9-12

WATER RESOURCES ELEMENT

FOR THE

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

SERVICE AREA

FOR THE

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

REGIONAL COMPREHENSIVE PLAN

Prepared for

Metropolitan Water District of Southern California
P.O. Box 54153
Los Angeles, California 90054-30153

Prepared by

Cordoba Corporation
811 Wilshire Blvd.
Los Angeles, California 90017
(213) 895-0224

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ACRONYMS AND ABBREVIATIONS

AF	Acre-feet
AFY	Acre-feet per year
BMP	Best management practices
CAP	Central Arizona Project
CAWCD	Central Arizona Conservation District
CEQA	California Environmental Quality Act
CRA	Colorado River Aqueduct
CRB	Colorado River Board
CVP	Central Valley Project
CVWD	Coachella Valley Water District
DWA	Desert Water Agency
DWR	State Department of Water Resources
ESA	Endangered Species Act
GPCD	Gallons per capita per day
GPD	Gallons per day
IICP	Incremental Interruption and Conservation Plan
IID	Imperial Irrigation District
IRP	Integrated Resources Planning
KFE	Kern Fan Element
KWB	Kern Water Bank
LAC/DPW	Los Angeles County Department of Public Works
LADWP	Los Angeles Department of Water and Power
LBG	Los Banos Grandes Reservoir
M&I	Municipal and Industrial
MAF	Million acre-feet
MAFY	Million acre-feet per year
MEA	Master Environmental Assessment
MGD	Million gallons per day
MWD	Metropolitan Water District
RCP	Regional Comprehensive Plan
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SDCWA	San Diego County Water Authority
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
VOC	Volatile Organic Compound

I. INTRODUCTION

Supply and Demand of Regional Water

Delivery of adequate water supplies to the semi-desert and desert environments of Southern California has been a central issue for more than 200 years. Over that time, increasingly sophisticated water delivery systems have been developed, together with the wholesale, retail, and regulatory agencies necessary to ensure reliable supplies of quality water to accommodate the demands of a growing region. While water agencies have no direct responsibility for land use planning, it is clear that the urban development and economy of Southern California would be dramatically different without adequate and reliable supplies of water for irrigation, domestic, and industrial use.

Local surface water, groundwater, and reclaimed water sources currently provide only about 40 percent of the six-county Southern California Association of Governments's (SCAG) regional water supply. Local water sources are fully developed and are expected to remain relatively stable in the future, with the exception of reclaimed water use. The remaining 60 percent of the regional water supply is currently imported from outside of the region. The continued availability of water from outside of the region is uncertain at current levels. The enlargement of the East Branch of the California Aqueduct will facilitate increased delivery from the State Water Project (SWP) systems. However, dependable yield from the SWP is expected to decrease slightly over time as water use in areas of origin in northern California increases and is expected to be further reduced due to increasing allocations of water for environmental needs in the Delta. The amount of water that California imports from the Colorado River under California's apportionment is expected to decline substantially in the near future with increasing demand for water in Arizona and Nevada.

Is the current water supply adequate to accommodate future demand? Recent population projections indicate that the region may grow by approximately five million residents by the year 2010[1]. Substantial increases in urban water demand and loss of dependable supplies may result in a projected shortfall of about 0.54 million acre feet (MAF)[2] within MWD's service area in 2010 with existing water supplies and under average hydrologic conditions. Clearly, substantial changes in levels of consumption and supplies of water will be required to meet expected water demands to sustain the region's growth and economic health.

The Relationship of the Metropolitan Water District and the Water Resource Element of SCAG's Regional Comprehensive Plan

Water facilities are part of the region's infrastructure system in the same way that electrical power, natural gas, waste treatment, and other utilities are considered infrastructure. Therefore, development of an appropriate and adequate water supply infrastructure follows and is dependent on the anticipated level of growth for the region. The inexorable interrelationship between land use and water supply planning points to the conclusion that the two areas should be coordinated to the fullest extent feasible.

In response to federal and state mandates and the need for better regional planning, SCAG is developing a Regional Comprehensive Plan (RCP) which will have 14 integrated elements (growth management, mobility, housing, air quality, economic development, energy, hazardous waste management, solid waste management, open space and resources, water resources, water quality, finance, human resources and services, and a strategic element). The Water Resources Element will focus on current and future water supply and conservation to meet the needs of the SCAG region.

At the request of SCAG, the Metropolitan Water District of Southern California (MWD) prepared the RCP's Water Resources Element for its service area. The MWD service area is 5,139 square miles of California's coastal plain and extends from the city of Oxnard to the international boundary with Mexico. MWD's service area within the SCAG region, as shown in Figure I-1, includes portions of Ventura, Los Angeles, Riverside and San Bernardino Counties and nearly all of Orange County. Although Imperial County is part of the SCAG region, it is not served by MWD. The coastal portion of San Diego County is served by MWD through the San Diego County Water Authority (SDCWA) but it is not a part of the SCAG region. Table I-1 shows the MWD service area accounting for approximately 10 percent of the total SCAG land area and 85 percent of the total 1990 SCAG population.

The Water Resources Element for the MWD service area is based primarily on the updated 1990 Regional Urban Water Management Plan, which includes a description of MWD's management policies and the delivery system. The 1990 Regional Urban Water Management Plan was prepared in response to the Urban Water Management Planning Act which requires every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet per year (AFY) of water to prepare and adopt a plan every five years. The first plan was prepared in 1985 and revised in 1990.

Addressing the need to coordinate water supply and land use planning, AB 455 of the 1992 legislative session, which is now law, encourages local agencies that are approving development projects to coordinate and consult with water supply agencies to ensure that proper water supply planning occurs.

As a wholesale water agency, MWD is responsible for providing a high quality, reliable imported water supply to supplement local water supplies and, in conjunction with its member agencies, to implement regional water supply and demand management strategies to accommodate the region's existing and future needs. MWD relies on regional planning agencies to provide accurate regional growth estimates, which serve as the basis for water supply planning. SCAG and the San Diego Association of Governments (SANDAG), as regional planning agencies develop population, housing and employment forecasts to the year 2010. Based on these regionally adopted forecasts, MWD is able to project future water needs and develop appropriate and adequate infrastructure.

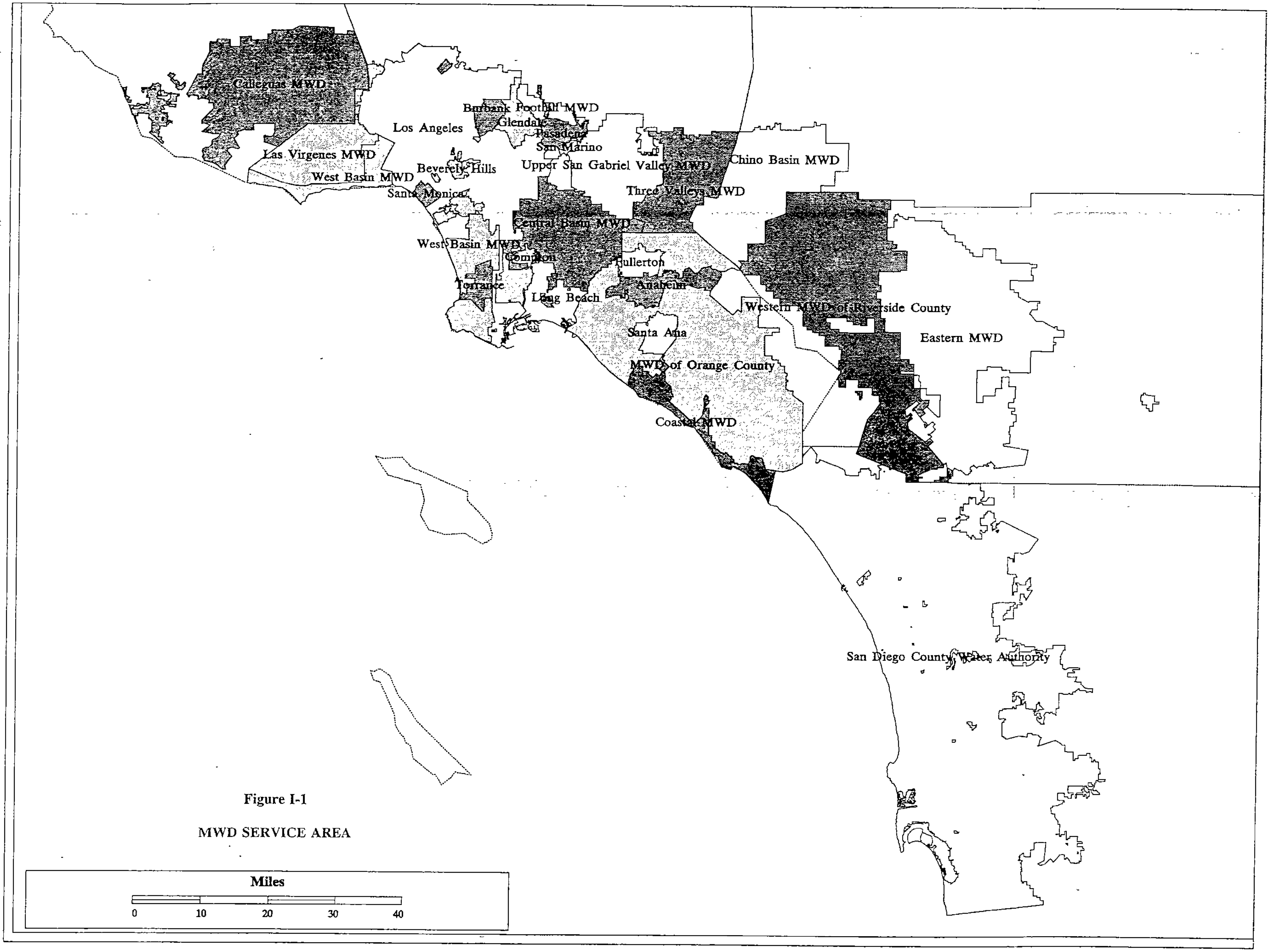


Figure I-1

MWD SERVICE AREA

Table I-1

AREA AND POPULATION OF THE MWD SERVICE AREA WITHIN THE SCAG REGION 1990

County (Portion Within MWD)	Total County	MWD Service Area	Percent MWD
Land Use (Sq.Mi)			
Imperial	4,175	0	0
Los Angeles	4,080	1,394	34.2
Orange	786	695	88.4
Riverside	7,249	1,043	14.4
San Bernardino	20,154	242	1.2
Ventura	1,865	349	18.7
Total	**38,309**	**3,722**	**9.7**
Population (1,000s)			
Imperial	109	0	0
Los Angeles	8,877	8,208	92.6
Orange	2,411	2,411	100.0
Riverside	1,170	862	73.7
San Bernardino	1,418	560	39.5
Ventura	669	476	71.2
Total	**14,655**	**12,516**	**85.4**

Source: MWD, 1993; U.S. Census

As presented in Table I-2, the population of the MWD service area within the SCAG region is projected to increase from 12.5 million in 1990 to 16.2 million by the year 2010. This represents an increase of 3.7 million people or 29.7 percent during the 20 year period. The fastest growth area will be Riverside County where population is projected to more than double over the period.

Table 1-2

POPULATION PROJECTIONS
MWD SERVICE AREA
1990 AND 2010

County (Portion Within MWD)	1990	2010	Growth	Percent Growth
Los Angeles	8,207,800	9,896,100	1,688,300	20.6
Orange	2,410,700	3,067,300	656,600	27.2
Riverside	862,200	1,796,800	934,600	108.4
San Bernardino	559,600	864,700	305,100	54.5
Ventura	476,100	607,200	131,100	27.5
Within SCAG Region	**12,516,400**	**16,232,100**	**3,715,700**	**29.7**
San Diego	2,361,400	3,293,000*	931,000	39.5
MWD Service Area	**14,877,800**	**19,525,100**	**4,647,300**	**31.2**

Source: SCAG Draft RCP, 1993, SANDAG Draft Series 8 Forecasts, 1993
* SANDAG has just released higher population projections under its "Economic prosperity" alternative.

Under the Metropolitan Water District Act, "districts may be organized...for the purpose of developing, storing, and distributing water for domestic purposes and may be formed of the territory included within the boundaries of any two or more municipalities, which need not be contiguous..."[3] MWD has the power of eminent domain, authority to occupy public streets and other public lands, the authority to borrow and create indebtedness, and to levy and collect taxes, as well as acquisition, distribution, and sale of water. As Table I-3 shows, MWD's member agencies include 12 Municipal Water Districts, 14 member cities, and the San Diego County Water Authority. Member agencies of MWD either provide retail water service directly to consumers or in turn wholesale imported water to retail water purveyors. Approximately 300 retail water purveyors serve the 250 cities and communities within MWD's service area.

Objectives of the Water Resources Element

The objectives of the Water Resources Element for the MWD service area are as follows:

- Clarify the relationship of the Water Resources Element for the MWD service area and the SCAG RCP;
- Provide an assessment of regional water demands based on SCAG's growth forecasts for the MWD service area;
- Provide an assessment of current water supplies to the MWD service area;
- Provide a system of programs that will meet the requirements of a reliable urban water supply for the MWD service area and appropriate watershed mitigation measures for the SCAG Master Environmental Assessment (MEA); and
- Identify issues for resolution in the next RCP update.

Table I-3

**MEMBER AGENCIES OF
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA**

Member Cities	Municipal Water District
1. Anaheim	15. Calleguas Municipal Water District
2. Beverly Hills	16. Central Basin Municipal Water District
3. Burbank	17. Chino Basin Municipal Water District
4. Compton	18. Coastal Municipal Water District
5. Fullerton	19. Eastern Municipal Water District
6. Glendale	20. Foothill Municipal Water District
7. Long Beach	21. Las Virgenes Municipal Water District
8. Los Angeles	22. Municipal Water District of Orange County
9. Pasadena	23. Three Valleys Municipal Water District
10. San Fernando	24. Upper San Gabriel Valley Municipal Water District
11. San Marino	25. West Basin Municipal Water District
12. Santa Ana	26. Western Municipal Water District of Riverside
13. Santa Monica	
14. Torrance	County Water Authority
	27. San Diego County Water Authority

Source: The Regional Urban Water Management Plan, MWD, 1990

II. REGIONAL WATER DEMANDS

Determinants of Water Usage

In general, as the region's population increases, so does the overall demand for water. In addition to population changes, socioeconomic characteristics, geographic growth, climate and water conservation practices influence regional water demand. Table II-1 lists the water usage factors.

Table II-1

WATER USAGE FACTORS

Factors that Increase Per Capita Water Use	Factors that Decrease Per Capita Water Use
▪ Increased Household Income	▪ Increased Household Size
▪ Increased Labor Force	▪ Increased Proportion of Multifamily Housing
▪ Increased Commercial Development	▪ Change in Industrial Mix
▪ Growth in the Inland Region	▪ Urban Water Conservation

Source: Current and Projected Water Needs in the Metropolitan Water District of Southern California Service Area, State Water Contractors, WRINT SWC Exhibit 3b, June 1992.

The following factors tend to increase water usage:

Increased Household Income: Income, the ability to pay for necessities and luxuries, directly impacts water usage. However, the importance of income in residential water use modeling goes beyond its effects on the consumers' ability to pay for water. It also measures the standard of living as expressed by the presence of appliances and facilities in the house (e.g., washing machine, dishwasher, garbage disposal, multiple bathrooms, evaporative cooler, humidifier), outdoor features and facilities (lawn, flower beds, decorative shrubs, swimming pool, sauna, water-mist systems, fountains), and perceived health-related fixtures such as home water treatment systems. Studies suggest that a ten percent increase in income corresponds to a two to four percent increase in water consumption.[4] Factors influencing the increase in household income include: 1) two-income earners, and 2) increased productivity. A projected increase in household income by $900 could result in an increase of one gallon per capita per day (GPCD)[5] usage.

Increased Labor Force: As the labor force participation rate increases--more people entering the work force--water usage increases as a result of greater commercial and industrial activity. Factors contributing to increasing labor force participation rates include: 1) increase in women entering the labor force, 2) increase in the prime wage-earning age group, and 3) increase in young people working.

Increased Commercial Development: Commercial uses such as hospitals, hotels, schools and colleges, and restaurants consume more water per employee than retail stores, auto shops and offices. Current employment projections indicate that the commercial establishments which use more water per employee will generally grow faster than other commercial uses.

Growth in the Inland Region: More water is required in hot climate areas. An increasing proportion of residential and commercial growth is occurring in the hotter, drier inland valley and desert section of MWD's service area, such as San Bernardino and Riverside Counties. This increasing requirement for water reflects the higher demand for cooling and landscape maintenance in these areas.

Factors decreasing water usage include the following:

Increased Household Size: Larger household size translates into lower per capita use due to the presence of fewer homes with less landscaped areas for the same number of people. The 1990 Census revealed that during the 1980s, California's population grew faster than the number of households, leading to an increase in the average household size, which was counter to national trends. This recent counter-trend at the regional level may be the result of: 1) more adults sharing housing, particularly young adult Asians and Hispanics remaining at home and the doubling up of immigrant families; and 2) higher birth rates, primarily reflecting the changing ethnic mix of the region. Within the MWD service area, the average household size increased from 2.75 persons in 1980 to 2.91 persons in 1990, an increase of approximately six percent. Recent SCAG and SANDAG projections assume a continued increase in the regional household size, from 2.91 in 1990 to 2.99 in 2010. The increase reflects a continued shift in the ethnic population of the region. For example, the recent SCAG Draft RCP forecasts an increase in the Hispanic proportion of the regional population from 33 percent in 1990 to 44 percent by the year 2010.

Increased Proportion of Multifamily Housing: Because multifamily structures share landscaping and swimming pools and generally have fewer water using appliances, the average water use is lower than in detached single-family residences. Currently, multifamily structures represent approximately 41 percent of the housing stock in the MWD service area and its share is projected to increase to 52 percent by 2010. Major factors influencing the shifting housing mix include: 1) limited land availability, and 2) higher housing costs.

Change in Industrial Mix: Industrial categories such as petroleum refining, beverage products, and paper mills consume more water per employee than industries such as high-technology and textiles. Current projections indicate that many of the top water users are projected to level off or even decline in terms of employment growth and water use.

Urban Water Conservation: Reductions in water use will result from the implementation of conservation measures such as: 1) use of water-efficient plumbing fixtures as required by plumbing codes; 2) residential retrofit programs induced by MWD's Conservation Credits Program; 3) the expansion of ongoing leak detection and repair programs conducted by retail agencies; and 4) landscaping water efficiency measures, including education about irrigation practices and low-water use plants. (Please refer to Section IV for more detail on water conservation.)

Climate/Weather: As a determinant of water usage, climate and weather present several complex issues including:

- Geographic variations in normal seasonal conditions,
- Geographic variations in per capita demand,
- Seasonal population, and
- Prolonged drought conditions.

Southern California is characterized as having a Mediterranean, or dry summer, subtropical climate. As illustrated in Figure II-1, the MWD service area can be divided into three broad zones: the Coastal Zone, the Inland Valley Zone, and the Desert Zone. The Coastal Zone is predominantly under the ocean's influence, while weather in the Inland Valley Zone is influenced more or less equally by both the ocean and inland areas. The Desert Zone is hotter and dryer, being only rarely influenced by the ocean. Average rainfall in the Coastal Zone is about 12 inches per year, decreasing to about five inches per year in the hotter inland areas of Riverside and San Bernardino Counties. Average maximum daily temperatures during the summer are approximately 70 to 80 degrees along the coast, and up to 110 degrees in the inland area. Table II-2 shows that the coastal area's per capita demand is lower than demand in inland areas.

Increased development in the hotter, dryer inland areas of the region will result in increased water usage for cooling and landscape irrigation. Residential water usage is approximately 85 percent higher (per dwelling unit) for Desert Zone areas than for Coastal Zone areas. Higher seasonal peaks will require development of additional storage capacity to regulate demands on regional delivery systems.

Local weather patterns also include the potential for recurring and prolonged drought conditions. Drought reduces the ability of water agencies to rely on local surface and groundwater sources, in effect requiring water storage and/or additional importation from other regions.

Figure II-1

CLIMATE ZONES OF SOUTHERN CALIFORNIA WITHIN THE SCAG REGION

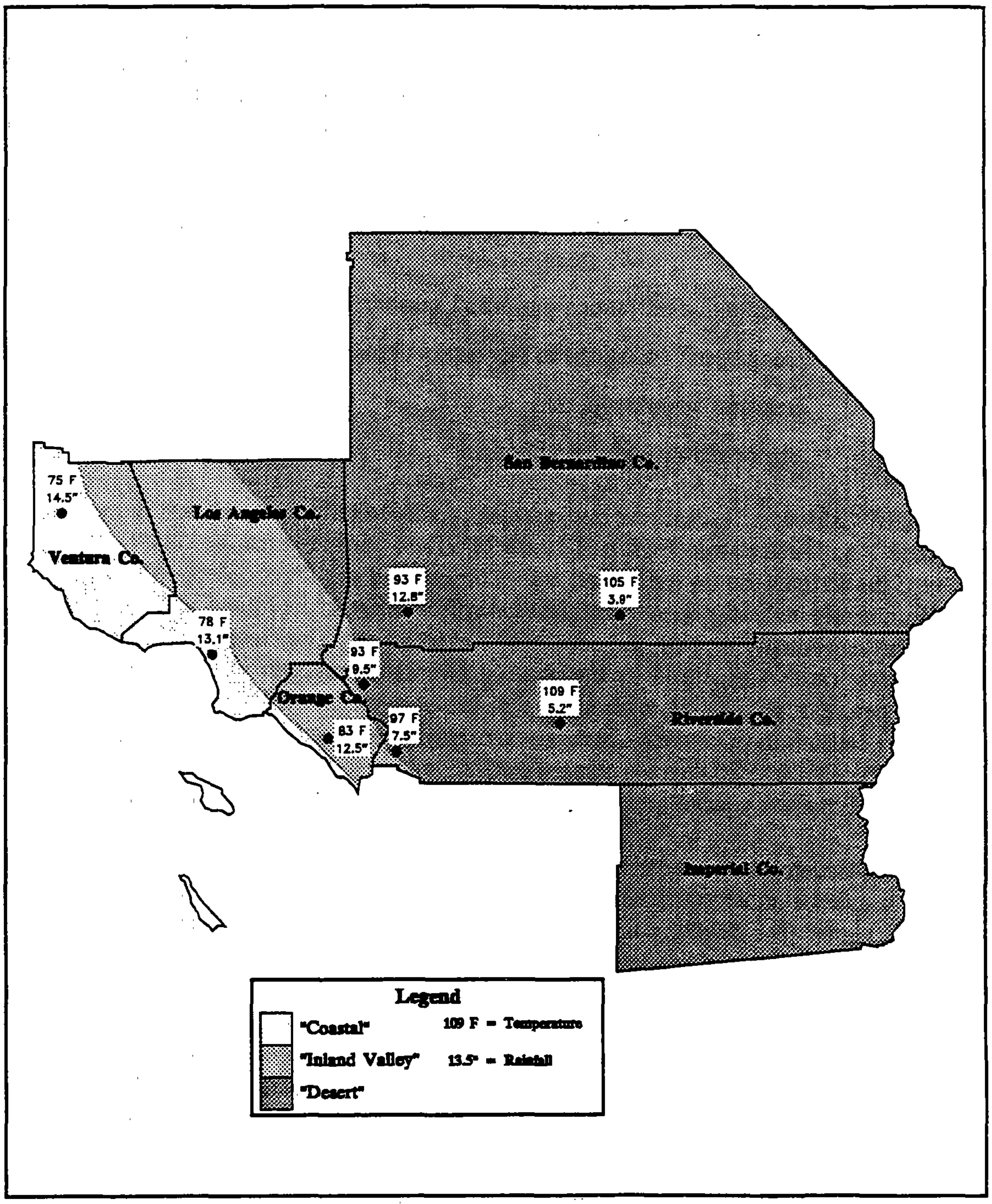


Table II-2

GEOGRAPHIC DIFFERENCES IN AVERAGE ANNUAL RESIDENTIAL USE IN SOUTHERN CALIFORNIA

Climate Zone/Sector	Gallons/Day/ Dwelling Unit	Gallons/Day/ Person
ZONE 1 (COASTAL)		
Single-family	282	104
Multifamily	248	94
All residential	261	97
ZONE 2 (INLAND VALLEY)		
Single-family	421	154
Multifamily	258	94
All residential	337	123
ZONE 3 (DESERT)		
Single-family	522	156
Multifamily	241	70
All residential	482	162

Source: "Seasonal Components of Urban Water Use in Southern California," MWD, 1990.

Urban Water Demand

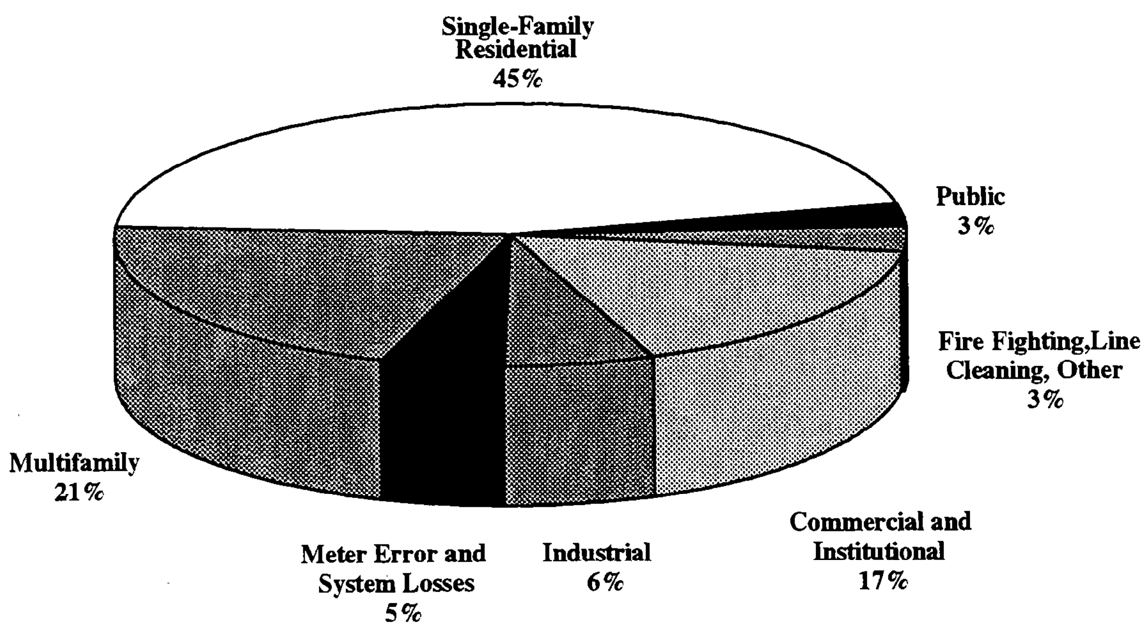
Total water use in the MWD service area in 1990 was approximately 4.0 million acre feet (MAF), with 3.6 MAF used for municipal and industrial (M&I) purposes and 0.4 MAF used for agricultural purposes. In the MWD service area, water use increased by nine percent in the 1970s and by over 25 percent in the 1980s, predominantly due to population growth, eastward growth of the urbanized area, and below-normal precipitation in the late 1980s.

Major Water Use Components

Figure II-2 presents the percentage breakdown of urban water use in the MWD service area by major sectors of users. An estimated 66 percent of all urban use occurs in the residential sector. The residential sector is followed by the commercial/institutional and industrial sectors at 17 percent and six percent respectively. The remaining component of urban water use are public uses (3%), water use for fire fighting and line cleaning (3%), and meter error and system losses (5%).

Figure II-2

MUNICIPAL AND INDUSTRIAL WATER USE



Residential Sector

Residential sector use is generally divided between single- and multifamily, the use profiles of which are somewhat different. Single-family residences generally include more water-using appliances and facilities per capita (e.g. an additional bathroom) and also have a larger per capita outdoor use. Thus, both single-family base (indoor) use and seasonal (outdoor) use are higher than that of multifamily units. Estimates prepared for MWD indicate that the average percentage of seasonal use for all residential units is 27.9 percent, ranging from 7.5 percent in Santa Monica (mostly multifamily units and a cooler climate) to 46.9 percent in Rancho Cucamonga (mostly single-family units and warmer climate).[6] The minimum use month is usually January or February (rarely December or March) and the peak use months are usually June, July, or August.

Table II-3 summarizes the components of indoor and outdoor average daily residential water use in the MWD service area. It is estimated that under normal weather conditions, residential water use is 135 gallons per capita per day (GPCD). Indoor accounts for 93 GPCD (69%) and outdoor 42 GPCD (31%). Of all residential uses, landscape irrigation and gardening consume the most water, followed by toilet flushings. Water consumed by toilet flush varies according to the year of the toilet. Pre-1979 code toilets use approximately 5-7 gallons per flush as compared to 1992 code toilets at 1.6 gallons per flush.

Table II-3

AVERAGE DAILY RESIDENTIAL WATER USE BY CATEGORY
MWD SERVICE AREA

Category of Water Use	Gallons/Person	Gallons/Household
Indoor:		
Toilets	30	84
Showers/Bath	26	73
Clothes washing	20	56
Faucets (cooking/cleaning)	12	34
Dish washing	5	15
Total Indoor	**93**	**262**
Outdoor:		
Landscape Irrigation, Gardening	36	101
Other	6	17
Total Outdoor	**42**	**118**
TOTAL	**135**	**380**

Source: Urban Water Use Characteristics in the Metropolitan Water District of Southern California, MWD, April 1993

Commercial/Institutional Sector

The commercial/institutional sector accounts for 17 percent of the total urban water use. This sector includes businesses, services, government, and institutions such as hospitals, schools and colleges. In 1990, there were an estimated 354,000 commercial and institutional establishments in the MWD service area. Water use was estimated at 1,480 gallons per day (GPD) per establishment and 92 GPD per employee. About 71 percent of this sector's water is used indoors, while the remaining 29 percent is used outdoors, including water for cooling.

Table II-4 shows the largest commercial/institutional users based on a recent survey of non-residential water users. The top five water users include: schools, hospitals, hotels/motels, amusement/recreation, and colleges/universities. These water users are also projected to grow the fastest among the commercial sector.

Table II-4

**MAJOR COMMERCIAL/
INSTITUTIONAL WATER USERS
MWD SERVICE AREA**

Commercial/ Institutional User	Percent of Total
Schools	15.0
Hospitals	13.2
Hotels/Motels	11.1
Amusement/Recreation	9.5
Colleges/Universities	7.7
Nursing Homes	4.8
Restaurants	4.4
Public Administrations	4.4
Laundries	4.2
Real Estate Developments	3.9
Others	21.8

Source: Urban Water Use Characteristics in the Metropolitan Water District of Southern California, MWD, April 1993.

Industrial Sector

Industrial water use currently represents six percent of all M&I demand. This includes all manufacturing establishments. Currently, the average industrial water use is approximately 5,600 GPD per establishment and 127 GPD per employee. About 79 percent of industrial water use is indoors while 21 percent is outdoors, mainly for cooling.

By the year 2010, industrial use is projected to decline slightly to account for five percent of M&I demand. This decline is a result of improvements in recycling and reuse technologies, and a slowdown of the heavy manufacturing industry.

Table II-5

**MAJOR MANUFACTURING WATER USERS
MWD SERVICE AREA**

Industrial User	Percent of Total
Electronics	10.8
Aircraft	9.7
Petroleum refining	8.3
Preserved fruits	6.6
Beverages	6.2
Paper mills	5.2
Guided missiles	4.9
Communication	4.2
Textile finishing	2.6
Metal products	2.3
Office/Comp. Equip.	2.2
Ships/Boats	2.1
Dairy	1.9
Others	33.2

Source: Urban Water Use Characteristics in the Metropolitan Water District of Southern California, MWD, April 1993.

As Table II-5 shows, the largest manufacturing water users include: electronics, aircraft, petroleum refining, preserved fruits, and beverages. These five water users account for 41.6 percent of the total manufacturing users of MWD water.

Public and Other Sectors

In addition to the major use sectors (residential, commercial, and industrial), there are several minor sectors of water use. These are the public and other sectors. Public uses include sanitation in public buildings, irrigation of parks and medians, public fountains, street washing, public swimming pools, and cooling towers. The public sector represents 3.0 percent of the M&I use.

Unaccounted use represents the remaining 8.0 percent of the total M&I water use. Unaccounted use includes such subcategories as authorized unmetered uses (fire fighting, unmetered customers, under-registration of meters, and street washing) and unauthorized uses (leakage, major breaks, meter slippage, and illegal connections).

Agricultural Water Demands

Agricultural water use in the MWD service area in 1990 was 427,838 AF, approximately 10 percent of the total regional water use. In the MWD service area, irrigated agricultural areas are located primarily in San Diego (69,100 acres) and Riverside (59,000 acres) counties, and to a lesser extent in San Bernardino (20,900 acres), Orange (20,200 acres) and Ventura (15,500 acres) counties. In the service area of Los Angeles County, there are less than 2,000 acres of irrigated agricultural land. In 1988, the annual gross crop value of agriculture within the MWD service area was approximately $2.0 billion. The total contribution to the regional economy was estimated at three time the gross crop value, or $6.0 billion.

Total Regional Water Demands

Total regional water demand is the sum of urban and agricultural water demands. As shown in Table II-6, total regional water use in the MWD service area in 1990 was 4.01 MAF.

Table II-6

TOTAL REGIONAL WATER DEMANDS
MWD SERVICE AREA
1990
(AF)

County	Urban	Agricultural	Total
Los Angeles	1,799,100	3,900	1,803,000
Orange	647,800	35,200	683,000
Riverside	236,900	208,400	445,300
San Bernardino	184,200	33,500	217,700
Ventura	115,100	25,600	140,700
Within SCAG Region	**2,983,100**	**306,600**	**3,289,700**
San Diego	595,900	121,200	717,100
MWD Service Area	**3,579,000**	**427,800**	**4,006,800**

Source: MWD, 1993

III. REGIONAL WATER RESOURCES

Water demands in the MWD service area are met by both local and imported sources. About one-third of the water supply is from local sources while two-thirds is imported via the Los Angeles Aqueduct serving the City of Los Angeles, MWD's Colorado River Aqueduct, and through MWD's entitlement to State Water Project (SWP) water. Table III-1 shows the major water supplies used in the MWD service area in fiscal year 1989-90.

Table III-1

MAJOR SOURCES OF WATER SUPPLY
MWD SERVICE AREA
FISCAL YEAR 1989-1990
(AF)

County	Local Water Supply	MWD Delivery	Los Angeles Aqueduct	Total Water Supply
Los Angeles	507,715	1,089,419	205,837	1,802,971
Orange	271,113	411,940	0	683,053
Riverside	300,025	145,277	0	445,302
San Bernardino	149,099	68,665	0	217,764
Ventura	29,636	111,086	0	140,722
Within SCAG Region	**1,257,588**	**1,826,387**	**205,837**	**3,289,812**
San Diego	44,172	672,844	0	717,016
MWD Service Area	**1,301,760***	**2,499,231**	**205,837**	**4,006,828**

Source: MWD, 1993

* Actual local water production was 1,498,266 AF, including 196,506 AF of MWD replenishment water.

Local Supplies

Local water supplies, which include surface water, groundwater, and reclaimed water, currently provide 30 to 40 percent of the MWD service area's needs. Groundwater is the major source of local water supply. It is dependent on groundwater basin replenishment through local precipitation, runoff from the coastal range, artificial recharge with imported water supplies and reclaimed wastewater. Local water agencies manage their surface, ground, and reclaimed water supplies conjunctively. For example, MWD member agencies can utilize MWD's seasonal storage program to purchase imported water, at a discounted rate, from October through April to store in their local reservoir or groundwater basin for use during peak demand season. This program serves to offset the demand for imported water during peak season.

Surface Water

Virtually all of the major rivers in Southern California have been developed into systems of dams, flood control channels, and percolation ponds. Only a small amount of surface water is diverted for use directly as a water supply. Most surface supplies are retained for artificially recharging groundwater basins. Figure III-1 presents the major river systems and reservoirs in the SCAG region. A large percentage of the rainfall and runoff in Los Angeles County either percolates naturally into the ground or is captured in flood control reservoirs for later release to groundwater recharge basins. Only during the largest storms does fresh water reach the ocean.

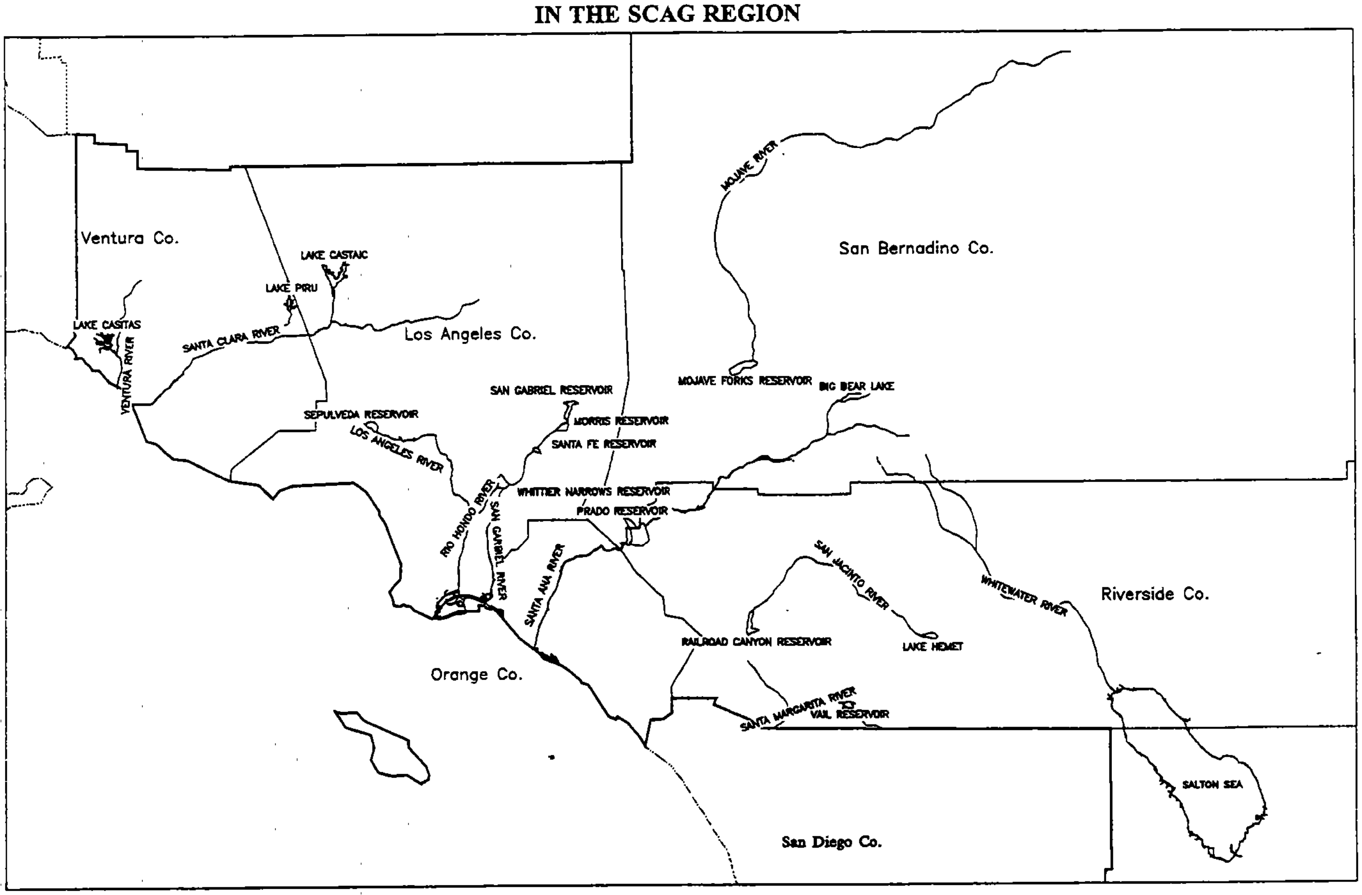
Groundwater

Groundwater supplies account for about 90 percent of the natural local water supplies. These supplies are found in many basins throughout the Southern California region, with total yield of 900,000 AFY. Natural recharge of groundwater basins is accomplished through the natural percolation of rainfall and stream runoff. In addition, runoff in certain areas is retained in flood control reservoirs constructed in major drainage areas and released into spreading basins or ponds for additional percolation into the groundwater basins. Groundwater is then pumped to meet local needs.

Almost all major groundwater basins in Southern California are either adjudicated or managed by special districts or agencies. Adjudicated basins in the Southern California region include Raymond Basin, Central Basin, West Coast Basin, Main San Gabriel Basin, Upper Los Angeles River System, and Chino Basin. Portions of the southern Ventura County groundwater are managed by the Fox Canyon Groundwater Management Agency and the Orange County basin is managed by the Orange County Water District. These basins are managed in such a way that extractions are limited, or replenishment is provided using imported supplies when the safe yield of the basin or other groundwater management criteria is being exceeded. In general, basin management plans include protection from seawater intrusion, water quality deterioration, and excessive lowering of water levels.

Figure III-1

MAJOR RIVER SYSTEMS AND RESERVOIRS
IN THE SCAG REGION



The existing and projected quality of groundwater supplies is of great concern to the Southern California region. High mineral and nitrogen content of groundwater due to historic agricultural and other man-made activities has affected usability of groundwater. In recent years, organic chemicals have been found in Southern California groundwater basins due to industrial activities. Loss of local production capacity due to groundwater quality problems may be viewed as a temporary problem because the value of the resource to Southern California is too great to allow its abandonment. Current planning studies assume that these water quality problems will not affect the long-term availability of groundwater, as there are efforts being undertaken to develop treatment and management approaches to reclaim these supplies and maintain their availability in the future. MWD and its member agencies have developed the Groundwater Recovery Program to rehabilitate contaminated groundwater and increase groundwater production. Refer to Section V for a description of the program.

Reclaimed Water

Reclaimed wastewater in the Southern California region has been used for several decades. Water reclamation involves: 1) recapturing or treating wastewater, degraded or contaminated groundwater, or other nonpotable water for beneficial uses; 2) its transportation to the place of use; and 3) its actual use.

Water reclamation is an integral part of Southern California's water supplies. Locally, water reclamation projects are integrated into a complex regional water supply system which maximizes the yield of local sources and the beneficial use of imported supplies.

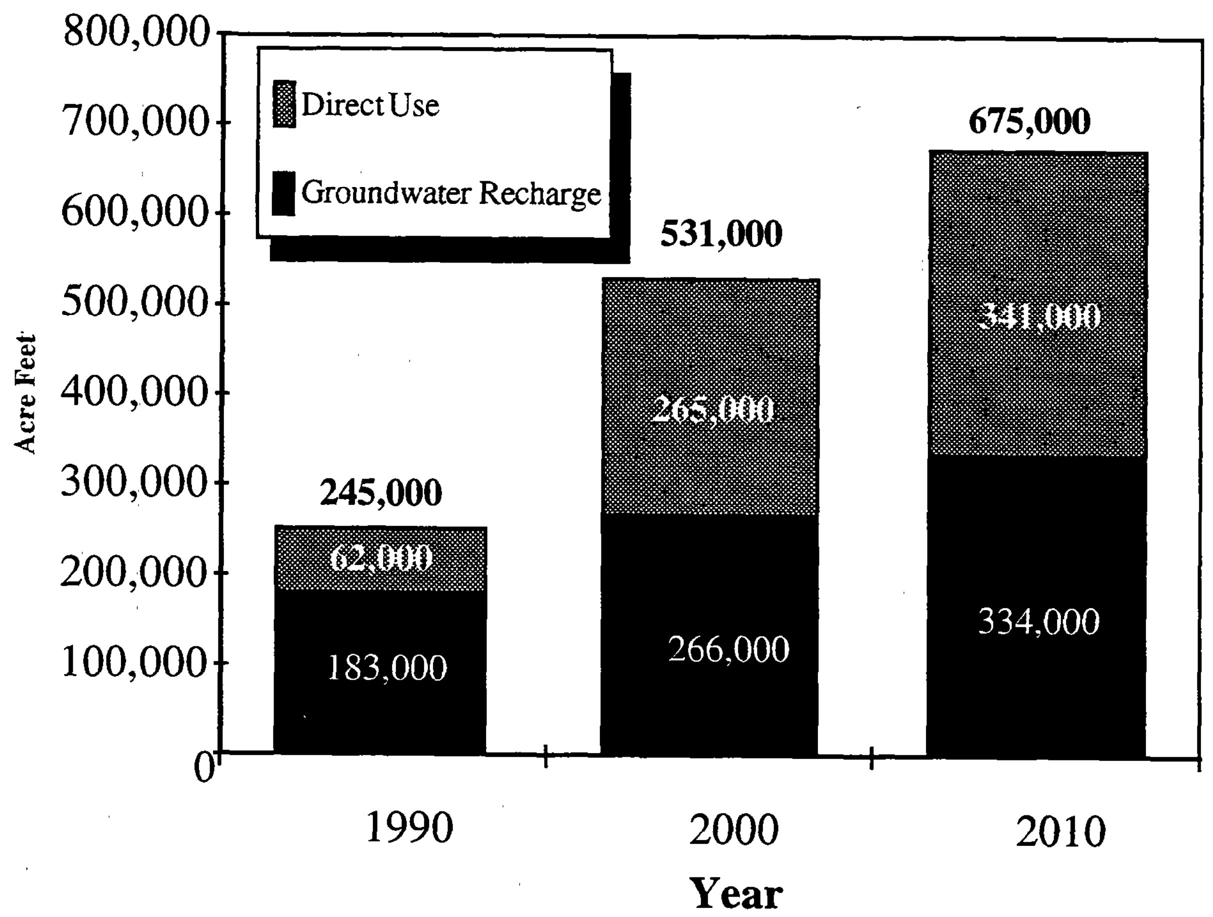
Many reclamation projects in Southern California have gone beyond traditional irrigation purposes to encompass groundwater recharge and industrial applications. Industrial applications include power plant and petroleum refinery cooling water and process water for paper plants. The largest use of reclaimed water in Southern California is for groundwater recharge. Groundwater replenishment is the most efficient use of reclaimed water, allowing large amounts of reclaimed water to be used at a relatively modest cost. The reclaimed water is percolated in spreading basins for eventual reuse in potable systems. Direct use of reclaimed water is primarily for irrigation purposes. A variety of golf courses, cemeteries, school yards, parks, street medians, and freeway landscapes in Southern California are irrigated with reclaimed water.

To ensure the maximum reuse of local reclaimed supplies and thus reduce demand on its distribution system, MWD is providing financial assistance to local agencies (through the Local Projects Program) to build treatment plants and distribution system facilities. Most of the regional increase in the reclamation of wastewater will be undertaken through this program. As presented in Figure III-2, reclaimed water use in 1990 was approximately 245,000 AF, with direct use representing a quarter (25.3%) and groundwater recharge representing three-quarters (74.7%) of total use. Under favorable conditions, by 2010, total use of reclaimed water could reach about 675,000 AF with approximately half (50.5%) for direct use and the other half (49.5%) for groundwater recharge.

Figure III-3 shows the location of existing and potential reclaimed water use projects in the MWD service area within the SCAG region.

Figure III-2

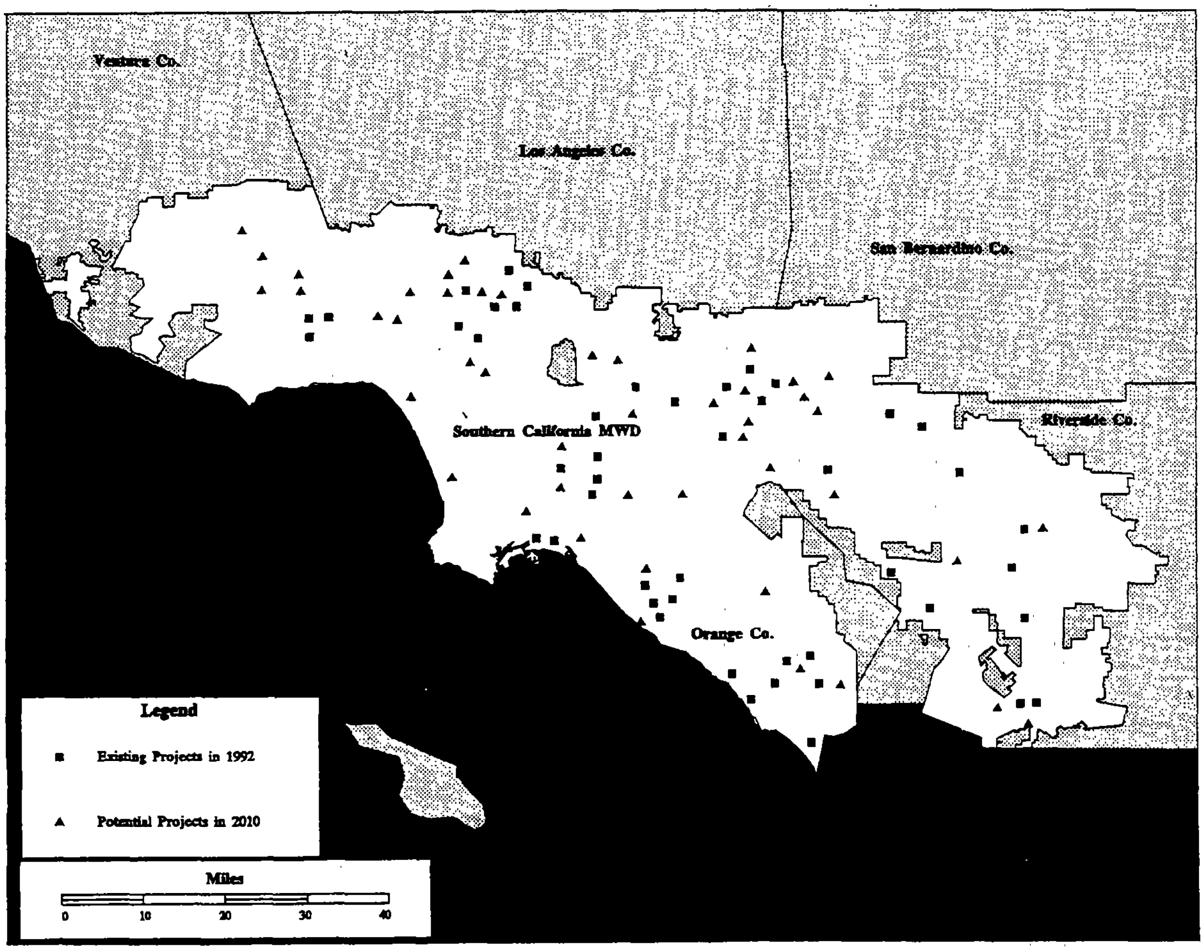
RECLAIMED WATER USE
MWD SERVICE AREA



Source: MWD 1993

Figure III-3

LOCATION OF RECLAIMED WATER USE PROJECTS
IN THE MWD SERVICE AREA WITHIN THE SCAG REGION



Imported Supplies

Figure III-4 shows historic local and imported water supplies to the MWD service area.

Colorado River Aqueduct

The Colorado River originates in the Rocky Mountains and flows through seven states and the Republic of Mexico to the Gulf of California. The water generated by the River is shared among the seven states in the United States of America and Mexico, and is used for irrigation, municipal, and industrial purposes.

California began utilizing water from the Colorado River in 1855; and in 1928 the MWD was formed to bring Colorado River water to Southern California. In 1985, California relied on Colorado River water for approximately 15 percent of the state's water needs. Furthermore, California receives approximately 3.5 billion kilowatt-hours of clean, renewable energy from the hydroelectric generating plants along the River.

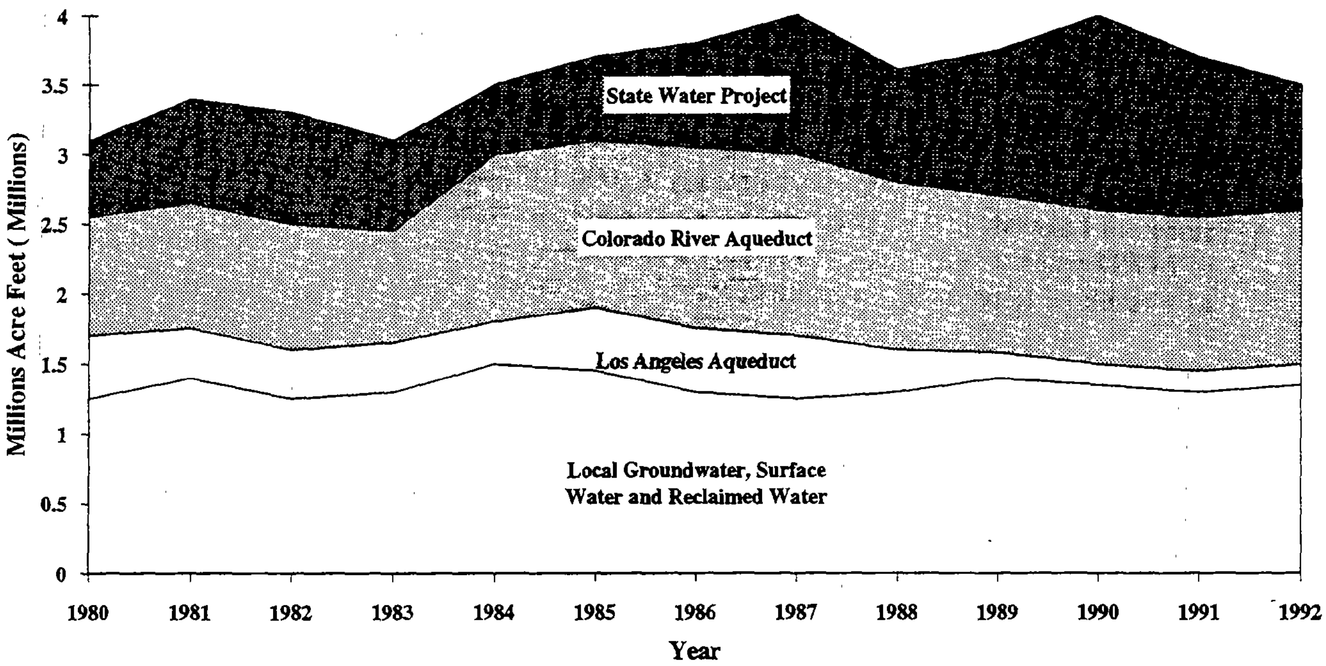
Under the water delivery contracts with the United States, California entities could depend on receiving up to approximately 5.4 MAFY of Colorado River water until the start of the Central Arizona Project (CAP) operation in 1985. MWD's share of the 5.4 MAFY was approximately 1.2 MAFY. Once the CAP began operation, California could depend on receiving only its basic apportionment of Colorado River supplies. That basic apportionment consists of 4.4 MAFY. In addition, California is apportioned half of any surplus water available over the 7.5 MAF apportioned to California, Arizona and Nevada. (The amount of surplus water available, if any, is decided on an annual basis; therefore it cannot be relied upon as a dependable supply). Of the 4.4 MAFY that is apportioned California, 550,000 AFY was allocated to MWD by the 1931 California Seven-Party Agreement which is incorporated in the water delivery contracts with the United States. However, under the 1964 U.S. Supreme Court decree in Arizona v. California, current water use by holders of present perfected rights (such as Indian reservations, towns, and other individuals along the Colorado River whose rights predate MWD's rights) can reduce the dependable supply by about 30,000 AFY. Conveyance losses along the Colorado River Aqueduct of 10,000 AFY further reduce the amount of Colorado River water received in the coastal plain. Considering these reductions, MWD could have obtained 510,000 AFY on a dependable basis beginning in 1985.

However, due to above normal runoff conditions in the Colorado River Basin and the States of Arizona and Nevada not using their full apportionments, California has received an average of 4.8 MAFY in recent years. Consequently, MWD has received an average of 1.2 MAFY in recent years.

Over the last decade, Californians have analyzed ways for managing their apportionment of Colorado River water. Under agreements with Coachella Valley Water District (CVWD) and the Desert Water Agency (DWA), MWD exchanges Colorado River water for CVWD's and 23 DWA's State Water Project entitlements. Through a third agreement, MWD delivers Colorado River water in advance to CVWD and DWA for groundwater storage. As needed, MWD will

Figure III-4

REGIONAL WATER SUPPLY TO THE MWD SERVICE AREA



be able to continue to use its full Colorado River supply augmented by up to 61,200 AFY of CVWD's and DWA's State Water Project entitlements, while CVWD and DWA use the previously stored Colorado River water.

Implementation of a water conservation program with Imperial Irrigation District (IID), the largest agricultural user of Colorado River water, began in January 1990. The IID/MWD agreement provides for MWD to finance the costs of specific conservation projects. These projects include implementing structural and nonstructural conservation measures including lining existing canals, constructing local reservoirs and spill interceptor canals, installing nonleak gates and automation equipment, and instituting distribution system and on-farm management activities. In return, MWD will be entitled to divert from the Colorado River, or store in a reservoir on the river, a quantity of water equal to the amount of conserved water resulting from these projects, which is estimated to total 106,100 AFY upon full implementation. With the agreement, MWD's dependable supply from the Colorado River Aqueduct increases to 616,000 AFY.

MWD implemented a test land fallowing program with Palo Verde Irrigation District beginning August 1, 1992 for a two-year period. Under the program about 20,000 acres of agricultural land is not being irrigated with Colorado River water. MWD is compensating the lessees or landowners in the Palo Verde Valley who are voluntarily fallowing approximately 25 percent of their land. By not irrigating, approximately 93,000 AFY of Colorado River water is to be saved, stored in Lake Mead and made available by the United States Bureau of Reclamation (Bureau) to MWD when needed prior to the year 2000 unless the water has been spilled by the Bureau as a result of flood control requirements.

In October 1992, MWD and the Central Arizona Conservation District (CAWCD) executed an agreement to create and implement a demonstration project for underground storage of unused Colorado River water in Arizona. CAWCD stored 30,000 AF in 1992 and 70,000 AF in 1993 as part of this project for MWD and the Southern Nevada Water Authority. In times of need following a declaration of the availability of surplus water by the Secretary of the Interior or the release of water to control floods, CAWCD would draw upon the stored water and make about 91 percent of that amount of water available, half to MWD and half to the Southern Nevada Water Authority.

State Water Project

Delivery of SWP water was first made to Southern California in 1972. SWP supplies are delivered to Southern California via the California Aqueduct, with delivery points at Castaic Lake in Los Angeles County, Devil Canyon Afterbay in San Bernardino County, and Box Spring Turnout and Lake Perris in Riverside County.

MWD contracted for delivery of 2.01 MAFY of SWP water, about 48 percent of the total planned SWP yield of 4.23 MAFY. The contracts between the State and SWP contracting agencies provided for a buildup in deliveries over time, with most agencies reaching their maximum annual entitlement by the year 1990. The SWP was planned so that construction would be phased, with additional facilities constructed over time as the contract entitlements and contractor demands increased. However, no Delta transfer facilities or additional reservoir storage has been built to increase SWP yield since completion of the initial storage and delivery facilities about 20 years ago. Meanwhile, SWP contractors' needs for SWP water have been increasing. Currently, contractor demands are approximately 90 percent of the ultimate amount that the State contracted to deliver, while the SWP is providing a dependable supply of about one-half of that ultimate amount. The dependable supply is the amount of water expected to be available during a repeat of the seven-year critical dry period which occurred from 1928 to 1934.

The SWP must be operated to comply with both State water quality and flow standards for the Delta, and federal constraints imposed under the Endangered Species Act (ESA). Current State standards were adopted in 1978 by the State Water Resources Control Board (SWRCB) in Water Rights Decision 1485 (D-1485). The SWRCB began a process in 1987 to review the existing standards and adopt new standards. This process is ongoing. Federal constraints have been imposed by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to protect winter-run Chinook salmon and Delta smelt, listed under the federal ESA in 1989 and 1993, respectively. Additional constraints are proposed by the U.S. Environmental Protection Agency to set water quality requirements for the Delta under the Clean Water Act. Due to these recent and proposed constraints, the quantity of dependable SWP supply that will be available to Southern California is uncertain.

Los Angeles Aqueduct

The City of Los Angeles imports water through the Los Angeles Aqueducts from the Owens Valley and Mono Basin. The original Los Angeles Aqueduct was completed in 1913 and imported water from the Owens Valley. In 1940, the aqueduct was extended to Mono Basin. A second Los Angeles Aqueduct, which parallels the original aqueduct, was completed in 1970.

The aqueducts have historically supplied an average of about 450,000 AFY, consisting of 360,000 AFY from surface water and groundwater supplies in the Owens Valley and 90,000 AFY from surface supplies in the Mono Basin. However, in drier periods, deliveries have been considerably lower.

The continuing ability of the Los Angeles Aqueducts to deliver 450,000 AFY on the average is unlikely because of litigation aimed at reducing the City's diversion from the Mono Basin. Under California court ruling, the City has not received any Mono Basin supplies since May 1989. The amount of water that can be delivered from the Los Angeles Aqueducts is also affected by the City's groundwater management agreement with the county of Inyo for the Owens Valley. For planning purposes, an average supply of 380,000 AFY and a dependable supply of 310,000 AFY is used. During severe droughts, the supplies can be reduced to 125,000 AFY. The recent statewide drought and ongoing litigation reduced the Los Angeles Aqueduct supplies to 178,000 AF in calendar year 1991 and to 172,000 AF in calendar year 1992.

IV. PROJECTED WATER SUPPLY AND DEMAND

Projected Water Demand

Projection Methodology

MWD uses an econometric model to project water demand. The model was developed in the early 1960s by the U.S. Army Corps of Engineers' Institute for Water Resources and recently updated to incorporate water use patterns of Southern California residents and businesses. Separate projections for the four major water use sectors (residential, commercial, industrial, and public/unaccounted) are estimated by MWD.

In order to make long-term water demand projections, economic, demographic, and climate factors are taken into account. Regarding residential water demand forecasting, the model takes into consideration the following variables: population, housing mix, household occupancy (persons per household), housing values, weather conditions, and the implementation of conservation measures. SCAG's and SANDAG's projected population, housing, and employment data are basic demographic input for the model. The model assimilates the effects of water conservation measures currently practiced in the MWD service area since 1980. These measures include savings from the 1981 and 1992 California Plumbing Codes, public education programs, and the effects of changes in retail prices from 1980-1990. For projections of future water needs, the model also incorporates future water conservation practices and projected increases in water rates.

Projected commercial and industrial water demands are a function of employment in the numerous types of commercial, institutional, and manufacturing establishments as well as water/wastewater prices and conservation practices. SCAG's and SANDAG's employment projections were used in the model.

A key assumption of the model is the incorporation of varied weather conditions. MWD is able to project water demands during years of above-average or below-average rainfall and temperature. The analysis has established that the above-normal water demand, occurring on average every one-in-twenty years, was approximately seven percent greater than normal (average) water demand.

Conservation and Best Management Practices

Over the past several years, a group of urban water agencies, the environmental community, and other public interest groups have worked as the State Water Conservation Coalition to reach a consensus on a process of standardized water conservation practices known as "Best Management Practices" (BMP). Under the BMP process, participating water agencies commit to use "good faith efforts" to implement proven water conservation measures, develop new measures, and implement them as they become feasible. MWD has committed to implementation of 16 BMPs over the next ten years.

These 16 MWD Best Management Practices are:

1. Interior and exterior water audits and incentive programs for single-family residential, multi-family residential, and governmental/institutional customers.

2. Plumbing, new and retrofit:
   A. Enforcement of requirement for ultra-low flush toilets in all new construction beginning January 1, 1992;
   B. Support of State and Federal legislation prohibiting sale of toilets using more than 1.6 gallons per flush; and
   C. Plumbing retrofit.

3. Distribution system water audits, leak detection and repair.

4. Metering with commodity rates for all new connections and retrofit of existing connections.

5. Large landscape water audits and incentives.

6. Landscape water conservation requirements for new and existing commercial, industrial, institutional, governmental, and multifamily developments.

7. Public information.

8. School education.

9. Commercial and industrial water conservation.

10. New commercial and industrial water use review.

11. Conservation pricing.

12. Landscape water conservation for new and existing single-family houses.

13. Water waste prohibition.

14. Water conservation coordinator.

15. Financial incentives.

16. Ultra-low-flush toilet replacement.

As a result of established ongoing regional conservation programs and anticipated savings from the implementation of BMPs in the MWD service area of the SCAG region, water savings of 637,100 AFY are projected by the year 2010. To facilitate the implementation of BMPs, MWD has established its Conservation Credits Program. Under this program, MWD provides a financial incentive to its member agencies for the implementation of conservation programs that have a demonstrated ability to save water. MWD's incentive payment is based on the lesser of $154 per acre foot of water saved over the life of the program or one-half the cost of the proposed program.

Consumers Response to Water Rates Changes

It should be noted that MWD is a wholesale water agency. As such, it has no retail customers and, therefore, no retail water rates. MWD has no authority, nor does it have the ability to establish retail water rates in its service area. Any discussions of retail rates, such as increasing block, seasonal prices, and other conservation incentive structures is included in plans prepared by local agencies. In fact, Water Code Section 10610.2(b) states that "The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the implementation of those plans can best be accomplished at the local level." The following sections describe the average retail prices in Southern California and present the theoretical relationships between prices and water use.

A survey of retail prices of water services in Southern California was conducted as part of a MWD water demand study. Table IV-1 summarizes retail "average prices" of water obtained from 45 agencies in the six counties in MWD's water service area. The 1980 weighted average price was $0.72 per 1000 gallons, while the 1990 average price has risen to $1.55 per 1000 gallons, an apparent increase of 115 percent over 10 years. However, after converting the 1980 value to 1990 dollars (thus removing the effect of general price inflation), the real increase in water price was 40 percent for the decade or four percent per year.

The understanding of consumer behavior in responding to changes in water rates is critical to the efficient management of urban water demand. Retail water agencies in Southern California can implement price incentives only if they can predict the effects of price changes upon the current and future use of water by their customers. However, the current understanding does not allow predictions of the effectiveness of alternative rate designs in reducing water use to a level of accuracy and predictability that is required in water supply planning.

Economists predict the consumer response to price based on the theory which states that the quantity demanded is a function of price paid for the last unit of water used. This responsiveness to price is often termed the price elasticity of water demand. According to historical data, MWD statistically estimated, by regression analysis, price elasticity for its service area. When water price increases are implemented together with non-price conservation measures, the interrelationship of price and the other measures must be considered. Based on historic data and other studies regarding price and conservation, it was estimated that 50 percent of the price effect (elasticity) is exerted in BMP, or conservation compliance. These conservation measures include water efficient plumbing, home and governmental audits, landscaping measures for existing construction, distribution system leak detection and repair, commercial and industrial

Table IV-1

1990 RETAIL WATER PRICES IN SOUTHERN CALIFORNIA

County	Number of Sampled Agencies	Range of Average Prices $/1000 gal. $/AF	Weighted County Average $/1000 gal. $/AF
Los Angeles	17	1.11 - 2.63 362 - 857	1.62 528
Orange	12	0.84 - 2.42 274 - 789	1.37 446
Riverside	4	0.91 - 2.05 297 - 668	1.04 339
San Bernardino	2	0.92 - 1.35 300 - 440	1.14 371
San Diego	6	1.52 - 2.72 496 - 887	1.70 554
Ventura	4	1.42 - 1.79 463 - 584	1.56 509
TOTAL	**45**	**0.84 - 2.72** **274 - 887**	**1.55** **505**

Source:MWD 1990, Regional Urban Water Management Plan for the Metropolitan Water District of Southern California.

Note:The 45 agencies surveyed serve approximately nine million people (or 61 percent of the population in MWD's service area).

conservation, ultra low-flush toilet retrofits, conservation pricing, public education and information, metering, and water waste prohibition. The remaining 50 percent of the price effect was estimated to represent savings from behavioral changes and commercial and industrial conservation not explicitly specified in the BMPs. A more technical discussion on price elasticity can be found in MWD report "Municipal and Industrial Water Use In the Metropolitan Water District Service Area: Interim Report No. 4" prepared in June 1991.

Projected real increases (without inflation) in retail prices as shown in Table IV-2 have been used for water demand projections.

Table IV-2

PROJECTED INCREASES IN RETAIL PRICES 1990-2010

County	Percent Change
Los Angeles	26
Orange	33
Riverside	24
San Bernardino	19
San Diego	49
Ventura	44

Source: MWD, 1991 Municipal & Industrial Water Use in the MWD Service Area Interim Report No.4.

Projected Water Demand

Projected urban water demands are based on SCAG and SANDAG population, household, and employment projections developed under the Growth Management Element of the RCP, and take into account full implementation of BMPs and projected increases in retail water rates. As shown in Table IV-3, the implementation of best management practices will result in water conservation savings of about 766,200 AF by the year 2010. Urban water demand within MWD service area is projected to increase from 3.58 MAF to 4.24 MAF by 2010 under average weather condition (1990 urban water demand was higher than normal due to the hotter and drier climate). Figure IV-1 shows the resulting urban per capita water use decreasing from 217 gallons per capita per day (gpcd) in 1990 to 194 gpcd by 2010, over 10 percent decrease in per capita water use.

Table IV-3

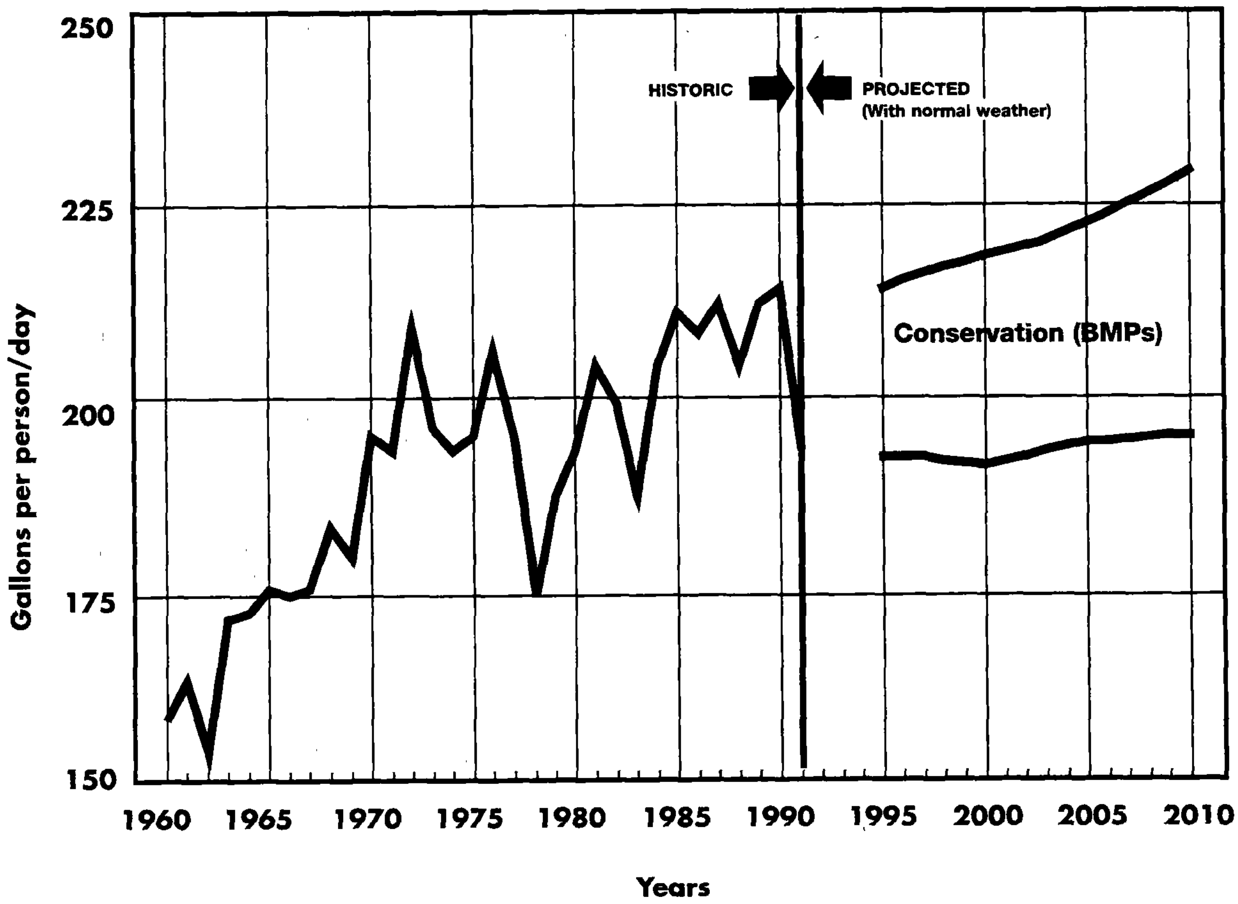
**URBAN WATER DEMANDS
IN MWD SERVICE AREA
1990 AND 2010
(AF)**

County	1990 Actual	2010 Without BMP's	2010 Conservation Savings	2010 With BMP's
Los Angeles	1,799,115	2,284,400	353,500	1,930,900
Orange	647,840	830,100	124,300	705,800
Riverside	236,855	590,300	91,900	498,400
San Bernardino	184,236	309,700	44,300	265,400
Ventura	115,091	155,000	23,100	131,900
With SCAG Region	**2,983,137**	**4,169,500**	**637,100**	**3,532,400**
San Diego	595,852	833,500	129,100	704,400
MWD Service Area	**3,578,989**	**5,003,000**	**766,200**	**4,236,800**

Source: MWD 1993

Figure IV-1

URBAN PER CAPITA WATER USE
MWD SERVICE AREA



Based on SCAG Draft RCP 1993; SANDAG Draft Series 8 Forecast
Source: MWD, 1993

Table IV-4 shows that projected agricultural water demands in Metropolitan's service area are decreasing from 428,000 AF in 1990 to 299,000 AF by 2010. The largest reduction is projected in Riverside County. A significant portion of the agriculture in MWD's service area in Riverside County is in the path of immediate urbanization.

Table IV-5 and Figure IV-2 show the projected regional water demands for MWD's service area. Based on SCAG and SANDAG draft growth management plans, population within MWD's service area will increase from 14.9 million in 1990 to 19.5 million by the year 2010 (Table 1-2). Population is expected to grow approximately 30 percent from 1990 to 2010. With the implementation of water conservation best management practices and decreasing agricultural water demands, regional water demand is expected increase from 3.9 million acre-feet (MAF) to 4.5 MAF by 2010 under average weather condition. (Actual 1990 water demand was 4.0 MAF due to the hotter and drier climate). Hence, water demand is expected to increase approximately 15 percent from 1990 to 2010.

Table IV-4

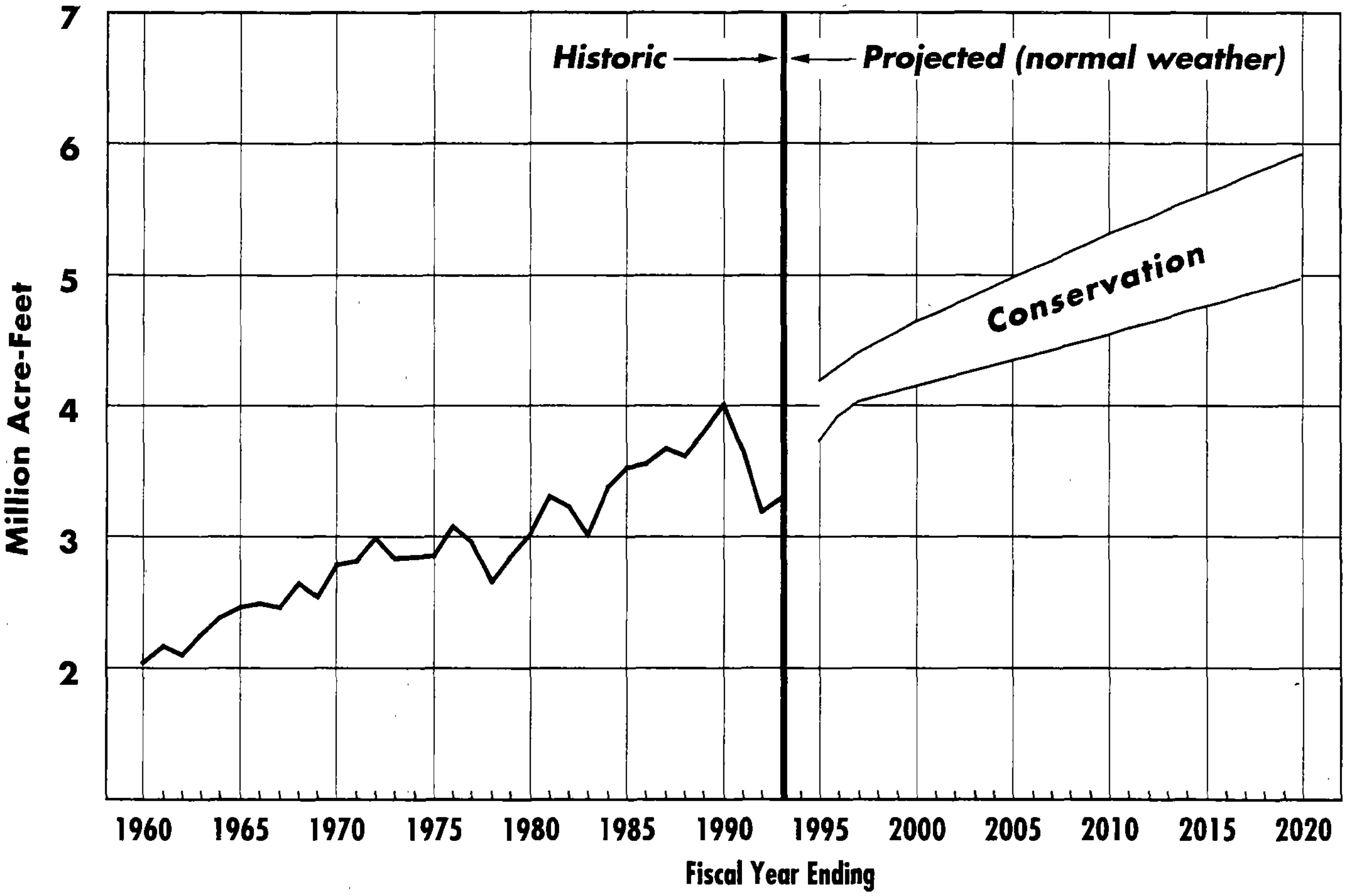
AGRICULTURAL WATER DEMAND
MWD SERVICE AREA
1990 AND 2010
(AF)

County	1990	2010	Change
Los Angeles	3,900	3,500	-400
Orange	35,200	21,400	-13,800
Riverside	208,400	114,500	-93,900
San Bernardino	33,500	35,000	1,500
Ventura	25,600	16,200	-9,400
Within SCAG Region	**306,600**	**190,600**	**-116,000**
San Diego	121,200	108,000	-13,200
MWD Service Area	**427,800**	**298,600**	**-129,200**

Source: MWD, 1990 Agricultural Water Use in Metropolitan's Service Area, Report No. 1018

Figure IV-2

REGIONAL WATER DEMANDS
MWD SERVICE AREA



Based on SCAG Draft RCP 1993; SANDAG Draft Series 8 Forecast
Source: MWD, 1993

Table IV-5

ACTUAL AND PROJECTED WATER DEMAND IN THE MWD SERVICE AREA 1990 AND 2010 (MAF)

County	1990	2010
Los Angeles	1.80	1.93
Orange	0.68	0.73
Riverside	0.44	0.62
San Bernardino	0.22	0.30
Ventura	0.14	0.15
Within SCAG Region	**3.29**	**3.73**
San Diego	0.72	0.81
MWD Service Area	**4.01**	**4.54**

Source: MWD, 1993

Projected Water Supply

As shown in Table IV-6, existing supplies in an average year are expected to total 4.00 MAF in the year 2010. Of the existing supplies, 1.05 MAF will come from local production, 0.40 MAF from reclaimed water, 0.37 MAF from the Los Angeles Aqueducts, 0.62 MAF from the Colorado River, and 1.56 MAF from the State Water Project. MWD is pursuing additional supplies of 1.02 MAFY through the implementation of a number of programs such as obtaining additional water from the Colorado River and State Water Project, water reclamation, groundwater recovery, water management and transfers. These programs, described in Chapter V, could increase total average year supplies to 5.02 MAF.

Also shown in Table IV-6 is the minimum supplies condition. The minimum supplies condition is equivalent to the 1991 experience when both Los Angeles Aqueduct and State Water Project supplies had dwindled after four previous critically dry years statewide (1987-1990). Based on historic weather data, it is estimated that the 1991 supply condition occurs about once in 50 years. Under this extreme drought condition, existing supplies for MWD service area could decrease to 2.40 MAF and water management and supply augmentation programs could increase total supplies to 4.35 MAF.

Table IV-6

EXISTING AND POTENTIAL WATER SUPPLY FOR THE MWD SERVICE AREA 2010 (MAF)

	Average Year Supply	Minimum Year Supply
Existing Supplies		
Local Production	1.05	1.05
Reclaimed Water	0.40	0.40
Los Angeles Aqueducts	0.37	0.12
Colorado River	0.62	0.62
State Water Project	1.56	0.21
Total	**4.00**	**2.40**
Potential Increase in Supplies		
Additional Colorado River	0.45	0.45
Additional State Water Project & Transfer*	0.20	1.13
Reclaimed Water	0.27	0.27
Groundwater Recovery	0.10	0.10
Total	**1.02**	**1.95**
TOTAL SUPPLIES	**5.02**	**4.35**

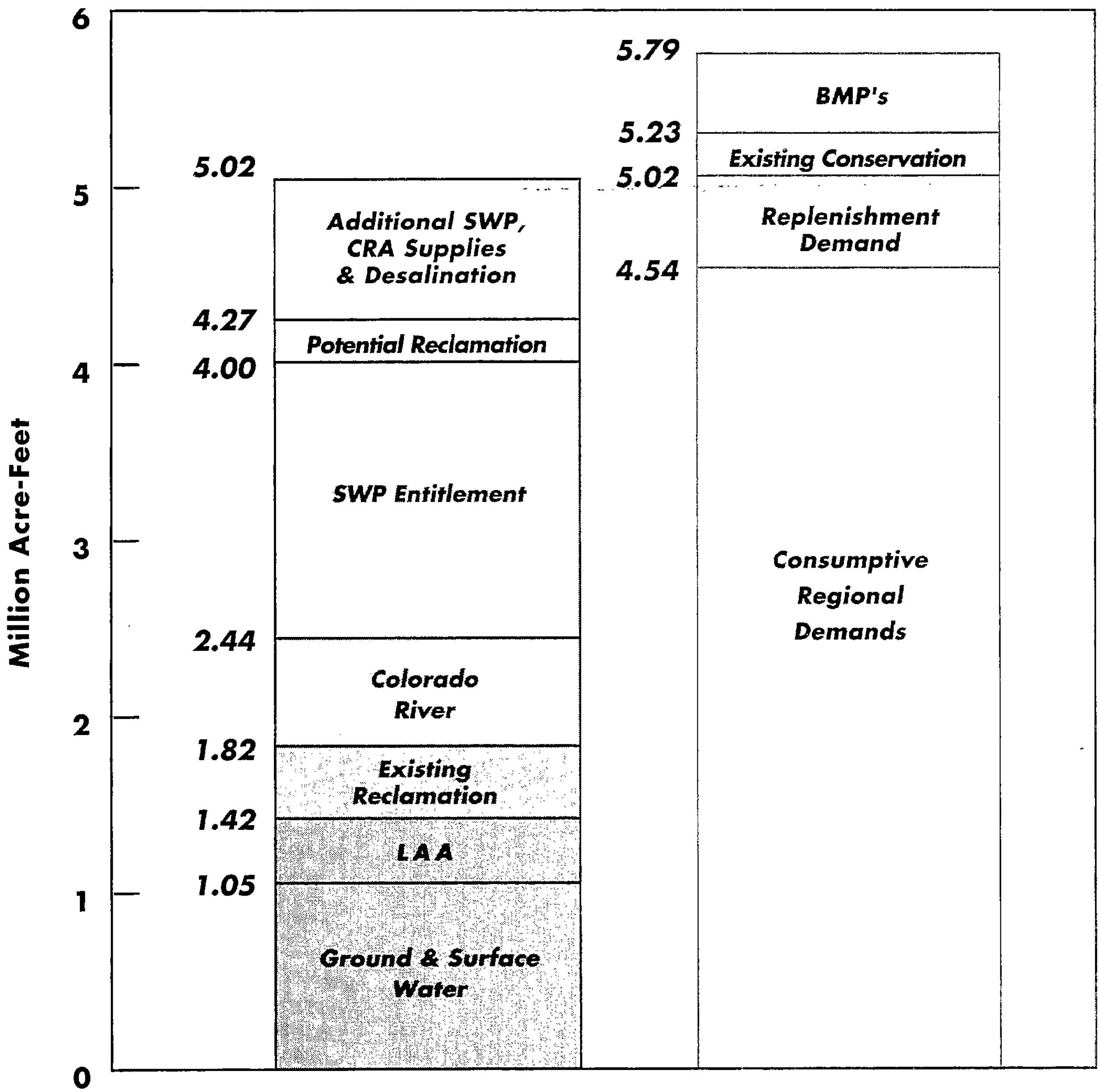
Source: MWD, 1993
* Includes SWP water stored in surface reservoirs and groundwater basins in wet and normal years.

Projected Water Supply and Demand Balance

The projected water demand and supply balances for MWD service area are shown in Table IV-7 and Figures IV-3 and IV-4. As shown in Table IV-7, consumptive water demand for MWD's service area, under average weather conditions, is projected at 4.54 MAF in the year 2010. If no additional supplies are developed, MWD's service area could potentially experience a shortage up to 540,000 AFY under average weather conditions. Assuming shortages within MWD's service area are shared based on water needs, shortages within SCAG's region could potentially be 444,000 AFY. With supply augmentation and management programs being pursued an additional 1.02 MAF of water supplies is expected as shown in Table IV-7 and Figure IV-3.

Figure IV-3

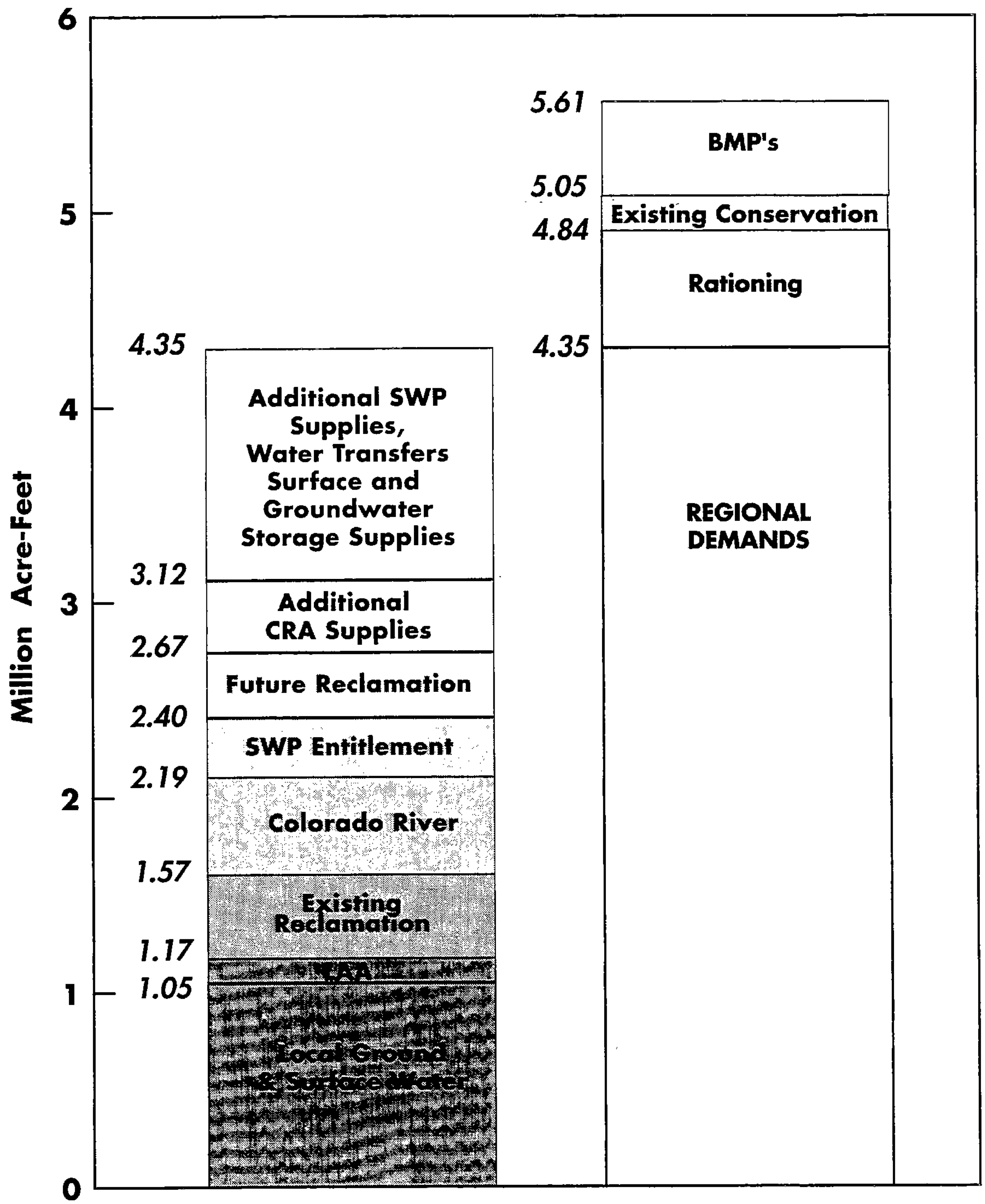
DEMAND AND SUPPLIES IN 2010
AVERAGE YEAR CONDITIONS



Based on SCAG Draft RCP 1993; SANDAG Draft Series 8 Forecast
Source: MWD, 1993

Figure IV-4

DEMAND AND SUPPLIES IN 2010
MINIMUM SUPPLIES CONDITION



Based on SCAG Draft RCP 1993; SANDAG Draft Series 8 Forecast
Source: MWD, 1993

The projected yield from existing and potential supplies is estimated to total 5.02 MAF, which will meet consumptive demands of 4.54 MAF and have water stored in surface reservoirs and the groundwater basins for use in drier years. The supply augmentations and water management programs (such as development of reclaimed water, development of storage strategies including conjunctive use of imported surface and local groundwater supplies, and water conservation) are consistent with mitigation measures for water supplies proposed in SCAG's 1989 Growth Management Plan Environmental Impact Report.

In the year 2010, regional consumptive demand with BMP implementation is expected to increase from 4.54 MAF to 4.85 MAF under drought condition due to the hotter and drier weather. At the same time, water supplies are expected to decrease. Under a record drought such as 1991, existing water supplies could dwindle to 2.40 MAF as shown in Table IV-7. Recognizing that it is too expensive to plan for no shortages under extreme drought conditions, MWD's reliability goal for its service area allows for a 10 percent reduction in water demand beyond BMPs at a frequency of one in 50 years. Hence, the water supply augmentation and water management programs being pursued are expected to yield 4.35 MAF to meet 90 percent of the region's consumptive demands (see Figure IV-4).

Table IV-7

WATER SUPPLY AND DEMAND BALANCE FOR THE MWD SERVICE AREA 2010 (MAF)

	Average Year Supply	Minimum Year Supply
Projected Demands with BMPs	4.54	4.84
Existing Supplies	4.00	2.40
Potential Shortage with Existing Supplies	0.54	2.44
Potential Additional Supplies	1.02	1.95
Available for Storage	0.48	--
Potential Need for Demand Reduction	--	0.49

Source: MWD, 1993

V. PROGRAMS TO MEET FUTURE DEMANDS

Colorado River Programs

MWD is continuing its efforts to obtain additional Colorado River supplies. Both short- and long-range supplies are being pursued on intermittent and dependable bases, as appropriate. A number of programs being considered by MWD are described in this section.[7] Long term studies by the Bureau of Reclamation indicate that surplus Colorado River water could be made available to MWD in the future in certain years. As the amount of Colorado River water available to MWD continues to be determined on an annual basis, surplus water cannot be relied upon as a dependable supply.

All American Canal and Coachella Canal Lining

Title II of Public Law 100-675 authorized the Secretary of the Interior to line 65 miles of the All American Canal and the Coachella Canal. The lining of the canals could potentially conserve about 94,000 AFY of water. The projects are to be constructed with 100 percent non-federal funding provided by MWD, Coachella Valley Water District, Imperial Irrigation District and/or Palo Verde Irrigation District. It is estimated that approximately 68,000 AFY would be conserved by the lining of the All American Canal, and 26,000 AFY by the lining of the Coachella Canal. The water conserved would be made available to one or more of these four agencies in accordance with the priorities to use of water contained in their water delivery contracts with the United States.

Interstate Underground Storage of Unused Colorado River Water

The states of Arizona, California and Nevada are discussing the feasibility of increasing the interstate underground storage of unused Colorado River water. To date, 100,000 AF has been stored. Under this concept, Colorado River water would be stored in a groundwater basin in central Arizona when unused water is available and made available when needed.

Phase II Water Conservation Program with Imperial Irrigation District

MWD is considering a Phase II water conservation program with the Imperial Irrigation District (IID). Under this potential program, MWD would provide funding for constructing a regulatory reservoir and a spill-interceptor canal, lining canals with concrete, and further managing irrigation water on farms. Such a program could conserve 150,000 AFY. In return, the water conserved by this program would be made available to MWD.

Modified Irrigation Practices and Land Fallowing Proposal of Imperial Irrigation District

The implementation of a modified irrigation practice program and a land fallowing program with IID could provide 100,000 AFY of Colorado River water to MWD for a two-year period. Under this proposal, farmers growing alfalfa in the Imperial Valley would enter into contracts with IID, agreeing not to irrigate their crops for a 75-day period during the summer, thus saving an estimated 1.4 AF per acre, in return for compensation. Farmers could also enter into contracts, agreeing to fallow irrigated fields in return for compensation. In turn, IID would enter into an agreement with MWD agreeing to not divert the water saved, permitting it to be stored in Lake Mead for future use by MWD.

State Water Project Programs

In April, 1992, the Governor delivered a water policy statement outlining a comprehensive program to meet the water needs of urban, agricultural, and environmental interests in the State. In his policy statement, the Governor acknowledged the current problems in the Delta and the need for timely completion of environmental documentation for selection of a comprehensive Delta solution, and recognized the need to implement several SWP facilities currently planned by the State Department of Water Resources. The SWP facilities specified were South Delta improvements, Kern Water Bank (KWB), and Los Banos Grandes Reservoir (LBG).

Implementation of a Delta water transfer solution and completion of the specific SWP facilities referred to by the Governor would significantly increase SWP water supplies. These facilities would allow diversion and storage of additional water from the Delta for delivery to MWD and the other SWP contractors. It is expected that the first facilities to be completed would be the initial phase of the KWB's Kern Fan Element (KFE) and South Delta improvements, followed by completion of and a later phase of the KFE. Following completion of these facilities is the anticipated implementation of a Delta water transfer solution and completion of LBG. These facilities are anticipated to be complete by the year 2010.

Existing SWP facilities are estimated to provide an average-year supply to MWD of about 1.56 MAFY. This estimate is based on an MWD SWP demand of 1.8 MAF and standards proposed by the SWRCB in their Draft Water Rights Decision 1630, which is an approximation of constraints required for protection under the Endangered Species Act for winter-run salmon and Delta smelt. The additional SWP facilities described above are estimated to increase SWP supplies to MWD by an average of approximately 0.20 MAFY. Minimum-year supplies with existing SWP facilities are estimated to be 0.21 MAFY. The minimum-year increase in SWP supplies resulting from additional facilities is projected to be approximately 1.13 MAFY. Operation of the SWP under more restrictive standards and constraints than assumed in these studies result in reductions from the supplies indicated here, both with existing and additional SWP facilities.

Water Transfer and Exchange Programs

California's agricultural activities consume approximately 27 MAFY or 83 percent of California's 32.5 MAFY of developed water supplies. Voluntary water transfers and exchanges can make a portion of this agricultural water supply available to support the State's urban economies.

Consistent with the Governor's April 1992 Water Policy Statement, voluntary water transfers and exchanges are a critical element for improving the water supply reliability within MWD's service area and accomplishing the reliability goal set by MWD's Board of Directors. MWD is vigorously pursuing a full-range of voluntary water transfer and exchange programs with state, federal, public and private water districts and individuals.

The enactment of the Federal Central Valley Project Improvement Act on October 30, 1992 represents a major breakthrough in California water policy and has significantly enhanced MWD's ability to transfer water from Central Valley Project (CVP) contractors. By removing restrictions which prevented the transfer of CVP water supplies outside of its service areas and providing CVP water users the ability to directly transfer water, this act has substantially increased the amount of water available for water transfer and exchange programs.

Other provisions of the Central Valley Project Improvement Act provide for restoration and enhancement of fish, wildlife and related habitats in the Central Valley and Trinity Basins, assist in Bay-Delta protection efforts, and balance demands for CVP water among urban, agriculture and environmental demands. MWD is currently developing the following transfer and exchange projects.

Arvin-Edison/Metropolitan Water Storage and Exchange Program. This program involves storing up to 800,000 acre-feet (AF) of MWD's SWP supply in the groundwater basin underlying the Arvin-Edison Water Storage District (Arvin-Edison) which is located in the southern portion of the San Joaquin Valley. During shortage years, a portion of Arvin-Edison's federal CVP water would be delivered to MWD. In exchange, Arvin-Edison would serve its customers by pumping groundwater previously stored by MWD. As originally formulated, the program could increase MWD's dry-year supplies by approximately 93,000 AF per year (AFY). MWD's and Arvin-Edison's Board of Directors have approved an interim agreement for the storage of potential near-term surplus water. Actions taken under the endangered species act to protect winter-run salmon and Delta smelt as well as the allocation of CVP water for environmental purposes, has reduced the reliability of the CVP water to be delivered to MWD. As a result, MWD and Arvin-Edison are assessing alternative formulations of this program.

Semitropic/Metropolitan Water Storage and Exchange Program. This program would involve groundwater storage and recovery operations. Under the program, MWD would store water in the groundwater basin underlying the Semitropic Water Storage District (Semitropic) when MWD's water supplies are in excess of its demand. During shortage years, Semitropic would pump MWD's stored water supplies from the groundwater basin into the California Aqueduct through facilities owned and operated by Semitropic. A minimum pumpback of 40,000-60,000 AFY would be guaranteed. In addition, Semitropic has a contract for 158,000 AFY of Kern County Water Agency's SWP entitlement. Semitropic could exchange a portion of this entitlement water for MWD's stored water supplies, thereby substantially increasing the annual yield of the program. An initial agreement to store water in 1993 has been executed and approximately 45,000 AF of MWD's 1992 SWP carryover water was stored. Negotiations on a long-term agreement continue to progress. In July 1993 MWD and Semitropic initiated preparation of environmental documentation necessary to comply with the California Environmental Quality Act (CEQA).

Dudley Ridge/Metropolitan Water Transfer Program. MWD executed an agreement for an option to transfer in 1993 a portion of Dudley Ridge Water District's (Dudley Ridge) 57,700 AF

SWP entitlement. Under the terms of the agreement, MWD agreed to purchase all SWP water made available by Dudley Ridge in 1993 if SWP deliveries for that year were less than 50 percent. In February 1993, DWR announced that SWP deliveries would exceed 50 percent. Therefore, MWD did not receive any water from Dudley Ridge in 1993 and does not have any obligation to purchase its SWP water. The long-term transfer program is currently being negotiated.

Local Management Strategies

Water Reclamation

Use of reclaimed water has grown nearly 160 percent in just six years. Presently, the largest use of reclaimed water in Southern California is for groundwater recharge. Reclaimed water can be injected into seawater intrusion barriers or percolated in spreading basins for eventual reuse in potable systems.

In October of 1990, MWD began work on a Water Reclamation Databank, a survey of the status of existing and proposed water reclamation projects in its service area. The Databank includes information on more than 40 new wastewater reuse projects which are in various stages of feasibility study, design, or construction. As presented in Figure III-2 of Section III, under optimal conditions (i.e., successful completion of all proposed projects), existing and new wastewater treatment projects in the MWD service area could provide up to 675,000 AFY by 2010. The projections for expansion of wastewater reuse are subject to several constraints that will be discussed in Section VI.

Groundwater Management Programs

Conjunctive use of surface water and groundwater basins has been a local management practice since the 1950's. Conjunctive use refers to both storage of surface water in available groundwater basin storage space and increased pumping from basins in order to create storage space. A groundwater basin is recharged with storm waters and imported surface water during the winter months or wet years when supplies exceed demands. When surface water is in shortage during dry periods, stored water is extracted from the basins to meet peak water demands.

Currently, the Seasonal Storage Program is MWD's basic conjunctive use program. The current Seasonal Storage Program was instituted in fiscal year 1989-90 to consolidate several programs designed to encourage conjunctive use. Seasonal storage service is generally available between October 1 and April 30, whenever and so long as MWD determines that water and system capacity are available, and at other times of the year at MWD's discretion. Under this program, member agencies are encouraged to take delivery of imported MWD supplies through a discounted water rate. Member agencies can store this water for use in the summer months to offset peak water demands on imported supplies, or water can be stored for use in later years. Since 1989, member agencies have purchased over 600,000 AF of water under the Seasonal Storage Program. The economic incentive offered by MWD allows local agencies to invest in new water production, storage, and treatment facilities. Some examples of investments and innovative water management as a result of the program can be found in: storage arrangements in the Raymond groundwater basin, new wells constructed in the San Fernando Basin by the City of Los Angeles, a low-interest loan program offered by Orange County Water District for construction of new wells in Orange County, and amendments to Central and West Coast Basin judgements to increase carryover storage from 10 to 20 percent of extraction rights in a given year.

Expansion of the conjunctive use program continues to be a high priority for increasing water supplies in drought years and reducing peak period demands on importation facilities. MWD, in cooperation with several member agencies, is evaluating the expansion of existing conjunctive use projects in the Chino, San Gabriel, and San Jacinto groundwater basins. The success of these projects depends on the availability, in some years, of imported water above consumptive needs. This surplus water would be recharged and stored in local groundwater basins, to be withdrawn in years of shortfall. Conjunctive use also includes exchanging entitlement to stored groundwater for imported water, thus leaving the groundwater in storage for later use.

In the Chino Basin, MWD has a cyclic storage program which can deliver up to 100,000 AFY of imported water for groundwater replenishment and storage for subsequent use during shortfalls. Chino Basin has also been used for groundwater/import water exchanges amounting to 43,000 AFY. During the 1987-1992 drought period 111,000 AF was withdrawn and sold for local use from these cyclic and exchange accounts.

Currently, MWD is negotiating provisions for a new 50,000 AFY conjunctive use demonstration project which would store imported water in the Chino Basin through spreading, exchange, and injection operations. This project would allow MWD to store imported water during periods of availability and subsequently pump up to 30,000 AFY into its distribution system to improve regional water service reliability during droughts and peak demand periods.

MWD currently has two contracts with the Main San Gabriel Basin Watermaster for cyclic storage of up to 167,000 AFY of imported water for subsequent transfer to two member agencies, the Upper San Gabriel Valley Municipal Water District and Three Valleys Municipal Water District. Over the 1987-92 drought about 129,000 AF of water was withdrawn and sold for local use from this cyclic storage program. Additionally, MWD is negotiating development of a large conjunctive use project which would be compatible with the U.S. Environmental Protection Agency's Superfund cleanup program for the basin. The conjunctive use program would consist of a well field and groundwater treatment plant in the Baldwin Park area to pump and recover groundwater that is presently contaminated. The program could provide up to 150,000 AF of storage and up to 30,000 AFY of supply during drought periods. Up to 25% of the cost to design, plan, and construct the conjunctive use facility will be funded by the Department of the Interior under Section 1614 of the Reclamation Projects Authorization and Adjustment Act of 1992 (H.R. 429).

Under a pilot demonstration project with Eastern Municipal Water District of Riverside County (Eastern), MWD stored about 2,000 AFY of imported water by spreading its SWP water for the first time in 1990 in the San Jacinto Basin. Eastern recently purchased that water to supplement its drought supply and is planning to store additional imported water in the basin. Additionally, a local pumpers association has been formed to maximize the use of the local San Jacinto and Hemet Basins.

Groundwater Recovery

Groundwater quality data from the period of 1974 to 1989, shows that almost half of the local groundwater wells exceeded at least one primary or secondary drinking water standard. Major regional groundwater problems include:

- nitrate concentrations
- total dissolved solids (TDS)
- volatile organic compounds (VOC)

In general, groundwater contamination is increasing as the long lasting residual impacts of industrial, dairy, agricultural, and municipal activities spread. Thus, at the same time that groundwater basins are being more intensively used to meet increasing water demands, this critical resource will be increasingly stressed due to historical and current waste disposal practices and resulting contamination.

Because of this growing concern, MWD and other water utilities have undertaken a large scale program to improve regional water supply reliability through reclamation of groundwater degraded by minerals and other contaminants. Under its Groundwater Recovery Program, MWD will provide financial assistance to local agencies of up to $250 per acre-foot to recover contaminated groundwater for potable use. Approximately 40 projects at a cost to MWD of about $30 million per year are expected to be operational by the year 2005.

The Groundwater Recovery Program is expected to recover 200,000 AFY. However, approximately 100,000 AF of this ultimate annual production will be untapped local yield or new supplies. The remainder will require replenishment from imported supplies and reclaimed water sources to avoid basin overdraft. The region will benefit from the projects requiring replenishment through a conjunctive use concept. In order to participate, each project must have sufficient storage reserves to sustain production during a three-year drought without receiving replenishment service from MWD.

Surface Water Management

Final design and land acquisition for the Domenigoni Valley Reservoir project are currently underway. The Reservoir will be located in western Riverside County south of Hemet. The project, in combination with comprehensive groundwater management, will:

- maximize groundwater storage by regulating the flow of imported water used for conjunctive use programs;

- provide emergency water reserves for use following facility damage resulting from major seismic events or other natural disasters;
- provide supplies to reduce water shortages during droughts;
- meet seasonal operating requirements, including seasonal peak demands; and
- preserve the operating reliability of MWD's distribution system.

The project, together with groundwater storage, is intended to provide two years of drought or carryover storage for meeting demands above normal projections.

Desalination

MWD has participated in several studies to evaluate the feasibility of seawater desalination and is pursuing the development of seawater desalination technologies. As a result of these studies, the San Diego County Water Authority (SDCWA) is completing a detailed study of the potential for constructing a reverse osmosis desalination facility as part of the South Bay Power Plant Repowerings Project. The plant could provide up to 92 AF per day.

Desalination is one of the options available for providing adequate water supplies to coastal islands, such as Santa Catalina. In conjunction with the Santa Catalina Island Company, the city of Avalon has developed a desalination plant which converts 30 percent of the sea water entering the plant into fresh water. The 132,000 gallons of desalinated waster per day translates into almost one-third of the island's annual water consumption. Currently, the desalination plant is not in operation as a result of sufficient water supply on the island.[8]

MWD is currently planning to build, operate and test a seawater desalination plant to provide a means for conducting research and development of advanced desalination processes. The demonstration plant would employ multi-effect distillation technologies to process 5 MGD (5,600 AFY) of seawater using heat from an existing adjacent coastal power plant. The results from the demonstration project could be used to assess the viability of a full scale desalination plant with a capacity of 50 to 100 MGD (56,000 to 112,000 AFY). A full scale desalination project can only feasibly be built in conjunction with renovation of coastal power plants scheduled around the year 2000. In addition, MWD along with the City of Long Beach, Central Basin MWD, West Basin MWD, and Southern California Edison (SCE) are currently completing feasibility studies on a 5 MGD seawater desalination plant at the SCE Alamitos generation station.

Management Response During Drought or Other Emergencies

Effective management of water supply deficiencies is one of the most important responsibilities of regional water agencies. Possible deficiencies in supply can be caused by; droughts, failures of major water transmission facilities during earthquakes, an acute contamination of supplies due to chemical spills, or other adverse conditions. Management response programs were initially developed during the drought of 1976-1977 and have been expanded and refined over the past six years. Management techniques include provisions for increasing supply and for reducing demand.

During the drought of 1976-1977, MWD was able to divert Colorado River water to the full capacity of its pumping facilities. As a result, it was able to release 320,000 AF of SWP water for use elsewhere in the State.

In order to cope with the water supply shortfall beginning in 1991 and ending in June 1992, MWD adopted an Incremental Interruption and Conservation Plan (IICP). The IICP was designed to encourage member agencies to utilize water held in local groundwater and surface water storage reserves and promote consumer water conservation to reduce demands on imported sources during droughts. Each member agency was assigned a monthly target quantity of water and an annual discretionary pool based on the total amount of water which the agency purchased from MWD in 1989-90. The monthly target was established using "firm service" (that is, excluding agricultural and seawater barrier uses). Proportional reductions were then applied to each category ("firm" and "nonfirm"), with the proportions determined by which stage of the IICP was in effect. Changes to the target quantity were based on population growth, changes in local water supplies, conservation implementation, and reclamation. Excess use beyond the target quantity resulted in a surcharge for the excess quantity at double the base rate. During the operation of the IICP, almost all member agencies met their assigned targets. The overall success of the IICP is being reviewed by MWD.

VI. POTENTIAL WATER ISSUES

In order to meet the future water demands of this region, the Water Resources Element identifies and addresses a number of key issues that are related to future development of water supplies.

Growth Management

Issue:

What is the relationship between growth management and water supply?

Background:

Growth related decisions have historically been addressed by local governments. Accommodating this growth and meeting all reasonable needs has been the expressed purpose of most water agencies. The three primary means of meeting water needs has been through:

- Planning based on future water requirement projections.
- Identifying various existing and adequate sources of supply.
- Providing facilities for transmission, treatment, storage, and distribution.

In the 1980s, water demand increased significantly in proportion to tremendous population growth. Coinciding with this growth, huge capital costs and a lengthy regulatory process of facility expansion made large scale projects increasingly difficult to accomplish. In addition, supply sources became less reliable, due to water quality and environmental concerns, especially during the drought period of 1987 through 1991. Consequently, both general purpose government and water utilities have been confronted with the issue of supplying adequate amounts of water and how it relates to growth management concerns.

Public water agencies and other special districts do not have statutory or constitutional power to regulate land use. Water districts can only restrict service for utility related purposes, and must make certain that such restrictions will not burden existing users.[9] But, due to the decisions of recent court cases, general purpose governments can use service restrictions to implement land use decisions under the police power granted by Article XI of the State Constitution.

The city of Santa Barbara is an example of a local government using their police power to maintain levels of water demand in the form of growth management controls to stem growth pressure from the sprawling edges of Los Angeles and Ventura Counties. Although there were plans to meet growing local needs by tapping new water sources, the residents of Santa Barbara resisted plans to connect the city to the SWP for years. The rationale for not connecting with the SWP, was that by agreeing to provide water, they would be promoting uncontrolled urban growth. Despite efforts to limit the availability of water supplies, growth continued in the city of Santa Barbara. In 1991, after long drought years, and strict use regulation, the residents voted to construct a desalination plant and connect to the SWP.

Water supply and urban growth are linked issues and are best addressed by greater coordination and communication between water agencies, land use agencies and general purpose governments. Consequently, MWD relies on SCAG and SANDAG for growth projections for its service area to determine future water demands and facility needs. To further integrate the regional planning effort, MWD is preparing this Water Resources Element and assisting SCAG to develop mitigation measures for water supply development for the RCP master environmental assessment and environmental impact report.

The goal of the MWD water management program has been to maximize efficient use of existing supplies and to assure adequate supplies to meet future water demand.[10] Due to the rapid growth of Southern California, meeting the growing demand for water has been an ongoing challenge. In addition, a number of concerns have been raised about how to efficiently prioritize and integrate infrastructure investment to support California's pending population growth and to provide a strong economic base. As a result, MWD's Board of Directors has adopted the following policy principles related to growth management.[11]

1. Water supply is not a reason in and of itself to limit or control growth in California. There are sufficient water resources to accommodate continued population and economic growth through better management, including conservation, voluntary transfers and additional storage and conveyance facilities. Water supply for urban, agricultural and environmental uses will be adequate and reliable.

2. Growth management and the allocation and direction of development should be the responsibility of general purpose government. Utilities, including water purveyors, should provide adequate facilities to serve the projected growth at the state, regional and local levels.

3. For planning and infrastructure purposes, water supply should be treated as a utility not required to be a general purpose government plan element. However, water purveyors at the state, regional and local levels should be members of any proposed infrastructure planning structure to ensure optimum coordination and infrastructure resources investment.

4. Financing mechanisms should be developed for general purpose and special district governments to develop adequate facilities to serve the projected growth.

5. Infrastructure financing programs should provide for new growth to pay a "fair-share" relative to the total infrastructure program.

6. At the local level, water districts that participate in the coordinated development of a comprehensive plan, and demonstrate infrastructure needs to accommodate the local growth management plan, should be eligible for funding from any infrastructure pool or bank that is established to fund local infrastructure.

7. Market mechanisms to improve the efficiency in use of natural resources and public facilities such as water transfers should be encouraged.

Planning Strategy:

The MWD service area has a long history of economic and population growth. MWD is committed to continuing to accommodate population growth and to remain consistent with regional growth management plans, without becoming a major growth inducing force. One important aspect of meeting that challenge is close coordination with SCAG and SANDAG. MWD intends to continue to use growth projections developed by these agencies as the basis for its planning activities and to work with them to identify appropriate water supply mitigation measures for inclusion in regional growth management plans.

MWD and its member agencies are undergoing an Integrated Resources Planning (IRP) process. The IRP process will identify an appropriate resource mix that is regionally affordable and provides a reliable water supply to both areas of new growth and established communities - consistent with the growth management population projections. MWD will also be preparing a Long Range Finance Plan, which is linked to the IRP, that will identify a rate structure that assures that growth (new system demand) pays its fair share of the costs associated with providing expanded service and reliability.

Water Transfer Policies

Issue:

What role will water transfers (also known as water marketing) take in the future to respond to the water needs of urban, agricultural and environmental users - statewide and in Southern California?

Background:

Although the concept of water transfers was developed over 10 years ago, the recent water shortages brought about by a drought period has made California increasingly interested in water transfers as an expedient means of alleviating these shortages. In April 1992, Governor Pete Wilson announced a Statewide Water Policy, which encouraged legislation proposing voluntary, environmentally safe transfers. The policy defines a transfer as the acquisition of short- or long-term supplies, agreements with water districts and individuals, and initiatives which involve management and market transactions for the purchase of water, water rights or land to increase supply. The debate has been extensive among politicians, economists, urban water users, environmentalists, and farmers who are all looking for ways to resolve the widening gap between available water supplies and increasing demand.

Currently there are institutional and physical limits to water transfers. Several proposals are being debated in the legislature that could affect the price and availability of water transfers. One of the most significant legislative actions regarding water transfer is the recent passage of the Federal Central Valley Project Improvement Act. The availability of water to users or districts outside the Central Valley Project is at the crux of determining an approach to large scale water transfers. Most major water transfer activities within the state will involve participation and cooperation of the State Water Project and/or the Central Valley Project as facilitators and wheelers of the transferred water to the receiving agency. Due to the recent severe drought period (1989 - 1992), the prevailing attitude has changed from how to establish these markets, to what type of water transfer system should be developed. Some of the key issues with the development of this system include:

- Determining whether or not further facilities in the Sacramento-San Joaquin Delta would be necessary to support water transfers.
- Mitigating environmental needs and concerns which may be caused by direct transfers.
- Developing a means to address potential loss of income to third-party concerns. This would include; agricultural suppliers, farm workers, non-agricultural business, and fallout social and economic effects on rural communities dependent on agriculture.
- Defining the level of involvement the state and local government should have in the transfer system.

- Determining what power an irrigation or urban water district should have over a transfer initiated by a member.

These issues continue to be addressed in debates, local meetings, and state sessions. Perhaps the most useful policy tool is the, 'Interim Guidelines for Implementation of the Water Transfer Provisions of the Central Valley Project Improvement Act' (Title XXXIV of Public Law 102-575). The most recent revision (dated February 19, 1993) of the stated objective is to:

> "........address all water transfers equitably, to provide for a more efficient and effective use of the water supply developed by the Central Valley Project, and to provide greater flexibility to water users in transferring water developed by the project."

As the discussion deepens, there are many other issues of concern to this topic. For the most part, the current status is summarized in a statement made by Secretary of the Interior, Bruce Babbitt, "The issue is devising and creating a reasonable reallocation system. It won't be easy."[12] In December, 1991 MWD's Board of Directors adopted a "Water Transfer Policy Statement" (Policy), (Metropolitan Administrative Code Section 4203) to guide MWD water transfer activities.

In summary, the Policy states that the combined factors of continued population and economic growth and reductions in traditional water supply sources will require MWD to pursue additional supplemental water supplies to ensure the continued health of the Southern California economy. The Policy recognizes that water transfers from agricultural to urban uses will be a critical and necessary element of a comprehensive management plan that includes water conservation, reclamation and reuse, and infrastructure improvements. The Policy provides that MWD will vigorously pursue a wide range of voluntary transfer activities including fallowing of agricultural lands and transfers initiated by water rights holders. The Policy provides that such transfers will be designed to protect and where feasible, enhance environmental and groundwater resources. Finally, the Policy provides that efforts continue to develop for water transfers which seek to avoid unreasonable operational and financial impacts in the agricultural community.

<u>Planning Strategy</u>:

Water transfers will be an integral aspect of water supply in the future, as new water sources become more difficult and expensive to develop. It is therefore imperative that the most equitable system of transfers be developed so that agricultural uses do not literally get "bought-out" by the urban uses and that MWD maintain its commitment to developing transfers with willing partners.

Water Supply Development and Environmental Regulations

Issue Statement:

What strategies can water agencies take for future development of water supplies and facilities in view of increasingly stringent environmental regulations?

Background:

Continual development of water supplies and facilities to transport, treat and store water is necessary to support the growing population and economic base of Southern California. On the other hand, increasingly stringent environmental regulations have, and will continue to have, impacts on development of the needed supplies and facilities. Strategies that will integrate environmental values and meet environmental regulations are essential for developing appropriate water supplies and maintaining the quality of life of the region.

MWD recognizes that environmental responsibility is an essential component of developing and operating a reliable water supply for Southern California. Together with public support, responsiveness to environmental issues is an essential element of any project or program undertaken in the State.

MWD also recognizes the need to be proactive in its approach to environmental needs and requirements, taking a leadership role, where possible, in the acceptable resolution of environmental issues affecting water in California. Significant environmental challenges remain to be resolved in the Delta and in the service area.

An example of such a proactive approach is the Central Valley Project Improvement Act. It establishes an explicit, competing right of the natural environment. Together with the needs of urban and agricultural users, environmental needs for available water supply will combine to challenge the ingenuity and creativity of MWD, its member agencies and all water users (urban, agricultural, and environmental) in the state and region in the fulfillment of their commitment to stewardship.

Another example of a proactive stance on environmental issues is MWD's strategy in the development of the Domenigoni Valley Reservoir project to the south of the city of Hemet. MWD signed an agreement with wildlife agencies to establish a "Multi-species Habitat Conservation Plan for Southwestern Riverside County" to protect sensitive species of plants and wildlife near the site of the reservoir. The signatories of the agreement include the U.S. Fish and Wildlife Service, California Department of Fish and Game, Riverside County Habitat Conservation Agency, and Riverside County Regional Parks and Open Space District. With this conservation plan, there will be a total of nearly 20,000 contiguous acres of publicly owned open space extending from the Domenigoni Valley reservoir through the Shipley Reserve to MWD's Lake Skinner. As a result, the project had little to no dissent from environmentalists, state and federal regulatory agencies, local governments and nearby tribal councils.

In addition, MWD has also established biodiversity management at two areas in Riverside County to mitigate impacts of the Domenigoni Valley reservoir and anticipated facility developments in western Riverside County. MWD, in partnership with the California Department of Fish and Game, Riverside County and the Nature Conservancy established the 9,000 acre, "Santa Rosa Plateau Mitigation Bank" preserve. The other area is a 5,000 acre "Lake Mathews Multi-species Habitat Conservation Plan". MWD is currently pursuing similar plans in southern Orange County and San Bernardino County.

Metropolitan's member agencies have also adopted environmental values and considerations in their water supply development strategies. Some examples are the West Basin Recycling Project in the South Bay area of Los Angeles County and Eastern Municipal Water District's wetlands enhancement program using reclaimed water in Riverside County. Both projects have received statewide and national recognition for their environmental benefits.

Planning Strategy:

MWD integrates environmental values in its decision making procedure for water resources and facilities development. Environmental needs for available water supply and the protection of endangered species and their habitats offer a significant challenge to MWD and its member agencies to develop effective physical, institutional, and management solutions that lead to "win-win-win" outcomes for the environment, agricultural, and urban users. MWD intends to apply the same level of creativity and innovation to the development of effective environmental strategies that it has demonstrated in the development and implementation of large scale regional infrastructure projects.

Federal and state environmental laws place the burden of proof on MWD to show that its proposed projects do not have significant adverse impacts on the environment. MWD has demonstrated and will continue to demonstrate its commitment to full compliance with environmental standards and to the implementation of measures needed to mitigate impacts.

Desalination

Issue:

How could desalination contribute to future water supply?

Background:

Desalination has intrigued engineers, politicians, and the public for years because of the tremendous possibility it offers as a means to increase water supply. Unfortunately, the large energy requirements of the current technology make the process too costly to implement, relative to imported supplies and more conventional local water supply development. Throughout the world however, desalination is an important source of usable water and accounts for more than three billion gallons per day from 3,500 plants.[13] Extensive research has developed ways to extract high percentages of inorganic and organic constituents from brackish groundwater and sea water.

Of the various desalination methods, the membrane processes (reverse osmosis and electrodialysis) offer the best potential to increase supply, especially by desalting brackish ground water. However, existence of high concentration of nitrate in local groundwater has promoted an increased effort to achieve new and more efficient membranes. The reverse osmosis method can also desalt domestic waste water which can then be injected into the local groundwater basin, and industrial discharge can be treated to reduce waste water and reused to supplement process water supplies. At the Diablo Canyon Power Plant, sea water is used in a reverse osmosis plant to provide water for on site power production. Local efforts in Southern California to desalt brackish groundwater and ocean water are being implemented and studied by MWD. Please refer to Section V, for a more detailed description of various efforts by MWD to utilize desalination programs and projects. In addition, research continues to study the disposal of brackish agricultural drainage. Although the drainage water contains toxic elements, it can be reclaimed through reverse osmosis.

In spite of the great potential desalination has to offer to the existing water supply, there are a number of issues which need to be addressed in order for its full success. These issues include the following:

Regulatory and Institutional. The two primary issues related to the regulation of desalinated water quality include the level of salinity and related chemical constituents in the product water and the disposal of brine. Both the U. S. Environmental Protection Agency and the California Department of Health Services require that all brackish groundwater or seawater desalination projects producing water for municipal water supply purposes meet all drinking water regulations. In addition, no brine discharge is allowed in any inland waterway. Seawater brine disposal is an issue being dealt with by Regional Water Quality Control Boards. This issue focuses on the dilution of the brine discharge and the potential impacts on the ocean biota.

Technical Constraints. Current desalination processes are generally divided into four categories by water and process type: Brackish-Thermal, Brackish-Non-thermal, Seawater-Thermal, and Seawater-Non-thermal. The measure of source water is based on total dissolved solids (TDS) content and ranges from 500 mg/l for brackish to 50,000 mg/l for seawater. Among the various types of desalination processes, energy consumption accounts for a significant portion of operation and maintenance costs. Intake and pre-treatment is a function of the source water and desalination process. Most thermal processes require less pre-treatment than non-thermal processes. The methods for brine disposal are critical to limiting impacts on local ground and surface water. For brine disposal, existing outfall facilities must be used because of the time, cost, and permit difficulties of constructing new ones. Interfacing with existing electric power plants along the California coastal zone is an opportunity for locating desalination plants. By operating jointly, cost savings may be realized by both plants. Other constraints include: corrosiveness of treated water in the system and the retrofitting of existing distribution systems to incorporate desalination facilities.

Economics. The costs associated with desalination are related to the source water quality, the desired product water quality, the treatment process, the installed capacity and the method of brine disposal. The total cost for desalination of brackish water ranges from $350-1,000/acre-ft. Seawater ranges in cost from $1,300-2,400/acre-ft. These costs do not reflect the cost of pumping water back into the distribution system. In addition to operating costs, the capital investment to build desalination facilities adds to the unit cost of producing water.

Environmental Issues. Among the various impacts to the environment associated with desalination plants are: construction disturbances, emissions, and interference; energy consumption and possible new power facilities, which may produce air emissions; biological resources affected by water source and brine disposal.

<u>Planning Strategy</u>:

The potential for use of desalted water may increase as the available water supply continues to decrease. Several key factors that relate to the issue of increasing use of desalination include: reducing cost of operation by coordinating facilities with coastal electric power plants, integrating and refitting the existing distribution system, and pursuing a comprehensive and regional approach to this issue. MWD is currently supporting brackish groundwater desalination through its Groundwater Recovery Program (See Section V). MWD is also actively supporting and participating in research efforts for ocean desalination technology.

Conservation of Storm Runoff

Issue:

How can conservation of storm runoff enhance the region's water supply?

Background:

Through a system of natural basins, gravel pits, control channels, dams, and pumping facilities, much of the water that is typically headed for the sea can be retained for the replenishment of groundwater. Because of the specific geography and geology of the Los Angeles Basin, surrounding mountains release large amount of water during heavy rain periods. Prior to the creation of a network of flood control works in the early 1900s this region was prone to catastrophic floods.[14]

The development of the dams and flood control facilities led to a major program of artificially recharging the groundwater aquifers by spreading storm runoff and reclaimed wastewater at spreading basins and gravel pits. Spreading facilities are located throughout the region along main water paths and tributaries. The diversion and overflow of water into these spreading grounds resulting from storms is the objective of the artificial recharge program. Once water accumulates in the spreading areas it can percolate into the underground aquifers. This process contributes to the groundwater supply throughout the region. The three major river systems in SCAG's region and the MWD service area are the San Gabriel River, the Santa Ana River, and the Los Angeles River. The three rivers have different conservation rates and efforts as described below.

1. The San Gabriel Watershed is operating at approximately an 80 percent conservation rate (conservation of storm runoff). This high rate of conservation is due to excellent geology for spreading and percolation of runoff water. Extensive facilities include a series of dams in the San Gabriel Canyon, San Gabriel River spreading and recharge facilities, and the Montebello Forebay facilities. This system recharges between 200,000 to 250,000 acre-feet per year of water. During very wet years, such as 1992-93, nearly 400,000 acre-feet reached the spreading basin system.[15] The system is operated by the Los Angeles County Department of Public Works.

2. Orange County has a high rate of conserving runoff water in the Santa Ana River due to an extensive system of collecting basins, off-river diverting channels, debris management (to scrape basins), and pervious riverbed for recharge. The Santa Ana Watershed has nearly a 95 percent conservation rate for runoff water and is operated by the Orange County Water District. The network of Santa Ana 'Lakes' or basins lead to a final basin which is equipped with a pump back system to recycle remaining runoff into the network.

3. The Los Angeles River Watershed is operating at approximately a 10 percent conservation rate. This lower rate of conservation is due to a lack of spreading facilities. All of the recharge facilities are located in the San Fernando Valley and are

operated by LADWP. The remaining length of the Los Angeles River south of the San Fernando Valley is lined and therefore does not permit percolation. Total normal runoff into the ocean is about 236,000 acre-feet per year..

4. Surface water conservation is practiced along the Santa Clara River in Ventura County and the Santa Margarita - San Luis Rey watershed in the Riverside and San Diego Counties. The United Water Conservation District, through its Vern Freeman Diversion Project, can direct up to 133,000 AF in wet years for groundwater recharge. The Santa Margarita - San Luis Rey Watershed Planning Agency is a joint power composed of water and wastewater agencies that manage the streams and groundwater basins in the watershed.

In addition, the U.S. Army Corps of Engineers, in cooperation with the Los Angeles County Department of Public Works has initiated the Los Angeles County Drainage Area Water Conservation and Supply Reconnaissance Study to identify potential alternatives to capture stormwater runoff, and increase the water supply through modifications to the existing Los Angeles County Drainage Area System. The preliminary study will determine whether economic, hydrological, engineering, environmental, and current-use considerations are sufficiently favorable to recommend proceeding to a feasibility phase investigation.

In the future, continued and increased conservation efforts depend on several factors. Major debris management, or scrape programs, are needed to keep percolation at existing recharge basins at optimum levels. It is also important to protect recharge areas from potential contaminants in urban runoff. Large scale approaches to conservation have been proposed by the Los Angeles County Department of Public Works to address the lost runoff from the Los Angeles River watershed. The creation of a fresh water harbor at the mouth of the river, in Long Beach Port, has been proposed as means of capturing 60,000 to 200,000 acre-feet per year.[16]

Planning Strategy:

It is imperative to maintain existing recharge basins in the San Gabriel and Santa Ana river systems at optimum percolation rates with debris management programs and prevent potential contamination of groundwater from urban runoff into recharge areas. Due to a majority of the water from the Los Angeles River being lost to the ocean, different alternatives have been developed for capturing more of the Los Angeles River's runoff. Specific projects which would afford an increase in storm runoff capture are to develop a portion of the Long Beach Harbor (beyond the mouth of the Los Angeles River) into a freshwater detention basin to hold the water and to develop a tunnel to channel the water to a nearby groundwater recharge facility. Furthermore, maximizing use of existing dams and reservoirs capacities could increase groundwater recharge.

Potential for Increases in the Use of Reclaimed Water

Issue:

What is the potential of increasing the use of reclaimed water?

Description:

Reclaimed water has been used as a nonpotable water supply source in California since the early 1960s. As discussed in Section III, about 250,000 AFY of reclaimed water is currently used within MWD's service area and 675,000 AFY is expected to be developed by the year 2010. Over half of the existing and projected reclaimed water is used for recharging groundwater basins. The second largest current use is golf course and greenbelt irrigation, with the remainder used for industrial purposes.

Although reclaimed water use has increased significantly since the mid-1970s, there are still factors which stand in the way of greater use. The issues of constraint to reclaimed water use were examined in a plan prepared by the joint effort of the State Water Conservation Coalition's Reclamation/Reuse Task Force and the Bay Delta Reclamation Sub-work Group. Their plan, "Water Recycling 2000: California's Plan for the Future," was prepared in September 1991. As part of the plan, a survey was conducted to identify the key factors which limit their ability to construct reclamation facilities. The major factors included:

Funding. The survey indicated that funding is a significant barrier to developing reuse. The lack of an extensive infrastructure to deliver reclaimed water from the source to customers tends to increase the price of using reclaimed water above the fresh-water alternative. This disparity should lessen as the cost of finding new fresh water sources increases. Furthermore, the current availability of funds to construct reclamation facilities is scarce, and will need to be increased.

Regulatory. Some constraints come from policies, procedures, and other activities of regulatory agencies. Implementing a new reclamation project often involves approval from a number of regulatory agencies including the State Water Resources Control Board, Regional Water Quality Control Board, State Department of Health Services, and County Health Departments. Timely and consistent reviews are essential to maximize reclaimed water use.

Institutional. There is a need for interagency coordination to accomplish the development and implementation of reclaimed water facilities. The most common example on interagency coordination is where the wastewater management agency which produces the reclaimed water is not the water purveyor within the reuse area. Coordination and cooperation between both agencies is vital to the success of projects. In developing communities that desire to increase use of reclaimed water, communication and coordination among land use planning agencies, water reclamation agencies and water purveyors are key to maximize water reuse. Reclamation projects may also involve two or more cities or counties as either users or producers - again coordination is essential for efficient project development.

Public acceptance. It would be difficult for any local government or special district to site, finance, construct and operate a water reclamation project without public acceptance. Public acceptance is not a straightforward issue in that a variety of interest groups and community groups sometimes have conflicting interests. One group may support the use of reclaimed water, but object to the siting of the project in its community ("not in my backyard"). Health concerns of the public must also be addressed to increase public acceptance, particularly for potable reuse.

Planning Strategy:

Reclaimed water is a reliable water resource which can be used to augment existing supplies. "Water Recycling 2000" suggested that statewide water resources planning agencies and other state and federal agencies adopt policies that identify reclaimed water as a resource. Furthermore, the plan gives seventy recommendations to promote increased use of reclaimed water. Among them are:

Political Support. A need by policy makers at all levels of government to strongly commit to and support reclaimed water development. For example, the U.S. Bureau of Reclamation has initiated a three-year study of regional wastewater reuse opportunities in Southern California demonstrating that reclaimed water development is not just a local or regional issue.

Benefit Cost Analysis. A better understanding of who benefits and who pays for reclamation should be initiated from both a local and statewide perspective.

Funding Issues. Funding is considered the number one barrier to the use of reclaimed water; therefore, new funding sources (such as bonds, grants and loans), a new rate structure which encourages reclaimed water use, and provision of power to reclamation projects should be initiated. Federal cost-sharing would greatly encourage local reclaimed water development. An example of such cost-sharing is included under the Central Valley Improvement Act (H.R. 429 Title XVI (P.L. 102-575) where federal funds would be available for 25 percent of the construction costs of the West Basin Recycling Project, the City of Los Angeles' East Valley Project, and the San Diego Clean Water Program.

Regulatory Issues. Involvement, approval and support of state and local health departments, Regional Water Quality Control Boards and other related agencies will be crucial for the implementation of reclaimed water projects. Furthermore, establishment of a formal process to expedite reclamation projects will be helpful.

Public Acceptance. Public involvement in all stages of project development through citizen advisory committees, public workshops, education programs, and other environmental review processes would tremendously improve public acceptance. Education of the public on the safety of using reclaimed water will be necessary for increased use and acceptance of reclaimed water as a plausible potable resource.

VII. CURRENT PLANNING PROCESS

The basic goal of MWD and its member agencies is to provide reliable water supplies to meet the water needs of its service area at the lowest possible cost. To achieve this goal, it is important to evaluate a diverse mix of resources that will balance costs, reliability, risks, environmental considerations, and other factors. MWD's service area has a wide range of resources and demand management strategies including: Colorado River Aqueduct supplies, State Water Project supplies, reclamation and reuse, groundwater conjunctive use and recovery, water conservation, desalination, development of surface storage facilities, etc., as described in previous chapters. Virtually all of these strategies and resources appear worthwhile when considered in isolation. However, implementation of all of these strategies would result in duplicated efforts, unnecessary costs, and unacceptable water rate increases. As a result, MWD and its member agencies are currently implementing an Integrated Resources Planning (IRP) process.

Integrated Resource Planning Process

Integrated resource planning is a procedure to develop efficient and reliable resource supply plans to meet customer demands. Specifically, it calls for the appropriate mix of supply sources and demand management strategies to meet a stated reliability objective. IRP encompasses evaluation of water demands, least-cost analysis of supplies, an objective decision making process, evaluation of risk, and environmental, institutional, operational and financial concerns.

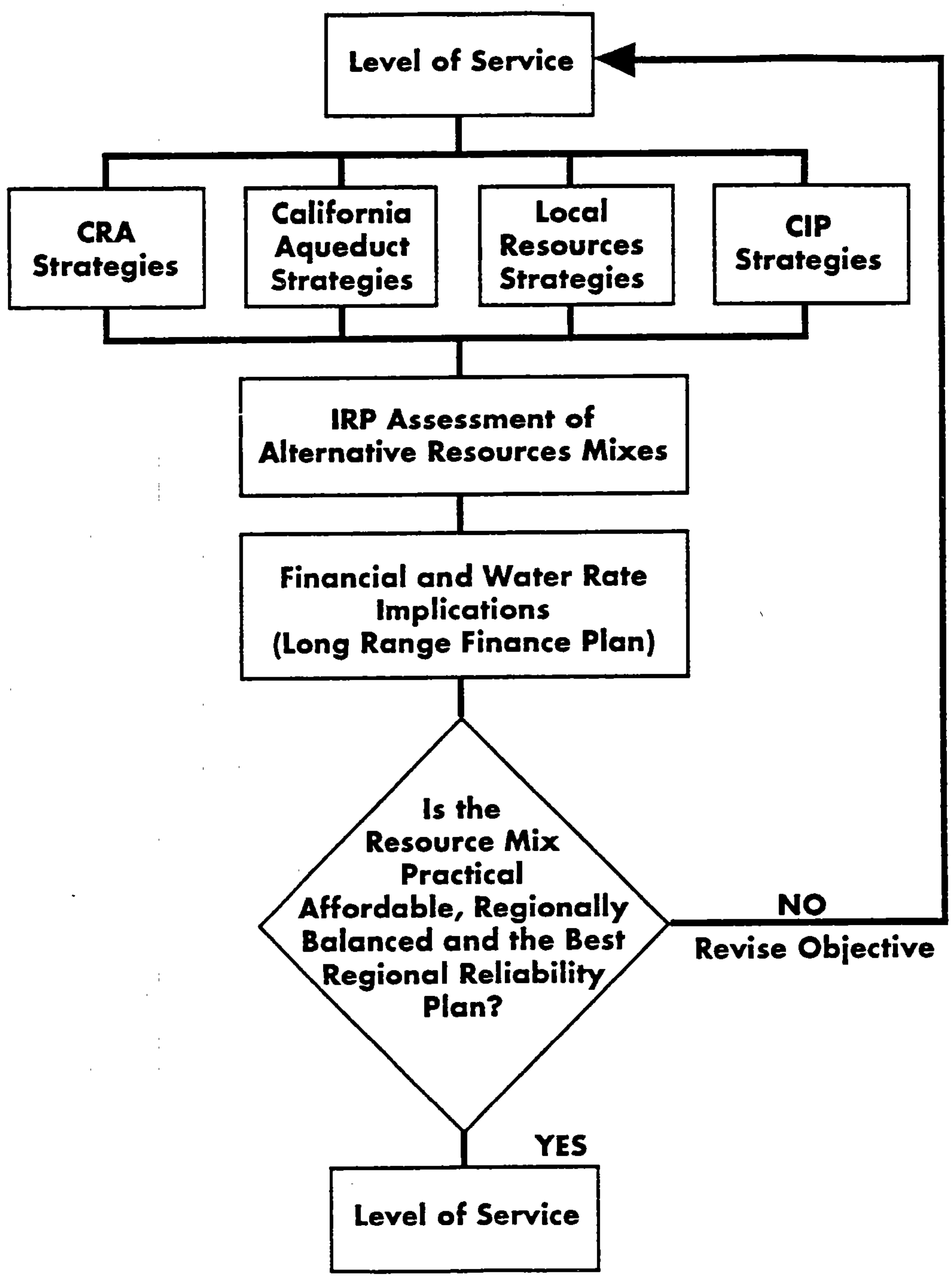
Although MWD has been following the logic of IRP in its water supply planning for many years, increasing financial constraints and environmental concerns requires a more rigorous evaluation of water resource development. The IRP process is shown graphically in Figure VII-1.

At the center of this planning process is the adoption of a quantified level of service (reliability) objective by the MWD Board of Directors. This reliability objective provides a specific and measurable performance goal for MWD service. This objective provides a signal when additional water resources are required, and when additional expenditures would constitute an over-investment in reliability and unnecessary increase in water rates.

To achieve the specified reliability objective, the region can utilize a wide range of resource strategies -- actions that could increase imported supplies, local water resources, or demand management efforts. These strategies fall into the four general categories shown in Figure VII-1 -- Colorado River Aqueduct supplies, California Aqueduct (State Water Project) deliveries, local water resources (including groundwater, local surface water, water conservation, water reclamation, and desalination), and capital improvement programs.

Figure VII-1

THE INTEGRATED RESOURCE PLANNING PROCESS



The next step in the IRP process is to compile and evaluate alternate resource mixes representing various levels of development of complementary resources. The evaluation process takes into consideration the variability and uncertainties associated with projected yield of each water resource and projected water demands. Evaluation criteria for alternate resource mixes include: ability to meet reliability goal, regional costs of development, potential risks, equity for MWD customers, environmental and institutional considerations, impact on local economy, and public acceptance.

The final step in the planning process is a careful examination of the financial implications of the resource alternative, and the determination of the rate increases required for its implementation. If MWD's Board of Directors determines that the preferred plan would not lead to unreasonable rate increases, then the resource alternative will be implemented with detailed planning steps, environmental documentation, and funding appropriations. If the resultant resource mix is deemed too expensive, then the reliability objective must be revised with appropriate modifications in the resource mix to reduce costs.

Planning Schedule

Since July 1992 and prior to the formal initiation of the IRP process, MWD and member agencies had been engaged in a Southern California Water Resources Strategic Assessment. The mission of the Strategic Assessment is to assess opportunities to optimize local water resources development. In 1993, the effort was expanded to the IRP process incorporating findings from the earlier study. MWD and its member agencies formally started the IRP process in June 1993. The first phase of the IRP process is the data gathering and analysis phase. Tasks included in this phase are: projections of anticipated demand, identification of possible resource options for meeting this demand, and examination of different "mixes" of these resource options. By October 1993, the work group developed several alternate resources mixes for analysis and evaluation.

The IRP process then entered the refinement and decision making phase. During this phase, major stakeholder in Southern California's water future were identified and invited to join the process. These major stakeholders include MWD's Board of Directors, Directors of its Member Agencies, representatives of other water providers and water management agencies, and representatives of community, business, agricultural, and environmental interests. The stakeholder weighed the findings of the data gathering and analysis phase and sought to establish a regional resource strategy. The phase was concluded with six public forums and an Integrated Resources Plan Assembly in June 1994. Over 100 water leaders from across southern California attended the June Assembly. The main questions the Assembly addressed were which resource mix to emphasize, and how to implement it. The Assembly prepared and adopted an Assembly Statement based on the positions and recommendations developed during the three-day assembly.

The IRP process is currently in the implementation phase. The IRP work group is currently developing the "preferred mix" and strategies for implementing the resource options. This phase seeks to develop a resource management plan that describes a resource mix that will meet the desired reliability goal at least cost to the region. The resource management plan will include demand-management strategies, water supply augmentation plans, and guidelines to development of capital facilities. The resource management plan will also become the basis for MWD's Financial Structure Study and Long-Range Financial Plan. Public forums and an IRP Assembly will be held in January 1995 to evaluate and refine the work group's findings. The resource management plan is scheduled for completion in March 1995.

ENDNOTES

1. Preliminary population projections shown in SCAG's Regional Comprehensive Plan indicate a regional total of 20.5 million persons by the year 2010.

2. An acre foot (AF) is the amount of water which would cover an area of one acre (roughly the size of a football field) to a depth of one foot. An acre foot is equivalent to about 326,169 gallons. Large volume water usage is typically expressed in hundreds of cubic feet (CCF), acre feet (AF), or millions of acre feet (MAF).

3. California Metropolitan Water District Act, Chapter 429, Statutes of 1927, Section 3.

4. Planning and Management Consultants, Ltd., Interim Report No. 4, June 1991.

5. State Water Contractors, Current and Projected Water Needs in the Metropolitan Water District of Southern California Service Area ,WRINT SWC Exhibit 3B, Bay-Delta Hearing, June 1992. Demand factor based on Center For the Continuing Study of the California Economy projections using 1980 dollars.

6. Dziegielseski, Ben; Opitz, Eva; and Rodrigo, Dan, Seasonal Components of Urban Water Use in Southern California, Planning and Management Consultants, Ltd., Metropolitan Water District of Southern California, March, 1990. Weighted averages were computed using data from 28 Southern California cities using the 1987 volume of seasonal use as the weighing factor.

7. State Water Contractors, Interim Hearing, WRINT SWC Exhibit 10 June 1992 Update.

8. Southern California Gas Company, 1993.

9. Thomas Anne, Es., 1991, "No Water, No Growth: What's the Connection?, California Water Reporter, November 1991, pp. 23-27.

10. Program goal statement as part of 'The Regional Urban Water Management Plan for the Metropolitan Water District of Southern California', November 1990, p. 73.

11. "Legislation Policy Principles', delivered to the MWD Board of Directors by General Manager. Metropolitan Water District: March 9, 1993, p.2.

12. "Changes in the Central Valley Project", Western Water, Water Education Foundation, Sacramento, CA: May/June 1992, p.4.

13. "California Water: Looking to the Future," Department of Water Resources State of California. Bulletin 160-87, Sacramento: November 1987, pp. 55-56.

14. The Los Angeles County Department of Public Works (LAC/DPW) has documented the history of implementation of the flood control system. See: "Conserving Water in Los Angeles County" and "The San Gabriel River and Montebello Forebay Water Conservation System."

15. Values from LAC/DPW documents discussion with DPW staff.

16. A description and proposal of this project and various alternatives was presented in 1991 to the County Board of Supervisors.