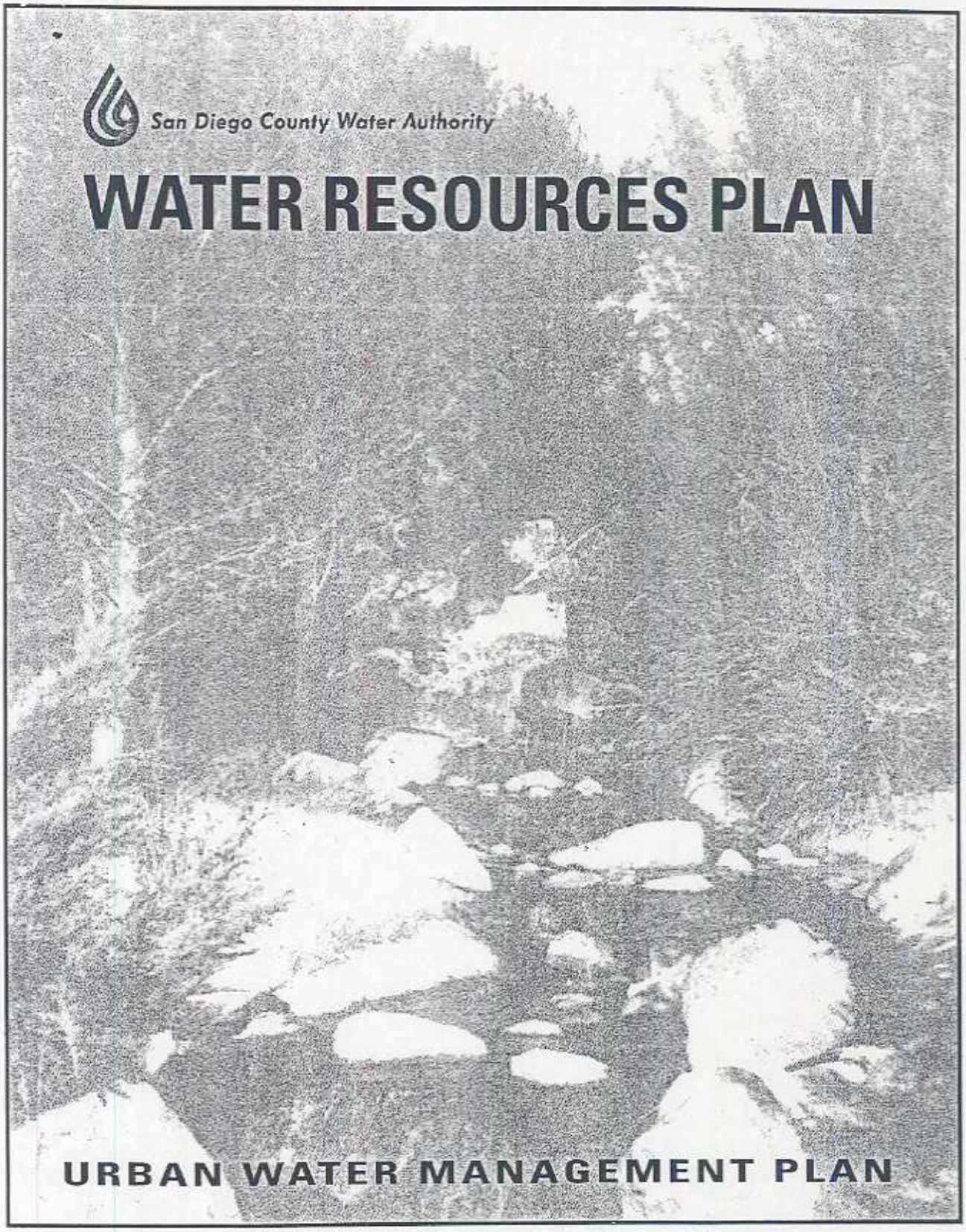

November 1993

Prepared by:
Water Resources Division

San Diego County Water Authority

WATER RESOURCES PLAN

URBAN WATER MANAGEMENT PLAN

NOVEMBER 1993

PREPARED BY:
WATER RESOURCES DIVISION

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SECTION 1

EXECUTIVE SUMMARY

The mission of the San Diego County Water Authority (Authority) is to provide a safe and reliable water supply to its member agencies in the San Diego region. The Water Resources Plan, as required by the Authority's Strategic Plan, is one important and necessary component in the effort to provide a reliable supply.

The flip side of reliability is supply shortages. Each incremental improvement in reliability has an associated and escalating cost. At some point, the improvement in reliability becomes too costly and occasional supply shortages become economically justifiable. In the future, the Authority will strive to develop local sources of supply that are more reliable than current imported supplies and with a cost comparable to future imported supplies.

Locally developed supply projects will avoid the costs of purchasing, transporting and storing imported supplies throughout the life of each project. These avoided costs should be considered when evaluating the feasibility of local projects. Supply development recommendations made by this plan do not represent a commitment for implementing any particular project. Rather, the plan should be considered a generalized tool for identifying the best supply options for meeting future needs. The plan will be updated every two years and is subject to revision as conditions change.

In 1991, the Authority's Board of Directors determined that the avoided cost of constructing additional pipeline capacity and the reliability of having local supplies should be valued by the Authority at $100 per acre-foot. Future local supplies should be considered economically feasible if they cost less than Metropolitan Water District's (MWD) future water rate plus its local projects and groundwater recovery contributions (currently $154-$250 per acre-foot) plus the Authority's contribution as well as any other avoided costs.

Currently, the Authority receives 90 percent of its supply from MWD, thus the Authority's supply is only as reliable as the MWD supply. In any shortage condition affecting MWD, the more dependent agencies, such as the Authority, will likewise suffer the greater loss of supply. The Authority can improve its reliability by diversifying its sources of supply and reducing its dependence on MWD. This Resources Plan forecasts the quantities of water,

developed from various sources, that will increase reliability and satisfy the Authority's cost criteria as detailed in Section 13.

In addition to establishing supply forecasts, the Water Resources Plan establishes programs and dependable water savings forecasts in the closely related field of demand management or water conservation. The Authority will meet or exceed all of the water conservation provisions as detailed in the State of California's Best Management Practices Memorandum of Understanding. It is estimated that these water conservation measures will reduce the expected 2010 demands of 902,000 acre-feet by 70,000 acre-feet to a demand level of 832,000 acre-feet.

The primary local water supply sources analyzed in this plan include water reclamation, groundwater and seawater desalination. Upon careful examination of these supply sources and evaluation of future conditions, this plan foresees various cost-effective quantities of water (in acre-feet) being developed in each of these resource areas as shown in **Figure 1-1.**

Projected Water Resource Development

	1995	2000	2005	2010
Reclamation	11,000	18,000	36,000	50,000
Groundwater	2,000	5,000	10,000	15,000
Desalination	0	0	0	20,000
Total	13,000	23,000	46,000	85,000

Figure 1-1

By 2010, if this plan is successfully implemented, local supply in the Authority's service area in a normal year would increase from 60,000 acre-feet to 145,000 acre-feet. Accordingly, assuming 2010 is a normal year, the imported supply from MWD would be 687,000 acre-feet. However, the exact quantities from each source will depend upon an economic analysis of each project at the time of development.

The Authority's imported supply from MWD has suffered shortages from time to time. The most severe cutback ever experienced was a shortage of 31 percent in 1991, during the fifth year of a drought. This shortage would have been greater if water transfers from agricultural to urban users had not been

arranged by MWD through the State Water Bank. It is expected that future imported water shortages will not be greater than 31 percent since water transfers can and will be arranged to meet critical needs in urban areas. It is anticipated that the Authority will need dry-year transfers of 75,000 acre-foot by 2010. Further, by 2010 it is expected that carryover storage will be available from MWD's Domenigoni Reservoir, however additional carryover storage in local reservoirs will also be essential.

If 2010 should happen to be a drought year and the Authority's imported supplies were reduced by 31 percent, then imported deliveries, including 50,000 acre-feet of carryover storage, would be 524,000 acre-feet. The Authority's dependable local supplies plus local carryover storage and transfers would total 214,000 acre-feet. Thus, the Authority's total available supply would be 738,000 acre-feet or 88 percent of the expected normal supply.

Under these assumed dry-year conditions, a conservation effort of 12 percent would be required. This is considered to be the maximum reasonable effort in 2010 since implementation of long-term conservation projects will have reduced the conservation opportunities available to manage future shortages. This level of reliability is a specific goal of the Authority's Strategic Plan.

In conclusion, even after undertaking an ambitious effort to develop local supplies, the Authority will continue to be dependent upon MWD for a substantial portion of its total water needs. It is therefore incumbent upon the Authority to work closely with MWD to increase the reliability of their supplies, as well as develop fair and reasonable methods of distributing those supplies during periods of shortage. Reviews and updates of the Water Resources Plan will be done in coordination with MWD's Integrated Resources Plan (IRP).

SECTION 2

SUMMARY OF GOALS AND OBJECTIVES

The purpose of the Water Resources Plan is to identify future resource demands, review resource options and develop forecasts to guide the programs of the Authority's Resources Division in securing adequate water supplies. This chapter summarizes the primary goals, objectives and policies which are discussed throughout this report.

Primary Goal

Provide water resources that meet the Authority's need for a reliable water supply, quantified as no less than 88 percent of normal demands by 2010.

Primary Objectives

1. Operating Plan: Provide an annually updated operating plan that establishes specific resource objectives for the ensuing three-year period to meet the following overall local supply development targets for reclamation, groundwater, and desalination:

1995	13,000 AF
2000	23,000 AF
2005	46,000 AF
2010	85,000 AF

2. Water Reclamation: Implement programs and policies in cooperation with MWD to assist local agencies to achieve the following annual targets for beneficial reuse:

1995	11,000 AF
2000	18,000 AF
2005	36,000 AF
2010	50,000 AF

3. Groundwater Development: Assist local agencies to qualify for MWD's program to develop the following annual quantities of groundwater:

1995	2,000 AF
2000	5,000 AF
2005	10,000 AF
2010	15,000 AF

4. Desalination: Continue to monitor desalination technology as a potential future source of water with near-term financial participation only through the ongoing desalination projects of the Metropolitan Water District.

1995	0 AF
2000	0 AF
2005	0 AF
2010	20,000 AF

5. Demand Management: Implement Best Management Practices (BMP) in cooperation with other agencies to achieve the following annual conservation targets:

1995	21,000 AF
2000	37,000 AF
2005	52,000 AF
2010	70,000 AF

6. Water Transfers: Secure water transfers through a "State Water Bank" and/or "dry-year-options", and attain the following targets:

1995	28,000 AF
2000	57,000 AF
2005	57,000 AF
2010	75,000 AF

7. Carryover Storage: Implement storage options and operations to increase carryover storage capacity from current levels to 100,000 acre-foot in 2010 in the following increments:

1995	45,000 AF
2000	60,000 AF
2005	90,000 AF
2010	100,000 AF

8. Imported Water: Secure adequate quantities of imported water that, in conjunction with local supplies, will meet 100 percent of demands in normal and above normal water years and will meet no less than the following percent of normal demands in critically dry years:

1995	74%
2000	80%
2005	84%
2010	88%

SECTION 3

INTRODUCTION

Purpose

This Water Resources Plan was written to show the direction the Authority will take in providing a safe and reliable water supply to its member agencies. The fundamental purpose of the Plan is to examine water demands through the year 2010, then review options for future supplies and recommend specific alternatives for supplying water. Recommendations made by this Plan should be kept in proper context; the Plan is not a commitment to implement certain projects, but is instead a long-term planning document that will be formally updated every two years and revised to meet changing conditions.

Five supply options are provided for review, with one option recommended as best meeting the Authority's current water supply goals and objectives. The Plan will be updated every two years to incorporate changing demand projections and economic conditions affecting various water supply options. An operating plan should be written to establish specific resource objectives for meeting the forecasts identified in this Water Resources Plan.

The completion of the Water Resources Plan will provide the direction to fulfill one of the Strategic Goals of the Authority's Strategic Plan. The Strategic Plan identifies areas in which the Authority should focus attention to meet its water supply objectives. The above-referenced goal sets a target of using imported and local water supplies to meet no less than 88 percent of the Authority's normal demands in a critically dry year by the year 2010.

Background

The Authority was founded June 9, 1944 under the County Water Authority Act to provide public water agencies in San Diego County with a supplemental water supply for domestic, municipal, and agricultural uses. In 1946, the Authority joined the Metropolitan Water District of Southern California (MWD) which supplies the Authority from its Colorado River Aqueduct and its supplies from the State Water Project. MWD was established to supply the supplemental water needs of its member agencies such as the Authority. As with the Authority, MWD has grown from being simply a source of supplemental water supply to the major source of water for some of its member agencies. MWD currently supplies about 60 percent of the water used

in its service area. In turn, the Authority provides about 90 percent of the water used in its service area in an average year.

Distribution System

The Authority delivers water purchased from MWD on a wholesale basis to 23 retail member agencies. The Authority operates five large-diameter gravity-fed pipelines in two aqueduct corridors spanning the length of the County. The Authority takes delivery of water six miles south of the San Diego County line from the adjoining MWD system.

The Authority does not own or operate any water treatment or storage facilities but supplies treated water to member agencies from MWD's Skinner Filtration Plant. Approximately 50 percent of the total water delivered by the Authority is treated by MWD. The Authority is in the process of adding another pipeline to its aqueduct system and is planning to build water storage to improve system reliability and flexibility and to meet the emergency needs of the region. This effort is being guided by the 10-year Capital Improvement Plan, annually updated by the Board of Directors. The Authority's aqueduct system is shown on **Figure 3-1.**

Definitions

Above-Normal Demand - Demand that occurs during warmer-than-normal and or/dryer-than-normal weather conditions.

Average Yield - The amount of water produced in a drainage basin in an average year.

Avoided Cost - Relative to imported water, the costs that can be avoided or delayed by developing local supplies, such costs as pumping costs, larger or more pipelines, and reservoir capacity.

Best Management Practices (BMP) - A list of proven conservation measures that are to be implemented state-wide to provide uniform, prioritized demand management programs.

Groundwater Recovery Program (GRP)- Financial reimbursement program whereby MWD provides funds on a unit price basis for treatment of groundwater. Financial assistance is limited to treatment costs

exceeding MWD's treated non-interruptible rates up to a $250 payment per acre-foot developed.

Local Projects Program (LPP)- The MWD program to provide financial support of $154 per acre-foot to local agencies which develop local reclaimed water supply projects and correspondingly reduce their demands for imported supplies.

Local Water - Water produced within the San Diego region by the Authority or its member agencies for beneficial use. Local water includes surface water runoff, groundwater, reclamation, and desalination.

Marginal Cost - The incremental cost of developing an additional acre-foot of new water supply.

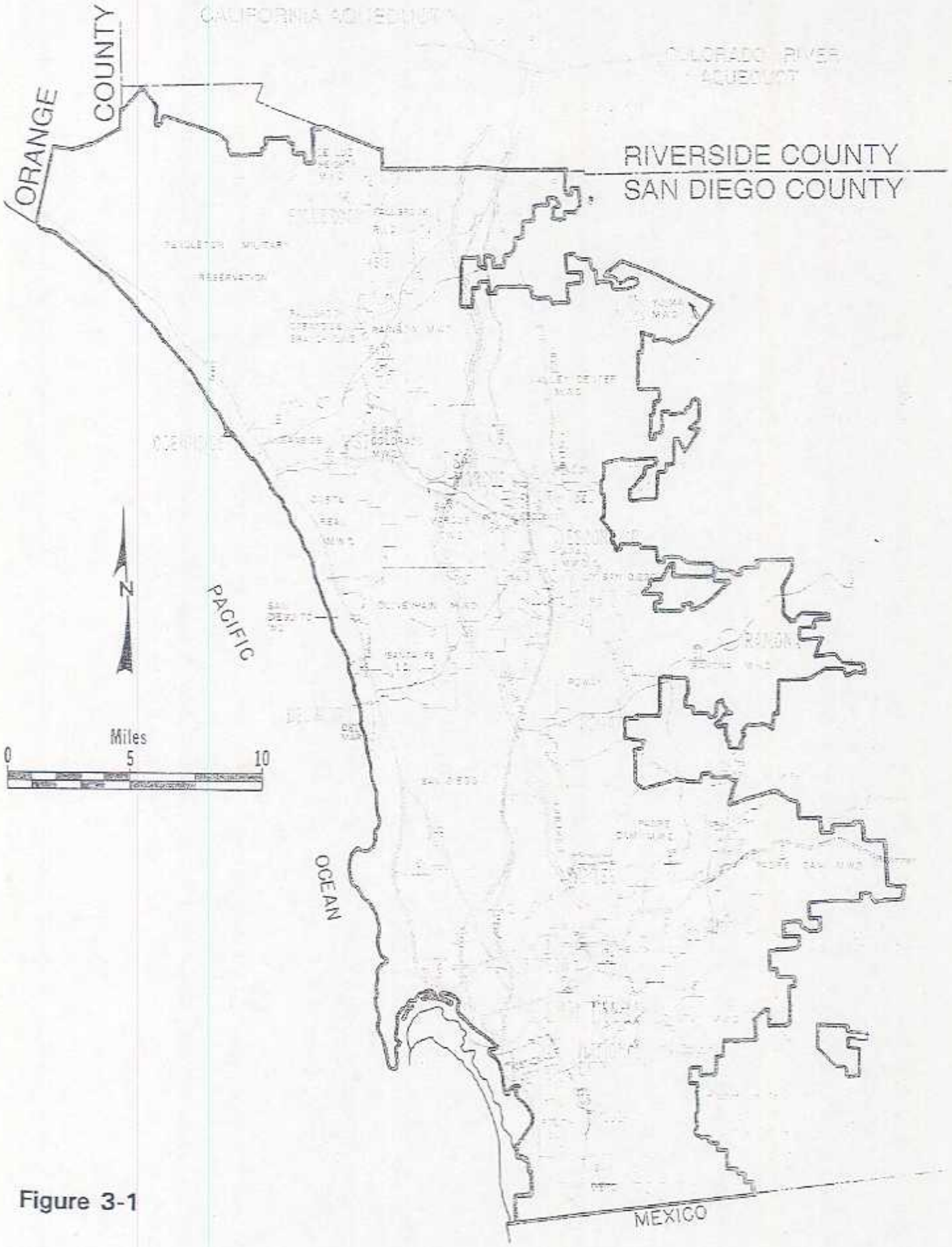
Mission - The primary purpose or reason for an organization's existence.

Normal Demand - Demand that occurs during normal weather conditions.

Reliable Yield - The least amount of water that has been historically produced in a drainage basin in 90 percent of all years.

State Water Project Yield - The average annual deliveries including contractually allowable initial agricultural shortages (50 percent maximum in any one year, 100 percent total in a seven-year period) available if a repeat of hydrologic conditions during the seven year dry period of 1928-1934 were to occur.

Water Use - The quantity of water the Authority or its member agency obtains from all sources to meet consumers' needs. Includes losses between the source and consumer.


ORANGE COUNTY
RIVERSIDE COUNTY
SAN DIEGO COUNTY
PACIFIC OCEAN
N
Miles
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5
10
MEXICO

Figure 3-1

SECTION 4

CURRENT AND FUTURE DEMAND

Demand for water in the Authority's service area is divided into two basic categories: municipal and industrial (M&I), and agricultural. Municipal and industrial use constitutes about 81 percent of regional water consumption. This category includes water used for residential landscaping, human consumption, and other domestic purposes, as well as water supplied for commercial and industrial use. Agricultural water is used mostly for irrigating crops, and accounts for the remaining 19 percent of demand. In San Diego County,agriculture provides much of the required green belt areas and cannot be distinguished from municipal uses.

During the 1989-90 fiscal year, 524,191 acre-feet of water went to M&I use, and agriculture applied 122,297 acre-feet to various crops and products. That year set the record to date for most water ever supplied by the Authority. Water use by economic sector for 1989-90 is shown on **Figure 4-1** (based on statistics supplied by member agencies).

The MWD, from which the Authority purchases all of its water, selected 1989-90 as a base year for its drought management program, called the Incremental Interruption and Conservation Plan (IICP). This program sets delivery allocations based upon percentages of growth-adjusted 1989-90 monthly deliveries. The allocations are based upon available supplies from the State Water Project and the Colorado River Aqueduct. First instituted in November 1991, the program has reduced Authority deliveries by as much as 31 percent, and remains in effect today (at a 10 percent reduction).

Since June 1990, demand for both M&I and agricultural water has declined significantly. This decrease is chiefly the result of drought induced delivery reductions, but it also includes local conservation measures and a "water ethic" that the public has developed after six consecutive years of drought. For fiscal year 1990-91, M&I use was 466,686 acre-feet, down about 11 percent from the previous year. Agricultural use was down only about three percent, to 118,933 acre-feet. In 1991-92, use declined even further, dropping to about 410,639 acre-feet for M&I use, and 92,571 acre-feet for agriculture.

These drought-induced reductions in deliveries, along with other factors, have complicated the task of forecasting near-term regional water demand. "Normal" demand for water may have been permanently reduced by

conservation measures such as low-flow showers and toilets and the public's awareness of water as a limited resource. During the relatively warm summer of 1992, when the Authority had a 10 percent conservation goal, actual usage was down by about 15-20 percent. A combination of factors may have been responsible for this, but conservation and water awareness are certain to have played a large role.

Current and Projected Municipal and Industrial Demand

During 1990, approximately 81 percent of the total water used within the Authority's service area was consumed by the municipal and industrial sectors. Urban water use is classified into four user groups: residential, commercial, industrial, and public/other. Among municipal and industrial uses, the residential sector consumes 54 percent, commercial 13 percent, industrial 4 percent and public/other 10 percent as shown on **Figure 4-1**.

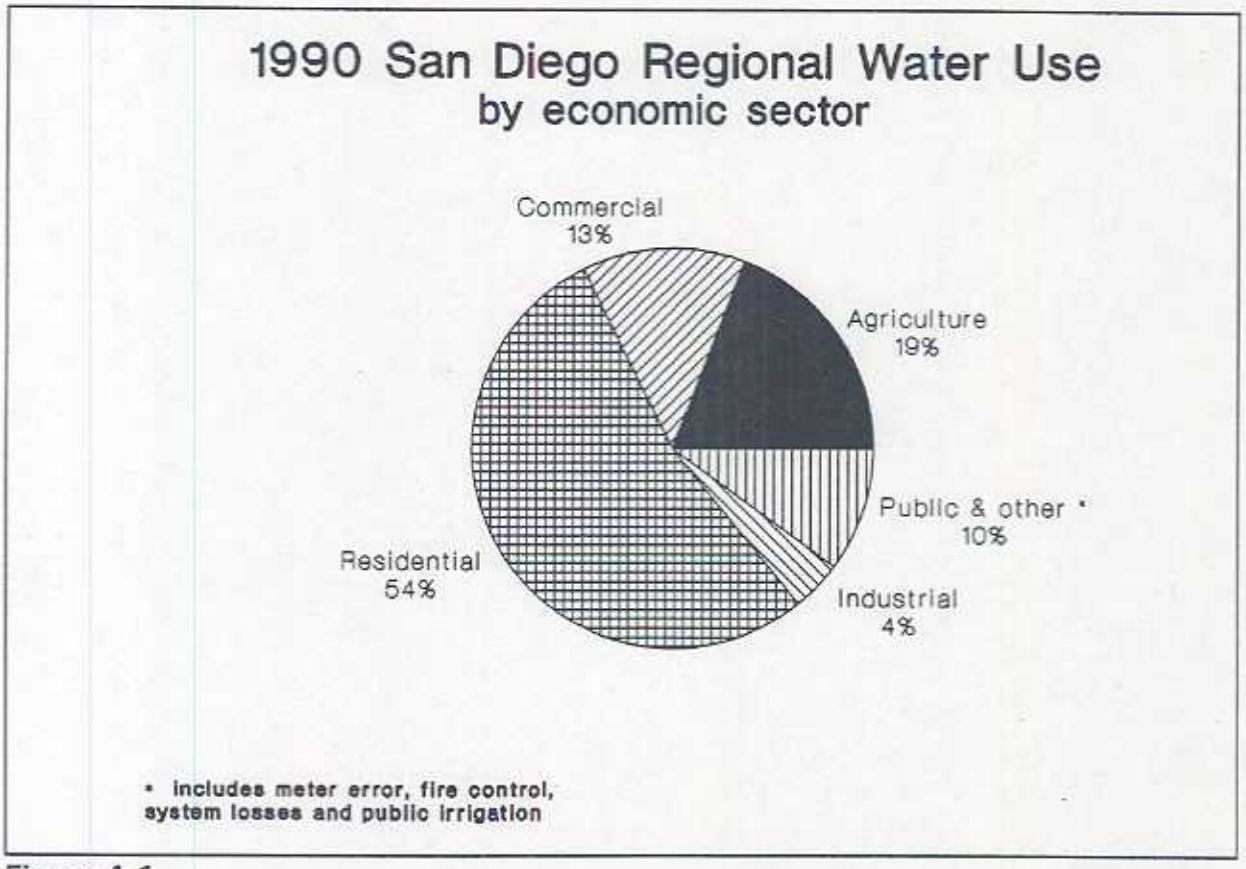

Figure 4-1

Residential Demand

Residential water consumption is composed of indoor and outdoor uses. The components of indoor water use include sanitation, bathing, laundry, cooking, and drinking. The majority of outdoor water use is for turf and other landscaping irrigation requirements. Other minor outdoor uses include car washing, surface cleaning and similar activities. For single family homes and rural areas, outdoor demands may be as high as 60 percent of total residential use.

Indoor uses remain generally constant throughout the year while outdoor uses fluctuate considerably from winter to summer, depending on the irrigation requirements and landscape types. Annual and seasonal climatic conditions significantly change evapotranspiration rates and irrigation requirements. A homeowner's perception of irrigation requirements is also influenced by weather changes, and in most cases results in over-irrigation during hot periods and under-irrigation during the cooler seasons.

Based on U.S. Census data, the San Diego region housing stock composition in 1990 was 59 percent single-family homes, 36 percent multi-family homes and 5 percent mobile homes. Single-family residences generally contain larger landscaped areas, predominantly planted in turf, and require more water for outdoor application in comparison to other types of housing. Larger lot sizes will further increase the amount of landscaped area of single-family homes. The general characteristics of multi-family and mobile homes limit outdoor landscaping and water use, although some condominium and apartment developments do contain green belt areas which are generally landscaped with water-consuming plant stock.

Changes in the service area housing stock, as well as development occurring further from the coast, impact water use, particularly in the area of outdoor water use. Indoor water use will also change as the number of bathrooms and other water-consuming appliances increase in single-family homes. Generally, increased construction of single-family versus multi-family homes or denser types of development will promote higher per capita demands. Current SANDAG forecasts show a decline in the number of single-family compared to multi-family homes by the year 2010, indicating a possibility of a slight reduction in residential per capita demand based on housing stock. However, the household size is forecasted to drop from 2.70 persons per dwelling to 2.68 in 2010, possibly promoting higher per capita demands by increasing the ratio of dwellings to residents. For Authority forecasting

purposes, it will be assumed that per capita rates will remain level into the future.

Commercial and Industrial Demand

Since 1950, San Diego's economy has continued to diversify from a primarily military defense-based economy. High long-term employment growth is forecast in the commercial, wholesale and services industries along with the self employed. According to SANDAG regional growth forecasts, the commercial sector grew 2.7 times faster in employment than manufacturing industries since 1980. The ratio of jobs to households has also increased 11.8 percent along with declines in unemployment. These changes, as well as the continued growth in the tourist industry, are contributing to higher per capita water use.

Industrial water consumption consists of a wide range of uses, including product processing and small-scale equipment cooling, sanitation, and air conditioning. Water-intensive industrial uses in the City of San Diego, such as kelp processing, electronics manufacturing, and aerospace manufacturing typically require smaller amounts of water when compared to other water-intensive industries found elsewhere in Southern California, such as petroleum refineries, smelters, chemical processors, and canneries.

It is estimated that industrial water use is only 4 percent of the total use within the Authority. SANDAG growth forecasts indicate the industrial sector of the economy will grow 11.5 percent by 2010, but will actually drop in relation to total employment from 11.3 to 10.4 percent within the regional economy. With conservation efforts, industrial water demand is expected to remain relatively constant in the future.

Commercial water demands consist of uses which are generally incidental but necessary for the operation of a business or institution, such as drinking, sanitation and landscape irrigation. Commercial users include service industries such as restaurants, car washes, laundries, hotels, and golf courses. The commercial sector uses an estimated 13 percent of the total water consumed. Employment data from SANDAG indicates over 50 percent of San Diego's residents are employed in commercial and service industries. The commercial water use sector is forecasted to have the highest growth, increasing 25 percent and employing 58 percent of the work force by 2010 as a result. Water use in the commercial sector is expected to continue to grow in the future.

The tourist industry in San Diego County affects the per capita rate of consumption within the Authority by not only the number of visitors, but also through expansion of service industries and attractions, which tend to be large outdoor water users. The Visitor and Convention Bureau estimated that there were 35 million visitors to the county in 1989, a 13.2 percent increase over 1986. The number of hotel rooms has increased to 41,000 with occupancy rates generally holding steady. Tourism is concentrated in the summer months and affects seasonal demands and peaking. SANDAG regional population forecasts do not specifically account for tourism, but as an economic sector it is reflected in the economic forecasts and causes per capita use to increase.

Projecting Municipal and Industrial Demand

Water demand forecasting in the San Diego region has generally been done using per capita water use multiplied by the population projection. While these forecasts have proven quite accurate, they are unable to take into account economic, demographic and land use changes which affect water use. In recent years, the Authority has worked with MWD and its consultants to calibrate MWD's version of the U.S. Army Corps of Engineers IWR-MAIN (Institute for Water Resources - Municipal And Industrial Needs) computer model, which predicts water use. Versions of this econometric model have evolved over a 20-year period and are being used by many cities and water agencies. MWD's version is known as the MWD-MAIN System.

The MWD-MAIN System accounts for a wide variety of economic, demographic and climatic factors. In forecasting residential water demands, the MWD-MAIN System takes into consideration population, housing mix, household occupancy, housing values, weather conditions and the implementation of conservation measures. For commercial and industrial water use, the System projects demands as a function of employment in subdivisions of these sectors and accounts for water and wastewater prices and conservation practices. Demand projections from the model are made by individual demand sectors, such as commercial, industrial, and residential. The effect of weather on water demand has also been studied and the findings indicate that the above-normal water demand in San Diego County was about 7 percent greater than normal (average) water demand.

Population forecasts from SANDAG are a prime input into the MWD-MAIN model. These forecasts are intended for local government and special agency use, and are provided both on a regional and sub-regional basis. The latest

forecast adopted by SANDAG's Board of Directors, called the Series 7 forecast, was used for the most recent MWD-MAIN water demand projection.

SANDAG has since updated its population estimate, called the revised Series 8 forecast, which incorporates results from the 1990 U. S. Census. This forecast is available for planning purposes, although detailed subregional allocations have yet to be completed and adopted by the SANDAG Board. As shown in **Figure 4-2**, Series 8 regional projections indicate that actual population is running well ahead of that projected by Series 7. The Series 8 regional forecast and Series 7 MWD-Main results were used to develop the water demand projections presented in **Figure 4-3.** Actual 1989-90 water use closely matched the projections with 647,000 acre-feet of total use, including 122,000 acre-feet of agricultural use and 525,000 acre-feet of municipal and industrial use.

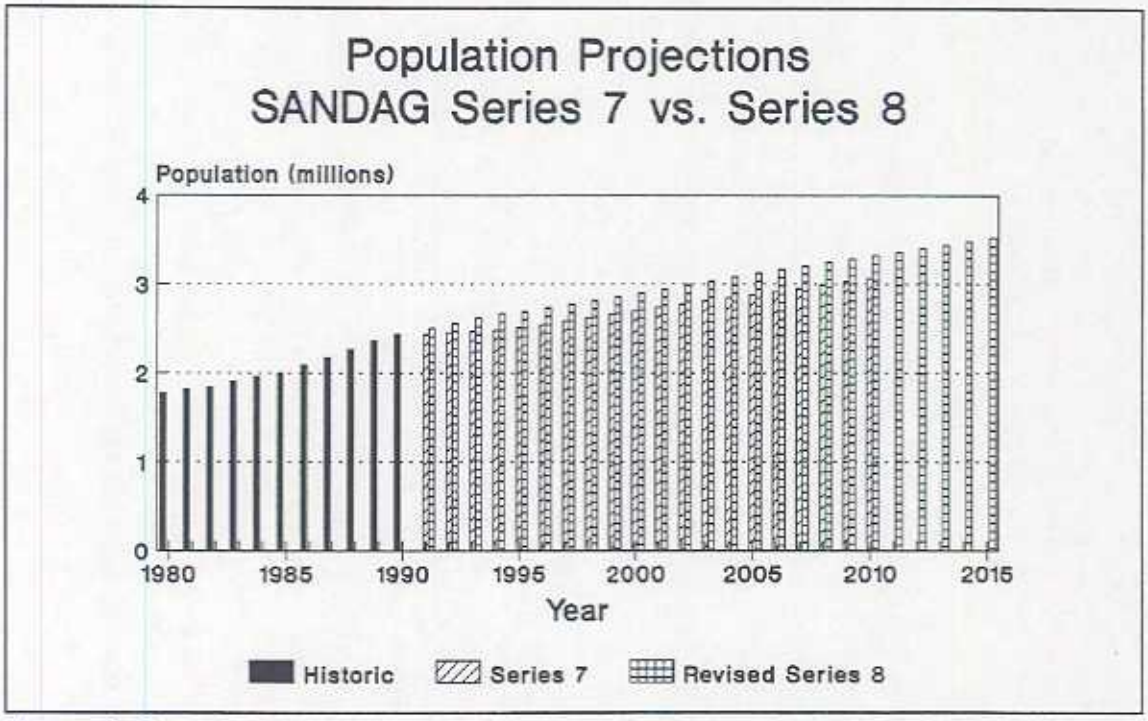

Figure 4-2

Water Demand Projections (AF/Yr)

Demand Sectors	1990	2000	2010
Municipal & Industrial			
Residential			
Single Family	259,000	334,000	397,000
Multi-family	116,000	148,000	175,000
Commercial	92,000	119,000	141,000
Industrial	16,000	22,000	27,000
Public/Other	79,000	102,000	120,000
Total M & I	562,000	725,000	860,000
Agriculture (1990 Actual)	122,000	113,000	108,000
Total Base Use	684,000	838,000	968,000
Existing Conservation	(31,000)	(49,000)	(66,000)
Total w/Existing Cons.	653,000	789,000	902,000
BMP Conservation	(0)	(37,000)	(70,000)
Total Use w/BMP	653,000	752,000	832,000

Figure 4-3

Current and Projected Agricultural Demand

In the San Diego region, agriculture ranks as the fourth largest industry in the economy and accounts for 1.7 percent of the region's economy. The coastal and inland valley areas of the county possess a moderate and virtually frost-free climate able to support a variety of sub-tropical crops, making the San Diego area a unique agricultural region. The primary crops being grown for the national and international markets are avocados, citrus, cut flowers, and nursery products. To a lesser extent, local fresh market crops and livestock are produced in the Authority service area.

The Authority is the largest agricultural water consuming agency within MWD, requiring approximately 50 percent of MWD's total agricultural water supply each year. Agricultural water use within the Authority is concentrated mainly in north county member agencies such as Rainbow MWD, Valley Center MWD, Fallbrook PUD and Yuima MWD.

Figure 4-4 represents the trend in agricultural water demand over the last 30 years. The changes in water use and crop acreage have been relatively

small over the last eight years. The variations in water use are mainly attributed to a cropping pattern shift from field and row crops to permanent crops, along with varying irrigation requirements due to climatic conditions.

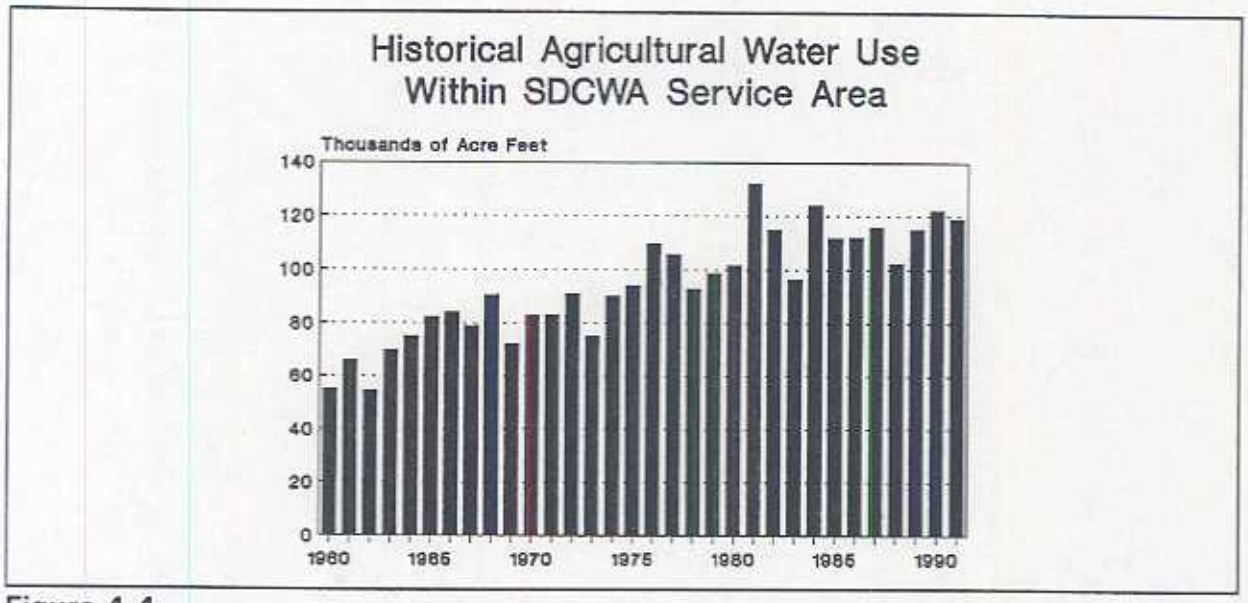

Figure 4-4

The agricultural industry served by the Authority pays some of the highest water rates in the state. The rates are over 30 times greater when compared to the Central Valley Project or Imperial Irrigation District rate structures. Because of these high rates and crops adaptable to efficient irrigation technology, irrigation efficiency is very high in comparison to other agricultural regions of the state. Additionally, due to the high water cost, crops grown in the Authority service area are generally not able to be in direct market competition with other areas operating with lower water costs.

The methodology used in producing an agricultural water demand forecast to 2010 for the Authority is based on the economic outlook for crop production, and corresponding estimates of producing acreage and water use. Climatological variations also significantly affect annual irrigation demand, although it is difficult to establish a true correlation with the data available.

Given the variability of crop market conditions, land costs, water supply costs and urbanization, there is a significant amount of uncertainty in forecasting agricultural water use toward the year 2010. For purposes of this

plan, agricultural demand in the Authority service area is assumed to decline about 8% by 1995, and then begin a steady but less steep decline to 2010 as shown in **Figure 4-5.**

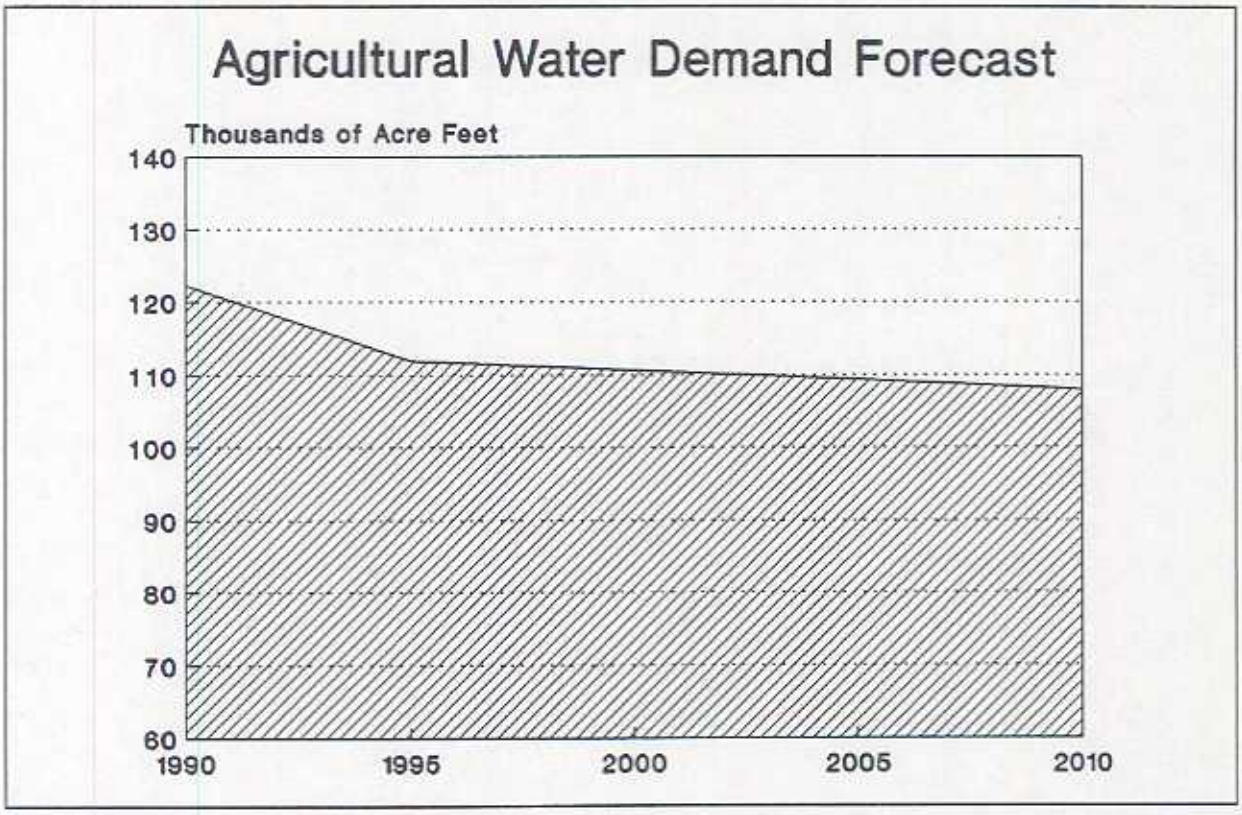

Figure 4-5

This agricultural forecast is based upon average weather conditions. By the year 2010, agriculture in San Diego County is expected to use 108,000 acre-feet or about 14 percent of total water demands, down from 19 percent of current demands. Water and power price increases could dramatically affect permanent crops and water demands. Sustained drought conditions in the future could also reduce or eliminate imported supplies available for agricultural use which would have long-term effects. These trends and contingencies which may affect this water use sector must be carefully considered in future resource and capital improvement planning efforts. To this end, a study to examine the sensitivity of agricultural production to future rate increases was undertaken.

Total 2010 Water Demand Projections

Figure 4-6 shows the normal M & I and agricultural water demands projected for the Authority to the year 2010. Total demand is expected to reach 832,000 acre-feet by 2010 under normal conditions assuming current conservation programs continue and with implementation of conservation Best Management Practices (BMP), which will be discussed in Section 6. Higher demands during an above-normal year would result in an additional 57,000 acre-feet of demand in 2010.

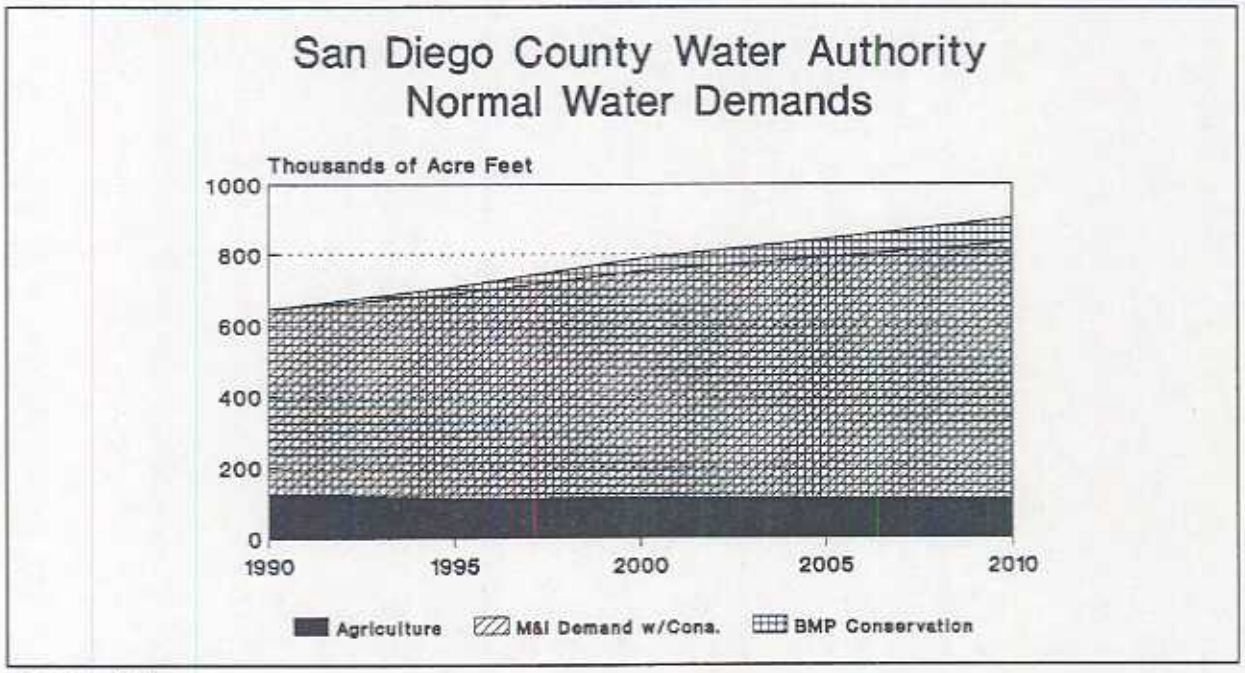

Figure 4-6

Total demand projections may increase somewhat with revisions to SANDAG's Series 8 population forecast and possible annexations to the Authority service area over the next 10-15 years. The SANDAG board has not yet adopted Series 8, but did release a preliminary Series 8 forecast for planning purposes in December 1992. This forecast was used in the Water Resources Plan.

SANDAG is considering the adoption of a revised Series 8 that would increase the current forecast of 3.633 million people in year 2015 to 3.816 million. If this forecast is approved, the upward population adjustment of 5 percent will be incorporated into the MWD-MAIN computer model to forecast demands for use in future revisions of the Water Resources Plan. Using a

hypothetical example, if the current forecast M&I demand were increased at that rate, the total demand (M&I and agriculture) for year 2010 would be about 868,000 acre-feet, rather than 832,000 acre-feet. However, such an increase could be offset if agricultural water usage were to decline at a rate greater than that shown in this plan.

Possible annexations to the Authority service area could also result in slight increases in demand. However, proposed annexations would result in relatively small increases that would be considerably less significant, on an order of magnitude basis, than the proposed revision to the Series 8 forecast. These increases are within the range of error that could reasonably be expected from long-range population and water demand projections.

Reliability

The Authority is committed to providing a reliable water supply to its member agencies. Reliability does not mean supplying 100 percent of normal or above-normal demands all of the time. During prolonged dry periods it is not economically feasible, and sometimes impossible, to meet 100 percent of all demands. The Authority is also committed to providing a reliable supply to all of its constituent water users. Water reliability is an issue that impacts all uses, from agricultural to municipal and industrial, and efforts to improve reliability benefit all users.

Figure 4-7 provides an illustration of the tradeoffs involved between increased reliability and the costs of new water facilities. Line 3 of the graph sums the costs of new facilities (Line 1) and the economic costs of water shortages (Line 2). The lowest point of Line 3 is the theoretical least cost or the point of optimal shortage that would result from new facility expenditures.

Past experience indicates that it is possible to reduce demands to about 80 percent of normal without causing extensive economic damage. In the future, as additional conservation measures are implemented, it is estimated that demands can only be reduced to about 88 percent of normal. The Authority is committed to maintaining this level of reliability which limits economic damage, as required by the Authority's Strategic Plan.

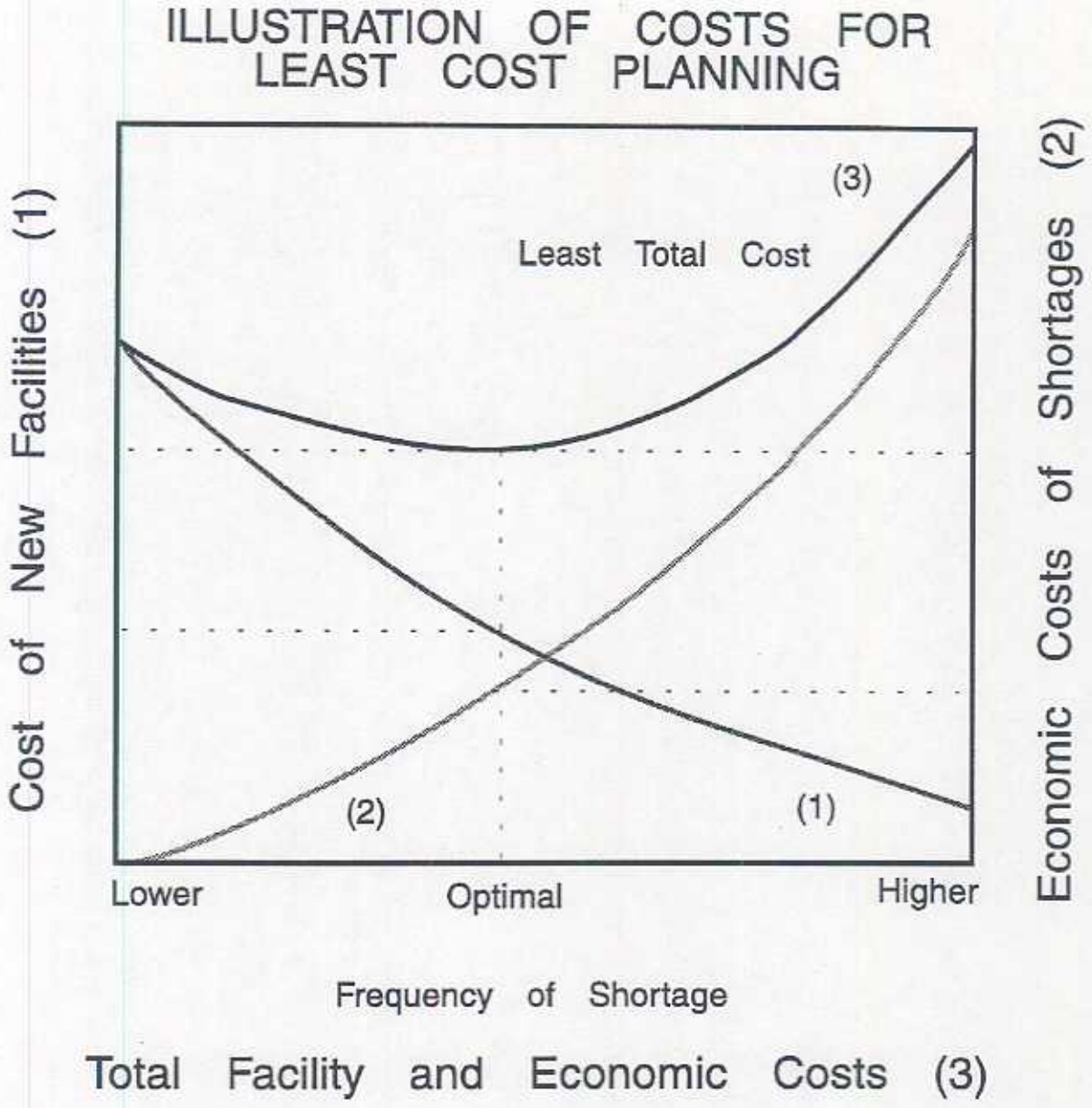
ILLUSTRATION OF COSTS FOR LEAST COST PLANNING
Cost of New Facilities (1)
Economic Costs of Shortages (2)
(3)
Least Total Cost
(2)
(1)
Lower
Optimal
Higher
Frequency of Shortage
Total Facility and Economic Costs (3)

Figure 4-7

SECTION 5

CURRENT AND FUTURE SUPPLY

Local Supplies

Local supplies of water consist of developed surface water impoundments and groundwater within the San Diego region. Average use since 1948 is about 84,000 acre-feet annually. This use, however, is highly variable, with annual yields varying from a low of just over 17,000 acre-feet to just over 173,000 acre-feet. Prolonged dry periods (1961-1966) with annual local supply yields of around 25,000 acre-feet are contrasted by wet cycles where local production has averaged up to 141,000 acre-feet (1979-1985). For planning purposes, local supplies are assumed to have a dependable yield of 25,000 acre-feet and a normal yield of 60,000 acre-feet.

Surface Water Supplies

Additional local surface water development has been studied numerous times in the recent past. Two projects were identified that could yield significant local water resources. These were a dam and reservoir project in the Pamo Valley, north of Ramona, and a site in Fallbrook on the Santa Margarita River. These projects were designed as multi-purpose storage projects (emergency storage, flood control, operational storage and local yield) and would have yielded an annual average of 11,000 acre-feet and 15,000 acre-feet, respectively. Federal funding was never secured for the Fallbrook project and the Pamo project was withdrawn by the Authority for further study. Both sites present formidable environmental problems in securing the necessary federal permission for construction.

Groundwater Supplies

Groundwater supplies in San Diego County are minimal due to the geology of the region. Short, steep river valleys with small alluvial basins are characteristic local geology. Outside of these alluvial basins, the underlying bedrock geology consists of massive fractured crystalline rock structures which are not conducive to groundwater accumulation except in certain fractures. Alluvial aquifers, which have well yields appropriate for large municipal water supplies, are alrady fully developed for local yield. Many of these basins have been overdrafted in the past and are suffering from water quality problems due to seawater intrusion and urban and agricultural runoff contamination. Potential

exists for additional development of groundwater supplies through conjunctive use of imported water placed in local basins, demineralization of poor quality groundwater combined with additions of imported water, and recharge of groundwater basins with reclaimed water for either potable or nonpotable purposes. This potential is evaluated in Section 8.

Metropolitan Water District Supply Status

The Metropolitan Water District of Southern California (MWD), a wholesale water agency serving supplemental imported water to portions of Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties, has a current population of over 16 million people. Approximately 60 percent of the total water used throughout the MWD service area is imported water provided by MWD to supplement local water supplies.

The Authority has traditionally relied upon MWD to meet its water demands. MWD was formed "for the purpose of developing, storing and distributing water for domestic and municipal purposes." In 1952 MWD adopted a statement of policy, reaffirmed in 1989, which has become known as the "Laguna Declaration". This statement was a simple and clear commitment "to provide its service area with adequate supplies of water to meet expanding and increasing needs in the years ahead." On November 19, 1991 the MWD Board adopted the following Mission Statement:

> The Mission of the Metropolitan Water District of Southern California is to provide its service area with adequate and reliable supplies of high quality water to meet present and future needs in an environmentally and economically responsible way.

MWD obtains imported supplies from the Colorado River and the State Water Project (SWP). The general locations of these aqueduct facilities are shown in **Figure 5-1.**

Colorado River Aqueduct

The Colorado River Aqueduct, owned and operated by MWD, transports water from Lake Havasu on the Colorado River, 242 miles to its terminus at Lake Matthews in Riverside County. Construction of the Colorado River Aqueduct began in 1931 and the first deliveries of water to member agencies took place in 1941. The aqueduct has an annual maximum capacity of 1.3 million acre-feet.

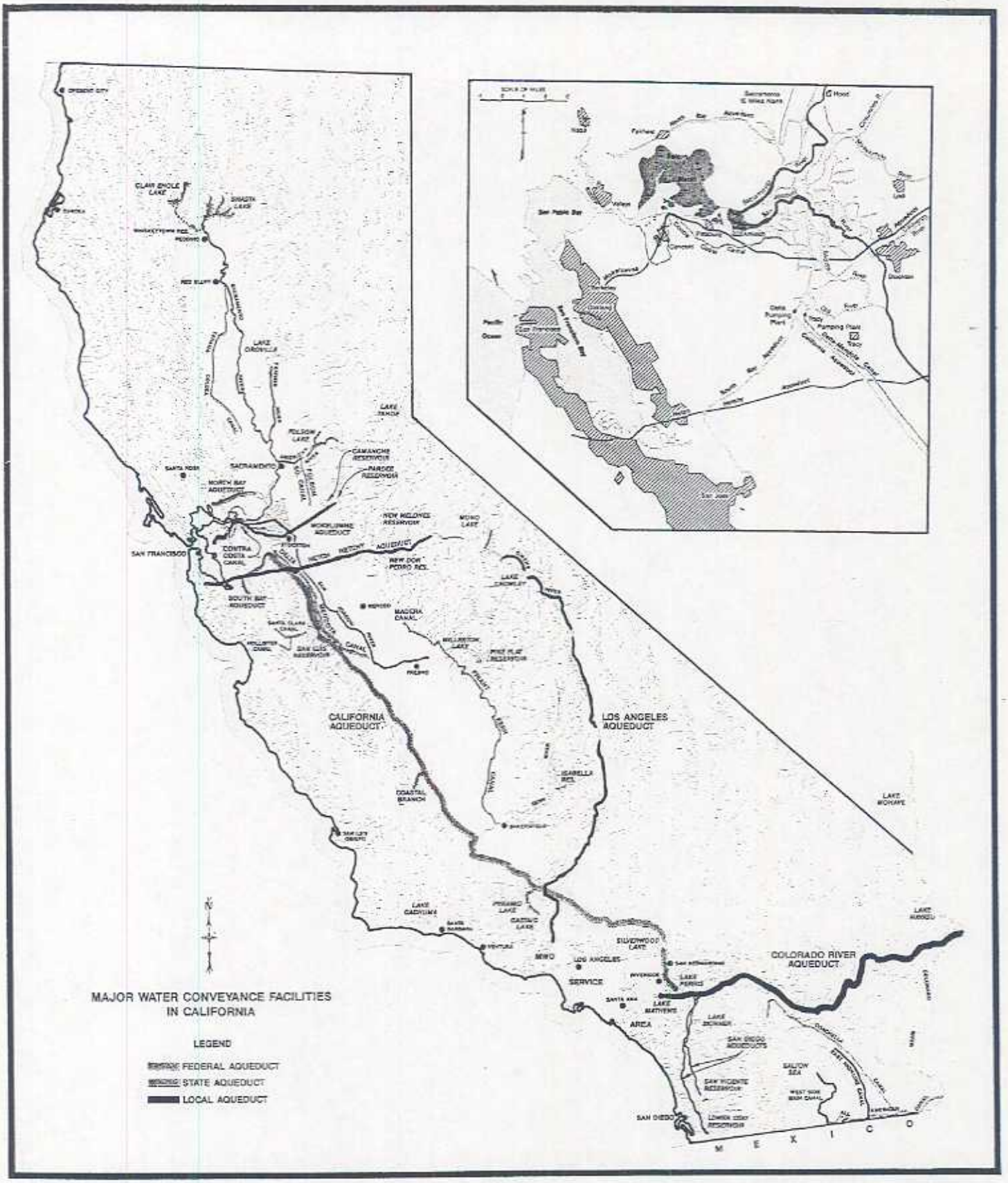
CALIFORNIA AQUEDUCT
LOS ANGELES AQUEDUCT
COLORADO RIVER AQUEDUCT
MAJOR WATER CONVEYANCE FACILITIES IN CALIFORNIA
LEGEND
FEDERAL AQUEDUCT
STATE AQUEDUCT
LOCAL AQUEDUCT
MEXICO

Figure 5-1

MWD's total annual entitlement to Colorado River water is approximately 1.39 million acre-feet. This entitlement consists of a fourth priority right to 550,000 acre-feet, a fifth priority right of 662,000 acre-feet and surplus contract rights of 180,000 acre-feet. Several irrigation districts hold higher priority rights to 3.85 million acre-feet. Certain Indian reservations, towns and individuals also hold present perfected rights that predate MWD's rights. In 1964, the United States Supreme Court limited California's annual diversions on a dependable basis to 4.4 million acre-feet in the case *Arizona v. California*). As such, MWD's annual diversions from the Colorado River on a dependable basis were limited to approximately 550,000 acre-feet. During declarations of surplus, MWD has the highest priority of any California contractor to divert these surplus waters.

The Secretary of the Interior has the discretion to allow California to use any water that Arizona and Nevada have available from the Colorado River, but do not use. It is difficult to predict the criteria the Secretary will use in determining whether to release unused water to California. If the agricultural agencies in California do not use the entire supply available to them, MWD also has the right to divert the unused portion.

The MWD has been actively seeking additional water supplies from the Colorado River. MWD recently signed a long-term Conservation Agreement with the Imperial Irrigation District (IID) in which MWD will pay for specific water-conserving improvements within IID including lining canals. MWD negotiated this Agreement following a finding by the State Water Resources Control Board that IID's operating practices were wasting substantial quantities of water. In return, MWD will have the use of the water saved by these improvements. Under the Agreement, IID agreed not to divert the water conserved by the projects under its higher priority. This Conservation Agreement, essentially established by the Seven Party Agreement apportioning California's use of the Colorado River, allows the water to be diverted by MWD's Colorado River Aqueduct at Lake Havasu. The Imperial Irrigation District and MWD signed the Conservation Agreement in December 1988. The Conservation Agreement is for a minimum 35-year term and is estimated to conserve 106,000 acre-feet per year once fully implemented.

The MWD is implementing a pilot two-year land fallowing program with Palo Verde Irrigation District (PVID) and considering other programs to leave land fallow. This would permit MWD to divert water that would have otherwise been used for agricultural purposes. Under the Test Land Fallowing Agreement, PVID agreed not to divert the water saved under its higher priority.

Approximately 20,000 acres of farmland in the Palo Verde Valley will be fallowed for the test period resulting in an approximately 93,000 acre-feet per year reduction in PVID's diversions from the Colorado River. MWD is paying farmers in the Palo Verde Valley to reduce their irrigated acreage.

The MWD is also participating in the preparation of environmental impact statements/reports evaluating projects to concrete line the All American and Coachella canals. It is estimated that 100,000 acre-feet of the water lost due to seepage can be conserved each year from implementation of these projects. The Metropolitan Water District, Coachella Valley Water District, and the United States Bureau of Reclamation (USBR) have also investigated a groundwater storage and recovery project on the East Mesa in Imperial County. This project would involve storing surplus Colorado River water for future use. Coachella would take delivery of pumped groundwater in-lieu of direct river diversions, making additional river water available to MWD. If all these projects are implemented, an additional annual Colorado River supply for MWD in excess of 300,000 acre-feet could be developed by the year 2000.

State Water Project

Metropolitan's other primary source of water is the State Water Project (SWP). The SWP is owned by the State of California and operated by the California Department of Water Resources (DWR). This project transports water from the Sacramento-San Joaquin Delta via the 444-mile-long California Aqueduct to 29 contract agencies in the state.

The MWD has an annual entitlement to SWP water of 2,011,500 acre-feet out of a total maximum contractual entitlement of 4.2 million acre-feet for the 29 contractors. The current firm yield of the SWP, 2.4 million acre-feet, falls below the project-wide SWP contractor requests of 3.6 million acre-feet in 1992. The current yield is based on the average annual supplies available if the hydrologic conditions which occurred during the seven year period from 1928-1934 reoccurred. In certain future years, the supply of water available to MWD will be less. Demands for SWP water are expected to increase to 4.2 million acre-feet by the year 2010. Thus, MWD's water supply from the SWP faces potential limitations. The current firm yield of the SWP can supply only about one-half of the contract entitlements due to the lack of sufficient water conveyance facilities.

In April 1992, Governor Wilson outlined a California Water Policy to meet the water needs of urban, agricultural and environmental interests in the state.

In the policy statements, the Governor recognized the need to implement several currently planned SWP programs, complete the environmental documentation for selection of a comprehensive Delta solution, as well as provide for the reallocation of State water supplies through voluntary transfers.

The SWP programs referred to by the Governor include:

- Kern Water Bank (KWB)
- South Delta Water Management Program (SDWMP)
- Los Banos Grandes Reservoir (LBG)
- Delta conveyance facility.

Assuming current (State Water Resources Control Board Decision 1485) or proposed standards and measures to protect threatened or endangered species do not further restrict SWP operations, these facilities would significantly increase SWP water supplies by enabling the increased diversion and storage of excess Delta outflows. By 1995, it is expected that the initial phase of the KWB Fan Element could be operational. Based on DWR studies, MWD estimates the resulting increase in SWP average annual critical period water supplies would be approximately 50,000 acre-feet. By the year 2000, a later phase of the KWB Fan Element and the SDWMP could be operational. These programs are estimated to increase SWP supplies by approximately 200,000 acre-feet on average during the seven-year critical period. Shortly after 2000, it is projected that a Delta conveyance facility and LBG could also be operational. These programs, along with the SDWMP and the KWB, are estimated to increase average annual SWP critical period water supplies by approximately 800,000 acre-feet over current supply levels.

In addition, the Governor's Policy calls for water marketing to play a more important role in meeting California water needs. The viability of using market forces to voluntarily reallocate water supplies was demonstrated in 1991 when the California Drought Emergency Water Bank acquired 820,805 acre-feet for critical needs including those of urban areas and agriculture.

Bay Delta Hearings

In 1978, the State Water Resources Control Board (State Board) established water quality standards for the Delta and assigned responsibility to meet these standards to the SWP and the Central Valley project (CVP) exclusively. The State Board began hearings in 1987 to review the existing

standards and adopt new standards to protect beneficial uses of the water of the Delta and San Francisco Bay. In these proceedings, which are ongoing, all water users that divert from the Delta upstream in the Central Valley river system are potentially responsible for meeting a portion of new standards that are adopted. Once this hearing process is complete, new terms and conditions will be established in SWP and CVP water rights permits. Other water users will also face having their water rights modified.

The State Board has completed the first two phases of the hearing process and has adopted a Water Quality Control Plan for Salinity and Pollutant Policy Document. The third phase, called the Scoping Phase, was initiated in March 1991. During this phase, the State Board received testimony and recommendations from the hearing parties regarding: (1) alternatives to protect uses of Bay-Delta waters, and (2) measures to implement the previously adopted water quality objectives. During this phase, the State Water Board is also considering methods to provide additional protection for fisheries, including flow measures and export curtailments. The information received and developed by the State Board during the Scoping Phase will be incorporated in a Draft Environmental Impact Report (EIR) for a new water rights decision. During the Water Rights Phase, the State Board will finalize the EIR and adopt the new water rights decision.

The Governor's April 1992 policy statement directed the State Board and the California Environmental Protection Agency (CAL-EPA) to develop interim requirements for the Delta by the end of 1992. The Governor's stated purpose for this action is that the Bay-Delta proceeding, now in its fifth year, has failed to come to a conclusion. The water rights decision, previously scheduled to be adopted by the end of 1992, is projected to take at least two more years to complete.

MWD cannot, at this time, predict the outcome of either the Bay-Delta Proceeding or the Bay-Delta Interim Requirements. To the extent that reduction in exports from the Delta area or increased reservoir releases for the environment are considered, a new water rights decision would reduce the amount of water for SWP contractors, including MWD. MWD is actively participating in both proceedings.

Sacramento River Winter-Run Salmon Listing

In 1989, the Sacramento River winter-run chinook salmon was listed as an "endangered" species by the California Fish and Game Commission under the California Endangered Species Act. Also in 1989, the National Marine Fisheries Service (NMFS) enacted emergency listing of the winter-run as

"threatened" under the Federal Endangered Species Act. The adult winter-run salmon migrate from the ocean through the San Francisco Bay/Delta Estuary (Bay/Delta) to their spawning area in the upper Sacramento River. After spawning, the young salmon return from the spawning area to the ocean. Because the migration route of the winter-run salmon includes the Sacramento River as well as the Bay/Delta, fishery biologists are concerned about whether the operations of the State Water Project or the USBR Central Valley Project have an adverse impact on the fish.

In 1992, the USBR and the Department of Water Resources (DWR) were involved in a consultation process with NMFS regarding protection measures that can be taken for winter-run salmon. As a result of these consultations, the USBR and DWR agreed to modify their water project operations and perform additional preventive measures to minimize impacts on the fish. These measures resulted in minimal water supply impact to the SWP during 1992. The USBR, DWR, and NMFS will continue their consultations in order to develop protection measures for future years.

Delta Smelt Listing

In October 1991, the United States Fish and Wildlife Service proposed listing the Delta Smelt as a "threatened" species under the authority of the Federal Endangered Species Act. This action initiated an approximately year-long process to determine whether the proposed listing is appropriate. A final decision on the listing is expected sometime after November 1993.

The Delta Smelt is a small forage fish, about three inches long at maturity. It is not a sport or commercial fish, but rather it is part of the food supply for larger fish. According to the biologists who monitor the fish, the Smelt lives its one and occasionally two- year life solely within the Sacramento-San Joaquin Delta and adjacent waterways. The Delta is also the source of water for more than 20 million Californians, including MWD through its contract for State Water Project supplies. It is unknown at this time whether listing the Delta Smelt would adversely impact MWD's water supply from the Delta since a management or recovery plan for the fish, including water project operational modifications, has not yet been proposed.

The California Fish and Game Commission ruled in August 1990 and again in February 1993 that the scientific information regarding the Delta Smelt was inconclusive and insufficient to support listing status under the authority of the California Endangered Species Act. Instead, it directed the California Department of Fish and Game to work with the Department of Water Resources to develop and implement an improved data-gathering program before listing is

considered. Preliminary estimates of this work indicate that the Delta Smelt population may have been underestimated in the past by 300 percent or more.

Los Angeles Aqueduct

Another imported water supply into the MWD region is the Los Angeles Aqueduct (LAA). This supply, which serves only the City of Los Angeles, consists of surface and groundwater supplies obtained from the Owens Valley and Mono Basin. The availability of water from this source bears directly upon the amount of water that MWD must supply. The First Los Angeles Aqueduct was completed in 1913. The aqueduct was extended to the Mono Basin in 1940. The "second barrel" of the aqueduct was completed in 1970. **Figure 5-1** presents the general location of the Los Angeles Aqueduct facilities relative to the other imported facilities.

As a result of recent litigation involving the City of Los Angeles' Mono Basin supply and the long-term ground water management plan proposed in the Draft Environmental Impact Statement, dependable supply for the Los Angeles Aqueduct has been reduced from 415,000 acre-feet to 295,000 acre-feet. In years of average runoff, this supply is projected to total 448,000 acre-feet while the probable minimum supply, based on the current drought, is projected to be about 172,000 acre-feet.

Storage

Additional water storage facilities can have the effect of increasing the yield of water supply delivery systems under certain conditions. It is generally recognized that the State Water Project carryover storage is inadequate. Additional storage on this system would allow water available in wet seasons and years to be stored for use in dry seasons and dry years. Any additional water stored in the wet periods would be additional yield for the system, less any evaporation and transmission losses. This type of storage is called either seasonal storage (water stored during the winter for later summer use) or carryover storage (water held for use during dry years).

The MWD is pursuing the Eastside Reservoir Project in Riverside County, which is designed to meet various storage needs for the MWD system. The proposed reservoir will have major benefits to the San Diego region. The Authority has evaluated its storage needs in the Optimal Storage Study. Review of potential storage sites within the County reveal that no single feasible site will be capable of meeting all of the Authority's storage needs. The Eastside Reservoir project will reduce the Authority's storage needs to a point

where existing feasible sites within the county could meet the remaining deficit. The Authority supports the construction of the Eastside Reservoir Project to help meet its own storage goals. Continual monitoring of this project will be essential for ultimate development of storage which will meet the Authority's carryover, seasonal and emergency storage needs.

In dry years, from the present up to 2010, carryover storage of the following annual amounts shall be assumed to be available from all local storage sources:

1995	15,000 AF
2000	20,000 AF
2005	30,000 AF
2010	34,000 AF

In order to have these amounts of carryover storage available in a series of dry years, a total capacity of about three times these amounts should be provided within the Authority's service area. The following amounts of carryover storage capacity will be needed in the following years:

1995	45,000 AF
2000	60,000 AF
2005	90,000 AF
2010	100,000 AF

Some of this carryover storage capacity could be provided in local groundwater basins and the balance could be provided through the reoperation of existing reservoirs.

MWD will be building the Eastside Storage Reservoir and filling it over a period of time. This will result in increasing carryover storage for the San Diego region in dry years. For this study, the following amounts of carryover storage from MWD shall be assumed:

1995	5,000 AF
2000	20,000 AF
2005	40,000 AF
2010	50,000 AF

Water Management Issues

While MWD has aggressive plans underway to continue to meet the needs of its member agencies, there is no assurance that the potential supplies

MWD has identified are developable in the time frame needed. All of these potential supplies are subject to many factors, a great deal of which are beyond the sole control of MWD. Many involve innovative water management programs which are not currently universally accepted by all of those outside of MWD who may be involved. Of particular note is the status of the State Water Project and efforts to improve its supply capability and reliability.

SECTION 6

CONSERVATION AND DEMAND MANAGEMENT

Water conservation and demand management techniques present a favorable water resource option to the Authority and its member agencies as they evaluate new resources. Review of conservation measures indicates that the cost of implementing many of these measures is often less expensive than developing a new unit of supply. Additionally, there are other societal benefits not tied to the cost of water. Positive environmental impacts as a result of the implementation of conservation measures will translate into reduced wastewater flows and less demand for wastewater disposal. The cost of developing new supplies and the incremental impact of new transmission and storage capacity is also avoided. Further there is little potential for institutional and legal obstacles to hinder implementation of conservation measures.

Limitations to Conservation and Demand Management

The role of conservation as a water resource option is an important one. An acre-foot of conserved water is just as good as developing an acre-foot of new supply. Additionally, conservation measures are important tools to be used in emergency water management planning. There are, however, limitations on how projected savings can be used. First, the effectiveness of measures that require a change in water use habits, such as home landscape irrigation practices, are difficult to gauge. Second, as more conservation measures are implemented, the average demand for water declines making it more difficult to achieve any additional savings during a drought or an emergency, i.e., demand "hardens". Finally, it is difficult to accurately quantify the reliable long-term savings that will be achieved through implementation of a comprehensive conservation program.

Identifying Savings

The actual amount of water conserved because of individual conservation measures is difficult to ascertain. This uncertainty stems from a number of circumstances. First, many water conserving devices and measures are relatively new and there has not been adequate time to fully study the impact of their implementation on savings over an extended period of time. Specific measures (e.g. public information programs or water conservation pricing structures) designed to influence behavior and implemented at the same time as other measures may influence the effectiveness of that measure. Finally,

many of the measures have been implemented during a water shortage when consumers are more likely to participate in conservation efforts. Much of the water savings data have been collected over short spans during water emergency times when consumers perceived a water crisis and were willing to participate until the crisis dissipated. The long-term reliability of these data are therefore questionable.

For all of the reasons stated above, savings generated from a specific water conservation measure are typically used cautiously in prudent water resource planning. Based upon review of previous studies analyzing the effectiveness of specific conservation retrofit programs, savings from implementation of "Best Management Practices", discussed further in this chapter, have been forecasted in the MWD-MAIN System model to amount to the following:

1995	21,000 AF
2000	37,000 AF
2005	52,000 AF
2010	70,000 AF

These amounts are in addition to the conservation which would have occurred due to the requirements of the 1980 plumbing code changes and the change in retail prices (1980-1990).

Best Management Practices and the Bay Delta Process

The Bay/Delta process, currently being conducted by the State Water Resources Control Board (SWRCB), is examining water quality issues in the San Francisco Bay and Sacramento/San Joaquin River Delta. The process is attempting to balance competing uses of fresh water from this system. Of major importance in the process discussions has been the role of urban conservation. The first SWRCB Draft Water Quality Control Plan for the Delta looked to urban conservation as a key to resolving problems in the Bay and Delta. Perhaps because of this draft plan, major water agencies throughout the state, including the Authority, became active in work groups to advise the SWRCB on technical issues such as urban conservation strategies. The group focused on urban conservation and devised a list of "Best Management Practices" (BMPs) to be used in the prioritization of conservation measures. In essence, the BMPs are proven conservation measures that are to be implemented state-wide over a given period of time. Additionally, as experience with BMP programs progresses statewide, measures now considered to be

"Potential Best Management Practices" and found to be effective will be added to the process to further permanent conservation savings. **Figure 6-1** lists the BMPs and shows the Authority's implementation schedule for each item. Programs not yet implemented will be evaluated for implementation in the budget year indicated and are subject to revision, replacement or deferral. The BMP list can be divided into two categories for discussion purposes: Public Information Programs and Water Use Efficiency Programs.

Public Affairs Programs

The Public Affairs Department has many programs in place to educate the public about where most of this semi-arid region's water comes from and the resulting need for people to think of water as a precious commodity that must always be used efficiently.

In addition, programs are in place to inform the public of the challenges the Authority faces in importing water for the county, and what the Authority is doing to make the most of the water it has: reclamation, conservation, and the capital improvement program. These information programs reinforce awareness of how precious water is, and educate the public about ways they can help. The Public Affairs Department's efforts can be generally divided into Public Information/Education activities and School Program activities.

The Public Affairs Department's Public Information/Education programs educate and inform the public about water either directly or indirectly through a myriad of activities. These include: electronic, outdoor and multilingual print advertising; public service announcements for electronic media; good media relations practices (distribution of press releases, arranging electronic and print interviews and talk show appearances, responding promptly to media requests for information) resulting in water-related news stories and editorials; writing guest editorials and letters to the editor; development and distribution of literature, translated as appropriate (bill inserts, brochures, fact sheets, charts, etc.) and other materials (restaurant table tents, hotel room cards, magnets, stickers, etc.); speakers' presentations to community groups; development of audiovisual presentation materials for speakers; sponsorship of conservation-related competitions/awards; presence (through booths, displays) at community vents; coordinating all such informational/educational efforts with appropriate governmental agencies, business and community groups.

Best Management Practices for Urban Water Conservation in California

	Practices	SDCWA Implementation Schedule
1.	Interior and exterior water audits and incentive programs for single-family residential, multi-family residential, and governmental/institutional customers.	Residential to be implemented in FY 94 - Non-residential now implemented.
2.	Plumbing, new and retrofit.	
	a. Enforcement of water conserving plumbing fixture standards including requirement for ultra low flush (ULF) toilets in all new construction beginning January 1, 1992.	Implemented.
	b. Support of state and federal legislation prohibiting sale of toilets using more than 1.6 gallons per flush.	Authority-sponsored legislation adopted.
	c. Plumbing retrofit.	Implemented.
3.	Distribution system water audits, leak detection and repair.	To be implemented in FY 93.
4.	Metering with commodity rates for all new connections.	Implemented.
5.	Large landscape water audits and incentives.	Implemented.
6.	Landscape water conservation requirements for new and existing commercial, industrial, institutional, governmental and multi-family developments.	Implemented.
7.	Public information.	Implemented.
8.	School education.	Implemented.
9.	Commercial and industrial water conservation.	Implemented.
10.	New commercial and industrial water conservation.	To be implemented in FY 94.
11.	Conservation pricing.	Implemented.
12.	Landscaping water conservation on new and existing single-family homes.	Implemented.
13.	Water waste prohibition.	Implemented.
14.	Water conservation coordinator.	Implemented.
15.	Financial incentives.	To be implemented in FY 94.
16.	Ultra-low-flush toilet replacement.	Implemented.

Figure 6-1

The Public Affairs Department's School Program focuses on educating the next generation of water users about where the region's water comes from and instilling in them the importance of conservation. An ongoing program for kindergarten through 12th-grade students consists of development of curriculum, in-classroom presentations for fourth-grade and secondary students and in-service training for teachers. Other student-centered activities include an interactive play about the importance of wise water use, a garden designed to educate teachers and students about water-efficient landscaping, a conservation patch program for youth groups, and sponsorship of water-focused computer software through National Geographic Kids' Network.

Water Use Efficiency Programs

The purpose of the water use efficiency program is to actively implement measures which will result in long-term improvements in water use efficiency. These programs are developed around the Best Management Practices process with additional programs designed to achieve savings available due to the specific nature of water use in the Authority service area. The Water Use Efficiency Programs are developed under three criteria as follows:

1. Program costs must be comparable to the real marginal cost of developing and delivering water to the end user.

2. Program components shall not rely on long-term daily habit changes by the domestic user to achieve savings.

3. Program components shall incorporate statistically valid analyses to verify projected savings where feasible.

Turf Audits

Turf audits are performed on sites of two acres or more to assist irrigators in achieving increased water use efficiency. The audits result in advice that the irrigator can use to reduce water use while still maintaining a healthy and attractive lawn. The Mission Resource Conservation District (MRCD) and a private contractor currently operate such programs throughout the Authority's service area.

Agricultural Audits

Agricultural audits are similar to turf audits, but performed by MRCD as a service to agricultural irrigators. These audits are performed for irrigators of a variety of high value agricultural crops. The Authority, along with three of its member agencies and DWR, sponsor agricultural audits in the northern portion of the county.

Conservation Rebates

Programs that provide rebates for implementing water saving measures have proven a popular alternative to legislation in a number of communities in California. One such rebate program is designed to retrofit existing toilets with ultra-low-flush (ULF) models. The Authority, its member agencies, and MWD are currently cooperating to operate a ULF toilet rebate program. A rebate of up to $75 is offered when proof of purchase and installation of the toilet is provided by the customer.

Residential Retrofit Projects

There are a number of different adaptations of a residential retrofit project. Typically the projects involve devices to increase the efficiency of plumbing fixtures in existing housing stock. Water conserving showerheads, ULF toilets, toilet leak detection tablets and flush reducing devices are the most commonly used devices.

In cooperation with its member agencies and San Diego Gas and Electric, the Authority has shared the funding of a program to accomplish retrofits in over 58,000 homes. Additionally, the Authority has made approximately 170,000 showerhead retrofit kits available to its member agencies for distribution to residential users.

System Audits/Leak Detection

System water audits are conducted on a yearly basis at a minimum to compare total water sales with water not directly reflected as metered water sales and enables the agency to review the need, if any, for implementation of formal water loss reduction programs. A key water loss reduction program is leak detection. Using sonic leak detection equipment, field crews specifically identify the location of underground water leaks, thus allowing for their quick repair.

Water Conservation Legislation

Opportunities exist to require additional water conservation measures be implemented through adoption of local, state or federal legislation. The Authority sponsored state legislation that will prohibit the sale or installation of toilets using more than 1.6 gallons per flush after January 1, 1994.

Conservation Surveys

There are opportunities to provide direct assistance to homeowners, business and multi-family housing units through interior and exterior conservation surveys.

One method is the residential survey for either single-family or multi-family structures. This program involves a comprehensive survey, both interior and exterior, to detect inefficient plumbing fixtures, poor irrigation habits and leaks in the water system. Assistance in remedying the deficiencies uncovered is then provided as part of the program. That assistance can include installing water conserving showerheads, toilet flush modifiers, making minor toilet leak repairs or providing specific landscape irrigation direction.

Another type of survey is performed for commercial, government and industrial water users. These audits concentrate on water use for such purposes as air conditioning, industrial processes and other business-related purposes. The Authority has funded a series of workshops and field audits to address these needs.

Costs

The various demand management programs that are expected to be implemented have estimated costs of $200 per acre-foot to $600 per acre-foot in 1992 dollars. Most programs' costs will be shared in some fashion by MWD, the Authority and local water agencies. Only programs that meet the financial criteria discussed in Section 13 shall be implemented.

SECTION 7

WATER RECLAMATION

Water reclamation is the extensive treatment and reuse of municipal wastewater to produce a safe and reliable water supply for non-potable uses. Reclaimed water can be used to irrigate parks, agriculture, planned community greenbelt areas, golf courses, and freeway landscaping. Additional uses being considered include industrial supply, toilet flushing and groundwater recharge. Water reclamation represents an important element in future local water supply development that will assist in meeting the future water demands of the region.

Water Reclamation Project Development

As shown in **Figure 7-1**, there are 20 water reclamation projects in various stages of development across the Authority service area. Several local agencies are proceeding with plans to maximize reclaimed water use by upgrading the level of treatment provided at existing wastewater treatment plants and expanding the capacity of reclaimed water distribution facilities. The city of San Diego and 15 other public agencies providing wastewater service to the greater San Diego metropolitan area are in the midst of a major physical and organizational restructuring known as The Clean Water Program for Greater San Diego. The Clean Water Program is expected to include significant emphasis on water reclamation, although many factors will affect the ultimate commitment that the region makes.

The total reuse potential from the regional reclamation effort is estimated to provide approximately 50,000 acre-feet per year of beneficial water reuse by the year 2010.

Implementation of the 20 projects is predicated upon agencies being able to overcome the constraints associated with developing water reclamation projects. Obtaining capital project funding, regulatory and health agency approval, overcoming institutional matters, and securing public acceptance are often the key issues that need to be resolved.

Water quality and associated regulations are also major issues for reclamation. The quality of wastewater is perhaps the most critical factor for local reclamation. If wastewater is initially laden with excessive salts, then it will have limited market use after being reclaimed. Most agricultural crops, for example, cannot tolerate irrigation with water that has a high salt content.

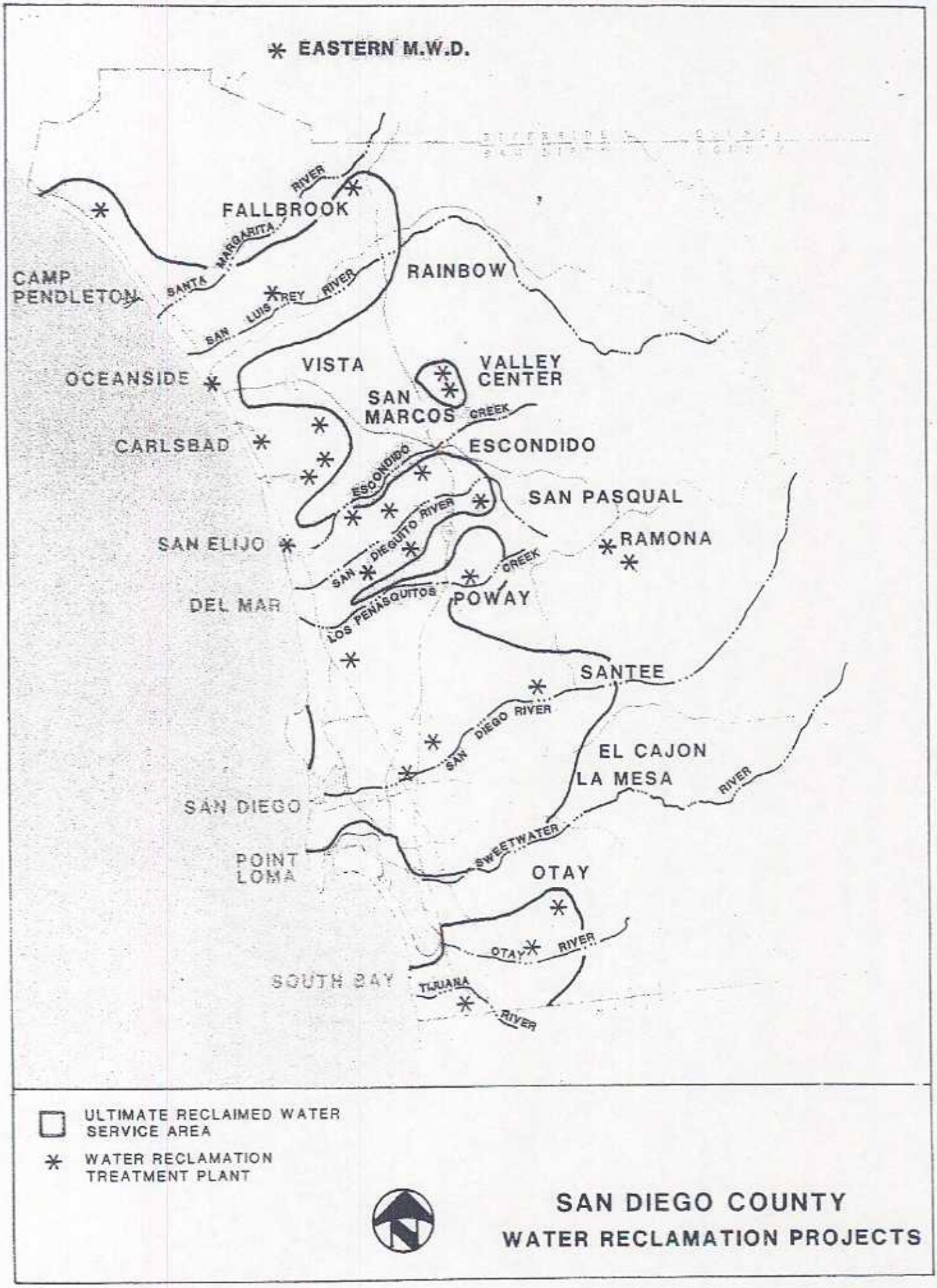
* EASTERN M.W.D.
FALLBROOK
SANTA MARGARITA RIVER
CAMP PENDLETON
SAN LUIS REY RIVER
RAINBOW
OCEANSIDE
VISTA
VALLEY CENTER
SAN MARCOS
CREEK
CARLSBAD
ESCONDIDO
ESCONDIDO
SAN PASQUAL
SAN DIEGUITO RIVER
SAN ELIJO
RAMONA
SAN DIEGUITO CREEK
DEL MAR
LOS PEÑASQUITOS
POWAY
SANTEE
SAN DIEGO RIVER
EL CAJON
LA MESA
RIVER
SAN DIEGO
SWEETWATER
POINT LOMA
OTAY
OTAY RIVER
SOUTH BAY
TIJUANA
RIVER
ULTIMATE RECLAIMED WATER SERVICE AREA
WATER RECLAMATION TREATMENT PLANT
SAN DIEGO COUNTY
WATER RECLAMATION PROJECTS

Figure 7-1

The Authority supports efforts by cities and other public agencies to limit the introduction of salts into wastewater in three major ways: reduce total dissolved solids (TDS) in imported supplies by blending more State Water Project water; reduce the introduction of salts from sources such as home water softeners and from industrial sources; and reduce infiltration flows to existing wastewater conveyance systems.

Reclamation is also affected by proposed water quality regulations from the federal Clean Water Act that place severe restrictions upon chemical discharges into inland surface waters. These rules could prohibit discharging reclaimed water into streams for delivery to users or for groundwater recharge.

Water Authority Water Reclamation Program

The Authority Board of Directors established a water reclamation department in 1988 to address regional implementation issues identified by local agencies. The programs that the Authority has developed to assist agencies in implementing reclamation projects are discussed below.

The Authority Board of Directors established the Water Authority Reclamation Advisory Committee (WARAC). WARAC is comprised of representatives from wastewater and water agencies, the Farm Bureau, Department of Health Services, Regional Water Quality Control Board, and regional planning groups all interested or involved in the production and utilization of reclaimed water. The primary purpose of WARAC is to organize, plan and develop regional water reclamation projects. WARAC also provides recommendations to the Authority Board of Directors on issues related to reclaimed water development.

Local agencies often identify reclamation project funding as their number one constraint. In response to this need, the Authority developed the Financial Assistance Program (FAP). Approved in 1988, FAP provides funding assistance to agencies for development of water reclamation facilities plans, feasibility investigations, State loan applications, and preliminary engineering studies. The funding is provided on a 50:50 cost sharing basis, up to $50,000. As of FY 93, the Authority has funded 1.5 million dollars in water reclamation planning studies.

MWD provides an incentive of $154 per acre-foot for water reclamation through its Local Projects Program. In addition, the Authority Board of Directors recently approved its own Reclaimed Water Development Fund (RWDF). The purpose of RWDF is to provide Authority member agencies financial assistance

to develop cost-effective water reclamation projects capable of relieving a demand upon the Authority. The maximum financial contribution currently available through RWDF is $100 per acre-foot of reclaimed water used, for a total commitment of about $100 million through 2010. Additional funding will be required to meet commitments to this program that extend beyond 2010.

The Authority has adopted a number of policies, model ordinances and guidance documents to assist the local agencies with water reclamation project implementation. For example, it is the policy of the Authority that where reclaimed water use is allowed by law and it is available in sufficient quantities, reclaimed water shall be the sole water supply delivered. Local agencies have adopted Authority-sponsored ordinances related to reclaimed water master planning and have conditioned new development projects to require reclaimed water irrigation systems. Water reclamation guidance documents available from the Authority include: Model Rules and Regulations for Reclaimed Water Service, Standard Construction Specifications for Reclaimed Water Piping *Systems and Guidelines* for Retrofit of user Facilities to Accommodate Reclaimed Water Service.

Costs

The cost of producing and distributing reclaimed water varies from $700 to $1200 per acre-foot. Reuse projects should only be implemented that compare favorably to MWD's future water rate plus MWD's local projects contribution plus the Authority's RWDF contribution plus any other avoided costs. These contributions reflect the additional costs of importing a future acre-feet of water. This subject is discussed further in Section 13.

Reclaimed Water Forecasts

While the Authority had an established goal of 100,000 acre-feet per year of beneficial refuse by the year 2010, a number of serious constraints are yet to be resolved. The Authority's ability to meet this potential is also largely contingent upon the ultimate success of the Clean Water Program. Each reclamation project should only be implemented when it meets the financial criteria discussed previously. In recognition of these uncertainties associated with reclaimed water development, the amount of reclaimed water reasonably expected to be available in future years is forecast as follows:

1995	11,000 AF
2000	18,000 AF
2005	36,000 AF
2010	50,000 AF

Reclaimed Water Losses in Dry Years

In dry years when both indoor and outdoor conservation efforts are being stressed, water users respond appropriately resulting in a net reduction in wastewater flows available for reclamation purposes. In 1991, wastewater flow reductions of about 10 percent were observed. This reduced flow must be accounted for, when evaluating future supplies. For the purposes of this study the following reductions in reclaimed water shall be assumed under drought conditions:

1995	1,000 AF
2000	2,000 AF
2005	4,000 AF
2010	5,000 AF

SECTION 8

GROUNDWATER BASIN DEVELOPMENT

As noted in Section 5, groundwater resources within San Diego County are relatively insignificant in comparison to water demand. Although the potential is limited, groundwater resources can be developed to provide an additional increment of supply for the region. The Authority is evaluating the larger groundwater basins identified on **Figure 8-1** in terms of local supply potential and seasonal storage capabilities. Potential uses are divided into the following categories:

1) Conjunctive use of high quality groundwater basins with imported water for potable uses; and

2) Conjunctive use of degraded quality groundwater basins with imported and/or reclaimed water plus wellhead treatment for potable and/or non-potable uses.

A number of issues need to be resolved in each potential use scenario. In the first category, institutional, legal and operational issues are apparent. High-quality groundwater basins which have the potential for conjunctive use must be collectively managed to effectively utilize available storage capacity. Currently, most of the higher quality basins are utilized by a number of individual private interests. In most cases, private wells are not regulated. Specific basin management agreements would have to be developed to establish rights and responsibilities under a conjunctive use program. In some cases the basin may have to be adjudicated, a time-consuming process. Operational problems would also have to be resolved before the reliability of a conjunctive use program can be established.

Conjunctive use of degraded groundwater basins may not have as many institutional and operational problems as those associated with higher quality basins. In most cases, degraded groundwater basins have been abandoned by well owners in favor of the imported water. Nonetheless, groundwater rights in degraded basins would need to be established. Developing degraded groundwater would involve extraction followed by demineralization to obtain water suitable for domestic purposes. The normal safe yield of the groundwater basins in certain locations could be supplemented with reclaimed and/or imported supplies. Limitations related to brine disposal requirements associated with the need to demineralize brackish groundwater supplies may be a significant constraint related to siting such a project.

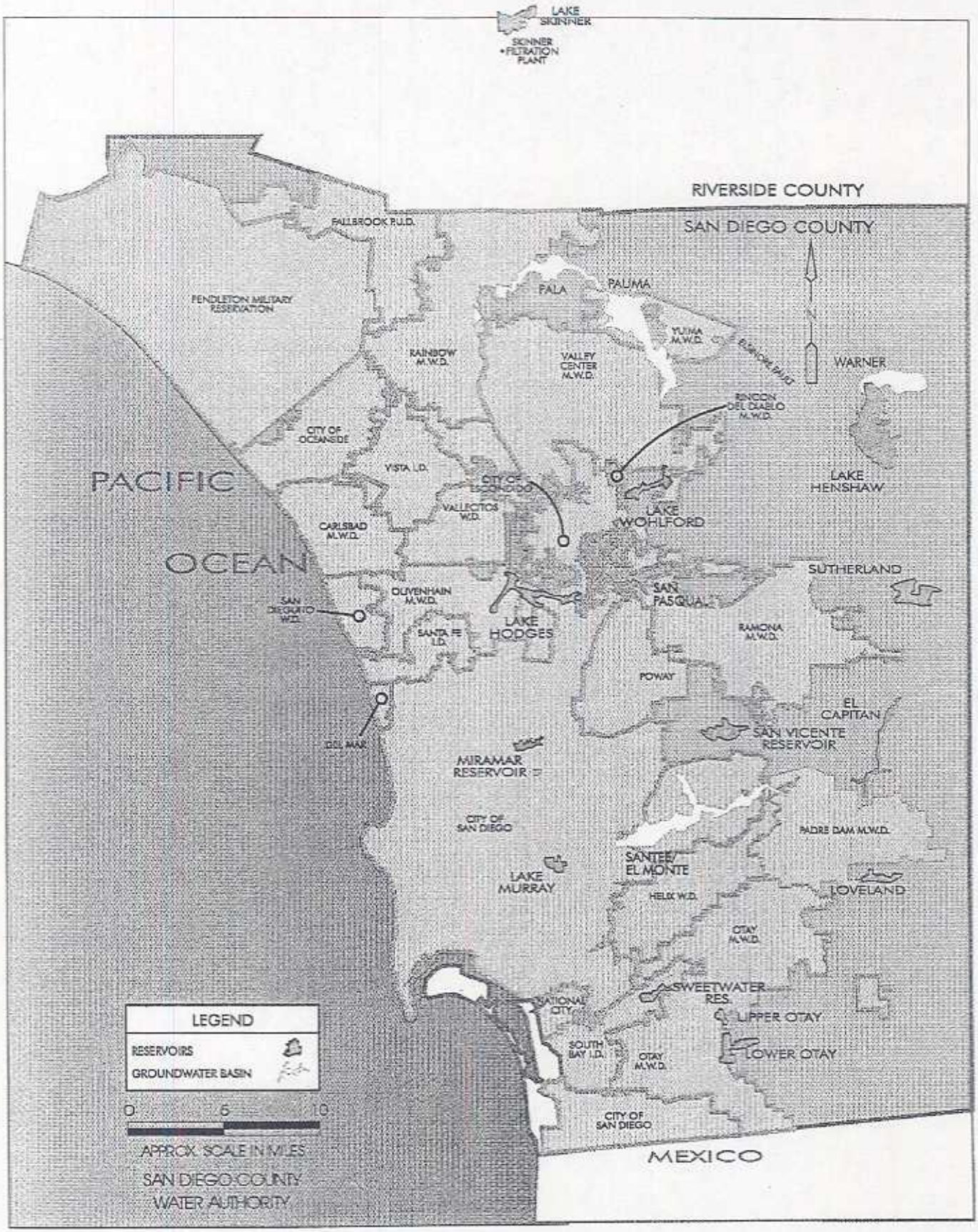
LAKE SKINNER
SKINNER FILTRATION PLANT
RIVERSIDE COUNTY
SAN DIEGO COUNTY
FALLBROOK P.U.D.
PENDLETON MILITARY RESERVATION
FALLBROOK
PAUMA
YUIMA M.W.D.
RAINBOW M.W.D.
VALLEY CENTER M.W.D.
WARNER
RINCON DEL DIABLO M.W.D.
CITY OF OCEANSIDE
VISTA I.D.
CITY OF ESCONDIDO
LAKE HENSHAW
PACIFIC
OCEAN
VALLECITOS W.D.
LAKE WOHLFORD
CARLSBAD M.W.D.
SUTHERLAND
OLIVENHAIN M.W.D.
SAN PASQUAL
SAN DIEGUITO W.D.
SANTA FE I.D.
LAKE HODGES
RAMONA M.W.D.
POWAY
EL CAPITAN
SAN VICENTE RESERVOIR
DEL MAR
MIRAMAR RESERVOIR
CITY OF SAN DIEGO
PADRE DAM M.W.D.
SANTEE/ EL MONTE
LAKE MURRAY
HELIX W.D.
LOVELAND
OTAY M.W.D.
SWEETWATER RES.
NATIONAL CITY
UPPER OTAY
SOUTH BAY I.D.
OTAY M.W.D.
LOWER OTAY
CITY OF SAN DIEGO
MEXICO
LEGEND
RESERVOIRS
GROUNDWATER BASIN
0
5
10
APPROX. SCALE IN MILES
SAN DIEGO COUNTY WATER AUTHORITY

Figure 8-1

Degraded groundwater basins offer an opportunity to extend the yield of a water reclamation project. Excess reclaimed water available when demand is low could be stored in these basins and subsequently extracted during periods of high demand.

One consideration which transcends the operation of all potential groundwater recovery projects is that of water quality control. Water contamination issues potentially affecting the viability of the use of the groundwater must be evaluated. Past, present and future land use within the watershed is a critical consideration.

Proposed Program

Given current knowledge of the resource and available technology, approximately 25,000 to 30,000 acre-feet of additional groundwater yield appears to be the maximum potential. The Authority administers a program to provide funding for groundwater recovery studies. MWD provides an incentive of $250 per acre-foot for development of groundwater recovery projects. The amount of groundwater that will be developed locally is forecasted as follows:

1995	2,000 AF
2000	5,000 AF
2005	10,000 AF
2010	15,000 AF

Costs

Groundwater development costs are projected to range from $500 per acre-foot to $1500 per acre-foot depending on the level of treatment required, brine disposal costs, water rights acquisition, etc. Developable groundwater beyond the forecasts shown above is expected to be at the higher end of the cost range. Implementation should be limited to those projects meeting criteria set forth in Section 13.

SECTION 9

SEAWATER DESALINATION

Desalination is the separation of water from dissolved impurities. In the desalination process, part of the water is recovered in a product stream which is in a relatively pure form. The dissolved impurities are concentrated in a waste stream or brine which is discharged from the desalination system as a plant "blowdown" or "reject." A high energy input is required in all desalination methods. High capital costs and the cost of energy have been the principal limitations to the application of desalination technology within the United States.

Desalination processes used for large-scale production of water fall into two general classifications, distillation or thermal processes and membrane processes (reverse osmosis). The process selected for a particular application depends upon the source water quality, energy cost and availablity, and quantity of product water desired. Examples of these processes are shown on **Figures 9-1 and 9-2.**

Distillation processes are based on the utilization of heat to produce a separation between the saline water supply and the potable water produced. Membrane desalination processes utilize a membrane which restricts the passage of salts. Distillation processes have historically been selected for larger seawater desalting facilities while membrane processes have been more cost effective for smaller seawater applications and brackish water projects (less than 5,000 ppm source water). Recent improvements in membrane technologies have made reverse osmosis more cost effective than thermal processes for larger seawater desalination applications.

Distillation Processes

All distillation processes are based on the partial evaporation of feedwater. The condensed vapor constitutes the purified product water. The non-volatile dissolved impurities are left behind in the waste stream. Multi-stage flash distillation is the most widely used process for seawater desalination, however multi-effect distillation is now regarded as the most cost-effective means of thermal seawater distillation. Another distillation method, vapor compression, shows some promise as a cost-effective desalination method but has not yet been demonstrate on a large scale.

MWD is currently evaluating the development of a pilot plant vertical tube evaporator which will test materials and construction methods utilizing an evaporative technology. Such a technology, if proven feasible, could eventually provide relatively large quantities (up to 50 million gallons per day) of desalinated seawater. The advantage to such a technology would be its use of less costly materials and economies of scale. This technology has yet to be tested and proven and therefore can not be considered viable at this time.

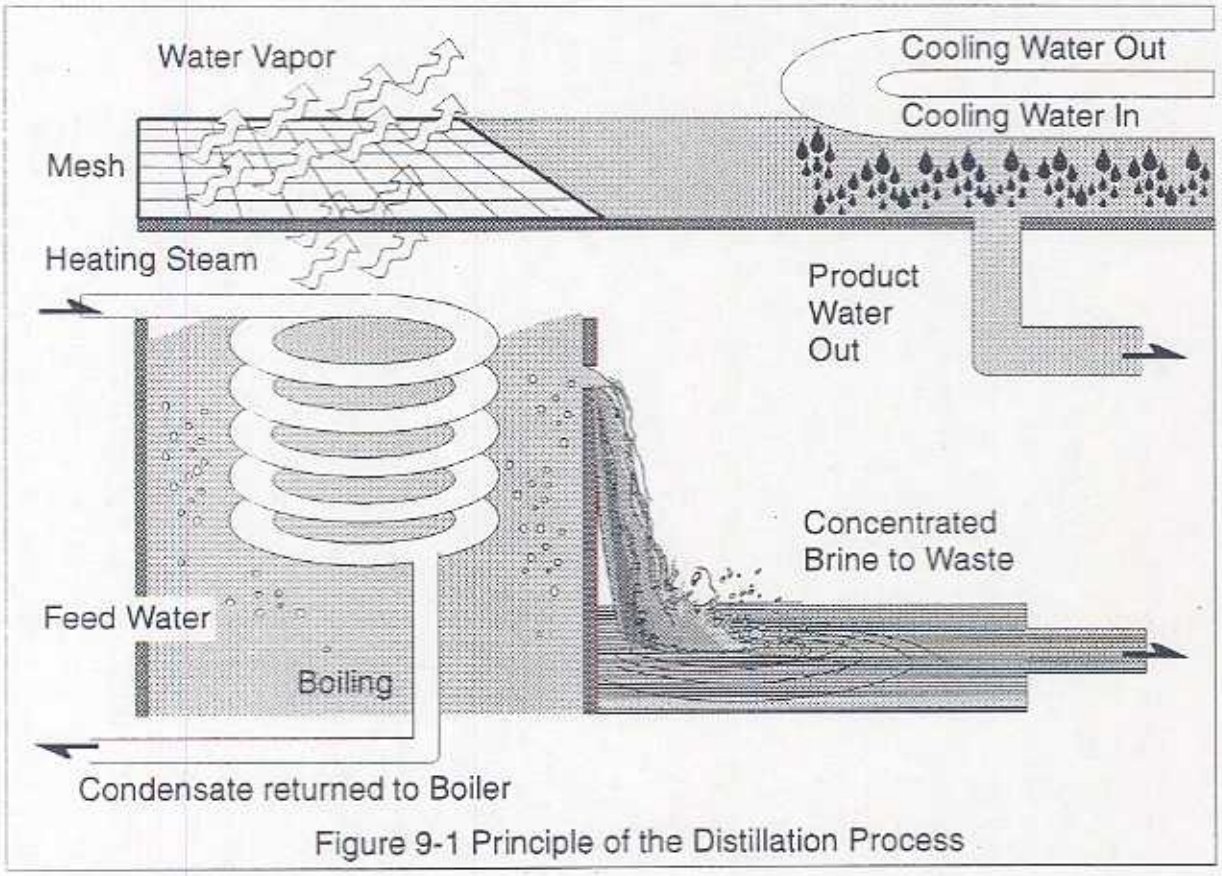

Figure 9-1 Principle of the Distillation Process

Membrane Processes

The reverse osmosis (RO) membrane process consists of applying pressure to feedwater and forcing a fraction of the water content of seawater or brackish water to pass through a semi-permeable membrane. The membrane is specially constructed of materials which will selectively pass water but is almost impermeable to dissolved impurities. Thus, most of the dissolved impurities remain behind and are discharged in a waste stream. The water that

has passed through the membrane leaves the RO unit as product water. Reverse osmosis desalination operates at ambient temperatures. Unlike distillation processes which produce practically pure water, the quality of the product water can be controlled. Membrane processes are being used very successfully in many areas of the world for brackish water desalination. Reverse osmosis is currently the most common brackish water desalination process in the United States and would likely be the process used in groundwater basin development previously discussed. The technology holds considerable promise for seawater desalination and is the process being used in recent installations in Santa Barbara and Santa Catalina Island, California.

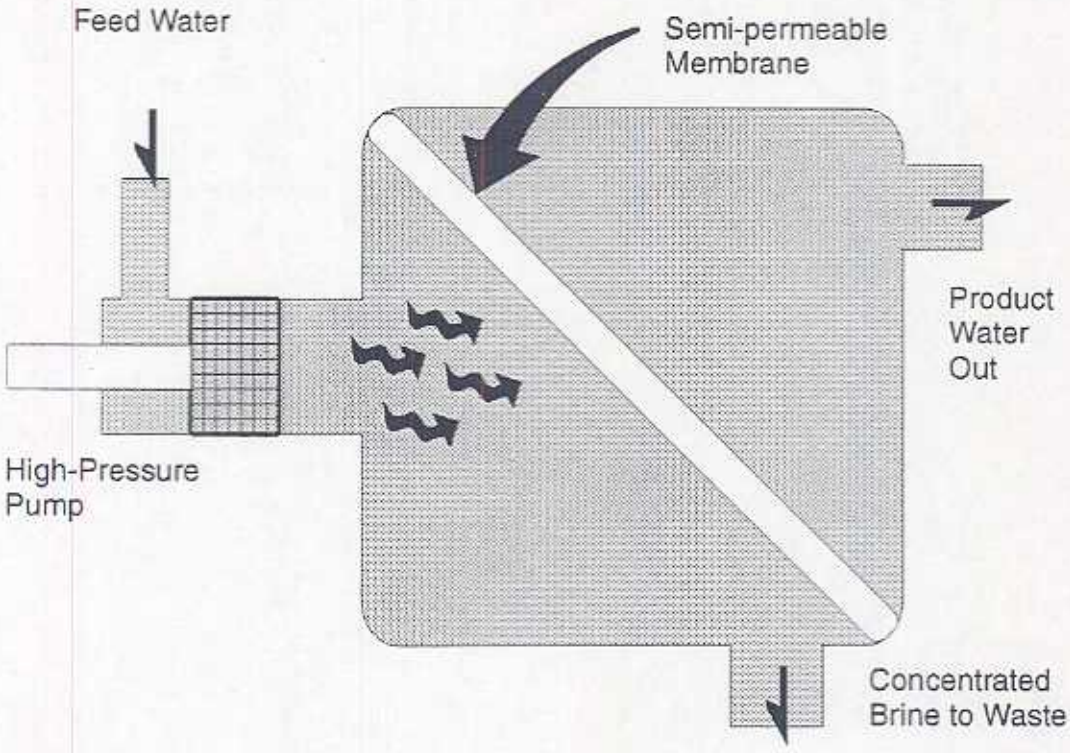

Figure 9-2 Principle of the Reverse Osmosis Process

Potential Projects

Historically, local seawater desalination projects have been for research and development purposes. Two projects, the Point Loma Seawater Conversion Project and the San Diego Saline Water Test Facility collectively produced about

4,500 acre-feet of water before operations were terminated in the 1960's and 1970's.

In April 1991, the Authority completed a feasibility study which examined the possibility of constructing a 30 million gallon per day (mgd) desalination plant in conjunction with San Diego Gas and Electric's (SDG&E's) proposal to build a new coastal powerplant. The study revealed that many economies can be realized by combining a powerplant and desalination plant. After being used to generate electricity, the steam can be directed to the desalination plant for water production. Economies could be realized by shared land, seawater intake facilities, brine disposal systems, operation and maintenance, and labor costs.

Based upon the results of this study and current needs of SDG&E, the Authority and SDG&E in July 1991 agreed to study the feasibility of combining a desalination plant with a repowering (refurbishment) of SDG&E's South Bay Powerplant. This study examined the appropriate technology and operating parameters of a joint power and desalination plant with the goal of specifying a project for construction and operation by 1997.

The study, completed in April 1992, determined that the South Bay Desalination Project was technically feasible and that a 30 mgd facility could produce and deliver water at a cost of $1,264 to $1,589 (1997 dollars) per acre-foot. The recommended desalination process to be used is reverse osmosis, with steam or electrically driven pumps supplying the needed pressure. Brine disposal into San Diego Bay was identified as an environmental concern and computer modeling of the Bay's salinity and hydrodynamics was recommended. The study identified two additional brine disposal options. These options included delivery of brine to a local salt company and offshore ocean disposal.

To address concerns regarding brine and also the high initial capital cost of the plant, a 3-phase implementation plan was developed. Phase 1 envisioned the production of 5 mgd of desalinated water which would be distributed directly to a member agency's water system. San Diego Bay environmental standards for brine discharge would be met by blending brine with powerplant cooling water. Phase 2 and 3 would have produced 15 and 30 mgd respectively, with ocean brine disposal and distribution of product water into the CWA regional water supply pipelines. Recent decisions by SDG&E, including an unwillingness to allow CWA to use powerplant cooling waters for phase 1 blending and significant reductions in their planned powerplant operating times, eliminated major collocation benefits. With the

elimination of these benefits the South Bay Desalination Project no longer possesses unique attributes in terms of timing and economies. The Authority Board subsequently instructed staff to look at alternatives to the project and provide near-term financial participation for seawater desalination only through the ongoing projects of the Metropolitan Water District.

In 1991, the Authority also participated in a study which examined the feasibility of building a large powerplant and desalination plant in Northern Baja, Mexico. Mexico was chosen as the possible location because less time would have been required for permitting than if the plant were to be constructed in southern California. Moreover, siting such a new plant in southern California would be difficult due to a lack of suitable coastal locations. The plant would have met all U.S. environmental standards.

The study suggested that a combination of distillation and reverse osmosis desalination methods (also known as a hybrid system) be used for this project. The cost of water from the plant would be comparable to the South Bay Desalination Project. However, the additional cost of pumping the product water 25 miles into the Authority's distribution system added an additional $300 to $400 dollars per acre-foot to the cost of water. The project is not considered economical at this time.

Limitations of Seawater Desalination

Seawater desalination is often identified as the ultimate solution to California's and especially Southern California's water problems. While seawater desalination may well have an important part to play in the overall reliability of Southern California's water supply, there are many problems confronting this technology which are likely to prevent its large-scale use. Primary among these problems is facility siting. Desalination on a large-scale requires relatively large parcels of land. Distillation processes require a source of heat, typically a powerplant. Given current air quality regulations and recent Clean Air Act amendments, it is virtually certain that no new large-scale powerplants will be located in San Diego County's air basin. Modification of existing power plants will be limited to rebuilding or repowering to result in a a net emissions reduction. Utilization of RO processes on a large-scale would not result in direct air pollutant emissions but would produce significant electrical power demands resulting in the need for more power. Coastal siting of such plants would also be desirable as the ocean would provide both the source water and the brine disposal area for such plants. Pumping of seawater

and brine back and forth over long distances to avoid the need for a coastal location would add to desalination's already considerable expense.

Desalination is included as a local supply development strategy in the Authority's Strategic Plan. By recommending desalination as a local supply development objective, the Authority can pursue opportunities to evaluate potentially cost effective projects and support MWD in the development of new methods which may result in future costs savings. Therefore, it is reasonable to maintain desalination as a component of the total local supply development forecast.

The amounts of desalinated water to be developed are forecasted as follows:

1995	0 AF
2000	0 AF
2005	0 AF
2010	20,000 AF

Costs

Desalinated seawater is expected to cost from $1,200 per acre-foot to $2,000 per acre-foot. Only projects that meet the criteria set out in Section 13 shall be implemented.

SECTION 10

WATER TRANSFERS

Background

Water transfers as a solution to water shortages for urban areas in the West have been the focus of much activity in recent years. In simple terms, water transfers encompass a variety of transactions reallocating water supplies, which to a large extent, have already been developed and are being used. These transactions generally involve a shift of use of the water from relatively low-value use, usually an agricultural use, to a higher value use, usually municipal and industrial. Proponents of water transfers offer this solution as an economically sound and relatively environmentally benign way of increasing water supplies for urban areas. Given the difficulty in planning and building physical facilities for increased development of water resources within California, the option of water transfers must be fully evaluated as a means of meeting demands.

Federal legislation enacted in October 1992 allows the transfer of water from the Central Valley Project (CVP) to regions outside the Project's service area. Called the Central Valley Improvement Act, H.R. 429 permits water sales from CVP users to buyers outside of the originating water agency. In addition to transfer provisions, the measure dedicates water for environmental purposes and includes environmental restoration funds. The San Diego region should benefit from increased supply reliability as a result of the Act. To fully complement the federal legislation, state transfer legislation is also necessary.

The concept of water transfers has many sub-definitions which define particular types of transactions. The following are generally accepted water transfer definitions:

Water Exchange

A traditional arrangement whereby one entity temporarily obtains rights to use water belonging to another entity in exchange for returning the same amount of water at a later date. Exchanges can be short or long-term, with the former being most popular during drought periods.

Water Marketing

An arrangement whereby current users voluntarily curtail or eliminate their water use so that others may purchase the water made available. The purchase may involve the sale of land with the water or simply the water right (usually a surface water right).

Water Ranching

A form of water transfers where agricultural lands are purchased to gain control of the water rights associated with those lands. The water is then "ranched", i. e., used in its traditional form until a drought forces diversion to the purchaser. This method of water transfers is popular in states such as Colorado and Arizona where water rights are salable commodities severable from the land.

Water Salvage

The practice of implementing conservation measures to reduce levels of consumption or unreasonable use. The salvaged water is then put to a new and beneficial use.

Water Sharing

The sharing of water supplies and facilities by two or more parties in ways beneficial to both parties.

Dry-year Options

The practice of landowners agreeing to reduce the amount of land in production during dry years in exchange for standby payments received every year and additional option payments when the transferee exercises its options.

Water Transfer Conditions

To change a point of water use in California at least the following three conditions need to exist:

1) There must be a willing buyer and seller and there must be a means of conveyance;

2) The exchange must not create significant environmental or unreasonable economic effects, i.e., it must be in the public interest; and,

3) The seller of the water must be able to provide documented rights he uses and intends to transfer.

In California as in other states, the opportunity for water transfers depends upon the above factors as well as the specific geographic and institutional circumstances. While using water transfers to solve urban water needs is conceptually simple, on a project-specific level it has historically been extremely complex given the physical and institutional arrangements. For example, if a large irrigator in the southern San Joaquin Valley wanted to quit farming and sell his water to San Diego, he would have generally only been able to do so with the consent of the water district delivering his water. Most irrigators receiving surface waters have only a contract specifying an amount to be delivered to them for beneficial use on their property. The actual water right is most often held by the water district or yet another agency which delivers water to the district. Generally, it has been the policy of most water districts to discourage transfers of water to areas outside their boundaries. Given that most of California's water has been developed by large governmental projects which then wholesale to smaller agencies, few situations existed where willing water users could easily sell water to interested buyers. Even where such situations do exist, wheeling issues often complicate the transaction. This facet of the California water situation stands in sharp contrast to states such as Arizona and Colorado where appropriative water rights are often held directly by the user and are severable from the land.

In 1991, as a drought emergency measure, the California State Department of Water Resources (DWR) initiated the State Water Bank. The State Water Bank provided opportunities for water districts located in water short areas to purchase water supplies to reduce the level of drought induced shortage. The DWR "purchased" water supplies, primarily from northern California agricultural entities, and sold these water supplies to water districts experiencing severe shortages. The Metropolitan Water District in 1991 purchased 215,000 acre-feet of bank water. Of this 215,000 acre-feet, 188,000 acre-feet was melded into MWD's overall supply. 27,000 acre-feet was purchased through MWD directly by MWD member agencies, including 21,600 acre-feet purchased directly by the Authority. In 1992 a small amount of additional bank water was purchased by MWD. State Water Bank supplies were available to only those agencies whose normal water supplies were

reduced by at least 25 percent. It is expected that any future State Water Bank would have similar limitations.

While classic water marketing as defined above has, up to now been difficult to achieve in California, the passage of HR 429 is a significant step towards ending the institutional obstacles which have historically limited water transfers. The following is a listing of other major projects being pursued which will have an impact on San Diego region water supplies and which fall within the definitions of water transfers:

Coachella Valley Groundwater Storage Program

An existing program allows the MWD to store Colorado River water underground in exchange for increased deliveries of SWP water. This agreement with the Coachella Valley Water District (CVWD) and the Desert Water Agency (DWA), allows MWD to deliver water from the Colorado River Aqueduct for recharge into the Coachella Valley groundwater basin. During a dry year, MWD will cease deliveries to Coachella and receive up to an additional 61,000 acre-feet of state water out of these other agencies' SWP entitlements. Over 550,000 acre-feet have been stored underground through this program.

Imperial Valley Pipeline

Numerous plans and programs have been proposed to develop water transfers from the Imperial Valley to urban areas. The capacity of the Colorado River Aqueduct is limited to 1.3 million acre-feet per year, thus additional conveyance capacity may be needed in the future. In June of 1991, the Authority completed a study of a proposed pump/generation pipeline from the Imperial Valley. The pipeline would deliver 100,000 acre-feet annually, begin at Dixieland and terminate at El Capitan Reservoir or Morena Reservoir. Some facilities options were sized large enough to avoid on-peak electrical demands.

The report concluded as follows:

> The cost of constructing and operating facilities to deliver water from the Imperial Valley, over the local mountains, and into El Capitan or Morena Reservoirs, is expected to be approximately $1000 per acre-foot of water delivered. Facility concepts that avoid on-peak pumping are less costly than facilities sized for constant 24-hour pumping. Costs in addition to the $1000 per acre-foot for delivery will be incurred in developing a water source

in the Imperial Valley, in accounting for environmental concerns, and in distributing water from either of the terminal reservoirs. These additional costs were not examined as part of this study.

Arvin-Edison Water Storage and Exchange Agreement

This agreement involves the Arvin-Edison Water Storage District, located southeast of Bakersfield, California. An agreement has been developed to allow MWD to store part of its water supply in the Arvin-Edison groundwater basin. In wet years, MWD would deliver up to 135,000 acre-feet of SWP water to Arvin-Edison for storage in a MWD groundwater account. Arvin-Edison would use this water directly and for percolation into the groundwater basin via new spreading facilities to be paid for by MWD. In dry years, Arvin-Edison would deliver CVP water via the SWP to MWD. During these dry years Arvin-Edison would pump a like amount of groundwater stored by MWD during the wet years. The benefit to MWD would be an increase in firm water supplies of about 93,000 acre-feet during dry years. Arvin-Edison would benefit by the construction of enhanced conjunctive use facilities, an improved integration of surface and groundwater resources and by lowered groundwater pumping costs.

Policy Recommendations

The opportunities for the Authority to become directly involved in long-term water transfer arrangements are currently limited due to the scarcity of locally developed water and the single source of MWD. Short-term arrangements are possible, such as during the 1991 drought for short term transfers when there is excess capacity in the MWD system and water available beyond MWD's requests. In the long-term, the Authority will have to evaluate the success of MWD's water transfer programs and other efforts to adequately supply its member agencies. As long as MWD aggressively and successfully pursues supplying member agency demands, there are no sound economic reasons for unilateral action to secure independent long-term imported water supplies.

The securing of "dry-year options" through voluntary water transfers is critical to meeting the mission of both the Authority and MWD. Arranging these types of transfers will require complicated and lengthy negotiations. The

amounts of water that will be developed through water transfers for Authority use is forecasted as follows:

1995	28,000 AF
2000	57,000 AF
2005	57,000 AF
2010	75,000 AF

Costs

The estimated costs to purchase or develop and transport various sources of transfer water is from $700 per acre-foot to $1000 per acre-foot. These costs would need to be shared by all water agencies that derive a benefit from the transferred water.

SECTION 11

EXOTIC RESOURCE DEVELOPMENT

In addition to traditional water resource projects discussed in this plan, a variety of non-traditional resource projects are often offered as supply solutions for San Diego, Southern California and other water-short regions. A brief discussion of each follows.

Tankers and Other Vessels

Proposals have been made to ship water by tanker from northern coastal rivers to southern California. While technically feasible, costs of such transfers have been estimated to be in the range of $2000-3000 per acre-foot. This order of cost makes tankering of water viable only in areas which cannot effectively receive other imported supplies or which cannot pursue desalination projects.

Vessels other than tankers have been designed which would carry water from the northwest, synthetic fabric and rubber bladders or "baggies", which could be towed in series. Theoretically, these devices could deliver water at a competitive water cost but the proposal is too speculative for further consideration at this time.

Deep Wells

A number of local well drillers profess that large untapped groundwater bodies exist in the county. Some of these drillers have been minimally successful in developing some deep wells of 1000 feet or more which have relatively low yields. Review of geologic maps of the county and discussions with hydrogeologists at the United States Geologic Survey familiar with groundwater in the region indicate that pursuit of a program to locate alleged major groundwater sources is unwarranted. While water does often exist in granitic fracture zones, the well yields are usually less than 100 gallons per minute, too low for municipal water systems. Additionally, while initial well yields may be impressive, wells in such geologic formations defy normal pump testing techniques and assessing their reliability over the long-term is not currently possible.

Recommendation

These exotic sources are not considered reliable enough to be included as an integral part of the Resources Plan.

SECTION 12

WATER RESOURCES OPTIONS

A fairly wide spectrum of water resource options exist. They are constrained however by limited opportunity and finances. A series of five options was examined for the year 2010 to help define the spectrum of resource opportunities. These options are shown in **Figure 12-1.**

Water Resources Plan

Supply Development Options Year 2010

(acre feet)

	Option I	Option II	Option III	Option IV	Option V
Conservation	70,000	70,000	70,000	70,000	70,000
Reclamation	30,000	40,000	50,000	70,000	100,000
Groundwater	0	10,000	15,000	20,000	30,000
Desalination	0	0	20,000	40,000	60,000
Transfers	37,000	51,000	75,000	106,000	138,000
Total	**137,000**	**171,000**	**230,000**	**306,000**	**398,000**

Figure 12-1

Water conservation projects have been defined by the statewide BMP process and are actively being pursued by the Authority. Therefore, the forecasted reduction in demands of 70,000 acre-feet per year is shown for all options. As conservation studies are completed and more knowledge gained, this forecast can be updated and additional cost-effective projects may be identified.

Some water reclamation projects are well underway, and others are making progress through the planning and design phases. Thus, the options show reclamation forecasts varying from 30,000 acre-feet to 100,000 acre-feet annually. While the Authority had a goal of reclaiming 100,000 acre-feet of water by 2010, the Resources Plan cannot be based on actually achieving such an optimistic goal.

A recent MWD proposal to contribute up to $250 per acre-foot to clean up groundwater basins has created new groundwater development opportunities in San Diego County. The options shown in **Figure 12-1** include groundwater development of up to 30,000 acre-feet by 2010. In the future, additional studies will help refine this forecast.

Desalinated seawater is still an uncertain resource due to its cost and evolving technology. The options considered in this plan forecast a potential of up to 60,000 acre-feet of desalinated water by 2010. A number of hurdles, both financial and technical must be overcome before any water will be available from this resource.

Some form of water transfers will be essential to the Authority's future. In 1991, the Governor's water bank was vital to the economic well being of the San Diego area. Similar efforts will be necessary in future droughts. The Authority should support MWD efforts to arrange water transfers and consider transfer opportunities on a case-by-case basis. The options shown above include water transfers of up to 138,000 acre-feet in dry years. Future transfers might be negotiated by the Authority, MWD, through a state agency, or some combined efforts.

These options were analyzed as shown on **Figure 12-2** to determine the effect upon normal year imported supply and the possible deficiencies in a dry year similar to 1991. It is assumed that 1991 represents the worst drought condition since the Governor's water bank was available to limit the drought impacts and similar transfers can be arranged in the future. Using SANDAG Series 8 as a basis for demand projections, the amount of imported water needed for each option is as follows:

Option I	742,000 AF
Option II	722,000 AF
Option III	687,000 AF
Option IV	642,000 AF
Option V	582,000 AF

Under the shortage scenario stated above, these options would require the following conservation efforts:

Option I	18% cutback
Option II	16% cutback
Option III	12% cutback
Option IV	7% cutback
Option V	0% cutback

WATER RESOURCES PLAN
Normal-Year Demand and Dry-Year Supply Forecasts
For
Supply Development Options

Year 2010

Normal-Year Demand	Option I (AF)	Option II (AF)	Option III (AF)	Option IV (AF)	Option V (AF)
Normal-Year Demand Forecasts Without Conservation	902,000	902,000	902,000	902,000	902,000
Dependable Savings with BMPs	(70,000)	(70,000)	(70,000)	(70,000)	(70,000)
Normal-Year Demand Forecasts With Conservation	832,000	832,000	832,000	832,000	832,000
Existing Normal-Year Local Supply	(60,000)	(60,000)	(60,000)	(60,000)	(60,000)
Water Reclamation Forecasts	(30,000)	(40,000)	(50,000)	(70,000)	(100,000)
Groundwater Forecasts	0	(10,000)	(15,000)	(20,000)	(30,000)
Seawater Desalination Forecasts	0	0	(20,000)	(40,000)	(60,000)
Imported Water Supply Forecast	742,000	722,000	687,000	642,000	582,000
Dry-Year Supply					
Imported Water Shortage of 31%	(230,000)	(224,000)	(213,000)	(199,000)	(180,000)
MWD Carryover Storage	50,000	50,000	50,000	50,000	50,000
Imported Dry-Year Supply Forecast	562,000	548,000	524,000	493,000	452,000
Water Authority Carryover Storage	34,000	34,000	34,000	34,000	34,000
Dependable Local Supply Existing	25,000	25,000	25,000	25,000	25,000
Local Supply Development Forecasts	30,000	50,000	85,000	130,000	190,000
Dry-Year Transfers	37,000	51,000	75,000	106,000	138,000
Dry-Year Loss of Reclaimed Water Supply	(3,000)	(4,000)	(5,000)	(7,000)	(7,000)
Dry-Year Supply Forecast	685,000	704,000	738,000	781,000	832,000
Percent of Normal Demands	82%	84%	88%	93%	100%
Conservation Effort Required	18%	16%	12%	7%	0

Figure 12-2

This Resources Plan in conjunction with imported water is designed to meet the long-term needs of the San Diego region. Occasional short-term drought conditions however will require reasonable conservation efforts. The Option III proposal would require a 12 percent conservation effort. This appears to be a reasonable effort in 2010 given the plumbing and landscaping replacement projects that will be accomplished by then.

Option III was analyzed over time to gain a better understanding of the impacts upon future water supplies. This analysis is shown on **Figure 12-3.** By pursuing a resources plan similar to Option III, the Authority's dependence on imported water in a normal year will be reduced from the current 90 percent dependent to 82 percent dependent in 2010. While this represents a substantial improvement in the Authority's dependence on imported water, it certainly will not eliminate the Authority's need for imported water. The reliability of the imported supply is still critical to the continued well-being of the Authority.

In the worst-case shortage scenario, Option III will reduce the need for short-term conservation from 26 percent in 1995 to 12 percent in 2010. In order to achieve this result however, dry-year transfers of up to 75,000 acre-feet are needed by 2010. A resources plan similar to Option III appears to be reasonable. However, each resources project must be economically justified by comparing it with the economic model described in Section 13.

WATER RESOURCES PLAN
Normal-Year Demand and Dry-Year Supply Forecasts
Option III

Normal-Year Demand	1995 (AF)	2000 (AF)	2005 (AF)	2010 (AF)
Normal-Year Demand Forecasts Without Conservation	709,000	789,000	842,000	902,000
Dependable Savings with BMPs	(21,000)	(37,000)	(52,000)	(70,000)
Normal-Year Demand Forecasts With Conservation	688,000	752,000	790,000	832,000
Existing Normal-Year Local Supply	(60,000)	(60,000)	(60,000)	(60,000)
Water Reclamation Forecasts	(11,000)	(18,000)	(36,000)	(50,000)
Groundwater Forecasts	(2,000)	(5,000)	(10,000)	(15,000)
Seawater Desalination Forecasts	0	0	0	(20,000)
Imported Water Supply Forecasts	615,000	669,000	684,000	687,000
Dry-Year Supply				
Imported Water Shortage of 31%	(191,000)	(207,000)	(212,000)	(213,000)
MWD Carryover Storage	5,000	20,000	40,000	50,000
Import.Dry-Year Supply Forecasts	429,000	482,000	512,000	524,000
Water Authority Carryover Storage	15,000	20,000	30,000	34,000
Dependable Local Supply (Existing)	25,000	25,000	25,000	25,000
Local Sup. Development Forecasts	13,000	23,000	46,000	85,000
Dry-Year Transfers	28,000	57,000	57,000	75,000
Dry-Year Loss of Reclaimed Water	(1,000)	(2,000)	(4,000)	(5,000)
Dry-Year Supply Forecasts	509,000	605,000	666,000	738,000
Percent of Normal Demands	74%	80%	84%	88%
Conservation Effort Required	26%	20%	16%	12%

Figure 12-3

SECTION 13

RESOURCES PLAN ECONOMIC MODEL

All of the water the Authority sells to its member agencies is first purchased from MWD. In recent years, the costs for these imported water purchases have increased significantly. MWD water rates have increased from $197 per acre-foot in fiscal year 1989-90 (untreated water), to $318 per acre-foot in 1993-94. A trend of increasing rates is expected to continue through the next decade, as MWD seeks to secure, develop, and transport additional supplies of imported water.

Imported water from MWD has been and will continue to be the primary source of water for San Diego County. However, as the development of new imported supplies become more costly, other supplies that previously were not economical to develop may become cost effective. These alternative sources of water are expected to increase in proportion to the total Authority supply.

The economic model for this Water Resources Plan is based on the premise that the incremental unit cost to the Authority and its member agencies of developing and operating any resource project must be less than MWD's water rate. Due to the nature of local supply options in San Diego County, the Authority will not always absorb the total cost of developing local water resources. For water reclamation and groundwater development, local wastewater and water agencies bear most of the financial burden. The Authority pays only one-fourth of the total cost for implementing conservation projects, but might pay the full development cost of future seawater desalination.

Local supply projects should not necessarily be funded exclusively through water rates. Fixed revenue sources, such as the existing capacity charge or some new type of resource development fee, could be used in part to pay for local resource development and offset increases in water rates. If a desalination project were developed, for example, it would become part of the Authority's Capital Improvement Program (CIP), and could be partially funded through standby or capacity charges, as are other CIP projects.

The revenue received by the Authority from local supply projects will vary with the level of investment the Authority makes in each project. For Authority-developed supplies such as seawater desalination, all revenue generated by the project would be realized by the Authority. For options where

the Authority provides only partial financial support, revenues may benefit the implementing agency.

These types of financial issues will be addressed at greater length in a subsequent Water Resources Financing Plan, which will deal with the fiscal impacts to the Authority of pursuing specific resource projects. The balance of this chapter will focus on the economics of developing alternative water supplies within the Authority's service area.

Economic analyses of water supply projects require the identification of all costs and benefits associated with each specific project. For example, the local supply options being considered in this Water Resources Plan will reduce demand for imported water, resulting in specific avoided costs. All such benefits associated with developing alternative supplies should be factored into a resource project economic cost equation.

Resource Project Cost Equation

The first step in developing local supplies is to determine whether a specific project is economically justified relative to available alternatives. This is true regardless of which agency actually pays for developing the local supply. The economics of any potential resource project in the Authority's service area should be evaluated using the following equation:

Total Resource Project Cost (Capital and O & M)

less Direct Avoided Costs

less MWD Local Projects Credits

less Other Project Benefits

Equals Adjusted Project Cost

If the adjusted project cost, computed on a unit or per-acre-foot of project yield basis, is less than the present worth cost of purchasing MWD supplies, development of that resource project is considered economically viable. If the adjusted project cost is greater than the cost of MWD supplies, assuming equal reliability, the project is not economically viable. All costs, including MWD

supplies, should be evaluated on a comparable basis and for the life of the proposed project.

Projected MWD Rates

MWD's projected water rates are shown in **Figure 13-1**. These rates are subject to regular review by the MWD Board and are influenced by water sales, revenues from other sources, the need to make system improvements, and the need to develop future supplies. Over the past 15 years, MWD water rates have increased at an average annual rate of 8.66 percent. However, recent information suggests that MWD rate increases may slow in the future as fixed revenue sources, such as existing standby charges or connection maintenance charges, become a greater component of MWD's total revenues.

For the purposes of this plan and the Authority's evaluation of alternative local resource development projects, the economic feasibility of individual projects will be based upon the net present value of MWD's future rates through the year 2010. Future MWD rate projections are based on MWD staff estimates through 2003. After the year 2003, MWD's rate is assumed to continue increasing at a rate of 8.66 percent per year.

The net present value of the MWD treated rate over the 17 years from fiscal 1993-94 to 2009-2010 is $485 per acre foot.

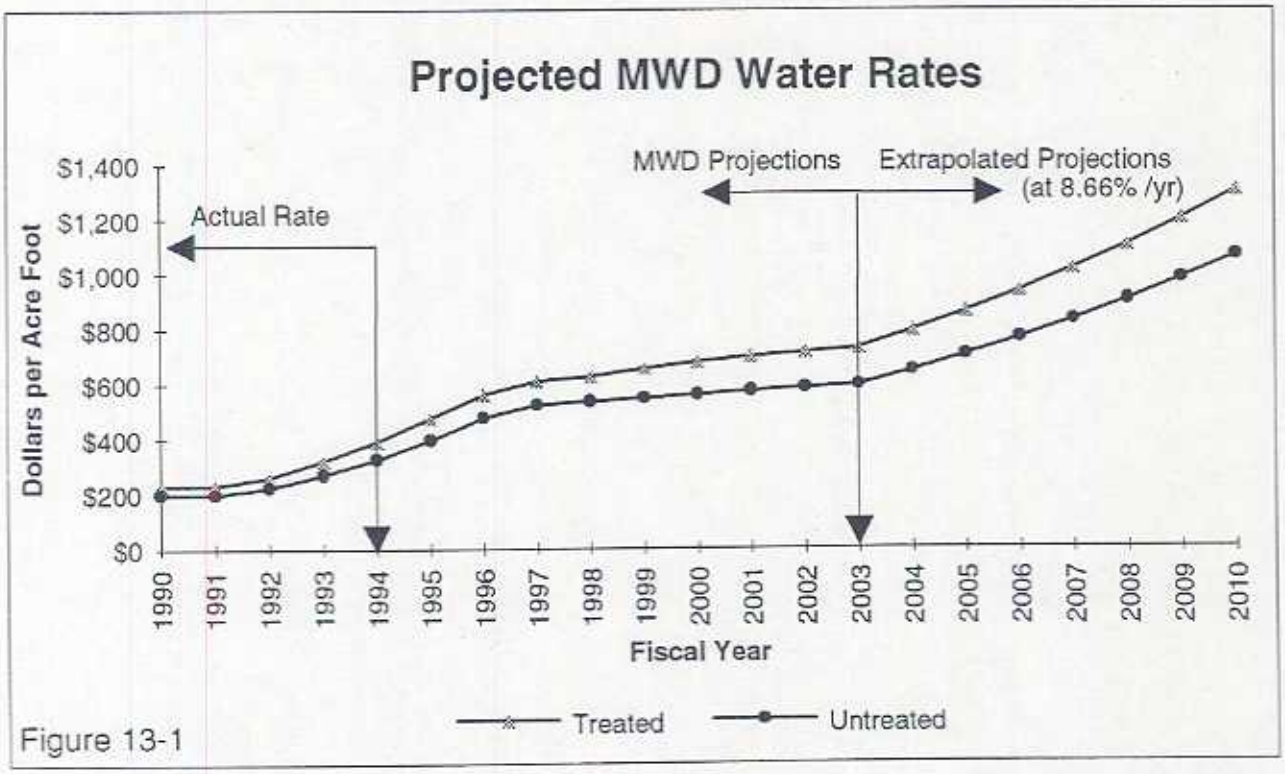

Figure 13-1

Resource Project Cost

The Resource Project Cost is the cost to the Authority or its member agencies of developing and operating an alternative water resource project. The cost of the project may be calculated on a unit basis, by determining annual cost of the project based upon the project life, and dividing by the number of acre-feet of water per year the project will yield. Any financial participation or cost sharing of a project by federal or state agencies or others is not included in the Authority's cost. For example, federal cost sharing may reduce the Authority's unit cost of water from a project, as would low interest state bond financing. The reduced unit cost that would result from such participation shall be used to evaluate the economics of a project.

Direct Avoided Costs

Developing and constructing a water resource project may lead to cost savings in other areas. These cost savings, or avoided costs, can be for both future capital and operational expenditures. For example, a desalination plant or a water reclamation facility, located in an area where growth is occurring or existing storage is deficient, may offset fully or partially the need for expanded treatment plant capacity or the construction of 10-day operational storage capacity.

MWD Credits / Avoided Costs

MWD has two programs designed to encourage its member agencies to develop local water resources. A local projects program (LPP) provides payments of $154 for each acre-foot of reclaimed water produced. Brackish or contaminated groundwater recovered by member agencies under MWD's groundwater recovery program (GRP) is eligible for a payment of up to $250 per acre-foot of water produced. These programs provide, up to the maximum allowable credit, the difference between MWD's current water rate and the actual cost of producing water.

While LPP and GRP payments encourage local water supply development, MWD has not taken steps to ensure that the credit value is equal to its avoided capital and operating expenses of developing new water supplies. MWD should be encouraged to regularly review and update the LPP and GRP payment schedule to ensure that its programs provide sufficient incentive for local supply development. The LPP and GRP should reflect the actual value of avoided costs for securing, developing, and delivering alternative MWD water resources.

Financial Participation / Avoided Costs

Some resource development programs have opportunities for shared financial participation with MWD and other agencies. MWD is expected to continue its policy of funding conservation and demand management programs by providing up to 50 percent of the program costs. Additionally, local member agencies, the local power company, and the California Department of Water Resources (DWR) have provided funding for Authority conservation programs. These funds reduce the Authority's costs for demand management programs.

Future funding sources for local water development projects may come from the federal government. The United States Army Corps of Engineers (COE) study looked at opportunities for developing additional water supplies for San Diego County. Included in its study were various water reclamation facilities and the South Bay Desalination Project. The United States Bureau of Reclamation is also considering opportunities for a reclaimed water distribution system for Southern California. Should these federal studies indicate that individual projects under consideration meet the criteria for federal cost sharing, then efforts to secure such funding should be made. If successful, the Authority's cost to develop these supplies would be reduced.

Other Project Benefits

A proposed resource development project may provide benefits without providing avoided costs. Such benefits can often be quantified in terms of a value per acre-foot of water produced. For example, the Authority is investigating the need for additional emergency storage within San Diego County. Local water supply development may provide some limited emergency water supplies.

The annual cost of providing emergency storage can be estimated on a unit basis to determine the emergency storage value of the local supply development project. While a proposed supply development project such as seawater desalination may not result in a significant reduction in needed emergency storage, its value as an emergency supply can be included in the adjusted project cost.

Local water resource development may provide benefits to the overall Authority system by making available pipeline capacity which otherwise would be used. The Authority's Board recognized this value when it agreed to provide a $100 per acre-foot payment to member agencies for water reclamation

development. Development of potable water supplies within San Diego County provides similar benefits to the Authority system.

Summary of Avoided Costs or Project Benefits

Figure 13-2 lists the Authority's resource development options, possible avoided costs, and other benefits associated with developing local resource. Each category of avoided costs or project benefits represents an opportunity for the Authority to reduce its cost of developing the new supply. Obviously, the price tag associated with developing a resource is unaffected by funding source. However, when one considers cost savings that are realized in other areas, or when other benefits brought about by the development of a local resource are quantified, the net cost to the Authority is reduced and each option becomes more attractive and cost effective for the Authority.

Potential Avoided Costs or Project Benefits					
Water Resources					
	Conservation	Water Reclamation	Groundwater Basin Development	Seawater Desalination	Water Transfers
Financial Participation	X			X	
MWD Credits		X	X	X	
Water Authority Local Project		X	X	X	
Avoided 10 Day Local Storage		X	X	X	
Avoided Emergency Storage	X	X	X	X	
Avoided Treatment Plant Capacity	X	X	X	X	

Figure 13-2

Resource Cost Comparisons

Each resource area has a number of potential projects that can be implemented with varying degrees of difficulty and cost. Estimated cost ranges for the resources are shown in **Figure 13-3**.

It should be noted that although Demand Management has generally lower costs, it does not produce a water supply that can be sold to generate an income.

Resource Cost Comparisons	
Resource	Potential Cost Range Per Acre Foot
Demand Management	$ 200 - $ 600
Reclamation	$ 700 - $1200
Groundwater	$ 500 - $1500
Desalination	$1200 - $2000
Transfers	$ 700 - $1000

Figure 13-3

The economic evaluation for each resource option should include avoided costs and other benefits to the Authority attributable to the option. **Figure-13-4** indicates the potential avoided costs and other benefits that may result from the development of various local resources. **Figure 13-5** shows the range of costs for each local resource option, both actual costs and adjusted costs, when avoided costs and other project benefits are considered. Individual project costs can vary widely, depending upon water source location, treatment, and distribution system requirements. Each potential project should be evaluated based on its individual costs and benefits to determine its economic feasibility.

Cost Effectiveness of Local Supply Development Options

The resource options presented in Section 12 include various combinations of local supply development and transfers. Dependable supplies as outlined in Option 3 will prevent regional economic damage from occurring during years of water shortage. While supply development opportunities need to be evaluated individually, the economics of each option can be estimated based upon the range of costs shown in **Figure 13-3**. **Figure 13-5** shows the range of costs for the base cost and the net cost for each local resource. The net costs were derived in **Figure 13-4**.

Cost Effectiveness of Supply Options

		Local Resource Option			
		Conservation	Water Reclamation	Groundwater Basin Development	Seawater Desalination
Resource Cost		$200-600	$700-1200	$500-1500	$1200-2000
Avoided Costs/Benefits:					
Financial Participation by Others					$0-300
MWD LPP & GRP[1] Contribution		$0-300	$154	$15-250	$250-350
Water Authority Local Project Value			$100	$100	$100
Avoided 10-day Local Storage			$0-88	$0-88	$0-88
Avoided Emergency Storage		$0-60	$0-60	$0-60	$0-60
Avoided Treatment Plant Capacity[2]		$67	$67	$67	$67
Total Benefits		$67-427	$321-469	$182-565	$417-965
Net Cost Water	Low Range	$0	$231	$170	$235
	High Range	$547	$879	$1,083	$1,583

[1] GRP funding varies, depending on cost of development and recovery
[2] Current MWD treatment surcharge

Figure 13-4

Figure 13-6 shows the estimated range of annual local supply development costs for each water resource development option. These costs represent the midrange of the expected annual cost of water if each option were developed using the expected low and high adjusted cost of water shown in **Figure 13-4**. Also shown are annual expenditures for an equal quantity of imported water, using the present value of MWD rates of $485. By using the present value of future MWD rates, a comparison can be made, in current dollars, between each option and the alternative of purchasing an equal amount of imported water.

Figure 13-6 shows that Options 1 and 2 will be cost effective, given the estimated cost of developing local supplies and anticipated MWD rate increases included in the present value MWD rate. The annual cost resulting from developing the local supply component of these options, considered with the benefits provided, is estimated to be less than what would otherwise be spent on purchasing MWD imported supplies. Option 3 provides greater local supplies and supply reliability than Options 1 or 2. It is also cost effective, as the total

annual cost to the Authority and its member agencies is equal to the cost of MWD supplies at the present value rate. It should be noted that the net cost of water shown includes the $100 Authority contribution for local supply development.

Options 4 and 5 could also be cost effective if all local projects developed were near the lower limit of adjusted costs. This is not likely to occur because the most cost effective local supplies will be developed first. Incremental supplies developed in Options 4 and 5 will be more costly and are likely to be toward the high end of the cost range shown. Therefore Options 4 and 5 present greater economic risk to the Authority than Options 1 through 3. Option 3 represents a combination of local projects whose costs are likely to be competitive with future MWD rates, and provides supplies that are sufficient to limit dry-year shortages to 12 percent of normal demand.

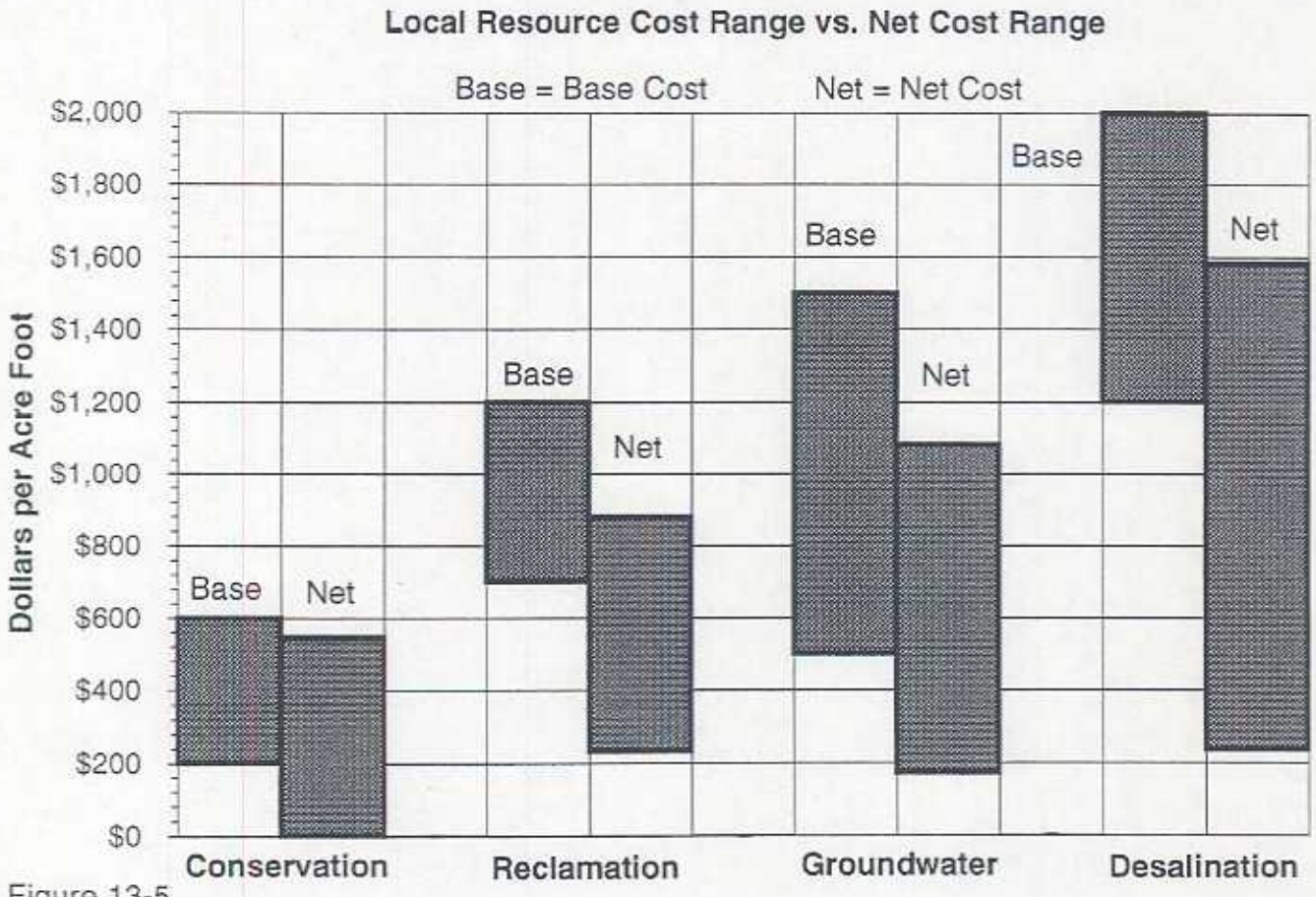

Figure 13-5

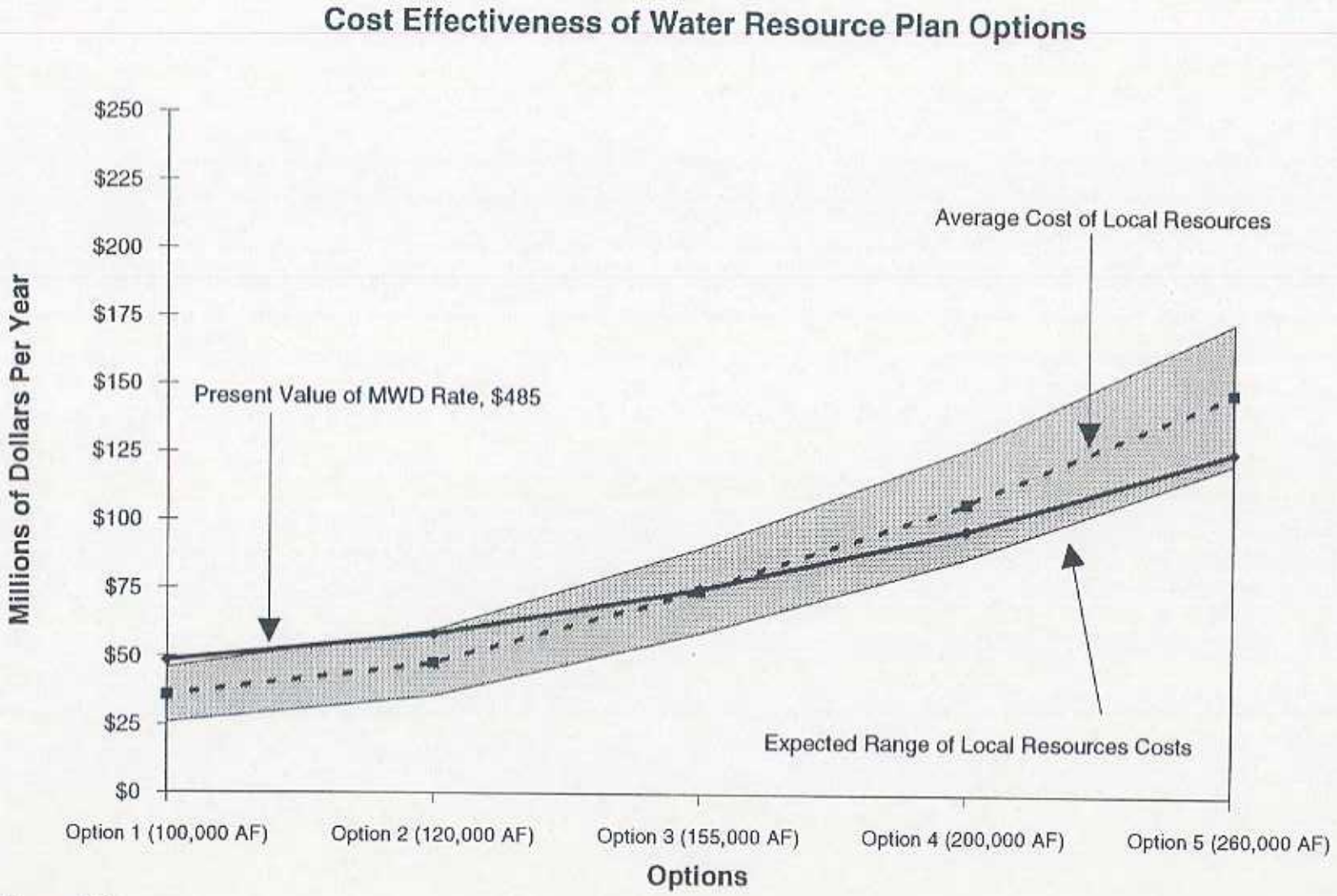
Cost Effectiveness of Water Resource Plan Options
$250
$225
$200
$175
$150
$125
$100
$75
$50
$25
$0
Millions of Dollars Per Year
Average Cost of Local Resources
Present Value of MWD Rate, $485
Expected Range of Local Resources Costs
Option 1 (100,000 AF)
Option 2 (120,000 AF)
Option 3 (155,000 AF)
Option 4 (200,000 AF)
Option 5 (260,000 AF)
Options

Figure 13-6

SECTION 14

RESOURCES PLAN AND POLICY RECOMMENDATIONS

It is recommended that a resources plan with water quantities similar to Option III be pursued. The actual quantities of water to be developed must be determined in the future by comparison with the economic model. The types and quantities of water forecast for development are shown below in **Figure 14-1**. The balance of the resource needs will be met through the purchase of imported water or withdrawals from carryover storage.

Water Resources Plan Forecast

	Acre Feet			
Forecast Categories	1995	2000	2005	2010
Water Conservation	21,000	37,000	52,000	70,000
Water Reclamation	11,000	18,000	36,000	50,000
Groundwater	2,000	5,000	10,000	15,000
Seawater Desalination	0	0	0	20,000
Dry-Year Transfers	28,000	57,000	57,000	75,000
Total Forecast	62,000	117,000	155,000	230,000

Figure 14-1

Support of the Metropolitan Water District

The Authority will continue to rely upon MWD to provide most of its water supplies. The Authority will support MWD in its efforts to provide a reliable water supply provided the costs for developing those supplies are divided equitably among MWD's customers and water deliveries during shortages are based upon need. MWD's supply development activities and resource allocation policies have a profound impact upon the incentive for, and ability of, local member agencies to develop local water supply projects which enhance both the member agency's supply reliability and the overall reliability of Southern California's water supply. In recent years, MWD has been at the

forefront in developing innovative programs to encourage water conservation and additional local supply development. Additional improvements in these programs should continue to be pursued.

Because of its heavy reliance upon MWD for imported water, the Authority will also seek to improve the quality of its supplies. This includes continued support for efforts by both the Authority and MWD to provide an equal blend of water from the Colorado River Aqueduct (CRA) and the State Water Project (SWP). Since 1992, Authority supplies have been entirely from the Colorado River, which has much higher total dissolved solids (TDS) than state water. Historically, the Authority has received a blend that has been about 70 percent from the CRA and 30 percent from the SWP. Improving the quality of imported supplies will also assist Authority reclamation goals by increasing the quality of reclaimed supplies and expanding potential markets for reclaimed water.

Metropolitan's Support of Local Supply Development

The primary obstacle to development of local water resource projects has been the cost differential between an acre-foot of additional water from MWD versus the cost of an acre-foot of newly generated local supply. Due to the melding of the costs of historically developed, cheaper supplies with more costly recent supplies which often are still being financed, a new local supply can rarely compete with additional water supplied by MWD. MWD has recognized this problem since 1981 when the Local Projects Program was introduced. In an effort to reduce the financial disincentive toward local supply development, MWD provides a subsidy of $154 per acre-foot for locally developed supplies meeting specified criteria. This cost is based in part upon MWD's avoided cost to treat and deliver water.

MWD is currently engaged in a $6 billion capital improvement program to expand delivery capacity, provide additional water storage and upgrade water treatment processes. Costs for these projects will be blended with current water supply costs resulting in a MWD rate something less than the marginal cost of developing the new increment of supply, transmission, storage and treatment capability necessary to bringing the additional supplies on line. Development of local supplies have the effect of lessening the need for improvement of MWD's system, as an acre-foot developed and used locally means an acre-foot MWD does not have to provide. Therefore, MWD should logically be willing to pay the same cost to develop a local supply as its marginal cost to develop and deliver additional imported supplies. Such a policy

will increase the number of local projects that are feasible and expand overall resource opportunities.

Shortage Allocation

One disincentive to the development of local supplies is the effect the new supply has on the allocation of water from MWD during shortages. Development of local supplies by a member agency which are utilized annually have the effect of lowering the agency's baseline demand for water from MWD. Shortages in MWD's supplies have thus far been allocated based upon a percentage of previous demands. Thus, an agency which develops local supplies on the theory of improving supply reliability does not get the full benefit of developing those supplies. However, the predominant cost of developing that regional benefit was paid by the local agency. The more dependent an agency is upon MWD, the less incentive there is to develop local supplies due to both the cost and the effect upon water supplies to that agency during a shortage. This analysis argues for MWD either paying a larger share of local project costs or adjusting local agencies baseline water use for local water supplies which are developed in the future.

Section 135

Section 135 of the Metropolitan Water District Act provides, in part, that member agencies have a:

> "preferential right to purchase... a portion of the water served by the district which... bears the same ratio... as the total accumulation of amounts paid... on tax assessments and otherwise, excepting purchase of water... shall bear to the total of such payments...."

In plain language what this section means is that water deliveries to member agencies of MWD in times of shortage are based upon accumulated tax payments to MWD and not on other considerations such as need and availability of local supplies. In recent times the water delivered to the Authority has amounted to about 30 percent of MWD supplies. Based upon Section 135, the Authority could be entitled to only about 11 percent of MWD's supplies. In 1987 the Authority's General Counsel opined that this provision of the MWD code was archaic, unfair and illogical. Further, that this section conflicted with MWD's Laguna Declaration (MWD Administrative Code Section 4201(a)) and the State Water Code, Section 350.

Recent events have tended to reinforce the view that Section 135 is essentially meaningless in the context of today's water supply environment. In 1991 MWD was faced with the catastrophic potential of a loss of 50 percent of its normal supplies. Instead of referring to Section 135 as a means of allocation, MWD developed special rules for allocating available supplies which bore no resemblance to Section 135. Indeed, no serious efforts to invoke Section 135 were undertaken from any quarter.

For the purposes of the Authority's long-term supply planning process and drought management planning, Section 135 is considered unreasonable and unenforceable. However, the Authority should continue, as opportunities arise to seek repeal of Section 135, and codification of a more reasonable means of allocating shortages among member agencies.

State Water Project - Current Status and Long-term Issues

The San Diego region's water needs cannot be resolved in isolation. To a large degree, solving San Diego's needs means solving the dilemmas of water allocation and changing water demands within the State. Unfortunately, the past 30 years of water policy within the state can be characterized as a history of false starts, acrimony and inaction. This has led to a situation where urban, environmental and agricultural interests all have unmet needs, and collectively the state's economy and quality of life is suffering as a result. The lack of a coherent policy on the state's water resources has been complicated by the adoption of landmark legislation seeking protection of the environment. In particular, the California Environmental Quality Act, the Federal National Environmental Policy, the Federal and State Endangered Species Act, Federal Clean Water Act and State Porter-Cologne Act, and the Safe Drinking Water Act have dramatically changed the way water as a resource is perceived, developed and used. Additionally, the Public Trust Doctrine established by the State Supreme Court and the Racannelli decision currently evolving out of the litigation surrounding diversions from the Mono Basin and the Bay Delta process, respectively, have signaled a major shift in the view of water rights as permanent private property. By asserting a public trust value in water rights granted by the state, previous rights granted may be periodically reviewed in light of changing public values and needs.

Struggling to deal with changes in their customers' needs are over 1,400 separate water purveyors within the state, each having to largely find its own solution without a coherent state policy as guidance. The closest process to forming a state policy on water use has been the State Water Resources

Control Board Bay Delta Process. This process is intended to set water quality standards for the Sacramento-San Joaquin River Delta and San Francisco Bay system. In doing so the Board must balance the competing beneficial uses of water. Virtually all of the important issues involving California's water are part of this process. However, though the Board has great legal power to revisit historic water rights, it lacks the mandate to plan for or direct physical solutions which are viewed by many as necessary to equitably solve Delta problems, meet growing water needs and improve drinking water quality.

California water planning, in the traditional sense of pursuing water development projects, is managed by the Department of Water Resources. Following defeat of the referendum regarding the Peripheral Canal and other water resource projects in 1982, the DWR was left without any basic guidance from the Legislature on how the SWP should meet growing water demands. As the Burns-Porter Act contains legislative authority to construct a delta transfer facility as part of the SWP, DWR has pursued an incremental policy of developing projects to enhance the yield of the SWP, including widening and deepening channels in the North and South Delta, and adding additional pumps at the H. O. Banks Delta Pumping Plant. In addition, DWR is pursuing construction of a large off-stream storage reservoir south of the Delta called Los Banos Grandes, and implementation of a groundwater banking/conjunctive use project, the Kern Water Bank. Additional steps will still be needed for the SWP to meet its long-term contractual obligations and current demands. Additionally, as the planning has progressed for these projects, issues of water quality, ecological health of the Delta, fishery, wetland and endangered species have complicated and may collectively prevent implementation of some or most of DWR's proposed projects.

Governor Wilson's April 1992 statement on California water policy outlined a comprehensive plan to meet the water needs of urban, agricultural and environmental interests. The Governor called for enhancing the ability to store water south of the Delta by constructing the South Delta improvements, Los Banos Grandes Reservoir and the Kern Water Bank. He also recognized the need to fix the Delta, calling for the completion of environmental documentation to select a solution within three years. Further, he recognized the need to provide for reallocation of water supplies through voluntary transfers.

State Water Project Short-Term Needs

Given the current low reliability of urban water supplies in the State and the long lead-time necessary to effectively deal with the long-term issues, short-term tactics need to be pursued to meet critical urban and agricultural needs during drought or other shortage periods. The California Drought Emergency Water Bank which provided for these needs in 1991 and 1992 is being pursued as a partial solution available to ameliorate acute shortages in the future. It must be recognized that the State Water Bank is not a substitute for the obligation of the DWR to complete the facilities necessary to meet state water contracts.

Federal Water Policies in California

The largest water project in California is the Central Valley Project, administered by the Department of the Interior's Bureau of Reclamation. While not directly connected to the San Diego region's water supply system, the existence and administration of the Central Valley Project (CVP) affects California's water supply as a whole. This project supplies over 7.0 million acre-feet of water, nearly four times the dependable yield of the State Water Project to mostly agricultural agencies within the Sacramento and San Joaquin Valleys. Originally conceived as a state project, the fiscal realities of the Great Depression required the project to be taken over by the federal government. Operating under federal reclamation law, the project delivers subsidized water to its mostly agricultural customers who grow a wide variety of crops for local, national and international markets on approximately 2.8 million acres of land. The project also provides flood control for the Sacramento and San Joaquin Valleys and hydropower for much of the region.

The CVP is anchored by the 4.5 million acre-feet (maf) Shasta Lake in the north on the Sacramento River, and Clair Engle Lake (2.5 maf) on the Trinity River. In the south the main impoundment for the project is on the San Joaquin River, which allows storage of up to 0.5 maf in Millerton Lake. Other major reservoirs are Folsom at 1.0 maf, the San Luis Reservoir, a joint state/federal project at 2.3 maf and the recently completed New Melones Reservoir on the Stanislaus at 2.5 maf. The proposed 2.5 maf Auburn Dam and Reservoir on the American River was halted during initial construction due to seismic concerns and has subsequently been deferred due to fiscal and environmental concerns.

As with the State Water Project (SWP), water from the northern section of the project is brought through the Sacramento-San Joaquin Delta and

recovered by pumping plants at the Tracy and Contra Costa pumping stations. Due to this project's use of the Delta, operation of the project is affected by the controversy surrounding the Delta resources. In contrast to the SWP, the CVP can be summarized as a storage-rich and conveyance poor project. The CVP has up to 1.5 maf of uncontracted water per year available which could temporarily meet much of the unmet demand on the SWP. For these and other reasons related to operational impacts of the project and limitations on the use of federal water, periodic calls for state ownership and operation of the project have been made. However, these calls have been tempered by the fact that the project is deeply in debt, having repaid less than 25 percent of its 2 billion debt. The burden of the project's 40-year water contracts which do not account for interest expense and have not been sufficient to cover operation and maintenance costs also constrain the feasibility of a purchase.

Many of the problems of having independent operation of the CVP and SWP have been addressed in a Coordinated Operating Agreement between the State and the U.S. Bureau of Reclamation signed in November of 1986. This agreement requires both projects to meet existing Delta water standards, allows the State to purchase interim CVP water, allows the CVP to use excess SWP conveyance capacity and allows for sale of uncontracted water by the CVP. While this agreement ameliorates many of the problems of the independent operation of the projects, complete resource management of California's water is impaired by the existence of this federal project which although serving only California, is not sufficiently responsive to state policy or statewide needs.

In order for California to solve its water supply problems in a systematic and equitable fashion, the resource use and operational polices of the CVP must be able to be part of the solution. While it was appropriate at the CVP's inception that the federal government play a dominant role in development of the state's water, the conditions since that time have changed enormously from a largely agrarian state with ample undeveloped water to the most populous urbanized state in the nation with fiercely competing interests for developed and undeveloped water alike. The policies which shaped development of California's water supplies then may not be appropriate now. Nonetheless, the current values and uses of water from the CVP cannot be casually dismissed in a rush to reallocate supplies or redress environmental damage. Solving urban resource problems and environmental damage at the expense of rural economies is neither necessary nor desirable. Ample opportunities exist to manage the system to the mutual benefit of all parties by providing incentives for agricultural conservation, allowing transfers of CVP water to non-project customers and joint projects to build facilities to provide farms alternate water

resources in dry years and improved surface supplies to urban areas. The Authority will support legislative and policy changes in operation of the CVP which allow more flexibility in resource management for the benefit of the entire state.