Appendix E

1991 Warren Valley Basin Management Plan and 1996 Addendum
(*included on CD-ROM*)

Office Copy

Final Draft Report

Warren Valley Basin Management Plan

Warren Valley Basin Watermaster
Yucca Valley, California

30 January 1991
K/J/C 904619.00

Kennedy/Jenks/Chilton

Kennedy/Jenks/Chilton

Consulting Engineers and Scientists

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30 January 1991

Warren Valley Basin Watermaster
6955 Old Woman Springs Road
Yucca Valley, California 92284

Subject: Final Draft Report
Warren Valley Basin Management Plan
K/J/C 904619.00

Gentlemen:

In accordance with our work authorization dated 1 October 1990, Kennedy/Jenks/Chilton is pleased to submit twenty (20) copies of the final draft Warren Valley Basin Management Plan. This management plan provides a comprehensive strategy to balance water supplies and demands in the Yucca Valley area, develop a physical solution to the overdraft of the Warren Valley Basin, protect groundwater quality, and inform the public and the Court of the Watermaster's progress in implementation of the plan.

We appreciate the review comments and valuable contributions of the Watermaster Board, and particularly the engineering committee, and we would be pleased to meet with you to discuss the contents of the plan.

Very truly yours,

KENNEDY/JENKS/CHILTON

Lynn M. Takaichi

Lynn M. Takaichi
Vice President

LMT/cakWPC15

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CHAPTER 1

EXECUTIVE SUMMARY

The Warren Valley Basin provides a groundwater supply for the community of Yucca Valley in San Bernardino County, California. Since the 1950's, extractions from the Basin have exceeded its safe yield of 200 acre-feet per year. Due to an increasing overdraft problem, the Basin was adjudicated in 1977. In its adjudication judgement, the Court appointed the Hi-Desert Water District (HDWD) Watermaster and ordered the Watermaster to develop a physical solution to the overdraft problem.

Since the adjudication, several studies of the Basin have been conducted; however, a comprehensive Basin management plan had not been prepared. Accordingly, when the Watermaster requested approval of several motions in August 1990, the Court expressed its frustration at the seemingly slow pace of addressing the overdraft problem and appointed six new non-voting members to the Watermaster Board. These new Board members were directed to report to the Court in six months regarding the progress of the Watermaster in developing a viable plan to address the overdraft problem.

In recognition of the need to develop a consensus regarding a solution to the overdraft problem, the Watermaster Board authorized the preparation of this Warren Valley Basin Management Plan. The management plan presented in this report is a result of engineering evaluations and monthly review meetings with the engineering committee of the Watermaster which is composed of eight of the eleven Board members. The plan also reflects the significant level of current HDWD activities which affect water supply planning. Among these activities are the following:

1. An aggressive water conservation program.

2. Settlement of the Mainstream Well litigation.

3. Voter-approval of the Morongo Basin Pipeline and ongoing contractual, environmental, financial, and program management activities related to its implementation.

4. Imposition of new connection moratoriums by HDWD, Department of Health Services and Superior Court.

5. Ongoing evaluations of potential new imported water sources.

6. Purchase of the Yucca Water Company's (YWC) water system.

7. Preparation of water rate study to generate sufficient funds for ongoing activities.

8. Discussions with Metropolitan Water District (MWD) regarding the possibility of interagency conjunctive use of the Warren Valley Basin.

9. Approval of stormwater conservation concepts by the San Bernardino County Flood Control District.

10. Expanded representation of the Watermaster Board.

These recent activities affect both water supply and demand and are incorporated into the management plan.

Initially, management objectives for the Watermaster were established. Based on these objectives, current activities and potential program elements to increase water supplies or decrease water demands were evaluated and specific recommendations were formulated. The implementation of each recommended action was categorized as short-term (1 to 2 years), intermediate-term (3 to 5 years), or long-term (beyond 5 years). Based on the recommended roles of the Watermaster and HDWD, the responsibility for implementation was also recommended. A summary of the management objectives, recommended program elements, implementation responsibility, and implementation schedule is presented in Table 1-1.

For planning purposes, a 20-year water supply planning horizon was selected. This period provides sufficient time to accommodate changing water supply and demand scenarios without an unnecessary commitment of financial resources. It is intended that this management plan would be reviewed and adjusted on an annual basis so that water supplies are constantly maintained 20 years ahead of water demands. This dynamic assessment process is the foundation of the management plan.

Based on this 20-year planning period, the balance between water supply and demand was evaluated for five alternative growth scenarios. The growth alternatives range from a zero growth rate (GA-0) to the most rapid growth rate (GA-4). Scenario GA-1 is based on an annual water consumption increase of 50 acre-feet per year (AFY). Scenario GA-2 is based on a 2 percent annual growth rate in water demand. Scenario GA-3 is based on HDWD's draft water supply master plan in which the decreased availability of developable land and the connection limitations within the YWC service area were taken into account. Scenario GA-4 assumes a 3.25 percent annual growth rate projected by the Southern California Association of Governments (SCAG). The growth alternatives assume that existing moratoriums placed on the HDWD and YWC service areas will suppress the growth rate to one percent for the period from 1990 to 1995. The use of higher growth rates after 1995 anticipates removal of the moratoriums. Water supply estimates are based on the safe yield of the Warren Valley Basin, anticipated supplies from the Mainstream Well and Morongo Basin Pipeline, and the recommended actions summarized in Table 1-1. These activities are the key components of the recommended physical solution to the overdraft problem of the Warren Valley Basin.

The results of this water supply/demand balance for each growth scenario, as well as the anticipated impact on Basin capacity, are presented in Tables 1-2 to 1-6. Based on this analysis, to restore the Basin capacity to its current level, the growth in water demands should be maintained within those represented by GA-4 if the recommended management plan is fully implemented.

To implement the ongoing activities of the Watermaster, it is recommended that an annual budget of $235,000 be established; however, of this amount, approximately $67,000 must be utilized to repay the HDWD for advanced funds. To generate these funds, it is recommended that a production assessment of $84 per acre-foot be established. This assessment would apply to every acre-foot of groundwater extracted by HDWD, Blue Skies Country Club, or other future water users. In addition, to recharge the Basin, it is recommended that a replenishment assessment of $1,009 per acre-foot be established. This assessment would apply to extractions beyond the safe yield allocations of HDWD, Blue Skies Country Club, or other future water users. Furthermore, it is recommended that Basin equity assessments be authorized when imported water becomes available. Basin equity assessments are a revenue-neutral management tool that can be used to economically encourage the use of one water supply in preference to the others.

TABLE 1-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 1. Manage extractions from the Basin to provide a dependable and cost-effective long-term water supply for the Yucca Valley area.		
1.1 Continue to develop groundwater resources on the mesa	District	Ongoing (litigation settled 1/91)
1.2 Continue to implement State water importation by construction of the Morongo Basin Pipeline (MBP)	District	Ongoing
1.3 Maintain annual water demand growth below 2 percent (GA-2) if only ongoing programs are implemented or below 3.25 percent (GA-4) if all recommended programs are implemented	District	Short-term
1.4 Obtain early SWP delivery or temporary water transfers	Watermaster/District	Short-term
1.5 Evaluate opportunities to obtain groundwater along the MBP and/or water supplies in the low desert	Watermaster	Intermediate-term
1.6 Evaluate opportunities to obtain additional SWP entitlements or develop water supplies in other areas	Watermaster	Long-term
1.7 Develop a computerized groundwater flow model	Watermaster	Short-term
1.8 Evaluate opportunities for interagency conjuctive use of the Basin	Watermaster	Short-term

TABLE 1-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 2. Equitably distribute available groundwater and imported water supplies.		
2.1 Restrict the drilling of new wells for individual residences unless the District cannot provide water service	Watermaster	Short-term
2.2 Establish interim and long-term groundwater allocations	Watermaster	Short-term
2.3 Establish a water rate structure which recovers the cost of providing water service	District	Short-term
2.4 Establish Basin equity assessments to manage the utilization of groundwater and imported water supplies	Watermaster	Intermediate-term
2.5 Establish a water shortage contingency plan	District	Short-term
Goal 3. Conserve stormwaters tributary to the Basin.		
3.1 Construct retention ponds in Yucca Creek flood control channel and its tributaries	District	Short-term
3.2 Construct recharge basins in Water Canyon	District	Intermediate-term
3.3 Evaluate the feasibility of recharge basins at Blue Skies Country Club	District	Short-term
Goal 4. Encourage water conservation and water reclamation.		
4.1 Continue ongoing water conservation programs	District	Ongoing
4.2 Pursue regulatory approval for greywater use	Watermaster	Short-term
4.3 Conduct feasibility study of wastewater reclamation (Phase 1)	District	Intermediate-term
4.4 Implement additional water conservation programs	District	Short-term

TABLE 1-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 5. Manage and protect groundwater quality for potable uses.		
5.1 Establish a water quality monitoring program	Watermaster/District	Short-term
5.2 Identify potential sources of contamination	Watermaster	Short-term
5.3 Prepare a groundwater quality protection plan	Watermaster	Intermediate-term
Goal 6. Monitor activities affecting the Basin.		
6.1 Establish a Basin monitoring plan	Watermaster	Short-term
6.2 Prepare a groundwater quality protection plan	Watermaster	Intermediate-term
6.3 Prepare an annual report of Basin condition and implementation plan status	Watermaster	Short-term
Goal 7. Conduct public education and information programs.		
7.1 Expand the current public information program	Watermaster/District	Short-term
7.2 Hire a public information officer	District	Short-term (completed 1/91)
7.3 Develop an educational resource center	District	Intermediate-term
7.4 Participate in special events	District	Short-term
7.5 Establish a conservation awards program	District	Short-term
Goal 8. Generate sufficient revenues to achieve the objectives of the Watermaster.		
8.1 Establish a water rate structure which recovers the cost of providing water service	District	Short-term
8.2 Establish production assessments to recover the cost of Watermaster activities	Watermaster	Short-term

TABLE 1-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 8. Generate sufficient revenues to achieve the objectives of the Watermaster. (cont.)		
8.3 Establish replenishment assessments to recover the cost of Basin recharge	Watermaster	Short-term
8.4 Establish Basin equity assessments to manage the utilization of groundwater and imported water supplies	Watermaster	Intermediate-term
Goal 9. Perform court-mandated directives.		
a. Develop physical solution		
9.1 Continue to develop groundwater resources on the mesa	District	Ongoing (litigation settled 1/91)
9.2 Continue to implement State water importation by construction of the Morongo Basin Pipeline	District	Ongoing
9.3 Obtain early SWP delivery or temporary water transfers	Watermaster/District	Short-term
9.4 Evaluate opportunities to obtain groundwater along the MBP and/or water supplies in the low desert	Watermaster	Intermediate-term
9.5 Evaluate opportunities to obtain additional SWP entitlements or develop water supplies in other areas	Watermaster	Long-term
b. Report progress to the Court		
9.6 Prepare an annual report of Basin condition and implementation plan status	Watermaster	Short-term

TABLE 1-2
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-0)

YEAR	SAFE YIELD	SWP	M. WELL	WATER SUPPLIES (AFY) EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-0	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	0	0	0	200	3565	-3365	36000
1991	200	0	0	0	30	75	305	3555	-3250	32750
1992	200	0	800	0	60	75	1135	3545	-2410	30340
1993	200	0	806	0	90	75	1172	3534	-2362	27978
1994	200	0	813	0	120	75	1208	3524	-2316	25662
1995	200	4282	820	0	150	75	5527	3514	2013	27675
1996	200	4116	820	166	150	75	5527	3514	2013	29688
1997	200	3990	820	292	150	75	5527	3514	2013	31701
1998	200	4104	820	178	150	75	5527	3514	2013	33714
1999	200	3043	820	1239	150	75	5527	3514	2013	35727
2000	200	4282	820	0	150	75	5527	3514	2013	37740
2001	200	4282	820	0	150	75	5527	3514	2013	39753
2002	200	4282	820	0	150	75	5527	3514	2013	41766
2003	200	3871	820	411	150	75	5527	3514	2013	43779
2004	200	4282	820	0	150	75	5527	3514	2013	45792
2005	200	4282	820	0	150	75	5527	3514	2013	47805
2006	200	3551	820	731	150	75	5527	3514	2013	49818
2007	200	3695	820	587	150	75	5527	3514	2013	51831
2008	200	3455	820	827	150	75	5527	3514	2013	53844
2009	200	3998	820	284	150	75	5527	3514	2013	55857
2010	200	3613	820	669	150	75	5527	3514	2013	57870

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 1-3
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-1)

	WATER SUPPLIES (AFY)									
YEAR	SAFE YIELD	SWP	M. WELL	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-1	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE (AF)
1990	200	0	0	0	0	0	200	3565	-3365	36000
1991	200	0	0	0	30	75	305	3555	-3250	32750
1992	200	0	800	0	60	75	1135	3545	-2410	30340
1993	200	0	806	0	90	75	1172	3534	-2362	27978
1994	200	0	813	0	120	75	1208	3524	-2316	25662
1995	200	4282	820	0	150	75	5527	3514	2013	27675
1996	200	4116	831	166	150	75	5538	3564	1974	29649
1997	200	3990	842	292	150	75	5549	3614	1935	31584
1998	200	4104	853	178	150	75	5560	3664	1896	33480
1999	200	3043	864	1239	150	75	5571	3714	1857	35337
2000	200	4282	875	0	150	75	5582	3764	1818	37155
2001	200	4282	886	0	150	75	5593	3814	1779	38934
2002	200	4282	897	0	150	75	5604	3864	1740	40674
2003	200	3871	908	411	150	75	5615	3914	1701	42375
2004	200	4282	919	0	150	75	5626	3964	1662	44037
2005	200	4282	930	0	150	75	5637	4014	1623	45660
2006	200	3551	941	731	150	75	5648	4064	1584	47244
2007	200	3695	952	587	150	75	5659	4114	1545	48789
2008	200	3455	963	827	150	75	5670	4164	1506	50295
2009	200	3998	974	284	150	75	5681	4214	1467	51762
2010	200	3613	985	669	150	75	5692	4264	1428	53190

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 1-4
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-2)

		WATER SUPPLIES (AFY)								
YEAR	SAFE YIELD	SWP	M. WELL	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-2	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE (AF)
1990	200	0	0	0	0	0	200	3565	-3365	36000
1991	200	0	0	0	30	75	305	3555	-3250	32750
1992	200	0	800	0	60	75	1135	3545	-2410	30340
1993	200	0	806	0	90	75	1172	3534	-2362	27978
1994	200	0	813	0	120	75	1208	3524	-2316	25662
1995	200	4282	820	0	150	75	5527	3514	2013	27675
1996	200	4116	836	166	150	75	5543	3588	1955	29630
1997	200	3990	853	292	150	75	5560	3664	1896	31526
1998	200	4104	870	178	150	75	5577	3741	1836	33362
1999	200	3043	887	1239	150	75	5594	3820	1774	35136
2000	200	4282	905	0	150	75	5612	3901	1711	36847
2001	200	4282	923	0	150	75	5630	3983	1647	38494
2002	200	4282	942	0	150	75	5649	4066	1583	40077
2003	200	3871	960	411	150	75	5667	4152	1515	41592
2004	200	4282	980	0	150	75	5687	4239	1448	43040
2005	200	4282	999	0	150	75	5706	4327	1379	44419
2006	200	3551	1019	731	150	75	5726	4418	1308	45727
2007	200	3695	1040	587	150	75	5747	4510	1237	46964
2008	200	3455	1060	827	150	75	5767	4604	1163	48127
2009	200	3998	1082	284	150	75	5789	4701	1088	49215
2010	200	3613	1103	669	150	75	5810	4799	1011	50226

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 1-5
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-3)

YEAR	SAFE YIELD	SWP	M. WELL	WATER SUPPLIES (AFY) EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-3	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE (AF)
1990	200	0	0	0	0	0	200	3565	-3365	36000
1991	200	0	0	0	30	75	305	3555	-3250	32750
1992	200	0	800	0	60	75	1135	3545	-2410	30340
1993	200	0	806	0	90	75	1172	3534	-2362	27978
1994	200	0	813	0	120	75	1208	3524	-2316	25662
1995	200	4282	820	0	150	75	5527	3514	2013	27675
1996	200	4116	854	166	150	75	5561	3668	1893	29568
1997	200	3990	888	292	150	75	5595	3822	1773	31341
1998	200	4104	922	178	150	75	5629	3976	1653	32994
1999	200	3043	956	1239	150	75	5663	4130	1533	34527
2000	200	4282	990	0	150	75	5697	4284	1413	35940
2001	200	4282	1015	0	150	75	5722	4397	1325	37265
2002	200	4282	1040	0	150	75	5747	4511	1236	38501
2003	200	3871	1065	411	150	75	5772	4624	1148	39649
2004	200	4282	1090	0	150	75	5797	4738	1059	40708
2005	200	4282	1115	0	150	75	5822	4851	971	41679
2006	200	3551	1144	731	150	75	5851	4981	870	42549
2007	200	3695	1172	587	150	75	5879	5112	767	43316
2008	200	3455	1201	827	150	75	5908	5242	666	43982
2009	200	3998	1230	284	150	75	5937	5373	564	44546
2010	200	3613	1259	669	150	75	5966	5503	463	45009

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS.

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 1-6
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-4)

YEAR	SAFE YIELD	WATER SUPPLIES (AFY) SWP	M. WELL	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-4	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE (AF)
1990	200	0	0	0	0	0	200	3565	-3365	36000
1991	200	0	0	0	30	75	305	3555	-3250	32750
1992	200	0	800	0	60	75	1135	3545	-2410	30340
1993	200	0	806	0	90	75	1172	3534	-2363	27978
1994	200	0	813	0	120	75	1208	3524	-2316	25662
1995	200	4282	820	0	150	75	5527	3514	2013	27675
1996	200	4116	846	166	150	75	5553	3635	1918	29593
1997	200	3990	874	292	150	75	5581	3759	1822	31415
1998	200	4104	902	178	150	75	5609	3888	1721	33136
1999	200	3043	932	1239	150	75	5639	4021	1618	34754
2000	200	4282	962	0	150	75	5669	4158	1511	36265
2001	200	4282	993	0	150	75	5700	4300	1400	37665
2002	200	4282	1025	0	150	75	5732	4446	1286	38951
2003	200	3871	1059	411	150	75	5766	4597	1169	40120
2004	200	4282	1093	0	150	75	5800	4753	1047	41167
2005	200	4282	1129	0	150	75	5836	4914	922	42089
2006	200	3551	1165	731	150	75	5872	5080	792	42881
2007	200	3695	1203	587	150	75	5910	5252	658	43539
2008	200	3455	1242	827	150	75	5949	5429	520	44059
2009	200	3998	1283	284	150	75	5990	5612	378	44437
2010	200	3613	1324	669	150	75	6031	5801	230	44667

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEAR

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

CHAPTER 2

INTRODUCTION

This chapter presents a brief background of the water supply problems of the Warren Valley Basin and the need for this management plan. The objectives and scope of this plan are summarized.

BACKGROUND AND AUTHORIZATION

Early development in the Yucca Valley area resulted in the formation of many privately owned water companies that provided water for domestic consumption. In 1962, several of them merged and the Yucca Valley County Water District was formed (presently the Hi-Desert Water District.) This District served customers on the east end of town. Between 1964 and 1966, a series of assessment districts were formed that expanded the water service to areas of Yucca Mesa.

In the early 1960's, a portion of the Mesa formed the Star Vista District. Because its well did not produce adequate water to supply its customers, this District tried without success to locate water in the Pipes Sub-basin. Unable to locate adequate water, the Star Vista District requested that the Green Water Development Association annex it. Because the request was denied, Star Vista made the same request to the Hi-Desert Water District (HDWD) and was annexed in 1965. At that time, the Green Water Development Association had a very small territory to the north (Flamingo Heights). Its boundary extended between Tracy Blvd. on the south end to the Dalton Tanks property on the north and only customers along Old Woman Springs Road were served. Many years later, the Green Water Development Association would become the Desert View County Water District. However, at the time the Mesa was annexed into HDWD, it was a long distance from the Mesa. In 1966, Improvement District #1 was formed to purchase the Rancho Ramon and Mountain Mutual Water Companies on the Mesa. The systems purchased or installed by HDWD on the Mesa are those still in existence today, After the formation of Assessment District 1972-1, another 34 miles of pipelines were installed and a 750,000 gallon reservoir was constructed to serve customers in the north and north-east portions of the Mesa.

The northern boundaries of HDWD have not changed since 1972, and the majority of the Mesa has been served by HDWD since the mid-sixties. In 1990, HDWD acquired the water system of the Yucca Water Company and now serves most of the water users overlying the Warren Valley Basin as well as water users on Yucca Mesa which overlie the Ames Valley Sub-basin.

The Warren Valley Basin provides a groundwater supply for the community of Yucca Valley in San Bernardino County, California. The average annual recharge and replenishment to the Basin is approximately 200 acre-feet per year (AFY). Extractions from the Basin are made by the

Hi-Desert Water District (HDWD), Yucca Water Company, Ltd. (YWC) (recently acquired by HDWD), Blue Skies Country Club, Institute of Mental Physics, and numerous individuals for small domestic uses. From the 1950's, the extractions from the Basin have exceeded its safe yield.

Concerned about the prospect of not only continuing but even significantly increasing overdraft, HDWD filed a complaint for adjudication of the groundwater in 1976 (Case No. MCV198, formerly Case No. 172103). In 1977, the Superior Court for the County of San Bernardino issued its judgement for adjudication. In the adjudication, the Court recognized the need to issue groundwater rights in excess of the Basin safe yield so that the local economy could support the cost of a solution to the overdraft problem. Accordingly, overlying rights to Basin groundwater were issued to Blue Skies Country Club (585 AFY) and 16 individuals (1 AFY each); appropriative rights were issued to HDWD (896 AFY) and YWC (726 AFY); and rights of 80 AFY were issued to the Institute of Mental Physics in the Zone of Transmission between the Warren Valley Basin and the adjacent basin. To administer the provisions of the adjudication judgement, the Court appointed the HDWD as the Watermaster for the Basin and ordered that the Watermaster develop a physical solution to the overdraft problem.

Prior to 1984, the Watermaster did not receive financial support from the users of the Basin. In 1984, the HDWD financed the preliminary hydrogeologic and geophysical studies of the Basin and prepared the 1984 Interim Report. This report presented a workplan and budget for development of a Basin management plan. The Court found the proposed workplan and budget to be reasonable and authorized a production assessment to complete the authorized work and repay HDWD for the funds advanced for the preliminary work. The workplan contained four phases and focused on the feasibility of Basin recharge. In 1986, the Watermaster approved a revised seven phase workplan and authorized completion of the first three phases with funds advanced by the HDWD. Phases 1 and 2 which consisted of site investigations of potential recharge sites were completed in 1986. Phase 3 which is an assessment of basin outflows has not been completed.

In an effort to update the previous workplans and revise the production assessments, the Watermaster prepared the Interim Report for 1989-1990. This Interim Report considers the level of production assessments necessary to fund the cost of imported State water. In 1990, the Watermaster requested Court approval of the Interim Report for 1989-1990, adoption of certain of its recommendations, and implementation of water conservation measures. At this time, YWC requested replacement of HDWD as Watermaster. Upon considering these requests, the Court ordered a moratorium on new connections, adopted the recommended water conservation measures, required the maintenance of meters on well pumps, authorized the Watermaster to make meter repairs, and

appointed an additional six non-voting members to the Watermaster Board. In addition, the Court continued the hearing for six months (22 February 1991) at which time the new Board members would report on the progress of Watermaster activities and the Court would consider the remainder of the Interim Report for 1989-1990.

In recognition of the immediate need to formulate a physical solution to the overdraft problem as well as the need to develop consensus on its implementation, the Watermaster for the Warren Valley Basin authorized Kennedy/Jenks/Chilton to prepare a management plan for the Basin. This plan is intended to satisfy the Superior Court mandate for a physical solution to the overdraft problem and will be presented to the Court by 22 February 1991.

SCOPE OF SERVICES

To accomplish the objectives of this plan, the following scope of services was developed:

1. Collect background data regarding groundwater management issues.

2. Review the Interim Report and relevant Superior Court documents.

3. Meet with the engineering committee and Board to define the scope and objectives of the study.

4. Prepare interim submittals of draft report chapters on a monthly basis.

5. Attend engineering committee meetings to review interim submittals.

6. Incorporate review comments and prepare a draft groundwater management plan.

7. Attend Watermaster Board meetings and public hearings to review the draft plan.

8. Incorporate review comments and prepare the final management plan and submit fifty (50) copies of the final plan to the Watermaster.

CONDUCT OF THE STUDY

The information developed in this plan is a result of existing information sources, office analysis, discussions with the staff of the Hi-Desert Water District, and discussions with the engineering committee

of the Watermaster Board of Directors. To initiate the study, outlines of the objectives of the Watermaster, as well as the identified elements of the plan, were prepared and discussed with the engineering committee. Based on these discussions, priorities for preparation of the plan elements were established.

Initial phases of the study were focused on the collection and evaluation of necessary data, reports and literature so that the overdraft problem could be defined and the feasibility of alternative physical solutions could be assessed. Based on the evaluation of this information, draft elements of the management plan were prepared according to the established priorities and distributed to the engineering committee on a monthly basis for discussion. Review comments were incorporated into the individual plan elements. Based on the results of the plan elements, a basin operating plan and implementation were developed. A revenue program to finance the recommended activities was also developed. A draft of the management plan was reviewed by the Watermaster Board of Directors. After incorporating review comments, the final Warren Valley Basin Management Plan was prepared.

It is intended that the management plan would be reviewed on an annual basis by the Watermaster and that adjustments to reflect additional information or differing conditions would be incorporated. This dynamic assessment process is the foundation of the management plan and will allow the Watermaster to maintain an adequate planning horizon without an unnecessary commitment of financial resources.

CHAPTER 3

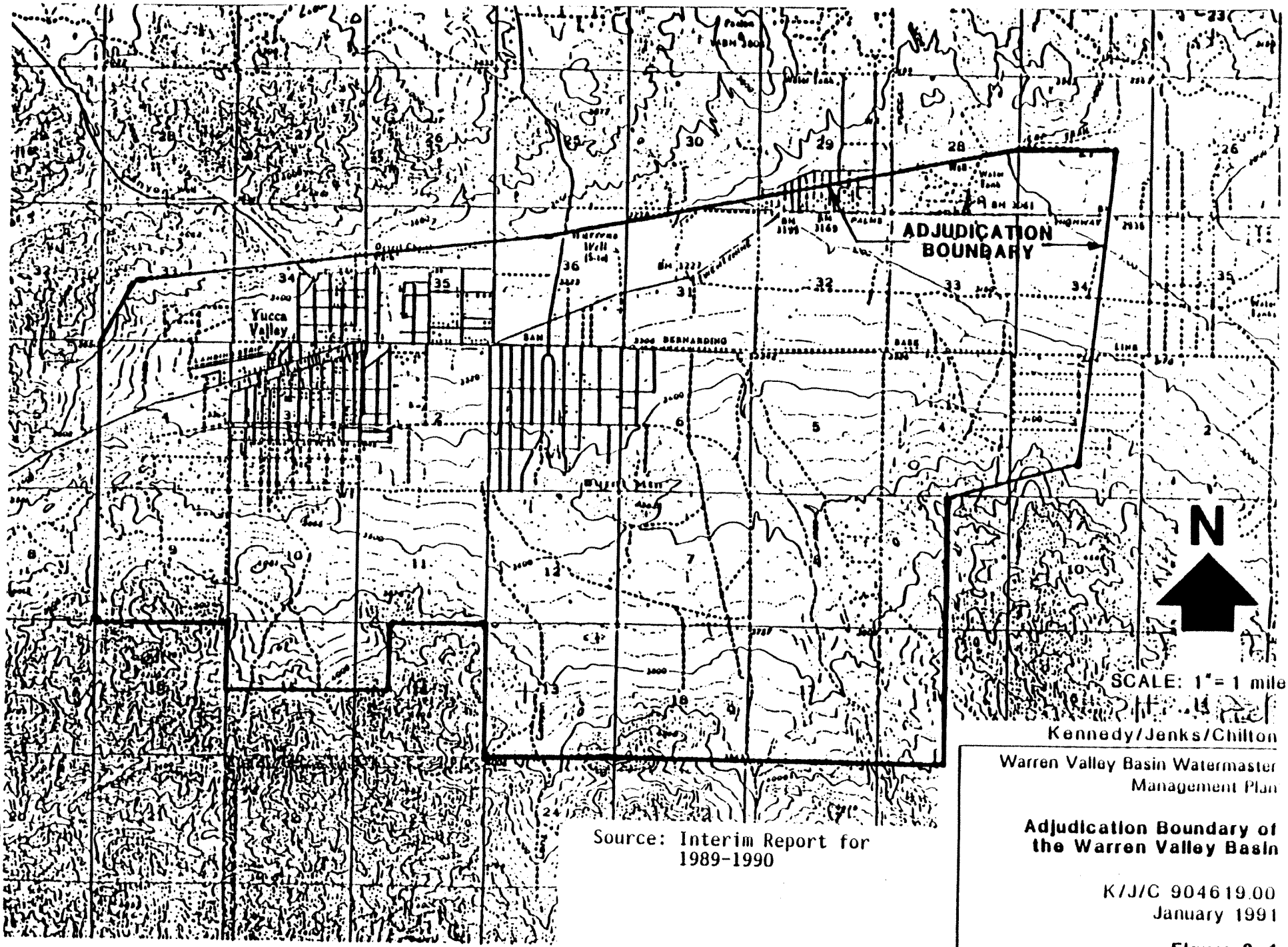
GOALS AND OBJECTIVES

Prior to developing a management plan for the Warren Valley Basin, the goals and objectives of the Watermaster should be established. These objectives include not only those established by Court mandate, but also those established by Board policy. This chapter provides a description of the Warren Valley Basin and its historical overdraft problem. This information is derived primarily from the Interim Report for 1989-1990 prepared by Max Sloan & Associates, a preliminary hydrogeologic evaluation by Leighton and Associates (1985), and an open-file report of the Groundwater Resources of the Yucca Valley - Joshua Tree Area prepared by U.S. Geological Survey (USGS) (1972). This chapter also presents the goals and objectives of the Watermaster which will guide the formulation of the management plan.

OVERVIEW OF THE WARREN VALLEY BASIN

The Warren Valley Basin is located in the community of Yucca Valley in San Bernardino County, approximately 35 miles northerly of Palm Springs. The Warren Valley Basin is characterized by three topographic units: (1) a north sloping alluvial fan which generally lies south of the San Bernardino Base Line; (2) a plateau-like area which stands at an elevation of about 3,000 feet above sea level, occupying most of the basin; and (3) a mountainous area on the south and west. The adjudication boundary of the Warren Valley Basin, as determined in an earlier study, is shown on Figure 3-1.

Yucca Valley is underlain by relatively permeable, unconsolidated gravels, sands and finer sediments shed from adjacent highlands composed of igneous and metamorphic rocks. The groundwater basin is structurally controlled by several northeast-trending faults related to the Pinto Mountain fault zone. The groundwater basin is bordered by the monzonitic rocks of the Sawtooth Mountains to the north, and the gneissic rocks of the Little San Bernardino Mountains to the south. Flanking the valley to the south and southeast and underlying recent alluvial deposits are older fanglomerates and alluvial deposits consisting of poorly sorted clays, silts, sands, and gravels. Groundwater in the valley is primarily recovered from recent and older alluvial deposits. The basin is surrounded and underlain by granitic-type bedrock which, in some cases, is capped by younger basaltic lava flows. Although igneous and metamorphic rocks contain some water in fractures and other open areas, they generally produce much less groundwater than the more permeable alluvial deposits. The depth of unconsolidated alluvial deposits varies from as little as 90 feet to in excess of 800 feet. Below the unconsolidated alluvial deposit, an intermediate layer of denser alluvial material extends to a maximum depth of approximately 3,100 feet.



Source: Interim Report for 1989-1990

Kennedy/Jenks/Chilton

Warren Valley Basin Watermaster Management Plan

Adjudication Boundary of the Warren Valley Basin

K/J/C 904619.00
January 1991

Figure 3-1

Figure 3-1

Generally, the climate of the area is arid. Precipitation, while scant and irregular, is the primary source of groundwater in the region. In the valley and mesa lands, mean annual precipitation is about four inches. On the surrounding mountainous areas, precipitation varies and reaches a maximum of approximately 45 inches on the peaks and ridges.

Groundwater recharge to the alluvial groundwater basin underlying Yucca Valley occurs as precipitation runoff from adjacent igneous and metamorphic highlands infiltrates into the Basin along effemeral streams which flow into the valley. The largest drainage area (and hence the most significant recharge source) is located to the south of Yucca Valley in the Little San Bernardino Mountains. The drainage of Water Canyon to the north of Yucca Valley is also a significant source of recharge to the area. After entering the permeable alluvial basin deposits, groundwater generally flows eastward. The 1977 Basin adjudication judgement declared the safe yield of the Basin to be 200 acre-feet/year (AFY) from recharge and replenishment from precipitation and runoff.

Groundwater levels in the Warren Valley Basin have declined at an ever increasing rate each year since the first purveyors commenced extracting water from the basin aquifer. The collection of water level and water extraction data on a basin wide basis is a continuing task of the Watermaster. In 1983, Harding Lawson Associates performed a geophysical study to determine the configuration and prospective capacity of the Warren Valley Groundwater Basin. Subsequent interpretation of the report by Robert Fox, Consulting Groundwater Geologist for both the Watermaster and Hi-Desert Water District (HDWD), resulted in estimates that the Basin contains approximately 45,000 to 59,000 acre-feet of remaining extractable water in 1987. The total usable storage capacity of the Basin was estimated to be approximately 160,000 acre-feet. The most recent hydrogeological studies in the Warren Valley Basin indicate that the depth to groundwater has increased from an average rate of approximately seven feet per year in 1972 to up to forty feet per year in 1990.

OVERVIEW OF EXISTING OVERDRAFT PROBLEMS

Since the 1950's, the Warren Valley Basin appears to have been in an overdraft condition. As significant growth occurred in the Yucca Valley area, this overdraft condition worsened and groundwater levels declined at an accelerating rate. The depth to groundwater is currently increasing as much as 40 feet per year. This overdraft problem has been known for many years. In its 1972 open-file report on the groundwater resources in the Yucca area, USGS estimated that the groundwater would be depleted by the year 2000.

Recognizing the severity and inevitability of the problem, as well as the need to create the institutional framework to address the problem, the Hi-Desert Water District filed an adjudication complaint against the Yucca Water Company, Ltd. In 1977, a judgement was rendered by the Superior Court for the County of San Bernardino. In the judgement, the

Court established water rights to the Basin groundwater. These rights were established at extraction levels above the safe yield of the Basin so that economic development could occur. This economic base could then be utilized to support the cost of a physical solution to the overdraft problem. The Court appointed the Hi-Desert Water District as the Watermaster for the Basin and directed the Watermaster to develop a physical solution to the problem.

Over the following thirteen years, several studies related to Basin geohydrology and the importation of supplemental water from the State Water Project. Several of these studies were prepared in accordance with a previous interim report (1984) submitted to and approved by the Court.

In 1990, the Hi-Desert Water District filed several motions with the Court. These motions requested approval of the 1989-1990 Interim Report and the implementation of water conservation measures throughout the Basin. The Yucca Valley Water Company also filed a motion for replacement of the Watermaster. At a hearing in August 1990, the Court expressed its frustration with the slow pace of addressing the overdraft problem. Accordingly, the Court appointed six new non-voting members to the Watermaster Board and directed them to report to the Court in six months regarding the progress of the Watermaster in developing a viable plan to address the overdraft problem.

MANAGEMENT OBJECTIVES OF THE WATERMASTER

As directed by the Court, the Watermaster has authorized the preparation of this management plan and is responsible for its administration and implementation. A viable plan to address the groundwater overdraft problems of the Warren Valley Basin must be based on clear management objectives. These objectives can also guide the Watermaster in delineating the appropriate activities of Watermaster as distinct from those of the Hi-Desert Water District or other Basin water users.

Based on the initial meeting of the expanded Watermaster Board in September, draft management objectives were prepared. These objectives received extensive discussion in a subsequent meeting of the Board's engineering committee. Through this process, the following management objectives for the Watermaster were established:

1. Manage extractions from the Basin to provide a dependable and cost-effective long-term water supply for the Yucca Valley area.

2. Equitably distribute available groundwater and imported water supplies.

3. Conserve stormwaters tributary to the Basin.

4. Encourage water conservation and water reclamation.

5. Manage and protect groundwater quality for potable uses.

6. Monitor activities affecting the Basin.

7. Conduct public education and information programs.

8. Generate sufficient revenues to achieve the objectives of the Watermaster.

9. Perform court-mandated directives.

These objectives form the basis for the management plan presented in the following chapters.

RECENT ACTIVITIES

During 1990 and early 1991, several activities which affect the responsibilities of the Watermaster have occurred. Most of these activities are the result of actions by the Hi-Desert Water District. However, because the District serves as the Watermaster, its actions as the District are not independent of its responsibilities as the Watermaster. These activities are described briefly below:

1. Several water conservation ordinances have been enacted to reduce water demands and District staff has been dedicated to implement this program.

2. The District has entered into a purchase contract with a private water developer to utilize water from the Ames Groundwater Basin. In early 1988, a well was successfully completed and can produce up to 2,100 AFY. Unfortunately, because this well was the subject of litigation with an adjacent water district, it could not be utilized. In January 1991, a settlement agreement between the parties was executed. This agreement provides for the extraction of up to 800 AFY for District customers overlying the Ames Valley Water Basin and additional extractions of up to 0.5 AFY for each new residential water meter.

3. The voters within Division Two of the Mojave Water Agency, which includes the Yucca Valley area, approved by more than a two-thirds vote a financing plan for a State water importation project. This project consists of a 71-mile pipeline from the State Water Project near Hesperia to the Yucca Valley area.

Contractual, environmental, financial and program management activities are currently in progress and imported State water is expected to be available by 1995.

4. The District has imposed a six-month moratorium on new connections. The Yucca Water Company service area previously had a moratorium imposed by the Department of Health Services and the recent Superior Court action in August 1990 imposed an additional moratorium on will-serve letters and new connections.

5. The District has met with several prospective sellers of excess water. Although no formal arrangements have been completed, the District is actively pursuing several of these potential water sources. A major impediment to several of these sources is the lack of delivery facilities to the Yucca Valley area.

6. In September 1990, the District purchased the water system of the Yucca Water Company. Although this purchase is not expected to significantly affect the water supply or demand, the integration of the major water purveyors in the Basin should facilitate the implementation of the management plan developed by the Watermaster.

7. The District recently completed a water rate study which recommended steep inverted block rates. This rate structure will promote water conservation and should reduce water demand. These rate increases will also provide the funds to import State water and construct local treatment and recharge facilities.

8. Discussions have been initiated with the Metropolitan Water District of Southern California (MWD) regarding the possibility of banking MWD water in the Warren Valley Basin. Although additional yield is not created, groundwater levels would rise and could reduce extraction costs of the District's groundwater.

9. The San Bernardino County Flood Control District has approved the concept of stormwater conservation within its flood control channels. This program should increase groundwater recharge.

10. The Board of the Watermaster has been expanded to include representatives of the other users of the Basin. This Board meets on a monthly basis and is actively developing a management plan.

These recent activities and their implications to this management plan are described in more detail in the following chapters.

CHAPTER 4

WATER REQUIREMENTS

To assess long term supplemental water needs as well as potential impacts on the Warren Valley Basin, the existing and projected water demands must be identified. In addition, the degree to which these requirements are met by existing and anticipated water supplies must also be addressed. This chapter presents an overview of the water demands and supplies in the Yucca Valley area.

EXISTING AND PROJECTED WATER DEMANDS

The two principal water purveyors in the Yucca Valley area are the Hi-Desert Water District (HDWD) and the Yucca Water Company, Ltd. (YWC), which was recently acquired by the HDWD. Users not served by the two principal purveyors include Blue Skies Country Club (BSCC), the Institute of Mental Physics (IMP), and other individual domestic users. Water use in the Yucca Valley area is primarily for domestic and municipal purposes. Groundwater extractions by BSCC are for golf course irrigation purposes. The IMP, which extracts groundwater from the Zone of Transmission, (i.e. Basin outflow), uses the water for overlying domestic and irrigation purposes. Exceptions are irrigation of the BSCC golf course and overlying use by IMP. Basin water is generally not used for commercial agricultural or industrial purposes. In 1990, the total demand on the Basin is expected to be 3,565 acre-feet of which 1,661 acre-feet will be used by HDWD, 1,263 acre-feet in the YWC service area, 585 acre-feet by BSCC, 40 acre-feet by IMP, and 16 acre-feet by other users.

Due to recent conservation efforts in the HDWD and YWC service areas, water production per connection and water use per capita has decreased in the last four years. According to a draft water supply Master Plan prepared by Egan (1990), the current HDWD per capita use is 0.14 acre-feet per year and the current YWC per capita use is 0.16 acre-feet per year. The total current population is 13,100 for HDWD and 9,360 for YWC. There are currently 5,143 connections in the HDWD service area and approximately 3,300 connections in the YWC service area.

To project water demands, five growth scenarios were developed using projections utilized in previous studies. Future water conservation efforts may reduce the water consumption of each connection and thereby increase the number of connections that may be served by the area's future water supplies. Therefore, the growth scenarios are expressed as volumetric water demands and are not correlated to specific number of connections. Table 4-1 presents the projected water demands generated by these growth alternatives (GA) for the next 75 years. Figure 4-1 shows the five growth alternatives graphically. The growth alternatives range from a zero growth rate (GA-0) to the most rapid growth rate

TABLE 4-1

PROJECTED WATER DEMANDS FOR THE VARIOUS GROWTH SCENARIOS (GA)

GROWTH SCENARIOS	YEAR															
	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
GA-0	3565	3714	3714	3714	3714	3714	3714	3714	3714	3714	3714	3714	3714	3714	3714	3714
GA-1	3565	3714	3964	4214	4464	4714	4964	5214	5464	5714	5964	6214	6464	6714	6964	7214
GA-2	3565	3714	4101	4527	4999	5519	6093	6727	7428	8201	9054	9997	11037	12186	13454	14854
GA-3	3565	3714	4484	5051	5703	6451	7311	8300	9437	10743	12245	13973	15960	18245	20873	23898
GA-4	3565	3714	4358	5114	6001	7041	8262	9695	11376	13349	15664	18380	21567	25307	29696	34845

NOTE: A SUPPRESSED ANNUAL GROWTH RATE OF 1% FOR HDWD AND YWC IS APPLIED TO ALL SCENARIOS BETWEEN 1990-95
GA-0 -- 0% ANNUAL GROWTH
GA-1 -- ANNUAL INCREASE OF 50 ACRE-FEET
GA-2 -- 2% ANNUAL GROWTH
GA-3 -- SEE TABLE 4-2
GA-4 -- 3.25% ANNUAL GROWTH

TABLE 4-2

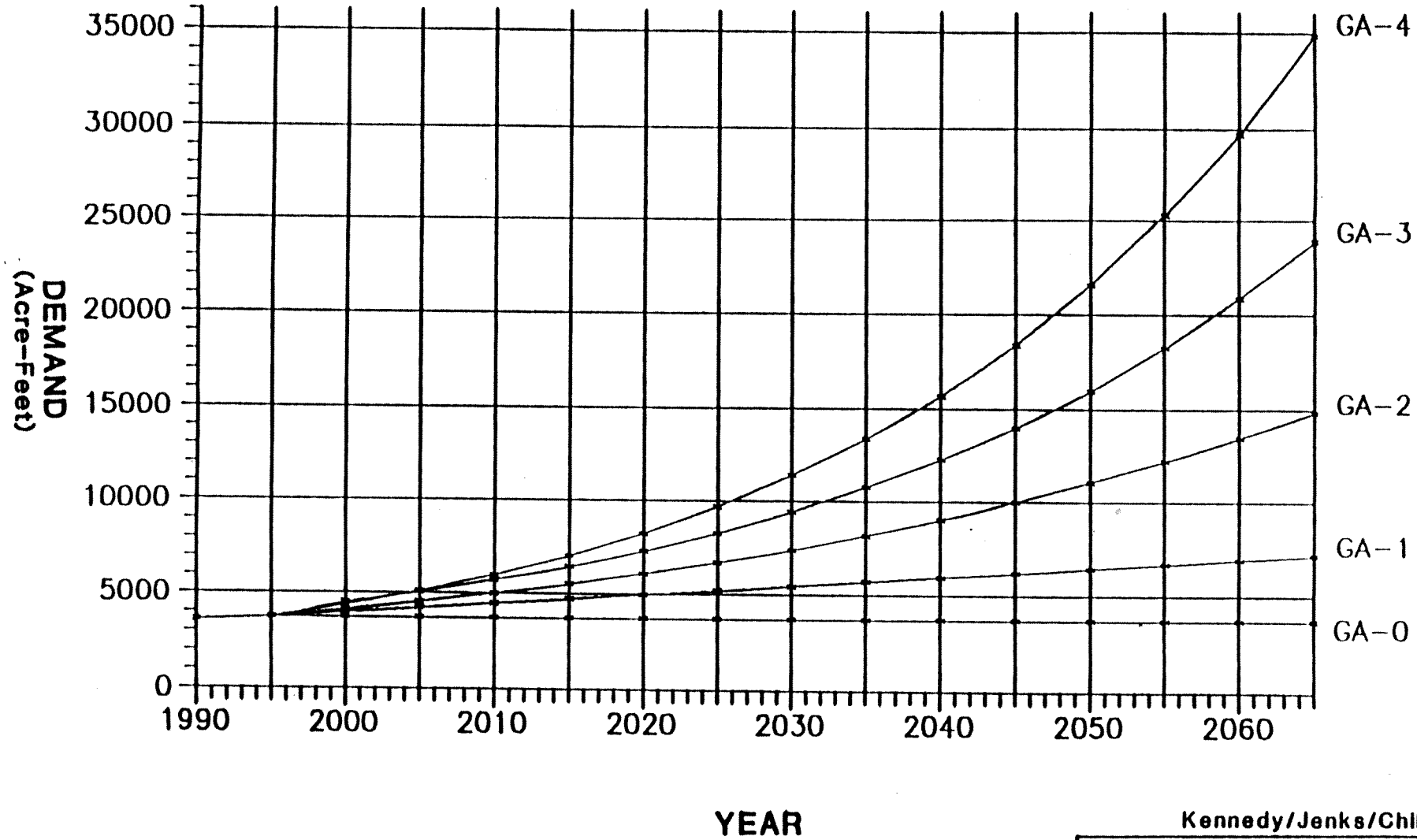
GA-3: EXISTING AND PROJECTED DEMANDS BASED ON HDWD'S DRAFT WATER SUPPLY MASTER PLAN

WATER USER	YEAR															
	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
HDWD	1661	1746	2228	2583	2994	3471	4024	4665	5408	6269	7268	8426	9768	11323	13127	15217
YWC	1263	1327	1615	1827	2067	2339	2646	2994	3388	3833	4336	4906	5551	6280	7106	8039
BSCC	585	585	585	585	585	585	585	585	585	585	585	585	585	585	585	585
IMP	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
OTHERS	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
TOTAL	3565	3714	4484	5051	5703	6451	7311	8300	9437	10743	12245	13973	15960	18245	20873	23898

NOTE: PERCENT ANNUAL INCREASES WERE TAKEN FROM HDWD'S DRAFT WATER SUPPLY MASTER PLAN (JUNE 1990)

HDWD -- 1990-95 2% (USE 1%)
1995-00 5%
2000-05 3%

YWC -- 1990-95 1%
1995-00 4%
2000-05 2.5%



Kennedy/Jenks/Chilton

Warren Valley Basin Watermaster
Management Plan

Projected Water Demands
Yucca Valley Area

K/J/C 904619.00
January 1991
Figure 4-1

Figure 4-1

(GA-4). The specific growth rates are noted in Table 4-1. Scenario GA-1 is based on an annual water consumption increase of 50 acre-feet per year (AFY). Scenario GA-2 is based on a 2 percent annual growth rate in water demand. Scenario GA-3 is based on HDWD's draft water supply master plan in which the decreased availability of developable land and the connection limitations within the YWC service area were taken into account. Scenario GA-4 assumes a 3.25 percent annual growth rate projected by the Southern California Association of Governments (SCAG). The growth alternatives assume that existing moratoriums placed on the HDWD and YWC service areas will suppress the growth rate to one percent for the period from 1990 to 1995. The use of higher growth rates after 1995 anticipates removal of the moratoriums.

EXISTING WATER SOURCES

Currently, the sole source of water for the Yucca Valley area is the Warren Valley Groundwater Basin which has an average annual recharge of approximately 200 acre-feet per year. The apparent source of the Basin recharge is precipitation on the Basin and runoff from its limited watershed. In 1977, the Superior Court for the County of San Bernardino appropriated 896 acre-feet per year to HDWD and 726 acre-feet to the YWC service area. The recommended short-term withdrawal rate from the Warren Valley Basin is 3,783 acre-feet per year as specified in the 1989-90 Interim Report. The Basin is and has been seriously overdrafted and groundwater levels have recently declined as much as 20 to 40 feet per year.

In 1983, Harding Lawson Associates performed a geophysical study in order to determine the configuration and prospective capacity of the Warren Valley Basin. Interpretations by the Consulting Groundwater Geologist for the Watermaster resulted in estimates that the Basin contained 45,000 to 59,000 acre-feet of remaining extractable water. Using a depth of 200 feet to the top of the aquifer, the total usable storage capacity of the Basin was estimated to be 160,000 acre feet. A depth of 200 feet was used since that was the depth to the ground water table when data collection began, and a 200 foot depth avoids potential contamination from septic effluent and other contaminants. (Sloan, 1989)

The HDWD service area is currently served by eight operating wells (Numbers 5, 7, 9, 10, 12, 14, 16, and 17) with an additional well currently under construction and expected to be operable by the end of October 1990. Water storage is accomplished by nine above-ground welded steel reservoirs with a usable total capacity of 6.52 million gallons (20 acre-feet). The YWC service area obtains its water via five wells. In addition, the YWC service area has two emergency interconnections to the HDWD system with an estimated combined capacity of 800 gpm (1290 acre-feet per year). In order to become operational, these two connections require the installation of portable boosters and temporary hoses. The HDWD is currently installing permanent interconnections between the

HDWD and YWC service areas. In addition, BSCC, IMP, and other users have their respective wells which produce water from the Basin. (Egan, 1990; Webb, 1985)

ANTICIPATED WATER SOURCES

Anticipated water sources consist of existing water supplies that are currently not being utilized. The Mainstream well in the northern part of the Yucca Valley area and State water are anticipated water sources.

Mainstream Well

In 1987, HDWD contracted with the Mainstream Water Development Company to locate and develop a well outside the Basin that is capable of producing 1,500 AFY. Subsequently, the proposed well site was placed within the Sphere of Influence of the Desert View Water Agency, one of the predecessor agencies to the Bighorn Desert View Water Agency (BDVWA). This well was successfully drilled on Bureau of Land Management property. The well can produce up to 2,100 AFY from the Ames Groundwater Basin, which much of HDWD's Mesa area overlies. The mesa area utilizes approximately 800 AFY from the Warren Valley Basin. In 1989, the environmental issues related to this well resulted in complex litigation with the BDVWA. This litigation prevented the production of water from the well. However, after prolonged negotiations with BDVWA, a settlement agreement which allows the extraction of 800 AFY as well as 0.5 AFY for each new residential meter was executed by both parties in January 1991. The settlement agreement is included in Appendix J. The well is anticipated to be operational in 1992.

State Water Project

State Water Project (SWP) water is an additional existing, but unused, source of water for the Yucca Valley area. The service areas of the two purveyors are located within Division 2 of the Mojave Water Agency (MWA). Division 2 (Improvement District M) has an entitlement to 7,257 acre-feet per year of State Project water or 1/7 of MWA's allocation. HDWD has an entitlement to 31 percent (2,250 acre-feet) while the YWC service area has an entitlement to 28 percent (2,032 acre-feet) of the amount allocated to Division 2. State Project water will be brought to the area via the proposed Morongo Basin Pipeline, a $66.5 million project consisting of a 71-mile, 36- and 30-inch pipeline beginning at the California Aqueduct in Hesperia. The capacity of the proposed pipeline will be nearly 11,000 acre-feet per year allowing for delivery of excess water when available. In June 1990, the voters approved a financing plan for the Morongo Basin Pipeline by more than a two-thirds vote.

State water entitlements are susceptible to delivery reductions during drought years and, thus, are not completely reliable sources. The procedure utilized to allocate deliveries during droughts is described

in Article 18 of the State contract. The interpretation of this provision, specifically whether reductions should be made to entitlements or to deliveries, is the subject of ongoing discussions. Reduction in agricultural deliveries takes place first, the restrictions being that deliveries can be reduced no more than 50 percent in one year and no more than 100 percent in seven years. For most agricultural contractors, "deliveries" is synonymous with "entitlements"; thus, calculation of these initial reductions is not in question. The total annual reduction is calculated based on the total delivery requests as compared to the total available supply.

After the initial reductions have occurred, if further reductions are necessary, a portion of the reduction is allocated to all contractors, both agricultural, municipal and industrial (M&I). Because the M&I requests often do not equal the entitlements, the way in which Article 18 is interpreted affects the allocation of the remaining reductions. Historically, the reduction was prorated based on the ratio of each contractor's entitlement to the total project entitlements. The prorated reductions were then subtracted from each contractor's request. In this study, due to the critical state of the Warren Valley Basin, it is assumed that the requests are the same as the entitlements.

To assess potential future reductions, a model of the State supply available was developed based on the State Model of Yield. Three statistical analyses which incorporated historical hydrologic data were performed. The expected SWP yield increases are 60,000 acre-feet per year in 1991 due to completion of Banks Pumping Plant improvements, 300,000 acre-feet per year in 1995 due to completion of the Kern Water Bank recharge and extraction facilities, and 300,000 acre-feet per year in 2000 due to completion of the Los Banos Grandes Reservoir. The three tables for the three scenarios are presented in Appendix A.

By using the M&I delivery reductions from the State supply model for the 1995 and 2000 projected yield increases, delivery reductions to Warren Valley Basin agencies were estimated as shown in Table 4-3. Since State water data were only available up to the year 2010, the average of the reductions between 1995 and 2010 was used for the years 2011-65. Table 4-3 shows that during the period 1995 to 2010, delivery of the full 4,282 acre-feet entitlements may occur only 6 of the 16 years. The probability of occurrence is 38 percent. However, at least 90 percent of the entitlements may be available 11 of the 16 years, and at least 80 percent of the entitlements may be available 15 of the 16 years.

Alternative concepts for the local facilities necessary to utilize the District's full entitlement of State water have been evaluated previously for the District. This evaluation is summarized in a 24 October 1990 memorandum which is included in Appendix K. The recommended concept involves the treatment and direct use of a portion of the District's entitlement. The remainder of the entitlement (untreated) would be pumped through Pipes Canyon and released down Water Canyon for recharge in basins along Water Canyon. The recharge basins would have the

capacity to handle the District's full entitlement, if necessary, as well as stormwater runoff in Water Canyon. In addition, these facilities may be able to provide recreational opportunities for the community.

As an alternative to recharge basins entirely in Water Canyon, recharge basins at Blue Skies Country Club, which would be used in conjunction with smaller basins in Water Canyon, may be possible. Test holes drilled on the east and west boundaries of the golf course indicate some favorable soil conditions on the western boundary although one test hole on the eastern boundary encountered significant clay formations. The location of recharge basins at Blue Skies Country Club would have several benefits including:

1. The land requirements in Water Canyon could be reduced.

2. The lease of land and the use of maintenance personnel could be a source of funds which could offset the cost of imported water.

3. The golf course could utilize untreated imported water directly thereby avoiding the cost to pump water from the groundwater basin.

4. The recharge basins could enhance the aesthetic and recreational value of the golf course.

However, to minimize evapotranspiration around the recharge basins, it may be necessary to modify the landscaping near the basins. Because this alternative concept may be mutually beneficial to both the District and Blue Skies Country Club, it is recommended that the Watermaster encourage these entities to conduct a joint feasibility evaluation of recharge basins at the golf course.

WATER SUPPLY PLANNING

In planning for future water supplies, it is necessary to maintain water supply entitlements for a foreseeable planning horizon. Generally, this horizon is 20 years. As this horizon is extended, it is prudent to obtain additional water supply entitlements so that water supplies are constantly maintained 20 years ahead of water demands. Conversely, it may be an unnecessary and possibly a wasteful commitment of financial resources to obtain water supplies beyond a 20 year period. Most of the water utilities in California operate with this dynamic assessment of water needs.

Unfortunately, water supplies historically have not been maintained ahead of water demands in the Yucca Valley area and new water supplies often require 5 to 10 years to become available. Consequently, the Warren Valley Basin will continue to be overdrafted until State Project water and mainstream well water are available for delivery. Projected

completion dates for availability of these anticipated water supplies are 1995 for State water and 1992 for the mainstream well. Based on these completion dates, it will take almost 15 years for the Basin to return to its 1990 storage capacity considering only the demands from the existing population.

A comparison of projected supplies and demands for each growth scenario are shown in Tables 4-4 through 4-8. The current (1990) Basin capacity was conservatively assumed to be 36,000 acre-feet. The negative values in the "supply less demand" column represent Basin overdraft while the positive values represent the amount of excess water available for recharge.

The lowest Basin capacity projected using all five growth scenarios is about 24,662 acre-feet and occurs in 1994. Growth scenarios GA-0 and GA-1 reach the assumed 1990 capacity of 36,000 acre-feet between 2003 and 2004. The Basin capacity will continue to increase for GA-0 and GA-1. Scenario GA-2 results in an approximate balance between water supply and demand for the 20 year planning period. Scenarios GA-3 and GA-4 involve continued overdraft of the Basin and, therefore, are undesirable until additional water supplies have been obtained.

Based on this evaluation, it is recommended that the growth in water demands be maintained within the amounts described in scenario GA-2 until additional water supplies can be obtained. Lower growth rates would allow additional Basin recharge; however, increased groundwater levels could also be achieved by the delivery of temporary water supplies or interagency conjunctive use. It should also be noted that these growth scenarios could accommodate more rapid building construction if the existing water users reduced their consumption voluntarily or through a voluntary plumbing retrofit program.

The critical Basin condition will occur between 1990 and the time at which State water and the mainstream well are available. Accordingly, it is recommended that the Watermaster and the water users in the Yucca Valley area focus on obtaining these water supplies at the earliest possible time.

TABLE 4-3

STOCHASTIC ESTIMATE OF DELIVERY REDUCTIONS
TO YUCCA VALLEY AREA

YEAR	M&I DELIVERY REDUCTION (%)	DELIVERY HDWD	ESTIMATE YWC	(ACRE-FEET) TOTAL
1995	0.00	2250	2032	4282
1996	3.88	2163	1953	4116
1997	6.81	2097	1894	3990
1998	4.16	2156	1947	4104
1999	28.94	1599	1444	3043
2000	0.00	2250	2032	4282
2001	0.00	2250	2032	4282
2002	0.00	2250	2032	4282
2003	9.60	2034	1837	3871
2004	0.00	2250	2032	4282
2005	0.00	2250	2032	4282
2006	17.08	1866	1685	3551
2007	13.72	1941	1753	3695
2008	19.31	1816	1640	3455
2009	6.63	2101	1897	3998
2010	15.63	1898	1714	3613
2011-65	7.86	2073	1872	3945

NOTE: PERCENT REDUCTION FOR THE YEARS 2011-65 IS AN AVERAGE OF THE REDUCTIONS BETWEEN 1995-2010

TABLE 4-4
PROJECTED WATER SUPPLY AND DEMAND
(GROWTH SCENARIO GA-0)

YEAR	WATER SUPPLIES (AFY) SAFE YIELD	SWP	M. WELL	SUPPLY	DEMAND GA-0	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	200	3565	-3365	36000
1991	200	0	0	200	3595	-3395	32605
1992	200	0	800	1000	3625	-2625	29980
1993	200	0	807	1007	3654	-2647	27333
1994	200	0	813	1013	3684	-2671	24662
1995	200	4282	820	5302	3714	1588	26250
1996	200	4116	820	5136	3714	1422	27672
1997	200	3990	820	5010	3714	1296	28968
1998	200	4104	820	5124	3714	1410	30378
1999	200	3043	820	4063	3714	349	30727
2000	200	4282	820	5302	3714	1588	32315
2001	200	4282	820	5302	3714	1588	33903
2002	200	4282	820	5302	3714	1588	35491
2003	200	3871	820	4891	3714	1177	36668
2004	200	4282	820	5302	3714	1588	38256
2005	200	4282	820	5302	3714	1588	39844
2006	200	3551	820	4571	3714	857	40701
2007	200	3695	820	4715	3714	1001	41702
2008	200	3455	820	4475	3714	761	42463
2009	200	3998	820	5018	3714	1304	43767
2010	200	3613	820	4633	3714	919	44686

NOTE: REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990

TABLE 4-5
PROJECTED WATER SUPPLY AND DEMAND
(GROWTH SCENARIO GA-1)

YEAR	WATER SUPPLIES (AFY) SAFE YIELD	SWP	M. WELL	SUPPLY	DEMAND GA-1	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	200	3565	-3365	36000
1991	200	0	0	200	3595	-3395	32605
1992	200	0	800	1000	3625	-2625	29980
1993	200	0	807	1007	3654	-2647	27333
1994	200	0	813	1013	3684	-2671	24662
1995	200	4282	820	5302	3714	1588	26240
1996	200	4116	831	5147	3764	1383	27633
1997	200	3990	842	5032	3814	1218	28851
1998	200	4104	853	5157	3864	1293	30144
1999	200	3043	864	4107	3914	193	30337
2000	200	4282	875	5357	3964	1393	31730
2001	200	4282	886	5368	4014	1354	33084
2002	200	4282	897	5379	4064	1315	34399
2003	200	3871	908	4979	4114	865	35264
2004	200	4282	919	5401	4164	1237	36501
2005	200	4282	930	5412	4214	1198	37699
2006	200	3551	941	4692	4264	428	38127
2007	200	3695	952	4847	4314	533	38660
2008	200	3455	963	4618	4364	254	38914
2009	200	3998	974	5172	4414	758	39672
2010	200	3613	985	4798	4464	334	40006

NOTE: REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990

TABLE 4-6
PROJECTED WATER SUPPLY AND DEMAND
(GROWTH SCENARIO GA-2)

YEAR	WATER SUPPLIES (AFY) SAFE YIELD	SWP	M. WELL	SUPPLY	DEMAND GA-2	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	200	3565	-3365	36000
1991	200	0	0	200	3595	-3395	32605
1992	200	0	800	1000	3625	-2625	29980
1993	200	0	807	1007	3654	-2647	27333
1994	200	0	813	1013	3684	-2671	24662
1995	200	4282	820	5302	3714	1588	26250
1996	200	4116	836	5152	3788	1364	27614
1997	200	3990	853	5043	3864	1179	28793
1998	200	4104	870	5174	3941	1233	30026
1999	200	3043	887	4130	4020	110	30136
2000	200	4282	905	5387	4101	1286	31422
2001	200	4282	923	5405	4183	1222	32644
2002	200	4282	942	5424	4266	1158	33802
2003	200	3871	960	5031	4352	679	34481
2004	200	4282	980	5462	4439	1022	35503
2005	200	4282	999	5481	4527	954	36457
2006	200	3551	1019	4770	4618	152	36619
2007	200	3695	1040	4935	4710	225	36834
2008	200	3455	1060	4715	4804	-89	36745
2009	200	3998	1082	5280	4901	379	37124
2010	200	3613	1103	4916	4999	-83	37041

NOTE: REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990

TABLE 4-7
PROJECTED WATER SUPPLY AND DEMAND
(GROWTH SCENARIO GA-3)

YEAR	WATER SUPPLIES (AFY) SAFE YIELD	SWP	M. WELL	SUPPLY	DEMAND GA-3	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	200	3565	-3365	36000
1991	200	0	0	200	3595	-3395	32605
1992	200	0	800	1000	3625	-2625	29980
1993	200	0	807	1007	3654	-2647	27333
1994	200	0	813	1013	3684	-2671	24662
1995	200	4282	820	5302	3714	1588	26250
1996	200	4116	854	5170	3868	1302	27552
1997	200	3990	888	5078	4022	1056	28608
1998	200	4104	922	5226	4176	1050	29658
1999	200	3043	956	4199	4330	-131	29527
2000	200	4282	990	5472	4484	988	30515
2001	200	4282	1015	5497	4597	900	31415
2002	200	4282	1040	5522	4711	811	32226
2003	200	3871	1065	5136	4824	312	32538
2004	200	4282	1090	5572	4938	634	33172
2005	200	4282	1115	5597	5051	546	33718
2006	200	3551	1144	4895	5181	-286	33432
2007	200	3695	1172	5067	5312	-245	33187
2008	200	3455	1201	4856	5442	-586	32601
2009	200	3998	1230	5428	5573	-145	32456
2010	200	3613	1259	5072	5703	-631	31825

NOTE: REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990

TABLE 4-8
PROJECTED WATER SUPPLY AND DEMAND
(GROWTH SCENARIO GA-4)

YEAR	WATER SUPPLIES (AFY) SAFE YIELD	SWP	M. WELL	SUPPLY	DEMAND GA-4	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	200	3565	-3365	36000
1991	200	0	0	200	3595	-3395	32605
1992	200	0	800	1000	3625	-2625	29980
1993	200	0	807	1007	3654	-2647	27333
1994	200	0	813	1013	3684	-2671	24662
1995	200	4282	820	5302	3714	1588	26250
1996	200	4116	846	5162	3835	1327	27577
1997	200	3990	874	5064	3959	1105	28682
1998	200	4104	902	5206	4088	1118	29800
1999	200	3043	932	4175	4221	-46	29754
2000	200	4282	962	5444	4358	1086	30840
2001	200	4282	993	5475	4500	975	31815
2002	200	4282	1025	5507	4646	861	32676
2003	200	3871	1059	5130	4797	333	33009
2004	200	4282	1093	5575	4953	622	33631
2005	200	4282	1129	5611	5114	497	34128
2006	200	3551	1165	4916	5280	-364	33764
2007	200	3695	1203	5098	5452	-354	33410
2008	200	3455	1242	4897	5629	-732	32678
2009	200	3998	1283	5481	5812	-331	32347
2010	200	3613	1324	5137	6001	-864	31483

NOTE: REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990

CHAPTER 5

IMPORTED WATER

The evaluation presented in the previous chapter identified potential growth limitations which would result from current and anticipated water supplies. To support growth beyond these limitations or to secure water supplies beyond the 20 year planning period, additional imported water supplies must be obtained and existing and anticipated water supplies must be utilized more efficiently. This chapter presents the imported water alternatives. Subsequent chapters discuss alternatives to utilize existing and anticipated water supplies more efficiently.

PROGRAM GOALS

Regardless of the degree to which existing and anticipated water supplies are utilized more efficiently, additional imported water supplies will be necessary. Imported water supplies can be used for several purposes:

1. replenishment of the groundwater basin
2. increased growth in the community
3. water supply security beyond the 20 year planning period
4. water supply security during droughts or emergencies

Each of these uses require different imported water supply characteristics. For example, groundwater replenishment can be accomplished with temporary or interruptible water supplies whereas water supplies for growth or security must be fairly reliable. Similarly, the water supplies for growth or long-term security should be of good quality whereas water supplies for groundwater replenishment or drought security can generally be of lesser quality because they will be of limited duration. The immediacy of the water supplies also differs for these uses. Water supplies for groundwater replenishment or growth should be developed in a relatively short-term time frame whereas water supplies for security can be developed over a longer time frame. Based on these considerations, the alternatives for imported water supplies can be evaluated and prioritized.

CURRENT ACTIVITIES

Obtaining imported water supplies has been the primary focus of the Hi-Desert Water District. Consequently, significant activities related to the importation of State water and development of groundwater on Yucca Mesa are currently being undertaken by the District. Activities related to the contractual, environmental, financial, and program management issues related to the Morongo Basin Pipeline are currently in progress. Similarly, although the use of the mainstream well has been precluded by

litigation, settlement negotiations are continuing and other mesa wells are being equipped to serve groundwater to District customers which do not overlie the Warren Valley Basin. More detailed discussions of these activities are presented in Chapters 3 and 4. This chapter focuses on additional opportunities for imported water.

On behalf of the Watermaster, the District is actively evaluating several other specific imported water supply alternatives. These alternatives can generally be categorized into the generic opportunities described below. In the short-term, most of the alternatives are limited by the absence of delivery facilities to the Yucca Valley area. When the Morongo Basin Pipeline (MBP) is completed in 1994, some importation capacity will be available; however, additional pumping facilities will be required to significantly increase the MBP capacity.

POTENTIAL PROGRAM ELEMENTS

The Watermaster, through the Hi-Desert Water District has identified numerous opportunities to obtain additional imported water supplies. However, to actually obtain these supplies, a variety of technical, legal, environmental, institutional, and economic issues must be resolved for each one of these opportunities. For this reason, the Hi-Desert Water District is concurrently evaluating and negotiating to obtain several of these imported water supplies. To protect the confidentiality of these discussions, these alternatives are presented generically in this chapter; however, these generic alternatives represent specific opportunities under consideration by the District. Among the potential imported water supplies being considered by the District are the following alternatives:

Additional State Water Project Entitlements

Entitlements to the yield of the State Water Project (SWP) are outlined in Table A of the contract between the Department of Water Resources and the SWP contractors. Several SWP contractors or subunits of SWP contractors have indicated that their Table A entitlements are in excess of their anticipated water needs. Many of these opportunities are summarized in A Catalog of Water Transfer Proposals by the Department of Water Resources, excerpts of which are included in Appendix D. Additional SWP entitlements could provide a relatively reliable long-term water supply which could supply growth in the community as well as replenish the groundwater basin.

To utilize any of these opportunities, the District must negotiate through the Mojave Water Agency, its SWP contractor. The District must also address several technical, environmental, and economic issues. One of the most important technical issues is procurement of the necessary delivery facilities to convey additional SWP entitlements to the Yucca Valley area. These facilities include both the SWP conveyance facilities and the regional conveyance facilities. In a recent Table A

entitlement transfer, SWP capacity was created by rerating the canal capacity which was purchased by the transferring agency. If the amount of water transferred is not large, it is likely that the Department of Water Resources would utilize similar principles for subsequent transfers.

Utilization of regional importation facilities (i.e., Morongo Basin Pipeline) may be more limited. The Morongo Basin Pipeline (MBP) will have a proposed design capacity of 10,900 acre-feet per year (AFY) of which 7,257 AFY will be utilized to deliver entitlement water to Improvement District M. Thus, using the current design concept, the remaining capacity available for additional imported water supplies would be limited to 3,643 AFY. In addition, this excess capacity could only be utilized under the procedures and limitations outlined in the draft agreement between the Mojave Water Agency and Hi-Desert Water District. Additional MBP capacity may be available if additional pumping facilities were constructed and higher pipeline pressures and velocities were utilized. Because the MBP has yet to be designed, this additional capacity cannot be determined at this time; however, a pipeline capacity in excess of 20,000 AFY appears feasible.

In addition to these technical issues, there are several environmental and economic issues which must be addressed. The proposed transfer of SWP entitlements generally results in significant opposition by groups which feel adversely affected by the transfer. If the entitlement is not currently utilized, the agricultural SWP contractors believe that the transfer would accelerate SWP water demands, thereby exacerbating water shortage which disproportionally affect agricultural contractors. Conversely, if the entitlement is currently utilized, SWP entitlement transfers may adversely affect the local economy. Finally, if the technical and environmental issues can be resolved, SWP entitlements are generally costly and these costs must be weighed not only against alternative imported water supplies but also against the social impacts in the Yucca Valley area.

Early SWP Delivery

The MWA has a Table A entitlement of 50,800 AFY, of which 7,257 AFY is allocated to Improvement District M. Because the MBP is not expected to be available before 1994, this entitlement cannot be directly utilized by the District. To address water supply problems elsewhere, the MWA is currently considering the release of its SWP entitlement into the Mojave River to replenish the groundwater basin serving Apple Valley, Hesperia, and Victorville.

If acceptable contractual agreements can be negotiated, the District may be able to take early delivery of its SWP entitlement and bank it in the Mojave River Basin. When the MBP is available, the District could then exchange this water for the entitlement from another area within the MWA or install extraction facilities to directly pump groundwater into the

MBP. Alternatively, the District could indefinitely store the water in this basin and utilize it when water supply shortages in the SWP reduce deliveries in the MBP. Like additional SWP entitlements, the early SWP delivery and use of the MBP are subject to the procedures and limitations of the MWA; however, early SWP delivery appears to be a feasible option to obtain a temporary water supply which could be used directly or indirectly to replenish the Warren Valley Basin.

Temporary Water Transfers

Although the prolonged drought has severely limited the availability of temporary water supplies, many areas in California still have water supplies which are temporarily available for purchase by other water agencies. Generally, these water supplies are surface water which would otherwise be lost if not used. To utilize these temporary water supplies, the purchasing agency must have sufficient delivery facilities or must be in a position to accomplish a water exchange. These capabilities appear to be the primary limitations for the District to purchase temporary water.

There appears to be, however, two potential opportunities to utilize temporary water supplies. One way would be to purchase a temporary water supply and bank it in the Mojave River Basin for later delivery through the MBP. The other would be to purchase groundwater from adjacent water districts whose proximity would preclude the need for extensive delivery facilities. In either opportunity, institutional constraints must be addressed. To bank temporary water in the Mojave River Basin, the District must contract through the MWA who must obtain the approval of the Department of Water Resources to utilize SWP facilities. Alternatively, to obtain temporary groundwater supplies from adjacent districts, the District must negotiate mutually acceptable agreements with either Bighorn-Desert View Water Agency or Joshua Basin Water District, both of which have adopted resolutions that severely limit the opportunity for groundwater export. Despite these obstacles, temporary water supplies could be a cost-effective way to provide water supply security or to replenish the Warren Valley Basin and should be pursued by the District. The storage of approximately 5,400 acre-feet of early SWP or temporary water should increase the District's estimated average SWP yield from 3,946 AFY over 16 years of SWP deliveries to its full entitlement of 4,282 AFY.

Groundwater Along the Morongo Basin Pipeline

Groundwater rights can be established through beneficial use by overlying property owners. These rights can be transferred and the groundwater exported if it does not overdraft the groundwater basin. While it is unlikely that the District will be able to develop new extraction facilities or transfer existing groundwater rights from property within adjacent water districts, there may be opportunities to transfer groundwater rights from property which is not within another water

district. These opportunities can be developed because the proposed MBP can provide a delivery facility for the groundwater. Imported groundwater can provide a reliable water supply that could be used for community growth or for groundwater replenishment.

Because groundwater export may impact the local economy, there appears to be two approaches to minimize these impacts. One approach would be to utilize water on the property more efficiently, thereby freeing groundwater that may be wasted. For example, water-intensive crops could be substituted with less water-intensive crops. Another approach would be to export only a portion of the available groundwater, thereby leaving sufficient water to maintain the local economy at a comparable level. By utilizing these approaches, groundwater along the MBP may be a viable long-term water supply.

Surface Water and Groundwater in the Low Desert

Because of its proximity to the low desert, the District has identified several opportunities in the low desert which could provide transferable surface water or groundwater supplies. However, to utilize these potential water supplies either a water delivery facility from the low desert must be constructed or an exchange agreement with the Metropolitan Water District of Southern California (MWD) must be negotiated. For the quantities of imported water available from the low desert, a separate water delivery system would be costly. However, if an interagency conjunctive use program can be negotiated with MWD (See Chapter 7), a delivery system may be cost effective. Accordingly, it is recommended that the feasibility of a joint water delivery system from the low desert be evaluated concurrently with the feasibility of an interagency conjunctive use program. Although previous studies indicate that this delivery system may not be cost-effective, this economic evaluation will be more favorable with MWD's participation. Alternatively, MWD may elect to construct this delivery system at its own cost.

As an alternative to a separate delivery system, an exchange agreement with MWD could be utilized to receive additional water supplies through the MBP. The use of the MBP would be subject to the procedures and limitations of the District's agreement with the MWA. It is anticipated that the exchange agreement would be similar to MWD's agreements with Desert Water Agency and Coachella Valley Water District. Prior to negotiating an exchange agreement, MWD usually requires that technical, legal, environmental, and economic issues be resolved with any local water agencies potentially affected by the water rights transfer. Often, resolutions of these issues is a lengthy process. Therefore, it is recommended that the Watermaster actively pursue potential water supplies in the low desert and identify the local issues associated with each opportunity.

Water Supply Development in Other Areas

A unique opportunity which has been identified by the District is the possibility of developing a water supply in the service area of another water district and exchanging SWP water for the new local supply. This opportunity is available within water districts which have low quality water sources, such as wastewater effluent or groundwater with high dissolved solids content, that cannot be utilized without costly treatment. Because many other areas have access to less costly water supplies, the value of imported water is higher to the District than it is to many other areas. Consequently, the District may be able to cost-effectively develop water supplies which are more expensive than the existing water supplies in another area but less expensive than the cost of imported water to the District. To complete the exchange, the other water district must have an entitlement to SWP water which can be conveyed to the Yucca Valley area through the MBP. Like many of the other imported water supply alternatives, the use of the MBP will be subject to the procedures and limitations of the District's agreement with the MWA.

RECOMMENDED ACTIVITIES

Due to the lack of delivery facilities, it is recommended that the Watermaster focus its short-term efforts on early SWP delivery and temporary water transfers. Although these imported water supplies may not provide a reliable supply upon which future growth can be accommodated, they will extend the usable life of the Warren Valley Basin and provide supplies for groundwater replenishment and/or security during drought or emergencies. It is estimated that the storage of approximately 5,400 acre-feet of early SWP or temporary water would enable the Yucca Valley area to receive its full SWP entitlement of 4,282 AFY over the 16 years of SWP deliveries.

In the intermediate term, it is recommended that the Watermaster focus its water supply efforts on obtaining groundwater along the Morongo Basin Pipeline and/or water supplies in the low desert. These water supplies can provide a reliable water supply to accommodate future growth in the community as well as provide a secure long-term water supply. Furthermore, because the opportunities for imported water supplies will be significantly expanded by additional delivery systems to the Yucca Valley area, it is also recommended that the Watermaster evaluate the feasibility of a joint delivery system from the low desert in conjunction with an interagency conjunctive use program with MWD.

To alleviate long-term water shortages, it is recommended that the Watermaster evaluate additional SWP entitlements or water developments in other areas. It is likely that these alternatives will take several years to develop and may involve several complex water transfer issues that must be resolved before water deliveries can be received. However,

such water sources may be the only options available to provide a large and reliable water supply to accommodate the future growth of the Yucca Valley area.

CHAPTER 6

WATER RECLAMATION

Domestic wastewater is generally considered to be a waste product which is treated and disposed of. However, treated wastewater is increasingly becoming a valuable water resource. Due to the serious overdraft of the Warren Valley Basin, innovative water sources such as water reclamation must be explored. There appears to be two alternative approaches to water reclamation. One is the generally practiced approach of wastewater collection, treatment, and reuse; and the other is the use of greywater by individual property owners. This chapter discusses these alternative concepts.

PROGRAM GOALS

Wastewater in the Yucca Valley area is currently disposed of through individual septic tank systems. Although significant public health problems do not appear evident, the feasibility of continued use of septic tanks will diminish as the Yucca Valley area grows.

There are several public health concerns related to the widespread use of septic tanks in the Warren Valley Basin:

1. Groundwater contamination
2. Improper disposal of septic tank pumpage
3. Leach field failure

Of these concerns, the most important for the Watermaster is the potential for nitrate contamination of the groundwater. Although elevated nitrate concentrations do not appear widespread in the Basin, nitrate contamination of individual wells has been experienced. Furthermore, other areas have experienced increased nitrate contamination as groundwater levels rise. Because groundwater levels in the Warren Valley Basin have declined continuously, this potential nitrate problem may not occur until groundwater levels recover. Because nitrate removal is costly, groundwater aquifers, once contaminated, are difficult to remediate.

Regardless of whether centralized wastewater service is provided, maximum utilization of wastewater as a water resource would be desirable. If individual septic tank systems are retained, utilization of greywater can be considered. Alternatively, if a centralized wastewater system is implemented, reclaimed water can be utilized. The primary potential user of reclaimed water is the Blue Skies Country Club. Because most of its large water use (585 acre-feet per year) is for irrigation, utilization of reclaimed water would significantly benefit

the Basin. In addition, because vegetation would beneficially utilize the nitrates in the reclaimed water, efficient irrigation practices would minimize the potential for groundwater contamination.

Based on these considerations, the primary goals of water reclamation are the following:

1. To prevent groundwater contamination
2. To maximize the use of wastewater as a water resource

To achieve these objectives will require significant effort by the Watermaster and the Hi-Desert Water District. Accordingly, the program elements discussed in this chapter are conceptual and more detailed evaluations will be necessary.

CURRENT ACTIVITIES

Because the Yucca Valley area is served entirely by septic tank systems, neither reclaimed water nor greywater is utilized legally. There have been informal reports of isolated greywater use at individual residences; however, these reports are unverified. Both the California Department of Health Services (DHS) and the San Bernardino Department of Environmental Health Services have regulations which discourage the use of greywater. In its proposed revisions of the water reclamation regulations (Title 22 of the California Code of Regulations), the DHS outlined its concern over greywater use. Excerpts of this document are included in Appendix E. This position has been generally adopted by all County health authorities except in Santa Barbara and San Luis Obispo Counties which are experiencing severe drought conditions. Because of this water shortage, the Santa Barbara County Environmental Health Department has approved certain uses of greywater during the Stage III drought condition. These uses of greywater are regulated by the City of Santa Barbara. Information regarding the use of greywater in Santa Barbara County is included in Appendix F.

POTENTIAL PROGRAM ELEMENTS

Because the current level of water reclamation is limited, significant new water sources could be developed through water reclamation while concurrently protecting groundwater quality. There appears to be two potential water reclamation programs:

1. Limited greywater use
2. Wastewater collection, treatment and reclamation

Each of these is discussed below.

Greywater Use

Greywater sources may contain infectious bacteria and viruses or grease and food residues. Greywater is normally required to be drained to a sewer or septic system for safety; however, during emergency water supply conditions, some greywater sources can be safely used for limited irrigation purposes in a carefully designed and constructed system. Collecting greywater in open containers or applying greywater to any lawn, garden, paved, or other surface through any type of spraying device is usually prohibited in order to prevent direct human contact with greywater.

To minimize public health risks, the potential greywater program would utilize only laundry wash and rinse water. This water would be distributed through a closed piping system to an underground mini-leach field system similar to that required by the City of Santa Barbara in its greywater use guidelines. This system is described in more detail in Appendix F. This system may provide irrigation for trees, shrubs, and groundcover but not for vegetable gardens. If laundry includes soiled diapers or clothes from a person with an infectious illness, a greywater system should not be utilized. Laundry wash and rinse water is considered as the only feasible source of greywater because other greywater sources, such as showers and sinks, require extensive plumbing modifications.

One load of laundry uses about 40 gallons of water for both washing and rinsing. A typical residential household with three to four occupants requires about four to five laundry loads per week. This produces approximately 200 gallons per week of potential greywater that could be used for irrigation. Assuming 50 percent of the customers install greywater systems, the potential water savings would be approximately 150 acre-feet per year. The average water requirement for a typical desert landscaped home is approximately 500 to 1,000 gallons per week. Therefore, greywater from washing machines could only satisfy a quarter to a half of the irrigation requirements of a typical household.

The quality of the greywater coming from washing machines depends mainly on the type of detergent used. Powdered detergents and soaps include "filler" ingredients which are usually some compound of sodium. Sodium can concentrate in the soil and damage the ability of the soil to absorb water resulting in damaged plants. Liquid soaps, however, contain few fillers and less sodium resulting in better greywater. If bleaches or softeners are used, the greywater should be sent directly to the sewer or septic system and should not be used for irrigation purposes.

To obtain approval for a greywater program, the Watermaster must demonstrate to the County Department of Environmental Health Services (DEHS) that greywater represents a critically needed water supply and

that the District can administer an approval and enforcement program so that public health is not compromised. To demonstrate a need for this water source, the declaration of a water supply emergency may be necessary. Obtaining DEHS approval for a greywater program is likely to be a prolonged process and negotiation of the specific program elements should begin as early as feasible.

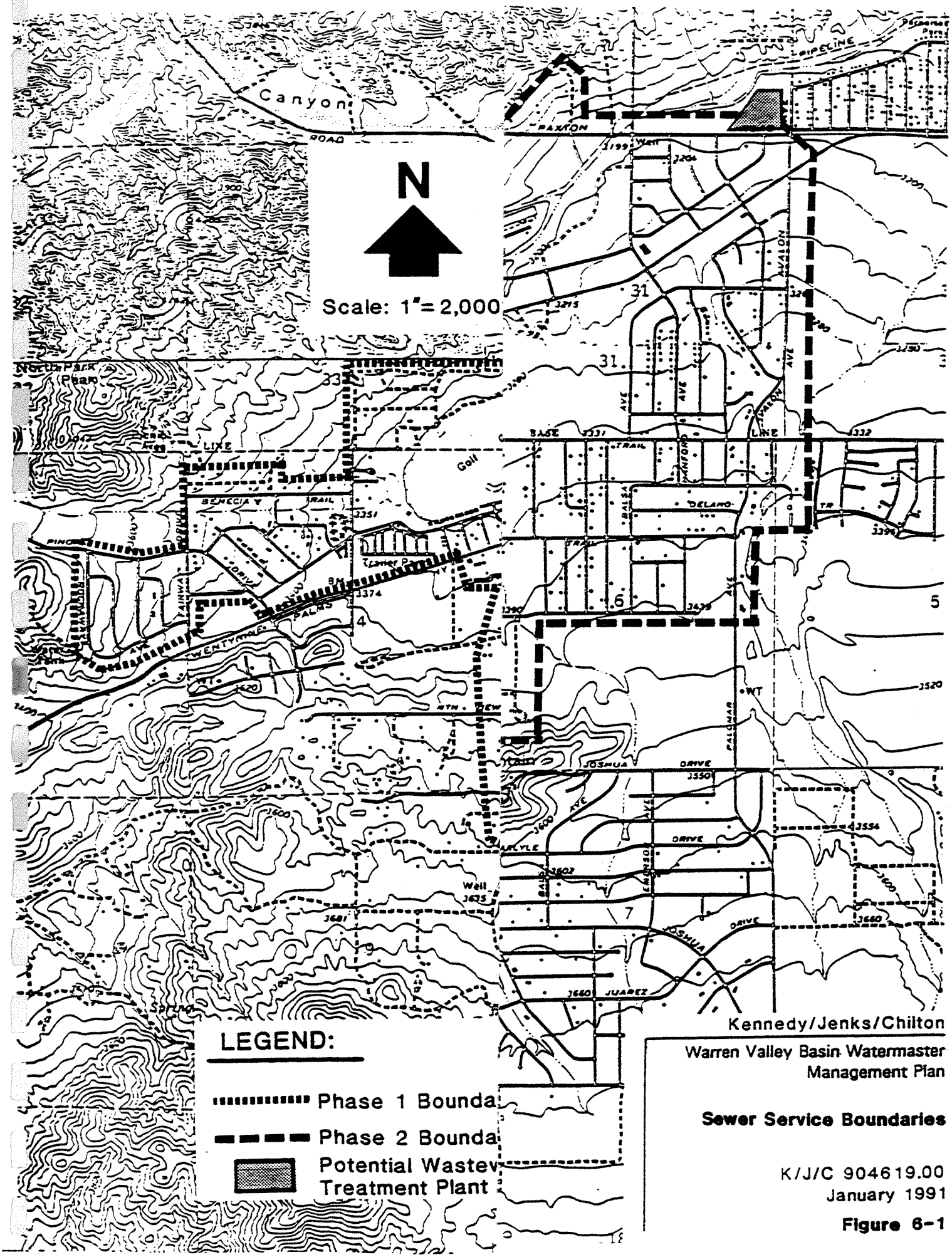
Wastewater Collection, Treatment and Reclamation

Because the Yucca Valley area is unsewered, a complete wastewater collection, treatment and reclamation system would be necessary to utilize this water source. To evaluate the feasibility of this potential program element, a preliminary concept for wastewater collection, treatment and reclamation was developed. It should be noted, however, that sewerage facilities not only provide water supply benefits but also reduce current wastewater disposal costs (i.e. septage pumping) and protect groundwater quality.

Because water reclamation is a primary goal, the Yucca Valley area is fortunate that it has a large potential user of reclaimed water, the Blue Skies Country Club (BSCC). Accordingly, based on topographic and reclamation considerations, a two phase wastewater collection and treatment program was developed. Phased development allows implementation to progress at a level that can be prudently financed by the District. These phases are shown in Figure 6-1. Although these phases are based on topographic and reclamation considerations, they have been developed for two distinct purposes. The primary objective of Phase 1 is to utilize wastewater in the western portion of the District for reclamation at BSCC. Alternatively, the primary objective of Phase 2 is to create a hydraulic barrier to Basin outflow by recharging the aquifer downgradient. This recharge will create a hydraulic mound which will retard Basin outflow. The service areas of Phases 1 and 2 are approximately 1,100 and 4,200 acres respectively. Both service areas contain sparsely located single-family residential and general commercial type developments.

A gravity flow sewer system with a wastewater treatment plant is proposed for each service area. Phase 1 shows a potential treatment plant immediately southeast of the BSCC golf course. Phase 2 shows a treatment plant at the corner of Avalon Avenue and Paxton Road. Preliminary treatment capacities were based on wastewater generation of 75 gallons per capita per day and a total population of approximately 22,500. The total estimated wastewater generation was proportioned by the areas served by each phase.

Based on these assumptions, Phase 1 would have an average daily flow capacity of 0.35 million gallons per day (mgd) and Phase 2 would have a capacity of 1.34 mgd. Treated wastewater from Phase 1 would be used to irrigate the BSCC golf course. If sufficient effluent storage facilities were available, the Phase 1 system could provide as much as 392



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Warren Valley Basin Watermaster
Management Plan

Sewer Service Boundaries

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Figure 6-1

acre-feet per year (AFY) of the 585 AFY of irrigation water required by BSCC. Treated wastewater from Phase 2 would be recharge in spreading basins to create a barrier. Up to 1,492 AFY of treated effluent would be used for this purpose. The preliminary capital cost of this program is summarized in Table 6-1.

Based on a total capital cost of $37.0 million, the average cost per connection is expected to be $4,500. These cost estimates are preliminary and more detailed evaluations will be necessary before implementation of a water reclamation system.

RECOMMENDED ACTIVITIES

Because previous efforts have not focused on the activities necessary to implement a water reclamation program, it is unlikely that either greywater use or reclaimed water use can be implemented without significant effort; however, water reclamation is one of the few programs that can provide significant quantities of new water supplies and can be implemented locally. Accordingly, it is recommended that the Watermaster initiate the activities necessary to implement a greywater program and encourage the District to initiate a more detailed evaluation of a wastewater collection, treatment, and reclamation system.

Greywater use can be implemented in a relatively short time; therefore, as a short-term activity, it is recommended that the Watermaster initiate discussions with the County Department of Environmental Health Services to determine the conditions under which greywater use can be implemented. This program element could provide up to 150 AFY of additional water supplies.

As an intermediate-term activity, it is recommended that the Watermaster request the District to initiate a more detailed feasibility study of the Phase 1 wastewater system for the Yucca Valley area. When more specific information on the costs and benefits of such a system are available, it is recommended that the Watermaster, in conjunction with the District, conduct a survey of the residents and/or a hearing to assess the willingness of the public to finance a wastewater system. Although a wastewater system is expected to be costly, it could provide up to 1,900 AFY of new water supplies as well as provide a better protection of groundwater quality.

TABLE 6-1

PRELIMINARY CAPITAL COST ESTIMATES FOR
WATER RECLAMATION FACILITIES (1990)

COST CATEGORY	CAPITAL COST ($ MILLIONS) PHASE 1	PHASE 2	TOTAL
Collection System	$4.0	$15.3	$19.3
Treatment Plant	1.4	5.4	6.8
Reclamation System	0.2	0.2	0.4
Subtotal - Facilities	$5.6	$20.9	$26.5
Engineering & Administration	0.8	3.1	3.9
Contingency	1.4	5.2	6.6
Total Estimated Capital Cost	$7.8	$29.2	$37.0

CHAPTER 7

GROUNDWATER RECHARGE/BANKING

To restore the storage capacity of the Basin and reduce pumping costs, the Basin must be recharged. Groundwater recharge has been the subject of several previous studies prepared for the Watermaster. Groundwater recharge can also be utilized to "bank" water in the Basin to optimize available water supplies. This chapter discusses the recharge and banking options available to the Watermaster. Stormwater availability as well as other potential recharge sources is addressed. Potential interagency conjunctive use of the Basin is also discussed. Specific implementation activities are recommended.

PROGRAM GOALS

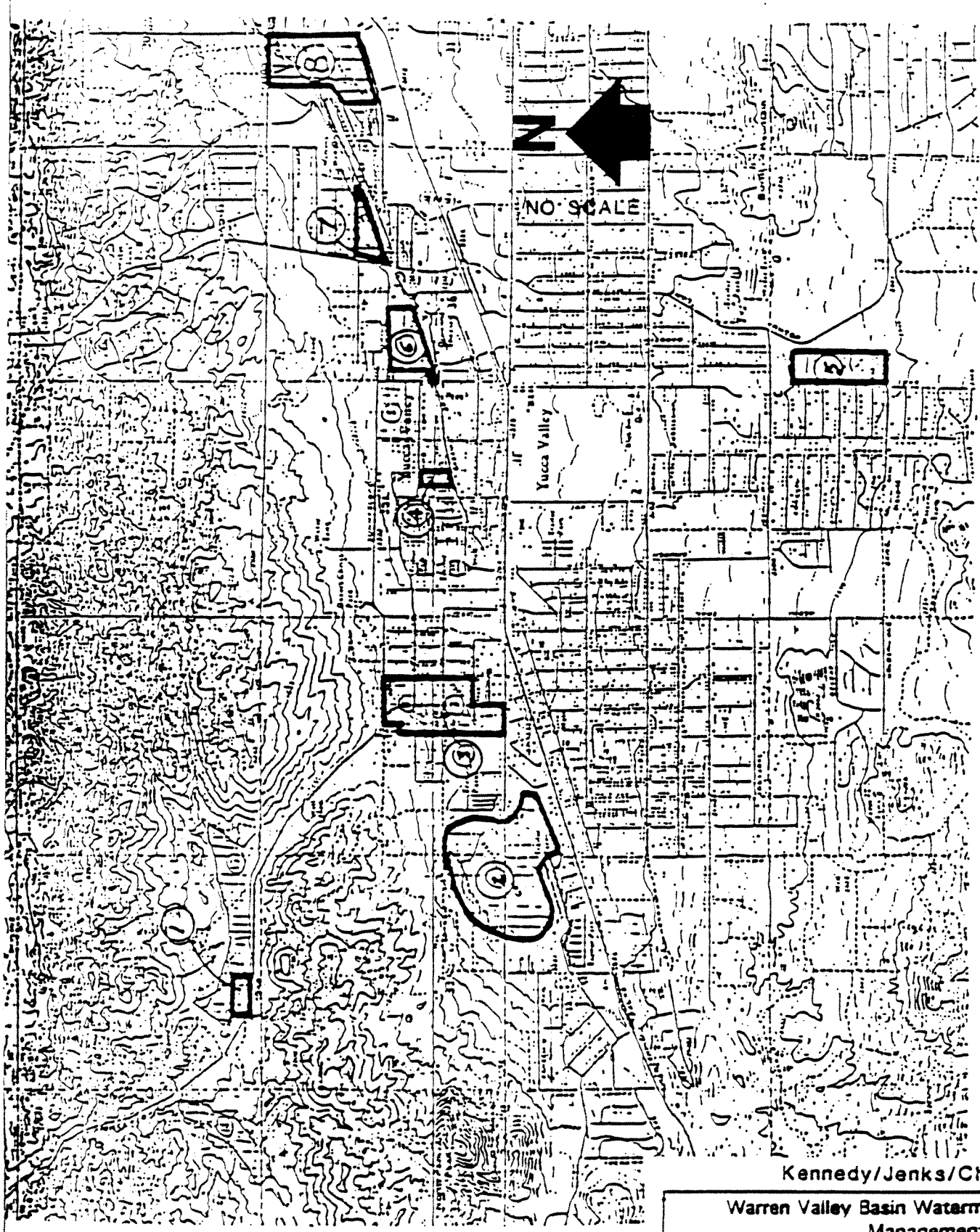
The primary goal of artificial recharge is to replenish the groundwater water supply by utilizing runoff from the surrounding terrain or other available sources. In the Yucca Valley area, the Warren Valley Groundwater Basin is the main source of water. With annual uses in excess of the Basin's safe yield, groundwater levels have dropped significantly, thereby producing Basin storage capacity which could be utilized by recharge or banking. Recharging the Basin could reduce the current overdrafting.

By using existing facilities, the addition of new facilities could be minimized. The drainage channels, detention basins, golf course, and recharge basins for State water are potential recharge areas. If demands are less than the available supply, excess supplies could be utilized to recharge the Basin. Recharge or banking could be accomplished using State water or water obtained from other agencies. When State water is available, recharging the Basin would increase the amount of groundwater available. Increased groundwater supplies would reduce the cost of pumping as well as improve the reliability of the water supply.

PREVIOUS STUDIES

In 1983, Harding Lawson Associates performed electrical resistivity and gravity measurements in the Warren Valley Basin. From these measurements, data on configuration of bedrock, aquifers, saturated materials and groundwater flow in the Yucca Valley area were presented. This information is useful when evaluating the possibility of artificial recharge.

In 1986, Max Sloan and Associates and Robert C. Fox completed Phase II of the Warren Valley Basin Recharge Study. This study provides information on specific recharge sites throughout the Yucca Valley area.



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Potential Recharge Locations

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Figure 7-1

Source: Warren Valley Basin
Recharge Study Phase II
Detailed Site Investigation
1986

These recharge areas are shown on Figure 7-1. The results indicate that the Warren Valley Basin is suitable for artificial recharge for the purpose of replenishing the local groundwater resource. The most practical method of Basin recharge appears to be the construction of ponding basins; however, other methods such as injection wells also could be used.

POTENTIAL PROGRAM ELEMENTS

Because of its ability to be implemented immediately, utilizing available stormwater for recharge is the primary program element to be considered. Other potential recharge sources such as excess State water or other supplemental water sources can also be integrated into a recharge or banking program. Potential interagency conjunctive use of the Basin is also discussed.

Availability of Stormwater

Natural recharge to the Warren Valley Basin is small and may not exceed 200 acre-feet per year. The small quantity of recharge to the Basin is from precipitation in the higher mountains and underflow in unconsolidated deposits along stream channels. The largest drainage area is in the Little San Bernardino Mountains to the south and consists of about 7000 acres. The USGS open-file report on Groundwater Resources in the Yucca Valley area (1972) indicates an annual precipitation of about 8 inches. The drainage area to the north and northwest of the Basin in the San Bernardino Mountains and Water Canyon is about 11,500 acres and the annual precipitation is about 7 inches (USGS, 1972). Because rainfall in the Yucca Valley area is infrequent but occasionally of high intensity, the most feasible approach to capture and recharge of stormwater appears to be the construction of small temporary earth dikes within existing drainage courses. During low intensity storms, runoff would be retained behind these small dams and recharge the groundwater basin. During higher intensity storms, these small dams would wash away, thereby not impeding the flood control purposes of the drainage courses. This water conservation approach is used commonly throughout Southern California.

There are two existing detention basins in the Yucca Valley area. The main purpose of these two detention basins is to catch peak runoff from their respective tributary areas for downstream flood control. One is located next to Old Woman Springs Road off Old Woman Springs Wash south of Paxton Road. Old Woman Springs Basin was designed and built by the San Bernardino County Flood Control District in 1984-85. The capacity of the basin is approximately 20 acre-feet at the top of the spillway. It has a 42-inch reinforced concrete pipe (RCP) located at its lowest point that constantly releases retained water to the downstream channel. The other basin is located off Long Canyon Wash south of Joshua Drive

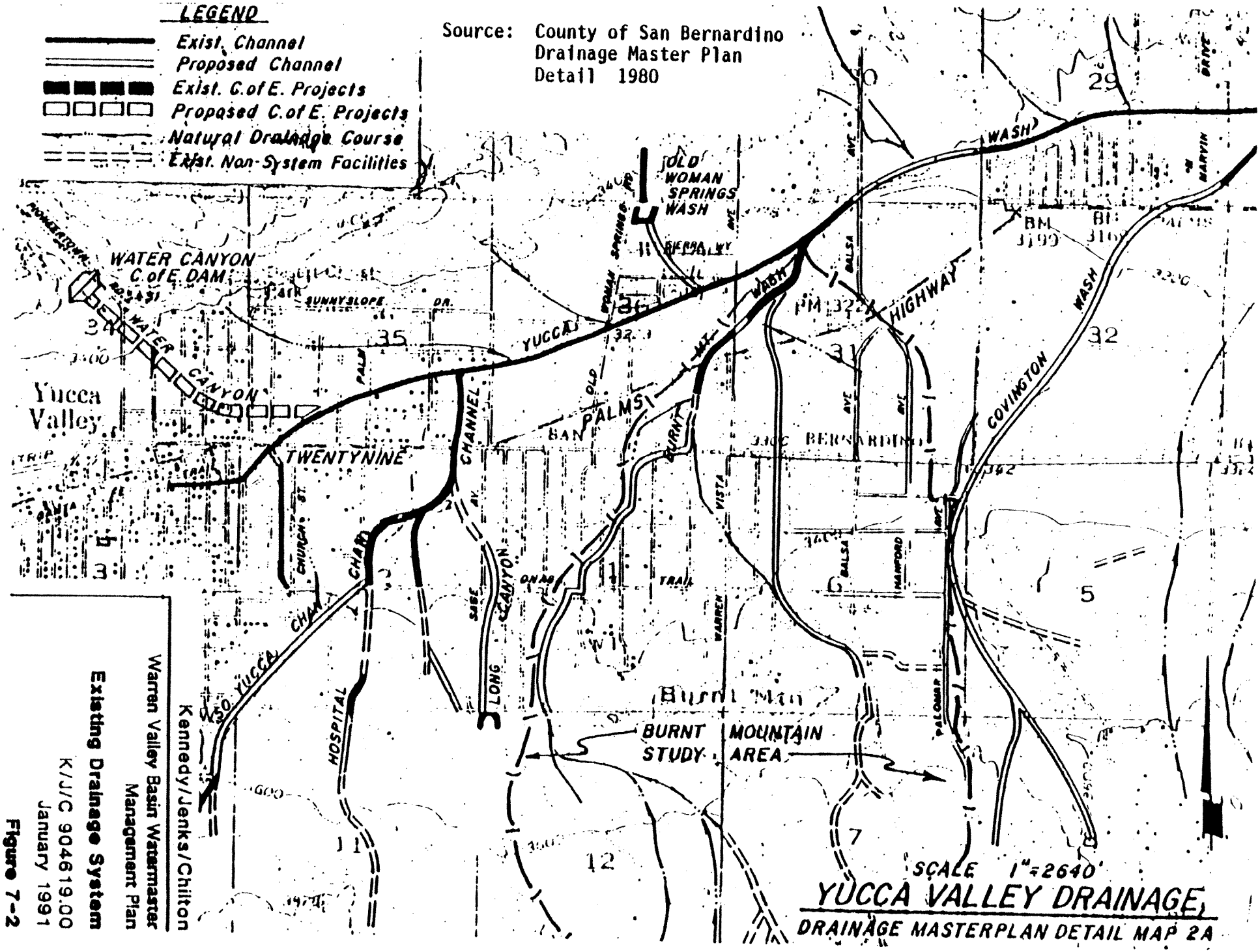
and east of Sage Avenue. This basin has a design capacity of approximately 10 acre-feet. Its purpose is to retain peak runoff from a subdivision which has not yet been completed. It is designed to drain completely within 24 hours after the design storm. Because these detention basins regulate downstream stormwater flows, they provide an opportunity to retain runoff behind downstream dikes or in spreading basins.

The main drainage channel running east-to-west through the Yucca Valley area is Yucca Creek. Tributaries to Yucca Creek include Water Canyon and Old Woman Springs Wash from the north. South Yucca Channel, Hospital Channel, and Long Canyon Channel merge into one tributary before connecting to Yucca Creek between Sage Avenue and Grand Avenue near Little League Drive. Further downstream is Burnt Mountain Wash which is also tributary to Yucca Creek. The construction of small earth dikes within these drainage courses could retain stormwater from these tributaries. The County of San Bernardino Drainage Masterplan Detail (1980) is shown on Figure 7-2. This plan also shows the area's natural drainage courses. These drainage channels flow in a northwest direction which is the same flow direction as the groundwater in the Warren Valley Basin. Existing dimensions and cross-section information for the corresponding drainage channels is found in the Project Systems Inventory of the San Bernardino County Flood Control District (1975). The information on the Yucca Valley drainage system is presented in Appendix B.

Using these existing drainage channels and detention basins in conjunction with new facilities could provide a means of capturing flood water for recharge. Constructing depressions along Yucca Creek downstream of where the tributaries connect to Yucca Creek would capture flows from minor storms. These depressions would fill with sediment carried with the stormwater; however, because they are inexpensive to construct, building new depressions would be relatively easy. Constructing spreading basins downstream from the existing detention basins could help in recharging the Basin by utilizing the captured stormwater before it is released downstream. Diverting stormwater in Yucca Creek into spreading basins alongside the channel is also a possibility for recharging the Basin. However, because rainfall in the area is infrequent and often of high intensity, offstream spreading basins would be used only occasionally and would provide little recharge capability. Therefore, they are not recommended at this time. Other recharge methods such as the use of injection wells are also available. However, success of the injection method depends on pretreating water to remove silt, bacteria, and entrained air, together with continuous and expensive maintenance. Accordingly, this recharge method is not recommended for untreated water.

Return Irrigation Water

Based on information from Mr. William Ellis of BSCC, the 1989 annual water demand from BSCC was approximately 320 acre-feet. The current



Warren Valley Basin Watermaster Management Plan

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Existing Drainage System

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Figure 7-2

water usage is 581 acre-feet with the anticipation of reaching the allocated 585 acre-feet by the end of 1990. Evapotranspiration on the golf course was analyzed to determine if return irrigation water may recharge the Basin. Evapotranspiration maps from the Department of Water Resources were used to estimate the water demand due to evaporation and transpiration. As shown in Table 7-1, the yearly evapotranspiration is 82.5 inches of which 4 inches per year is provided by rainfall. The crop coefficient (Kc) is based on guidelines from "Irrigation with Reclaimed Municipal Wastewater - A Guidance Manual" by the State Water Resources Control Board. The evapotranspiration requirement of 78.5 inches over the approximately 90 acres of irrigated golf course correspond to 589 acre-feet per year. Because the evapotranspiration rate is approximately equal to the applied irrigation, it appears that return irrigation water does not provide significant contributions to groundwater recharge. However, it is recommended that BSCC utilize evapotranspiration data to control irrigation cycles and minimize water use.

State Water Entitlement

State water will be delivered to the Yucca Valley area by the Morongo Basin Pipeline (MBP) which will be constructed by the Mojave Water Agency. The recommended local facilities to utilize State water is presented in a 24 October 1990 memorandum to the Hi-Desert Water District (Appendix K). The MBP pipeline will be located along Old Woman Springs Road to a proposed water treatment plant. The recommended location of the water treatment plant is an area south of Flamingo Heights. Treated water would be conveyed eastward to the existing distribution system. Because the HDWD distribution system does not have the capacity to utilize the full entitlement throughout the year, untreated water would be pumped to a recharge basin located in Water Canyon. The Phase II Recharge Study identified this site as the best location for water recharge by the ponding method. Based on an infiltration rate of 2 inches per hour, a recharge basin covering an area of at least 3 acres would be necessary for a State water entitlement of 4,282 acre-feet per year. The recharge facilities recommended in Appendix K include 20 acres of recharge basins. Figure 7-3 shows the area recommended for these recharge basins. As discussed in Chapter 5, to minimize land requirements in Water Canyon, supplemental recharge basins at the Blue Skies Country Club may be feasible.

As previously shown in Tables 4-4 through 4-8, there are also years when the supply is greater than the demand for the five growth alternatives. This excess supply could provide additional State water that can be conveyed to the proposed recharge basins. Because the recharge basins would be sized to accept the full State water entitlement, stormwater from the mountains to the north of the recharge basin can also be

TABLE 7-1

ESTIMATE OF EVAPOTRANSPIRATION AT
BLUE SKIES COUNTRY CLUB

MONTH	# OF DAYS	ETo (MM/D)	MONTHLY (MM)	ETo (IN)
JAN.	31	2.0	62.0	2.4
FEB.	28	3.3	92.4	3.6
MAR.	31	4.8	148.8	5.9
APR.	30	6.7	201.0	7.9
MAY	31	8.3	257.3	10.1
JUNE	30	9.4	282.0	11.1
JULY	31	9.2	285.2	11.2
AUG.	31	8.4	260.4	10.3
SEP.	30	7.3	219.0	8.6
OCT.	31	4.7	145.7	5.7
NOV.	30	2.9	87.0	3.4
DEC.	31	1.8	55.8	2.2
			TOTAL =	82.5 INCHES

ABBREVIATIONS:
MM/D - MILLIMETERS PER DAY
MM - MILLIMETERS
IN - INCHES

diverted into these recharge basins. When high intensity storms occur, State water can be discontinued until the storms pass.

Until the MBP and associated local facilities are available, it may also be possible to utilize early SWP deliveries for groundwater banking. Although this water must be banked in another groundwater basin until the MBP is constructed, it can be transferred to the Warren Valley Basin at a later date by extraction and conveyance or by exchange of SWP entitlements. One current opportunity is the possibility of receiving early SWP deliveries and banking them in the Mojave River Basin. This opportunity is discussed in Chapter 5. Banked groundwater can be utilized to firm deliveries of SWP entitlements. It is estimated that the storage of approximately 5,400 acre-feet of banked water would enable the District to receive its full SWP entitlement of 4,282 AFY over the 20 year planning period.

Surplus and Unscheduled State Water

The Department of Water Resources (DWR) defines surplus water as water in excess of that required to meet entitlement demands, reservoir storage goals, water quality requirements, and other State water requirements such as recreation water, that can be delivered to contractors when the capability is available (Department of Water Resources, 1989). Surplus water may be released from storage and scheduled in advance for use by contractors. First priority for surplus water is given to State Water Project (SWP) contractors for agricultural use or for groundwater replenishment. Second priority is given to SWP contractors for other uses, and lowest priority is given to non-SWP contractors.

Unscheduled water is also water in excess of SWP needs, but not scheduled in advance. Unscheduled water is water which is sometimes available in the Delta, as opposed to water released from SWP storage in the case of surplus water. The availability of unscheduled water can be as brief as one day or as long as several weeks. The unscheduled water program was initiated in 1980 as "extra surplus water." First priority for unscheduled water is given to groundwater replenishment or to agricultural use in lieu of pumping from groundwater. Second priority is given to pre-irrigation. Generally, surplus and unscheduled water is available only to contractors that fully utilize their Table A entitlements. Therefore, these water supplies will only be available after the Mojave Water Agency utilizes its full 50,800 AFY Table A entitlement.

The California Aqueduct is supplied by water pumped from the Delta at the Banks Pumping Plant. The amount of water diverted to the aqueduct has been limited by the Corps of Engineers in the interest of protecting the navigable capacity of the Delta waterways. Four additional pumps are currently being added to the plant to increase its total capacity to 10,300 cubic feet per second (cfs). DWR estimates that the additional pumping capacity may result in an additional 60,000 acre-feet increase

in firm deliverable water during critical dry periods, under the Corps of Engineers limitations. This water would be pumped in high-flow winter months, and would be primarily used to meet entitlement deliveries.

Given the current restrictions on diversions from the Delta, and the current and anticipated levels of entitlement water delivery requests, DWR staff believe that little surplus and unscheduled water will be available in the future. This conclusion is supported by the reliability model shown in Appendix A. Based on the anticipated contractor delivery requests and the SWP capacity improvements, surplus water is expected only 6 times between 1995-2010. The potential delivery of unscheduled water is difficult to assess.

Other Potential Water Sources

Other recharge sources include imported water and reclaimed water which are discussed in Chapters 5 and 6.

Interagency Conjunctive Use

The Warren Valley Basin has a usable storage capacity of approximately 160,000 acre-feet. As shown on Tables 4-4 through 4-8, the amount of water stored in the Basin recovers slowly under any growth scenario. By the year 2010, water storage would only recover from its current level of 36,000 acre-feet to approximately 45,000 acre-feet under the zero growth scenario. Consequently, because much of the Basin capacity will remain unused in the foreseeable future, there is a possibility of interagency conjunctive use of the Basin.

In interagency conjunctive use, another agency with unused water rights would bank this water in the Basin. Although additional water supplies are not obtained, this water would cause water levels to rise, thereby reducing pumping costs. When the water is needed by the agency, it could be extracted and conveyed to the agency, or it could be transfered by water exchange agreements.

Based on staff discussions, a letter was sent to the Metropolitan Water District of Southern California (MWD) by the Hi-Desert Water District to explore the possibility of a jointly-funded feasibility study. MWD could either bank SWP water through the MBP or Colorado River water by constructing a delivery system from the low desert. Subsequent discussions with MWD staff indicate an interest in this opportunity and MWD is continuing its evaluation of the project.

CURRENT ACTIVITIES

The Watermaster and the HDWD are currently involved in several activities which are necessary to implement a groundwater recharge/banking program. These activities include:

1. HDWD is currently working with the Mojave Water Agency to complete the contractual, environmental, financial, and program management activities necessary to deliver State water to the Yucca Valley area by 1995.

2. HDWD is planning the local facilities necessary to treat and/or recharge State water when received.

3. The San Bernardino County Flood Control District has approved the concept of stormwater conservation within its flood control channels.

4. Discussions have been initiated with the Metropolitan Water District of Southern California (MWD) regarding the possibility of banking MWD water in the Warren Valley Basin.

RECOMMENDED ACTIVITIES

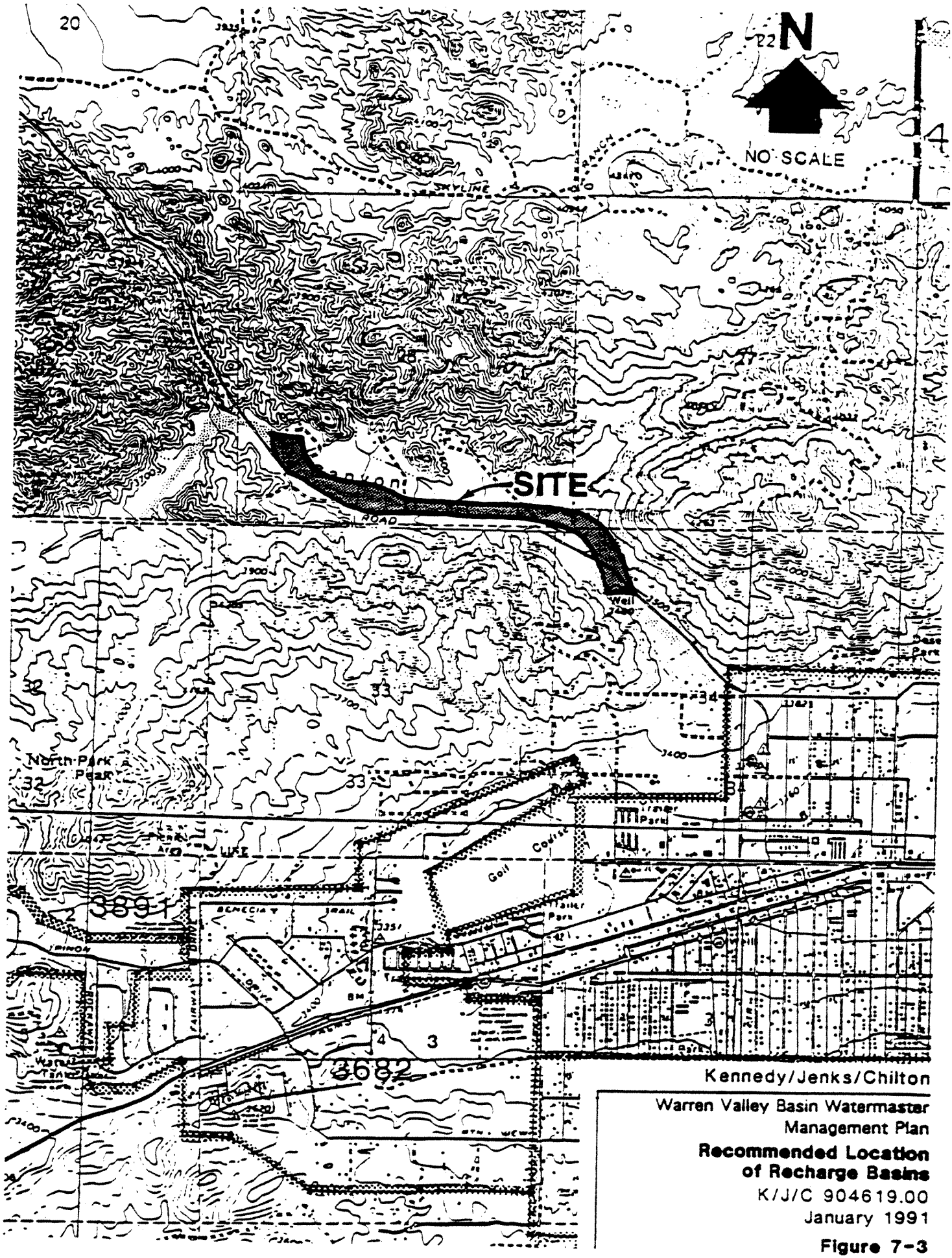
Based on the evaluation presented in this chapter, it is recommended that at least eight stormwater retention areas be constructed within the Yucca Creek flood control channel and its tributaries. These dams would consist of depressions in the channel bottom which would retain stormwaters. The recommended locations of these retention areas are shown on Figure 7-4. In addition, it is recommended that recharge basins of at least 3 acres be constructed in Water Canyon. The recharge facilities recommended in Appendix K include 20 acres of recharge basins. Alternatively, it is recommended that the feasibility of constructing recharge basins at the golf course be evaluated. These recharge basins would be utilized for stormwater diversions as well as State water not utilized directly. Similarly, these basins could also be utilized for interagency conjunctive use opportunities. In addition, a diversion facility along Water Canyon would be required to divert stormwater or State water released from the pipeline to Pioneertown. The location of the recommended recharge basins is shown on Figure 7-3.

Based on a review of 32 years of hydrologic data (1957 to 1989) compiled by the San Bernardino County Flood Control District (Appendix C), an average of 10 days per year have storms greater than 0.2 inches per day. Smaller storms are not estimated to produce significant runoff. Assuming an average retained volume of 0.22 acre-feet for each retention area and 6 acre-feet for the recharge basin, the additional Basin recharge is estimated to be 50 to 100 AFY. The actual increased Basin recharge will depend on hydrologic conditions in the area. Accordingly, it is recommended that after this program is initiated, the Watermaster monitor the amount of stormwater retained so that more accurate assessments of additional Basin recharge can be performed.

Five stormwater retention areas are proposed along Yucca Creek near the Twentynine Palms Highway and would retain stormwaters south of the highway. The next location is between Cholla Avenue and Palm Avenue which would retain stormwater from Water Canyon and the west end of Yucca Creek. The next downstream location is between Sage Avenue and Old Woman Springs Road which would retain stormwater coming from South Yucca Channel, Hospital Channel, and Long Canyon Channel. The next downstream location is between Old Woman Springs Wash and Burnt Mountain Wash, and the farthest downstream location is between Burnt Mountain Wash and Paxton Road. In addition, recharge areas would be located downstream of the detention basin on Long Canyon Channel, within Burnt Mountain Wash, and downstream of the detention basin on Old Woman Springs Wash.

Yucca Creek is generally made up of earth trapezoidal sections and road dip sections. The earth dike locations are proposed where the bottom width of Yucca Creek is about 24 feet and the depth is between 4 and 5 feet. The side slope of Yucca Creek is 1.5:1 which gives a top width of about 36 feet. The depressions should be no more than 3 feet deep for safety reasons.

In addition to these recharge activities, it is also recommended that the Watermaster continue to evaluate the feasibility of interagency conjunctive use opportunities. Although this opportunity will not provide additional water supplies, it will raise groundwater levels and reduce pumping costs.



Kennedy/Jenks/Chilton

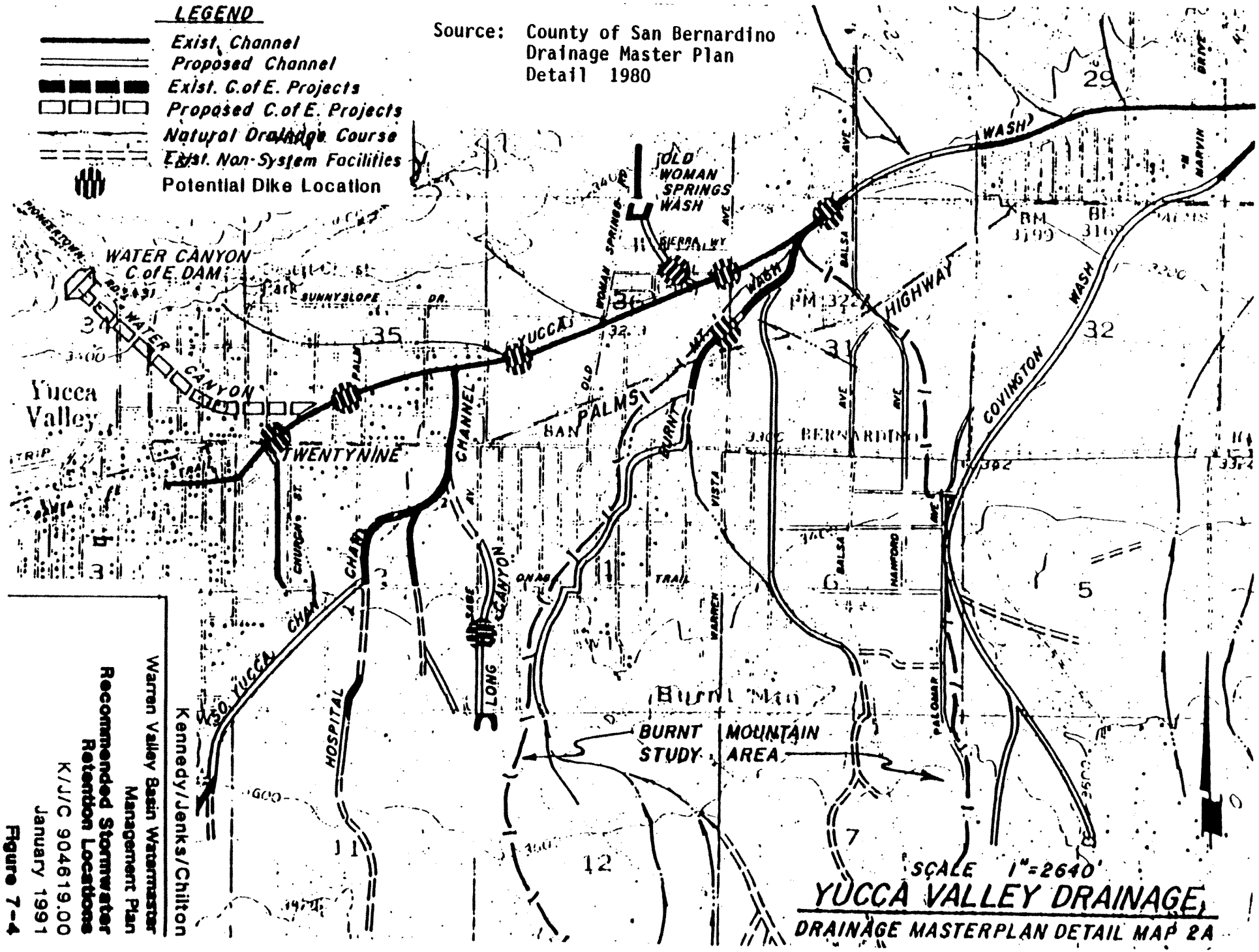
Warren Valley Basin Watermaster Management Plan

Recommended Location of Recharge Basins

K/J/C 904619.00

January 1991

Figure 7-3



Warren Valley Basin Watermaster
Management Plan
Recommended Stormwater Retention Locations
K/J/C 904619.00
January 1991
Figure 7-4

Kennedy/Jenks/Chilton

CHAPTER 8

WATER CONSERVATION

The preceding chapters focused on the activities necessary to obtain additional water supplies as well as to effectively manage these supplies. However, to optimize the utilization of these costly imported supplies, water demands should be reduced to the maximum extent feasible. This chapter focuses on current and potential water conservation activities in the Yucca Valley area.

PROGRAM GOALS

One of the primary goals of the Hi-Desert Water District is to assertively pursue a conservation program that will reduce current extractions from the Warren Valley Basin and minimize the need for additional imported water supplies. Public education programs which will facilitate the realization of this goal are discussed in a subsequent chapter. With the acquisition of Yucca Water Company, Ltd. (YWC), the goal of the District is to implement conservation programs over the entire Basin to reduce extractions to 1986-87 levels of 3,783 acre-feet per year (AFY) to the short-term and to the safe yield of 200 AFY in the intermediate term.

CURRENT ACTIVITIES

In recognition of the prolonged drought and the severe overdrafting of the Warren Valley Basin as well as previous problems with its extraction wells, the Hi-Desert Water District has recently implemented an aggressive water conservation program within the District. The conservation program which included the hiring of a conservation coordinator was implemented in September of 1990.

The current per capita usage excluding non-residential uses is approximately 103 gallons per day compared to a statewide average of approximately 140 gallons per day. These statistics do not include the YWC service area which was recently acquired by the District; however, the water use characteristics of this area are expected to be similar. The following sections describe the water conservation activities which are currently being implemented. Public education programs currently being implemented are discussed in Chapter 10.

Growth Control

The 1977 adjudication of the Warren Valley Basin allowed extractions in excess of the safe yield in order to create sufficient economic development to support the cost of solving the overdraft problem. Since that time, economic growth has occurred and the overdraft has worsened. As a

result, growth in the Yucca Valley area has been severely limited. Due to public health considerations, the Department of Health Services imposed a moratorium on new connections in the YWC service area. In July 1990, the District imposed a similar moratorium in the eastern area of the Valley to stabilize the overdraft. In addition, as a result of the hearing in August 1990, the Superior Court of San Bernardino imposed a moratorium on new connections throughout the Yucca Valley area.

These moratoriums are expected to limit population and economic growth within the area and should preclude the need for expanded extractions from the Basin. However, they will also increase the financial impact on existing water users who must bear not only the cost of obtaining adequate long-term water supplies and replenishing the Basin but also the cost of obtaining water supplies for future economic growth until these new customers are available to support these costs.

Conservation Ordinance

The District currently has a conservation ordinance to regulate landscape irrigation and other wasteful uses of water such as vehicle or sidewalk washing. This conservation ordinance is included in Appendix L. To enforce the provisions of this ordinance, the District employs a "water cop" who can issue fines or restrict water use. This program has resulted in significant water reductions in the District. As a result of an August 1990 hearing, the Superior Court of San Bernardino extended this water conservation program to the area which was formerly served by the Yucca Water Company and recently acquired by the District.

Leak Detection

An aggressive leak detection and repair response program and regular replacement of problem areas in the distribution system has minimized unaccounted for water losses. Upon request, District personnel will perform a leak detection audit for its customers.

Water Rate Structure

The District currently has an inverted block rate structure (i.e. unit costs escalate with increasing consumption). Copies of the District's current rate ordinances are included in Appendix G. This type of rate structure encourages water conservation by making water use increasingly expensive. The District has recently authorized the preparation of a Water Revenue and Rate Analysis. In the draft report, the inverted block rate structure is maintained but a reduced number of blocks and more rapidly escalating unit costs are recommended.

Plumbing Retrofit

The District provides ultra-low flow showerheads not to exceed 2.75 gallons per minute to customers in exchange for old showerheads. Over 500 have been distributed since May with the expectation that the in-

stallation rate is high since they are distributed pending exchange of the older head.

In addition, a mandatory ultra-low flow fixture replacement program was implemented with Resolution 90-4 which sets flow and flushing standards for plumbing fixtures in the service area. This resolution is included in Appendix L. For new construction, it requires the installation of hot water recirculating units. For existing services, it requires that at the time of change of service, whether it be by sale or rental/lease, the existing fixtures must be retrofitted. Based on the District's pilot test project, it is estimated that these changes will achieve 20 to 30 percent reductions in the historical usage of a retrofitted home without adversely impacting the lifestyle of the customer. Any estimated adverse impacts to the customer are based upon the incompatibility of the fixture due to plumbing construction not to code or pre-existing blockage and the initial cost of the change out.

Review of New Construction Plans

The District has established specific guidelines for landscaping at new commercial and multifamily construction. Because the County of San Bernardino has not imposed water conservation requirements for landscaping, the District performs plan check services for conformance with its conservation ordinances.

Emergency Stage Response Program (ESRP)

The ESRP was created to implement more stringent water conservation measures in the community when the District's ability to provide an adequate, safe supply of water is exceeded by systems demands. The initial provisions of the ESRP are implemented when the system exceeds 80 percent of capacity for three consecutive days. As demands increase, Stage 2 which places increasing restrictions on the use of water (mainly outdoor use) is implemented. If delivery capacity continues to be inadequate, Stage 3 requests a 50 percent voluntary cutback. This measure is designed to be short term until delivery problems are mitigated and demands are reduced.

POTENTIAL PROGRAM ELEMENTS

In addition to its current water conservation programs, the District is currently evaluating several additional programs to improve water use efficiency. These programs are discussed in more detail in the District's 1990 Urban Water Management Plan. Among these potential programs are the following.

Landscape Retrofit

During the summer months, it is estimated that the system increases due to landscape irrigation represent 50 to 75 percent of a household's water use. Utilizing water efficient technology for irrigation could

reduce water use by as much as 30 to 50 percent. These techniques include water conserving drip systems and bubblers. Providing rebates for the retrofitting of existing irrigation systems would result in water savings and a reduction in water bills. Assuming a 5-year program is implemented, potential water savings of up to 50 AFY are expected by 1995. These rebates would create a revenue loss that under the current rate structure must be replaced by increased water rates. However, a revised rate structure has recently been recommended. Under this rate structure, the commodity rates only reflect variable costs; therefore, reductions in water usage should not adversely affect the District's financial status.

Meter Replacement

The District recently acquired the YWC service area where a recent meter survey indicated that the average water meter is 20 years old. Of the 2827 meters in the YWC service area, 559 were in poor condition and 300 were in bad condition. The amount of unmeasured water through these meters was conservatively estimated at 22 to 25 percent. This unmetered water not only represents lost revenues but also makes leak detection more difficult. Therefore, it is recommended the Watermaster encourage the District to implement a meter replacement program to prevent continued revenue losses and reduce water leakage.

Customer Water Audits

In this program, District staff would visit homes and businesses of the community in order to communicate water conservation opportunities and to distribute literature and retrofit kits. District staff would help to identify leaks and make landscape irrigation recommendations. The conservation kits would include a toilet displacement device, faucet aerators and showerheads. The commercial audits would be done on a canvass basis while the residential audits would be set by appointment. Assuming a 5-year program is implemented, potential water savings of up to 150 acre-feet per year are expected by 1995.

Plumbing Fixture Rebate Program

In this program, the District would provide a rebate or credit for each high water use fixture replaced with a low water use fixture. These water savings could be utilized to allow a limited number of new connections to accommodate customers who have pre-sold meters or new development under a new construction offsets program.

New Construction Offsets

A new construction "offsets" program would utilize the water savings from a voluntary plumbing fixture retrofit program in existing homes to offset the estimated annual use of a new service. The specific number of homes to be retrofitted would be determined by the District's Board

of Directors. Toilets, showerheads, and faucets in existing homes would be replaced to reduce the historical consumption of those homes. Implementation of this program would allow additional economic growth without increased overdraft of the Basin.

RECOMMENDED ACTIVITIES

The Hi-Desert Water District which now serves most of the Yucca Valley area currently has an aggressive water conservation program. This program has effectively reduced water consumption. Additional programs have been identified which could reduce water use even further. Whereas the current programs focus on water use efficiency, the potential programs identified previously in this chapter also maximize revenues to support the costs associated with addressing groundwater overdraft. For these reasons, it is recommended that the Watermaster encourage the District to implement the following additional water conservation programs:

1. Landscape Retrofit
2. Meter Replacement
3. Customer Water Audits
4. Plumbing Fixture Rebate
5. New Construction Offsets

These programs should reduce water demands on the Warren Valley Basin to a minimum level until supplemental water sources can be delivered. Assuming 5-year programs are implemented, the landscape retrofit and customer water audit programs are estimated to save up to 200 AFY by 1995. Water savings for the meter replacement and new construction offsets program cannot be estimated at this time, but the potential savings should be significant.

CHAPTER 9

BASIN OPERATING PLAN

The previous chapters discuss the anticipated water supplies and demands for the Yucca Valley area as well as the recommended actions to satisfy the shortfall between supplies and demands. These recommended actions focus on reducing water demands, utilizing available water more efficiently, and developing new imported water supplies. This chapter discusses the integration of these recommendations into a comprehensive basin operating plan.

GENERAL MANAGEMENT STRATEGY

To achieve the management objectives outlined in Chapter 3, the Watermaster should establish a general management strategy which will form the basis of an operating plan for the Basin. Based on the evaluations presented in the previous chapters, the following management strategy for the Basin is recommended:

1. Utilize currently available water supplies such as stormwater and greywater to the extent feasible.

2. Utilize groundwater supplies that are outside the Basin but adjacent to or within the District (i.e., mesa wells) to extend Basin supplies as long as possible.

3. Reduce water demands through aggressive conservation efforts.

4. Until anticipated imported water supplies are available, continue to overdraft the Basin.

5. Utilize as much SWP water directly in the distribution system as possible and utilize any other available SWP water for groundwater recharge.

6. Obtain temporary water supplies or early State water deliveries to replenish the Basin when the MBP is constructed.

7. Pursue interagency conjunctive use opportunities to replenish the Basin as early as possible and reduce pumping costs.

8. Evaluate opportunities to obtain additional water supplies such as other imported water supplies and water reclamation to secure water supplies beyond the 20-year planning period.

9. Utilize recharge and extraction techniques to maximize the long-term yield of the Basin.

10. Compile groundwater monitoring data including water quality information and prepare annual reports of Basin status to the Watermaster.

11. Obtain the financial capability to implement this strategy.

12. Communicate the problems, issues, and management plan to the public.

To effectively utilize this general strategy, both the Watermaster and the District must concur on the approach and their individual areas of responsibility. The District is currently undertaking many of the activities which are necessary to implement this strategy. Accordingly, the Watermaster should integrate these activities into a comprehensive management plan and assess its role in the implementation of the plan.

RECOMMENDED ROLE OF THE WATERMASTER

As an entity established by the Superior Court of San Bernardino County, the Watermaster is responsible for formulating a plan and program for a physical solution to the Basin. According to this judgement, the overdraft plan must also include provisions for the administration of the program. Since the 1977 judgement, the Board of Directors of the Hi-Desert Water District served as Watermaster and District staff served as staff for the Watermaster; however, in 1990, the Court appointed six additional non-voting members to the Watermaster Board. These additional members represent specific interests in the Warren Valley Basin and the current Watermaster Board represents a broad spectrum of water interests in the Yucca Valley area.

In assessing the appropriate role for the Watermaster in the implementation of the recommended plan, the responsibilities established by the Court must be fulfilled by the Watermaster; however, beyond these responsibilities, several limitations of the Watermaster must be recognized. These limitations include:

1. The lack of staff directly responsible to the Watermaster

2. Limited revenue sources (i.e., Production assessments appears to be the only revenue source available to the Watermaster)

3. The need to obtain Court approval prior to initiating significant actions.

Based on these considerations, it is recommended that the Watermaster assume the following responsibilities:

1. formulation of water management plans

2. evaluation of imported water and conjunctive use opportunities

3. monitoring of plan implementation and the preparation of progress reports to the Court

4. development of a system of equitable groundwater and imported water allocations

5. data analysis and reporting of Basin condition (i.e., quantity and quality)

6. establishment of assessments to fund the above activities and to equalize the cost of groundwater and imported water supplies.

These activities would be supplemented by the responsibilities of the Hi-Desert Water District. As an operating water utility, the District would generally be responsible for the design, construction and operation of the facilities necessary to deliver sufficient potable water supplies to its customers. In relation to the Watermaster's management plan, it is recommended that the District assume the following responsibilities:

1. design, construction, and operation of groundwater extraction and recharge facilities

2. contracting, delivery, and treatment of imported water supplies identified by the Watermaster

3. collection of groundwater levels, production volumes and water quality data

4. evaluation of a potential wastewater collection, treatment, and reclamation system

5. continued implementation of the water conservation program

6. development of an ongoing public education program.

Although there are likely to be many issues which must be addressed by both the Watermaster and the District, the recommended division of responsibilities between these utilities attempt to avoid an inefficient duplication of efforts. Generally, the Watermaster would fulfill the broad-scale water supply planning and monitoring functions and the District would fulfill the day-to-day implementation functions. This arrangement would take advantage of the diverse representation of the Watermaster as well as the technical, operational, and financial resources of the District.

RECOMMENDED PROGRAM ELEMENTS

Based on the current and ongoing activities of the District, the current and anticipated water requirements for the Yucca Valley area are pre-

sented in Chapter 4. To maintain acceptable Basin water levels, this evaluation resulted in a recommendation to maintain water demand growth within Scenario GA-2 which represents a 2 percent growth rate. To restore Basin water levels, allow increased growth, and provide water supplies beyond the 20 year planning period, several water management activities have also been recommended. In general, these activities either reduce water consumption or increase groundwater recharge. Specific water supply demand recommendations presented in the previous chapters and their potential long-term impacts on water supplies or demands are summarized below:

Chapter		Recommendation	Potential Long-term Water Supply Impacts
5	5.1	Early SWP delivery and temporary water transfers	336 AFY
	5.2	Groundwater along the MBP and water supplies in the low desert	Unknown
	5.3	Additional SWP entitlements or water developments in other areas	Unknown
6	6.1	Greywater use	150 AFY
	6.2	Evaluation of wastewater collection, treatment, and reclamation	
7	7.1	Stormwater Recharge	50-100 AFY
	7.2	SWP Recharge	Included in SWP delivery estimate (See Chapter 4)
	7.3	Evaluation of Interagency Conjunctive Use	None
8	8.1	Additional water conservation programs	200 AFY

These recommended program elements, together with the other recommendations contained in this report, constitute the basic plan for the Watermaster to manage the Warren Valley Basin so that adequate long-term water supplies are available for the Yucca Valley area.

PROJECTED WATER REQUIREMENTS

For the recommended 20-year planning period, the balance between current and anticipated water supplies and various scenarios of projected demands is presented in Tables 4-4 through 4-8. This evaluation is based on existing water supplies as well as the current activities to obtain additional water supplies or to reduce water demands through

TABLE 9-1
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-0)

YEAR	WATER SUPPLIES (AFY) EXISTING SUPPLY (TABLE 4-4)	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-0	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	0	200	3565	-3365	36000
1991	200	0	30	75	305	3555	-3250	32750
1992	1000	0	60	75	1135	3545	-2410	30340
1993	1007	0	90	75	1172	3534	-2362	27978
1994	1013	0	120	75	1208	3524	-2316	25662
1995	5302	0	150	75	5527	3514	2013	27675
1996	5136	166	150	75	5527	3514	2013	29688
1997	5010	292	150	75	5527	3514	2013	31701
1998	5124	178	150	75	5527	3514	2013	33714
1999	4063	1239	150	75	5527	3514	2013	35727
2000	5302	0	150	75	5527	3514	2013	37740
2001	5302	0	150	75	5527	3514	2013	39753
2002	5302	0	150	75	5527	3514	2013	41766
2003	4891	411	150	75	5527	3514	2013	43779
2004	5302	0	150	75	5527	3514	2013	45792
2005	5302	0	150	75	5527	3514	2013	47805
2006	4571	731	150	75	5527	3514	2013	49818
2007	4715	587	150	75	5527	3514	2013	51831
2008	4475	827	150	75	5527	3514	2013	53844
2009	5018	284	150	75	5527	3514	2013	55857
2010	4633	669	150	75	5527	3514	2013	57870

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 9-2
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-1)

YEAR	WATER SUPPLIES (AFY) EXISTING SUPPLY (TABLE 4-5)	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-1	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	0	200	3565	-3365	36000
1991	200	0	30	75	305	3555	-3250	32750
1992	1000	0	60	75	1135	3545	-2410	30340
1993	1007	0	90	75	1172	3534	-2362	27978
1994	1013	0	120	75	1208	3524	-2316	25662
1995	5302	0	150	75	5527	3514	2013	27675
1996	5147	166	150	75	5538	3564	1974	29649
1997	5032	292	150	75	5549	3614	1935	31584
1998	5157	178	150	75	5560	3664	1896	33480
1999	4107	1239	150	75	5571	3714	1857	35337
2000	5357	0	150	75	5582	3764	1818	37155
2001	5368	0	150	75	5593	3814	1779	38934
2002	5379	0	150	75	5604	3864	1740	40674
2003	4979	411	150	75	5615	3914	1701	42375
2004	5401	0	150	75	5626	3964	1662	44037
2005	5412	0	150	75	5637	4014	1623	45660
2006	4692	731	150	75	5648	4064	1584	47244
2007	4847	587	150	75	5659	4114	1545	48789
2008	4618	827	150	75	5670	4164	1506	50295
2009	5172	284	150	75	5681	4214	1467	51762
2010	4798	669	150	75	5692	4264	1428	53190

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 9-3
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-2)

YEAR	WATER SUPPLIES (AFY) EXISTING SUPPLY (TABLE 4-6)	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-2	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	0	200	3565	-3365	36000
1991	200	0	30	75	305	3555	-3250	32750
1992	1000	0	60	75	1135	3545	-2410	30340
1993	1007	0	90	75	1172	3534	-2362	27978
1994	1013	0	120	75	1208	3524	-2316	25662
1995	5302	0	150	75	5527	3514	2013	27675
1996	5152	166	150	75	5543	3588	1955	29630
1997	5043	292	150	75	5560	3664	1896	31526
1998	5174	178	150	75	5577	3741	1836	33362
1999	4130	1239	150	75	5594	3820	1774	35136
2000	5387	0	150	75	5612	3901	1711	36847
2001	5405	0	150	75	5630	3983	1647	38494
2002	5424	0	150	75	5649	4066	1583	40077
2003	5031	411	150	75	5667	4152	1515	41592
2004	5462	0	150	75	5687	4239	1448	43040
2005	5481	0	150	75	5706	4327	1379	44419
2006	4770	731	150	75	5726	4418	1308	45727
2007	4935	587	150	75	5747	4510	1237	46964
2008	4715	827	150	75	5767	4604	1163	48127
2009	5280	284	150	75	5789	4701	1088	49215
2010	4916	669	150	75	5810	4799	1011	50226

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 9-4
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-3)

YEAR	WATER SUPPLIES (AFY) EXISTING SUPPLY (TABLE 4-7)	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-3	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE(AF)
1990	200	0	0	0	200	3565	-3365	36000
1991	200	0	30	75	305	3555	-3250	32750
1992	1000	0	60	75	1135	3545	-2410	30340
1993	1007	0	90	75	1172	3534	-2362	27978
1994	1013	0	120	75	1208	3524	-2316	25662
1995	5302	0	150	75	5527	3514	2013	27675
1996	5170	166	150	75	5561	3668	1893	29568
1997	5078	292	150	75	5595	3822	1773	31341
1998	5226	178	150	75	5629	3976	1653	32994
1999	4199	1239	150	75	5663	4130	1533	34527
2000	5472	0	150	75	5697	4284	1413	35940
2001	5497	0	150	75	5722	4397	1325	37265
2002	5522	0	150	75	5747	4511	1236	38501
2003	5136	411	150	75	5772	4624	1148	39649
2004	5572	0	150	75	5797	4738	1059	40708
2005	5597	0	150	75	5822	4851	971	41679
2006	4895	731	150	75	5851	4981	870	42549
2007	5067	587	150	75	5879	5112	767	43316
2008	4856	827	150	75	5908	5242	666	43982
2009	5428	284	150	75	5937	5373	564	44546
2010	5072	669	150	75	5966	5503	463	45009

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

TABLE 9-5
PROJECTED WATER SUPPLY AND DEMAND WITH RECOMMENDED PROGRAM ELEMENTS
(GROWTH SCENARIO GA-4)

	WATER SUPPLIES (AFY)							
YEAR	EXISTING SUPPLY (TABLE 4-8)	EARLY SWP	GREY-WATER USE	STORM-WATER RECHARGE	SUPPLY	DEMAND* GA-0	SUPPLY LESS DEMAND	ESTIMATED BASIN STORAGE
1990	200	0	0	0	200	3565	-3365	36000
1991	200	0	30	75	305	3555	-3250	32750
1992	1000	0	60	75	1135	3545	-2410	30340
1993	1007	0	90	75	1172	3534	-2362	27978
1994	1013	0	120	75	1208	3524	-2316	25662
1995	5302	0	150	75	5527	3514	2013	27675
1996	5162	166	150	75	5553	3635	1918	29593
1997	5064	292	150	75	5581	3759	1822	31415
1998	5206	178	150	75	5609	3888	1721	33136
1999	4175	1239	150	75	5639	4021	1618	34754
2000	5444	0	150	75	5669	4158	1511	36265
2001	5475	0	150	75	5700	4300	1400	37665
2002	5507	0	150	75	5732	4446	1286	38951
2003	5130	411	150	75	5766	4597	1169	40120
2004	5575	0	150	75	5800	4753	1047	41167
2005	5611	0	150	75	5836	4914	922	42089
2006	4916	731	150	75	5872	5080	792	42881
2007	5098	587	150	75	5910	5252	658	43539
2008	4897	827	150	75	5949	5429	520	44059
2009	5481	284	150	75	5990	5612	378	44437
2010	5137	669	150	75	6031	5801	230	44667

* INCLUDES ADDITIONAL WATER CONSERVATION OF 200 AFY AFTER 5 YEARS

NOTES:

1. REMAINING EXTRACTABLE WATER FROM THE BASIN IS ASSUMED TO BE AT LEAST 36,000 ACRE-FEET IN 1990.
2. THE ACQUISITION OF ADDITIONAL IMPORTED WATER SUPPLIES IS ALSO A RECOMMENDED PROGRAM ELEMENT; HOWEVER, BECAUSE THE MAGNITUDE OF THESE SUPPLIES ARE UNKNOWN, THEY ARE NOT INCLUDED IN THESE PROJECTIONS.

conservation. If the recommended program elements are implemented, the balance between projected supplies and demands are presented in Tables 9-1 through 9-5. Because the potential magnitude of additional imported water supplies cannot be determined at this time, this evaluation does not include the impact of these supplies.

Based on this evaluation, the critical period for the Basin continues to be the present to 1994, prior to the delivery of State water. However, by implementing the recommended programs, the Basin capacity at its minimum level (25,661 acre-feet) is expected to be higher than the Basin capacity without these programs (24,661 acre-feet). Furthermore, during the 20 year planning period, the Basin capacity is expected to recover well beyond its estimated current capacity of 36,000 acre-feet, even at the most rapid growth rate (growth scenario GA-4). Consequently, if the recommended management plan is implemented, the growth in water demands can be allowed to expand to those represented by growth scenario GA-4, if desired by the Watermaster. However, until State water or additional imported groundwater can be delivered, it is recommended that water demand be maintained below the levels represented by growth scenario GA-2.

BASIN OPERATION PLAN

Operation of the Warren Valley Basin will depend primarily upon the delivery of SWP entitlements through the MBP in the mid-1990's. Until this water supply is available, the Yucca Valley area will be dependent upon groundwater stored in the Warren Valley Basin together with groundwater developed on the mesa. This operating concept is embodied in the supply/demand balances presented in Tables 9-1 through 9-5. Accordingly, the recommended basin operation plan has two phases. The first phase relies on the continued use of groundwater and the second phase relies on imported SWP water.

The Phase 1 operation plan will continue from the present to 1995 when the delivery of SWP water is available. During this period, the water demands for the area will be provided by groundwater. The recommended plan includes the development of 800 AFY of groundwater on the mesa by 1992. This groundwater supply would eliminate the need for non-overlying users on the mesa to utilize the Warren Valley Basin for their water supply. However, the remaining water users whose requirements currently exceed 2,700 AFY must continue to utilize the Basin. Although the safe yield of the Basin is only 200 AFY, the Phase 1 plan also includes the development of greywater as a source of water and additional water conservation measures. These recommended programs are expected to reduce withdrawals from the Basin by up to 350 AFY during the Phase 1 period. In addition, the recommended stormwater recharge program is expected to increase the safe yield by 50 to 100 AFY. Accordingly, based on the total projected 1990 water demand of 3,565 AFY, the recommended groundwater allocations during the Phase 1 period are 585 AFY for the Blue Skies Country Club and 2,924 AFY for the Hi-Desert Water District.

However, when groundwater on the mesa is developed, this allocation can be reduced for the District. Because the Institute of Mental Physics (IMP) overlies the zone of transmission (i.e., Basin outflow), it is recommended that Basin withdrawals by IMP continue to be excluded from the allocation of the safe yield.

After imported SWP is available, the recommended Phase 2 operation plan would be implemented. During Phase 2, imported SWP water would be treated and delivered to the distribution system. SWP water entitlements in excess of the amount that could be utilized directly would be delivered to recharge basins for storage. Groundwater stored in the Basin would be used primarily for peaking demands and to serve areas that cannot be served by imported water. During Phase 2, Basin water levels should recover to levels higher than their current 1990 level. Assuming the stormwater recharge program adds approximately 75 AFY to the safe yield, the allocation of the safe yield of the Basin based on proportional shares of the adjudicated allocations would be 73 AFY for Blue Skies Country Club and 202 AFY for the Hi-Desert Water District. Because water use by individual domestic wells is small and IMP overlies the zone of transmission, these users have been excluded from safe yield allocations. However, to limit increased drilling of individual wells as the cost of water increases, it is recommended that unless the District cannot serve a specific residence, the Watermaster restrict new wells for individual residences by court order or by basin equity assessments. Beyond these safe yield allocations, Basin extractions would be subject to production assessments which would recover the cost of recharging imported water beyond the safe yield allocations. The estimated cost of these production assessments are discussed in a later chapter of this report.

In addition to the program elements included in Phases 1 and 2, it is recommended that the Watermaster and the District continue their evaluations of additional imported water supplies, interagency conjunctive use, and wastewater reclamation. Because these activities as well as the recommended Phase 2 operation plan will create much more complex hydrogeologic conditions, it is also recommended that the Watermaster create a computerized groundwater flow model of the Basin. This model could be utilized to reassess the safe yield of the Basin under a more complex operating plan as well as to assess the quantity and quality impacts of specific recharge or extraction scenarios.

WATER SHORTAGE CONTINGENCY PLAN

The District currently has an Emergency Stage Response Program (Appendix H) to address short-term water shortages caused by demands in excess of its production capabilities. When imported SWP water is available, the risk of this potential shortage should be significantly reduced. However, there appears to be three additional water shortage conditions which must be addressed. These conditions are:

1. a significant delay in SWP water delivery

2. hydrologic conditions which reduce SWP water deliveries
3. contamination of groundwater supplies.

Based on the water supply/demand projections presented in Tables 9-1 through 9-5, the projected minimum Basin storage is approximately 25,642 acre-feet. Although this water could theoretically sustain the area for up to 7 years, it is likely that the physical problems of extraction would severely limit the District's ability to meet the water demands of the area. This condition would initiate the ESRP on an increasing basis. Outdoor water use would be significantly curtailed although indoor use would also be affected. Because this management plan is dependent upon the delivery of SWP water which is expected in 1995, any significant delay in this schedule would create a serious risk in the ability of the groundwater basin to support the water needs of the community. Accordingly, it is recommended that if the MBP is delayed more than 2 years beyond 1995, outdoor water use with potable water supplies, including irrigation at Blue Skies Country Club, be severely curtailed and that strict water rationing be implemented. Although this recommendation would create significant economic hardships to Blue Skies Country Club, it is likely that the wells used for irrigation would be unable to provide sufficient water as groundwater levels declined. Furthermore, it would be unlikely that the District could provide irrigation water while strict water rationing is imposed on its customers.

As discussed in Chapter 4, the SWP is subject to delivery reductions caused by increasing contractor requests in excess of hydrologic yields. Based on stochastic estimates of historical hydrology, delivery reductions are expected to occur on an increasing basis. To mitigate the impact of these reductions, it is recommended that the District "bank" early SWP deliveries or temporary water transfers which can be utilized when delivery reductions occur. Due to the lack of delivery facilities, these water supplies must be "banked" in another groundwater basin. However, when the MBP is completed, these supplies can be transferred to the Warren Valley Basin.

Although the safe yield of the Basin is small, the Basin has a significant role in providing water supply reliability. Consequently, potential contamination of the Basin could cause serious problems in implementing this management plan. According to the District's Annual Water Quality Report for 1989, the current groundwater quality is excellent. To maintain this high quality, it is recommended that the Watermaster initiate a water quality monitoring and reporting program. Because there are few industrial operations overlying the Basin, it is recommended that the monitoring program focus on total dissolved solids and nitrates from septic tanks and petroleum hydrocarbons from gas stations. It is also recommended that the Watermaster identify potential sources of contamination and monitor reports of hazardous material spills to the Department of Health Services and Regional Water Quality Control Board. This monitoring program will serve as an interim groundwater quality protection plan and early warning system for possible remedial actions

by the Watermaster. When the results of these evaluations have been completed, it is recommended that the Watermaster prepare a complete groundwater quality protection plan.

BASIN MONITORING PLAN

To assess the success of the Basin operation plan, the Watermaster must monitor the key measures of performance. These measures include:

1. groundwater extractions
2. Basin recharge
3. groundwater levels
4. groundwater quality
5. financial status

These data are generally collected by the District as a routine part of its operations. For monitoring data which is not collected by the District, it is recommended that the Watermaster compile this supplemental information. In addition, the need for additional monitoring wells has not been assessed as part of this plan; consequently, it is recommended that the monitoring requirements of the Basin be assessed concurrently with the development of the recommended groundwater model which would utilize these data.

It is recommended that collected information, together with appropriate interpretive narrative, be compiled in an annual report which will be available to the public. An example of an annual report for the Orange County groundwater basin in included in Appendix I. This report can serve not only as a public information document but also as a report to the Court.

CHAPTER 10

PUBLIC EDUCATION

To effectively communicate the objectives and programs of the Watermaster, an active public education program is necessary. Because the Hi-Desert Water District currently maintains a public education program, it appears desirable for the Watermaster to utilize the District to communicate the objectives and programs of the Watermaster to the community. This chapter describes the existing public education activities of the District and presents recommendations to incorporate the needs of the Watermaster into these ongoing activities.

PROGRAM GOALS

In developing a public education program for the Watermaster, it is important to identify the specific areas which are important to implementing the programs identified in this management plan. Based on the discussions presented in the previous chapters, these areas include:

1. The severe overdraft of the Warren Valley Basin
2. The complex issues related to obtaining supplemental water supplies
3. The need for aggressive water conservation to minimize the need for supplemental supplies
4. The high cost associated with these activities
5. The Watermaster's has a comprehensive plan to comprehensively address these issues
6. The potential cost to the community if the Watermaster's plan is not implemented

The success of the public education program depends on the credibility of the District in presenting the information necessary to understand these complex issues. This credibility is developed not only by public education but also through public participation in the development of solutions to the wide range of water issues facing the Yucca Valley area.

CURRENT ACTIVITIES

Previously, the District utilized a public education program to discuss the issues related to State Water importation. In June 1990, the voters of Improvement District M approved the financing plan for the Morongo Basin Pipeline by more than a two-thirds vote. The Hi-Desert Water District currently focuses its public education program on water

conservation. The District utilizes many forums which have had a significant impact on water conservation. The positive results of this effort is manifested through the District's relatively low per capita water use of 103 gallons per day. Recently, the District also utilized a public education program to communicate the detailed evaluation of the District's water rates. The primary ongoing public education activities of the District are summarized below:

Water Awareness Month

Water awareness and conservation activities are promoted by the Department of Water Resources (DWR) and the American Water Works Association (AWWA) throughout the month of May. The activities tend to focus on elementary schools in order to help educate children through fun activities.

Speaker's Bureau

District personnel are available to speak to groups in the community and deal with the media on the many issues pertaining to water.

Conservation Literature and Advertising

This ongoing program includes the distribution of literature and brochures as well as a constant outreach through multi-media sources. Distributed information includes literature on leak detection and repair, landscape irrigation, greywater use, and water conservation. For fiscal year (FY) 1990-1991, public education costs have been budgeted at nearly $50,000 based on purchasing and production expenses and media advertising costs. Materials are distributed at events and are available through the District office.

A regular, quarterly newsletter is published to inform the public of past actions and future plans as well as conservation hints and system updates. Special mailings are used when new ordinances and resolutions are coming into effect that may impact certain sectors of the community.

The local news media are frequently involved through news releases. There is also an extensive ad campaign within the conservation program.

School Programs

The District currently participates with several nearby water districts through the Joint Powers Authority to bring water conservation workshops into the elementary schools of the community. The District is responsible for 59 percent of the funding for this program which provides a specialist and literature for the 1st, 3rd and 5th grades.

Public Involvement

Working groups comprised of the most interested and involved citizens in the community are created on an ad hoc basis to provide an opportunity for the community to work with District staff and board committee members on current water issues. District board meetings are regularly scheduled on the first and third Wednesday of each month and special meetings are called when the need arises. Postings and news releases of meeting agendas are used to encourage public attendance. Public hearings are utilized when the community may be faced with rate changes or other issues for which public testimony would be beneficial. Special mailings, postings and news releases are utilized to notify the public.

POTENTIAL PROGRAM ELEMENTS

Although the District currently has an active public education program, there appears to be several additional activities which could be incorporated into the District's program to make it even more effective. Several of these activities are summarized below:

Expanded Public Information Program

Expanding the disbursement of brochures and other literature is anticipated to provide greater public awareness. Brochures could be distributed at locations throughout the community such as libraries and other public offices. Utility companies can also be encouraged to send energy and water conserving brochures with their bills. Expanding and maintaining an educational format in the various media is also a potential program element. Specific information includes landscaping and indoor retrofitting. In January 1991, the District initiated a "hot line" which customers can call to get current information regarding watering hours, announcements of upcoming meetings, information regarding new ordinances, and other relevant information.

Public Information Officer

As the public information expands, it is recommended that the Watermaster encourage the District to employ a public information officer (PIO) to coordinate the numerous activities which will be occurring. The PIO should serve as a focal point for the media and be the creative force in the implementation of the public education program. As such, the PIO should be a professional in public relations, journalism, or related field. In January 1991, the District hired a PIO to fulfill this function.

Educational Resource Center

Supplying additional instructional material to the local schools and training teachers to use the material is an alternative to having a District representative go to the schools. Having trained teachers and providing resource materials facilitates lessons on water and conserva-

tion and increases the access to students at selected grade levels. This type of program would probably be the most cost effective approach if the District intends to make a continuing commitment to educational programs and engrain good long-term water use habits in the community. The acquisition of additional water conservation curriculum materials and teacher resource supplements to augment existing materials would be needed to help the schools in providing the water conservation education. The use of computers and conservation software could be used for the upper elementary grades. A hands-on learning program could accompany the software, which would include monitoring of water use at the school through leak detection by students using the computer software.

Participation in Special Events

Utilizing community events such as fairs and symposiums to inform the public is a potential program element that could increase public involvement in District activities. Information on water issues, conservation and activities could be made available by setting up a table at these various functions.

Conservation Awards

Awards presented to both residential and commercial users for noticeable conservation efforts could help in encouraging the public to conserve water. Awards could be given during Water Awareness Month which would compliment the other existing activities. Continuing to present water efficient landscape awards during Water Awareness Month is a good way to promote water efficient landscaping in the area.

RECOMMENDED ACTIVITIES

When implemented, the public education programs appear to be an effective method of communicating water issues to the public. Previous efforts appear to be well-received as well as to achieve their basic objectives. For these reasons, it is recommended that the Watermaster incorporate its public education needs into the District's program and encourage the District to include the following expanded activities:

1. Expanded Public Information Program
2. Public Information Officer (Hired January 1991)
3. Educational Resource Center
4. Participation in Special Events
5. Conservation Awards

The public education program may be the best opportunity to maintain support for the Watermaster activities during the implementation of this management plan. The complex issues and high implementation cost will create community concern and only through the maintenance of a long-term public education program will the Watermaster be able to continue its progress in solving the overdraft problem of the Warren Valley Basin.

CHAPTER 11

REVENUE PROGRAM

To effectively implement the recommended management plan, the Watermaster must have sufficient funding to perform the activities for which it is responsible. These responsibilities are presented in other chapters of this report. This chapter presents the recommended revenue program to recover the cost of ongoing operations as well as the cost of the recommended program elements.

ESTIMATED REVENUE REQUIREMENTS

Based on the recommended role of the Watermaster presented in Chapter 9, the Watermaster will require revenues to fulfill its assigned functions. These functions generally include planning, water supply evaluations, monitoring, and reporting. In addition, based on the Interim Report for 1989-1990, the Watermaster must repay funds previously advanced by the Hi-Desert Water District as well as the funds for the preparation of this plan. The general categories of expenditures are as follows:

1. Administrative staff support provided by the District
2. Legal and engineering consultants for general administrative activities
3. Cost of consultants to prepare recommended plans
4. Cost of public information programs
5. Repayment of advanced funds
6. Cost of groundwater recharge

Each of these expense categories is discussed in the following paragraphs.

Administrative Staff Support

This expenditure category includes staff salaries and fringe benefits, equipment, and supplies provided by the District to support the administrative activities of the Watermaster. The Interim Report recommended a revised budget of approximately $12,000. However, because of the significantly increased activities of the Watermaster, it is recommended that an annual budget of $30,000 be established.

Legal and Engineering Consultants

This category includes the costs for ongoing administrative support by the Watermaster's legal and engineering consultants. Assuming monthly meetings with the Watermaster Board and staff, an annual budget of $25,000 is recommended.

Planning Activities

This cost category includes the costs of consultants and staff to prepare the supplemented studies recommended in this management plan. These studies include imported water supply evaluations, computerized groundwater flow model, water quality monitoring program, groundwater quality protection plan, and Basin monitoring plan. Based on the preparation of these studies over a several year period, an annual budget of $90,000 is recommended.

Public Information Program

These costs are budgeted for the preparation of a public information program for the Watermaster. Activities will include educational materials, public information activities, and the preparation and production of the annual report. An annual budget of $23,000 is recommended.

Repayment of Advanced Funds

Based on the Interim Report, the District has advanced approximately $110,000 to the Watermaster as of 31 March 1989. Due to subsequent support by District staff, attorneys, and consultants beyond the revenues of the Watermaster, this amount is estimated to be $394,414 as of 30 June 1990. For the purpose of assessing the revenue requirements of the Watermaster, it is assumed that the funds advanced by the District will total $450,000 by the time revised production assessments are levied. In the Interim Report, these advanced funds were amortized at 13.5 percent over 10 years. Because this interest rate exceeds the cost of funds to the District, it is recommended that the advanced funds be amortized at 8 percent over 10 years. The resulting annual budget for these advanced funds is $67,000 per year.

Groundwater Recharge

Extractions for the Basin in excess of its safe yield must be offset by recharge of imported water supplies. Of the potential imported water supplies, only State water can be anticipated in the near future. Thus, the cost of groundwater recharge is based on the incremental cost to import State water. The cost to import State water includes both the capital and operation and maintenance (O&M) cost of the system. Based on the Cost of Service Rate Study and Feasibility Report for the Morongo Basin Pipeline (MBP) the amortized capital cost of the MBP is expected

to be $5,630,637 per year of which $2,280,000 per year would be funded by property taxes within Improvement District M. Consequently, the incremental amortized capital cost to funded by water users is $3,350,637 per year. The estimated O&M cost for the MBP is $3,510,500. Therefore, the incremental cost of imported State water is $6,861,137. Based on the delivery of 7,250 acre-feet per year, the incremental cost of State water is $946 per acre-foot. Because groundwater recharge operations are expected to cost approximately $63 per acre-foot, the incremental cost for groundwater recharge is estimated to be $1,009 per acre-foot for each acre-foot of extracted groundwater beyond the safe yield allocation. For 1990, estimated extractions from the Basin totaled 3,565 acre-feet. Excluding the demands of individual wells and the Institute of Mental Physics, the extractions beyond the improved safe yield of 275 acre-feet were 3,234 acre-feet. Therefore, the estimated revenue requirements to recharge the Basin would be $3,263,106 in 1990.

Summary of Estimated Revenue Requirements

Based upon the cost categories presented above, the estimated annual revenue requirements for the Watermaster's recommended activities are as follows:

Cost Category	Estimated Annual Revenue Requirement
1. Administrative Staff Support	$ 30,000
2. Legal & Engineering Consultants	$ 25,000
3. Planning Activities	$ 90,000
4. Public Information Program	$ 23,000
5. Repayment of Advanced Funds	$ 67,000
Total Administrative Activities	$235,000
6. Groundwater Recharge	$ 1,009/acre-feet above allocation

RECOMMENDED REVENUE SOURCES

The only apparent source of revenue for the Watermaster's activities is assessments on the production of groundwater. However, there are several ways in which assessments can be levied to further the goals of the Watermaster. Accordingly, the following system of assessments is recommended:

1. Production assessments on all extractions except those of individual wells and the Institute of Mental Physics will be used to fund annual administrative costs.

2. Replenishment assessments on extractions beyond the improved safe yield of 275 acre-feet per year will be used to fund the cost of groundwater recharge.

Basin Equity Assessments

After State water is available, the Yucca Valley area will have 2 sources of water: groundwater from the Warren Valley Basin and treated or untreated State water. Basin equity assessments (BEAs) are a financial mechanism to assist the Watermaster in better managing the use of these alternative water supplies. The revenues from BEAs are generally used to reduce the cost of water from the other source; thus, BEAs are revenue-neutral to the Watermaster. However, BEAs can be used to encourage or discourage the use of specific sources of water. The amount of these assessments will depend on the magnitude of the water use shift desired as well as the urgency of the shift. Until alternative water sources are available, Basin equity assessments will not serve a useful purpose; thus, it is recommended that the implementation of BEAs be deferred until State water is available. However, because BEAs will be a useful groundwater management tool for the Watermaster, it is recommended that the Watermaster seek Court approval as soon as possible.

Summary of Recommended Revenue Sources

Based upon the revenue sources discussed above, the recommended assessments to fund the estimated revenue requirements of the Watermaster are as follows:

	Revenue Source	Recommended Assessment
1.	Production Assessment	$84 per acre-foot
2.	Replenishment Assessment	$1,009 per acre-foot above safe yield allocations
3.	Basin Equity Assessment	To be determined when State water is available

The recommended revenue sources will provide significant financial security to achieving the goals established by the Watermaster. Although the recommended assessments appear high, they reflect the "true" cost of water in the Yucca Valley area. The Hi-Desert Water District is currently in the process of revising its water rates to incorporate these costs; therefore, the primary impact of these assessments will be on the Blue Skies Country Club. However, because this facility is a major user of groundwater, the failure of the Watermaster to levy the recommended assessments would require the ratepayers of the District to assume these costs.

3. Basin equity assessments on extractions beyond the improved safe yield of 275 acre-feet per year will be used on a revenue-neutral basis by the Watermaster to manage the extractions from the Basin.

Each of these revenue sources is discussed in the following paragraphs.

Production Assessments

The current activities of the Watermaster are funded by production assessments. These assessments, in effect since 1984, are levied at a uniform rate of $10 per acre-foot on extractions up to the production rights established by the Court and a separate uniform rate which declines each fiscal year (i.e., $49.29 per acre-foot in 1984-85 to $5.80 per acre-foot in 1998-99) on extractions beyond the established production rights. Unfortunately, these production assessments have been unable to adequately fund the activities of the Watermaster; consequently, it has been necessary for the District to advance funds to the Watermaster. As discussed previously, these advanced funds are expected to total $450,000 by mid-1991.

Because the Watermaster must have a secure source of funding to perform the expanded functions recommended in this plan, it is recommended that a uniform production assessment be levied on all extractions from the Basin and that these revenues be utilized to fund the administrative, planning, public information, and oversight functions recommended in this plan. Until State water is available, the average (1991 to 1994) extractions from the Basin which can be assessed are projected to be 2,809 AFY. Based on the estimated revenue requirements of $235,000 per year, the recommended production assessment is $84 per acre-feet.

Replenishment Assessments

As discussed previously, the cost of groundwater recharge is estimated to be $1,009 per acre-foot for extractions beyond the safe yield allocations. Therefore, it is recommended that a replenishment assessment of $1,009 per acre-foot be established for extractions beyond the safe yield allocations of 73 AFY for Blue Skies Country Club and 202 AFY for the Hi-Desert Water District. A significant issue is the schedule for implementation of this assessment. Because State water is not expected to be available until 1995, Basin replenishment cannot occur prior to this period. However, failure to levy this assessment until 1995 would increase the burden of Basin recharge on future water users. Accordingly, it is recommended that the replenishment assessment be levied upon approval from the Court and that these funds be utilized for early SWP deliveries or accumulated for future recharge activities. Although this assessment is costly, it reflects the current cost of water in the Yucca Valley area and its immediate implementation would be the most equitable approach to cost-sharing between current and future water users.

CHAPTER 12

IMPLEMENTATION PLAN

The foregoing chapters presented a summary of the overdraft problem in the Warren Valley Basin, the goals of this management plan, and a discussion of the specific program elements of the plan. Attention is now directed to integration of these program elements and implementation of the recommended plan.

IMPLEMENTATION CONSIDERATIONS

In integrating the individual elements of the management plan, consideration must be given to the implementation issues associated with the recommended plan. The specific program elements recommended in this report are intended to address one or more of the goals identified previously. Once specific activities have been identified, it is also necessary to determine implementation responsibility, schedule for implementation, and performance monitoring.

Because there are few pumpers from the Basin, implementation of specific activities will generally remain the responsibility of the Watermaster or the Hi-Desert Water District. The schedule for implementation of recommended activities can be categorized as short-term (1 to 2 years), intermediate-term (3 to 5 years) or long-term (beyond 5 years). As discussed in previous chapters, monitoring the progress of implementation should be the responsibility of the Watermaster.

In developing this management plan, it is recognized that water supply planning is a dynamic process and that the management plan presented in this report may require adjustment in the future. Accordingly, it is intended that the Watermaster review the water supply conditions and management plan on an annual basis and incorporate necessary modifications.

IMPLEMENTATION PLAN

To address the overdraft problem of the Warren Valley Basin, as well as other potential groundwater management problems, specific program elements have been developed and integrated into a management plan. This plan is intended to provide a flexible framework for unifying the activities of the Watermaster, District, and other pumpers from the Basin. A summary of the goals of the management plan, recommended activities, their implementation responsibility, and schedule is presented in Table 12-1. This plan should enable the Watermaster to monitor the condition of the Basin and provide cost-effective solutions to current and potential problems.

IMPLEMENTATION MONITORING

As recommended in Chapter 9, one of the primary functions of the Watermaster is to monitor the implementation of the groundwater management plan. Although monitoring of the plan should be an ongoing activity, it is recommended that the Watermaster prepare an annual report that summarizes groundwater extractions, Basin recharge, groundwater quality, and financial status.

The report should also present the status of plan implementation and other relevant activities. This report should become a part of the public education program and should be submitted to the Court for judicial monitoring of the Watermaster's performance in executing Court directions.

TABLE 12-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 1. Manage extractions from the Basin to provide a dependable and cost-effective long-term water supply for the Yucca Valley area.		
1.1 Continue to develop groundwater resources on the mesa	District	Ongoing (litigation settled 1/91)
1.2 Continue to implement State water importation by construction of the Morongo Basin Pipeline (MBP)	District	Ongoing
1.3 Maintain annual water demand growth below 2 percent (GA-2) if only ongoing programs are implemented or below 3.25 percent (GA-4) if all recommended programs are implemented	District	Short-term
1.4 Obtain early SWP delivery or temporary water transfers	Watermaster/District	Short-term
1.5 Evaluate opportunities to obtain groundwater along the MBP and/or water supplies in the low desert	Watermaster	Intermediate-term
1.6 Evaluate opportunities to obtain additional SWP entitlements or develop water supplies in other areas	Watermaster	Long-term
1.7 Develop a computerized groundwater flow model	Watermaster	Short-term
1.8 Evaluate opportunities for interagency conjuctive use of the Basin	Watermaster	Short-term

TABLE 12-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 2. Equitably distribute available groundwater and imported water supplies.		
2.1 Restrict the drilling of new wells for individual residences unless the District cannot provide water service	Watermaster	Short-term
2.2 Establish interim and long-term groundwater allocations	Watermaster	Short-term
2.3 Establish a water rate structure which recovers the cost of providing water service	District	Short-term
2.4 Establish Basin equity assessments to manage the utilization of groundwater and imported water supplies	Watermaster	Intermediate-term
2.5 Establish a water supply contingency plan	District	Short-term
Goal 3. Conserve stormwaters tributary to the Basin.		
3.1 Construct retention ponds in Yucca Creek flood control channel and its tributaries	District	Short-term
3.2 Construct recharge basins in Water Canyon	District	Intermediate-term
3.3 Evaluate the feasibility of recharge basins at Blue Skies Country Club	District	Short-term
Goal 4. Encourage water conservation and water reclamation.		
4.1 Continue ongoing water conservation programs	District	Ongoing
4.2 Pursue regulatory approval for greywater use	Watermaster	Short-term
4.3 Conduct feasibility study of wastewater reclamation (Phase 1)	District	Intermediate-term
4.4 Implement additional water conservation programs	District	Short-term

TABLE 12-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 5. Manage and protect groundwater quality for potable uses.		
5.1 Establish a water quality monitoring program	Watermaster/District	Short-term
5.2 Identify potential sources of contamination	Watermaster	Short-term
5.3 Prepare a groundwater quality protection plan	Watermaster	Intermediate-term
Goal 6. Monitor activities affecting the Basin.		
6.1 Establish a Basin monitoring plan	Watermaster	Short-term
6.2 Prepare a groundwater quality protection plan	Watermaster	Intermediate-term
6.3 Prepare an annual report of Basin condition and implementation plan status	Watermaster	Short-term
Goal 7. Conduct public education and information programs.		
7.1 Expand the current public information program	Watermaster/District	Short-term
7.2 Hire a public information officer	District	Short-term (completed 1/91)
7.3 Develop an educational resource center	District	Intermediate-term
7.4 Participate in special events	District	Short-term
7.5 Establish a conservation awards program	District	Short-term
Goal 8. Generate sufficient revenues to achieve the objectives of the Watermaster.		
8.1 Establish a water rate structure which recovers the cost of providing water service	District	Short-term
8.2 Establish production assessments to recover the cost of Watermaster activities	Watermaster	Short-term

TABLE 12-1

SUMMARY OF THE RECOMMENDED MANAGEMENT PLAN

RECOMMEND PROGRAM ELEMENT	IMPLEMENTATION RESPONSIBILITY	IMPLEMENTATION SCHEDULE
Goal 8. Generate sufficient revenues to achieve the objectives of the Watermaster. (cont.)		
8.3 Establish replenishment assessments to recover the cost of Basin recharge	Watermaster	Short-term
8.4 Establish Basin equity assessments to manage the utilization of groundwater and imported water supplies	Watermaster	Intermediate-term
Goal 9. Perform court-mandated directives.		
a. Develop physical solution		
9.1 Continue to develop groundwater resources on the mesa	District	Ongoing (litigation settled 1/91)
9.2 Continue to implement State water importation by construction of the Morongo Basin Pipeline	District	Ongoing
9.3 Obtain early SWP delivery or temporary water transfers	Watermaster/District	Short-term
9.4 Evaluate opportunities to obtain groundwater along the MBP and/or water supplies in the low desert	Watermaster	Intermediate-term
9.5 Evaluate opportunities to obtain additional SWP entitlements or develop water supplies in other areas	Watermaster	Long-term
b. Report progress to the Court		
9.6 Prepare an annual report of Basin condition and implementation plan status	Watermaster	Short-term

APPENDIX A

DESCRIPTION OF STATE WATER PROJECT RELIABILITY MODEL

A brief description of the procedures used in performing the reliability analysis follows. The primary source of information is Department of Water Resources (DWR) Bulletin 132-89.

SWP OPERATIONAL RULES

SWP's delivery capability is based on the concept of "firm yield." Firm yield as applied to the SWP is the dependable annual water supply which can be made available without exceeding specified allowable reductions in agricultural deliveries during extended dry periods. The SWP's existing firm yield is approximately 2.4 million acre-feet annually. Contractor requests for entitlement water deliveries have exceeded 2.4 million acre-feet since 1987.

Firm yield of a project is typically determined by routing a historical hydrologic time series through the storage facilities of a project, and modeling the deliveries under assumed operating rules. The maximum quantity of water which can be delivered from the storage facility under the operating rules is the project's firm yield. Under this method of calculation, the project will be able to deliver the firm yield during any single year of operation.

In addition to consideration of additional structural features to improve the project yield, DWR and the contractors have been examining alternative operational strategies to improve the existing facilities' average annual delivery. Attention has been focused primarily on the use of a risk analysis procedure instead of a normal firm yield calculation. Operational decisions for the SWP have been based on a risk analysis concept since 1978.

1978 Analysis

The risk analysis procedure as originally applied in 1978 was designed to assure a high probability of meeting delivery schedules for the current and following year, assuming a water supply equivalent to that of the two driest years on record. The procedure, termed the "Rule Curve," beginning in 1979, has three parts. The first part uses known beginning storage (carryover from the previous year), defined target storage (end-of-year storage in SWP conservation facilities), and historical hydrology to chart annual SWP water delivery capability against an index which represents unimpaired runoff of streams entering the Sacramento Valley.

A key element of the first part of the analysis is the determination of operations criteria and target storage. By varying the operational rules for the project, deliveries can be increased or decreased

accordingly. This is primarily accomplished by modifying target storages. Utilizing the operating rules and historical hydrologic series, exceedance probabilities for various levels of delivered water volumes can be developed. DWR has developed several such "Rule Curves." Examples of these curves are attached.

The second part of the procedure uses the chart and periodic forecasts of the index to determine the capability of the SWP to deliver water. The forecast ordinarily used is that which would probably be exceeded 99 percent of the time.

The third part of the procedure is allocation of the calculated water delivery capability to contractors and confirmation of the results using a complete operational study. If the operational study indicates that the delivery schedule cannot be met, the schedule is reduced to the amount which can be delivered. Due to the two-year analysis period, the procedure failed to address how storage should be managed over an extended dry period.

1986 Analysis

The analysis for 1986 incorporated a schedule of target storage which decreased each year by equal amounts, reaching a minimum after seven years. Target storage selected each year depended on carryover storage and the previous year's target storage. Further study by DWR and input from SWP contractors led to a 1987 schedule which incorporated lower schedules of target storage and, in 1988, to a target storage calculation based on carryover storage only.

1989 Analysis

In 1989, the "Rule Curve" became the Water Delivery Risk Analysis (WDRA), the "Four Basin Index" became the Sacramento River Index (SRI), and "conservation storage" was interpreted as including Lake Oroville, the State's share of San Luis Reservoir, and the balance owed to DWR by the United States Bureau of Reclamation (USBR) under the Coordinated Operations Agreement. The 1989 WDRA used the same criteria as the 1988 analysis, but the procedure for determining delivery approvals was changed, so that initial delivery approvals were based on a forecast of the SRI with a probability of exceedance of 90 percent. Previous analyses were based on a SRI forecast with a probability of exceedance of 99 percent. DWR continued to perform monthly updates of delivery forecasts using exceedance probabilities of 99 percent.

RELIABILITY ANALYSIS

The reliability analysis utilized these operational data to forecast future SWP deliveries. It incorporated stochastic hydrology as input, and DWR's previously developed operational rules (the "Rule Curves" discussed above) to estimate the probable deliveries through 2010.

Stochastic Hydrology (Monte Carlo Analysis)

In hydrology, "stochastic" is used to refer to a time series (rainfall, runoff, or other hydrologic parameter) which is partially random. Stochastic hydrology falls midway between deterministic and probabilistic hydrology. Deterministic hydrology assumes that time variability is totally explained by other variables as processed through an appropriate model. Probabilistic hydrology is not concerned with time sequence, but only with the probability of a particular event being equalled or exceeded.

For a given hydrologic time series, it is possible to construct other time series which differ from the historical series but retain the essential statistical properties of the original series. Essentially, the stochastic series is constructed so that the events have the same probability of occurrence as the historical series. Development of a stochastic series is often termed a Monte Carlo Analysis. Generation of a time series assumes that the series process is stationary, i.e. that the series' statistical properties do not vary with time. For the SWP project, the time series of interest would be either the Sacramento River Index or some other series representing the runoff available to the SWP.

SWP Delivery Forecasts

Several stochastic records were developed through 2010. Based on contractor delivery requests and proposed SWP capacity improvements, DWR's Rule Curve 4b (shown following Page A.3) was applied to the generated records. On the basis of these analyses, forecasts of SWP deliveries were developed. Portions of this evaluation, dated 5 October 1988, are included.

INTRODUCTION

In March 1986, the Director of the Department of Water Resources (D established a Water Transfers Committee staff to help the Department respo widespread interest in water marketing and water transfers. The Committee charged with reviewing DWR programs that would provide information helpful evaluating and implementing transfers, reviewing proposed legislation, identifying known active transfer proposals, and assisting in clarificatio DWR's role in water transfers.

The Committee has met numerous times and spent considerable time discussing water transfers, water marketing, water sharing, water exchange, DWR's role, existing and proposed legislation, and most predominantly, past present proposed water transfers.

This catalog is a product of the Water Transfers Committee. It cont information on current water transfer proposals in California, and its aim to inform and assist those who are interested in the subject of water transfers. It should help identify and advance proposals which will lead t improved management and use of California's water resources.

Definition of Water Transfers

In order to determine what types of proposals should be included in catalog, the Committee struggled with the issue of developing a precise definition of water transfers or water markets or water exchanges and concl that almost any well constructed definition will exclude someone's specific idea of what constitutes improved, more efficient water use. Therefore, we have not set forth a definition but rather have included proposals known to that may be construed as a water transfer. Thus, no suggested transfer has been eliminated exclusively on definitional issues. However, conventional proposals for large surface water reservoir developments within the federal

Central Valley Project (CVP) or the State Water Project (SWP) have not been included.

Most of the proposals included here are under active consideration by the principal parties that would be involved in the transfer.

One other note concerning definitions—those ideas which may have the broadest basis of support appear to be proposals that might be best described as "water sharing." These involve sharing of existing available supplies and facilities between water agencies or water users in a way that is mutually beneficial. One example is the proposed New Melones-East San Joaquin County proposal whereby the SWP would finance part of the costs for two districts' local distribution systems for New Melones water, which would go to the two districts. In exchange, during dry years, the districts would pump ground water and allow the New Melones water to flow downstream to the SWP. Another example of water sharing is the proposed conveyance and purchase arrangement between the SWP and CVP.

Other Considerations

The concept of water transfers is by no means a new one. In the 1950s while the State Water Project was being formulated, several economists, particularly those at the universities, pointed out the possibility of transferring water used for agriculture in the Colorado River service area to urban uses in the Coastal Plain of Southern California. In 1973, the President's National Water Commission strongly endorsed the concept of voluntary water transfers in their report, Water Policies for the Future. During the 1976-77 drought in California, numerous temporary water transfers were accomplished, some to meet the needs of urban users and some to meet the needs of agricultural users.

INTRODUCTION

Implementation of water transfers is perhaps most advanced in Ari where additional sources of water supply are virtually nonexistent. Ari has adopted a policy of transferring water from agricultural to urban an industrial users and has enacted a body of law to implement the policy. However, unlike Arizona, where water transfers and water marketing are a established method of allocating water supply, California is not running supply sources but is fast approaching the limits of low priced water.

In California, the financial difficulties presently being experier many agricultural interests have encouraged them to look to the possibili marketing the water now used on their lands as a means of increasing the revenue of their enterprises. Concurrently, the steady increase in munic and industrial water needs and the difficulty of developing new supplies the urban water agencies to an active interest in transferring water from agricultural users as one means of meeting these needs. Thus, water mark is receiving increased attention in California.

Some of the potential transfers included in this catalog involve specific proposals by communities in Northern California to build new sto facilities and market the water to areas of need south of the Delta. Tra which involve a supply source north of the Sacramento-San Joaquin Delta mu develop a supply capability that is about 50 percent greater than the need seek to meet because of constrictions in north Delta channels (carriage wa requirements). These constrictions force much of the supply intended for export pumps in the south Delta to take a circuitous route around the west edge of Sherman Island, resulting in reverse flows in the lower San Joaqui River and in water supply losses to offset the seawater intrusion encourag those reverse flows. This factor, which reduces project yields by 30 to 3

percent, must be accounted for when assessing proposals involving a supply source north of the Delta and a proposed use south of the Delta.

Transfers and marketing can move water from areas of surplus to area greater need. In so doing, they may put greater pressure on existing facilities and in fact induce pressures to build additional facilities. Th condition is most obvious in the Sacramento-San Joaquin Delta and in situat where transportation facilities are limited. Where water is to be transpor when available and stored underground for later use, new facilities may be needed to spread the water and to extract it. In the long run, improved wat management represented by many of those transfer proposals must be complemen by additional water supply facilities.

An important factor of proposals involving the use of stored ground water is their potential impact on adjacent ground water users. Ground wate recharge and extraction activities will cause ground water levels in the immediate area to fluctuate. However, the effects of such fluctuations on adjacent extraction or recharge activities will depend on the distance to su adjacent activities, the magnitude and frequency of ground water level fluctuation, and the lag time associated with drawdown or recharge. Some solutions to potential problems include creation of buffer zones and limitations on recharge and extraction activities. Such limitations could include a maximum annual change in ground water level fluctuations and a maximum use of ground water basin storage.

The development of this catalog stimulated considerable thought on methods for evaluating a transfer proposal. One thing is clear: transaction must be evaluated on their individual merits on a case-by-case basis. Some general guidelines for making such assessments would include the following: (1) the involved parties should fully understand what they are gaining, what

they are giving up and for how long; (2) those parties should also fully understand the conditions of the transfer and the responsibilities of each party during periods of surplus and/or deficiency; (3) social, environmental, and primary and secondary economic impacts should be identified and mitigated where practicable; and (4) existing water rights should be protected. The Committee is currently working on a check list that should prove useful in case-by-case evaluations of water transfer proposals.

Categorization of the Proposals

An effort was made to categorize some of the ideas under discussion in order to convey a better understanding of the water management options available. The Committee proposes three broad categories of water transfers: (1) interim or temporary use of water by someone other than the water right holder; (2) permanent transfer of a water right; and (3) development and transfer of new supplies and water rights. Within these broad categories, a transfer proposal can be most usefully discussed from the standpoint of how the water is to be made available and the conditions for its transfer. Among the ways the water can be made available are:

- Development of new supplies through water conservation, wastewater reclamation, storage, or diversion with some or all to be earmarked for transfer.
- Retirement of land from irrigated crop production or other consumptive uses.
- Coordinated operation of water projects with differing capabilities to provide water under varying conditions.
- Conjunctive use of surface and ground water supplies.

Conditions for the transfer of the water can be on an interim or permanent basis (e.g., sale of a water right) and can involve the following:

- Transfer during time of drought or other water system shortfalls (contingency transfer).

- Transfer during normal or wet years when supplies are plentiful (typically for underground storage).
- Transfer on a continuous basis.

The Transfer Proposals

The main body of this catalog presents a write-up on each water tra proposal known to the Department. Each write-up includes a discussion of potential third party impacts, legal and institutional constraints, potent controversy, and the status of the proposal. At the end of the catalog is table which shows some key features of each proposal.

The proposals are sequenced in a loose grouping that reflects: (1) specific offers to sell water by the current water user, (2) transfers whic rely heavily upon ground water resources, (3) transfers which rely heavily the Colorado River as a water source, (4) transfers that focus primarily up the SWP or CVP, (5) transfers that rely heavily upon the development of new facilities, and (6) others. In many cases, the proposal could have fallen more than one of the groups, but none are repeated; each proposal is listed only once.

It is important to recognize that some of the proposals listed are competitive in the sense that they seek to use the same supply source or th same transportation systems or both. In some cases, they compete in that t seek to satisfy the same need. Because of these factors, the potential wat supply production of the transfers is not cumulative.

Much of the information presented is skimpy. Some descriptions may be complete and some proposals may have been overlooked. Little effort was into describing beneficial impacts. It is assumed that as a proposal moves forward, the proponents will fully evaluate potential benefits.

DRAFT

The Committee expects to improve, update, and publish this catalog. Anyone wishing to comment on any of the transfers described herein, or on the general subject area of water sharing, should send a note to the chairman or contact one of the Committee members.

Committee Members	Telephone Number
Bob Potter, Chairman	(213) 620-4108
Norm Hill, Office of the Chief Counsel	(916) 445-9778
Ray Hoagland, Division of Planning	(916) 445-7325
Steve Macaulay, State Water Project Analysis Office	(916) 324-7192
Bill Mierke, Division of Operations & Maintenance	(916) 324-0400
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Glenn Sawyer, Division of Planning	(916) 445-6746

Committee Staff	
Ralph Allison, Division of Planning	(916) 445-2356
Jay Federman, Southern District	(213) 620-2165
Susan Tatayon, Division of Planning	(916) 445-0987

Proposals Included

1. Berrenda Mesa Water District Offer to Sell
2. Cabin Bar Ranch Offer to Sell
3. Wheeler Ridge-Maricopa Water Storage District Offer to Sell
4. George McArthur Offer to Sell
5. New Melones-East San Joaquin County-SWP Exchange
6. Kern Water Bank
7. White Wolf Basin Ground Water Storage
8. Semitropic Ground Water Storage
9. Arvin-Edison/MWD Conjunctive Use
10. Chino Basin Conjunctive Use
11. Potential Transfer of Excess Ground Water from the Bunker Hill Basin
12. Imperial Irrigation District-Metropolitan Water District
13. Palo Verde-Metropolitan Water District
14. All American Canal Lining (MWD and USBR)

15. Colorado River Banking
16. Lower Colorado Water Users-All American Canal Ground Water Salvage
17. SWP Wheeling for CVP Contractors
18. CVP-SWP Conveyance/Purchase
19. Kern County Water Agency Purchase of CVP Water
20. Santa Barbara Relinquished SWP Entitlement
21. Mid-Valley Canal
22. Water for State and Federal Wildlife Refuges
23. Garden Bar Project
24. Cosumnes River Project
25. Orestimba Project
26. Galloway Project
27. San Luis Rey Indians Water Settlement
28. Sierra Valley-Reno
29. Turlock-Kern Exchange—Assembly Office of Research
30. Anderson-Cottonwood Irrigation District
31. Agricultural Water Purchase Plan (AWPP)

# # # # # # # #

WORKING DRAFT FOR PUBLIC COMMENT
May 23, 1990

SECTION 1.0 OF INITIAL STATEMENT OF REASONS FOR PROPOSED CHANGES IN THE REGULATIONS OF THE DEPARTMENT OF HEALTH SERVICES

Pertaining to Use of Reclaimed Water other than for Groundwater Recharge

and

Pertaining to Use of Household Gray Water at Residences

and

TEXT OF PROPOSED REGULATIONS

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL MANAGEMENT BRANCH
P.O. BOX 942732
714 P STREET
SACRAMENTO, CA 94234-7320

states the following concerning midges propagated at a city's wastewater oxidation ponds (153):

> "Substantial product spoilage has occurred in the industrial parks adjacent to the plant when adult midges have fallen into frozen food during packaging, and when females alighted and oviposited on moist surfaces such as freshly painted buses and trucks and on oiled metal parts being machined to a fine tolerance.

She notes that there is precedent in California and elsewhere that municipal agencies responsible for uncontrolled midge producrtion pay the cost of control of adults at complaint sites or relocation costs if control is not effective. A California municipality was directed to buy land near its oxidation pond to compensate for property devaluation resulting from midge nuisance.

She states:

> "Aversion of workers and residents in the area to the insects is based on real aggravations as well as misinformation about midges. Because of their superficial resemblance to mosquitoes, people fear being bitten, although the adult midge has no functional biting mouth parts. However, inhaling midges, having them enter the ear, or loss of visibility when driving through their swarms are severe annoyances.
>
> "Walls defiled by their defection and oviposition while roosting are very difficult to clean. The egg masses deposited on dew covered walls form a gluey smear when scrubbed.
>
> "Due to their short lifespan and occurrence in huge numbers, windrows of bodies 6 inches deep pile up at resting sites. These rapidly decompose, producing a sickening odor and attracting filth flies, yellow jackets, wasps, and rats. This condition plus the increase in spider population which occurs with midge infestations poses real health hazards from wasp stings (these can be deadly to sensitized individuals, 7% of the population), spider bites, and vectoring or diseases by flies and rats.
>
> "Hangers and warehouses with unscreened openings will be attractive during the day to midges seeking to rest away from the drying effects of wind and sun. Operations which require outdoor work at night under lights will hear vigorous employee complaints about contact with photo positive midges which then fly in thick concentrations (swarms) over large objects such as parked cars. Any moist surfaces such as wet paint will attract ovipositing females."

1.16 GRAY WATER AT RESIDENCES

Water shortages bring much attention to the need for water conservation and requirements for efficient use of our available water supplies. Many groups and individuals advocate the reuse of certain household wastewaters such as

sink, shower, tub, or laundry washwaters. These household wastewaters other than toilet wastes are referred to as gray water.

1.16.1 Microorganisms in Gray Water

Microorganisms capable of causing disease can be imparted from an infected person to graywater by (1) washing fecal matter from the body or urinating in bathing water; (2) laundering of diapers or undergarments soiled with fecal matter or urine; and (3) any other use of water that causes the water to receive residues from bodily excretions or secretions. Fecal matter from an infected person can contain viable enteric viruses and cysts or oocysts of protozoa capable of imparting infection.

If more than one person resides where graywater is used and one sheds infectious organisms into graywater in the amount that would cause an infective dose for another person exposed to the water, undisinfected graywater can be a mode of transmission of infection. In susceptible persons, infection can result in disease.

1.16.2 Household Gray Water Separation and Treatment Systems

In 1979 and 1980 Enferadi et al. of DHS observed and sampled nine operating grey water systems consisting of: three systems without treatment; one system with a septic tank; two systems with proprietary settling tanks; one system with a single medium filter; and two systems with dual media filter (121). They note that most of the gray water treatment systems studied failed to perform their functions successfully, and state the following regarding the gray water and systems (121):

> "Analytical work performed during this investigation demonstrated that individual households produced highly variable grey water of a quality similar to raw domestic sewage. Merely separating toilet wastes from the remainder of household waste stream does not insure personal or public safety. Both clothes washing and bathing activities produced a wide range of indicator organisms. The major portion of coliforms detected were of fecal origin. None of the treatment and/or segregation schemes resulted in a reduction of microbiological hazards or a discernible wastewater treatment. Only one treatment scheme (involving a series of settling tanks) resulted in consistent removal of particular matter.
>
> "Nearly all reuse schemes involved seasonal irrigation of landscape and/or food crops, but most were used year-round and had no provisions for ultimate disposal of poor-quality grey water and surge loads or for storage when use was contraindicated by wet weather. Homeowners did not establish a routine program for operating and maintaining their systems. They were generally aware of them only when malfunctions or problems occurred, and even then they did not place a high priority on resolving the matter."
>
> "At sites of grey water systems, investigators were to examine the immediate area for signs of leakage and overflow resulting from surge

loading of the treatment unit. The presence and absence of odors and insects, especially mosquitoes, were noted.

1.16.3 Estimated Incidence of Enteric Viruses Based on DHS Data

Data obtained in the above-cited study of gray water systems undertaken by the DHS in 1979-80 (121) indicate that average bacteria concentrations in untreated gray water were roughly 8,000,000 most probable number (MPN) total coliforms/100 milliliters (ml) and 400,000 MPN fecal coliforms/100 ml in water from bathtub or shower, and 3,000 to 50,000,000 MPN total coliforms/100 ml and 2,000 to 10,000,000 MPN fecal coliforms/100 ml in water from washing machines. Thus these types of graywater have substantial concentrations of excreta.

An underestimate of the number of enteric viruses that could accompany fecal coliform bacteria shed into graywater can be made by basing calulations on a community-wide average incidence of infection, wherein three percent of the population is presumed infected and shedding virus in feces, after the calculations of Clarke et al. (155), discussed in subdivision 1.9.2 of this document. (In a household of four, where one is infected and shedding, the incidence of infected persons would be 25 percent, not three percent.) The presumption of a three percent incidence indicates that there are roughly 60 virus units per million fecal coliform bacteria.

It follows from the above premises that there could be roughly 200 enteric viruses per liter of undisinfected graywater from a bathtub or shower, and roughly 0.1 to 6000 per liter of graywater from a washing machine. The concentration 200 per liter is about four percent of the concentration in raw sewage, eight percent of the concentration in undisinfected effluent of a trickling filter treating sewage, and 40 percent of the concentration in undisinfected effluent of secondary treatment of sewage by the activated sludge process.

1.16.4 Routes of Exposure

A finger or hand may be contaminated by contact with graywater, surface irrigated with graywater, or other surface harboring constituents of graywater. Ingestion of constituents of graywater can occur when a contaminated finger or hand enters the mouth or touches a cigarette, food, or other article that enters the mouth.

Food crops can be contaminated with constituents of undisinfected or partially disinfected wastewater, by: (1) spray irrigation of an area with food crops; (2) surface irrigation of an area with low growing food crops or root crops; and (3) subsurface irrigation of an area with root crops. Contaminated food crops harvested from such an area can contaminate kitchen counter surfaces and utensils, with subsequent contamination of food from other sources. Constituents of undisinfected or partially disinfected wastewater would be ingested.

1.16.5 Probability of Infection from Virus from Land Surface

If the above-cited gray water from bathtub or shower were used fo above-ground irrigation at application rates appropriate for July in the nort coast coastal valleys and plains, the underestimated (see subdivision 1.15.2) long term average number of viable enteric viruses would be the following, considering the expected rate of virus survival between applications:

(a) two per square inch of irrigated surface in a garden with plants with a three foot root zone; and

(b) one per square inch on a lawn.

It is assumed that the greater rates of application required for more arid areas are accompanied by rates of virus survival directly proportional to humidity, such that the above numbers would apply generally throughout the State.

DHS assumes that the average infectivity of viruses present is the average of infectivities of echovirus 12 and poliovirus 1. Thus the percent probability of infection is nine-tenths of the number of viruses ingested. (The factor 0.9 is the average of 1.7 for echo 12 and 0.06 for polio 1.)

A fifty percent probability of infection would obtain from ingestion of all virus adhering to a 30 square inch irrigated surface in a garden (e.g., an area of soil, or of a food crop spray-irrigated or fallen on the irrigated area). That is the area of a square roughly six inches per side or a circle of diameter roughly six inches.

For the case wherein the palm of the hand of a small adult (surface area 25 square inches) is pressed onto irrigated turf at one location and all viruses adhere to the palm, the palm would hold roughly the number of viruses associated with a 30 percent probability of infection. The palm is capable of retaining even more solids than that on 25 square inches of turf: experiments have shown that roughly 80 milligrams of solids can be retained on the palm.

A three-inch diameter ball rolled 60 feet on turf, or a 1.6 inch diameter golf ball rolled 120 feet, would contact an area containing the above-cited 80 milligrams of solids that presumedly could be retained on the palm. That amount of solids would contain roughly 1000 viruses, which is about 10 times the dosage that would pose a 100% probability of infection.

1.16.7 Conclusion

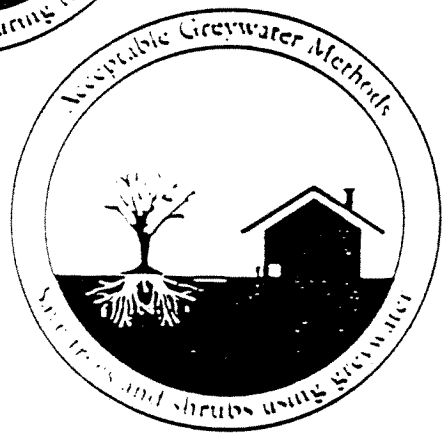
Poor maintenance of gray water systems by the general public has been observed. Household use of gray water appears to be a low volume, high risk use.

The amount of water conserved by such use is insignificant compared to the amount conservation-oriented communities can reclaim from municipal wastewater. The risk to public health and the repute of water reclamation associated with use of gray water at households compels the conclusion that the general public should not handle or use gray water.

Guidelines to the approved use of

Grey Water

during the Stage III Drought Condition
in the City of Santa Barbara.



How To:

- Reduce your water bill during the drought.
- Safely increase your water saving efforts.
- Save trees and shrubs using grey water.

Call the Water Conservation Hotline at 564-5460 for further information.

This brochure has been prepared by the City Department of Public Works and Building and Zoning Division, with review and approval by the Santa Barbara County Environmental Health Department.

April 1990

WATER REDUCTION STRATEGIES

First Steps -

WATER CONSERVATION METHODS

Recommended Practice

Bathing
Install low-flow showerheads
Take short showers instead of baths
Turn off water while soaping

Toilet Flushing
Install low-flow toilets
Do not use toilet for trash disposal
Flush only when necessary

Dishwashing
Hand wash instead of dishwasher
Use basins, rather than running water
Only run dishwasher when completely full

Laundry
Only run full loads

General
Check for and repair any leaks
By-pass the water softener
Avoid use of garbage disposal
Do not allow tap to run while shaving, brushing teeth, washing hands, etc.

Outdoor Water Use — Observe all Stage III Drought Rules (call 564-5460 if you need information)

Second Steps -

WATER RECYCLING METHODS

CLEAR WATER

Water Sources
Warm up water from shower
Warm up water from bathroom sink
Warm up water from kitchen sink

Collection*
Bowls and buckets

Unacceptable Practices
Collection through disconnection of drains

LAUNDRY RINSE WATER

Collection
Clean trash container

Acceptable Uses
Flushing toilets (see note below)
Wash water for laundry (see diagrams which follow)

Unacceptable Uses
Any surface irrigation with laundry water

Note on flushing toilets: Rinse water should be poured directly into the bowl, not into the tank.

Third Steps -

USE OF GREYWATER

Water Source
Laundry - wash and rinse water. If laundry includes soiled diapers or clothes from person with infectious illness, do not use greywater system.

Collection and Distribution*
Diversion to surge tank and underground mini-leach field, ensuring no bodily contact with the water will occur.

Requires temporary permit from City building department, valid for the duration of Stage III Drought.

Acceptable Uses
Sub-surface irrigation of groundcover, shrubs and trees, including fruit trees.

Unacceptable Sources
Wastewater from sinks, showers, and bathtubs
Water from laundry of soiled diapers

Unacceptable Uses
Irrigation of vegetable garden
Any surface irrigation or application
Any washing of pavement, vehicles, boats
Any connection to potable water system

WHAT IS GREYWATER?

GREYWATER is used water from washing machines, bathtubs, showers, bathroom sinks, kitchen sinks and dishwashers. The water that is flushed down toilets is considered BLACKWATER and should only be drained to a sewer or septic system. All greywater sources may contain infectious bacteria and viruses or grease and food residues and are normally required to be drained to a sewer or septic system for safety. However, during emergency drought conditions, some greywater sources can be safely used for limited irrigation purposes in a carefully designed and constructed system.

Some uncontaminated household water is called CLEARWATER. This includes warm-up water from showers and faucets. This water may be safely collected and recycled for flushing toilets and bucket watering of plants. In addition, laundry rinse water also may be recycled, but only for uses resulting in disposal to the sewer or septic system, such as to flush toilets or to start the next laundry wash cycle.

SAFETY CONSIDERATIONS

Soiled diapers and clothes from any person infected with or carrying an infectious disease may contain bacteria and viruses in sufficient quantities to transmit diseases to other individuals. Thus, laundry wash and rinse water in these situations should not be used in a greywater system.

Because greywater may contain infectious bacteria and viruses, methods of use must prevent any direct contact with the water. Thus, collection of greywater in open containers or application to any lawn, garden, paved, or other surface or through any spraying device is clearly prohibited and potentially dangerous. An underground leach field system should not be used for any vegetable garden. The collection and application system should be designed to minimize storage times and to prevent backups.

HOW CAN GREYWATER BE USED

For health and safety, any alterations of plumbing systems must be permitted and inspected by the City Building Department. For the duration of Stage III Drought Conditions only, the Building Department will approve greywater systems which collect laundry wash and rinse water and which distribute the water through a closed piping system to an underground mini-leach field system. (See description and diagrams, that follow.) This system may provide irrigation for fruit and ornamental trees, shrubs, and groundcover.

WHY ARE OTHER GREYWATER USES PROHIBITED

Because all greywater sources may contain disease carrying organisms or grease and food residues, any collection and distribution system must be designed to prevent exposure to the wastewater. Washing machine plumbing provides the most accessible fixtures to install the necessary additions and connections. To safely connect other greywater sources, such as shower or bathroom sink wastes, will require expensive plumbing modifications which are not justified for temporary installations.

HOW IS GREYWATER DIFFERENT FROM RECLAIMED WATER

Greywater should not be confused with reclaimed water. Greywater is untreated water that usually flows into a sewage or septic system for treatment. Reclaimed water is treated water from a sewage treatment plant which has received additional processing for disinfection and removal of contaminants. The quality, distribution and use of reclaimed water is regulated under State permit and carefully monitored by State Water Quality and Health Officials.

HOW MUCH GREYWATER IS AVAILABLE?

Most residences that use greywater from their washing machine will have 10-15 gallons of greywater available per person each day. This amount of greywater may be enough to provide all the water needs of several mature fruit trees or a half dozen shrubs.

Greywater is distributed to designated plantings through pipes from a storage tank into mini-leach fields for irrigation. A minimum of four (4) mini-leach fields should be installed initially to disperse greywater and allow adequate discharge as the water is produced. Add additional leach fields if the available greywater exceeds your initial irrigation needs, or if ponding occurs. If you have a sloped property, spread out your laundry loads to avoid runoff or ponding.

SAMPLE IRRIGATION NEED CHART

Plant	Gallons Per Week
Mature fruit tree	75 gallons
Large shade tree	50 gallons
Large shrub	10 gallons
Source	
One Load of Laundry	40 gallons (wash and rinse)

BEFORE CONSIDERING THE MINI-LEACH FIELD SYSTEM

All other conservation methods should be fully implemented (installation of low flow showerheads, toilets, and faucet flow restrictors, and repair of all leaks). Additionally, the un-restricted use of clear water (warm-up water) and the approved uses of recycled water (flushing toilets with bath or shower water and using washing machine rinse water for wash water in the next load; permit not required) should be fully implemented before considering the mini-leach field system.

BUILDING PERMIT PROCESS

A building permit is required for the greywater mini-leach field system, and progress and final inspection approvals are required before use. A simple plot plan must be submitted with an application for the building permit. The plot plan should show the location of the fixtures to be included in the greywater system and the areas on which the greywater will be distributed. Review of the plot plan and permit issuance can usually be accomplished at the City's Building Division counter at 630 Garden Street for a nominal fee of $32.00. Call 564-5485 for information.

UNIFORM PLUMBING CODE REQUIREMENTS

All new greywater systems, and any modifications to existing plumbing for utilization with a greywater system, shall comply with all applicable sections of the 1988 edition of the Uniform Plumbing Code. This shall include, but is not limited to; provisions for approved materials, trapping and venting of plumbing fixtures, joints and connectors, all applicable backflow prevention and cross-connection requirements.

MINI-LEACH FIELD SYSTEM

The only approved method of irrigating landscaping with greywater in the City of Santa Barbara is through the use of the mini-leach field system (only during an officially declared Stage III drought condition). The only plumbing fixture allowed to be connected to the mini-leach field system in the City of Santa Barbara is the washing machine. Irrigation of plantings utilizing clear water (warm-up water not contaminated by human contact) is not restricted or regulated.

To create a mini-leach field, dig a trench approximately 16" deep along the dripline (the outer edge of the foliage). Install necessary perforated pipe into a gravel bed. Then fill with gravel to within 4" of the surface. Be sure to cover the gravel with building paper or weed-stop matting before filling the trench with soil. An inspection of the trench, gravel and paper is required prior to covering with soil. If the soil is able to infiltrate down into the gravel, the mini-leach field will quickly clog and the water will be forced to the surface. Remember, surface application of greywater is not approved by the County Health Department. For your safety, please distribute greywater to subsurface mini-leach field irrigation points. See diagram.

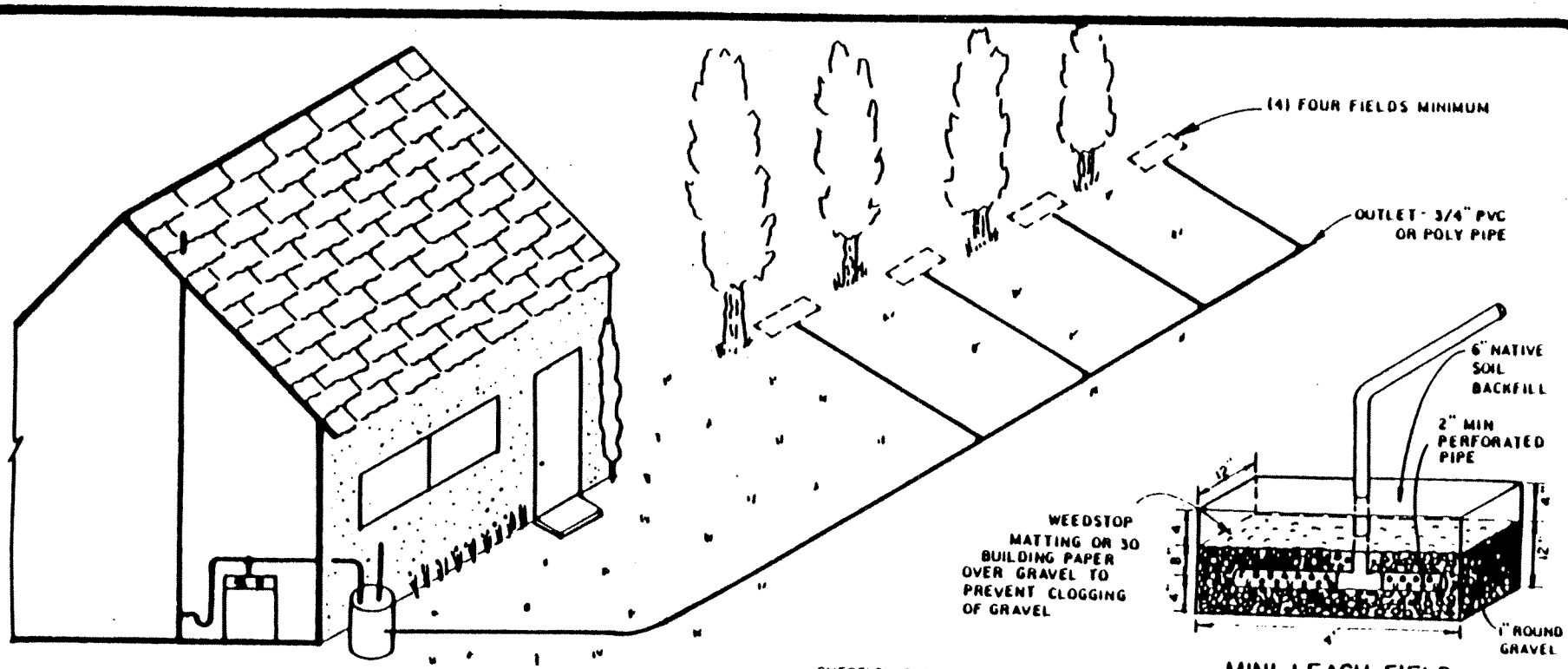
LOCATION OF GREYWATER DISPOSAL SYSTEM

Minimum Horizontal Distance In Clear Required From:	Distribution Lines		Mini-Leach field	
Buildings or Structures[1]	2 feet	(.6 m)	8 feet	(2.4 m)
Property line adjoining private property	Clear[2]		8 feet	(2.4 m)
Water supply wells	50 feet[3]	(15.2 m)	150 feet	(45.7 m)
Streams	50 feet	(15.2 m)	100 feet	(30.5 m)
Trees	———		10 feet	(3 m)
Seepage pits or cesspools	———		12 feet	(3.7 m)
Disposal field	———		5 feet	(1.5 m)
On site domestic water service line	1 foot[5]	(.3 m)	5 feet	(1.5 m)
Distribution box	———		5 feet	(1.5 m)
Public water main	10 feet[6]	(3 m)	10 feet	(3 m)

NOTE:

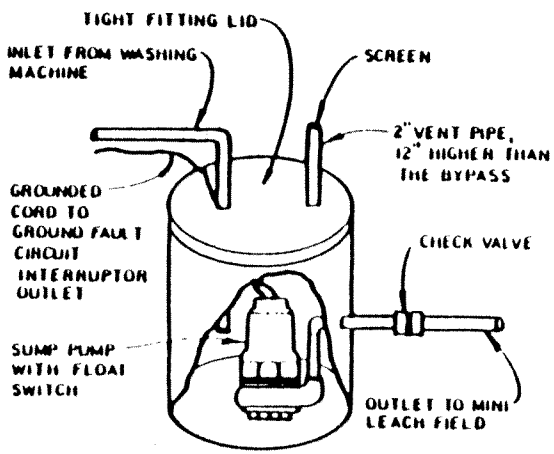
When mini-leach fields are installed in sloping ground, the minimum horizontal distance between any part of the leaching system and ground surface shall be fifteen (15) feet (4.6 m).

1. Including porches and steps, whether covered or uncovered, breezeways, roofed porte-cocheres, roofed patios, car ports, covered walks, covered driveways and similar structures or appurtenances.
2. See also Section 315(c) of the Uniform Plumbing Code.
3. All drainage piping shall clear domestic water supply wells by at least fifty (50) feet (15.2 m). This distance may be reduced to not less than twenty-five (25) feet (7.6 m) when the drainage piping is constructed of materials approved for use within a building.
4. Plus two (2) feet (.6 m) for each additional foot (.3 m) of depth in excess of one (1) foot (.3 m) below the bottom of the drain line. (See also Section 16.)
5. See Section 1108 of the Uniform Plumbing Code.
6. For parallel construction. For crossing, approval by the Health Department shall be required.

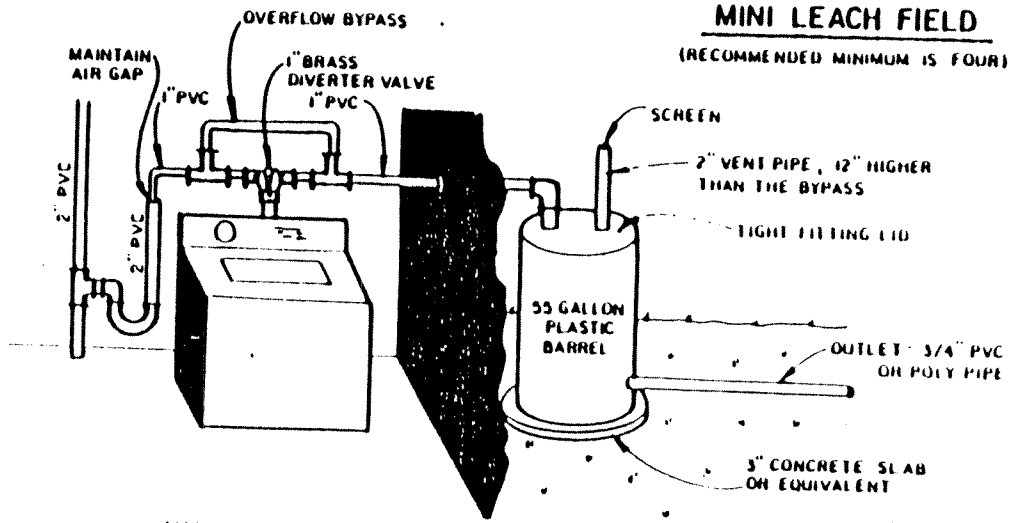


MINI LEACH FIELD

(RECOMMENDED MINIMUM IS FOUR)



ALTERNATE - SURGE PIT



WASHING MACHINE SYSTEM

CITY APPROVED SYSTEM - REQUIRES PERMIT

WATER RECYCLING AND CLEAR WATER USES

Recycled water uses are those that re-use greywater with standard plumbing fixtures such as in a toilet or a washing machine. Typical uses include recovery of bath or shower water with a bucket for use in the bowl of a toilet.

Another recovery and re-use method is utilizing washing machine rinse water for the wash cycle of your next load. Two systems are illustrated on the following page. This water is relatively clean with minor amounts of residual soap.

The simplest system is a clean, 32-gallon round trash container with a 1" gate valve attached to the base (with the standard fitting commonly used for "Smitty pan" drains used under water heaters). The container is positioned on a dryer or platform adjacent to the washing machine such that the drain is positioned close enough to the lid from the washing machine. A "barb" fitting with a short piece of hose attached may help in filling the washer from the container.

To utilize the system, one simply removes the washing machine drain hose from the sewer standpipe after the wash cycle has fully drained and places it such that it will drain in to the elevated container (on the dryer or platform). An extension to this hose and a coupler with hose clamps may be needed, which can be obtained at a plumbing or major appliance store. When the rinse cycle has fully drainedinto the container, the hose is moved back to the sewer standpipe. The clean clothes are then removed and replaced with soiled clothes for the next load. The rinse water from the storage container is then drained into the washer to fill the next load (to be done before you start the washer; otherwise it will fill with potable water from the faucet connections).

The result is that laundry water needs are reduced by 1/2, yet all of the water is safely disposed in the sewer system without a significant expense to do so.

The other system is essentially the same in use. Instead of moving the hose between cycles, one simply shifts the diverter valve handle. It also features an over flow drain in the unlikely event the rinse water was not drained out and more water from a subsequent load was inadvertently added.

CLEAR WATER (WARM-UP WATER) USE

The use of clear water is essentially unrestricted provided it has not been contaminated through bodily contact, soaps, food stuffs, or other contaminates. It may be used for irrigation, flushing toilets, washing clothes or a variety of other uses. The County Environmental Health Department endorses clear water as a short and long term conservation method.

WHAT PARTS DO GREYWATER SYSTEMS REQUIRE?

The City's only allowed greywater source for irrigation is washing machine water applied through the use of the mini-leach field system. Required permits and parts include:

For a Gravity-Fed System:

(1) A City building permit ($32.00)

(2) A 3-way manual diverter valve to direct greywater to the sewer or plants ($25 manual, $200 electronic)

(3) A 55-gallon surge tank to hold water flows from the washing machine until water can drain to mini-leach fields for irrigation.

(4) Inexpensive polyethylene irrigation hose ($40 for 500 ft.).

(5) Necessary pvc pipes, fittings, and hose ($50-70)

(6) Perforated PVC pipe, minimum 2" size.

(7) Gravel to fill the mini-leach fields.

(8) A minimum of four (4) mini-leach fields for plant irrigation.

(9) A washing machine.

Pressurized Systems may also require:

(1) A sump pump and check valve

(2) Manual ($2) or electronic ($175-200) irrigation valves

(3) Electronic irrigation clock ($50 to $250)

FOR PARTS AND ASSISTANCE

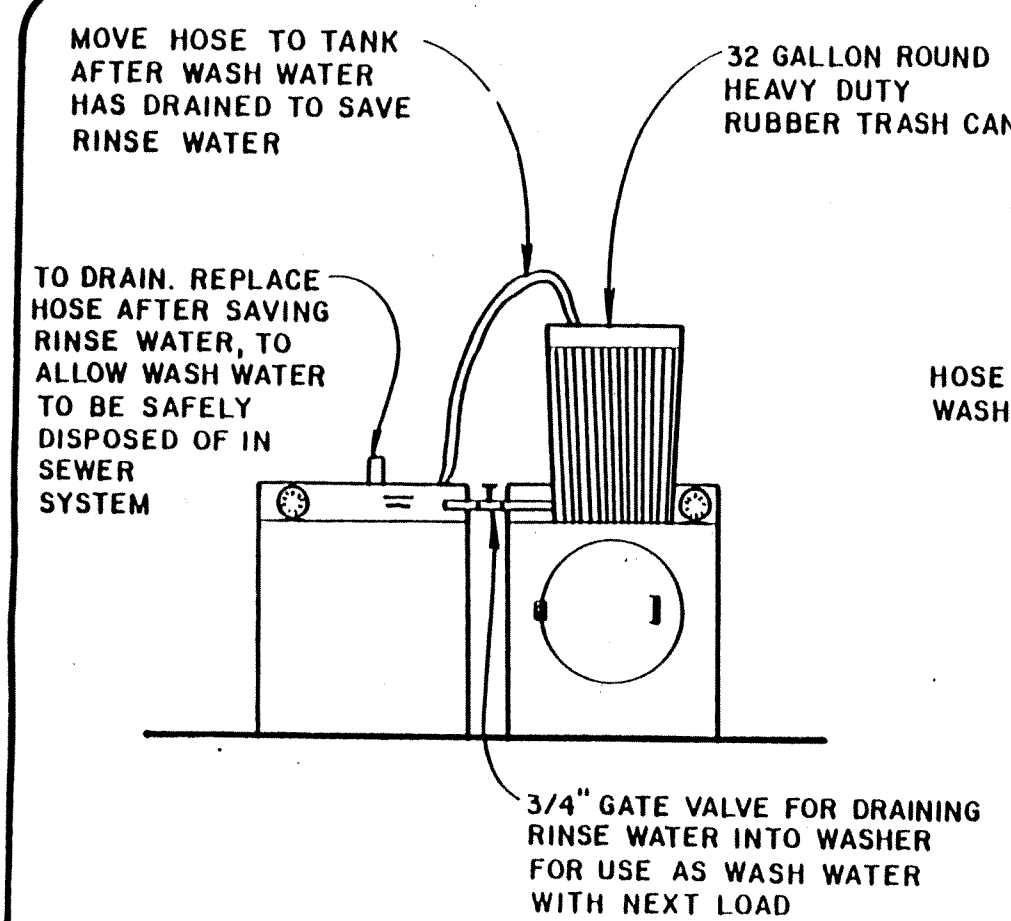
Several local plumbing supply stores now carry all or most of the parts you will need for a greywater system. Because the number of plumbing stores carrying greywater system parts is constantly increasing, visit or call your local plumbing store to obtain design and installation advice.

Please consult a licensed plumbing contractor if you have any questions about the systems and information in this brochure.

A FINAL WORD

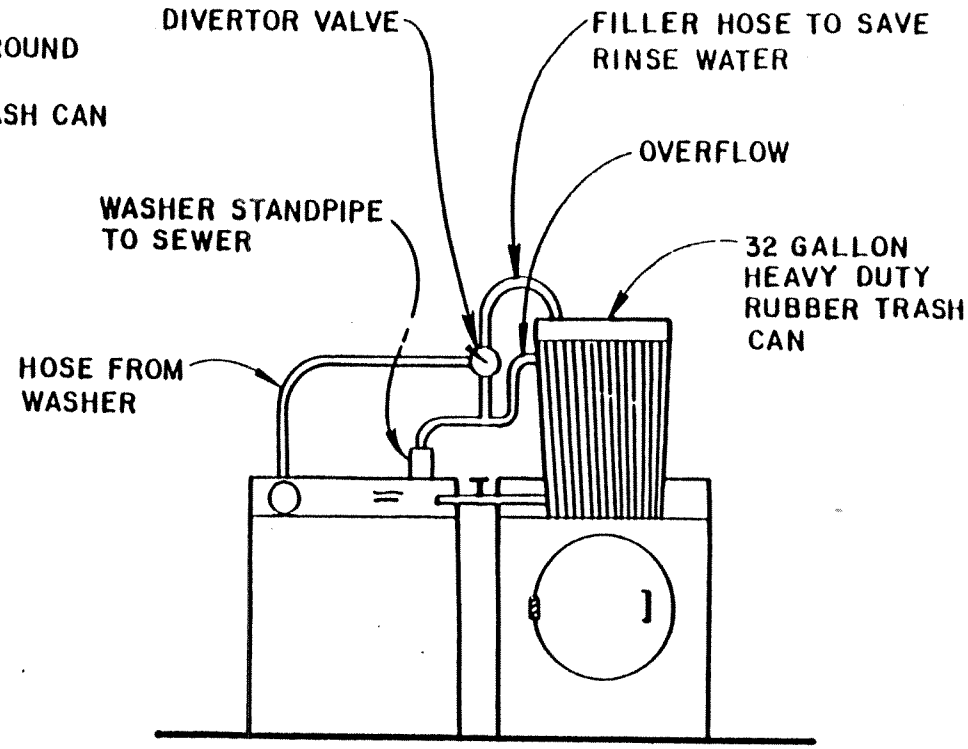
If you are using the recycled or greywater methods described above, you should not use detergents and cleansers which contain a significant amount of sodium, boron, or chlorine - all of which can be damaging to the health of plants and soils. A small percentage of plants may be damaged by greywater, most of which are listed on the back cover. Also, be aware that the use of softened water may be detrimental to the health of plants and soils because of the very high sodium content.

When irrigating plants, do not provide more water to the soil than can be absorbed. Allow the soil to dry out between irrigations in order to keep your plants healthy. Add mini-leach fields if necessary to spread out greywater and avoid ponding or run off problems. Thank you for your conservation efforts and the safe use of recycled and greywater.



SIMPLE REUSE OF RINSE CYCLE WATER FOR WASH CYCLE OF NEXT LOAD (NO OVERFLOW PROTECTION)

WATER SAVINGS = 50%



DIVERTER VALVE ASSEMBLY WITH OVERFLOW PROTECTION

*DETAILED PLAN AVAILABLE FROM PUBLIC WORKS DEPARTMENT 630 GARDEN STREET

WASHING MACHINE RINSE WATER RECYCLING SYSTEMS

ABOUT YOUR WASHING MACHINE AS A GREYWATER SOURCE

(using the mini-leach field system)

Detergents, Bleaches and Soaps Information

Powdered detergents and soaps include 'filler' (not essential to clothes cleaning) ingredients which are usually some compound of sodium. Over several months, sodium can concentrate in the soil and damage the ability of the soil to absorb water and directly damage plants. Liquid soaps contain few fillers and contain less sodium.

Cleaners and Laundry Soaps you may wish to avoid:

- detergents which include 'with bleach' in the name
- detergents with ingredients which include:
  - boron, borax, or chlorine
  - peroxygen or sodium perborate
  - petroleum distillates or alkylbenzene
  - sodium trypochlorite
- bleaches (send greywater to the sewer when used)
- softeners (send greywater to the sewer when used)

WATERING YOUR LANDSCAPING WITH GREYWATER

Trees and shrubs are the main target for greywater.

Plants not suitable for greywater irrigation:

- Any vegetable plants
- Shade loving, acid loving plants such as:

Rhododendrons	Azaleas
Ferns	Bleeding Hearts (Dicentra)
Voilets	Foxgloves
Oxalis (Wood Sorrel)	Impatiens
Gardenias	Primroses
Hydrangeas	Begonias
Philodendrons	Camellias

- Citrus trees may be adversely affected by the use of greywater.

When the rains come, turn off or disconnect your greywater system. This will allow the rains to leach away any soapy build-up in the soil and prevent surface ponding that could create a health hazard.

RESOLUTION NO. 90-037

A RESOLUTION OF THE COUNCIL OF THE CITY OF SANTA BARBARA ESTABLISHING CONDITIONS FOR CITY OF SANTA BARBARA WATER CUSTOMERS TO TEMPORARILY USE GREYWATER FOR IRRIGATION PURPOSES DURING THE STAGE III DROUGHT EMERGENCY CONDITION.

WHEREAS, the County Water Agency of Santa Barbara has declared a Drought Emergency due to lack of rainfall during the past four years;

WHEREAS, the City of Santa Barbara has declared a Stage III Drought Emergency Condition due to lack of rainfall causing a 45% water shortage during the May 15, 1990 - May 14, 1991 Water Year;

WHEREAS, City water customers will be asked to reduce their water consumption considerably during the severe drought condition using a wide array of water conservation methods;

WHEREAS, certain uses of greywater are permitted by the Santa Barbara County Health Department during the severe drought condition;

WHEREAS, Health and Safety Code Section 17958.7 provides for local amendment of the State adopted Uniform Plumbing Code when necessary, due to unique climatic, geographic or geologic conditions.

WHEREAS, Uniform Plumbing Code Section 201 provides for consideration of alternate disposal systems when approved by the administrative authority and the local health authority;

WHEREAS, proper use of greywater in accordance with established guidelines can be a safe means of reducing water consumption and preserving landscaping that could otherwise be damaged during the drought;

NOW, THEREFORE, BE IT RESOLVED that the Council of the City of Santa Barbara hereby supports and acknowledges the authority of the Chief of Building and Zoning to review, consider, and approve greywater systems in accordance with State adopted Uniform Plumbing Code Sections 201 (f) and (k), and Uniform Administrative Code Section 107, as adopted and amended by Municipal Code Section 22.04.010. Accordingly, the Chief of Building and Zoning may permit the use of greywater by City water customers during the Stage III Drought Condition as outlined in

the "Guidelines to the Approved Use of Greywater in the City of Santa Barbara" brochure. Any additional uses of greywater not included in the above mentioned brochure must be specifically approved by the Chief of Building and Zoning.

Adopted April 3, 1990

K:D/Res/greywat

ORDINANCE NO. 55

ORDINANCE OF THE BOARD OF DIRECTORS OF THE HI-DESERT WATER DISTRICT, SAN BERNARDINO COUNTY, CALIFORNIA, AMENDING ORDINANCE NO. 51 AND ESTABLISHING RATES FOR WATER SERVICE

BE IT ORDAINED by the Board of Directors of the Hi-Desert Wate District as follows:

Section 1. Amendment. That section 270 of Article 18 of Ordinance No. 6, as amended by Ordinance No. 35, No. 37, No. 40, No. 44, No. 47 No. 49, and No. 51, is hereby amended to read:

"270. Rate Schedule. Rates for water service are hereby established as follows:

Residential and Commercial Meters

Property Service - Basic Fee $10.22 each two months

Quantity		Rate
From	To	
0	3,000	$ 0.65/100 cu. ft.
3,100	4,000	$ 1.75/100 cu. ft.
4,100	5,000	$ 1.80/100 cu. ft.
5,100	6,000	$ 1.85/100 cu. ft.
6,100	7,000	$ 1.90/100 cu. ft.
7,100	8,000	$ 1.95/100 cu. ft.
8,100	9,000	$ 2.00/100 cu. ft.
9,100	10,000	$ 2.05/100 cu. ft.
10,100	11,000	$ 2.10/100 cu. ft.
11,100	12,000	$ 2.15/100 cu. ft.

Quantity		Rate
From	To	
12,100	13,000	$ 2.20/100 cu. ft.
13,100	14,000	$ 2.25/100 cu. ft.
14,100	15,000	$ 2.30/100 cu. ft.
15,100	16,000	$ 2.40/100 cu. ft.
16,100	17,000	$ 2.50/100 cu. ft.
17,100	18,000	$ 2.60/100 cu. ft.
18,100	19,000	$ 2.70/100 cu. ft.
19,100	20,000	$ 2.80/100 cu. ft.
20,100	21,000	$ 2.90/100 cu. ft.
21,100	22,000	$ 3.00/100 cu. ft.
22,100	23,000	$ 3.10/100 cu. ft.
23,100	24,000	$ 3.20/100 cu. ft.
24,100	25,000	$ 3.30/100 cu. ft.
25,100	26,000	$ 3.40/100 cu. ft.
26,100	27,000	$ 3.50/100 cu. ft.
27,100	28,000	$ 3.60/100 cu. ft.
28,100	29,000	$ 3.70/100 cu. ft.
29,100	30,000	$ 3.80/100 cu. ft.
Over	30,000	$ 3.90/100 cu. ft.

Multi-Family units -- each unit will be considered as one-half a residence.

A delinquent reconnect fee of $20.00 will be charged.

Construction Water and Bulk Water:

Meter Deposit.....$500.00

Water Usage Rate.....$ 1.95 per 100 cubic feet

Statements are rendered bi-monthly. Whenever statements are rendered monthly, the fees will be prorated.

Section 2. Effective Date. This Ordinance shall be effective immediately upon its adoption.

Section 3. Publication. That the Secretary shall publish this Ordinance once a week for two (2) consecutive weeks commencing within ten (10) days after adoption hereof.

ADOPTED this 1st day of June, 1988.

President of the Hi-Desert Water District and of the Board of Directors thereof.

ATTEST:

Secretary of the Hi-Desert Water District and of the Board of Directors thereof.

(SEAL)

RESOLUTION NO. 83-21

RESOLUTION OF THE BOARD OF DIRECTORS OF THE HI-DESERT WATER DISTRICT, SAN BERNARDINO COUNTY, CALIFORNIA, AMENDING SECTION 7, "UNITS OF SERVICE" OF RESOLUTION NO. 508

WHEREAS, Resolution No. 508 establishes an "Acquisition of Water Service Charge" pursuant to Section 512 of Article V of Resolution No. 431, wherein classifications of types of property and use were listed, together with an appropriate units of service fixed for each; and

WHEREAS, Review of the listed classifications and the respecti units of service reflected, deems it necessary to amend and adjust several to a more realistic and justifiable quantity of "units of service."

NOW, THEREFORE BE IT RESOLVED that Section 7, Units of Service of Resolution No. 508 is hereby amended to read as follows:

"Section 7. Units of Service. In order to compute applicabl acquisition of water service charges, units of service are hereby fixed and established for the following classifications of types of property and use:

Type of Connection	Units of Service
(1) Residential	
Single family Dwellings	1.0
Apartment houses (a)	2.0
Courts (a)	2.0
Duplexes	2.0
Triplex	3.0
Quadplex	4.0
Motels (b)	1.0
Mobile Home or Recreational Vehicle Parks (c)	3.0
Rooming Houses (n)	1.0

Type of Connection	Units of Service
(2) Commercial	
Animal Clinics	3.0
Barber Shops	2.0
Beauty Shops	3.0
Bottling Works (h)	
(Soft drinks)	3.0
Campground and Parks (q)	4.0
Churches	
with kitchens	2.0
without kitchens	1.0
Convents (n)	1.0
Dairies (e)	3.0
Day Nurseries (k)	2.0
Drug Stores (o)	1.5
Food Market (g)	2.0
Laundries and Laundromats (f)	5.0
Libraries	1.0
Meak Packing (i)	4.0
Meeting Halls	
with kitchens	2.0
with kitchens and bar	4.0
without kitchens	1.0
Pet Shops	2.0
Poultry Processing (j)	8.0
Professional Buildings (p)	2.0
Public Buildings (g)	1.0
Restaurants (d)	
with bar	5.0
without bar	3.0
Schools	
Elementary and Nursery	10.0
High and Junior High	17.0
Service Stations	2.0
Swimming Schools (m)	1.0
Taverns (d)	3.0
(3) General Commercial	1.5

(All commercial establishments not listed above or separately classifed by future action of the Board of Directors) (p)

Included in the above classification but not limited to the following are:

Appliance Stores
Automobile Repair Shops and Garages
Bakeries
Brickyards
Furniture Stores
Hardware Stores
Insurance Offices
Light Manufacturing (Investigate Employee Level)

Cabinet Shops
Candy Stores
Cleaning Establishments
Clothing Stores
Food Lockers
Nurseries - Horticultural Type
Plumbing Shops
Radio Stations (Transmitter)
Radio and TV Sales, Service
Real Estate Offices
Roofing Yards
Liquor Stores
Lumber Yards
Miscellaneous Repair Shops
Moving and Storage
New and Used Car Dealers
Sign Painting
Tire Sales and Repair
Mobile Home or Recreational Vehicle Sales and Service
Warehouses
Welding Shops

(4) Encompass Clause

Any installation not covered above would be assessed as follows until a determination can be established:

Units shall be based on size of meter installed:

Meter Size	Units
5/8 x 3/4"	1.0
1"	2.5
1 1/2"	5.0
2"	6.15

(5) Additional Units of Service

(a) Apartment Houses and Courts: 1 service unit for each apartment up to 4, then 2/3 additional unit for each apartment over 4.

(b) Motels: 1 additional service unit for up to each 3 motel units after first 3.

(c) Mobile Home or Recreational Vehicle Parks: 3 additional service units for up to each 4 stalls after first 4.

(d) Restaurants: 1 additional service unit for up to each 20 seats after first 20. (Small restaurants can be less than 3 for basic rate.) Add 2 units for bar.

(e) Dairies: 1 additional service unit for up to each 400 pounds per day of milk received after first 1,000 pounds per day.

(f) Laundries and Laundromats: 1/2 additional service unit for each additional machine over 15.

(g) Food Markets and Public Buildings: 1 additional service unit for up to every 5 persons employed after first 5. Eating facilities to be classified separately as restaurants. Add 5 units per month for commercial garbage grinder. Employee working 24 hours per week or less are considered 1/2 person

(h) Soft Drink Bottling Works: 1 additional unit for up to each 700 cases per month after the first 2,000 cases.

(i) Meat Packing Plant: 1 additional unit for up to each 1,000 pounds meat processed per month after first 4,000 pounds.

(j) Poultry Processing: 1 additional unit for up to each 20 pounds killed per day (dressed weight) after the first 200 pounds per day.

(k) Day Nursery: 1 additional unit for up to each 6 children after the first 10.

(l) (Not used)

(m) Swimming School: 1 additional unit for up to each 3 toilets and/or showers after the first 3. (Does not include pool discharge.)

(n) Rooming House and Convent: 1 additional unit for up to each 3 persons after first 5.

(o) Drug Store: 1 additional unit for up to each 5 employees after first 5. Add 2 units for fountain.

(p) Professional and Commercial Buildings. 1 additional unit per each 3 tenants or 2,000 square feet, whichever is greater.

(q) Campgrounds and Parks: 1 additional service unit for up to each 3 spaces after the first 10 spaces.

(6) Other Types of Connections

Units of service for establishments not listed above, and for establishments that have unusual characteristics insofar as water is concerned, shall be determined in each case by the Board of Directors."

Effective Date. This Resolution shall take effect upon adoption hereof.

Separability. If any section, subsection, sentence, clause or phase of this Resolution is for any reason held to be unconsti tional, such decision shall not affect the validity of the remair portions of this Resolution.

ADOPTED this 21st day of September, 1983.

A. J. Napier

President of the Hi-Desert Water District and of the Board of Directors thereof.

ATTEST:

Secretary of the Hi-Desert Water District and of the Board of Directors thereof.

(SEAL)

RESOLUTION NO. 90-3

A RESOLUTION OF THE HI-DESERT WATER DISTRICT ESTABLISHED AS AN EMERGENCY AND DROUGHT MEASURE THAT IS RESPONSIVE TO DISTRICT PRODUCTION CAPABILITIES IN ORDER TO MAINTAIN THE ABILITY TO PROVIDE FOR BASIC DOMESTIC, HEALTH AND FIRE PROTECTION NEEDS

WHEREAS, the Hi-Desert Water District describes as its priority of service to provide for the basic domestic, health and fire protection needs of the people within its service area,

WHEREAS, there are times when production system capabilities are inadequate to provide for these needs due to the increased demands placed upon the system by unnecessary uses of water,

WHEREAS, the definitions of what is considered to be unnecessary are: ornamental and recreational landscape, carwashing, filling of swimming pools and fountains, construction uses as defined below, wasteful practices as defined in Conservation Ordinance No. 61 and any other uses of water that may be liberally construed to be wasteful,

THE BOARD OF DIRECTORS hereby establish this resolution to insure that the District can continue to supply the basic needs of the community without threat to the production system, which is enacted as follows:

SECTION 1. Conditions of response

(A) On a daily basis, the General Manager shall receive a report concerning the supply system capacity. This report is based upon total system production capabilities in relation to the actual runtime of the system.

(B) Stage 1 responses will be placed in effect when the production capacity is at 80 percent for three (3) consecutive days, only one of which will include a weekend day. Stage 1 is then in effect for 15 days and is then subject to Board review to determine whether to remove or continue or increase restrictions.

(C) Stage 2 response is put in place when the production capacity reaches 90 percent and is in place until demand is reduced to less than 85 percent and the General Manager determines that it is prudent to reduce restrictions.

(D) Stage 3 automatically goes into effect in the event that any portion of the production and booster system fails resulting in a loss or reduction of service. Stage 3 also will be put in place in the event that all efforts to prevent the production capacity from reaching 100 percent fails. Stage 3 is reduced when full service is restored and production capacity is reduced to safe levels as determined by the General Manager.

SECTION 2. Restrictions regarding Stage Response

(A) Stage 1 restrictions:

1. Irrigation limited to one (1) day per week according to the odd or even designation of the last number of the street address.
   a. Odd numbered addresses would be allowed to water once a week on Tuesdays following the same hour designations as allowed in Ordinance No. 61.
   b. Even numbered addresses would be allowed to water once a week on Thursdays following the same hour designations as allowed in Ordinance No. 61.
2. No washing of privately owned vehicles, trailers, motorhomes, busses, or boats from a private facility. (This does not effect commercial carwashing but it is discouraged.)
3. No filling of pools or other unnecessary waste of water in accordance with Ordinance No. 61.
4. No water used for construction, including but not limited to debrushing of vacant land, compaction of fills and pads, trench, backfill and other uses, unless water is brought in from outside of the Warren Valley Basin.

(B) Stage 2 restrictions:

1. No irrigation.
2. No carwashing except approved commercial.
3. No construction water in accordance to part A4 above.
4. Requested voluntary reduction in home water use.

(C) Stage 3 restrictions:

1. All Stage 2 responses in effect.
2. Request community to reduce usage by 50 percent

SECTION 3. Enforcement

(A) Enforcement will be the same as in Ordinance No. 61. All previous notifications of violations of No. 61.

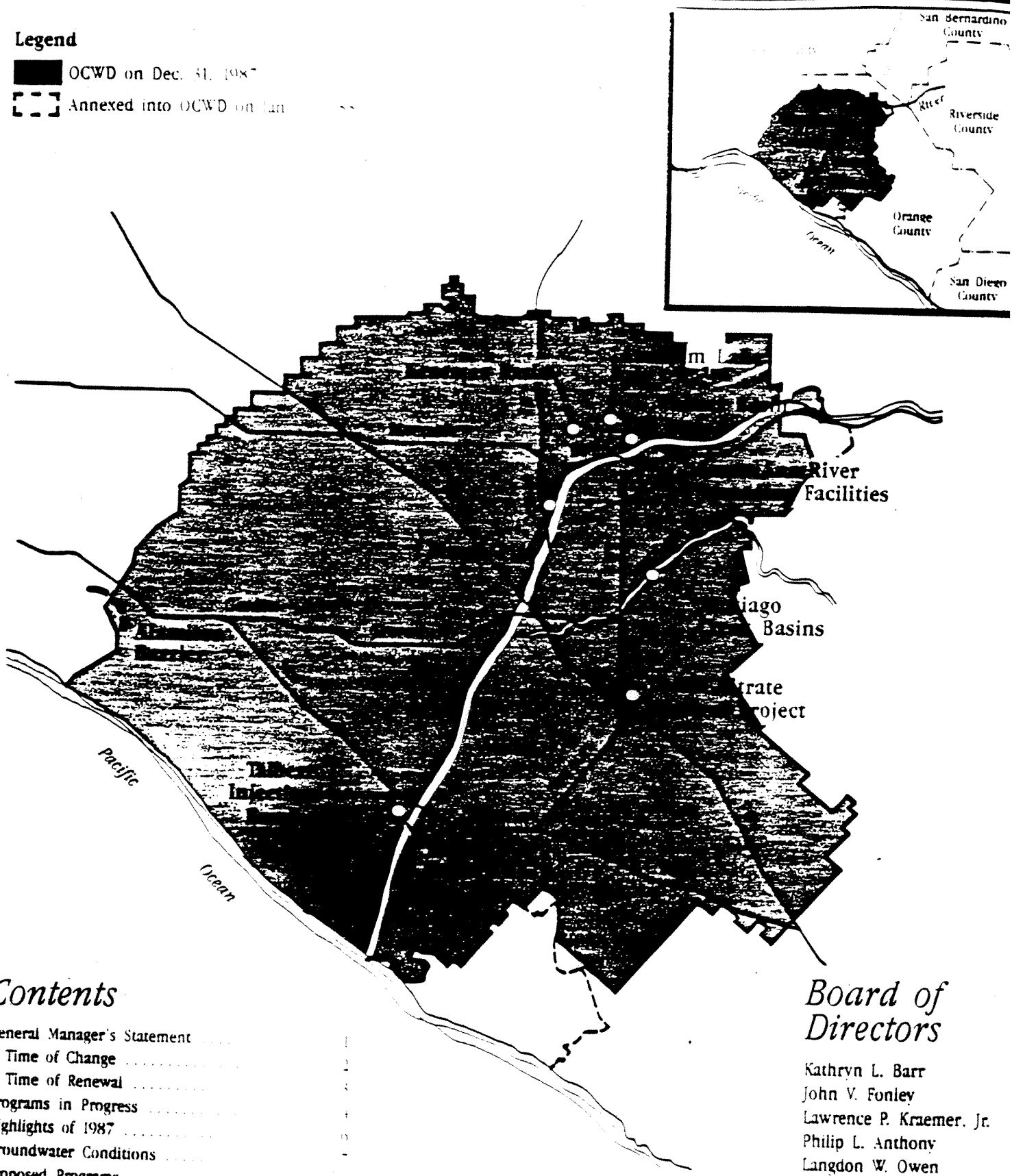
SECTION 4. Allowances of Variances

(A) Allowances of variances will be determined by the General Manager and be set within a specific time frame. Variances should be confined to requests concerning undue hardships or economic loss.

(B) Nurseries are not covered by this resolution but are requested to water only as absolutely needed.

ANNUAL REPORT
FISCAL YEAR 1988
(March 1, 1987 – Feb. 29, 1988)

ORANGE COUNTY WATER DISTRICT



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A Time of Change
A Time of Renewal
Programs in Progress
Highlights of 1987
Groundwater Conditions
Proposed Programs
Financial Highlights
1987-88 Budget
Budget Summary (86-87 to 90-91)

Board of Directors

Kathryn L. Barr
John V. Fonley
Lawrence P. Kraemer, Jr.
Philip L. Anthony
Langdon W. Owen
Noble J. Waite
Donn Hall
John Garthe
August F. Lenain
George Osborne

General Manager's Statement

For Orange County Water District, fiscal 1988 was a year of both change and renewal. The District's position of leadership in the water supply industry, based on its successful management of the Orange County groundwater basin, was not only maintained but enhanced. Innovative managerial and treatment techniques now support groundwater service to nearly two million people.

During the past half-century, Orange County Water District has responded decisively to change and to rapid growth in water consumption. OCWD has balanced creativity with economy in managing the lower Santa Ana River groundwater basin. The challenge of the future will be to continue this tradition while addressing water quality and other environmental issues. A key concern will be the ability to meet burgeoning demands at a time when imported water supplies will be drastically curtailed.

For much of its history, the District's practice of conjunctive use of imported supplies and groundwater has provided a ready, dependable supply for its customers. Our unique management philosophy is possible because pumping rights in the Orange County groundwater basin have not been adjudicated (regulated by the courts) and because of the cooperation of agencies and individuals who pump water from the basin.

OCWD will continue its current conjunctive use program and will implement new water management strategies to decrease Orange County's reliance on imported supplies. Additional cost-effective local programs of water conservation and reuse hold promise for steadily improving our extraction and infiltration capabilities.

The District's groundwater recharge activities have greatly increased its ability to conserve storm flows, but a major expansion of these projects is necessary if water supply is to keep pace with population growth. Water quality is also a major concern, as recent years have seen a gradual decline in the quality of Santa Ana River water. Upstream urbanization, high salinity in historic supplemental sources, and the potential for toxics and other contaminants pose a constant threat to the integrity of this water source.

In 1988 the District embarked on a multi-phase program to develop a number of projects, for which the specific objectives are:

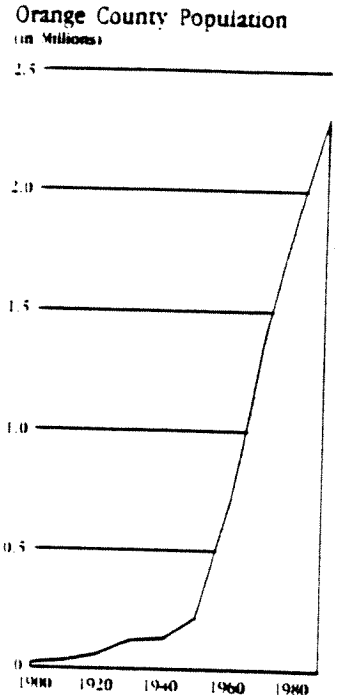
- Improve the quality of water served.
- Minimize the cost of water service.
- Reduce the basin's dependency on imported water.
- Protect the water supply in the groundwater basin.
- Protect and enhance the environment.

Last year's progress toward these goals is highlighted in this Annual Report.

William R. Mills Jr.

William R. Mills Jr.
General Manager

A Time of Change



William R. Mills Jr. became General Manager of the District on September 1, 1987, after Nick Richardson had served capably for ten months as acting manager. Mills inherited a standard of excellence from former managers Neil M. Cline, Langdon W. Owen and Howard Crooke, who pioneered conjunctive use of surface and groundwater, purchase of imported water for groundwater replenishment, reclamation of wastewater, and development of hydraulic barriers to prevent seawater instrusion. Many of these programs have been recognized and adopted by other water agencies across the country.

William R. Mills Jr.

Background

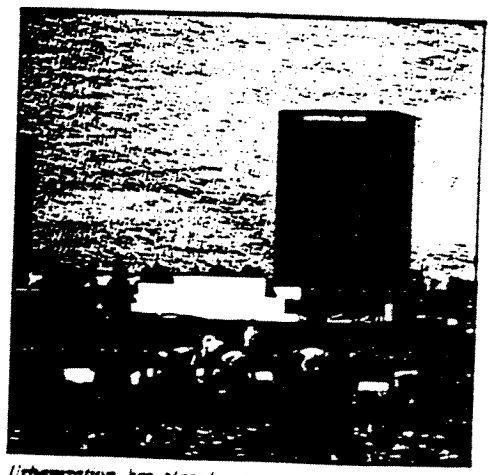
The Orange County Water District manages its groundwater basin to accomplish two objectives: 1) to distribute high quality water to pumpers throughout the basin and 2) to store water during periods of surplus availability for later use during times of above-normal demand, droughts and emergencies.

Since the District's formation in 1933, it has captured Santa Ana River base and storm flows for percolation into the underground basin. The goal is to replace supplies withdrawn for domestic, industrial and agricultural use. Through the years, the District has devised efficient, innovative methods for groundwater recharge — a pioneering effort that continues to this day through ongoing research programs.

Within a year after OCWD's formation in 1933, the Board of Directors went on record "in favor of sewerage reclamation." That far-sighted decision established a tradition of innovation that led, in the early 1960's, to the development of Water Factory 21, an advanced wastewater treatment facility which has become an international showplace for water reuse. The plant provides a source for seawater intrusion control in the Talbert Gap area, where recycled wastewater is injected into the groundwater reservoir.

Recharge basins in the Santa Ana River

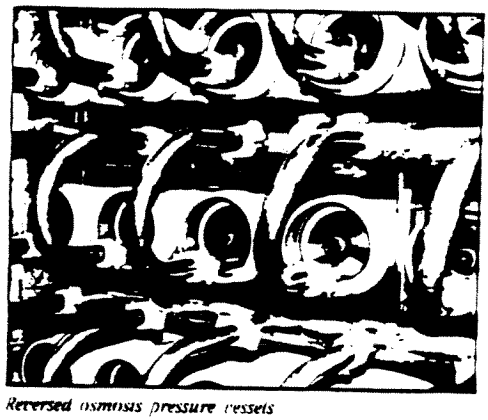
Water Factory 21 reclaims wastewater for groundwater injection



Urbanization has placed increasing demands on water supplies

A Time of Renewal

The District continues to advance beyond the old frontiers. As Californians face the second consecutive statewide critical dry year, we are reminded of the practical side of creative projects such as Water Factory 21. This demineralization project provides a dependable seawater barrier during years of lowered groundwater levels, when protection is most critical.



Reversed osmosis pressure vessels

As fiscal 1988 drew to a close, the District was already involved in its latest innovation, a wellhead water treatment project. A reverse osmosis unit and an ion exchange unit are being installed at a pair of wells taken out of service several years ago, to reclaim water that has been contaminated with high levels of nitrates. This project will supply 3,000 acre-feet of potable water per year to the city of Tustin and will reduce the demand on imported water by 3,000 acre-feet per year.

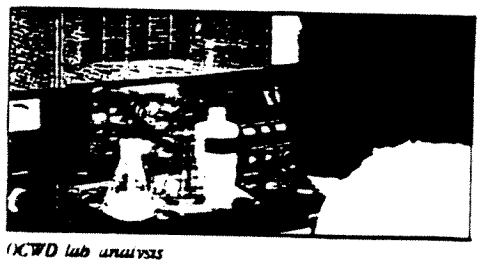
The restoration of useful reservoir capacity for conservation is of major importance to Southern California. The wellhead denitrification project, like other technological advances made by the District in earlier years, immediately attracted the attention of water suppliers in the area and throughout the United States.

When founded, the District covered 150,000 acres. Now increased through annexations to 218,000 acres (340 square miles), its boundaries roughly coincide with the geologic limits of the Santa Ana River groundwater basin that underlies the northern half of the county. Approximately 500 operational wells within the basin supply between 60 and 70 percent of the water used by members of the District. In addition to local runoff and Santa Ana River flows, the District buys water from the Metropolitan Water District of Southern California, when surplus water is available, for use in the District's groundwater recharge program.

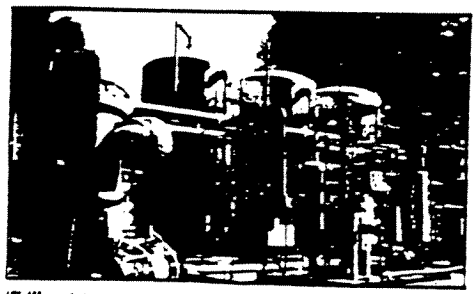
Increased groundwater quality monitoring

Throughout its history, OCWD has energetically pursued methods for extending local water supplies. In recent years concern for water quality has become as urgent as that for quantity, and the District has initiated state-of-the-art programs in water quality control and enhancement. In 1988, OCWD renewed its historic dedication to the goal of providing an adequate supply of clean water for the citizens of Orange County.

Groundwater monitoring site



OCWD lab analysis



Wellhead treatment facility for nitrate removal in Tustin

Programs in Progress

Maximizing Replenishment

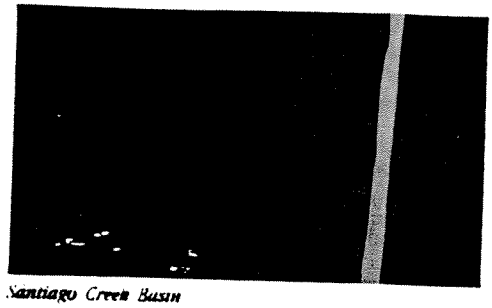
Purchasing land, thereby increasing the capacity to capture natural Santa Ana River flows, is less costly than purchasing additional imported supplies. For this reason, the District recently acquired 270 acres of former sand and gravel pits along Santiago Creek for use in its expanding groundwater replenishment program. This will add an estimated 20,000 to 30,000 acre-feet per year to OCWD's present recharge capacity.

To take full advantage of this additional acreage, the District has initiated the Santiago Creek Replenishment Project. This is the second largest capital improvement project in its history (Water Factory 21 was the largest). In this major undertaking, OCWD will augment Santiago Creek runoff by building a pump station at Burris Pit and a four and one-half mile pipeline to transfer Santa Ana River water to the Santiago Basin for storage and percolation. The $20 million project, now under construction, will be completed in 1989.

Recent improvements at Kraemer Basin provide increased flexibility to transfer water from Anaheim Lake, and system modifications now in progress will further maximize basin recharge capability.

In fiscal 1988 the District also launched a program aimed at enhancing recharge efficiency. A comprehensive study, completed in October, provided a blueprint both for modifications to the existing system and for methods to remove silt from the river water prior to its diversion to the spreading basins.

Initial water delivery at Kraemer Basin dedication



Santiago Creek Basin

Safeguarding Water Quality

Since 1974, OCWD has conducted extensive water quality sampling and testing. Last year the District provided a structured framework for these programs by adopting a comprehensive Groundwater Quality Protection Policy, which establishes specific guidelines for identifying and assessing potential problems and, when necessary, providing funds for cleanup.

In order to implement this policy, the District completed a laboratory expansion project last year. The $933,000 venture gives the District in-house capability to make the extremely sensitive measurements necessary to identify "hot spots" of trace contaminants. The monies spent for the expansion should be recouped within a year-and-a-half via the laboratory's increased capabilities, representing considerable savings to OCWD's groundwater producers.

Through another new program, the District will be conducting research and developing a color removal demonstration project to determine an effective color removal process for use on existing and future wells. Although not a public health threat, color represents the most significant water quality problem in the basin in terms of the amount of groundwater affected, an estimated 6 to 12 million acre-feet. Development of a safe and effective color removal process could open up this enormous resource.

Laboratory expansion greatly increased capability of organic and other quality analyses

Removing Nitrates

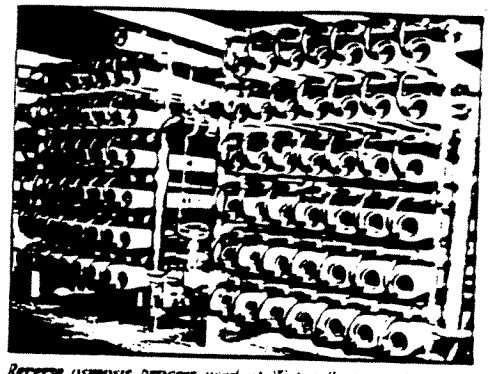
In addition to broad-based water quality programs, the District has initiated research and demonstration projects to solve specific problems. For example, an increasing concentration of nitrates has led to the loss of several wells in the basin, particularly in the Tustin and Garden Grove areas.

In fiscal 1988, OCWD awarded a $1.26 million contract for installation of two independently operated one-half mgd systems (one using reverse osmosis and the other ion exchange) to remove nitrates from a million gallons of well water each day. This project, mentioned on page 3, will provide approximately 3,000 acre-feet per year to the City of Tustin from formerly unusable groundwater. Treated water from one well will be blended with untreated raw water from an adjacent well.

Specific project objectives are twofold: to restore both wells, and to compare the performance and economics of the two treatment systems. The City of Tustin will operate the units for a two-year period and then, after successful completion of the demonstration phase, will reimburse the District for capital costs. Total estimated unit cost, specified in the contractor's performance guarantee bond, is approximately $200 per acre-foot, as compared to $230 per acre-foot for a firm supply of treated imported water.

Thanks to a cooperative agreement with the Department of Water Resources (DWR), signed in the closing weeks of 1987, the District was able to advance its schedule for a companion project in the Garden Grove area. Because the state "will ultimately benefit from the investigations," DWR has loaned the District a similar reverse osmosis unit and an ion exchange unit on a long-term basis. After testing and modifying the equipment, OCWD will use it to treat nitrate contaminated groundwater in the City of Garden Grove.

Diver collects bottom sand samples for ration research



Reverse osmosis process used at Water Factory 21 can also be used to remove nitrates from groundwater

Advancing Research

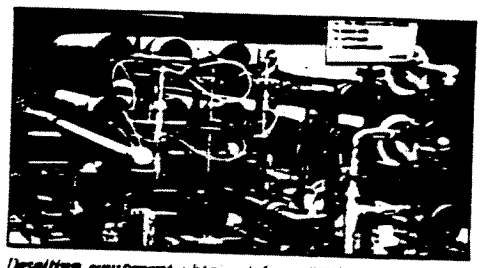
The District is participating in a privately-funded research project to find practical, cost-effective solutions to biological fouling of semipermeable reverse osmosis membranes used in wastewater demineralization (desalting) processes. This research, being conducted at Water Factory 21, has already resulted in the development of promising laboratory analytical techniques.

In another important research program, OCWD is investigating factors regulating the breakdown of gasoline hydrocarbons in the environment. The goal is to develop a biological method to alleviate groundwater contamination caused by gasoline and other hydrocarbons. A similar project is under way for biological removal of nitrates, one of the District's greatest groundwater quality concerns.

State-of-the-art analytical equipment identifies and categorizes microorganisms

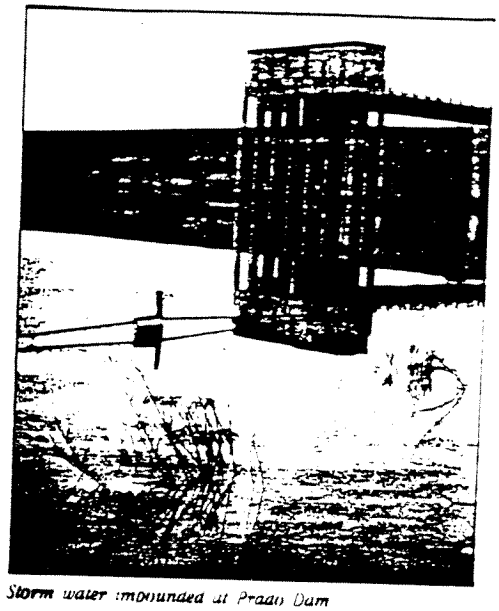
Highlights of Fiscal Year 1988

- Participated in State Water Resources Control Board's Bay/Delta hearings to reestablish priorities for Northern California water flowing through Sacramento/San Joaquin Delta.
- Reannexed City of Newport Beach.
- Adopted Groundwater Quality Protection Policy, including establishment of a $4 million toxic cleanup reserve fund.
- Funded study by U.S. Army Corps of Engineers to determine feasibility of conserving water behind Prado Dam for groundwater recharge in Orange County.
- Replaced membranes and pressure vessels in Water Factory 21 reverse osmosis plant.
- Constructed new field headquarters building and additional office space above warehouse.
- Expanded main laboratory building and added equipment to detect organic contaminants.
- Initiated $1.3 million Tustin nitrate removal project.
- Obtained reverse osmosis and ion exchange equipment from DWR to treat high nitrate groundwater in Garden Grove.
- Participated in statewide water awareness campaign.
- Completed excavation of Kraemer Basin.
- Received bids for construction of pipeline and pump station to transfer water from Santa Ana River to Santiago Basins.

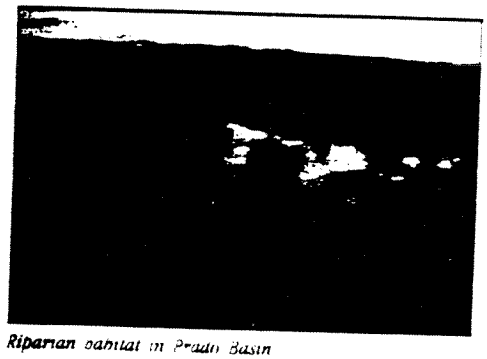


Desalting equipment obtained from DWR for local groundwater treatment

Santiago Creek Basins



Storm water impounded at Prado Dam

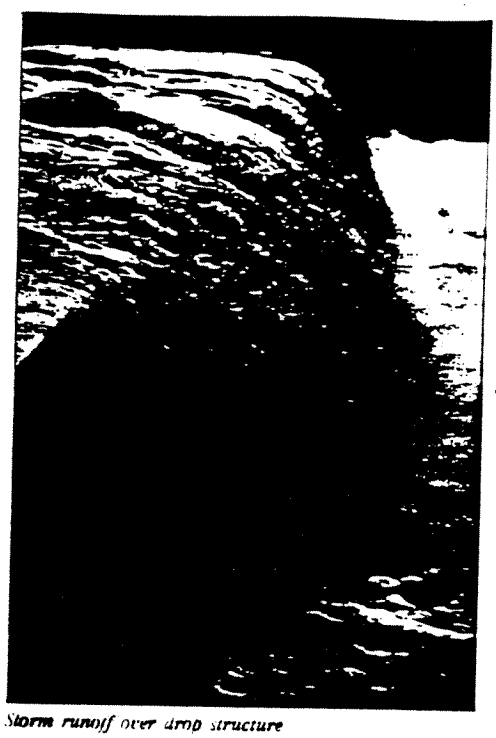


Riparian habitat in Prado Basin

Replacing reverse osmosis membranes at Water Factory 21

Sand and gravel excavation during development of Kraemer Basin

Ground-water Conditions, Water Supply and Basin Utilization



Storm runoff over drop structure

Santa Ana River flow into recharge area

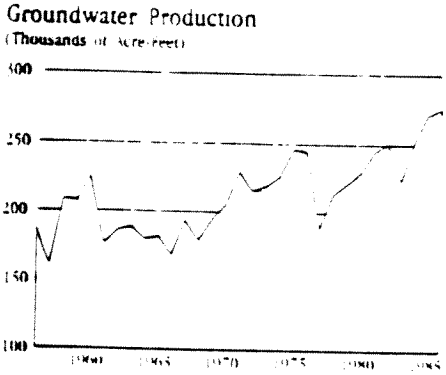
Between July 1, 1986 and June 30, 1987, an all-time record of 276,400 acre-feet of water was extracted from the Orange County Water District groundwater basin. Of that amount, 12,800 acre-feet was used for irrigation and the remaining 273,600 acre-feet (95%) for all other purposes.

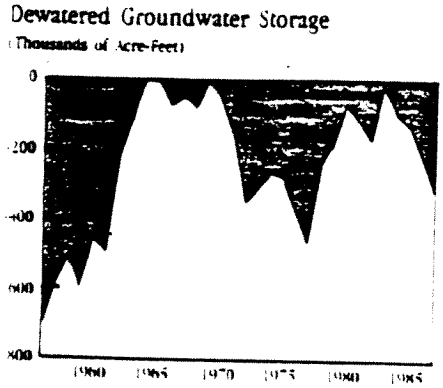
Orange County's annual rainfall was only 48% of normal, totalling 6.5 inches at the District's field headquarters in Anaheim. Local precipitation, coupled with 141,000 acre-feet of Santa Ana River flow through Prado Dam into Orange County and 29,000 acre-feet of imported water purchased from MWD for groundwater replenishment, was not enough to keep the water table from dropping as a result of the record extractions.

Water levels dropped an average of 6.3 feet from the preceding year to 1.1 feet above sea level. This drop represents a basin-wide decrease in storage of 85,400 acre-feet, bringing the accumulated overdraft to 309,000 acre-feet. The basin was considered full following the heavy rains of 1969.

To supplement the 276,400 acre-feet of groundwater, Orange County water users purchased 181,800 acre-feet of imported water for direct use. Groundwater therefore made up 60% of the total 458,200 acre-feet.

Water quality, measured in total dissolved solids (TDS), improved slightly over the preceding year. The mineral content of all water served during the past year was 460 mg/L TDS, and for groundwater 461 mg/L, a decrease of 23 mg/L and 14 mg/L, respectively.



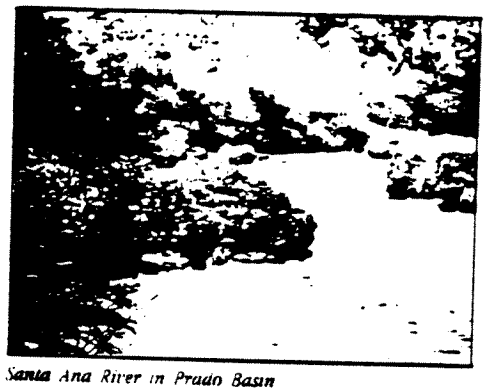


Proposed Programs

Expanding Storage Capacity

Prado Dam in Riverside County, built by the U.S. Army Corps of Engineers and completed in 1941, harnesses storm flows in the Santa Ana River. It is capable of impounding about 195,000 acre-feet of water. Although the dam originally was intended primarily for flood protection, recent broadening of the Corps' authority could permit greater use of the reservoir for water conservation. Preliminary analyses indicate an additional 20,000 acre-feet could be salvaged in wet years.

OCWD funded a $620,000 study by the Corps to determine the feasibility of seasonal water conservation at Prado Dam. The study, scheduled for completion in April 1988, will identify potential effects of impoundment for conservation and propose mitigation measures which may cost OCWD millions of dollars in the future.



Santa Ana River in Prado Basin

Reducing Underflow Losses

Another way to extend local supplies is to reduce historic groundwater "underflow" to other basins. These losses occur because Orange County's basin is maintained at higher levels than the Central and West Basins across the Los Angeles-Orange County line. The District is studying the idea of a West Orange County wellfield. Under this project, OCWD would install a series of wells, spaced along the western county line, to intercept subsurface outflow. Additional pumping wells may also be needed in the Seal Beach, Cypress and Stanton areas.

Increasing Wastewater Reclamation

OCWD's current reclamation efforts will be expanded by construction of the Green Acres Project. Scheduled to begin in fiscal '89 this project will provide tertiary treated wastewater for irrigation of parks, golf courses and greenbelts near the District's Fountain Valley plant. Although Green Acres has been on the drawing board for several years, significant progress has been made in 1987 toward making it a reality. A key factor was the signing of required agreements between OCWD and the other agencies involved, including The Metropolitan Water District of Southern California, Municipal Water District of Orange County, Coastal Municipal Water District, Mesa Consolidated Water District, and the Cities of Santa Ana and Fountain Valley.

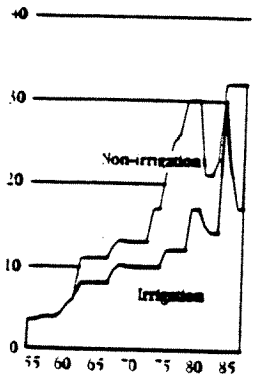
The $22 million Green Acres Project in its first phase will provide 7,000 acre-feet annually to users within a five-mile radius of the plant. Ultimate capacity is 15,000 acre-feet per year. MWD has included Green Acres in its Local Projects Program and will reimburse OCWD at least $75 per acre-foot for water delivered because the project will reduce the need for water importation.

A forebay reclamation plant is also being considered. This project, currently in the planning stage, would involve design and construction of a reclamation plant in Anaheim to provide 23,000 acre-feet for beneficial reuse at an estimated cost of $60 million.

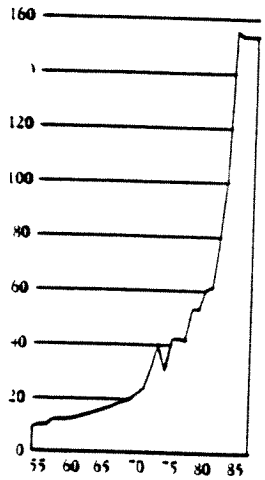
Green Acres will provide reclaimed water for golf courses and parks

Financial Highlights

Groundwater Replenishment Assessment
(Dollars)



MWD Replenishment Rate
(Dollars)



To finance the District's ambitious basin management objective of protecting water quality and maximizing local groundwater supplies at the lowest possible cost, fiscal activities have been subdivided into four funds.

The General Fund supports the administrative operations of the District.

The Capital Projects (formerly Water Reserve) Fund has been created to finance major capital improvement projects, including design and major equipment purchases.

The Replenishment Fund provides for the purchase of imported water to offset the five-year average annual overdraft and one-tenth of the accumulated overdraft.

Effective management of the groundwater basin is achieved through the Basin Equity Assessment Fund, which equalizes water costs throughout the basin.

Funding sources vary by specific fund, but generally include carry-over balances; ad valorem taxes; interest on savings; royalties, rents and miscellaneous fees; replenishment assessments on groundwater pumped; and basin equity assessments on groundwater pumped in excess of a predetermined basin production percentage.

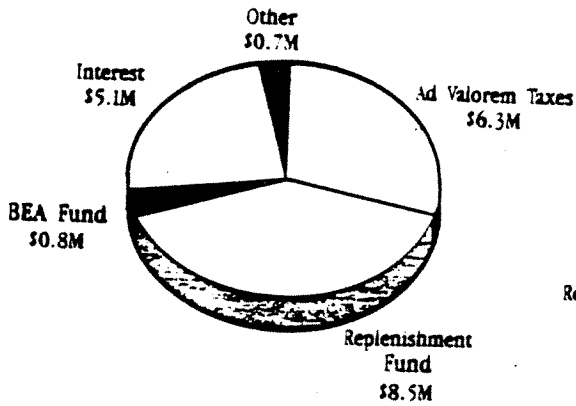
The Replenishment Assessment for the period July 1, 1987 - June 30, 1988 was set at $32 per acre-foot for purposes other than irrigation and $16 for irrigation. A comparison of District replenishment rates with imported water costs since 1954 is shown at left.

To accomplish the extensive capital building program anticipated during the next six years, bond financing is being considered. For the first time in its 55-year history, the District is evaluating the feasibility of a debt issuance of approximately $100 million in fiscal 1989-90.

The current 1987-88 budget is detailed on pages 10 and 11 for each of the four specific funds. A summary of income and expenses for all funds is shown below.

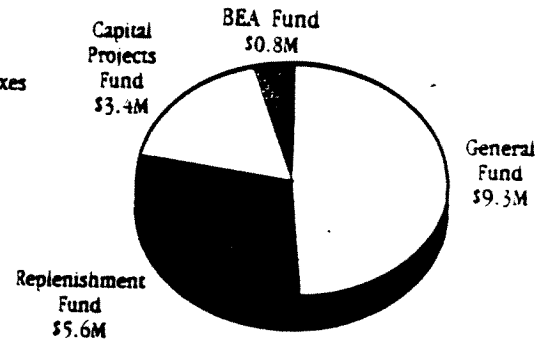
FISCAL 1987-88 BUDGET — ALL FUNDS
(March 1, 1987 — February 29, 1988)

Revenue



Total: $21.4 million

Expenses

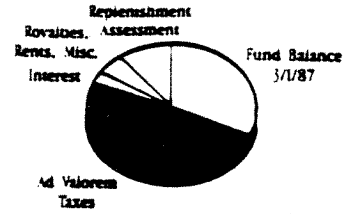


Total: $19.2 million

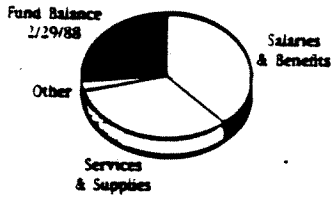
1987-88 BUDGET (March 1, 1987 — February 29, 1988)

GENERAL FUND

Revenue



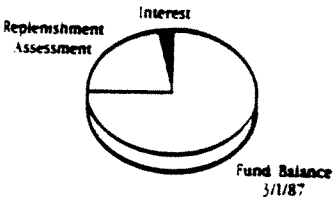
Expenses



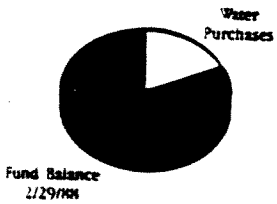
FUNDS AVAILABLE		
Fund Balance 3/1/87		$ 4,127,000
REVENUE		
Ad Valorem Tax	$6,203,000	
Interest	381,000	
Royalties, Rents, Miscellaneous	694,000	
Replenishment Assessment for Operations	1,349,000	
TOTAL REVENUE		8,627,000
TOTAL FUNDS AVAILABLE		$12,754,000
EXPENDITURES		
Salaries and Benefits	$4,810,000	
Services and Supplies	4,191,000	
Other	338,000	
TOTAL EXPENDITURES		$9,339,000
FUND BALANCE 2/29/88		$ 3,416,000

REPLENISHMENT FUND

Revenue



Expenses

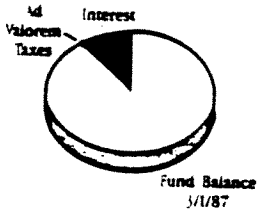


FUNDS AVAILABLE		
Fund Balance 3/1/87		$24,267,000
REVENUE		
Replenishment Assessment Collections	$ 7,173,000	
Miscellaneous	5,000	
Interest	979,000	
TOTAL REVENUE		8,157,000
TOTAL FUNDS AVAILABLE		$32,424,000
EXPENDITURES		
Water Purchases	$5,605,000	
Miscellaneous Fees	10,000	
TOTAL EXPENDITURES		5,615,000
FUND BALANCE 2/29/88		$26,808,000

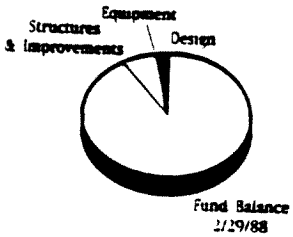
ORANGE COUNTY WATER DISTRICT

CAPITAL PROJECTS (WATER RESERVE) FUND

Revenue



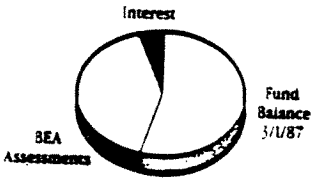
Expenses



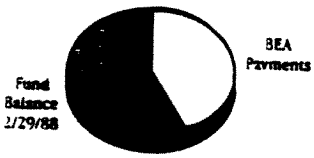
FUNDS AVAILABLE		
Fund Balance 3/1/87		$32,677,000
REVENUE		
Ad Valorem Tax	$ 91,000	
Interest	3,641,000	
TOTAL REVENUE		$3,732,000
TOTAL FUNDS AVAILABLE		$36,409,000
EXPENDITURES		
Structures & Improvements	$2,396,000	
Design	132,000	
Equipment	841,000	
Miscellaneous Fees	38,000	
TOTAL EXPENDITURES		$3,407,000
FUND BALANCE 2/29/88		$33,002,000

BASIN EQUITY ASSESSMENT FUND

Revenue



Expenses



FUNDS AVAILABLE		
Fund Balance 3/1/87		$1,050,000
REVENUE		
Basin Equity Assessment Collections	$803,000	
Miscellaneous	4,000	
Interest	94,000	
TOTAL REVENUE		901,000
TOTAL FUNDS AVAILABLE		$1,951,000
EXPENDITURES		
Basin Equity Assessment Payments	$827,000	
Miscellaneous Fees	1,000	
TOTAL EXPENDITURES		$828,000
FUND BALANCE 2/29/88		$1,123,000

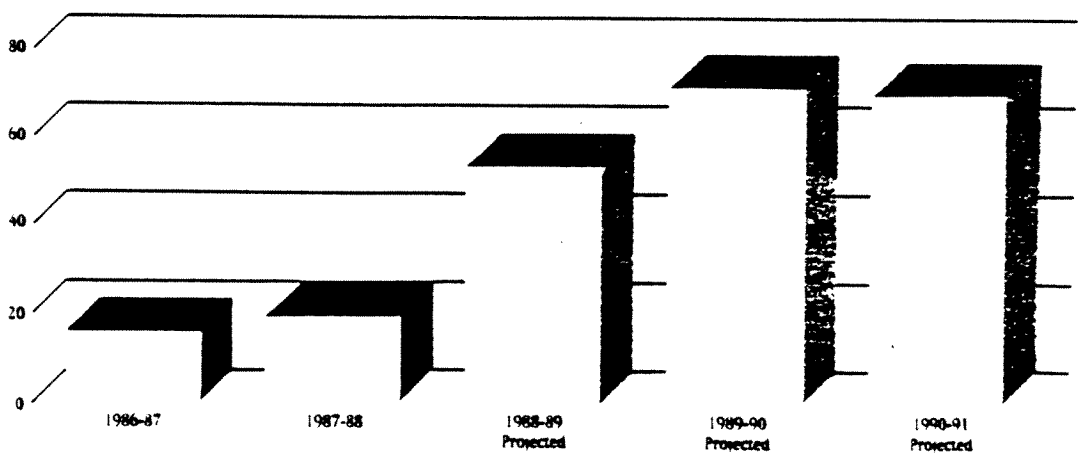
The following table summarizes actual revenue and expenditures for fiscal years 1986-87 and 1987-88 and projects budgets for fiscal 1988-89, 1989-90 and 1990-91. The bar graph at the bottom of the page emphasizes increasing expenditures as a result of construction activity dealing with basin management and water production and seawater barrier programs.

BUDGET SUMMARY — ALL FUNDS
(In Thousands of Dollars)
Fiscal 1986-87 through 1990-91

	1986-87	1987-88	1988-89	1989-90	1990-91
FUNDS AVAILABLE					
Prior Year Carryover	$56,228	$62,121	$64,349	$ 35,629	$130,156
Bond Money	-0-	-0-	-0-	140,000	-0-
Revenue					
Ad Valorem Taxes	5,519	6,294	6,826	7,167	7,525
Green Acres	-0-	-0-	-0-	-0-	400
Assessments (Replenishment & Basin Equity)	9,195	9,325	11,725	15,568	20,057
Interest	5,155	5,095	5,272	2,481	10,044
Royalties, Rents, Miscellaneous	1,507	703	680	715	751
Total Revenue	21,376	21,417	24,503	25,932	38,777
TOTAL FUNDS AVAILABLE	$77,604	$83,538	$88,852	$201,561	$168,933
EXPENDITURES					
General Fund	$ 8,311	$ 9,339	$13,264	$24,941	$25,707
Replenishment Fund	4,505	5,615	7,498	11,140	12,581
Capital Projects Fund	1,514	3,407	31,661	34,484	30,586
Basin Equity Assessment Fund	1,153	828	800	840	882
Total Expenditures	$15,483	$19,189	$53,223	$71,405	$69,756
Balance at Year End	$62,121	$64,349	$35,629	$130,156	$99,177

Note: Actual figures shown were obtained from Final Audit Report for 1986-87 and 1987-88. Projected figures for 1988-89, 1989-90 and 1990-91 were estimated in the 1988-89 Budget Report.

Total Expenditures
(In Millions of Dollars)



AMES VALLEY WATER BASIN AGREEMENT

THIS AGREEMENT is entered into as of the 10th day of January, 1991 by and between the HI-DESERT WATER DISTRICT, a County Water District (hereinafter "HDWD") and the BIGHORN-DESERT VIEW WATER AGENCY, a public agency, (hereinafter "BDVWA").

R E C I T A L S

A. HDWD is a County Water District organized and operating pursuant to Section 30000 et seq., of the California Water Code.

B. BDVWA is a public agency formed by an special act of the legislature and operating under the Water Code Appendix Section 112-1, et seq.

C. HDWD has entered into a contract for water to be extracted from a well located in Section 24, Township 2 North, Range 5 East, SBBM in San Bernardino County, California (also referred to as the "Mainstream Well") and has adopted an Environmental Impact Report (EIR) for the construction of facilities to take water from that well.

D. BDVWA has protested that EIR, and filed suit in the Superior Court of San Bernardino County (Bighorn Mountain Water Agency, et al. v. Hi-Desert Water District, Case No. BCV 5157).

E. The parties desire to enter into this AGREEMENT for the purpose of settling the litigation, and providing information on, and dealing with the environmental impacts from water extractions from the Ames Valley Water Basin in San Bernardino County. This AGREEMENT shall never be treated or otherwise construed as an admission of liability and/or inadequacy of the EIR by either party for any purpose.

C O V E N A N T S

NOW THEREFORE, in consideration of the preceding RECITALS and the mutual COVENANTS contained herein, the parties agree as follows:

Section 1.0 STIPULATED JUDGMENT AS AMENDMENT OF "EIR". The parties will enter into a Stipulation for Judgment embodying the terms and conditions of this AGREEMENT, and such stipulated judgment shall be deemed to be an amendment of the EIR.

Section 2.0 LIMITATION ON THE USE OF WATER. HDWD agrees that water pumped from the Section 24 Well and any additional wells owned, operated or controlled by HDWD within the Ames Valley Water Basin will be limited to eight hundred (800) acre feet per year, and that the water delivered from wells within the Ames Valley Water Basin will be used only within the Ames Valley Water Basin. The amount of water pumped in the Ames Valley Water Basin may be increased depending on the water needs of property owners within the Ames Valley Water Basin by an amount equal to one half acre feet per year for each new residential water meter installation by HDWD following approval of this AGREEMENT by the parties. The Ames Valley Water Basin is identified for the purposes of this AGREEMENT in Exhibit "A", which is attached hereto and incorporated herein by reference.

Section 2.1 MODIFICATION TO THE WELL. HDWD agrees at its expense to place a "sleeve", or other device, in the Section 24 Well to seal the upper aquifer and to prevent pumping of water from that zone. The HDWD engineer, in consultation with the BDVWA engineer, shall evaluate water quality individually in both the upper and lower aquifer and shall test for possible flow between the upper and lower aquifers. If there is agreement between engineers that a "sleeve", or other device, is not required prior to production, BDVWA agrees that the "sleeve", or other device, will be installed at a future date, if so required at that time.

Section 3.0 MONITORING PROGRAM. The parties hereto agree to establish and implement a groundwater monitoring program to mitigate any potential environmental damage to the hydrologic resources of the Ames Valley Water Basin caused by the Section 24 Well, or from additional production wells. Monitoring of the wells included in the program, as listed in Exhibit "B", which is attached hereto and incorporated herein by reference, will commence immediately following execution of this AGREEMENT. Any new production wells shall be added automatically to Exhibit "B" for inclusion in the monitoring program, and if production shall be terminated as to any production well included in Exhibit "B", it shall be dropped from the program.

Section 3.1 MONITORING TEAM. The recording of well data, sampling and the taking of well measurements shall be accomplished by a team consisting of one representative each from HDWD and BDVWA. Working together, one team member shall sample, sound and take readings and record them on a form approved by both parties. The other team member shall confirm all recorded data and both team members shall initial and date the form and distribute copies to the respective parties. Team members shall be instructed in correct data collection, sampling and sounding techniques.

Section 3.2 PREPARATION OF WELLS. All wells in the program shall be identified by State Well Number, where possible. All wells shall have a designated reference point (top of casing or measuring tube, etc.) and the elevation of the reference point of selected wells shall be determined by a surveyor prior to production. Each well to be monitored for production shall be equipped with a totalizing flowmeter reading in gallons per minute for pumping rate and in gallons per minute, or cubic feet, for total quantity pumped.

Section 3.3 WELL MEASUREMENT AND SAMPLING. All well sounding measurements shall be taken with a sounding device approved by both parties. The sounding device shall be calibrated at the start of the program and recalibrated at least every six (6) months thereafter. Each production well shall be off, if possible, at least two (2) hours prior to sounding for a static level. The recovery time should be consistent for all readings taken at a given well. Well measurements shall be taken on the same time of the day and date of the month, insofar as possible. Any deviation from the regular monitoring schedule shall be so noted on the recording form. Water quality samples shall be taken from production wells and the method of sampling shall be consistent for all wells sampled. All laboratory testing shall be accomplished by the same firm, if possible. Samples shall be tested according to the latest requirements of Title 22 of the California Domestic Water Quality and Monitoring Regulations and other applicable regulations. The frequency of monitoring shall be accordance with Exhibit "C", which is attached hereto and incorporated herein by reference. HDWD and BDVWA shall provide to each party copies of all available historical well data, including static and pumping water levels, pumping quantities and water quality reports and each party shall maintain identical data bases in a mutually agreed format.

Section 3.4 DATA EVALUATION. HDWD and BDVWA shall be responsible for the submission to, and evaluation of, monitoring data by their respective consultants. Within thirty (30) days following the end of each six (6) month period, each respective consultant shall evaluate the collected data and make a written report on the progress of the monitoring program, including recommendations, if any. Copies of these, and other applicable reports shall be distributed to the other parties to this AGREEMENT.

Section 4.0 ENVIRONMENTAL ACTION CRITERIA. Criteria which shall initiate immediate environmental review are identified in Exhibit "D", which is attached hereto and incorporated herein by reference. Any water level or water quality decline exceeding the criteria shall be cause for a written request for a reduction or cessation of the pumping of the Section 24 Well. Such request shall be delivered to the HDWD office and shall be documented with supporting data.

Section 5.0 CORRECTIVE ACTION. HDWD shall reduce pumping in the Section 24 Well to an amount not to exceed one (1) acre foot per twenty-four (24) hour period within forty-eight (48) hours of receiving a written request from BDVWA. HDWD shall maintain the reduced pumping level until the general managers of HDWD and BDVWA, and their designated consultants, have reviewed collected data, met in conference to make recommendations, and have reached agreement regarding the future operations of the well. If HDWD and BDVWA are unable to agree on a course of action within thirty (30) days from the date of the original request, reduced production in pumping shall continue and the matter shall be submitted for arbitration by an independent consultant, as provided in Section 5.3 herein.

Section 5.1 PRODUCTION REMEDY. BDVWA shall, if so requested in writing by HDWD, replace water production lost from the Section 24 Well during the period of reduced pumping, not to exceed six (6) months, at a price per acre foot comparable to that currently paid by HDWD for the lost production.

Section 5.2 DESIGNATION OF CONSULTANTS. Each party hereto, shall designate the consultant to be retained to evaluate the data from the monitoring program. Such consultant shall remain the primary consultant of the party during the term of this agreement unless notification of a change is provided in writing.

Section 5.3 ARBITRATION OF ENVIRONMENTAL ACTIONS. Respective to Section 5.0 herein, HDWD and BDVWA consultants shall recommend an independent arbitrator who shall be capable of making proper evaluation of the data, and he shall provide recommendations on corrective action, if any. The parties agree that this arbitrator will be retained to examine the data and reports of the consultants and make a binding determination on the impacts of the data and impose the most effective corrective action, if any. If the respective consultants of HDWD and BDVWA are unable to agree on a designated arbitrator within a forty-five (45) day period from the date of the original request, an arbitrator shall be appointed in accordance with the California Arbitration Act, Section 1280 through 1294.2 of the Code of Civil Procedure. At any time following implementation of the arbitrator's decision, either party may request a conference as between the general managers of HDWD and BDVWA and their respective designated consultants, to reach agreement on a proposed modification or elimination of the corrective action imposed by the arbitrator. If the general managers and the designated consultants are unable to arrive at a mutually acceptable solution, the parties shall again proceed in accordance with this Section 5.3.

Section 6.0 PROGRAM COSTS. Program costs, other than in-house manpower, designated consultants and the support thereof, incurred by the parties relating to the program (survey, sampling, laboratory, arbitration, etc.) shall be shared equally by the parties.

Section 7.0 PROGRAM PERIOD. The program shall be ongoing and may be expanded or terminated by the unanimous consent of all parties.

Section 8.0 INDEMNIFICATION. Each party agrees to indemnify, hold harmless, and assume the defense of the other party, its officers, agents, employees, and elective Boards, and pay all court costs and reasonable attorneys fees relating thereto, in any action, with respect to a claim, loss, damage or injury, asserted by a third party against the party entitled to indemnification hereunder, and arising out of a negligent act, error or omission, or wilful misconduct, of an employee or agent of the party whose actions under this AGREEMENT gave rise to such third party claim.

Section 9.0 NOTICES. Any notice, tender or delivery to be given hereunder by either party to the other shall be effected by personal delivery in writing or by registered or certified mail, postage prepaid, return receipt requested, and shall be deemed communicated as of mailing or in the case of personal delivery, as of actual receipt. Mailed notices shall be addressed as set forth below, but each party may change its address by written notice in accordance with this Section.

TO: HI-DESERT WATER DISTRICT
6955 Old Woman Springs Road
Yucca Valley, CA 92284
Attention: General Manager

TO: BIGHORN-DESERT VIEW WATER AGENCY
P. O. Box 3838
1720 North Cherokee Trail
Landers, CA 92285
Attention: General Manager

Section 10.0 ARBITRATION OF DISPUTES. Other than those disputes which shall be arbitrated under Section 5.3, any dispute or controversy arising out of, under, or in connection with, or in relation to the AGREEMENT, and any amendments thereof, or the breach thereof, shall be submitted to arbitration in accordance with the following procedures:

A party desiring arbitration ("First Party") shall give written notice to the other party ("Second Party") containing a general description of the controversy to be submitted to arbitration and designating by name and address, three proposed arbitrators acceptable to the First Party, each of whom have agreed to act as arbitrator, if selected. If the Second Party agrees upon one of the three proposed arbitrators. The Second Party shall so advise the First Party in writing within ten (10) business days of such written notice by the First Party.

The arbitrator selected shall promptly give written notice of the arbitration hearing which shall take place within sixty (60) days of the date as is selected by the arbitrator. The arbitration hearing shall take place at a location mutually agreeable to the parties, but within San Bernardino County, California.

If the Second Party fails to agree to the selection of one of the three proposed arbitrators within the ten (10) business day period, an arbitrator shall be appointed in accordance with the California Arbitration Act, Section 1280 through 1294.2 of the Code of Civil Procedure.

The cost of the arbitration shall be paid by the parties equally. Except as otherwise provided herein, the arbitration shall be conducted and enforced in accordance with the provisions of the California Arbitration Act, Section 1280 through 1294.2 of the Code of Civil Procedure.

AMES VALLEY WATER BASIN MONITORING PROGRAM
EXHIBIT "B"
LIST OF MONITORING WELLS

OWNER	LOCATION	STATUS
Archie King	2N/5E/26B,SBM	Dormant
DV #1 (BDVWA)	2N/5E/23M,SBM	Dormant
Joan Hayes	2N/5E/23D,SBM	Dormant
DV #2 (BDVWA)	2N/5E/27J1,SBM	Producing
DV #3 (BDVWA)	2N/5E/27J01S,SBM	Producing
DV #4 (BDVWA)	2N/5E/27R,SBM	Producing
USGS Test Well	2N/5E/27A,SBM	Dormant
Moran	2N/5E/13A,SBM	Dormant
BH #2 (BDVWA)	2N/5E/12B1,SBM	Producing
BH #3 (BDVWA)	2N/5E/12B2,SBM	Producing
Gubler Farm	2N/5E/1K1,SBM	Producing
Gubler Farm	2N/5E/1K2,SBM	Dormant
Gubler Farm	2N/5E/1G1,SBM	Dormant
Gubler Farm	2N/5E/1H1,SBM	Producing
BH #1 (BDVWA)	2N/6E/18P,SBM	Dormant
W-1 #3 (COUNTY)	2N/5E/18,SBM	Producing
W-1 #2 (COUNTY)	2N/6E/18,SBM	Producing
W-1 #1 (COUNTY)	2N/6E/7,SBM	Dormant
HD #6 (HDWD)	2N/6E/30,SBM	Dormant
HD #10 (HDWD)	1N/6E/17,SBM	Producing
MAINSTREAM (HDWD)	2N/5E/24,SBM	Producing
HD #20 (HDWD)	2N/6E/36,SBM	Producing
HD #21 (HDWD)	2N/5E/2,SBM	Dormant
Patty Karawczyk	2N/5E/25,SBM	Producing

Section 11.0 ATTORNEYS FEES. If a dispute arises, which cannot be resolved by arbitration, regarding breach or enforcement of the provisions of this AGREEMENT, the responding and/or defending party who is determined to be the prevailing party therein shall be entitled to recover all attorneys fees or other costs actually incurred in connection with resolving the dispute only if litigation is filed and judgment is rendered. In any action brought, the entitlement to recover attorneys fees and costs will be considered an element of costs and not of damages

Section 12.0 AMENDMENTS. This is an entire AGREEMENT and supercedes all prior agreements oral or written between the parties, and their agents, and cannot be amended unless in writing, with specific reference hereto by the parties authorized to be charged. Failure by either party to enforce any provisions shall not constitute a waiver of said party's right to enforce subsequent violation of the same or any other provisions.

Section 13.0 INUREMENT. This AGREEMENT shall be binding upon and inure to the benefit of the successors and assigns of the parties.

Section 14.0 CAPTIONS. The captions of Sections and Subsections of this AGREEMENT are for reference only and are not to be construed in any way as a part of this AGREEMENT.

Section 15.0 VALIDITY. This AGREEMENT will be construed in accordance with the laws of the State of California.

Section 16.0 SEVERABILITY. If any section, clause or phrase of this AGREEMENT is for any reason held to be unconstitutional or unlawful, such a decision shall not effect the validity of the remaining portions of this AGREEMENT.

IN WITNESS WHEREOF, the parties have caused this AGREEMENT to be executed by their respective officers as of this date first above written.

HI-DESERT WATER DISTRICT

BY _____
Board President

ATTEST _____
Board Secretary

BIGHORN-DESERT VIEW WATER AGENCY

BY _____
Board President

ATTEST _____
Board Secretary

AMES VALLEY WATER BASIN MONITORING PROGRAM
EXHIBIT "A"
LEGAL BOUNDARIES OF THE AMES VALLEY WATER BASIN
(MAP ATTACHED)

The boundaries of the Ames Valley Water Basin, for the purposes of this monitoring program, shall be as follows: Township 1 North, Range 5 East, Sections 1, 2, 3, 10, 11, 12, 13, 14, 15, 22, 23, and 24; Township 1 North, Range 6 East, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, and 21; Township 2 North, Range 5 East, Sections 1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 21, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36; Township 2 North, Range 6 East, Sections 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, and 34; all located within San Bernardino County.

Kennedy/Jenks/Chilton

24 October 1990

MEMORANDUM

To: Mr. Marsh Goldblatt
General Manager

From: Lynn M. Takaichi

Subject: Technical and Economic Issues
Related to State Water Importation
K/J/C 904616.00

In planning for the Morongo Basin Pipeline (MBP), as well as the local facilities to utilize State water, the Hi-Desert Water District (HDWD) must consider the desirability of several facility-related options. Of immediate concern are the following issues outlined in our 19 October 1990 telephone conversation:

1. Operation and Maintenance (O&M) differences between the transmission untreated or treated water.

2. Location of the MBP booster pump station.

3. Location of water treatment facilities.

4. Groundwater recharge options.

5. Concepts for local facilities to utilize State water.

This memorandum summarizes our preliminary evaluation. As requested, we have evaluated the technical and economic considerations related to these issues.

WATER TRANSMISSION

Generally, State water has good water quality for water transmission and any differences in pipeline O&M costs due to physical wear and tear are expected to be nominal. Telephone conversations with State water contractors which maintain both untreated and treated water pipelines generally confirm this expectation. However, a potential difference in O&M costs may occur from additional water treatment costs if treated water is used in the MBP. There are several areas of concern associated with the transmission of treated water. The primary areas of concern are bacterial regrowth in the pipeline and the formation of disinfection by-products (DBP) such as trihalomethanes (THM).

If water treatment is provided near Hesperia and treated water is conveyed in the MBP, disinfectant residuals may dissipate in this long pipeline. Under these conditions, bacteria may grow on biofilms attached to the pipe wall and contaminate the treated water. To avoid this problem, additional disinfection

facilities along the pipeline route or near the point-of-delivery may be necessary. This problem may become particularly difficult if EPA establishes DBP standards which require disinfection by chloramination or if EPA establishes disinfection standards which require post-ozonation. As required by the Safe Drinking Water Act Amendments of 1986, these standards are currently being considered by EPA. Both chloramines and assimilable organic carbon, which is formed by post-ozonation, can stimulate bacteria regrowth in water pipelines. Alternatively, if untreated water is conveyed in the MBP, water treatment can be provided near the point-of-delivery and these potential problems can be minimized.

The second concern related to the conveyance of treated water is the potential formation of DBPs, particularly THMs. The formation of THMs is a time-dependent reaction of chlorine and THM precursors in State water. In a long pipeline, THMs will continue to form as long as a chlorine residual and THM precursors are present in the treated water. Using chloramines as a final disinfectant reduces the magnitude of this problem but may encourage bacterial regrowth. Using chlorine as a final disinfectant, the Metropolitan Water District of Southern California (MWD) has experienced a THM increase of 31 ug/l above the THM level at the water treatment plant in approximately 7 hours of contact time. Using chloramines as a final disinfectant, MWD experienced a THM increase of 6 ug/l in the same system. At 15 cfs, the contact time in the MBP will be over 35 hours. Because the current THM standard of 100 mg/l is expected to be reduced to below 50 mg/l, potential water quality degradation may be a significant problem if the MBP is used to convey treated water.

LOCATION OF THE MBP BOOSTER PUMP STATION

The proposed location of the booster pump station (BPS) is a site along Highway 247 in Johnson Valley. An alternative location suggested by others is at the Mojave Water Agency (MWA) turnout in Hesperia. Functionally, we believe that the alternative locations are generally equivalent; however, there may be significant differences in construction costs between the 2 alternative sites.

Based on the Morongo Basin Pipeline Preliminary Engineering Report by Malcolm Pirnie, the primary construction cost difference would be the higher cost of electrical service at the Johnson Valley site versus the higher cost of pipeline due to higher pressure rating. By locating the BPS at the highest possible elevation that does not produce negative pipeline pressure (or does not produce system pressures below the minimum design pressure) on the suction side of the BPS, the pressure requirements of the pipeline can be minimized. Lower pressure requirements generally result in lower pipeline material costs, particularly for a long pipeline. This criterion probably resulted in the recommended BPS location in Johnson Valley. However, it should be noted that

additional advantage could have been achieved by locating the BPS slightly eastward. Unfortunately, this site is remote from potential sources of electrical power. Consequently, $3.0 million plus 10 percent contingency is budgeted for electrical service. The cost of the substation is required at both locations.

The alternative BPS site near Hesperia is likely to have a lower cost for electrical service but a higher cost for pipeline materials. To optimize the BPS location, a detailed cost analysis of these factors should be conducted. A key determinant of the optimum (i.e., lowest cost) location will be the nearest transmission line from which service can be delivered. The results of this optimization analysis will probably indicate that a BPS location between Apple Valley and Lucerne Valley is optimum.

Regardless of the selected BPS site, the HDWD should require that the BPS be capable of delivering water at an elevation that allows gravity delivery to HDWD's 3495 pressure zone after headloss allowances for a water treatment plant. If this delivery capability cannot be provided, an additional BPS will be required before or after a water treatment plant. Generally, two BPSs in series provides significantly less reliability that a single BPS since a failure of either BPS would cause a failure to deliver water.

LOCATION OF WATER TREATMENT FACILITIES

To utilize State water directly, the water must be treated according to Department of Health Services requirements. Water from the MBP can be treated centrally near Hesperia prior to being conveyed to Division 2 or locally at each point-of-delivery. The advantages and disadvantages of each location are summarized below:

Centralized Water Treatment Plant

Advantages:

1. Possible reduced capital and O&M costs due to economy-of-scale.

2. MBP water can be used directly for domestic purposes along the pipeline route thereby reducing water distribution costs.

3. Plant capacity could be shared thereby delaying expansion needs.

Disadvantages:

1. Possible water quality degradation during transmission resulting in additional treatment needs.

2. Increased cost for other than direct use (i.e., groundwater recharge).

Local Water Treatment Plants

Advantages:

1. Untreated (i.e., lower cost) water would be available for groundwater recharge.

2. Local control of project cost, implementation schedule, and water quality.

3. Possible reduced O&M costs by utilizing current local staff.

4. Local control of expansion or improvements to the plant.

Disadvantages:

1. Several small water treatment plants may be required along the pipeline route.

Because the HDWD will not be able to fully utilize its MWA entitlement for direct consumption, groundwater recharge will be utilized to maximize State water importation. Consequently, we believe that the HDWD would not benefit from a centralized water treatment plant unless it were located near the HDWD. The primary beneficiary of a centralized plant in Hesperia would appear to be Bighorn/Desert View Water Agency. Because its MWA entitlement is relatively small, the cost of local treatment would be high. Because of its proximity to HDWD, Joshua Basin Water District could utilize a joint facility with HDWD or a separate local facility. For these reasons, it is recommended that HDWD provide its own water treatment plant near the point-of-delivery.

GROUNDWATER RECHARGE OPTIONS

Imported State water from the MBP will be received at a relatively constant flowrate. Because the direct use of imported water may be less than the rate of delivery, groundwater recharge would be utilized to maximize imported water deliveries. At times, the entire imported water supply (4,282 acre-feet per year) may be recharged. There appears to be 2 basic options for groundwater recharge: ponding of untreated water in spreading basins or injection of untreated water into production wells. Specific concepts which utilize these options are evaluated in the following section of this memorandum.

Potential sites for spreading basins were evaluated in the draft Warren Valley Basin Recharge Study-Phase II (1986). Based on the Phase I evaluation, 8 potential recharge sites were evaluated. Of these sites, 4 appeared suitable for recharge by ponding. The best location identified was along Pioneertown Road near Water Canyon. Anticipated percolation rates for these areas should be over 2 inches per hour. Based on discussions with the Desert Water Agency (DWA), which recharges the Coachella Valley groundwater basin with Colorado

River water, the expected water recovery should be high. After initial wetting, the estimated water recovery experienced by DWA is 95 percent of the water spread. However, even though the initial percolation rates were high, the long-term percolation rate appears to be approximately 1-inch per hour due to biological fouling. It is anticipated that the HDWD would experience similar percolation rates.

Alternatively, the existing production wells could be utilized to inject treated water. Treated water is necessary to avoid fouling of the well screens. Injection of treated water is not as common in Southern California as ponding in spreading basins. However, the injection of treated State water is currently being tested in a demonstration project in the City of Oxnard. This project involves the Metropolitan Water District of Southern California, Calleguas Municipal Water District, and City of Oxnard. Initially, significant clogging of well screen perforations was experienced when older wells were utilized. Tests with a newer well at two-thirds of the well capacity appear to be more successful; however, preliminary conclusions indicate that separate injection wells should be utilized to avoid long-term clogging problems. This result is similar to the conclusions of similar tests that utilized treated water for injection through production wells.

CONCEPTS FOR LOCAL FACILITIES TO UTILIZE STATE WATER

There appears to be 3 alternative concepts to utilize State water. These alternatives are shown schematically on the attached figures. Although there are numerous variations of these alternatives, the basic concepts are briefly discussed below:

Alternative 1 - Treatment/Spreading from Proposed MBP Delivery Point

From the proposed MBP delivery point, a water treatment plant capable of treating the entire HDWD entitlement would produce treated water which would be pumped into the 3495 pressure zone. In addition, a pipeline capable of conveying both entitlement water and surplus water would deliver untreated water to the spreading basin locations recommended in the Phase II Recharge Study.

Preliminary estimates of the incremental capital costs and incremental annual costs (including amortized capital costs) from a common point on the MBP are summarized below:

Element *	Incremental Capital Cost ($millions)
30" MBP (63,900 lf)	$ 6.7
5.0 MG MWA Reservoir	0.9
3.0 MGD WTP	3.0
BPS (350 hp)	0.4

Element *	Incremental Capital Cost ($millions)
24" Untreated Water (24,000 lf)	2.0
Spreading Basins (20 acres)	1.0
Incremental Capital Cost	$14.0 million

Element *	Incremental Annual Cost ($)
Amortized Capital Cost (8%, 30 years)	$1,244,000
WTP (3000 AF)	150,000
BPS power ($0.08/kwh)	116,000
Incremental Annual Cost	$1,510,000

*Elements common to all alternatives are omitted.

Alternative 2 - Treatment/Spreading from Revised MBP Delivery Point

In this alternative, the MBP would be terminated near HDWD's northern boundary where a portion of the water would be treated and delivered to the 3495 pressure zone. In addition, a booster pump station and pipeline capable of conveying both entitlement water and surplus water would deliver untreated water to Water Canyon where it would flow to spreading basins along the Pioneertown Road.

Preliminary estimates of the incremental capital costs and incremental annual cost (including amortized capital cost) from a common point are summarized below:

Element *	Incremental Capital Cost ($millions)
30" MBP (17,000 lf)	$ 1.8
5.0 MG MWA Reservoir	0.9
3.0 MGD WTP	3.0
16" Treated Water (14,000 lf)	0.8
BPS (750 hp)	0.8
24" Untreated Water (33,000 lf)	2.8
Spreading Basins (20 acres)	1.0
Incremental Capital Cost	$11.1 million

Element *	Incremental Annual Cost ($)
Amortized Capital Cost (8%, 30 years)	$ 959,000
Additional MWA BPS power ($0.08/kwh)	41,000
WTP (2000 AF)	100,000
BPS power ($0.08/kwh)	120,000
Incremental Annual Cost	$1,220,000

*Elements common to all alternatives are omitted.

Alternative 3 - Injection of Treated Water

This alternative is similar to Alternative 1 except that treated water would be delivered to the existing production wells through the existing distribution system. Water would be injected into the groundwater basin through these wells. To be able to receive surplus water beyond HDWD's entitlement, the water treatment plant must have a capacity greater than the other alternatives. In addition, to avoid clogging the well screens, the recharge capacity of this alternative may be limited to 4100 gpm (6600 AFY).

Preliminary estimates of the incremental capital costs and incremental annual cost (including amortized capital cost) from a common point are summarized below:

Element *	Incremental Capital Cost ($millions)
30" MBP (63,900 lf)	$ 6.7
5.0 MG MWA Reservoir	0.9
6.5 MGD WTP	6.5
BPS (550 hp)	0.6
Incremental Capital Cost	$14.7 million

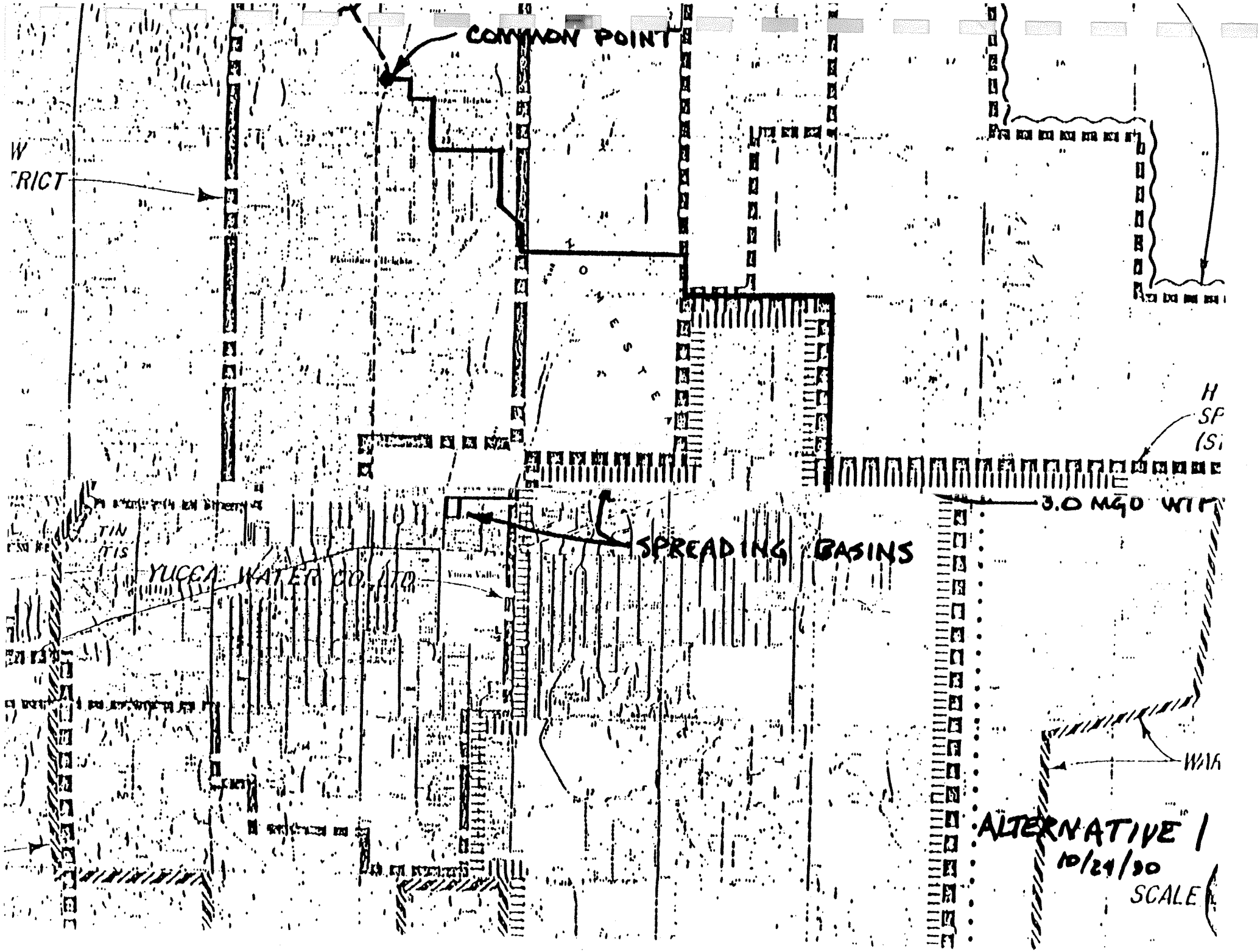
Element *	Incremental Annual Cost ($)
Amortized Capital Cost (8%, 30 years)	$1,306,000
WTP (4282 AF)	214,000
BPS power ($0.08/kwh)	166,000
Incremental Annual Cost	$1,686,000

*Elements common to all alternatives are omitted.

Based on a comparison of the incremental annual cost of the alternatives, Alternative 2 appears to be the most cost-effective alternative. In addition, this alternative recharges the groundwater basin further upgradient than the other alternatives and has the capability to utilize significantly more water than HDWD's entitlement. Accordingly, it is recommended that HDWD implement Alternative 2 and work with MWA to modify the MBP delivery concept.

LMT/kmk16

Attachments (3)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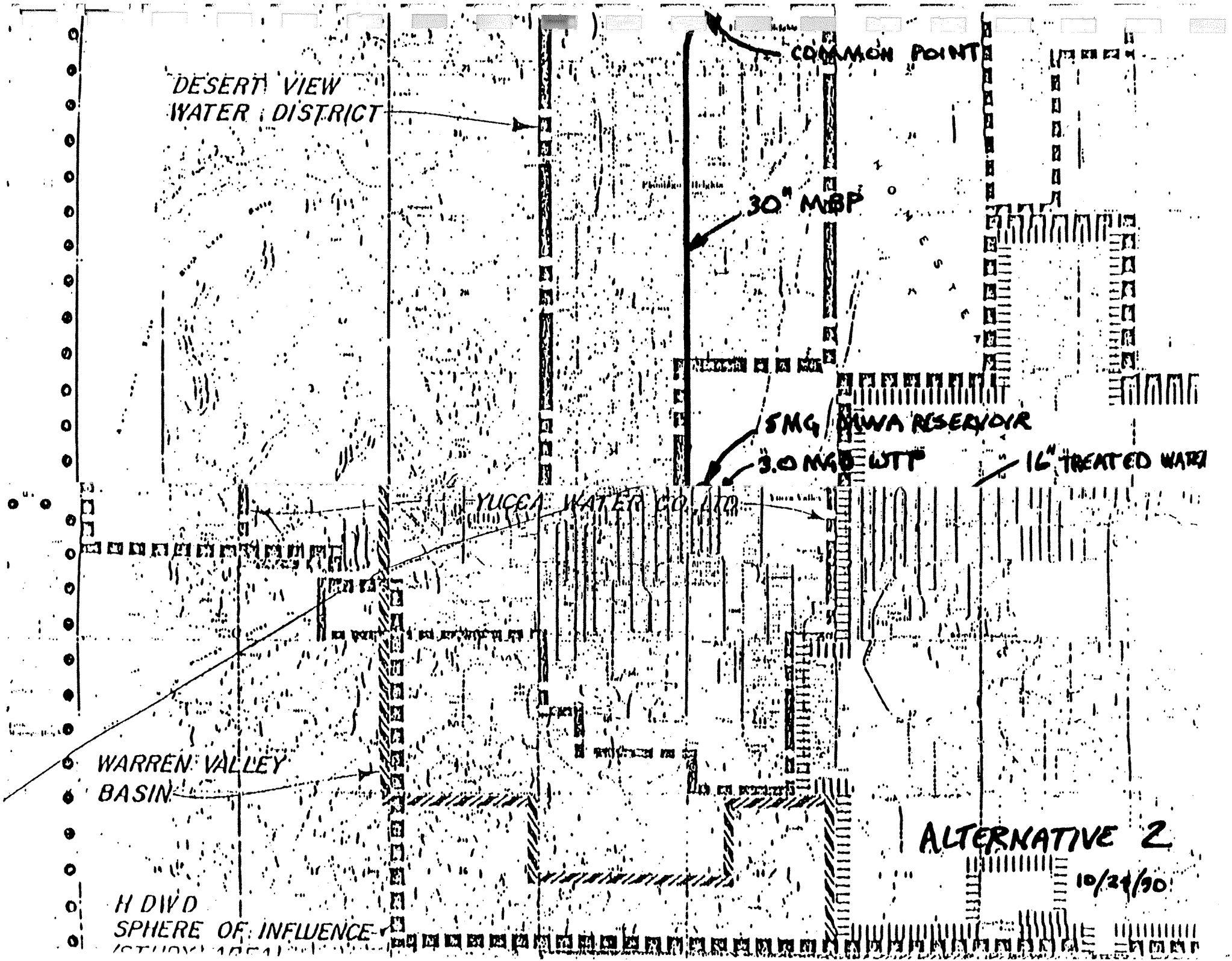
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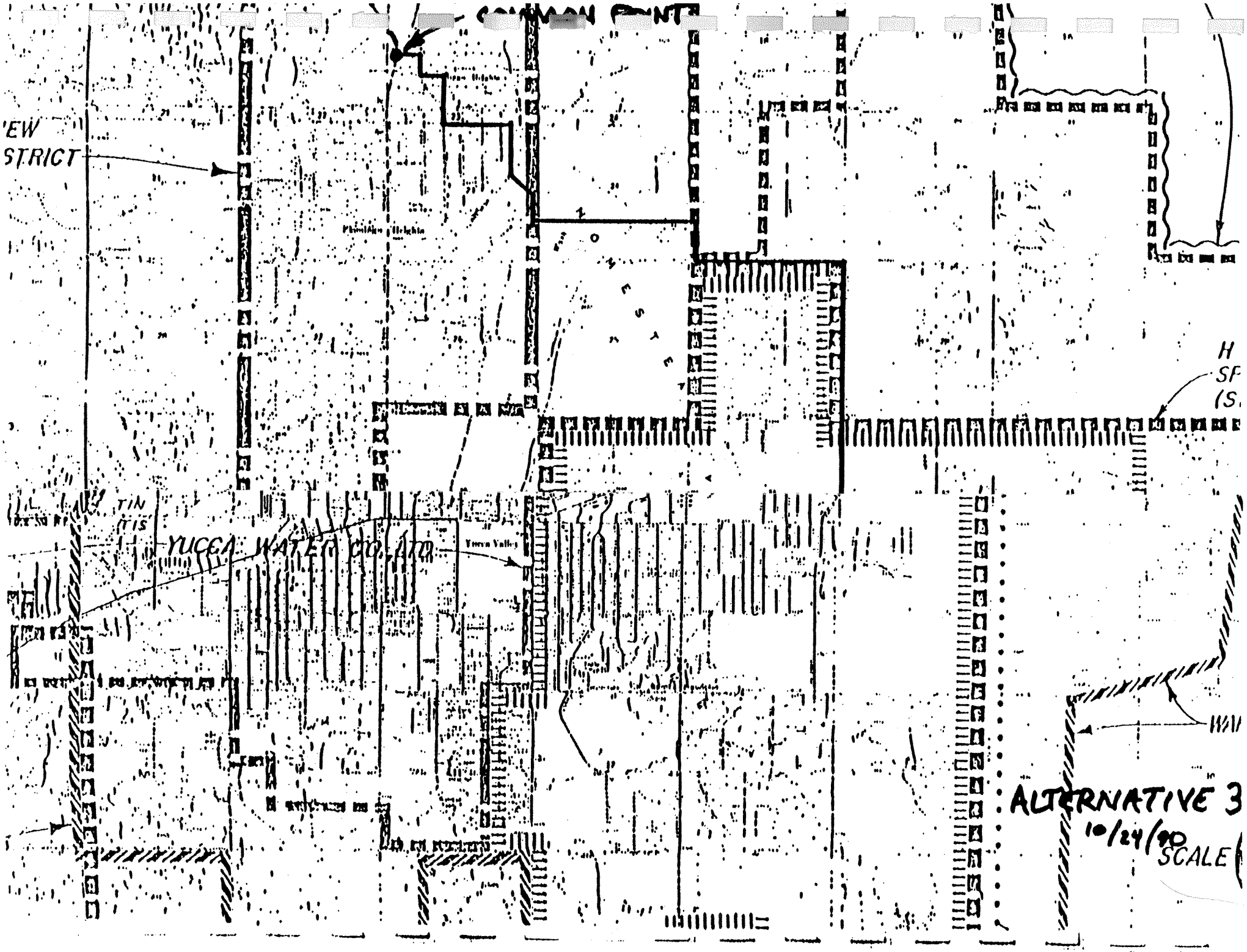
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WATERMASTER

WARREN VALLEY BASIN

YUCCA VALLEY
SAN BERNARDINO COUNTY, CALIFORNIA

WATER CONSERVATION

MANUAL

1990

Prepared By

Hi-Desert Water District
Yucca Valley, Ca

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ORDINANCE NO. 61

AN ORDINANCE OF THE BOARD OF DIRECTORS OF THE HI-DESERT WATER DISTRICT, SAN BERNARDINO COUNTY, CALIFORNIA, ESTABLISHING PROHIBITIONS AND RESTRICTIONS ON THE USE OF WATER

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF THE HI-DESERT WATER DISTRICT AS FOLLOWS:

SECTION 1. Recision

The Board of Directors of the Hi-Desert Water District hereby rescinds Ordinance No. 57 in its entirety.

SECTION 2. The Board of Directors of the Hi-Desert Water District Hereby Finds That:

A. A water shortage emergency condition continues to exist within the Hi-Desert Water District due to a water shortage caused by the continuing overdraft of the Warren Valley Basin;

B. As in all desert communities, adequate water supply is important to the longevity of the community served by Hi-Desert Water District, and all water consumers should know and act with this knowledge in regard to the use of water;

C. In order to conserve the remaining aquifer water supply for the greatest public benefit, which is prioritized in this order; for domestic use, sanitation and fire protection, and commercial necessary use not including landscape maintenance;

D. The water uses prohibited and restricted by this Ordinance are hereby determined to be nonessential.

SECTION 3. Prohibitions and Restrictions on the Use of Water.

A. No hose washing of sidewalks, walkways, driveways, parking areas, patios, porches or verandas, or any hardscape that results in runoff;

B. No water shall be used to clean, fill, operate or maintain levels in decorative fountains, unless such water is part of a recycling system;

C. No person shall permit water to leak from any facility on his or her premises;

D. No use of potable water to irrigate, water or sprinkle grass, lawns, groundcover, shrubbery, crops, vegetation

and trees between the hours of 8 o'clock a.m. and 6 o'clock p.m. during the high use season which starts April 1 and ending October 31 of each year. During this season, watering shall be allowed on the designated days of Sunday, Tuesday, and Thursday as needed.

In the low use season starting November 1 and ending March 31, watering is limited to the hours between 8 o'clock a.m. and 1 o'clock p.m. of the same Sunday, Tuesday, and Thursday designated days as needed.

E. Water shall be allowed for construction purposes, including but not limited to debrushing of vacant land, compaction of fills and pads, trench backfill and other construction uses, but shall be used in an efficient manner and not result in runoff. A representative of the owner or builder shall be on site during all water use. The use of "rainbird" type sprinklers is not recommended. Amended 7-5-90

F. Potable water shall not be used to maintain dirt roads. Amended 7-5-90

G. Restaurants shall provide water to customers only upon request.

H. Non-commercial washing of privately owned vehicles, trailers, motorhomes, busses or boats will not be permitted except from a bucket and a hose equipped with an automatic shut-off nozzle which may be used for a quick rinse.

I. No use of water for any purpose, except as provided herein, which results in flooding or runoff onto hardscape, driveways, streets, adjacent lands or into gutters.

SECTION 4. Penalty for Violation.

The penalties for violation of the prohibitions and restrictions set forth in Section 3 of the Ordinance are:

A. First Violation - Warning Citation
B. Second Violation - Written notice of second violation and warning of flow restriction device or future shutoff upon Third Violation
C. Third Violation - The General Manager may direct the installation of flow restriction device or shutoff of service for a determined period.

SECTION 5. Appeal

A. Any person wishing to appeal shall do so in writing to the District.

B. A staff committee made up of the Conservation Coordinator and the Operations Superintendent shall review and make decisions on the granting of the appeal.

C. If an applicant for appeal disagrees with the decision, the request may be appealed to the General Manager.

D. If the General Manager and the applicant are unable to reach an accord, then the request for appeal shall be heard by the Conservation Committee of the Board of Directors who shall then refer it to the Board of Directors at a regularly scheduled meeting with a recommendation for approval or denial.

E. All appeals shall be reported monthly to the Board of Directors as part of the Manager's Report.

SECTION 6. Future Restrictions

All users of water within the District's service area are hereby put on notice that further prohibitions and restrictions may hereafter become necessary, and that such users shall be subject to all further prohibitions, restrictions, rules and regulations as may be imposed.

Those changes may be instituted as resolution and shall not require the rescinding of this Ordinance as a whole but shall allow the change, through resolution, of parts.

Subsequent Emergency Orders shall supersede parts of this Ordinance when there is a conflict.

SECTION 7. Definitions

The terms user and consumer used herein shall apply to every person, firm, partnership, association, corporation, county, state or local agency, political subdivisions, district or entity of every kind within the District service area except the Hi-Desert Water District.

SECTION 8. Purpose and Intent

It is the purpose of this Ordinance to limit the use of water to beneficial purposes only and to prohibit and restrict the unnecessary and wasteful use of water except to the extent expressly authorized by the terms of this Ordinance, and this Ordinance shall be liberally construed to effectuate such purpose and intent.

SECTION 9. Ordinance Controlling

The provisions of this Ordinance shall prevail and control in the event of any inconsistency between this Ordinance and any other rule, regulation or code of this District, except as later amended by resolution or emergency rule.

SECTION 10. Effective Date

This ordinance shall be effective immediately upon its adoption.

ADOPTED this 6th day of December, 1989

President of the Hi-Desert Water District and of the Board of Directors thereof.

ATTEST:

Secretary of the Hi-Desert Water District and of the Board of Directors thereof.

(SEAL)

AMENDMENT TO ORDINANCE NO. 61 ADOPTED JULY 5, 1990, BY THE FOLLOWING VOTE:

Director Dunn	- aye
Director Flowers	- aye
Director Jordanan	- aye
Director Zarakov	- nay
Director Dalton	- aye

Section 3

E. During the hot months of July through October, all grading construction water shall either be imported from outside the District and/or the Warren Basin or nonpotable, if available.

F. Potable water from within the District shall not be used to maintain dirt roads and yards or other grounds.

STATE OF CALIFORNIA)
)
COUNTY OF SAN BERNARDINO)

I, HAROLD D. SUTTON, Secretary of the Board of Directors of t Hi-Desert Water District, DO HEREBY CERTIFY that the foregoing ordinance, being Ordinance No. 61, was duly adopted by the Board o Directors of said District at a regular meeting of said Board held on the 6th day of December, 1989, and that it was so adopted by the following vote:

AYES: Directors Dunn, Flowers, Jordan, and Zarakov

NOES: None

ABSTAIN: Director Dalton

ABSENT: None

Secretary of the Hi-Desert Water District and of the Board of Directors thereof.

(SEAL)

STATE OF CALIFORNIA)
) ss.
COUNTY OF SAN BERNARDINO)

I, HAROLD D. SUTTON, Secretary of the Board of Directors of th Hi-Desert Water District, DO HEREBY CERTIFY that the above and foregoing is a full, true and correct copy of Ordinance No. 61 of said Board and that the same has not been amended or repealed.

DATED: December 6, 1989

Secretary of the Hi-Desert Water District and of the Board of Directors thereof.

(SEAL)

RESOLUTION NO. 90-4

A RESOLUTION OF THE HI-DESERT WATER DISTRICT REQUIRING THE INSTALLATION OF ULTRA-LOW FLOW CONSERVATION FIXTURES IN ALL NEW CONSTRUCTION AND WHEN REPLACING FIXTURES IN EXISTING STRUCTURES AND UPON CHANGE OF OWNERSHIP OR USE

WHEREAS, the Warren Valley Basin is in severe overdraft and is continuing to be depleted at a rate far exceeding the ability to keep up with growing demand; and

WHEREAS, the continued rate of growth will speed up the depletion of the Warren Basin; and

WHEREAS, there is a need to reduce the impact that new services will have on our water supply; and

WHEREAS, certain household fixtures designed to reduce water use have been thoroughly tested with adequate national standards applied and are currently available; and

NOW, THEREFORE, for purposes of reducing the impact of new services on future supply, the Board of Directors of the Hi-Desert Water District does hereby ordain as follows:

SECTION 1. Requirements

(A) Prior to the issuance of a Will Serve from the Hi-Desert Water District, for both commercial and residential applicants, applicant must identify types of fixtures to be installed and sign an agreement that affirms that such fixtures will be installed. Upon completion of the project, a representative of the Hi-Desert Water District shall inspect the facilities and certify that the required and designated fixtures have been installed. Service shall be contingent upon such certification and will not be provided until such fixtures are installed and reinspected.

(B) Any building which is being substantially remodeled (ie., any building where plumbing fixtures are removed and replaced because of structural or cosmetic remodeling; or, any building which makes structural changes other than original construction affecting plumbing) shall replace existing fixtures with Ultra-Low Flow toilets or water closets, and showerheads and faucets.

(C) Prior to transfer of ownership of either commercial or residential property, all existing structures shall be retrofited, if not already so, with ultra-low flow toilets or water closets, showerheads and faucets that conform to the standards expressed in this ordinance. Prior to transfer of water service, both the transferor and the transferee shall certify in writing that the property has been retrofited in conformance with this ordinance, and service shall be transferred and continued upon inspection and certification of said property by a representative of the Hi-Desert Water District.

(D) Upon change of user of property, as in rental properties changing tenants, owner shall sign certification that said property has been retrofited, if not already so, and shall have service transferred and continued upon inspection of said property by a representative of the Hi-Desert Water District.

SECTION 2. Required certification of fixtures

The plumbing fixtures and devices required to be installed pursuant to this Ordinance shall be certified by the International Association of Plumbing and Mechanical Officials and comply with all applicable American-National Standards Institute standards.

SECTION 3. Requirements of water saving fixtures

(A) Toilets, water closets, urinals and flushometer valves designed to use a maximum of one and one-half (1.5) gallons of water per flush shall be utilized only.

(B) Showerheads, except where provided for safety reasons, shall be installed and will not allow a water flow rate in excess of 2.75 gallons per minute. The flow limitation device must be a permanent and integral part of the showerhead and must not be removeable to allow flow rates in excess of 2.75 gallons per minute.

(C) Faucets (general) installed in all lavatory, kitchen and bar sinks shall be equipped with a flow control device or aereator which will not allow a water flow rate in excess of 2.75 gallons per minute.

(D) Faucets (public restrooms) in addition to the general requirements set forth in subsection (C) above, lavatory faucets located in restrooms intended for the use by the general public shall be of the metering or self-closing type.

SECTION 4. Specific requirements for new construction

(A) Hot water recirculating units shall be required in all new construction and they must be equipped either with a timer or a thermostat for energy conservation. And all pipes shall be wrapped and insulated.

(B) All new construction prior to issuance of will serve shall submit plans to the District showing exterior landscape development and are required to comply with the low water use guidelines established by the District.

(C) Water-cooled refrigerating systems must utilize the best available technology for water savings and shall be equipped with one or a combination of the following devices:

1. Cooling tower
2. Evaporative condenser
3. An acceptable water recirculating device

(C1) The provisions of subsection (C) above, shall not apply to systems with an aggregate total of two tons or less or a rating of two horsepower or less and located at one street address. Multiple dwelling unit structures are considered as one street address. However, such systems must be equipped with:

1. Water regulation valves adjusted to use the minimum amount of water
2. Thermostats that will positively stop water flow when off

Section 5.

Allowances of variance can be set by the General Manager for a specific amount of time and until the requirement can be met if certain products are not available at the time required. But changes must be made within a 90 day period and are subject to inspection by a representative of the District.

Section 6.

In the event the building inspector finds that the plumbing situation, drainage situation is such that there is not sufficient water to flow the sewage to the septic tank, there will be an allowance made.

PASSED, APPROVED AND ADOPTED this 21st day of March, 1990

President of the Board or Directors
of the Hi-Desert Water District

ATTEST:

Secretary of the Board of Directors
of the Hi-Desert Water District

(SEAL)

Addendum to the

Warren Valley Basin Management Plan

Warren Valley Basin Watermaster
Yucca Valley, California

Revised: November, 1996

Addendum to the Warren Valley Basin Management Plan

CHAPTER 1 - EXECUTIVE SUMMARY

Since the adjudication of the Warren Valley Basin in 1977, the safe yield of the basin has always been estimated to be 200 acre feet per year. However, in 1992, the Court determined that the revised safe yield of the Basin is 900 acre feet based on studies conducted by two engineering firms; Robert Fox in conjunction with John Egan & Associates and Krieger & Stewart. The Judge ruled that the safe yield would remain at 900 acre feet per year until such time future studies prove otherwise. (para 1, page 1.1)

In 1995 the Watermaster Board of Directors was restructured and approved by the Court. The Board is currently comprised of five voting directors, which also serve as the Board of Directors of the Eli-Desert Water District; one representative from Blue Skies Country Club; one representative from the Institute of Mental Physics; and one individual representing the 16 minimal producers. (para 2, page 1.1)

The original Warren Valley Basin Management Plan (WVBMP) was adopted in January 1991. Many activities have transpired since adoption of the Plan. These activities include the following: (para 3, page 1.1)

1. In June 1990, voter-approval of the Morongo Basin Pipeline (MBP) where importation of State Project Water commenced in January, 1995.

2. Development of recharge basins to be used for recharging the WVB with State Project Water and conjunctive use water.

3. Ongoing cooperation with the San Bernardino County Flood Control District and the Town of Yucca Valley for storm water conservation concepts.

4. Restructuring of the Watermaster Board in 1995 by including representation from the 16 minimal producers. Representation of Blue Skies Country Club and the Institute of Mental Physics was restructured to include one representative of each.

5. Acquisition of supplemental water from the Bighorn-Desert View Water Agency over a five year period ending September 3, 1996.

6. Execution of a conjunctive use agreement with Mojave Water Agency for the storage of additional water into the WVB.

7. The Watermaster Board adopted Rules & Regulations outlining procedures for the Watermaster to comply with in order to perform Court directives and administer the management plan. The Rules & Regulations are updated on an as-needed basis.

A summary of management objectives, recommended program elements, implementation responsibility, and implementation schedule was developed in the W B M P and presented as Table 1-1. Table 1-1 has been revised and attached to reflect recent activities of the Watermaster and Hi-Desert Water District. (para 2, page 1.2)

In 1991, the Court adopted the W B M P with a 2% growth rate scenario based on water demand. This growth rate, also referred to as GA-2, was developed by evaluating the balance between water supply and demand over a 50 year period and the effect it would have on the Basin. The results of this water supply/demand balance for GA-2 have been revised and attached as Table 1-2. (para 4, page 1.2)

To implement the ongoing activities of the Watermaster, the Watermaster Board adopts and files with the court an annual budget. To support the annual budget, funds are generated by a three-tiered production assessment which applies to both HDWD and Blue Skies Country Club. The three-tiered production was approved by the Court in 1995. (para 2, page 1.3)

CHAPTER 2 - INTRODUCTION

As mentioned in Chapter 1, the safe yield of the basin has always been estimated to be 200 acre feet per year and subsequently revised to 900 acre feet per year by the Court in 1992. Currently extractions from the Basin are made by Hi-Desert Water District, Blue Skies Country Club, Institute of Mental Physics, and up to 16 minimal producers which were allotted 1 acre-foot per year. Yucca Water Company no longer produces water from the Basin since Hi-Desert Water District acquired the privately owned utility in 1990. (para 5, page 2.1)

Subsequent to the Watermaster Board being restructured in 1990, the Board has been restructured once more in 1995. The Watermaster Board is now comprised of five voting directors, which also serve as the Board of Directors of the Hi-Desert Water District; one representative from Blue Skies Country Club; one representative from the Institute of Mental Physics; and one individual representing the 16 minimal producers. (para 4, page 2.2)

CHAPTER 3 - GOALS AND OBJECTIVES

At the time the WVBMP was adopted in 1991, previous studies were conducted to evaluate the hydrogeologic condition of the Warren Valley Basin. Subsequently, two additional studies were conducted to determine the perennial yield of the Basin. These studies are referred to as the "Perennial Yield Study of the Warren Valley Basin" by Robert Fox and John Egan & Associates, completed in 1991 and the "Warren Valley Basin Safe Yield Study" by Krieger & Stewart, completed in 1991. (para 1, page 3.1)

Although the 1977 adjudication judgement declared the safe yield of the Basin to be 200 acre-feet per year from precipitation and runoff, the Judge determined that the safe yield was 900 acre feet per year. His judgement was based on more recent studies conducted by Robert Fox and John Egan & Associates and Krieger & Stewart. (para 2, page 3.2)

The collection of water level and water extraction data on a basin wide basis is a continuing task of the Watermaster. In the perennial study conducted by Robert Fox and John Egan & Associates, it was estimated that the Warren Valley Basin contained approximately 53,000 acre-feet of remaining extractable water in 1992. (para **3,** page 3.2)

CHAPTER 4 - WATER REQUIREMENTS

In recent years the total demand on the WVB has been approximately 3,500 acre-feet, of which 2,812 AF is produced by HDWD, 585 AF by BSCC, 80 AF by IMP, and up to 16 AF by 16 minimal producers authorized by the court to extract 1 acre-foot per year. (para 2, page 4.1)

Due to conservation efforts first implemented in 1989 by HDWD, water production per connection and water use per capita has decreased from 1986 through 1990. According to the most recent Water Supply Master Plan prepared by Egan (1995), the current HDWD per capita use is 0.15 acre feet per year (AFY). The total current population HDWD serves is 24,342. There are currently 8,437 service connections in the HDWD service area which equates to 9,546 residential and commercial units. One service connection is capable of providing water service to an excess of one residential unit (i.e. an apartment building). (para 3, page 4.1)

Existing Water Sources

Currently, a major source of water for the Greater Yucca Valley area is the WVB which has a court determined annual recharge of 900 acre-feet per year. The apparent source of the WVB recharge is precipitation; runoff from its limited watershed, and artificial recharge of State Project Water (SWP). (para 2, page 4.2)

The HDWD service area is currently served by 15 operating wells within the WVB. Water storage is accomplished by 16 above-ground welded steel reservoirs with a total usable capacity of

12.66 million gallons. In addition, BSCC, IMP, and the minimal producers have their respective wells which produce water from the WVB. (para 4, page 4.2)

Mainstream Well

In 1987, HDWD contracted with the Mainstream Water Development Company to locate and develop a well outside the WVB that is capable of producing 800 GPM. Subsequently, the proposed well site was placed within the Sphere of Influence of the Desert View Water Agency, one of the predecessor agencies to the Bighorn-Desert View Water Agency (BDVWA). This well was successfully drilled on Bureau of Land Management property. By pumping 330 days per year and 18 hours per day, the well can produce 850 AF from the Means Valley Basin, which much of HDWD's service area overlies. (para 3, page 4.3)

State Water Project

SWP water is an additional source of water for the greater Yucca Valley area. The service area of HDWD is located within Division 2 of the Mojave Water Agency (MWA). Division 2 (Improvement District M) has an entitlement of 7,257 AFY of SPW or 1/7 of MWA's allocation. HDWD has an entitlement to 59% (4,282 AF) of the amount allocated to Division 2. The other participating agencies within Division 2 include Joshua Basin Water District, Bighorn-Desert View Water Agency, and the County of San Bernardino. MWA is currently negotiating the purchase of additional State Project allotment with Berrenda Mesa Water District of 25,000 AF. When completed, HDWD will be entitled to an additional 2,107 AFY. SPW is being imported to the area via the Morongo Basin Pipeline, a $52 million project consisting of approximately 71 mile, 36 and 30 inch pipeline beginning at the California Aqueduct in Hesperia and terminating at a regulatory reservoir located at Warren Vista Avenue and Aberdeen Drive in Yucca Valley. The capacity of the pipeline is nearly 11,000 AFY allowing for delivery of excess water when available. In June 1990 more than a two-thirds of the voters approved the financing plan for the Morongo Basin Pipeline. (para 4, page 4.3)

SPW entitlements are subject to water availability and susceptible to delivery reductions during drought years and thus, are not completely reliable sources. For planning purposes, it is estimated that overall deliveries of SPW will vary from 75% to 80% of water ordered on a year to year basis.(para 5, page 4.3)

In January 1995, HDWD started receiving SPW via the Morongo Basin Pipeline and the 24 inch Hi-Desert Pipeline Extension from the terminating reservoir on Warren Vista and Aberdeen to Yucca Valley . Two percolation ponds were constructed to recharge this water into the WVB. The first percolation site (Site No. 7) is located on Crestview Drive and Old Woman Springs Road containing approximately 6 acres of recharge area. The second site (Site No. 6), with approximately 4 acres, is located on Sunnyslope Drive between Sage Avenue and Old Woman Springs Road. Since the percolation ponds are relatively new, the maximum recharge capability remains undetermined.

It is also anticipated that these sites may provide future opportunity to recharge storm water runoff. (para 5, page 4.4)

Water Supply Planning

For planning purposes, this WVB management plan shall be based on 50 year planning horizon. A comparison of projected supplies and demands for a 2% growth scenario is shown in Table 1-2. In 1992, water stored in the WVB was conservatively assumed to be 53,500 AF. The negative values in the "supply less demand" column represent WVB overdraft while the positive values represent the amount of excess water available for recharge. (para 4, page 4.5)

Water demands will be maintained within the amounts described in the 2% growth scenario. Lower growth rates would allow additional WVB recharge; however, increased groundwater levels could also be achieved by the interagency conjunctive use such as the HDWD and MWA conjunctive use agreement. It should also be noted that these growth evaluation could accommodate more rapid building construction if the existing water users reduced their consumption voluntarily or through HDWD's plumbing retrofit program. (para 4, page 4.6)

CHAPTER 5 - IMPORTED WATER

State Project Water started flowing into Yucca Valley in January of 1995 through the Morongo Basin Pipeline. In order to utilize the State Project Water, HDWD constructed two percolation ponds to recharge this water into the WVB. The first percolation site (Site No. 7) is located on Crestview Drive and Old Woman Springs Road with an approximate recharge area of 6 acres. The second site (Site No. *6)*, with approximately 4 acres, is located on Sunnyslope Drive between Sage Avenue and Old Woman Springs Road. Since the percolation ponds are relatively new, the maximum recharge capability remains undetermined pending more well data. (para 4, page 5.1)

HDWD has a yearly State Project Water entitlement of 4,282 acre-feet per year. MWA is currently negotiating for the purchase of additional State Project allotment from the Berrenda Mesa Water District of 25,000 AF. When completed, HDWD will be entitled to an additional 2,107 AFY. In addition, HDWD has executed a conjunctive use agreement with MWA. This agreement provides the opportunity to import an additional 10,000 acre feet of SWP water through the Morongo Basin Pipeline for recharge into the Warren Valley Basin over a period of time. Although MWA is storing this water into the basin, only HDWD may extract it for its use in the future during times of drought and a shortage of SWP availability. (para 5, page 5.2)

State Project Water is being imported to the area via the Morongo Basin Pipeline, a $52 million project consisting of approximately 71 mile, 36 and 30 inch pipeline beginning at the California Aqueduct in Hesperia and terminating at a regulating reservoir located at Warren Vista Avenue and

Aberdeen Drive in Yucca Valley. The capacity of the pipeline is nearly 11,000 AFY allowing for delivery of excess water when available. (para 2, page 5.3)

CHAPTER 6 - WATER RECLAMATION

Because the Yucca Valley area is un-sewered and on septic systems, a complete wastewater collection, treatment and reclamation system would be necessary to utilize this water source. To evaluate the feasibility of this potential program element, HDWD has contracted the engineering firm of Montgomery Watson to prepare a master plan for wastewater collection, treatment and reclamation. In 1993, Montgomery Watson completed Phase 1 of the wastewater master plan. By the first quarter of 1997, it is anticipated that Phase 2 will be completed. It should be noted, however, that sewerage facilities not only provide water supply benefits but also reduce current wastewater disposal costs (i.e. seepage pumping) and protect groundwater quality. (para 2, page 6.4)

Recently, Hi-Desert Water District was included in a bill passed by the U.S. House of Representatives for providing partial funding of the wastewater system. Grant funds in the amount of $3,750,000 were included in the bill. Other funding sources are also being evaluated such as the State of California's Revolving Fund Program. (para 2, page 6.5)

CHAPTER 7 - GROUNDWATER RECHARGE/BANKING

Availability of Stormwater

The court determined that the natural recharge of the Warren Valley Basin is 900 acre-feet per year. Because rainfall in the Yucca Valley area is infrequent but occasionally of high intensity, the most feasible approach to capture and recharge of stormwater appears to be the construction of small temporary earth dikes within existing drainage courses. During low intensity storms, runoff would be retained behind these small dams and recharge the groundwater basin. During higher intensity storms, these small dams would wash away, thereby not impeding the flood control purposes of the drainage courses. This water conservation approach is used commonly throughout Southern California. Currently the Hi-Desert Water District is working jointly with the Town of Yucca Valley and the County of San Bernardino Flood Control District to utilize these methods for capturing stormwater runoff. One project currently in progress is the installation of an outlet by the County of San Bernardino at the Old Woman Springs Creek Channel. With the installation of the outlet, the District will be able to install a pipeline from the outlet to the percolation site no. 6 and capture a portion of the storm water for recharge into the basin. (para 3, page 7.2)

State Water Entitlement

Hi-Desert Water District is entitled to 4,270 acre-feet per year of State Project Water. In January 1995, HDWD started receiving SPW via the Morongo Basin Pipeline. Two percolation ponds were constructed to recharge this water into the WVB. The first percolation site (Site No. 7) is located on Crestview Drive and Old Woman Springs Road containing approximately 6 acres of recharge area. The second site (Site No. *6),* with approximately 4 acres, is located on Sunnyslope Drive between Sage Avenue and Old Woman Springs Road. In addition, MWA is currently negotiating for the purchase of additional State Project allotment from the Berrenda Mesa Water District of 25,000 AF. When completed, HDWD will be entitled to an additional 2,107 AFY. (para 2, page 7.4)

Interagency Conjunctive Use

In 1994 HDWD executed a conjunctive use agreement with MWA. This agreement provides the opportunity to import additional SWP water through the MBP for recharge into the Warren Valley Basin. Although MWA is storing this water into the basin, only HDWD may extract it for its use in the future during times of drought and a shortage of SWP availability. As a result of the agreement, it is anticipated that 10,000 acre-feet of water will be recharged over a period of time in addition to the District's yearly allotment. (para 4, page 7.6)

CHAPTER 8 - WATER CONSERVATION

One of the primary goals of the Hi-Desert Water District is to actively pursue a conservation program that ultimately reduces current extractions from the Warren Valley Basin and minimizes the need for additional imported water supplies. The following conservation programs have been implemented since the Warren Valley Basin Management Plan was adopted in 1991: (para 3, page 8.1)

1. Household Water Awareness Program - In 1995, the Hi-Desert Water District adopted this program to provide conservation information to customers at their home. By making an appointment, a District representative visits with customers and instructs them how to read their meter, how to check for leaks, and much more. Each session normally consumes an average of one hour. Upon completion, the customer is provided with a pamphlet with conservation information.

2. Adoption of a Landscape Ordinance - In 1995, The District adopted a landscape ordinance which applies to all new and rehabilitated landscape areas greater than 500 square feet for industrial, commercial, recreational projects, and developer installed landscaping. The ordinance establishes water budgets and requires water audits to assure that the irrigation system is operating efficiently. The water budget is allotted based on water tolerant plants and turf. If the budget is exceeded in any given year, then a penalty water rate is applied which is under consideration.

3. Installation of a CIMIS Station - In 1996, Hi-Desert Water District jointly with Mojave Water Agency and the Town of Yucca Valley installed a weather station in Yucca Valley to assist organizations with high landscape water needs. The weather station will provide evapotranspiration data to their irrigation systems and control the amount of watering on an as-needed basis, thus conserving water.

CHAPTER 9 - BASIN OPERATING PLAN

Recommended Role of the Watermaster

As an entity established by the Superior Court of San Bernardino County, the Watermaster is responsible for formulating a plan and program for a physical solution to the Basin. According to this judgement, the overdraft plan must also include provisions for the administration of the program. A summary of management objectives, recommended program elements, implementation responsibility, and implementation schedule was developed in the WVBMP and presented as Table 1-1. (para 2, page 9.2)

Projected Water Requirements

For the recommended 50 year planning period, the balance between current and anticipated water supplies and various scenarios of projected demands is presented in Table 1-2. This evaluation is based on existing water supplies as well as the current activities to obtain additional water supplies or to reduce water demands through conservation. (para 3, page 9.4)

CHAPTER 10 - PUBLIC EDUCATION

Educating the public on District and Watermaster activities remains a priority for the Hi-Desert Water District. For fiscal year 1996-97, The District allocated approximately $20,000 for public education. Recent activities implemented by the District include the following: (para 4, page 10.1)

1. Century Cable television commercials emphasizing the amount of State Project Water the District is purchasing, the District's Household Water Awareness Program, and drought tolerant planting.

2. Internet service where information about the District is available to computer users all around the world.

3. Cinema slides where the public is informed of the District's purchase of State Project Water and other activities.

4. Water conservation signs placed at each entry to the Town of Yucca Valley to emphasize the importance of water conservation in the community.

5. Museum exhibit to display useful information of Hi-Desert Water District including the purchase of State Project Water, water quality, water conservation, etc.

CHAPTER 11 - REVENUE PROGRAM

To effectively implement the activities outlined in the WVBMP, the Watermaster must have sufficient funding. Currently all funding for the Watermaster is derived by a three tiered production assessment. Both Hi-Desert Water District and Blue Skies Country Club are obligated for the first two tiers up to their respective production allotments as provided for in the 1977 Judgment. The third tier primarily applies to Hi-Desert Water District in order to supplement any shortfall of revenues derived from the first two tiers. (para 2, page 11.1)

Activities included in the 1996-97 budget include administration, secretarial, accounting, meter reading, engineering, legal, directors fees, audit report and miscellaneous expenses.

CHAPTER 12 - IMPLEMENTATION PLAN

A summary of management objectives, recommended program elements, implementation responsibility, and implementation schedule was developed in the WVBMP and presented as Table 1-1. Table 1-1 has been revised and attached to reflect recent activities of the Watermaster and Hi-Desert Water District.

Table 1-1

Summary of the Recommended Management Plan

Recommend Program Element		Implementation Responsibility	Implementation Schedule
Goal 1.	**Manage extractions from the Basin to provide a dependable and cost effective long-term water supply for the Yucca Valley area.**		
1.1	Develop groundwater resources on the Mesa	HDWD	Ongoing
1.2	Import State Project Water through the MBP	HDWD	Ongoing
1.3	Maintain annual water demand growth below or at 2% (GA-2)	HDWD	Ongoing
1.4	Evaluate opportunities to obtain groundwater along the MBP	Watermaster	Ongoing
1.5	Evaluate opportunities to obtain additional SWP entitlements or develop water supplies in other areas	Watermaster/HDWD	Ongoing
1.6	Develop a computerized groundwater flow model	Watermaster/HDWD	Intermediate-term
1.7	Evaluate opportunities for interagency conjunctive use of the Basin	Watermaster/HDWD	Ongoing
Goal 2.	**Equitably distribute available groundwater and imported water supplies.**		
2.1	Restrict the drilling of new wells unless water service cannot be provided	Watermaster	Ongoing
2.2	Establish a water shortage contingency plan	HDWD	Ongoing

Short-term (1-2 years) Intermediate-term (3-5 years) Long-term (beyond 5 years)

Table 1-1

Summary of the Recommended Management Plan

Recommend Program Element		Implementation Responsibility	Implementation Schedule
Goal 3. Conserve storm waters tributary to the Basin.			
3.1	Construct retention ponds in Yucca Creek, flood control channel and its tributaries	HDWD	Long-term
3.2	Evaluate additional recharge basins	Watermaster/HDWD	Intermediate
Goal 4. Encourage and promote water conservation and water reclamation.			
4.1	Water conservation programs	HDWD	Ongoing
4.2	Complete wastewater master plan	HDWD	Short-term
Goal 5. Manage and protect groundwater quality for potable uses.			
5.1	Water quality monitoring program	HDWD	Ongoing
5.2	Identify potential sources of contamination	HDWD	Ongoing
5.3	Prepare a groundwater quality protection plan	HDWD	Intermediate-term

Short-term (1-2 years) Intermediate-term (3-5 years) Long-term (beyond 5 years)

Table 1-1

Summary of The Recommended Management Plan

Recommend Program Element		Implementation Responsibility	Implementation Schedule
Goal 6. Monitor activities affecting the Basin.			
6.1	Basin monitoring plan	Watermaster	Ongoing
6.2	Prepare a groundwater quality protection plan	HDWD	Intermediate-term
6.3	Prepare an annual report of Basin condition and implementation plan status	Watermaster	Ongoing
Goal 7. Conduct public education and information programs.			
7.1	Expand the current public information program	HDWD	Ongoing
7.2	Develop an educational resource center	HDWD	Short-term
7.3	Participate in special events	HDWD	Ongoing
7.4	Establish a conservation awards program with the schools	Watermaster/HDWD	Short-term
Goal 8.	**Generate sufficient revenues to achieve the objectives of the Watermaster.**		
8.1	Establish production and special assessments to recover the cost of Watermaster activities	Watermaster	Ongoing

Short-term (1-2 years) Intermediate-term (3-5 years) Long-term (beyond 5 years)

Table 1-1

Summary of the Recommended Management Plan

Recommend Program Element	Implementation Responsibility	Implementation Schedule
Goal 9. Perform court-mandated directives.		
A. Develop physical solution		
9.1 Develop groundwater resources on the Mesa	HDWD	Ongoing
9.2 Continue State Water Project (SWP) importation	HDWD	Ongoing
9.3 Evaluate opportunities to obtain groundwater along the MBP	HDWD	Ongoing
9.4 Evaluate opportunities to obtain additional SWP entitlements or develop water supplies in other areas	HDWD	Ongoing
B. Report progress to the Court		
9.5 Prepare an annual report of Basin conditions	Watermaster	Ongoing

Short-term (1-2 years) Intermediate-term (3-5 years) Long-term (beyond 5 years)

TABLE 1-2

PROJECTED WATER SUPPLY AND DEMAND (Acre Feet)

(GROWTH SCENARIO 2%)

YEAR	SAFE YIELD	SWP	M.S. WELL	INTERTIE	STORM WATER	C.U. WATER	TOTAL SUPPLY	DEMAND* 2%	SUPPLY LESS DEMAND	EST. BASIN STORAGE
										53500
1992	900	0	0	77	0	0	977	3279	-2302	51198
1993	900	0	85	512	0	0	1497	3509	-2012	49186
1994	900	0	408	573	0	0	1881	3644	-1763	47423
1995	900	2885	450	659	0	0	4894	3438	1456	48879
1996	900	5127	454	679	0	0	7160	3493	3667	52546
1997	900	6390	800	0	0	0	8090	3549	4541	57087
1998	900	5112	801	0	0	1000	7813	3607	4206	61293
1999	900	4793	802	0	0	1000	7495	3665	3830	65123
2000	900	4793	803	0	0	1000	7496	3725	3771	68894
2001	900	4793	804	0	105	1000	7602	3786	3816	72711
2002	900	4793	805	0	105	1000	7603	3848	3755	76466
2003	900	4793	806	0	105	1000	7604	3911	3693	80159
2004	900	4793	807	0	105	0	6605	3976	2629	82788
2005	900	4793	808	0	105	0	6606	4042	2564	85352
2006	900	4793	809	0	105	0	6607	4109	2498	87851
2007	900	4793	810	0	105	0	6608	4177	2431	90281
2008	900	4793	811	0	105	0	6609	4247	2362	92643
2009	900	4793	812	0	105	0	6610	4319	2291	94934
2010	900	4793	813	0	105	1000	7611	4391	3220	98154
2011	900	4793	814	0	105	1000	7612	4466	3146	101300
2012	900	4793	815	0	105	1000	7613	4541	3072	104372
2013	900	4793	816	0	105	1000	7614	4618	2996	107368
2014	900	4793	817	0	105	0	6615	4697	1918	109285
2015	900	4793	818	0	105	0	6616	4778	1838	111124
2016	900	4793	819	0	105	0	6617	4859	1758	112881
2017	900	4793	820	0	105	0	6618	4943	1675	114556
2018	900	4793	821	0	105	0	6619	5028	1591	116147
2019	900	4793	822	0	105	0	6620	5115	1505	117652
2020	900	4793	823	0	105	0	6621	5204	1417	119069
2021	900	4793	824	0	105	0	6622	5294	1328	120396
2022	900	4793	825	0	105	0	6623	5387	1236	121633
2023	900	4793	826	0	105	0	6624	5481	1143	122776
2024	900	4793	827	0	105	0	6625	5577	1048	123824
2025	900	4793	828	0	105	0	6626	5675	951	124776
2026	900	4793	829	0	105	0	6627	5775	852	125628
2027	900	4793	830	0	105	0	6628	5876	752	126380
2028	900	4793	831	0	105	0	6629	5980	649	127028
2029	900	4793	832	0	105	0	6630	6086	544	127572
2030	900	4793	833	0	105	0	6631	6194	437	128009
2031	900	4793	834	0	105	0	6632	6305	327	128336
2032	900	4793	835	0	105	0	6633	6417	216	128552
2033	900	4793	836	0	105	0	6634	6532	102	128654
2034	900	4793	837	0	105	0	6635	6649	-14	128640
2035	900	4793	838	0	105	0	6636	6768	-132	128508
2036	900	4793	839	0	105	0	6637	6890	-253	128255
2037	900	4793	840	0	105	0	6638	7014	-376	127878
2038	900	4793	841	0	105	0	6639	7141	-502	127377
2039	900	4793	842	0	105	0	6640	7270	-630	126747
2040	900	4793	843	0	105	0	6641	7402	-761	125986
2041	900	4793	844	0	105	0	6642	7536	-894	125091
2042	900	4793	845	0	105	0	6643	7673	-1030	124061
2043	900	4793	846	0	105	0	6644	7813	-1169	122892
2044	900	4793	847	0	105	0	6645	7956	-1311	121581
2045	900	4793	848	0	105	0	6646	8101	-1455	120126
2046	900	4793	849	0	105	0	6647	8250	-1603	118523

* Demand includes the following:

HDWD Production
Blues Skies 585 **AF**
Institute of Mental Physics 80 **AF**
Minimal Producers 16 **AF**