



ORANGE COUNTY WATER DISTRICT

2000-2001

Engineer's Report

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

2000-2001
ENGINEER'S REPORT ON
GROUNDWATER CONDITIONS,
WATER SUPPLY AND BASIN UTILIZATION
IN THE
ORANGE COUNTY WATER DISTRICT

FEBRUARY 2002

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ORANGE COUNTY WATER DISTRICT

February 13, 2002

Mr. William R. Mills Jr., P.E.
General Manager
Orange County Water District
Post Office Box 8300
Fountain Valley, CA 92728-8300

Dear Mr. Mills:

In accordance with Section 26 of the District Act, the 2000-2001 Engineer's Report is hereby submitted.

Precipitation for the water year July 1, 2000 through June 30, 2001 was 8% above normal (total of 14.5 inches), which followed the previous year's rainfall that measured 62% below normal. Santa Ana River flow past Prado Dam was 7% above the 30-year average, totaling 221,610 acre-feet for the water year. Flow past the District's spreading grounds that was lost to the ocean totaled 34,665 acre-feet.

Total water demand within the District plus water used for seawater intrusion barriers and groundwater replenishment for the water year was 572,705 acre-feet, which is an increase of approximately 1% from the prior year. Imported water purchased and received in 2000-01 for groundwater recharge at the District's Forebay facilities totaled 64,316 acre-feet (includes water from Arlington Desalter). Groundwater production within the basin totaled 369,025 acre-feet (includes In-Lieu Program water) for the water year, which is a decrease of 4% from the prior year.

Accumulated basin overdraft increased from 296,000 acre-feet in June 2000 to 328,000 acre-feet in June 2001, an increase of 32,000 acre-feet. The current accumulated basin overdraft is approximately 47% 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 2002-03 Replenishment Assessment allocated for District replenishment water purchases could equal the amount necessary to purchase up to 97,000 acre-feet.

Very truly yours,

Steven R. Conklin, P.E.
Associate General Manager



Charles Z. Steinbergs, P.E.
Senior Engineer



EXECUTIVE SUMMARY

Total water demand within Orange County Water District (OCWD) was 504,144 acre-feet for the 2000-01 water year (beginning July 1, 2000 and ending June 30, 2001), a 4 percent decrease from the previous year's total demand of 526,397 acre-feet. Groundwater production (including In-Lieu Program water) for the water year totaled 369,025 acre-feet, a 4 percent decrease from the previous year's total of 383,369 acre-feet. For the water year, a total of 64,655 acre-feet (includes water from Arlington Desalter) was purchased for groundwater replenishment at the District's Forebay facilities. Total water demand plus water used for seawater intrusion barriers and groundwater replenishment for the water year was 572,705 acre-feet.

As in previous years, District staff estimated the change in basin storage by evaluating the change in measured groundwater levels from November 2000 to November 2001. As of November 2001, the groundwater levels throughout the basin, when averaged, lowered 8 feet from the prior year. For the water year, which ended June 30, 2001, it is estimated that the basin storage decreased by 32,000 acre-feet when compared to the same time one year earlier. Furthermore, on November 1, 2001, the basin storage had decreased by 60,000 acre-feet when compared to one year earlier. Precipitation within the basin was 8 percent above normal during the water year, totaling 14.5 inches.

Based on the groundwater basin conditions for the water year ending June 30, 2001, OCWD may purchase up to 97,000 acre-feet for groundwater basin replenishment during the ensuing water year, beginning July 1, 2002, 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
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
City of Westminster
Yorba Linda Water District

The cooperation received from all agencies is gratefully acknowledged.

This report is based on the 2000-01 Basic Data Report, which is placed on file in the District office.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY.....	i
ACKNOWLEDGMENTS.....	ii
GLOSSARY OF ACRONYMS.....	vi
PART I: GROUNDWATER CONDITIONS.....	1
2000-01 Summary of Findings.....	1
Basin Hydrology.....	2
Groundwater Production.....	2
Basin Production Percentage.....	4
Groundwater Levels.....	4
Coastal Groundwater Conditions.....	6
Groundwater Basin Overdraft.....	6
Replenishment Recommendation.....	8
Recommended Basin Production Percentage.....	9
PART II: WATER SUPPLY AND BASIN UTILIZATION.....	10
2000-01 Summary of Findings.....	10
Supplemental Water.....	11
Availability of Supplemental Replenishment Water.....	13
Wastewater Reclamation.....	13
Water Demands and Usage.....	13
Water Quality.....	14
Water Resources Data.....	15
Water Conservation.....	15
Water Demand Forecast.....	17
PART III: WATER PRODUCTION COSTS FOR ENSUING YEAR (2002-03).....	18
Summary of Findings.....	18
Groundwater Production Costs for Non-Irrigation Use.....	19
Groundwater Production Costs for Irrigation Use.....	19
Cost of Supplemental Water.....	20

LIST OF TABLES

No.		Page
1	Historical Groundwater Production Within Orange County Water District	3
2	2002-03 Water Budget for Purchase of Replenishment Water	9
3	2000-01 Supplemental Water Usage.....	12
4	In-Lieu Program 2000-01 Water Deliveries	12
5	Water Demands Within Orange County Water District	14
6	2000-01 Water Quality Summary.....	16
7	2002-03 Groundwater Production Costs.....	20
8	2002-03 Supplemental Water Costs	21
9	2002-03 Water Production Cost Comparison.....	22

LIST OF FIGURES

No.		Page
1	Groundwater Production.....	3
2	Groundwater Basin Production Percentage.....	4
3	Average Piezometric Elevations	5
4	Accumulated Basin Overdraft	8
5	Historical Supplemental Water Usage.....	11
6	Water Demand Projections	17
7	Adopted and Projected Water Rates for Non-Irrigation Use	22

LIST OF PLATES

No.		Page
1	Groundwater Contour Map, November 2001	23
2	Change in Water Level, November 2000 to November 2001	24
3	Monitoring Well Hydrograph Trends	25

APPENDICES

No.		Page
1	Water Production Data 2000-01	26
2	2000-01 Groundwater Production – Non-Irrigation Use Production Over 25 Acre-feet	27
3	2000-01 Groundwater Production – Irrigation Use Production Over 25 Acre-feet	28
4	Typical Groundwater Extraction Facility Characteristics 2000-01	29
5	Reclaimed Water Production and Usage 2000-01	29
6	2000-01 Water Resources Summary	30
7	Non-Local Water Purchases by Orange County Water District for Water Years 1990-91 through 2000-01.....	31
8	Values Used in Figure 7 for Water Rates for Non-Irrigation Use.....	32

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
MWDOC	Municipal Water District of Orange County
OCS	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 District 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, 2000 to June 30, 2001 water year are as follows:

GROUNDWATER CONDITIONS 2000-01 SUMMARY OF FINDINGS

1. Groundwater production totaled 350,385 acre-feet for the 2000-01 water year.
2. Groundwater stored in OCWD's basin decreased by 32,000 acre-feet for the water year.
3. Accumulated overdraft on the last day of the 2000-01 water year was 328,000 acre-feet.¹
4. Annual overdraft for the 2000-01 water year was 119,000 acre-feet.
5. Average annual overdraft for the immediate past five water years (1996-97 to 2000-01) was 84,000 acre-feet.
6. Estimated annual overdraft for the 2001-02 water year is 95,000 acre-feet.
7. Estimated accumulated overdraft for the 2001-02 water year is 337,000 acre-feet.
8. Estimated annual overdraft for the 2002-03 water year is 95,000 acre-feet.
9. Under the provisions of Section 27 of the District Act, a portion or all of the 2002-03 Replenishment Assessment (RA) could be equal to an amount necessary to purchase 97,000 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 2000-01. 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, 2001. Prior to 1992, the monthly data was not available to make the adjustment to June basin conditions.

² The replenishment limit is determined by adding the five-year annual average overdraft (84,000 acre-feet) to one-tenth of the difference between the accumulated overdraft (328,000 acre-feet) and the "target" dewatered basin storage (200,000 acre-feet), which results in the following: $84,000 \text{ acre-feet} + [(328,000 - 200,000 \text{ acre-feet}) \times 0.10] = 96,800 \text{ acre-feet}$ (or 97,000 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, 2000 yielded 14.5 inches of rainfall on average within OCWD, which is 8 percent above the normal 13.4 inches. Stream flow in the Santa Ana River was 7 percent above normal for the water year, totaling 221,610 acre-feet of flow through Prado Dam, a 14,723 acre-foot increase over the 30-year average of 206,887 acre-feet.

GROUNDWATER PRODUCTION

Groundwater production from wells within OCWD for the 2000-01 water year totaled 350,385 acre-feet: 342,206 acre-feet for non-irrigation uses (all exempt uses are included) and 8,179 acre-feet for irrigation uses. This year's groundwater production increased 1 percent from the previous year's total of 345,362 acre-feet. The non-irrigation category of use showed an increase for groundwater production over the previous water year's total, while the irrigation use showed a decrease for the same comparative period.

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 18,640 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 1957-1958 through 2000-01 are presented in Figure 1 and Table 1. Without the In-Lieu Program, groundwater production would have reached 369,025 acre-feet for the 2000-01 water year

2000-01 groundwater production for producers producing over 25 acre-feet per year for non-irrigation and irrigation purposes, are listed in Appendices 2 and 3, respectively.

FIGURE 1. Groundwater Production

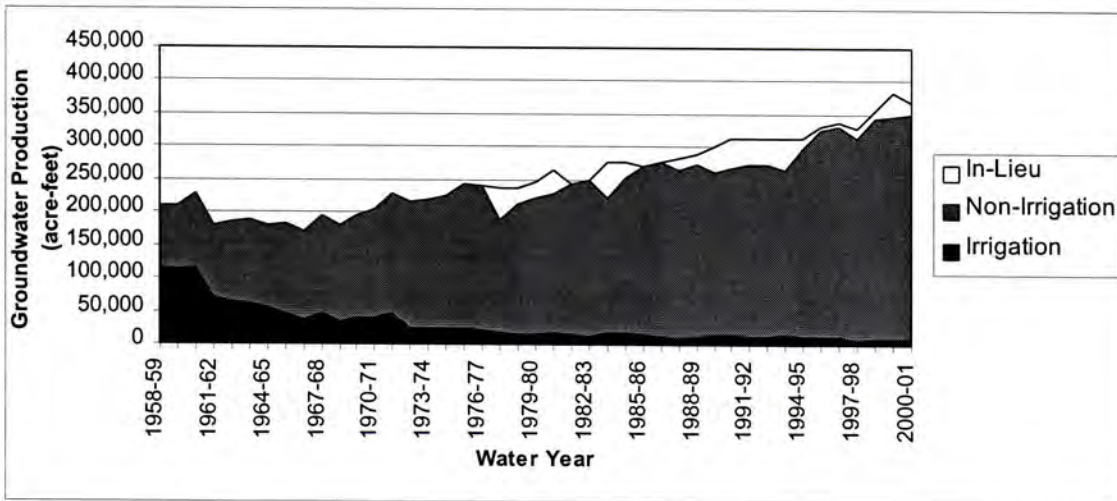


TABLE 1. Historical Groundwater Production Within Orange County Water District

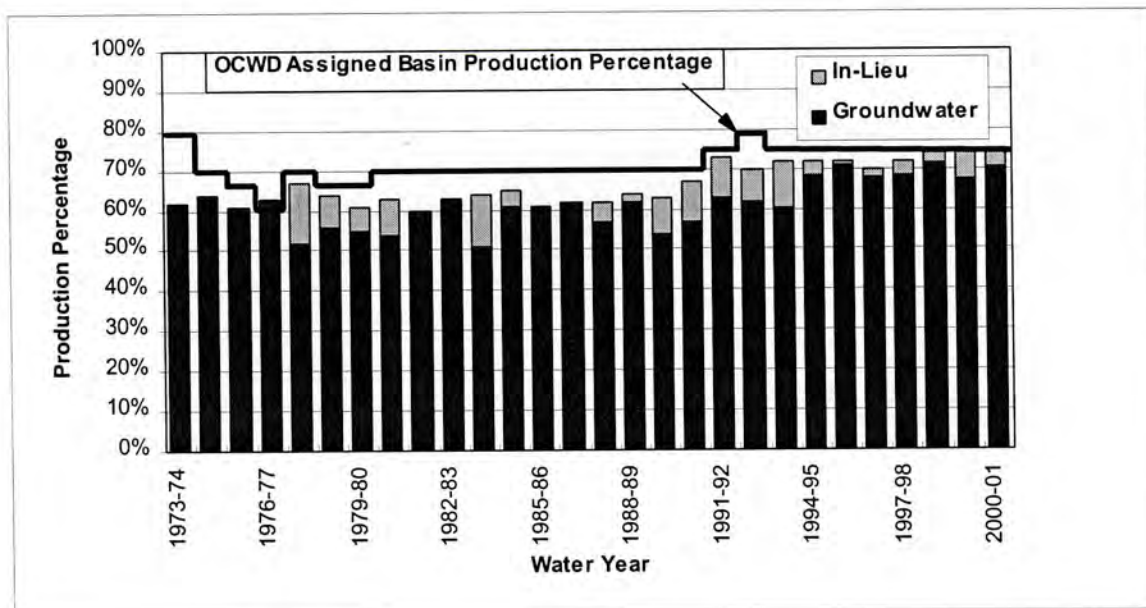
Water Year Jul 1-Jun 30	Groundwater Production (acre-feet)	In-Lieu Program (acre-feet)	Water Year Jul 1-Jun 30	Groundwater Production (acre-feet)	In-Lieu Program (acre-feet)
1957-58	160,258	-	1979-80	221,453	24,861
1958-59	208,571	-	1980-81	228,943	36,373
1959-60	207,448	-	1981-82	244,184	-
1960-61	226,025	-	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

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 2000-01 water year was established at 75 percent by the OCWD Board of Directors in April 2000. The actual 2000-01 BPP achieved by the District’s major groundwater producers, including In-Lieu Program deliveries, was 74.7 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 2001 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

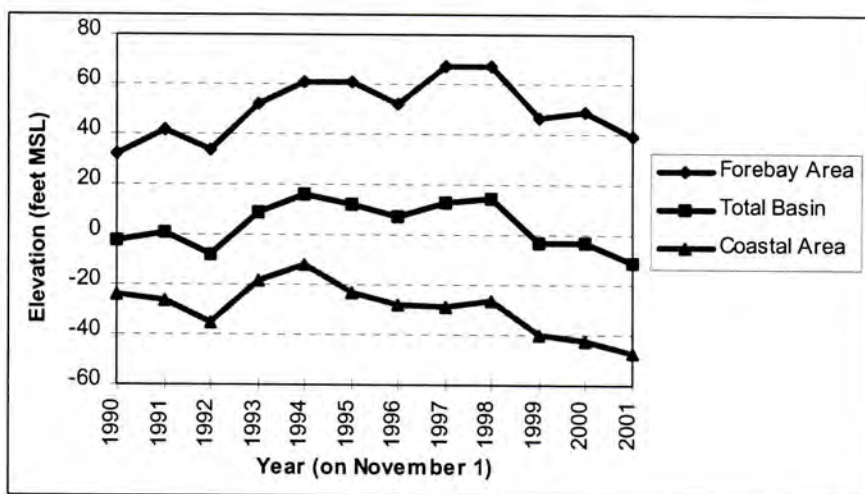
sea level in coastal and western areas of the basin. A general indicator of changing basin levels is the zero (0) mean sea level elevation contour line. The “zero contour line” shifted approximately 0.5 mile inland in the vicinity of the cities of Anaheim and Orange, but remained relatively stable in other areas when compared to its alignment in the prior year.

Plate 2 shows changes in groundwater levels from November 2000 to November 2001. As shown on this plate, changes in water levels in the central and coastal portions of the basin ranged from essentially unchanged to slightly lower (i.e., a change of minus 10 feet). The Irvine area showed a decrease in water levels (5 to 20 feet), which may have resulted from increased pumping during September and October 2001 by the Irvine Company and the Irvine Ranch Water District (IRWD). The net result of the water level changes in the basin was an estimated overall decrease of 60,000 acre-feet in the amount of groundwater storage in the basin as of November 2001.

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 2001.

Based on Figure 3, during the five-year period of November 1, 1996 to November 1, 2001, average water levels in the District’s Forebay (intake) area decreased 13 feet and average water levels in the Pressure (coastal) area decreased 19 feet. For this five-year period, the overall average water level for the whole basin decreased 18 feet. Although average basin water levels have decreased approximately 18 feet over the last five years, water level declines of approximately 35 feet have been observed in the north Costa Mesa area during the same time period.

FIGURE 3. Average Piezometric Elevations



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, 2001, groundwater production from the cities of Fountain Valley, Huntington Beach, Newport Beach, Seal Beach, and Westminster as well as Irvine Ranch Water District, Mesa Consolidated Water District and Orange County Water District totaled 94,000 acre-feet, an increase of approximately 1 percent from the previous year. The Talbert and Alamitos Barriers injection totaled approximately 12,500 acre-feet for the 2000-01 water year, a quantity that was unchanged from the prior year.

Coastal groundwater levels typically reach their lowest point during the period of August through September. Minimum water levels in summer 2001 were generally lower by 5 to 10 feet when compared to the minimum levels from the prior year's summer. However, when comparing summer 2001 with summer 1999 (i.e., two years prior), the minimum water levels were essentially unchanged.

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 2000-01 water year, it is estimated that the volume of groundwater in storage decreased by 32,000 acre-feet. In addition, approximately 87,000 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) and Arlington Desalter water. The annual overdraft for the 2000-01 water year is 119,000 acre-feet (the sum of the amount of decrease in storage plus the amount percolated or injected). During the five years from July 1, 1996 to June 30, 2001, an annual average of 61,300 acre-feet of supplemental water and recycled water (sources include Alamitos Barrier and In-Lieu Program; Colorado River, State Water Project, Bunker Hill Basin transfers and Water Factory 21) 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 84,000 acre-feet. Average seasonal rainfall in the OCWD service area

during this five-year period was 14.5 inches, or 8 percent over 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 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 utilized for the past several years as the appropriate accumulated overdraft level for the basin. This level reflects OCWD's increased capabilities to capture Santa Ana River flows through its conservation program at Prado Dam and its expanded recharge facilities. The target dewatered storage of 200,000 acre-feet is used as a component of the equation to determine the annual water budget for purchase of replenishment water (see Replenishment Recommendation section).

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, 2001 show an accumulated overdraft of approximately 381,000 acre-feet, as shown in Figure 4. For the 2000-01 water year, which ended June 30, it is estimated (by means of back-calculating from November 1, 2001 to June 30, 2001) that the accumulated overdraft totaled 328,000 acre-feet.

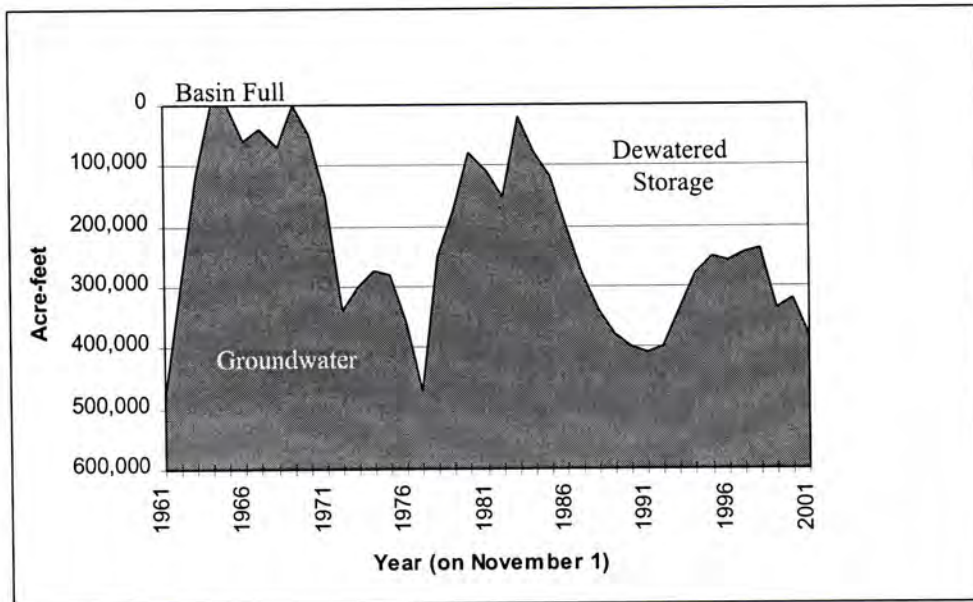
Projected annual overdraft for the current water year (2001-02) is estimated to be 95,000 acre-feet. This estimate is based on the assumption that annual groundwater production for the current water year will total 375,000 acre-feet (including In-Lieu Program water) and that natural replenishment will total 280,000 acre-feet. Projected accumulated overdraft for 2001-02 is estimated to be 337,000 acre-feet.

Projected annual overdraft for the ensuing water year (2002-03) is estimated to be 95,000 acre-feet. This estimate is based on the assumption that annual groundwater production for the ensuing water year will total 380,000 acre-feet and that natural replenishment will total 285,000 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). For the 2000-01 water year, MWD supplied 7,449 acre-feet for storage. As of June 30, 2001, a total of 61,757 acre-feet has been delivered and stored in the basin under this program.

FIGURE 4. Accumulated Basin Overdraft



REPLENISHMENT RECOMMENDATION

The District Act allows the Board of Directors to determine a Replenishment Assessment that would provide the funds necessary to purchase sufficient water to replenish the average annual overdraft for the immediate past five years, plus an additional amount of water sufficient to mitigate the accumulated overdraft of not less than 10 years nor more than 20 years. As explained earlier, the accumulated overdraft (328,000 acre-feet for 2000-01) less the target dewatered storage (200,000 acre-feet), will be used to determine the required quantity of replenishment water needed for the ensuing 2002-03 water year.

Based on the 2000-01 water year, the five-year (July 1, 1996 through June 30, 2001) average annual overdraft is 84,000 acre-feet, and one-tenth of the accumulated overdraft (i.e., herein used 10 years to complete refill effort) less the target dewatered storage equals 12,800 acre-feet [i.e., $(328,000 - 200,000 \text{ acre-feet})/10 \text{ years}$]. Therefore, in accordance with Section 27 of the District Act, the portion of the Replenishment Assessment levied in 2002-03 for the purchase of replenishment water could equal the amount necessary to purchase the sum of the two quantities, which equals 97,000 acre-feet (rounded).

Table 2 presents the estimated 2002-03 budget required to purchase 97,000 acre-feet of replenishment water.

**TABLE 2. 2002-03 Water Budget
for Purchase of Replenishment Water**

Water Source	Acre-Feet	Cost (\$/AF)	Total Costst
Alamitos Barrier	4,000	\$455 ¹	\$ 1,820,000
Arlington Desalter	5,000	\$233	\$ 1,165,000
City of Fountain Valley	4,000	\$410 ²	\$ 1,640,000
City of Huntington Beach	4,000	\$447 ³	\$ 1,788,000
San Bernardino Valley MWD	16,000	\$150	\$ 2,400,000
Water Factory 21	5,000	\$435	\$ 2,175,000
Replenishment Water	59,000	\$249 ⁴	\$14,718,000
TOTAL	97,000	—	\$25,706,000

¹ Equals MWD treated non-interruptible water rate plus CBMWD surcharge (includes RTS and CM charges).

² Estimated melded rate for a combination of MWD treated non-interruptible water and City well water. Rate includes estimated RTS, CR and CM charges and MWDOC surcharge.

³ Rate includes MWD treated non-interruptible water rate plus estimated RTS, CR and CM charges and MWDOC surcharge.

⁴ Equals MWD untreated interruptible water rate plus RTS and CMC charges and MWDOC surcharge.

RECOMMENDED BASIN PRODUCTION PERCENTAGE (BPP)

For the 2002-03 water year, a BPP of 75 percent is recommended. This recommendation is based on the projected availability of groundwater supplies in the basin and on the availability of supplemental water supplies.

In order to achieve water quality objectives in the groundwater basin, it is recommended for the water year 2002-03 that additional production (above the 75 percent BPP) be allowed for the cities of Garden Grove, Orange and 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 2002-03 the cities of Anaheim and Orange, and MCWD be encouraged to continue participating in the Demonstration Coastal Pumping Transfer 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 75% BPP and for MCWD to limit its groundwater production to below the 75% BPP.

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 2000-01 SUMMARY OF FINDINGS

1. Water usage from all supplemental sources totaled 191,230 acre-feet for the 2000-01 water year.
2. Water usage from other sources for the 2000-01 water year totaled 3,230 acre-feet.
3. Water served through the In-Lieu Program totaled 18,640 acre-feet for the 2000-01 water year.
4. Water demand within OCWD totaled 504,144 acre-feet for the 2000-01 water year.
5. Estimated demand for imported water for the 2002-03 water year is 124,000 acre-feet.
6. Water available for groundwater recharge is expected to exceed the recharge budget limit of 97,000 acre-feet in the 2002-03 water year.

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 2000-01 water year, use of supplemental water in the OCWD service area totaled 191,230 acre-feet: 105,660 acre-feet used directly by water agencies and 85,570 acre-feet used for groundwater replenishment. Water agencies’ uses included 114,069 acre-feet for municipal and industrial use and 10,231 acre-feet for agricultural purposes; groundwater replenishment included 18,640 acre-feet for the In-Lieu Program. Historical supplemental water usage for the 2000-01 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 2000-01 is presented in Appendix 7.

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

FIGURE 5. Historical Supplemental Water Usage

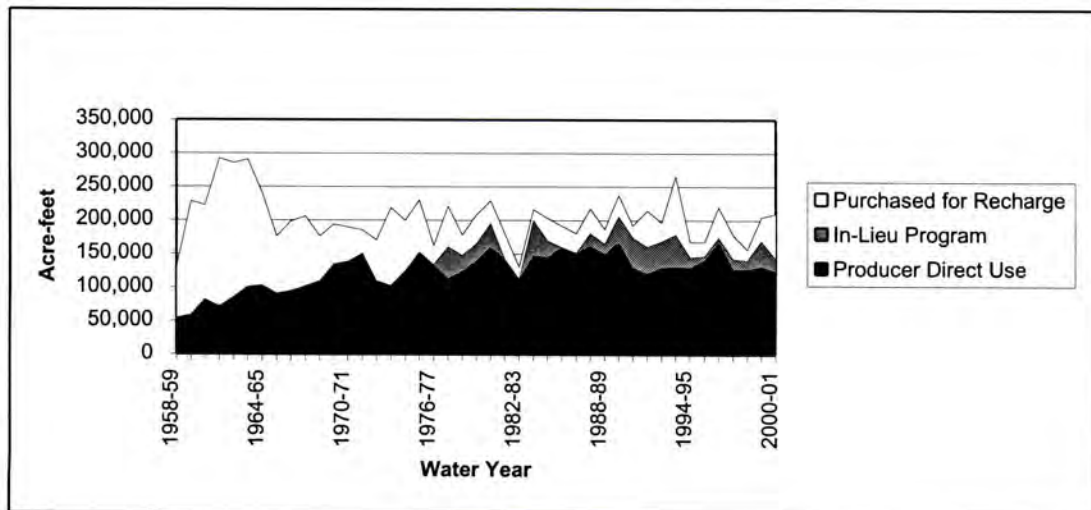


TABLE 3. 2000-01 Supplemental Water Usage

Direct Agency Use	Acre-feet
Agencies	121,069
Other Sources	3,230
Subtotal	124,299
Groundwater Replenishment	
In-Lieu Program	18,640 ¹
Forebay Recharge	59,138
Arlington Desalter	5,178
Alamitos Barrier	1,673
Talbert Barrier	942
Subtotal	85,571 ²
TOTAL	209,870

¹ For the water year 2000-01, 7,449 acre-feet of In-Lieu Program water is designated as Basin Water Supply Management Program water under terms of the September 1, 1997 Basin Water Supply Management Agreement between OCWD and MWD.

² San Bernardino Valley Municipal Water District water was received into the OCWD basin as of June 30, 2001. However, finalization of the quantity received was not determined until after February 2002 and is not included in this report. The quantity received will be reported in the 2001-02 Engineer's Report.

For the 2000-01 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 18,640 acre-feet for the 2000-01 water year, as shown in Table 4.

**TABLE 4. In-Lieu Program
2000-01 Water Deliveries**

Agency	Acre-feet
City of Fountain Valley	381
City of Garden Grove	2,810
City of Huntington Beach	1,745
City of Newport Beach	1,863
Irvine Ranch Water District	8,000
Mesa Consolidated Water District	3,841
TOTAL	18,640¹

¹ For the water year 2000-01, 7,449 acre-feet of In-Lieu Program water is designated as Basin Water Supply Management Program water under terms of the September 1, 1997 Basin Water Supply Management Agreement between OCWD and MWD.

AVAILABILITY OF SUPPLEMENTAL REPLENISHMENT WATER

For the 2002-03 water year, availability of supplemental water is anticipated primarily from the Colorado River and State Water Project, which are imported by MWD. It is estimated that supplemental water available for groundwater replenishment during 2002-03 will exceed 97,000 acre-feet, which is the quantity budgeted for groundwater replenishment.

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 2000-01 water year, GAP and IRWD produced 10,820 acre-feet of recycled wastewater as detailed in Appendix 5.

At WF-21 and the Talbert Barrier, 3 new injection wells were completed during the 2000-01 water year. In addition, at the Alamitos Barrier (seawater intrusion barrier near Seal Beach), 10 new injection wells were constructed. Design was also completed for the Water Replenishment District of Southern California's 3 mgd Alamitos Barrier Advanced Water Treatment Facility, which when constructed (scheduled to be operating in November 2002) 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 2000-01 water year, total water demands within OCWD's service area totaled 504,144 acre-feet, 4 percent less than the previous year's demand of 526,397 acre-feet. Total demand includes the use of groundwater, imported water, water from other sources and reclaimed wastewater. Total demand excludes water used by OCWD for groundwater recharge and water credits given for water conservation.

Total water usage (i.e., quantity of water for all categories of use) for the 2000-01 water year was 572,705 acre-feet. Total water usage includes "total water demand" plus water purchased for groundwater replenishment (less In-Lieu Program water, which has been

included in “total demand”) plus groundwater injection with recycled water (i.e., WF-21 production excluding use of deep wells) for seawater intrusion protection.

2000-01 water demands and projected water demands for 2001-02 and 2002-03 are shown in Table 5. 2001-02 (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. 2002-03 (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
2000-01					
(s4362t1b0s12.00v1P	360,846	111,553	2,515	10,820	485,734
Irrigation	8,179	9,516	715	-	18,410
Total	369,025	121,069	3,230	10,820	504,144
2001-02 (Current Year)⁵					
Non-Irrigation	371,000	113,000	4,000	11,000	499,000
Irrigation	9,000	10,000	2,000	-	21,000
Total	380,000	123,000	6,000	11,000	520,000
2002-03 (Ensuing Year)⁵					
Non-Irrigation	381,000	114,000	4,000	11,000	510,000
Irrigation	9,000	10,000	2,000	-	21,000
Total	390,000	124,000	6,000	11,000	531,000

¹ Includes In-Lieu Program water and OCWD’s use of groundwater (i.e., as a producer).

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, groundwater (without treatment) and treated supplemental water are determined to have a flow-weighted average of 462 milligrams per liter (mg/L) of total dissolved solids (TDS). The average groundwater TDS concentration for the basin was 465 mg/L, ranging from a low of 228 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 2000-01 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 2000-01 water year and the previous year (1999-2000) 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 2000-01, a total of 2,158 acre-feet of water (i.e., water conservation credits) were conserved through this program.

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 Orange County Sanitation District (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 MWDOC. For the 2000-01 water year, a total of 32,126 ULF toilets were given out with an estimated annual water savings of 1,014 acre-feet.

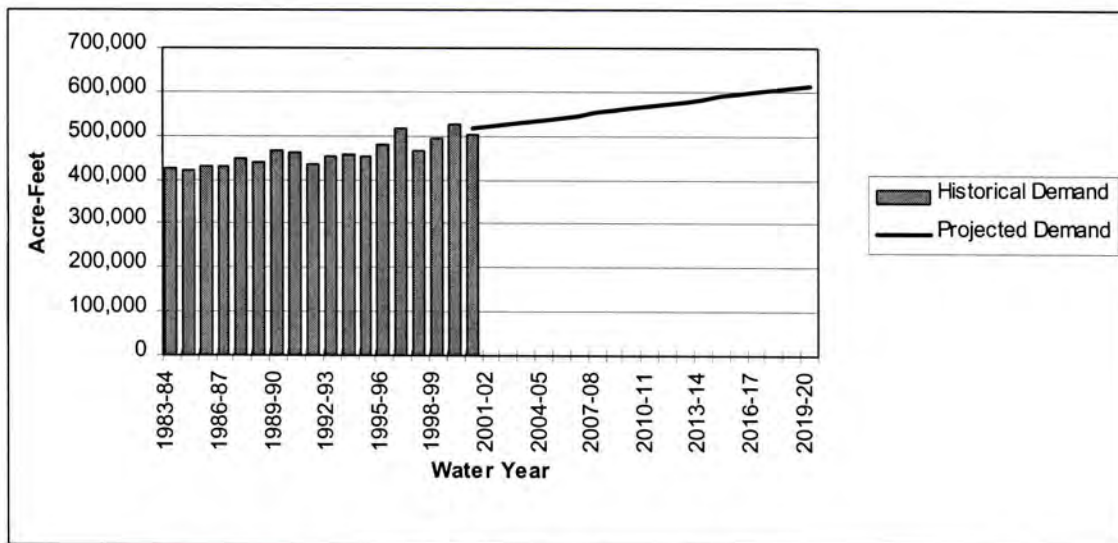
Together, both programs conserved 3,172 acre-feet of water for the 2000-01 water year.

WATER DEMAND FORECAST

During the past year, OCWD has participated with MWDOC 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 504,000 acre-feet per year to 615,000 acre-feet per year in 2020. With these future demands and assuming a BPP of 75 percent, groundwater production levels will increase from 369,000 acre-feet per year to 460,000 acre-feet per year during the next 20 years. To support these high levels of groundwater production, OCWD must continue to purchase imported supplies for groundwater recharge, capture Santa Ana River flows, and develop local reclaimed water supplies for replenishment purposes.

FIGURE 6. Water Demand Projections



PART III: WATER PRODUCTION COSTS FOR ENSUING YEAR (2002-03)

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 (2002-03) is as follows:

SUMMARY OF FINDINGS FOR ENSUING YEAR WATER PRODUCTION COSTS

1. Groundwater production cost (i.e., energy cost plus the Replenishment Assessment) for non-irrigation use in the 2002-03 water year is estimated to be \$176 per acre-foot.
2. Groundwater production cost (i.e., energy cost plus the Replenishment Assessment) for irrigation use in the 2002-03 water year is estimated to be \$136 per acre-foot.
3. Estimated cost of MWD water (i.e., treated, non-interruptible rate) for non-irrigation use in the 2002-03 water year is \$454 per acre-foot.
4. Estimated cost of MWD water (i.e., untreated, interruptible rate) for groundwater replenishment use in the 2002-03 water year is \$250 per acre-foot.

GROUNDWATER PRODUCTION COSTS FOR NON-IRRIGATION USE

The groundwater production cost, consisting of energy costs and the proposed Replenishment Assessment, for non-irrigation use for the 2002-03 water year, is estimated to total \$176 per acre-foot, as detailed in Table 7. Energy costs for the production of an acre-foot of groundwater for each of the major producers 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 October 2001 agency survey, energy costs range from \$22.12 per acre-foot to \$68.60 per acre-foot, and operation and maintenance costs range from \$3.22 per acre-foot to \$243.30 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 62 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 during the 2002-03 water year are expected to total \$135.50 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 \$72.00 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. 2002-03 Groundwater Production Costs

Item	Non-irrigation		Irrigation with Supplemental Connection		Irrigation without Supplemental Connection	
	Annual \$	\$/AF ¹	Annual \$	\$/AF ²	Annual \$	\$/AF ³
Groundwater Production Costs						
Energy Replenishment	55,762	49.00 ⁴	29,880	72.00	13,464	72.00
Assessment	144,526	127.00 ⁵	26,352	63.50 ⁵	11,875	63.50 ⁵
Total Groundwater Production Costs	200,288	176.00	56,232	135.50	25,339	135.50
Other Costs to Producers						
Capital Costs	84,252 ⁶	74.04	33,701 ⁶	81.21	33,701 ⁶	180.22
Operation & Maintenance	72,092	63.35 ⁴	20,403	49.16	9,193	49.16
Total Other Costs to Producers	156,344	137.39	54,104	130.37	42,894	229.38
Total Cost to Producers						
	356,632	313.39	110,336	265.87	68,223	409.60

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 adoption in the 2002-03 budget.

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 in either a non-interruptible supply or interruptible supply. As a result, there are 4 cost categories reported herein. Two rates apply to treated water and 2 rates to untreated water. Treated water is used primarily for municipal and industrial purposes, while untreated water is used primarily for irrigation (i.e., agriculture) and groundwater replenishment purposes. Table 8 shows the estimated costs for these MWD water categories for the 2002-03 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 (2002-03) 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. 2002-03 Supplemental Water Costs¹

	Treated (\$/AF)	Untreated (\$/AF)
Non-Interruptible (Firm Deliveries)	"Full Service Water"	
MWD Commodity Charge ²	423	341
MWD RTS and CR Charges ²	26	26
MWDOC Surcharge	5	5
Total	454	372
Interruptible (Long-Term Seasonal Storage)	"In-Lieu Water"	"Replenishment Water"
MWD Commodity Charge ²	293	236
MWD RTS Charge ²	9	9
MWDOC Surcharge	5	5
Total	307	250

¹ Typical costs for MWDOC member agencies are used.

² MWD's new rate structure will be in effect January 1, 2003. Rates herein are a meld of the old and new rates.

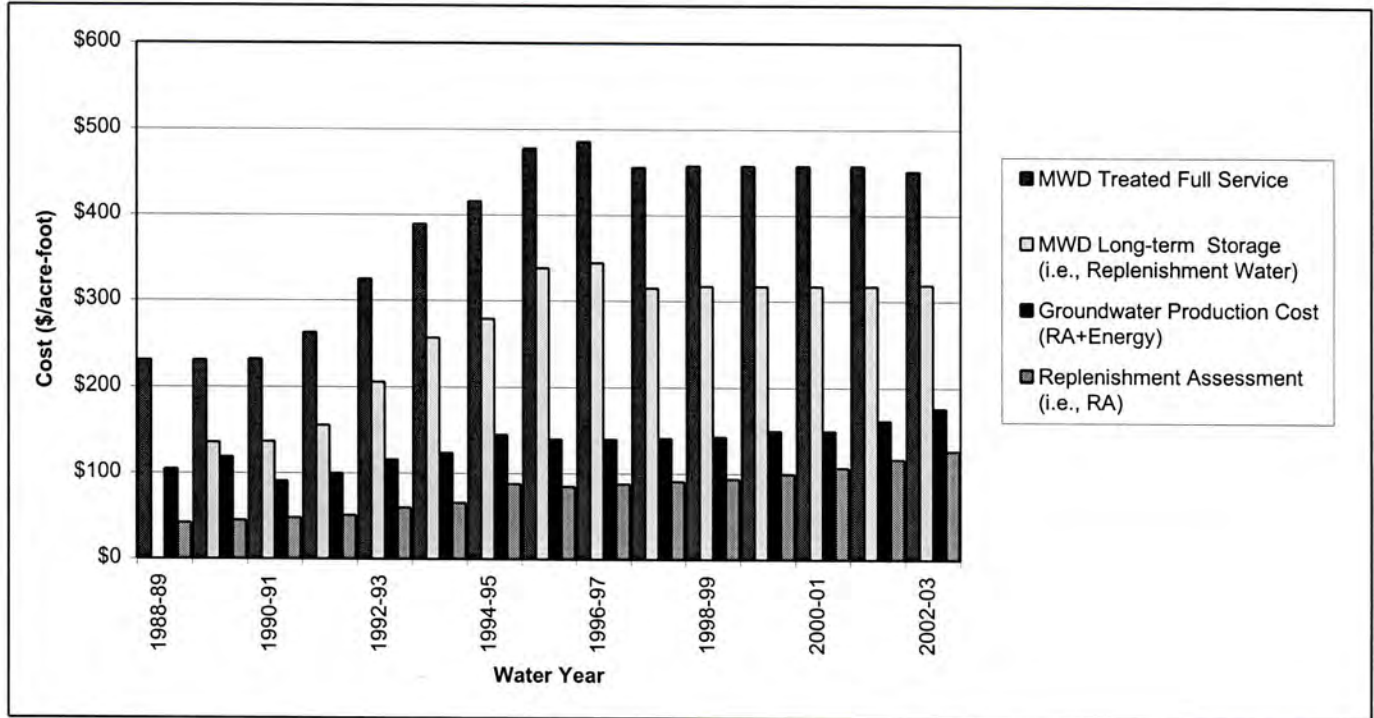
Components of supplemental water cost include: MWD's commodity charge, distribution facility costs and annual operation and maintenance costs. Additional costs include primarily MWD's "Readiness-to-Serve" (RTS) charge and "Capacity Reservation" (CR) charge, and a water surcharge by the Municipal Water District of Orange County (MWDOC).

The amortized costs of distribution facilities and annual operation and maintenance costs were determined and found to vary widely between producers. The costs for some producers are minimal, while for other producers the costs are quite high. Because of these variables, no unit costs are given in this report; however, it should be kept in mind that this component may be substantial for some producers.

MWD uses the RTS charge to recover its cost for providing standby and peak conveyance capacity and system emergency storage capacity for its member agencies. MWD uses the CR charge to recover its cost for reserving peak capacity within its distribution system. For 2002-03, the average RTS charge (to be discontinued for "Interruptible" deliveries effective January 1, 2003) and the average CR charge (to commence for "Non-Interruptible" deliveries effective January 1, 2003) are approximately \$18 per acre-foot and \$17 per acre-foot, respectively.

MWDOC distributes MWD supplemental water to many water producers within OCWD. The water surcharge by MWDOC applies only to producers who purchase supplemental water from MWDOC. Producers that purchase supplemental water directly from MWD avoid this cost. This surcharge, \$5 per acre-foot, provides general funding for MWDOC.

FIGURE 7¹. Adopted and Projected Water Rates for Non-Irrigation Use



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

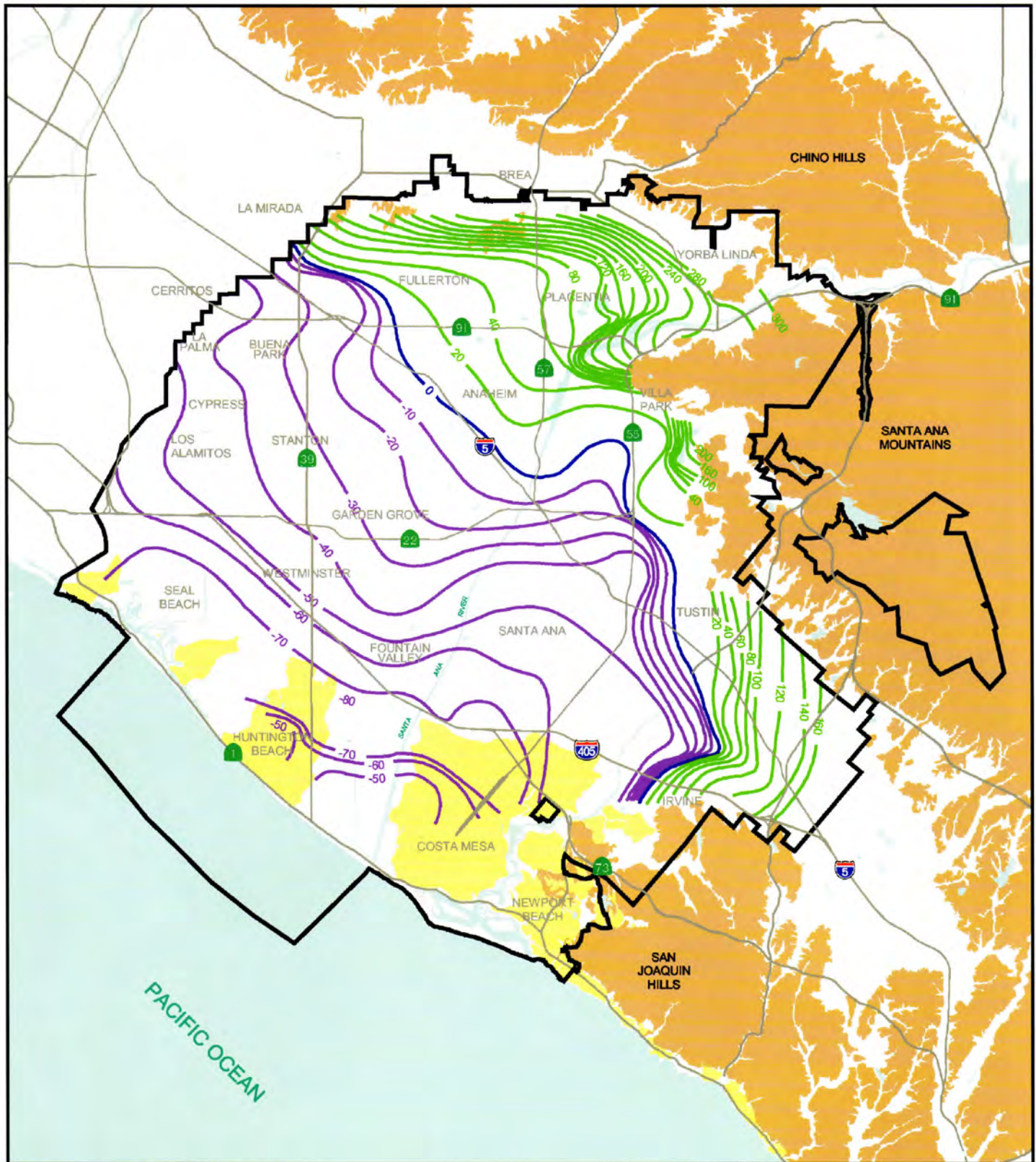
TABLE 9. 2002-03 Water Production Cost Comparison







	Groundwater (\$/AF)	Supplemental Water (\$/AF)
Non-Irrigation Use Fixed Cost	74.04 ¹	454.00 ³
Variable Cost	239.35 ²	
Total	313.39	454.00

¹ Capital costs.

² Costs for energy, Replenishment Assessment and Operation & Maintenance.

³ Delineation of fixed and variable costs are not available.



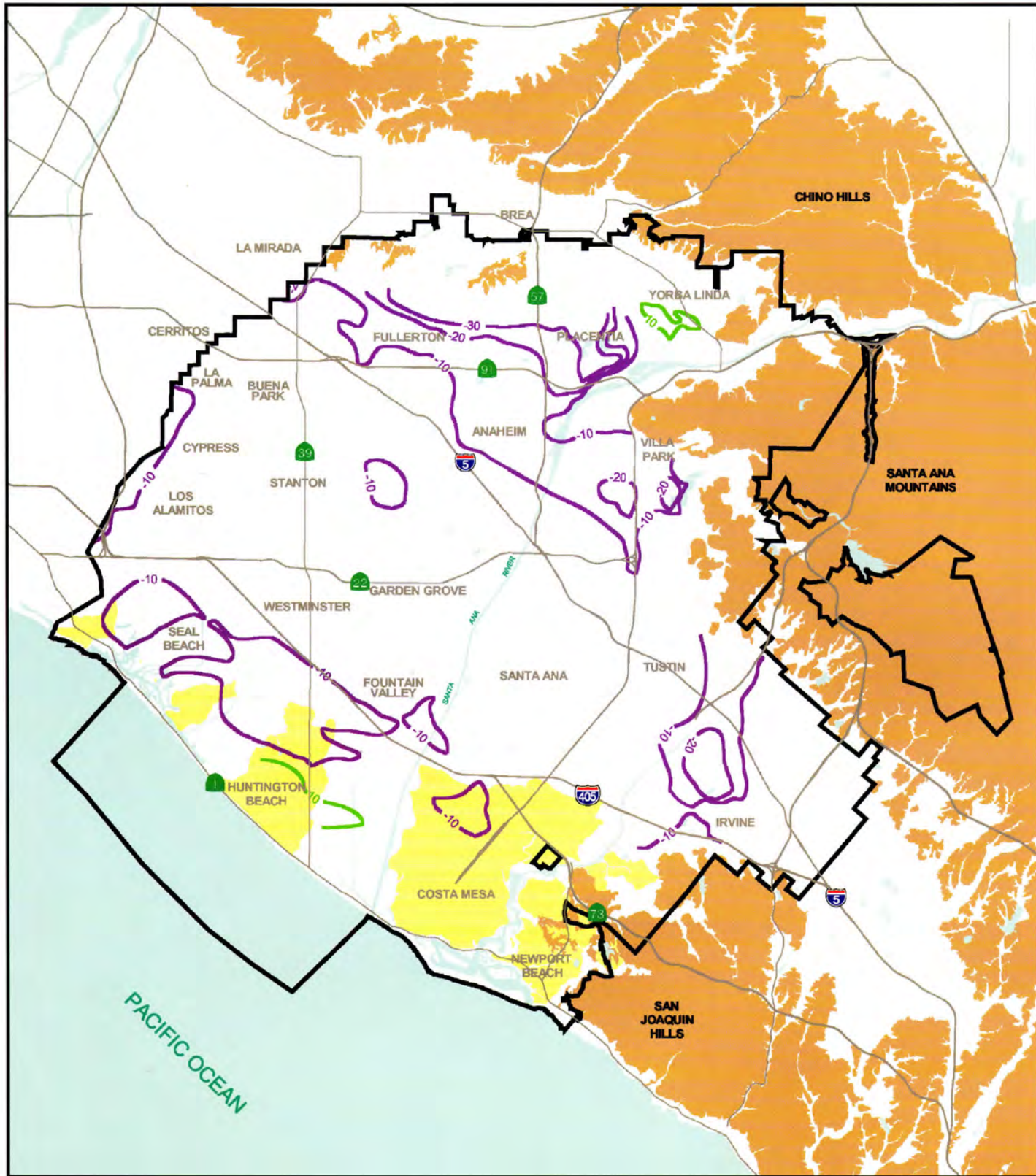
-  Groundwater Elevation, feet MSL
(Contour Interval = 20 Feet)
-  Groundwater Elevation, feet MSL
(Contour Interval = 10 Feet)
-  Freeway
-  OCWD Boundary
-  Water Body
-  Impermeable Formation
-  Mesa








**GROUNDWATER CONTOUR MAP
NOVEMBER 2001
PLATE 1**



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-  Positive Change in Water Elevation (feet)
-  Negative Change in Water Elevation (feet)
-  Freeway
-  OCWD Boundary
-  Water Body
-  Impermeable Formation
-  Mesa

CHANGE IN WATER LEVEL BETWEEN NOVEMBER 2000 AND NOVEMBER 2001

PLATE 2




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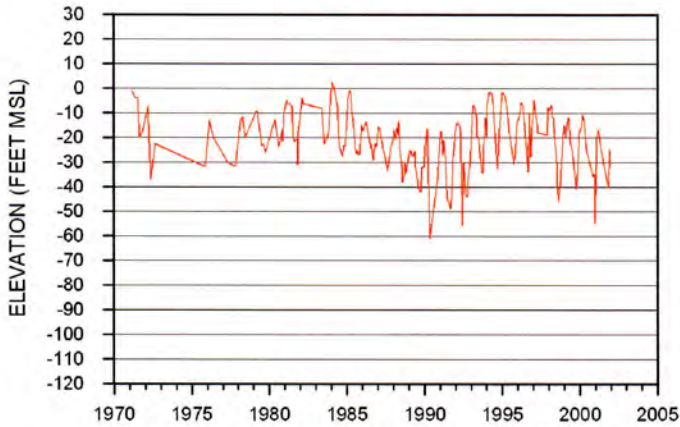
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PLATE 3

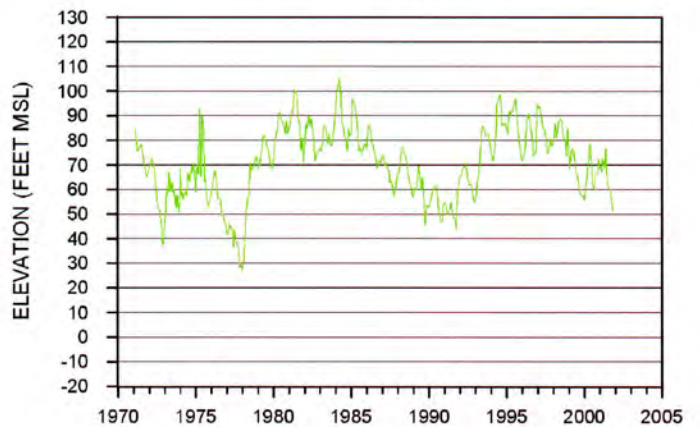
MONITORING WELL HYDROGRAPH TRENDS

 Measured water level elevations
in feet relative to mean sea level

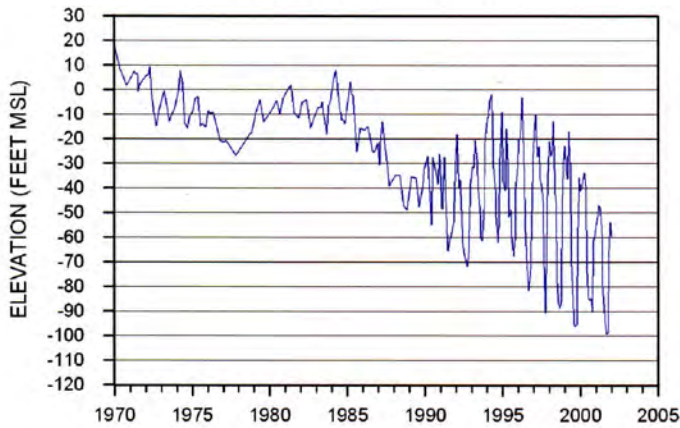
GG-16
04S/11W-33L01



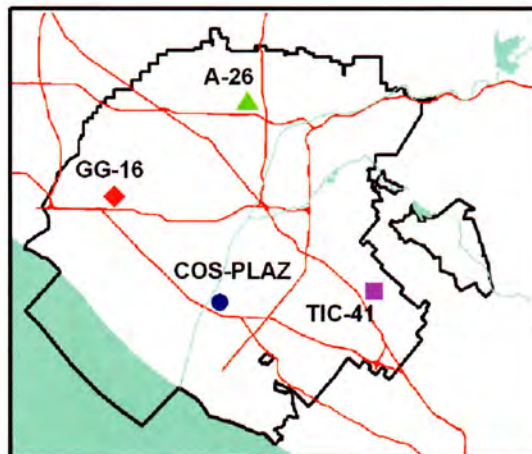
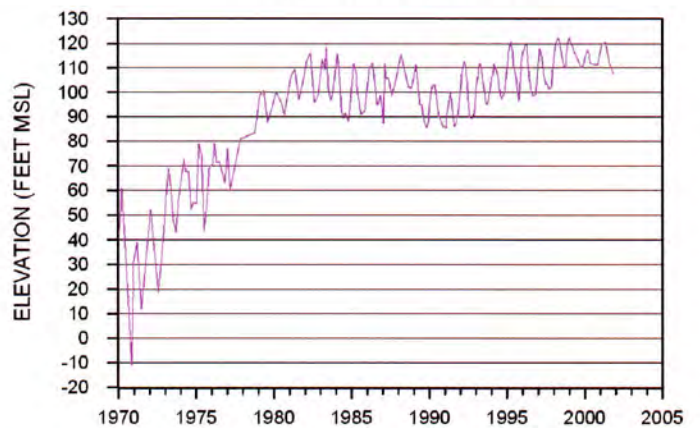
A-26
04S/10W-01F01



COS-PLAZ
05S/10W-35K01



TIC-41
05S/09W-36B01



APPENDIX 1. Water Production Data 2000-01

Groundwater Producer	Groundwater (AF)				Supplemental Water (AF)				Actual BPP Non-Irrigation ¹ and Irrigation	Energy (\$/AF)	BEA ³ (\$/AF)	Reclaimed Water (AF)		
	Non-Irrigation ¹	Irrigation	In-Lieu Program ²	Total	Non-Irrigation ¹	Irrigation	Conservation Credit ⁸	Total				Non-Irrigation ¹	Irrigation	Total
Anaheim, City of	60,048	-	-	60,048	16,560	-	362	16,922	78.0%	48	248	-	-	-
Buena Park, City of	12,995	-	-	12,995	5,013	-	47	5,060	72.0%	34	317	-	-	-
East Orange County Water District	785	-	-	785	292	-	3	295	72.7%	45	306	-	-	-
County of Orange	144	-	-	144	136	-	-	136	51.4%	43	308	-	-	-
Fountain Valley, City of	7,622	-	381	8,003	2,731	-	85	2,816	74.0%	42	309	1,126	-	1,126
Fullerton, City of	23,891	24	-	23,915	7,696	9	120	7,825	75.4/73.3%	52	294/192	-	-	-
Garden Grove, City of	23,300	-	2,810	26,110	3,914	-	241	4,155	86.3%	40	311/192 ⁶	-	-	-
Huntington Beach, City of	18,243	-	1,745	19,988	15,011	-	232	15,243	56.7%	15	336	-	-	-
Irvine Company, The ⁴	-	3,967	-	3,967	-	8,592	-	8,592	31.6%	76	192	-	-	-
Irvine Ranch Water District ⁴	21,145	919	8,000	30,064	11,326	1,555	111	12,992	71.8/37.2%	53	298/192	7,858	-	7,858
La Palma, City of	2,418	-	-	2,418	263	-	15	278	89.7%	40	311	-	-	-
Mesa Consolidated Water District	11,867	-	3,841	15,708	5,867	-	175	6,042	72.2%	55	296/0 ⁶	985	-	985
Newport Beach, City of	12,436	-	1,863	14,299	4,005	-	42	4,047	77.9%	30	321	443	-	443
Orange, City of ⁴	25,448	178	-	25,626	8,081	53	106	8,240	75.7/76.9%	50	251/192	-	-	-
Orange County Water District ⁵	9,037	-	-	9,037	N/a	n/a	n/a	0	n/a	n/a	308	12	-	12
Orange Park Acres Mutual Wtr. Co.	691	-	-	691	314	-	-	314	68.7%	43	308	-	-	-
Santa Ana, City of	43,268	-	-	43,268	7,135	-	168	7,303	85.6%	60	153	396	-	396
Seal Beach, City of	3,208	-	-	3,208	1,006	-	27	1,033	75.6%	21	330	-	-	-
Serrano Water District ⁴	2,398	-	-	2,398	897	-	5	902	72.7%	54	297	-	-	-
Southern California Water Co.	22,434	-	-	22,434	8,171	-	191	8,362	72.9%	42	309	-	-	-
Tustin, City of	11,229	-	-	11,229	2,859	-	60	2,919	79.4%	57	294/0 ⁶	-	-	-
Westminster, City of	10,721	-	-	10,721	3,428	-	125	3,553	75.1%	37	314	-	-	-
Yorba Linda Water District	9,543	75	-	9,618	9,363	22	43	9,428	50.4/77.1%	52	299/192	-	-	-
Total Major Groundwater Producers	332,871	5,163	18,640	356,674	114,068	10,231	2,158	126,457	75.2/33.5%			10,820	-	10,820
Other Producers	8,306	3,016	-	11,322	-	-	-	-	100.0/100.0%		308/0 ⁷	-	-	-
Exempt Well Production	1,031	-	-	1,031	-	-	-	-	100.0%		0	-	-	-
Total All Groundwater Producers	342,208	8,179	18,640	369,027	114,068	10,231	2,158	126,457	74.5%			10,820	-	10,820
Basin Production Percentage (BPP) for major groundwater producers with non-irrigation usage (excluding OCWD)									74.7%					

¹ All water used for purposes other than commercial agriculture.

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

³ Basin Equity Assessment (BEA) costs are based on MWD water costs. BEA rates for full exemption (\$0), partial exemption (\$192), irrigation (\$192) and non-irrigation (various rates) 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 (\$0) or partial (\$192) BEA exemptions for groundwater produced from groundwater quality improvement projects.

⁷ Irrigation-class producers who do not have access to supplemental water are exempt from the BEA.

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

**APPENDIX 2. 2000-01¹ Groundwater Production—
Non-Irrigation Use Production Over 25 Acre-feet**

PRODUCER	ACRE- FEET	PRODUCER	ACRE- FEET
Anaheim Cemetery	46.7	McKesson Water Products	185.2
Anaheim, City of	60,048.4	MDJ Management	376.8
Angelica Textile Services – Plant 10	357.0	Melrose Abbey Funeral Center	58.6
Appleman and Goldman	65.9	Mesa Consolidated Water District	11,866.7
Bit O Home LCC	33.4	Mesa Verde Country Club	325.5
Bixby Ranch Company	691.4	Midway City Mutual Water Co.	119.1
Blue Diamond/Livingston Graham	64.0	Mile Square Golf Course	358.3
Buena Park, City of	12,995.1	Navy Golf Course	433.7
Canyon RV Park	59.1	Newport Beach Golf Course	92.9
Catalina St. Pump Owners	41.2	Newport Beach, City of	12,435.7
Community College District	31.8	Niagara Drinking Water	201.6
County of Orange	143.9	Oasis Drinking Waters	55.0
Danone Waters of N. America	183.1	Orange, City of	25,447.8
Diamond-Newport Ice Corp.	40.0	Orange County Water District	9,037.5
Donovan Golf Course Mgmt., Inc.	279.2	Orange Park Acres Mutual Water Co.	690.7
Eastlake Village HOA	74.0	Orange Park Community Assn.	27.3
East Orange County Water District	784.7	Page Avenue Mutual Water Co.	55.7
Eastside Water Association	275.2	River View Golf	335.2
Fairhaven Memorial Park	154.0	Robertson's Ready Mix	114.0
FJC U.S.A., Inc./Cypress Golf Club	240.7	Santa Ana, City of	43,268.3
Forest Lawn Memorial Park	200.6	Santa Ana Country Club	218.6
Fountain Valley, City of	7,621.9	Seal Beach, City of	3,208.5
Fullerton, City of	23,890.8	Serrano Water District	2,398.2
Garden Grove, City of	23,300.0	South Midway City Water Co.	90.4
Hanson Aggregates West, Inc.	64.4	Southern California Water Co.	22,433.7
Harding Water	25.6	The Good Shepherd Cemetery	34.2
Huntington Beach Unified HS District	28.1	Tustin, City of	11,228.7
Huntington Beach, City of	18,242.6	Villa Capri Mobile Home Park	46.5
Hynes Estates, Inc.	79.8	Westminster Memorial Park	408.5
Irvine Ranch Water District	21,144.8	Westminster, City of	10,720.8
Knott's Berry Farm	286.8	Woodbridge Village Homeowners Assoc.	192.9
Kwikset Corporation	181.7	Yorba Linda Country Club	362.8
La Palma, City of	2,417.6	Yorba Linda Water District	9,542.9
Liberty Park Water Association	32.4	Yosemite Water Company	46.4
Los Alamitos Race Course	284.2		
		Total	340,828.8

¹Water year begins July 1.

**APPENDIX 3. 2000-01¹ Groundwater Production—
Irrigation Use Production Over 25 Acre-feet**

PRODUCER	ACRE-FEET	PRODUCER	ACRE-FEET
A-B Nursery	33.4	Orange, City of	177.6
C. J. Segerstrom & Sons	114.2	Osumi Farms, Inc.	496.0
Crimson Farms	153.7	Pursche, Roy	67.1
Fairhaven Memorial Park	51.2	Sakioka Farms	198.3
Fujishige, Hiroshi	141.0	Seaview Ag, LLC	1,233.0
Irvine Company, The	3,967.3	Shozi Brothers	47.0
Irvine Ranch Water District	919.5	Village Nurseries	123.6
Ito-Ozawa Farms	207.1	Yorba Linda Water District	74.7
Laguna Farms	27.3		
		Total	8,032.0

¹Water year begins July 1.

APPENDIX 4. Typical Groundwater Extraction Facility Characteristics 2000-01

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	\$84,252	\$33,701

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 2000-01

RETAIL AGENCY	ACRE-FEET
Green Acres Project	
Fountain Valley, City of	1,126
Huntington Beach, City of	0
Mesa Consolidated Water District	986
Newport Beach, City of	442
Santa Ana, City of	396
Orange County Sanitation District (serves own sites)	5,032
Orange County Water District (serves own site)	12
Green Acres Project Total	7,994
Green Acres Project (excluding service to OCSD)	2,962
Irvine Ranch Water District	7,858
Total Usage	10,820

APPENDIX 6. 2000-01 Water Resources Summary

	2000-2001 Water Year (AF)	1999-2000 Water Year (AF)	Change from last year to this year (AF)
SUMMARY OF BASIN CONDITIONS			
BASIN SUPPLIES			
Supplemental/Nonlocal Recharge Water	66,930	35,365	31,565
Natural Flows (SAR & Santiago Creek)	212,012	193,958	18,054
Incidental Recharge ¹	59,047	77,542	(18,495)
Seawater Barriers (with Deep Wells)	12,487	12,484	3
TOTAL	350,477	319,349	31,128
BASIN LOSSES			
Groundwater Production (with Deep Wells)	350,386	345,362	5,024
River Flow Lost to Ocean	34,665	17,420	17,245
TOTAL	385,051	362,782	22,269
BASIN STATUS			
Change in Storage - Surface Water & Groundwater ¹	(31,574)	(34,297)	2,723
Basin Operation Storage ² - Producibile from Storage	372,105	403,857	(31,752)
Basin Operation Storage ² - Recharge Storage	327,895	296,143	31,752
OTHER KEY INFORMATION			
1. Imported Deliveries to Producers ³	142,940	169,311	26,371
2. Producers' Seasonal Storage Program:	26,087	54,648	(28,561)
Short-term In-Lieu (Put & Take)	7,447	16,641	(9,194)
Long-term In-Lieu (OCWD)	18,640	38,007	(19,367)
3. Basin Production Percentage (includes OCWD In-Lieu)	75%	75%	0%
4. Total Water Demand	504,144	526,397	(22,253)
5. Wellhead Treatment/Water Reclamation Projects:			
Arlington Desalter	5,178	5,013	165
Other OCWD Wellhead Treatment Projects	7,482	9,461	(1,979)
Green Acres Project (without Deep Wells)	7,994	6,396	1,598
Water Factory 21 (without Deep Wells)	1,630	5,773	(4,143)
6. Deep Well Water for WF21 & GAP	8,913	5,859	3,054
7. Baseflow of Santa Ana River	152,963	150,273	2,690
8. Effluent discharge to SAR above Prado Dam	145,432	145,459	(27)
9. Fountain Valley water to Talbert Barrier (w/o wells)	942	0	942
10. SBVMWD High Groundwater Mitigation Project ⁴	—	4,428	—
11. Prado Wetlands Inflow (4/01 - 6/01 flow unavailable)	42,731	55,649	N/A
12. SARI Flow at Prado	9,081	6,238	2,843
13. Year-end Storage behind Prado Dam	0	0	0
14. Year-end Storage in Deep Basins	19,799	19,719	80
15. Total Artificial Recharge (Percolation + Barriers)	259,764	229,392	30,372
16. Rainfall (inches)	14.5	8.2	6.3
17. OCSD Discharge to Ocean	269,018	262,246	6,772

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 SBVMWD water was received into the OCWD basin as of June 30, 2001. However, finalization of the quantity received was not determined until after February 2002 and is not included in this report. The quantity received will be reported in the 2001-02 Engineer's Report.

**APPENDIX 7. Non-Local Water Purchases by Orange County Water District
for Water Years 1990-91 through 2000-01**

Water Year	Arlington Desalter Purchases AF	Alamitos Barrier Purchases AF	Talbert Barrier Purchases ¹ AF	Forebay Recharge Purchases AF	In-Lieu Program Purchases AF	Basin Water Supply Mgmt. Program Purchases ² AF	SAR Upstream Transfers		TOTAL	
							Western MWD Purchases ³ AF	San Bern. Valley MWD Purchases ⁴ AF	Purchases AF	Payment
1990-91	4,490.7	1,933.1	-	15,619.0	44,738.6	-	-	-	66,781.4	\$9,354,652
1991-92	3,325.7	1,623.0	-	51,691.9	39,788.7	-	-	-	96,429.3	\$13,320,832
1992-93	2,952.7	1,614.0	-	26,293.4	38,900.3	-	-	-	69,760.4	\$12,162,175
1993-94	5,158.9	1,432.6	-	78,521.3	48,133.9	-	2,093.8	-	135,340.5	\$28,774,477
1994-95	1,930.3	798.3	-	15,354.2	15,622.2	-	2,343.2	-	36,048.2	\$8,090,109
1995-96	2,770.6	1,691.6	-	15,278.7	5,542.4	-	888.2	-	26,171.5	\$6,359,947
1996-97	6,176.2	1,885.5	-	33,742.7	7,883.0	-	2,958.0	-	52,645.4	\$12,241,183
1997-98	2,516.9	1,613.8	-	19,029.4	-	27,674.9	701.8	-	51,536.8	\$9,417,940
1998-99	2,351.3	1,493.6	-	10,371.5	-	13,351.9	996.1	1,283.5	29,847.9	\$3,395,967
1999-00	4,994.6	1,873.6	-	28,478.1	24,726.0	13,280.8	-	4,428.4	77,781.5	\$15,077,050
2000-01	5,177.9	1,672.5	941.7	59,138.4	11,191.0	7,449.0	-	-	85,570.5	\$18,766,276
Total	41,845.8	17,631.6	941.7	353,518.6	236,526.1	61,756.6	9,981.1	5,711.9	727,913.4	\$136,960,608

¹ Includes only water delivered from MWD connection OC32A. Groundwater purchased for barrier from the City of Fountain Valley are excluded (I.e., categorized as local water).

² Basin Water Supply Management Program (effective 10/1/97) water charges have not been incurred as of June 30, 2001. Price of water is to be set and charged at the time OCWD takes possession of deliveries.

³ Western MWD program was terminated at end of WY 1999-2000.

⁴ SBVMWD water was received into the OCWD basin as of June 30, 2001. However, finalization of the quantity received was not determined until after February 2002 and is not included in this report. The quantity received will be reported in the 2001-02 Engineer's Report.

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

¹Includes RA plus cost of energy to produce groundwater.

²MWD Treated Water Long-Term Seasonal Storage Rate.



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