SALT CREEK RANCH

WATER CONSERVATION PLAN

WATER CONSERVATION PLAN
FOR
SALT CREEK RANCH

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TABLE OF CONTENTS

PAGE NO.

INTRODUCTION 1

PURPOSE 2

WATER SUPPLY 3

SALT CREEK RANCH WATER USE 3

WATER CONSERVATION MEASURES 6

INDOOR MEASURES 6

Ultra-Low Flow Toilet 6

Ultra-Low Flow Showerhead 6

Faucet Aerators 7

Water Efficient Clothes Washer 7

Water Efficient Dishwasher 7

Water Pressure Reduction 7

OUTDOOR MEASURES 8

Water Conservation Guide 8

Low Water Use Landscaping 9

Xeriscaping 9

Soil Moisture Sensors 9

Automatic Timer Shutoffs for Manual Hose System 9

Water Reclamation 10

WATER CONSERVATION COSTS 10

WATER RATE 11

TYPICAL WATER CONSERVATION PLAN 15

RECOMMENDED WATER CONSERVATION PLAN 17

RECOMMENDATIONS 17

REFERENCES 18

LIST OF TABLES

PAGE NO.

Table 1 Salt Creek Ranch Housing and Population 4

Table 2 Projected Water Use for Salt Creek Ranch 5

Table 3 Costs for Water Conservation Devices 12

Table 4 Salt Creek Ranch Water Conservation Measures 13

Table 5 Potential Water Conservation Plan for Salt Creek Ranch 16

Introduction

In recent years, due to the ongoing drought conditions in California, the subject of water conservation has been given increased attention. The growing awareness of the need and value of water conservation has been sparked by local and regional water purveyors concerned about meeting the water demands of their customers during a time where water supplies have diminished. Water conservation provides an alternative approach to the problem of finding new water sources to meet the water demand for a proposed community. The intent of water conservation is to manage water demand so that the customers receive adequate service from less water.

Much has been done to educate consumers about the serious implications of a long-term drought and the need for water conservation, but there is a practical limit to the percentage reduction of water use in established communities. This limit is a result of the types of plumbing fixtures installed in existing homes as well as the difficulty in altering consumers' established pattern of water use. Any water conservation effort, voluntary or mandatory, requires the cooperation of the public. Public information should be utilized to inform and convince the consumer that a change in personal water use habits is in everyone's best interest. The best long term results are expected to be achieved by educating children in water conservation.

In recent years, the private development sector has become more attuned to the concerns of water availability and has recognized the value of addressing water conservation issues throughout planned development projects. By incorporating low water use plumbing fixtures, promoting drought tolerant landscaping, and providing educational materials to homeowners within the development project, private developments can do much to cultivate an interest in water conservation and establish new patterns of water use. These efforts can have significant impacts with regard to reducing the need for securing and importing larger quantities of water for use in San Diego County.

Purpose

This report presents a review of the presently available technologies and practices which result in water conservation in primarily residential developments. The purpose of this report is to determine which of these technologies and practices are economically efficient and most cost effective to implement within the Salt Creek Ranch project.

Based on an analysis of cost versus benefit, this report will present recommendations for water conservation measures which should be incorporated into the planning and design of the Salt Creek Ranch project. This water conservation plan will identify the incremental costs associated with installing water saving technologies and present the long-term benefits with regard to water use reduction for the project.

Proposed development within the Salt Creek Ranch project boundary includes mixed density residential, one school, one community purpose facility, a fire station, neighborhood and community parks, and open space. Because the majority of this project consists of residential development, the emphasis of this report will be on urban water control devices.

Approximately half of the water used by residences in California is used outdoors. For this reason, several options are presented that serve to reduce outdoor water use. The latest water conservation devices will be presented along with an evaluation of their feasibility. In addition to evaluating residential water conservation devices, the benefits of using reclaimed water for the irrigation of parks and other landscaped areas will be discussed.

Although not covered in detail, there are several secondary benefits to conserving water that should be kept in mind when reviewing material in this report. These benefits include reduced sewage flows, reduced natural gas use, and reduced electricity use. Using less water in the shower, for example, reduces the amount of water input into the sewer system and reduces the amount of energy required to heat the water.

Water Supply

The Otay Water District (OWD) is the local water agency which will provide potable water service and reclaimed water to the Salt Creek Ranch project. The OWD owns and operates a water reclamation plant which has a capacity of 1.3 mgd. The Otay Water district relies solely on the San Diego County Water Authority (SDCWA) for water supply. The SDCWA is the largest member agency of Metropolitan Water District of Southern California, which is the primary source of domestic water in Southern California.

Salt Creek Ranch Water Use

Water use is affected by, among other things, climate and the type of development. In California, recent trends towards the construction of more multi-unit housing, the general reduction in residential lot size, and a number of local agency water conservation programs in effect are all tending to reduce per capita water consumption. Total water use within the boundaries of the San Diego County Water Authority is approximately 241 gallons per capita per day and total use within the boundaries of the Otay Water District is estimated at 223 gallons per capita per day[1].

These values take into account commercial, agricultural, and industrial water uses as well as residential use. The City of San Diego Water Utilities Department calculated that an average single family household used approximately 372 gallons per day in 1989. Assuming three persons per household, this equates to an average residential water use of 124 gallons per person per day.

Table 1 provides the proportion of single family (L and LM) and multi-family (LM and M) housing along with an estimate of population density for the Salt Creek Ranch project.

Table 1
Salt Creek Ranch
Housing and Population

Residential Development Type	Acres	Dwelling Units	Household Size	Population
L	387.3	820	3.0	2,460
LM	266.6	1,150	3.0	3,450
*LM	35.0	168	2.5	420
M	47.6	524	2.2	1,153
TOTAL		**2,662**	**2.80 (avg.)**	**7,483**

* LM use at highest allowable density of LM category.

Table 2 gives the projected water demand for the project broken down by land use and residential density. Note that of the total estimated water use of 1.78 mgd, there is the potential to meet 0.29 mgd of this demand with reclaimed water.

Table 2
Projected Water Use for Salt Creek Ranch

Type of Development	Area of Development, acres	Number of DUs	Development Water Duty Factor	Development Water Demand, gdp	% of Area to be Irrigated	Amount of Land to be Irrigated, acres	Irrigation Water Duty Factor, gpd/ac	Irrigation Water Demand, gpd	Total Average Water Demand, gpd
RESIDENTIAL									
L	387.3	820	525 gpd/du	430,500	10	41.1	3,570	146,727	577,227
LM	266.6	1,150	450 gpd/du	517,500	10	26.7	3,570	95,319	612,819
*LM	35.0	211	375 gpd/du	79,125	15	5.3	3,570	18,921 **	98,046
M	47.6	524	225 gpd/du	117,900	15	7.1	3,570	25,347 **	143,247
Schools	13.1		2,000 gpd/ac	26,200	20	2.6	3,570	9,282 **	35,482
Community Purpose Facilities	3.0		2,000 gpd/ac	6,000	20	0.6	3,570	2,142 **	8,142
Fire Station	1.0		2,000 gpd/ac	2,000	10	0.1	3,570	357 **	2,357
Parks	29.3		2,000 gpd/ac	58,600	75	22.0	3,570	78,540 **	137,140
Parkway Landscaping	7.5				100	7.5	3,570	26,775 **	26,775
Open Space	35.1				100	35.1	3,570	125,307 **	125,307
Total		**2,662**		**1,239,825**				**505,155 ** **	**1,744,980**
Total Average Potable Water Demand									**1,487,807**
Total Average Reclaimed Water Demand									**293,811**

* LM use at highest allowable density of LM category.
** Proposed to be irrigated with reclaimed water.

Water Conservation Measures

Implementing water conservation measures before the construction of a new development project provides an opportunity to include measures that might not be feasible or cost effective to retrofit within a developed area. There are several measures described below that would be expensive to retrofit, but may be cost effective if included in the initial construction. From the Department of Water Resources[2], statistics on several indoor and outdoor water conservation measures were obtained and are listed along with a brief description below. The statistics represent results from surveys of manufacturers of the various water conservation devices. Indoor and outdoor measures are discussed separately.

INDOOR MEASURES

Ultra-Low Flow Toilet - The ultra-low flow toilet is designed to reduce water used for toilet flushing to approximately 1.6 gallons per flush. This compares to a standard low flush toilet which is rated at 3.5 gallons per flush. Section 17921.3 of the California Health and Safety Code requires that all toilets in buildings constructed after January 1, 1983 use a maximum of 3.5 gallons per flush. This standard will be used as a basis for evaluating the benefits of installing ultra-low flow toilets. The toilet is the largest single indoor use of water, so large savings can be realized by installing ultra-low flow toilets.

Ultra-Low Flow Showerhead - Ultra-low flow showerheads reduce the flow rate for showers to 1.5 gallons per minute, whereas standard low flow showerheads use 2.75 gallons per minute. California regulations require that all showerheads sold in the state have a maximum flow rate of 2.75 gallons per minute. This standard will be used as a basis for evaluating the benefits of installing ultra-low flow showerheads.

Faucet Aerators - Aerators can save water by reducing both the flow rate and splash, thereby increasing wetting effectiveness. Standard faucets have average rated flow rates of 3.25 gpm and faucets with aerators have a flow rate of about 2.75 gpm. This translates into a daily savings of about 0.5 gallons per person.

Water Efficient Clothes Washer - Efficient clothes washers are designed to reduce the amount of water used per load. Efficient clothes washers may use about 45 gallons per load, whereas standard washers use about 55 gallons per load. Clothes washers are often supplied by the owner so it is often times their decision whether or not to install the more efficient machines.

Water Efficient Dishwasher - Efficient dishwashers, like clothes washers, are designed to reduce the amount of water used per load. Efficient dishwashers use about 11 gallons per load versus standard dishwashers that use about 14 gallons per load.

Water Pressure Reduction - Pressure reducing valves are used to lower water consumption through system leakage by reducing the pressure head to between 50 and 60 psi. Lower water pressure also reduces the flow rate from faucets in wash basins resulting in more efficient use of the water. This device is mainly useful in areas where water pressure is greater than 60 psi.

OUTDOOR MEASURES

Water Conservation Guide - It is often a good idea to produce a landscape watering guide and distribute it to the homeowners of a new development project. The guide is designed to educate the homeowner on the efficient irrigation of landscaping. Studies have shown that increased public awareness and information is very important in an effective water conservation plan[3]. Besides efficient irrigation, a home water conservation guide can include information on general conservation techniques, such as listing commonly available drought resistant plants, and explaining how to install efficient irrigation systems such as drip irrigation.

A sample of some tips that should be included in a water conservation guide are listed below:

- Select drought resistant plants.
- Irrigate early in the morning.
- Use drip irrigation as opposed to sprinklers to reduce evaporation losses.
- Build basins around trees and plants to avoid water run off.
- Use mulch around plants to absorb and retain water better.
- Sweep sidewalks and patios rather than hosing them off.
- Do not leave water running while washing car.
- Do not leave water running while washing dishes, shaving, or brushing teeth.

Check for and fix leaks in pipes, faucets, and toilets.

This list is not intended to be all inclusive, but should provide some ideas on what to include in a water conservation guide.

Low Water Use Landscaping - The purpose of this measure is to replace the familiar ornamental plants imported from the east coast with plants that are more adapted to the hot and dry conditions of California. These plants require less water and, if irrigated properly, will result in water savings. This measure is especially attractive in new developments because low water use plants are no more costly to plant than the familiar ornamental plants. Under this measure, turf area is not reduced; the substitution is made in the border areas surrounding the turf. Water savings from low water use plants is estimated to be 7.5 percent of outdoor water use.

Xeriscaping - Xeriscaping involves several principles that all serve to reduce water use. These principles include reduction of turf area, use of low water use plants, efficient irrigation, use of mulches to reduce evaporation from the soil, and appropriate maintenance. The limiting of turf size provides the most significant savings of water. Xeriscaping, while still attractive, can cut outdoor water use by 50% if maintained properly.

Soil Moisture Sensors - Soil moisture sensors for automatic electronic systems permit irrigation only when the turf needs water. Soil moisture sensors can produce impressive water savings while permitting accurate and unattended irrigation. Soil moisture sensors are particularly effective for large turf areas such as those typically found in parks and multi-family residential developments. It is estimated that this device can reduce outdoor water use in these areas by 25%.

Automatic Timer Shutoffs for Manual Hose Systems - In the event that a home is manually watered, automatic timer shutoffs are available for hoses so that it becomes convenient to irrigate more accurately. The hose is shut off automatically after the desired amount of time rather than when the homeowner

returns to shut it off. The effectiveness of this measure is further increased if the homeowner has a knowledge of how long to irrigate. This device is expected to reduce outdoor water use by 15% for houses using hoses to irrigate.

There are other types of irrigation systems available for use, but statistics on their effectiveness in saving water were not readily available. An automatic timer controlled sprinkler system is available and serves to eliminate the possibility of forgetting to turn off the sprinklers. Drip irrigation systems are also available. These systems reduce evaporation losses and losses due to wind blown spray. In the past few years there have been amendments to the zoning ordinance which establishes regulations and guidelines to conserve water on outdoor landscaping in projects requiring County approval. This trend is expected to continue to control the amount of water that will be used outdoors in residential projects.

Water Reclamation - Using reclaimed water for irrigation can conserve large amounts of potable water. Water reclamation can defer or eliminate the need to develop new fresh water supplies. Within the Salt Creek Ranch project, the major opportunities to conserve potable water by irrigating with reclaimed water are provided by the neighborhood and community parks.

Water Conservation Costs

Costs for the various water saving measures are listed in Table 3. The benefit over the service life of a measure is divided by its incremental cost to determine the benefit/cost ratio, as shown in Table 4. The higher the benefit of a measure is relative to its cost (benefit/cost ratio), the more feasible it is to implement. A benefit/cost ratio of 1.0 implies that the benefits received from a measure are equal to the cost of implementing that measure. Therefore, all water conservation measures in Table 4 with a benefit/cost ratio greater than 1 will more than pay for themselves in water savings if implemented. Also, remember that additional benefits are received by reduced sewage volume and energy

savings. All cost data was revised to January 1991, dollars using an ENR-CCI-LA of 5995[4].

Water Rate

The water rate used to estimate the potable water savings in this study is $1.10 per 100 cubic feet. This rate represents an average that was computed from Section 25 of the Otay Water District's Code of Ordinances. Under this ordinance, the monthly charge is $0.91 per 100 cubic feet for the first 500 cubic feet of use and $1.16 per 100 cubic feet for water use from 500 cubic feet to 2,500 cubic feet. An average water use of 2,000 cubic feet per month was used to establish the average cost of potable water for the Salt Creek Ranch project. Rates differ according to land use, but since Salt Creek Ranch is predominantly residential, $1.10 per 100 cubic feet was considered appropriate. Based on the Code of Ordinances, the current cost of reclaimed water from Otay Water District is $1.17 per 100 cubic feet.

Table 3

Costs for Water Conservation Devices
(All Costs in January 1991 Dollars)

Item	Standard Cost, dollars	Low Water Use Cost, dollars	Average Number per DU	Incremental Cost, dollars/DU
INSIDE				
Toilet	99	131	1.8	58
Showerhead	3	10	1.7	12
Faucet Aerator	----	3	3.4	10
Clothes Washer	517	633	1	116
Dishwasher	480	513	1	33
Pressure Reducing Valve	----	165	1	165
OUTSIDE				
Low Water Use Plants	930	930	----	----
Xeriscape	1,550	5,170	----	3,620
Soil Moisture Sensors	----	110	1	110
Automatic Timer Shutoffs for Manual Hose Systems	----	20	2	40
Water Conservation Guide	----	2	1	2
Water Reclamation	0	960,000	----	960,000*

* Total estimated cost for the entire Salt Creek Ranch project.

Table 4

Salt Creek Ranch Water Conservation Measures
(All Costs in January 1991 Dollars)

Water Conservation Measure	Function	Water Savings Per Residence (gpd/DU)	Incremental Cost ($/DU)	Service Life (years)	VALUE OF WATER SAVED		Benefit/Cost Ratio (Column 5/ Column 2)
					Annual Savings per Residence ($/DU/Yr)	Savings over Service Life ($/DU)	
		1	2	3	4	5	6
INSIDE							
Ultra Low Flow Toilet	Reduces Flush Volume	22.7	58	25	12.18	304.50	5.3
Ultra Low Flow Shower	Reduces Shower Flow Rate	14.2	12	15	7.62	114.30	9.5
Faucet Aerator	Appearance of Greater Flow	1.4	10	7	0.76	5.32	0.53
Efficient Clothes Washer	Reduces Flow/Load	8.5	116	12	4.57	54.84	0.47
Efficient Dishwasher	Reduces Flow/Load	1.4	33	12	0.76	9.12	0.28
Pressure Reducing Valve	Reduces Flow Rate	8.5	165	20	4.57	91.40	0.55
OUTSIDE							
Low Water Use Landscape	Lowers Demand for Watering	25.6	0	20	13.72	274.40	(very high)
Xeriscaping	Lower Demand Landscaping	85.2	3,620	20	45.73	914.60	0.25
Soil Moisture Sensors	More Efficient Watering	42.6	110	15	22.87	343.05	3.1
Automatic Timer Shutoff	Precise, Timed Watering	25.6	40	5	13.74	68.70	1.7
Water Conservation Guide	Increases Watering Efficiency	28.4	2	5	15.24	76.20	38.1

Explanation and Sample Calculations for Table 4

Column 1 = Savings per capita x 2.80 capita/DU average.

Column 2 = Estimated cost per dwelling unit, See Table 3.

Column 3 = Estimated service life.

Column 4 = Column 1 x ($1.10/100 cf) x (1 cf/7.48 gallon) x (365 day/year)

Column 5 = Column 3 x Column 4

Column 6 = Benefit/cost ratio = Column 5/Column 2

Note: cf = cubic feet
1 cf = 7.48 gallons

Typical Water Conservation Plan

Table 5 shows some of the water conservation devices and their combined savings if they are implemented. Notice that not all of the conservation measures in Table 4 are listed in Table 5. This is because some of the measures, especially outdoor measures, are overlapping in purpose. Because an item is not listed in Table 5, however, does not imply that it is not feasible.

The purpose of Table 5 is to provide a typical water conservation plan for a single family dwelling unit and to demonstrate the potential water savings associated with such a plan. Note that implementing these devices results in a water savings of 110.7 gallons per household per day while maintaining a benefit/cost ratio of 2.3. In addition, it is estimated that the Salt Creek Ranch project could save an additional 293,811 gallons of potable water per day by using reclaimed water for irrigation of parks, selected landscaping, streetscapes, and open space.

Table 5

Potential Water Conservation Plan for Salt Creek Ranch
(All Costs in March 1990 Dollars)

Water Conservation Measure	Water Savings Per Residence (gpd/DU)	Incremental Cost Per Residence ($)	Savings Over Service Life ($/DU)	Benefit/Cost Ratio
Ultra Low Flow Toilet	22.7	58	304.50	5.3
Ultra Low Flow Shower	14.2	12	114.30	9.5
Faucet Aerator	1.4	10	5.32	0.53
Efficient Clothes Washer	8.5	116	54.84	0.47
Efficient Dishwasher	1.4	33	9.12	0.28
Pressure Reducing Valve	8.5	165	91.40	0.55
Low Water Use Landscaping	25.6	0	274.40	(Very High)
Water Conservation Guide	28.4	2	76.20	38.1
TOTAL	110.7	396	930.08	2.3

Recommended Water Conservation Plan

It is clear that implementing the recommended water conservation measures would result in significant water savings and would be cost-effective for the Salt Creek Ranch project. Aside from pressure reducing valves which are required by the Otay Water District, it is up to the developer and homeowner to implement measures that will result in water savings. The developer is limited in how much he can make the homeowner do, but the developer should set a good example and make the homeowner aware of the need to conserve water.

RECOMMENDATIONS

We recommend that in the development of the Salt Creek Ranch project, the following water conservation measures should be included:

- Ultra low flow toilets.
- Ultra low flow showerheads.
- Faucet aerators.
- Pressure reducing valves.
- Water conservation guide.
- Use of reclaimed water where possible.
- Drought resistant plants in parks and public landscaping.
- Effective irrigation system such as soil moisture sensors or drip irrigation.

The water conservation guide should urge the homeowner to use low water use landscaping, install automatic timers on hoses, and choose an effective irrigation system.

REFERENCES

1. San Diego County Water Authority, 1989 Annual Report.

2. State of California, Department of Water Resources, Water Plan, Water Conservation Assumptions, October 1989.

3. American Water Works Association Journal, Volume 79, No. 3, March 1987.

4. Engineering News Record Journal, January 1991.