RANCHO MURIETA WATER SUPPLY:

Planning for Future Droughts

Rancho Murieta Community Services District

GIBERSON & ASSOCIATES
Planning • Engineering • Project Management

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February 9, 1990

Mrs. Marion Cravens, Manager
Rancho Murieta Community Services District
P.O. Box 1050
Rancho Murieta, CA 95683

Re: Rancho Murieta Water Supply:
Planning for Future Droughts.

Dear Marion:

We are pleased to submit this report on the ability of the community's water supply system to meet projected municipal and industrial water demands during future drought periods.

As you know, droughts in California are a fact of life. No one can predict when they will begin or how long they will last. But everyone knows they can and probably will recur.

In the event of a drought, the capacity of the District's existing water supply system will be severely tested. In order to meet this challenge, the District will be required to carefully manage its water resources and reduce the overall water demands of the community utilizing strict conservation measures. This report concludes that augmentation of the District's water supply will be required in order to meet the ultimate demands of the community during severe droughts.

We would like to thank the District Staff for their assistance in the preparation of this report. While the computer analysis of residential use rates was tedious work, the results were very helpful and greatly appreciated.

We have enjoyed working on this challenging assignment. The next step is to begin implementation. We are available to assist the District in that task.

Sincerely,

Ken Giberson
District Engineer

KG/dep

Enclosure

11246 Gold Express Drive, Suite 101, Gold River, CA 95670 (916) 638-4060 FAX (916) 638-4506

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PLANNING FOR FUTURE DROUGHTS

FEBRUARY 1990

PREPARED BY:

GIBERSON & ASSOCIATES
PLANNING ENGINEERING PROJECT MANAGEMENT
11246 GOLD EXPRESS DRIVE, SUITE 101
GOLD RIVER, CALIFORNIA 95670
(916) 638-4060

PROJECT TEAM

PROJECT MANAGER	:	KEN GIBERSON
PROJECT ENGINEERS	:	ROBERT FRAZIER BOB STAEHS
WORD PROCESSING	:	DIANNE PEREGRINA
COMPUTER ANALYSIS	:	GREG HALL
DATA ENTRY	:	MARCIA KEELER

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EXECUTIVE SUMMARY

> "My friends in Mexico City ask, 'Why don't you seed the clouds?' "I say 'Great, that's a fine idea, but where are we going to buy the clouds?'"

A. INTRODUCTION

In April, 1989, the Rancho Murieta Community Services District Board of Directors expressed concern regarding the reliability of the District's water supply system to serve the needs of the community during future droughts. Previous studies had projected varying degrees of water supply shortages during the recurrence of a 1976-77 drought, the worst drought of record in California.

Realizing the potential for significant economic loss during future droughts, the Board authorized further studies to determine the magnitude of the problem and recommendation of steps to be taken to minimize the potential for customer hardship and economic loss during future droughts.

Droughts in California are a fact of life. No one can predict when they will begin or how long they will last. But everyone knows they can and probably will recur. Currently, California is experiencing a state-wide drought that is entering its forth year. Managers of urban water supplies cannot prevent these droughts. But they can plan ahead and lessen the adverse impacts.

The purpose of this report is to provide the District Board with sufficient information on which to base future water supply and drought response decisions. The report will also provide District Staff with water supply and drought response information to enable them to implement the Board's decision in an efficient and timely fashion.

B. CONCLUSIONS

The following conclusions are based on the data and analyses presented in this report. These conclusions are grouped into several categories (i.e., Impacts, Water Supply, Supply Augmentation, and Drought Contingency Plan).

IMPACTS

Droughts can have a significant adverse impact on urban areas. Fortunately, Rancho Murieta was only partially developed during the 1976-77 drought, and impacts to the District's customers were minimal. When a severe drought occurs in the future, the District's customers will suffer significant adverse impacts unless additional water supplies are developed.

Studies have indicated that customers are responsive to requests for voluntary conservation in the magnitude of 20% - 25% during a drought. Studies have also found that customer hardship is not usually incurred until conservation rates exceed 25% and that customer hardship increases dramatically above 35% conservation rates.

Conservation rates in the range of 50% - 60% were recorded during the 1977 drought in several severely impacted water agencies. While significant customer hardship and economic losses occurred, customers seemed to adapt and survive the crisis.

WATER SUPPLY

The annual yield of the Cosumnes River varies significantly from year to year. The river basin is subject to frequent and prolonged drought - occasionally severe in nature. The river is the sole source of water for the District's municipal and industrial (M & I) demands.

The District's existing water supply system has the capacity to serve the ultimate development of Rancho Murieta (5,968 EDU) during the recurrence of a 25-year drought similar to the 1924 drought without conservation efforts. With development of an additional 1,900 acre feet of water supplies, the District's enhanced water supply system will have the capacity to serve the ultimate development of the community during a 100-year drought with a 25% conservation rate without significant customer hardship.

During a very severe 200-year drought, similar to the 1977 drought, the District's enhanced water supply system will have the capacity to serve the ultimate demands of the community with a 50% conservation rate. Customer hardship will be unavoidable during such an event.

These projected supply deficits are summarized as follows:

DROUGHT EVENT	LEVEL OF CONSERVATION	LEVEL OF DEVELOPMENT	PROJECTED SUPPLY DEFICIT
25-YEAR	NONE	5,968 EDU	NONE
100-YEAR	25%	5,968 EDU	1,900 AF
200-YEAR	50%	5,968 EDU	2,500 AF

Prior to the enhancement of the District's water supply system, the existing system has the capacity to safely meet the following municipal and industrial demands:

	DROUGHT EVENT		
DESCRIPTION	25-YEAR	100-YEAR	200-YEAR
Level of Conservation	NONE	25%	50%
Level of Maximum Development:			
Residential	5,189 DU	3,800 DU	3,500 DU
Commercial/ Industrial	779 EDU	451 EDU	451 EDU
Total	5,968 EDU	4,251 EDU	3,951 EDU

The District will be required to carefully manage its water resources during future droughts. Maximizing river diversions, minimizing reservoir losses, and reducing customer water demands are the keys to successfully balancing the water supply and demand equation.

SUPPLY AUGMENTATION

Development activities are increasing within Rancho Murieta. At the projected rate of development, the capacity of the water supply system will be exceeded within 3-4 years. Accordingly, the District's planning horizon for augmentation of its water supply is 3 - 4 years.

In order to meet the ultimate M & I demands during future droughts, the District must develop additional water supplies. Three alternatives have been identified that have the potential to provide the additional 2,500 acre feet of water within the District's 3 - 4 year planning horizon. These alternatives are summarized as follows:

ALTERNATIVE NUMBER	DESCRIPTION	ESTIMATED COST
1	On-site well system	$2.5-3.0 Million ($800/EDU)
2	Off-site well system	$5.5-6.0 Million ($1,600/EDU)
3	On-site storage Reservoir	$13.5-14.5 Million ($3,900/EDU)

While alternative No. 1 is the least expensive of the three alternatives, it has a limited potential to yield a proven groundwater supply. Alternative No. 2 appears to have excellent potential to become a reliable groundwater water supply. The cost of this alternative does not appear to be unreasonable at approximately $1,600/EDU for all future customers. Alternative No. 3 is the most expensive of the three alternatives. It's development would require amendment to the District's principal water right (Application 23416) - a time consuming and sometimes risky process.

A financing plan will need to be developed to fund the needed water supply improvements. Several financing alternatives were evaluated. Each financing alternative investigated appeared to have a potential pitfall. The first action the District should take is to adopt a Water Supply Augmentation fee. Once in place, the fee could be capitalized in some fashion to generate the large sum of money required to construct the project within the next 3 - 4 years. Solution of the funding problem will be critical to the success of the supply augmentation project.

If a long term water supply is developed sometime in the future, then the potential for severe customer hardships could be minimized in even the most severe drought events. A multi-purpose Auburn Dam could provide this long term supply. The development of this project is actively being pursued by many public and private organizations.

Obtaining water entitlements from Auburn Dam at this time appears to be feasible. Once obtained, these entitlements could be exercised upon the completion of Auburn Dam. The Sacramento Area Water Authority, a proposed joint powers authority of ten local water purveyors, is currently in the formation stage. The mission of the Authority is to assure that a multi-purpose Auburn Dam is built.

DROUGHT CONTINGENCY PLAN

The adoption of a drought contingency plan will allow the District to be prepared to respond quickly and decisively to a future drought. Customer acceptance of demand reduction requests will be enhanced by a well designed and properly implemented drought contingency plan. Lastly, District responsiveness to changing drought conditions will be greatly enhanced by the adoption of such a plan.

C. RECOMMENDATIONS

The following recommendations are based on the finding and conclusions contained in this report. It is recommended that the Rancho Murieta CSD immediately begin implementation of the following recommendations:

1. Adopt the following water supply reliability standard:

   The District's water supply system shall be designed to :

   A. Provide normal annual water demands during a 25-year drought without conservation.

   B. Provide annual water demands with a maximum conservation rate of 25% during a 100-year drought.

   C. Provide annual water demands with a maximum conservation rate of 50% during a 200-year drought.

2. Finance and develop a 2,500 acre-foot per annum conjunctive use ground water supply system, including the adoption of a Water Supply Augmentation Fee.

3. Prepare and adopt a Drought Contingency Plan.

4. Actively pursue the procurement of water entitlements from and the development of future long term water supplies, including a multi-purpose Auburn Dam.

5. Undertake all actions necessary to become an active member of the Sacramento Area Water Authority.

6. Allow development within the District to progress to a maximum of 3,951 EDU (composed of approximately 3,500 residential DU and 451 EDU of related commercial and industrial uses) until the District's water supply is augmented to support additional growth.

CHAPTER 2

INTRODUCTION

A. DROUGHT IMPACTS ON URBAN AREAS

Droughts in California are a fact of life. No one can predict when they will begin or how long they will last. But everyone knows they can and probably will recur. Droughts do not recur in precise historical sequence or in equal severity. The occurrence of frequent, prolonged and severe droughts in California are well documented.

Managers of urban water supplies cannot prevent these droughts. But they can plan ahead and lessen the adverse impacts. Managers of urban water systems need to perform drought contingency planning for their water supply system. The goal is to put into place, in advance, the paper work necessary to implement a drought contingency plan.

The California Department of Water Resources (DWR) recommends that managers of urban water supply systems should draw upon the lessons learned from the 1976-77 drought in anticipating the possible severity and adverse impacts of the next prolonged and/or severe drought.

The DWR reports that 60 percent of California's annual water supply is derived from surface water sources. The remaining 40 percent is derived from ground water sources. In the absence of surface water supplies, greater dependence is placed on ground water sources. This greater dependency can result in unsafe depletion of ground water sources if the drought is prolonged.

The DWR reports significant reductions in the water supply of most California water purveyors during the 1976-77 drought. Particularly hard hit were urban water purveyors with water supply systems which are entirely, or nearly so, dependent upon surface water supplies - like Rancho Murieta.

Following is a DWR list of several large urban water purveyors throughout California and their respective reductions in demands needed to balance water supplies with water demands during the 1976-77 drought:

WATER PURVEYOR	REDUCTION IN DEMANDS (AS A % OF NORMAL)
Marin Municipal Water District	57% *
East Bay Municipal Utility District	35%
Contra Costa County Water District	30%
San Francisco Water Department	25%
Sunnyvale Water Department	25%
Santa Clara Valley Water District	25%
Los Angeles Department of Water & Power	10%
AVERAGE	30%

* Severe customer hardship experienced

Locally, DWR lists the following water purveyors and their respective reductions in demands needed to balance the supply and demand equation during the 1976-77 drought:

WATER PURVEYOR	REDUCTION IN DEMANDS (AS A % OF NORMAL)
El Dorado Irrigation District	57% *
Placer County Water Agency	50% *
City of Sonora	35%
Calaveras County Water Agency	25%
City of Plymouth	50% *
City of Jackson	25%
City of Ione	25%
City of Angels Camp	25%
Sacramento Area Water Purveyors	28%
AVERAGE	35%

* Severe customer hardship experienced

Prior to the 1977 drought, many of the foothill water purveyors had water supply systems with questionable reliability and relatively small reserve capacities. In comparison, many larger urban water purveyors had water supply systems with relatively good reliability and adequate reserve capacities. This would support the higher percentage of reduction in demands required to balance the supply and demand equation for smaller systems as compared to larger urban water systems.

Based on the experiences of the 1976-77 drought, DWR reports that voluntary reductions in water usage can reduce urban water demands up to 20-25%. Reductions in excess of this amount typically required mandatory rationing and active enforcement. DWR also reports that consumer hardship begins to occur above 25% conservation levels - severely above 35% conservation levels. Conservation rates in the vicinity of 50% can create significant economic loss on the part of customers.

In addition to reducing demands, many California water purveyors augmented their water supplies during the 1976-77 drought. The augmentation methods most utilized included trucking in water and laying emergency pipelines.

Obviously, these augmentation methods were time consuming, costly, and, in most cases, yielded relatively small quantities of additional water. Typically, little flexibility is possible to augment a community's water supply during times of low surface water availability.

Apart from creating water shortages, droughts also degrade water quality. Not only is there less water, but the water that is available is less suitable for its intended uses. Most drought related water quality problems result from lack of dilution and increased temperatures in the water source. In addition, minor taste, odor and turbidity problems are experienced in water storage reservoirs due to their depleted levels during a drought.

As a result of limited surface water sources during the 1976-77 drought, urban water purveyors across the state have been developing additional dual ground and surface water sources. These permanent supplies will help to lessen the impacts of future water shortages.

During the 1976-77 drought, most Californians carried on nearly all domestic activities, with little more than a minor crimp in lifestyles, with a rather substantial reduction in water consumption. Few people really suffered from water shortages, changing habits to waste less water. Customers of severely impacted water purveyors experienced significant hardships.

A large part of the water used by residents is used outdoors, mostly to maintain landscaping. Heavy loss of shrubs, lawns and ground cover were experienced during the 1976-77 drought, since they are generally not drought tolerant and are more easily replaced than trees. Some losses of major landscaping plants and trees were experienced, most notably in the East Bay Area.

Made more apparent during the 1976-77 drought was the fact that water is a price elastic commodity. Reduction in water use was observed when its price was increased. Several variables have significant effects on price elasticity. Large water users were found to be more price sensitive than smaller volume customers. Also, the income level of residential customers is an important variable. The higher the income level, the lower the price elasticity.

Several California water purveyors suffered financial difficulties during and after the 1976-77 drought. The customers of some water purveyors were so frugal with their use of water that water revenues fell short of operational expenses during the drought. In some cases, the post-drought water consumption rates were lower than those that existed prior to the drought. Again, water revenues were less than expected, requiring water purveyors to change their rate structures accordingly.

Droughts have shown again and again the finite nature of California's water resources and man's limited ability to control nature. There is no assurance that the next drought is not just beyond the horizon. We can be assured that drought will return, and, considering the greater needs of that future time, its impact, unless prepared for, will be much greater than the impacts of past droughts.

C. DROUGHT SURVEY

A survey of Northern California water purveyors regarding water use and drought contingency planning was performed in conjunction with the preparation of this report. The results of this survey are included in Appendix "A" along with a copy of the survey questionnaire.

The results of this survey indicate that many of the agencies responding have established drought contingency plans in anticipation of another drought. The survey results also indicates that many of the agencies have a backup water supply to draw upon in the event of a drought or water shortage.

Several of the agencies responding furnished copies of there drought contingency plans, ordinances and water supply reliability standards. Of particular importance in the preparation of this report was the level of reliability that a responsible agency sets for its water supply.

Further telephone conversations with several of these agencies regarding the reliability of their water supplies revealed the following:

1. El Dorado Irrigation District - EID adopted water reliability standard in July 1989 - after the 1977 drought. This standard formalized a longstanding unofficial standard that requires that the District's water supply shall be capable of supplying normal service in 95% of all years without conservation. In the remaining 5% of all years, shortages of varying degrees will be encountered.

   Since 1977, EID has pursued the development of several water supply projects to augment their existing water supply. Several projects have been completed.

2. Calaveras County Water District - CCWD strives for a 100% reliability in all years. They have been successful in developing several water projects in the last decade.

3. Santa Clara Valley Water District - SCVWD has a water reliability policy on the books. Their existing standard is currently being rewritten to incorporate a reliability standard that requires their supply to be capable of supplying normal service in 95% of all years. SCVWD has a successful ground water recharge program to augment their surface water supplies.

In addition, DWR reports that Marin Municipal Water District, a surface water dependent water district in greater Marin County, also adopted a water supply reliability standard after the 1977 drought. Their standard requires that their water supply shall be capable of serving normal demands in 95% of all years without conservation. In the remaining 5% of all years their water supply shall be capable of serving demands with a maximum conservation rate of 15% in the first year and

35% in the second year (an average of 25% for both years).

DWR also reports that Marin Municipal Water District has increased their storage reservoir capacity by 60% since 1977. They have also contracted for an additional 4,300 AF of water from the Sonora County Water Agency.

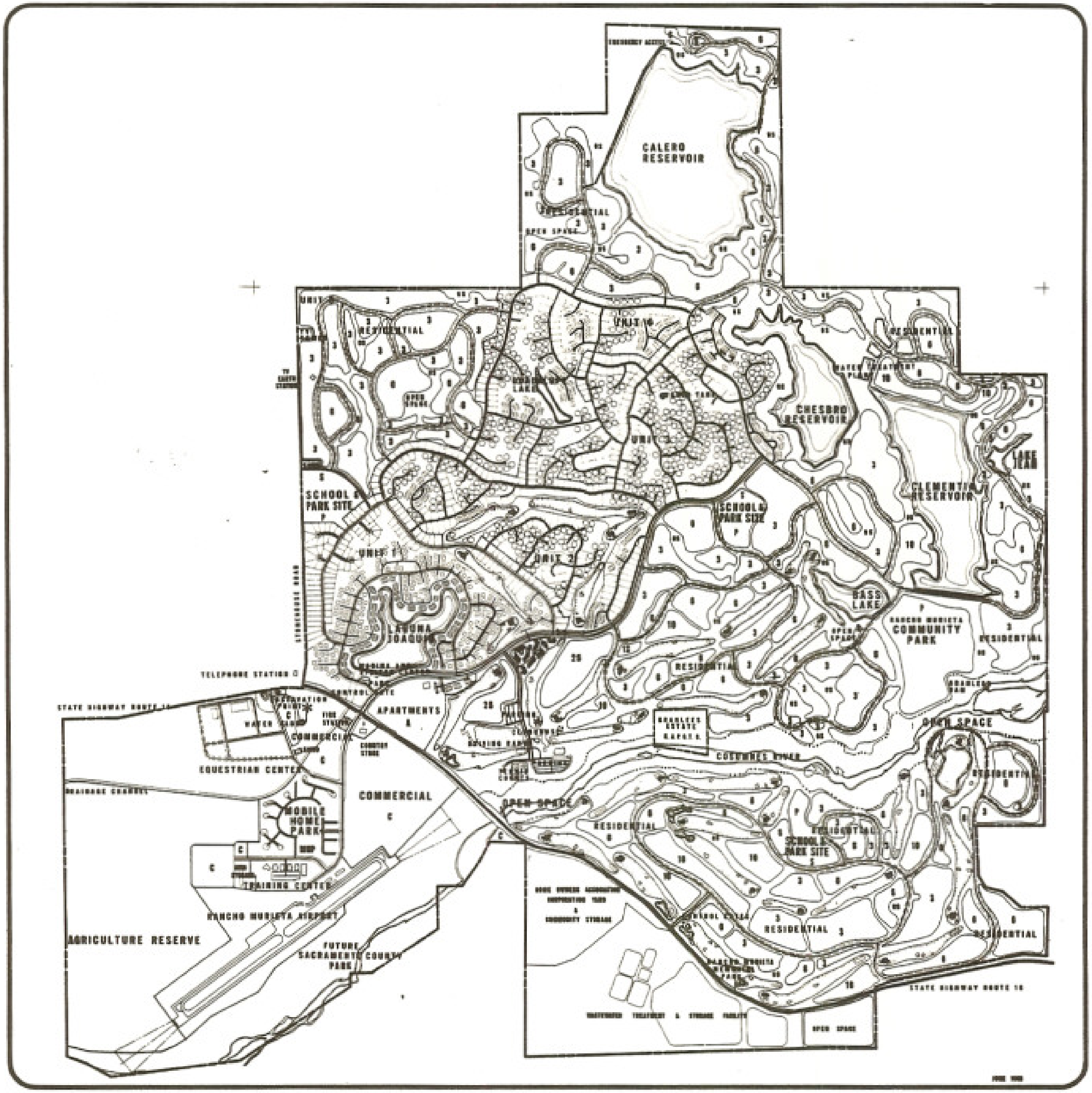
C. RANCHO MURIETA'S HYDROLOGIC SETTING

Rancho Murieta is located on the east side of the Sacramento Valley at the general area where the foothills of the Sierra Nevada mountain range begin and approximately 24 miles southeast of the City of Sacramento. This region is naturally semi-arid.

The boundaries of the Rancho Murieta Community Services District (District) are identical to the boundaries of the Rancho Murieta Master Plan approved by Sacramento County on June 13, 1984. All urban land use shown on Figure No. 1 are planned to be served by the District's water supply system. Figure No. 2 shows the major hydrologic features within the community, including the Cosumnes River and the District's three water storage reservoirs (Calero, Chesbro and Clementia).

FIGURE No. 1

Rancho Murieta



Master Plan

legend

RESIDENTIAL/EXISTING DENSITIES

ESTATE LOTS	3	PER ACRE MAXIMUM
CIRCLE LOTS	3	PER ACRE MAXIMUM
COTTAGE LOTS	6	PER ACRE MAXIMUM
TOWNHOUSES	10	PER ACRE MAXIMUM
APARTMENTS	25	PER ACRE MAXIMUM

RESIDENTIAL/PROPOSED DENSITIES

- 3 PER ACRE MAXIMUM
- 6 PER ACRE MAXIMUM
- 10 PER ACRE MAXIMUM
- 25 PER ACRE MAXIMUM

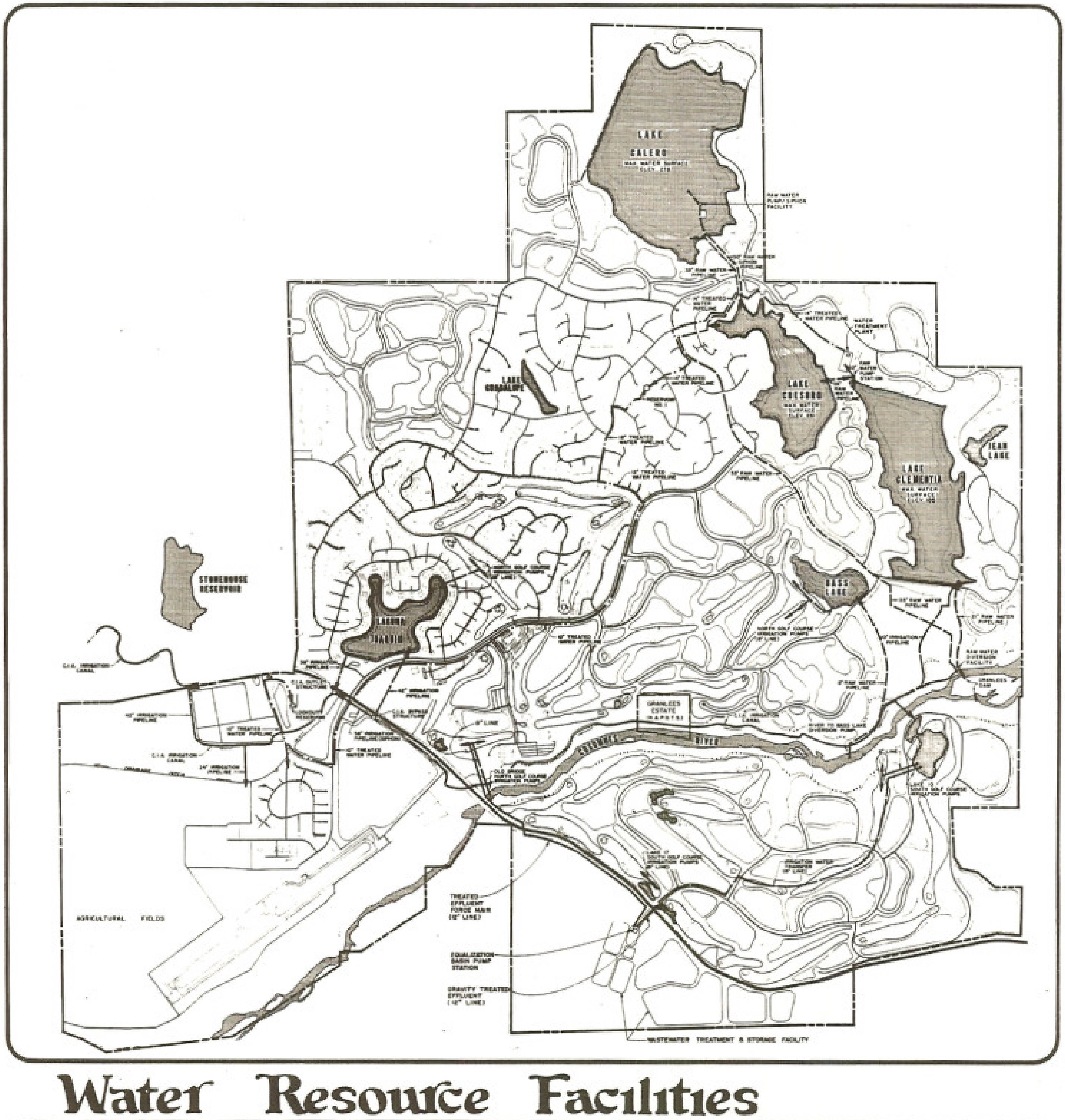
- PARKS
- OPEN SPACE
- COMMERCIAL
- SCHOOL SITES
- MOBILE HOME PARK
- GOLF COURSE

- EXISTING STREETS
- PROPOSED STREETS
- RESERVOIRS
- RESOURCE PROTECTION LINE
- RANCHO MURIETA BOUNDARY
- UNIT BOUNDARIES

SCALE IN FEET

FIGURE No. 2

Rancho Murieta



Water Resource Facilities

LAKE	SURFACE AREA	STORAGE VOLUME
CLEMENTIA	70 ACRES	907.1 ACRE FEET
CHESBRO	46 ACRES	1140.4 ACRE FEET
CALERO	118 ACRES	2822.5 ACRE FEET

RESERVOIR	STORAGE VOLUME
NO. 1	1.2 MILLION GALLONS
LOOKOUT	.2 MILLION GALLONS

DESCRIPTION OF FACILITIES

DURING PERIODS OF HIGH FLOWS IN THE COSUMNES RIVER, RAW WATER IS DIVERTED FROM GRANLEES DAM INTO THE LAKE SYSTEM FOR STORAGE. UNDER NORMAL OPERATION, RAW WATER IS PUMPED TO LAKE CALERO AT A MAXIMUM PUMPING RATE OF 46 c.f.s. THROUGH THE 33" RAW WATER PIPELINE. THE PUMPING SYSTEM HAS THE CAPABILITY OF ALSO PUMPING DIRECTLY TO LAKES CLEMENTIA AND CHESBRO WHEN REQUIRED. THE STORED RAW WATER IN LAKE CALERO IS TRANSFERRED TO LAKE CHESBRO VIA THE RAW WATER PUMP/SIPHON FACILITY UPON DEMAND. THE RAW WATER IS THEN TRANSFERRED FROM LAKE CHESBRO BY GRAVITY TO LAKE CLEMENTIA. THE WATER TREATMENT PLANT DRAWS RAW WATER FROM EITHER LAKE CHESBRO OR LAKE CLEMENTIA. THE WATER TREATMENT PLANT IS A FULLY AUTOMATED, RAPID SAND FILTER, CHEMICAL INJECTION FACILITY CAPABLE OF TREATING THE RAW WATER TO ACCEPTABLE STANDARDS FOR DOMESTIC CONSUMPTION. AFTER TREATMENT, THE TREATED WATER IS PUMPED TO RESERVOIR NO. 1 OR THE LOOKOUT RESERVOIR FOR STORAGE AND SUBSEQUENT DISTRIBUTION INTO THE COMMUNITY.

SOURCE: RAYMOND VAIL AND ASSOCIATES

SCALE: 1" = 400'

SCALE IN FEET

The mean seasonal precipitation at Rancho Murieta is approximately 21 inches (Nolte 1961). In comparison, the mean seasonal precipitation in the City of Sacramento is 17.88 inches (NWS 1989). While there is a difference in mean seasonal precipitation between these two locations, there is a direct relationship between the total precipitation in each of the locations in any given year.

The Cosumnes River is a virtual wild river in that only about 4% of the river's 536 square mile watershed upstream of Rancho Murieta is controlled by dams or reservoirs. As a result, the vast majority of the watershed's 38 inches of mean seasonal precipitation flows through Rancho Murieta uncontrolled (Nolte 1961).

The Cosumnes River basin extends easterly of Rancho Murieta into the lower Sierra Nevada Mountains. The annual yield of the Cosumnes River is highly variable and significantly influenced by the amount of winter snow pack within the river basin. Due to its low elevation, the basin does not receive a heavy snow pack as do the higher mountains further to the east. Spring snow melt runoff accounts for the majority of the Cosumnes River's annual yield.

The U.S.G.S. stream gage at Michigan Bar has recorded the annual yield of the Cosumnes River since the early 1900's. This gaging station is located one mile upstream of Rancho Murieta. The annual yield for 81 years of record (1908-1988) is shown in Table No. 1. The minimum annual yield recorded to date occurred during the 1977 water year when the Cosumnes River's yield was 15,760 acre-feet (AF). The maximum annual yield occurred during the 1983 water year when the Cosumnes River's yield was 1,221,000 AF. The mean yield of the Cosumnes River, based on the 81 years of record, is 274,400 AF. The Cosumnes River typically dries up to a trickle or less during the late summer and early fall of each year.

The 1977 water year, the lowest water year of record, is considered by most water supply experts to be a catastrophic event. During that year the Cosumnes River's yield amounted to only 6% of mean annual yield. In comparison, during the 1924 water year, the second lowest water year of record, the Cosumnes River's yield amounted to approximately 15% of mean annual yield. The 11 lowest water years of record, including the catastrophic 1977 water year, are shown below in descending order of magnitude:

TABLE No.1

ANNUAL YIELD OF THE COSUMNES RIVER IN ACRE-FEET
(AS MEASURED AT MICHIGAN BAR)

WATER YEAR	1900	1910	1920	1930	1940	1950	1960	1970	1980
0		462,100	170,600	165,100	501,800	331,400	150,200	448,600	565,400
1		876,000	406,800	45,820	401,600	762,400	54,910	332,000	117,900
2		138,700	426,500	314,300	510,200	781,900	210,900	182,600	955,200
3		127,400	438,400	113,200	660,100	264,400	453,900	441,900	1,221,000
4		546,200	40,350	122,400	187,900	229,100	143,200	544,900	597,800
5		408,700	380,600	369,300	356,600	178,500	656,000	364,500	163,000
6		571,600	147,800	522,600	390,300	667,400	167,900	54,870	704,600
7		415,700	452,400	399,500	144,800	238,200	601,200	15,760	72,880
8	144,100	224,200	315,600	683,200	269,000	655,100	169,700	453,000	52,610
9	596,600	259,300	115,300	92,220	237,400	116,800	679,900	309,600	
TOTAL	740,700	3,999,900	2,894,350	2,827,640	3,659,700	4,225,200	3,287,810	3,147,730	4,450,390

MEAN YIELD (81 YEARS) = 274,400 ACRE-FEET
AVERAGE YIELD (81 YEARS) = 360,900 ACRE-FEET
MAXIMUM YIELD (1983) = 1,221,000 ACRE-FEET
MINIMUM YIELD (1977) = 15,760 ACRE-FEET

SOURCE: U.S. GEOLOGICAL SURVEY (DECEMBER 1989)

ORDER OF MAGNITUDE	WATER YEAR	ANNUAL YIELD, AF	PERCENT OF MEAN
1	1977	15,760	6%
2	1924	40,350	15%
3	1931	45,820	17%
4	1988	52,610	19%
5	1976	54,870	20%
6	1961	54,910	20%
7	1987	72,880	27%
8	1939	92,220	34%
9	1933	113,200	41%
10	1929	115,300	42%
11	1959	116,800	43%
AVERAGE	(INCLUDING 1977)	70,400	26%
AVERAGE	(EXCLUDING 1977)	75,900	28%

It is apparent that the Cosumnes River is subject to relatively frequent droughts. During these periods, the annual yield of the river is not sufficient to support all the demands along the river. It is this natural phenomenon that can cause significant water supply shortages to Rancho Murieta.

D. RANCHO MURIETA'S WATER SUPPLY

The Cosumnes River is the sole source of water for the Rancho Murieta community. During periods of high river flows in the river, surface water is diverted from Granlees Dam into the District's water storage reservoirs for use during the summer when river flows are non-existent. The raw water is delivered from the reservoirs to the District's water treatment plant at the base of Lake Chesbro as the community needs water throughout the year.

The principal domestic water right held by the District is Application 23416, Permit 16762. A copy of Application 23416 is included in Appendix "B". This water right allows for diversions from the Cosumnes River from November 1st through May 31st under the following conditions:

A. No water can be diverted when river flows are less than 70 cubic feet per second (cfs) at Michigan Bar and the evidence of visible flow at McConnell Gage located near Highway 99 (approximately 21 miles downstream). For river flows between 70 cfs and 175 cfs, a maximum diversion of 6 cfs is allowed provided this diversion does not reduce the downstream flow below 70 cfs.

B. When river flows exceed 175 cfs, a diversion of 6 cfs is allowed for direct use plus an additional 3,900 AF to storage as follows:

1. 1,250 AF to Chesbro Reservoir.
2. 2,610 AF to Calero Reservoir.
3. 850 AF to Clementia Reservoir.
4. 40 AF to South Course Lake 10.

C. The combined amount of B (2), (3) and (4) above cannot exceed 2,650 AF. The maximum allowable rate of diversion to storage is 46 cfs. The total amount of water to be taken cannot exceed 6,368 acre feet per year.

It should be noted that the District is under contractual obligation to reasonably prosecute any application(s) to add to the place of use of Application 23416 to provide water service to additional acreage in the vicinity of Rancho Murieta. Section 4 (d) of the December 7, 1987 Water Rights Transfer Agreement, between the District and Rancho Murieta Properties, Inc. (RMPI), requires the District to reasonably prosecute the extension of water service to additional lands to serve up to a total of 5,189 residential dwelling units (DU). It is for this reason that the District's planning horizon includes provision of service to the entirety of Rancho Murieta Master Plan entitlements even though the housing yield within the current District boundary may be lower than 5,189 DU.

E. PREVIOUS STUDIES

Several studies of Rancho Murieta's water supply have been made since the community's inception in 1969. Those previous studies are referenced in the Bibliography.

The ability of the District's water supply system to support the full build out of the community has been debated extensively since the 1977 drought. Previous studies have, of necessity, been based upon estimates of future water consumption patterns and the ultimate level of development with the community.

The Rancho Murieta Master Plan (Figure No. 1) envisions a community of 5,968 equivalent dwelling units (EDU), consisting of not more than 5,189 DU and approximately 779 EDU of related commercial and industrial uses.

Estimates of water consumption utilized in the previous studies have varied considerably. Understandably, the resulting projections of the capacity of the District's water supply system have varied significantly.

These previous studies provide a good foundation upon which to base this report. Since the District now has several years of water consumption records from meter readings, projections of future water consumption patterns can be based on actual consumption data in lieu of estimates of future use based on industry averages. Accordingly, this report will rely upon this database to project future water demands and the ability of the District's water supply system to meet these water demands during a drought event.

CHAPTER 3

WATER SUPPLY

A. COSUMNES RIVER ANNUAL YIELD

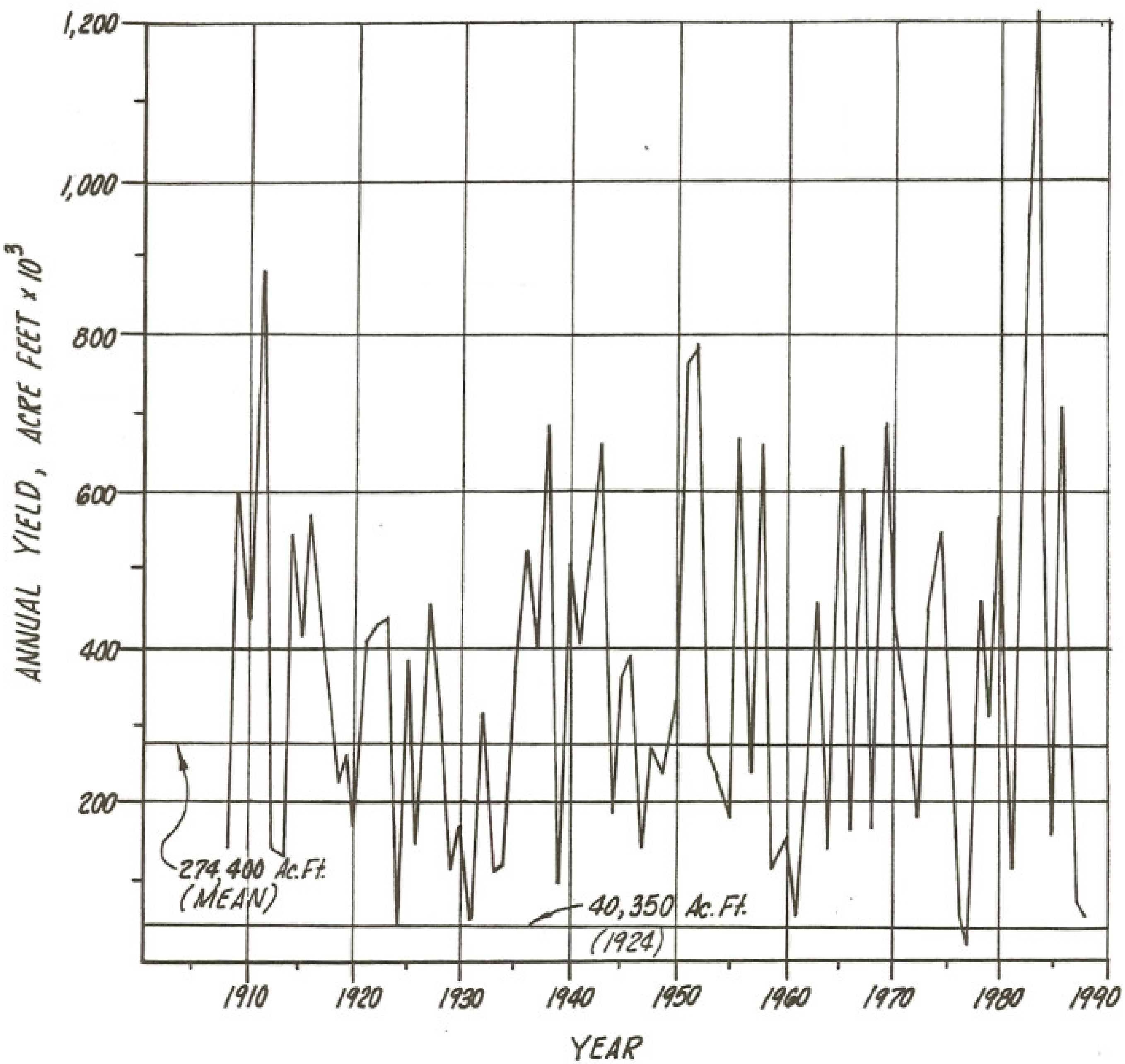
The Cosumnes River is the sole source of water for the Rancho Murieta Community. The annual yield of the river for the 81 years of record, as shown in Table No. 1, is graphically represented in Figure No. 3. It is readily apparent from Figure No. 3 that the annual yield of the river varies drastically from year to year.

The annual yield of the Cosumnes River was analyzed for the 81 years of record utilizing standard hydrological frequency analysis techniques. The objective of this frequency analysis was to relate the magnitude of the periodic low annual yields of the river (i.e. drought events) to their frequency of occurrence through the use of probability distributions. The magnitude of a drought event is inversely related to its frequency of occurrence, very severe droughts occurring less frequently than more moderate events.

The frequency analysis technique utilized in this analysis was the Log-Pearson Type III Distribution. Appendix

FIGURE No. 3

COSUMNES RIVER ANNUAL YIELD
AS MEASURED AT MICHIGAN BAR



"C" includes the complete drought frequency analysis of the Cosumnes River for the 81 years of record. This particular statistical distribution is widely used for evaluation of extreme hydrological events, such as droughts and floods. The results of this analysis indicate that the variations in the annual yield of the Cosumnes River fit the Log-Pearson Type III Distribution with very favorable statistical significance. A summary of this drought frequency analysis is shown in Table No. 2.

Evaluation of the data contained in Table No. 1 indicates that the average recurrence interval of annual yields equal to or less than 75,900 AF (the average of the 10 lowest years of record - excluding 1977) is approximately 10.7 years. This agrees very closely with the results of the Log-Pearson Type III Distribution where the recurrence interval of the average dry year was estimated to be 11 years.

The data in Table No. 1 indicates that two consecutive dry years have occurred four times in the last 81 years (1912-13, 1933-34, 1976-77 and 1987-88). The worst of these two year droughts was in 1976-77 when the total annual yield of the Cosumnes River was only 80,630 AF for the two year period.

Further review of the data presented in Table No. 1 indicates that there have been three periods wherein the

TABLE No. 2

SUMMARY OF
COSUMNES RIVER DROUGHT FREQUENCY ANALYSIS
UTILIZING LOG-PEARSON TYPE III DISTRIBUTION

WATER YEAR	ANNUAL YIELD ACRE FEET	PROBABILITY OF EXCEEDENCE	PROBABILITY OF RECURRENCE	APPROXIMATE RECURRENCE INTERVAL
1977	15,760	99.5%	0.5%	200 YEARS
N/A	23,000 (EST.)	99.0%	1.0%	100 YEARS
N/A	31,000 (EST.)	98.0%	2.0%	50 YEARS
1924	40,350	96.0%	4.0%	25 YEARS
AVERAGE DRY YEAR (1)	75,900	91.2%	8.8%	11 YEARS
N/A	84,000 (EST.)	90.0%	10.0%	10 YEARS
MEAN ANNUAL YIELD	274,380	56.0%	44.0%	2 YEARS

FOOTNOTES:

(1) AVERAGE OF THE 10 LOWEST YEARS OF RECORD (EXCLUDING 1977)

annual yield of the Cosumnes River was below the mean annual yield for three or more consecutive water years (1918-20, 1929-34 (6 years) and 1959-62 (4 years)). The 1929-34 and 1959-62 periods include five of the 11 lowest water years of record.

An evaluation of the eleven lowest water years of record indicates that there were five years in which the annual yield of the Cosumnes River was between 41,000 AF and 55,000 AF (1924, 1931, 1961, 1976 and 1988). It is interesting to note that any one of these years could have been as bad or worse than the 1924 water year if the total annual runoff within the Cosumnes River basin had been reduced by as little as one-half inch. One-half inch of runoff from the basin is equivalent to approximately 14,300 AF. It is apparent that the annual yield of the Cosumnes River is very sensitive to minor changes in precipitation during dry years.

It is quite obvious from this analysis that there is a strong likelihood of the recurrence of severe and prolonged droughts in the Cosumnes River basin. Accordingly, it is prudent to evaluate the impact that a drought induced water shortages will have on Rancho Murieta's water supply system and its ability to meet the future water demands of the community.

B. COSUMNES RIVER DIVERSIONS

The late winter and spring flow of the Cosumnes River provide the bulk of all water that is divertable under the District's principal water right (Application 23416). In addition to the conditions of this permit outlined in Chapter 1, the permit includes two different diversion schedules.

The overall availability of divertable flow in the river during the diversion season is the principal factor that determines which schedule is utilized. The intent of the two schedules is to allow for more aggressive diversions in dry water years.

The District's diversion facilities were originally designed to maximize the diversion of water from the river in dry water years. Theoretically, careful monitoring of the river flows and maximum utilization of the diversion facilities should result in maximum diversions under the extreme conditions present during dry water years. Of course, there are always practical limitations on the effectiveness of the operation of diversion facilities due to actual pumping configurations, etc.

For this reason an analysis of the theoretical and practical diversions of the 11 lowest water years of record was performed. The mean daily flow of the Cosumnes River for these 11 lowest years of record is included in Appendix "D". This data was evaluated to determine the theoretical maximum diversions allowed under Application 23416 and the practical maximum diversions allowed by the actual pumping configuration of the diversion facilities. The theoretical and practical diversion were then compared to determine the efficiency of the diversion facilities.

To a certain degree, this analysis is somewhat academic in nature. The District's principal water right, Application 23416, contains several restrictions pertaining to maximum annual diversions, maximum storage volumes and downstream visible flow. For the purposes of this analysis, the maximum diversion and storage requirements are assumed to be non-existent and it was assumed that downstream flow was visible as required by the water right. The intent of this analysis is to determine the magnitude of theoretical and practical diversions that are possible while respecting the other provisions of the water right pertaining to protection of fisheries and downstream agricultural interests.

The results of this analysis is shown in Table Nos. 3, 4 & 5. The efficiency of the diversion facilities range from 92-96% during these dry years. It appears from this analysis that the practical diversions from the diversion facilities will closely approximate the theoretical diversions allowed under Application 23416 during drought events. Again, it should be noted that the theoretical and practical diversion allowed under Application 23416 may not always be realized due to the limitations in the permit pertaining to maximum annual diversions and maximum storage volumes.

It may be possible to increase the overall efficiency of the diversion facilities with the installation of a variable speed pump in the diversion pump station. This modification does not appear to be warranted at this time due to the marginal increase in water diversions that would result as compared with the significant cost of the pumping equipment.

The results of this diversion analysis were compared with the annual yield records of the Cosumnes River for the six lowest years of record utilizing regression analysis. The intent of this analysis was to develop a statistical model to estimate the probable magnitude of practical diversions that can be expected during the 50 and 100-year droughts. The results of this regression analysis is shown in Table No. 6

TABLE No.3

THEORETICAL DIVERSIONS FROM THE COSUMNES RIVER (UNDER APPLICATION 23416)
IN ACRE FEET

WATER YEAR	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	TOTAL
1977	4	0	24	256	0	0	18	302
1924	0	38	200	2186	192	2608	258	5,482
1931	64	0	373	1079	2818	1743	559	6,636
1988	0	115	1029	345	2648	1980	1732	7,849
1976	349	366	165	339	2828	2737	1436	8,220
1961	52	218	22	1484	1837	2737	2769	9,119
1987	0	14	232	1890	2662	1059	182	6,039
1939	105	180	470	944	2828	2737	2257	9,521
1933	0	12	462	430	2797	2737	2828	9,266
1929	28	266	549	1047	2814	2737	2828	10,269
1959	12	36	1252	1841	2828	2737	815	9,521
AVG.DRY YEAR (EXCLUDING '77)	61.00	124.50	475.40	1,158.50	2,425.20	2,381.20	1,566.40	8,192.20

TABLE No.4

PRACTICAL DIVERSIONS FROM THE COSUMNES RIVER (UNDER APPLICATION 23416)
IN ACRE FEET

WATER YEAR	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	TOTAL
1977	4	0	24	231	0	0	18	277
1924	0	14	192	2084	192	2555	194	5,231
1931	54	0	372	1066	2646	2281	468	6,887
1988	0	115	906	345	2404	1817	1589	7,176
1976	349	366	153	260	2828	2737	1390	8,083
1961	52	218	22	1372	1784	2737	2768	8,953
1987	0	14	228	1784	2511	858	182	5,577
1939	105	180	470	883	2828	2737	2164	9,367
1933	0	12	447	341	2768	2737	2828	9,133
1929	28	266	530	1035	2737	2737	2340	9,673
1959	0	36	1237	1841	2828	2737	764	9,443
AVG.DRY YEAR (EXCLUDING '77)	58.80	122.10	455.70	1,101.10	2,352.60	2,393.30	1,468.70	7,952.30

NOTE: THE PUMPING CONFIGURATION OF THE EXISTING DIVERSION FACILITIES IS AS FOLLOWS:

A. 3 EACH, 500 H.P. PUMPS (15.3 C.F.S. PER PUMP)
B. 2 EACH, 125 H.P. PUMPS (6.0 C.F.S. PER PUMP)
C. 125 H.P. PUMPS ARE LOCKED OUT WHEN 500 H.P. PUMPS OPERATE AND VICE VERSA.

TABLE No.5

COMPARISON OF THEORETICAL & PRACTICAL DIVERSIONS
FROM THE COSUMNES RIVER (UNDER APPLICATION 23416)
IN ACRE FEET

A. 1977 WATER YEAR (200-YEAR DROUGHT)

MONTH	THEORETICAL DIVERSIONS	PRACTICAL DIVERSIONS	PERCENT OF THEORETICAL
NOVEMBER	4	4	100.0 %
DECEMBER	0	0	0.0 %
JANUARY	24	24	100.0 %
FEBRUARY	256	231	90.2 %
MARCH	0	0	0.0 %
APRIL	0	0	0.0 %
MAY	18	18	100.0 %
TOTAL	302	277	91.7 %

B. 1924 WATER YEAR (25-YEAR DROUGHT)

MONTH	THEORETICAL DIVERSIONS	PRACTICAL DIVERSIONS	PERCENT OF THEORETICAL
NOVEMBER	0	0	0.0 %
DECEMBER	38	14	36.8 %
JANUARY	200	192	96.0 %
FEBRUARY	2186	2084	95.3 %
MARCH	192	192	100.0 %
APRIL	2608	2555	98.0 %
MAY	258	194	75.2 %
TOTAL	5482	5231	95.4 %

C. AVERAGE DRY YEAR (11-YEAR DROUGHT)

MONTH	THEORETICAL DIVERSIONS	PRACTICAL DIVERSIONS	PERCENT OF THEORETICAL
NOVEMBER	61.0	58.8	96.4 %
DECEMBER	124.5	122.1	98.1 %
JANUARY	475.4	455.7	95.9 %
FEBRUARY	1,158.5	1,101.1	95.0 %
MARCH	2,425.2	2,352.6	97.0 %
APRIL	2,456.6	2,393.3	97.4 %
MAY	1,566.4	1,468.7	93.8 %
TOTAL	8,267.6	7,952.3	96.2 %

and Figure No. 4. The result of this diversion analysis is summarized as follows:

DROUGHT EVENT	ANNUAL YIELD, AF	ESTIMATED PRACTICAL DIVERSIONS, AF
25 Year	40,350	5,234
50 Year	31,000 (Est)	3,400
100 Year	23,000 (Est)	1,800
200 Year	15,760	277

It should be noted that no two water years are exactly alike. While the total annual yield of the river for two years may be similar, it is highly unlikely that the flows in the river in each of those years will follow the same patterns of timing, intensity and duration. It is for this reason that statistical analysis techniques are utilized to predict probable patterns of timing, intensity and duration of river flows during a particular design drought event.

Regression analysis of the annual yield of the Cosumnes River vs. seasonal precipitation in the City of Sacramento (through January 31 st) and DWR snow pack water content readings (early February) was performed. The intent of this analysis was to determine if a significant correlation existed between the mid-winter precipitation and snow pack readings and the annual yield of the river. While the results of this regression analysis were encouraging, no strong correlation was found.

TABLE No.6

REGRESSION ANALYSIS OF PRACTICAL DIVERSIONS
VS. ANNUAL YIELDS

A. REGRESSION ANALYSIS

WATER YEAR	ANNUAL YIELD (ACRE FEET)	PRACTICAL DIVERSIONS (ACRE FEET)	
1924	40,350	5,234	
1931	45,820	6,887	
1961	54,910	8,953	43,449
1976	54,870	8,083	32,695
1977	15,760	277	822
1988	52,610	7,176	

Regression Output:

Constant		14998.08
Std Err of Y Est		2526.812
R Squared		0.977307
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	4.761855	
Std Err of Coef.	0.362805	

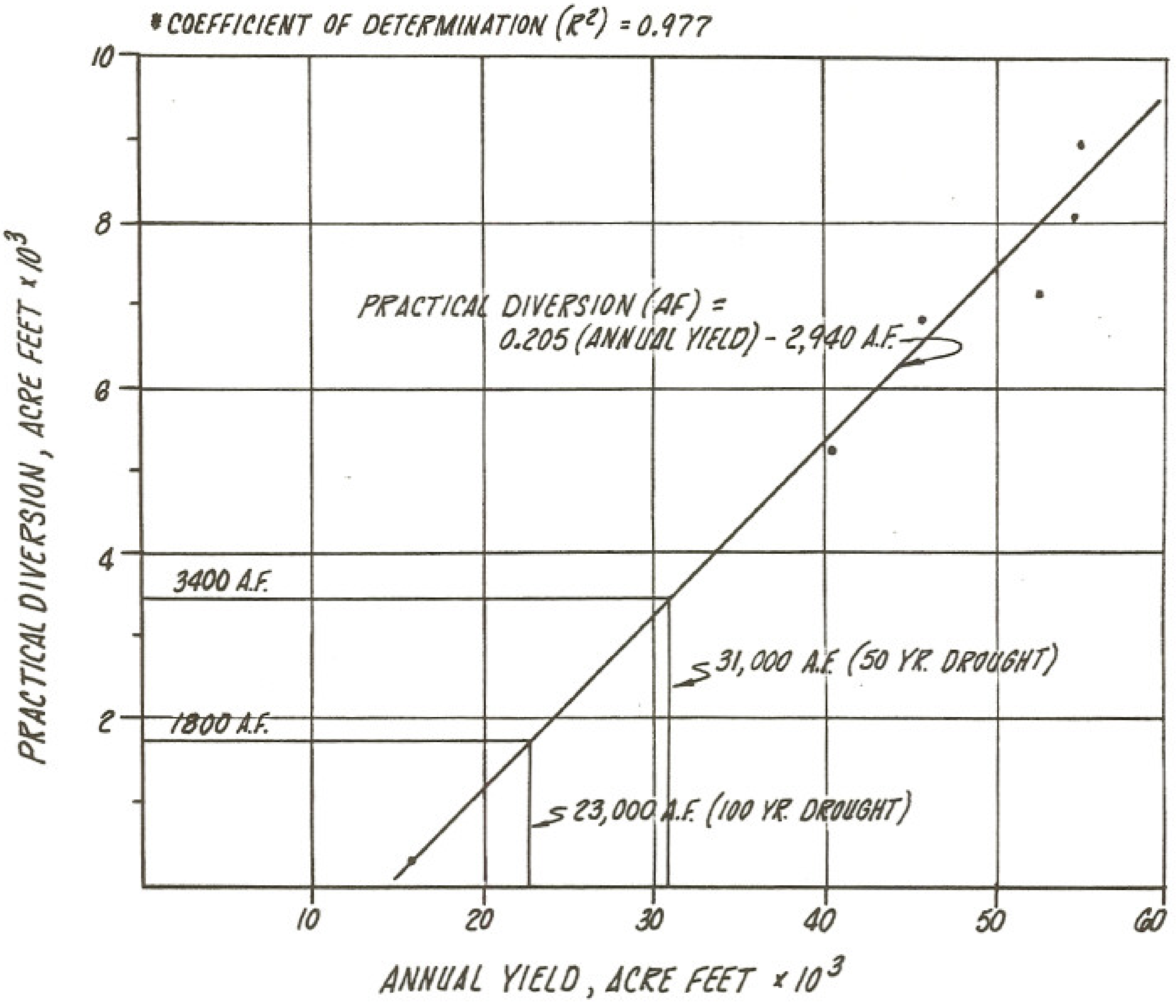
B. PROJECTION OF 50 & 100 YEAR DIVERSIONS

ESTIMATED PRACTICAL DIVERSION (A.F.) =
0.205 (ESTIMATED ANNUAL YIELD, A.F.) - 2940 A.F.

DROUGHT EVENT	ESTIMATED ANNUAL YIELD (ACRE FEET)	ESTIMATED PRACTICAL DIVERSIONS (ACRE FEET)
50 YEAR	31,000	3,400
100 YEAR	23,000	1,800

FIGURE No. 4

REGRESSION ANALYSIS OF PRACTICAL DIVERSION VS. ANNUAL YIELDS



Further regression analysis may discover a combination of independent variables (precipitation, snow pack water content, etc.) that can accurately predict the annual yield of the river each year. Estimates of spring diversions could then be made to assist the District in estimating the water supply picture in future years.

The results of the diversion analyses presented in this Chapter are reflected in the water budgets presented in Chapter 5.

C. DIRECT RAINFALL & RUNOFF

One additional factor that must be considered in evaluating the net yield of the District's water supply system is direct rainfall and runoff. Direct rainfall & runoff effectively increase the volume of diverted river flows while they are held in storage in the District's water storage reservoirs.

Lakes Calero and Chesbro have watersheds that are negligible in size. In comparison, Lake Clementia has a relatively large watershed. The characteristics of these three storage reservoirs are shown below:

CHARACTERISTICS	LAKE CALERO	LAKE CHESBRO	LAKE CLEMENTIA
Storage Volume			
Usable	2,322 AF	1,094 AF	857 AF
Dead	300 AF	50 AF	50 AF
Total	2,622 AF	1,144 AF	907 AF
Surface Area	118 AC	46 AC	70 AC
Watershed Area	125 AC	50 AC	1,150 AC
Spillway Elevation	278 ft.	261 ft.	185 ft.
Maximum Depth	54 ft.	53 ft.	25 ft.

The actual volume of direct rainfall and runoff from the watershed of each lake varies from year to year, depending upon the amount of precipitation received during each year. An analysis of annual precipitation was made to determine the total amount of direct rainfall and runoff that would enter each of the lakes for the various dry years under study.

The National Weather Service (NWS) precipitation records were reviewed for the 11 lowest years of record under study. Utilizing the relationship between the mean annual precipitation at Rancho Murieta (21 inches) and the mean annual precipitation in the City of Sacramento (17.88 inches), estimates of the total precipitation at Rancho Murieta were made for the 11 years under study. The results of this analysis are as follows:

WATER YEAR	CITY OF SACRAMENTO	RANCHO MURIETA
1977	7.53"	8.85"
1924	8.89"	10.45"
AVG. DRY YEAR [1]	10.58"	12.43"

1. Average of 10 lowest years of record excluding 1977.

Monthly distribution of each dry year's estimated annual precipitation at Rancho Murieta was performed based on the actual distribution of monthly precipitation for the same years as recorded by the NWS in the City of Sacramento. Estimates of the direct rainfall and runoff quantities that would enter into each of the storage reservoirs were then performed. The results of this analysis are reflected in the water budgets presented in Chapter 5.

CHAPTER 4

WATER DEMANDS

A. FACTORS AFFECTING THE USE OF WATER

Many factors affect the demand of municipal and industrial water in urban areas. Past records and estimated future average water consumption rates indicate a wide range in values across the United States. Some of the factors which are responsible for the non-uniformity are discussed below.

CLIMATIC CONDITIONS

Lawn-sprinkling, gardening, bathing, and air-conditioning demands are usually greater in warm, dry regions than in humid areas. Regions subject to extreme cold often report significant demands to prevent freezing of water lines. Definite correlations between climatic factors such as temperature and rainfall have been reported. Data published by the American Water Works Association indicates that precipitation is the climatic factor having the greatest influence on per capita residential consumption.

ECONOMIC CONDITIONS

It has been demonstrated that water use is a function of the economic status or living standard of the consumer. High-priced residential dwelling units, for example, will normally show rates which are significantly greater than those for medium and low-priced units (Clark, Viessman & Hammer 1971).

COMPOSITION OF THE COMMUNITY OR REGION

The type and magnitude of residential, commercial, and industrial development in an area will have a pronounced effect on local water-use rates. Industrial requirements often are exceedingly large. The per capita requirements of a region endowed with large-scale industrial development might therefore be strikingly affected, providing industrial water is supplied by the municipality.

WATER PRESSURE

Rates of water use rise with increases in pressure. This result is due partly to distribution system leakage and partly to the increased volumes of flow through water fixtures per unit of time.

COST OF WATER

There is a tendency towards conservation when costs are high. While it has been reported that domestic demands are relatively inelastic with respect to price, studies also show that lawn sprinkling demands are somewhat elastic with respect to price (Clark, Viessman & Hammer 1971).

NON-CONSUMPTIVE LOSSES

Certain water losses, though not "consumptive" in nature, have the effect of reducing the available water supply of a community. Sources of these losses include reservoir seepage and evaporation, distribution system leakage, fire flows, etc. The growth and water-use patterns of communities should be reviewed periodically for trends if water supply systems are to keep abreast of continually increasing demands.

Distribution system leakage is not anticipated to be major since the District's system is relatively new. The District's system was constructed with modern methods and materials that are less subject to leakage.

Evidence in recent years indicates that the average per capita consumption, the peak daily consumption, and the peak hourly consumption are all on the increase. Each of these demands is of special interest to the designer. The first, average consumption, is used in estimating total water requirements and in designing water supply and storage facilities.

B. WATER USE AT RANCHO MURIETA

The County approved Rancho Murieta Master Plan authorizes at total of 5,189 residential dwelling units (DU) and of related commercial and industrial uses (estimated to be approximately 779 equivalent dwelling units (EDU)). The total development authorized by the County approved Master Plan therefore is estimated to be 5,968 EDU (including residential, commercial and industrial).

All residential water customers at Rancho Murieta are metered. In recent years the District has installed meters on nearly all commercial and industrial customers. The District had 1,200 residential and 56 commercial water customers as of January 1, 1990. Permanent records of all meter readings have been maintained since the District's operations began in 1983.

While the overall development rate of Rancho Murieta has been sluggish in the last few years, there is significant development activity currently. This higher level of development activity is projected to continue for the next several years.

Current development activities on the residential lands lying south of the Cosumnes River suggest that this 1,300 lot project could be completed within 2-3 years. Interest in developing the remaining residential lands north of the river has been increasing lately. Development of the commercial and industrial lands south of Jackson Road is projected to closely follow the dramatic population increases that will occur upon development of the residential lands north and south of the river.

Major landowners within the District submitted build-out projections to the District on January 10, 1990. These projections were evaluated and modified somewhat for this report. For the purposes of this report, the build-out projections shown in Table No. 7 have been assumed.

C. RESIDENTIAL USE RATES

The District's meter reading database was utilized to obtain accurate estimates of the residential water consumption patterns and trends within the District. Specifically, the

TABLE No.7

ASSUMED BUILDOUT PROJECTIONS
(EQUIVALENT DWELLING UNITS)

AREA	1990	1991	1992	1993	1994	1995	1996	TOTAL
A. RESIDENTIAL								
1. RANCHO MURIETA-SOUTH	350	525	375	50				1,300
2. RANCHO MURIETA-NORTH	50	225	300	375	375	300	300	1,925
SUB-TOTAL	400	750	675	425	375	300	300	3,225
B. COMMERCIAL & INDUSTRIAL								
1. OFFICE PARKS		10	15					25
2. HOTEL				100	100			200
3. COMMERCIAL BLDGS.				70		70	5	145
4. INDUSTRIAL BLDGS.					30	30		60
5. SCHOOLS			20			20	20	60
SUB-TOTAL	0	10	25	170	130	120	25	490
TOTAL	400	760	700	595	505	420	325	3,715

residential water use patterns of all residential customers were studied for the period of January 1, 1984 through December 31, 1988 - a period of five years. The study period included the wet year of 1986, the dry year of 1988 and a significant rate structure change that occurred in August of 1987.

The residential water use records of the database were accessed utilizing the dBase IV database management program. The residential customer data was then sorted by class of residential customer (cottage lot, estate lot, townhouse lot, circle lot and mobile home lot) and by recorded subdivision number. Annual average consumption rates for each residential customer for each of the study years were then calculated. These consumption rates were inspected and abnormally low and high annual average rates were eliminated from further consideration.

Since the water meters are set at the time water service is first requested, it is not uncommon for the customer to take several months to construct the house and install landscaping. Clearly, a lag in time exists between the time the meter is set and the time the customer occupies the home and initiates normal domestic consumption and landscape irrigation. This was reflected as very low usage in the

TABLE No.8

1984-88 RESIDENTIAL WATER CONSUMPTION ANALYSIS

CUSTOMER CLASS	1984 GPD/LOT	1984 LOT COUNT	1985 GPD/LOT	1985 LOT COUNT	1986 GPD/LOT	1986 LOT COUNT	1987 GPD/LOT	1987 LOT COUNT	1988 GPD/LOT	1988 LOT COUNT	5-YEAR WEIGHTED AVG., GPD/LOT
UNIT No.1											
COTTAGE (1)	517	103	491	107	499	118	479	136	504	141	497
ESTATE	859	69	841	74	859	80	844	89	823	94	896
TOWNHOUSE (1)	244	58	245	77	239	84	269	96	248	99	250
UNIT No.2											
ESTATE	770	43	791	49	753	56	800	71	717	84	763
CIRCLE	572	37	585	45	554	58	607	69	550	83	572
TOWNHOUSE	356	40	351	40	339	41	367	43	332	44	349
UNIT No.3 (2)											
ESTATE	530	21	536	29	601	40	628	56	686	77	622
CIRCLE	318	12	534	16	460	28	480	49	495	67	476
TOWNHOUSE	0	0	0	0	0	0	0	0	0	0	0
UNIT No.4											
ESTATE	0	0	0	0	551	3	689	13	762	24	722
CIRCLE	0	0	613	1	451	9	556	14	571	30	548
TOWNHOUSE	0	0	0	0	0	0	0	0	0	0	0
MURIETA VILLAGE											
MOBILE HOME	0	0	174	19	213	36	218	41	227	40	213

FOOTNOTES:

(1) SOME COTTAGE LOTS & ALL TOWNHOUSES ARE IRRIGATED BY RANCHO MURIETA ASSOCIATION IRRIGATION SYSTEM - NOT DOMESTIC
(2) INCLUDES UNIT No.3A & 3B

annual average consumption rates when in fact the customer was not utilizing water service in the normal sense of the word. Also, there are a few customers who use inordinately high amounts of water. Including these low and high end consumption rates into the annual averages tends to distort the normal average consumption rates of each customer class.

The remaining annual average consumption rates for each customer in each customer class were averaged for each year. Finally, 5-year weighted average rates were calculated for each class of customer. The results of this analysis are presented in Table No. 8.

Some cottage lots and all townhouse lots in Unit No. 1 are irrigated by the Rancho Murieta Association (RMA) irrigation system. The reported consumption rates for these customer classes don't include the irrigation demands reflected in the other customer classes.

The consumption rates for the three circle lot customer classes were further evaluated. The 5-year weighted average consumption rates for all three classes were consolidated into a single consumption rate for the 5-year period utilizing the method of weighted averages. The 5-year weighted average annual consumption rate for all circle lot classes was 538 gallons per day per lot.

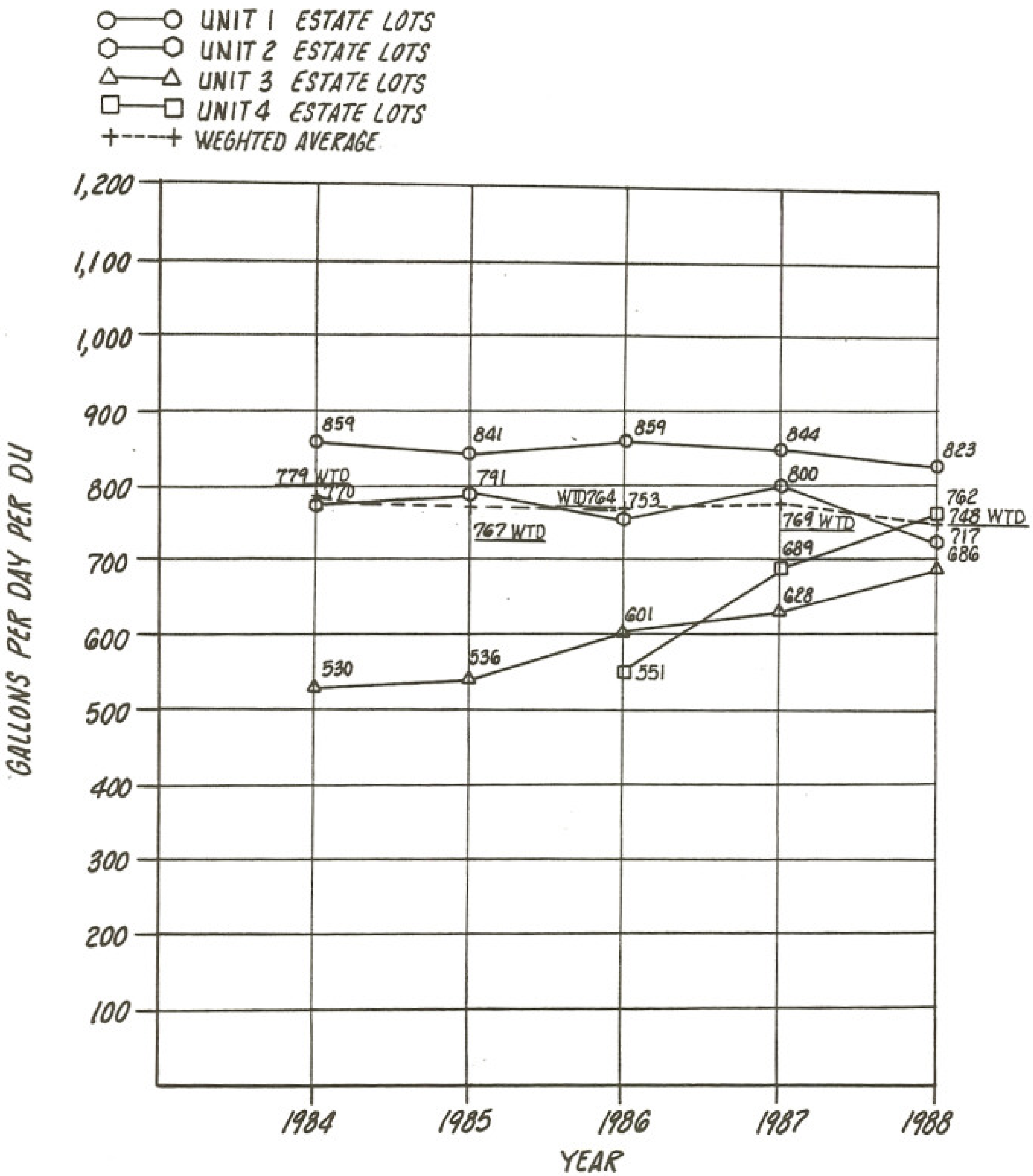
The four estate lot classes were also subjected to further analysis. Since the predominant land use lotting pattern of all future subdivisions within Rancho Murieta is projected to be estate lots, estate lots will make up the vast majority of the ultimate residential water demands within the District. Also, the consumption rates for Unit No. 1 estate lots appeared to be significantly greater than that of the other three estate lot classes. For these reasons, careful analysis of estate lot consumption rates was important.

The annual average consumption rate for all estate lot classes is shown in Figure No. 5. A weighted average annual rate of all four estate lot classes is also shown on Figure No. 5. The overall 5-year weighted average rate for all estate lots during the five year period is 765 gallons per day per lot.

The future estate lots north of the Cosumnes River are projected to be predominately large square footage estate lots (10,000-20,000 sf). These lots are anticipated to be similar in size and have consumption rates similar to the estate lots in Unit Nos. 1-4 which have an average lot size of approximately 14,000 s.f.

FIGURE No. 5

RESIDENTIAL WATER USE
ESTATE LOTS



The future estate lots south of the Cosumnes River are projected to be predominately smaller square footage estate lots (6,000-10,000 sf). These lots are anticipated to have lower consumption rates than estate lots north of the river.

While the actual consumption rate of the future smaller estate lots south of the Cosumnes River is not known exactly, projections of the usage rate were made by comparing lot size and usage for the estate lots in Unit No. 2. Unit No. 2 was chosen because the homes on these lots were constructed under building code imposed water conservation measures and because of the larger number of lots and longer usage records than any other estate lot customer class.

The results of this analysis indicate that estate lots of 12,000 s.f. and less had an average consumption of 641 gallons per day per lot. The average size of the smaller estate lots studied was approximately 10,000 square feet. Compared to the overall weighted average rate for estate lots (765 gpd/lot), the smaller estate lot usage (641 gpd/lot) appears logical.

These estate lot consumption rates were then compared to the results of a recent study of several Sacramento area water purveyors (Boyle, 1989). This comparison indicates that the existing estate lot consumption rates within Rancho Murieta are slightly higher than those observed by Sacramento area water purveyors. This is probably a reflection of higher housing values at Rancho Murieta than in most suburban Sacramento communities. As mentioned earlier, higher housing values typically have water consumption rates that are higher than those of medium and low-priced units.

Accordingly, the consumption rates determined from this analysis appear to be reasonable. The consumption rates determined from this analysis, and the corresponding design consumption rates to be used in this report, are summarized as follows:

RESIDENTIAL CUSTOMER CLASS	1984-88 USAGE, GPD/LOT	DESIGN RATE GPD/LOT
Cottage	497	500
Townhouse	349	350
Circle	538	550
Estate (North)	765	750
Estate (South)	641 (Est)	650
Mobile Home	213	200

D. COMMERCIAL & INDUSTRIAL USE RATES

In most cases, the District's meter reading database does not include sufficient records for all commercial and industrial customer classes due to the relatively short period of time that meters have been in place. Accordingly, previous estimates of water consumption rates (Raymond Vail & Associates 1987) were reviewed and adjusted as deemed appropriate. These estimated consumption rates were then used to predict the ultimate water demands for these customer classes.

E. GOLF COURSE IRRIGATION

The two existing golf courses at Rancho Murieta are currently irrigated with a combination of raw water and reclaimed wastewater. The North Course raw water comes from appropriative and riparian water rights that are independent of Application 23416. The South Course raw water comes from an independent appropriative water right and from reclaimed wastewater. During drought periods, both courses can obtain water from Clementia Reservoir.

Overtime, the wastewater flows from the community are anticipated to meet the annual irrigation needs of both golf courses. At that time, golf course dependency upon water from Clementia Reservoir during a drought would be eliminated. This phased process is not anticipated to provide any constraints on the ability of water from Clementia Reservoir to be delivered into the community to help meet municipal and industrial demands during a drought.

F. TOTAL MUNICIPAL AND INDUSTRIAL DEMANDS

The total estimated municipal and industrial (M & I) water demands for the ultimate development of the County approved Master Plan (5,968 EDU) are shown in Table No. 9. these total estimated M & I demands are reflected in the water budgets presented in Chapter 5.

G. SEASONALLY VARIABLE AND NON-VARIABLE USES

Municipal and industrial water demands can be classified as either seasonally variable or seasonally non-variable. Seasonally variable uses are those that vary in rate throughout the year in relationship to the changing seasons. Customers who have heavy irrigation requirements are classified as seasonally variable customers.

On the other hand, seasonally non-variable uses do not vary significantly with the season of the year. Customers who do not have heavy irrigation requirements are classified as seasonally non-variable.

Because of these basic differences, two types of customers are treated differently in the water budgets presented Chapter 5. Seasonally non-variable customers use

TABLE No.9

ESTIMATED TOTAL MUNICIPAL & INDUSTRIAL DEMANDS
(5,968 EDU)

A. SEASONALLY VARIABLE DEMANDS

TYPE OF USE	NUMBER OF LOTS	CONSUMPTION (GPD/DU)	TOTAL ANNUAL USE (GPD)	TOTAL ANNUAL USE (AC.FT.)
1. RESIDENTIAL				
ESTATE LOTS-NORTH (F):	2,125	750	1,593,750	
ESTATE LOTS-NORTH (E):	494	750	370,500	
ESTATE LOTS-SOUTH (F):	1,300	650	845,000	
COTTAGE LOTS (E):	197	500	98,500	
CIRCLE LOTS (E):	457	550	251,350	
TOWNHOUSE LOTS (E):	389	350	136,150	
MOBILE HOME LOTS (E):	189	200	37,800	
SUB-TOTAL:	5,151		3,333,050	3,733.7
2. COMMERCIAL/INDUSTRIAL				
HOTEL:		N/A	49,000 (1)	
AIRPORT:		N/A	10,000	
FIRE DEPT:		N/A	410	
RMPI FACILITY:		N/A	3,255	
R.M. VILLAGE (CLUBHOUSE):		N/A	1,225	
R.M. VILLAGE (IRRIGATION):		N/A	15,000	
R.M. LODGE:		N/A	15,000	
AUXILIARY GOLF COURSE:		N/A	3,175	
RMA FACILITIES:		N/A	2,000	
PLAZA IRRIGATION (EST.):		N/A	35,000	
SUB-TOTAL:			134,065	150.2
3. PARKS				
80 ACRES (EST.)		N/A	249,951 (2)	
SUB-TOTAL:			249,951	280.0
ESTIMATED TOTAL SEASONALLY VARIABLE DEMANDS:			3,717,066	4,163.9

647 gpd

721 gpd

B. SEASONALLY NON-VARIABLE DEMANDS:

TYPE OF USE	NUMBER OF LOTS	CONSUMPTION (GPD/DU)	TOTAL ANNUAL USE (GPD)	TOTAL ANNUAL USE (AC.FT.)
1. COMMERCIAL/INDUSTRIAL				
LIGHT INDUSTRY:		N/A	22,000 (3)	
RETAIL SHOPPING:		N/A	74,096 (4)	
OFFICES:		N/A	32,930 (5)	
CLUBHOUSE FACILITIES (E) (INCLUDES 38 LODGE UNITS):	38	N/A	25,200	
SUB-TOTAL:	38		154,226	172.8
2. SCHOOLS				
SCHOOLS W/O SHOWERS (EST.):		N/A	37,500 (6)	
SCHOOLS W/ SHOWERS (EST.):		N/A	24,057 (6)	
SUB-TOTAL:			61,557	51.7
ESTIMATED TOTAL SEASONALLY NON-VARIABLE DEMANDS:			215,783	224.5
ESTIMATED SUB-TOTAL MUNICIPAL & INDUSTRIAL DEMANDS:			3,932,849	4,388.7
+ 10% SYSTEM LOSS			393,285	438.9
ESTIMATED TOTAL MUNICIPAL & INDUSTRIAL DEMANDS	5189		4,326,134	4,827.6

834 gpd.
÷ by 750 gpd ⇒ 5768 EDU

FOOTNOTES:

(1) HOTEL BASED ON 200 ROOMS @ 350 GPD/ROOM AND 70% OCCUPANCY FACTOR
(2) PARK IRRIGATION ASSUMED TO BE 3.5 FEET PER YEAR
(3) INDUSTRIAL BASED ON 1,100 EMPLOYEES @ 20 GPD/EMPLOYEE
(4) SHOPPING BASED ON 30% FLOOR AREA RATIO YIELDING 411,642 S.F. @ 0.18 GPD/S.F.
(5) OFFICE BASED ON 30% FLOOR AREA RATIO YIELDING 411,642 S.F. @ 0.08 GPD/S.F.
(6) SCHOOLS ARE ASSUMED TO BE IN SESSION 9 MONTHS PER YEAR WITH:
  A. SCHOOLS W/O SHOWERS ASSUMED TO BE 1200 STUDENTS @ 15 GPD/STUDENT
  B. SCHOOLS W/ SHOWERS ASSUMED TO BE 2000 STUDENTS @ 20 GPD/STUDENT
(7) ALL DEMANDS ARE BASED ON METER READING DATABASE EXCEPT AS NOTED OTHERWISE
(8) DEVELOPMENT MIX OF COMMERCIAL LANDS ASSUMED TO BE 50% RETAIL AND 50% OFFICE
(9) (E) = EXISTING
(10) (F) = FUTURE

rates are handled as a constant demand each month throughout the year. Seasonally variable customer use rates are adjusted each month to correspond to the changing irrigation requirements throughout the year.

The District's water treatment plant records were reviewed for the period of 1984-1987 to determine the monthly fluctuation in seasonally variable demands. The results of this review are shown below:

MONTH	PERCENT OF ANNUAL PRODUCTION
JANUARY	4.0%
FEBRUARY	3.7%
MARCH	4.9%
APRIL	7.4%
MAY	10.5%
JUNE	12.2%
JULY	13.6%
AUGUST	13.2%
SEPTEMBER	10.6%
OCTOBER	9.2%
NOVEMBER	5.8%
DECEMBER	4.8%
	100.0%

H. NON CONSUMPTIVE USES

Two non-consumptive water uses have been estimated for Rancho Murieta. They are evaporation and seepage from the reservoirs.

EVAPORATION

Uncovered reservoirs are subject to evaporation losses all year long. The rate of evaporation varies directly with the ambient temperature. The higher the ambient temperature, the higher the rate of evaporation, and vice versa.

The California Department of Water Resources (DWR) reports that the closest and most reliable evaporation station in the proximity of Rancho Murieta is at Davis, California. The DWR monitors and reports evaporation of water from an evaporation pan at this station.

The DWR advises that this data can be reliably used to predict lake evaporation at Rancho Murieta if the pan evaporation data is reduced by 20-30% to account for the differences between pan and lake evaporation conditions.

Estimates of evaporation losses from each of the District's storage reservoirs were made for each month of the year by reducing the DWR pan evaporation data by 25%. The results of this analysis are reflected in the water budgets presented in Chapter 5. The monthly pan and lake evaporation rates are as follows:

MONTH	DWR "DAVIS" PAN EVAPORATION RATE	STORAGE RESERVOIR EVAPORATION RATE (75%)
JANUARY	1.3 INCHES	1.0 INCHES
FEBRUARY	2.6 INCHES	2.0 INCHES
MARCH	4.7 INCHES	3.5 INCHES
APRIL	6.5 INCHES	4.9 INCHES
MAY	8.4 INCHES	6.3 INCHES
JUNE	10.2 INCHES	7.6 INCHES
JULY	10.5 INCHES	7.9 INCHES
AUGUST	9.2 INCHES	6.9 INCHES
SEPTEMBER	7.1 INCHES	5.3 INCHES
OCTOBER	5.4 INCHES	4.0 INCHES
NOVEMBER	2.6 INCHES	2.0 INCHES
DECEMBER	1.4 INCHES	1.0 INCHES
TOTAL	69.9 INCHES	52.4 INCHES

SEEPAGE

Earthen lined reservoirs are subject to seepage losses all year long. The rate of seepage is directly related to the permeability of the soils in the floor of the reservoir. Seepage occurs at a more or less constant rate throughout the year.

While specific permeability rates for the soils under each of the District's storage reservoirs is unavailable, previous studies have estimated the seepage rate to be two and one-half feet per year (Raymond Vail & Associates, 1987). The seepage rate is equivalent to approximately 0.000002 cm/sec. This estimated rate appears to be reasonable.

Estimates of seepage losses from each of the District's storage reservoirs were made for each month of the year by utilizing the estimated annual rate of 2-1/2 feet per year. This rate of seepage is deemed acceptable in light of the extremely high cost to drain and line the floors of all storage reservoirs. The results of this analysis are reflected in the water budgets presented in Chapter 5.

I. CONSERVATION RATES

Annual average water use rates cannot be used to predict total water consumption during periods of drought. During droughts, use rates tend to decrease temporarily in response to an overall water shortage. After a drought, water usage rates will return to pre-drought levels.

The beneficial results of conservation need to be accounted for in the water budgets for drought events. Table No. 10 & Figure No. 6 depict the assumed changes in monthly water consumption that are projected to occur during periods of normal, 25% conservation and 50% conservation usage rates. Actual monthly conservation rates will vary according to weather conditions. While the actual monthly conservation rates may differ from the assumed monthly rates, no significant change in the overall annual conservation rate is

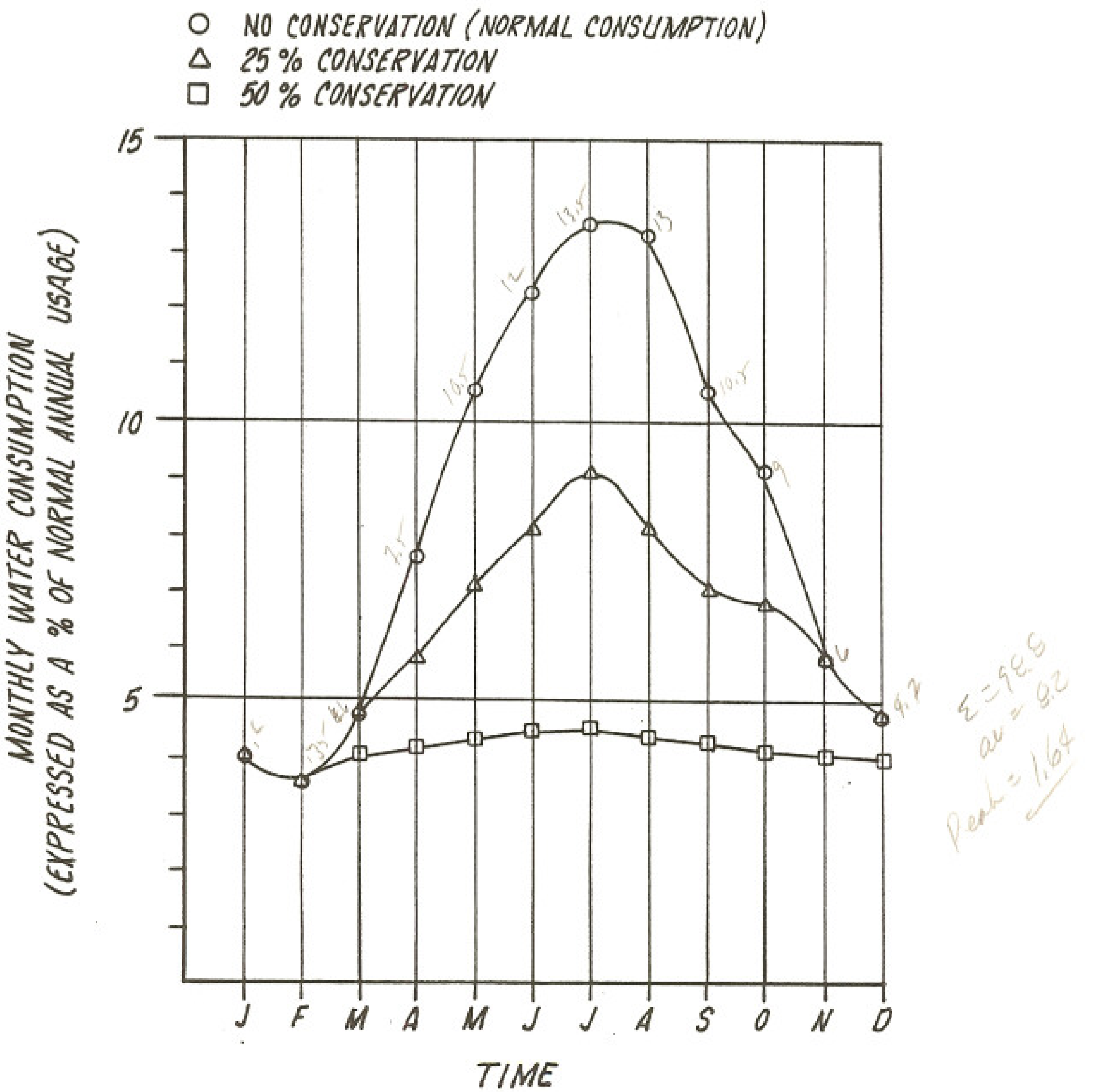
TABLE No.10

MONTHLY WATER CONSUMPTION
UNDER VARYING LEVELS OF CONSERVATION
(EXPRESSED AS A PERCENTAGE OF NORMAL ANNUAL USAGE)

	LEVEL OF CONSERVATION				
MONTH	0%	25%	MONTHLY REDUCTION %	50%	MONTHLY REDUCTION %
JANUARY	4.0 %	4.0 %	0.0 %	4.0 %	0.0 %
FEBRUARY	3.7	3.7	0.0	3.7	0.0
MARCH	4.9	4.9	0.0	4.0	18.4
APRIL	7.4	5.7	23.0	4.1	44.6
MAY	10.5	7.0	33.3	4.3	59.0
JUNE	12.2	8.1	33.6	4.4	63.9
JULY	13.6	9.0	33.8	4.5	66.9
AUGUST	13.3	8.1	39.1	4.4	66.9
SEPTEMBER	10.6	7.1	33.0	4.3	59.4
OCTOBER	9.2	6.8	26.1	4.2	54.3
NOVEMBER	5.8	5.8	0.0	4.1	29.3
DECEMBER	4.8	4.8	0.0	4.0	16.7
TOTAL	100.0 %	75.0 %	25.0 %	50.0 %	50.0 %

FIGURE No. 6

MONTHLY WATER CONSUMPTION UNDER VARYING LEVELS OF CONSERVATION



anticipated. These monthly consumption rates will be included in the water budgets presented in Chapter 5.

CHAPTER 5

SYSTEM CAPACITY

A. THE WATER BUDGET

In theory, accounting for the water resources of a community is relatively simple. The basic procedure involves the separate evaluation of each factor in the water budget so that a quantitative comparison of the available water resources with the known or anticipated water requirements of the area can be made. In practice, however, the evaluation of the water budget is often quite complex, and extensive and time-consuming investigations are generally required.

Both natural and artificial gains and losses in the water supply must be considered. The primary natural gains to surface bodies are those which result from direct rainfall and runoff caused by precipitation. Evaporation and seepage are the major natural losses. Diversions out of the water supply will decrease the quantity of water available.

After the gross dependable water supply has been estimated, the net dependable supply may be determined at any point of interest by subtracting the quantity used, detained, or lost as a result of man's activities, from the gross supply.

A water supply may be considered adequate for present needs but inadequate to provide for future requirements. In many cases it is therefore necessary to predict future needs based on estimated changes in population, industrial development, agricultural practices, and on changes in water policy and technology which will affect the supply and use of water.

Water budgets were prepared for the District's water supply system for the 25-year, 100-year and 200-year droughts. These water budgets utilize the water supply data presented in Chapter 3 and the water demand data presented in Chapter 4. The water budgets prepared for this report also respect all provisions of the District's water right (Application 23416). Water budgets for the following combinations of drought events, conservation rates and development levels are presented in this Chapter:

DROUGHT EVENT	LEVEL OF CONSERVATION	LEVEL OF DEVELOPMENT
25-YEAR	NONE	FULL
200-YEAR	NONE	FULL
200-YEAR	25%	FULL
200-YEAR	50%	FULL

DROUGHT EVENT	LEVEL OF CONSERVATION	LEVEL OF DEVELOPMENT
200-YEAR	NONE	PARTIAL
200-YEAR	25%	PARTIAL
200-YEAR	50%	PARTIAL
100-YEAR	25%	FULL
100-YEAR	25%	PARTIAL

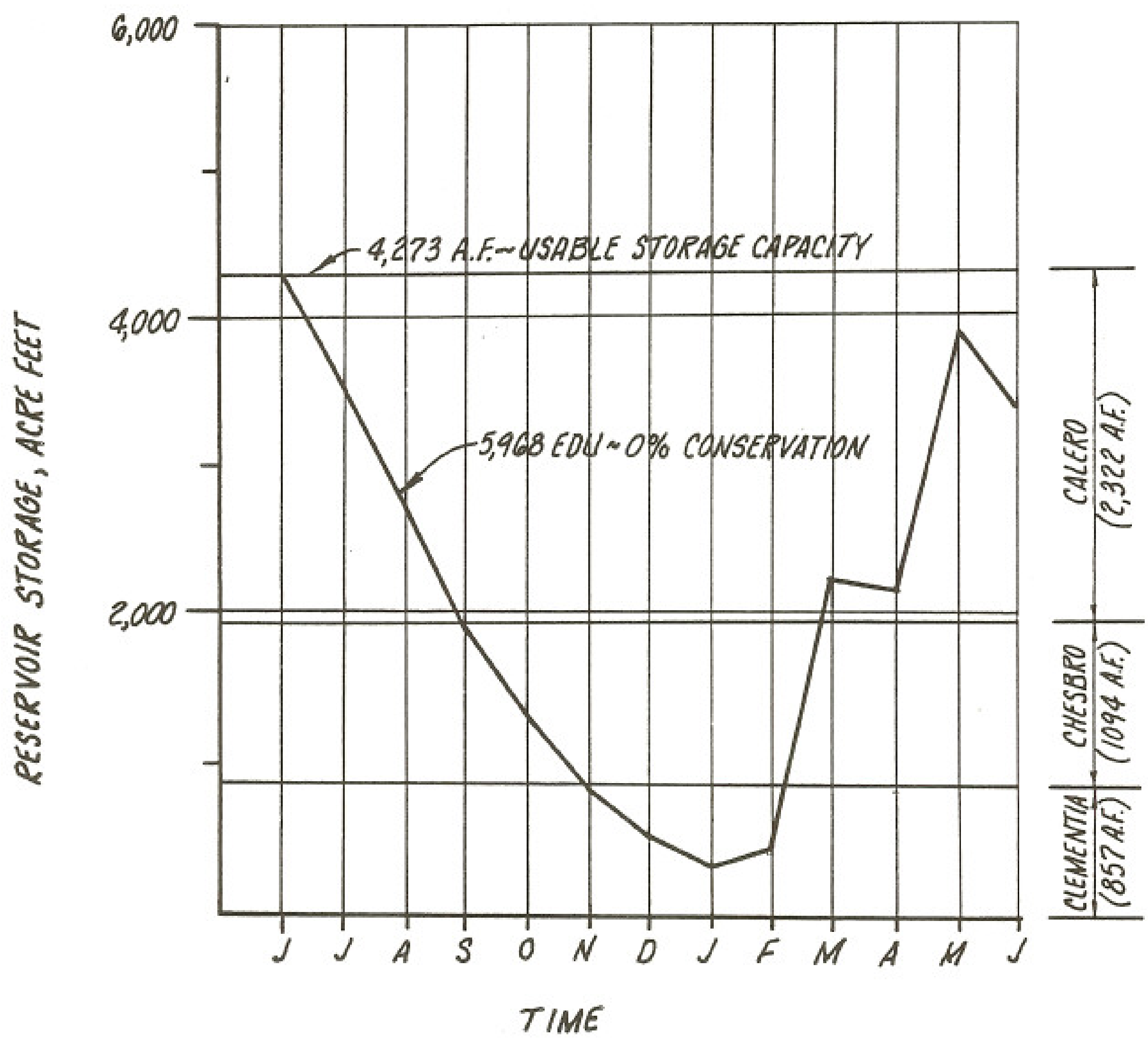
B. 25-YEAR DROUGHT & FULL DEVELOPMENT

The water supply resulting from the 25-year drought (1924 Water Year) and the total estimated municipal and industrial (M & I) water demands for the ultimate development of the community (5,968 EDU) were analyzed assuming normal consumption rates (no conservation). The results of this analysis, presented in Appendix E, indicates that the District's existing water supply will safely satisfy the total estimated M & I water demands of the ultimate development of Rancho Murieta during a 25 year drought.

In fact, the water budget indicates that the minimum amount of usable water remaining in the District's reservoirs during this event will be approximately 347 AF. Reservoir storage levels will fluctuate greatly during this event as shown in Figure No. 7. While Calero & Chesbro Reservoirs will be depleted during such an event, the storage volume Clementia Reservoir would be nearly 40% full.

FIGURE No. 7

RESERVOIR STORAGE LEVEL DURING 25-YEAR DROUGHT



It is recommended that Clementia Reservoir not be depended upon during normal conditions, including a 25-year drought. Due to water quality problems in Clementia Reservoir and the need to reserve some storage, Clementia Reservoir should be depended upon to meet M & I demands only in a severe drought. In order to satisfy this recommendation, an additional 510 AF of water would be required. This technical deficiency could be eliminated with a minor amount of conservation during a 25-year drought. Therefore, this technical deficiency can be considered not to be an actual deficiency.

C. 200-YEAR DROUGHT & FULL DEVELOPMENT

The water supply resulting from the 200-year drought (1977) and the total estimated M & I water demands for the ultimate development of the community (5,968 EDU) were analyzed assuming normal (no conservation), 25% conservation and 50% conservation reduced consumption rates followed by an average dry year. The results of these analyses, presented in Appendix F, indicate that the District's existing water supply will not satisfy the total estimated M & I water demands of the ultimate development during a 200-year drought even though conservation rates up to 50% were achieved. Reservoir storage levels will fluctuate greatly during this event as shown on Figure No. 8.

All reservoirs would be depleted early during such events. The M & I demand for the remaining duration of the drought would not be met. The cumulative shortfall in the water budgets represent net deficit volumes. That is, reservoir evaporation and seepage losses associated with these unmet demands are not included in the deficit volumes shown in the water budgets.

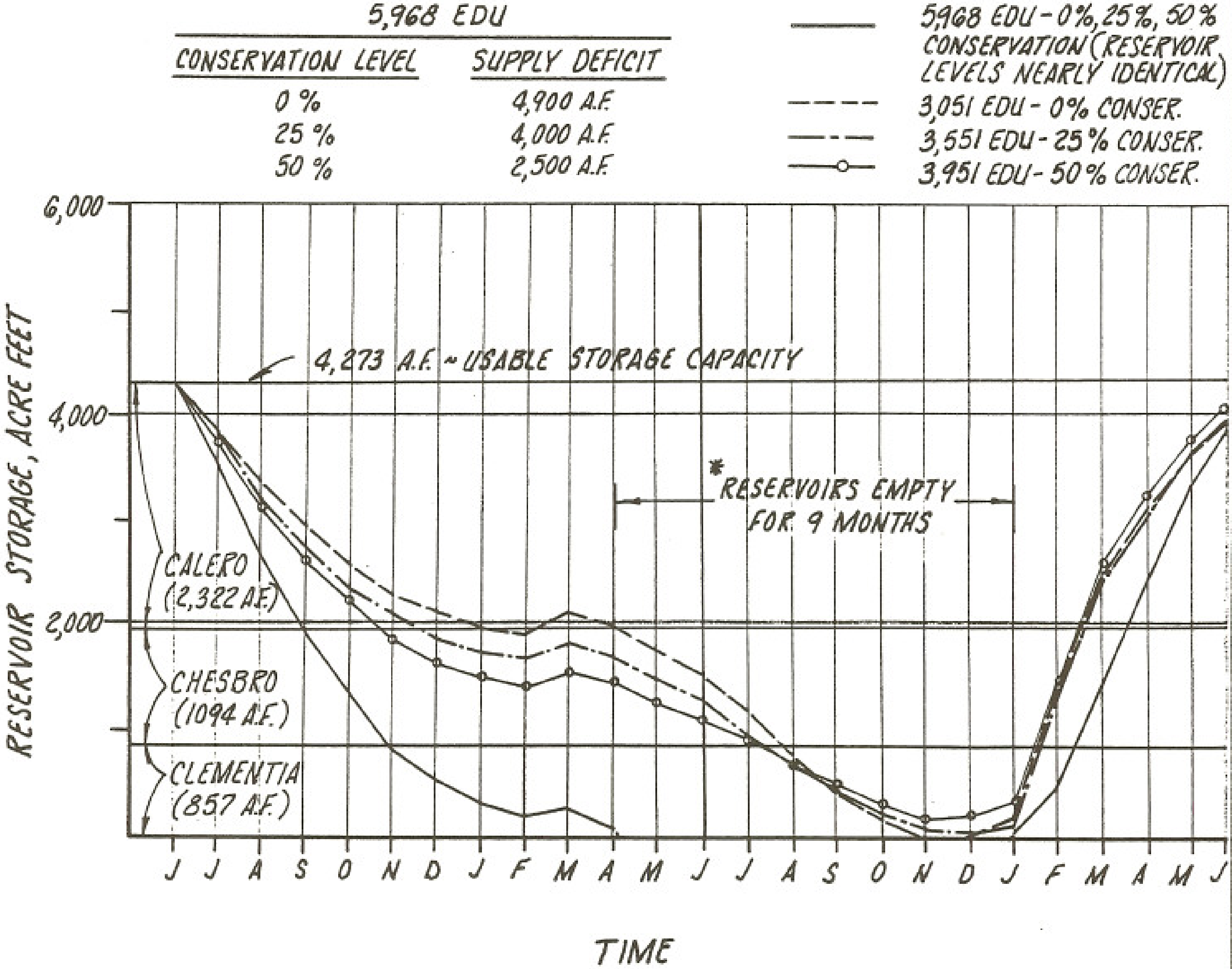
Annual reservoir losses were estimated at 25% for the District's reservoir's. Accordingly, projected gross supply deficits are estimated to be 33% larger than the projected net deficits reflected in the water budgets for these events.

The specific results of each of these analyses are shown below:

LEVEL OF CONSUMPTION	PROJECTED SUPPLY DEFICIT (NET)	PROJECTED SUPPLY DEFICIT (GROSS)
Normal (No Conserv.)	3,650 AF	4,900 AF
25% Conservation	2,980 AF	4,000 AF
50% Conservation	1,870 AF	2,500 AF

FIGURE No. 8

RESERVOIR STORAGE LEVEL
DURING 200-YEAR DROUGHT



D. 200-YEAR DROUGHT & PARTIAL DEVELOPMENT

If the total development of the community (5,968 EDU) could not be served during a 200-year drought, what level of development could be safely supported during such an event? The answer to this question requires that the limited water supply resulting from a 200-year drought be carefully balanced with the total estimated M & I water demands for a given level of development and an assumed level of conservation.

This analysis requires assumptions regarding the mix of residential and commercial uses within the community at various levels of development. Also, the amount of commercial and industrial uses, park and open space landscaping, etc., that would be needed to support a residential community of a given size need to be estimated. Once these mixes have been assumed, water demands can be estimated. Then the supply and demand of water can be balanced such that water supply deficits will be avoided by limiting the total build out of the community to the capacity of the system under the various design constraints.

The water supply resulting from a 200-year drought (1977) and the total estimated M & I water demands for various levels of development of the community followed by an average dry year were then analyzed. Utilizing an iteration process, a level of development was determined that evenly balanced the supply and demand for each of the levels of consumption (i.e., 0%, 25% & 50% Conservation). Reservoir storage levels will fluctuate greatly during this event as is also shown on Figure No. 8.

The results of these analyses, presented in Appendix G, are summarized below:

	LEVEL OF DEVELOPMENT		
LEVEL OF CONSUMPTION	RES.	COMMER./INDUS.	TOTAL M&I
Normal (No Conservation)	2600 DU	451 EDU	3,051 EDU
25% Conservation	3100 DU	451 EDU	3,551 EDU
50% Conservation	3500 DU	451 EDU	3,951 EDU

The levels of development shown above can be safely served by the District's existing water supply system during a 200-year drought. All reservoirs would be nearly depleted during the end of such events but all demands would have been met and no supply deficits would result.

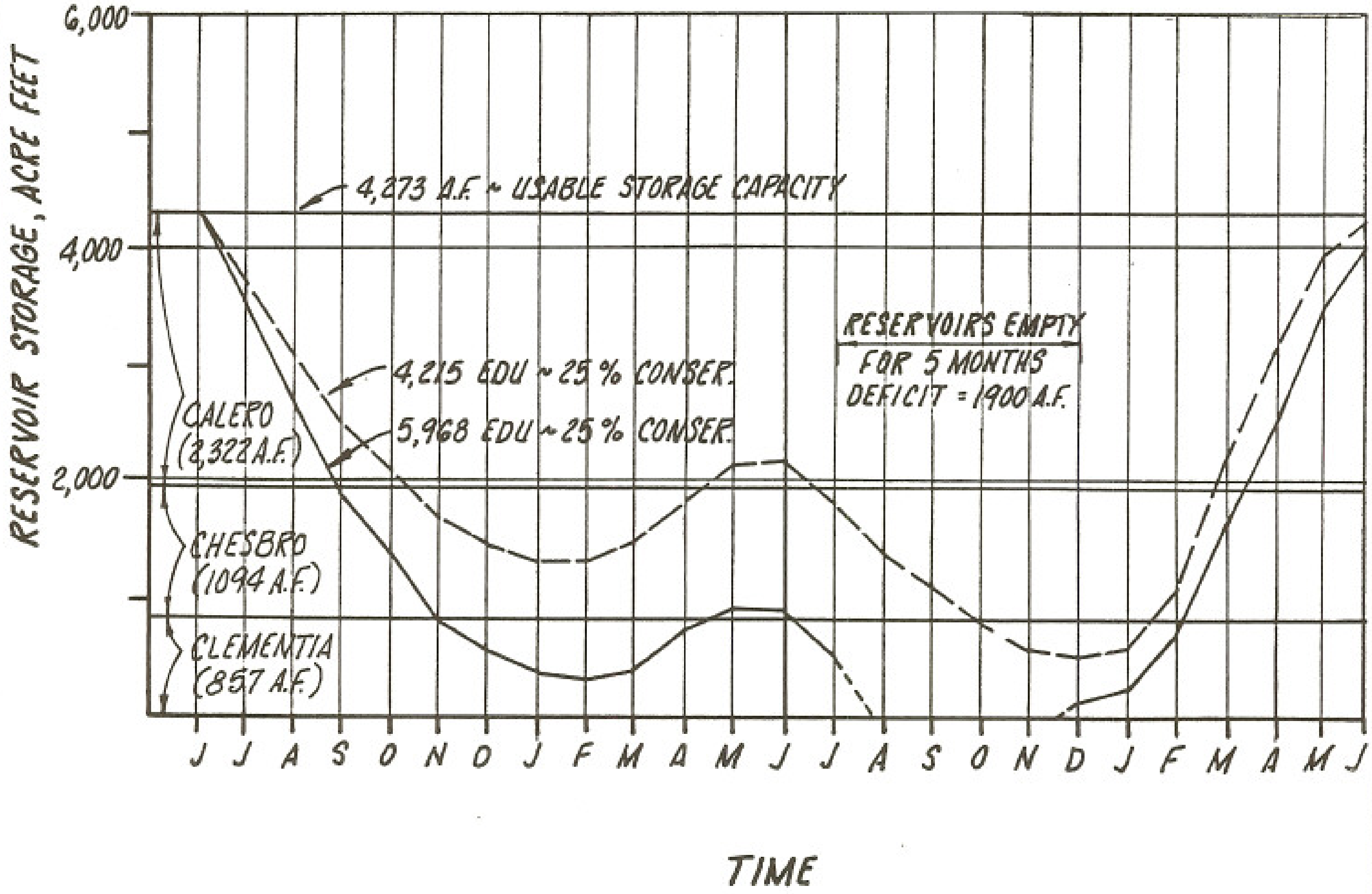
E. 100-YEAR DROUGHT & FULL DEVELOPMENT

Previous sections of this chapter contain analyses of the service capacity of the District's water supply system during two design droughts (25-year and 200-year droughts) assuming full development and levels of demand reduction resulting from conservation efforts during these drought events. The results of these analyses, in conjunction with the estimated levels of river diversions that are projected during a 100-year drought presented in Chapter 3, can be used to estimate water supply deficits that may occur at full development of the District during a 100-year drought.

The water supply resulting from the 100-year drought and the total estimated M & I water demands for the ultimate development of the community (5,968 EDU) were analyzed assuming 25% conservation reduced consumption rates followed by an average dry year. The results of these analysis, presented in Appendix "H", indicate that the District's existing water supply will not satisfy the total estimated M & I water demands of the ultimate development during a 100-year drought even though conservation rates of 25% were achieved. Reservoir storage levels will fluctuate greatly during this event as shown on Figure No. 9.

FIGURE No. 9

RESERVOIR STORAGE LEVEL DURING 100-YEAR DROUGHT



All reservoirs would be depleted early during such an event. The M & I demand for the remaining duration of the drought would not be met. The cumulative shortfall in the water budget represents net deficit volumes. That is, reservoir evaporation and seepage losses associated with these unmet demands are not included.

The results of this analysis indicate that the District's total water supply deficit for a fully developed community during a 100-year drought with 25% conservation is approximately 1,900 AF. It is interesting to note that this deficit is of the same magnitude as the projected total water supply the 200-year drought with 50% conservation (2,500 AF).

This indicates that augmentation of the District's existing water supply by approximately 2,500 AF will provide adequate reserves for both the 100-year, and 200-year droughts. This amount of additional water supply would provide the District with a great deal of flexibility in responding to droughts of varying severity with corresponding changes in conservation rates.

F. 100-YEAR DROUGHT PARTIAL DEVELOPMENT

The estimated water supply resulting from the 100-year drought, 25% conservation rates and the total estimated M & I water demands for various levels of development of the community followed by an average dry year were analyzed. Utilizing the iteration process described earlier, a level of development was determined that evenly balanced the supply and demand equation.

The results of this analysis, presented in Appendix "I", indicates that approximately 4,251 EDU (3,800 residential DU and 451 EDU of related commercial and industrial uses) could be safely served by the District's existing water supply system. All reservoirs would be nearly depleted during the end of this event but all demands would be met and no supply deficit would result. Reservoir storage levels will fluctuate greatly during this event as is also shown in Figure No. 9.

G. SUMMARY OF FINDINGS

The results of the various water budgets presented above are summarized as follows:

DROUGHT EVENT	DEVELOPMENT LEVEL, EDU	LEVEL OF CONSERVATION	PROJECTED SUPPLY DEFICIT (GROSS)
25-YEAR	5,968	NONE	NONE
200-YEAR	5,968	NONE	4,900 AF
200-YEAR	5,968	25%	4,000 AF
200-YEAR	5,968	50%	2,500 AF
200-YEAR	3,051	NONE	NONE
200-YEAR	3,551	25%	NONE
200-YEAR	3,951	50%	NONE
100-YEAR	5,968	25%	1,900 AF
100-YEAR	4,215	25%	NONE

It is interesting to note that the supply deficit that is projected to result from the 200-year drought with 50% conservation (2,500 AF) is of the same magnitude as the supply deficit that is projected to result from the 100-year drought with 25% conservation (1,900 AF). Of these two design events, the 200-year event creates the largest projected supply deficit (2,500 AF) and the smallest level of development (3,951) EDU) given the capacity of the District's existing water supply system.

H. WATER RIGHTS MODIFICATIONS

During the preparation of this report it was observed that the maximum diversion entitlement of Application 23416 (6,368 AF) will not be fully utilized due to limitations of the existing storage capacity of the reservoirs and the maximum storage limitation of Application 23416 (3,900 AF). If the District had additional storage capacity, then approximately 1,000 AF of additional water could be diverted to storage during an average dry year. Amendment of Application 23416 to increase the maximum storage limitation is warranted only if the District's reservoir capacity is increased to hold the additional diversions.

Any other possible change to the water right does not appear to be warranted at this time. Any other possible changes have either nominal potential or tend to lower the existing level of protection of fisheries and downstream agricultural interests.

I. WATER SUPPLY RELIABILITY STANDARD

Designing water supplies to meet M & I demands during a drought is as much an art as it is a science. The designer is required to apply technical knowledge and professional judgment in the designing of water supply systems to survive a drought induced water shortage.

In the absence of specific design standards, the designers must evaluate the adequacy of similar water supply systems to determine levels of protection utilized by other designer on comparable systems. The results of this comparison provide the designer with generally accepted engineering practices that can be utilized in a similar situation.

Ideally, an urban water supply system should meet the anticipated water demands to minimize inconveniences and the economic losses that could result from a water shortage. These two objectives are not mutually achievable without extremely high cost for facility capacity that is rarely used. The need is obvious - to strike a realistic balance between elimination of inconvenience and protection against economic losses. The goal is to establish a water supply reliability standard that balances the need for an adequate level of protection and elimination of inconvenience with reasonable total costs. This dilemma has been addressed many times before by other communities.

One design standard that needs to be considered relates to the severity of the drought event itself. Evaluation of the data presented in Chapter 3 indicates that several other surface water dependent water purveyors have adopted a design standard that states that normal demands should be met in 95% of all years (a 20-year drought), and demands should be met during the remaining 5% of all years with some level of conservation efforts.

The District Board has expressed a desire to have the District's water supply system designed with the ability to survive another 1977 drought. The water budgets presented earlier indicate that, if the water supply was expanded by 2,500 AF, then the District could survive a 1977 type drought (200-year drought) with a conservation rate of 50%. Although significant customer hardship would result, all customers would have sufficient water to survive the drought.

Another design standard that needs to be considered relates to the level of conservation to be utilized during a drought. Evaluation of data presented in Chapter 3 indicates that many reliable urban water supply systems are typically designed to survive minor and moderate droughts without utilizing conservation efforts. These water systems are typically designed to supply M & I demands during major droughts by achieving 25% conservation levels.

The water supply reliability standard envisioned for Rancho Murieta's water supply system is as follows:

1. Provide normal annual water demands during a 25-year drought.
2. Provide annual water demands with a maximum conservation rate of 25% during a 100-year drought.
3. Provide annual water demands with a maximum conservation rate of 50% during a 200-year drought.

CHAPTER 6

SUPPLY AUGMENTATION

A. SUPPLY AUGMENTATION

The development of additional water supplies to supplement existing water supplies is commonly referred to as supply augmentation. There are many supply augmentation methods that could be used to eliminate the 2,500 acre-foot supply deficit that is projected to occur during a 200-year drought utilizing 50% conservation efforts.

Augmentation of the District's water supply needs to be completed within a relatively short period of time in order to meet the community's projected growth. At projected growth rates, the District's water supply could be exceeded in as short a period as 3-4 years.

All supply augmentation methods fall into five general categories:

1. Methods to increase existing supplies
2. Drawing from reserve supplies
3. Methods to increase supply efficiency
4. Modifications to operations
5. Cooperative efforts with other agencies

Examples of supply augmentation techniques in these five general categories are shown in Table No. 11.

A review of Table No. 11 reveals that the District is currently utilizing several of these techniques. Many other of the examples listed are not consistent with the District's water supply system or they may yield only nominal benefits.

An assessment of the District's particular situation indicates that there are two primary methods of significantly augmenting the District's water supply. The two methods are as follows:

1. Surface water diversion
2. Ground water extraction

B. SURFACE WATER DIVERSION

Additional surface water diversions and storage facilities could be developed to offset the projected 2,500 acre foot supply deficit. The difficulty with this alternative is an increased dependency on surface water - a relatively unreliable water source. Significant reserve capacity would have to be developed in order to be assured that the storage facilities would yield an adequate volume of

TABLE No.11

SUPPLY AUGMENTATION METHODS

SUPPLY AUGMENTATION CATEGORY	EXAMPLES
METHODS TO INCREASE EXISTING SUPPLIES	1. INCREASE USE OF RECLAIMED WATER 2. INCREASE USE OF NONPOTABLE WATER FOR NONPOTABLE USES 3. BUILD EMERGENCY DAMS 4. REACTIVATE ABANDONED DAMS
DRAWING FROM RESERVE SUPPLIES	1. USE RESERVOIR DEAD STORAGE 2. ADD WELLS 3. DEEPEN WELLS 4. REACTIVATE ABANDONED WELLS 5. REHABILITATE OPERATING WELLS 6. RENEGOTIATE CONTRACTUALLY CONTROLLED SUPPLIES
METHODS TO INCREASE EFFICIENCY	1. SUPPRESS RESERVOIR EVAPORATION 2. REDUCE DAM LEAKAGE 3. MINIMIZE RESERVOIR SPILLS 4. REDUCE DISTRIBUTION SYSTEM PRESSURE 5. CONDUCT DISTRIBUTION SYSTEM WATER AUDIT 6. CONDUCT DISTRIBUTION SYSTEM LEAK DETECTION & REPAIR 7. SURGE & CLEAN WELLS
MODIFICATIONS TO OPERATIONS	1. RECIRCULATE WASH WATER 2. BLEND PRIMARY WATER SUPPLY WITH WATER OF LESSER QUALITY 3. TRANSFER SURPLUS WATER TO AREAS OF DEFICIT 4. CHANGE PATTERN OF WATER STORAGE AND RELEASE OPERATIONS
COOPERATE EFFORTS WITH OTHER AGENCIES	1. EXCHANGES 2. TRANSFERS OR INTERCONNECTIONS 3. MUTUAL AID AGREEMENTS

water to meet projected demands during a drought.

The following is a list of several surface water options that the District may want to consider and an assessment of their potential given the 3-4 year planning horizon:

1. **INCREASE DIVERSION FACILITY EFFICIENCY:** Install variable speed pump in existing diversion pump station - nominal potential due to small additional yield that would be realized.

2. **INCREASE ON-SITE STORAGE:** Modify Application 23416 to increase the maximum storage entitlement and construct an additional on-site storage reservoir at a near by site - good potential.

3. **RIPARIAN WATER RIGHTS:** Maximize the use of riparian water rights held by lands within the District - nominal potential due to lack of riparian flows during droughts.

4. **COSUMNES RIVER STORAGE:** Develop one of the off-stream storage reservoirs that was proposed as a part of the Cosumnes River Project - nominal

potential due to legal and environmental issues and long lead time.

5. **COUNTY LINE RESERVOIR:** Develop the County Line Reservoir component of the U.S. Bureau of Reclamations Central Valley Project on Dry Creek and obtain water entitlements from Folsom Dam - nominal potential due to legal and environmental issues and long lead time.

6. **FOLSOM SOUTH CANAL:** Obtain entitlement to divert water from Folsom South Canal and construct transmission facilities - nominal potential due to legal issues relating to lower American River flows and long lead time.

7. **AUBURN DAM:** Obtain water entitlements from and participate in the financing and development of a multi-purpose Auburn Dam. Water could then be transferred to Folsom South Canal via Folsom Dam for eventual transmission to Rancho Murieta - nominal potential due to legal and environmental issues and long lead time.

It appears that the only viable surface water option is to increase on-site storage and modify the existing direct diversion and maximum storage entitlements. All other options are not viable or will require long time frames before they could provide service.

C. GROUND WATER EXTRACTION

Over one-half of the water purveyors surveyed by the California DWR in 1988 indicated that they had, or were intending to, increase ground water pumping or development in order to augment their water supplies to cope with another drought. This finding was consistent with the actions of water purveyors during the 1976-77 drought when many of them turned to groundwater sources during a shortage of surface water supplies.

Many water purveyors have dual ground and surface water supplies. The DWR predicts that California water purveyors will look to ground water to play a larger role in combating droughts in the future when surface water sources are significantly reduced.

A conjunctive (combined surface and groundwater) use operation provides the water purveyor with great flexibility in coping with drought conditions. During periods of diminished surface water supply, a water purveyor with a conjunctive use operation can draw groundwater at safe yield rates to meet projected demands. When surface water supplies are ample, the water purveyor can rely on surface water while allowing the groundwater basin to recharge itself.

Groundwater extraction is not without potential problems. These potential problems include:

1. Ground Water Overdraft
2. Increasing Pumping Costs
3. Subsidence
4. Water Quality Decline
5. Aquifer Depletion

Proper management of groundwater supplies can minimize or eliminate the probability that these potential problems will occur.

The following is a list of several groundwater options that the District may want to consider and an assessment of their potential given the 3-4 year planning horizon:

1. **ON-SITE WELL SYSTEM:** Development of one or more wells in the southwest portion of the District and develop transmission facilities to deliver the water to Chesbro Reservoir - limited potential

according to previous groundwater studies funded by the District.

2. **OFF-SITE WELL SYSTEM (SLOUGHHOUSE):** Development of a well in the alluvial deposits between the Cosumnes River and Deer Creek southwesterly of Sloughhouse and develop transmission facilities to deliver the water to Chesbro Reservoir - good to excellent potential.

3. **OFF-SITE WELL SYSTEM (SUNRISE BLVD. AND DOUGLAS BLVD.):** Development of a well in buried stream channels in the vicinity of Sunrise Blvd. and Douglas Blvd. and develop transmission facilities to deliver the water to Chesbro Reservoir - fair to good potential but there is a potential threat of groundwater contamination from the nearby Aerojet & McDonnell-Douglas sites.

It appears that the most viable groundwater option is the development of a well in the alluvial deposits between the Cosumnes River and Deer Creek southwest of Sloughhouse. The on-site well option warrants further testing prior to being eliminated from further consideration. If a ground water source in this location was proven, significant cost savings could be realized over the Sloughhouse option because of shorter transmission distances. Due to the extremely high capital costs of the Sunrise/Douglas option, resulting from the very long transmission distances, this option should be considered only after the other two groundwater options are proven not to be viable.

As mentioned earlier, the level of the District's storage reservoirs will begin to fluctuate greatly each year as the community is developed. If a groundwater source is developed to augment the District's water supply system, public pressure to keep the lakes filled may result. Use of the goundwater source for aesthetic purposes may jeopardize the reliability of the groundwater supply to meet M & I demands during a drought. Careful evaluation of the consequences of such action is advised.

D. SHORT TERM ALTERNATIVES

Review of the surface water diversion and groundwater extraction alternatives presented above indicates that there are three viable supply augmentation alternatives that should be given serious consideration. These alternatives all have the potential to meet the District's water supply needs within a 3-4 year planning horizon. The location of these short term alternatives are shown on Figure No. 10.

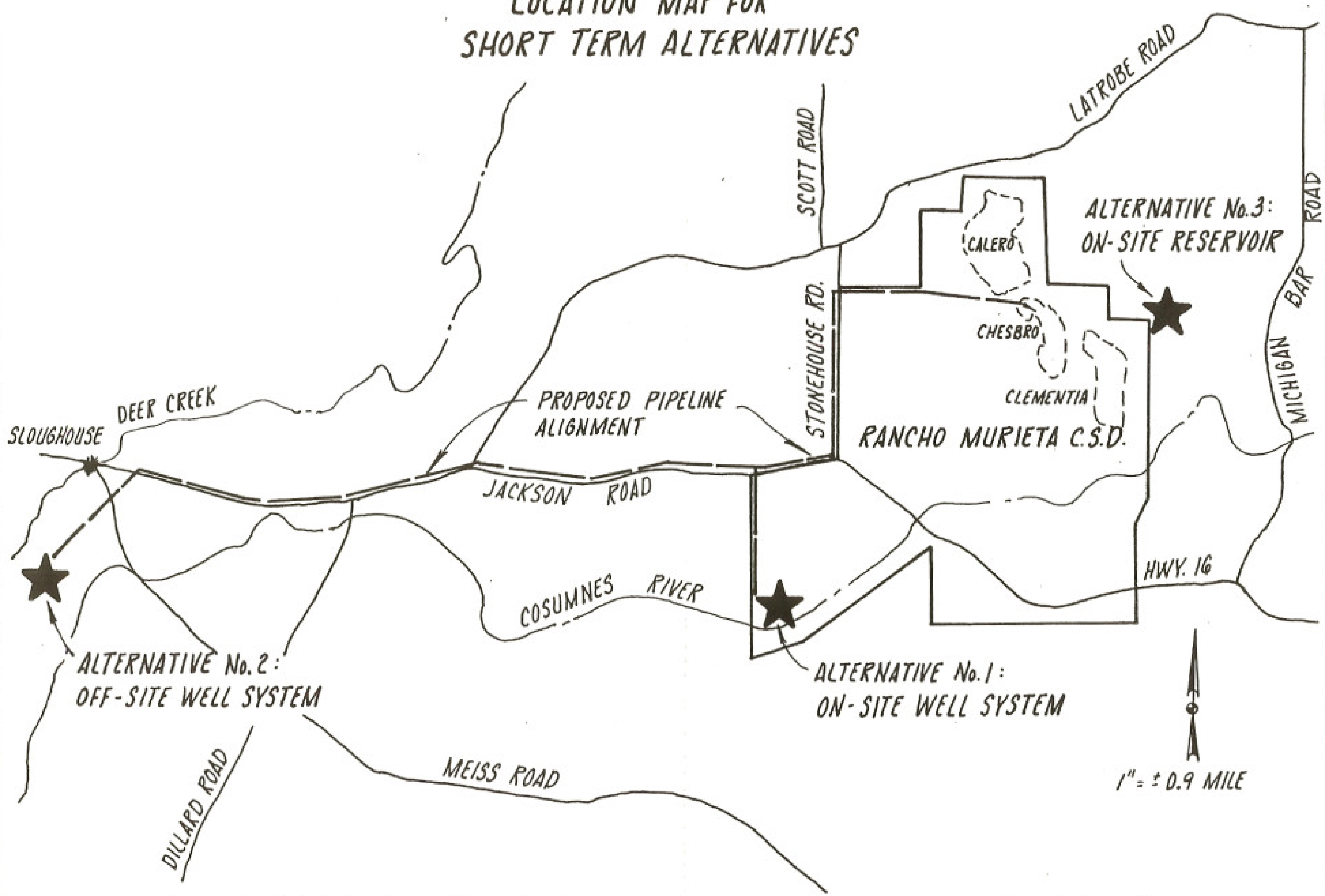
Appendix "J" includes a December 20, 1989 report on Water Supply Alternatives prepared by Harvey J. Dunlop that supplements this discussion. A more detailed explanation of each of these alternatives, their relative merits and preliminary cost estimates follows:

1. **ON-SITE WELL SYSTEM:** Previous groundwater studies authorized by the District indicate that there is a limited potential for groundwater in the alluvial deposits along the Cosumnes River in the southwest portion of the District (Luhdorff & Scalamini 1988). Test boring logs indicate the existence of a minor groundwater strata at a depth of approximately 250-300 feet. Yield estimates are in the range of 300-500 gallons per minute.

   If this ground water source is proven, then a field of wells 4-8 wells would be constructed along the southwestern perimeter of the District. This well field would be connected to a transmission pipeline that would generally be routed northerly to Jackson Road, easterly to Sloughouse Road, northerly to the northern perimeter

FIGURE No. 10

LOCATION MAP FOR
SHORT TERM ALTERNATIVES



of the District, and then easterly to a point of discharge in Chesbro Reservoir a distance of approximately 3 1/2 miles.

During periods of surface water shortages, the well field would be activated to meet the M & I demands of the District. In addition, it may be possible to provide a interconnection between the transmission pipeline and the proposed commercial area irrigation system. This inter-tie could act as a backup supply for irrigation during years when the well field was not needed to meet M & I demands.

Assuming that the 2,500 acre-foot supply deficit will occur in over an 9 month period, the total continuous flow from the well field would need to be approximately 2,000 gpm. If each well produced 400 gpm, then a total of 5 wells would be required. Preliminary engineering costs for this alternative has been estimated to be in the range of $2.5 - 3.0 million (Appendix "K"). The cost per future customer is estimated to be $800 per EDU.

2. **OFF-SITE WELL SYSTEM (SLOUGHHOUSE):** The California DWR records indicate that the alluvial deposits located between the Cosumnes River and Deer Creek southwest of Sloughhouse have a very good chance of yielding reliable groundwater. The U.S.G.S. Quad map for this area indicates the existence of many agricultural wells in this vicinity.

Below this area, at depths of 300-500 feet, there exists Mehrten Formation. Mehrten Formation is the principal aquifer in the greater Sacramento area. Domestic wells tapping this aquifer often yield 2,000-3,000 gpm. The actual yield in this locale will probable be somewhat less than these amounts due to the smaller aquifer thickness of the Mehrten Formation that exists in the east county area.

If an acceptable groundwater source is proven in this area, then one or two large wells would be constructed. These wells would be connected to a transmission pipeline that would generally be routed northwesterly to Jackson Road, easterly along Jackson Road to Sloughhouse Road and then northerly and easterly along the route described earlier to a point of discharge in Chesbro Reservoir a distance of approximately 8 miles.

The pre-engineering costs for this alternative has been estimated to be in the range of $5.5 - 6.0 million (Appendix "K"). The cost per future customer is estimated to be $1,600/EDU.

The selection of this alternative would result in the construction of a transmission pipeline that could be utilized to transport Folsom South Canal flows to Rancho Murieta. The transmission pipeline route would come within 2-3 miles of the Folsom South Canal. A pump station and a pipeline inter-tie could be constructed at a future date to transport flows from the Folsom South Canal to Chesbro Reservoir.

3. **ON-SITE STORAGE:** The results presented in Chapter 5 indicate that the maximum diversion entitlement of Application 23416 (6,368 AF) will not be fully utilized in future years. The water budgets presented in Chapter 5 indicate that this entitlement will be under utilized by approximately 1,000 acre feet during an average dry year.

An increase in on-site storage capacity would allow for the full utilization of the maximum diversion entitlement. Modification of the maximum storage entitlement (3,900 AF) would allow for full utilization of the maximum diversion entitlement (6,368 AF) and allow for diversion of the projected 2,500 acre-foot supply deficit over a period of several non-drought years.

While it is not economically feasible to increase the storage volume of the District's existing storage reservoirs, there is a reservoir site to the northeast of Clementia Reservoir, just beyond the District boundaries - a distance of approximately 1/2 mile. A second possible reservoir site is located north of Clementia Reservoir. River flows could be diverted through the District's existing diversion facilities to Clementia Reservoir. The water could then be pumped to the newly constructed reservoir.

Assuming that the maximum diversion entitlement is not increased, river diversions over several years could fill the new reservoir. The water stored in the new reservoir would be held in reserve for use during a drought event. In the event of a drought, water would be released from the new reservoir by gravity to Clementia Reservoir for subsequent consumption.

After initial filling, only the annual evaporation and seepage losses of the new reservoir would have to be diverted from the river in subsequent years. After a drought, the depleted volume of the new reservoir would need to be replenished. The pre-engineering cost estimate for the alternative has been estimated to be in the range of $13.5 - 14.5 million (Appendix "K"). The cost per future customer is estimated to be $3,900/EDU.

The estimated costs of the short term supply augmentation alternatives is summarized as follows:

ALTERNATIVE NUMBER	DESCRIPTION	ESTIMATED COST
1.	ON-SITE WELL SYSTEM	$2.5 - 3.0 MILLION ($800/EDU)
2.	OFF-SITE WELL SYSTEM (SLOUGHHOUSE)	$5.5 - 6.0 MILLION ($1,600/EDU)
3.	ON-SITE STORAGE	$13.5 - 14.5 MILLION ($3,900/EDU)

If the on-site groundwater supply can be proven, Alternative No. 1 (On-Site Well System) is the most economical of all alternatives. If the on-site groundwater source is proven to be inadequate, the Alternative No 2 (Off-Site Well System - Sloughhouse) should be investigated for feasibility. Lastly, if groundwater sources are not available, Alternative No. 3 (On-Site Storage) should be investigated due to its extraordinarily high cost.

E. LONG TERM ALTERNATIVES

Several of the long range alternatives have encouraging future potential - but they can not be developed within the 3-4 year planning horizon. Most notable of these long range alternatives is the construction of a multi-purpose Auburn Dam. This project has received significant attention in the Sacramento area recently due to its potential to control devastating floods and provide a much needed water supply. If this facility was developed, water could be delivered to Rancho Murieta either through the Folsom South Canal or through the County Line Reservoir.

The potential exists to develop a joint powers agreement (JPA) with neighboring water purveyors to jointly develop one or more of the long term alternatives. Ten local water purveyors are currently in the process of creating a JPA, the Sacramento Area Water Authority, for this very purpose. The District could become a charter member of this JPA and participate in the development of one or more of these projects.

The City of Folsom is currently looking at developing additional water supplies. Perhaps a JPA with the City of Folsom could lead to the development of the County Line Reservoir Project.

Similar opportunities may exist with San Joaquin County, East Bay Municipal Utilities District, Sacramento County, El Dorado County and Amador County. The District should begin to actively pursue the development of a JPA or other interagency agreement that could lead to a permanent and reliable long term water supply.

F. FINANCING ALTERNATIVES

A financing plan for the selected alternative will need to be developed. While several alternatives are possible, the simplest would be the establishment of a development fee to finance the construction of the preferred alternative. The difficulty with this financing mechanism is that it is a "pay as you go" financing method. That is, only after development has occurred and customer demands realized will sufficient funds be available to develop the water supply.

An alternative to this method is to utilize a public benefit assessment district to fund the needed water supply without the needed water improvements and the improvement could not be financed until land values increased from development activities - the classic "Catch-22".

The first action the District should take is to adopt a Water Supply Augmentation Fee (a development fee) to fund the needed water supply improvements. Once in place, the fee could be capitalized in some fashion to generate the large sum of money required to construct the project within the next 3 - 4 years. Solution of the funding problem will be critical to the success of the supply augmentation project.

Obviously, the financing of the needed water supply improvements will need to be carefully studied. Once a financing plan is adopted, the improvements could be developed in a timely fashion to meet the projected water needs of the community.

CHAPTER 7

DROUGHT CONTINGENCY PLAN

A. BASIC CONCEPTS

The essential role that a reliable water supply plays in supporting our society highlights the need for advance preparation in the event of a drought. Also, such contingency planning allows selection of an appropriate response consistent with the severity of the drought. The actions taken should be adequate to deal with the circumstances but no more severe than are warranted. This chapter will describe, in concept, a planning process designed to guide Rancho Murieta's actions during pre-drought and drought stages.

Many of these concepts can be put in place before a drought begins. For instance, an ordinance authorizing a staged water use reduction program can be enacted and "on the books," ready for such an eventuality. This can smooth the transition to drought response.

Gaining public acceptance of the drought contingency plan may be the hardest obstacle faced by the District during a drought. A key to successfully obtaining public acceptance lies in well organized public information and education programs. Actively soliciting public involvement in the preparation of the drought response plan can greatly increase its chance of success. The establishment of an "ad-hoc" task force representing all segments of the community can be useful in tying together the public involvement effort.

B. LEGAL AUTHORITY

Chapter 3 of the State Water Code provides that, during a drought, local governments may establish and enforce water conservation measures. Examples are restricting car washing, landscape irrigation, and pool refilling; installing water meters; and establishing maximum allowable daily use of water per person or connection. Penalties provided under drought emergency ordinances can include such actions as civil fines, installing flow restrictors, or terminating water service.

Local water agencies also have the authority to declare a water shortage emergency when they determine that the ordinary demands of water users cannot be met without depleting the water supply to a level insufficient to supply human consumption needs. The local agency has the authority to adopt regulations and restrictions to conserve water for domestic, sanitation, and fire protection use.

The District Water Code, Section 10, "Conservation," sets forth the specific water conservation requirements of the District. In conjunction with Chapter 3 of the State Water Code, the District has the legal authority to establish and enforce a drought contingency plan.

C. DROUGHT CONTINGENCY PLANNING

While the development of a drought contingency plan for Rancho Murieta is beyond the scope of this report, it is important to review the basic concepts that should be included in Rancho Murieta's Drought Contingency Plan. There are six steps that need to be taken in the preparation of a drought contingency plan.

It is important to note that these steps are part of a dynamic process which is constantly evolving as new information becomes available. The California DWR "Urban Drought Guidebook" includes an excellent model for drought contingency planning. The majority of drought contingency concepts discussed in this chapter were modeled after DWR recommendations. These six steps are as follows:

STEP	DESCRIPTION
1	FORECAST SUPPLY IN RELATION TO DEMAND
2	ASSESS DROUGHT MITIGATION OPTIONS
3	ESTABLISH TRIGGERING LEVELS
4	DEVELOP DEMAND REDUCTION PROGRAM
5	ADOPT THE DROUGHT PLAN
6	MONITOR RESULTS AND ADJUST DROUGHT STATUS

1. FORECAST SUPPLY IN RELATION TO DEMAND

The process is initiated in Step 1 where supply and demand data are collected. This activity is needed as a basis for planning and estimating how much water of acceptable quality will be available under various crisis conditions. Physical constraints, such as pumping capacity and operational limitations, are considered as well as basic supply and demand information. The best time to initiate the planning process is before a drought takes place. Step 1 is the subject of this report.

2. ASSESS DROUGHT MITIGATION MEASURES

During this step, supply augmentation and demand reduction options are investigated and evaluated, including any problems or constraints resulting from the use of such options. The ability to temporarily augment supply or reduce water demand is subject to varying degrees of effectiveness. The effective elements of drought contingency plans which have a proven track record establish a firm foundation for effective future drought management.

SUPPLY AUGMENTATION

Methods of supply augmentation can be classified into five groups: (1) methods to increase existing supplies; (2) drawing from reserve supplies; (3) methods to increase efficiency; (4) modifications to operations; and, (5) cooperative efforts with other agencies. Implementation of supply augmentation is often difficult because few of these actions can be undertaken quickly. Also, many of these methods involve balancing environmental and jurisdictional considerations. Finally, if reserves are used these resources must eventually be replenished.

Despite the inherent difficulties with using supply augmentation options, even minimal supply augmentation programs have been helpful in drought situations for several reasons. Developing extra supply will increase the District's credibility with customers by demonstrating that the utility is maximizing its efforts to deal with the drought. Also, supply augmentation reduces the amount of demand reduction golf course and open space irrigation.

Two additional methods of demand reduction exist which are generally imposed to affect all customer classes - rationing and price restructuring.

RATIONING

Consumer response to rationing programs is more predictable than to other measures, and these are generally the most effective programs to achieve significant demand reduction. In nearly every instance where mandatory rationing was implemented during the 1976-77 drought, consumers responded by reducing water use further than was requested.

During the 1976-77 drought, in fact, one of the inherent problems with a rationing system is in accurately designing the program to achieve the desired demand reduction level without greatly exceeding this amount. Although mid-course corrections can be made to lessen the impact of a program proving to be too severe, such adjustments are risky and most managers are reluctant to make them. Water agency officials feel that changing programs once they are in place sends a message to the customers that the utility lacks resolve. Therefore, necessary rationing program corrections, needed to expressed as:

$$\text{elasticity} = \frac{\text{Percent change in quantity consumed}}{\text{Percent change in price}}$$

The DWR reports that published studies show elasticities in the demand for urban water supply to vary from -1.2 to -0.5. For a community with an elasticity of -0.5, a 10 percent price <u>increase</u> will result in a 5 percent <u>decrease</u> in usage (DWR 1988).

Several variables have significant effects on price elasticity. For example, elasticity varies with type of customer. Single family residences using a large amount of water for outside irrigation or industries involved in wet processes generally are more price sensitive than smaller volume customers. Also, the income level of residential users is an important variable.

Therefore, although it is clear that consumption will be reduced to some extent if prices are increased by an amount significantly greater than that needed to compensate for inflation, it is not easy to predict the magnitude of the reduction. The District needs to develop its own data showing how customer consumption is affected by price changes.

Analyzing existing data from a nearby community of similar composition may also yield workable predictions. Values quoted in the literature should be used with caution.

Significant water conservation is unlikely to be achieved through the use of normal rate increases. However, there are several pricing structures suitable to enhance the effects of a drought management plan:

1. Seasonal rates
2. Excess use charges
3. Penalty charges
4. Drought surcharge

Under a seasonal rate schedule a higher unit price is imposed during peak usage months. An excess use charge (or inclining block rate structure) applies a higher unit price to the volume consumed above a set limit. Penalty charges are similar to excess-use charges except that the same unit price is charged for the entire volume consumed and a flat fee is assessed if total usage exceeds a set ceiling. With either of these pricing structures, care must be taken in defining what is excess consumption on the part of various customer classes. A drought surcharge may also cause reduction in water use. Since this is primarily a revenue generation measure, it is normally included with revenue issues in the program formalization step (Step 5).

Whenever price structure changes are contemplated for use as part of a drought management plan, a realistic assessment of the time and effort to complete the approval process must be made. Often, the water rate setting process takes several months. Also, it may be inappropriate to expect the conservation benefits of price changes to make an immediate impact if billing cycles are staggered or are on a bimonthly basis.

ENFORCEMENT

During extreme shortages, a call for voluntary conservation may not bring sufficient reduction of water use, especially where water consumption is to be reduced by more than 20 to 25 percent. In such cases it may be necessary to institute mandatory conservation measures (such as rationing), enforceable under the authority of special ordinances or revised rate schedules. Penalties can vary from warnings, to fines to flow restrictions. The most severe violations may call for discontinuance of service.

Many utility managers have noted that the simple fact that enforcement mechanisms are available is the most important feature, and that application of enforcement procedures is rare. Nevertheless, it is important that customers know that those few who choose not to cooperate will be dealt with firmly. In this way, the consumer receives added assurance that the program is uniformly applied and fair to all. District policy makers must be certain to communicate their resolve in this regard at the very start of the program.

Monitoring customers for compliance with mandatory measures that are not strictly consumption related is a complex issue. Most utilities rely heavily on peer group pressure and observation by water agency field employees during their regular work schedule. Also, District employees, whose daily routine work requires them to be moving about the community, can be empowered to issue citations. This is an effective method of covering the service area at minimum expense and with little interruption of the employee's regular duties. Police are not widely used unless there is a problem with a specific customer.

EVALUATING DROUGHT MITIGATION MEASURES

Once drought mitigation measure are identified, certain information must be generated to provide the District decision makers with a rational basis to review and select appropriate measures that will be used in the plan. Basic considerations include:

1. Yield/water savings
2. Quality of supply
3. Adequacy of treatment facilities to utilize supplemental source
4. Technical and/or environment impacts of developing supplemental source
5. Lead time required to activate measure
6. Direct and indirect costs
7. Legal or procedural requirements for implementation

Supply augmentation methods must be scrutinized against all of these items. Only items 1, 5, 6, and 7 would apply to demand reduction options.

Step 2 is finalized by eliminating measures which are infeasible and arranging the remaining feasible measures in logical groups. Identifying the specific application of a drought management measure (mandatory versus voluntary, residential versus nonresidential) will serve as a basis for the plan formulation activity in Steps 3 (setting triggering levels) and 4 (the demand reduction program).

This report includes a preliminary evaluation of supply augmentation methods in Chapter 6, but only a cursory review of demand reduction methods, primarily in the form of overall reductions as a percentage of normal use that can be utilized at Rancho Murieta. Additional evaluation of these options and their eventual implementation will be required to complete a drought contingency plan for Rancho Murieta.

3. ESTABLISH TRIGGERING LEVELS

Knowledge of the supply deficit situation generated in Step 1 must be refined in this step. The specific data used to "trigger" sequential drought plan phases must be identified. Then, with deficit reduction goals quantified, the appropriate water-saving measures can be subsequently selected for the demand reduction program in Step 4.

Comparison of forecasted supply and demand provides the basis for initiating or upgrading a drought emergency. The extent of supply sources and the complexity of their allocation determine how elaborate a drought stage trigger mechanism should be. A relatively simple scheme, measurement of the water level of the impoundment reservoir (expressed as a percent of normal seasonal capacity) gives sufficient indication of drought status in a community primarily dependent on a single supply source such as is the case at Rancho Murieta.

A more complex supply situation may require monitoring of several parameters and the preparation of multiple sets of trigger mechanisms to reflect the seasonal relationship of supply versus demand. The development of multiple sets of trigger mechanisms is probably not required for Rancho Murieta.

Whatever parameters are used for trigger mechanisms, they must be ones that can be assessed on a frequent basis. The analysis of such information must also be made readily available to District decision makers in a timely manner. Using such a quantified system, advancement through drought stages generally will be automatic.

Typically, trigger levels are determined for a number of varying drought alert stages - usually three to five stages. The number of stages is determined by balancing the need to be responsive to varying severity of droughts and the need to keep the drought response plan simple to implement and manage. The careful balancing of these needs can have a great deal of influence on gaining customer support for the plan and achieving programmed goals.

Drought stage triggering levels for Rancho Murieta should be based on objective criteria that can be assessed on a frequent basis. Cosumnes River flows and actual diversions are one of the criteria that could be used. Other criteria include levels of reservoir storage, DWR winter and spring river flow forecasts and NWS long range weather forecasts.

Some consideration has been given to the number and form of drought stages that could be adopted for Rancho Murieta. This staging sequence is based upon a phasing model suggested by the California DWR. The suggested drought stages for Rancho Murieta are shown in Table No. 12.

The number of successive levels of drought staging should be correlated with a series of realistic deficit reduction goals. Deficit reduction objectives for each drought state are commonly expressed as a percentage of average demand levels or as a quantity (volume or rate) of water saved.

Setting of realistic goals includes avoiding instituting demand reduction efforts that are overly conservative in light of the drought situation at hand, even if they are technically achievable. It must be recognized that curtailment of water use results in economic impacts, on the District as well as the customer, at relatively low levels of restriction. Establishing appropriate levels of deficit reduction is also important in terms of sustaining consumer support of voluntary and mandatory measures.

TABLE No.12

PROPOSED DROUGHT STAGE PROGRAM

DROUGHT STAGE No.I: DROUGHT ALERT (MINOR SHORTAGE POTENTIAL - FEBRUARY 1)

(1) MID WINTER STREAM FLOW AND SNOWMELT FORECASTS INDICATE THAT RIVER FLOWS AND DIVERSIONS WOULD BE INADEQUATE TO FILL STORAGE FACILITIES PRIOR TO JUNE 1

(2) BELOW NORMAL PRECIPITATION

(3) WEATHER FORECASTS PREDICT A CONTINUING TREND OF WARMER, DRIER THAN NORMAL CONDITIONS

DROUGHT STAGE No.II: DROUGHT WATCH (MODERATE-MAJOR SHORTAGE POTENTIAL - APRIL 1)

(1) RIVER FLOWS AND DIVERSIONS CONTINUE TO BE LOW

(2) STORAGE RESERVOIR LEVELS BELOW NORMAL

(3) MID SPRING STREAM FLOW AND SNOWMELT FORECASTS INDICATE THAT RIVER FLOWS AND DIVERSIONS WOULD BE INADEQUATE TO FILL STORAGE FACILITIES PRIOR TO JUNE 1

(4) BELOW NORMAL PRECIPITATION

(5) WEATHER FORECASTS PREDICT A CONTINUING TREND OF WARMER, DRIER THAN NORMAL CONDITIONS

DROUGHT STAGE No.III: MINOR DROUGHT (MINOR SHORTAGE - JUNE 1)

(1) TOTAL SYSTEM STORAGE IS NOT FILLED TO CAPACITY AS OF JUNE 1

(2) TOTAL SYSTEM STORAGE IS BELOW THE LEVEL REQUIRED TO MEET EXPECTED DEMANDS DURING A 1 IN 10 YEAR DROUGHT

(3) WEATHER FORECASTS PREDICT A CONTINUING TREND OF WARMER, DRIER THAN NORMAL CONDITIONS

DROUGHT STAGE No.IV: MODERATE DROUGHT (MODERATE SHORTAGE - JUNE 1)

(1) TOTAL SYSTEM STORAGE IS NOT FILLED TO CAPACITY AS OF JUNE 1

(2) TOTAL SYSTEM STORAGE IS BELOW THE LEVEL REQUIRED TO MEET EXPECTED DEMANDS DURING A 1 IN 25 YEAR DROUGHT

(3) WEATHER FORECASTS PREDICT A CONTINUING TREND OF WARMER, DRIER THAN NORMAL CONDITIONS

DROUGHT STAGE No.V: MAJOR DROUGHT (MAJOR SHORTAGE - JUNE 1)

(1) TOTAL SYSTEM STORAGE IS NOT FILLED TO CAPACITY AS OF JUNE 1

(2) TOTAL SYSTEM STORAGE IS BELOW THE LEVEL REQUIRED TO MEET EXPECTED DEMANDS DURING A 1 IN 100 YEAR DROUGHT

(3) WEATHER FORECASTS PREDICT A CONTINUING TREND OF WARMER, DRIER THAN NORMAL CONDITIONS

DROUGHT STAGE No.VI: CRITICAL EMERGENCY

(1) CUSTOMER DEMANDS AND SYSTEM PRESSURE REQUIREMENTS CANNOT BE MET

4. DEVELOP DEMAND REDUCTION PROGRAM

In this step, the actual contingency plan is developed. The types of customers served and the statutory authority of the District are some of the considerations that need to be taken into account in this step. Specific supply augmentation and demand reduction options generated during Step 2 are matched with the drought triggering stages developed in Step 3 to achieve the deficit reduction objectives established. A good public information program is extremely important at this stage. Deciding which measures should be used at a given level of shortage will, to a large extent, determine how well the public accepts the program.

The best approach to managing water demand during a drought is to use a phased approach, with increasing levels of savings in each successive phase. The California DWR has developed a model phasing program as a guide to water purveyors.

Early phases rely primarily upon voluntary action by the water consumers. These actions are taken in anticipation of a future drought creating a modest water shortage. Subsequent phases are in response to increasingly severe drought conditions. Later stages utilize some mandatory measures and involve water rationing. The last phase would be initiated only in rare circumstances and is typically set at the maximum level of water savings that could be achieved in a community without severe hardship.

The typical demand reduction goals for phased plans normally range from 5 to 10 percent in the first stage to as much as 35 percent in the last stage. The final phase of the model program could achieve more than 35 percent savings by reducing the water allotment contained in the water rationing program. However, community hardship increases dramatically above 35 percent. For example, in most communities a 50 percent cutback would necessitate that most turf and landscaping dies and later it would need to be replaced at great expense.

Phases are designed to be somewhat flexible and it is not intended that the District would move through each phase in every circumstance. It is more likely that a voluntary program would be tried at the first sign of a drought and then, if the drought worsened, a more stringent phase would be entered. Deciding which phase is in effect at any time during a drought would be the responsibility of the District.

The water saved by the various phases will vary from month to month. Many measures included in the various phases emphasize outside water use reduction. Therefore, their effectiveness will be higher in the warmer months. Not only will the percentage of total demand saved be higher, but also the total quantity of water saved because of the higher demand level during those months. For example, if a water rationing plan is expected to save 25 percent of the total demand on an annual average basis, savings may be as much as 35 percent in the summer months. There would be a correspondingly lower rate of savings, perhaps 15 percent, during the winter.

Exactly how much water savings can be achieved in any given month is difficult to predict. A service area where most of the water use is residential with a large proportion used for landscape irrigation can expect high summer savings relative to the annual average; whereas a service area with low summer irrigation demand would experience much less variation from the predicted annual average savings. One way to account for this variation is to assume that the savings can be scaled to the normal year demand curve.

This report utilizes these demand reduction assumptions in the water budgets presented in Chapter 5. These calculations include, during periods of water conservation, greater reduction in seasonally variable demands than compared to the seasonally non-variable demands.

Some consideration was given to the levels of demand reduction that should correspond to the suggested drought stages for Rancho Murieta presented in Table No. 12. The suggested levels of demand reduction for Rancho Murieta are shown in Table No. 13.

Customer reaction to a well planned drought response plan is generally very good. In fact, it is not uncommon for customers to exceed the demand reduction objectives. These additional reductions in demands will reduce the amount of supply depletion. This reduction in supply depletion then acts as added reserve capacity so that it can be available in the latter stages of the drought.

5. ADOPT THE DROUGHT PLAN

Once it is decided that a drought plan is needed, the District should move quickly to adopt a plan. The process can usually be completed within 1 to 3 months. If drought conditions are imminent, the District will need to treat the situation as an emergency with the necessary people mobilized

TABLE No.13

PROPOSED LEVELS OF DEMAND REDUCTION

DROUGHT STAGE	DESCRIPTION	DEMAND REDUCTION OBJECTIVE	VOLUNTARY OR MANDATORY
I	DROUGHT ALERT - FEBRUARY 1 (MINOR SHORTAGE POTENTIAL)	10%	VOLUNTARY
II	DROUGHT WATCH - APRIL 1 (MODERATE-MAJOR SHORTAGE POTENTIAL)	15%	VOLUNTARY
III	MINOR DROUGHT - JUNE 1 (MINOR SHORTAGE)	15%	VOLUNTARY
IV	MODERATE DROUGHT - JUNE 1 (MODERATE SHORTAGE)	20%	VOLUNTARY
V	MAJOR DROUGHT - JUNE 1 (MAJOR SHORTAGE)	25%	MANDATORY
VI	CRITICAL EMERGENCY	AS REQUIRED	MANDATORY

to develop and implement the procedures to carry out whichever drought phase may be needed.

Completing a drought plan requires identification of the budget and staffing resources necessary to maintain the program during pre-drought and drought phases. The requisite authority to initiate any actions or enforce plan compliance must also be provided before the plan can be considered complete.

When all issues and procedures are defined as much as possible, the plan should undergo a formal public review process and the finalized document adopted. The basic elements that should be part of the drought plan are outlined below.

PREPARE A REVENUE PROGRAM

A reduction in water use will mean a revenue shortfall for most utilities. This is especially true when the additional costs of dealing with a drought are added in. There are two common ways of balancing the budget: (1) raising water rates and (2) imposing a drought surcharge. Two additional ways that may be available are to use the financial reserves in the general or water revenue fund, and to draw from a designated drought emergency account. Various combinations of these methods can be used to create a comprehensive revenue program.

Raising water rates can include an excess charge for each unit of water over the customer's allotment when rationing is in effect. This helps to reinforce adherence to the allotted amounts. If the District simply wants to recover all or part of its extraordinary drought-related expenses and lost revenues necessary to meet fixed costs, a drought surcharge method is easier to administer and enables accurate prediction of the additional revenue that will be generated. This method is also easier for the customers to understand as a one-time, drought related charge and not a disguise for a rate increase which may not be lifted after the drought is over.

The District could consider the financial feasibility of funding part of the revenue shortfall from emergency reserves. It may be practical to cover a significant portion of the extraordinary expenses and lost revenue from such funds.

Regardless of the method selected, it is necessary to include the following actions as part of the revenue program:

1. Estimate the amount of water use reduction that will be achieved and the associated lost revenue.
2. Design a rate adjustment or drought surcharge that will cover the anticipated revenue deficit.
3. Monitor actual revenue and compare with forecasted revenue and adjust drought surcharges as needed - but not too often.

State and federal agencies offered financial assistance to communities affected by drought in the 1976-77 drought. Many of these programs are still in effect. Programs which have been discontinued serve as examples of assistance that might be made available during a future drought. Use of such external sources of financial assistance may reduce the District's revenue shortfall.

DEVELOP AN ADMINISTRATION PROGRAM

Administration of the drought plan combines the skills needed to undertake a comprehensive public information program with the judgment required to deal with the equity issues arising from a mandatory program and enforcement of the program. The District should establish a Drought Management Team to deal with the drought, implement the conservation plan, the public information plan, the revenue program and the monitoring program.

DEVELOP INTERAGENCY AGREEMENT AND ORDINANCES

Ordinances should be drafted that will be adopted and "on the books" for future droughts. They may contain various levels of mandatory restrictions and provisions that will go into effect when a state of emergency is declared by the District.

Joint utility planning in anticipation of a drought can provide a common approach to drought management among adjacent utilities, identification of emergency supplies, and possibly provide for emergency interconnections or other joint activities. Interagency agreements confirmed in advance will speed response to an emergency and help to avoid hurried decisions on matters such as price and equity.

REVIEW AND FINALIZE PLAN

The drought plan should undergo a formal public review process. This will help minimize future objections when mandatory provisions are needed. The drought plan elements and the need for them should be described in clear, concise presentations by staff to the policy makers and the public.

A public hearing of the more controversial aspects of the plan should be held following sufficient notice. Opposition to the plan should be anticipated from those involved with potentially affected business activities. The "green" industry, i.e., landscape contractors, nurseries, etc., will probably suffer economic harm during a water shortage and can be expected to have concerns about certain elements of the plan. Contacting industry representatives ahead of time and meeting with them while the plan is being developed may help them understand the reasons for plan requirements. The plan should be communicated to the public so that the voluntary phases have a better chance of being effective. The message should be "if we voluntarily reduce water use now, we may not have to ration water later."

6. MONITOR RESULTS AND ADJUST DROUGHT STATUS

Implementation of a drought management plan includes ongoing monitoring of the effectiveness of the individual conservation measures included in the present phase, monitoring supply availability, and monitoring actual water use. The following procedure, is suggested:

1. Overlay actual water supply and demand on a graph. A 7-day average can be used to smooth out daily fluctuations. Frequent updating of this graph is essential.

2. Compare actual demand and supply with projected supply and demand to determine if phase adjustments may be needed. Prior to altering the demand reduction phase, the District should consider other program adjustments, such as raising the level of expenditure on public information and/or increasing enforcement efforts. If this does not achieve the required stabilization, then further adjustment is required.

Using these techniques, the District can stay on top of the situation and make informed decisions throughout the duration of the drought.

CHAPTER 8

CONCLUSIONS & RECOMMENDATIONS

A. CONCLUSIONS

The following conclusions are based on the data and analyses presented in this report. These conclusions are grouped into several categories (i.e., Impacts, Water Supply, Supply Augmentation, and Drought Contingency Plan).

IMPACTS

Droughts can have a significant adverse impact on urban areas. Fortunately, Rancho Murieta was only partially developed during the 1976-77 drought, and impacts to the District's customers were minimal. When a severe drought occurs in the future, the District's customers will suffer significant adverse impacts unless additional water supplies are developed.

Studies have indicated that customers are responsive to requests for voluntary conservation in the magnitude of 20% - 25% during a drought. Studies have also found that customer hardship is not usually incurred until conservation rates exceed 25% and that customer hardship increases dramatically above 35% conservation rates.

Conservation rates in the range of 50% - 60% were recorded during the 1977 drought in several severely impacted water agencies. While significant customer hardship and economic losses occurred, customers seemed to adapt and survive the crisis.

WATER SUPPLY

The annual yield of the Cosumnes River varies significantly from year to year. The river basin is subject to frequent and prolonged drought - occasionally severe in nature. The river is the sole source of water for the District's municipal and industrial (M & I) demands.

The District's existing water supply system has the capacity to serve the ultimate development of Rancho Murieta (5,968 EDU) during the recurrence of a 25-year drought similar to the 1924 drought without conservation efforts. With development of an additional 1,900 acre feet of water supplies, the District's enhanced water supply system will have the capacity to serve the ultimate development of the community during a 100-year drought with a 25% conservation rate without significant customer hardship.

During a very severe 200-year drought, similar to the 1977 drought, the District's enhanced water supply system will have the capacity to serve the ultimate demands of the community with a 50% conservation rate. Customer hardship will be unavoidable during such an event.

These projected supply deficits are summarized as follows:

DROUGHT EVENT	LEVEL OF CONSERVATION	LEVEL OF DEVELOPMENT	PROJECTED SUPPLY DEFICIT
25-YEAR	NONE	5,968 EDU	NONE
100-YEAR	25%	5,968 EDU	1,900 AF
200-YEAR	50%	5,968 EDU	2,500 AF

Prior to the enhancement of the District's water supply system, the existing system has the capacity to safely meet the following municipal and industrial demands:

	DROUGHT EVENT		
DESCRIPTION	25-YEAR	100-YEAR	200-YEAR
Level of Conservation	NONE	25%	50%
Level of Maximum Development:			
Residential	5,189 DU	3,800 DU	3,500 DU
Commercial/ Industrial	779 EDU	451 EDU	451 EDU
Total	5,968 EDU	4,251 EDU	3,951 EDU

The District will be required to carefully manage its water resources during future droughts. Maximizing river diversions, minimizing reservoir losses, and reducing customer water demands are the keys to successfully balancing the water supply and demand equation.

SUPPLY AUGMENTATION

Development activities are increasing within Rancho Murieta. At the projected rate of development, the capacity of the water supply system will be exceeded within 3-4 years. Accordingly, the District's planning horizon for augmentation of its water supply is 3 - 4 years.

In order to meet the ultimate M & I demands during future droughts, the District must develop additional water supplies. Three alternatives have been identified that have the potential to provide the additional 2,500 acre feet of water within the District's 3 - 4 year planning horizon. These alternatives are summarized as follows:

ALTERNATIVE NUMBER	DESCRIPTION	ESTIMATED COST
1	On-site well system	$2.5-3.0 Million ($800/EDU)
2	Off-site well system	$5.5-6.0 Million ($1,600/EDU)
3	On-site storage Reservoir	$13.5-14.5 Million ($3,900/EDU)

While alternative No. 1 is the least expensive of the three alternatives, it has a limited potential to yield a proven groundwater supply. Alternative No. 2 appears to have excellent potential to become a reliable groundwater water supply. The cost of this alternative does not appear to be unreasonable at approximately $1,600/EDU for all future customers. Alternative No. 3 is the most expensive of the three alternatives. It's development would require amendment to the District's principal water right (Application 23416) - a time consuming and sometimes risky process.

A financing plan will need to be developed to fund the needed water supply improvements. Several financing alternatives were evaluated. Each financing alternative investigated appeared to have a potential pitfall. The first action the District should take is to adopt a Water Supply Augmentation fee. Once in place, the fee could be capitalized in some fashion to generate the large sum of money required to construct the project within the next 3 - 4 years. Solution of the funding problem will be critical to the success of the supply augmentation project.

If a long term water supply is developed sometime in the future, then the potential for severe customer hardships could be minimized in even the most severe drought events. A multi-purpose Auburn Dam could provide this long term supply. The development of this project is actively being pursued by many public and private organizations.

Obtaining water entitlements from Auburn Dam at this time appears to be feasible. Once obtained, these entitlements could be exercised upon the completion of Auburn Dam. The Sacramento Area Water Authority, a proposed joint powers authority of ten local water purveyors, is currently in the formation stage. The mission of the Authority is to assure that a multi-purpose Auburn Dam is built.

DROUGHT CONTINGENCY PLAN

The adoption of a drought contingency plan will allow the District to be prepared to respond quickly and decisively to a future drought. Customer acceptance of demand reduction requests will be enhanced by a well designed and properly implemented drought contingency plan. Lastly, District responsiveness to changing drought conditions will be greatly enhanced by the adoption of such a plan.

B. RECOMMENDATIONS

The following recommendations are based on the finding and conclusions contained in this report. It is recommended that the Rancho Murieta CSD immediately begin implementation of the following recommendations:

1. Adopt the following water supply reliability standard:

   The District's water supply system shall be designed to :

   A. Provide normal annual water demands

during a 25-year drought without conservation.

B. Provide annual water demands with a maximum conservation rate of 25% during a 100-year drought.

C. Provide annual water demands with a maximum conservation rate of 50% during a 200-year drought.

2. Finance and develop a 2,500 acre-foot per annum conjunctive use ground water supply system, including the adoption of a Water Supply Augmentation Fee.

3. Prepare and adopt a Drought Contingency Plan.

4. Actively pursue the procurement of water entitlements from and the development of future long term water supplies, including a multi-purpose Auburn Dam.

5. Undertake all actions necessary to become an active member of the Sacramento Area Water Authority.

6. Allow development within the District to progress to a maximum of 3,951 EDU (composed of approximately 3,500 residential DU and 451 EDU of related commercial and industrial uses) until the District's water supply is augmented to support additional growth.

APPENDIX "A"

WATER USE SURVEY

RANCHO MURIETA C.S.D.
WATER USE QUESTIONNAIRE

DATE: ______________________________

AGENCY: ______________________________

CONTACT: ______________________________

TITLE: ______________________________

PHONE NO.: ______________________________

---

1. Approximately how many residential customers on your water distribution system? ______________________.

2. What percentage of your residential customers are metered?______________________________________.

3. On an annual average basis, aproximately how much water is used by each residential customer each day? ______________.

4. What is your design consumption rate for each residential customer? ______________________________________.

5. What is the design standard for your water supply? __________
____.

6. What is the source of your domestic water? ______________
____.

7. How did you handle the 1976-77 drought? ________________
____
____.

8. What percent reduction did you achieve from your conservation and rationing efforts in 1976-77:

   a) In peak water demands?______________________________.

   b) In average annual demands? __________________________.

   c) In overall consumption? ____________________________.

9. What measures did you use to curtail demands in 1976-77? (i.e. education, rationing, pricing, etc). ______________________

____

____.

10. What provisions have you made in anticipation of another prolonged drought? ______________________________________

____.

11. Do you have a backup water supply in the event of a drought or water shortage? Explain briefly ______________________

____

____.

12. To what extent do you plan to use rationing to curtail demands during a prolonged drought in the future? ______________

____.

13. What part does drought planning play in your decision to make commitment to serve new development? ____________________

____

____.

14. If you have a written water policy, could you provide us a copy? ____________________.

15. Additional Comments: ____

____

____

____

____

____

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER USE QUESTIONNAIRE RESULTS

QUESTIONS (SEE ATTACHED QUESTIONNAIRE)

AGENCY	1	2	3	4	5	6	7	8A	8B	8C
1 FRUITRIDGE VISTA WATER COMPANY	4500	0	930 GAL.	N/A	N/A	WELLS	PUMPED WELLS	N/A	N/A	25%
2 DEL PASO MANOR WATER DISTRICT	1860	0	N/A	N/A	N/A	WELLS	EDUCATION, PATROLS, & CONSERVATION KITS	N/A	16-18%	16-18%
3 YUBA COUNTY WATER AGENCY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4 OAKLEY COUNTY WATER DISTRICT	4800	100%	500 GAL.	650 GAL. PER DAY	N/A	CONTRA COSTA WATER DIST.	EDUCATION & PUBLIC AWARENESS	N/A	N/A	40%
5 ORANGEVALE MUTUAL WATER COMPANY	4000	0	N/A	N/A	3.8 AC.FT. PER ACRE	FOLSOM RES. VIA SAN JUAN W.D.	EDUCATION & ALTERNATE DAY	N/A	N/A	MINIMAL
6 RIO LINDA WATER DISTRICT	3650	100%	650 GAL.	N/A	2000 GAL./ DAY/SERVICE	12 WELLS	NOT AFFECTED	N/A	17%	17%
7 FLORIN COUNTY WATER DISTRICT	3200	4.7% APARTMENTS	242 GAL. (QST.#2)	N/A	(1)	8 WELLS	SAWWA CONSERVATION PROGRAM	N/A	N/A	16.6%
8 CITY OF SACRAMENTO WATER DIVISION	110,663	4%	300 GAL./ CAPITA	N/A	N/A	SURFACE & WELLS	VOLUNTARY CONSERVATION PROGRAM	N/A	10-15%	10-15%
9 EL DORADO IRRIGATION DISTRICT	18,500	100%	700-800 GAL.	8.1-8.9 AC.FT./YR.	N/A	FOLSOM & SLY PARK RES., PG&E FOREBAY	WATER CONSERVATION PROGRAM	46%	N/A	57%
10 CALVERAS COUNTY WATER DISTRICT	7000	100%	235 GAL./ CAPITA	250 GAL./ DAY/CAPITA	250 GAL./DAY/ CAPITA	SURFACE	20% REDUCTION IN USE	15%	20%	20%
11 CITRUS HEIGHTS IRRIGATION DISTRICT	17,500	0	193 GAL./ CAPITA	N/A	AWWA STDS. & DIST. CRITERIA	FOLSOM RES. VIA SAN JUAN W.D.	EDUCATION, PATROLS, & CONSERVATION PROGRAM	N/A	22%	22%
12 CITIZENS UTILITIES CO. OF CALIFORNIA	39,300	0.2%	933.5 GAL.	2.6 GPM PEAK HR.	CAL. P.U.C. GEN. ORDER 103	WELLS	NO SIGNIFICANT PROBLEMS	N/A	N/A	N/A
13 SANTA CLARA VALLEY WATER DISTRICT	N/A	N/A	N/A	N/A	N/A	GRNDWATER. & IMP. SURFACE WATER	EDUCATION & PUBLIC AWARENESS	N/A	N/A	20%
14 NORTHRIDGE WATER DISTRICT	60,000	2%	275 GAL./ CAPITA	N/A	275 GAL./DAY/ CAPITA	WELLS	EDUCATION, INVESTIGATED NON-DOMESTIC USE	20.8%	21.6%	N/A
15 NORTH MARIN WATER DISTRICT	16,000	100%	127 GAL./ CAPITA		YR.2015 DEVEL.+5%	SURFACE	VOLUNTEER RATIONING	38%	36.7%	36.7%
16 INVERNESS P.U.D. WATER SYSTEM	460	100%	160 GAL.	250 GAL./ DAY	(4)	SURFACE DIVERSIONS	VOLUNTARY CONSERVATION	N/A	N/A	N/A
17 TOKAY PARK WATER COMPANY	163	0	N/A	N/A	N/A	2 WELLS	VOLUNTARY CONSERVATION	N/A	N/A	N/A
18 FAIR OAKS WATER DISTRICT	11,646	3.3%	1300 GAL.	1.35 GPM	8" WATER MAINS	SAN JUAN WATER DISTRICT	CONSERVATION PROGRAM	N/A	1976-NONE 1977-20%	(5)
19 MARIN MUNICIPAL WATER DISTRICT	50,816	100%	305 GAL.	0.2-0.8 A.F.	SUPPLY 95% W/O SHORTAGE (1976-77)	90% SURFACE, 10% SONOMA CO. W.A.	LEVEL OF USE REDUCTIONS & EMERGENCY PIPELINES	75%	53%	65%
20 CITY OF FOLSOM	5,000	6%	N/A	N/A	N/A	SURFACE, FOLSOM LAKE	ADOPTED ORDINANCE #346	33%	27%	27%

AGENCY	QUESTIONS (SEE ATTACHED QUESTIONNAIRE) 9	10	11	12	13	14	15
1 FRUITRIDGE VISTA WATER COMPANY	EDUCATION	NONE	NO, GROUND WATER SUPPLY IS SUFFICIENT	NONE	NONE	N/A	
2 DEL PASO MANOR WATER DISTRICT	EDUCATION, PATROLS, & CONSERVATION KITS	EDUCATION & PATROL DURING PEAK MONTHS	YES, CONTRACT WITH CITY OF SACRAMENTO	NONE	BUILT-OUT	N/A	
3 YUBA COUNTY WATER AGENCY	N/A	N/A	N/A	N/A	N/A	N/A	NO SALES OF DOMESTIC WATER
4 OAKLEY COUNTY WATER DISTRICT	EDUCATION & PUBLIC AWARENESS PROGRAMS	NONE	YES, 12" WELL	NONE	ADOPT COUNTY CONSERVATION PLAN	N/A	
5 ORANGEVALE MUTUAL WATER COMPANY	EDUCATION & ALTERNATE DAY	EDUCATION & EMERGENCY WELL	YES, FOLSOM DAM	METERS	CONSERVATION IN LANDSCAPE DESIGN	N/A	PRO-AUBURN DAM
6 RIO LINDA WATER DISTRICT	SAWWA CONSERVATION PROGRAM	NONE	NO	PRICING	NONE	N/A	
7 FLORIN COUNTY WATER DISTRICT	SAWWA CONSERVATION PROGRAM	NONE	NO, GROUNDWATER SUPPLY SUFFICIENT	NONE	NONE	N/A	2/3 USE IS FOR IRRIGATION
8 CITY OF SACRAMENTO WATER DIVISION	EDUCATION & WATER WASTE INSPECTORS	PERMANENT WATER CONSERVATION INSPECTOR	NO	NONE	NONE	PROVIDED	
9 EL DORADO IRRIGATION DISTRICT	EDUCATION & PUBLIC AWARENESS PROGRAMS	5-STAGE WATER CONSERVATION PROGRAM & WATER MATRIX	NO	AS NEEDED	5-STAGE CONSERVATION PROGRAM	PROVIDED	
10 CALVERAS COUNTY WATER DISTRICT	(2)	NONE, YET	YES, DIFFERENT AREAS HAVE DIFFERENT SOURCES	UNKNOWN AT THIS TIME	MAY LIMIT NEW SERVICES TO PROP. OUTSIDE DIST.	N/A	
11 CITRUS HEIGHTS IRRIGATION DISTRICT	EDUCATION, PATROLS & CONSERVATION PROGRAM	WATER CONSERVATION ORDINANCE	YES, WELLS & INTERTIES W/ NEIGHBOR UTILITIES	PATROLS FOR OVERWATERING	NONE	N/A	
12 CITIZENS UTILITIES CO. OF CALIFORNIA	EDUCATION & SAWWA CONSERVATION PROGRAM	EDUCATION & SAWWA CONSERVATION PROGRAM	YES, INTERTIES WITH NEIGHBOR UTILITIES	NONE	ADEQUATE SUPPLY AVAIL. PER C.P.U.C. REQMTS.	N/A	
13 SANTA CLARA VALLEY WATER DISTRICT	EDUCATION & PUBLIC AWARENESS	DROUGHT TASK FORCE & WRITTEN DROUGHT PLAN	NO	FINANCIAL PENALTIES	NO CONTROL OVER DEVELOPMENT	N/A	WHOLESALE SUPPLIER
14 NORTHRIDGE WATER DISTRICT	EDUC., ORDINANCE, PUBLIC AWARENESS & PATROLS	(3)	NO	RATIONING NOT CONSIDERED	LANDSCAPE GUIDELINES & FLOW RESTRICTING FAC.	YES	
15 NORTH MARIN WATER DISTRICT	VOLUNTARY RATIONING	EMERGENCY DROUGHT REGULATION	NO, BUT CAN PUMP ADD. WATER FROM RUSSIAN RIV.	VOLUNTARY 20%	NONE	PROVIDED	IMPLEMENTED LONG TERM CONSERV. PLAN
16 INVERNESS P.U.D. WATER SYSTEM	VOLUNTARY CONSERVATION	6-STAGE PROGRAM OF USAGE RESTRICTIONS	YES, INTERTIES W/ NORTH MARIN W.D.	6-STAGE PROGRAM	SYSTEM SIZED FOR BUILD-OUT W/ DROUGHT CONSIDERED	PROVIDED	SYSTEM WAS PRIVATE UNTIL 1980
17 TOKAY PARK WATER COMPANY	EDUCATION	CONSISTENT PUBLIC AWARENESS	NO	CURRENTLY UNDER DISCUSSION	NONE	N/A	EACH CUSTOMER IS A SHAREHOLDER
18 FAIR OAKS WATER DISTRICT	EDUCATION, PATROLS & ODD-EVEN IRRIGATION DAYS	3-STAGE CONSERVATION PROGRAM	YES, PUMPING OF GROUND WATER	3RD STAGE-INC. RATIONING	W.D. HAS LITTLE CONTROL	PROVIDED	
19 MARIN MUNICIPAL WATER DISTRICT	EDUCATION, PRICING & ALLOTMENTS	CONSERVATION EDUCATION & INCREASED RESERVOIR STORAGE	YES, LIMITED SUPPLY FROM OTHER AGENCIES	15%-35% REDUCTION	PREVIOUSLY NOT CONSIDERED BUT RECENTLY BEING REVIEWED	UNDER PREPARATION	
20 CITY OF FOLSOM	ADOPTED ORDINANCE #346	N/A	NO	N/A	N/A	N/A	

FOOTNOTES:

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(1) NOT TO EXCEED 55-60% RUN-TIME OF FULL PUMP CAPACITY (8.4 MGD) BASED ON PAST HISTORICAL RECORDS FOR THE MOST-GALLONS-PUMPED DAY (3.8 MGD) IN THE YEAR.

(2) EDUCATION, LOW FLOW SHOWER DEVICES, WATER DAMS FOR TOILETS, DYE TABLETS FOR LEAK DETECTION & ORDINANCES.

(3) MADE PUMP STATIONS MORE EFFECIENT, STRICTER REGULATIONS, & CONSERVATION EDUCATION.

(4) TO LIVE WITHIN THE YIELD AVAILABLE FROM OUR OWN WATERSHED.

(5) USED 2,448 AC.FT. LESS WATER THAN AVERAGE IN 1977

APPENDIX "B"

RANCHO MURIETA'S PRINCIPAL WATER RIGHT
(APPLICATION 23416, PERMIT 16762)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
STATE WATER RESOURCES CONTROL BOARD
DIVISION OF WATER RIGHTS

PERMIT FOR DIVERSION AND USE OF WATER

AMENDED **PERMIT** 16762

Application 23416 of Bank of America, N.T.&S.A. as Corporate Custodian of the Pension Trust Fund for Operating Engineers c/o Daniel F. Gallery, Attorney, 926 J Building, Sacramento, California 95814

filed on December 19, 1969, has been approved by the State Water Resources Control Board SUBJECT TO VESTED RIGHTS and to the limitations and conditions of this Permit.

Permittee is hereby authorized to divert and use water as follows:

1. Source:

Source	Tributary to:
(1) Cosumnes River	Mokelumne River
(2-8) Unnamed Streams	Cosumnes River
(9) Unnamed Stream	Crevis Creek thence
	Deer Creek thence
	Cosumnes River

2. Location of point of diversion:	40-acre subdivision of public land survey or projection thereof	Section	Township	Range	Base and Meridian
See Supplement Page 2					

County of Sacramento

3. Purpose of use:	4. Place of use:	Section	Township	Range	Base and Meridian	Acres
Municipal						
Recreational						
Industrial	3,600 acres in Sections 2, 3					
	and 4, T7N, R8E, MDB&M; and					
	Sections 26, 27, 28, 33, 34					
	and 35, T8N, R8E, MDB&M					
Irrigation	500 acres net within gross					
	area of the 3,600 acres					

The place of use is shown on map filed with the State Water Resources Control Board.

WRCB 14 (11-70)

(SUPPLEMENT)

2. Location and Point of diversion:	40-acre subdivision of public land survey or projection thereof	Section	Township	Range	Base and Meridian
(1) Cosumnes River - by California Coordinates, zone 2, X = 2,267,670 and Y=303,970	SW¼ of SE¼	35	8N	8E	MD
Diversion and Rediversion					
(2) Chesbro Reservoir - by California Coordinates zone 2, X=2,265,570 and Y=308,460	NW¼ of NW¼	35	8N	8E	MD
Rediversion:					
(3) Laguna Joaquin Reservoir - By California Coordinates, zone 2, X=2,258,230 and Y=304,130	SE¼ of SE¼	33	8N	8E	MD
(4) Peralta Reservoir - by California coordinates, zone 2, X=2,258,400 and Y=307,200	SE¼ of NE¼	33	8N	8E	MD
(5) Clementia Reservoir - by California Coordinates, Zone 2, X=2,267,230 and Y=305,440	NE¼ of SW¼	35	8N	8E	MD
(6) Bass Reservoir - North 1,750 feet and East 1,260 feet from SW corner of Section 35	NW¼ of SW¼	35	8N	8E	MD
(7) Black Bass Reservoir - North 3,900 feet and East 3,170 feet from SW corner of Section 35	SW¼ of NE¼	35	8N	8E	MD
(8) Calero Reservoir - South 1,200 feet and West 2,500 feet from NE Corner of Section 27	NW¼ of NE¼	27	8N	8E	MD

5. The water appropriated shall be limited to the quantity which can be beneficially used and shall not exceed (a) 6 cubic feet per second by direct diversion from the Cosumnes River to be diverted from November 1 of each year to May 31 of the succeeding year, and (b) 4,050 acre-feet per annum by storage to be collected from November 1 of each year to May 31 of the succeeding year as follows:

A. 3,900 acre-feet per annum from the Cosumnes River to be stored as follows:

(1) 1,250 acre-feet per annum in Chesbro Reservoir,
(2) 2,610 acre-feet per annum in Calero Reservoir,
(3) 850 acre-feet per annum in Clementia Reservoir, and
(4) 40 acre-feet per annum in Fairway No. 10 Lower Lake.

The combined amount under (2), (3) and (4) shall not exceed a total of 2,650 acre-feet.

B. 50 acre-feet per annum from an unnamed stream to be stored in Chesbro Reservoir.

C. 100 acre-feet per annum from an unnamed stream to be stored in Calero Reservoir.

The maximum rate of diversion from the Cosumnes River to offstream storage shall not exceed 46 cubic feet per second. The equivalent of the continuous flow allowance by direct diversion for any 7-day period may be diverted in a shorter time if there is no interference with vested rights. The total amount of water to be taken from the source shall not exceed 6,368 acre-feet per water year of October 1 to September 30.

This permit does not authorize collection of water to storage outside of the specified season to offset evaporation and seepage losses or for any other purpose.

6. The amount authorized for appropriation may be reduced in the license if investigation warrants.

7. Said construction work shall be completed on or before December 1, ~~1980~~ 1990

See 1952 Supplement

8. Complete application of the water to the proposed use shall be made on or before December 1, ~~1990~~ 2000

9. Progress reports shall be submitted promptly by permittee when requested by the State Water Resources Control Board until license is issued.

10. Pursuant to California Water Code Sections 100 and 275, all rights and privileges under this permit and under any license issued pursuant thereto, including method of diversion, method of use, and quantity of water diverted, are subject to the continuing authority of the State Water Resources Control Board in accordance with law and in the interest of the public welfare to prevent waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of said water.

The continuing authority of the Board may be exercised by imposing specific requirements over and above those contained in this permit with a view to minimizing waste of water and to meeting the reasonable water requirements of permittee without unreasonable draft on the source. Permittee may be required to implement such programs as (1) reusing or reclaiming the water allocated; (2) using water reclaimed by another entity instead of all or part of the water allocated; (3) restricting diversions so as to eliminate agricultural tailwater or to reduce return flow; (4) suppressing evaporation losses from water surfaces; (5) controlling phreatophytic growth; and (6) installing, maintaining, and operating efficient water measuring devices to assure compliance with the quantity limitations of this permit and to determine accurately water use as against reasonable water requirements for the authorized project. No action will be taken pursuant to this paragraph unless the Board determines, after notice to affected parties and opportunity for hearing, that such specific requirements are physically and financially feasible and are appropriate to the particular situation.

11. Permittee shall allow representatives of the State Water Resources Control Board, employees of Omochumne-Hartnell Water District, and other parties as may be authorized from time to time by said board, reasonable access to project works to detrmine compliance with the terms of this permit.

12. The quantity of water diverted under this permit and under any license issued pursuant thereto is subject to modification by the State Water Resources Control Board if, after notice to the permittee and an opportunity for hearing, the Board finds that such modification is necessary to meet water quality objectives in water quality control plans which have been or hereafter may be established or modified pursuant to Division 7 of the Water Code. No action will be taken pursuant to this paragraph unless the Board finds that (1) adequate waste discharge requirements have been prescribed and are in effect with respect to all waste discharges which have any substantial effect upon water quality in the area involved, and (2) the water quality objectives cannot be achieved solely through the control of waste discharges.

13. No water shall be appropriated under this permit until a public district or some other organization capable, to the satisfaction of the Board, of supplying the place of use on a continuous permanent basis, has been established.

14. Permittee shall install and maintain outlet pipes of adequate capacity in his dams as near as practicable to the bottom of the natural stream channels, or provide other means satisfactory to the State Water Resources Control Board, in order that water entering the reservoirs which is not authorized for appropriation under this permit may be released.

15. In accordance with the requirements of Water Code Section 1393, permittee shall clear the site of the proposed reservoirs of all structures, trees and other vegetation which would interfere with the use of the reservoirs for water storage and recreational purposes.

(3) If on April 1, the total amount that could have been diverted under the foregoing schedule is less than 4,400 acre-feet, then permittee may, during the remainder of the diversion season (April 1 to May 31), divert the flows in excess of 70 cubic feet per second up to a maximum of 46 cubic feet per second.

D. For the purpose of providing maximum continuous downstream fish migration flows as early as possible in the spring months during years when one of the schedules as set forth in paragraphs C(1), C(2), or C(3) above is commenced, the permittee shall continue such diversion schedule (set forth under C(1), C(2), or C(3) respectively) in order to complete the diversion to storage under the permit as soon as possible, and shall not revert to the diversion schedule under B and C above, except for direct diversion to supply its direct diversion requirements during the remainder of the diversion season not to exceed 6 cubic feet per second. The total seasonal diversion shall not exceed 6,368 acre-feet.

E. All measurements of flows shall be determined at the U.S. Geological survey gaging station "Cosumnes River at Michigan Bar."

19. The Board retains jurisdiction over this permit for the purpose of modifying the minimum fisheries flow requirements to conform to future Board determinations and fisheries flow requirements of permits issued pursuant to Applications 5645B, 5646, 5647A, 19266, and 21835.

20. Permittee shall, upon authorization by the U.S. Congress of the Nashville Unit of the Cosumnes River Division of the Federal Central Valley Project, report annually to the Board on the status of negotiations for a firm water supply for the place of use under this permit, to the extent such supply is not available under prior vested rights of permittee.

21. Permittee shall divert no water during the period November 1 to June 1 of each season except during such time as there is a continuous visible surface flow in the bed of Cosumnes River from permittee's point of diversion to the gaging station at Highway 99 known as "Cosumnes River at McConnell."

22. Permittee shall install and maintain measuring devices acceptable to the State Water Resources Control Board to measure accurately the quantity of water diverted from Cosumnes River.

23. No water shall be used under this permit until the permittee has, through grant of easement or dedication or other means satisfactory to the County of Sacramento, provided for access by the general public to Cosumnes River through the proposed place of use. Such access shall be minimum of 50 feet wide on each bank of the River, or such width as may be in conformity with the parkway plan of the County of Sacramento; provided, however, that reasonable public access along the river is maintained.

24. No water shall be used under this permit until the permittee has filed a report of waste discharge with the California Regional Water Quality Control Board, Central Valley Region, pursuant to Water Code Section 13260, and the Regional Board or State Water Resources Control Board has prescribed waste discharge requirements or has indicated that waste discharge requirements are not required. Thereafter, water may be diverted only during such times as all requirements prescribed by the Regional Board or State Board are being met. No discharges of waste to surface water shall be made unless waste discharge requirements are issued by a Regional Board or the State Board. A discharge to groundwater without issuance of a waste discharge requirement may be allowed if after filing the report pursuant to Section 13260:

(1) The Regional Board issues a waiver pursuant to Section 13269, or
(2) The Regional Board fails to act within 120 days of the filing of the report.

No report of waste discharge pursuant to Section 13260 of the Water Code shall be required for percolation to the groundwater of water resulting from the irrigation of crops.

25. In order to prevent degradation of the quality of water during and after construction of the project, prior to commencement of construction permittee shall file a report pursuant to Water Code Section 13260 and shall comply with any waste discharge requirements imposed by the California Regional Water Quality Control Board, Central Valley Region, or by the State Water Resources Control Board.

26. When the flow of treated wastewater reaches 424 acre-feet per annum, permittee shall implement the use of such wastewater for irrigation purposes in lieu of water from other sources as provided in Sections 15550 and 15551 of the Water Code. Such use shall be reported on the annual progress reports filed with the Board.

27. This permit is subject to the agreement dated March 26, 1979 bewteen permittee and Omochumne-Hartnell Water District, to the extent such agreement covers matters within the Board's jurisdiction.

28. Suitable metering and recording devices shall be installed, operated and maintained in good working order by Rancho Murieta at the following locations:

A. On the discharge line of each pumping station located within the forebay of the CIA diversion Canal headworks and which divert water to offstream storage pursuant to Permit 16762. A suitable recording device shall also be installed which will provide a continuous record on a strip or circular chart of rates and time of diversion for each pump.

B. At the headworks of the CIA canal a continuous stage recorder to record diversions into the canal. Direct measurements to be made at least bimonthly to provide an accurate stage-discharge relationship. The recorder may be removed during periods of high water.

C. On any other pumping facilities which divert water from the Cosumnes River including but not limited to those facilities commonly referred to as the:

(1) Bass Lake Pump
(2) Old Bridge Pump
(3) Rock Plant Pump

Totalizing meters will be deemed adequate for the foregoing and for (D) and (E).

D. A meter shall be installed in the Cosumnes Irrigation Association Canal downstream from the Laguna Joaquin Reservoir.

E. At all points where water is withdrawn from storage for beneficial use, except from Fairway No. 10 Upper Lake. Water withdrawn for transfer to another reservoir will also be measured except for transfers among Calero, Clementia and Chesbro or from those reservoirs to the Treatment Plant.

F. For purposes of the measurements described above, hour meters of KWH consumption shall not be considered adequate unless otherwise agreed to.

G. At Calero, Chesbro and Clementia Reservoirs changes in storage will be measured at least monthly, and this information, plus any additional measurements actually made regarding changes of storage, furnished to the Board upon request.

29. Permittee shall devise a method or plan satisfactory to the State Water Resources Control Board to obtain current stream flow data at the U. S. Geological Survey gaging station at Michigan Bar. Such plan shall be submitted to the Chief of the Division of Water Rights within 60 days.

Application 23416 Permit 16762

30. Permittee shall make all reasonable effort to collect local runoff to storage to the extent local runoff is available in lieu of diverting water from the Cosumnes River.

<u>*This permit is issued and permittee takes it*</u> subject to the following provisions of the Water Code:

Section 1390. A permit shall be effective for such time as the water actually appropriated under it is used for a useful and beneficial purpose in conformity with this division (of the Water Code), but no longer.

Section 1391. Every permit shall include the enumeration of conditions therein which in substance shall include all of the provisions of this article and the statement that any appropriator of water to whom a permit is issued takes it subject to the conditions therein expressed.

Section 1392. Every permittee, if he accepts a permit, does so under the conditions precedent that no value whatsoever in excess of the actual amount paid to the State therefor shall at any time be assigned to or claimed for any permit granted or issued under the provisions of this division (of the Water Code), or for any rights granted or acquired under the provisions of this division (of the Water Code), in respect to the regulation by any competent public authority of the services or the price of the services to be rendered by any permittee or by the holder of any rights granted or acquired under the provisions of this division (of the Water Code) or in respect to any valuation for purposes of sale to or purchase, whether through condemnation proceedings or otherwise, by the State or any city, city and county, municipal water district, irrigation district, lighting district, or any political subdivision of the State, of the rights and property of any permittee, or the possessor of any rights granted, issued, or acquired under the provisions of this division (of the Water Code).

Dated: AUGUST 5 1980

STATE WATER RESOURCES CONTROL BOARD

Walter G. Pettit

Chief, Division of Water Rights

STATE OF CALIFORNIA
THE RESOURCES AGENCY
STATE WATER RESOURCES CONTROL BOARD

DIVISION OF WATER RIGHTS

ORDER

APPLICATION 23416 PERMIT 16762 LICENSE

ORDER APPROVING A NEW DEVELOPMENT SCHEDULE
AND AMENDING THE PERMIT

WHEREAS:

1. A petition for extension of time within which to develop the project and apply the water to the proposed use has been filed with the State Water Resources Control Board.

2. The permittee has proceeded with diligence and good cause has been shown for extension of time.

NOW, THEREFORE, IT IS ORDERED THAT:

1. Paragraph 7 of the permit is amended to read as follows:

   CONSTRUCTION WORK SHALL BE
   COMPLETED ON OR BEFORE December 1, 1990

2. Paragraph 8 of the permit is amended to read as follows:

   COMPLETE APPLICATION OF THE
   WATER TO THE PROPOSED USE
   SHALL BE MADE ON OR BEFORE December 1, 2000

3. Paragraph 31 is added to this permit as follows:

   The State Water Resources Control Board, under its authority to conserve the public interest, retains continuing authority over this permit to require permittee to develop and implement a water conservation program, after notice and opportunity for hearing. The requirements for this term may be satisfied by permittee's compliance with any comprehensive water conservation program, approved by the State Water Resources Control Board, which may be imposed by a public agency.

Dated: SEPTEMBER 14 1982

Raymond Walsh

Raymond Walsh, Chief
Division of Water Rights

APPENDIX "C"

COSUMNES RIVER DROUGHT FREQUENCY ANALYSIS
UTILIZING
LOG-PEARSON TYPE III DISTRIBUTION

LOG-PEARSON TYPE III DISTRIBUTION
COSUMNES RIVER ANNUAL YIELD
(AS MEASURED AT MICHIGAN BAR)

ORDER	YEAR	ANNUAL YIELD AC-FT, X	LOG X	$(\log X - \overline{\log X})^2$	$(\log X - \overline{\log X})^3$
1	1908	144,100	5.1586640	0.07822656	-0.02187919
2	1909	596,600	5.7756832	0.11379096	0.03838501
3	1910	462,100	5.6647360	0.05124876	0.01160179
4	1911	876,000	5.9425041	0.25416724	0.12813842
5	1912	138,700	5.1420765	0.08778043	-0.02600738
6	1913	127,400	5.1051694	0.11101202	-0.03698750
7	1914	546,200	5.7373517	0.08939957	0.02673026
8	1915	408,700	5.6114046	0.02994649	0.00518226
9	1916	571,600	5.7570922	0.10159400	0.03238188
10	1917	415,700	5.6187800	0.03255352	0.00587350
11	1918	224,200	5.3506356	0.00769453	-0.00067495
12	1919	259,300	5.4138025	0.00060278	-0.00001480
13	1920	170,600	5.2319790	0.04259067	-0.00878965
14	1921	406,800	5.6093809	0.02925019	0.00500257
15	1922	426,500	5.6299190	0.03669713	0.00702988
16	1923	438,400	5.6418705	0.04141895	0.00842944
17	1924	40,350	4.6058435	0.69307382	-0.57699126
18	1925	380,600	5.5804688	0.02019659	0.00287023
19	1926	147,800	5.1696744	0.07218876	-0.01939565
20	1927	452,400	5.6555226	0.04716216	0.01024214
21	1928	315,600	5.4991370	0.00369456	0.00022457
22	1929	115,300	5.0618293	0.14177091	-0.05338026
23	1930	165,100	5.2177471	0.04866746	-0.01073638
24	1931	45,820	4.6610551	0.60419374	-0.46963919
25	1932	314,300	5.4973444	0.00347985	0.00020528
26	1933	113,200	5.0538464	0.14784614	-0.05684797
27	1934	122,400	5.0877814	0.12290120	-0.04308580
28	1935	369,300	5.5673793	0.01664751	0.00214795
29	1936	522,600	5.7181694	0.07829661	0.02190859
30	1937	399,500	5.6015168	0.02662206	0.00434373
31	1938	683,200	5.8345479	0.15696950	0.06219034
32	1939	92,220	4.9648251	0.22422969	-0.10617925
33	1940	501,800	5.7005307	0.06873655	0.01802111
34	1941	401,600	5.6037937	0.02737027	0.00452813
35	1942	510,200	5.7077405	0.07256901	0.01954910
36	1943	660,100	5.8196097	0.14535587	0.05541774
37	1944	187,900	5.2739268	0.02703634	-0.00444551
38	1945	356,600	5.5521813	0.01295664	0.00147482
39	1946	390,300	5.5913986	0.02342261	0.00358470
40	1947	144,800	5.1607686	0.07705373	-0.02138900
41	1948	269,000	5.4297523	0.00007399	-0.00000064
42	1949	237,400	5.3754807	0.00395306	-0.00024854
43	1950	331,400	5.5203525	0.00672374	0.00055134
44	1951	762,400	5.8821829	0.19698400	0.08742717
45	1952	781,900	5.8931512	0.20684042	0.09407043

ORDER	YEAR	ANNUAL YIELD AC-FT, X	LOG X	$(\text{LOG X} - \overline{\text{LOG X}})^2$	$(\text{LOG X} - \overline{\text{LOG X}})^3$
46	1953	264,400	5.4222615	0.00025897	-0.00000417
47	1954	229,100	5.3600251	0.00613543	-0.00048058
48	1955	178,500	5.2516382	0.03486282	-0.00650944
49	1956	667,400	5.8243862	0.14902079	0.05752681
50	1957	238,200	5.3769418	0.00377147	-0.00023162
51	1958	655,100	5.8163076	0.14284886	0.05399023
52	1959	116,800	5.0674428	0.13757515	-0.05102817
53	1960	150,200	5.1766699	0.06847860	-0.01791976
54	1961	54,910	4.7396514	0.48818539	-0.34109642
55	1962	210,900	5.3240766	0.01305935	-0.00149239
56	1963	453,900	5.6569602	0.04778862	0.01044688
57	1964	143,200	5.1559430	0.07975601	-0.02252398
58	1965	656,000	5.8169038	0.14329991	0.05424615
59	1966	167,900	5.2250507	0.04549834	-0.00970495
60	1967	601,200	5.7790190	0.11605256	0.03953503
61	1968	169,700	5.2296818	0.04354411	-0.00908645
62	1969	679,900	5.8324450	0.15530768	0.06120535
63	1970	448,600	5.6518593	0.04558446	0.00973252
64	1971	332,000	5.5211381	0.00685319	0.00056733
65	1972	182,600	5.2615008	0.03127710	-0.00553146
66	1973	441,900	5.6453240	0.04283654	0.00886588
67	1974	544,900	5.7363168	0.08878178	0.02645366
68	1975	364,500	5.5616975	0.01521360	0.00187650
69	1976	54,870	4.7393350	0.48862774	-0.34156014
70	1977	15,760	4.1975562	1.53957937	-1.91030681
71	1978	453,000	5.6560982	0.04741250	0.01032379
72	1979	309,600	5.4908010	0.00275067	0.00014426
73	1980	565,400	5.7523558	0.09859708	0.03095965
74	1981	117,900	5.0715138	0.13457179	-0.04936636
75	1982	955,200	5.9800943	0.29348247	0.15899126
76	1983	1,221,000	6.0867157	0.42037273	0.27255353
77	1984	597,800	5.7765559	0.11438047	0.03868368
78	1985	163,000	5.2121876	0.05115128	-0.01156870
79	1986	704,600	5.8479426	0.16776278	0.06871371
80	1987	72,880	4.8626084	0.33148314	-0.19085000
81	1988	52,610	4.7210683	0.51449890	-0.36904275
		29,263,420	440.5066813	10.49565224	-3.23266851

MEAN OF LOG (X) = 5.4383541

STANDARD DEVIATION OF LOG (X) = 0.36220940

SKEW COEFFICIENT = -0.87186641

CALCULATION OF ANNUAL YIELD VS. PERCENT CHANCE OF RECURRENCE:

PERCENT CHANCE	RECURRENCE INTERVAL, YR	(1) K	(2) LOG (X)	(3) ANNUAL YIELD
99	1.0101	-2.9381	4.37414664	23,522
80	1.2500	-0.7721	5.15869221	144,109
50	2.0000	0.1435	5.49033114	309,265
20	5.0000	0.8546	5.74789825	559,626
10	10.0000	1.1523	5.85572799	717,345
4	25.0000	1.4185	5.95214813	895,670
2	50.0000	1.565	6.00521181	1,012,073
1	100.000	1.6809	6.04719188	1,114,787
0.5	200.000	1.7748	6.08120334	1,205,600

FOOTNOTES:

(1) VALUES OF K FROM LOG-PEARSON TYPE III DISTRIBUTION TABLE (CHOW, MAIDMENT & MAYS (1988) AND LINSLEY, KOHLER & PAULHUS (1975)).
(2) LOG X = (MEAN OF LOG (X)) + (STANDARD DEVIATION OF LOG (X) * K).
(3) ANNUAL YIELD (ACRE-FEET) = INVERSE (LOG(X)).
(4) MEAN ANNUAL YIELD OF COSUMNES RIVER = INVERSE (MEAN LOG (X)) = 274,381 ACRE-FEET.

CHI-SQUARE TEST FOR GOODNESS OF FIT
OF LOG-PEARSON TYPE III DISTRIBUTION
FOR COSUMNES RIVER ANNUAL YIELD

ANNUAL YIELD	OBSERVED FREQ., Fo	PROBABILITY OF OCCURENCE	EXPECTED FREQ., Fe	(Fo-Fe)	$(Fo-Fe)^2$	$(Fo-Fe)^2$ / Fe
<100	8	0.113	9.153	-1.153	1.329	0.145
100 - 200	20	0.187	15.147	4.853	23.552	1.555
200 - 300	8	0.175	14.175	-6.175	38.131	2.690
300 - 400	11	0.150	12.150	-1.150	1.323	0.109
400 - 500	12	0.120	9.720	2.280	5.198	0.535
500 - 600	9	0.088	7.128	1.872	3.504	0.492
600 - 700	7	0.061	4.941	2.059	4.239	0.858
>700	6	0.106	8.586	-2.586	6.687	0.779
TOTAL	81	1.000	81.000	CHI-SQUARE =		7.162

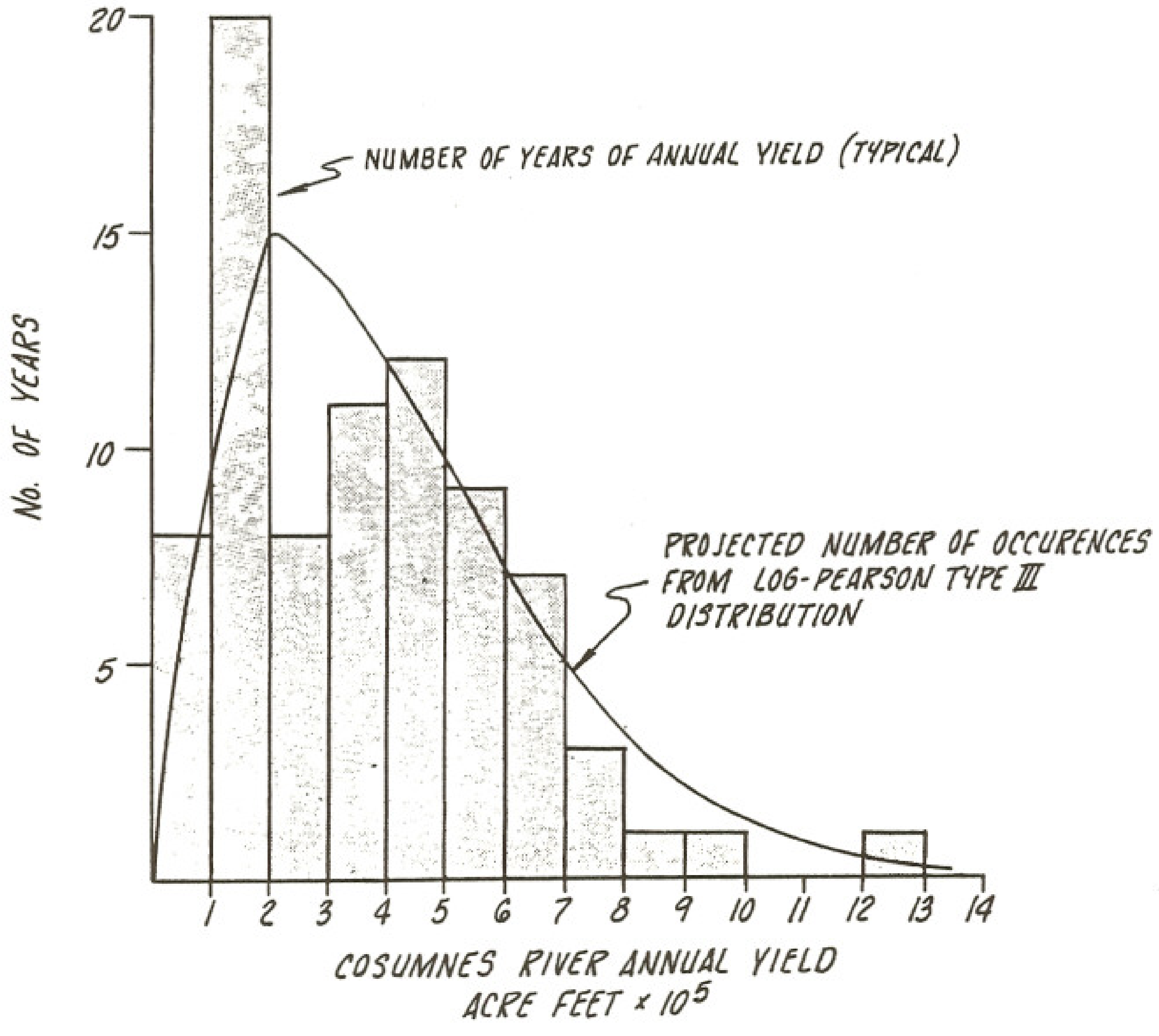
FOOTNOTES:

1. ANNUAL YIELD IN THOUSANDS OF ACRE-FEET AS MEASURED AT MICHIGAN BAR.

2. PROBABILITY OF OCCURENCE IS FROM LOG-PEARSON TYPE III DISTRIBUTION.

3. CHI-SQUARE FOR 95% CONFIDENCE INTERVAL AND 5 DEGREES OF FREEDOM IS 11.070 (CLARK & SCHKADE 1979). THEREFORE, DO NOT REJECT THE NULL HYPOTHESIS. THE OBSERVED DISTRIBUTION IS DRAWN FROM A PARENT POPULATION THAT IS LOG-PEARSON TYPE III DISTRIBUTED.

FREQUENCY DISTRIBUTION OF
ANNUAL YIELD OF COSUMNES RIVER
AS MEASURED AT MICHIGAN BAR

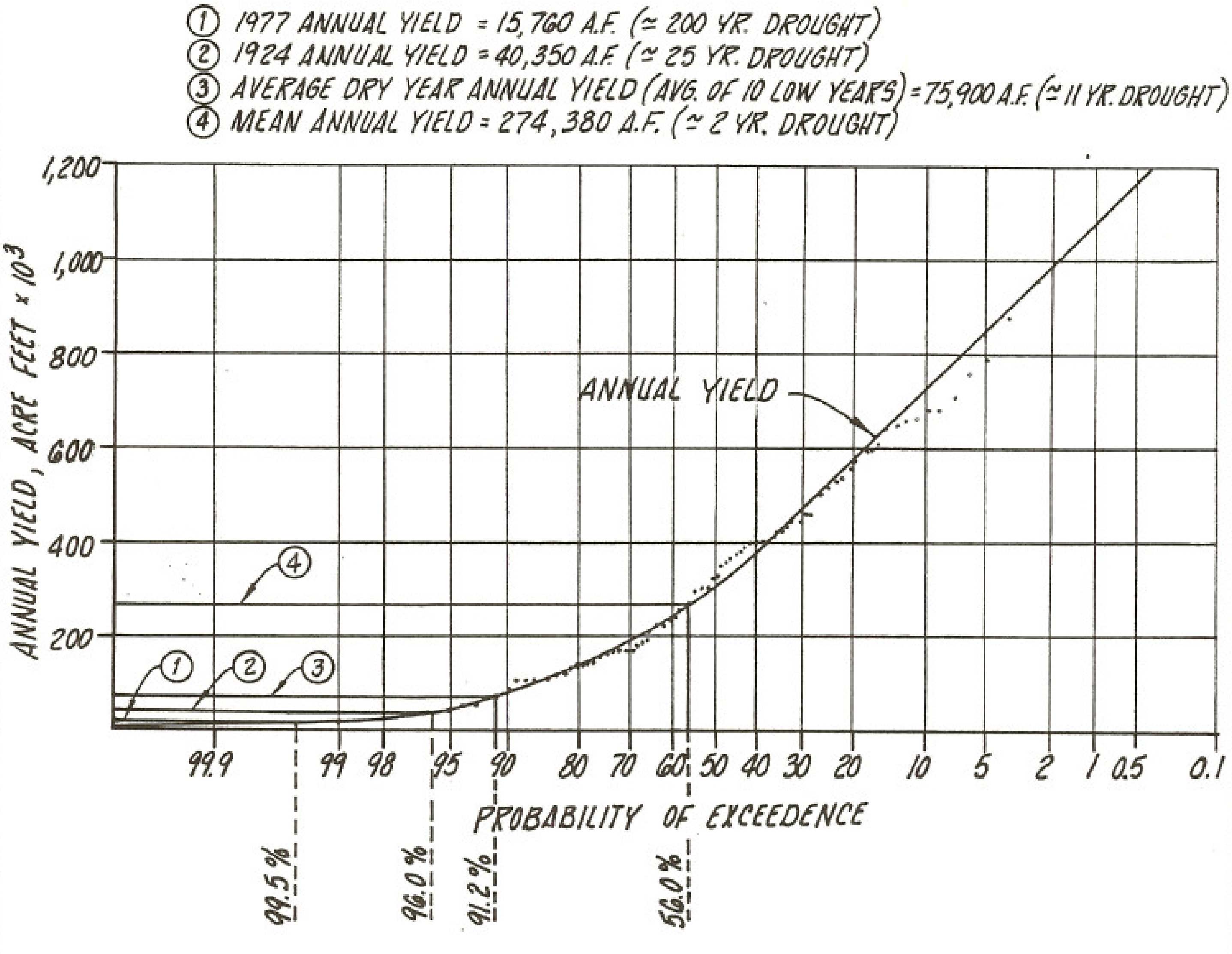


COSUMNES RIVER ANNUAL YIELD RANKED IN
DESCENDING ORDER OF MAGNITUDE AND
PLOTTING POSITION

RANK	WATER YEAR	FLOW, AF	PLOTTING POSITION	RANK	WATER YEAR	FLOW, AF	PLOTTING POSITION
1	1983	1,221,000	0.0122	43	1928	315,600	0.5244
2	1982	955,200	0.0244	44	1932	314,300	0.5366
3	1911	876,000	0.0366	45	1979	309,600	0.5488
4	1952	781,900	0.0488	46	1948	269,000	0.5610
5	1951	762,400	0.0610	47	1953	264,400	0.5732
6	1986	704,600	0.0732	48	1919	259,300	0.5854
7	1938	683,200	0.0854	49	1957	238,200	0.5976
8	1969	679,900	0.0976	50	1949	237,400	0.6098
9	1956	667,400	0.1098	51	1954	229,100	0.6220
10	1943	660,100	0.1220	52	1918	224,200	0.6341
11	1965	656,000	0.1341	53	1962	210,900	0.6463
12	1958	655,100	0.1463	54	1944	187,900	0.6585
13	1967	601,200	0.1585	55	1972	182,600	0.6707
14	1984	597,800	0.1707	56	1955	178,500	0.6829
15	1907	596,600	0.1829	57	1920	170,600	0.6951
16	1916	571,600	0.1951	58	1968	169,700	0.7073
17	1980	565,400	0.2073	59	1966	167,900	0.7195
18	1914	546,200	0.2195	60	1930	165,100	0.7317
19	1974	544,900	0.2317	61	1985	163,000	0.7439
20	1936	522,600	0.2439	62	1960	150,200	0.7561
21	1942	510,200	0.2561	63	1926	147,800	0.7683
22	1940	501,800	0.2683	64	1947	144,800	0.7805
23	1963	453,900	0.2805	65	1908	144,100	0.7927
24	1978	453,000	0.2927	66	1964	143,200	0.8049
25	1927	452,400	0.3049	67	1912	138,700	0.8171
26	1970	448,600	0.3171	68	1913	127,400	0.8293
27	1973	441,900	0.3293	69	1934	122,400	0.8415
28	1923	438,400	0.3415	70	1981	117,900	0.8537
29	1910	432,100	0.3537	71	1959	116,800	0.8659
30	1922	426,500	0.3659	72	1929	115,300	0.8780
31	1917	415,700	0.3780	73	1933	113,200	0.8902
32	1915	408,700	0.3902	74	1939	92,220	0.9024
33	1921	406,800	0.4024	75	1987	72,880	0.9146
34	1941	401,600	0.4146	76	1961	54,910	0.9268
35	1937	399,500	0.4268	77	1976	54,870	0.9390
36	1946	390,300	0.4390	78	1988	52,610	0.9512
37	1925	380,600	0.4512	79	1931	45,820	0.9634
38	1935	369,300	0.4634	80	1924	40,350	0.9756
39	1975	364,500	0.4756	81	1977	15,760	0.9878
40	1945	356,600	0.4878				
41	1971	332,000	0.5000				
42	1950	331,400	0.5122				

PLOTTING PROBABILITY = RANK/(N+1) (CHOW, MAIDMENT & MAYS 1988)

LOG-PEARSON TYPE III DISTRIBUTION
ANNUAL YIELD OF COSUMNES RIVER
AS MEASURED AT MICHIGAN BAR



APPENDIX "D"

COSUMNES RIVER FLOW DATA
AS MEASURED AT MICHIGAN BAR
FOR
THE ELEVEN LOWEST WATER YEARS OF RECORD
(1924,1929,1931,1939,1959,1961,1976,1977,1987, & 1988)

SOURCE: U.S. GEOLOGICAL SURVEY (1989)

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1923 TO SEPTEMBER 1924
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	31	31	33	68	105	85	116	95	8.0	1.0	.00	.00
2	26	33	52	57	105	85	110	95	8.0	.90	.00	.00
3	22	33	42	42	128	85	105	89	8.0	.50	.00	.00
4	22	31	40	128	105	85	162	95	7.0	.50	.00	.00
5	24	31	31	101	95	85	168	85	5.5	.20	.00	.00
6	42	31	33	85	89	85	131	85	5.5	.00	.00	.00
7	52	31	48	68	345	82	128	76	5.5	.50	.00	.00
8	85	31	76	68	910	75	172	68	5.0	.20	.00	.00
9	68	36	61	85	600	68	188	68	5.5	.00	.00	.00
10	52	42	54	76	400	68	188	68	5.5	.00	.00	.00
11	42	42	40	68	320	68	188	61	5.5	.00	.00	.00
12	42	42	42	54	248	68	188	61	5.5	.00	.00	.00
13	42	42	44	54	225	71	181	65	5.5	.00	.00	.00
14	36	40	54	54	188	67	172	54	5.5	.00	.00	.00
15	31	36	95	54	172	65	168	54	5.5	.00	.00	.00
16	31	38	68	54	155	61	155	52	5.5	.00	.00	.00
17	31	31	54	54	139	55	128	42	4.8	.00	.00	.00
18	31	31	54	48	128	54	128	42	4.2	.00	.00	.00
19	31	31	57	42	128	54	128	33	3.5	.00	.00	.00
20	31	31	48	42	128	54	128	31	3.0	.00	.00	.00
21	31	31	42	52	128	54	128	30	3.0	.00	.00	.00
22	31	31	42	54	123	68	128	26	3.0	.00	.00	.00
23	31	31	42	48	105	71	128	22	3.0	.00	.00	.00
24	31	31	42	54	105	85	142	22	2.2	.00	.00	.00
25	31	31	48	44	103	101	133	19	2.1	.00	.00	.00
26	31	31	61	61	95	142	123	20	1.5	.00	.00	.00
27	31	31	82	128	85	155	105	17	1.5	.00	.00	.00
28	31	31	68	248	85	133	105	16	1.5	.00	.00	.00
29	31	31	48	188	83	128	103	14	1.5	.00	.00	.00
30	31	40	68	155	---	128	103	12	1.2	.00	.00	.00
31	31	---	71	123	---	116	---	12	---	.00	.00	---
TOTAL	1113	1013	1640	2457	5625	2601	4230	1529	132.5	3.80	.00	.00
MEAN	35.9	33.8	52.9	79.3	194	83.9	141	49.3	4.42	.12	.000	.000
MAX	85	42	95	248	910	155	188	95	8.0	1.0	.00	.00
MIN	22	31	31	42	83	54	103	12	1.2	.00	.00	.00
AC-FT	2210	2010	3250	4870	11160	5160	8390	3030	263	7.5	.00	.00

CAL YR 1923 TOTAL 165671.40 MEAN 454 MAX 5490 MIN 2.6 AC-FT 328600
WTR YR 1924 TOTAL 20344.30 MEAN 55.6 MAX 910 MIN .00 AC-FT 40350

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1928 TO SEPTEMBER 1929
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.0	13	29	98	120	111	325	504	132	61	5.5	.80
2	7.0	15	29	98	470	115	320	525	136	51	5.0	.80
3	7.0	15	31	132	815	115	320	525	115	51	5.0	.80
4	7.0	15	36	228	2800	126	345	490	115	51	5.0	.80
5	7.5	16	38	132	1010	136	720	490	115	51	4.0	.90
6	8.5	22	38	98	640	136	525	490	115	45	3.8	.90
7	8.5	22	38	98	430	136	460	460	100	39	2.5	.90
8	9.5	29	31	84	320	141	442	460	111	37	2.5	.90
9	9.5	28	29	78	250	136	680	460	136	29	2.5	1.0
10	9.0	22	34	63	210	1240	460	430	199	29	2.2	1.0
11	8.5	22	56	63	192	860	430	370	157	26	2.2	1.0
12	7.5	22	98	63	177	640	442	370	136	26	2.2	1.0
13	8.0	38	84	63	177	460	370	370	115	28	1.8	1.0
14	8.5	109	63	63	157	370	370	370	111	23	1.8	.90
15	9.5	160	60	63	136	320	400	345	106	22	1.0	.90
16	9.5	72	56	102	136	320	442	370	511	21	1.0	.80
17	9.5	63	50	70	132	320	490	370	460	18	1.0	.80
18	10	50	50	63	132	320	490	320	320	15	1.0	.80
19	10	38	44	322	132	320	600	320	291	15	.80	.90
20	10	38	38	295	119	315	765	296	237	13	.80	.90
21	10	36	38	200	115	281	640	271	229	12	.80	.90
22	10	36	38	160	115	271	640	271	192	11	.80	.90
23	10	34	44	132	115	320	600	237	149	10	.80	.90
24	10	29	50	132	115	430	560	229	115	10	.80	.90
25	10	29	120	109	113	320	560	210	115	9.0	.80	.90
26	10	29	248	98	111	320	504	192	100	7.5	.80	1.0
27	10	29	145	98	106	296	490	162	96	5.0	.80	1.0
28	10	29	145	98	106	325	525	136	88	5.0	.80	1.0
29	10	29	228	98	---	350	490	136	79	5.0	.80	1.0
30	10	29	160	98	---	370	490	134	76	5.0	.80	1.0
31	10	---	132	120	---	370	---	119	---	5.0	.80	---
TOTAL	281.5	1118	2280	3619	9451	10290	14895	10432	4957	735.5	60.40	27.30
MEAN	9.08	37.3	73.5	117	338	332	497	337	165	23.7	1.95	.91
MAX	10	160	248	322	2800	1240	765	525	511	61	5.5	1.0
MIN	7.0	13	29	63	106	111	320	119	76	5.0	.80	.80
AC-FT	558	2220	4520	7180	18750	20410	29540	20690	9830	1460	120	54

CAL YR 1928 TOTAL 151227.00 MEAN 413 MAX 17400 MIN 2.0 AC-FT 300000
WTR YR 1929 TOTAL 58146.70 MEAN 159 MAX 2800 MIN .80 AC-FT 115300

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1930 TO SEPTEMBER 1931
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.0	8.5	35	42	78	136	141	123	19	7.0	.00	.00
2	7.0	8.5	32	162	85	130	139	119	17	5.5	.00	.00
3	10	9.0	30	230	80	126	136	111	15	4.8	.00	.00
4	10	9.0	30	126	76	126	134	111	14	3.6	.00	.00
5	10	9.0	29	119	80	126	132	106	13	2.8	.00	.00
6	10	9.5	28	141	100	121	128	98	12	2.8	.00	.00
7	8.5	9.5	27	106	91	109	123	91	12	2.1	.00	.00
8	7.5	9.5	26	82	82	106	121	87	13	2.1	.00	.00
9	7.0	10	26	72	76	100	121	76	14	2.1	.00	.00
10	7.0	10	26	59	78	98	117	68	13	1.8	.00	.00
11	7.0	10	25	54	82	150	115	63	13	1.7	.00	.00
12	8.5	10	25	51	111	400	128	58	12	1.3	.00	.00
13	10	15	26	50	139	280	113	54	10	1.1	.00	.00
14	10	22	28	49	234	212	113	55	9.5	1.0	.00	.00
15	11	40	32	46	602	184	107	59	10	.90	.00	.00
16	11	42	32	45	310	168	102	60	12	.70	.00	.00
17	10	198	28	50	230	165	100	50	68	.50	.00	.00
18	10	178	26	60	256	272	100	43	96	.40	.00	.00
19	9.5	96	24	50	879	490	102	38	58	.30	.00	.00
20	9.0	62	22	45	450	345	104	34	39	.20	.00	.00
21	8.5	49	24	45	290	300	104	30	30	.20	.00	.00
22	8.5	43	22	44	230	275	100	26	24	.10	.00	.00
23	8.5	37	17	116	197	250	111	24	20	.00	.00	.00
24	8.5	34	18	320	174	226	139	25	16	.00	.00	.00
25	8.5	32	18	193	157	238	139	30	14	.00	.00	.00
26	8.5	30	19	139	144	212	121	48	12	.00	.00	.00
27	8.0	29	20	117	159	187	132	51	10	.00	.00	.00
28	8.0	29	22	100	154	174	152	51	8.5	.00	.00	.00
29	8.5	31	22	89	---	162	139	39	8.0	.00	.00	.00
30	8.5	35	22	83	---	149	132	26	7.0	.00	.00	.00
31	8.5	---	23	78	---	144	---	22	---	.00	.00	---
TOTAL	271.5	1114.5	784	2963	5624	6161	3645	1876	619.0	43.00	.00	.00
MEAN	8.76	37.2	25.3	95.6	201	199	122	60.5	20.6	1.39	.000	.000
MAX	11	198	35	320	879	490	152	123	96	7.0	.00	.00
MIN	6.0	8.5	17	42	76	98	100	22	7.0	.00	.00	.00
AC-FT	539	2210	1560	5880	11160	12220	7230	3720	1230	85	.00	.00

CAL YR 1930 TOTAL 82158.20 MEAN 225 MAX 4360 MIN 1.0 AC-FT 163000
WTR YR 1931 TOTAL 23101.00 MEAN 63.3 MAX 879 MIN .00 AC-FT 45820

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1932 TO SEPTEMBER 1933
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.7	7.0	22	26	126	105	380	416	704	83	7.5	.10
2	2.8	7.5	39	26	107	111	416	482	626	76	7.0	.10
3	2.9	7.5	33	29	93	117	464	446	563	72	7.0	.10
4	2.4	7.5	26	32	83	138	528	416	507	68	7.5	.10
5	2.4	9.5	22	35	81	143	549	434	458	60	8.0	.10
6	2.6	12	19	36	78	138	535	446	470	56	8.5	.10
7	3.7	13	18	32	76	149	521	494	500	53	6.5	.10
8	3.5	12	16	30	69	165	482	633	482	50	5.5	.10
9	3.5	12	15	28	69	191	434	514	470	48	5.5	.10
10	7.5	12	15	28	69	201	380	542	464	44	4.2	.20
11	8.0	11	16	27	68	205	345	482	440	42	3.2	.30
12	5.5	11	16	25	177	240	335	464	428	38	2.6	.30
13	4.9	11	14	24	295	712	340	458	416	33	2.0	.40
14	4.5	11	13	27	194	458	360	458	392	30	1.4	.30
15	4.5	11	14	28	143	335	392	500	365	28	1.1	.30
16	4.5	11	18	27	165	416	422	556	330	26	1.0	.40
17	4.5	11	21	27	201	738	392	584	290	25	.80	.40
18	4.5	10	24	30	178	488	350	584	248	24	.70	.40
19	4.5	10	40	51	138	380	310	563	224	21	.70	.40
20	4.5	10	54	83	113	340	276	556	197	19	.50	.40
21	4.9	10	81	66	105	350	266	570	171	16	.50	.40
22	5.5	10	62	72	101	345	266	612	154	15	.50	.40
23	5.5	10	49	110	97	315	315	549	146	15	.50	.50
24	5.5	10	56	118	99	280	392	542	133	13	.40	.50
25	5.5	10	53	205	95	244	428	577	124	13	.30	.50
26	5.5	10	39	138	90	262	416	633	111	11	.20	.40
27	6.0	10	35	210	92	240	370	656	105	10	.30	.60
28	6.5	10	32	302	99	354	392	696	103	9.0	.30	.70
29	7.0	11	31	329	---	577	446	747	103	8.5	.30	1.0
30	7.0	14	26	326	---	446	482	783	92	8.0	.30	2.0
31	7.0	---	26	165	---	380	---	774	---	7.5	.20	---
TOTAL	149.8	312.0	945	2692	3301	9563	11984	17167	9816	1022.0	85.00	11.70
MEAN	4.83	10.4	30.5	86.8	118	308	399	554	327	33.0	2.74	.39
MAX	8.0	14	81	329	295	738	549	783	704	83	8.5	2.0
MIN	2.4	7.0	13	24	68	105	266	416	92	7.5	.20	.10
AC-FT	297	619	1870	5340	6550	18970	23770	34050	19470	2030	169	23

CAL YR 1932 TOTAL 142920.60 MEAN 390 MAX 7340 MIN 1.1 AC-FT 283500
WTR YR 1933 TOTAL 57048.50 MEAN 156 MAX 783 MIN .10 AC-FT 113200

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1938 TO SEPTEMBER 1939
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	27	112	77	62	151	159	487	201	80	12	.80	.00
2	25	135	91	62	112	143	550	191	72	10	.70	.00
3	34	117	91	63	162	146	668	182	66	10	.70	.00
4	58	87	126	66	230	143	644	172	62	10	.70	.00
5	42	80	121	144	171	133	620	163	60	10	.70	.00
6	38	82	98	325	209	133	592	155	59	10	.60	.00
7	39	75	89	177	444	146	578	150	56	10	.50	.00
8	36	69	82	135	613	226	571	141	54	10	.30	.00
9	37	62	79	117	282	1500	550	129	48	10	.10	.00
10	39	63	77	104	235	1060	515	134	45	9.0	.10	.00
11	37	87	72	97	222	536	487	158	40	7.5	.10	.00
12	35	82	69	93	200	382	474	155	36	7.0	.10	.00
13	33	70	66	87	200	330	438	131	34	6.0	.10	.00
14	35	64	68	86	183	320	404	124	31	4.8	.10	.00
15	70	63	69	80	165	284	360	118	32	4.2	.10	.00
16	102	63	69	80	177	279	345	105	37	3.8	.00	.00
17	70	60	68	79	168	306	330	97	46	3.5	.00	.00
18	58	57	66	75	162	350	325	88	41	2.5	.00	.00
19	52	57	66	77	168	404	320	82	39	2.1	.00	.00
20	45	57	80	77	174	456	315	80	35	2.1	.00	.00
21	44	57	108	84	177	487	310	93	31	1.9	.00	.00
22	43	57	93	93	168	522	302	201	29	1.8	.00	.00
23	43	56	82	84	168	536	288	254	24	1.5	.00	.00
24	42	53	75	77	171	543	270	185	21	1.4	.00	.00
25	41	53	70	74	180	571	246	155	19	1.3	.00	.00
26	40	54	69	74	174	636	238	147	17	1.2	.00	.00
27	39	54	66	82	162	754	226	131	16	1.0	.00	.00
28	38	53	64	108	156	660	223	127	15	1.0	.00	.00
29	38	56	64	115	---	564	216	109	14	.90	.00	11
30	44	64	63	158	---	508	208	99	12	.90	.00	13
31	89	---	63	222	---	480	---	89	---	.80	.00	---
TOTAL	1413	2099	2441	3257	5784	13697	12100	4346	1171	158.20	5.70	24.00
MEAN	45.6	70.0	78.7	105	207	442	403	140	39.0	5.10	.18	.80
MAX	102	135	126	325	613	1500	668	254	80	12	.80	13
MIN	25	53	63	62	112	133	208	80	12	.80	.00	.00
AC-FT	2800	4160	4840	6460	11470	27170	24000	8620	2320	314	11	48

CAL YR 1938 TOTAL 333017.00 MEAN 912 MAX 15500 MIN 14 AC-FT 660500
WTR YR 1939 TOTAL 46495.90 MEAN 127 MAX 1500 MIN .00 AC-FT 92220

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1958 TO SEPTEMBER 1959
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	34	42	55	144	387	413	241	66	18	26	3.8
2	26	33	42	54	131	409	445	263	63	18	25	3.3
3	24	33	42	51	123	427	466	250	61	17	26	3.3
4	25	33	42	49	121	440	466	234	59	15	26	3.0
5	25	33	43	49	117	445	480	218	57	13	25	2.2
6	25	33	43	123	113	431	466	202	54	15	25	1.9
7	25	34	43	176	109	427	466	192	53	35	24	2.4
8	27	33	43	109	107	418	418	170	56	36	20	2.2
9	29	34	44	157	109	405	382	164	54	38	19	1.9
10	29	36	43	1100	264	382	360	167	51	38	19	2.5
11	30	39	43	676	1200	369	342	160	49	36	33	2.5
12	31	44	43	610	613	360	342	154	47	35	33	1.9
13	30	44	43	550	364	356	329	144	42	34	34	1.8
14	30	44	43	320	280	360	315	141	36	35	34	2.5
15	29	64	43	231	260	342	293	133	33	35	33	2.5
16	29	85	42	189	1960	329	275	121	32	34	33	2.2
17	29	62	42	160	2590	315	263	115	31	33	35	3.3
18	30	53	40	141	2320	307	254	115	30	32	35	12
19	31	49	41	129	2210	302	237	113	30	31	26	43
20	33	53	42	121	1200	293	225	109	29	29	25	100
21	35	53	44	113	1010	284	225	105	28	29	20	62
22	36	49	47	107	753	284	215	98	26	29	19	40
23	36	47	48	103	613	293	205	98	24	29	19	29
24	36	47	54	237	508	369	208	98	22	29	22	24
25	36	44	53	347	445	320	208	103	20	27	19	22
26	36	44	54	387	409	320	457	109	19	26	11	18
27	36	44	77	257	396	369	445	100	19	22	7.4	17
28	36	43	121	234	391	338	307	88	20	21	5.8	17
29	37	43	87	208	---	320	260	82	20	20	4.5	16
30	36	43	66	176	---	329	244	77	19	20	4.0	15
31	36	---	59	160	---	445	---	72	---	23	3.8	---
TOTAL	959	1330	1559	7379	18860	11175	10011	4436	1150	852	691.5	458.2
MEAN	30.9	44.3	50.3	238	674	360	334	143	38.3	27.5	22.3	15.3
MAX	37	85	121	1100	2590	445	480	263	66	38	35	100
MIN	24	33	40	49	107	284	205	72	19	13	3.8	1.8
AC-FT	1900	2640	3090	14640	37410	22170	19860	8800	2280	1690	1370	909

CAL YR 1958 TOTAL 327851.0 MEAN 898 MAX 20100 MIN 22 AC-FT 650300
WTR YR 1959 TOTAL 58860.7 MEAN 161 MAX 2590 MIN 1.8 AC-FT 116800

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1960 TO SEPTEMBER 1961
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.2	13	50	40	94	65	228	187	103	17	27	20
2	4.2	13	230	38	149	65	232	204	99	16	27	18
3	4.0	14	252	34	153	66	242	180	97	29	21	17
4	3.0	14	134	32	142	70	242	170	92	37	14	17
5	4.5	14	94	37	106	71	256	164	82	36	13	12
6	4.5	15	76	38	88	74	242	161	76	37	11	10
7	4.5	16	62	37	80	83	221	197	70	37	9.6	11
8	5.0	15	56	39	76	82	204	184	65	35	11	11
9	15	19	52	39	80	80	180	174	64	35	14	9.0
10	16	22	52	38	88	103	170	174	60	37	16	7.4
11	15	21	53	37	123	94	161	246	52	39	17	6.2
12	15	21	51	37	260	88	156	249	52	41	16	5.0
13	14	36	48	37	174	87	187	232	49	44	11	4.0
14	14	103	45	37	130	82	156	218	41	43	9.0	4.0
15	13	87	46	36	125	231	153	210	37	42	8.6	3.8
16	14	58	45	37	150	274	139	197	34	37	8.6	2.5
17	13	43	45	36	132	322	139	190	27	41	12	2.5
18	13	39	44	36	114	294	137	180	38	38	13	3.2
19	13	45	46	36	103	221	137	177	45	35	11	2.8
20	12	58	46	35	94	221	128	174	45	31	11	2.0
21	12	45	45	35	90	238	121	174	42	30	13	2.2
22	12	37	43	35	85	221	150	164	41	29	13	3.2
23	12	32	43	35	83	242	228	156	50	23	11	4.2
24	11	29	43	36	78	286	228	145	46	21	11	4.5
25	11	29	42	36	76	405	164	134	40	26	11	5.0
26	11	72	42	46	72	338	159	130	37	25	11	5.0
27	11	161	42	60	71	306	153	121	34	26	11	4.5
28	12	88	42	74	68	330	156	112	25	26	11	3.8
29	13	61	39	71	---	270	167	106	19	24	14	4.2
30	13	48	37	62	---	238	177	101	19	19	18	4.0
31	13	---	37	106	---	228	---	95	---	23	19	---
TOTAL	331.9	1268	1982	1332	3084	5775	5413	5306	1581	979	423.8	209.0
MEAN	10.7	42.3	63.9	43.0	110	186	180	171	52.7	31.6	13.7	6.97
MAX	16	161	252	106	260	405	256	249	103	44	27	20
MIN	3.0	13	37	32	68	65	121	95	19	16	8.6	2.0
AC-FT	658	2520	3930	2640	6120	11450	10740	10520	3140	1940	841	415

CAL YR 1960 TOTAL 77776.8 MEAN 213 MAX 6300 MIN 2.0 AC-FT 154300
WTR YR 1961 TOTAL 27684.7 MEAN 75.8 MAX 405 MIN 2.0 AC-FT 54910

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1975 TO SEPTEMBER 1976
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	157	81	80	58	253	127	144	46	7.2	2.4	8.8
2	21	116	85	68	60	271	126	151	45	7.0	3.1	7.1
3	21	97	91	64	60	236	126	151	42	6.2	3.3	7.1
4	21	87	92	82	60	200	120	144	39	5.8	2.6	6.3
5	20	82	89	97	68	176	120	144	39	6.7	3.9	6.0
6	21	77	84	86	74	159	121	143	39	7.1	4.4	6.1
7	22	74	85	82	72	149	121	143	42	5.5	4.4	5.9
8	35	74	83	77	71	145	132	132	37	7.1	4.8	5.3
9	52	93	80	78	74	141	168	129	37	7.6	6.2	4.2
10	61	97	82	90	81	140	152	137	38	6.3	6.3	4.9
11	134	119	85	88	87	134	170	147	39	5.9	4.9	8.1
12	219	105	87	82	78	135	177	127	33	7.1	4.4	8.8
13	117	92	96	80	77	131	164	117	28	6.3	4.8	37
14	87	87	101	75	108	129	158	109	25	4.8	4.9	31
15	74	86	90	75	168	130	159	101	23	4.8	7.5	24
16	66	114	76	73	137	130	178	95	20	5.9	42	19
17	60	130	83	72	126	133	161	88	18	5.2	85	18
18	59	128	83	72	128	140	154	81	18	4.5	47	16
19	57	105	79	70	140	169	157	72	15	3.9	33	13
20	56	92	76	67	226	168	161	69	14	4.0	27	13
21	59	93	74	65	169	152	167	64	14	3.3	23	13
22	50	90	84	65	147	151	173	63	14	3.9	27	13
23	47	86	132	65	130	149	174	63	13	4.3	26	11
24	48	83	125	65	119	145	171	60	12	3.2	24	11
25	52	81	103	64	109	148	172	57	11	2.8	20	11
26	65	80	97	63	103	155	173	53	9.5	3.3	17	11
27	266	82	92	60	100	145	164	55	8.9	2.9	17	11
28	224	90	89	64	98	134	155	51	8.8	1.7	15	11
29	141	104	87	64	106	128	147	50	7.8	2.4	12	11
30	137	90	86	62	---	123	143	48	7.0	2.9	10	10
31	197	---	84	62	---	124	---	48	---	2.0	9.1	---
TOTAL	2510	2891	2761	2257	3034	4823	4591	3036	743.0	151.6	502.0	362.6
MEAN	81.0	96.4	89.1	72.8	105	156	153	97.9	24.8	4.89	16.2	12.1
MAX	266	157	132	97	226	271	178	151	46	7.6	85	37
MIN	20	74	74	60	58	123	120	48	7.0	1.7	2.4	4.2
AC-FT	4980	5730	5480	4480	6020	9570	9110	6020	1470	301	996	719

CAL YR 1975 TOTAL 185989.0 MEAN 510 MAX 7000 MIN 20 AC-FT 368900
WTR YR 1976 TOTAL 27662.2 MEAN 75.6 MAX 271 MIN 1.7 AC-FT 54870

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1976 TO SEPTEMBER 1977
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	13	20	19	23	44	39	29	32	1.1	.00	.00
2	12	12	20	24	25	45	34	54	31	.60	.00	.00
3	14	11	20	47	24	41	31	68	27	.09	.00	.00
4	20	10	21	122	22	36	33	47	22	.40	.00	.00
5	24	9.3	19	83	22	36	32	37	20	.38	.00	.00
6	20	9.8	20	52	23	33	30	35	19	.30	.00	.00
7	17	9.8	20	39	24	31	31	34	19	.11	.00	.00
8	15	9.7	20	30	24	32	36	37	18	.00	.00	.00
9	16	11	19	26	27	33	42	43	16	.00	.00	.00
10	15	11	18	24	32	40	51	48	13	.00	.00	.00
11	13	8.9	19	24	36	56	52	66	12	.00	.00	.00
12	13	12	19	27	30	47	43	75	11	.00	.00	.00
13	12	12	19	26	28	59	38	74	14	.00	.00	.00
14	11	18	18	26	27	67	36	63	15	.00	.00	.00
15	11	32	18	25	26	57	36	54	14	.00	.00	.00
16	10	72	18	23	26	56	36	52	12	.00	.00	.00
17	9.5	48	18	23	26	52	36	53	11	.00	.00	.00
18	9.4	34	17	23	26	47	35	56	8.6	.00	.00	.00
19	11	28	18	23	22	42	36	51	8.1	.00	.00	.00
20	11	24	17	24	23	38	35	46	6.6	.00	.00	.00
21	12	22	17	25	28	37	34	40	6.5	.00	.00	.00
22	12	21	17	27	98	37	28	40	5.4	.00	.00	.00
23	12	21	17	30	134	37	24	41	4.0	.00	.00	.00
24	13	20	17	33	98	39	23	44	4.3	.00	.00	.00
25	13	20	18	34	79	52	28	48	3.8	.00	.00	.00
26	12	20	18	30	58	51	26	52	2.3	.00	.00	.00
27	13	20	16	28	48	45	27	49	2.0	.00	.00	.00
28	17	19	16	27	45	40	28	46	2.4	.00	.00	.00
29	18	19	16	26	---	40	25	45	1.7	.00	.00	.00
30	19	22	18	25	---	39	27	40	.66	.00	.00	.00
31	16	---	18	24	---	39	---	35	---	.00	.00	---
TOTAL	431.9	599.5	566	1019	1104	1348	1012	1502	362.36	2.98	.00	.00
MEAN	13.9	20.0	18.3	32.9	39.4	43.5	33.7	48.5	12.1	.096	.000	.000
MAX	24	72	21	122	134	67	52	75	32	1.1	.00	.00
MIN	9.4	8.9	16	19	22	31	23	29	.66	.00	.00	.00
AC-FT	857	1190	1120	2020	2190	2670	2010	2980	719	5.9	.00	.00

CAL YR 1976 TOTAL 21097.60 MEAN 57.6 MAX 271 MIN 1.7 AC-FT 41850
WTR YR 1977 TOTAL 7947.74 MEAN 21.8 MAX 134 MIN .00 AC-FT 15760

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1986 TO SEPTEMBER 1987
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	62	38	52	48	82	97	227	180	45	12	4.6	.98
2	54	39	50	51	84	96	221	169	43	11	4.3	1.0
3	49	38	47	77	135	94	220	144	39	11	3.8	.59
4	46	37	45	231	144	93	237	130	36	11	3.5	.45
5	43	36	45	186	110	545	219	121	34	10	3.5	.38
6	42	36	49	112	90	1450	203	114	33	9.8	3.3	.10
7	39	35	52	88	80	634	195	109	32	9.6	2.8	.15
8	39	34	52	76	74	395	194	102	30	9.7	2.4	.53
9	39	35	50	68	71	327	196	100	28	9.6	2.0	.55
10	38	36	48	62	69	282	195	104	27	9.0	1.6	.24
11	38	36	45	58	80	263	200	97	25	8.3	1.7	.94
12	38	36	45	57	159	287	203	122	22	7.5	1.7	1.3
13	38	36	44	56	1040	1380	201	102	22	7.1	1.4	1.5
14	38	36	45	56	1160	1030	190	92	22	6.9	1.2	2.1
15	38	36	45	55	668	1150	187	79	21	6.9	1.2	2.6
16	38	36	45	50	584	840	184	72	21	6.7	1.0	2.8
17	38	37	45	44	348	591	178	66	22	6.2	.92	2.1
18	39	37	45	41	250	473	177	63	26	5.4	1.1	2.4
19	39	37	46	53	201	463	176	60	23	4.7	1.3	2.3
20	40	38	54	59	171	412	162	57	21	4.3	1.1	2.8
21	40	40	75	54	151	375	151	57	20	4.2	1.0	2.4
22	40	43	72	51	141	381	145	67	20	4.2	1.1	2.7
23	39	47	64	51	135	415	146	70	19	4.2	1.0	2.9
24	39	47	62	54	127	485	145	63	19	4.4	1.0	2.3
25	39	44	60	60	120	388	142	57	18	4.8	1.3	2.8
26	39	42	55	84	113	333	141	54	17	5.2	1.6	2.5
27	39	41	52	77	103	297	142	53	15	5.3	1.1	2.0
28	38	40	50	87	100	279	134	52	13	5.5	1.2	2.1
29	38	42	50	143	---	257	135	51	12	5.5	1.2	2.2
30	38	45	48	123	---	241	140	50	12	5.0	1.0	2.1
31	38	---	48	95	---	232	---	47	---	4.9	.85	---
TOTAL	1262	1160	1585	2407	6590	14585	5386	2704	737	219.9	56.77	49.81
MEAN	40.7	38.7	51.1	77.6	235	470	180	87.2	24.6	7.09	1.83	1.66
MAX	62	47	75	231	1160	1450	237	180	45	12	4.6	2.9
MIN	38	34	44	41	69	93	134	47	12	4.2	.85	.10
AC-FT	2500	2300	3140	4770	13070	28930	10680	5360	1460	436	113	99

CAL YR 1986 TOTAL 345531.00 MEAN 947 MAX 34400 MIN 18 AC-FT 685400
WTR YR 1987 TOTAL 36742.48 MEAN 101 MAX 1450 MIN .10 AC-FT 72880

UNITED STATES DEPARTMENT OF INTERIOR - GEOLOGICAL SURVEY PROCESS DATE IS 12-01-89

STATION NUMBER 11335000 COSUMNES RIVER AT MICHIGAN BAR CALIF STREAM SOURCE AGENCY USGS
LATITUDE 383001 LONGITUDE 1210239 DRAINAGE AREA 536.00 DATUM 168.09 STATE 06 COUNTY 067

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
PROVISIONAL DATA MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.84	32	29	76	148	219	99	168	72	13	.00	.00
2	1.6	26	31	58	136	416	95	160	65	11	.04	.00
3	1.4	23	37	91	129	245	92	149	58	11	.01	.00
4	.74	21	42	153	118	210	92	140	52	10	.01	.00
5	1.2	22	38	241	112	190	91	135	46	9.1	.00	.00
6	1.8	22	37	292	106	184	88	128	44	8.1	.00	.00
7	1.7	22	38	203	107	178	85	134	45	7.4	.00	.00
8	1.0	21	103	168	103	172	86	137	47	7.7	.00	.00
9	1.7	22	87	165	101	165	87	139	52	6.9	.00	.00
10	1.9	22	71	155	101	163	86	131	51	6.3	.00	.00
11	1.5	21	89	193	103	157	83	122	45	6.5	.00	.00
12	1.9	21	83	270	104	147	83	115	40	6.0	.00	.00
13	3.6	24	67	184	108	139	85	112	38	5.5	.00	.00
14	4.1	30	54	152	110	132	95	107	35	4.5	.00	.00
15	3.9	36	42	182	110	127	144	103	32	5.1	.00	.00
16	5.9	42	44	538	110	123	133	101	29	4.9	.00	.00
17	6.0	36	49	953	110	119	118	100	28	4.2	.00	.00
18	8.5	34	49	559	107	113	111	109	26	4.3	.00	.00
19	12	32	45	281	106	109	144	104	25	3.9	.00	.00
20	8.4	34	41	202	101	108	344	95	23	3.4	.00	.00
21	8.4	38	42	172	98	108	343	86	23	2.7	.00	.00
22	8.5	51	43	153	97	108	224	79	22	3.1	.00	.00
23	9.8	47	83	142	99	108	251	74	21	1.9	.00	.00
24	11	38	106	133	99	107	224	70	22	1.4	.00	.00
25	24	33	64	129	99	114	197	66	19	2.1	.00	.00
26	32	30	48	128	100	112	187	63	18	1.7	.00	.00
27	25	29	49	129	102	113	186	55	18	1.1	.00	.00
28	22	29	73	129	109	114	189	53	17	.25	.00	.00
29	20	27	192	129	134	111	183	55	16	.38	.00	.00
30	29	27	144	145	---	106	176	76	14	.09	.00	.00
31	42	---	103	166	---	102	---	86	---	.01	.00	---
TOTAL	301.38	892	2023	6671	3167	4619	4401	3252	1043	153.53	.06	.00
MEAN	9.72	29.7	65.3	215	109	149	147	105	34.8	4.95	.002	.000
MAX	42	51	192	953	148	416	344	168	72	13	.04	.00
MIN	.74	21	29	58	97	102	83	53	14	.01	.00	.00
AC-FT	598	1770	4010	13230	6280	9160	8730	6450	2070	305	.1	.00

CAL YR 1987 TOTAL 35951.86 MEAN 98.5 MAX 1450 MIN .10 AC-FT 71310
WTR YR 1988 TOTAL 26522.97 MEAN 72.5 MAX 953 MIN .00 AC-FT 52610

APPENDIX "E"

WATER BUDGET
FOR
25-YEAR DROUGHT AND FULL DEVELOPMENT

NORMAL ANNUAL CONSUMPTION
FOR
25-YEAR DROUGHT AND FULL DEVELOPMENT
(5,968 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	2,125	LOTS @ 750 GPD =	1,593,750.0	GPD
ESTATE LOTS-NORTH (E):	494	LOTS @ 750 GPD =	370,500.0	GPD
ESTATE LOTS-SOUTH (F):	1,300	LOTS @ 650 GPD =	845,000.0	GPD
COTTAGE LOTS (E):	197	LOTS @ 500 GPD =	98,500.0	GPD
CIRCLE LOTS (E):	457	LOTS @ 550 GPD =	251,350.0	GPD
TOWNHOUSE LOTS (E):	389	LOTS @ 350 GPD =	136,150.0	GPD
MOBIL HOME LOTS (E):	189	LOTS @ 200 GPD =	37,800.0	GPD
OTHER SEASONAL:			134,065.0	GPD
PARKS:		80 ACRES =	249,951.0	GPD
SUB-TOTAL SEASONALLY VARIABLE		=	3,717,066.0	GPD
		=	4,163.9	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	51.7	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	172.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	224.5	A.F./YEAR

SUB-TOTAL	4,388.4	A.F./YEAR
+10% SYSTEM LOSS	438.8	A.F./YEAR
TOTAL M & I	4,827.3	A.F./YEAR

NOTES:

(1) TOTAL RESIDENTIAL DWELLING UNITS = 5189 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 25-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 0%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	574.6	1.6	21.9	9.2	14.2	66.4	27.9	43.1	701.6	701.6	0.0	0.0	0.0	9.7	3.9	6.1	0.0	13.6	13.6	1,934.5	1,144.0	807.5	
JULY	638.8	1.6	18.0	9.2	14.0	56.7	29.0	44.8	753.3	1,454.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6	1,181.2	1,144.0	748.7	
AUGUST	625.0	1.4	12.3	9.2	13.6	34.0	25.3	37.7	707.2	2,162.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.6	474.0	1,144.0	697.4	
SEPTEMBER	507.8	1.2	7.2	8.5	13.4	15.2	18.1	28.5	558.0	2,720.1	0.0	0.0	0.0	5.3	2.1	3.3	0.0	7.4	21.0	300.0	767.4	658.8	
OCTOBER	443.6	1.0	(6.3)	7.0	13.2	(10.0)	11.2	21.2	462.8	3,182.9	0.0	0.0	0.0	(6.2)	2.5	3.9	0.0	2.5	23.5	(289.9)	308.1	628.3	
NOVEMBER	287.9	0.0	(6.2)	4.2	12.9	(4.9)	3.3	10.3	295.4	3,478.3	0.0	0.0	0.0	(6.7)	2.7	4.2	24.6	2.7	26.2	(285.5)	50.0	599.3	
DECEMBER	242.1	0.0	(6.1)	(1.9)	12.8	(2.2)	(0.8)	5.1	242.1	3,720.4	0.0	0.0	14.0	(10.2)	(4.1)	6.4	37.5	14.0	40.2	(287.4)	(51.4)	397.2	
JANUARY	205.5	0.0	(6.4)	(3.8)	13.0	(2.5)	(1.5)	5.2	205.5	3,925.9	0.0	0.0	192.0	(19.3)	(7.7)	12.1	71.2	192.0	232.2	(297.8)	(53.8)	467.0	
FEBRUARY	191.7	0.0	10.5	7.8	13.5	8.4	6.3	10.8	224.8	4,150.7	700.0	1,114.7	191.7	21.5	8.6	13.5	79.3	2,036.5	2,268.7	997.8	1,144.0	535.5	
MARCH	246.6	0.0	13.4	9.2	13.8	18.8	12.8	19.2	300.8	4,451.5	0.0	0.0	192.0	12.8	5.1	8.0	47.2	209.9	2,478.6	906.9	1,144.0	557.7	
APRIL	361.2	0.0	19.4	9.2	13.8	38.1	18.0	27.0	445.9	4,897.4	1,806.9	0.0	350.0	3.3	1.3	2.1	12.2	2,161.5	4,640.1	2,622.5	1,144.0	531.2	
MAY	503.1	0.0	22.6	9.2	13.5	57.0	23.1	34.1	615.0	5,512.4	0.0	0.0	194.0	0.6	0.3	0.4	0.0	194.9	4,835.0	2,202.4	1,144.0	484.0	
TOTAL	4,827.9	6.8	125.3	82.8		294.6	175.0		5,512.4		2,506.9	1,114.7	1,133.7	53.2	26.5			4,835.0					

EXPLANATION OF WATER BUDGET WORKSHEETS

COLUMN 1

Domestic water requirements for the level of development being analyzed as explained in Chapter 4 and shown in the water budget calculations.

COLUMN 2

Miscellaneous irrigation is water required to make up seepage and evaporation from Lake Guadalupe.

COLUMNS 3, 4 AND 5

Seepage is that water lost from a lake or reservoir due to percolation as explained in Chapter 4. The figures shown are for the average surface area during the month.

COLUMNS 6, 7 AND 8

This is the evaporation from the surface of a lake or reservoir as explained in Chapter 4. The figures shown are for the average surface area during the month.

COLUMN 9

This is the total water demands for each month (Columns 1 through 7 except Column 5). Clementia Reservoir seepage and evaporation losses are not made up from water stored in Calero and Chesbro Reservoirs.

COLUMN 10

The cumulative total of the monthly demands.

COLUMNS 11, 12 AND 13

The amount of water diverted from the Cosumnes River during each month as explained in Chapter 3.

COLUMNS 14, 15 AND 16

This represents the rainfall occurring on an area equal to the area of the given lake or reservoir at its spillway water surface area as explained in Chapter 3.

COLUMN 17

The expected runoff from approximately 1,150 acre of land above Clementia Lake for the rainfall as explained in Chapter 3 (runoff coefficient = 0.30).

COLUMN 18

The total raw water supply from all sources for the month except columns 16 and 17. Clementia Reservoir direct rainfall and runoff are counted only in the end of month balance for that reservoir.

COLUMN 19

The cumulative total of all monthly water supplies.

COLUMNS 20, 21 AND 22

The total amount of water in storage for each major reservoir at the end of the month in Acre Feet.

COLUMN 23

The total cumulative shortfall in unmet raw water demands - a net deficit. These values do not include allowances for seepage and evaporation losses of the unmet demand.

NOTES (1) Analysis indicates that Clementia Reservoir will fill during an average dry year by mid-spring from natural runoff, that is, river diversions are not normally required to fill the reservoir. Once filled by natural runoff, seepage and evaporation losses begin to reduce the reservoir level below its maximum level of

907 AF. Analysis indicated that Clementia Reservoir storage will be 858.7 AF on June 1st of an average dry year. Accordingly, all water budgets assume that the volume of water in Clementia Reservoir on June 1st is 858.7 AF.

(2) Valves shown in parenthesis ( ) indicates that the reservoir volume is below the minimum (dead) pool elevation and that the reservoir is out of the storage system. While the actual volume in storage may exceed the dead pool volume by a nominal amount, judgment indicates that the reservoir volume is not sufficient to classify the reservoir as "in-use". These positive valves are not included in totals for the month.

(3) Domestic demands include a 10% allowance for system losses (leakage, fireflow, etc.).

(4) Water budgets for the 100-year and 200-year droughts assume that normal water consumption occurs until February 1st of the first water year. After that time the water consumption

rate is reduced to correspond with the appropriate level of conservation being studied.

APPENDIX "F"

WATER BUDGETS
FOR
200-YEAR DROUGHT AND FULL DEVELOPMENT

NORMAL ANNUAL CONSUMPTION
FOR
200-YEAR DROUGHT AND FULL DEVELOPMENT
(5,968 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	2,125	LOTS @ 750 GPD =		1,593,750.0	GPD
ESTATE LOTS-NORTH (E):	494	LOTS @ 750 GPD =		370,500.0	GPD
ESTATE LOTS-SOUTH (F):	1,300	LOTS @ 650 GPD =		845,000.0	GPD
COTTAGE LOTS (E):	197	LOTS @ 500 GPD =		98,500.0	GPD
CIRCLE LOTS (E):	457	LOTS @ 550 GPD =		251,350.0	GPD
TOWNHOUSE LOTS (E):	389	LOTS @ 350 GPD =		136,150.0	GPD
MOBIL HOME LOTS (E):	189	LOTS @ 200 GPD =		37,800.0	GPD
OTHER SEASONAL:				134,065.0	GPD
PARKS:		80 ACRES =		249,951.0	GPD
SUB-TOTAL SEASONALLY VARIABLE			=	3,717,066.0	GPD
			=	4,163.9	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	51.7	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	172.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	224.5	A.F./YEAR

SUB-TOTAL	4,388.4	A.F./YEAR
+10% SYSTEM LOSS	438.8	A.F./YEAR
TOTAL M & I	4,827.3	A.F./YEAR

NOTES:

(1) TOTAL RESIDENTIAL DWELLING UNITS = 5189 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 0%

RAW WATER DEMANDS (AC.-FT.)

MONTH	1 DOMESTIC	2 MISC. IRRIG.	3 SEEPAGE CALERO	4 SEEPAGE CHESBRO	5 SEEPAGE CLEMENTIA	6 EVAPORATION CALERO	7 EVAPORATION CHESBRO	8 EVAPORATION CLEMENTIA	9 TOTALS MONTH	10 TOTALS CUMUL.
JUNE	574.6	1.6	21.9	9.2	14.2	66.4	27.9	43.1	701.6	701.6
JULY	638.8	1.6	18.0	9.2	14.0	56.7	29.0	44.1	753.3	1,454.9
AUGUST	625.0	1.4	12.3	9.2	13.7	34.0	25.3	37.7	707.2	2,162.1
SEPTEMBER	507.8	1.2	7.2	8.5	13.4	15.2	18.1	28.5	558.0	2,720.1
OCTOBER	443.6	1.0	(7.2)	7.1	13.3	(11.5)	11.3	21.2	463.0	3,183.1
NOVEMBER	287.9	0.0	(5.3)	4.1	12.8	(4.2)	3.3	10.3	295.3	2,478.4
DECEMBER	242.1	0.0	(6.1)	(1.8)	11.2	(2.3)	(0.7)	4.5	242.1	3,720.5
JANUARY	205.5	0.0	(6.1)	(2.0)	9.2	(2.5)	(0.8)	3.7	205.5	3,926.0
FEBRUARY	191.7	0.0	(6.2)	(2.0)	8.9	(4.9)	(1.6)	7.2	191.7	4,117.7
MARCH	246.6	0.0	(6.2)	(2.0)	7.8	(8.6)	(2.8)	10.9	246.6	4,364.3
APRIL	361.2	0.0	(6.1)	(1.9)	4.8	(11.9)	(3.8)	9.5	361.2	4,725.5
MAY	503.1	0.0	(5.9)	(1.8)	3.7	(14.9)	(4.6)	9.2	503.1	5,228.6
TOTAL	4,827.9	6.8	59.4	47.3		172.3	114.9		5,228.6	

RAW WATER SUPPLY (AC.-FT.) / STORAGE

MONTH	11 RIVER DIVERSION CALERO	12 RIVER DIVERSION CHESBRO	13 RIVER DIVERSION DIRECT	14 DIRECT RAINFALL CALERO	15 DIRECT RAINFALL CHESBRO	16 DIRECT RAINFALL CLEMENTIA	17 RUNOFF CLEMENTIA	18 TOTALS MONTH	19 TOTALS CUMUL.	20 END OF MONTH BALANCE CALERO	21 END OF MONTH BALANCE CHESBRO	22 END OF MONTH BALANCE CLEMENTIA	23 CUM. SHRTFALL
JUNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,920.9	1,144.0	801.4	
JULY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,167.6	1,144.0	743.3	
AUGUST	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	469.0	1,144.0	697.3	
SEPTEMBER	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	300.0	767.3	663.1	
OCTOBER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	(281.3)	304.3	628.6	
NOVEMBER	0.0	0.0	4.0	(6.7)	2.7	5.8	0.0	6.7	27.6	(278.5)	50.0	577.0	
DECEMBER	0.0	0.0	0.0	(6.7)	(2.7)	5.8	25.0	0.0	27.6	(276.8)	(50.2)	350.0	
JANUARY	0.0	0.0	24.0	(14.7)	(5.9)	12.8	54.0	24.0	51.6	(282.9)	(53.3)	222.4	
FEBRUARY	0.0	0.0	230.9	(11.8)	(4.7)	10.3	44.0	230.9	282.5	(283.6)	(54.4)	299.8	
MARCH	0.0	0.0	0.0	(14.4)	(5.8)	12.6	53.0	0.0	282.5	(283.2)	(55.4)	100.1	
APRIL	0.0	0.0	0.0	(3.8)	(1.5)	3.4	14.0	0.0	282.5	(289.0)	(51.2)	50.0	308.1
MAY	0.0	0.0	18.0	(8.1)	(3.2)	7.0	30.0	18.0	300.5	(256.3)	(48.0)	50.0	719.1
TOTAL			276.9	14.9	8.7			300.5					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 0%

	RAW WATER DEMANDS (AC.-FT.)									
	1	2	3	4	5	6	7	8	9	10
			SEEPAGE			EVAPORATION			TOTALS	
MONTH	DOMESTIC	MISC. IRRIG.	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.
JUNE	574.6	1.6	(5.7)	(1.7)	3.7	(17.4)	(5.3)	11.1	576.2	576.2
JULY	638.8	1.6	(5.5)	(1.6)	2.7	(17.2)	(4.9)	8.5	640.4	1,216.6
AUGUST	625.0	1.4	(5.2)	(1.4)	2.1	(11.0)	(2.9)	4.6	626.4	1,843.0
SEPTEMBER	507.8	1.2	(5.0)	(1.3)	2.0	(10.7)	(2.7)	4.2	509.0	2,352.0
OCTOBER	443.6	1.0	(5.0)	(1.2)	2.9	(8.0)	(2.0)	4.7	444.6	2,796.6
NOVEMBER	287.9	0.0	(5.0)	(1.4)	3.7	(4.0)	(1.1)	2.9	287.9	3,084.5
DECEMBER	242.1	0.0	(5.3)	(1.7)	3.7	(2.1)	(0.7)	1.5	242.1	3,326.6
JANUARY	205.5	0.0	(5.6)	4.2	6.9	(2.3)	1.7	2.8	211.4	3,538.0
FEBRUARY	191.7	0.0	(6.0)	7.9	9.4	(4.8)	9.1	7.5	208.7	3,746.7
MARCH	246.6	0.0	12.3	9.2	10.3	17.2	12.8	14.4	298.1	4,044.8
APRIL	361.2	0.0	18.8	9.2	10.9	36.8	18.0	21.3	444.0	4,488.8
MAY	503.1	0.0	22.1	9.2	10.9	55.7	23.1	27.4	613.2	5,102.0
TOTAL	4,827.9	6.8	53.2	39.7		109.7	64.7		5,102.0	

	RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	11	12	13	14	15	16	17	18	19	20	21	22	23
	RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	0.0	0.0	0.0	(1.4)	(0.6)	0.9	0.0	0.0	0.0	(234.6)	(41.6)	36.1	1,295.3
JULY	0.0	0.0	0.0	(0.6)	(0.2)	0.4	0.0	0.0	0.0	(212.5)	(35.3)	25.3	1,935.7
AUGUST	0.0	0.0	0.0	(1.0)	(0.4)	0.6	0.0	0.0	0.0	(197.3)	(31.3)	19.2	2,562.1
SEPTEMBER	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	0.0	(184.8)	(28.6)	15.0	3,071.1
OCTOBER	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	0.0	(181.5)	(29.3)	48.0	3,515.7
NOVEMBER	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	58.8	(197.4)	(36.8)	50.0	3,649.1
DECEMBER	0.0	0.0	122.1	(32.4)	(12.9)	20.6	114.7	122.1	180.9	(222.4)	(47.3)	60.1	
JANUARY	0.0	250.2	205.5	(45.0)	18.0	28.6	159.6	473.7	654.6	(259.5)	309.6	238.6	
FEBRUARY	54.5	854.9	191.7	(31.6)	12.6	20.1	112.1	1,113.7	1,768.3	(370.8)	1,144.0	353.9	
MARCH	900.0	0.0	246.6	23.5	9.4	14.9	83.2	1,179.5	2,947.8	1,234.3	1,144.0	427.3	
APRIL	900.0	0.0	350.0	15.5	6.2	9.9	54.9	1,271.7	4,219.5	2,062.0	1,144.0	459.9	
MAY	818.4	0.0	350.0	3.8	1.5	2.4	0.0	1,173.7	5,393.2	2,622.5	1,144.0	424.0	
TOTAL	2,672.9	1,105.1	1,524.7	42.8	47.7			5,393.2					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		MISC.	SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	574.6	1.6	21.9	9.2	14.2	66.4	27.9	43.1	701.6	701.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,920.9	1,144.0	801.4	
JULY	638.8	1.6	18.0	9.2	14.0	56.7	29.0	44.1	753.3	1,454.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,167.6	1,144.0	743.3	
AUGUST	625.0	1.4	12.3	9.2	13.7	34.0	25.3	37.7	707.2	2,162.1	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	469.0	1,144.0	697.3	
SEPTEMBER	507.8	1.2	7.2	8.5	13.4	15.2	18.1	28.5	558.0	2,720.1	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	300.0	767.3	663.1	
OCTOBER	443.6	1.0	(7.2)	7.1	13.3	(11.5)	11.3	21.2	463.0	3,183.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	(281.3)	304.3	628.6	
NOVEMBER	287.9	0.0	(5.3)	4.1	12.8	(4.2)	3.3	10.3	295.3	3,478.4	0.0	0.0	4.0	(6.7)	2.7	5.8	0.0	6.7	27.6	(278.5)	50.0	577.0	
DECEMBER	242.1	0.0	(6.1)	(1.8)	11.4	(2.3)	(0.7)	4.6	242.1	3,720.5	0.0	0.0	0.0	(6.7)	(2.7)	5.8	25.0	0.0	27.6	(276.8)	(54.2)	349.7	
JANUARY	205.5	0.0	(6.1)	(2.0)	9.2	(2.5)	(0.8)	3.7	205.5	3,926.0	0.0	0.0	24.0	(14.4)	(5.9)	12.8	54.0	24.0	51.6	(282.9)	(53.3)	222.1	
FEBRUARY	201.5	0.0	(6.2)	(2.0)	9.0	(4.9)	(1.6)	7.2	201.5	4,127.5	0.0	0.0	230.9	(11.8)	(4.7)	10.3	44.0	230.9	282.5	(283.6)	(54.4)	289.6	
MARCH	260.0	0.0	(6.2)	(2.0)	7.7	(8.6)	(2.8)	10.7	260.0	4,387.5	0.0	0.0	0.0	(14.4)	(5.8)	12.6	53.0	0.0	282.5	(283.2)	(55.4)	76.8	
APRIL	284.2	0.0	(6.1)	(1.9)	4.3	(11.9)	(3.8)	8.4	284.2	4,671.7	0.0	0.0	0.0	(3.8)	(1.5)	3.4	14.0	0.0	282.5	(269.0)	(51.2)	50.0	262.7
MAY	335.9	0.0	(5.9)	(1.8)	3.7	(14.9)	(4.6)	9.2	335.9	5,007.6	0.0	0.0	18.0	(8.1)	(3.2)	7.0	30.0	18.0	300.5	(256.3)	(48.0)	74.1	580.6
TOTAL	4,606.9	6.8	59.4	47.3		172.3	114.9		5,007.6				276.9	14.9	8.7			300.5					

higher than w/o conservation

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM. SHRTFAL
JUNE	377.7	0.0	(5.7)	(1.7)	4.6	(17.4)	(5.3)	13.9	377.7	377.7	0.0	0.0	0.0	(1.4)	(0.6)	0.2	0.0	0.0	0.0	(234.6)	(41.6)	56.5	958.3
JULY	429.6	0.0	(5.5)	(1.6)	3.6	(17.2)	(4.9)	11.4	429.6	807.3	0.0	0.0	0.0	(0.6)	(0.2)	0.4	0.0	0.0	0.0	(212.5)	(35.3)	41.9	1387.9
AUGUST	360.6	0.0	(5.2)	(1.4)	3.0	(11.0)	(2.9)	8.4	360.6	1,167.9	0.0	0.0	0.0	(1.0)	(0.4)	0.6	0.0	0.0	0.0	(197.3)	(31.3)	31.1	1748.5
SEPTEMBER	332.4	0.0	(5.0)	(1.3)	2.6	(10.7)	(2.7)	5.5	332.4	1,500.3	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	0.0	(184.8)	(28.6)	25.0	2080.9
OCTOBER	332.4	0.0	(5.0)	(1.2)	3.2	(8.0)	(2.0)	5.2	332.4	1,832.7	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	0.0	(181.5)	(29.3)	57.2	2413.3
NOVEMBER	304.9	0.0	(5.0)	(1.4)	5.8	(4.0)	(1.1)	4.6	304.9	2,137.6	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	58.8	(197.4)	(36.8)	151.1	2718.2
DECEMBER	256.6	0.0	(5.3)	(1.7)	8.2	(2.1)	(0.7)	3.3	256.6	2,394.2	0.0	0.0	122.1	(32.4)	(12.9)	20.6	114.7	122.1	180.9	(222.4)	(47.3)	274.9	2974.8
JANUARY	218.7	0.0	(5.6)	4.2	10.0	(2.3)	1.7	4.0	224.6	2,618.8	0.0	237.0	218.7	(45.0)	18.0	28.6	159.6	473.7	654.6	(259.5)	296.4	449.1	
FEBRUARY	191.7	0.0	(6.0)	7.9	11.7	(4.8)	9.1	9.3	208.7	2,827.5	57.4	852.0	191.7	(31.6)	12.6	20.1	112.1	1,113.7	1,768.3	(337.7)	1,144.0	560.3	
MARCH	246.6	0.0	12.3	9.2	12.8	17.2	12.8	17.9	298.1	3,125.6	900.0	0.0	246.6	23.5	9.4	14.9	83.2	1,179.5	2,947.8	1,219.5	1,144.0	627.7	
APRIL	361.2	0.0	18.8	9.2	13.2	36.8	18.0	25.9	444.0	3,569.6	900.0	0.0	350.0	15.5	6.2	9.9	54.9	1,271.7	4,219.5	2,046.8	1,144.0	653.4	
MAY	503.1	0.0	22.1	9.2	13.2	55.7	23.1	33.2	613.2	4,182.8	833.6	0.0	350.0	3.8	1.5	2.4	0.0	1,188.9	5,408.4	2,622.5	1,144.0	609.4	
TOTAL	3,915.5	0.0	53.2	39.7		109.7	64.7		4,182.8		2,691.0	1,089.0	1,537.9	42.8	47.7			5,408.4					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 50%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	574.6	1.6	21.9	9.2	14.2	66.4	27.9	43.1	701.6	701.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,920.9	1,144.0	801.4	
JULY	638.8	1.6	18.0	9.2	14.0	56.7	29.0	44.1	753.3	753.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,167.6	1,144.0	743.3	
AUGUST	625.0	1.4	12.3	9.2	13.7	34.0	25.3	37.7	707.2	2,162.1	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	469.0	1,144.0	697.3	
SEPTEMBER	507.8	1.2	7.2	8.5	13.4	15.2	18.1	28.5	558.0	2,720.1	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	300.0	767.3	663.1	
OCTOBER	443.6	1.0	(7.2)	7.1	13.3	(11.5)	11.3	21.2	463.0	3,183.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	(281.3)	304.3	628.6	
NOVEMBER	287.9	0.0	(5.3)	4.1	12.8	(4.2)	3.3	10.3	295.3	3,478.4	0.0	0.0	4.0	(6.7)	2.7	5.8	0.0	6.7	27.6	(278.5)	54.0	577.0	
DECEMBER	242.1	0.0	(6.1)	(1.8)	11.4	(2.3)	(0.7)	4.6	242.1	3,720.5	0.0	0.0	0.0	(6.7)	(2.7)	5.8	25.0	0.0	27.6	(276.8)	(50.2)	349.7	
JANUARY	205.5	0.0	(6.1)	(2.0)	9.2	(2.5)	(0.8)	3.7	205.5	3,926.0	0.0	0.0	24.0	(14.4)	(5.9)	12.8	54.0	24.0	51.6	(282.9)	(53.3)	222.1	
FEBRUARY	191.1	0.0	(6.2)	(2.0)	9.1	(4.9)	(1.6)	7.2	191.1	4,117.1	0.0	0.0	230.9	(11.8)	(4.7)	10.3	44.0	230.9	282.5	(283.6)	(54.4)	299.9	
MARCH	200.4	0.0	(6.2)	(2.0)	8.4	(8.6)	(2.8)	11.8	200.4	4,317.5	0.0	0.0	0.0	(14.4)	(5.8)	12.6	53.0	0.0	282.5	(283.2)	(55.4)	144.9	
APRIL	207.4	0.0	(6.1)	(1.9)	5.5	(11.9)	(3.8)	10.9	207.4	4,524.9	0.0	0.0	0.0	(3.8)	(1.5)	3.4	14.0	0.0	282.5	(269.0)	(51.2)	50.0	111.5
MAY	218.9	0.0	(5.9)	(1.8)	3.7	(14.9)	(4.6)	9.2	218.9	4,743.8	0.0	0.0	18.0	(8.1)	(3.2)	7.0	30.0	18.0	300.5	(256.3)	(48.0)	74.1	330.4
TOTAL	4,343.1	6.8	59.4	47.3		172.3	114.9		4,743.8				276.9	14.9	8.7			300.5					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 50%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	217.1	0.0	(5.7)	(1.7)	4.6	(17.4)	(5.3)	13.9	217.1	217.1	0.0	0.0	0.0	(1.4)	(0.6)	0.9	0.0	0.0	0.0	(234.6)	(41.6)	56.5	547.5
JULY	226.4	0.0	(5.5)	(1.6)	3.6	(17.2)	(4.9)	11.4	226.4	443.5	0.0	0.0	0.0	(0.6)	(0.2)	0.4	0.0	0.0	0.0	(212.5)	(35.3)	41.9	773.9
AUGUST	224.1	0.0	(5.2)	(1.4)	3.0	(11.0)	(2.9)	8.4	224.1	667.6	0.0	0.0	0.0	(1.0)	(0.4)	0.6	0.0	0.0	0.0	(197.3)	(31.3)	31.1	998.0
SEPTEMBER	225.8	0.0	(5.0)	(1.3)	2.6	(10.7)	(2.7)	5.5	225.8	893.4	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	0.0	(184.8)	(28.6)	25.0	1,223.8
OCTOBER	221.2	0.0	(5.0)	(1.2)	3.2	(8.0)	(2.0)	5.2	221.2	1,114.6	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	0.0	(181.5)	(29.3)	57.2	1,445.0
NOVEMBER	216.6	0.0	(5.0)	(1.4)	5.8	(4.0)	(1.1)	4.6	216.6	1,331.2	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	58.8	(197.4)	(36.8)	151.1	1,661.6
DECEMBER	207.4	0.0	(5.3)	(1.7)	8.2	(2.1)	(0.7)	3.3	207.4	1,538.6	0.0	0.0	122.1	(32.4)	(12.9)	20.6	114.7	122.1	180.9	(222.4)	(47.3)	274.9	1,869.0
JANUARY	205.6	0.0	(5.6)	4.2	10.0	(2.3)	1.7	4.0	210.9	1,749.5	0.0	250.7	205.0	(45.0)	18.0	28.6	159.6	473.7	654.6	(259.5)	310.1	449.1	
FEBRUARY	191.7	0.0	(6.0)	7.9	11.7	(4.8)	9.1	9.3	208.7	1,958.2	71.1	838.3	191.7	(31.6)	12.6	20.1	112.1	1,113.7	1,768.3	(351.4)	1,144.0	560.3	
MARCH	246.6	0.0	12.3	9.2	12.8	17.2	12.8	17.9	298.1	2,256.3	900.0	0.0	246.6	23.5	9.4	14.9	83.2	1,179.5	2,947.8	1,232.8	1,144.0	627.7	
APRIL	361.2	0.0	18.8	9.2	13.2	36.8	18.0	25.9	444.0	2,700.3	900.0	0.0	350.0	15.5	6.2	9.9	54.9	1,271.7	4,219.5	2,060.5	1,144.0	653.4	
MAY	503.1	0.0	22.1	9.2	13.2	55.7	23.1	33.7	613.2	3,313.5	819.9	0.0	350.0	3.8	1.5	2.4	0.0	1,175.2	5,394.7	2,622.5	1,144.0	609.4	
TOTAL	3,046.2	0.0	53.2	39.7		109.7	64.7		3,313.5		2,691.0	1,089.0	1,524.2	42.8	47.7			5,394.7					

APPENDIX "G"

WATER BUDGETS
FOR
200-YEAR DROUGHT AND PARTIAL DEVELOPMENT

NORMAL ANNUAL CONSUMPTION
FOR
200-YEAR DROUGHT AND PARTIAL DEVELOPMENT
(3,051 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	110 LOTS @ 750 GPD =	82,500.0	GPD
ESTATE LOTS-NORTH (E):	494 LOTS @ 750 GPD =	370,500.0	GPD
ESTATE LOTS-SOUTH (F):	734 LOTS @ 650 GPD =	477,100.0	GPD
COTTAGE LOTS (E):	197 LOTS @ 500 GPD =	98,500.0	GPD
CIRCLE LOTS (E):	457 LOTS @ 550 GPD =	251,350.0	GPD
TOWNHOUSE LOTS (E):	389 LOTS @ 350 GPD =	136,150.0	GPD
MOBIL HOME LOTS (E):	189 LOTS @ 200 GPD =	37,800.0	GPD
OTHER SEASONAL:		85,067.0	GPD
PARKS:	40 ACRES =	124,974.0	GPD
SUB-TOTAL SEASONALLY VARIABLE	=	1,663,941.0	GPD
	=	1,864.0	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	31.5	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	112.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	144.3	A.F./YEAR

SUB-TOTAL	2,008.3	A.F./YEAR
+10% SYSTEM LOSS	200.8	A.F./YEAR
TOTAL M & I	2,209.1	A.F./YEAR

NOTES:

(1) TOTAL RESIDENTIAL DWELLING UNITS = 2600 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 3,051 EDU
LEVEL OF CONSERVATION: 0%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	260.5	1.6	22.9	9.2	14.2	68.1	27.9	43.1	390.2	390.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,232.3	1,144.0	802.3	
JULY	289.2	1.6	20.8	9.2	14.0	65.8	29.0	44.8	415.6	805.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,816.7	1,144.0	743.5	
AUGUST	283.0	1.4	18.5	9.2	13.6	50.9	25.3	43.1	388.3	1,194.1	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	1,437.0	1,144.0	692.2	
SEPTEMBER	231.6	1.2	16.0	9.2	13.4	33.9	19.4	28.5	311.3	1,505.4	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	1,138.0	1,144.0	658.0	
OCTOBER	202.8	1.0	13.9	9.2	13.2	22.2	14.7	21.2	263.8	1,769.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	874.2	1,144.0	623.6	
NOVEMBER	133.1	0.0	11.9	9.2	12.9	9.6	7.3	10.3	171.1	1,940.3	0.0	0.0	4.0	6.7	2.7	5.8	0.0	13.4	34.3	716.5	1,144.0	606.2	
DECEMBER	112.6	0.0	10.4	9.2	12.9	4.2	3.7	5.2	140.1	2,080.4	0.0	0.0	0.0	6.7	2.7	5.8	25.0	9.4	43.7	585.8	1,144.0	618.9	
JANUARY	96.2	0.0	8.9	9.2	13.6	3.5	3.7	5.3	121.5	2,201.9	0.0	0.0	24.0	14.4	5.9	12.8	54.0	44.6	88.3	508.9	1,144.0	666.8	
FEBRUARY	90.1	0.0	7.9	9.2	13.4	6.3	7.3	10.8	120.8	2,322.7	140.8	0.0	90.1	11.8	4.7	10.3	44.0	247.4	335.7	635.5	1,144.0	696.9	
MARCH	114.6	0.0	9.3	9.2	13.6	13.0	12.8	19.1	158.9	2,481.6	0.0	0.0	0.0	14.4	5.8	12.6	53.0	20.2	355.9	496.8	1,144.0	729.8	
APRIL	165.9	0.0	7.3	9.2	13.6	14.3	18.0	26.7	214.7	2,696.3	0.0	0.0	0.0	3.8	1.5	3.4	14.0	5.3	361.2	300.0	1,131.4	706.9	
MAY	229.5	0.0	(6.2)	8.8	13.5	(15.8)	22.2	34.1	260.5	2,956.8	0.0	0.0	18.0	(8.1)	3.2	7.0	30.0	21.2	382.4	(286.1)	892.1	696.3	
TOTAL	2,209.1	6.8	147.8	110.0		291.8	191.3		2,956.8		140.8		136.1	73.6	32.5			382.4					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 3,051 EDU
LEVEL OF CONSERVATION: 0%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG.	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	260.5	1.6	(6.1)	7.9	13.4	(18.7)	24.1	40.8	294.1	294.1	0.0	0.0	0.0	(1.4)	0.6	0.9	0.0	0.6	0.6	(262.7)	600.2	643.0	
JULY	289.2	1.6	(5.8)	6.6	13.0	(18.3)	20.7	41.2	318.1	612.2	0.0	0.0	0.0	(0.6)	0.2	0.4	0.0	0.2	0.8	(239.2)	283.9	580.2	
AUGUST	283.0	1.4	(5.6)	4.0	12.4	(15.4)	11.0	34.2	299.4	911.6	0.0	0.0	0.0	(1.0)	0.4	0.6	0.0	0.4	1.2	(219.2)	50.0	479.5	
SEPTEMBER	231.6	1.2	(5.3)	(1.9)	9.9	(11.3)	(4.0)	20.9	232.8	1,144.4	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	1.2	(205.8)	(45.4)	219.1	
OCTOBER	202.8	1.0	(5.2)	(1.7)	8.3	(8.4)	(2.8)	13.2	203.8	1,348.2	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	1.2	(201.9)	(44.8)	35.4	
NOVEMBER	133.1	0.0	(5.3)	(1.8)	3.7	(4.2)	(1.4)	2.9	133.1	1,481.3	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	60.0	(217.3)	(51.6)	58.8	
DECEMBER	112.6	0.0	(5.5)	2.0	6.4	(2.2)	0.8	2.5	115.4	1,596.7	0.0	9.5	112.6	(32.4)	12.9	20.6	114.7	135.0	195.0	(242.0)	71.2	185.2	
JANUARY	96.2	0.0	(5.8)	7.4	9.1	(2.3)	3.0	3.6	106.6	1,703.3	0.0	1,004.9	96.2	(45.0)	18.0	28.6	159.6	1,119.1	1,314.1	(278.9)	1,083.7	360.7	
FEBRUARY	90.1	0.0	11.4	9.2	10.5	9.1	7.3	8.4	127.1	1,830.4	900.0	64.2	90.1	31.6	12.6	20.1	112.1	1,098.5	2,412.6	1,190.0	1,144.0	474.0	
MARCH	114.6	0.0	17.8	9.2	11.8	24.9	12.8	16.5	179.3	2,009.7	600.0	0.0	114.6	23.5	9.4	14.9	83.2	747.5	3,160.1	1,758.2	1,144.0	543.8	
APRIL	165.9	0.0	21.4	9.2	12.4	42.0	18.0	24.3	256.5	2,266.2	600.0	0.0	165.9	15.5	6.2	9.9	54.9	787.6	3,947.7	2,289.3	1,144.0	571.9	
MAY	229.5	0.0	22.6	9.2	12.4	56.9	23.1	31.2	341.3	2,607.5	439.7	0.0	229.5	3.8	1.5	2.4	0.0	674.5	4,622.2	2,622.5	1,144.0	530.7	
TOTAL	2,209.1	6.8	73.2	64.7		132.9	120.8		2,607.5		2,539.7	1,078.6	867.7	74.4	61.8			4,622.2					

NORMAL ANNUAL CONSUMPTION
FOR
200-YEAR DROUGHT AND PARTIAL DEVELOPMENT
(3,551 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	336	LOTS @ 750 GPD =	252,000.0	GPD
ESTATE LOTS-NORTH (E):	494	LOTS @ 750 GPD =	370,500.0	GPD
ESTATE LOTS-SOUTH (F):	1,400	LOTS @ 650 GPD =	910,000.0	GPD
COTTAGE LOTS (E):	197	LOTS @ 500 GPD =	98,500.0	GPD
CIRCLE LOTS (E):	457	LOTS @ 550 GPD =	251,350.0	GPD
TOWNHOUSE LOTS (E):	389	LOTS @ 350 GPD =	136,150.0	GPD
MOBIL HOME LOTS (E):	189	LOTS @ 200 GPD =	37,800.0	GPD
OTHER SEASONAL:			85,067.0	GPD
PARKS:		40 ACRES =	124,974.0	GPD
SUB-TOTAL SEASONALLY VARIABLE		=	2,266,341.0	GPD
		=	2,538.8	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	31.5	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	112.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	144.3	A.F./YEAR

SUB-TOTAL	2,683.1	A.F./YEAR
+10% SYSTEM LOSS	268.3	A.F./YEAR
TOTAL M & I	2,951.4	A.F./YEAR

NOTES:
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(1) TOTAL RESIDENTIAL DWELLING UNITS = 3100 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 3,551 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG.	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	308.6	1.6	22.4	9.2	14.2	68.1	27.9	43.1	437.8	437.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,184.7	1,144.0	802.3	
JULY	342.8	1.6	20.4	9.2	14.0	64.9	29.0	44.8	467.5	905.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,718.8	1,144.0	743.5	
AUGUST	335.5	1.4	17.6	9.2	13.6	48.6	25.3	43.1	437.6	1,342.9	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	1,289.8	1,144.0	692.2	
SEPTEMBER	273.4	1.2	14.7	9.2	13.4	31.1	19.4	28.5	349.0	1,691.9	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	953.1	1,144.0	658.0	
OCTOBER	239.1	1.0	12.4	9.2	13.2	19.8	14.7	21.2	296.2	1,988.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	656.9	1,144.0	623.6	
NOVEMBER	156.0	0.0	9.3	9.2	12.9	7.5	7.3	10.3	189.3	2,177.4	0.0	0.0	4.0	6.7	2.7	5.8	0.0	13.4	34.3	481.0	1,144.0	606.2	
DECEMBER	131.6	0.0	7.4	9.2	12.9	2.9	3.7	5.2	154.8	2,332.2	0.0	0.0	0.0	6.7	2.7	5.8	25.0	9.4	43.7	335.6	1,144.0	618.9	
JANUARY	112.0	0.0	6.5	9.1	13.6	2.6	3.6	5.3	133.8	2,466.0	0.0	0.0	24.0	14.4	5.9	12.8	54.0	44.6	88.3	300.0	1,090.4	666.8	
FEBRUARY	110.1	0.0	6.9	9.1	13.4	5.5	7.3	10.8	138.9	2,604.9	126.3	0.0	104.6	11.8	4.7	10.3	44.0	247.4	335.7	354.9	1,144.0	696.9	
MARCH	141.5	0.0	6.9	9.1	13.6	9.0	12.8	19.1	179.3	2,784.2	0.0	0.0	0.0	14.4	5.8	12.6	53.0	20.2	355.9	300.0	1,039.8	729.8	
APRIL	154.4	0.0	(6.1)	8.6	13.6	(12.0)	16.9	26.7	179.9	2,964.1	0.0	0.0	0.0	(3.8)	1.5	3.4	14.0	1.5	357.4	(285.7)	861.4	706.9	
MAY	185.8	0.0	(6.0)	8.0	13.5	(15.2)	20.1	34.1	213.9	3,178.0	0.0	0.0	18.0	(8.1)	3.2	7.0	30.0	21.2	378.6	(272.6)	668.7	696.3	
TOTAL	2,490.8	6.8	124.5	108.3		259.6	188.0		3,178.0		126.3	0.0	150.6	69.2	32.5			378.6					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 3,551 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM. SHRTFAL
JUNE	204.1	0.0	(5.9)	7.4	13.4	(18.0)	21.7	40.8	233.2	233.2	0.0	0.0	0.0	(1.4)	0.6	0.9	0.0	0.6	0.6	(250.1)	436.1	643.0	
JULY	228.0	0.0	(5.7)	5.6	13.0	(17.9)	17.6	41.2	251.2	484.4	0.0	0.0	0.0	(0.6)	0.2	0.4	0.0	0.2	0.8	(227.1)	185.1	589.2	
AUGUST	194.8	0.0	(5.3)	3.2	12.0	(14.7)	8.8	33.1	206.8	691.2	0.0	0.0	0.0	(1.0)	0.4	0.6	0.0	0.4	1.2	(208.1)	50.0	473.4	
SEPTEMBER	180.3	0.0	(5.2)	(1.9)	10.1	(11.0)	(4.0)	21.4	180.3	871.5	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	1.2	(195.1)	(45.4)	263.6	
OCTOBER	180.3	0.0	(5.1)	(1.7)	7.7	(8.2)	(2.6)	12.3	180.3	1,051.8	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	1.2	(191.5)	(45.0)	103.9	
NOVEMBER	165.4	0.0	(5.1)	(1.9)	5.8	(4.1)	(1.5)	4.6	165.4	1,217.2	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	60.0	(207.2)	(51.6)	91.2	
DECEMBER	139.7	0.0	(5.3)	(2.0)	6.9	(2.1)	(0.8)	2.7	139.7	1,356.9	0.0	0.0	122.1	(32.4)	(12.9)	20.6	114.7	122.1	182.1	(232.2)	(61.7)	199.3	
JANUARY	119.4	0.0	(5.7)	7.2	9.3	(2.3)	2.9	3.7	129.5	1,486.4	0.0	981.7	119.4	(45.0)	18.0	28.6	159.1	1,119.1	1,301.2	(269.2)	1,051.3	374.0	
FEBRUARY	110.1	0.0	9.9	9.1	10.7	7.9	7.3	8.6	144.3	1,630.7	900.0	96.5	110.1	31.6	12.6	20.1	112.1	1,150.8	2,452.0	1,183.0	1,144.0	486.9	
MARCH	134.0	0.0	17.5	9.2	11.9	24.5	12.8	16.6	198.0	1,828.7	600.0	0.0	134.0	23.5	9.4	14.9	83.2	766.9	3,218.9	1,751.9	1,144.0	556.5	
APRIL	195.1	0.0	20.9	9.2	12.4	41.0	18.0	24.3	284.2	2,112.9	600.0	0.0	195.1	15.5	6.2	9.9	54.9	816.8	4,035.7	2,284.5	1,144.0	584.6	
MAY	270.9	0.0	22.7	9.2	12.5	57.2	23.1	31.5	383.1	2,496.0	444.9	0.0	270.9	3.8	1.5	2.4	0.0	721.1	4,756.9	2,622.5	1,144.0	543.0	
TOTAL	2,122.1	0.0	71.0	60.1		130.6	112.2		2,496.0		2,544.9	1,078.2	1,010.4	74.4	48.9			4,756.9					

NORMAL ANNUAL CONSUMPTION
FOR
200-YEAR DROUGHT AND PARTIAL DEVELOPMENT
(3,951 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	336	LOTS @ 750 GPD =	252,000.0	GPD
ESTATE LOTS-NORTH (E):	494	LOTS @ 750 GPD =	370,500.0	GPD
ESTATE LOTS-SOUTH (F):	1,400	LOTS @ 650 GPD =	910,000.0	GPD
COTTAGE LOTS (E):	197	LOTS @ 500 GPD =	98,500.0	GPD
CIRCLE LOTS (E):	457	LOTS @ 550 GPD =	251,350.0	GPD
TOWNHOUSE LOTS (E):	389	LOTS @ 350 GPD =	136,150.0	GPD
MOBIL HOME LOTS (E):	189	LOTS @ 200 GPD =	37,800.0	GPD
OTHER SEASONAL:			85,067.0	GPD
PARKS:		40 ACRES =	124,974.0	GPD
SUB-TOTAL SEASONALLY VARIABLE		=	2,266,341.0	GPD
		=	2,538.8	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	31.5	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	112.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	144.3	A.F./YEAR

SUB-TOTAL	2,683.1	A.F./YEAR
+10% SYSTEM LOSS	268.3	A.F./YEAR
TOTAL M & I	2,951.4	A.F./YEAR

NOTES:

(1) TOTAL RESIDENTIAL DWELLING UNITS = 3500 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 3,951 EDU
LEVEL OF CONSERVATION: 50%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	351.1	1.6	22.9	9.2	14.2	67.6	27.9	43.1	480.3	480.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,142.2	1,144.0	802.3	
JULY	390.2	1.6	20.1	9.2	14.0	63.5	44.8	44.8	529.4	1,009.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,612.8	1,144.0	743.5	
AUGUST	381.8	1.4	16.8	9.2	13.6	46.3	25.3	43.1	480.8	1,490.5	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	1,140.6	1,144.0	692.2	
SEPTEMBER	302.3	1.2	13.4	9.2	13.4	28.5	19.4	28.5	374.0	1,864.5	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	778.9	1,144.0	658.0	
OCTOBER	271.2	1.0	10.0	9.2	13.2	16.0	14.7	21.2	322.1	2,186.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	456.8	1,144.0	623.6	
NOVEMBER	176.2	0.0	7.1	9.2	12.9	5.7	7.3	10.3	205.5	2,392.1	0.0	0.0	4.0	6.7	2.7	5.8	0.0	13.4	34.3	300.0	1,108.7	606.2	
DECEMBER	148.3	0.0	(6.3)	8.9	12.9	(2.5)	3.6	5.2	160.8	2,552.9	0.0	0.0	0.0	(6.7)	2.7	5.8	25.0	2.7	37.0	(297.9)	950.6	618.9	
JANUARY	126.0	0.0	(6.4)	8.4	13.6	(2.5)	3.4	5.3	137.8	2,690.7	0.0	0.0	24.0	(14.4)	5.9	12.8	54.0	29.9	66.9	(303.4)	818.7	666.8	
FEBRUARY	117.8	0.0	(6.4)	8.4	13.4	(5.1)	6.7	10.8	132.9	2,823.6	0.0	113.1	117.8	(11.8)	4.7	10.3	44.0	235.6	302.5	(303.7)	921.4	696.9	
MARCH	126.4	0.0	(6.4)	8.3	13.6	(9.0)	11.6	19.1	146.3	2,969.9	0.0	0.0	0.0	(14.4)	5.8	12.6	53.0	5.8	308.3	(302.7)	780.9	729.8	
APRIL	130.6	0.0	(6.3)	7.8	13.6	(12.3)	15.3	26.7	153.7	3,123.6	0.0	0.0	0.0	(3.8)	1.5	3.4	14.0	1.5	309.8	(287.9)	628.7	706.9	
MAY	136.3	0.0	(6.1)	7.2	13.5	(15.4)	18.1	34.1	161.6	3,285.2	0.0	0.0	18.0	(8.1)	3.2	7.0	30.0	21.2	331.0	(274.5)	488.3	696.3	
TOTAL	2,658.2	6.8	90.3	104.2		227.6	198.1		3,285.2		0.0	113.1	163.8	21.6	32.5			331.0					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 200-YEAR DROUGHT
DEVELOPMENT LEVEL: 3,951 EDU
LEVEL OF CONSERVATION: 50%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	135.3	0.0	(5.9)	6.3	13.4	(18.0)	19.1	40.8	160.7	160.7	0.0	0.0	0.0	(1.4)	0.6	0.9	0.0	0.6	0.6	(252.0)	328.2	643.0	
JULY	140.9	0.0	(5.6)	5.1	13.0	(17.6)	16.1	41.2	162.1	322.8	0.0	0.0	0.0	(0.6)	0.2	0.4	0.0	0.2	0.8	(229.4)	166.3	589.2	
AUGUST	135.3	0.0	(5.4)	3.0	12.4	(15.0)	8.4	26.3	146.7	469.5	0.0	0.0	0.0	(1.0)	0.4	0.6	0.0	0.4	1.2	(210.0)	50.0	521.1	
SEPTEMBER	136.3	0.0	(5.2)	(1.8)	10.8	(11.0)	(3.8)	22.9	136.3	605.8	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	1.2	(197.0)	(45.7)	351.1	
OCTOBER	133.4	0.0	(5.1)	(1.7)	9.4	(8.1)	(2.8)	15.0	133.4	739.2	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	1.2	(193.5)	(45.1)	233.9	
NOVEMBER	130.6	0.0	(5.2)	(1.8)	8.7	(4.2)	(1.5)	6.9	130.6	869.8	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	60.0	(209.0)	(51.8)	250.8	
DECEMBER	129.1	0.0	(5.4)	(2.0)	9.5	(2.2)	(0.8)	3.8	129.1	998.9	0.0	0.0	122.7	(32.4)	(12.9)	20.6	114.7	122.1	182.1	(233.8)	(61.9)	365.8	
JANUARY	126.4	0.0	(5.8)	7.1	11.0	(2.3)	2.8	4.4	136.3	1,135.2	0.0	974.7	126.4	(45.0)	18.0	28.6	159.1	1,119.1	1,301.2	(270.7)	1,044.7	538.1	
FEBRUARY	117.5	0.0	11.2	9.1	12.8	9.0	7.2	10.2	154.0	1,289.2	900.0	103.0	117.5	31.6	12.6	20.1	112.1	1,164.7	2,465.9	1,182.1	1,144.0	629.3	
MARCH	151.0	0.0	17.4	9.2	13.3	24.4	12.8	18.7	214.8	1,504.0	600.0	0.0	151.0	23.5	9.4	14.9	83.2	783.9	3,249.8	1,751.2	1,144.0	695.4	
APRIL	220.9	0.0	20.8	9.2	13.6	40.8	18.0	26.6	309.7	1,813.7	600.0	0.0	220.9	15.5	6.2	9.9	54.9	842.6	4,092.4	2,284.1	1,144.0	720.0	
MAY	307.4	0.0	22.6	9.2	13.6	44.2	23.1	34.3	406.5	2,220.2	432.2	0.0	307.4	3.8	1.5	2.4	0.0	744.9	4,837.3	2,622.5	1,144.0	674.5	
TOTAL	1,864.1	0.0	72.0	58.2		118.4	107.5		2,220.2		2,532.2	1,077.7	1,104.1	74.4	48.9			4,837.3					

APPENDIX "H"

WATER BUDGET
FOR
100-YEAR DROUGHT AND FULL DEVELOPMENT

NORMAL ANNUAL CONSUMPTION
FOR
100-YEAR DROUGHT AND FULL DEVELOPMENT
(5,968 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	2,125 LOTS @ 750 GPD =		1,593,750.0	GPD
ESTATE LOTS-NORTH (E):	494 LOTS @ 750 GPD =		370,500.0	GPD
ESTATE LOTS-SOUTH (F):	1,300 LOTS @ 650 GPD =		845,000.0	GPD
COTTAGE LOTS (E):	197 LOTS @ 500 GPD =		98,500.0	GPD
CIRCLE LOTS (E):	457 LOTS @ 550 GPD =		251,350.0	GPD
TOWNHOUSE LOTS (E):	389 LOTS @ 350 GPD =		136,150.0	GPD
MOBIL HOME LOTS (E):	189 LOTS @ 200 GPD =		37,800.0	GPD
OTHER SEASONAL:			134,067.0	GPD
PARKS:	80 ACRES =		249,951.0	GPD
SUB-TOTAL SEASONALLY VARIABLE		=	3,717,068.0	GPD
		=	4,163.9	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	52.2	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	172.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	225.0	A.F./YEAR

SUB-TOTAL	4,388.9	A.F./YEAR
+10% SYSTEM LOSS	438.9	A.F./YEAR
TOTAL M & I	4,827.8	A.F./YEAR

NOTES:

(1) TOTAL RESIDENTIAL DWELLING UNITS = 5189 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 100-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	574.6	1.6	21.9	9.2	14.2	66.4	27.9	43.1	701.6	701.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,920.9	1,144.0	801.4	
JULY	638.8	1.6	18.0	9.2	14.0	56.7	29.0	44.1	753.3	1,454.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,167.6	1,144.0	743.3	
AUGUST	625.0	1.4	12.3	9.2	13.7	34.0	25.3	37.7	707.2	2,162.1	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	469.0	1,144.0	697.3	
SEPTEMBER	705.8	1.2	7.2	8.5	13.4	15.2	18.1	28.5	558.0	2,720.1	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	300.0	767.3	663.1	
OCTOBER	443.6	1.0	(7.2)	7.1	13.3	(11.5)	11.3	21.2	463.0	3,183.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	(281.3)	304.3	628.6	
NOVEMBER	287.9	0.0	(5.3)	4.1	12.8	(4.2)	3.3	10.3	295.3	3,478.4	0.0	0.0	12.6	(6.7)	2.7	5.8	0.0	15.3	36.2	(278.5)	50.0	585.6	
DECEMBER	242.1	0.0	(6.1)	(1.8)	11.4	(2.3)	(0.7)	4.6	242.1	3,720.5	0.0	0.0	27.0	(6.7)	(2.7)	5.8	25.0	27.0	63.2	(276.8)	(50.2)	411.3	
JANUARY	205.5	0.0	(6.1)	(2.0)	9.2	(2.5)	(0.8)	3.7	205.5	3,926.0	0.0	0.0	102.6	(14.4)	(5.9)	12.8	54.0	102.6	165.8	(282.9)	(53.3)	362.3	
FEBRUARY	201.5	0.0	(6.2)	2.0	9.2	(4.9)	1.6	7.4	205.1	4,131.1	0.0	46.9	201.5	(11.8)	4.7	10.3	44.0	253.1	418.9	(283.6)	101.3	400.0	
MARCH	260.0	0.0	(6.2)	4.9	10.6	(8.6)	6.9	14.8	271.8	4,402.9	0.0	272.8	260.0	(14.4)	5.8	12.6	53.0	538.5	957.4	(283.2)	368.0	440.2	
APRIL	284.2	0.0	(6.1)	6.8	10.7	(11.9)	13.4	20.9	304.4	4,707.3	0.0	257.6	284.2	(3.8)	1.5	3.4	14.0	543.3	1,500.7	(269.0)	606.9	426.0	
MAY	335.9	0.0	(5.9)	7.1	10.6	(14.9)	17.8	26.7	360.8	5,068.1	0.0	0.0	334.8	(8.1)	3.2	7.0	30.0	338.0	1,838.7	(256.3)	584.1	425.7	
TOTAL	4,606.9	6.8	59.4	68.1		172.3	154.6		5,068.1		0.0	577.3	1,222.7	14.9	23.9			1,838.8					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 100-YEAR DROUGHT
DEVELOPMENT LEVEL: 5,968 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	377.7	0.0	(5.7)	6.0	10.4	(17.4)	18.4	31.6	402.1	402.1	0.0	0.0	0.0	(1.4)	0.6	0.9	0.0	0.0	0.6	(234.6)	182.6	384.6	
JULY	429.6	0.0	(5.5)	3.2	8.3	(17.2)	10.0	26.1	442.8	844.9	0.0	0.0	0.0	(0.6)	0.2	0.4	0.0	0.0	0.8	(212.5)	50.0	50.0	9.4
AUGUST	360.6	0.0	(5.2)	(1.9)	3.3	(11.0)	(5.2)	9.1	360.6	1,205.5	0.0	0.0	0.0	(1.0)	(0.4)	0.6	0.0	0.0	0.8	(197.3)	(43.3)	38.2	370.0
SEPTEMBER	332.4	0.0	(5.0)	(1.6)	3.1	(10.7)	(3.4)	6.5	332.4	1,537.9	0.0	0.0	0.0	(3.2)	(1.3)	2.0	0.0	0.0	0.8	(184.8)	(39.6)	30.6	702.4
OCTOBER	332.4	0.0	(5.0)	(1.6)	3.5	(8.0)	(2.6)	5.6	332.4	1,870.3	0.0	0.0	0.0	(9.7)	(3.9)	6.2	34.4	0.0	0.8	(181.5)	(39.3)	62.1	1034.8
NOVEMBER	304.9	0.0	(5.0)	(1.7)	5.9	(4.0)	(1.3)	4.7	304.9	2,175.2	0.0	0.0	58.8	(24.9)	(10.0)	15.9	88.4	58.8	59.6	(197.4)	(46.3)	155.8	1280.9
DECEMBER	256.6	0.0	(5.3)	(1.9)	8.3	(2.1)	(0.8)	3.3	256.6	2,431.8	0.0	0.0	122.1	(32.4)	(12.9)	20.6	114.7	122.1	181.7	(222.4)	(56.5)	279.5	1415.4
JANUARY	218.7	0.0	(5.6)	4.1	10.0	(2.3)	1.6	4.0	224.4	2,656.2	0.0	237.0	218.7	(45.0)	18.0	28.6	159.6	473.7	655.4	(259.5)	305.8	453.4	
FEBRUARY	191.7	0.0	(6.0)	7.9	11.7	(4.8)	9.1	9.4	208.7	2,864.9	54.2	852.2	191.7	(31.6)	12.6	20.1	112.1	1,113.7	1,769.1	(334.5)	1,144.0	564.5	
MARCH	246.6	0.0	12.3	9.2	12.8	17.2	12.8	18.0	298.1	3,163.0	900.0	0.0	246.6	23.5	9.4	14.9	83.2	1,179.5	2,948.6	1,215.9	1,144.0	631.8	
APRIL	361.2	0.0	18.8	9.2	13.2	36.8	18.0	26.0	444.0	3,607.0	900.0	0.0	350.0	15.5	6.2	9.9	54.9	1,271.7	4,220.3	2,043.6	1,144.0	657.4	
MAY	503.1	0.0	22.1	9.2	13.2	55.7	23.1	33.4	613.2	4,220.2	836.8	0.0	350.0	3.8	1.5	2.4	0.0	1,192.1	5,412.4	2,622.5	1,144.0	613.2	
TOTAL	3,915.5	0.0	53.2	48.8		109.7	93.0		4,220.2		2,691.0	1,092.2	1,537.9	42.8	48.5			5,412.4					

APPENDIX "I"

WATER BUDGET
FOR
100-YEAR DROUGHT AND PARTIAL DEVELOPMENT

NORMAL ANNUAL CONSUMPTION
FOR
100-YEAR DROUGHT AND PARTIAL DEVELOPMENT
(4,251 EDU TOTAL)

SEASONALLY VARIABLE

ESTATE LOTS-NORTH (F):	736 LOTS @ 750 GPD =	552,000.0	GPD
ESTATE LOTS-NORTH (E):	494 LOTS @ 750 GPD =	370,500.0	GPD
ESTATE LOTS-SOUTH (F):	1,300 LOTS @ 650 GPD =	845,000.0	GPD
COTTAGE LOTS (E):	197 LOTS @ 500 GPD =	98,500.0	GPD
CIRCLE LOTS (E):	457 LOTS @ 550 GPD =	251,350.0	GPD
TOWNHOUSE LOTS (E):	389 LOTS @ 350 GPD =	136,150.0	GPD
MOBIL HOME LOTS (E):	189 LOTS @ 200 GPD =	37,800.0	GPD
OTHER SEASONAL (EXCLUDING HOTEL):		85,067.0	GPD
PARKS:	40 ACRES =	124,974.0	GPD
SUB-TOTAL SEASONALLY VARIABLE	=	2,501,341.0	GPD
	=	2,802.1	A.F./YEAR

SEASONALLY NON-VARIABLE

SCHOOLS:	31.5	A.F./YEAR
COMMERCIAL-INDUSTRIAL (INCLUDES 38 LODGE UNITS):	112.8	A.F./YEAR
SUB-TOTAL SEASONALLY NON-VARIABLE	144.3	A.F./YEAR

SUB-TOTAL	2,946.4	A.F./YEAR
+10% SYSTEM LOSS	294.6	A.F./YEAR
TOTAL M & I	3,241.0	A.F./YEAR

NOTES:
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(1) TOTAL RESIDENTIAL DWELLING UNITS = 3800 DU

(2) (F) = FUTURE

(3) (E) = EXISTING

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: 100-YEAR DROUGHT
DEVELOPMENT LEVEL: 4,215 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)									
	1	2	3	4	5	6	7	8	9	10
			SEEPAGE			EVAPORATION			TOTALS	
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.
JUNE	386.4	1.6	22.2	9.2	14.2	67.4	27.9	43.1	514.7	514.7
JULY	429.6	1.6	19.8	9.2	14.0	62.5	29.0	44.8	551.7	1,066.4
AUGUST	420.3	1.4	16.1	9.2	13.6	44.6	25.3	43.1	516.9	1,583.3
SEPTEMBER	340.9	1.2	12.4	9.2	13.4	26.3	19.4	28.5	409.4	1,992.7
OCTOBER	297.8	1.0	8.3	9.2	12.9	13.3	14.7	21.2	344.3	2,337.0
NOVEMBER	192.9	0.0	6.5	9.0	12.9	5.2	7.2	10.3	220.8	2,557.8
DECEMBER	162.1	0.0	(6.3)	8.4	13.6	(2.5)	3.3	5.2	173.8	2,731.6
JANUARY	137.5	0.0	(6.4)	7.9	13.4	(2.5)	3.2	5.3	148.6	2,880.2
FEBRUARY	135.0	0.0	(6.4)	8.1	13.6	(5.1)	6.5	10.8	149.6	3,029.8
MARCH	174.5	0.0	7.9	8.9	13.6	11.1	12.4	19.1	214.8	3,244.6
APRIL	190.7	0.0	8.9	9.2	13.6	17.4	18.0	26.7	244.2	3,488.8
MAY	230.2	0.0	11.5	9.2	13.5	28.9	23.1	34.1	302.9	3,791.7
TOTAL	3,097.8	6.8	113.6	106.7		276.7	190.0		3,791.7	

	RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	11	12	13	14	15	16	17	18	19	20	21	22	23
	RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,107.8	1,144.0	802.3	
JULY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,556.1	1,144.0	743.5	
AUGUST	0.0	0.0	0.0	6.1	2.5	5.4	0.0	8.6	8.6	1,047.8	1,144.0	692.2	
SEPTEMBER	0.0	0.0	0.0	8.8	3.5	7.7	0.0	12.3	20.9	650.7	1,144.0	658.0	
OCTOBER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	306.4	1,144.0	623.6	
NOVEMBER	0.0	0.0	12.6	6.7	2.7	5.8	0.0	22.0	42.9	300.0	951.6	606.2	
DECEMBER	0.0	0.0	27.0	(6.7)	2.7	5.8	25.0	29.7	72.6	(297.9)	807.5	618.9	
JANUARY	0.0	0.0	102.6	(14.4)	5.9	12.8	54.0	108.5	181.1	(303.4)	767.4	666.8	
FEBRUARY	0.0	113.4	135.0	(11.8)	4.2	10.3	44.0	253.1	434.2	(303.7)	870.9	696.9	
MARCH	69.7	288.6	174.5	14.4	5.8	12.6	53.0	553.0	987.2	368.8	1,144.0	729.8	
APRIL	351.1	0.0	190.7	3.8	1.5	3.4	14.0	547.1	1,534.3	671.7	1,144.0	706.9	
MAY	104.6	0.0	230.2	8.1	3.2	7.0	30.0	346.1	1,880.4	714.9	1,144.0	696.3	
TOTAL	525.4	402.0	872.6	47.9	32.5			1,880.4					

RANCHO MURIETA COMMUNITY SERVICES DISTRICT
WATER BUDGET WORKSHEET

WATER YEAR: AVERAGE DRY YEAR FOLLOWING A 100-YEAR DROUGHT
DEVELOPMENT LEVEL: 4,215 EDU
LEVEL OF CONSERVATION: 25%

	RAW WATER DEMANDS (AC.-FT.)										RAW WATER SUPPLY (AC.-FT.)									STORAGE			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			SEEPAGE			EVAPORATION			TOTALS		RIVER DIVERSION			DIRECT RAINFALL			RUNOFF	TOTALS		END OF MONTH BALANCE			
MONTH	DOMESTIC	MISC. IRRIG	CALERO	CHESBRO	CLEMENTIA	CALERO	CHESBRO	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	DIRECT	CALERO	CHESBRO	CLEMENTIA	CLEMENTIA	MONTH	CUMUL.	CALERO	CHESBRO	CLEMENTIA	CUM.SHRTFAL
JUNE	254.3	0.0	9.3	9.2	13.4	23.1	23.4	40.8	319.3	319.3	0.0	0.0	0.0	1.4	0.6	0.9	0.0	2.0	2.0	397.6	1,144.0	643.0	
JULY	284.5	0.0	5.7	8.9	13.0	18.1	28.0	41.1	345.2	664.5	0.0	0.0	0.0	0.6	0.2	0.4	0.0	0.8	2.8	300.0	897.2	589.3	
AUGUST	242.7	0.0	(6.2)	7.9	12.4	(17.2)	21.8	34.2	272.4	936.9	0.0	0.0	0.0	(1.0)	0.4	0.6	0.0	0.4	3.2	(277.6)	625.2	543.3	
SEPTEMBER	223.3	0.0	(6.0)	6.9	12.0	(12.8)	14.7	25.4	244.9	1,181.8	0.0	0.0	0.0	(3.2)	1.3	2.0	0.0	1.3	4.5	(262.0)	381.6	507.9	
OCTOBER	223.3	0.0	(5.8)	5.2	11.9	(9.3)	8.3	19.0	236.8	1,418.6	0.0	0.0	0.0	(9.7)	3.9	6.2	34.4	3.9	8.4	(256.6)	148.7	517.6	
NOVEMBER	204.7	0.0	(5.8)	2.9	12.4	(4.7)	2.3	9.9	209.9	1,628.5	0.0	0.0	58.8	(24.9)	10.0	15.9	88.4	68.8	77.2	(271.0)	50.0	557.2	
DECEMBER	172.2	0.0	(6.1)	(1.9)	12.7	(2.5)	(0.8)	5.1	172.2	1,800.7	0.0	0.0	122.1	(32.4)	(12.9)	20.6	114.7	122.1	199.3	(294.8)	(60.2)	624.6	
JANUARY	146.6	0.0	(6.2)	5.2	13.6	(2.6)	2.1	5.5	153.9	1,954.6	0.0	309.1	146.6	(45.0)	18.0	28.6	159.6	473.7	673.0	(331.5)	380.0	793.7	
FEBRUARY	128.3	0.0	7.7	8.3	14.6	6.2	6.7	11.7	157.2	2,111.8	206.4	766.4	128.3	(31.6)	12.6	20.1	112.1	1,113.7	1,786.7	555.6	1,144.0	899.6	
MARCH	165.2	0.0	13.0	9.2	14.6	18.2	12.8	20.4	218.4	2,330.2	900.0	0.0	165.2	23.5	9.4	14.9	83.2	1,098.1	2,884.8	1,435.3	1,144.0	907.1	
APRIL	242.3	0.0	19.9	9.2	14.6	39.0	18.0	28.6	328.4	2,658.8	900.0	0.0	242.3	15.5	6.2	9.9	54.9	1,164.0	4,048.8	2,270.9	1,144.0	907.1	
MAY	337.8	0.0	22.5	9.2	14.6	56.8	23.1	36.8	449.4	3,108.0	457.9	0.0	337.8	3.8	1.5	2.4	0.0	801.0	4,849.8	2,622.5	1,144.0	858.1	
TOTAL	2,625.2	0.0	78.1	82.1		161.4	161.2		3,108.0		2,464.3	1,075.5	1,201.1	44.8	64.1			4,849.8					

APPENDIX "J"

REPORT ON WATER SUPPLY ALTERNATIVES
BY
HARRY J. DUNLOP

4284 Missouri Flat Road
Placerville, CA 95607

December 20, 1989

Mr. Ken Giberson
Giberson & Associates
11246 Gold Express Drive, Suite 101
Gold River, CA 95670

Dear Mr. Giberson:

In our discussions on December 11, 1989, we reviewed the adequacy of the water supply for full development of lands at Rancho Murieta under the Planned Development Ordinance. We concluded that there appears to be a need for about 2,000 acre feet more water over the next five years to accommodate full development. You requested that I report on the current status of potential additional water supplies from: 1) The Folsom South Canal, 2) County Line Reservoir, 3) The Cosumnes River and off stream storage, and 4) Ground Water.

From a review of these items as described below, it is recommended that Rancho Murieta Community Services District (RMCSD) take the following actions:

1. Pursue the availability of off site ground water at the earliest opportunity by identifying potential sources.

2. Continue to pursue additional on or off site storage projects for the sole benefit of Rancho Murieta as well as other off site storage projects in conjunction with other parties interested in such off site storage projects.

3. Review present raw water system operations to determine how these operations may be modified to maximize the use of riparian water rights in meeting the total water supply needs under full development at Rancho Murieta.

4. Write letters to:

a. The Sacramento County Water Agency placing the Agency on notice that RMCSD is interested in a water supply directly from the Folsom South Canal or as a part of the Sunrise East Service

b. The Cosumnes River Water and Power Authority placing that authority on notice that RMCSD is interested in a water supply from the Cosumnes River.

c. The City of Folsom advising the City of RMCSD's interest in exploring the potentials of water service to the area west of the Sacramento - Eldorado County line from Folsom southerly to Rancho Murieta.

Discussions:

Following are pertinent comments on the status of potential additional water supplies:

1) Folsom South Canal:

The U.S. Bureau of Reclamation (USBR) owns and operates the Folsom South Canal, a unit of the Central Valley Project. The USBR's position is that water service from the canal to areas in Sacramento County must be thru contracts with the Sacramento County Water Agency. The USBR will not contract directly with users like Rancho Murieta. The long standing contract with SMUD is the exception, not the rule.

From discussions with Mr. Jim Dixon, Chief of the Water Resources Division, Sacramento County Department of Public Works, it is understood that Rancho Murieta is within the proposed Sunrise East service area - an area bounded by Sunrise on the west, Highway 50 on the north, Sacramento County line on the east, and Jackson Road on the south. The Water Agency does not have any immediate plans for water service to this area. Indeed, Sacramento County is a bit uncertain of the potential for any service from Folsom South Canal in light of the recent court decision on the lower American River (East Bay Municipal Utility District case). The Agency does sell some water from the canal to individual agricultural users, but such sales are for non-firm water on a year to year basis.

Sacramento Municipal Utility District (SMUD) has a contract for 75,000 acre feet of water for industrial use at Rancho Seco. With the generating station presently shut down, SMUD has received a number of inquiries concerning the availability of that water, or portions thereof, for use by other customers. San Joaquin County made such an inquiry and was advised that SMUD will not relinquish any of that water at this time. (see attached letter from David Boggs to Evelyn L. Costa dated July 10, 1989). USBR advises that they will not favor any direct subcontracting of any of that water by SMUD. Any relinquishment of water by SMUD would return the unused amount to USBR for disposition by that Agency.

It does not appear that any substantial amount of water is immediately available to Rancho Murieta from the Folsom South Canal. However, in the interest of keeping options open on long term solutions, RMCSD should direct a letter to Sacramento County Water Agency with a copy to USBR expressing an interest in water service from the Folsom South Canal and urging the Water Agency to resolve any impediments to service at an early date.

2) County Line Reservoir:

County Line Reservoir is a feature of the Federally authorized Auburn-Folsom South Unit of the Central Valley Project. The USBR has no present plans to construct the feature. It has been reported that any Federal legislation which would reauthorized the Auburn-Folsom South Unit would most likely deauthorize the County Line Reservoir. Construction of a reservoir at the County Line site is not dependent on its being a feature of a Federal or State project. Any agency could build a reservoir at this efficient site. An 80 foot high, 650 foot long dam would impound 40,000 acre feet of water with an active capacity of 25,000 acre feet at a high water elevation of 445 feet. Most of the area between U.S. Highway 50 and south to Rancho Murieta could be served by gravity. The reservoir could impound the waters of Deer Creek supplemented by water from Folsom Reservoir thru two pumping plants and a 10.8 mile pipe line. Costs for these facilities were estimated by the USBR in 1963 to be about $12 million.

But there are a number of items which detract from this site. A regional waste water treatment plant (sewer treatment plant) is now located upstream with an established discharge to Deer Creek. The Cameron Park development lies within the upstream drainage area. The natural runoff from streets and other urban development is tributary to the site presenting a water quality problem. It may be possible to mitigate these difficulties by bypassing Deer Creed around the reservoir and using only water imported from Folsom Reservoir as the water supply. This would increase operating costs by some amount, but most likely not be prohibitive.

If adequate financing can be obtained, County Line Reservoir continues to be an attractive site for 25,000 acre feet of water to serve the area west of the Sacramento County line between U.S. Highway 50 and Rancho Murieta. It will most likely take some time to obtain the financing and as such, it may be beyond the time constraints of meeting the present needs.

3. Cosumnes River and Off Stream Storage:

The four county Joint Powers Agency (Eldorado, Amador, San Joaquin, and Sacramento) has disbanded. The Cosumnes River

Water and Power Authority is still in existence with Eldorado County Water Agency and Eldorado County as members of the Authority. The Authority is currently seeking an extension of its permit from the Federal Energy Regulatory Commission (FERC) to build a multipurpose project on the Cosumnes River. Substantial time will be required to complete any such project. In the interest of preserving long term options for additional water supplies, RMCSD should advise the Authority in writing of its interest in a water supply from the Cosumnes River.

The potential exists for an independent project sponsored by RMCSD. However, the District should be prepared for a long and relatively expensive (estimated at over $1 million) effort if it chooses to pursue this course.

A further approach suggests some additional off stream storage either on site or in close proximity to Rancho Murieta. Another reservoir of about the size of Calero would provide the 2,000 acre feet of supplemental water desired for full development. Current water rights for water from the Cosumnes River as further modified by State Water Resources Control Board Orders 79-13 and 79-23 specify: "The water appropriated shall be limited to the quantity which can be beneficially used and shall not exceed (a) 6 cubic feet per second by direct diversion from the Cosumnes River to be diverted from November 1 of each year to May 31 of the succeeding year, and (b) 4,050 acre-feet per annum by storage to be collected from November 1 of each year to May 31 of the succeeding year as follows:

1. 3,900 acre-feet per annum from the Cosumnes River to be stored as follows:

(A) 1,250 acre-feet per annum in Chesbro Reservoir,
(B) 2,610 acre-feet per annum in Calero Reservoir,
(C) 850 acre-feet per annum in Clementia Reservoir, and
(D) 40 acre-feet per annum in Fairway No. 10 Lower Lake.

The combined amount under B, C and D shall not exceed a total of 2,650 acre-feet.

2. 50 acre-feet per annum from an unnamed stream to be stored in Chesbro Reservoir.

3. 100 acre-feet per annum from an unnamed stream to be stored in Calero Reservoir.

The maximum rate of diversion from the Cosumnes River to offstream storage shall not exceed 46 cubic feet per second. The equivalent of the continuous flow allowance by direct diversion for any 7-day period may be diverted in a shorter time if there is no interference with vested rights. The Total amount of water to be taken from the source shall not exceed 6,368 acre-feet per water year of October 1 to September 30.

This permit does not authorize collection of water to storage outside of the specified season to offset evaporation and seepage losses or for any other purpose."

This provision suggests a right for direct diversion of 2,468 acre feet (6,368-3,900 = 2,468) during the year. With additional offstream storage it is possible to convert this direct diversion right to a storage right. It would then be possible to more nearly meet water demands without exceeding the total amount of authorized diversions. (see page 5 of Decision No. D940 attached, for a policy statement on converting direct diversion to storage.) Such a change does require filing a Petition for change in distribution of storage and such other documents as the State Water Resources Control Board may require.

4. Ground Water:

Information of a general nature on ground water is contained in Bulletin No. 118 of the California Department of Water Resources and the USBR report on the Auburn-Folsom South Unit, Central Valley Project, dated March 1963. More site specific information is contained in a report to RMCSD by Luhdorff & Scalmanini dated January 1988. Information available tends to indicate that there may be limited amounts of ground water at Rancho Murieta but the area is generally east of and uphill from any significant ground water aquifers. The can be verified further by discussions with landowners who have existing wells. About 2,000 acre feet per year of additional water is needed for full development at Rancho Murieta which could be met from wells producing about 1,500 gpm continuously over a 10 month period. It is essential in selecting well sites to be certain that the under ground aquifers are large enough to permit sustained pumping of these amounts over long periods so as not to develop a false sense of security in a water supply that may not be there. A survey of the production rates of wells located further downstream on the Cosumnes River should provide the necessary information on acceptable locations for wells.

Based on institutional constraints and very preliminary cost estimates, it appears that a ground water source of supplemental water provides the most easily doable, and least costly source of supplemental water for Rancho Murieta. An under ground source will always be a useful supply, particularly in dry years when surface waters are least available. From these considerations, RMCSD should identify the location of potential underground water supplies at the earliest opportunity.

It has been my privilege to be of assistance to you and Rancho Murieta Community Services District in this matter.

Very truly yours,

Harry J. Dunlop

HJD:s

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ P. O. Box 15830, Sacramento CA 95852-1830, (916) 452-3211
AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

GM 89-524

July 10, 1989

RECEIVED
DEPARTMENT OF PUBLIC WORKS
WATER RESOURCES DIVISION
JUL 17 1989
FILE
6 12 24 36 P

Evelyn L. Costa, Chairman
San Joaquin County Board of Supervisors
222 East Weber Avenue, Room 701
Stockton, CA. 95202

Dear Chairman Costa:

We have reviewed your June 20, 1989 letter regarding sources of additional water for municipal use in your county.

Our contractual entitlement to water from the Folsom South Canal fulfills a basic requirement for cooling, dilution and plant water at the Rancho Seco Nuclear Generation Station. In fact, the 75,000 acre foot entitlement was obtained to support the development of several plants.

Although Rancho Seco is currently shut down, at some time in the future it is likely that some type of thermal generation will be operated at the site to meet our growing customer demands. Accordingly, SMUD must retain the long term contractual entitlements we now hold to Central Valley Project (CVP) water. It is our understanding that the Bureau of Reclamation is making progress in resolving some of the Folsom South Unit litigation and is also pursuing the marketing of additional CVP water. You may want to pursue this issue with the Bureau directly.

Please contact Dan Whitney, Manager, Power Planning, at (916) 732-5351 with any further questions you may have on this matter.

Sincerely,

David A. Boggs

David A. Boggs
General Manager

cc: Regional Director, Attn: MP 440
U.S. Bureau of Reclamation
2800 Cottage Way
Sacramento, CA. 95825

James Dixon, Chief, Water Resources Division
Sacramento County Public Works Department
827 7th Street, Room 301
Sacramento, CA. 95814

Board Members

DISTRICT HEADQUARTERS ☐ 6201 S Street, Sacramento CA 95817-1899

STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

* * *

In the Matter of Application 16849 by Glenn R. Baker to appropriate from Crooks Creek and an unnamed stream in Madera County	Decision No. D 940 ADOPTED NOV 12 '59

Substance of the Application

The application filed January 29, 1956, is for a permit to appropriate a total of 10.5 acre-feet per annum by storage (7.0 acre-feet from Crooks Creek and 3.5 acre-feet from an unnamed stream) to be collected between November 1 and May 31 of each season for irrigation and stockwatering purposes. Storage is to be effected by means of two earthfill dams located within the SE¼ of Section 23, T6S, R20E, MDB&M. Both dams are constructed. According to the application the dam on Crooks Creek is 21 feet high, 198 feet long, and creates a reservoir of 7.0 acre-feet capacity. The dam on the unnamed stream is 20 feet high, 175 feet long and creates a reservoir of 3.5 acre-feet capacity. Some 17 acres of land are to be irrigated.

Protests and Hearing

Application 16849 was completed and advertised in accordance with the provisions of the Water Code and applicable rules and regulations, protests were received from Leland J. and Dorothy M. Davis and from Madera Irrigation District. A public hearing was held on August 11, 1959, in Madera, California, before Kent Silverthorne, Chairman, and Ralph J. McGill, Member, of the State Water Rights Board. The applicant, protestants and other interested parties were duly notified of the hearing. The applicant appeared on behalf of himself, protestants Davis were represented by Attorney William H. Haupt, and Madera Irrigation District was represented by Attorney Denver C. Peckinpah. The protest of Madera Irrigation District was withdrawn at the commencement of the hearing (RT p. 9).

The application was heard under a common record with Applications 17208, 17425, and 18273. These latter applications will be considered by separate decisions and orders.

Sources

The sources are the two forks which form the main stem of Crooks Creek and each storage dam receives the runoff from about 1.25 square miles of drainage area. Crooks Creek is a tributary from the north and joins Fresno River in Section 2, T7S, R20E, MDB&M, at a point about three miles downstream from the applicant's points of diversion. Protestants Davis' property (Ahwahnee Meadow Ranch) is located on Crooks Creek extending from the north line of the S½ of S½ of Section 26, T6S, R20E, to the south line of the N½ of Section 1, T7S, R20E, MDB&M, immediately downstream from the applicant.

The Issues

The protest of Leland J. and Dorothy M. Davis is based upon the contention that the appropriation contemplated under Application 16849 will interfere with their use of water from

Crooks Creek under an appropriative right initiated prior to the effective date of the Water Commission Act in 1914 and by virtue of riparian ownership. The only issue involved is whether unappropriated water exists in sufficient quantity to justify approval of the application.

Discussion of the Evidence

The Davis Ahwahnee Meadow Ranch was originally owned and developed by William H. Crooks. In the 1850's Mr. Crooks constructed a log diversion dam about four feet high (RT p. 51) in Crooks Creek for the purpose of diverting water onto a meadow and for the irrigation of some crops on the west side of the Creek (RT pp. 39, 40). The dam was used in this manner until the death of Mr. Crooks in 1912 (RT pp. 40, 41). From 1912 to 1950 diversion was made intermittently during wet years (RT p. 51) and water was used continuously direct from the creek for stock water (RT p. 44). In 1950 the then owners of the ranch, Gellhardt and Cox, constructed a storage dam on the creek under the supervision of the Soil Conservation Service (RT p. 45). There is no evidence as to the capacity of the reservoir. However, testimony is to the effect that the dam is 24 feet high and forms a lake 1100 feet long with a width of 600 feet (RT p. 52). A second dam was built on the Davis property in 1954 by a Mr. Tharalson who owned the ranch at that time (RT p. 53). Water from both reservoirs is used for stockwatering and for irrigation purposes.

The applicant's property was homesteaded by the Baker family in 1910 (RT p. 10). Except in an exceptionally wet year

Crooks Creek ceases flowing in June and has always been dry by the first of July within the Baker property (RT pp. 11, 49) which is adjacent to and upstream from the Davis property.

The applicant's dam on Crooks Creek was built in 1942, the dam on the unnamed stream was built in 1956 (RT pp. 11, 12). According to Mr. George H. Crooks, a former owner of the Davis property, and also Mr. Davis, there has been no substantial change in the flow conditions of the creek during the summer months since the construction of the applicant's dams (RT pp. 50, 103). Also, there is no question as to the adequacy of runoff during the winter months (RT pp. 112, 114). In fact, Mr. Davis does not attempt to completely fill his reservoirs (by placing flashboards in the spillway) until most of the winter flow has passed in order to avoid possible flood damage to his works (RT p. 114).

Under Application 16849 water will be collected to storage during the period of November 1 to May 31. The primary concern of the protestants is that with the existence of the applicant's upstream reservoirs the runoff after about March 15 will not be adequate to meet their requirements. Protestants' problem then is obviously not one of adequate total seasonal runoff but of correctly predicting the occurrence of flow during the spring months. Under these circumstances it must be concluded that there is unappropriated water available to supply the applicant without material injury to protestants, and that approval of the application will permit greater conservation of the water resources involved.

The discussion thus far has assumed that protestants produced satisfactory evidence of their prior right to impound water of Crooks Creek during the season covered by Application 16849 for use later in the year. In fact, they did not do so, since there is no evidence that water was stored by them or their predecessors until 1950, and they have not received a permit authorizing storage. Prior to that time all use of water on the Ahwahnee Meadow Ranch from Crooks Creek was by direct diversion of the natural flow. A right to appropriate water acquired by beneficial use prior to the effective date of the Water Commission Act (December 19, 1914) is measured and limited by actual beneficial use, both as to quantity and time. Although there are no California court decisions directly in point, it follows logically that a right to divert natural flow at a stated rate for irrigation use during the irrigation season cannot be converted into a right to divert at a greater rate during the winter season and to hold the water over for use during the irrigation season. Such change would constitute a new appropriation of water for which, since 1914, a permit from the State has been required. A direct diversion right can be converted to a storage right only to the extent there is no change in rate of diversion from the stream or in the period of the year during which the water is diverted.

As to the protestants' alleged riparian right, the courts have held (<u>Seneca Consol. Gold Mines Co. v. Great Western Power Co.</u>, 209 Cal. 206, 287 P. 93; <u>Colorado Power Co. v. Pacific Gas and Electric Co.</u>, 218 Cal. 559, 24 P. 2d 495; and <u>Moore v. California-Oregon Power Co.</u>, 22 Cal. 2d 725, 140 P. 2d 798) that water cannot be stored and withheld for a deferred use under a claim of riparian right. "... the right of storage may be exercised only pursuant to appropriations lawfully made." (Meridian, Ltd. v. San Francisco, 13 Cal. 2d 424)

A further factor which casts doubt upon the present validity of protestants' alleged prior water right, and consequently upon their standing objection to Application 16849, is the apparent intermittent use of water by protestants' predecessors between 1912 and 1950, since, generally speaking, non-use of water for a continuous period of five years results in loss of a pre-1914 appropriative water right.

Conclusions

The evidence indicates and the Board finds that unappropriated water exists at times in the sources named in Application 16849 and that such water may be taken and used in the manner proposed by the applicant during such times without injury to downstream water users holding prior vested rights. It is therefore the conclusion of the Board that Application 16849 should be approved and that a permit should be issued to the applicant subject to the usual terms and conditions.

Order

Application 16849 for a permit to appropriate unappropriated water having been filed with the former Division of Water Resources, jurisdiction of water rights including the subject application having been subsequently transferred to the State Water Rights Board, protests having been received, a public hearing having been held, evidence having been received and considered by the Board, and said Board now being fully informed in the premises:

IT IS HEREBY ORDERED that Application 16849 be, and the same is, hereby approved, and it is ordered that a permit be issued to the applicant subject to vested rights and to the following terms and conditions, to wit:

1. The amount of water appropriated shall be limited to the amount which can be beneficially used and shall not exceed 10.5 acre-feet per annum by storage, from about November 1 of each year to about May 31 of the succeeding year, all as more explicitly set forth in Paragraph 2 of the approved application.

2. The maximum amount herein stated may be reduced in the license if investigation so warrants.

3. Complete application of the water to the proposed use shall be made on or before December 1, 1960.

4. Progress reports shall be filed promptly by permittee on forms to be provided annually by the State Water Rights Board.

5. All rights and privileges under this permit including method of diversion, method of use and quantity of water diverted are subject to the continuing authority of the State Water Rights Board in

accordance with law and in the interest of the public welfare to prevent waste, unreasonable use, unreasonable method of use or unreasonable method of diversion of said water.

Adopted as the decision and order of the State Water Rights Board at a meeting duly called and held at ______________, California, on this _____ day of ____________, 1959.

Kent Silverthorne, Chairman

W. P. Rowe, Member

Ralph J. McGill, Member

APPENDIX "K"

PRELIMINARY ENGINEERING COST ESTIMATES
FOR
SHORT TERM SUPPLY AUGMENTATION ALTERNATIVES

PRE-ENGINEERING COST ESTIMATE

* ALTERNATIVE No.1: ON-SITE WELL SYSTEM

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
1.	DOMESTIC WELL (250-300 FEET DEEP, 400 GPM @ 60 H.P.)	5 EA.	$150,000/EA.	$750000
2.	16-INCH DIAMETER TRANSMISSION PIPELINE	18,000 L.F.	64/L.F.	1,150,000
3.	RIGHT OF WAY (EASEMENT)	2 AC.	50,000/AC.	100,000
		SUB-TOTAL		$2,000,000
		+20% CONTIGENCY		400,000
		+25% ENGINEERING, ADMINISTRATION & INSPECTION		500,000
		TOTAL		$2,900,000

ESTIMATED TOTAL COST ALTERNATIVE No.1 = $2.5 - 3.0 MILLION

* ALTERNATIVE No.2: OFF-SITE WELL SYSTEM (SLOUGHOUSE)

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
1.	DOMESTIC WELL (300-500 FEET DEEP, 1,000 GPM @ 250 H.P.)	2 EA.	$175,000/EA.	$350,000
2.	18-INCH DIAMETER TRANSMISSION PIPELINE	42,000 L.F.	72/L.F.	3,020,000
3.	RIGHT OF WAY (EASEMENT)	10 AC.	20,000/AC.	200,000
4.	WELL SITE PROPERTY	20 AC.	20,000/AC.	400,000
		SUB-TOTAL		$3,970,000
		+20% CONTIGENCY		800,000
		+25% ENGINEERING, ADMINISTRATION & INSPECTION		990,000
		TOTAL		$5,760,000

ESTIMATED TOTAL COST ALTERNATIVE No.2 = $5.5 - 6.0 MILLION

* ALTERNATIVE No.3: ON-SITE STORAGE

ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT
1.	CUTOFF TRENCH EXCAVATION	35,000 C.Y.	$2.50/C.Y.	$90,000
2.	RANDOM FILL	250,000 C.Y.	4.00/C.Y.	1,000,000
3.	CLAY CORE	125,000 C.Y.	4.00/C.Y.	500,000
4.	ROCK ZONE	10,000 C.Y.	25.00/C.Y.	250,000
5.	SAND ZONE	35,000 C.Y.	25.00/C.Y.	875,000
6.	TOPSOIL	7,000 C.Y.	10.00/C.Y.	70,000
7.	UNDERDRAIN SYSTEM	LUMP SUM	LUMP SUM	100,000
8.	EMERGENCY SPILLWAY	LUMP SUM	LUMP SUM	75,000
9.	OUTLET WORKS	LUMP SUM	LUMP SUM	250,000
10.	PIEZOMETERS & SETTLEMENT MARKERS	LUMP SUM	LUMP SUM	50,000
11.	EROSION CONTROL	LUMP SUM	LUMP SUM	100,000
12.	ACCESS ROAD	3,000 L.F.	50.00/L.F.	150,000
13.	PUMP STATION	LUMP SUM	LUMP SUM	200,000
14.	12-INCH DIAMETER DELIVERY PIPELINE	4,000 L.F.	50.00/L.F.	200,000
15.	RIGHT OF WAY (FEE SIMPLE)	250 AC.	20,000/AC.	5,000,000
		SUB-TOTAL		$8,910,000
		+30% CONTIGENCY		2,673,000
		+30% ENGINEERING, ADMINISTRATION & INSPECTION		2,673,000
		TOTAL		$14,256,000

ESTIMATED TOTAL COST ALTERNATIVE No.3 = $13.5 - 14.5 MILLION

GLOSSARY

Acre foot (AF) - The volume of water necessary to cover one acre of land to a depth of one foot (1 AF = 43,560 cubic feet).

Alluvium - A geologic term describing beds of sand, gravel, silt, and clay deposited by flowing water.

Annual Yield - The total volume of flow of a river for a water year.

Aquifer - A geologic formation that stores, transmits, and yields significant quantities of water to wells and springs.

Conjunctive operation - A term used to describe operation of ground water basin in coordination with a surface water reservoir system. The purpose is to naturally recharge the basin during years of above-average precipitation so that the water can be withdrawn during years of below-average precipitation, when surface supplies are below normal. Conjunctive operation typically provides more water at a lower cost than would otherwise be possible.

Cubic feet per second (CFS) - A measure of the rate of flow of water (1 cubic foot per second = 448.8 gallons per minute).

Cubic foot - The volume of water contained in a three dimensional cube with one foot sides (1 cubic foot = 7.48 gallons).

Drought - A condition in nature where precipitation and surface water sources are significantly below average. For the purposes of this report, a drought exists when the annual yield of the Cosumnes River is below 84,000 acre feet.

Gallons per minute (gpm) - A measure of the rate of flow of water.

Overdraft - The temporary condition of a ground water basin where the amount of water withdrawn by pumping exceeds the amount of water replenishing the basin over a period of time.

Permeability - The capability of soil or other geologic formation to transmit water.

Recharge - Flow to ground water storage from precipitation, infiltration from streams, and other sources of water.

Safe yield - The maximum quantity of water that can be continuously withdrawn from a ground water basin without adverse effect.

Surface supply - water in reservoirs, lakes, or streams; expressed either in terms of rate of flow (cubic feet per second) or volume (acre feet).

Water budget - A mass balance calculation used to compare the available supply of water with competing water demands.

Water budget year - A consecutive 12-month period beginning June 1st and ending May 31st of the following year.

Water year - A consecutive 12-month period usually beginning October 1st and ending September 30th of the following year.

BIBLIOGRAPHY

American Water Works Association, Ground Water Manual No. M21, 1973.

Boyle Engineering Corporation, Rancho Murieta Water Supply, November 1989.

California Department of Water Resources, California's Ground Water, September 1975.

__________. Cocke, Rich, Telephone Interview, Sacramento, California, January 8, 1990.

__________. Drought Contingency Planning Guidelines for 1989, January 1989.

__________. Elevation of Ground Water Resources, July 1974.

__________. Impact of Severe Drought in Marin County, 1979.

__________. Managing Limited Urban Water Supplies, November 1, 1989.

__________. Thomas, Dean, Telephone Interview, Sacramento, California, January 24, 1990.

__________. Urban Drought Guidebook, March 1988.

__________. 1976-77 California Drought: A Review, 1978.

CH2M/Hill, Sacramento Couhty Wide Water Plan - Final Report, August 1976.

__________. Sacramento County Wide Water Plan - Summary, September 1976.

Chow, Laidment and Mays, Applied Hydrology, McGraw-Hill, 1988.

Clark & Schkade, Statistical Analysis for Administrative Decisions, Third Edition, South-Western Publishing, 1979.

Clark, Viessman & Hammer, Water Supply & Pollution Control, Second Edition, International Textbook, 1971.

Dunlop, Harry J. - Consultant, Report on Water Supply Alternatives, December 20, 1989.

Giberson & Associates, Analysis of Rancho Murieta Water Supply System, May 22, 1989.

__________. Rancho Murieta Storm Drainage & Flood Control Master Plan, June 10, 1988.

Linsley, Kohler & Paulhus, Hydrology for Engineers, McGraw-Hill, 1975.

Luhdorff & Scalamini, Consulting Engineers, Ground-Water Evaluation & Site Assessment of Wells, January 1988.

Metcalf & Eddy, Water Supply Study for Rancho Murieta, March 1980.

National Geographic, "Baja California: Mexico's Land Apart", December 1989.

Nolte & Associates, Evaluation of Water Use at Rancho Murieta, November 15, 1989.

Nolte, George S. - Consulting Civil Engineers, County of Sacramento Master Drainage Plan - Part I: County-Wide Hydrology, October 1961.

Sacramento Area Water Authority, Duncan, Lou, Telephone Interview, Sacramento California, February 7, 1990.

Sacramento Bee, The Auburn Dam Finds New Allies," December 14, 1989.

__________. Folsom Development Spurs Hunt For Water," December 23, 1989.

__________. "Largest Water Supplier Warns of Big Cuts," January 30, 1990.

__________. "Water Meters Could Outdo Auburn Dam, Study Finds," December 29, 1989.

__________, Water Officials Ask: Why Pray For Sunshine? We Need Rain," December 28, 1989.

Sacramento County Department of Public Works, Water Resources Division, Water Issues Policy Recommendations, February 8, 1988.

Sacramento County Planning Department, Rancho Murieta Planned Development Ordinance No 77-PD-10, December 14, 1977.

Trutt, M., The N-Year Flood: What does it mean?, Public Works, June 1979.

U.S. Department of Commerce, National Weather Service, Climate of Sacramento, California, April 1989.

U.S. Water Resources Council, Guidelines for Determining Flood Flow Frequency, September 1981.

Vail & Associates, Raymond, Disposal of Treated Wastewater at Rancho Murieta, September 1978.

__________. Rancho Murieta Master Water Resources Report - Draft, July 1987.

__________. Rancho Murieta Water Demand Pattern and Raw Water Supply Report, December 1977.

__________. Rancho Murieta Water Supply Reports to Sacramento LAFCO, July 20, 1981 & September 29, 1981.

__________. Rancho Murieta Wastewater Disposal Program, April 1981.