated water, which is referred to as "replenishment water." Treated water is used directly by the various producers for municipal and industrial purposes, while untreated water is used by OCWD for groundwater replenishment. Table 8 shows the estimated costs for the 3 aforementioned MWD water categories for the 2003-04 ensuing water year. Figure 7 shows historical supplemental water costs along with historical groundwater production costs. A comparison of estimated costs for groundwater versus supplemental water (non-irrigation use) during the ensuing water year (2003-04) is shown in Table 9 and also in Figure 7. Values used in Figure 7 are presented in tabular form in Appendix 8.

TABLE 8. 2003-04 Supplemental Water Costs[1]

Rate and Charge Components	Treated Water Rates ($/AF)
Firm Deliveries	"Full Service Water"
MWD Supply Rate (MWD of OC Melded Rate)	82.00
MWD System Access Rate	152.00
MWD System Power Rate	74.50
MWD Water Stewardship Rate	26.50
MWD Capacity Reservation (CR) Charge	14.50
MWD Treatment Surcharge	87.00
MWD Readiness-to-Serve (RTS) Charge	20.00
MWD of OC Surcharge	6.00
Total	462.50

Rate and Charge Components	Treated Water Rates ($/AF)	Untreated Water Rates ($/AF)
Interruptible Deliveries	"In-Lieu Water"	"Replenishment Water"
MWD Long-term Storage Water Rate	295.00	233.00
MWD of OC Surcharge	6.00	6.00
Total	301.00	239.00

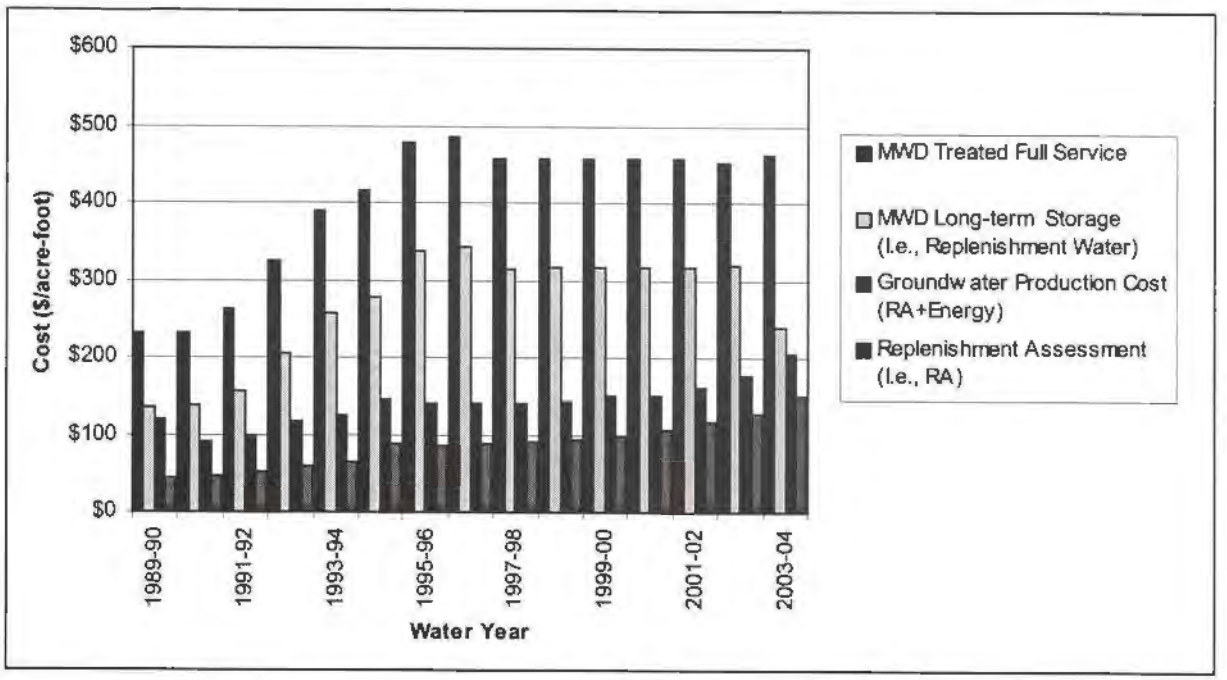
[1] *MWD rates are current for calendar year 2003 and proposed for calendar year 2004. MWD of OC rates are proposed. Supplemental water costs for MWD member agencies are not reported herein due to the variability between agencies on water supply allocations between MWD's Tier 1 and Tier 2.*

Cost components for supplemental treated and untreated water are listed in Table 8. Beyond the normally expected water supply, treatment and power charges, there are several other charges. The System Access charge is for costs associated with the conveyance and distribution system, including capital and operating and maintenance costs. The Water Stewardship charge is used to support MWD's financial commitment to conservation, water recycling, groundwater recovery and other water management programs approved by MWD. MWD uses the Capacity Reservation (CR) charge to recover its cost for reserving peak capacity within its distribution system. The Readiness-to-Serve (RTS) charge is to recover MWD's cost associated with providing standby and peak conveyance capacity and system emergency storage capacity. As of January 1, 2003, the RTS charge was discontinued for "Interruptible" deliveries. At the same time the CR charge commenced for "Non-Interruptible" deliveries.

MWD of OC is a MWD member agency that distributes MWD supplemental water to many water producers within OCWD. The MWD of OC surcharge, which for 2003-04 is proposed to be $6.00 per acre-foot, provides general funding for MWD of OC.

Producers within MWD of OC's service area that purchase supplemental water directly from MWD (i.e., Cities of Anaheim, Fullerton and Santa Ana) avoid this cost.

FIGURE 7[1]. Adopted and Projected Water Rates for Non-Irrigation Use

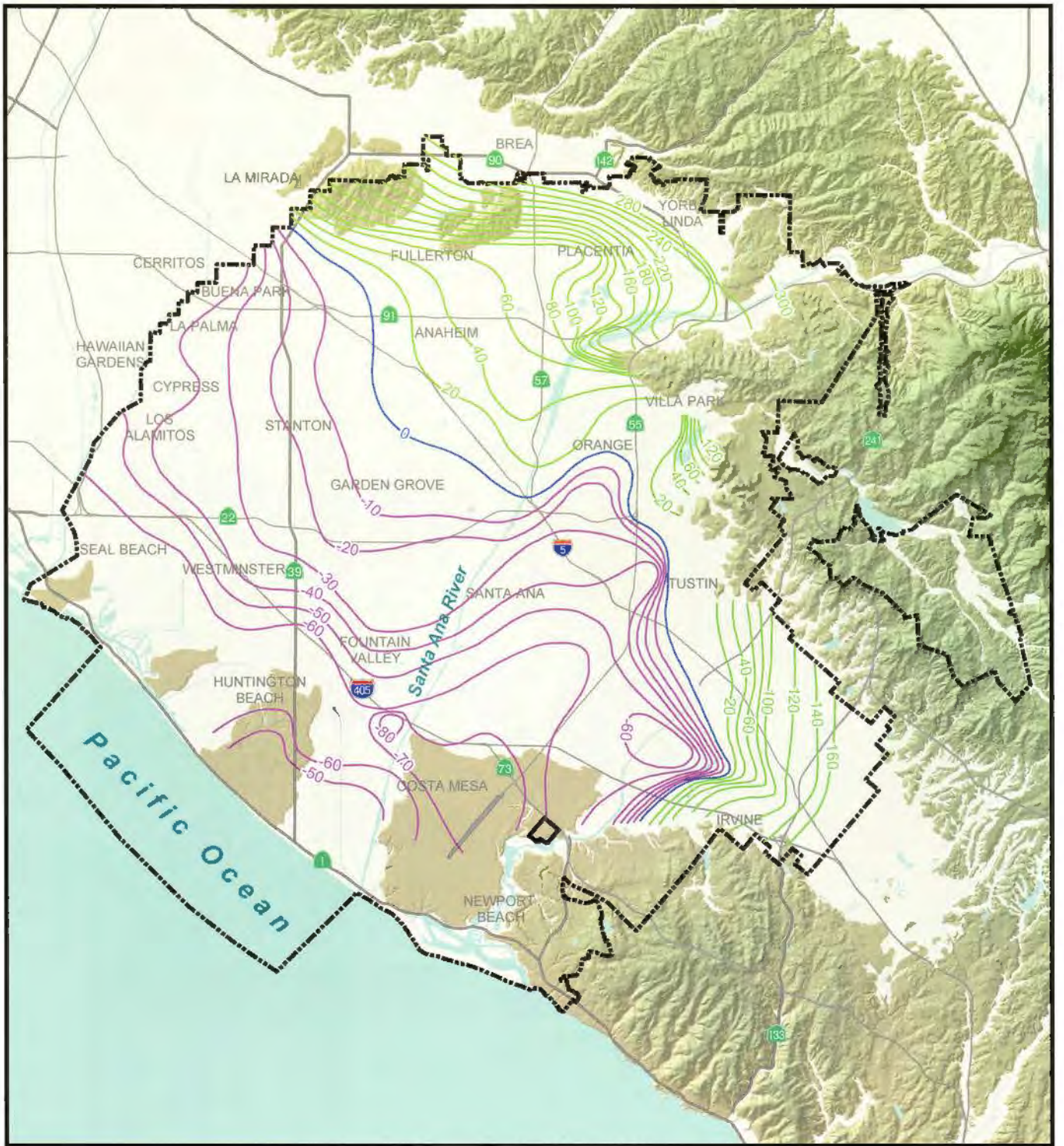


[1] *Refer to Appendix 8 for actual values used in Figure 7.*

TABLE 9. 2003-04 Water Production Cost Comparison

Non-Irrigation Use	Groundwater ($/AF)	Supplemental Water ($/AF)
Fixed Cost	69.00[1]	462.50[3]
Variable Cost	271.00[2]	
Total	340.00	462.50

[1] *Capital costs.*
[2] *Costs for energy, proposed Replenishment Assessment and Operation & Maintenance.*
[3] *Delineation of fixed and variable costs are not available.*



Groundwater Elevations Within The Principal Water-Bearing Zones (Feet Mean Sea Level)

- 0
- 1 to 300
- -100 to -1

Freeways / Highways

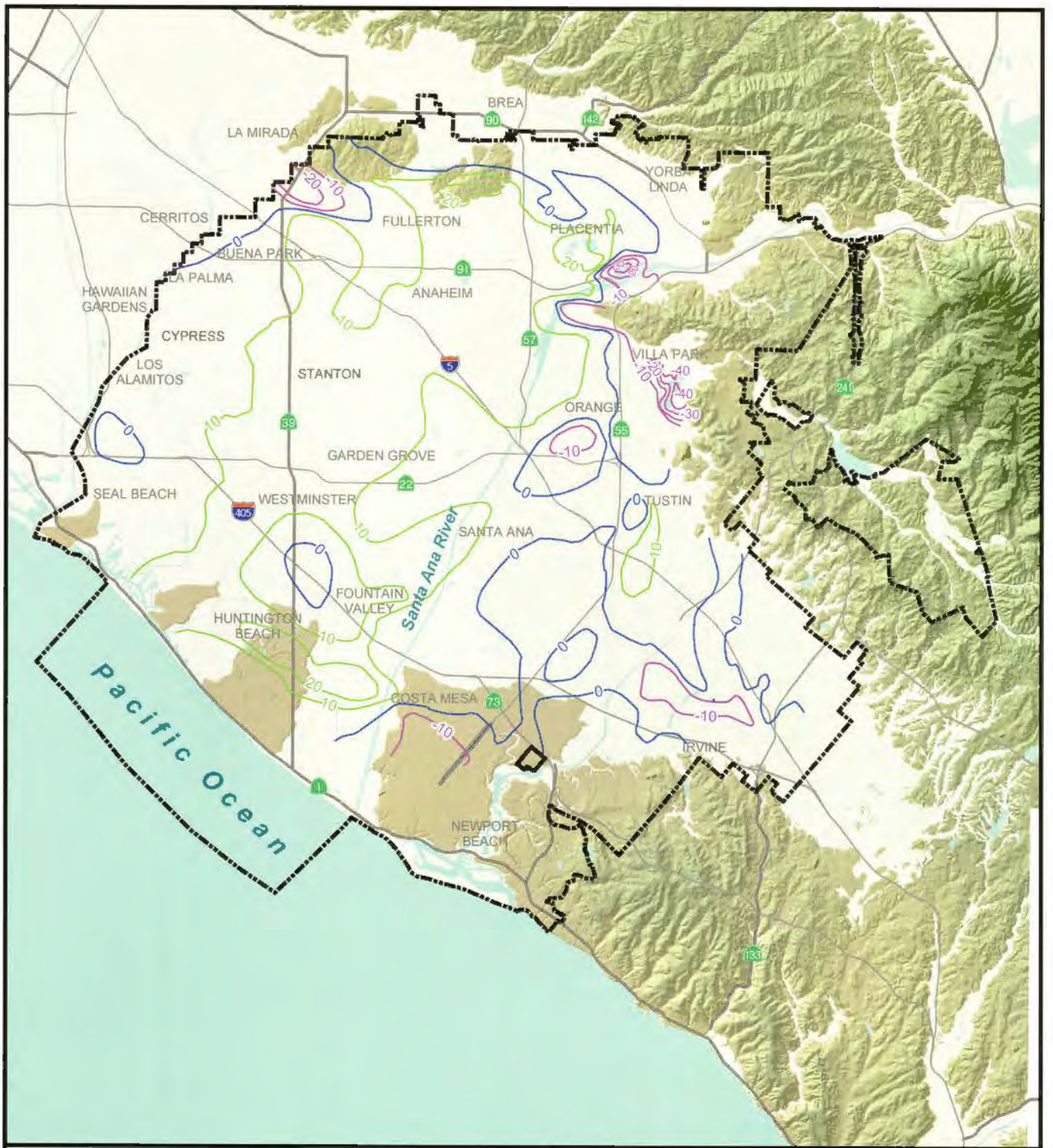
Orange County Water District

Water Features

PLATE 1
GROUNDWATER CONTOUR MAP
NOVEMBER 2002

0 1 2 3 4 5 Miles

N W E S



Change In Elevations Within The Principal Water-Bearing Zones (Feet)

- 0
- 1 to 20
- -10 to -1

Freeways / Highways

Orange County Water District

Water Features

PLATE 2
CHANGE IN WATER LEVEL BETWEEN NOVEMBER 2001 AND 2002

0 1 2 3 4 5 Miles

N
W
E
S
ORANGE COUNTY WATER DISTRICT

PLATE 3
MONITORING WELL HYDROGRAPH TRENDS

Measured water level elevations in feet relative to mean sea level

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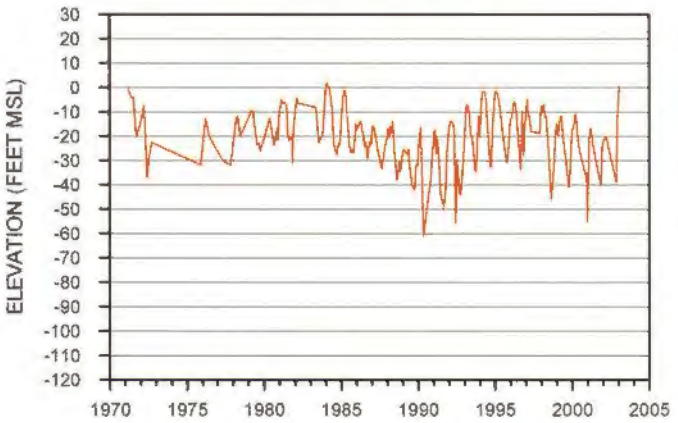

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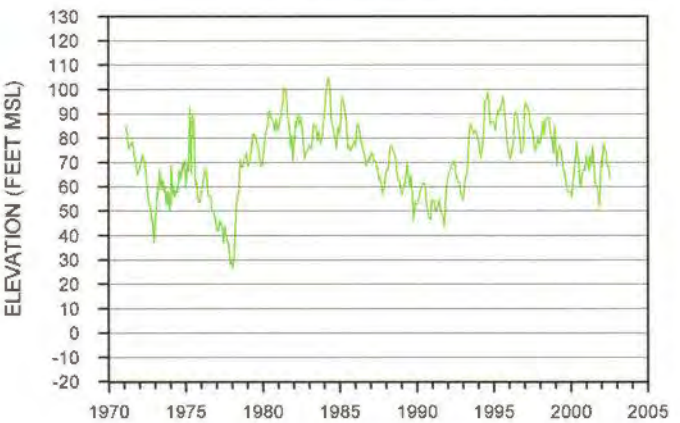

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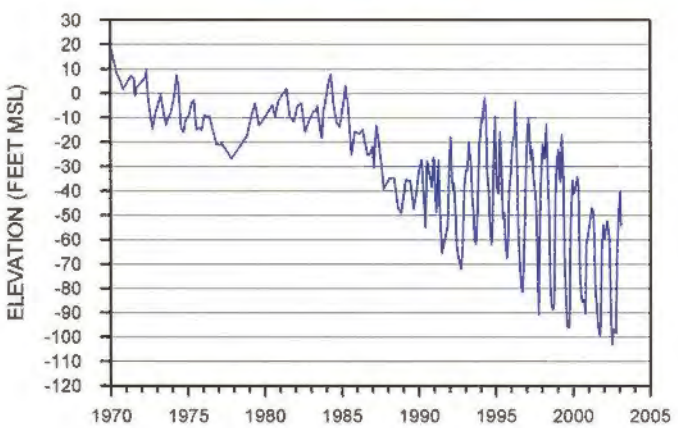

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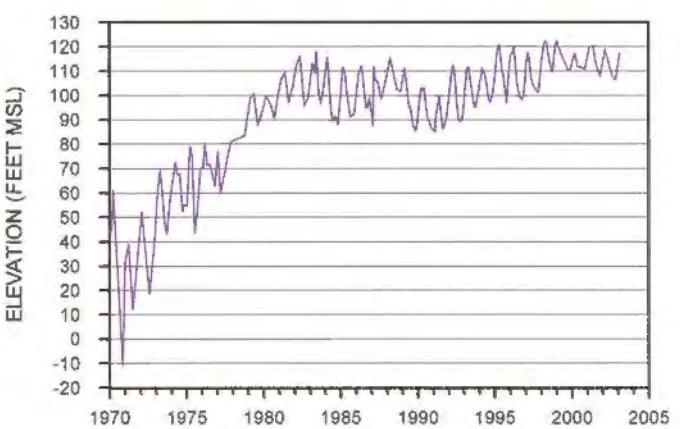

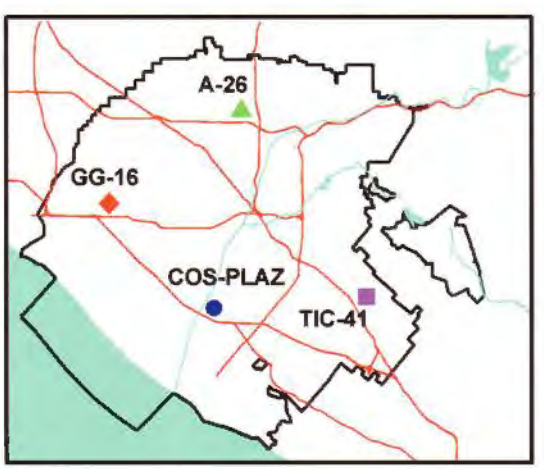

APPENDIX 1. Water Production Data 2001-02

Groundwater Producer	Groundwater (AF)				Supplemental Water (AF)				Actual BPP	Energy	BEA[3]	Reclaimed Water (AF)		
	Non-Irrigation[1]	Irrigation	In-Lieu Program[2]	Total	Non-Irrigation[1]	Irrigation	Conservation Credit[8]	Total	Non-Irrigation[1] and Irrigation	($/AF)	($/AF)	Non-Irrigation[1]	Irrigation[1]	Total
Anaheim, City of	62,900	-	-	62,900	17,237	-	391	17,628	78.1%	48	238	-	-	-
Buena Park, City of	10,915	-	-	10,915	6,670	-	47	6,717	61.9%	35	306	-	-	-
East Orange County Water District	718	-	-	718	429	-	3	432	62.4%	42	299	-	-	-
County of Orange	149	-	-	149	146	-	-	146	50.6%	45	214	-	-	-
Fountain Valley, City of	8,057	-	-	8,057	2,722	-	85	2,807	74.2%	44	297	1,155	-	1,155
Fullerton, City of	23,966	22	-	23,988	8,579	9	117	8,705	73.4/70.7%	49	287/186	-	-	-
Garden Grove, City of	23,261	-	3,306	26,567	4,035	-	239	4,274	86.1%	43	298/224.16[6]	-	-	-
Huntington Beach, City of	24,581	-	-	24,581	10,458	-	234	10,692	69.7%	26	315	-	-	-
Irvine Company, The[4]	-	5,076	-	5,076	-	9,237	-	9,237	35.5%	77	186	-	-	-
Irvine Ranch Water District[4]	27,085	1,303	6,929	35,317	15,243	1,370	111	16,724	68.9/48.8%	52	289/186	8,967	-	8,967
La Palma, City of	2,186	-	-	2,186	434	-	15	449	83.0%	31	310	-	-	-
Mesa Consolidated Water District	14,622	-	-	14,622	5,703	-	172	5,875	71.3%	57	284/0[6]	833	-	833
Newport Beach, City of	13,126	-	-	13,126	5,009	-	42	5,051	72.2%	25	316	390	-	390
Orange, City of [4]	26,175	190	-	26,365	7,375	52	106	7,533	77.8/78.5%	42	249/186	-	-	-
Orange County Water District[5]	8,577	-	-	8,577	n/a	n/a	n/a	0	n/a	n/a	214	14	-	14
Orange Park Acres Mutual Wtr. Co.	133	-	-	133	843	-	-	843	13.6%	45	214	-	-	-
Santa Ana, City of	27,718	-	9,238	36,956	12,534	-	166	12,700	74.4%	60	276	97	-	97
Seal Beach, City of	2,914	-	-	2,914	1,407	-	27	1,434	67.0%	21	320	-	-	-
Serrano Water District[4]	2,563	-	-	2,563	885	-	5	890	74.2%	54	205	-	-	-
Southern California Water Co.	20,473	-	-	20,473	10,407	-	193	10,600	65.9%	40	301	-	-	-
Tustin, City of	9,753	-	-	9,753	4,453	-	60	4,513	68.4%	53	288/0[6]	-	-	-
Westminster, City of	10,809	-	-	10,809	3,466	-	127	3,593	75.1%	36	305	-	-	-
Yorba Linda Water District	11,912	153	-	12,065	8,962	23	43	9,028	57.0/87.0%	26	315/186	-	-	-
Total Major Groundwater Producers	332,593	6,744	19,473	358,810	126,997	10,691	2,183	139,871	73.2/38.7%	-	-	11,456	-	11,456
Other Producers	8,803	3,056	-	11,859	-	-	-	-	100.0/100.0%	-	214/0[7]	-	-	-
Exempt Well Production	917	-	-	917	-	-	-	-	100.0%	-	-	-	-	-
Total All Groundwater Producers	342,313	9,800	19,473	371,586	126,997	10,691	2,183	139,871	72.7%	-	-	11,456	-	11,456
Basin Production Percentage (BPP) for major groundwater producers (excluding irrigation usage and OCWD usage)									72.7%					

[1] *All recycled water is classed as being used for purposes other than commercial agriculture.*

[2] *Imported MWD water purchased for domestic use to offset groundwater pumping.*

[3] *Basin Equity Assessment (BEA). BEA rates for full exemption ($0), partial exemption (varies), irrigation ($186) and non-irrigation (varies) are shown.*

[4] *Agency totals include Santiago Creek diversions above Villa Park Dam that are conveyed to users within OCWD. Such water is included within the classification of "Supplemental Water" as defined in the District Act, and also referred to as "other sources" elsewhere in this report.*

[5] *OCWD's purchase and use of supplemental imported water for groundwater replenishment is not considered as production, and therefore is excluded from this Appendix.*

[6] *Full or partial BEA exemptions for groundwater produced from groundwater quality improvement projects.*

[7] *Irrigation-class producers who do not have access to supplemental water and any producer producing less than 25 af/year are exempt from the BEA.*

[8] *Accounts for only those credits allowed for under the program initiated on September 20, 1995.*

APPENDIX 2. 2001-02[1] Groundwater Production— Non-Irrigation Use Production Over 25 Acre-feet

PRODUCER	ACRE-FEET
AC Products	334.3
Anaheim Cemetery	48.9
Anaheim, City of	62,899.5
Angelica Textile Services – Plant 10	333.4
Appleman and Goldman	88.6
8it O Home LCC	31.9
8ixby Ranch Company	663.1
8uena Park, City of	10,915.1
Canyon RV Park	65.9
Catalina St. Pump Owners	42.4
County of Orange	149.0
Danone Waters of N. America	333.4
Diamond-Newport Ice Corp.	53.8
Donovan Golf Course Mgmt., Inc.	275.8
Eastlake Village HOA	77.1
East Orange County Water District	717.9
Eastside Water Association	288.4
Fairhaven Memorial Park	174.4
FJC U.S.A., Inc./Cypress Golf Club	288.8
Forest Lawn Memorial Park	240.5
Fountain Valley, City of	8,057.2
Fullerton, City of	23,966.3
Garden Grove, City of	23,260.5
Hanson Aggregates West, Inc.	166.4
Harding Water	27.0
Huntington Beach, City of	24,580.6
Hynes Estates, Inc.	87.1
Irvine Ranch Water District	27,085.2
Knott's Berry Farm	346.0
La Palma, City of	2,186.4
Los Alamitos Race Course	267.6
Magic Lamb Mobile Home Park	25.1
MDJ Management	438.5
Mesa Consolidated Water District	14,621.5
Mesa Verde Country Club	321.6
Midway City Mutual Water Co.	112.1
Mile Square Golf Course	316.7
Navy Golf Course	622.6
Newport Beach Golf Course	126.8
Newport Beach, City of	13,126.0
Niagara Drinking Water	113.9
Oasis Drinking Waters	39.5
Orange, City of	26,174.9
Orange County Water District	8,576.9
Orange Park Acres Mutual Water Co.	132.8
Orange Park Community Assn.	42.6
Page Avenue Mutual Water Co.	48.6
R.J. Noble Company	38.6
River View Golf	352.5
Robertson's Ready Mix	194.0
Santa Ana, City of	27,717.6
Santa Ana Country Club	242.4
Seal Beach, City of	2,914.1
Serrano Water District	2,562.7
South Midway City Water Co.	90.6
Southern California Water Co.	20,473.2
The Good Shepherd Cemetery	40.6
Tustin, City of	9,753.0
Villa Capri Mobile Home Park	47.8
Walt Disney Product Division	40.2
Westminster Memorial Park	398.0
Westminster, City of	10,809.8
Woodbridge Village Homeowners Assoc.	154.0
Yorba Linda Country Club	361.3
Yorba Linda Water District	11,912.4
Total	340,995.4

[1] *Water year begins July 1.*

APPENDIX 3. 2001-02[1] Groundwater Production— Irrigation Use Production Over 25 Acre-feet

PRODUCER	ACRE-FEET	PRODUCER	ACRE-FEET
A-B Nursery	47.3	Laguna Farms	37.4
C. J. Segerstrom & Sons	53.2	Orange, City of	189.9
Crimson Farms	149.8	Pursche, Roy	720.5
Fairhaven Memorial Park	27.1	Sakioka Farms	141.3
Fujishige, Hiroshi	69.5	Seaview Ag, LLC	1,213.2
Irvine Company, The	5,075.5	Shozi Brothers	54.4
Irvine Ranch Water District	1,303.4	Village Nurseries	179.4
Ito-Ozawa Farms	268.5	Yorba Linda Water District	152.6
		Total	9,683.0

[1] *Water year begins July 1.*

APPENDIX 4. Typical Groundwater Extraction Facility Characteristics 2001-02

PARAMETER	NON-IRRIGATION	IRRIGATION
System Pressure	70 psi	22 psi
Load (Use) Factor	60 percent	30 percent
Efficiency	65 percent	65 percent
Design Flow Rate	2,000 gpm	1,000 gpm
Motor Horsepower	200 hp	60 hp
Type Motor	Electric	Electric
Well Casing Diameter	20 inches	12 inches
Depth of Well	1,100 feet	700 feet
Type of Pump	Vertical Turbine	Vertical Turbine
Depth of Bowls	300 feet	140 feet
Average Lift	280 feet	123 feet
System Discharge Pressure	161 feet	20-50 feet
Total Pumping Lift	441 feet	153 feet
Estimated Life	30 years	30 years
Annual Cost of Facilities[1]	$86,359	$34,544

[1] *Based on an interest rate of 6 percent amortized over a 30-year period. Cost for land not included.*

APPENDIX 5. Reclaimed Water Production and Usage 2001-02

RETAIL AGENCY	ACRE-FEET
Green Acres Project	
Fountain Valley, City of	1,155
Huntington Beach, City of	0
Mesa Consolidated Water District	833
Newport Beach, City of	390
Santa Ana, City of	97
Orange County Sanitation District (serves own sites)	4,089
Orange County Water District (serves own site)	14
Green Acres Project Total	6,678
Green Acres Project (excluding service to OCSD)	2,489
Irvine Ranch Water District	8,967
Total Usage	11,456

APPENDIX 6. 2001-02 Water Resources Summary

	2001-2002 Water Year (AF)	2000-2001 Water Year (AF)	Change from last year to this year (AF)
SUMMARY OF BASIN CONDITIONS			
BASIN SUPPLIES			
Supplemental/Nonlocal Recharge Water	41,185	66,930	(25,745)
Natural Flows (SAR & Santiago Creek)	164,919	212,012	(47,093)
Incidental Recharge[1]	45,000	59,047	(14,047)
Seawater Barriers (with Deep Wells)	16,380	12,487	3,813
TOTAL	267,405	350,477	(83,071)
BASIN LOSSES			
Groundwater Production (with Deep Wells)	352,113	350,386	1,727
River Flow Lost to Ocean	930	34,665	(33,735)
TOTAL	353,043	385,051	(32,008)
BASIN STATUS			
Change in Storage – Surface Water & Groundwater[1]	(77,620)	(31,752)	(46,046)
Basin Operation Storage[2] – Producible from Storage	294,485	372,105	(77,620)
Basin Operation Storage[2] – Recharge Storage	405,515	327,895	77,620
OTHER KEY INFORMATION			
1. Imported Deliveries to Producers[3]	157,161	142,940	14,221
2. Producers' Seasonal Storage Program:	26,899	26,087	812
Short-term In-Lieu (Put & Take)	7,426	7,447	(21)
Long-term In-Lieu (OCWD)	19,472	18,640	832
3. Basin Production Percentage (includes OCWD In-Lieu)	73%	75%	(2%)
4. Total Water Demand	512,154	504,144	8,010
5. Wellhead Treatment/Water Reclamation Projects:			
Arlington Desalter	5,820	5,178	642
Other OCWD Wellhead Treatment Projects	14,181	7,482	6,699
Green Acres Project (without Deep Wells)	6,578	7,994	(1,416)
Water Factory 21 (without Deep Wells)	4,160	1,630	2,530
6. Fountain Valley water to WF-21 (w/o City wells)	2,673	942	1,731
7. Deep Well Water for WF21 & GAP	4,523	8,913	(4,390)
8. Base flow of Santa Ana River	151,667	152,964	(1,298)
9. Effluent discharge to SAR above Prado Dam	150,622	145,432	5,190
10. SBVMWD High Groundwater Mitigation Project[4]	4,296	2,788	1,508
11. Prado Wetlands Inflow (4/01 – 6/01 flow unavailable)	52,575	42,731	9,844
12. SARI Flow at Prado	8,078	9,081	(1,003)
13. Year-end Storage behind Prado Dam	0	0	0
14. Year-end Storage in Deep Basins	9,179	19,799	(10,620)
15. Total Artificial Recharge (Percolation + Barriers)	229,492	259,764	(30,272)
16. Rainfall (inches)	4.2	14.5	(10.3)
17. OCSD Discharge to Ocean	262,390	269,018	(6,628)

[1] *Estimated.*

[2] *Based on water in storage above 1956 low basin level.*

[3] *Includes water from "Other Sources" and In-lieu, but excludes imported water used for groundwater replenishment.*

[4] *The quantity of SBVMWD water received by OCWD for the water years 1998-99 through 2000-01 was determined after release of the 2000-01 Engineer's Report. The water received is as follows: zero in 1998-99; zero in 1999-2000; 2,788 acre-feet in 2000-01.*

APPENDIX 7. Non-Local Water Received Into OCWD Groundwater Basin For Water Years 1990-91 through 2001-02

Water Year	Arlington Desalter AF	Alamitos Barrier AF	Talbert Barrier[1] AF	Forebay Recharge AF	In-Lieu Program AF	Basin Water Supply Mgmt. Program AF	SAR Upstream Transfers		Total AF
							Western MWD AF	San Bernardino Valley MWD[2] AF	
1990-91	4,490.7	1,933.1	-	15,619.0	44,738.6	-	-	-	66,781.4
1991-92	3,325.7	1,623.0	-	51,691.9	39,788.7	-	-	-	96,429.3
1992-93	2,952.7	1,614.0	-	26,293.4	38,900.3	-	-	-	69,760.4
1993-94	5,158.9	1,432.6	-	78,521.3	48,133.9	-	2,093.8	-	135,340.5
1994-95	1,930.3	798.3	-	15,354.2	15,622.2	-	2,343.2	-	36,048.2
1995-96	2,770.6	1,691.6	-	15,278.7	5,542.4	-	888.2	-	26,171.5
1996-97	6,176.2	1,885.5	-	33,742.7	7,883.0	-	2,958.0	-	52,645.4
1997-98	2,516.9	1,613.8	-	19,029.4	-	27,674.9	701.8	-	51,536.8
1998-99	2,351.3	1,493.6	-	10,371.5	-	13,351.9	996.1	-	28,564.4
1999-00	4,994.6	1,873.6	-	28,478.1	24,726.0	13,280.8	-	-	73,353.1
2000-01	5,177.9	1,672.5	941.7	59,138.4	11,191.0	7,449.0	-	2,787.6	88,358.1
2001-02	5,819.8	2,282.2	2,673.0	30,092.6	19,472.4	-	2,990.3	4,296.4	67,626.7
Total	47,665.6	19,913.8	3,614.7	383,611.2	255,998.5	61,756.6	12,971.4	7,084.0	792,615.8

[1] *Includes only water delivered from MWD connection OC32A for use in Talbert Barrier. Groundwater purchased from City of Fountain Valley for use in Talbert Barrier is excluded from reported quantities because it is categorized as local water.*

[2] *Quantities of SBVMWD received by OCWD for the water years 1998-99 through 2001-02 as determined by the Santa Ana River Watermaster.*

APPENDIX 8. Values Used in Figure 7 for Water Rates for Non-Irrigation Use

Water Year	Replenishment Assessment $/AF	Groundwater Production Cost[1] $/AF	MWD Treated Interruptible Rate (In-Lieu Program)[2] $/AF	MWD Treated Non-Interruptible Rate (Full Service) $/AF
1985-86	32	85	—	225
1986-87	32	91	—	225
1987-88	32	91	—	225
1988-89	42	105	—	231
1989-90	45	119	136	231
1990-91	48	91	137	232
1991-92	51	100	156	263
1992-93	60	116	206	325
1993-94	65.50	124	257	389
1994-95	88	145	279	416
1995-96	85	140	338	478
1996-97	88	140	344	486
1997-98	91	141	315	456
1998-99	94	143	317	458
1999-00	100	150	317	458
2000-01	107	150	317	458
2001-02	117	162	317	458
2002-03	127	176	307	454
2003-04[3]	149	203	239	462.50

[1] *Includes RA plus cost of energy to produce groundwater.*
[2] *MWD Treated Water Long-Term Seasonal Storage Rate.*
[3] *Estimated.*

Orange County Water District
P.O. Box 8300
Fountain Valley, California 92728-8300
714/378-3200 Fax 714/378-3373
www.ocwd.com