Future Water Supply Study

Technical Appendix A

Final Report
August 1996

Contra Costa
Water District

C-100104

CONTRA COSTA WATER DISTRICT

PLANNING DEPARTMENT

FUTURE WATER SUPPLY STUDY

FINAL REPORT
TECHNICAL APPENDIX A

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August 1996

C-100105

CONTRA COSTA WATER DISTRICT

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Technical Appendix A: Demand Projections

SUMMARY

The major purpose of this Technical Appendix is to document the development of demand projections produced for the six Service Areas studied within the Future Water Supply Study (FWSS). This represents all supporting materials used in reviewing historical consumption rates, developing demand methodology, all major assumptions, qualifications, and water demand results. This appendix has included as much graphic information as possible to assist in the comprehension of the final demand projections and their implications.

The main part of this Technical Appendix presents summary tables and charts which have been incorporated into demand projections. Additional information and data related to the analysis can be found in attachments at the rear of this document.

Range of Service Areas

Six Service Areas were mapped for utilization in the demand projections. The Service Areas have been developed from logical groupings of subareas. Exhibit A-1 displays a description of the six Service Areas, and a map of the six Service Areas studied has been included in Exhibit A-2, for ease of reference while reviewing the demand projections.

Key Planning Issues

The goal of the FWSS was to "develop an action plan implementing environmentally responsible options that will ensure a reliable, high quality long term water supply". The mission of the Contra Costa Water District is to "strategically provide a reliable supply of high quality water at the lowest cost possible, in an environmentally responsible manner". A number of planning issues needed to be addressed in order to meet the mission of the District and the goal of the FWSS. Exhibit A-3 displays the key planning issues affecting the demand for water by the District.

FWSS Approach

The methodology for the FWSS involved a number of parallel planning tracks. After review of existing plans and data, identification of key planning issues, and confirmation of planning goals for the District, demand, conservation and supply alternatives were analyzed. As demand projections were being prepared, a range of conservation programs and supply components were being prepared. After the Board of Directors reduced the number of Service Areas for further study from six to three, water supply components were screened and the most promising components were assembled to match the three remaining demands for the Service Areas. Six water supply alternatives were then evaluated, ranked, and a preferred alternative was selected. Exhibit A-4 represents a flow chart showing the approach taken for the development of the demand projections.

Key Assumptions

Projecting the District's water demand for the next 50 years required many assumptions, and an extensive review and analysis of data. Exhibit A-5 lists extensively the assumptions used in developing the six Service Area demand projections. The principal demand components are listed below:

Treated Water Service Area

- Land Acreage by Land Use Designation (1991 County General Plan)
- Water Use Factors (developed by the District)

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Exhibit A-1
Range of Service Areas

- **Service Area A**
  Los Vaqueros Planning Area
  (plus minor annexations to June 1994)

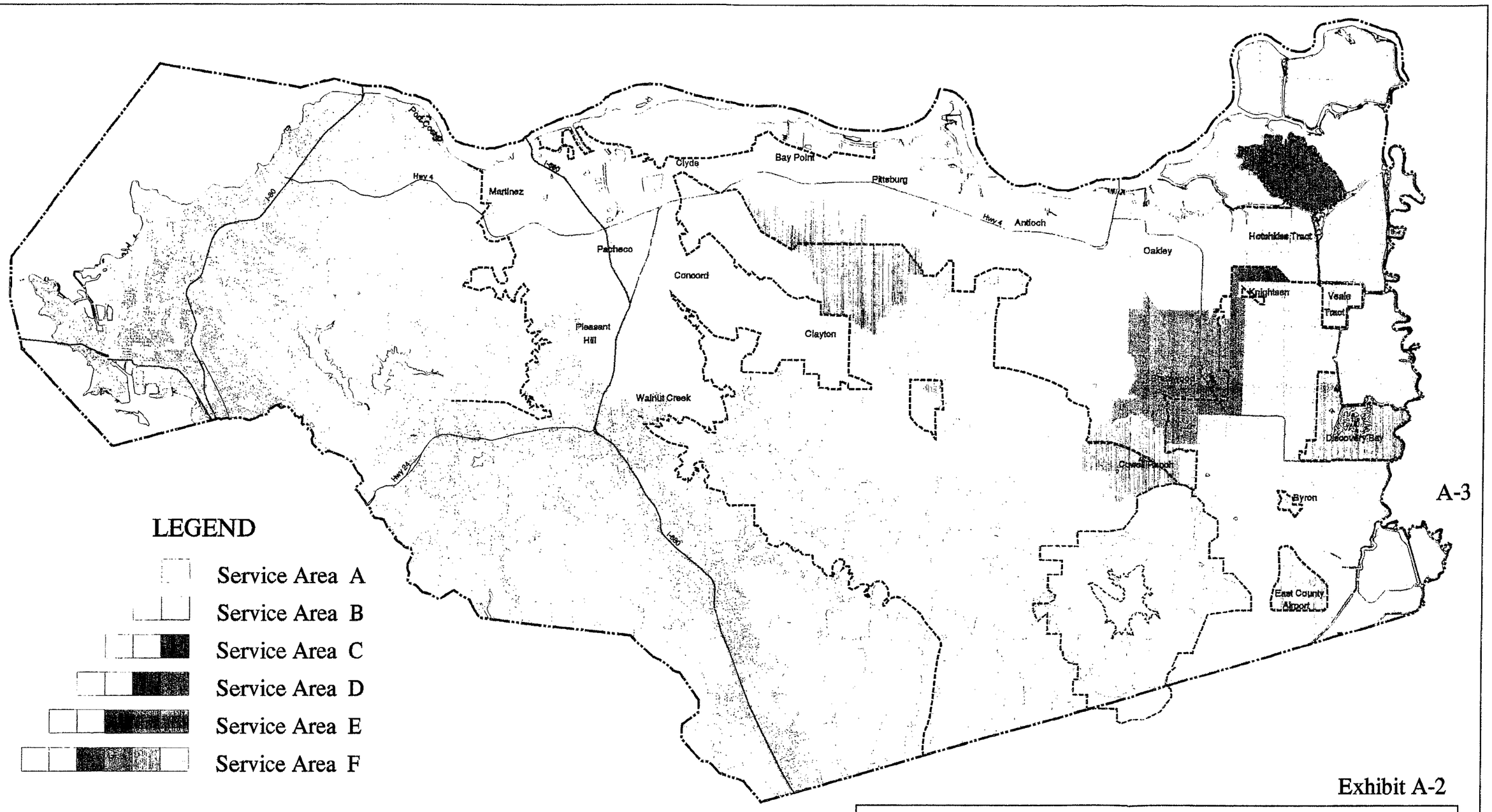
- **Service Area B**
  CCWD Sphere of Influence (SOI)
  (including Diablo Water District SOI)

- **Service Area C**
  Service Area B *plus*
  Diablo Water District Planning Area

- **Service Area D**
  Service Area C *plus*
  Brentwood Planning Area

- **Service Area E**
  Service Area D *plus*
  East County General Plan buildout

- **Service Area F**
  Service Area E *plus*
  East County "Combination" scenario



A-3

LEGEND

- Service Area A
- Service Area B
- Service Area C
- Service Area D
- Service Area E
- Service Area F

- County Line
- Urban Limit Line
- Los Vaqueros Watershed

N

Scale 1 : 200,000

Kilometers 1 0 1 2 3 4 5 6 7 8

Miles 1 0 1 2 3 4 5 6

1" = 3.16 miles

Exhibit A-2

Service Area Alternatives

CCWD Future Water Supply Study

GIS Mapping by EDAW - San Francisco

Sources: CCWD / Contra Costa County / Teale Data Center

07/15/96

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Exhibit A-3
Key Planning Issues Affecting Demand for Water

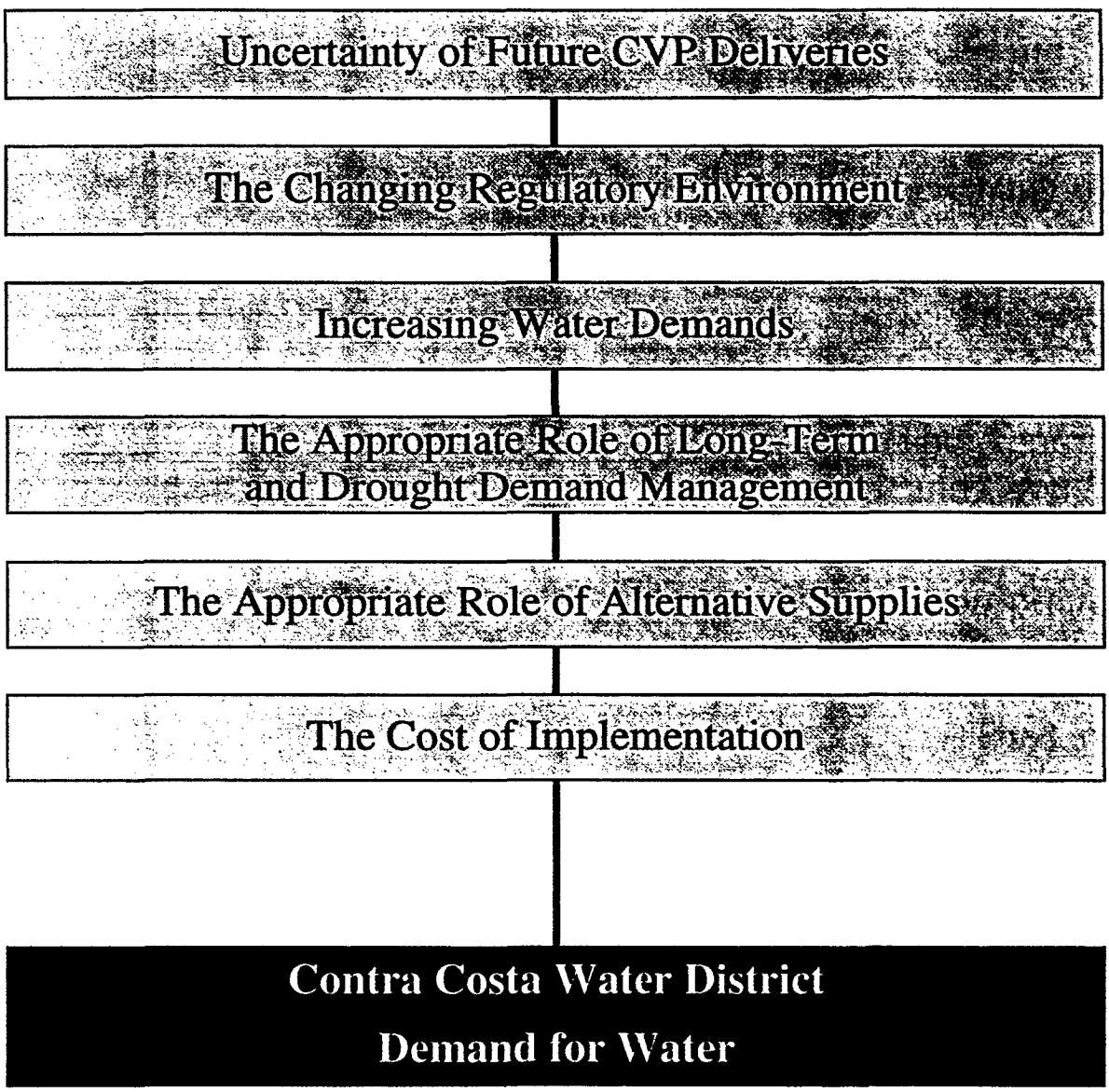

Exhibit A-4
Demand Approach

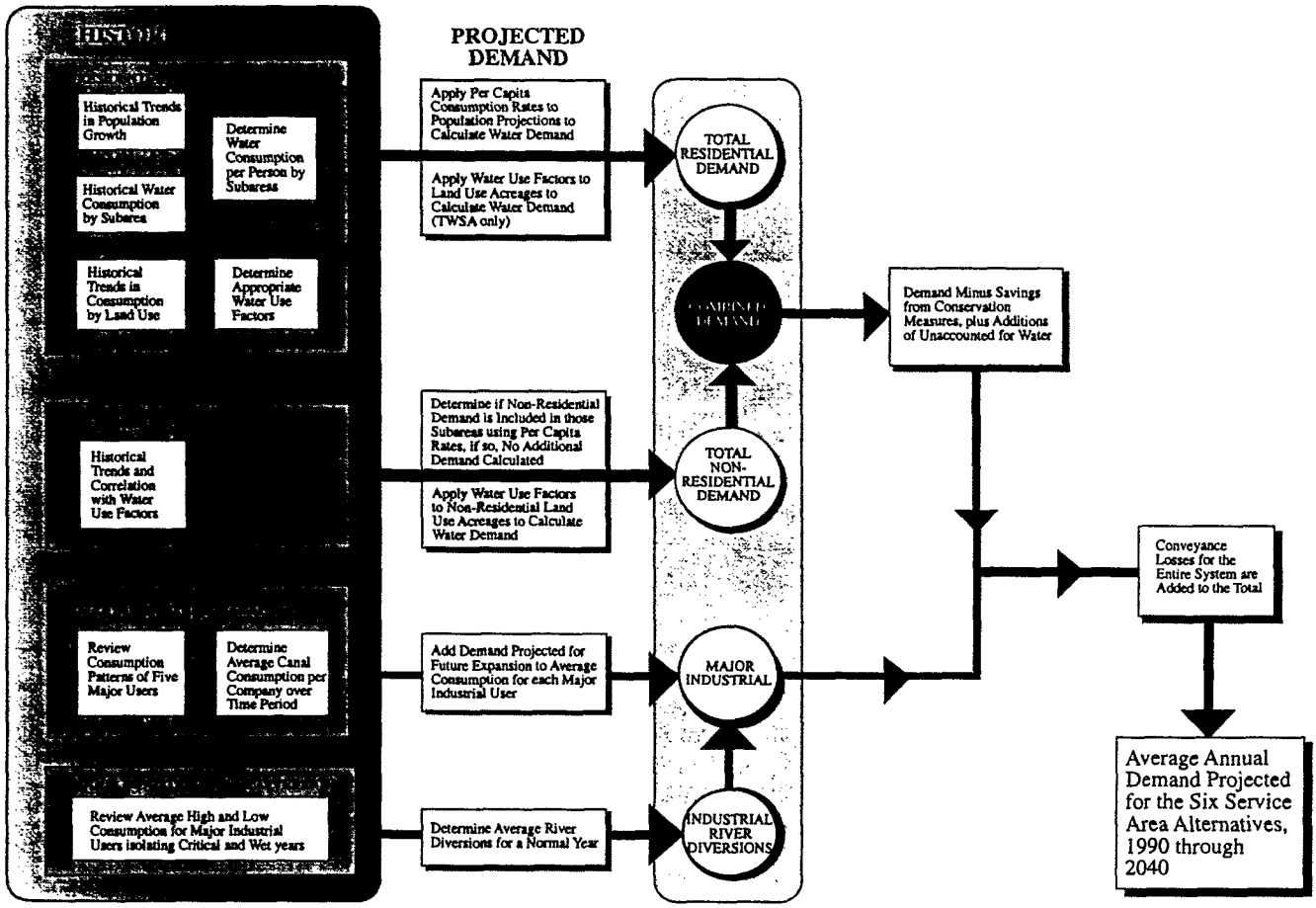

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Exhibit A-5
List of Assumptions
for FWSS Water Demand Projections

Mapping Standards

1. The Treated Water Service Area (TWSA) includes the cities within the TWSA including Clayton, Concord, Martinez, Pleasant Hill, Walnut Creek, and the communities of Clyde, Pacheco and Port Costa, which fall within the existing service area of the District. The TWSA Unincorporated subarea includes areas within the existing service area which are adjacent to the TWSA.
2. The Raw Water Service Area (RWSA) includes the cities of Martinez, Pittsburg, Antioch and the communities of Bay Point and Oakley, which fall within the existing service area of the District. The RWSA Unincorporated subarea includes areas within the existing service area which are adjacent to the RWSA.
3. Other Areas include the communities of Hotchkiss Tract, Bethel Island, Knightsen, Discovery Bay, Byron, E. County Airport, Veale Tract, Brentwood, Cowell Ranch and specified unincorporated areas, east of Sand Creek Road, south of Antioch.
4. Other Areas (Unincorporated within the Urban Limit Line [ULL]) include those remaining lands outside of the TWSA, RWSA, and those communities listed under "Other Areas" (east of Sand Creek Road), which are within the boundaries of the Urban Limit Line.
5. Other Areas (Unincorporated outside the ULL) include those remaining lands outside of the TWSA, RWSA, and those communities listed under "Other Areas" (east of Sand Creek Road), which are outside the boundaries of the Urban Limit Line.
6. All land uses for the purposes of this study are based on the planning horizon of the 1991 Contra Costa County General Plan, which is expected to occur within the period 2005 to 2010.
7. All projections shown for incorporated areas are for those areas within the city limits.
8. Discovery Bay projections are based on all existing and proposed development within the vicinity of Discovery Bay which is inside of the Urban Limit Line. In addition to the existing Discovery Bay community, this includes the proposed Discovery Bay West, and proposed general plan amendments in Byron 78 GPA.
9. The Cowell Property is listed separately because of its size and because it is not within the City of Brentwood's existing city limits. However, for the purposes of this study it has been assumed to eventually develop out under the City of Brentwood due to the interest the City has shown in this area. The Cowell Property is currently referred to in the City of Brentwood's General Plan as Special Planing Area "J" within the Planning Area Boundary.

Demand Projections

1. All population estimates for the years 1990 to 2010 were based on census tract information supplied by Projections 94 digital data published by ABAG. Extrapolations to 2040 were performed by EDAW, based on existing growth curves for each subarea, with interim years 2020 and 2030 interpolated between the ABAG 2010 and the extrapolated 2040 years. Projections were reviewed by each of the jurisdictions but only minor changes were needed.
2. Population estimates for census tracts divided by subarea, alternative, or both were split using: (1) the CCWD TWSA Population Estimate Database; (2) ABAG 94 Correspondence Tables, assuming 2010 splits for all subareas; and (3) local agency general plans and specific plans.

Exhibit A-5 (Continued)
List of Assumptions
for FWSS Water Demand Projections

3. Bethel Island and Hotchkiss Tract projections are based on population estimates from the Oakley Water Master Plan and ABAG growth projected for those census tracts.
4. Demands listed are for the average annual year referring to an average water year type. Average annual demand represents *demand* in an average year and does not include the effects of drought on water *use*[1].
5. The City of Martinez, which currently obtains water through both the TWSA and RWSA, has been shown in both categories for the purposes of this study. It was assumed for the purposes of this study that 24 percent of demand was associated with those lands in the TWSA and 76 percent from those lands in the RWSA. This was based on historical demand for raw water service in Martinez, acreage count for both service areas, and growth trends in the city. However, the methodology in determining demand remained the same for both (WUFs).
6. Major industrial customers and the land use acreage associated with their use were studied, and it was determined that actual use would be a more accurate measure of demand. This is due to the high water demand of particular major industrial customers. Historical use was averaged for the period 1984-1993, and used to determine overall demand rather than the application of WUFs in these cases. For this reason, heavy industrial acreage for these customers has been removed from the WUF calculation.
7. Certain minor industrial customers and the land use acreage associated with their use, were studied and it was determined that actual use would be a more accurate measure of demand. Many of these customers have large undeveloped acres and demand would be overstated if WUFs were used.
8. Major industrial demands were based on an average of historical canal demands in the period of 1984-1993. In addition, river diversions by major industrial customers were calculated and used to develop total demand. Shell Oil, Tosco Oil, USS-Posco and Gaylord Container water sales were analyzed. River diversions were assumed to be one-half of the difference between the average critical year canal sales and the average wet year canal sales for the period 1978 to 1993. This is due to the fluctuations which occur in demand from the river and the canal depending on water year type.
9. Demands calculated for Gaylord Container include those for Louisiana Pacific (one of its divisions). Although Gaylord has discontinued business, it was assumed that another industrial customer will take over, requiring a comparable demand for water .
10. All Major Industrial demand for Dow, Gaylord Container, Pacific Gas & Electric, USS-Posco, Shell Oil, and Tosco Oil have been included for the RWSA Unincorporated subarea. Demand for DuPont is included within those shown for the community of Oakley. Demand for Acme Fill, EBRPD and IT has been included within the TWSA Unincorporated subarea.
11. All demands shown by subarea include system losses. Unaccounted for water (UAW) includes demands from distribution system losses, canal seepage, evaporation and hydrants. This loss is calculated as the difference between the quantity of water delivered into the distribution system as measured at the pumping or treatment plant, and the total of all metered quantities billed to customers. For the purposes of this study, UAW for the TWSA was assigned at 7 percent. Other raw water municipal customers were assigned values consistent with the water master plans for those communities. In addition, losses from the Contra Costa Canal are assumed to be constant at 7,000 ac-ft/yr.

1 Demand includes all uses irrespective of who provides the water, and includes unaccounted for water. Water use refers to historical District water use within the service area.

Exhibit A-5 (Continued)
List of Assumptions
for FWSS Water Demand Projections

12. Estimated savings from conservation were estimated to range between 0 and 10 percent over the study period, irrespective of CCWD's or other water agencies interim or temporary programs. Conservation estimates for the years 2000, 2010, 2020, 2030 and 2040 have been estimated at 2,4,6,8 and 10 percent, respectively. These estimates are assumed to occur within the residential and non-residential sectors; major industrial customers are assumed to be operating in a relatively efficient manner and no future conservation savings are assumed for that class of water use.
13. After interviews with the County and local agencies, projected population estimates for the year 2000 were slightly reduced from original ABAG estimates. This reduction is based on the annual growth in housing units provided by the County for the 1990-1993 period, as well as the 1994 populations provided by ABAG. If these recent trends (since 1990) continue, growth projected for the year 2000 will be approximately 6 percent lower than published by ABAG.
14. Abbreviations used include:
    gpad: gallons per acre per day.
    gpcd: gallons per capita per day.
    gpdpdu: gallons per day per dwelling unit
    gpdhh: gallons per day per household

Subarea Calculations

1. Water demand was calculated for residential and non-residential uses. Conservation savings were subtracted, and unaccounted for water was added to the subtotals. Major Industrial demand was then added to the subtotal. Next, average river diversions and conveyance losses for the entire system were added to the total to achieve Average Annual Demand for each of the Service Areas.
2. Demands prepared for Bay Point (West Pittsburg) were calculated based on the application of a 150 gpcd rate to population, consistent with the method utilized for the RWSA. Non-residential customers were included in this unit rate. Conservation and unaccounted for water (7%) were applied to the final result.
3. Demands prepared for Antioch were calculated based on the application of a 141 gpcd rate to population. This is a weighted number developed from Zones I-IV (City of Antioch water zones). Non-residential acreage (except commercial, which was included in the per capita, and major industrial lands attributed to Gaylord) was then multiplied by water use factors and combined with the residential/commercial demand figure. Conservation and unaccounted for water are included in the Antioch consumption rate.
4. Demands prepared for the Future Urban Areas in Antioch were calculated based on the application of a 137 gpcd rate to population. Non-residential acreage (except commercial which was included in the per capita) was then multiplied by water use factors and combined with the other demand figure. Conservation and UAW are included within the consumption rate.
5. Demands prepared for Pittsburg were calculated based on the application of a 180 gpcd rate to population. Non-residential customers were included in this rate. Conservation and UAW (7%) estimates were applied to the subtotal.

Exhibit A-5 (Continued)
List of Assumptions
for FWSS Water Demand Projections

6. Demands prepared for Oakley, Hotchkiss Tract and Bethel Island were calculated based[2] on the application of a 197 gpcd rate to population. Non-residential acreage (except major industrial lands attributed to DuPont) was then multiplied by water use factors and combined with the other demand figure. Conservation and UAW (6.2%) estimates were then applied to the subtotal.
7. Demands prepared for RWSA Unincorporated were calculated based on the application of a 197 gpcd rate to population. Non-residential acreage (except those major and minor industrial lands mentioned previously) was then multiplied by water use factors and combined with the residential demand figure. Conservation and UAW (7%) estimates were then applied to the subtotal.
8. Demands prepared for Discovery Bay were calculated based on the application of a 264 gpcd rate to population. Non-residential customers were included within the per capita figure. Conservation and UAW (8.5%) estimates were then applied to the subtotal.
9. Demands prepared for Brentwood and Cowell Ranch were calculated based on the application of a 164 gpcd rate to population. Non-residential customers were included in this rate. Conservation and UAW (14% for Brentwood and 8.5% for Cowell) estimates were then applied to the subtotal.
10. Demands prepared for the communities of Knightsen, Byron, East County Airport, Veale Tract and the Unincorporated areas inside and outside of the Urban Limit Line were calculated based on the application of a 197 gpcd rate to population. Non-residential acreage was then multiplied by water use factors and combined with the residential demand figure. Conservation and UAW (8.5%) estimates were then applied to the subtotal.

A-10

Water Use Factors

1. Water Use Factors (WUFs) were developed by CCWD based on gross acres.
2. All land areas are assumed to be ultimately developed within the limits of their land use range.
3. WUFs are based on the 1991 General Plan designation of County land use and assume that existing open space, such as Lime Ridge, Black Diamond Mines Regional Park, etc., will remain as such, and require no additional water demand during the study period.
4. Concord Naval Weapons Station (CNWS) was assigned its current demand number of 380 ac-ft/year for each decade of the study.

2 Diablo Water District's (DWD) Master Plan (February 1991) used an average 560 gallons per day per dwelling unit (gpdpdu), and showed data for the 1984-1990 period which ranged from 538 to 616 gpdpdu. The Master Plan average of 560 gpdpdu has been used in this Study in the analysis of DWD's demands. However, a recent analysis that takes into account 1988 through 1994 found an average of 515 gpdpdu (M. Yeraka, DWD, 1995, personal communication). While the Master Plan values have been used in the FWSS, DWD currently uses the lower figure. The effect of using the lower figure on the results of the FWSS would be small and would not affect the conclusions.

Raw Water Service Area and Other Areas

Residential

- Historic and Projected Population
- Historic and Projected Consumption Rates

Non-Residential

- Land Acreage by Land Use Designation (1991 County General Plan)
- Water Use Factors (developed by the District)

Major Industrial Customers

- Historical Consumption over the period 1984-1993

HISTORICAL CONSUMPTION DATA

The following is a review of historical water consumption rates, existing District data, and summaries of the latest ABAG projections. The information and assumptions describe the major quantitative history of the CCWD system's production and sales. Where possible, a graphic representation of the key data is followed by the numerical backup. The data are first presented at the summary level, and followed by more detail as necessary. The 20-year period, 1974 to 1993, was selected as the most representative and comprehensive period for presenting historical data; the period is sufficient to develop assumptions for projections of demand, and for other concerns such as conservation savings estimates, seasonal variations, and water-year type adjustments. For some consumption rates, such as those analyzing the major categories, data was not available for the period 1974-1977, in which case only the 16-year period was shown.

Water Production

The major data source was the District's measurements at Pumping Plant No. 1, but production and sales data for the Bollman water treatment plant, Mallard Slough, and river diversions by others, are also included in order to more fully describe the system.

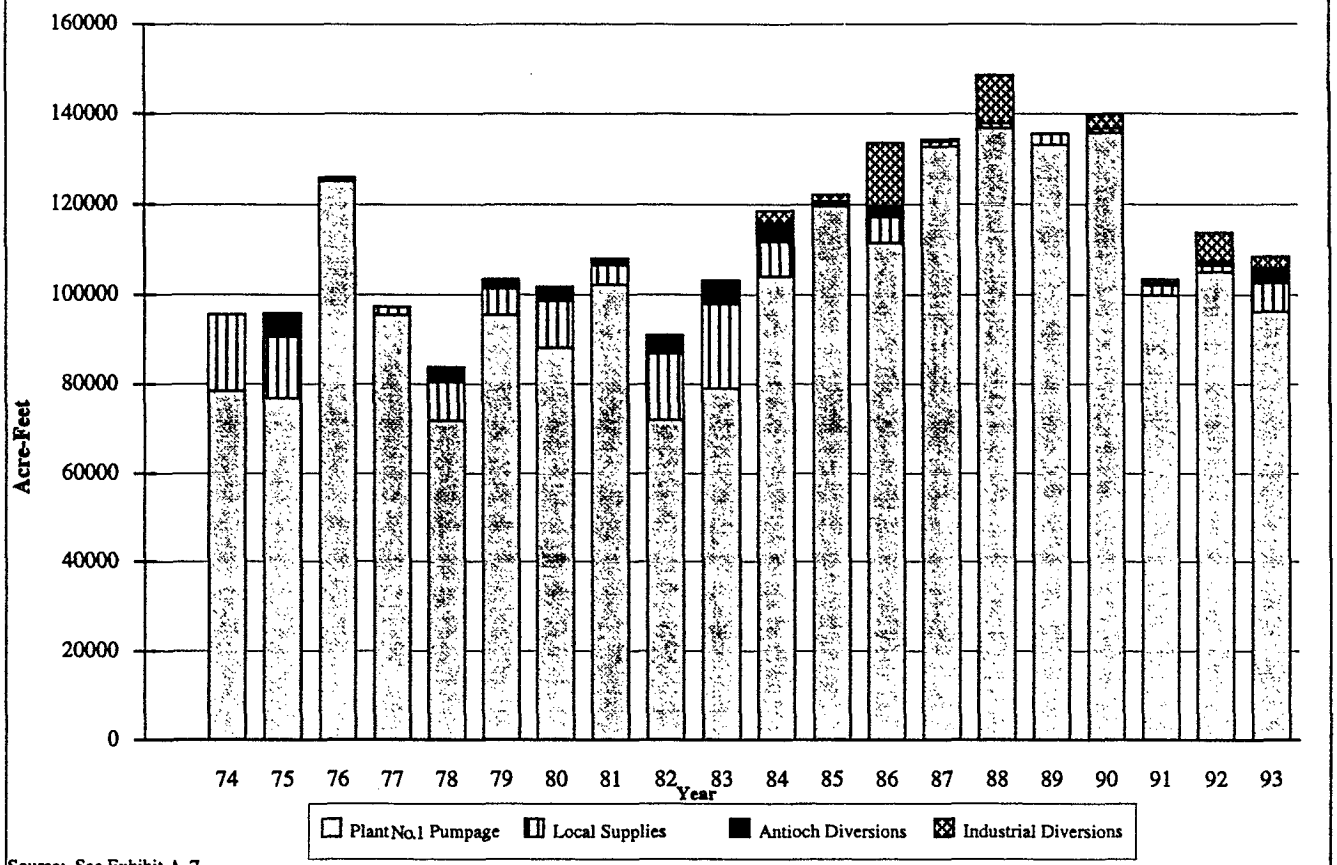
During the historical period, 1974-1993, production at Plant No. 1 has ranged from approximately 72,000 acre-feet per year to a peak of approximately 137,000 acre-feet, but has declined in recent years to less than 100,000 acre-feet. The annual average was almost 103,000 acre-feet during the period. Major municipal customers, including the Treated Water Service Area (TWSA) and the cities of Antioch, Pittsburg and Martinez, received more than half of the water produced at Plant No. 1 during the period. Industrial users such as Tosco, Posco, Shell and Gaylord received about a third of the Plant No. 1 production, with less than six percent going to minor municipal, minor industrial customers, and other uses. The remaining 10 percent is unaccounted water, or UAW. Exhibits A-6 and A-7 illustrate Plant No. 1 pumpage as a portion of total local supplies for the period.

The Bollman water treatment plant treats less than a third of the water measured at Plant No. 1, with more than three-quarters of the Bollman-treated water going to residential customers within the TWSA.

River Diversions

The historical production measured at Plant No. 1 reflects the major supply of the existing District system. Water is also diverted from the river by cities such as Antioch, and industries such as Gaylord Container, on an irregular basis for which measurements are not as comprehensive. The City of Antioch has water rights and current capability to pump an amount up to 9,300 acre-feet per year. However, the amount of diversions is directly linked to water quality, and during a critical year, the city often does not divert water at all. Over the past 19 years, the City of Antioch's diversions have averaged 2,058 acre-feet per year. Gaylord Container reported diversions of 10,600 ac-ft/

Exhibit A-6
Historical Water Supplies (Acre-Feet/Yr)
1974 to 1993 (20 years)



Source: See Exhibit A-7

Exhibit A-7
Historical Water Supplies (Acre-Feet/Yr)
1974 to 1993 (20 years)

Year	Plant No. 1 Pumpage	Local Supplies: Mallard Slough	Local Supplies: Mallard Wells	Total Local Supplies	River Diversions: City of Antioch	River Diversions: Industrial Diversions	Total River Diversions
1974	78,446	17,179	0	17,179	n/a	n/a	0
1975	76,756	13,775	0	13,775	5,377	n/a	5,377
1976	125,118	0	0	0	840	n/a	840
1977	95,567	0	1,700	1,700	0	n/a	0
1978	71,757	7,511	1,120	8,631	3,332	n/a	3,332
1979	95,508	4,632	1,120	5,752	2,106	n/a	2,106
1980	88,130	9,337	1,120	10,457	3,090	n/a	3,090
1981	102,181	4,183	0	4,183	1,395	n/a	1,395
1982	71,867	14,889	0	14,889	4,229	n/a	4,229
1983	79,017	18,867	0	18,867	5,189	n/a	5,189
1984	103,929	7,535	0	7,535	4,408	2,651	7,059
1985	119,644	157	0	157	1,049	1,338	2,387
1986	111,337	5,770	0	5,770	2,756	13,760	16,516
1987	132,799	64	960	1,024	440	7,071	7,511
1988	136,864	0	960	960	0	10,638	10,638
1989	133,224	1,436	960	2,396	0	6,630	6,630
1990	135,733	0	960	960	0	7,830	7,830
1991	99,870	536	1,700	2,236	529	803	1,332
1992	104,926	491	960	1,451	1,234	6,530	7,764
1993	96,284	6,290	a.	7,250	3,132	2,534	5,666
Averages	**102,948**	**5,633**	**626**	**6,259**	**2,058**	**5,979**	**4,945**

Sources:
Plant No. 1 Pumpage, 1974 to 1993: CCWD O&M Dept Contra Costa Canal Water Supply History.
Mallard Slough: TM# 4.1, Exhibit 4.1-3, CCWD's O&M Department, Water Operations Section.
Mallard Wells: Local Supplies less Mallard Slough production. Foster Wheeler is the primary user at 960 acre feet per year.
Local Supplies: CCWD's Water Conservation Plan, Appendix A, p. A-11, January 1995.
River Diversions, Antioch: Letter from S.E. Davis, City of Antioch Director of Public Works to W.F. Anton, CCWD, dated September 6, 199
CCWD Memo, "Historical Use Calculation for USBR" dated December 15, 1995.
River Diversions, Industrial: See Exhibit A-9
River Diversions, Total: Sum of City of Antioch diversions and known Industrial diversions.
Total Supplies: Sum of Plant No. 1 pumpage, Local Supplies and River Diversions.

A-1

yr in 1988 and then nothing until 1991 through 1993 when 783, 783, and 2,345 ac-ft/year were reported, respectively. These occurrences appear to bridge the latest drought, and may be sporadic due to the river water quality in critically dry years. Exhibit A-8 and its accompanying data table, Exhibit A-9, display most of the presently known data available on the river diversions.

Due to high chlorides and regulatory restrictions on water quality, the Mallard Slough has supplied less than one percent of the District's water over the past several years (1987 through 1992). In 1993, however, approximately 6,300 acre-feet of river water was conveyed to the Mallard Reservoir for treatment at Bollman. Over the 20-year period, water diversions from Mallard Slough ranged from zero in 1976-1977, 1988, and 1990, to as high as 18,867 acre-feet in 1983. Diversions averaged 5,633 acre-feet over the 20-year period. Over the past 26 years, however, diversions from Mallard Slough have averaged 6,510 acre-feet.

Type of Use and Major Demand Categories

Municipal and Industrial uses, as shown in Exhibits A-10 and A-11 account for the largest demand. Agricultural demand for water has been steadily decreasing, and since 1985 has generated less than one percent of total demand.

Water Sales measured at Plant No. 1 were aggregated into four major categories defined as major municipal, major industrial, minor industrial and other. Exhibits A-12 and A-13 show the largest user group over the 20-year period is the major municipal, which includes the TWSA and the raw water municipal sales areas of Antioch, Martinez, Pittsburg, Bay Point and the Diablo Water District. Exhibit A-14 shows the detailed sales history for customers off the Contra Costa Canal.

Treated Water Service Area Production and Sales

Exhibit A-15 is a graphical summary of the numerical data displayed in Exhibit A-16. The TWSA sales quantities are split into six customer groups (residential, commercial, irrigation, industrial, public authorities, and fire and temporary uses); the difference between sales and production is defined as UAW.

A-14

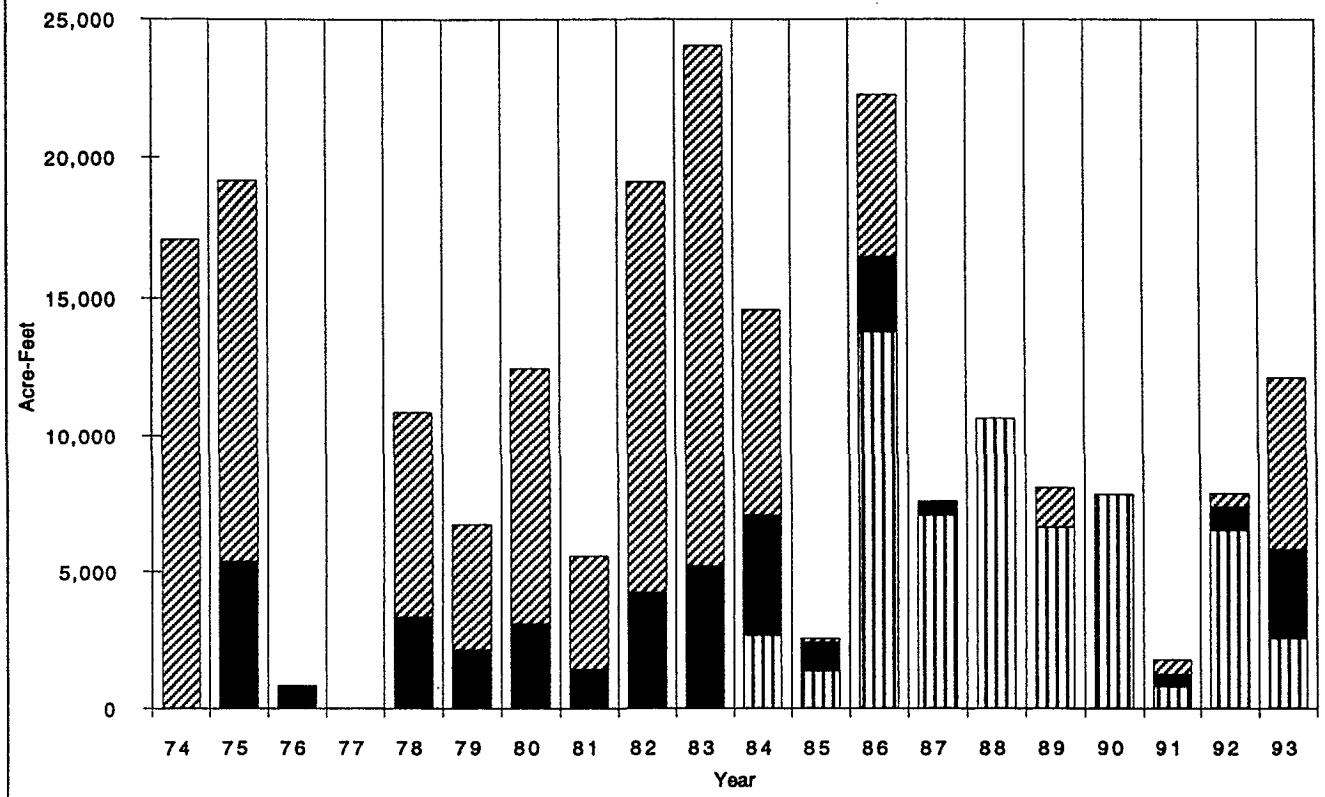
Exhibit A-17 provides a further breakdown of the treated water customer groups displayed in the earlier exhibits, but only for the recent years of 1988 through 1993, because of data availability. Of the total water sales in 1993, 55 percent was used by residential single-family customers. Multiple-family customers were the next largest group (17 percent) followed by commercial customers (12 percent). The remaining seven categories show relatively small amounts of consumption.

Population Trends and Projections

Population and household estimates and projections for the State, the Bay Area and Contra Costa County were reviewed to place the District's historical and projected growth into perspective. The population and household numbers available at this time indicate a significant amount of potential growth. Between 1990 and 2010, Contra Costa County is expected to add more households than any other county in the Bay Area, amounting to almost 21 percent of total household growth in the region during the period. The communities, wholly and partially within the District study area, will account for almost two-thirds of the county's growth. These trend relationships have been extended to the year 2040, and more precisely defined for each service area alternative, following the data/mapping integration in the GIS process, and with the assistance of the appropriate communities.

Regional and county projections are presented in Exhibit A-18, and display summary population estimates and projections for the State, the Bay Area, and Contra Costa County from 1970 to 2040. Contra Costa County is expected to continue providing a majority of the new housing opportunities in the Bay Area. Exhibit A-19 graphically displays growth for Contra Costa County representing significant and steady growth into the future. Exhibits A-20 through A-23 display ABAG's population and household projections, and annual growth rates for each of the communities and subareas defined by ABAG for Contra Costa County. Exhibit A-24 displays the household density (persons per household) values for those same communities. East County household sizes are projected to remain larger than the County average.

Exhibit A-8
Historical Known Diversions



Source: See Exhibit A-9

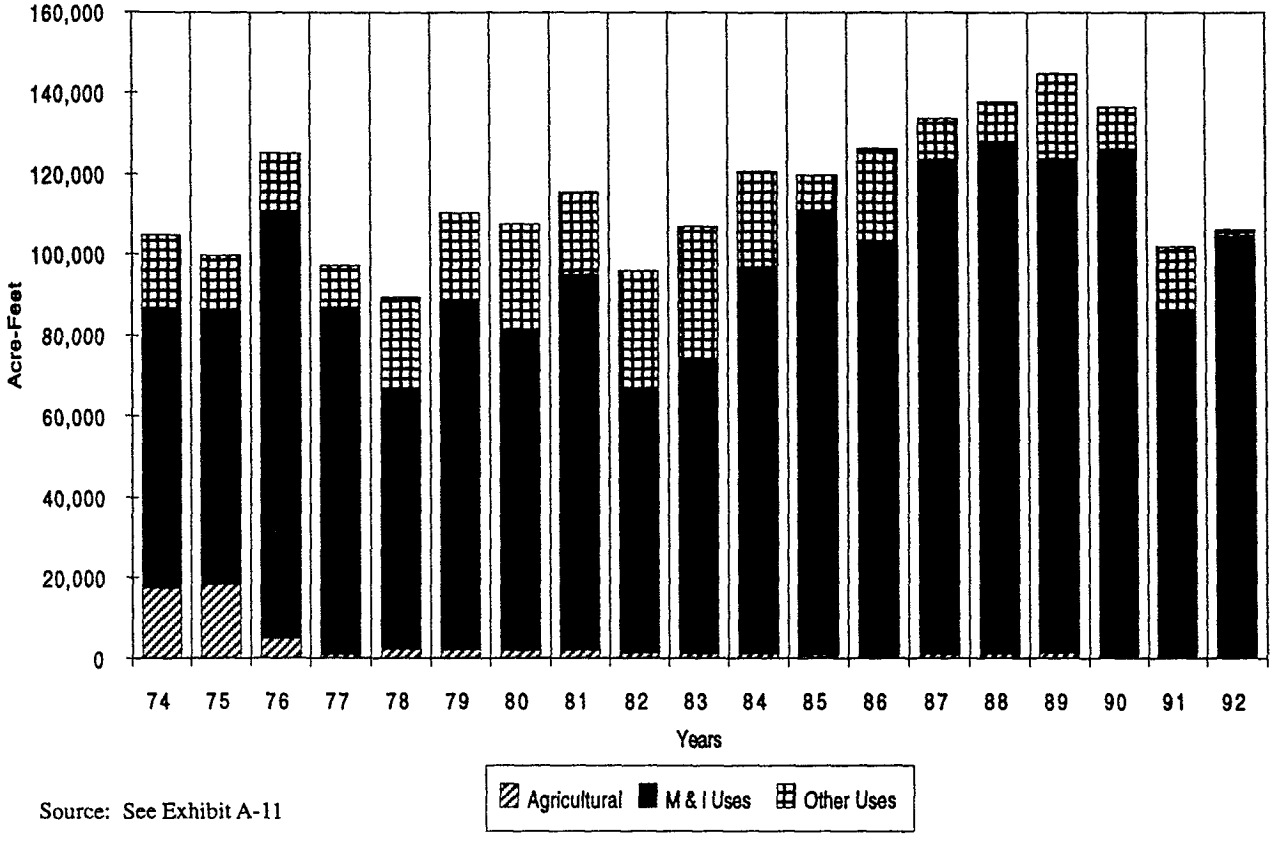
Exhibit A-9
Known River Diversions & Water Rights (Acre-Feet)
1974 to 1993 (20 years)

Year	Water Year Type					Total Known Industrial Diversions [1]	City of Antioch Diversions	Mallard Slough Diversions	Total City of Antioch, Mallard Slough & Known Industrial Diversions
Water Rights		28,000	16,650			44,650	9,300	26,700	80,650
1974	Wet					0		17,179	17,179
1975	AN					0	5,377	13,775	19,152
1976	Crit								
1977	Crit								
1978	Wet					0	3,332	7,511	10,843
1979	Dry					0	2,106	4,632	6,738
1980	Wet								
1981	Dry								
1982	Wet					0	4,229	14,889	19,118
1983	Wet					0	5,189	18,867	24,056
1984	Wet								
1985	Dry								
1986	Wet		860	12,900	28	13,788	2,756	5,770	22,314
1987	Crit	7,040	0		31	7,071	440	64	7,575
1988	Crit								
1989	BN								
1990	Crit	4,630		3,200	38	7,868	0	0	7,868
1991	Crit	783			20	803	529	536	1,868
1992	Crit								
1993	Wet								

1. Includes additional diversions by DuPont see Exhibit A-56.

Sources:
Water rights: See Chapter 4 in the FWSS Report.
Antioch, 1974: Not available
Antioch, 1975 to 1993: Letter from S.E. Davis, Antioch Director of Public Works to W.E. Anton, CCWD, dated September 6, 1994. (Converted from MGY).
Gaylord Container, 1974 to 1986: Not available.
Gaylord Container, 1988: SWRCB, Division of Water Rights. Personal communication (S. Okada) September 1994, but unconfirmed by Gaylord.
Gaylord Container, 1989-1990: Personal communication (C. Muma) on 11/29/95, 12/7/95 and 1/18/96, shown for completeness, not needed in projection methodology.
Gaylord Container, 1991 to 1993: E-Mail Message from Bill Zenoni to Art Jensen, November 3, 1994. (Converted from MG data for fiscal year ending October 30)
Tosco, 1974 to 1983 and 1989 to 1993: Not available. CCWD Memo "Historical Use Calculation for USBR", dated December 15, 1994.
Tosco, 1984 to 1986: SWRCB. Personal communication (R. Duff) September 1994. (Converted and rounded from MGY.)
Tosco, 1987 and 1988: Los Vaqueros Project Memo from Bill Blackmer to John Gregg, October 15, 1990.
USS-Posco, 1974 to 1985, 1987 to 1989, 1991 and 1993: Not available.
USS-Posco, 1986 and 1990: Steel Mill Modernization Draft EIR, January 1992.(Converted from gpm data)
USS-Posco, 1992: DDSD/CCWD Industrial Water Recycling Project, May 1993. (Converted from MGD data for "current year".)
DuPont, Updated from Mike Yeraka, Diablo Water District, 12/6/94 and 7/96.
DuPont, 1984-1993 River Diversions, SWRCB, Division of Water Rights. Personal communication (S. Okada), December, 1994.
Mallard Slough: TM #4.1, Exhibit 4.1-3, CCWD's O&M Dept, Water Operations Section.
Water Year Type, 1974 to 1986: SWRCB's Decision 1485 classifications; 1987 to 1993: G.Gartrell, CCWD

Exhibit A-10
Historical Water Uses (Acre-Feet)
1974 to 1993 (20 years)



Source: See Exhibit A-11

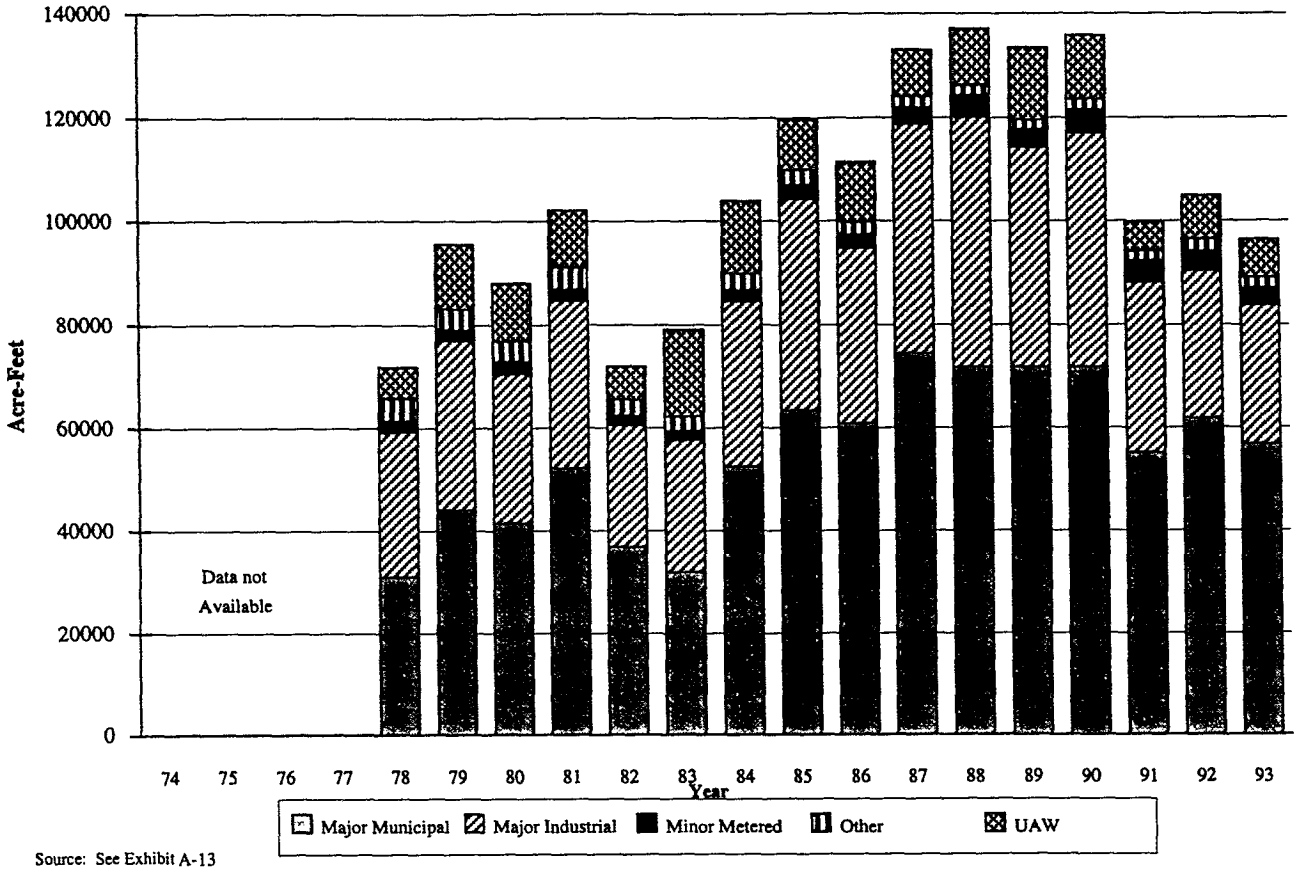
Exhibit A-11
Historical Water Uses (Acre-Feet)
1974 to 1993 (20 years)

Year	Agricultural Uses	M & I Uses	Other Uses	Total Uses
1974	17,463	69,437	17,925	104,825
1975	18,278	68,122	13,331	99,731
1976	4,924	105,076	15,118	125,118
1977	1,000	86,000	10,267	97,267
1978	2,395	64,323	22,870	89,588
1979	2,143	86,634	21,683	110,460
1980	1,935	79,423	26,429	107,787
1981	2,104	92,876	20,584	115,564
1982	1,391	65,410	29,155	95,956
1983	1,149	72,382	33,553	107,084
1984	1,239	95,569	23,856	120,664
1985	895	110,284	8,622	119,801
1986	614	102,957	22,736	126,307
1987	992	122,493	10,408	133,893
1988	998	126,546	10,320	137,864
1989	1,259	122,398	21,163	144,820
1990	659	125,463	10,571	136,693
1991	505	85,501	16,100	102,106
1992	326	104,439	1,612	106,377
Averages	**3,172**	**93,965**	**17,700**	**114,837**

Notes & Sources

Other uses includes canal/systems losses, EBRPD use, and well and river diversion uses.
Totals in this table differ from those shown in Exhibit A-13. Totals shown in this table reflect "historical water use" as defined by the USBR contract.
CCWD's Final Water Conservation Plan, Appendix A, p. A-12, January 1995.

Exhibit A-12
Water Production and Sales by Major Customer Group at Plant No. 1 (Acre-Feet)
1978-1993



Source: See Exhibit A-13

Exhibit A-13
Water Pumpage and Sales by Major Customer Group at Plant No. 1 (Acre-Feet)
1974 to 1993 (20 years)

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Plant No. 1 Pumpage	78,446	76,756	125,118	95,567	71,757	95,508	88,130	102,181	71,867	79,017
Unaccounted					5,925	12,287	11,241	10,969	6,375	16,791
Percent Unaccounted					8.3%	12.9%	12.8%	10.7%	8.9%	21.2%
Annual Water Sales					65,832	83,222	76,889	91,212	65,492	62,226
Major Municipal					30,939	44,040	41,408	52,233	36,771	31,956
Major Industrial					28,305	32,956	29,100	32,666	23,706	25,604
Minor Metered					2,143	1,994	2,264	2,023	1,781	1,762
Other					4,444	4,232	4,117	4,290	3,234	2,904

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Plant No. 1 Pumpage	103,929	119,644	111,337	132,799	136,864	133,224	135,733	99,870	104,926	96,284
Unaccounted	13,957	9,767	11,456	8,821	10,809	13,666	12,254	5,832	8,616	7,324
Percent Unaccounted	13.4%	8.2%	10.3%	6.6%	7.9%	10.3%	9.0%	5.8%	8.2%	7.6%
Annual Water Sales	89,972	109,877	99,881	123,978	126,055	119,559	123,479	94,038	96,310	88,960
Major Municipal	52,440	63,282	60,759	74,377	71,618	71,648	71,610	55,034	61,807	56,649
Major Industrial	32,275	41,132	33,969	44,387	48,448	42,474	45,394	33,124	28,495	27,093
Minor Metered	1,949	2,576	2,608	3,101	3,969	3,527	4,406	3,983	3,664	3,194
Other	3,309	2,886	2,545	2,113	2,020	1,909	2,069	1,897	2,345	2,024

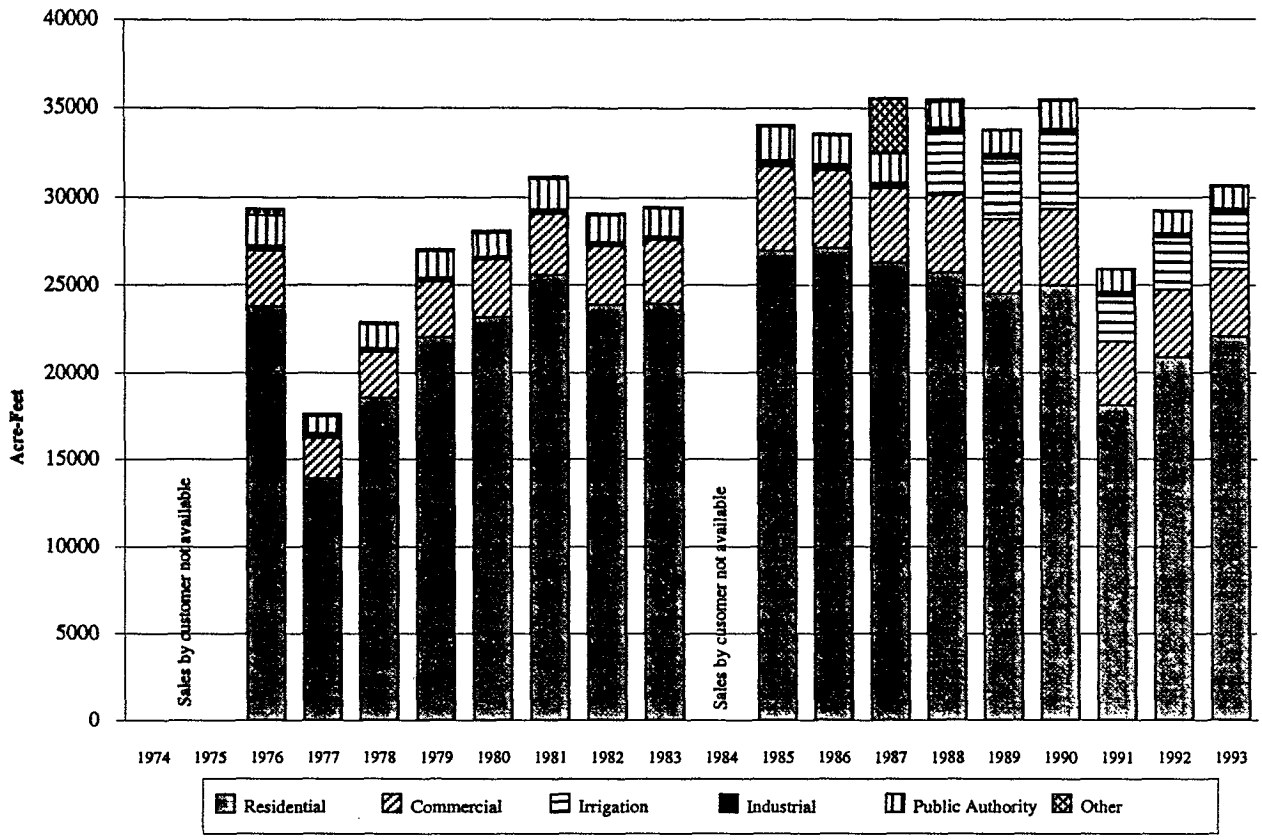
Notes and Sources:
Plant No. 1 Pumpage, 1974 to 1993: CCWD O&M Dept., Contra Costa Canal (monthly) Water Supply History.
Annual Water Sales data by Customer Groups, 1974 to 1977 are not available.
Annual Water Sales data by Customer Groups, 1978 to 1989: (annual) Raw Water Sales in Acre-Feet Report, May 14, 1990.
Annual Water Sales data by Customer Groups, 1990 to 1993: (monthly) Raw Water Sales in Acre-Feet Report spreadsheets for each year.
Unaccounted water equals Plant No. 1 Pumpage minus Sales.

Exhibit A-14
Water Sales by Customer and Customer Group at Plant No. 1 (Acre-Feet)
1978 to 1993

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Total Sales	**65,832**	**83,222**	**76,889**	**91,212**	**65,492**	**62,226**	**89,972**	**109,877**	**99,881**	**123,978**	**126,055**	**119,559**	**123,479**	**94,038**	**96,310**	**88,960**
Major Municipal	**30,939**	**44,040**	**41,408**	**52,233**	**36,771**	**31,956**	**52,440**	**63,282**	**60,759**	**74,377**	**71,618**	**71,648**	**71,610**	**55,034**	**61,807**	**56,649**
Treated Water	17,449	25,867	23,661	31,014	19,592	15,646	31,594	38,725	36,122	44,364	40,750	39,176	37,852	27,399	33,128	27,826
Treated Water (24")	7,864	7,931	12,875	11,968	11,884	9,617	14,127	17,054	18,511	25,950	19,938	19,026	12,239	9,376	10,526	16,468
Treated Water (30")	9,586	17,936	10,786	19,046	7,708	6,029	17,467	21,671	17,611	18,414	20,812	3,831	6,784	16,815	22,603	11,358
Treated Water (36")	0	0	0	0	0	0	0	0	0	0	0	16,319	18,829	1,208	0	0
Raw Water	13,490	18,173	17,747	21,219	17,180	16,311	20,846	24,557	24,638	30,013	30,868	32,472	33,758	27,635	28,678	28,823
Bay Point #1	787	1,017	973	1,193	1,551	1,360	1,575	1,403	1,435	1,763	1,993	2,273	2,294	2,096	2,158	1,643
Bay Point #2	493	398	507	456	475	662	612	807	676	659	371	328	391	239	3	15
City of Antioch	1,756	4,740	3,463	6,092	2,796	1,734	3,959	7,469	6,636	10,561	10,995	10,709	12,384	10,515	11,018	9,842
City of Martinez	3,560	3,928	4,160	4,509	4,404	4,573	5,160	5,126	5,212	5,505	5,177	5,028	5,205	3,958	3,800	4,101
Diablo (Oakley) Water	2,270	2,537	2,375	2,304	1,781	1,757	2,285	2,295	2,685	3,026	3,474	4,058	4,460	3,216	3,749	4,519
City of Pittsburg #1	2,436	3,617	3,257	3,456	3,420	3,254	3,981	3,775	4,267	4,957	4,292	5,816	5,966	3,144	3,933	3,425
City of Pittsburg #2	2,189	1,936	3,012	3,209	2,754	2,971	3,274	3,682	3,729	3,543	4,567	4,262	3,059	4,469	4,018	5,277
Major Industrial	**28,305**	**32,956**	**29,100**	**32,666**	**23,706**	**25,604**	**32,275**	**41,132**	**33,969**	**44,387**	**48,448**	**42,474**	**45,394**	**33,124**	**28,495**	**27,093**
Minor Metered	**2,143**	**1,994**	**2,264**	**2,023**	**1,781**	**1,762**	**1,949**	**2,576**	**2,608**	**3,101**	**3,969**	**3,527**	**4,406**	**3,983**	**3,664**	**3,194**
Minor Municipal	1,038	891	917	1,034	865	858	1,176	1,093	1,127	1,269	1,205	1,019	1,296	1,115	1,310	1,222
Minor Industrial	1,105	1,103	1,347	989	916	904	773	1,484	1,481	1,832	2,764	2,508	3,110	2,868	2,354	1,973
Other	**4,444**	**4,232**	**4,117**	**4,290**	**3,234**	**2,904**	**3,309**	**2,886**	**2,545**	**2,113**	**2,820**	**1,909**	**2,069**	**1,897**	**2,345**	**2,824**
Groups & Ass'ns	983	1,023	1,103	1,102	750	698	934	866	854	925	740	664	696	491	628	575

Source: CCWD Finance Department

Exhibit A-15
Treated Water Service Area Sales (Acre-Feet)
1974 to 1993 (20 years)



Source: See Exhibit A-16.

Exhibit A-16
Treated Water Service Area Production & Sales (Acre-Feet)
1974 to 1993

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Treated Water Production	**26,718**	**28,553**	**31,315**	**18,287**	**26,595**	**28,522**	**29,431**	**32,945**	**30,876**	**31,788**
Unaccounted for Water	1,777	2,391	1,930	644	3,686	1,424	1,258	1,783	1,728	2,289
Percent Unaccounted	6.7%	8.4%	6.2%	3.5%	13.9%	5.0%	4.3%	5.4%	5.6%	7.2%
Sales By Customer Class	**24,941**	**26,162**	**29,385**	**17,643**	**22,909**	**27,098**	**28,172**	**31,161**	**29,148**	**29,498**
Residential			23,808	13,874	18,545	22,059	23,216	25,564	23,904	23,962
Commercial			3,182	2,372	2,655	3,127	3,259	3,557	3,367	3,661
Irrigation			Prior to 1988, irrigation use is included in appropriate customer group.							
Industrial			313	261	218	215	181	246	230	227
Public Authorities			1,743	1,016	1,406	1,553	1,396	1,673	1,544	1,593
Fire and Temporary			338	120	86	144	120	123	104	55

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Treated Water Production	**36,538**	**37,017**	**38,174**	**39,208**	**36,333**	**35,486**	**37,155**	**28,314**	**32,837**	**33,709**
Unaccounted	2,710	2,931	4,563	3,686	896	1,645	1,697	2,400	3,523	3,041
Percent Unaccounted	7.4%	7.9%	12.0%	9.4%	2.5%	4.6%	4.6%	8.5%	10.7%	9.0%
Sales By Customer Class	**33,828**	**34,086**	**33,610**	**35,522**	**35,436**	**33,841**	**35,458**	**25,914**	**29,314**	**30,667**
Residential		26,991	27,132	26,285	25,705	24,508	24,978	18,159	20,911	22,084
Commercial		4,775	4,410	4,241	4,450	4,306	4,410	3,655	3,818	3,830
Irrigation		included by customer			3,462	3,376	4,214	2,581	3,047	3,271
Industrial		362	347	304	344	298	285	239	246	233
Public Authorities		1,918	1,663	1,676	1,360	1,329	1,498	1,249	1,246	1,212
Fire and Temporary		40	58	3,017	117	25	74	31	46	37

Notes and Sources:

Production totals (1974 to 1990) at Bollman are from Final Treated Water Master Plan, Table 4-1, August 1994. (Millions of gallons)

Production totals (1991 to 1993) at Bollman as shown in the Final Treated Water Master Plan, Table 4-1, August 1994, have been revised.
The 1991-93 totals were adjusted 11/10/94 by C. Scott, CCWD, because of master production meter errors.

Sales data by customer for 1974, 1975 and 1984 are not available. Total sales are from Final Treated Water Master Plan, Table 4-1, August 1994.

Sales data by customer for 1976 thru 1987 are from the Urban Water Management Plan, App. F, January 1991. (Original units were millions of gallons.)

Sales data by customer for 1988 thru 1993 are from CCWD's Final Treated Water Master Plan, Table 4.3, August 1994 (Original units were millions of gallons)

Conversions and other calculations include numbers to decimal places not shown.

Unaccounted water equals total treated water production minus sales.

Exhibit A-17
Treated Water Service Area Sales by Customer Category (Bollman)
1988 to 1993

Acre-Feet per Year	1988	1989	1990	1991	1992	1993	6-yr Average
Total Sales	**35,436**	**33,843**	**35,460**	**25,916**	**29,316**	**30,671**	**31,774**
Residential Single Units	20,114	19,159	19,508	13,285	15,737	16,757	17,427
Residential Multiple Units	5,592	5,350	5,471	4,875	5,174	5,330	5,298
Residential Irrigation	2,128	2,091	2,192	1,399	1,647	1,702	1,860
Commercial	4,449	4,306	4,412	3,656	3,819	3,829	4,078
Com'l & Ind'l Irrigation	821	816	1,519	884	941	989	995
Industrial	343	297	285	239	245	234	274
Public Authorities	1,358	1,330	1,497	1,249	1,247	1,212	1,316
Public Authority Irrigation	515	467	503	299	460	581	471
Private Fire Protection	*0*	*0*	*0*	*0*	0	*0*	0
Temporary Service	116	26	74	31	45	37	55

Percent Distribution	1988	1989	1990	1991	1992	1993	6-yr Average
Total Sales	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Residential Single Units	57%	57%	55%	51%	54%	55%	55%
Residential Multiple Units	16%	16%	15%	19%	18%	17%	17%
Residential Irrigation	6%	6%	6%	5%	6%	6%	6%
Commercial	13%	13%	12%	14%	13%	12%	13%
Com'l & Ind'l Irrigation	2%	2%	4%	3%	3%	3%	3%
Industrial	1%	1%	1%	1%	1%	1%	1%
Public Authorities	4%	4%	4%	5%	4%	4%	4%
Public Authority Irrigation	1%	1%	1%	1%	2%	2%	1%
Private Fire Protection	0%	0%	0%	0%	0%	0%	0%
Temporary Service	0%	0%	0%	0%	0%	0%	0%

A-24

Source:
TWSA annual spreadsheets (converted from HCF data), 13 March 1994
CCWD Finance Department.

Exhibit A-18
Population Estimates and Projections
California, Bay Area, Contra Costa County
1970-2040 (Thousands)

Population Growth in 10-Year Increments

Region	1970	1980	1990	2000	2010	2020	2030	2040
California (a)	20,039	23,782	29,976	36,444	42,408	48,977	56,100	63,343
Bay Area (a)	4,639	5,197	6,052	6,967	7,544	8,032	8,468	8,766
Bay Area (b)	4,631	5,180	6,021	6,875	7,533	[redacted]		
Contra Costa (a)	558	659	810	971	1,096	1,213	1,318	1,413
Contra Costa (b)	556	656	804	969	1,105	[redacted]		

Annual Growth Rates in 10-Year Increments

Region	1970 to 1980	1980 to 1990	1990 to 2000	2000 to 2010	2010 to 2020	2020 to 2030	2030 to 2040
California (a)	1.73%	2.34%	1.97%	1.53%	1.45%	1.37%	1.22%
Bay Area (a)	1.14%	1.53%	1.42%	0.80%	0.63%	0.53%	0.35%
Bay Area (b)	1.13%	1.52%	1.34%	0.92%	[redacted]		
Contra Costa (a)	1.68%	2.10%	1.83%	1.22%	1.02%	0.84%	0.70%
Contra Costa (b)	1.67%	2.05%	1.88%	1.32%	[redacted]		

Notes:

DOF projections are as of July 1 each year. ABAG data are as of April 1.
Most estimates and projections are to additional decimal places not shown.

Sources:

(a) CA and Bay Area: 1970-1990: California Statistical Abstract 1993.
CA and Bay Area: 1990-2040: California Dept of Finance, Report 93P-1, April 1993
(b) Bay Area: 1980-2010: ABAG's Projections '94, December 1993.
Bay Area: 2010-2040: Data not available

Exhibit A-18 (Continued)
Population Estimates and Projections
California, Bay Area, Contra Costa County
1970-2040 (Thousands)

Population Growth in 10-Year Increments (DOF)

Bay Area Counties	1970	1980	1990	2000	2010	2020	2030	2040
Alameda	1,073,000	1,109,500	1,282,400	1,457,400	1,561,900	1,664,000	1,756,500	1,816,500
Contra Costa	557,500	658,500	810,300	971,300	1,096,300	1,212,800	1,318,200	1,413,000
Marin	207,000	222,700	231,200	248,600	245,500	240,000	230,200	213,300
Napa	79,400	99,300	111,700	125,300	139,900	147,800	156,000	163,000
San Francisco	713,200	680,500	723,900	774,000	781,700	777,400	773,400	751,400
San Mateo	557,100	588,100	652,100	740,400	787,300	825,600	861,700	883,800
Santa Clara	1,072,600	1,300,200	1,502,200	1,703,900	1,839,700	1,958,600	2,064,100	2,130,700
Solano	172,500	237,200	345,700	477,700	557,400	625,300	687,800	743,100
Sonoma	206,500	301,400	392,000	468,600	534,300	580,900	620,300	651,500
Bay Area	4,638,800	5,197,400	6,051,500	6,967,200	7,544,000	8,032,400	8,468,200	8,766,300

Annual Growth Rates in 10-Year Increments (DOF)

Bay Area Counties	1970 to 1980	1980 to 1990	1990 to 2000	2000 to 2010	2010 to 2020	2020 to 2030	2030 to 2040
Alameda	0.34%	1.46%	1.29%	0.69%	0.64%	0.54%	0.34%
Contra Costa	1.68%	2.10%	1.83%	1.22%	1.02%	0.84%	0.70%
Marin	0.73%	0.38%	0.73%	-0.13%	-0.23%	-0.42%	-0.76%
Napa	2.26%	1.18%	1.16%	1.11%	0.55%	0.54%	0.44%
San Francisco	-0.47%	0.62%	0.67%	0.10%	-0.06%	-0.05%	-0.29%
San Mateo	0.54%	1.04%	1.28%	0.62%	0.48%	0.43%	0.25%
Santa Clara	1.94%	1.45%	1.27%	0.77%	0.63%	0.53%	0.32%
Solano	3.24%	3.84%	3.29%	1.55%	1.16%	0.96%	0.78%
Sonoma	3.85%	2.66%	1.80%	1.32%	0.84%	0.66%	0.49%
Bay Area	1.14%	1.53%	1.42%	0.80%	0.63%	0.53%	0.35%

Notes:
As of July 1 each year unless otherwise noted.

Sources:
Bay Area: 1970, 1980: California Statistical Abstract 1993.
Bay Area: 1990-2040: California Dept of Finance, Report 93P-1.

Exhibit A-18 (Continued)
Population Estimates and Projections
California, Bay Area, Contra Costa County
1970-2040 (Thousands)

Population Growth in 10-Year Increments (ABAG)

Bay Area Counties	1970	1980	1990	2000	2010	2020	2030	2040
Alameda	1,071,446	1,105,379	1,276,702	1,413,300	1,547,000			
Contra Costa	556,116	656,380	803,732	968,700	1,104,700			
Marin	208,652	222,568	230,096	253,600	270,300			
Napa	79,140	99,199	110,765	129,200	143,300			
San Francisco	715,674	678,974	723,959	784,400	819,000			
San Mateo	557,361	587,329	649,623	713,000	749,400			
Santa Clara	1,065,313	1,295,073	1,497,577	1,689,600	1,813,100			
Solano	171,989	235,203	340,421	454,700	546,800			
Sonoma	204,885	299,684	388,222	468,900	539,600			
Bay Area	4,630,576	5,179,789	6,021,097	6,875,400	7,533,200			

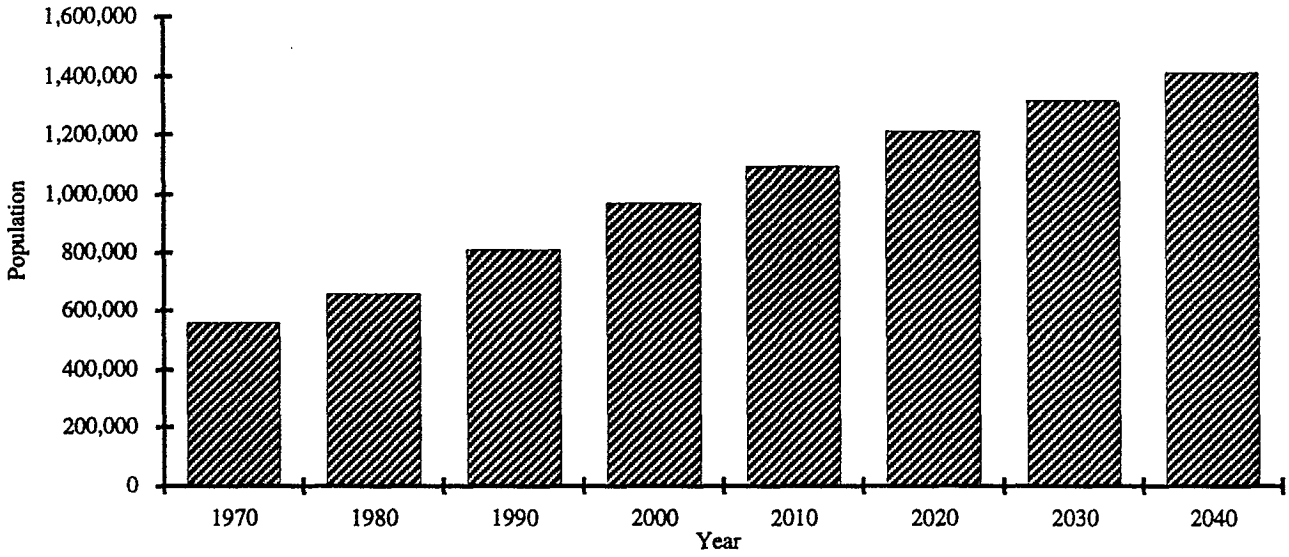
Annual Growth Rates in 10-Year Increments (ABAG)

Bay Area Counties	1970 to 1980	1980 to 1990	1990 to 2000	2000 to 2010	2010 to 2020	2020 to 2030	2030 to 2040
Alameda	0.31%	1.45%	1.02%	0.91%			
Contra Costa	1.67%	2.05%	1.88%	1.32%			
Marin	0.65%	0.33%	0.98%	0.64%			
Napa	2.28%	1.11%	1.55%	1.04%			
San Francisco	-0.53%	0.64%	0.81%	0.43%			
San Mateo	0.53%	1.01%	0.94%	0.50%			
Santa Clara	1.97%	1.46%	1.21%	0.71%			
Solano	3.18%	3.77%	2.94%	1.86%			
Sonoma	3.88%	2.62%	1.91%	1.41%			
Bay Area	1.13%	1.52%	1.34%	0.92%			

Notes:
As of April 1, each year.

Sources:
Bay Area: 1970: California Almanac, 4th Edition 1990.
Bay Area: 1980-2010: ABAG Projections '94, December 1993
Bay Area: 2020-2040: Projections not available.

Exhibit A-19
Population Trends: Contra Costa County
1970 to 2040



Source: Department of Finance, see Exhibit A-18

Exhibit A-20
Population Estimates and Projections
Cities and Unincorporated Areas within Contra Costa County
1980 to 2010

Communities	1980	1990	1995	2000	2005	2010
Antioch	44,195	63,062	76,700	93,500	106,300	113,200
Brentwood	6,785	9,815	14,100	24,000	33,200	43,700
Clayton	7,154	7,509	10,300	12,100	13,500	14,000
Concord	106,102	112,625	117,000	121,200	124,800	129,100
Martinez	30,822	39,432	42,300	43,900	44,800	45,500
Pittsburg	43,843	65,230	72,500	79,300	86,900	90,900
Pleasant Hill	30,089	38,429	41,400	42,400	43,000	43,800
Walnut Creek	70,544	72,989	75,700	77,900	79,700	81,100
Danville	29,479	31,617	36,600	40,600	43,200	46,400
El Cerrito	28,717	29,092	29,800	30,000	29,900	30,100
Hercules	6,826	16,839	19,900	21,700	22,700	23,600
Lafayette	24,003	25,091	25,900	26,000	26,400	27,200
Moraga	15,214	15,987	16,100	16,200	16,600	16,600
Orinda	16,223	16,642	17,100	17,300	17,400	17,900
Pinole	24,334	27,069	28,200	29,000	29,400	30,300
Richmond	88,889	101,287	109,500	114,000	118,500	119,200
San Pablo	23,010	28,569	29,700	32,000	32,600	33,400
San Ramon	20,245	35,403	40,600	41,900	43,800	46,500
Alamo-Blackhawk	10,413	21,225	24,900	25,800	25,900	26,000
Rodeo-Crockett	11,055	11,654	12,100	12,100	12,000	12,100
Rural East Contra Costa	14,056	29,111	37,900	48,700	63,000	79,500
Remainder	4,382	5,055	12,900	19,100	26,800	34,600
Contra Costa County	**656,380**	**803,732**	**891,200**	**968,700**	**1,040,400**	**1,104,700**

Source:
ABAG Projections '94

Exhibit A-21
Population Annual Growth Rates
Cities and Unincorporated Areas within Contra Costa County
1980 to 2010

Communities	1980 to 1990	1990 to 1995	1995 to 2000	2000 to 2005	2005 to 2010
Antioch	3.6%	4.0%	4.0%	2.6%	1.3%
Brentwood	3.8%	7.5%	11.2%	6.7%	5.6%
Clayton	0.5%	6.5%	3.3%	2.2%	0.7%
Concord	0.6%	0.8%	0.7%	0.6%	0.7%
Martinez	2.5%	1.4%	0.7%	0.4%	0.3%
Pittsburg	4.1%	2.1%	1.8%	1.8%	0.9%
Pleasant Hill	2.5%	1.5%	0.5%	0.3%	0.4%
Walnut Creek	0.3%	0.7%	0.6%	0.5%	0.3%
Danville	0.7%	3.0%	2.1%	1.2%	1.4%
El Cerrito	0.1%	0.5%	0.1%	-0.1%	0.1%
Hercules	9.4%	3.4%	1.7%	0.9%	0.8%
Lafayette	0.4%	0.6%	0.1%	0.3%	0.6%
Moraga	0.5%	0.1%	0.1%	0.5%	0.0%
Orinda	0.3%	0.5%	0.2%	0.1%	0.6%
Pinole	1.1%	0.8%	0.6%	0.3%	0.6%
Richmond	1.3%	1.6%	0.8%	0.8%	0.1%
San Pablo	2.2%	0.8%	1.5%	0.4%	0.5%
San Ramon	5.7%	2.8%	0.6%	0.9%	1.2%
Alamo-Blackhawk	7.4%	3.2%	0.7%	0.1%	0.1%
Rodeo-Crockett	0.5%	0.8%	0.0%	-0.2%	0.2%
Rural East Contra Costa	7.6%	5.4%	5.1%	5.3%	4.8%
Remainder	1.4%	20.6%	8.2%	7.0%	5.2%
Contra Costa County	2.0%	2.1%	1.7%	1.4%	1.2%

Source:
ABAG Projections '94

Exhibit A-22
Household Estimates and Projections
Cities and Unincorporated Areas within Contra Costa County
1980 to 2010

Communities	1980	1990	1995	2000	2005	2010
Antioch	15,543	21,729	26,060	31,890	36,930	39,740
Brentwood	2,233	3,208	4,480	7,690	10,860	14,340
Clayton	2,205	2,514	3,340	4,020	4,610	4,920
Concord	38,903	42,523	43,300	45,800	47,550	49,210
Martinez	11,405	15,315	16,400	17,340	17,820	18,280
Pittsburg	15,207	21,670	23,750	26,070	28,670	30,830
Pleasant Hill	11,695	15,898	16,950	17,660	18,260	18,810
Walnut Creek	30,057	33,465	34,660	36,020	37,040	37,850
Danville	9,455	11,088	12,780	14,280	15,480	16,760
El Cerrito	12,174	12,632	12,850	12,990	13,130	13,260
Hercules	2,099	5,308	6,280	6,960	7,660	8,160
Lafayette	8,878	9,734	9,860	10,060	10,310	10,610
Moraga	5,047	5,562	5,620	5,890	6,180	6,360
Orinda	5,798	6,347	6,510	6,640	6,910	7,170
Pinole	8,051	9,473	9,880	10,220	10,500	10,840
Richmond	33,621	38,078	40,410	42,870	44,940	45,520
San Pablo	9,097	9,833	10,020	10,170	10,520	10,800
San Ramon	6,393	12,895	14,690	15,670	16,580	17,830
Alamo-Blackhawk	3,339	7,252	8,500	9,080	9,320	9,520
Rodeo-Crockett	4,061	4,329	4,460	4,600	4,580	4,680
Rural East Contra Costa	5,078	10,064	12,860	16,700	21,240	26,770
Remainder	1,195	1,371	4,060	6,180	8,750	11,760
Contra Costa County	**241,534**	**300,288**	**327,720**	**358,800**	**387,840**	**414,020**

Source:
ABAG Projections '94

Exhibit A-23
Household Annual Growth Rates
Cities and Unincorporated Areas within Contra Costa County
1980 to 2010

Communities	1980 to 1990	1990 to 1995	1995 to 2000	2000 to 2005	2005 to 2010
Antioch	3.4%	3.7%	4.1%	3.0%	1.5%
Brentwood	3.7%	6.9%	11.4%	7.1%	5.7%
Clayton	1.3%	5.8%	3.8%	2.8%	1.3%
Concord	0.9%	0.4%	1.1%	0.8%	0.7%
Martinez	3.0%	1.4%	1.1%	0.5%	0.5%
Pittsburg	3.6%	1.8%	1.9%	1.9%	1.5%
Pleasant Hill	3.1%	1.3%	0.8%	0.7%	0.6%
Walnut Creek	1.1%	0.7%	0.8%	0.6%	0.4%
Danville	1.6%	2.9%	2.2%	1.6%	1.6%
El Cerrito	0.4%	0.3%	0.2%	0.2%	0.2%
Hercules	9.7%	3.4%	2.1%	1.9%	1.3%
Lafayette	0.9%	0.3%	0.4%	0.5%	0.6%
Moraga	1.0%	0.2%	0.9%	1.0%	0.6%
Orinda	0.9%	0.5%	0.4%	0.8%	0.7%
Pinole	1.6%	0.8%	0.7%	0.5%	0.6%
Richmond	1.3%	1.2%	1.2%	0.9%	0.3%
San Pablo	0.8%	0.4%	0.3%	0.7%	0.5%
San Ramon	7.3%	2.6%	1.3%	1.1%	1.5%
Alamo-Blackhawk	8.1%	3.2%	1.3%	0.5%	0.4%
Rodeo-Crockett	0.6%	0.6%	0.6%	-0.1%	0.4%
Rural East Contra Costa	7.1%	5.0%	5.4%	4.9%	4.7%
Remainder	1.4%	24.3%	8.8%	7.2%	6.1%
Contra Costa County	2.2%	1.8%	1.8%	1.6%	1.3%

Source:
ABAG Projections '94

Exhibit A-24
Persons per Household
Cities and Unincorporated Areas within Contra Costa County
1980 to 2010

Communities	1980	1990	1995	2000	2005	2010
Antioch	2.83	2.89	2.93	2.92	2.87	2.84
Brentwood	3.01	3.04	3.13	3.09	3.04	3.01
Clayton	3.24	2.99	3.08	3.01	2.93	2.85
Concord	2.70	2.63	2.68	2.62	2.60	2.60
Martinez	2.65	2.49	2.50	2.46	2.45	2.42
Pittsburg	2.88	2.99	3.03	3.02	3.01	2.93
Pleasant Hill	2.53	2.39	2.41	2.37	2.33	2.30
Walnut Creek	2.32	2.16	2.16	2.14	2.13	2.12
Danville	3.11	2.84	2.85	2.83	2.78	2.76
El Cerrito	2.35	2.29	2.31	2.30	2.27	2.26
Hercules	3.25	3.17	3.17	3.10	2.96	2.89
Lafayette	2.68	2.56	2.61	2.56	2.55	2.54
Moraga	2.84	2.63	2.62	2.53	2.48	2.44
Orinda	2.79	2.61	2.63	2.59	2.52	2.48
Pinole	3.02	2.86	2.85	2.83	2.80	2.79
Richmond	2.63	2.63	2.68	2.63	2.61	2.59
San Pablo	2.49	2.86	2.92	3.10	3.06	3.06
San Ramon	3.16	2.74	2.76	2.67	2.64	2.61
Alamo-Blackhawk	3.06	2.87	2.89	2.81	2.76	2.72
Rodeo-Crockett	2.71	2.68	2.69	2.63	2.60	2.56
Rural East Contra Costa	2.74	2.84	2.91	2.89	2.92	2.92
Remainder	2.91	2.82	2.83	2.80	2.81	2.76
Contra Costa County	**2.69**	**2.64**	**2.69**	**2.67**	**2.65**	**2.64**

Source:
Exhibit A-20 divided by Exhibit A-22

Exhibits A-25 and A-26 represent the annual growth in housing units for those cities within the TWSA, as well as those cities and unincorporated communities in the East County, as recorded by the Contra Costa County Community Development Department. East County cities and communities within the District's Service Area have experienced the majority of growth within recent years.

Weather Influence and Seasonal Distribution

Weather influence, water year types and their effect on monthly and annual water use were examined within the District, for the period 1974-1993. CCWD's *Weather Normalization Report* (May 1994) studied the relationship of weather to water consumption as it occurs within the TWSA. Based on extremes in temperature and the resulting increase in irrigation, the study concludes that weather impacts annual water use by a range of between -3.6 and +5.1 percent. Weather affects monthly water use more dramatically with monthly variations in water use ranging from 9 to 15%. Exhibit A-27 displays seasonal water use from the Contra Costa Canal as detailed in monthly pumpage data for the 20-year period measured at Plant No. 1. Months receiving the highest precipitation are typically December through March, so use is much lower during this period. Annual precipitation is slightly higher in the western portion of the county, while the eastern areas of Antioch, Brentwood, and rural East County experience slightly less, and also undergo more extreme temperatures, especially in the summer months. As expected, water use is highest during those summer months, reaching its highest level in July.

Exhibit A-28 lists the occurrence of each water year type since 1922. Exhibit A-29 examines the effect of water year type on average water use over the past twenty years. It shows how critical and non-critical year totals were calculated for the years 1974-1993. On a percentage basis from the average year type, critical years were found to be 15.3 percent higher and non-critical years 8.2 percent lower than the average for all water year types during that period. Critical years for this comparison included 1976-77, 1987-88, and 1990-92, while non-critical years included the remaining years. The difference between annual water use in an average critically dry year, versus that of an average wet year is just over 32,000 acre-feet per year.

Exhibit A-30 displays the effects of the recent drought and subsequent implementation of rationing (combined with rate increases) on annual water use. The District has experienced two serious droughts over the past twenty years. The first occurred in 1976-77. The second started in the winter of 1987-88 and continued into 1992. Despite a fourth consecutive dry year, 1990 annual water use levels had increased 24 percent over 1986 use prior to the drought. It was not until 1991, when implementation of rationing and substantial rate increases went into effect that reductions in water use occurred in almost all customer categories. Although sales have increased since 1993 (wet year), they have not returned to pre-drought levels.

Consumption Rates

Residential consumption rates have been recorded within the Treated Water Service Area, and are shown in Exhibit A-31, in gallons per households and gallons per capita per day. The per capita rate in water use over the last twenty years has ranged from a low of 80 gallons per day during the drought in 1977 to a high of 136 in 1985. The per household rate ranged between 210 and 346 gallons per day. Consumption rates for those areas outside the TWSA were gathered from each jurisdiction's Water Master Plan, and ranged from a low of 141 gpcd for Antioch to a high of 264 gpcd for Discovery Bay. As a comparison, Exhibit A-32 shows the residential consumption within the Diablo Water District for the period 1980 to 1990. Rates shown in gallons per dwelling unit ranged between 363 gallons in 1980 (wet year) to 616 gallons in 1986 (wet year). Consumption rates in the area may be higher due to rapid housing growth and the resultant increase in landscaping, as well as the permeability of sandy soils in the area. Seasonal data was also obtained and presented for the period 1989-1993, however four of the five years presented were during the recent drought.

The City of Brentwood Water Supply Study, October 1990, documents per capita water use at 164 gallons per day. This is consistent with the consumption rates shown for Brentwood in the report *Urban Water Use in California*, August 1994. In that report, per capita rates for the period 1980 to 1990 ranged between 127 gpcd and 193 gpcd

Exhibit A-25
Annual Growth in Housing Units
by Jurisdiction in Contra Costa County, (1980-1989)

City/Community	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Total 1980-1989
East County											
Antioch	478	361	273	462	267	865	1,197	1,105	895	1,040	**6,943**
Brentwood	36	79	16	5	15	100	327	118	151	68	**915**
Pittsburg	443	529	246	308	196	596	534	781	672	695	**5,000**
Discovery Bay[a]	187	139	92	44	112	154	62	258	252	304	**1,604**
Oakley[a]	300	80	73	214	307	234	335	518	360	651	**3,072**
Bay Point[a]	188	223	20	75	94	137	304	583	307	60	**1,991**
Other unincorporated	111	27	12	23	-2	15	16	17	26	50	**295**
Subtotal	**1,743**	**1,438**	**732**	**1,131**	**989**	**2,101**	**2,775**	**3,380**	**2,663**	**2,868**	**19,820**
North Central County											
Clayton	99	0	2	19	63	54	3	7	28	89	**364**
Concord	450	272	370	280	314	841	788	766	437	299	**4,817**
Martinez	240	360	199	239	1,020	371	210	481	191	120	**3,431**
Pleasant Hill	343	292	210	135	67	311	514	724	373	187	**3,156**
Walnut Creek	233	331	96	85	210	385	591	233	251	500	**2,915**
Other unincorporated	322	360	196	171	147	100	409	502	829	463	**3,499**
Subtotal	**1,687**	**1,615**	**1,073**	**929**	**1,821**	**2,062**	**2,515**	**2,713**	**2,109**	**1,658**	**18,182**

a. unincorporated community

Source:
Contra Costa Community Development Department

Exhibit A-26
Annual Growth in Housing Units
by Jurisdiction in Contra Costa County, (1990-1993)

City/Community	1990	1991	1992	1993	Total 1990-1993
East County					
Antioch	1,126	702	918	923	**3,669**
Brentwood	173	207	186	211	**777**
Pittsburg	254	220	226	166	**866**
Discovery Bay[a]	367	93	75	85	**620**
Oakley[a]	264	229	350	335	**1,178**
Bay Point[a]	109	123	82	87	**401**
Other unincorporated	104	32	19	15	**170**
Subtotal	**2,397**	**1,606**	**1,856**	**1,822**	**7,681**
North Central County					
Clayton	242	59	107	79	**487**
Concord	414	273	123	101	**911**
Martinez	101	95	158	51	**405**
Pleasant Hill	45	12	16	4	**77**
Walnut Creek	169	304	125	24	**622**
Other unincorporated	203	165	983	120	**1,471**
Subtotal	**1,174**	**908**	**1,512**	**379**	**3,973**

a. unincorporated community

Source:
Contra Costa Community Development Department

Exhibit A-27
Historical Seasonal Use, (Acre-Feet)
1974 to 1993 (20 years)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Plant No. 1 Pumpage	Year Type
1974	3,546	3,207	4,032	4,640	7,039	11,182	12,178	11,836	6,858	6,044	4,234	3,650	78,446	Wet
1975	4,138	4,595	4,502	5,767	6,875	9,929	10,744	10,518	8,180	5,349	3,636	2,523	76,756	AN
1976	6,238	9,522	8,852	10,239	12,742	13,230	14,318	13,034	11,323	8,296	9,640	7,684	125,118	Crit
1977	7,049	8,899	7,673	7,124	6,732	10,834	8,901	8,658	7,287	8,289	7,318	6,803	95,567	Crit
1978	3,152	1,986	2,215	3,714	5,503	8,142	11,859	10,966	7,369	6,188	5,278	5,385	71,757	Wet
1979	4,024	2,979	4,146	5,244	9,673	11,771	13,709	12,849	10,247	9,345	6,659	4,862	95,508	Dry
1980	3,622	3,115	3,353	4,419	8,379	9,851	10,631	12,116	10,773	10,120	7,044	4,707	88,130	Wet
1981	5,331	4,319	4,895	6,252	13,007	14,653	14,672	12,487	10,266	8,793	5,074	2,432	102,181	Dry
1982	3,013	2,792	2,974	3,163	8,184	10,144	10,458	11,205	6,963	5,099	4,094	3,778	71,867	Wet
1983	2,431	5,070	9,218	3,537	5,852	10,164	10,547	10,683	9,150	5,017	4,007	3,341	79,017	Wet
1984	2,814	3,871	3,712	8,527	11,631	12,803	15,591	15,363	11,051	9,189	6,121	3,256	103,929	Wet
1985	4,840	5,387	7,904	8,773	13,432	13,704	15,773	13,994	10,378	11,361	7,553	6,545	119,644	Dry
1986	8,903	3,920	3,578	4,975	11,054	13,221	14,089	13,764	11,713	8,246	8,801	9,073	111,337	Wet
1987	7,444	6,029	8,139	10,951	14,647	14,496	15,092	14,727	13,351	11,160	9,063	7,700	132,799	Crit
1988	7,879	7,352	10,554	12,317	11,959	12,459	15,226	15,667	13,287	12,104	9,017	9,043	136,864	Crit
1989	8,449	7,705	7,689	8,641	12,637	13,576	16,214	16,152	13,092	10,925	9,192	8,952	133,224	BN
1990	8,411	8,218	9,499	11,973	13,345	12,789	14,640	14,195	13,434	11,350	8,779	9,100	135,733	Crit
1991	8,982	7,614	6,815	5,936	7,962	9,230	10,645	10,295	9,585	9,325	6,539	6,942	99,870	Crit
1992	6,386	5,258	4,565	8,568	11,364	11,344	11,842	12,251	10,190	9,765	6,782	6,611	104,926	Crit
1993	4,264	4,087	4,073	5,587	8,773	10,249	12,364	12,228	11,026	9,065	8,016	6,552	96,284	Wet
Avg. % of use	**5.3%**	**5.1%**	**5.7%**	**6.6%**	**9.7%**	**11.6%**	**12.8%**	**12.5%**	**10.0%**	**8.5%**	**6.6%**	**5.7%**		

Notes:
CCWD O&M Dept., Contra Costa Canal Water Supply History (1-p. spreadsheet).
Comparison of Water Year Type Classification Schemes, 1922-1986 (1-p. spreadsheet).
Using SWRCB's Decision 1485 classifications. Years after 1986 from G. Gartrell.
Average percentage of use was calculated based on an average of each month's percentage of water use during each year.

Exhibit A-28
Historical Occurrence of Water Years (1922-1993)

Year	Water Year Type	Year	Water Year Type
1922	Above Normal	1958	Wet
1923	Below Normal	1959	Dry
1924	Critical	1960	Below Normal
1925	Above Normal	1961	Dry
1926	Dry	1962	Below Normal
1927	Wet	1963	Wet
1928	Above Normal	1964	Dry
1929	Critical	1965	Wet
1930	Below Normal	1966	Below Normal
1931	Critical	1967	Wet
1932	Below Normal	1968	Below Normal
1933	Critical	1969	Wet
1934	Critical	1970	Wet
1935	Above Normal	1971	Wet
1936	Above Normal	1972	Below Normal
1937	Below Normal	1973	Wet
1938	Wet	1974	Wet
1939	Critical	1975	Above Normal
1940	Wet	1976	Critical
1941	Wet	1977	Critical
1942	Wet	1978	Wet
1943	Wet	1979	Dry
1944	Dry	1980	Wet
1945	Below Normal	1981	Dry
1946	Above Normal	1982	Wet
1947	Dry	1983	Wet
1948	Above Normal	1984	Wet
1949	Dry	1985	Dry
1950	Below Normal	1986	Wet
1951	Wet	1987	Critical
1952	Wet	1988	Critical
1953	Wet	1989	Below Normal
1954	Above Normal	1990	Critical
1955	Dry	1991	Critical
1956	Wet	1992	Critical
1957	Below Normal	1993	Wet

Water Year Type	Total Years
Wet	26
Above Normal	9
Below Normal	13
Dry	11
Critical	13

Source: Water Year Types according to D1485, SWRCB, 1978.

Exhibit A-29
Historical Average Percentage of Monthly Demand for Selected Water Year Types, (Acre-Feet)
1974 to 1993 (20 years)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Average												
% of use	5.3%	5.1%	5.7%	6.6%	9.7%	11.6%	12.8%	12.5%	10.0%	8.5%	6.6%	5.7%
	Winter Average: 34.9%				Summer Average: 65.1%							
Wet Year Average												
% of use	4.5%	4.2%	5.0%	5.7%	9.3%	12.4%	14.1%	14.1%	10.6%	8.2%	6.5%	5.4%
	Winter Average: 31.3%				Summer Average: 68.7%							
Dry Year Average												
% of use	4.5%	3.9%	5.2%	6.3%	11.4%	12.7%	14.0%	12.5%	9.8%	9.3%	6.1%	4.3%
	Winter Average: 30.4%				Summer Average: 69.6%							
Bel. Norm. Average												
% of use	6.3%	5.8%	5.8%	6.5%	9.5%	10.2%	12.2%	12.1%	9.8%	8.2%	6.9%	6.7%
	Winter Average: 38.0%				Summer Average: 62.0%							
Crit. Dry Average												
% of use	6.4%	6.5%	6.7%	8.0%	9.4%	10.2%	10.9%	10.6%	9.4%	8.5%	6.9%	6.5%
	Winter Average: **41.0%**				Summer Average: **59.0%**							
Non Crit. Average												
% of use	4.7%	4.3%	5.1%	5.9%	9.8%	12.3%	13.9%	13.6%	10.4%	8.5%	6.4%	5.2%
	Winter Average: **31.6%**				Summer Average: **68.4%**							

Sources: Exhibit A-27.
CCWD O&M Dept., Contra Costa Canal Water Supply History. Comparison of water year type classification schemes, 1922-1986, using SWRCB's Decision 1485 classifications. Years after 1986 from Greg Gartrell, CCWD.

Notes: Wet Average is taken from years 1974, 1975, 1978, 1980, 1982, 1983, 1984, 1986 and 1993.
Dry Average is taken from years 1979, 1981, and 1985.
Below Normal is taken from year 1989.
Critical Dry Average is taken from years 1976, 1977, 1987, 1988, 1990, 1991 and 1992.
Non-Crit Average is taken from all years not included in the Critical Average (Wet, Dry and Below Normal years).

Exhibit A-30
Effect of Drought on Water Use, (Acre-Feet)

Major Customers	1986 Wet Year	1990 4th Dry Year	Drought [illegible]	1991 Rationing	Implementation of [illegible]	1993 Wet Year
Municipal	**60,759**	**71,610**	[illegible]	**55,034**	[illegible]	**56,649**
Bay Point	2,111	2,685	[illegible]	2,335	[illegible]	1,658
Treated Water Service Area	36,122	37,852	[illegible]	27,399	[illegible]	27,826
City of Antioch	6,636	12,384	[illegible]	10,515	[illegible]	9,842
City of Martinez	5,212	5,205	[illegible]	3,958	[illegible]	4,101
Diablo Water District	2,685	4,460	[illegible]	3,216	[illegible]	4,519
City of Pittsburg	7,996	9,025	[illegible]	7,613	[illegible]	8,702
Major Industrial	**33,971**	**45,394**	[illegible]	**33,126**	[illegible]	**27,094**
Louisiana Pacific	4,658	12,116	[illegible]	3,240	[illegible]	0
Tosco Oil	9,984	12,491	[illegible]	9,023	[illegible]	10,763
Shell Oil	9,466	10,667	[illegible]	9,930	[illegible]	9,736
USS-Posco	7,134	5,587	[illegible]	6,201	[illegible]	6,049
Gaylord Container	2,729	4,533	[illegible]	4,732	[illegible]	546
Minor Metered	**2,608**	**4,406**	[illegible]	**3,983**	[illegible]	**3,195**
Minor Municipal	1,127	1,296	[illegible]	1,115	[illegible]	1,222
Minor Industrial	1,481	3,110	[illegible]	2,868	[illegible]	1,973
Other	**2,545**	**2,068**	[illegible]	**1,897**	[illegible]	**2,024**
Groups and Associations	854	696	[illegible]	491	[illegible]	575
Agriculture	614	120	[illegible]	680	[illegible]	322
Flat Rate	1,066	1,066	[illegible]	721	[illegible]	1,065
Temporary	11	186	[illegible]	5	[illegible]	62
Total Sales:	**99,881**	**123,479**	[illegible]	**94,038**	[illegible]	**88,960**
(not including River Diversions)						
River						
City of Antioch	2,756	0	[illegible]	410	[illegible]	3,271
Tosco	860	0	[illegible]	0	[illegible]	0
USS-Posco	12,900	3,200	[illegible]	0	[illegible]	0
Gaylord Container	0	0	[illegible]	783	[illegible]	2,345
Mallard Slough	5,770	0	[illegible]	536	[illegible]	

Notes:
a. Figure for Treated Water Service Area is for Average Number of Active Services not Households.
Data have not been normalized for growth.
Source: Exhibit A-9 and Exhibit A-14.
Rounding errors may occur in Total Sales figures.

Exhibit A-31
Residential Annual Sales Treated Water Service Area
1974 to 1993 (20 years)

Year	Households	Population	Pop/HH Ratio	Residential Sales AF per Yr	Gallons per Households per Day	Gallons per Capita per Day	Water Year (Decision 1485)	Residential Sales (MG/Yr)	Residential Sales (gal/day)
1974	[redacted]						wet		
1975							above normal		
1976	58,500	152,685	2.61	23,808	363	139	crit	7,758	21,240,246
1977	59,000	153,990	2.61	13,874	210	80	crit	4,521	12,377,823
1978	59,500	155,000	2.61	18,545	278	107	wet	6,043	16,544,832
1979	60,040	157,500	2.62	22,059	328	125	dry	7,188	19,679,671
1980	61,502	160,177	2.60	23,216	337	129	wet	7,565	20,711,841
1981	62,503	161,979	2.59	25,564	365	141	dry	8,330	22,806,297
1982	63,604	164,013	2.58	23,904	335	130	wet	7,789	21,325,120
1983	63,845	163,812	2.57	23,962	335	130	wet	7,808	21,377,139
1984	[redacted]						wet		
1985	69,500	176,530	2.54	26,991	346	136	dry	8,795	24,079,398
1986	71,772	180,862	2.52	27,132	337	134	wet	8,841	24,205,339
1987	74,075	185,179	2.50	26,285	317	127	crit	8,565	23,449,692
1988	74,407	184,517	2.48	25,705	308	124	crit	8,376	22,932,238
1989	74,739	185,353	2.48	24,508	293	118	below normal	7,986	21,864,476
1990	75,745	186,333	2.46	24,978	294	120	crit	8,139	22,283,368
1991	76,721	188,734	2.46	18,159	211	86	crit	5,917	16,199,863
1992	77,772	189,764	2.44	20,911	240	98	crit	6,814	18,655,715
1993	78,077	190,508	2.44	22,084	252	103	wet	7,196	19,701,574
		17-Yr Avg (excl. 1974, 1975 & 1984)			301	119			

	Per HH/Day	Per Cap/Day	% Difference from Avg Per HH/Day	% Difference from Avg Per Cap/Day
Average wet (6 years, incl. above normal)	312	122	3.8%	2.8%
Average dry (3 years)	346	134	15.1%	12.7%
Average crit (8 years, incl. below normal)	279	112	-7.1%	-6.3%

Sources and Notes

Population & household data for 1974, 1975 and 1984 are not available.
Population data for 1976 to 1979 and 1985 are estimates by EDAW.
Household data for 1978 and 1979 are estimates by EDAW; Pop/HH ratio is calculated.
Household data for 1976, 1977 and 1985 are derived by dividing population for those years by assumed Pop/HH ratios.
Population & household data for 1980 thru 1983 and 1986 thru 1988 are from CCWD's Urban Water Management Plan, Table 3-2, January 1991.
Population data for 1989 thru 1993 are from CCWD's Revenue Code Count Listing spreadsheets.
Household data for 1989 thru 1993 are derived by dividing population for those years by assumed Pop/HH ratios.
The population/household ratio is not the same as household size.
Annual residential sales data for 1974, 1975 and 1984 are not available.
Annual residential sales data for 1976 thru 1987 are from CCWD's Urban Water Management Plan, App. F, January 1991. (MGY converted to AFY)
Annual residential sales data for 1988 thru 1993 are from CCWD's Final Treated Water Master Plan, Table 4.3, August 1994. (MGY converted to AFY)
Conversions and other calculations include decimal places not shown.

Exhibit A-32
Historical Residential Consumption,
Diablo Water District (1980 to 1990)

Year	Gal. per Day Per Dwelling Unit	Year Type
1980	363	wet
1981	437	dry
1982	410	wet
1983	503	wet
1984	582	wet
1985	586	dry
1986	616	wet
1987	602	crit
1988	591	crit
1989	538	below normal
1990	568	crit

Water Use
Gallons per Day per Service*

Month	1989 bn	1990 crit	1991 crit	1992 crit	1993 wet
January	218	336	178	248	192
February	281	302	391	260	243
March	274	318	249	237	229
April	423	481	265	342	277
May	653	643	375	557	448
June	745	736	522	721	636
July	864	806	610	674	747
August	917	847	636	578	712
September	737	771	643	729	671
October	563	851	582	507	490
November	397	472	399	354	423
December	319	321	240	259	319
Average Use	**533**	**574**	**424**	**456**	**449**

*Note: Services includes 5742 households, 111 commercial and 13 irrigation accounts, 12/93

Residential Consumption, 1993
Gallons per Household, (wet year)

Unit Type	Units	Annual Gallons	Avg. Gal. per Day
Single Family	5,284	871,957,812	452
Multi-Family	284	19,571,420	189

Source:
Master Water Plan, Update 1991, Diablo Water District, October, 1991.
Personal communication, Mike Yeraka, December 6, 1994.

averaging 160 gpcd over that period. Exhibit A-33 displays the per capita water use for that period, as well as the water year types in which each occurred. In the most recent *Draft Infrastructure Master Plan Report*, July 1994, water production records show that the City used 510 million gallons of water in 1991. Based on a population of 8,100 people, the City used an average of 172 gallons per day per person in 1991. The average flow per *residential* connection for that year was approximately 595 gallons per day or 196 gallons per day per person.

METHODOLOGY

The methodology for preparing the FWSS water demand projections for the district is described in the flow of events shown in Exhibit A-34. The demand projections were developed in three basic ways: (1) by the mapping of the land uses and applying the District's water use factors (WUFs) to the county's projected land uses by service area alternatives; (2) by the development of population projections and applying per capita water consumption rates to the projections; and (3) by a combination of the two methods. The projections relied on two basic data sets: (1) the County's projection of future land use changes to "buildout"; and (2) the Association of Bay Area Governments' (ABAG) projections of population changes between 1990 and 2010.

The choice of methodology was made to use the best available information for making projections, and to maintain consistency with the methods used by agencies within the study area. For example, CCWD uses WUFs, which rely on county General Plan land use designations, within its TWSA. Other jurisdictions use per capita rates, documented in their planning studies. Use of the two methodologies avoided a duplication of work and allowed the use of the best available data for the different geographic areas, and allowed the projections to be consistent with the methodology preferences of the local planning jurisdictions.

Demand Methodology Process

Average annual demands were developed by adding residential demands, plus major industrial demands, plus non-residential demands, minus water savings from conservation (irrespective of CCWD's and other retail agencies' programs), plus unaccounted for water. Exhibit A-35 displays the assumptions used to prepare water demand projections. The subareas within the study have been grouped into three areas: Treated Water Service Area (TWSA), Raw Water Service Area (RWSA), and Other Areas. Calculating water demand for any one subarea required identifying the most accurate information from each dataset and combining it with the other datasets to develop preliminary demand estimates.

For example, reviewing the exhibit from left to right, *residential demand* was projected in two ways: 1) acreage by land use was calculated for all areas within the TWSA and multiplied by the appropriate WUF; and 2) outside of the TWSA, population estimates (determined by subareas of census tracts) were multiplied by a per capita consumption rate. (Intensification assumptions were used for Alternative F only and are not included in Exhibit A-35.)

MAPPING AND DATA INTEGRATION

Land use mapping and designations were provided by the State's Teale Data Center and the Contra Costa County General Plan. Computerized map layers were obtained from Teale, which contained much of the existing base information, including roads, city and county boundaries, census tracts and "census designated places." Projected land use designations included within the 1991 County General Plan were integrated with the Teale Data within an Arc/Info database. Recent LAFCO and CCWD maps were then used to update peripheral boundaries of the CCWD service area and city boundaries to reflect the latest annexation information. The FWSS Service Areas were mapped on additional data layers. Exhibit A-36 displays the subareas included within each service area alternative. The GIS was used to calculate the acreage of each land use within the boundaries of each of the six service area alternatives. Exhibit A-37 lists the principal data used in developing water demand projections and the source for each.

Exhibit A-33
Per Capita Water Use
City of Brentwood (1980 to 1990)

Year	Gallons per Capita per Day	Water Year
1980	172	wet
1981	175	dry
1982	169	wet
1983	158	wet
1984	164	wet
1985	150	dry
1986	127	wet
1987	141	crit
1988	148	crit
1989	164	bn
1990	193	wet
Average	**160**	

Source: Urban Water Use in California, California Department of Water Resources, August 1994.

Exhibit A-34
CCWD Demand Projection Methodology

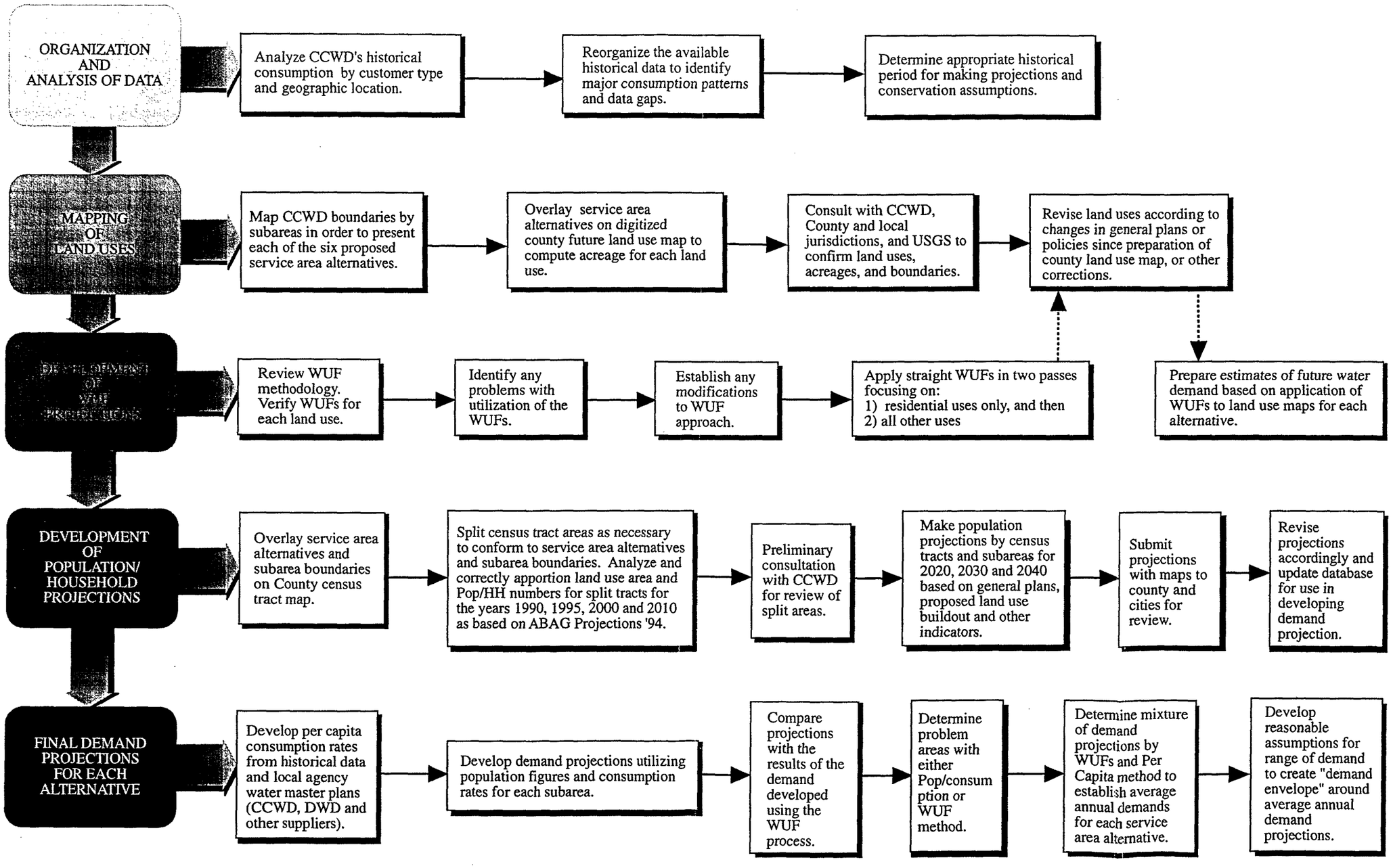


Exhibit A-35
Demand Methodology Assumptions
Service Areas A-E

Subareas	Residential		Consumption	
	Acres	Population	WUFs see Exh. A-43	per Capita Gallons per Day
Treated Water Service Area				
Clayton				
Clyde				
Concord [1]				
Martinez				
Pacheco				
Pleasant Hill				
Port Costa				
Walnut Creek				
Unincorporated				
CCWD Raw Water Service Area				
Bay Point				150 gpcd [2]
Antioch				141 gpcd [3/4]
FUA-1				137 gpcd [3/4]
FUA-2				137 gpcd [3/4]
Martinez				
Pittsburg				180 gpcd [5]
Oakley				197 gpcd [6]
Unincorporated				197 gpcd [6]
Other Areas				
Hotchkiss Tract				197 gpcd [6]
Bethel Island				197 gpcd [6]
Knightsen				197 gpcd [7]
Discovery Bay				264 gpcd [8]
Byron				197 gpcd [7]
E. County Airport				197 gpcd [7]
Veale Tract				197 gpcd [7]
Brentwood				164 gpcd [9]
Cowell Ranch				164 gpcd [10]
Unincorporated within ULL				197 gpcd [7]
Unincorporated outside ULL				197 gpcd [7]

Major Industrial

Company	Historical [a] Consumption	River Diversions	Future Expansion	Total Water Demand [i]
Concord Naval Weapon Station (CNWS) [b]	380 ac-ft/yr			380 ac-ft/yr
Totals	380 ac-ft/yr			380 ac-ft/yr

Major Industrial

Company	Historical [a] Consumption	Average River Diversions	Future Expansion	Total Water Demand [h]
Shell Oil	9,772 ac-ft/yr		5,000 ac-ft/yr [f]	14,772 ac-ft/yr
Tosco Oil	10,367 ac-ft/yr		3,000 ac-ft/yr [g]	13,367 ac-ft/yr
USS-Posco	6,853 ac-ft/yr		--	6,853 ac-ft/yr
Gaylord Container [c]	10,688 ac-ft/yr		--	10,688 ac-ft/yr
Dupont [d]	1,904 ac-ft/yr		--	1,904 ac-ft/yr
Totals	39,584 ac-ft/yr	5,700 ac-ft/yr [e]	8,000 ac-ft/yr	53,284 ac-ft/yr

Notes for Major Industrial:

a. 10-year Average for Total Industrial Canal Sales, 1984-1993.

b. CNWS water demand expected to increase only within Alternative F. In that scenario, development estimates of 10,000 to 20,000 residents based on contiguous densities in the area, would increase demand 1,545 to 3,090 ac-ft/yr for the year 2040.

c. Gaylord is combined with figures for Louisiana Pacific. Although Gaylord is closed, a replacement of comparable demand is assumed.

d. Information obtained from Master Water Plan for Diablo Water District, 1991. Includes placeholder for future customer with cogeneration use similar to that of GWF.

e. Based on one-half the difference between average critical and average wet year canal sales between 1978-1993.

f. Source: Draft EIR for the Shell Oil Clean Fuels Project.

g. Source: CCWD Memorandum regarding conversation with Dan Carlson of Tosco.

h. Total Major Industrial Water Demand = Historical Canal Sales + River Diversions + Future Expansions.

i. Total Water Demand for CNWS is based on past historical use.

Subareas	Non-Residential [11] WUF	Conservation [12] Percentage	UAW [13] Percentage
			7%
Treated Water Service Area			
Clayton		2 to 10%	
Clyde		2 to 10%	
Concord		2 to 10%	
Martinez		2 to 10%	
Pacheco		2 to 10%	
Pleasant Hill		2 to 10%	
Port Costa		2 to 10%	
Walnut Creek		2 to 10%	
Unincorporated		2 to 10%	
CCWD Raw Water Service Area			
Bay Point	14	2 to 10%	7%
Antioch		2 to 10%	15
FUA-1		2 to 10%	15
FUA-2		2 to 10%	15
Martinez		2 to 10%	7%
Pittsburg	14	2 to 10%	7%
Oakley		2 to 10%	6.2%
Unincorporated		2 to 10%	7%
Other Areas			
Hotchkiss Tract		2 to 10%	6.2%
Bethel Island		2 to 10%	6.2%
Knightsen		2 to 10%	8.5% [16]
Discovery Bay	14	2 to 10%	8.5% [16]
Byron		2 to 10%	8.5% [16]
E. County Airport		2 to 10%	8.5% [16]
Veale Tract		2 to 10%	8.5% [16]
Brentwood	14	2 to 10%	14%
Cowell Ranch	14	2 to 10%	8.5% [16]
Unincorporated within ULL		2 to 10%	8.5% [16]
Unincorporated outside ULL		2 to 10%	8.5% [16]

Indicates information used to generate water demand.

Notes:
1. Concord Naval Weapons Station demand figure of 380 ac-ft/yr based on current uses included.
2. Bay Point per capita based upon 1992 figure of 3,004 ac-ft/yr from Cal. Cities Water W. Pittsburg District General Plan, and converted to per capita rate based upon 1990 pop from ABAG, and annual increase in households from the county.
3. Value derived from City of Antioch Water System Master Plan Update. 141 gpcd is weighted number based on population within zones, (170 gpcd for Zone I and 137 gpcd Zones II-IV). Includes UAW. Based on Residential and Commercial use only.
4. WUFs used to calculate all non-residential land uses except residential and commercial, which are included within the per capita rate.
5. Pittsburg per capita number based upon 7-year average from 1985-1991. Source: City of Pittsburg 1992 Update to the Urban Water Management Plan. All uses included.
6. Diablo Water District's (DWD) Master Plan (February 1991) used an average 560 gallons per day per dwelling unit (gpdpdu), and showed data for the 1984-1990 period which ranged from 538 to 616 gpdpdu. The Master Plan average of 560 gpdpdu has been used in this Study in the analysis of DWD's demands. However, a recent analysis that takes into account 1988-1994 found an average of 515 gpdpdu (M. Yeraka, DWD, 1995, personal communication). While the Master Plan values have been used in the FWSS, DWD currently uses the lower figure. The effect of using the lower figure on the results of the FWSS would be small and would not affect the conclusions.
7. Knightsen, Byron, East County Airport, Veale Tract and Uninc. Inside and Outside ULL have been assigned per capitas consistent with Oakley and Diablo Water District due to similar land use patterns and weather types.
8. Discovery Bay per capita based on 58 percent of max. day demand to achieve a 696 gallons per connection figure. Conversion to per capita based on Discovery Bay West (Draft EIR) per household figures for Discovery Bay. All uses included.
9. Based on personal communication with Cameron Oden, Engineering Consultant, referencing Capital Improvements Financing Plan, prepared by John Stevenson, and the Water Supply Study, City of Brentwood, Oct. 1990. All uses included.
10. Cowell Ranch per capita rate is consistent with that of Brentwood, because it is assumed for the purposes of this study that City will eventually serve the area. All uses included
11. Non-Residential Demand includes all demand not represented within the residential, major industrial, and per capita columns.
12. Conservation figure is an average, which varies through the decades of the study. The year 2000 is calculated at 2 percent savings, 2010 at 4 percent, 2020 at 6 percent, 2030 at 8 percent and 2040 at 10 percent. Based on residential and non-residential customers only.
13. Unaccounted for water has been based upon current figures available for the TWSA. For remaining subareas, UAW was based on Water Master Plans or for Rural areas the UAW previously used in Los Vaqueros Scoping Report.
14. The non-residential areas within these subareas have been included within the respective per capita figure shown under the consumption column.
15. Unaccounted Water has been included within the per capita figure shown under the consumption column for Antioch.
16. UAWs for Rural Areas based upon UAW assigned to rural areas in the Los Vaqueros Scoping Report.

Exhibit A-36
Subareas within Each Service Area

SUBAREAS	ALTERNATIVE					
	A	B	C	D	E	F
Treated Water Service Area						
• Clayton						
• Clyde						
• Concord						
• Martinez						
• Pacheco						
• Pleasant Hill						
• Port Costa						
• Walnut Creek						
• Unincorporated in TWSA						
Raw Water Service Area						
• Bay Point						
• Antioch						
• FUA1						
• FUA2						
• Martinez						
• Pittsburg						
• Oakley						
• Unincorporated in TWSA						
Other Areas						
• Hotchkiss Tract						
• Knightsen						
• Bethel Island						
• Veale Tract						
• Discovery Bay						
• Byron						
• E. County Airport						
• Brentwood						
• Cowell Ranch						
• Within County Urban Limit Lines						
• Outside County Urban Limit Lines						

SOI Planning Area

Exhibit A-37
Principal Data Sources for Water Demand Projections

State Teale Data Center
- Digital base map information including (County boundary, public land survey, hydrology and transportation network)
- Census Tract and Block level digital data

LAFCO
- City boundaries, City Spheres of Influence, and Urban Limit Line
- Water District Boundaries, Water District Spheres of Influence

Association of Bay Area Governments
- Projections '94
  Population Projections by Census Tract for the years 1990, 2000, and 2010
  Household Projections by Census Tract for the years 1990, 2000, and 2010
- Correspondence Table
  Percentage allocations as to how census tract splits occurred among subregional study areas

Department of Finance
- Population Estimates and Projections for California, the Bay Area and Contra Costa County
- Annual growth rates for California and the Bay Area

Contra Costa Water District
- Alternative Service Area boundaries
- Historical Pumping and Sales Data for the District
- Treated Water System Population Estimate Database, Division 2, and portions of Divisions 1 and 3
- Digital data including the TWSA boundary, and Los Vaqueros Planning Area boundary
- Digitized General Plan - Land Use Element Map
- Refinements on alternative service area boundaries, and small recent annexations

County and City Agencies
- Water Master Plans and Infrastructure Plans
  Per Capita and Per Household Water Consumption Rates
- Agency feedback on accuracy of ABAG projections for their community
- County General Plan - Land Use Element Map (paper) from Contra Costa County Community Development Department

Exhibits A-38 through A-42 display each of the land use designations from the 1991 County General Plan Map, and the amount of acreage associated with each land use for each of the cities and unincorporated areas (subareas) within the study boundaries. Total acreage for Alternatives A through E has been shown separately in the exhibits. Alternative F, not shown in the exhibits, is an expansion of Alternative E, which adds 54,233 acres including some land outside the current Urban Limit Line.

WATER USE FACTORS

Water use factors (WUFs) were developed by CCWD and have been used by the District to determine future water demands within the TWSA. WUFs were used within the FWSS to avoid duplicating previous efforts by the District. The basis for determining water use factors consists of isolating specific land uses and measuring the consumption within those areas. The District applies those results to the number of acres being studied in order to come up with a WUF which can be applied to comparable land uses, in order to determine appropriate consumption factors.

In the FWSS, WUFs were used to determine future water demands for most uses within the TWSA, and for those non-residential uses outside of the TWSA not already included within a subarea's per capita rate. To avoid duplication of previous work by the District, the WUFs were assumed to be accurate since they were developed over the years 1988, 1989, and 1990, coinciding with the onset of the study period for the FWSS. Exhibit A-43 displays each of the County land use designations within the General Plan and the water use factor associated with that use. The water use factor is multiplied by number of gross acres in order to achieve a water demand result in acre-feet per acre per year. The water use factors were merged into the GIS, and were applied to each of the land use categories for each service area alternative. It is assumed using this method that all parcels will be developed according to the 1991 Contra Costa County General Plan, and that residential parcels will be developed at a density which falls within those designated land use ranges.

The application of WUFs to land uses only serves to determine demand for the year 2005 or 2010, the horizon year for the County General Plan and for many of the other general plans within the County. In order to obtain a reasonable demand curve for 1990-2040 using the WUF 2010 data, a growth curve was created with the ABAG data. The growth curve, identified by charting population projections for the period 1990-2040, was applied to the 2010 demand projections derived using the WUF method. The ratios between the year 2010 and other decades were then applied to the 2010 demand figure derived through WUFs, to develop demand estimates for the years 1990, 2000, 2020, 2030 and 2040.

POPULATION PROJECTIONS

Many capital-intensive programs rely on projection periods of up to 50 years but few jurisdictions in the District's service area have made population projections beyond the years 2005-2010. The year 2040 was selected as the horizon year for two important reasons. CCWD's current contract with the Central Valley Project expires in 2010. The contract could be renewed for 25 more years, which would carry the renewal to the year 2035. Using the year 2040 ensures ample time to accommodate the CVP contract period and allows the FWSS projections to be represented by decade. Secondly, water projects in the current regulatory environment need extensive lead times, beginning with planning, design and permitting, through construction and implementation. A long planning horizon allows short-term measures to be integrated with long-term alternatives resulting in a cost effective approach which is maintained through regular reviews of the program and updated or modified to meet planning expectations.

Census Tract Splits

Population estimates for all census tracts and subareas within the service area boundaries were developed with the use of ABAG's *Projections '94* digital database, by census tract. Census tracts split by alternative or subarea bound-

aries were closely analyzed with the assistance of ABAG's correspondence table, CCWD's Census Tract/Population Estimate Database, the review of general plans and specific plans for the affected cities within the study area, and input by the agencies involved during meetings held in August and September 1994. See Attachment A, at the back of this document, for population breakdowns for each census tract listed by subarea and alternative.

Population Projections by Subarea and Service Areas

The population projections for each of the service areas are shown in Exhibit A-44 through A-48. Subareas are again grouped under the headings TWSA, RWSA and Other Areas. Population projections are shown by decade from 1990 to 2040, and projections have been rounded to the nearest ten for the years 2000 to 2040, which accounts for some difference in totals between those of Attachment A.

City and County Review

ABAG projections, like the buildout or horizon years of many of the city general plans, only extend to the year 2010. EDAW, therefore, was responsible for the extension of the ABAG data to the year 2040. This was achieved by analyzing the growth curves for prior decades for each of the subareas, and then extrapolating the curves out to the year 2040 with some adjustments based on local land use plans. The years 2020 and 2030 were then found by interpolating between ABAG's estimate for the year 2010 and EDAW's estimate for the horizon year of 2040. These extended projection years were reviewed with the jurisdictions involved, and generally required only minor adjustments. Exhibit A-49 displays a copy of the letter sent out to eight cities, the County, and Diablo Water District, requesting review and response on preliminary population and household estimates. (For consistency of the study, household estimates and household consumption rates were later dropped, in favor of population and per capita rates to determine water demand). Attachment B to this Appendix contains a sample of the full information package provided to the various jurisdictions. Exhibit A-50 represents a summary of the local agency response to estimates and projections, as well as any resulting changes made to the FWSS database.

A-52

INTENSIFICATION

Due to the extended planning horizon necessary for this study, there has been significant speculation about the amount of potential development beyond the years 2005-2010, when many cities and the county reach their present planning horizons. In addition, Measure C expires in 2010, raising potential uncertainty for future development trends, especially in the East County and within or outside of the Urban Limit Line (ULL). Conjecture as to how land will ultimately develop between the years 2010 and 2040, might take on various scenarios including: 1) no additional buildout beyond the ULL, 2) a change in the County's existing 65/35 land preservation standard, or 3) the extension or removal of the ULL, with the potential for further development to existing agricultural and rural lands.

Intensification rates are applied to Alternative F only and assume increasing permitted residential densities and related increases in supporting services. Intensification would occur over time, because revisions in the County General Plan and associated local general plans may allow it. Exhibit A-51 lists the possible scenarios which could occur.

Areas within the cities of Antioch, Brentwood and Pittsburg were originally identified for intensification within Alternative F, based on the densification concept used in the *East County Water Supply Management Study*. As a result of discussions with District staff as well as the Customer Feedback Group, it was determined that cities within the TWSA are just as likely to experience intensification or redevelopment. Most of the cities within the TWSA are already approaching levels identified for "ultimate buildout", and would probably be intensified before the cities identified in the East County study.

C-100165

Exhibit A-38
Acreage by Land Use Designations
Service Area A

	Single Family Residential				Multi Family Residential						Mixed Use Areas						Commercial and Industrial								Open Space and Other Uses											
Subarea	SV	SL	SM	SH	ML	MM	MO	MH	MV	MS	M2	M3	M5	M6	M8	M9	RC	CO	ACO	OF	BP	LI	HI	CR	LF	PS	PSN	PR	PRI	DR	OS	AC	AL	WA	Total	Subarea
Treated Water Service Area																																			Treated Water Service Area
Clayton	20	219	817	249	158	3								4				47								37		63	97		781		19		2,514	Clayton
Clyde			13	48		1																2				20	8	1	2				0		96	Clyde
Concord	84	131	474	7,243	19	584		357									391	718		110	2	728	3		0	1,467	4,988	764	365		526		233		19,188	Concord
Martinez		116	73	340	204	52		65										82		17		14	1			96		91			355		28		1,534	Martinez
Pacheco		6		137	100	18		14										74	7	12		99				406		0	62		5				940	Pacheco
Pleasant Hill	17	127	1,794	83	9	313		27	2		29						18	209		76		23				461		70	50		165				3,471	Pleasant Hill
Port Costa				13														8					20			99		367			13		68	9	598	Port Costa
Walnut Creek	61	231	1,243	590	171	110		25				0						88		16	262					266		929	202		156		191		4,542	Walnut Creek
Unincorporated in TWSA	999	289	264	628	93	35		81	38			19						102		60		468	3,229			2,488	4	3,519	134		2,416		5,713	401	20,977	Unincorporated in TWSA
TOTALS	1,181	1,120	4,678	9,331	754	1,116	0	569	39	0	29	19	0	4	0	0	408	1,328	7	292	264	1,334	3,253	0	0	5,341	5,000	5,805	912	0	4,417	0	6,251	410	53,861	TOTALS
Raw Water Service Area																																			Raw Water Service Area
Bay Point		3	98	908	76	167		2		5			49					27		1		89	344	43		1,110	21	132	27		1,578		197	61	4,937	Bay Point
Antioch		291	844	4,408	817	384		80									77	401		154		443	544			830		204	776		2,693		712	170	13,829	Antioch
FUA-1			0	2	36																									14		2,071		2,124	FUA-1
FUA-2	0																									97				0		695		792	FUA-2
Martinez	100	185	422	670	372	99		49										149		37		126	959			392		984			1,175		334	35	6,088	Martinez
Pittsburg		105	0	2,666	134	287		96		2							0	546		58		375	296	26	72	807	5	177	340		205		1,368	9	7,575	Pittsburg
Oakley	175	941	589	1,784	109	171									647	19		298		54		463	484			641		79	18	253	4		586	71	7,385	Oakley
Unincorporated in RWSA	0	1	51	320	23	0												22				89	2,064		2	180		146	16	11	697		5,362	32	9,015	Unincorporated in RWSA
TOTALS	275	1,526	2,004	10,758	1,567	1,108	0	228	0	7	0	0	49	0	647	19	77	1,442	0	304	0	1,585	4,690	69	75	4,058	26	1,722	1,176	264	6,367	0	11,325	377	51,745	TOTALS
Other Areas																																			Other Areas
Hotchkiss Tract																																			Hotchkiss Tract
Bethel Island																																			Bethel Island
Knightsen																																			Knightsen
Discovery Bay																																			Discovery Bay
Byron																																			Byron
E. County Airport																																			E. County Airport
Veale Tract																																			Veale Tract
Brentwood																					13					3							811		827	Brentwood
Cowell Ranch																																			Cowell Ranch
Unincorporated inside ULL																																			Unincorporated inside ULL
Unincorporated outside ULL	11			1																		2			1		2				1	2		19	Unincorporated outside ULL
TOTALS	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	2	0	0	1	3	2	0	0	0	1	0	813	0	846	TOTALS
TOTAL ACREAGE	1,467	2,646	6,682	20,090	2,321	2,223	0	796	39	7	29	19	49	4	647	19	485	2,771	7	596	277	2,920	7,944	69	76	9,401	5,028	7,527	2,089	264	10,784	0	18,389	787	106,452	TOTAL ACREAGE

Represents subareas not included within this service area.

Exhibit A-39
Acreage by Land Use Designations
Service Area B

	Single Family Residential				Multi Family Residential						Mixed Use Areas						Commercial and Industrial								Open Space and Other Uses											
Subarea	SV	SL	SM	SH	ML	MM	MO	MH	MV	MS	M2	M3	M5	M6	M8	M9	RC	CO	ACO	OF	BP	LI	HI	CR	LF	PS	PSN	PR	PRI	DR	OS	AC	AL	WA	Total	Subarea
Treated Water Service Area																																				**Treated Water Service Area**
Clayton	20	219	817	249	158	3								4				47								37		63	97		781		19		**2,514**	Clayton
Clyde			13	48		1																2				20	8	1	2				0		**96**	Clyde
Concord	84	131	474	7,243	19	584		357									391	718		110	2	728	3		0	1,467	4,988	764	365		526		233		**19,188**	Concord
Martinez		116	73	340	204	52		65										82		17		14	1			96		91			355		28		**1,534**	Martinez
Pacheco		6		137	100	18		14										74	7	12		99				406		0	62		5				**940**	Pacheco
Pleasant Hill	17	127	1,794	83	9	313		27	2		29						18	209		76		23				461		70	50		165				**3,471**	Pleasant Hill
Port Costa				13														8					20			99		367			13		68	9	**598**	Port Costa
Walnut Creek	61	231	1,243	590	171	110		25				0						88		16	262					266		929	202		156		191		**4,542**	Walnut Creek
Unincorporated in TWSA	999	289	264	628	93	35		81	38			19						102		60		468	3,229			2,488	4	3,519	134		2,416		5,713	401	**20,977**	Unincorporated in TWSA
TOTALS	**1,181**	**1,120**	**4,678**	**9,331**	**754**	**1,116**	**0**	**569**	**39**	**0**	**29**	**19**	**0**	**4**	**0**	**0**	**408**	**1,328**	**7**	**292**	**264**	**1,334**	**3,253**	**0**	**0**	**5,341**	**5,000**	**5,805**	**912**	**0**	**4,417**	**0**	**6,251**	**410**	**53,861**	**TOTALS**
Raw Water Service Area																																				**Raw Water Service Area**
Bay Point		3	98	908	76	167		2		5			49					27		1		89	344	43		1,110	21	132	27		1,578		197	61	**4,937**	Bay Point
Antioch		291	844	4,467	817	384		80									77	401		154		443	544			830		333	776		2,753		938	170	**14,303**	Antioch
FUA-1			0	2	36																										14		2,071		**2,124**	FUA-1
FUA-2	0																									97					0		695		**792**	FUA-2
Martinez	100	185	422	670	372	99		49										149		37		126	959			392		984			1,175		334	35	**6,088**	Martinez
Pittsburg		105	0	2,666	134	287		96		2							0	546		58		375	296	26	72	807	5	854	340		205		1,368	28	**8,271**	Pittsburg
Oakley	544	1,082	589	1,793	109	171									647	19		301		54		463	484			653		79	18	253	4		625	71	**7,958**	Oakley
Unincorporated in RWSA	0	1	51	320	23	0												22				89	2,064		2	180		146	16	11	697		5,362	32	**9,015**	Unincorporated in RWSA
TOTALS	**644**	**1,667**	**2,004**	**10,826**	**1,567**	**1,108**	**0**	**228**	**0**	**7**	**0**	**0**	**49**	**0**	**647**	**19**	**77**	**1,446**	**0**	**304**	**0**	**1,585**	**4,690**	**69**	**75**	**4,069**	**26**	**2,527**	**1,177**	**264**	**6,427**	**0**	**11,590**	**396**	**53,488**	**TOTALS**
Other Areas																																				**Other Areas**
Hotchkiss Tract				72	17		8								425			57						14							150		2,222	47	**3,012**	Hotchkiss Tract
Bethel Island																																				Bethel Island
Knightsen			9	27														1				15				14							19		**85**	Knightsen
Discovery Bay																																				Discovery Bay
Byron																																				Byron
E. County Airport\																																				E. County Airport\
Veale Tract																														1,018			7	5	**1,031**	Veale Tract
Brentwood		77		4														19		13						3							811		**928**	Brentwood
Cowell Ranch																																				Cowell Ranch
Unincorporated within ULL	11	0		64											482							2			1	25	2	0	0		106		406	33	**1,131**	Unincorporated within ULL
Unincorporated outside ULL	29	0	6																						0	2	2	16	0		9		507		**573**	Unincorporated outside ULL
TOTALS	**40**	**77**	**15**	**167**	**17**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**907**	**0**	**0**	**78**	**0**	**0**	**13**	**17**	**0**	**14**	**1**	**44**	**4**	**17**	**0**	**1,018**	**266**	**0**	**3,973**	**85**	**6,759**	**TOTALS**
TOTAL ACREAGE	**1,865**	**2,864**	**6,697**	**20,324**	**2,338**	**2,223**	**8**	**796**	**39**	**7**	**29**	**19**	**49**	**4**	**1,554**	**19**	**485**	**2,852**	**7**	**596**	**277**	**2,935**	**7,944**	**83**	**76**	**9,454**	**5,030**	**8,349**	**2,090**	**1,283**	**11,109**	**0**	**21,813**	**891**	**114,108**	**TOTAL ACREAGE**

Represents subareas not included within this service area.

C-100169

Exhibit A-40
Acreage by Land Use Designations
Service Area C

	Single Family Residential				Multi Family Residential						Mixed Use Areas						Commercial and Industrial								Open Space and Other Uses											
Subarea	SV	SL	SM	SH	ML	MM	MO	MH	MV	MS	M2	M3	M5	M6	M8	M9	RC	CO	ACO	OF	BP	LI	HI	CR	LF	PS	PSN	PR	PRI	DR	OS	AC	AL	WA	Total	Subarea
Treated Water Service Area																																				**Treated Water Service Area**
Clayton	20	219	817	249	158	3								4				47								37		63	97		781		19		2,514	Clayton
Clyde			13	48		1																2				20	8	1	2				0		96	Clyde
Concord	84	131	474	7,243	19	584		357									391	718		110	2	728	3		0	1,467	4,988	764	365		526		233		19,188	Concord
Martinez		116	73	340	204	52		65										82		17		14	1			96		91			355		28		1,534	Martinez
Pacheco		6		137	100	18		14										74	7	12		99				406		0	62		5				940	Pacheco
Pleasant Hill	17	127	1,794	83	9	313		27	2		29						18	209		76		23				461		70	50		165				3,471	Pleasant Hill
Port Costa				13														8					20			99		367			13		68	9	598	Port Costa
Walnut Creek	61	231	1,243	590	171	110		25				0						88		16	262					266		929	202		156		191		4,542	Walnut Creek
Unincorporated in TWSA	999	289	264	628	93	35		81	38			19						102		60		468	3,229			2,488	4	3,519	134		2,416		5,713	401	20,977	Unincorporated in TWSA
TOTALS	**1,181**	**1,120**	**4,678**	**9,331**	**754**	**1,116**	**0**	**569**	**39**	**0**	**29**	**19**	**0**	**4**	**0**	**0**	**408**	**1,328**	**7**	**292**	**264**	**1,334**	**3,253**	**0**	**0**	**5,341**	**5,000**	**5,805**	**912**	**0**	**4,417**	**0**	**6,251**	**410**	**53,861**	**TOTALS**
Raw Water Service Area																																				**Raw Water Service Area**
Bay Point		3	98	908	76	167		2		5			49					27		1		89	344	43		1,110	21	132	27		1,578		197	61	4,937	Bay Point
Antioch		291	844	4,467	817	384		80									77	401		154		443	544			830		333	776		2,753		938	170	14,303	Antioch
FUA-1			0	2	36																										14		2,071		2,124	FUA-1
FUA-2	0																									97					0		695		792	FUA-2
Martinez	100	185	422	670	372	99		49										149		37		126	959			392		984			1,175		334	35	6,088	Martinez
Pittsburg		105	0	2,666	134	287		96		2							0	546		58		375	296	26	72	807	5	854	340		205		1,368	28	8,271	Pittsburg
Oakley	695	1,128	589	1,793	109	171									647	19		301		54		463	484			656		79	18	253	4		625	71	8,159	Oakley
Unincorporated in RWSA	0	1	51	320	23	0												22				89	2,064		2	180		146	16	11	697		5,362	32	9,015	Unincorporated in RWSA
TOTALS	**795**	**1,712**	**2,004**	**10,826**	**1,567**	**1,108**	**0**	**228**	**0**	**7**	**0**	**0**	**49**	**0**	**647**	**19**	**77**	**1,446**	**0**	**304**	**0**	**1,585**	**4,690**	**69**	**75**	**4,072**	**26**	**2,527**	**1,177**	**264**	**6,427**	**0**	**11,590**	**396**	**53,689**	**TOTALS**
Other Areas																																				**Other Areas**
Hotchkiss Tract				72	17		8								425			57						14						150		2,222	47	3,012	Hotchkiss Tract
Bethel Island		717		202	33		67											78						142				24	137		232		1,894	17	3,543	Bethel Island
Knightsen			9	27														1				15				14							19		85	Knightsen
Discovery Bay																																				Discovery Bay
Byron																																				Byron
E. County Airport																																				E. County Airport
Veale Tract																													1,018				7	5	1,031	Veale Tract
Brentwood		104		23	8													44			13					32							813		1,036	Brentwood
Cowell Ranch																																				Cowell Ranch
Unincorporated within ULL	11	0		64											482							2			1	25	2	0	0		106		406	33	1,131	Unincorporated within ULL
Unincorporated outside ULL	29	0	6																						0	14	2	16	0		9		1,268		1,346	Unincorporated outside ULL
TOTALS	**40**	**821**	**15**	**388**	**58**	**0**	**75**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**907**	**0**	**0**	**180**	**0**	**0**	**13**	**17**	**0**	**156**	**1**	**85**	**4**	**40**	**138**	**1,018**	**497**	**0**	**6,629**	**102**	**11,184**	**TOTALS**
TOTAL ACREAGE	**2,016**	**3,653**	**6,697**	**20,545**	**2,379**	**2,223**	**75**	**796**	**39**	**7**	**29**	**19**	**49**	**4**	**1,554**	**19**	**485**	**2,954**	**7**	**596**	**277**	**2,935**	**7,944**	**225**	**76**	**9,498**	**5,030**	**8,372**	**2,227**	**1,283**	**11,341**	**0**	**24,470**	**908**	**118,733**	**TOTAL ACREAGE**

Represents subareas not included within this service area.

C-100168

Exhibit A-41
Acreage by Land Use Designations
Service Area D

	Single Family Residential				Multi Family Residential						Mixed Use Areas						Commercial and Industrial								Open Space and Other Uses													
Subarea	SV	SL	SM	SH	ML	MM	MO	MH	MV	MS	M2	M3	M5	M6	M8	M9	RC	CO	ACO	OF	BP	LI	HI	CR	LF	PS	PSN	PR	PRI	DR	OS	AC	AL	WA	Total	Subarea
Treated Water Service Area																																					Treated Water Service Area
Clayton	20	219	817	249	158	3								4				47								37		63	97		781		19		2,514	Clayton
Clyde			13	48		1																2				20	8	1	2				0		96	Clyde
Concord	84	131	474	7,243	19	584		357									391	718		110	2	728	3		0	1,467	4,988	764	365		526		233		19,188	Concord
Martinez		116	73	340	204	52		65										82		17		14	1			96		91			355		28		1,534	Martinez
Pacheco		6		137	100	18		14										74	7	12		99				406		0	62		5				940	Pacheco
Pleasant Hill	17	127	1,794	83	9	313		27	2		29						18	209		76		23				461		70	50		165				3,471	Pleasant Hill
Port Costa				13														8					20			99		367			13		68	9	598	Port Costa
Walnut Creek	61	231	1,243	590	171	110		25				0						88		16	262					266		929	202		156		191		4,542	Walnut Creek
Unincorporated in TWSA	999	289	264	628	93	35		81	38			19						102		60		468	3,229			2,488	4	3,519	134		2,416		5,713	401	20,977	Unincorporated in TWSA
TOTALS	1,181	1,120	4,678	9,331	754	1,116	0	569	39	0	29	19	0	4	0	0	408	1,328	7	292	264	1,334	3,253	0	0	5,341	5,000	5,805	912	0	4,417	0	6,251	410	53,861	TOTALS
Raw Water Service Area																																					Raw Water Service Area
Bay Point		3	98	908	76	167		2		5			49					27		1		89	344	43		1,110	21	132	27		1,578		197	61	4,937	Bay Point
Antioch		291	844	4,467	817	384		80									77	401		154		443	544			830		333	776		2,753		938	170	14,303	Antioch
FUA-1			0	2	36																									14		2,071		2,124	FUA-1
FUA-2	0																									97				0		697		794	FUA-2
Martinez	100	185	422	670	372	99		49										149		37		126	959			392		984			1,175		334	35	6,088	Martinez
Pittsburg		105	0	2,666	134	287		96		2							0	546		58		375	296	26	72	807	5	854	340		205		1,368	28	8,271	Pittsburg
Oakley	852	1,149	589	1,793	109	171									647	19		301		54		463	484			658		79	18	253	4		625	71	8,339	Oakley
Unincorporated in RWSA	0	1	51	320	23	0												22				89	2,064		2	180		146	16	11	697		5,362	32	9,016	Unincorporated in RWSA
TOTALS	952	1,733	2,004	10,826	1,567	1,108	0	228	0	7	0	0	49	0	647	19	77	1,446	0	304	0	1,585	4,690	69	75	4,074	26	2,527	1,177	264	6,427	0	11,593	396	53,871	TOTALS
Other Areas																																					Other Areas
Hotchkiss Tract				72	17		8								425			57						14						150		2,222	47	3,012	Hotchkiss Tract
Bethel Island		717		202	33		67											78						142				24	137		232		1,894	17	3,543	Bethel Island
Knightsen			9	27														1				15				14							19		85	Knightsen
Discovery Bay																																					Discovery Bay
Byron																																					Byron
E. County Airport																																					E. County Airport
Veale Tract																														1,018		7	5	1,031	Veale Tract
Brentwood	28	551		945	526	95												216		46	652	367	1			205		1	8		8	198	1,311		5,160	Brentwood
Cowell Ranch																																					Cowell Ranch
Unincorporated within ULL	717	616		320	69	0									482			14		1	18	61			1	80	2	0	0		111	133	890	33	3,547	Unincorporated within ULL
Unincorporated outside ULL	29	0	6	5	3																	8			0	90	2	18	0		34	2,430	1,644		4,270	Unincorporated outside ULL
TOTALS	774	1,884	15	1,572	648	95	75	0	0	0	0	0	0	0	907	0	0	366	0	48	671	450	1	156	1	389	4	43	146	1,018	535	2,760	7,987	102	20,649	TOTALS
TOTAL ACREAGE	2,908	4,738	6,697	21,730	2,969	2,318	75	796	39	7	29	19	49	4	1,554	19	485	3,140	7	643	935	3,369	7,945	225	76	9,805	5,030	8,375	2,235	1,283	11,379	2,760	25,830	908	128,381	TOTAL ACREAGE

Represents subareas not included within this service area.

C-100170

Exhibit A-42
Acreage by Land Use Designations
Service Area E

	Single Family Residential				Multi Family Residential						Mixed Use Areas						Commercial and Industrial								Open Space and Other Uses												
Subarea	SV	SL	SM	SH	ML	MM	MO	MH	MV	MS	M2	M3	M5	M6	M8	M9	RC	CO	ACO	OF	BP	LI	HI	CR	LF	PS	PSN	PR	PRI	DR	OS	AC	AL	WA	Total	Subarea
Treated Water Service Area																																				Treated Water Service Area
Clayton	20	219	817	249	158	3								4				47								37		63	97		781		19		2,514	Clayton
Clyde			13	48		1																2				20	8	1	2				0		96	Clyde
Concord	84	131	474	7,243	19	584		357									391	718		110	2	728	3		0	1,467	4,989	764	365		526		233		19,190	Concord
Martinez		116	73	340	204	52		65										82		17		14	1			96		91			355		28		1,534	Martinez
Pacheco		6		137	100	18		14										74	7	12		99				406		0	62		5				940	Pacheco
Pleasant Hill	17	127	1,794	83	9	313		27	2		29						18	209		76		23				461		70	50		165				3,471	Pleasant Hill
Port Costa				13														8					20			99		367			13		68	9	598	Port Costa
Walnut Creek	61	231	1,243	590	171	110		25				0						88		16	262					266		929	202		156		191		4,542	Walnut Creek
Unincorporated in TWSA	999	289	264	628	93	35		81	38			19						102		60		468	3,229			2,488	4	3,519	134		2,416		5,713	401	20,977	Unincorporated in TWSA
TOTALS	1,181	1,120	4,678	9,331	754	1,116	0	569	39	0	29	19	0	4	0	0	408	1,328	7	292	264	1,334	3,253	0	0	5,341	5,001	5,805	912	0	4,417	0	6,251	410	53,863	TOTALS
Raw Water Service Area																																				Raw Water Service Area
Bay Point		3	98	908	76	167		2		5			49					27		1		89	344	43		1,110	21	132	27		1,578		197	61	4,937	Bay Point
Antioch		291	844	4,467	817	384		80									77	401		154		443	544			830		333	776		2,753		938	170	14,303	Antioch
FUA-1			0	2	36																									14		2,071		2,124	FUA-1
FUA-2	0																									97				0		697		794	FUA-2
Martinez	100	185	422	670	372	99		49										149		37		126	959			392		984			1,175		334	35	6,088	Martinez
Pittsburg		105	0	2,666	134	287		96		2							0	546		58		375	296	26	73	807	5	854	340		205		1,369	28	8,272	Pittsburg
Oakley	852	1,149	589	1,793	109	171									647	19		301		54		463	484			658		79	18	253	4		625	71	8,339	Oakley
Unincorporated in RWSA	0	1	51	320	23	0												22				89	2,064		2	180		146	16	11	697		5,362	32	9,016	Unincorporated in RWSA
TOTALS	952	1,733	2,004	10,826	1,567	1,108	0	228	0	7	0	0	49	0	647	19	77	1,446	0	304	0	1,585	4,690	69	75	4,074	26	2,527	1,177	264	6,427	0	11,593	396	53,872	TOTALS
Other Areas																																				Other Areas
Hotchkiss Tract				72	17		8								425			57						14						150		2,222	47	3,012	Hotchkiss Tract
Bethel Island		717		202	33		67											78						142				24	137		232		1,894	17	3,543	Bethel Island
Knightsen			9	27														1				15				14							19		85	Knightsen
Discovery Bay			778	18	107													14				3		39		42		6	186	1,150	2	35	1,272	562	4,214	Discovery Bay
Byron	3		36	81	13	2												7				8		6		12						15	44		226	Byron
E. County Airport																										1,007							854		1,861	E. County Airport
Veale Tract																														1,018			7	5	1,031	Veale Tract
Brentwood	28	551		945	526	95												216		46	652	367	1			205		1	8		8	198	1,311		5,161	Brentwood
Cowell Ranch																												100				60	4,239		4,399	Cowell Ranch
Unincorporated inside ULL	717	616		332	69	0									482			14		1	18	61			1,475	80	3	1	5		214	138	2,378	33	6,637	Unincorporated inside ULL
Unincorporated outside ULL	29	0	13	9	3																	8			1,048	90	2	27	0		42	2,576	6,277		10,126	Unincorporated outside ULL
TOTALS	777	1,884	835	1,687	768	96	75	0	0	0	0	0	0	0	907	0	0	387	0	48	671	461	1	201	2,524	1,450	5	158	337	2,168	648	3,022	20,517	665	40,294	TOTALS
TOTAL ACREAGE	2,910	4,738	7,517	21,845	3,089	2,320	75	796	39	7	29	19	49	4	1,554	19	485	3,162	7	643	935	3,380	7,945	270	2,599	10,866	5,032	8,490	2,426	2,433	11,492	3,022	38,361	1,470	148,029	TOTAL ACREAGE

Represents subareas not included within this service area.

Exhibit A-43
Water Use Factors for Specific Land Uses

County Code	District Code	Land Use Description	Range (residential) DUs per Net Acre Low	High	Water Use Factors
Single-Family Residential Densities					
SV	SV	Very Low	0.2	0.9	0.4
SL	SL	Low	1.0	2.9	1.1
SM	SM	Medium	3.0	4.9	1.9
SH	SH	High	5.0	7.3	2.0
Multiple-Family Residential Densities					
ML	ML	Low	7.4	11.9	3.0
MM	MM	Medium	12.0	20.9	4.0
MH	MH	High	21.0	29.9	6.5
MV	MV	Very High	30.0	44.9	6.5
MS	MS	Very High Special	45.0	99.0	interviews/6.5
MO	MO	Mobile Home	12.0	20.9	1.9
Commercial and Industrial					
RC	RC	Regional Commercial			2.5
CO	CO	Commercial			2.5
OF	OF	Office			1.5
BP	BP	Business Park			1.5
LI	LI	Light Industry			interviews/1.5
HI	HI	Heavy Industry			interviews/1.5
CR	CR	Commercial Recreation			2.5
MC	CM	Marina Commercial			0.5
ACO	ACO	Airport Commercial			2.5
Mixed Use Areas					
M2	M2	Pleasant Hill Redevelopment			2.5
M3	M3	Pleasant Hill Bart Station			2.5
M5	M5	West Pittsburg Corridor			2.5
M6	M6	Downtown Clayton			2.5
M8	M8	Oakley (Cypress Corridor)			2.5
M9	M9	Laurel Road (Oakley)			2.5
Open Space and Other Uses					
PS	PS	Public/Semi-Public			0.5
N/A	PSN	Concord Naval Weapons Station			.075
PR	PR	Parks and Recreation			0.0
N/A	PRI	Parks and Recreation Irrigated			3.0
OS	OS	Open Space			0.0
AL	AL	Agricultural Lands (assumes 1 du/5 acres)			0.5
AC	AC	Agricultural Core			0.0
LF	LF	Landfill			0.5
DR	DR	Delta Recreation			0.0
WA	WA	Water Area			0.0
WS	WS	Watershed			0.0

Note: Net acreage refers to residential land use designation only, and excludes streets, highways and all other public ROWs.
Net acreage is 75 percent of gross acres for single-family and 80% for multiple-family residential uses.

Source:
Water Use Factors were developed by CCWD, and are based on gross acreage. Land use designations are from County General Plan.

Exhibit A-44
Population Projections
Service Area A

	Population Projections					
	1990	2000[1]	2010[1]	2020[1]	2030[1]	2040[1]
Treated Water Service Area						
Clayton	7,512	10,490	11,670	12,190	12,480	12,640
Clyde	517	640	770	770	770	770
Concord	111,348	119,950	127,660	134,730	142,150	147,390
Martinez	7,630	8,650	8,960	9,050	9,110	9,130
Pacheco	3,325	3,450	3,410	3,410	3,410	3,410
Pleasant Hill	25,158	28,470	28,780	28,990	29,040	29,040
Port Costa	204	220	230	240	240	240
Walnut Creek	22,367	24,010	25,270	26,580	27,830	28,830
Unincorporated[2]	14,320	16,170	18,000	19,580	20,770	21,450
TOTAL	**192,381**	**212,050**	**224,750**	**235,540**	**245,800**	**252,900**
CCWD Raw Water Service Area						
Bay Point	17,453	18,110	18,790	19,150	19,300	19,320
Antioch	63,270	87,520	98,610	102,580	104,430	105,730
FUA-1	22	430	6,770	11,540	16,400	21,010
FUA-2	0	620	1,620	2,600	2,970	3,180
Martinez	24,166	27,420	28,360	28,670	28,870	28,920
Pittsburg	47,620	57,580	66,740	70,450	73,250	75,360
Oakley	16,923	23,000	38,730	47,370	52,390	55,500
Unincorporated[3]	428	1,060	2,710	4,110	4,440	4,630
TOTAL	**169,882**	**215,740**	**262,330**	**286,470**	**302,050**	**313,650**
Total for TWSA and RWSA	**362,263**	**427,790**	**487,080**	**522,010**	**547,850**	**566,550**
Other Areas						
Hotchkiss Tract						
Bethel Island						
Knightsen						
Discovery Bay						
Byron						
E. County Airport						
Veale Tract						
Brentwood	302	1,860	5,090	5,750	6,270	6,470
Cowell Ranch						
Unincorporated within ULL[4]						
Unincorporated outside ULL[5]	66	110	210	350	430	440
TOTAL	**368**	**1,970**	**5,300**	**6,100**	**6,700**	**6,910**
TOTAL SERVICE AREA A	**362,631***	**429,760**	**492,380**	**528,110**	**554,550**	**573,460**

Subareas not included within this Service Area.

Source:

ABAG Projections 94, extrapolations from 1990-2010 figures performed by EDAW based on existing growth curves.

*Population based on ABAG figures, CCWD 1990 District population figure of 368,784 was based on preliminary 1990 census, and calculated for slightly different boundaries than Service Area A.

Notes:

1. All projections for the years 2000 through 2040 have been rounded to the nearest 10.
2. Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
3. Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
4. Includes all other unincorporated areas within the Urban Limit Line.
5. Includes all unincorporated areas outside of the Urban Limit Line.

Exhibit A-45
Population Projections
Service Area B

	Population Projections					
	1990	2000[1]	2010[1]	2020[1]	2030[1]	2040[1]
Treated Water Service Area						
Clayton	7,512	10,490	11,670	12,190	12,480	12,640
Clyde	517	640	770	770	770	770
Concord	111,348	119,950	127,660	134,730	142,150	147,390
Martinez	7,631	8,650	8,960	9,050	9,110	9,130
Pacheco	3,325	3,450	3,410	3,410	3,410	3,410
Pleasant Hill	25,158	28,470	28,780	28,990	29,040	29,040
Port Costa	204	220	230	240	240	240
Walnut Creek	22,367	24,010	25,270	26,580	27,830	28,830
Unincorporated[2]	14,320	16,170	18,000	19,580	20,770	21,450
TOTAL	**192,382**	**212,050**	**224,750**	**235,540**	**245,800**	**252,900**
CCWD Raw Water Service Area						
Bay Point	17,453	18,110	18,790	19,150	19,300	19,320
Antioch	63,270	89,860	104,020	109,130	111,500	113,080
FUA-1	22	430	6,770	11,540	16,400	21,010
FUA-2	0	620	1,620	2,600	2,970	3,180
Martinez	24,165	27,420	28,360	28,670	28,870	28,920
Pittsburg	47,620	57,580	66,740	70,450	73,250	75,360
Oakley	17,514	23,830	40,360	50,110	55,730	58,910
Unincorporated[3]	428	1,060	2,710	4,110	4,440	4,630
TOTAL	**170,472**	**218,910**	**269,370**	**295,760**	**312,460**	**324,410**
Total for TWSA and RWSA	**362,854**	**430,960**	**494,120**	**531,300**	**558,260**	**577,310**
Other Areas						
Hotchkiss Tract	989	3,660	6,630	7,300	7,970	8,460
Bethel Island						
Knightsen	59	120	280	360	400	420
Discovery Bay						
Byron						
E. County Airport						
Veale Tract	15	30	60	90	120	150
Brentwood	358	1,950	5,270	6,050	6,640	6,840
Cowell Ranch						
Unincorporated within ULL[4]	0	0	550	790	830	850
Unincorporated outside ULL[5]	66	110	210	350	430	440
TOTAL	**1,487**	**5,870**	**13,000**	**14,940**	**16,390**	**17,160**
TOTAL SERVICE AREA B	**364,341**	**436,830**	**507,120**	**546,240**	**574,650**	**594,470**

Subareas not included within this Service Area.

Source:

ABAG Projections 94, extrapolations from 1990-2010 figures performed by EDAW based on existing growth curves.

Notes:

1. All projections for the years 2000 through 2040 have been rounded to the nearest 10.
2. Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
3. Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
4. Includes all other unincorporated areas within the Urban Limit Line.
5. Includes all unincorporated areas outside of the Urban Limit Line.

Exhibit A-46
Population Projections
Service Area C

	Population Projections					
	1990	2000[1]	2010[1]	2020[1]	2030[1]	2040[1]
Treated Water Service Area						
Clayton	7,512	10,490	11,670	12,190	12,480	12,640
Clyde	517	640	770	770	770	770
Concord	111,348	119,950	127,660	134,730	142,150	147,390
Martinez	7,631	8,650	8,960	9,050	9,110	9,130
Pacheco	3,325	3,450	3,410	3,410	3,410	3,410
Pleasant Hill	25,158	28,470	28,780	28,990	29,040	29,040
Port Costa	204	220	230	240	240	240
Walnut Creek	22,367	24,010	25,270	26,580	27,830	28,830
Unincorporated[2]	14,320	16,170	18,000	19,580	20,770	21,450
TOTAL	**192,382**	**212,050**	**224,750**	**235,540**	**245,800**	**252,900**
CCWD Raw Water Service Area						
Bay Point	17,453	18,110	18,790	19,150	19,300	19,320
Antioch	63,270	89,860	104,020	109,130	111,500	113,080
FUA-1	22	430	6,770	11,540	16,400	21,010
FUA-2	0	620	1,620	2,600	2,970	3,180
Martinez	24,165	27,420	28,360	28,670	28,870	28,920
Pittsburg	47,620	57,580	66,740	70,450	73,250	75,360
Oakley	17,923	24,490	41,660	52,300	58,390	61,630
Unincorporated[3]	428	1,060	2,710	4,110	4,440	4,630
TOTAL	**170,881**	**219,570**	**270,670**	**297,950**	**315,120**	**327,130**
Total for TWSA and RWSA	**363,263**	**431,620**	**495,420**	**533,490**	**560,920**	**580,030**
Other Areas						
Hotchkiss Tract	989	3,660	6,630	7,300	7,970	8,460
Bethel Island	2,115	2,420	2,670	3,340	4,040	4,600
Knightsen	59	120	280	360	400	420
Discovery Bay						
Byron						
E. County Airport						
Veale Tract	15	30	60	90	120	150
Brentwood	412	2,030	5,440	6,340	6,990	7,200
Cowell Ranch						
Unincorporated within ULL[4]	0	0	550	790	830	850
Unincorporated outside ULL[5]	278	540	1,170	1,620	1,850	1,930
TOTAL	**3,868**	**8,800**	**16,800**	**19,840**	**22,200**	**23,610**
TOTAL SERVICE AREA C	**367,131**	**440,420**	**512,220**	**553,330**	**583,120**	**603,640**

Subareas not included within this Service Area.

Source:
ABAG Projections 94, extrapolations from 1990-2010 figures performed by EDAW based on existing growth curves.

Notes:
1. All projections for the years 2000 through 2040 have been rounded to the nearest 10.
2. Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
3. Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
4. Includes all other unincorporated areas within the Urban Limit Line.
5. Includes all unincorporated areas outside of the Urban Limit Line.

Exhibit A-47
Population Projections
Service Area D

	Population Projections					
	1990	2000[1]	2010[1]	2020[1]	2030[1]	2040[1]
Treated Water Service Area						
Clayton	7,512	10,490	11,670	12,190	12,480	12,640
Clyde	517	640	770	770	770	770
Concord	111,348	119,950	127,660	134,730	142,150	147,390
Martinez	7,631	8,650	8,960	9,050	9,110	9,130
Pacheco	3,325	3,450	3,410	3,410	3,410	3,410
Pleasant Hill	25,158	28,470	28,780	28,990	29,040	29,040
Port Costa	204	220	230	240	240	240
Walnut Creek	22,367	24,010	25,270	26,580	27,830	28,830
Unincorporated[2]	14,320	16,170	18,000	19,580	20,770	21,450
TOTAL	**192,382**	**212,050**	**224,750**	**235,540**	**245,800**	**252,900**
CCWD Raw Water Service Area						
Bay Point	17,453	18,110	18,790	19,150	19,300	19,320
Antioch	63,270	89,860	104,020	109,130	111,500	113,080
FUA-1	22	430	6,770	11,540	16,400	21,010
FUA-2	0	620	1,620	2,600	2,970	3,180
	24,165	27,420	28,360	28,670	28,870	28,920
Pittsburg	47,620	57,580	66,740	70,450	73,250	75,360
Oakley	18,006	24,620	41,930	52,740	58,940	62,180
Unincorporated[3]	428	1,060	2,710	4,110	4,440	4,630
TOTAL	**170,964**	**219,700**	**270,940**	**298,390**	**315,670**	**327,680**
Total for TWSA and RWSA	**363,346**	**431,750**	**495,690**	**533,930**	**561,470**	**580,580**
Other Areas						
Hotchkiss Tract	989	3,660	6,630	7,300	7,970	8,460
Bethel Island	2,115	2,420	2,670	3,340	4,040	4,600
Knightsen	59	120	280	360	400	420
Discovery Bay						
Byron						
E. County Airport						
Veale Tract	15	30	60	90	120	150
Brentwood	7,563	17,290	38,430	49,400	55,460	56,770
Cowell Ranch						
Unincorporated within ULL[4]	1,044	1,900	4,850	5,320	6,060	6,190
Unincorporated outside ULL[5]	844	1,520	2,880	4,140	4,790	4,930
TOTAL	**12,629**	**26,940**	**55,800**	**69,950**	**78,840**	**81,520**
TOTAL SERVICE AREA D	**375,975**	**458,690**	**551,490**	**603,880**	**640,310**	**662,100**

Subareas not included within this Service Area.

Source:

ABAG Projections 94, extrapolations from 1990-2010 figures performed by EDAW based on existing growth curves.

Notes:

1. All projections for the years 2000 through 2040 have been rounded to the nearest 10.
2. Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
3. Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
4. Includes all other unincorporated areas within the Urban Limit Line.
5. Includes all unincorporated areas outside of the Urban Limit Line.

Exhibit A-48
Population Projections
Service Area E

	Population Projections					
	1990	2000[1]	2010[1]	2020[1]	2030[1]	2040[1]
Treated Water Service Area						
Clayton	7,512	10,490	11,670	12,190	12,480	12,640
Clyde	517	640	770	770	770	770
Concord	111,348	119,950	127,660	134,730	142,150	147,390
Martinez	7,631	8,650	8,960	9,050	9,110	9,130
Pacheco	3,325	3,450	3,410	3,410	3,410	3,410
Pleasant Hill	25,158	28,470	28,780	28,990	29,040	29,040
Port Costa	204	220	230	240	240	240
Walnut Creek	22,367	24,010	25,270	26,580	27,830	28,830
Unincorporated[2]	14,320	16,170	18,000	19,580	20,770	21,450
TOTAL	**192,382**	**212,050**	**224,750**	**235,540**	**245,800**	**252,900**
CCWD Raw Water Service Area						
Bay Point	17,453	18,110	18,790	19,150	19,300	19,320
Antioch	63,270	89,860	104,020	109,130	111,500	113,080
FUA-1	22	430	6,770	11,540	16,400	21,010
FUA-2	0	620	1,620	2,600	2,970	3,180
	24,165	27,420	28,360	28,670	28,870	28,920
Pittsburg	47,620	57,580	66,740	70,450	73,250	75,360
Oakley	18,006	24,620	41,930	52,740	58,940	62,180
Unincorporated[3]	428	1,060	2,710	4,110	4,440	4,630
TOTAL	**170,964**	**219,700**	**270,940**	**298,390**	**315,670**	**327,680**
Total for TWSA and RWSA	**363,346**	**431,750**	**495,690**	**533,930**	**561,470**	**580,580**
Other Areas						
Hotchkiss Tract	989	3,660	6,630	7,300	7,970	8,460
Bethel Island	2,115	2,420	2,670	3,340	4,040	4,600
Knightsen	59	120	280	360	400	420
Discovery Bay	5,351	10,140	15,700	17,750	18,060	18,230
Byron	761	1,220	1,680	2,160	2,570	2,650
E. County Airport	102	260	490	550	590	610
Veale Tract	15	30	60	90	120	150
Brentwood	7,563	17,290	38,430	49,400	55,460	56,770
Cowell Ranch	112	250	6,880	14,630	20,920	22,520
Unincorporated within ULL[4]	1,051	2,200	5,660	6,160	6,930	7,060
Unincorporated outside ULL[5]	844	1,560	3,380	4,980	5,640	5,770
TOTAL	**18,962**	**39,150**	**81,860**	**106,720**	**122,700**	**127,240**
TOTAL SERVICE AREA E	**382,308**	**470,900**	**577,550**	**640,650**	**684,170**	**707,820**

Source:

ABAG Projections 94, extrapolations from 1990-2010 figures performed by EDAW based on existing growth curves.

Notes:

1. All projections for the years 2000 through 2040 have been rounded to the nearest 10.
2. Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
3. Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
4. Includes all other unincorporated areas within the Urban Limit Line.
5. Includes all unincorporated areas outside of the Urban Limit Line.

Exhibit A-49
Letter to City and County Agencies Requesting Review of Projections

August 4, 1994

\Name
\Company
\Address
\City, State Zip

Subject: Contra Costa Water District, Future Water Supply Study

Dear \:

The Contra Costa Water District (CCWD) is in the process of preparing water demand projections for its Future Water Supply Study (FWSS). CCWD is being assisted by a consultant team led by EDAW Inc., San Francisco.

The water demand projections are being developed using three basic methodologies: (1) by mapping future land use patterns and applying water use factors (acre-feet per acre) to specific land uses; (2) by projecting population and households by decade, from 1990 to 2040, and applying per household or per capita consumption rates to those projections; and (3) combinations of the previous two methods.

To ensure the development of a reliable range of water demand projections, we need verification of the projections of population, households and land uses within your jurisdiction or sphere of influence (SOI) to the best of your ability. Specifically, we ask that you:

- Verify CCWD's subarea projections which are based on the most recent ABAG population and household projections to the year 2010;
- Verify our extension of those projections to the year 2040; and
- Indicate significant revisions to the current County land use plan buildout assumptions.

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Maps and data sheets for your jurisdiction are enclosed, along with brief explanations of the materials. Please make any corrections or revisions directly on these maps and data sheets. Joan Ryan from EDAW will be phoning you to provide assistance and to check for any difficulties you may be having. If questions or problems cannot be answered by phone or fax, she will be available to meet with you or members of your staff at your convenience.

Your help in expediting the review will be greatly appreciated. Our target date for receiving your comments on this portion of the FWSS is August 30, 1994. The results of this part of the FWSS will be made available to all interested parties upon completion. If there are any difficulties, please contact me at (510) 674-8057, or Fran Garland at (510) 603-8312. Thank you very much for your help!

Sincerely,

Greg Gartrell
Principal Engineer
Manager, FWSS

Exhibit A-50
Summary of Local Agency Responses to Population and Housing Estimates and Projections

City of Pittsburg

Written response 8/22/94	Comments:	City limits shown have expanded which would increase estimates in tracts 3141.02 and 3100.00. Also, city limits have expanded within tracts 3050.00 and 3090.00, however USS-Posco and other industrial lands are located there, so no significant increases.
Meeting 8/30/94	Comments:	The annexation lands to the south will need further study through the EIR process, as to what will eventually be developed. Buchanan Road Bypass is proposed at the southern boundary of the city, Draft EIR states no growth-inducing effects.

Change to Database After Agency Comments:
Households and populations were increased in tracts 3141.02 and 3100.00

City of Concord

Phone response 8/2/94	Comments:	General agreement with population and household estimates. Some concern that no demand is shown for Concord Naval Weapons Station. Redevelopment of the lands in the future could result in substantial increases in population.
Meeting 8/31/94	Comments:	Concord Naval Weapons Station could experience increases of up to 20,000 in population if densities mirrored adjacent neighborhoods, between 2020 and 2040. Also Cal State Campus and sand quarry site could result in an increase of 6,000 by 2040. Additional increases of approx. 1,650 persons and 1,260 persons were suggested for tracts 3280.00 and 3350.00 in the downtown and Concord BART areas, occurring between 2000 and 2040.

Change to Database After Agency Comments:
Households and populations were increased in tracts 3280.00 and 3350.00, and 3553.01.
Increases suggested for CNWS were added only to the Alternative F scenario.

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Exhibit A-50 (Continued)
Summary of Local Agency Responses to Population and Housing Estimates and Projections

City of Pleasant Hill

Phone response 8/26/94	Comments:	General agreement with estimates and projections, however tract 3270.00 split percentage between Concord and Pacheco needs to be adjusted.
Meeting 8/31/94	Comments:	Satisfied with projections, requested further checking on tract 3270.00 against the Traffic Zone Land Use Data published by the City. No growth or annexations foreseen beyond 2010.

Change to Database After Agency Comments:

No change found necessary. Traffic Zone Land Use Data confirmed ABAG split on tract in question was accurate.

City of Brentwood

Written response 8/23/94	Comments:	General agreement, with adjustments in a few small areas. Tract 3031.00, subarea 143b: the wastewater treatment plant is located in this subarea and expansion will probably utilize most of the subarea. No growth past 1990. Tract 3032.00, subarea 157c west Brentwood: population should be increased to 4,000 by 2010. Tract 3040.00, subarea 207a and 208, west Brentwood, should be increased to 3,000 by 2010.
Meeting 9/1/94	Comments:	Same general comments as reflected in letter. Projections are consistent with the latest General Plan. Cowell Ranch, approx. 7,300 units, will probably be annexed into the City in the future.

Change to Database After Agency Comments:

Adjustments were made to subareas as commented above. The timeline on growth in general was pushed slightly into the future. Estimates for 2040 are currently less than those shown in the current Brentwood general plan. County has reviewed.

Exhibit A-50 (Continued)
Summary of Local Agency Responses to Population and Housing Estimates and Projections

City of Clayton

Phone response 8/23/94	Comments:	Confident the projections are fairly accurate since they follow ABAG. The year 2010 is expected to be buildout, and should range between 12,000 and 15,000 people.
Meeting 9/6/94	Comments:	Same general comments, general agreement with estimates and projections. Marsh Creek Specific Plan is being scaled back in terms of area, but the pockets of proposed residential development will remain.

Change to Database After Agency Comments:
No adjustments found necessary.

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City of Antioch

Phone Response 9/9/94	Comments:	Not yet reviewed, feels comfortable with ABAG numbers being used, as a base. Will assist with new growth areas.
Sent additional copy 9/9/94		
Meeting 9/13/94	Comments:	General agreement with projections and estimates. No or very little development in FUA#1 and FUA#2 before the year 2000. 6,800 units (approximately) to be built in FUA #1 General agreement with projections and estimates.

Change to Database After Agency Comments:
Adjustments made to FUA#1 and FUA#2. Minimal development shown in FUA#1 and FUA#2 before the year 2000. The timeline on growth in general for Antioch was pushed slightly into the future.

Exhibit A-50 (Continued)
Summary of Local Agency Responses to Population and Housing Estimates and Projections

City of Walnut Creek

Phone response 8/24/94	Comments:	Will review and check against their computer system. Resend materials.
Sent additional copy 8/24/94		
Meeting 9/15/94	Comments:	Reviewed estimates and projections. Estimates of households for buildout were given to us for assistance with study. Numbers were consistent with ABAG. No annexations foreseen for residential development. Annexations of open space may occur to the east.

Change to Database After Agency Comments:
Minor adjustments were made, no substantial changes.

City of Martinez

Phone response 9/7/94	Comments:	Will review, but assumes estimates to be accurate since ABAG was used.
Meeting 9/15/94	Comments:	City is for the most part built out. City boundaries were reviewed. General agreement was made with estimates and projections. Buildout will probably occur prior to the County's buildout year of 2005.

Change to Database After Agency Comments:
Minor adjustments were made, no substantial changes.

Diablo Water District

Phone response 8/15	Comments:	Because the estimates sent do not break out Diablo Water District specifically, population projections would be difficult to review except in a very general sense. It was suggested that DWD gather any data that would be helpful to the study including information on consumption, industrial use and conservation measures and results. The county would be reviewing the same data for accuracy of estimates in the same area.
Written response 9/10/94	Comments:	Conservation program was discussed but no results given. Consumption figures were given on a monthly basis for the years 1989-1993.
Personal communication, 1995	Comments:	Recent analysis that takes into account 1988 through 1994 found a reduced average water use per dwelling unit (515 gpdpdu) as compared with DWD's earlier Master Plan (560 gpdpdu) shown for 1984 through 1990.

Change to Database After Agency Comments:
Materials were reviewed along with Water Master Plan for DWD, 1991.
No significant changes were made to the database, based on data received.

Exhibit A-50 (Continued)
Summary of Local Agency Responses to Population and Housing Estimates and Projections

Contra Costa County

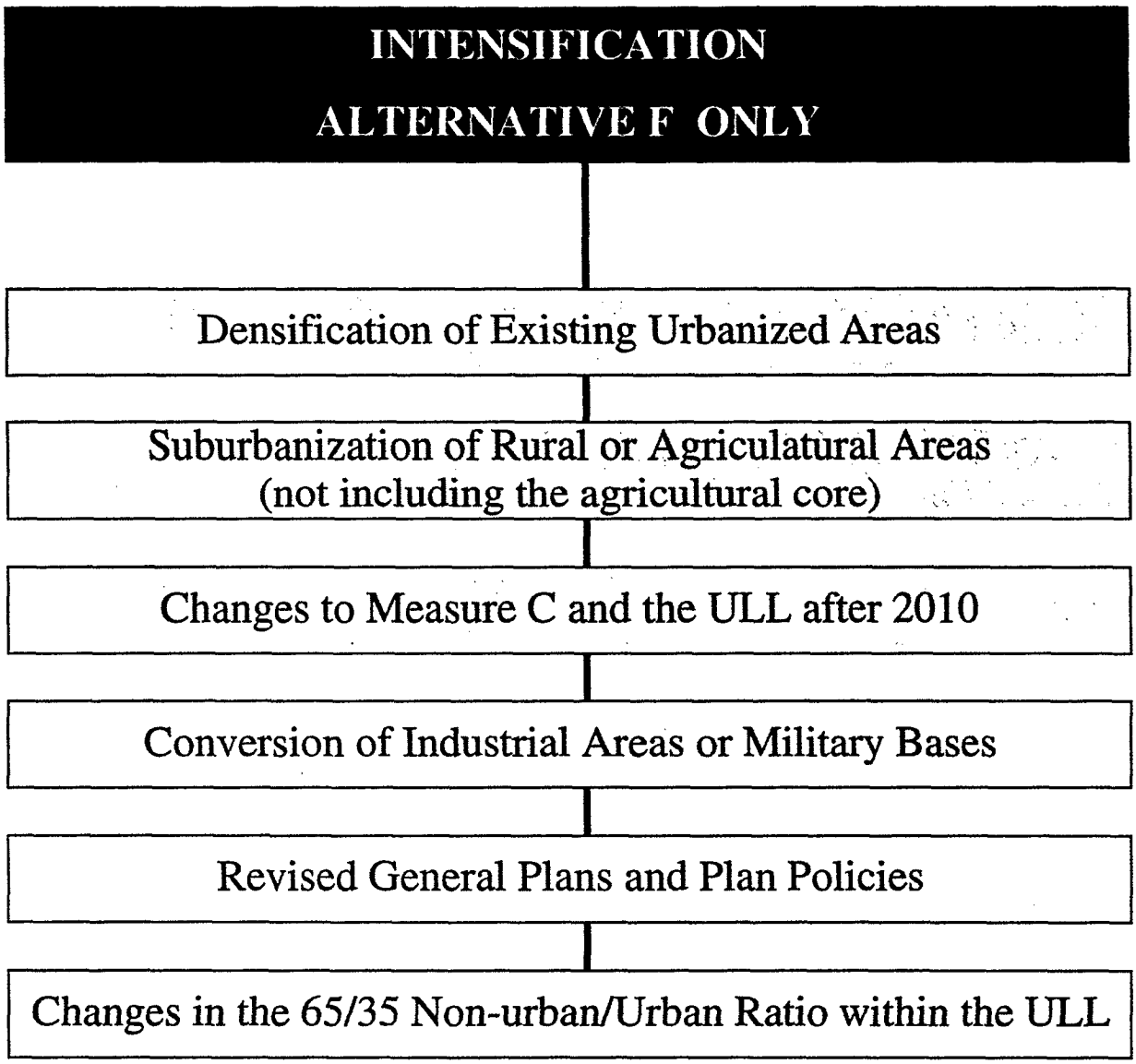
Written response 8/25/94

Comments: The County focussed primarily on 1990 numbers and reviewed them at a block level of detail. The East county communities of Antioch, Oakley, Knightsen, Discovery Bay, and Byron had changes recommended. Concord, Martinez and Pacheco had small adjustments.
In general, the county viewed growth projected by ABAG for the near term, (2000-2010) as possibly too aggressive, and suggested expanding the timeline for growth in many areas into the future.
The County also reviewed upcoming proposed development in the East County and assisted with timing of development for each.

Change to Database After Agency Comments:

Following guidance by the County, adjustments were made to some subareas.
ABAG proportions used to apportion the population are too general in some instances.
Also, ABAG splits population by sphere of influence and not necessarily by city boundaries.
Because alternatives split some blocks, another level of detail is required. The majority of major adjustments occurred within the east county area, and not in those communities already reviewed by other agencies.
Changes and additions were made to east county growth to account for new development proposed within the county.

Exhibit A-51
Potential Intensification Scenarios



Population Results from Intensification

Based on these future uncertainties, the potential for intensification could affect population estimates for the TWSA, the RWSA and Other Areas as shown in Exhibit A-52, given the possible scenarios shown in the previous exhibit. The potential intensification of each of the three areas is assumed to increase population as follows: TWSA, six percent; RWSA, nine percent; and Other Areas, 41 percent. "Other Areas" includes a large amount of agricultural land inside and outside of the Urban Limit Line, and it is assumed that one-half of the overall intensified growth would occur in converted agricultural lands, but no development would occur within the agricultural core.

There are approximately 31,000 acres designated as Agricultural Land, located outside of the ULL within Alternative F. The 13.5 percent intensified population figure shown in Exhibit A-52, represents approximately 95,390 additional people. Of this amount, it is assumed one-half would populate agricultural lands (not within the agricultural core). This would equate to approximately 17,344 new housing units, assuming 2.75 persons per household. Assuming two du/acre, such a population would require approximately 8,671 acres. If those same units were placed in a density of six dwelling units (du)/acre only 2,890 acres would be required. (These density assumptions are representative of the single family residential low [SL], and single family residential high [SH], County land use designations.) In both of these scenarios, it is only necessary to assume nine to 28 percent of existing agricultural lands would be converted to achieve such growth. This would not, however, include the lands necessary for non-residential support services. This discussion is not meant to advocate conversion of agricultural lands in this or any manner, but is presented as a high demand scenario for completeness.

This increase in population could lead to growth in commercial and industrial sectors as well, as cities strive to meet the jobs/housing balance in their area. Such increases in population could lead to an overall potential increase in residential, non-residential and major industrial water demand of 20 percent greater than Alternative E, in the year 2040. The distribution of such an increase has been assumed as follows: Residential, seven percent; Non-Residential, five percent; and Major Industrial, eight percent.

The Urban Limit Line

Approximately 32 percent of those unincorporated lands within Service Area F, and seven percent within Service Area E are outside of the ULL. The map shown earlier in Exhibit A-2 displays the ULL, as it relates to the six Service Areas. Exhibit A-53 lists all of the unincorporated lands outside of the ULL for Service Areas E and F, and the amount of acres which occur within each land use designation, which could be affected by any future changes in Measure C. There are approximately 2,500 acres of agricultural land inside, and 42,700 acres outside of the Urban Limit Line, some of which could potentially be developed after the year 2010, the mid-point for this study, and the year Measure C expires. As stated earlier, no development has been assumed within the FWSS for any lands designated as agricultural core. In addition, the Concord Naval Weapons Station is outside of the Urban Limit Line, even though it is considered to be within the City of Concord in the TWSA. The City of Concord notes the potential for between 10,000 to 20,000 additional people between the years 2020 and 2040 if CNWS were to convert to residential uses consistent with those densities adjacent to the station's existing boundaries.

RESIDENTIAL WATER DEMAND

CCWD historical consumption rates, ABAG population projections and existing Water Master Plans for the various jurisdictions were used to determine per capita consumption rates for residential demand. Exhibit A-54 presents historical residential water consumption rates in the District's TWSA based on customer sales during the period 1976-1993. Average consumption rates during this period of 119 gallons per capita per day (gpcd) and 301 gallons per day per household (gpdhh) were identified. These household and per capita numbers are an average among all water year types for that period. Although WUFs were used to determine residential demand in the TWSA, per capita figures were used in cross-checking results and developing conservation measures.

Exhibit A-52
Population Projections
Service Area F

	Population Projections						
	1990	2000	2010	2020	2030	2040	Increase Over Alternative E in 2040
Treated Water Service Area							
Intensification Increase	no change	no change	no change	7,260	11,720	16,590	6.0%
CCWD Raw Water Service Area							
Intensification Increase	no change	no change	no change	9,730	19,660	27,040	9.0%
Other Areas [1]							
Population Increase due to Increased Land Area	2,349	3,250	5,610	9,170	10,810	11,500	}
Intensification Increase	0	0	0	6,670	26,700	40,260	} 41.0%
INTENSIFICATION INCREASE	2,349	3,250	5,610	32,830	68,890	95,390	13.5%
TOTAL ALTERNATIVE F	384,657	474,150	583,160	673,480	753,060	803,210	

Source:
ABAG Projections 94, extrapolations from 1990-2010 figures performed by EDAW based on existing growth curves.

Note:
All projections for the years 1990 through 2040 have been rounded to the nearest 10.

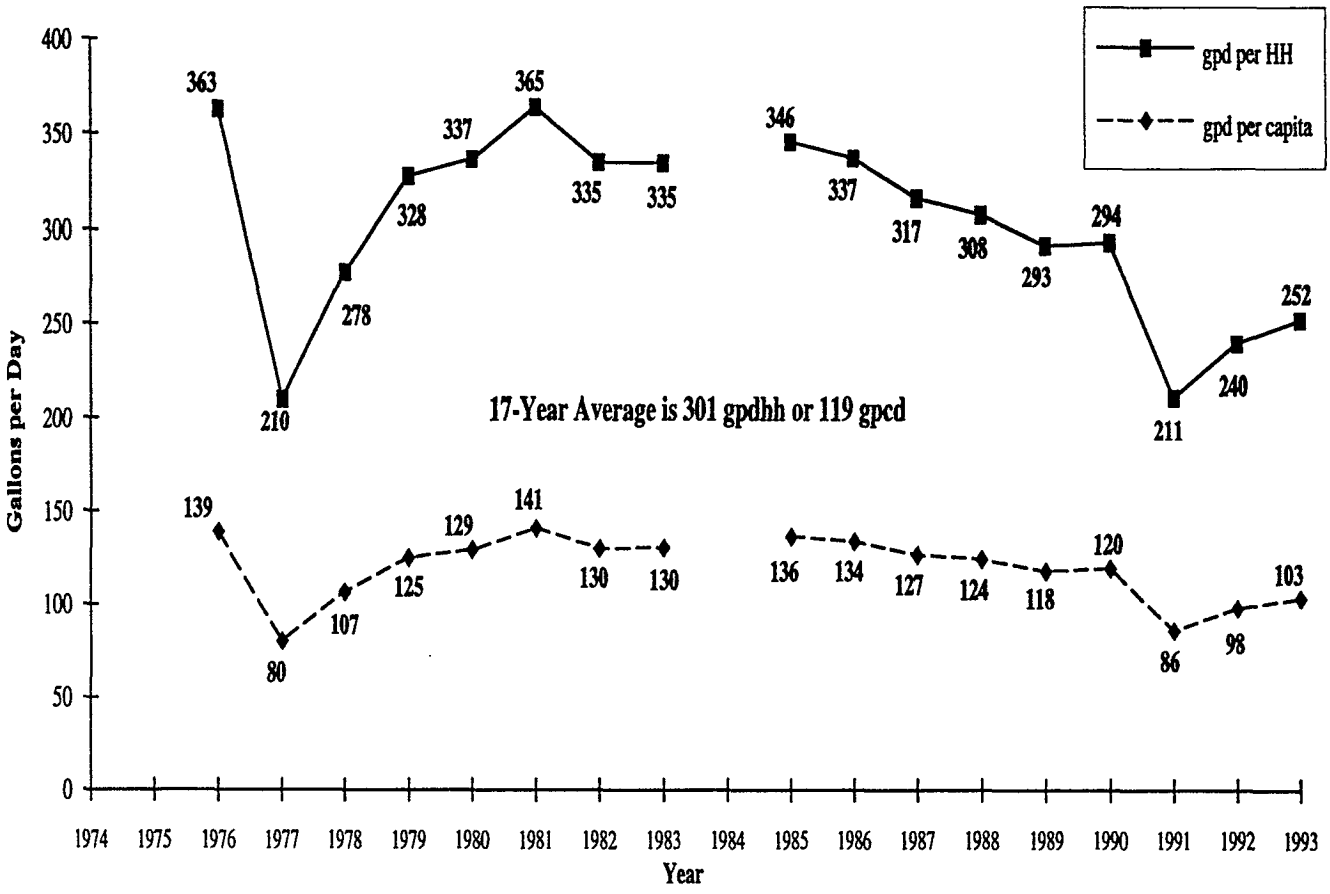
1. The increase in population in Other Areas includes both the population increase associated with the addition of lands in Service Area F, and the intensification of uses after 2010.

Exhibit A-53
Unincorporated Lands Outside the ULL

Land Use Designation	Number of Acres Outside the ULL Alt. E	Alt. F	Increase
SV	29	44	15
SM	13	21	8
SH	9	22	13
ML	3	22	19
LI	8	21	13
LF	1,048	1,048	0
PS	90	1,207	1,117
PSN	2	2	0
PR	27	493	466
PRI	0	5	5
DR	0	14,729	14,729
OS	42	288	246
AC	2,576	11,170	8,594
AL	6,277	31,610	25,333
WA	0	3,675	3,675
Total	**10,124**	**64,357**	**54,233**

Note: All lands outside the ULL within the TWSA and RWSA in Service Area A, were reflected within the appropriate community or unincorporated lands for the TWSA or RWSA categories to avoid double counting and make comparisons possible through the use of existing methodology in calculating demands.

Exhibit A-54
TWSA Residential Water Consumption Rates
(Gallons per Household and Gallons per Capita, per Day),
1976 to 1993



Source: See Exhibit A-31.

For areas outside of the TWSA, existing water master plan consumption figures for each of the jurisdictions were reviewed to determine per capita or per household consumption rates. This existing data was used, 1) to avoid duplication of work by other agencies, and 2) to maintain consistency with recognized methods already used by each agency in calculating existing and future water demands. Exhibit A-55 displays the corresponding per capita numbers which were used by Bay Point, Antioch, Pittsburg, Discovery Bay, Brentwood, and communities within the Diablo Water District for the FWSS demand projections. Per capita rates for these areas range between 141 gpcd in Antioch to 264 gpcd in Discovery Bay. Diablo Water District Master Plan, which includes Oakley, Bethel Island and Hotchkiss Tract, currently uses an overall per household rate of 560 gpd per dwelling unit (du) for water master planning. This figure, split between single family (600 gpdhh) and multi-family (400 gpdhh) uses, respectively, has been converted to an average per capita rate of 197 gpcd (based on an 80/20 single family/multi-family percentage split in housing units, and assuming ABAG persons per household ratios). Presently only five percent of the housing units are multi-family. Other subareas which also use a per household or per connection number, such as Bay Point, have also been converted to a per capita rate, for consistency of method. Each city is unique in calculating consumption rates; some include all customers within a consumption rate, while others include only residential customers, using separate factors for commercial or industrial customers. Some rates also include unaccounted for water. These inconsistencies are noted at the bottom of Exhibit A-35, the Demand Methodology Assumptions.

MAJOR INDUSTRIAL DEMAND AND LAND USE

Major industrial users, the top five raw water customers responsible for the highest use in this category, accounted for approximately one-third of CCWD's historical raw water demand in 1990. In addition, many industrial users divert water from the San Joaquin River. Some of these diversions are on a regular basis, and some are on an irregular basis since they are dependent on water quality, especially in critically dry years.

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Major Industrial Customers

Exhibit A-56 displays Water Sales and River Diversions for Major Industrial Customers for the period 1984-1993. Over that period, total canal sales to major industrial customers such as Tosco Oil, USS-Posco, Shell Oil and Gaylord Container ranged between 27,093 ac-ft and 48,449 ac-ft per year. (Gaylord's operations have recently closed down, however, it is assumed that an industry of comparable water needs will maintain this demand.) Historical average canal sales over that period for major industrial users is 37,680 ac-ft/year. DuPont, a major industrial customer within the Diablo Water District and located in Oakley, uses approximately 1,110[1] ac-ft/year (1984-93), and this amount has been added to the historical average for the other major industrial users for a total of 38,790 ac-ft/year.

Two major industries have reported plans for future expansion in recently published documents. Shell Oil and Tosco Oil have reported a planned increase in future water demand of 5,000 ac-ft/yr and 3,000 ac-ft/yr, respectively. These demands have been included with future demand projections beginning with the year 2000.

Minor Industrial Customers

Lands designated heavy industrial owned by Acme Fill, Industrial Tank Corporation, East Bay Regional Parks District, PG&E, and Dow Corporation also cover large areas, but have experienced very small levels of water demand. These lands were removed from the database and their future demand is assumed to be the same as their past average water use. (For example, PG&E is 680 ac-ft/yr and Dow is 260 ac-ft/year.) A "major industrial land use map" was used to identify large acreage of industrial land, to remove the land acreage from the database, and to substitute the acreage-related demand (WUF calculation) for these industries with actual or future demand data.

1 A placeholder of approximately 550 ac-ft was added to the amount shown for DuPont, to calculate future industrial demand for that area. This represents the potential for a new cogeneration facility within the DWD, which may occur prior to the year 2000, see Exhibit A-35.

Exhibit A-55
Unit Consumption Rates for Subareas within Service Areas A-F
Gallons per Capita per Day

Subareas	per Capita
TWSA	119[a]
Raw Water Service Area	
Bay Point	212[b]
Antioch	141[c]
FUA-1	137[c]
FUA-2	137[c]
Pittsburg	180[d]
Oakley	197[e]
Unincorporated	197[e]
Other Areas	
Hotchkiss Tract	197[e]
Bethel Island	197[e]
Knightsen	197[f]
Discovery Bay	264[g]
Byron	197[f]
E. County Airport	197[f]
Veale Tract	197[f]
Brentwood	164[h]
Cowell Ranch	164[i]
Unincorporated within ULL	197[f]
Unincorporated outside ULL	197[f]

a. 17-year average, 1976-1993, not including the year 1984. Residential use only. This rate was not used in calculating projected demands. See Water Use Factor discussion.
b. Bay Point per capita based upon 1992 figure of 600 gal. per connection from Calif. Cities Water, W. Pittsburg District Gen. Plan, and converted to 212 per capita based upon ABAG population data. All uses included.
c. Derived from City of Antioch Water System Master Plan Update. 141 gpcd is weighted based on population within zones, 170 gpcd for Zone 1 and 137 gpcd Zones II-IV. Includes UAW. Based on Res. and Com. only.
d. Pittsburg per capita number based upon 7-year average from 1985-1991. Source: City of Pittsburg 1992 Update to the Urban Water Management Plan. All uses included.
e. Diablo Water District's (DWD) Master Plan (February 1991) used an average 560 gpdpdu and showed data for the 1984-1990 period which ranged from 538 to 616 gpdpdu. The Master Plan average of 560 gpdpdu has been used in this Study in the analysis of DWD's demands. However, a recent analysis that takes into account 1988-1994 found an average of 515 gpdpdu (M. Yeraka, DWD, 1995, personal communication). While the Master Plan values have been used in the FWSS, DWD currently uses the lower figure. The effect of using the lower figure on the results of the FWSS would be small and would not affect the conclusions.
f. Knightsen, Byron, East County Airport, Veale Tract and Uninc. Inside and Outside ULL have been assigned per capitas consistent with Oakley due to similar land use patterns and weather types.
g. Based on 58 percent of max. day demand to achieve a 696 gallons per connection figure. Conversion to per capita based on Discovery Bay West (Draft EIR) per capita figures for Discovery Bay. All uses included.
h. Based on personal communication with Cameron Oden, Engineering Consultant, referencing Capital Improvements Financing Plan, and the Water Supply Study, City of Brentwood, Oct. 1990. All uses included.
i. Cowell Ranch per capita rate is consistent with that of Brentwood, because it is assumed for the purposes of this study, that City will eventually serve the area.

Sources:
Treated Water Master Plan, CCWD, December 1995.
California Cities Water West Pittsburg District General Plan, West Pittsburg, 1993.
Water System Master Plan Update, City of Antioch, July 1991.
1992 Update to the Urban Water Management Plan, City of Pittsburg, November 1992.
Master Water Plan, Oakley Water District, October 1991.
Master Plan for Water Supply and Water System Operation, Discovery Bay, January 1990.
Water Supply Study, City of Brentwood, October 1990.
East County Water Supply Management Study (Phase I), CCWD, January 1994.

Exhibit A-56
Water Sales and River Diversions by Major Industrial Customers, (Acre-Feet)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	10-Year
Water Year Type	wet	dry	wet	crit	crit	bn	crit	crit	crit	wet	Average
Major Industrial Customers											
Shell Oil	9,717	9,694	9,466	10,047	9,458	8,968	10,668	9,930	10,037	9,735	**9,772**
Tosco Oil (14" and 30")	9,565	9,756	9,983	10,874	10,318	10,528	12,491	9,023	10,366	10,762	**10,367**
USS-Posco (18" and 24")	7,521	7,677	7,133	7,610	7,439	7,686	5,587	6,200	5,627	6,050	**6,853**
Gaylord Container [c]	5,472	14,006	7,387	15,856	21,234	15,292	16,649	7,972	2,465	546	**10,688**
Total Major Industrial Canal Sales	**32,275**	**41,133**	**33,969**	**44,387**	**48,449**	**42,474**	**45,395**	**33,125**	**28,495**	**27,093**	**37,680**
Diablo Water District											
DuPont [d]	**825**	**868**	**878**	**874**	**1,171**	**1,303**	**1,303**	**1,219**	**1,317**	**1,345**	**1,110**
									Total Industrial Canal Sales		**38,790**

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Industrial River Diversions										
Tosco Oil	2,620	1,310	860	0	0	a.	a.	a.	a.	a.
USS-Posco	b.	b.	12,900	b.	b.	a.	3,200	a.	5,600	a.
Gaylord Container	a.	a.	a.	7,040	10,600	6,592	4,630	783	909	2,496
DuPont	31	28	28	31	38	38	38	20	21	38

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	10-Year
Municipal Diverters											Average
City of Antioch	4,408	1,049	2,756	440	0	0	0	529	1,234	3,132	**1,355**
Mallard Slough (CCWD)	7,535	157	5,770	64	0	1,436	0	536	491	6,290	**2,228**

Notes:
a) Denotes diversions may have taken place, but no records have been found.
b) Annual data not available but average from 1984 to 1988 is believed to be 12,900 ac-ft/yr.
c) Gaylord is combined with figures for Louisiana Pacific. Although closed, a replacement of comparable demand is assumed.
d) Industrial sales of water to DuPont via Diablo Water District.

Sources:
CCWD Total Industrial Canal Sales.
Tosco, 1984 to 1986: SWRCB, Division of Water Rights. Personal communication (R. Duff), September 1994.
1987 and 1988: CCWD, Los Vaqueros Memorandum dated Oct. 15,1990, from Bill Blackmer. (Converted and rounded from MGY).
USS-Posco, 1986 and 1990: Steel Mill Modernization... Draft EIR, January 1992. (Converted and rounded from GPM data).
USS-Posco, 1992: DDSD/CCWD Industrial Water Recycling Project. (Converted and rounded from MGD).
Gaylord Container diversions, 1991: CCWD memorandum; 1984 to 1986: not available; 1987: CCWD memo "Historical Use Calculation for USBR", dated December 15, 1995.
Gaylord Container, 1988 : SWRCB, Division of Water Rights. Personal communication (S. Okada) September 1994, but unconfirmed by Gaylord.
Gaylord Container, 1989-1990: personal communication (C. Muma) on 11/229/95, 12/7/95 and 1/18/96, shown for completeness, not needed in projection methodology.
Gaylord Container, 1991-1993 : E-Mail Message from Bill Zeenoni to Art Jensen, Nov. 3, 1994. (Converted from MG data for fiscal year ending Oct. 30).
DuPont, Updated data from Mike Yeraka, Diablo Water District, 12/6/94, and 7/96.
DuPont, 1984-1993 River Diversions, SWRCB, Division of Water Rights. Personal communication (S. Okada) December, 1994.
Mallard Slough, 1984-1993:CCWD's O&M Dept, Water Operations Section.
City of Antioch diversions: Letter from S. E. Davis, City of Antioch Director of Public Works to W.E. Anton, CCWD, dated September 6, 1994. (Converted from MGY).

Exhibit A-57 displays a list of major and minor industrial customers, number of acres removed from the WUF calculation, and average water demand assigned to that land use.

Major Industrial River Diversions

Records on these river diversions are not comprehensive. The State Water Resources Control Board (SWRCB) Division of Water Rights, Permits and Licenses, has supplied river diversion information for Gaylord Container for the years 1988 and 1991-93 only. Data for Tosco obtained from the SWRCB show specific diversions for the years 1984-1986. USS-Posco diversions have been reduced in recent years and currently hold at approximately 5,600 ac-ft/yr, and are not largely affected by water quality. DuPont diversions have been minimal, ranging between 20 and 38 ac-ft/yr for the ten-year period. Shell Oil does not divert river water. Draft EIRs for recent industrial projects and upgrades have been used to estimate existing and future water use. Interviews for the supply (reclamation) portion of the FWSS have not produced any significant changes to these estimates of future expansion and/or river diversions.

Major industrial water diversions were used only indirectly in calculating average annual demand. It was determined that major industrial canal sales represent an inverse relationship to river use, as water year types change (DuPont was not included in the analysis, due to its minimal diversion quantity). During the period 1978-1993, it was found that canal sales for major industrial customers during a critically dry year averaged 39,970 ac-ft, while sales during a wet year averaged 28,579 acre-feet, a difference of 11,391 acre-feet. This larger time period was analyzed when determining the impact of river diversions in order to include a larger number of wet years in the evaluation. In critically dry years, all major industries which have been meeting water needs through a combination of river and canal water, go off the river and switch over to the canal to receive higher quality water. Therefore, it is assumed that the difference between wet and critically dry years when reviewing historical canal sales is met through river diversions, since major industrial water use is relatively constant (based on years for which mandatory rationing did not influence demands). Exhibit A-58 displays an analysis of critical and wet year canal use. Exhibit A-59 represents those fluctuations in canal use, as occurring in the various water years. One-half of the difference (5,700 acre-feet) between critically dry and wet year canal sales, for the period above, was then used to represent a figure for average river diversions. This method was used to compensate for the incomplete data received on river diversions for most industries, and is shown on the Demand Methodology Assumptions in Exhibit A-35.

A-83

MUNICIPAL RIVER DIVERSIONS

The City of Antioch also diverts river water with a current capability of pumping up to 9,300 ac-ft/yr; however, these uses are being accounted for within the residential and non-residential demand methodology discussed earlier (a combination of per capita rates and water use factors). The manner in which the City of Antioch meets those demands, either by using canal or river water, is an issue of supply rather than demand. Exhibit A-60 displays river diversions from the San Joaquin River, for the years 1975 to 1993. Past records show that as a rule, Antioch diverts very little water during critical, below normal and dry years. The highest river diversions on record were during three consecutive wet years (1982-1984) when the city averaged 4,600 ac-ft/yr.

Mallard Slough is utilized by CCWD to divert water from the San Joaquin River. Water is diverted for direct use by raw water customers off the Mallard Pipeline and to the Mallard Reservoir for treatment at Bollman Water Treatment Plant. Again, diversions are shown here for information only as demand within the TWSA was calculated using WUFs. Historical diversions have averaged 5,633 ac-ft over the period 1974-1993, and have been as high as 18,867 ac-ft during a wet year. Exhibit A-61 represents diversions over the last 20 years. Recently, the slough has been used very little due to six years of drought conditions. During critically dry years, diversions have been reduced to under 1,000 ac-ft due to water quality issues. However, during a recent wet year, 1993, CCWD obtained 6,290 acre-feet from the River.

Exhibit A-57
Major and Minor Industrial Demand
Land Acreage Removed from WUF Application

Company	Land Acreage Removed from WUF calculation	Average Water Demand	Period of Average Demand Calculation	Increase in Future Demand
Major Industrial Customers				
Shell Oil	949	9,772	1984-93	5,000
Tosco Oil	1,695	10,367	1984-93	3,000
USS-Posco	566	6,853	1984-93	0
Gaylord Container	364	10,688	1984-93	0
Dupont	500	1,904[a]	1990 Demand	0
Subtotal	**4,074**	**39,584**		**8,000**
Minor Industrial Customers				
PG&E	733	680	1985-93	0
Dow Chemical	504	260	1984-93	0
Acme Fill, EBRPD, IT	888	0	1984-93	0
Concord Naval Weapons Station	4,988	380	CCWD historical	b
Subtotal	**7,113**	**1,320**		**0**

Note:
a. Includes a placeholder for other future industrial use which may occur in Oakley.
b. Future increases were calculated for Alternative F only, see Exhibit A-52

Exhibit A-58
Analysis of Critical and Wet Year Historical Use
Major Industrial Customers
Contra Costa Canal, (1978-1993)

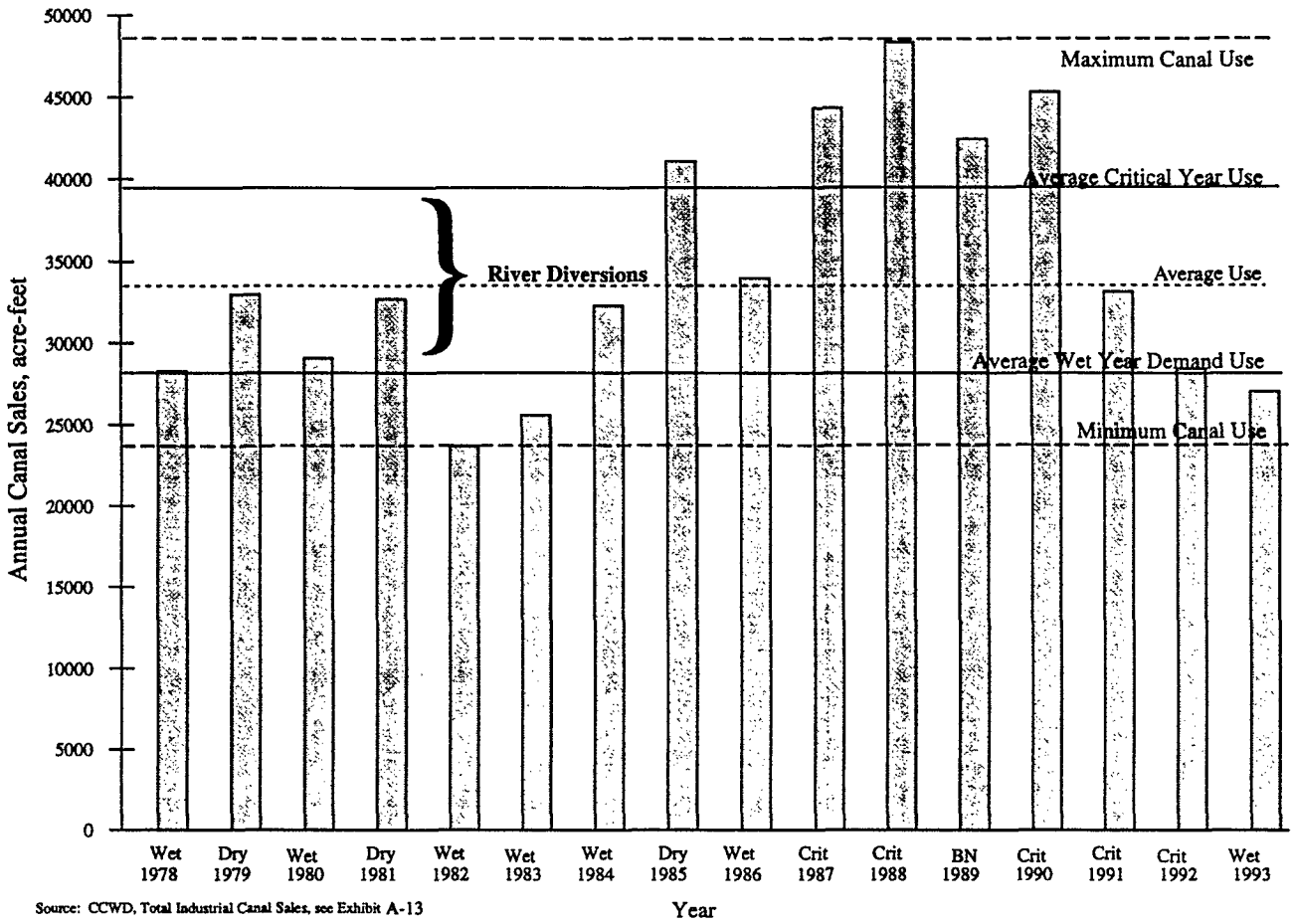
Year	Water Sales (acre-feet)	Water Year
1978	28,305	wet
1979	32,956	dry
1980	29,100	wet
1981	32,666	dry
1982	23,706	wet
1983	25,604	wet
1984	32,275	wet
1985	41,132	dry
1986	33,969	wet
1987	44,387	crit
1988	48,448	crit
1989	42,474	below normal
1990	45,394	crit
1991	33,124	crit
1992	28,495	crit
1993	27,093	wet

Critical Year Average Water Use	39,970 acre-feet
Wet Year Average Water Use	28,579 acre-feet
Difference in Water Use	11,391 acre-feet

Average Major Industrial River Diversions (one-half difference in water use) 5,700 acre-feet

Source:
See Exhibit A-13

Exhibit A-59
Major Industrial Canal Use, (1978-1993)



Source: CCWD, Total Industrial Canal Sales, see Exhibit A-13

A-86

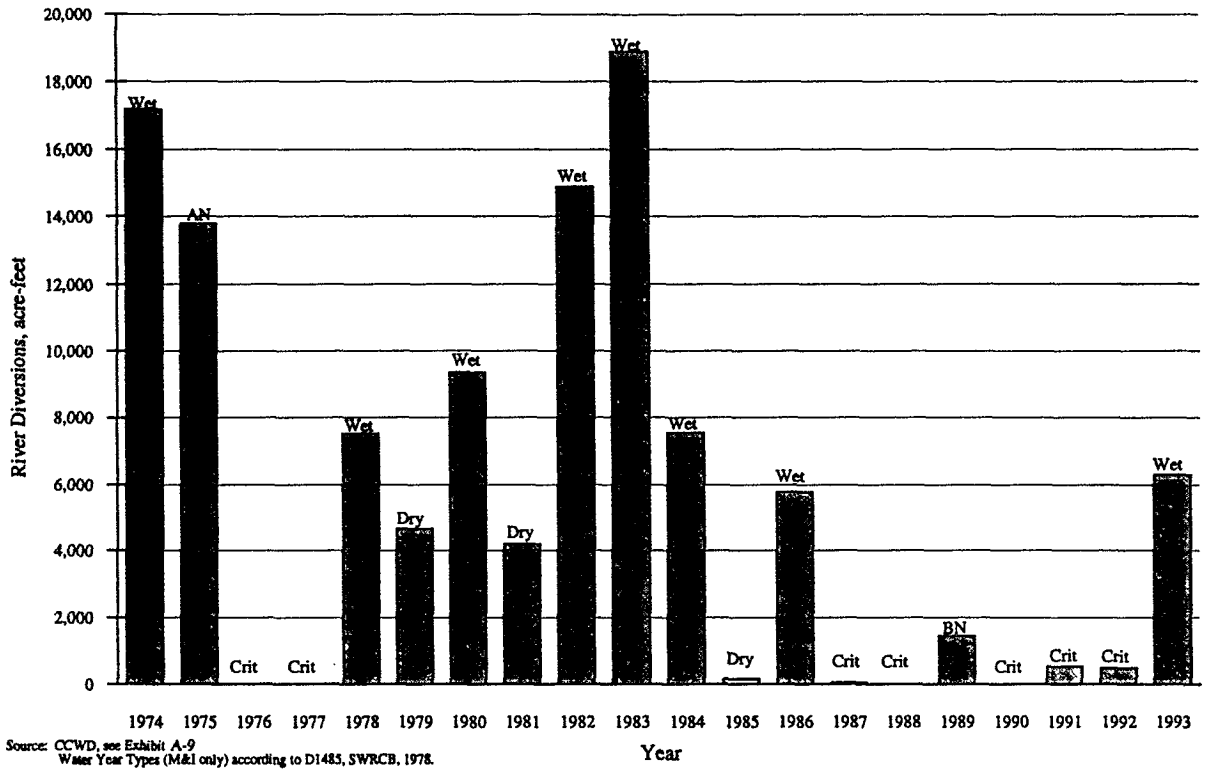
Exhibit A-60
Water Diverted from San Joaquin River, (1975-1993)
Antioch Pump Station

Year	Million[1] Gallons	Acre Feet
1975	1,752	5,377
1976	273	840
1977	0	0
1978	1,085	3,332
1979	686	2,106
1980	1,006	3,090
1981	454	1,395
1982	1,378	4,229
1983	1,690	5,189
1984	1,436	4,408
1985	341	1,049
1986	898	2,756
1987	143	440
1988	0	0
1989	0	0
1990	0	0
1991	172	529
1992	401	1,234
1993	1,018	3,132

1. Data given in million gallons per year and converted to acre-feet per year by EDAW for consistency with CCWD data.

Source:
City of Antioch, Public Works Department, September 6, 1994.

Exhibit A-61
River Diversions at Mallard Slough, (1974-1993)



Source: CCWD, see Exhibit A-9
Water Year Types (M&I only) according to D1485, SWRCB, 1978.

NON-RESIDENTIAL DEMAND

Non-residential demand includes uses by commercial and institutional customers, minor industry, parks, golf courses, landscape irrigation, public authority, fire and public safety, and other miscellaneous metered uses. The Major Municipal category includes some non-residential demand within the figures for that category. Minor Metered and Other Groups also include non-residential demand. Overall, such demand accounts for approximately 20 percent of the total demand.

The Minor Metered raw water customer group which includes minor municipal and minor industrial customers has accounted for an average of 2.7 percent of total historical consumption, while Other Groups, including homeowners associations, agricultural and temporary uses, account for 2.8 percent. The Other Groups category has generally declined since 1978, but includes homeowners associations, agriculture, and flat rate customers. Demand by both types of customers has been calculated using the land use/WUF method. Because these customer groups encompass a variety of land use designations, a direct comparison of historical use by customer group and demands generated by the WUF method was not practical.

A major non-residential land use requiring separate analysis was the Concord Naval Weapons Station (CNWS), which has been assigned a water demand number based on historical use. A demand of 380 ac-ft/yr is assumed as a total demand for the lands within the CNWS boundary. Almost 5,000 acres of the station are currently designated PSN (public semi-public) resulting in an implied WUF of 0.075 ac-ft/acre for this area.

For all non-residential demand not included within the TWSA or under a comprehensive consumption rate, WUFs were used for the calculations. Therefore, all non-residential areas within Antioch, Oakley and the East County, were calculated using WUFs.

CONSERVATION

Water savings from the existing State, federal and local conservation ordinances were estimated to range between 0 and 10 percent over the study period, irrespective of local water agencies' interim or temporary programs. These represent long-term water savings that should occur because of expected continuing efforts by residential and non-residential customers to reduce consumption. The water savings from conservation assumed in the demand projections includes measures which already exist in State, local or federal law, and savings attributed to the normal replacement of conventional water using devices (e.g. toilets and faucets) with water saving devices. State requirements for water savings hardware in new construction, the replacement of conventional toilets with low-flow hardware in existing households, and the greater awareness and willingness on the part of customers to apply conservation measures even in non-drought years, are expected to save an increasing percentage of overall water demand in the future. Conservation estimates for the years 2000, 2010, 2020, 2030 and 2040 have been estimated at 2, 4, 6, 8, and 10 percent, respectively, assuming "market penetration" and the meeting of newer plumbing codes will occur over time. These water savings estimates are assumed to occur primarily within the residential and non-residential sectors; major industrial customers are assumed to be operating in a relatively efficient manner.

Conservation savings by the year 2040 are expected to be achieved through many indoor and outdoor measures which are described in Technical Appendix C. Exhibit A-62 lists the assumptions for interior and exterior use on which savings estimates were developed. Three conservation program alternatives have been developed from six groupings of individual conservation measures. Suggested programs are meant to indicate the levels of implementation needed to achieve different levels of savings, in order to compare FWSS alternatives over the 50-year projection period.

Exhibit A-62
Indoor and Outdoor Residential Use

Category	TWSA/RWSA	Other Areas
Indoor Use	**50%**	**40%**
Toilet	21%	17%
Bath/Shower	15%	12%
Laundry	7%	6%
Dishwashing	3%	2%
Faucets	2%	2%
Cooking/Drinking	2%	2%
Outdoor Use	**50%**	**60%**
Landscaping	45%	54%
Other	5%	6%

UNACCOUNTED FOR WATER

Unaccounted for water use occurs within all water systems and is calculated as the difference between the quantity of water delivered into the distribution system as measured at the pumping or treatment plant, and the total of all metered quantities billed to customers. This includes leakage in the mains and distribution system, conveyance losses, system and street flushing, meter inaccuracies and unauthorized connections or use. Exhibit A-63 displays unaccounted for water use in the TWSA, which has ranged between 2.5 and almost 14 percent over the past twenty years. UAW in the TWSA distribution system is assumed to be seven percent, while the UAW in the other distribution areas is assumed to range between six and 14 percent. UAW figures have been obtained from each city's individual water master plan, and in the case of rural East County, UAW figures within the Los Vaqueros Scoping Report for that area were used. The city of Antioch has an eight percent UAW already calculated within their per capita figure. Due to the continuing extensive leak detection, repair and replacement program by the District, UAW is expected to be maintained at its current low level in future years. In addition, losses from the Contra Costa Canal are assumed to be constant, and represent a loss of 7,000 ac-ft/yr.

AVERAGE ANNUAL DEMANDS FOR SERVICE AREAS

The average annual demand projections for the FWSS analysis represents demand for a given geographic area, irrespective of who serves the water. Exhibit A-64 summarizes the demand projections for each of the six service area alternatives from 1990 to 2040. Average annual demand represents demand in an average year, and does not include the effects of drought on water use

Demand Projections for the Service Areas

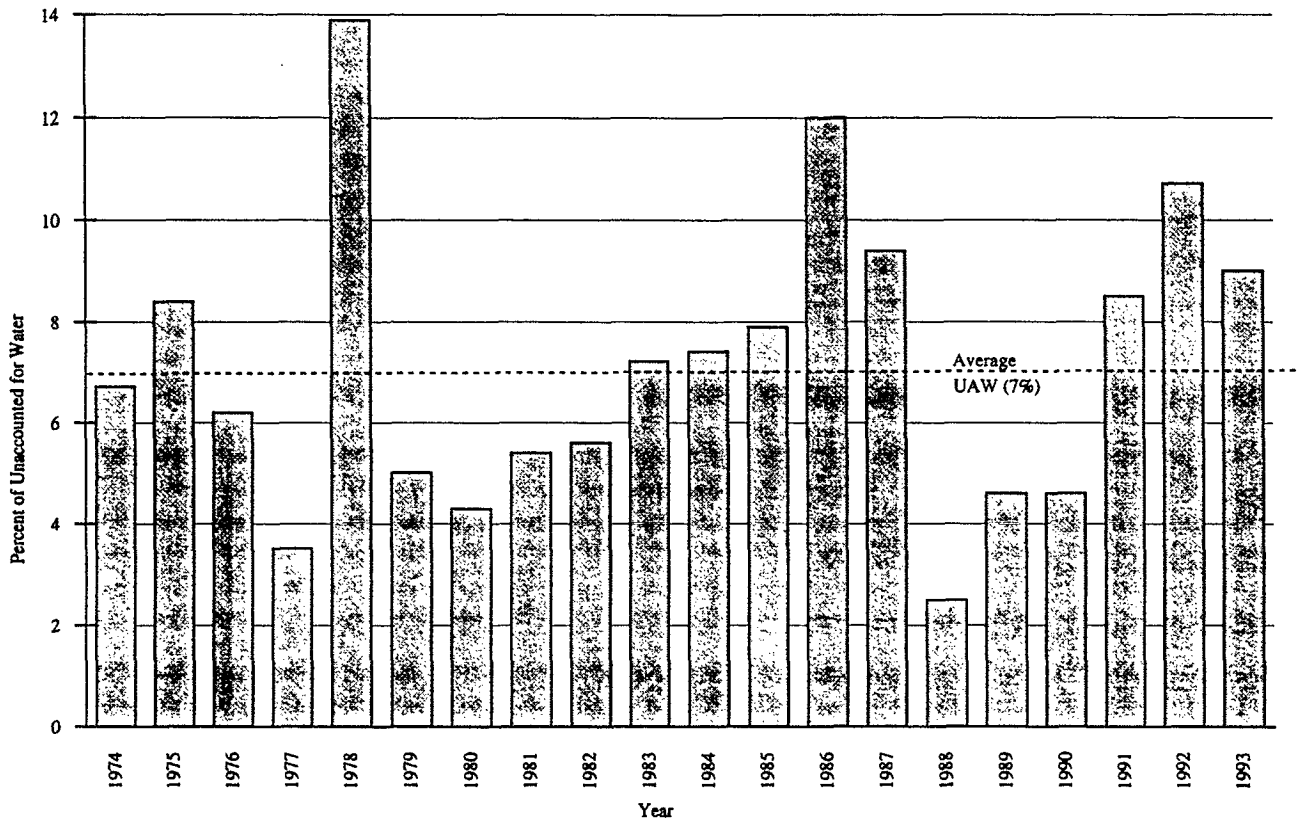
Exhibit A-65 through A-69 displays average annual water demand projections as calculated for each of the Alternatives A-F, from 1990 to 2040 (note: 1990 is projected, not actual water use). Demand represented in these exhibits has been grouped into subareas and unincorporated areas under each alternative. Demand by major industrial customers is included within the city or unincorporated lands in which they are located. Tosco, Shell Oil, USS-Posco, and Gaylord Container are reflected within the RWSA unincorporated row because they are raw water customers with a direct line to the Canal. DuPont demand is shown within the row for Oakley. Demand by Concord Naval Weapons Station is included within the demand projections shown for Concord.

Exhibit A-70 displays average annual demand for Alternative F, 1990 to 2040. The projections for service area Alternative F include demand resulting from the addition of 54,000 more acres of land, as well as the intensification of other land uses. Alternative F demands range from a four percent increase in 1990 to a 20 percent increase in 2040 over Alternative E. Of the 20 percent overall increase shown for the year 2040, 2.4 percent was allocated to the TWSA, 5.4 percent to the RWSA, and 12.2 percent to "Other Areas". Total increases combine to represent an increase in demand of 49,400 ac-ft/yr over Alternative E in the year 2040. Exhibit A-71 compares the six alternatives and the projected demand required for each decade.

Demand not Affected by Drought

Average annual *demand* represents demand in an average year, and is the amount of water that would be used in the absence of conservation or rationing that may be imposed because of a lack of supply. Drought demand is often higher than average demand, since the effects of weather (hot and dry) usually increases the need for exterior water. Drought use reductions occur after it is realized a drought is in effect, often a result of measures that are imposed to reduce use below the levels of available supply. Drought use is usually achieved as a result of customers modifying their behavior. The average annual demands shown here include drought demands, not drought use affected by rationing. Requirements to modify behavior or water use patterns will be examined in the conservation alternatives analysis.

Exhibit A-63
Unaccounted for Water in the TWSA, (1974-1993)



Source: See Exhibit A-16, unaccounted water equals total treated water production minus sales.

Exhibit A-64
Average Annual Demand Projections,
1990-2040, (ac-ft/yr)

	1990 [1]	2000	2010	2020	2030	2040
Service Area A	146,100	169,900	187,500	196,600	200,800	202,400
Service Area B	146,900	172,800	194,500	205,100	209,900	211,700
Service Area C	149,300	175,600	198,000	209,500	215,100	217,400
Service Area D	151,400	179,800	206,800	220,600	227,400	229,700
Service Area E	153,600	184,900	219,400	237,300	245,300	247,600
Service Area F	160,200	193,900	234,500	273,100	287,900	297,000

Notes:
All projections for the years 1990 through 2040 have been rounded to the nearest hundred.
1 The 1990 demand shown is not actual but an estimated demand level for 1990, based on the characteristics of each Service Area in 1990.

Exhibit A-65
Average Annual Water Demand Projections, (ac-ft/yr)
Service Area A

Subarea	1990	2000	2010	2020	2030	2040
TWSA						
Clayton	2,227	3,050	3,320	3,400	3,400	3,370
Clyde	107	130	150	150	150	140
Concord	25,532	26,950	28,100	28,840	29,260	29,190
Martinez	2,079	2,310	2,340	2,320	2,280	2,240
Pacheco	1,668	1,690	1,640	1,610	1,580	1,540
Pleasant Hill	5,961	6,610	6,550	6,460	6,330	6,190
Port Costa	174	180	190	190	190	180
Walnut Creek	6,072	6,390	6,590	6,780	6,950	7,040
Unincorporated in TWSA[1]	8,277	9,160	9,990	10,640	11,040	11,160
TWSA Total	**52,096**	**56,470**	**58,870**	**60,390**	**61,180**	**61,050**
RWSA						
Bay Point	3,143	3,200	3,250	3,240	3,200	3,130
Antioch	13,312	18,050	19,920	20,290	20,210	20,020
FUA-1	7	130	1,990	3,330	4,630	5,800
FUA-2	0	240	620	970	1,090	1,140
Martinez	6,584	7,320	7,420	7,340	7,240	7,090
Pittsburg	10,291	12,190	13,850	14,310	14,560	14,660
Oakley	8,439	10,610	16,260	19,100	20,520	21,190
Unincorporated in RWSA[2]	39,383	48,470	51,250	53,310	53,680	53,830
RWSA Total	**81,159**	**100,210**	**114,560**	**121,890**	**125,130**	**126,860**
Total for TWSA and RWSA	**133,255**	**156,680**	**173,430**	**182,280**	**186,310**	**187,910**
Other Areas						
Brentwood	63	380	1,020	1,130	1,210	1,220
Unincorporated outside ULL[3]	103	160	310	520	620	610
Other Areas Total	**166**	**540**	**1,330**	**1,650**	**1,830**	**1,830**
SUBTOTAL DEMAND	**133,421**	**157,220**	**174,760**	**183,930**	**188,140**	**189,740**
River Diversions (Major Industrial)	5,700	5,700	5,700	5,700	5,700	5,700
Conveyance Losses	7,000	7,000	7,000	7,000	7,000	7,000
TOTAL SERVICE AREA A[4]	**146,100**	**169,900**	**187,500**	**196,600**	**200,800**	**202,400**

Notes:
1 Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
2 Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
3 Includes the unincorporated areas outside of the Urban Limit Line.
4. All projections have been rounded to the nearest hundred.

*CCWD 1990 actual demand was 136,693 ac-ft, which does not include major industrial river diversions of 5,700 ac-ft, and miscellaneous annexations to 6/30/94.

Exhibit A-66
Average Annual Water Demand Projections, (ac-ft/yr)
Service Area B

Subarea	1990	2000	2010	2020	2030	2040
TWSA						
Clayton	2,227	3,050	3,320	3,400	3,400	3,370
Clyde	107	130	150	150	150	140
Concord	25,532	26,950	28,100	28,840	29,260	29,190
Martinez	2,079	2,310	2,340	2,320	2,280	2,240
Pacheco	1,668	1,690	1,640	1,610	1,580	1,540
Pleasant Hill	5,961	6,610	6,550	6,460	6,330	6,190
Port Costa	174	180	190	190	190	180
Walnut Creek	6,072	6,390	6,590	6,780	6,950	7,040
Unincorporated in TWSA[1]	8,277	9,160	9,990	10,640	11,040	11,160
TWSA Total	**52,096**	**56,470**	**58,870**	**60,390**	**61,180**	**61,050**
RWSA						
Bay Point	3,143	3,200	3,250	3,240	3,200	3,130
Antioch	13,312	18,460	20,850	21,390	21,380	21,210
FUA-1	7	130	1,990	3,330	4,630	5,800
FUA-2	0	240	620	970	1,090	1,140
Martinez	6,584	7,320	7,420	7,340	7,240	7,090
Pittsburg	10,291	12,190	13,850	14,310	14,560	14,660
Oakley	8,591	10,820	16,660	19,760	21,300	21,980
Unincorporated in RWSA[2]	39,383	48,470	51,250	53,310	53,680	53,830
RWSA Total	**81,311**	**100,830**	**115,890**	**123,650**	**127,080**	**128,840**
Total for TWSA and RWSA	**133,406**	**157,300**	**174,760**	**184,040**	**188,260**	**189,890**
Other Areas						
Hotchkiss Tract	604	2,190	3,890	4,190	4,480	4,650
Knightsen	27	60	120	160	170	170
Veale Tract	5	10	20	20	30	40
Brentwood	75	400	1,060	1,190	1,280	1,290
Unincorporated inside ULL[3]	0	0	1,610	2,250	2,310	2,330
Unincorporated outside ULL[4]	103	160	310	520	620	610
Other Areas Total	**814**	**2,820**	**7,010**	**8,330**	**8,890**	**9,090**
SUBTOTAL DEMAND	**134,220**	**160,120**	**181,770**	**192,370**	**197,150**	**198,980**
River Diversions (Major Industrial)	5,700	5,700	5,700	5,700	5,700	5,700
Conveyance Losses	7,000	7,000	7,000	7,000	7,000	7,000
TOTAL SERVICE AREA B[5]	**146,900**	**172,800**	**194,500**	**205,100**	**209,900**	**211,700**

Notes:

1 Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
2 Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
3 Includes the unincorporated areas inside of the Urban Limit Line.
4 Includes the unincorporated areas outside of the Urban Limit Line.
5. All projections have been rounded to the nearest hundred.

*CCWD 1990 actual demand was 136,693 ac-ft, which does not include major industrial river diversions of 5,700 ac-ft, and miscellaneous annexations to 6/30/94.

Exhibit A-67
Average Annual Water Demand Projections, (ac-ft/yr)
Service Area C

Subarea	1990	2000	2010	2020	2030	2040
TWSA						
Clayton	2,227	3,050	3,320	3,400	3,400	3,370
Clyde	107	130	150	150	150	140
Concord	25,532	26,950	28,100	28,840	29,260	29,190
Martinez	2,079	2,310	2,340	2,320	2,280	2,240
Pacheco	1,668	1,690	1,640	1,610	1,580	1,540
Pleasant Hill	5,961	6,610	6,550	6,460	6,330	6,190
Port Costa	174	180	190	190	190	180
Walnut Creek	6,072	6,390	6,590	6,780	6,950	7,040
Unincorporated in TWSA[1]	8,277	9,160	9,990	10,640	11,040	11,160
TWSA Total	**52,096**	**56,470**	**58,870**	**60,390**	**61,180**	**61,050**
RWSA						
Bay Point	3,143	3,200	3,250	3,240	3,200	3,130
Antioch	13,312	18,460	20,850	21,390	21,380	21,210
FUA-1	7	130	1,990	3,330	4,630	5,800
FUA-2	0	240	620	970	1,090	1,140
Martinez	6,584	7,320	7,420	7,340	7,240	7,090
Pittsburg	10,291	12,190	13,850	14,310	14,560	14,660
Oakley	8,688	10,970	16,960	20,250	21,880	22,560
Unincorporated in RWSA[2]	39,383	48,470	51,250	53,310	53,680	53,830
RWSA Total	**81,407**	**100,980**	**116,190**	**124,140**	**127,660**	**129,420**
Total for TWSA and RWSA	**133,503**	**157,450**	**175,060**	**184,530**	**188,840**	**190,470**
Other Areas						
Hotchkiss Tract	604	2,190	3,890	4,190	4,480	4,650
Bethel Island	2,102	2,350	2,550	3,120	3,690	4,120
Knightsen	27	60	120	160	170	170
Veale Tract	5	10	20	20	30	40
Brentwood	86	420	1,100	1,250	1,350	1,360
Unincorporated inside ULL[3]	0	0	1,610	2,250	2,310	2,330
Unincorporated outside ULL[4]	246	450	940	1,320	1,500	1,520
Other Areas	**3,071**	**5,480**	**10,230**	**12,310**	**13,530**	**14,190**
SUBTOTAL DEMAND	**136,574**	**162,930**	**185,290**	**196,840**	**202,370**	**204,660**
River Diversions (Major Industrial)	5,700	5,700	5,700	5,700	5,700	5,700
Conveyance Losses	7,000	7,000	7,000	7,000	7,000	7,000
TOTAL SERVICE AREA C [5]	**149,300**	**175,600**	**198,000**	**209,500**	**215,100**	**217,400**

Notes:

1 Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
2 Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
3 Includes the unincorporated areas inside of the Urban Limit Line.
4 Includes the unincorporated areas outside of the Urban Limit Line.
5. All projections have been rounded to the nearest hundred.

*CCWD 1990 actual demand was 136,693 ac-ft, which does not include major industrial river diversions of 5,700 ac-ft, and miscellaneous annexations to 6/30/94.

Exhibit A-68
Average Annual Water Demand Projections, (ac-ft/yr)
Service Area D

Subarea	1990	2000	2010	2020	2030	2040
TWSA						
Clayton	2,227	3,050	3,320	3,400	3,400	3,370
Clyde	107	130	150	150	150	140
Concord	25,532	26,950	28,100	28,840	29,260	29,190
Martinez	2,079	2,310	2,340	2,320	2,280	2,240
Pacheco	1,668	1,690	1,640	1,610	1,580	1,540
Pleasant Hill	5,961	6,610	6,550	6,460	6,330	6,190
Port Costa	174	180	190	190	190	180
Walnut Creek	6,072	6,390	6,590	6,780	6,950	7,040
Unincorporated in TWSA[1]	8,277	9,160	9,990	10,640	11,040	11,160
TWSA Total	**52,096**	**56,470**	**58,870**	**60,390**	**61,180**	**61,050**
RWSA						
Bay Point	3,143	3,200	3,250	3,240	3,200	3,130
Antioch	13,312	18,460	20,850	21,390	21,380	21,210
FUA-1	7	130	1,990	3,330	4,630	5,800
FUA-2	0	240	620	970	1,090	1,140
Martinez	6,584	7,320	7,420	7,340	7,240	7,090
Pittsburg	10,291	12,190	13,850	14,310	14,560	14,660
Oakley	8,708	11,000	17,020	20,350	22,010	22,680
Unincorporated in RWSA[2]	39,383	48,470	51,250	53,310	53,680	53,830
RWSA Total	**81,428**	**101,010**	**116,250**	**124,240**	**127,790**	**129,540**
Total for TWSA and RWSA	**133,523**	**157,480**	**175,120**	**184,630**	**188,970**	**190,590**
Other Areas						
Hotchkiss Tract	604	2,190	3,890	4,190	4,480	4,650
Bethel Island	2,102	2,350	2,550	3,120	3,690	4,120
Knightsen	27	60	120	160	170	170
Veale Tract	5	10	20	20	30	40
Brentwood	1,586	3,550	7,740	9,740	10,700	10,720
Unincorporated inside ULL[3]	377	670	3,100	3,790	4,050	4,070
Unincorporated outside ULL[4]	470	830	1,590	2,260	2,570	2,590
Other Areas	**5,171**	**9,660**	**19,010**	**23,280**	**25,690**	**26,360**
SUBTOTAL DEMAND	**138,695**	**167,140**	**194,130**	**207,910**	**214,660**	**216,950**
River Diversions (Major Industrial)	5,700	5,700	5,700	5,700	5,700	5,700
Conveyance Losses	7,000	7,000	7,000	7,000	7,000	7,000
TOTAL SERVICE AREA D[5]	**151,400**	**179,800**	**206,800**	**220,600**	**227,400**	**229,700**

Notes:
1 Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
2 Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
3 Includes the unincorporated areas inside of the Urban Limit Line.
4 Includes the unincorporated areas outside of the Urban Limit Line.
5. All projections have been rounded to the nearest hundred.

*CCWD 1990 actual demand was 136,693 ac-ft, which does not include major industrial river diversions of 5,700 ac-ft, and miscellaneous annexations to 6/30/94.

Exhibit A-69
Average Annual Water Demand Projections, (ac-ft/yr)
Service Area E

Subarea	1990	2000	2010	2020	2030	2040
TWSA						
Clayton	2,227	3,050	3,320	3,400	3,400	3,370
Clyde	107	130	150	150	150	140
Concord	25,532	26,950	28,100	28,840	29,260	29,190
Martinez	2,079	2,310	2,340	2,320	2,280	2,240
Pacheco	1,668	1,690	1,640	1,610	1,580	1,540
Pleasant Hill	5,961	6,610	6,550	6,460	6,330	6,190
Port Costa	174	180	190	190	190	180
Walnut Creek	6,072	6,390	6,590	6,780	6,950	7,040
Unincorporated in TWSA[1]	8,277	9,160	9,990	10,640	11,040	11,160
TWSA Total	**52,096**	**56,470**	**58,870**	**60,390**	**61,180**	**61,050**
RWSA						
Bay Point	3,143	3,200	3,250	3,240	3,200	3,130
Antioch	13,312	18,460	20,850	21,390	21,380	21,210
FUA-1	7	130	1,990	3,330	4,630	5,800
FUA-2	0	240	620	970	1,090	1,140
Martinez	6,584	7,320	7,420	7,340	7,240	7,090
Pittsburg	10,291	12,190	13,850	14,310	14,560	14,660
Oakley	8,708	11,000	17,020	20,350	22,010	22,680
Unincorporated in RWSA[2]	39,383	48,470	51,250	53,310	53,680	53,830
RWSA Total	**81,428**	**101,010**	**116,250**	**124,240**	**127,790**	**129,540**
Total for TWSA and RWSA	**133,523**	**157,480**	**175,120**	**184,630**	**188,970**	**190,590**
Other Areas						
Hotchkiss Tract	604	2,190	3,890	4,190	4,480	4,650
Bethel Island	2,102	2,350	2,550	3,120	3,690	4,120
Knightsen	27	60	120	160	170	170
Discovery Bay	1,720	3,190	4,840	5,360	5,340	5,270
Byron	223	350	470	590	690	700
E County Airport	234	590	1,080	1,190	1,240	1,260
Veale Tract	5	10	20	20	30	40
Brentwood	1,586	3,550	7,740	9,740	10,700	10,720
Cowell Ranch	22	50	1,320	2,750	3,840	4,050
Unincorporated inside ULL[3]	393	1,330	4,840	5,570	5,840	5,820
Unincorporated outside ULL[4]	470	1,060	4,660	7,300	7,570	7,490
Other Areas Total	**7,386**	**14,730**	**31,530**	**39,990**	**43,590**	**44,290**
SUBTOTAL DEMAND	**140,909**	**172,210**	**206,650**	**224,620**	**232,560**	**234,880**
River Diversions (Major Industrial)	5,700	5,700	5,700	5,700	5,700	5,700
Conveyance Losses	7,000	7,000	7,000	7,000	7,000	7,000
TOTAL SERVICE AREA E[5]	**153,600**	**184,900**	**219,400**	**237,300**	**245,300**	**247,600**

Notes:

1 Includes the unincorporated areas within the Sphere of Influence of those cities within the TWSA.
2 Includes the unincorporated areas within the Sphere of Influence of those cities within the Raw Water Service Area.
3 Includes the unincorporated areas inside of the Urban Limit Line.
4 Includes the unincorporated areas outside of the Urban Limit Line.
5. All projections have been rounded to the nearest hundred.

*CCWD 1990 actual demand was 136,693 ac-ft, which does not include major industrial river diversions of 5,700 ac-ft, and miscellaneous annexations to 6/30/94.

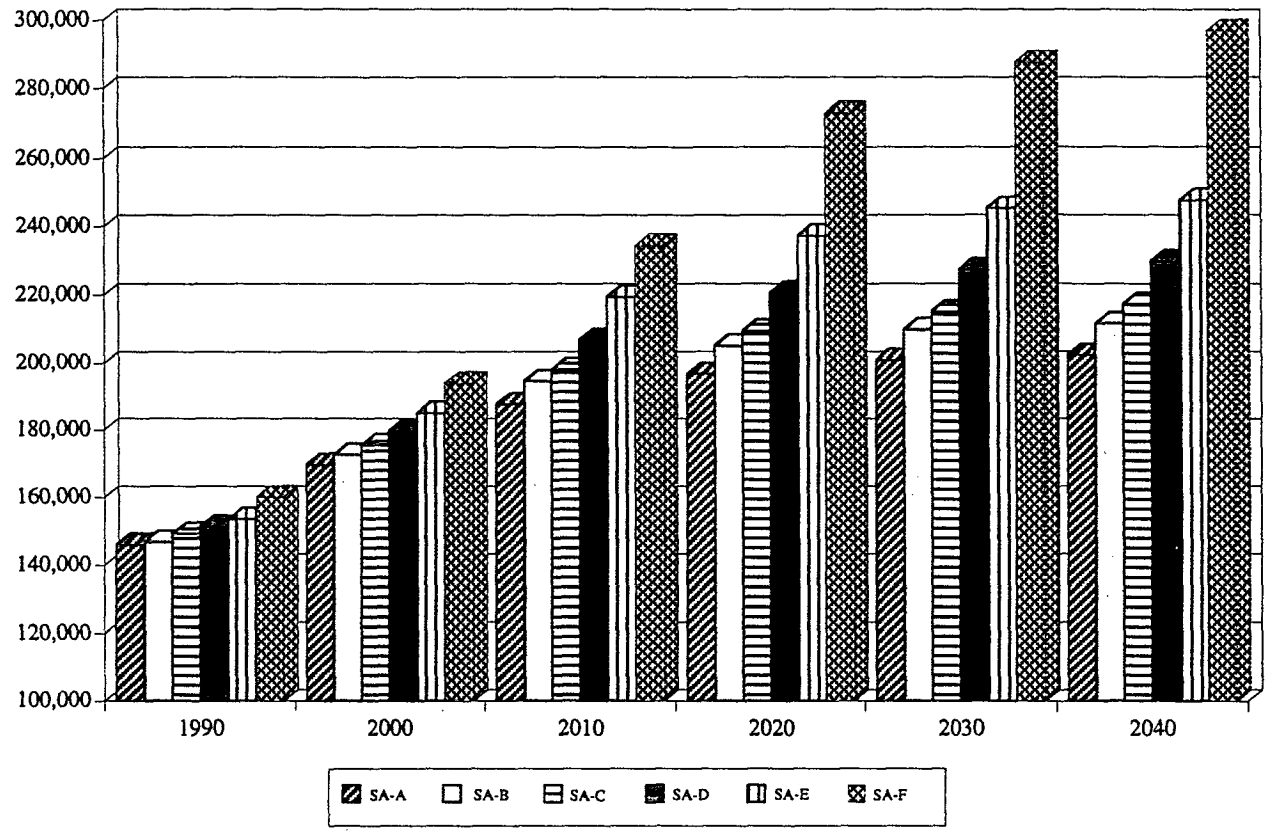
Exhibit A-70
Average Annual Water Demand Projections, (ac-ft/yr)
Service Area F

	Water Demand						
	1990	2000	2010	2020	2030	2040	Increase Over Alternative E in 2040
Treated Water Service Area							
Intensification Increase	no change	no change	no change	4,260	5,070	5,860	2.4%
CCWD Raw Water Service Area							
Intensification Increase	no change	no change	no change	9,700	11,530	13,310	5.4%
Other Areas [1]							
Water Demand due to Increase in Land Area	6,600	9,000	15,100	12,640	7,490	6,720	}
Intensification Increase	0	0	0	9,200	18,510	23,510	} 12.2%
TOTAL DEMAND INCREASE	6,600	9,000	15,100	35,800	42,600	49,400	20.0%

SUBTOTAL SERVICE AREA E (without conveyance losses)	146,600	177,900	212,400	230,300	238,300	240,600
TOTAL DEMAND INCREASE (see above)	6,600	9,000	15,100	35,800	42,600	49,400
Conveyance Losses	7,000	7,000	7,000	7,000	7,000	7,000
TOTAL SERVICE AREA F	160,200	193,900	234,500	273,100	287,900	297,000
TOTAL SERVICE AREA E	153,600	184,900	219,400	237,300	245,300	247,600
% Difference of SERVICE AREAS F AND E	4.3%	4.9%	6.9%	15.1%	17.4%	20.0%

Note:
All projections for the years 1990 through 2040 have been rounded to the nearest hundred.
1. Water Demands for Other Areas includes both the water demand resulting from a population increase associated with the addition of lands in Service Area F, and the intensification of uses on those lands after the year 2010.

Exhibit A-71
Service Area Demand Comparison, (ac-ft/year)



Comparison with Los Vaqueros Study

The average annual demand projections for the FWSS analysis represents demand for a given geographic area. The FWSS has projected demands irrespective of the source of supply. A possible source of confusion between the FWSS and the Los Vaqueros Project is that the Los Vaqueros planning started with the demand of 205,800 acre-feet and subtracted savings from assumed new conservation programs as well as supplies not delivered through the Contra Costa Canal (including new reclamation projects and water supplied from other water right holders). *Contra Costa Canal* demands of 188,000 acre-feet in a dry year and 174,600 acre-feet in a normal year were used for the *Reservoir* planning and were often cited as the demand levels. The correct values to compare are 191,400 ac-ft/yr (205,800 ac-ft /yr [LV projection] minus 7% conservation irrespective of District programs) and 198,700 ac-ft/yr (FWSS Service Area A) interpolated for the FWSS for the year 2025. The results represent a 3.8% increase for current projections from the critical year demands determined within the Los Vaqueros Project planning. Exhibit A-72 displays a breakdown of the comparison.

Comparison with 1990 Actual Use

The demands shown in Exhibits A-64 through A-70 for the year 1990 were determined using the demand methodology addressed earlier. Historical data for that year can be viewed within the first section--Past Consumption. The geographic area for Service Area A is slightly larger than the service area CCWD served in 1990, and includes minor annexations up until June of 1994. Exhibit A-73 shows a comparison of actual water use within the District in 1990 and compares that to those figures projected for 1990 using the demand methodology. The projected demand for FWSS represents *demand* in an average year and does not include the effects of drought on water *use*. Projected demand also includes average river diversions for major industrial customers, which supplement canal use with river water. Taking these differences into account, comparison of the two shows projected demand to be less than two percent higher than actual water use in the year 1990.

SENSITIVITY ANALYSIS

Reasonable assumptions about data reliability were tested through sensitivity analysis. Exhibit A-74 lists the major demand components and various ranges of possible error. The components were tested to determine what effect a reasonable range of error for each would have on total demand for Service Area A in the years 1990 and 2040. Because many of the variables tested only influence a segment of demand, the affect on the total outcome occurs to a lesser extent. It would be unreasonable to assume that all components would be in error in the same direction. It is more probable that some variations in each component will serve to offset others, and as shown in the exhibit, a +15/-10 percent margin of error is a reasonable approximation.

The influence of weather is the best documented variable; a change in annual use of +5/-3 percent (*Weather Normalization Report,* CCWD 1990) would result in a variation of the total 2040 demand projections of +3.8/-2.3 percent (because of the portion of demand accountable to residential and non-residential customers). Water quality is a demand issue with major industries that use River water; major industries' annual use of water has historically varied (by water year type) by +2 percent, which would result in a change in total 2040 demand of +0.5 percent.

Long-term growth projections always contain an element of uncertainty. If residential demand that has been projected for the year 2040 were to occur in the year 2010, for example, total average annual demand could vary by +10 percent. Not only are growth projections uncertain, but so are assumptions on per capita rates and WUFs. The above variation in demand, however, would accommodate these two uncertainties. The uncertainty of water savings from conservation by others is likely to be understated, not overstated. Therefore, the variables of weather, water quality and growth could together represent a combined high range in total 2040 demand of +15 percent.

The uncertainty of growth for the year 2040 alone could dictate the low range in demand. If growth associated with General Plan buildout were to occur in the year 2040 instead of by the year 2010, average annual demand in the year

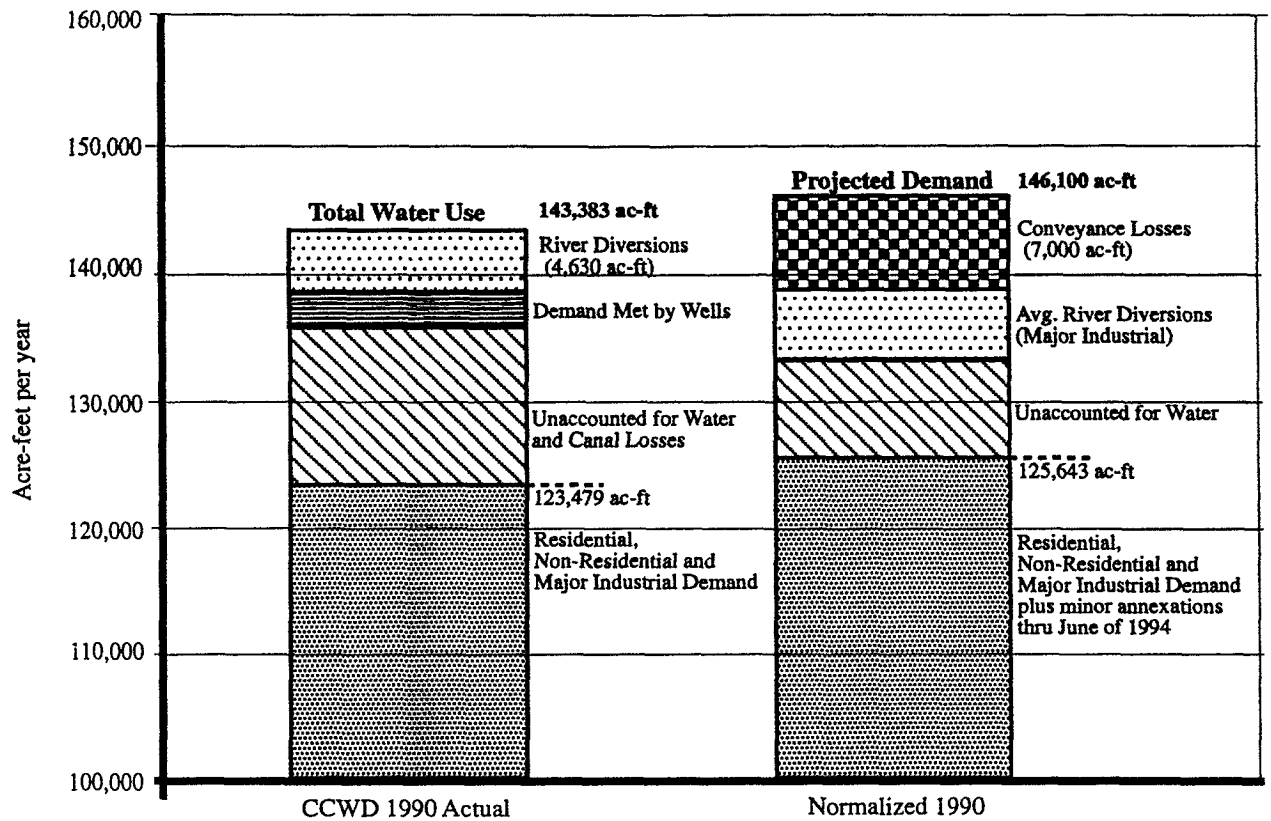
Exhibit A-72
FWSS/Los Vaqueros Comparison

	Los Vaqueros Report Critical	Los Vaqueros Report Non-Critical	CCWD-FWSS (2030) Report	CCWD-FWSS (2030) Before UAW+Conserv.	
Antioch	26,100	23,300	25,930	25,930	Antioch
Martinez	5,600	5,600	9,520	9,670	Martinez
Pittsburg	13,600	13,600	14,560	14,789	Pittsburg
Oakley	11,300	11,300	20,520	21,002	Oakley
TWSA[1]	72,700	68,700	64,380	65,395	TWSA[1]
Rural	4,300	4,300	2,726	2,731	Rural
Minor Uses	4,200	4,200	0	0	Minor Uses
			1830	1,745	Other Areas
Res. and Non-Res.	137,800	131,000	137,636	141,262	Subtotal
Major Industry	47,400	41,000		-9,783	Conservation
Subtotal	185,200	172,000		131,479	Subtotal
Water losses	13,580	12,988		7,757	System
	7,020	7,012		7,000	Conveyance
Water losses	20,600	20,000		14,757	UAW Total
Subtotal	**205,800**	**192,000**		146,236	Subtotal
Conservation	-8,200	-7,800		48,904	Major Industrial[2]
Reclaimed Water	-9,600	-9,600			
				195,140	**Subtotal**
River Diversions	Included in Antioch, TWSA and Industrial			5,700	River Diversions
Total Canal Demands	188,000	174,600		200,840	Total Demand 2030
Reclamation Added	9,600	9,600			
Conservation Added	8,200	7,800			
Comparable Demand	**205,800**[3]	**192,000**		**200,800**	Rounded
				198,700[4]	**Comparable**
				-3.4%	**2025 Demand**

1. Includes water demand for Bay Point
2. Includes Major Industrial and certain minor industrial customers with large acreages
3. 205,800 does not include conservation (7%) irrespective of District programs.
4. 198,700 includes 7% conservation irrespective of District programs.

Source:
Los Vaqueros Scoping Report and EDAW

Exhibit A-73
Comparison of Actual and Projected Demand



A-103

Exhibit A-74
Sensitivity Testing
Service Area A

Component	Range of Error	Result on Total Demand 1990	Result on Total Demand 2040
Weather	5%	3.60%	**3.80%**
(Res/Non-Res)	-3%	-2.20%	**-2.30%**
Water Quality (Industrial)	0 to +2%	0.50%	**0.50%**
Population Growth[1]	14%	0	**10.70%**
	-14%	0	-10.70%
Per Capita Consumption Rate	25%	4.60%	6%
	-25%	-4.60%	-6%
Water Use Factors	5%	1.20%	2.30%
	-20%	-8.60%	-8.10%
Conservation[2]	0 to +10%	0	**-6% , -8%**
Reasonable Error[3]		High Range	**15%**
		Low Range	**-10%**

1. Range of error tested was apportioned from 0 in 1990 (historical) to 14% in 2040
2. Range of error tested was apportioned from 0 in 1990 (historical) to 10% in 2040
3. See demand envelope discussion in Exhibit A-75

Source: EDAW, Inc.

2040 would vary by -10 percent. Since it is unlikely growth becomes arrested in the year 2010, however, the other element of uncertainty that could affect average annual demand is water savings from conservation (irrespective of CCWD programs). If conservation were to be twice as effective as projected (representing a 20 percent savings in residential and non-residential demand as compared to a 10 percent savings used in the current projections), the 2040 demands could be off by -6 to -8 percent. This potential change in 2040 demand, combined with the influence in 2040 demand caused by weather (-2.3 percent) suggests the low range in 2040 demand could be -10 percent.

DEMAND ENVELOPE FOR 1990-2040

An "envelope" was developed around the average annual demand, in order to acknowledge the possibility for higher and lower demands for each of the service areas, for the same 50-year period. The demand envelope represents a range of error above and below average annual demand. These ranges were developed through sensitivity analysis, where reasonable assumptions about data reliability were tested. Historic use shows a wide range of water use over the past twenty years, with CCWD sales and major industrial river diversions reaching a high of 148,462 acre-feet in 1988 (See Exhibit A-7). This is in contrast to two recent wet years, 1986 and 1993, when sales and diversions averaged 121,412 acre-feet.

The ranges of demand were developed based upon the possible variation in weather within the District (weather influence), water quality (the needs of major industrial customers), the uncertainty of the growth projections, and the uncertainty of water savings as a result of conservation (irrespective of CCWD's and other retail agencies' programs). Each of these variables has an influence on annual use, and therefore, annual demand. Exhibit A-75 displays a breakdown of the demand envelope, itemizing the individual components which have potential to alter average demand. It was determined through sensitivity testing that an envelope developed using +15/-10 percent margin of error is a reasonable approximation.

Weather Influence

CCWD's *Weather Normalization Report* (May 1994) studied the relationship of weather to water consumption as it occurs within the TWSA. Based on extremes in temperature and the resulting increase in irrigation, the study concludes that weather impacts annual water use by a range of between +5.1 and -3.6 percent. Because the study only included the TWSA, the range would probably increase if expanded to the RWSA or Diablo Water District. For example, average annual rainfall in Walnut Creek is almost 21 inches per year, where average rainfall in Oakley is approximately 12 inches. Temperatures are more extreme as well, with the East County temperatures averaging approximately 5-10 degrees higher than those of the Central County during the summer months. This +5.1 and -3.6 percent has been applied to the water demands of Alternative A in 1990 to indicate the range of demand.

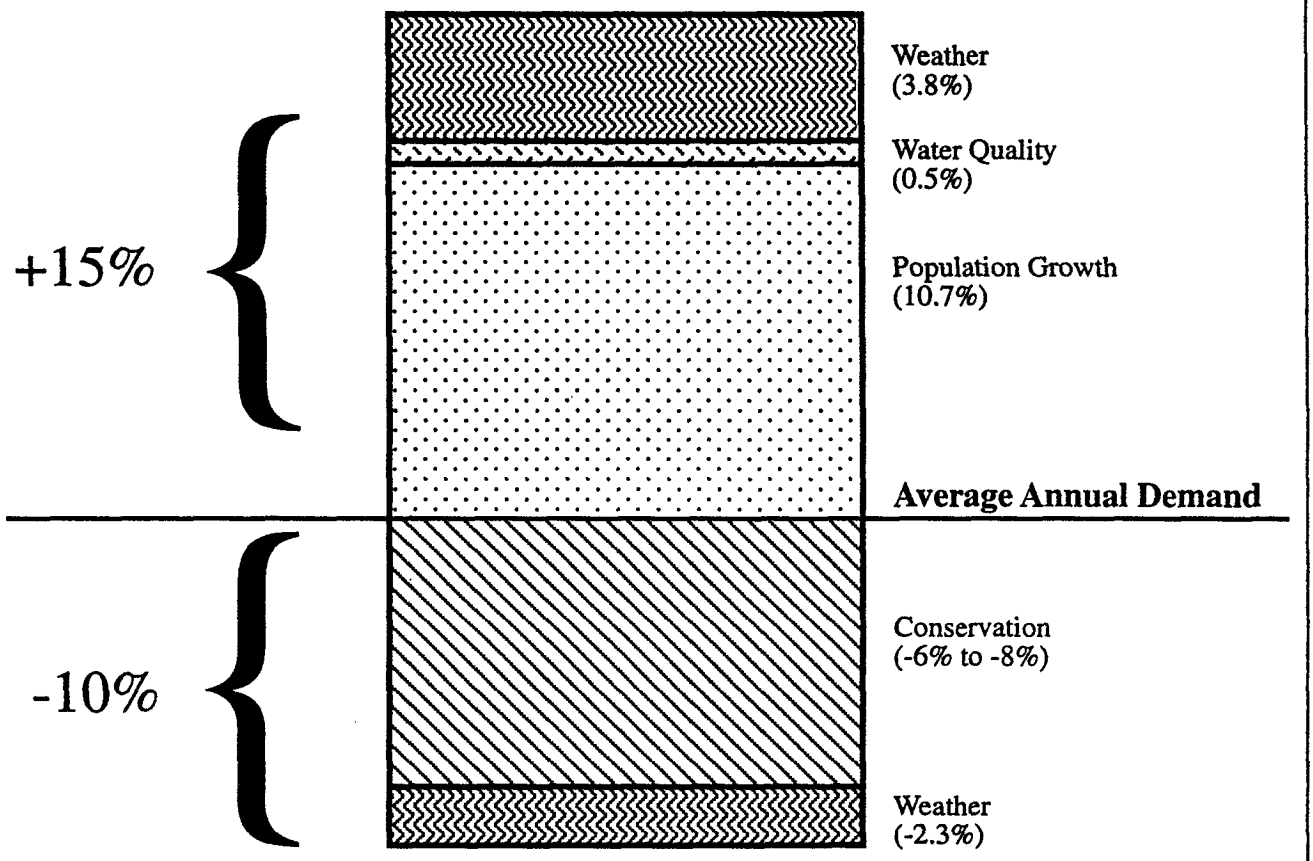
Water Year Types

Water year types, used to describe critical and non-critical water years, impact water quality which is of importance to those major industrial water customers that divert water from the river. Although weather-influenced, water year type refers more directly to the amount of snowpack which directly impacts supply. During a given winter it is the snowfall which determines the river flows and subsequently the quantity of water available during a given year. The water year types which were compared include dry, wet, above and below normal years within the non-critical category, while critical years include only critical dry years as defined by the SWRCB Decision-1485 (August 1978).

Uncertainty of Long Range Projections

Population growth, countywide planning policies, economic conditions, District policies and rate changes all serve as important components of water demand. Although past historical data are good indicators of future trends,

Exhibit A-75
Breakdown of the Demand Envelope



uncertainty grows as the study period increases. The horizon year of 2040 is difficult to speculate on given the wide variety of parameters, and the numerous variables which are constantly changing.

High and Low Range of Demand

Exhibits A-76 and A-77 represent the high and low range calculated from the average annual demand for each service area for the period 1990 to 2040. High demands for the year 2040 range between 232,800 ac-ft/yr for Service Area A and 341,600 ac-ft/yr for Service Area F, a difference of 108,800 ac-ft/yr.

In Exhibits A-78 through A-83, this range is represented as a band above and below average annual demand for each alternative. This band illustrates a narrower range for the immediate future, as opposed to the horizon year 2040, where a larger range would be expected to occur due to increased uncertainties in population growth. The variables of uncertainty are introduced incrementally by decade, since uncertainty increases over time. The influence of weather within the District is known to have an influence on current demands, therefore, the range represented by the demand envelope is smallest in the year 1990 (+5/-3 percent) and increases by decade to +15/-10 in the year 2040.

Seasonal Demand

These exhibits (A-78 through A-83) chart a demand envelope for the base, interim and horizon years. Average annual demand has been bound by the same high and low percentages for each Service Area, with increasing percentages occurring as the projections approach the horizon year of 2040. In order to determine the seasonal demand for each of the alternatives and study the effects throughout the study period, seasonal demand was examined. Exhibit A-84 displays a graphic representation of seasonal demand as calculated through the monthly historic use table shown earlier in Exhibit A-27. These seasonal percentages can be applied to the high and low range of average annual demand, as well to assist in determining appropriate supply options to smooth over seasonal peaks.

A series of tables were developed as shown in Exhibits A-85 through A-90. These exhibits compare the summer and winter requirements associated with average annual demand for each decade, contrasting each with those associated with the extremes of the demand envelope if such were to occur. This would prove valuable in planning for seasonal extremes and matching supply alternatives to meet the required shifts in demand.

Exhibit A-76
Average Annual Demand Projections, 1990-2040, (ac-ft/yr)
High Range

	1990	2000	2010	2020	2030	2040
Service Area A	153,600	181,900	204,500	218,300	226,900	232,800
Service Area B	154,400	185,000	212,100	227,700	237,200	243,500
Service Area C	156,900	188,000	215,900	232,600	243,100	250,000
Service Area D	159,100	192,500	225,500	245,000	257,000	264,200
Service Area E	161,400	198,000	239,300	263,500	277,200	284,700
Service Area F	168,400	207,600	255,700	303,300	325,400	341,600

Notes:
All projections for the years 1990 through 2040 have been rounded to the nearest hundred.

The year 1990 is represented as 105.1% of the average year demand.
The year 2000 is represented as 107.1% of the average year demand.
The year 2010 is represented as 109.1% of the average year demand.
The year 2020 is represented as 111.0% of the average year demand.
The year 2030 is represented as 113.0% of the average year demand.
The year 2040 is represented as 115.0% of the average year demand.

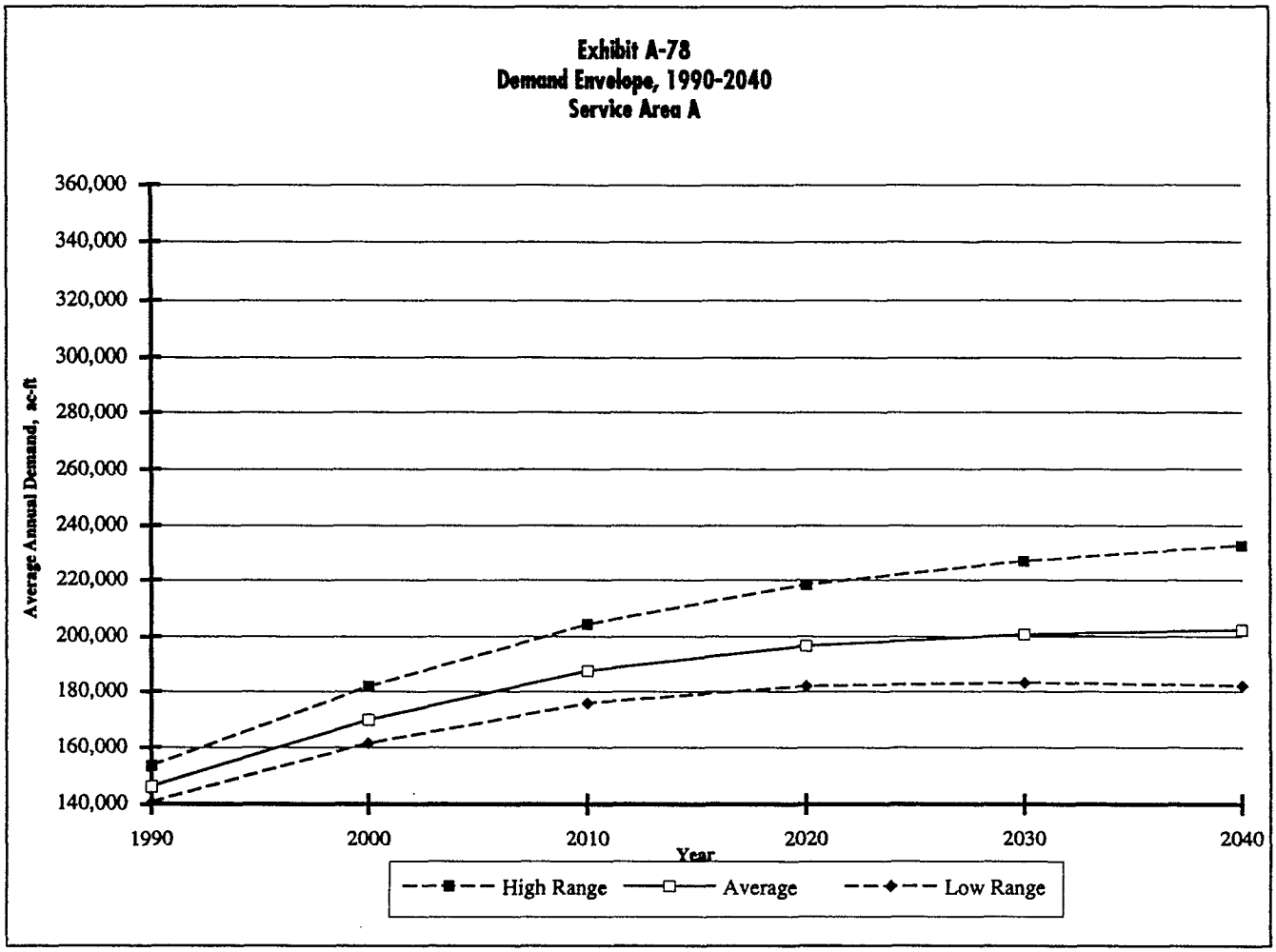
Exhibit A-77
Average Annual Demand Projections, 1990-2040, (ac-ft/yr)
Low Range

	1990	2000	2010	2020	2030	2040
Service Area A	140,800	161,600	176,000	182,000	183,300	182,200
Service Area B	141,600	164,400	182,500	189,800	191,600	190,500
Service Area C	143,900	167,000	185,800	193,900	196,300	195,700
Service Area D	145,900	171,000	194,100	204,200	207,600	206,700
Service Area E	148,100	175,900	205,900	219,600	223,900	222,800
Service Area F	154,400	184,400	220,100	252,800	262,800	267,300

Notes:
All projections for the years 1990 through 2040 have been rounded to the nearest hundred.

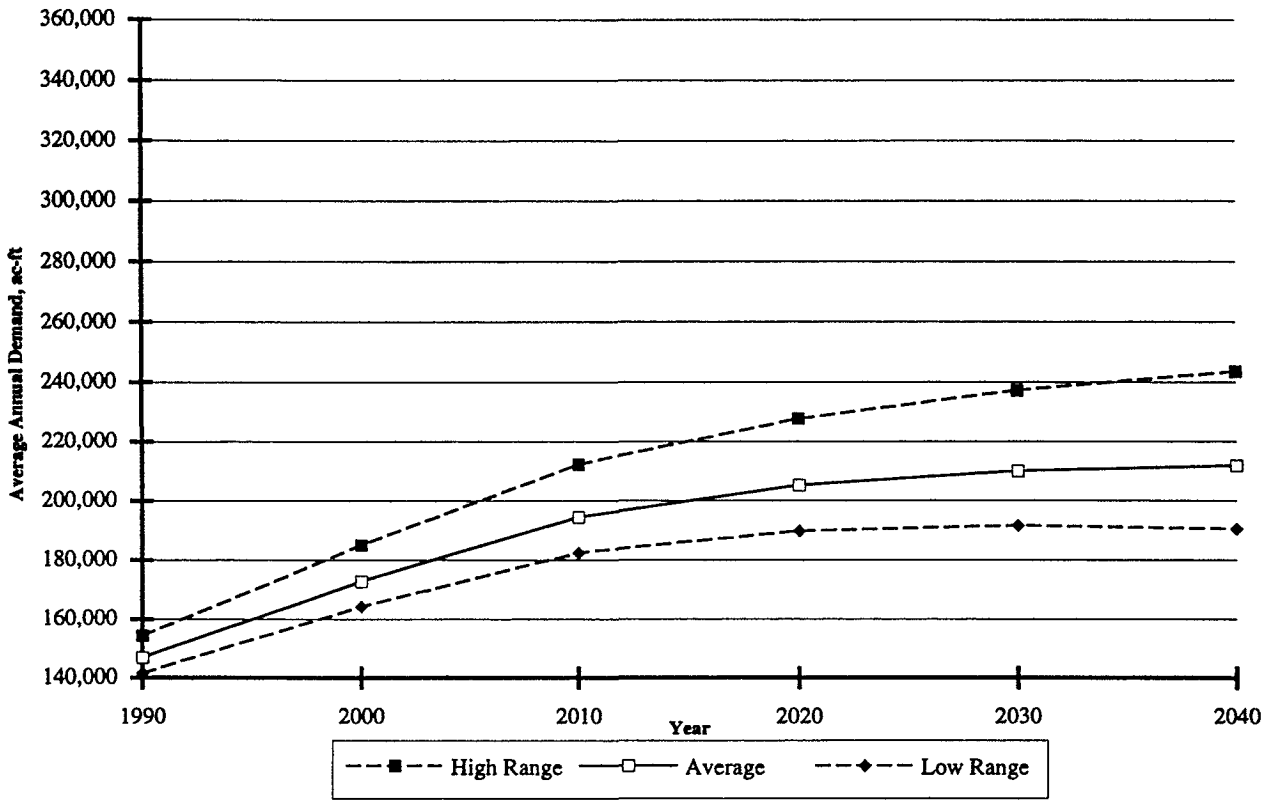
The year 1990 is represented as 96.4% of the average year demand.
The year 2000 is represented as 95.1% of the average year demand.
The year 2010 is represented as 93.8% of the average year demand.
The year 2020 is represented as 92.6% of the average year demand.
The year 2030 is represented as 91.8% of the average year demand.
The year 2040 is represented as 90.0% of the average year demand.

Exhibit A-78
Demand Envelope, 1990-2040
Service Area A



A-110

Exhibit A-79
Demand Envelope, 1990-2040
Service Area B



A-111

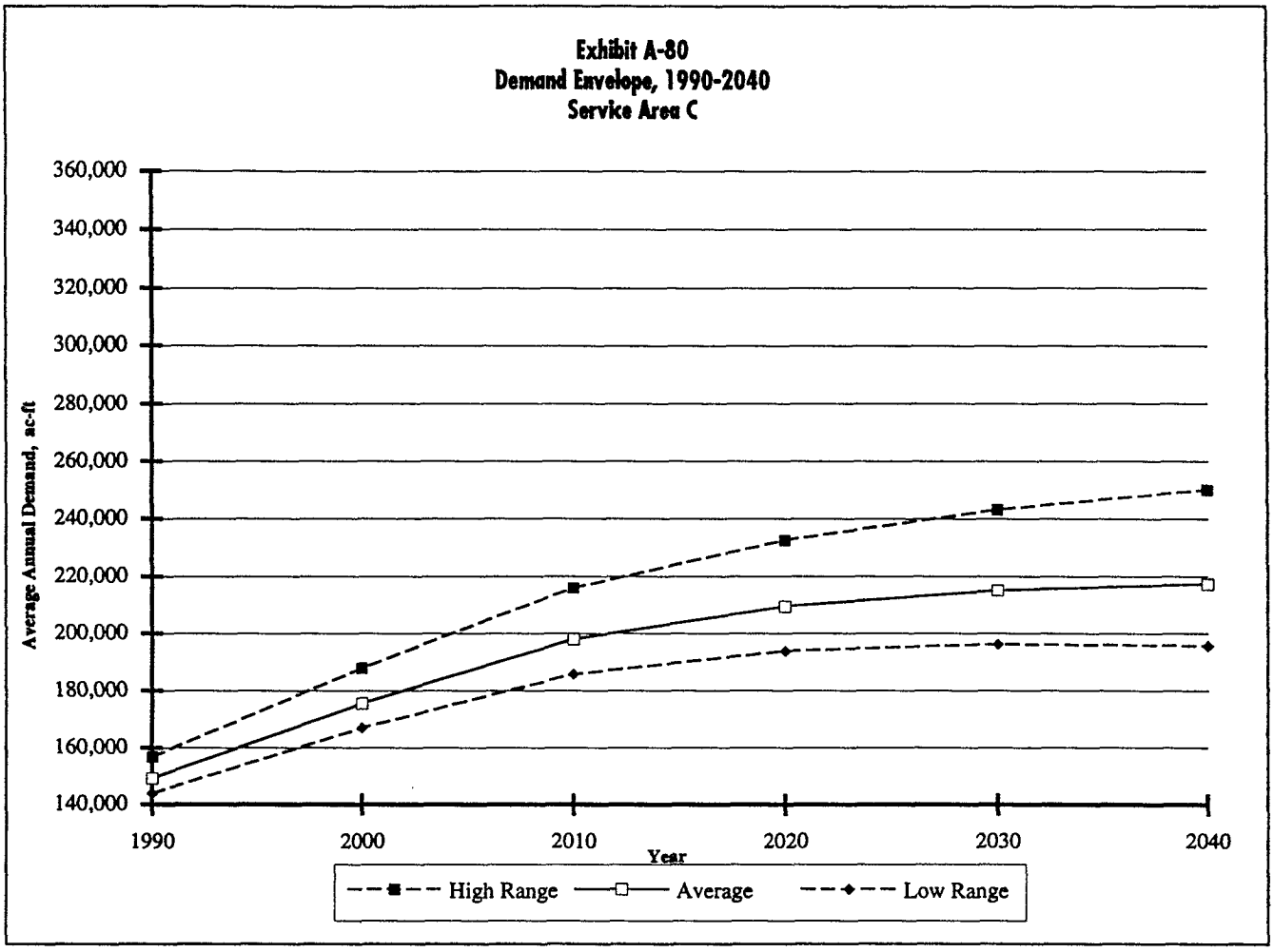
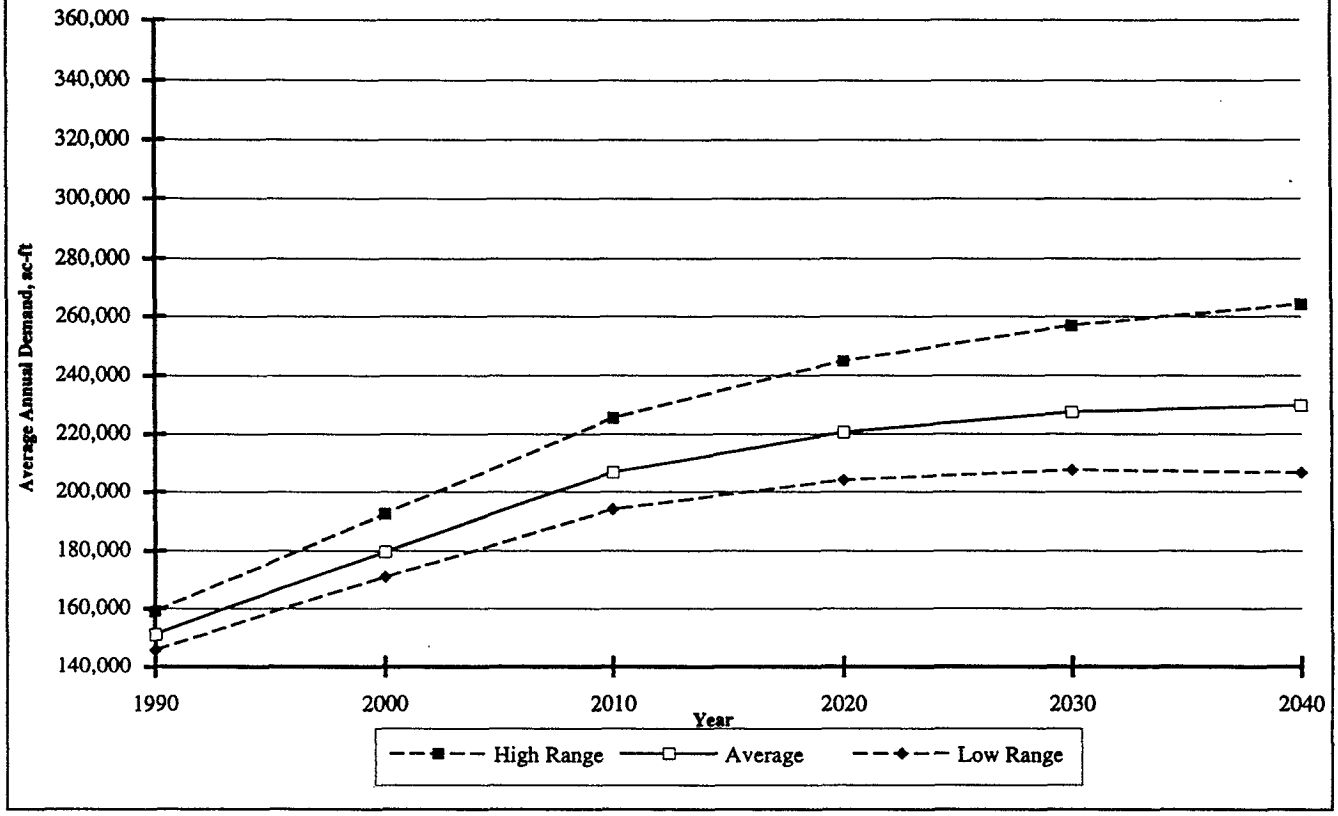


Exhibit A-80
Demand Envelope, 1990-2040
Service Area C
360,000
340,000
320,000
300,000
280,000
260,000
240,000
220,000
200,000
180,000
160,000
140,000
Average Annual Demand, ac-ft
1990
2000
2010
2020
2030
2040
Year
High Range
Average
Low Range

A-112

Exhibit A-81
Demand Envelope, 1990-2040
Service Area D



A-113

C-100225

Exhibit A-82
Demand Envelope, 1990-2040
Service Area E

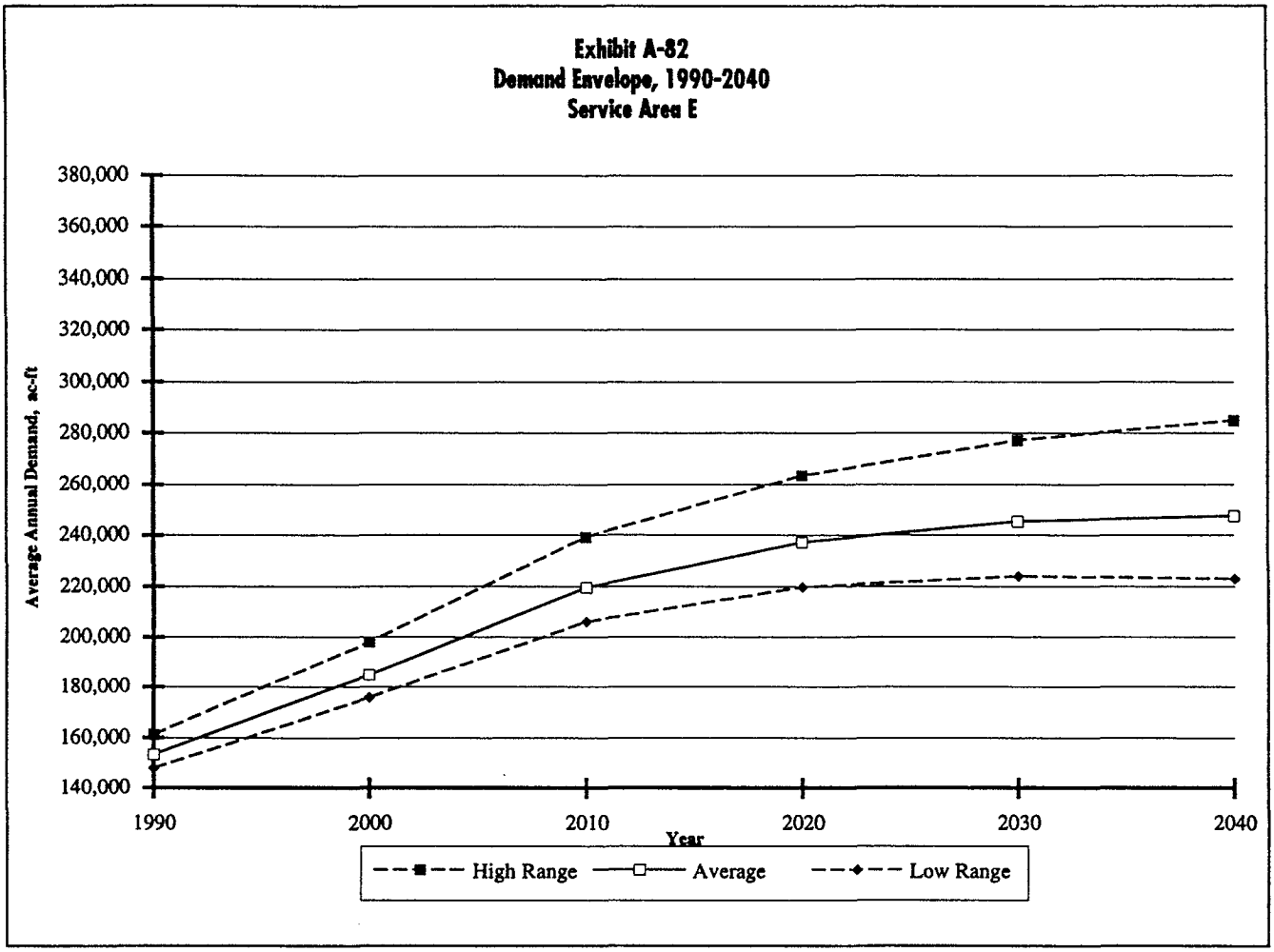
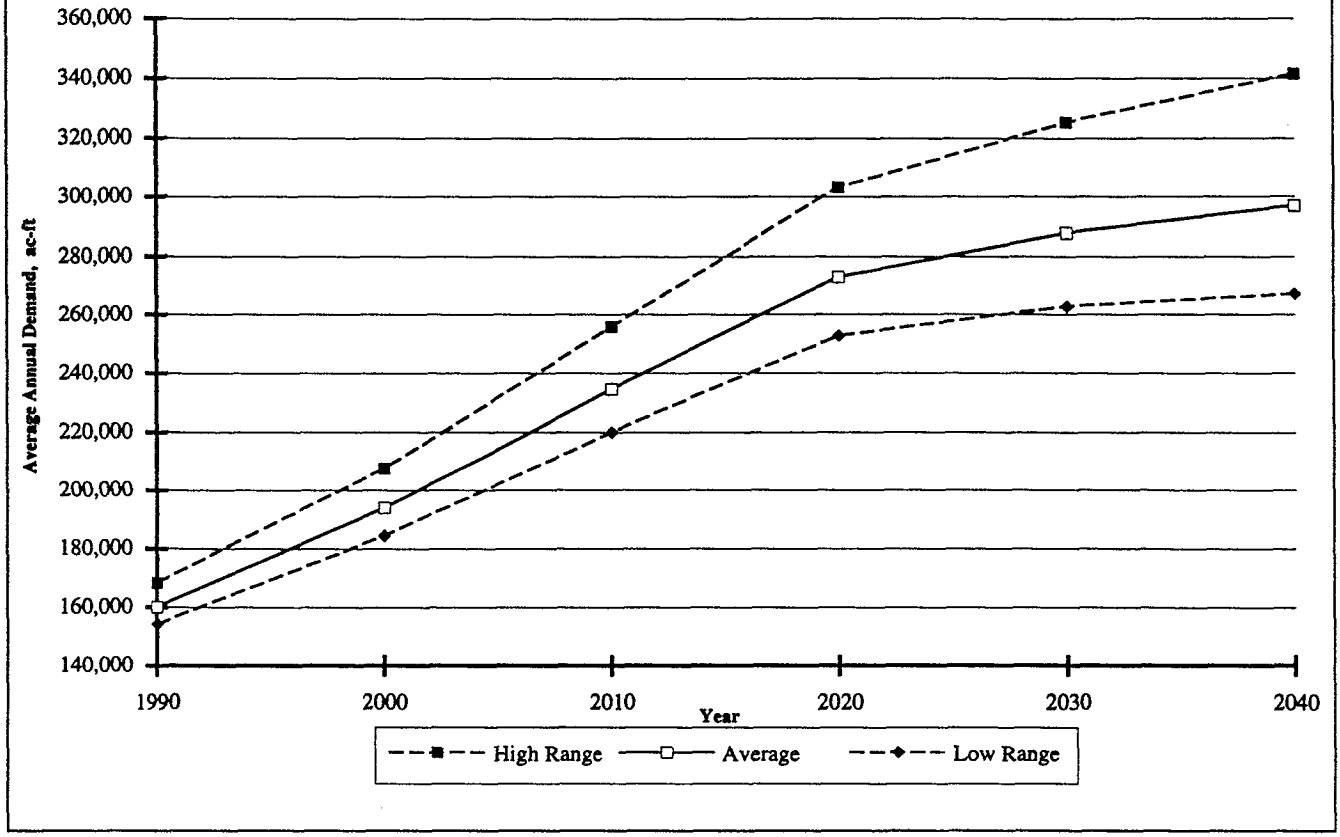


Exhibit A-83
Demand Envelope, 1990-2040
Service Area F



A-115

Exhibit A-84
Seasonal Water Use Curve, 1990-2040

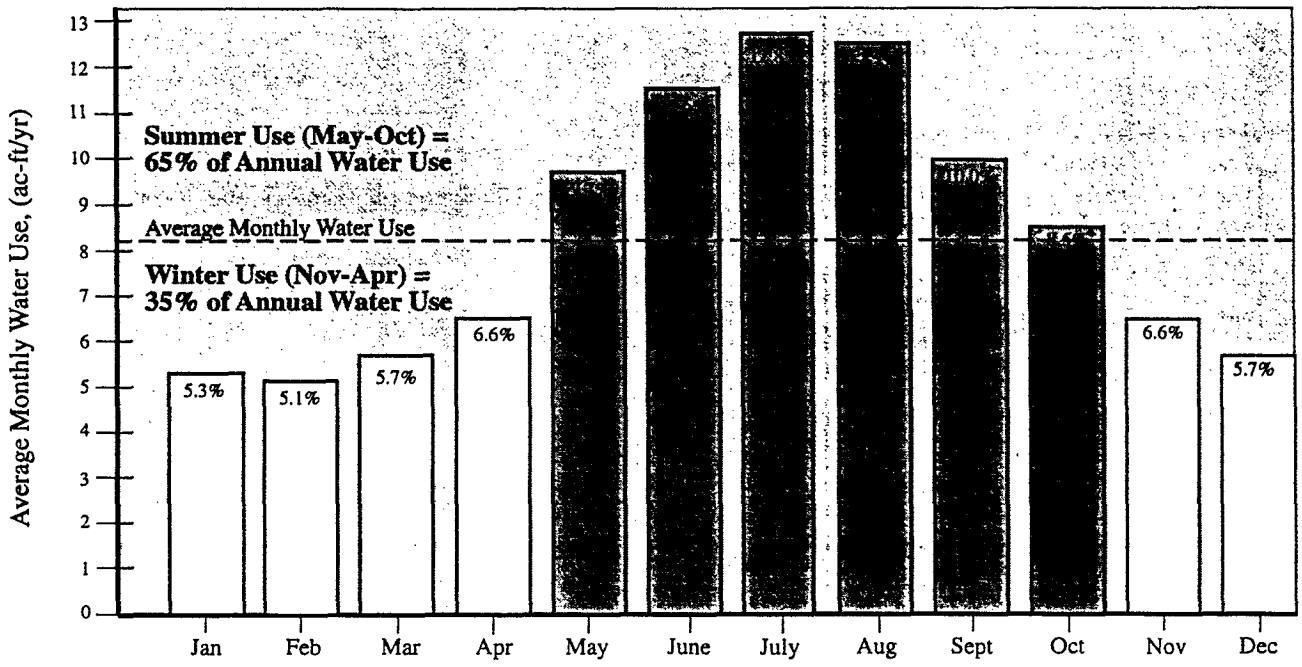


Exhibit A-85
Demand Projections for 1990, (ac-ft/yr)

	Average Year			High Range			Low Range		
	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
Service Area A	94,965	51,135	146,100	99,840	53,760	153,600	91,520	49,280	140,800
Service Area B	95,485	51,415	146,900	100,360	54,040	154,400	92,040	49,560	141,600
Service Area C	97,045	52,255	149,300	101,985	54,915	156,900	93,535	50,365	143,900
Service Area D	98,410	52,990	151,400	103,415	55,685	159,100	94,835	51,065	145,900
Service Area E	99,840	53,760	153,600	104,910	56,490	161,400	96,265	51,835	148,100
Service Area F	104,130	56,070	160,200	109,460	58,940	168,400	100,360	54,040	154,400

Notes: High Range Year Total is equal to 105.1% of Average year.
Low Range Year Total is equal to 96.4% of Average year.
Summer is equal to 65% of Total and may vary by water year type.
Winter is equal to 35% of Total and may vary by water year type.
Service Area A includes the Los Vaqueros Planning Area (including minor annexations to June 30, 1994).

Source: EDAW, Inc., and CCWD

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Exhibit A-86
Demand Projections for 2000, (ac-ft/yr)

	Average Year			High Range			Low Range		
	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
Service Area A	110,435	59,465	169,900	118,235	63,665	181,900	105,040	56,560	161,600
Service Area B	112,320	60,480	172,800	120,250	64,750	185,000	106,860	57,540	164,400
Service Area C	114,140	61,460	175,600	122,200	65,800	188,000	108,550	58,450	167,000
Service Area D	116,870	62,930	179,800	125,125	67,375	192,500	111,150	59,850	171,000
Service Area E	120,185	64,715	184,900	128,700	69,300	198,000	114,335	61,565	175,900
Service Area F	126,035	67,865	193,900	134,940	72,660	207,600	119,860	64,540	184,400

Notes: High Range Year Total is equal to 107.1% of Average year.
Low Range Year Total is equal to 95.1% of Average year.
Summer is equal to 65% of Total and may vary by water year type.
Winter is equal to 35% of Total and may vary by water year type.
Service Area A includes the Los Vaqueros Planning Area (including minor annexations to June 30, 1994).

Source: EDAW, Inc., and CCWD

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Exhibit A-87
Demand Projections for 2010, (ac-ft/yr)

	[illegible]			[illegible]			[illegible]		
	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
Service Area A	121,875	65,625	187,500	132,925	71,575	204,500	114,400	61,600	176,000
Service Area B	126,425	68,075	194,500	137,865	74,235	212,100	118,625	63,875	182,500
Service Area C	128,700	69,300	198,000	140,335	75,565	215,900	120,770	65,030	185,800
Service Area D	134,420	72,380	206,800	146,575	78,925	225,500	126,165	67,935	194,100
Service Area E	142,610	76,790	219,400	155,545	83,755	239,300	133,835	72,065	205,900
Service Area F	152,425	82,075	234,500	166,205	89,495	255,700	143,065	77,035	220,100

Notes: High Range Year Total is equal to 109.1% of Average year.
Low Range Year Total is equal to 93.8% of Average year.
Summer is equal to 65% of Total and may vary by water year type.
Winter is equal to 35% of Total and may vary by water year type.
Service Area A includes the Los Vaqueros Planning Area (including minor annexations to June 30, 1994).

Source: EDAW, Inc., and CCWD

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Exhibit A-88
Demand Projections for 2020, (ac-ft/yr)

	[redacted]			[redacted]			[redacted]		
	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
Service Area A	127,790	68,810	196,600	141,895	76,405	218,300	118,300	63,700	182,000
Service Area B	133,315	71,785	205,100	148,005	79,695	227,700	123,370	66,430	189,800
Service Area C	136,175	73,325	209,500	151,190	81,410	232,600	126,035	67,865	193,900
Service Area D	143,390	77,210	220,600	159,250	85,750	245,000	132,730	71,470	204,200
Service Area E	154,245	83,055	237,300	171,275	92,225	263,500	142,740	76,860	219,600
Service Area F	177,515	95,585	273,100	197,145	106,155	303,300	164,320	88,480	252,800

Notes: High Range Year Total is equal to 111% of Average year.
Low Range Year Total is equal to 92.6% of Average year.
Summer is equal to 65% of Total and may vary by water year type.
Winter is equal to 35% of Total and may vary by water year type.
Service Area A includes the Los Vaqueros Planning Area (including minor annexations to June 30, 1994).

Source: EDAW, Inc., and CCWD

Exhibit A-89
Demand Projections for 2030, (ac-ft/yr)

	[redacted]			[redacted]			[redacted]		
	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
Service Area A	130,520	70,280	200,800	147,485	79,415	226,900	119,145	64,155	183,300
Service Area B	136,435	73,465	209,900	154,180	83,020	237,200	124,540	67,060	191,600
Service Area C	139,815	75,285	215,100	158,015	85,085	243,100	127,595	68,705	196,300
Service Area D	147,810	79,590	227,400	167,050	89,950	257,000	134,940	72,660	207,600
Service Area E	159,445	85,855	245,300	180,180	97,020	277,200	145,535	78,365	223,900
Service Area F	187,135	100,765	287,900	211,510	113,890	325,400	170,820	91,980	262,800

Notes: High Range Year Total is equal to 113% of Average year.
Low Range Year Total is equal to 91.8% of Average year.
Summer is equal to 65% of Total and may vary by water year type.
Winter is equal to 35% of Total and may vary by water year type.
Service Area A includes the Los Vaqueros Planning Area (including minor annexations to June 30, 1994).

Source: EDAW, Inc., and CCWD

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Exhibit A-90
Demand Projections for 2040, (ac-ft/yr)

	Average Year			High Range			Low Range		
	Summer	Winter	Total	Summer	Winter	Total	Summer	Winter	Total
Service Area A	131,560	70,840	202,400	151,320	81,480	232,800	118,430	63,770	182,200
Service Area B	137,605	74,095	211,700	158,275	85,225	243,500	123,825	66,675	190,500
Service Area C	141,310	76,090	217,400	162,500	87,500	250,000	127,205	68,495	195,700
Service Area D	149,305	80,395	229,700	171,730	92,470	264,200	134,355	72,345	206,700
Service Area E	160,940	86,660	247,600	185,055	99,645	284,700	144,820	77,980	222,800
Service Area F	193,050	103,950	297,000	222,040	119,560	341,600	173,745	93,555	267,300

Notes: High Range Year Total is equal to 115% of Average year.
Low Range Year Total is equal to 90% of Average year.
Summer is equal to 65% of Total and may vary by water year type.
Winter is equal to 35% of Total and may vary by water year type.
Service Area A includes the Los Vaqueros Planning Area (including minor annexations to June 30, 1994).

Source: EDAW, Inc., and CCWD

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SOURCES

Principal Data Sources

- State Teale Data Center
- Local Agency Formation Commission - LAFCO
- Association of Bay Area Governments
- California Department of Finance
- Contra Costa Water District
- Contra Costa Community Development Department

Local Agency Planning Documents

- *ABAG Projection's 94*
- *Buchanan Road Bypass, Draft EIR*
- *CCWD; East County Water Supply Management Study Phase I*
- *CCWD; Treated Water Master Plan*
- *CCWD; Treated Water System Population Estimate Databases*
- *CCWD; Updated Buildout Treated and Raw Water Demand Projections*
- *CCWD; Urban Water Management Plan*
- *CCWD; Weather Normalization Report*
- *California Water Plan Update. Volumes 1 and 2 (Draft)*
- *Central Valley Project Improvement Act*
- *City of Antioch; Kaiser Project, Draft EIR*
- *City of Antioch; Water System Master Plan Update*
- *City of Brentwood; Comprehensive Annexation Program*
- *City of Brentwood; Infrastructure Master Plan Report; Water Distribution System Element*
- *City of Brentwood; Report on Water Supply Study*
- *City of Brentwood; Water Supply Study*
- *City of Martinez; Water Master Plan*
- *City of Pittsburg; 1992 Update to the Urban Water Management Plan*
- *City of Pittsburg; Water Master Plan Update*
- *DDSD/CCWD; Industrial Water Recycling Project*
- *Diablo Water District; Master Water Plan Update 1991 for Oakley Water District*
- *Diablo Water District; The Urban Water Management Plan of Oakley Water District*
- *Discovery Bay; Master Plan for Water Supply and Water System Operation*
- *Discovery Bay West General Plan Amendment and Related Actions, Draft EIR*

- *Tosco Refining Company; Clean Fuels Project, Draft EIR*
- *USS-Posco Steelmill Modernization and Ship Delivery Projects; Draft EIR*
- *West Pittsburg; Southern California Water Company Bay System Master Design*

ATTACHMENTS

A. FWSS Population Projections by Census Tract, Subarea and Alternative

B. Sample Letter and Attachments Sent to City and County Agencies

ATTACHMENT A
Population Projections by Subareas and Service Areas

ID	CENSUS TRACTS	POPULATION PROJECTIONS 1990	2000	2010	2020	2030	2040
TREATED WATER SERVICE AREA							
179b	355301	319	418	477	506	521	526
202a	355303	581	965	1,214	1,505	1,731	1,887
158a	355304	2,183	4,313	4,914	5,012	5,012	5,012
180	355305	4,429	4,895	5,062	5,163	5,215	5,215
TOTAL CLAYTON		7,512	10,491	11,667	12,186	12,479	12,640
5a	315000	517	635	766	766	766	766
TOTAL CLYDE		517	635	766	766	766	766
5b	315000	254	312	377	452	477	486
83a	327000	5,187	5,205	5,150	5,150	5,150	5,150
119	328000	1,345	1,624	2,105	2,485	2,865	3,245
76	329000	6,058	5,995	6,146	6,207	6,207	6,207
92	330000	5,822	6,221	6,358	6,422	6,422	6,422
117	331000	6,166	6,141	6,528	6,789	6,857	6,857
101	332000	7,417	7,616	8,128	8,534	8,790	8,878
128a	333100	6,689	7,001	7,580	8,110	8,397	8,835
124	333200	6,106	6,032	6,184	6,246	6,246	6,246
138	334001	4,013	4,189	4,690	4,925	4,974	4,974
149	334002	8,417	9,548	10,633	11,696	12,632	13,516
174	334003	4,041	4,607	5,301	5,831	6,123	6,245
125	335000	3,306	3,834	4,002	4,277	4,814	5,306
126	336100	9,129	9,487	9,501	9,501	9,501	9,501
130	336200	6,782	6,851	6,871	6,871	6,871	6,871
147	337100	2,556	2,634	2,873	3,074	3,166	3,198
141	337200	7,214	7,949	8,290	8,456	8,540	8,540
173a	337300	3,808	4,044	4,272	4,486	4,710	4,899
170a	338100	7,378	7,313	7,710	8,019	8,179	8,179
184a	338201	1,147	1,215	1,224	1,249	1,261	1,261
53a	355200	728	742	756	1,420	2,451	2,637
179a	355301	5,955	7,807	8,903	10,380	13,162	15,758
185c	355302	40	42	44	44	44	44
158b	355304	1,790	3,537	4,029	4,110	4,110	4,110
TOTAL CONCORD		111,348	119,946	127,656	134,734	142,150	147,385
46	316000	1,722	1,770	1,856	1,912	1,931	1,950
49	317000	1,764	1,754	1,739	1,739	1,739	1,739
39	318000	3,316	3,430	3,544	3,544	3,544	3,544
63a	319000	4,593	5,026	5,238	5,343	5,396	5,396
17a	320001	0	956	1,101	1,211	1,308	1,347
55a	320002	4,466	6,507	7,046	7,116	7,187	7,187
96	321101	6,769	6,891	6,817	6,817	6,817	6,817
116a	321102	4,060	4,075	4,091	4,101	4,101	4,101
102a	321103	4,431	4,952	5,072	5,072	5,072	5,072
99c	321200	114	121	121	121	121	121
140a	347000	449	457	510	530	540	546
105b	356002	112	128	183	214	222	224
TOTAL MARTINEZ [1]		31,796	36,067	37,318	37,719	37,978	38,045
116d	321102	192	195	192	194	194	194
99a	321200	1,845	1,957	1,941	1,941	1,941	1,941
83b	327000	1,288	1,292	1,279	1,279	1,279	1,279
TOTAL PACHECO		3,325	3,445	3,412	3,414	3,414	3,414
116b	321102	2,684	2,721	2,684	2,711	2,711	2,711
99b	321200	2,757	2,925	2,900	2,900	2,900	2,900
129	322000	4,840	5,101	5,063	5,063	5,063	5,063
162	323000	4,303	4,388	4,242	4,242	4,242	4,242
146a	324000	6,345	8,593	8,893	8,982	8,982	8,982
183	325000	4,229	4,745	4,993	5,093	5,143	5,143
TOTAL PLEASANT HILL		25,158	28,472	28,775	28,991	29,041	29,041

1. Demands for Martinez were split among the TWSA and RWSA, based on the existing TWSA boundary.

7	357000	204	216	228	237	239	239
TOTAL PORT COSTA		**204**	**216**	**228**	**237**	**239**	**239**
173b	337300	2,390	2,538	2,681	2,816	2,956	3,075
170b	338100	0	0	0	0	0	0
184b	338201	2,740	2,904	2,925	2,984	3,014	3,014
187a	338202	5,865	6,732	7,649	8,644	9,672	10,526
195	338301	2,996	3,048	3,062	3,062	3,062	3,062
225	338302	32	34	34	34	34	34
222a	338302	2,446	2,513	2,479	2,504	2,504	2,504
220	339000	557	633	656	662	662	662
189	340001	2,577	2,680	2,757	2,812	2,868	2,897
240	343003	0	0	0	0	0	0
185a	355302	2,764	2,924	3,030	3,060	3,060	3,060
TOTAL WALNUT CREEK		**22,367**	**24,006**	**25,273**	**26,578**	**27,833**	**28,834**
5c	315000	0	0	0	0	0	0
63b	319000	2,379	2,603	2,713	2,767	2,795	2,795
17b	320001	3,214	2,852	3,282	3,610	3,899	4,016
55b	320002	1,790	2,604	2,824	2,833	2,881	2,881
116c	321102	155	157	155	157	157	157
102b	321103	286	313	320	320	320	320
146b	324000	1,137	1,540	1,594	1,610	1,610	1,610
128b	333100	655	686	742	294	842	867
170b	338100	126	130	132	137	139	139
187b	338202	2,679	3,076	3,493	3,947	4,421	4,819
222b	338302	410	418	413	417	417	417
241	346102	0	16	32	32	32	32
250	346102	0	6	12	12	12	12
140b	347000	262	270	301	313	319	322
247	355102	12	18	24	120	130	135
205	355102	12	24	48	58	63	65
233	355103	785	792	852	1,176	1,364	1,432
185b	355302	68	84	262	275	275	275
192	355303	10	16	20	25	29	31
193	355303	0	6	9	11	13	14
202b	355303	238	354	497	616	709	773
105a	356002	102	196	279	327	340	343
TOTAL UNINCORPORATED		**14,320**	**16,165**	**18,004**	**19,578**	**20,765**	**21,454**
CCWD RAW WATER SERVICE AREA							
13a	314101	10,996	11,017	10,687	10,794	10,794	10,794
27c	314102	48	65	83	101	119	135
9	314200	5,206	5,299	5,530	5,696	5,753	5,753
42	315000	1,203	1,732	2,488	2,562	2,638	2,638
TOTAL BAY POINT		**17,453**	**18,113**	**18,788**	**19,153**	**19,304**	**19,320**
65c	302001	380	549	701	827	918	982
157b	303200	172	2,258	3,912	4,694	5,069	5,170
50	305000	5,955	6,019	5,840	5,840	5,840	5,840
67	306001	7,211	7,612	7,522	7,522	7,522	7,522
64a	306002	2,253	5,123	5,821	6,112	6,173	6,173
106	307101	4,370	4,433	4,312	4,312	4,312	4,312
82	307102	4,686	4,751	4,603	4,603	4,603	4,603
88	307201	3,045	3,130	3,219	3,283	3,316	3,349
72	307202	3,843	3,958	3,793	3,793	3,793	3,793
97	307204	3,813	3,867	3,944	3,983	4,023	4,023
94	307205	6,320	6,419	6,513	6,643	6,710	6,710
95	308001	6,956	7,795	7,706	7,783	7,783	7,783
100	308002	2,455	5,189	6,553	6,946	7,016	7,016
118	355101	11,597	21,758	26,877	27,415	27,415	27,415
137b	355102	214	4,660	7,270	8,797	9,902	11,007
113b	355102	0	0	25	30	33	34
TOTAL ANTIOCH		**63,270**	**87,521**	**98,611**	**102,584**	**104,428**	**105,733**
157a	303200	16	288	3,512	5,142	6,890	8,404
137a	355102	6	140	3,256	6,397	9,508	12,607
TOTAL FUA-1		**22**	**428**	**6,768**	**11,539**	**16,398**	**21,011**
65b	302001	0	618	1,617	2,598	2,973	3,181
TOTAL FUA-2		**0**	**618**	**1,617**	**2,598**	**2,973**	**3,181**

34	309000	2,063	2,778	2,952	2,982	2,982	2,982
47	310000	3,958	4,474	4,625	4,671	4,671	4,671
51	311000	4,142	3,998	4,204	4,372	4,460	4,504
57	312000	2,200	2,100	2,144	2,165	2,187	2,187
66	313101	6,540	6,641	6,888	7,026	7,096	7,096
74	313102	3,743	4,304	4,456	4,545	4,591	4,636
98a	313103	5,036	7,857	11,171	11,618	11,734	11,734
60	313201	7,190	7,294	7,544	7,619	7,695	7,695
62	313202	7,595	7,617	7,326	7,619	7,695	7,695
13b	314101	30	30	29	29	29	29
27a	314102	4,138	5,606	7,184	8,764	10,342	11,789
111	355102	0	6	9	11	12	12
103	355200	12	18	18	20	21	21
53b	355200	973	4,731	8,104	8,914	9,627	10,204
89	355200	0	26	89	98	104	105
93	355200	0	0	0	0	0	0
TOTAL PITTSBURG		47,620	57,580	66,743	70,454	73,246	75,363
65a	302001	11,084	14,048	20,468	24,152	26,809	28,686
77	302002	5,479	8,337	17,384	22,078	24,285	25,500
143a	303100	88	184	363	610	744	759
64b	306002	272	434	517	532	547	557
TOTAL OAKLEY		16,923	23,003	38,732	47,372	52,385	55,501
157d	303200	165	565	1,078	1,294	1,397	1,425
207b	304000	28	135	527	627	748	836
98b	313103	43	89	640	1,621	1,637	1,637
27b	314102	192	260	333	407	490	547
137c	355102	0	12	118	143	154	160
113a	355102	0	0	11	20	22	22
RAW WATER UNINCORPORATED		428	1,062	2,707	4,111	4,438	4,628
OTHER AREAS							
143b	303100	16	33	66	111	135	138
157c	303200	244	1,317	4,011	4,371	4,721	4,815
207a	304000	42	506	1,012	1,267	1,418	1,517
TOTAL BRENTWOOD		302	1,856	5,089	5,749	6,274	6,470
143c	303100	66	107	210	353	430	439
UNINCORPORATED OUTSIDE ULL		66	107	210	353	430	439
TOTAL SERVICE AREA A		362,629	429,731	492,363	528,114	554,540	573,464
RAW WATER SERVICE AREA							
139	355102	0	68	130	157	170	177
165	355102	0	2,065	4,734	5,728	6,186	6,434
181	355102	0	210	545	659	712	741
TOTAL ANTIOCH		0	2,343	5,409	6,545	7,068	7,351
148a	303100	591	826	1,630	2,738	3,340	3,407
TOTAL OAKLEY		591	826	1,630	2,738	3,340	3,407
OTHER AREAS							
84	302002	137	291	663	841	926	972
85	301000	852	3,369	5,967	6,459	7,042	7,490
TOTAL HOTCHKISS TRACT		989	3,660	6,630	7,300	7,968	8,462
142	302002	55	117	266	338	372	390
152	303100	4	6	13	21	26	27
TOTAL KNIGHTSEN		59	123	279	359	398	417

136	304000	15	29	58	87	117	146
TOTAL VEALE TRACT		15	29	58	87	117	146
148b	303100	56	90	178	300	366	373
TOTAL BRENTWOOD		56	90	178	300	366	373
18	309000	0	0	0	0	0	0
112	313103	0	0	293	394	414	427
114	355102	0	0	258	394	414	427
RAW WATER UNINCORPORATED		0	0	551	788	828	854
SERVICE AREA B INCREASE		1,710	7,070	14,734	18,117	20,085	21,010
TOTAL SERVICE AREA B		364,339	436,801	507,097	546,232	574,624	594,474

CCWD RAW WATER SERVICE AREA							
167a	303100	409	660	1,301	2,186	2,667	2,720
TOTAL OAKLEY		409	660	1,301	2,186	2,667	2,720
OTHER AREAS							
26	301000	2,115	2,416	2,671	3,338	4,039	4,604
TOTAL BETHEL ISLAND		2,115	2,416	2,671	3,338	4,039	4,604
167b	303100	54	87	172	289	353	360
TOTAL BRENTWOOD		54	87	172	289	353	360
122	302002	172	365	832	1,056	1,162	1,220
150	303100	40	65	127	214	261	266
UNINCORPORATED OUTSIDE ULL		212	429	959	1,271	1,423	1,487
SERVICE AREA C INCREASE		2,790	3,592	5,103	7,083	8,482	9,171
TOTAL SERVICE AREA C		367,129	440,394	512,201	553,315	583,106	603,645

CCWD RAW WATER SERVICE AREA							
154c	303100	83	135	265	446	544	554
TOTAL OAKLEY		83	135	265	446	544	554
OTHER AREAS							
154a	303100	2,489	4,016	7,928	13,318	16,248	16,573
145a	303200	4,602	10,301	23,042	27,419	29,613	30,205
208	304000	60	942	2,024	2,327	2,606	2,788
TOTAL BRENTWOOD		7,151	15,259	32,994	43,064	48,467	49,567
154b	303100	497	726	2,233	2,407	2,937	2,996
145b	303200	547	1,170	2,068	2,121	2,291	2,337
UNINCORPORATED INSIDE ULL		1,044	1,896	4,301	4,528	5,228	5,333
154b	303100	332	484	956	1,606	1,959	1,997
145b	303200	234	501	758	910	982	1,002
UNINCORPORATED OUTSIDE ULL		566	985	1,714	2,516	2,941	2,999
SERVICE AREA D INCREASE		8,844	18,275	39,274	50,554	57,180	58,453
TOTAL SERVICE AREA D		375,973	458,669	551,474	603,869	640,286	662,097

OTHER AREAS							
200	304000	5,351	10,139	15700	17,754	18,057	18,228
TOTAL DISCOVERY BAY		**5,351**	**10,139**	**15,700**	**17,754**	**18,057**	**18,228**
267	304000	761	1,217	1,677	2,161	2,573	2,650
TOTAL BYRON		**761**	**1,217**	**1,677**	**2,161**	**2,573**	**2,650**
277	304000	102	264	492	551	589	612
TOTAL EAST COUNTY AIRPORT		**102**	**264**	**492**	**551**	**589**	**612**
231	304000	106	237	6,866	14,612	20,905	22,498
251	355102	0	0	0	0	0	0
261	355103	6	12	12	17	19	20
TOTAL COWELL RANCH		**112**	**249**	**6,878**	**14,629**	**20,924**	**22,518**
110	313103	0	0	360	374	378	378
70	313202	0	80	80	83	84	84
80	313202	0	16	16	17	17	17
91	313202	0	16	48	50	50	50
69	314101	0	80	80	80	80	80
300	355102	0	0	9	16	17	18
68	355200	7	108	217	228	242	244
UNINCORPORATED WITHIN ULL		**7**	**300**	**810**	**848**	**869**	**871**
108	355102	0	0	16	19	21	22
301	355102	0	0	0	9	16	17
68	355200	0	12	16	28	30	30
120	355304	0	24	467	780	780	780
UNINCORPORATED OUTSIDE ULL		**0**	**36**	**499**	**836**	**847**	**848**
CUMULATIVE SERVICE AREA E		**6,333**	**12,205**	**26,056**	**36,779**	**43,859**	**45,728**
TOTAL SERVICE AREA E		**382,306**	**470,874**	**577,530**	**640,648**	**684,145**	**707,825**

OTHER AREAS							
45	301000	35	40	52	60	73	83
131	302002	107	227	518	657	723	759
153	303100	917	1,480	2,921	4,907	5,987	6,106
232	303200	36	123	213	256	277	282
132	304000	748	806	1,266	2,510	2,889	3,366
256	304000	30	51	72	93	111	124
228	355102	464	501	542	656	708	737
252	355103	12	25	25	35	40	42
UNINCORPORATED OUTSIDE ULL		**2,349**	**3,252**	**5,609**	**9,173**	**10,807**	**11,499**
SERVICE AREA F INCREASE		**2,349**	**3,252**	**5,609**	**9,173**	**10,807**	**11,499**
TOTAL SERVICE AREA F		**384,655**	**474,127**	**583,139**	**649,821**	**694,952**	**719,324**

ATTACHMENT B

EDAW

August 4, 1994

\Name
\Company
\Address
\City, State Zip

Landscape Architecture
Planning
Urban Design
Environmental Analysis
Site Engineering
Graphic Design

Subject: Contra Costa Water District, Future Water Supply Study

Dear \:

The Contra Costa Water District (CCWD) is in the process of preparing water demand projections for its Future Water Supply Study (FWSS). CCWD is being assisted by a consultant team led by EDAW Inc., San Francisco.

EDAW, Inc.
753 Davis Street
San Francisco, CA 94111
415 433-1484
FAX 415 788-4875
License No. 1744

The water demand projections are being developed using three basic methodologies: (1) by mapping future land use patterns and applying water use factors (acre-feet per acre) to specific land uses; (2) by projecting population and households by decade, from 1990 to 2040, and applying per household or per capita consumption rates to those projections; and (3) combinations of the previous two methods.

To ensure the development of a reliable range of water demand projections, we need verification of the projections of population, households and land uses within your jurisdiction or sphere of influence (SOI) to the best of your ability. Specifically, we ask that you:

- Verify CCWD's subarea projections which are based on the most recent ABAG population and household projections to the year 2010;
- Verify our extension of those projections to the year 2040; and
- Indicate significant revisions to the current County land use plan buildout assumptions.

Maps and data sheets for your jurisdiction are enclosed, along with brief explanations of the materials. Please make any corrections or revisions directly on these maps and data sheets. Joan Ryan from EDAW will be phoning you to provide assistance and to check for any difficulties you may be having. If questions or problems cannot be answered by phone or fax, she will be available to meet with you or members of your staff at your convenience.

Your help in expediting the review will be greatly appreciated. Our target date for receiving your comments on this portion of the FWSS is August 30, 1994. The results of this part of the FWSS will be made available to all interested parties upon completion. If there are any difficulties, please contact me at (510) 674-8057, or Fran Garland at (510) 603-8312. Thank you very much for your help!

Sincerely,

Greg Gartrell
Principal Engineer
Manager, FWSS

N:4s205:055

San Francisco
Alexandria
Atlanta
Denver/Fort Collins
Irvine
Seattle
London
Glasgow
Berlin
Sydney

DESCRIPTION OF ATTACHMENTS AND OTHER ASSUMPTIONS

A number of maps and data sheets are presented for your review. Given the uncertainties typical of long-range projections, you should be looking primarily for major errors, omissions, or inconsistencies. The final projections will be bracketed as a range of demand in order to convey the uncertainty associated with this type of long-range analysis.

We have broken down your jurisdiction into smaller subareas than you are probably used to seeing. Your ability to verify the smaller area data may be limited, unless you have made recent traffic zone analyses that approximately coincide with our subareas. We do not expect you to spend much time on these subareas unless our bottom line totals are significantly different from your expectations, or if some areas are obviously out of line. We allocated population and households using ABAG's area correspondence tables, USGS and Thomas Bros. Atlas maps, and your own general and specific plan maps where available.

The following maps and data sheets are presented for your review. If corrections or revisions are needed, please make them directly on the documents.

- **Service Area Alternatives Map**: All our maps were produced from digitized sources using AutoCad and the Arc/Info Geographic Information System (GIS) software. This GIS-generated map is a working tool for the development of the demand projections, and allows us to manipulate geographic information. Boundaries were derived from a number of sources, but principally from the State's Teale Data Center, Contra Costa County's general plan and LAFCO maps. They were developed at a 1:100,000 scale but are presented for your review at 1:48,000. If boundaries are incorrect, please make any necessary changes. We have attached two separate exhibits: **Range of Service Area Alternatives** and **Subareas by Service Area Matrix** to assist in your understanding of the Service Area Alternatives under consideration in the FWSS.

- **Population by Census Tracts and Subareas (1990 to 2040)**: This exhibit includes projections of population by subarea, by decade, to the year 2040. The subareas are coded to the enclosed maps. The "subarea split percent" column denotes the percent of population (or households) from a subarea that has been assigned to your jurisdiction. The next column shows the other locations within that subarea not included in your jurisdiction and the associated percent assigned to those areas. Estimates have been displayed separately for areas within your city limits and sphere of influence, with totals shown.

This exhibit also shows ABAG's comparable projections and trends as reported in its publication *Projections '94*. Our totals may differ from ABAG's published totals (to 2010) for a number of reasons: (1) Our areas may not exactly coincide with ABAG's because of our service area alternatives; or, (2) ABAG's census tract inputs differ from their final published city report totals; or, (3) ABAG's allocations and rounding assumptions may be slightly different from ours. As long as these totals are within a few percentage points, however, we do not expect any problems, especially given the long projection period and our other assumptions and cross-checks. Please verify the population projections.

We have attached an additional map to facilitate your review. The **Map of Census Tracts and Subareas** is a GIS-generated map that identifies census tracts and subareas for your jurisdiction; they are shown by incorporated boundaries (pink) and by areas outside the city but within your sphere of influence (SOI in the light green). The various subareas below the census

tract level are for our analysis, and they may refer to areas with which you are not necessarily familiar; see also the Range of Service Area Alternatives exhibit.

- **Households by Census Tracts and Subareas (1990 to 2040)**: Please refer to the previous discussion on population projections.

- **Map of Land Uses According to the Latest Contra Costa County General Plan**: Contra Costa County developed its plan of "buildout" land uses by incorporating each city's land use plan into its own land use classification system. Please note major differences between this exhibit and your jurisdiction's future land use plans; small differences will not impact the range of water demand projections. Additionally, please provide an indication of when you expect "buildout" to be reached within your jurisdiction.

It would also be useful if you could geographically identify those areas most likely to be developed or redeveloped past your present general plan timeline. Approximate boundaries or circles are sufficient.

On a separate sheet, we have provided the legend for the county's land use system, and the acreage of each land use in your SOI. In some cases, such as Pleasant Hill and Walnut Creek, only land uses within our Service Area Alternatives are shown. The land use acreages were calculated utilizing the GIS.