Appendix J Facility Plan

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DOMESTIC WATER, IRRIGATION WATER WASTEWATER AND RECYCLED WATER FACILITY PLAN

ARROWHEAD SPRINGS PROPERTY

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SECTION 1

INTRODUCTION

The historic Arrowhead Springs Hotel and surrounding properties are planned for development through a Specific Plan to be processed through the City of San Bernardino as a policy document or regulatory document for the City to use as a guide for the development. The Arrowhead Springs Hotel and surrounding 1,916 acres of property is under ownership of the Campus Crusade for Christ. This hotel and properties was once the headquarters of the Campus Crusade for Christ prior to moving to Florida.

The water resources of the area include hot and cold springs, surface streams and groundwater. The hot springs known to the mission fathers as "Aqua Caliente" (hot water) and was to be believed to have healing qualities. This is recorded in a letter from Fray Zalvida in 1820 to a fellow priest that Fr. Jouquin (Nuez) "continues troubled with his diseases, and today (Sunday) he was unable to say Holy Mass. He is thinking of going, in a short time, to the sierras in order to take the baths of Aqua Caliente; he will stay there at least 15 days." In 1857, Dr. David Noble Smith along with John Brown developed the springs and created the Spa at Arrowhead Springs in 1863 also known as a Hygienic Sanitarium.

The first Arrowhead Hotel was built by David Noble Smith around 1868, and Messrs. Darby and Lyman of Los Angeles, who had been leasing the Hotel from Dr. Smith, built the second Arrowhead Springs Hotel in 1885. This beautiful wooden structure was the largest hostelry in San Bernardino County. A third Arrowhead Springs Hotel was constructed in 1905, by San Bernardino businessman Seth Marshall and he started bottling "Arrowhead Springs Water", actually water from Waterman Creek, to supply customers in southern California and Arizona. In 1930, the water supply changed from Waterman Creek to springs at the 5300-foot level in Strawberry Creek to upgrade the changing water quality in Waterman Creek due to the development of homes nearby.

In 1939, a new concrete hotel was constructed and after a number of owners, it was sold to Campus Crusade For Christ in 1962 and they still own the hotel and property at the present time.

The naturally formed Arrowhead on the mountainside northerly of the hotel has withstood many fires and in 1957, the United States National Forest Service designated the natural Arrowhead a "Landmark Geological Area."

During the periods of the hotel ownerships and Campus Crusade For Christ, the water resources have been expanded and restored and are in operation as of today. These resources will play an active part in the water supply for the proposed development. The water supply will include drinking water for domestic uses and non-potable irrigation water for landscape maintenance and aquatic features such a lakes, fountains and other

types.

The development, which will utilize about 506 acres of the 1916 acres of the ownership, will require the generated wastewater to be treated to a degree whereby effluent will be available for unrestricted use. These uses will allow the community to be "water-wise", self-contained.

This facility planning document will estimate the quantity of water required for both domestic and irrigation water use, the amount of wastewater generated and the use of the treated wastewater. Upon obtaining the quantities of water needed for each specific use, the water source will be identified. The type of wastewater treatment will be utilized and the "fail safe" facilities identified will be discussed and the location of the units determined.

The distribution of the domestic water will be described with potential water pressure zones identified with sizing the distribution reservoirs and estimates for fire suppression included. Booster stations with pumping capacity and redundant facilities will be determined. If surface water or certain springs are used, the use of treatment prior to domestic use will be discussed along with the type of treatment and shown on the appropriate plates herein.

The irrigation water facilities will be identified and the use of stream flows in conjunction with recycled water from the wastewater plant will be determined. A backbone system of the irrigation water sources, distribution system and pumping facilities along with capacities will be identified.

This report provides a comprehensive document for developing the water resources and the facilities to transport the water to the areas of proposed use as defined within the Specific Plan. The utilization of the recycled water from a wastewater treatment plant will be shown for a self-contained system for the Arrowhead Springs Specific Plan of development.

Alternative water supply sources and wastewater services will be discussed with the City of San Bernardino being an alternate provider to the on-development of wet-utilities. The alternate sources will be described and a preliminary "Opinion of Probable Construction Costs" shown for each alternate. A discussion of current policies and ability to serve will be included.

PLATE 1-1
LOCATION MAP

SECTION 2

STUDY AREA

The study area will consist of the 506 acres of development area and the water resources areas of the balance of the 1916 acres of the Arrowhead Springs ownership. There are areas outside the ownership that may be studied for water supplies and possible discharge of some wastewater. This will be determined during the study process.

The delineated description of the Study Area is shown on Plate 2-1, Study Area.

The Study Area will include the proposed development areas and the natural areas that will not include human occupation. The natural areas could include water resources and the routing for water conveyance pipelines but; these will be shown on other relative plates herein.

The man-made and natural landmarks such as highways will be shown so the reader may orientate himself with the location of areas within the Study Area. The sectional surveys and the periphery of the ownership of the Arrowhead Hotel properties will also be shown on Plate 2-1.

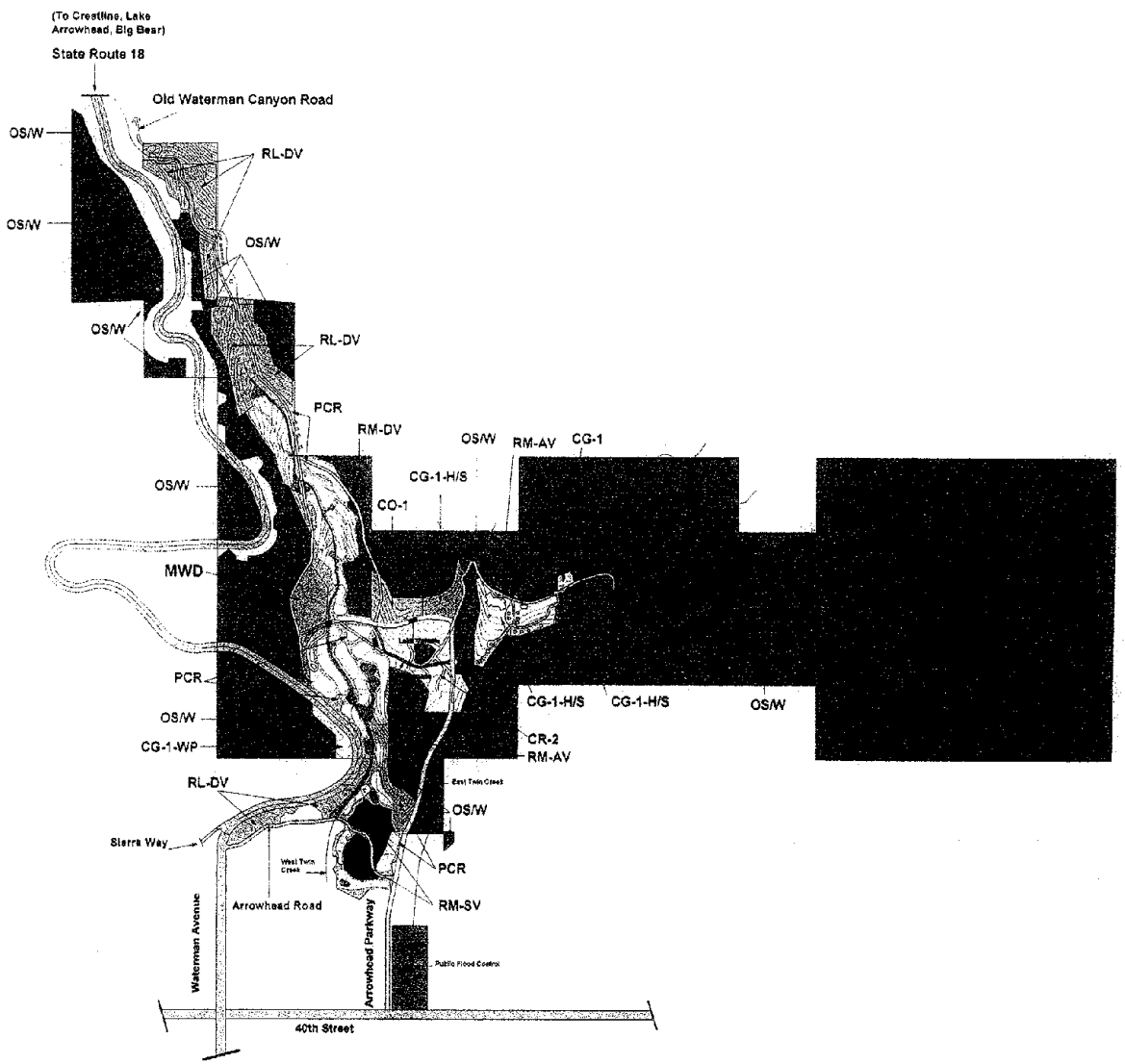

Plate 2-1

PROPOSED LAND USE

DISTRICT	LAND USE
CG-1-H/S	Historic Hotel and Conference Center
CG-1-H/S	Spa, Health Club and Historic Pool
RM-AV	Residential Medium - Attached Villages
RM-DV	Residential Medium - Detached Villages
RM-SV	Residential Medium - Semi-Villages
RL-DV	Residential Low - Detached Villages
PCR	18-Hole Golf Course
CG-1-H/S	Interpretive Hotel
CO-1	Corporate Office Complex
CR-2	Village Walk (Retail Complex with Apartments)
CG-1-WP	Windy Point (Restaurant/Wine Tasting)
CG-1	Commercial General
OS/W	Open Space/Watershed
MWD	Metropolitan Water District

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SECTION 3
DOMESTIC WATER

3.01 GENERAL

The domestic water system for the Arrowhead Springs development area will be provided, through either the West Twin Creek Water Company or the Del Rosa Mutual Water Company, wholly owned companies of the developer, a combination of both or other entity. The water supply for the domestic water system will be from wells in the San Bernardino Basin, groundwater on-site and from stream flows, properly treated to meet State of California. Department of Health Services, Drinking Water Division, Standards and Requirements. A network of distribution mains will conduct the water to the places of use and the construction of reservoirs, booster stations, wells treatment plant and appurtenances is necessary so the system will provide a high level of service to the consumers.

3.02 WATER SYSTEM DESIGN CRITERIA

The water system will be designed to provide adequate water service during the peak hour of the maximum day or during the maximum day plus fire suppression flows. The design locations of minimum service will be the most remote and highest elevation of service in the respective Pressure Zones. To establish this level of service, the following criteria, is used:

• Average annual daily water use per person	200 gallons
• Average daily water use per commercial bldg.	0.4 gpd/sq. ft. floor
• Average daily water use per office bldg.	0.5 gpd/sq. ft. floor
• Hotels	1.0 gpd/sq. ft. floor
• Senior facilities	400 gpd/unit
• Average day, maximum day demand	1.50 x average day
• Maximum day of maximum month demand	2.25 x average day
• Peak hour of maximum day	4.50 x average day
• Minimum hour of maximum day	0.50 x average day
• Equalization storage	0.40 x maximum day
• Emergency Storage	1.00 x average day
• Fire flow-residential	Est: 3000 gpm for
• Fire flow-commercial	2 hour duration
• Minimum pressure-peak hour	45 psi
• Maximum pressure – static	125 psi
• Occupancy per dwelling unit	3.2 people

The hotels are assumed to have a floor area of 1,250 square feet of gross area per occupant room. The senior facility is estimated to require 400 gallons per day per living unit.
All pumping plants will have the sufficient capacity to pump at the design rate of flow with the highest capacity pump not operating. Design pumping capacity will have the capacity to pump the maximum day quantity over an 18-hour period or less. The velocity of the water in the distribution mains should not exceed five (5) feet per second during the peak hour flows. During fire flow periods, the velocity can be 10 feet per second but, the residual water pressure, away from the fire hydrant, cannot drop below 20 psi (46 feet of head.).

All water system facilities shall be designed and constructed in accordance with the applicable standards of the American Water Works Association, The State of California and the water system operating entity.

3.03 WATER SOURCE

The water supply for the project can come from wells existing on the property, stream flows in little used watersheds, existing springs and wells constructed off-site in the San Bernardino Basin. The Arrowhead Springs Project has wells on the property currently providing domestic water to the facilities and has provided domestic water during periods of habitation in the past. There are streams within little used watersheds, which provided water to the hotel in the past and could be outfitted to deliver future water for domestic use. Prior to use, the stream water must be treated in accordance with the State Of California "Surface Water Rule", prior to placing the water in the domestic water system.

A detailed examination of the water sources will be discussed later on in this document to provide the necessary water supply for daily needs and redundancy in the domestic water system.

3.04 DOMESTIC WATER REQUIREMENTS

The water requirements are a result of population and land use within a given service area. The historical water use within the service area has been to the Arrowhead Springs Hotel, outbuildings and support facilities. The hotel has generally received water from Coldwater Canyon Stream and various wells on the property. The criteria shown in Section 3.02 above will be applied to the planned development to create the water requirements. The planned development water requirements will be converted to "Equivalent Dwelling Units" so a common unit is created for all water use facilities. An equivalent dwelling unit is equal to the projected water use of a single-family home. In this respect, the Equivalent Dwelling Unit is calculated to be 200 gallons per day per person, times an occupancy of 3.2 people per household or 640 gallons per day, annual average water use.

The development areas for domestic water, use has been broken down into three basic

categories: Residential, Commercial and Hotel/Spa. Within these categories, a further breakdown is done to refine the water requirement. Other water uses will be determined for irrigation, recycled water, water features and water uses, other than domestic uses.

The Equivalent Dwelling Units and Average Annual Daily Water Use are shown in Table 3-1 below:

Table 3-1
Facility Description, EDU's And Average Annual Domestic Water Requirement

Facility Description		EDU's	Water Req'd (Gallons per Day)
RESIDENTIAL			
RL-North		76	48,640
RL-South		12	7,680
RM-Residential		665	425,600
RM-Senior		188	120,320
CG-1-VW		297	190,080
	TOTALS	1,238	792,320
COMMERCIAL AND OFFICE			
RM-Commercial		8	5,120
CG-1-VW		125	80,000
CG-1-WP		13	8,320
CO-1		195	124,800
PCR		14	8,960
	TOTALS	355	227,200
HOTEL / CONFERENCE CENTER			
CG-1-H/S	250 Rooms + 8 Units	504	322,560
CG-1-H/S	50 Rooms	98	62,720
CG-1-H/S	300 Rooms	586	375,040
	TOTALS	1,188	760,320

SUMMARY OF DOMESTIC WATER DEMANDS

Facility Description		EDU	Water Required
Residential		1,238	792,320
Commercial and Office		355	227,200
Hotel/Spa		1,188	760,320
	TOTALS	2,781	1,779,840

PLATE 3-1
PROPOSED LAND USE

The average annual daily domestic water requirement is 1,779,840 gallons per day. The annual water requirement is 694,641,600 gallons or 1,993 acre-feet of water per year.

3.05 PROJECT PHASING

The draft Specific Plan for the Arrowhead Springs Development proposes a two (2) step Phasing Plan. Project Phasing is generally dictated by the demand for housing, commercial space and the orderly expansion of utilities. The projected phasing is shown in Table 3-2, Project Phasing. There is no timetable for the phasing since development occurs as demands needs are shown.

Table 3-2
Project Phasing

PHASE ONE

Residential
- RL-North
- RL-South
- RM-Residential
- RM-Senior
- CG-1-VW

Commercial-Office
- RM-Commercial
- CG-1-VW
- PCR
- Public Golf Course

Hotel/Spa
- CG-1-H/S-250 Rooms + 8 Units
- CG-1-H/S-50 Rooms

PHASE TWO

Commercial-Office
- CO-1
- CG-1-WP

Hotel/Spa
- CG-1-H/S-300 Rooms

Project phasing is shown on Plate 3-2 herein.

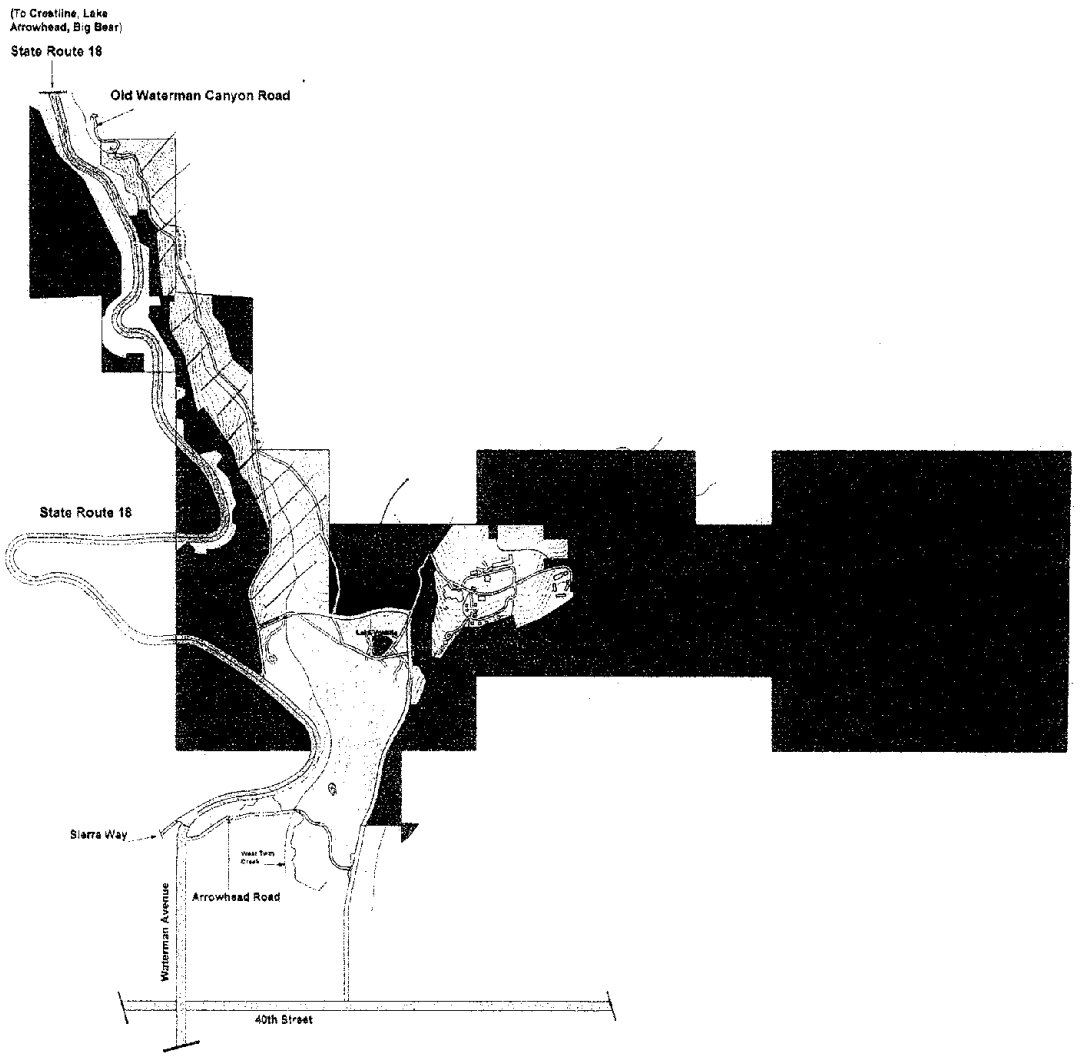

Plate 3-2

Proposed Phasing Plan

LEGEND

Phase 1

Phase 2

Natural Open Space

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3.06 DOMESTIC WATER PRESSURE ZONES

The domestic water distribution system will require multiple water pressure zones to accommodate the changing topography in the service area where domestic water will be provided. Pressure Zones will receive a supply of water to meet the maximum day of the maximum month requirement for that pressure zone plus the pressure zones that are higher. Pressure zones will operate from a distribution reservoir that will hold water for peak hour flows, emergency flows and fire suppression flows. After the peak demands are met from the reservoir, the water will be replaced at the rate of flow of the maximum day.

There is an elevation change of over 1,520 feet, requiring 8 separate pressure zones. The zones will be designed with pressures from 45 psi to 125 psi in each zone. There will be multiple reservoirs and pressure-regulating stations, which provide water for domestic use, localized irrigation, fire suppression and emergency conditions. There will be booster stations, which will raise the water from the lower reservoirs to the upper reservoirs serving the higher zones.

A Hydraulic Schematic is provided in Plate 3-3, showing the elevations of the zones, the bottom and tops of the proposed reservoirs, booster station locations and capacities and capacities for the reservoirs.

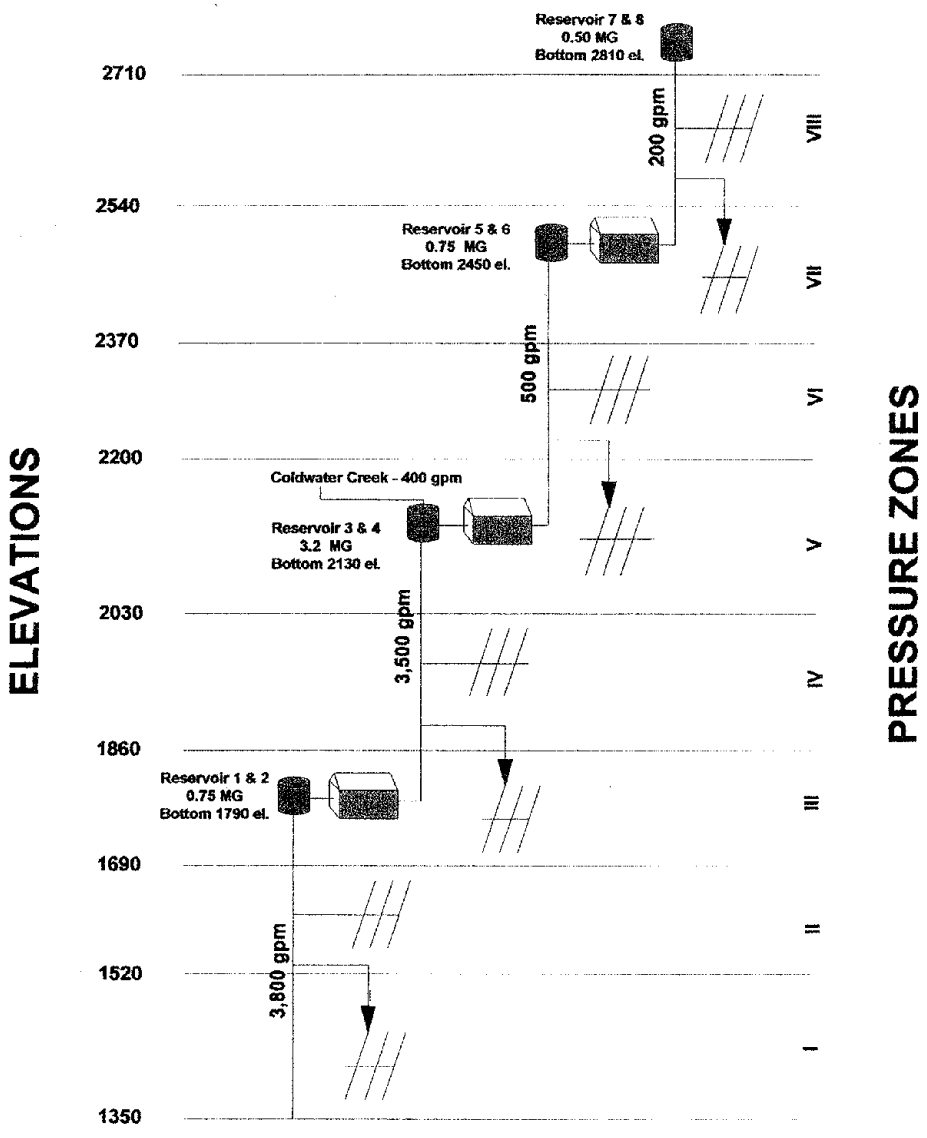
Table 3-3 shows the Pressure Zone, Equivalent Dwelling Units (EDU's) estimated within that pressure zone and the Average Daily Water Requirement for that particular Pressure Zone.

Table 3-3
Pressure Zones and Water Requirement

Pressure Zone	EDU's	Average Annual Daily Water Requirement- GPD
I	77	49,280
II	110	70,400
III	385	246,400
IV	1,933	1,237,120
V	200	128,000
VI	35	22,400
VII	10	6,400
VIII	31	19,840
	2,781	1,779,840

The pressure zone components of land use were developed as follows:

Plate 3-3



SCHEMATIC HYDRAULIC

ARROWHEAD SPRINGS WATER SYSTEM

LEGEND:

- Proposed Reservoir
- Proposed Booster Station
- Proposed Pressure Regulator Station

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Table 3-4
Pressure Zone Components and EDU Distribution

Pressure Zone	Component	EDU	Total EDU
I	RL-South	2	
I	RM	75	77
II	RL-South	10	
II	RM	100	110
III	CG-1-VW-Residential	247	
III	CG-1-VW-Commercial	125	
III	CG-1-WP	13	385
IV	RM	105	
IV	RM-Residential	185	
IV	RM-Commercial	8	
IV	RM-Senior	188	
IV	CG-1-VW-Residential	50	
IV	CG-1-H/S-250 Rooms	504	
IV	CG-1-H/S-50 Rooms	98	
IV	CG-1-H/S-300 Rooms	586	
IV	CO-1	195	
IV	PCR	14	1,933
V	RM	100	
V	RM- Residential	100	200
VI	RL- North	35	35
VII	RL- North	10	10
VIII	RL- North	31	31
		TOTAL	2,781

3.07 WATER SOURCE REQUIREMENTS

The water system within the Study Area will receive water from the water sources to the distribution system. The distribution system is within mountainous terrain and the differences in elevation, requires eight (8) separate zones to maintain adequate working pressures. Pressure Zone No. IV has the largest water requirement and the others are smaller. To reduce the number of storage reservoirs, two (2) zones will be combined, the upper zone will operate directly from the reservoir and the lower zone will operate through pressure regulating valves. Water supplies to the pressure zones will be from pumps, supplying water

sufficient to replace the water during the maximum day of the maximum month during an 18-hour period. The water supply will be from surface flows treated at an on-site facility, existing and proposed wells.

Table 3-5 illustrates the water requirement for the proposed development, by a combination of pressure zones.

Table 3-5

Total Development Area Water Source Requirements

The water source requirements for each combination of Pressure Zones will be equal to the quantity to re-fill the reservoir from usage on the maximum day of the maximum month during an eighteen (18) hour pumping period.

Pressure Zones No. I and No. II Combined

Pressure Zone	Average Daily Demand (gallons per day)	Maximum Day Demand (gallons per day)
I	49,280	110,880
II	70,400	158,400
III	246,400	554,400
IV	1,237,120	2,783,520
V	128,000	288,000
VI	22,400	50,400
VII	6,400	14,400
VIII	19,840	44,640
TOTALS	1,779,840	4,004,640

Rate-of –flow required over an 18-hour period: 4,004,640 / (18x60) = 3,708
USE 3,800 gallons per minute.

Pressure Zones No. III and No. IV Combined

Pressure Zone	Average Daily Demand (gallons per day)	Maximum Day Demand (gallons per day)
III	246,400	554,400
IV	1,237,120	2,783,520
V	128,000	288,000
VI	22,400	50,400
VII	6,400	14,400
VIII	19,840	44,640
TOTALS	1,660,160	3,735,360

Rate-of-flow required over an 18-hour period: 3,735,360 / (18x60) = 3,459,
USE 3,500 gallons per minute.

Pressure Zones No. V and No. VI Combined

Pressure Zone	Average Daily Demand (gallons per day)	Maximum Day Demand (gallons per day)
V	128,000	288,000
VI	22,400	50,400
VII	6,400	14,400
VIII	19,840	44,640
TOTALS	176,640	397,440

Rate-of-flow required over an 18-hour period: 397,440 / (18x60) = 368
USE 500 gallons per minute.

Pressure Zones No. VII and No. VIII Combined

Pressure Zone	Average Daily Demand (gallons per day)	Maximum Day Demand (gallons per day)
VII	6,400	14,400
VIII	19,840	44,640
TOTALS	26,240	59,040

Rate-of-flow required over an 18-hour period: 59,040 / (18x60) = 55,
USE 200 gallons per minute.

Water Sources

The rate of flow for the development at completion is estimated to be three thousand eight hundred (3,800) gallons per minute. There are several water supply sources available to the Arrowhead Springs Development. The available supplies are as follows:

Source	Estimated Supply
Coldwater Creek	500,000 gallons per day
Strawberry Creek	1,000,000 gallons per day
On-site Wells	71,000 gallons per day
Off-Site-Wells	2,533,000 gallons per day
TOTAL	4,104,000gallons per day

The off-site-wells would be constructed in the San Bernardino Basin southerly of the development. The perennial flow in these streams has flowed into the San Bernardino Basin for a number of years. The San Bernardino Basin was adjudicated in the Orange County lawsuit but the Arrowhead Springs area was outside of the limits of the Basin. Since both the West Twin Creek (Waterman Canyon Creek) and East Twin Creek (Coldwater Creek and Strawberry Creeks) are pre 1914 water rights, Arrowhead Springs would discharge water flow from East Twin and West Twin Creeks to the San Bernardino Basin for withdrawal

during that water year.

3.08 RESERVOIR SIZING

Each two combined pressure zones will operate from a distribution reservoir with the upper pressure zone operating directly from the reservoir and the lower zone operating through pressure regulators. The distribution reservoirs will operate by gravity flow and the pressure regulators will operate hydraulically, not requiring outside energy for controls. Each reservoir system will maintain water for daily operations, emergency water and fire suppression purposes. Each pair of pressure zones will operate independently from each other except in the case of water transfers. Water will be transferred during an 18-hour period, with no pumping from 12:00 noon to 6:00 p.m., the peak hour electrical usage period. This will save energy and with the power companies giving substantial reductions in energy rates for this non-use period. This is known as "Time-of-Use" electrical rates.

Since the type of construction is not known, fire suppression quantities are not known but, we will estimate a flow rate of 3,000 gallons per minute over a two hour period or a quantity of 360,000 gallons of water in each tank

Pressure Zones I and II Combined

The combined Average Annual Day combined flows will be:

Pressure Zone No. I.....	49,280 gallons per day
Pressure Zone No. II.....	70,400
TOTAL	119,680 gallons per day

Average Annual Day	119,680 gpd
Maximum Day-Maximum Month	269,280 gpd
Peak Hour-Maximum Day	538,560 gpd

Reservoir Sizing

Fire Flow-3,000 gpm, 2-hour duration	360,000 gallons
Emergency	119,680
Equalization	107,712
TOTAL	587,392 gallons

Use 0.75 million-gallon reservoir

Pressure Zones III and IV Combined

The combined Average Annual Day combined flows will be:

Pressure Zone No. III.....	246,400 gallons per day
Pressure Zone No. IV.....	1,237,120
TOTAL	1,483,520 gallons per day

Average Annual Day	1,483,520 gpd
Maximum Day-Maximum Month	3,337,920 gpd
Peak hour-Maximum Day	6,675,840 gpd

Reservoir Sizing

Fire Flow-3000 gpm, 2 hour duration	360,000 gallons
Emergency	1,483,520
Equalization	1,335,168
TOTAL	3,178,688 gallons

Use 3.2 million gallon reservoir

Pressure Zones V and VI Combined

The combined Average Annual Day combined flows will be:

Pressure Zone No. V.....	128,000 gallons per day
Pressure Zone No. VI.....	22,400
TOTAL	150,400 gallons per day

Average Annual Day	150,400 gpd
Maximum Day-Maximum Month	338,400 gpd
Peak Hour-Maximum Day	676,800 gpd

Reservoir Sizing

Fire Flow-3,000 gpm, 2 hour duration	360,000 gallons
Emergency	150,400
Equalization	135,360
TOTAL	645,760 gallons

Use 0.75 million-gallon reservoir

Pressure Zones VII and VIII Combined

The combined Average Annual Day combined flows will be:

Pressure Zone No. VII.....	6,400 gallons per day
Pressure Zone No. VIII.....	19,840
TOTAL	26,240 gallons per day

Average Annual Day	26,240 gpd
Maximum Day-Maximum Month	59,040 gpd
Peak Hour-Maximum Day	118,080 gpd

Reservoir Sizing

Fire Flow-3,000 gpm, 2 hour duration	360,000 gallons

Emergency		26,240
Equalization		23,616
	TOTAL	409,856 gallons

Use 0.50 million-gallon reservoir.

3.09 WATER TREATMENT

Water derived from stream flow and possibly some springs will require filtration and disinfection. Water from wells will require as a minimum, disinfection. Chlorine will be used as a disinfectant and most likely applied as calcium hypochlorite so no special construction will be necessary to house and operate chlorine cylinders. Where surface water is used, it must follow the State of California Health Department, Drinking Water Section requirements. This will require several steps to be taken to determine the exact treatment type. The following is a list of items necessary to obtain approval of the Coldwater Creek waters for domestic use:

- Perform a "Watershed Sanitary Survey" to the State Standards over a 12-month period to understand the deviations in water quality due to climatological conditions.
- Design a water filtration and disinfection system that will allow the finished water to meet the requirements of State Drinking Water Requirements.
- Obtain necessary permits, including a National Pollutant Discharge Elimination System permit for the backwash and drain water that will be discharged into dry streams that are tributary to the Santa Ana River and Pacific Ocean.

To understand the proposed water diversion and proposed treatment process, a schematic flow diagram is included as Plate 3-5 for Coldwater Creek and 3-6 for Strawberry Creek

3.10 WATER DISTRIBUTION

Domestic water distribution is accomplished through a series of reservoirs, booster stations, pressure regulator stations and a network of underground piping. Water will be received into the distribution system from the various sources as discussed in Section 3.07 above. The point of receiving the water will depend on the source and may be seen on Plate 3-3, Hydraulic Schematic. Water will be transferred between reservoirs by booster stations located adjacent to reservoirs. One reservoir will serve two separate pressure zone and at the break between these zones, a pressure regulator (s) stations will be located to provide that zone with water at a pressure between 45 psi and 125 psi. The water distribution piping network will be designed through a hydraulic network analysis for the piping sizes to meet the peak hour demands and required fire suppression flows.

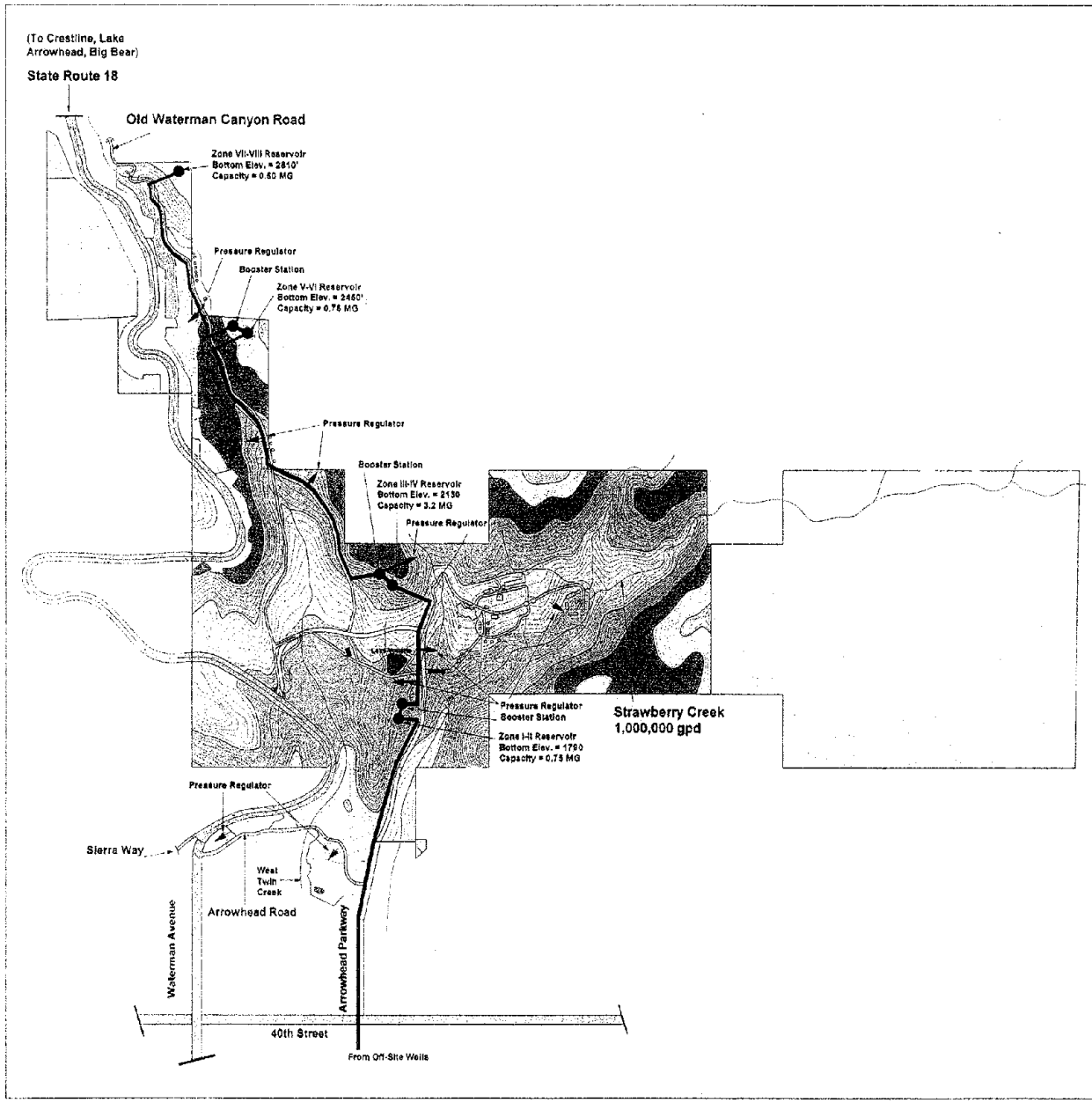
During peak hours of electrical consumption, 12:00 noon to 6:00 PM, the distribution flows will come from the reservoirs to reduce electrical energy costs through "Time-of Use" pumping. The reservoirs are sized to contain adequate water for the peak hour without encroaching upon the fire suppression water and emergency water capacity.

During the 18-hour period from 6:00 pm to 12:00 noon, or less, the water source and boosters will fill the reservoirs to capacity to prepare for the ensuing day.

The transfer of water and monitoring for vandalism will be monitored through an electronic radio transmission computer controlled system (SCADA system) with receivers and transmitters at all reservoirs, booster stations and water supply sources to detect any failures, tampering or unusual condition such as intermittent flows when they should be constant. Also, if anyone attempts to break into a facility such as a reservoir, well, booster pump or treatment plant, the computer will notify the personnel as programmed for immediate response.

Disinfection of the water will be done at the location of the water source, such as a well or treatment plant by a calcium hypochlorite injection system. The system will be controlled by a meter on the water discharge, telling the system to provide a preset solution in a quantity comparable to the rate of flow. The chlorinator will dissolve tablets of calcium hypochlorite in to an aqueous solution for injection into the water. Chlorinators are self sufficient except for the addition of tablets and normal maintenance.

Plate 3-4



LEGEND:

Pressure Zones

- VIII
- VII
- VI
- V
- IV
- III
- II
- I

July 2004

Arrowhead Springs Property

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Arrowhead Springs
Preliminary Surface Water Treatment System for Coldwater Canyon Creek

Plate 3-5

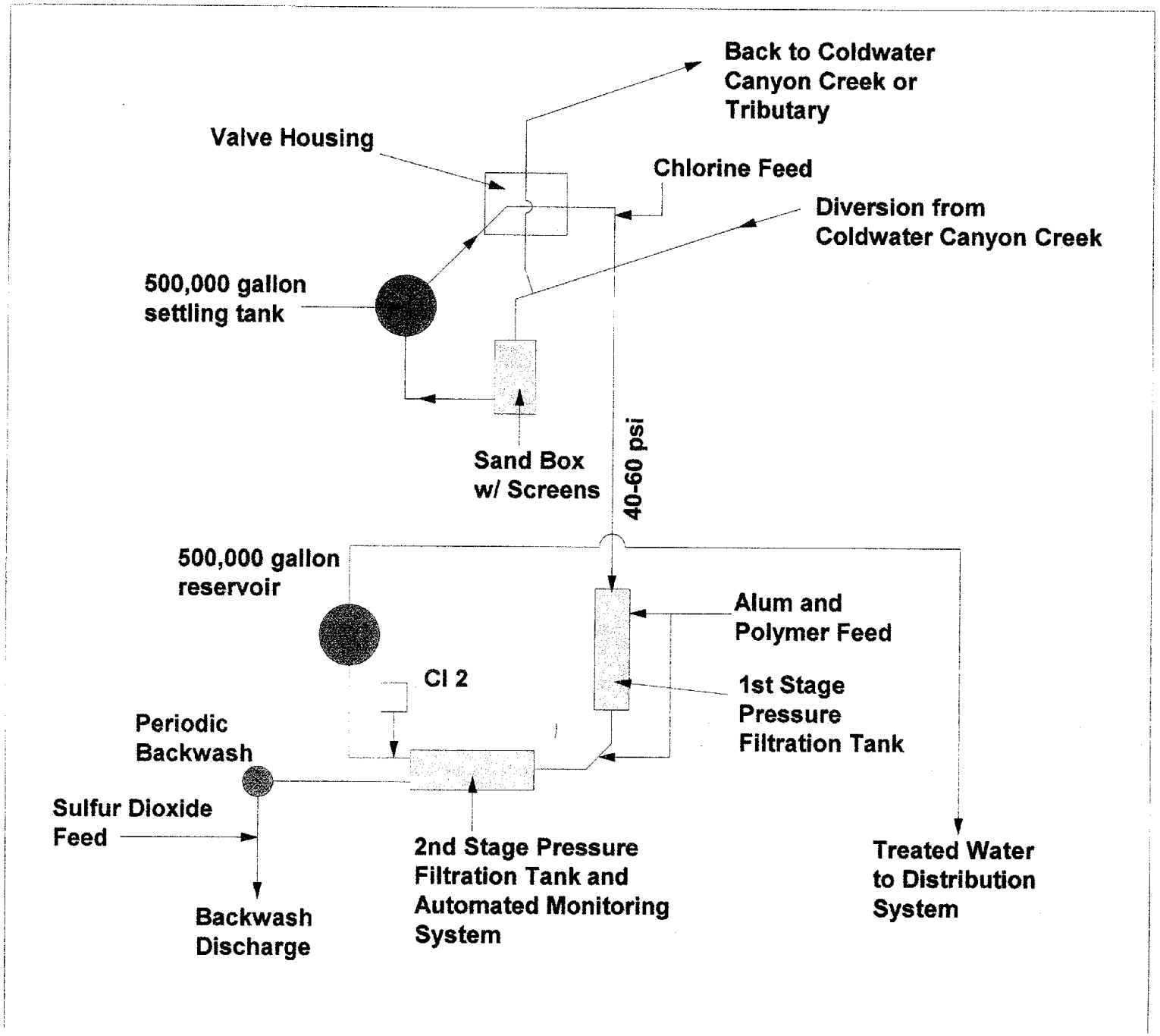
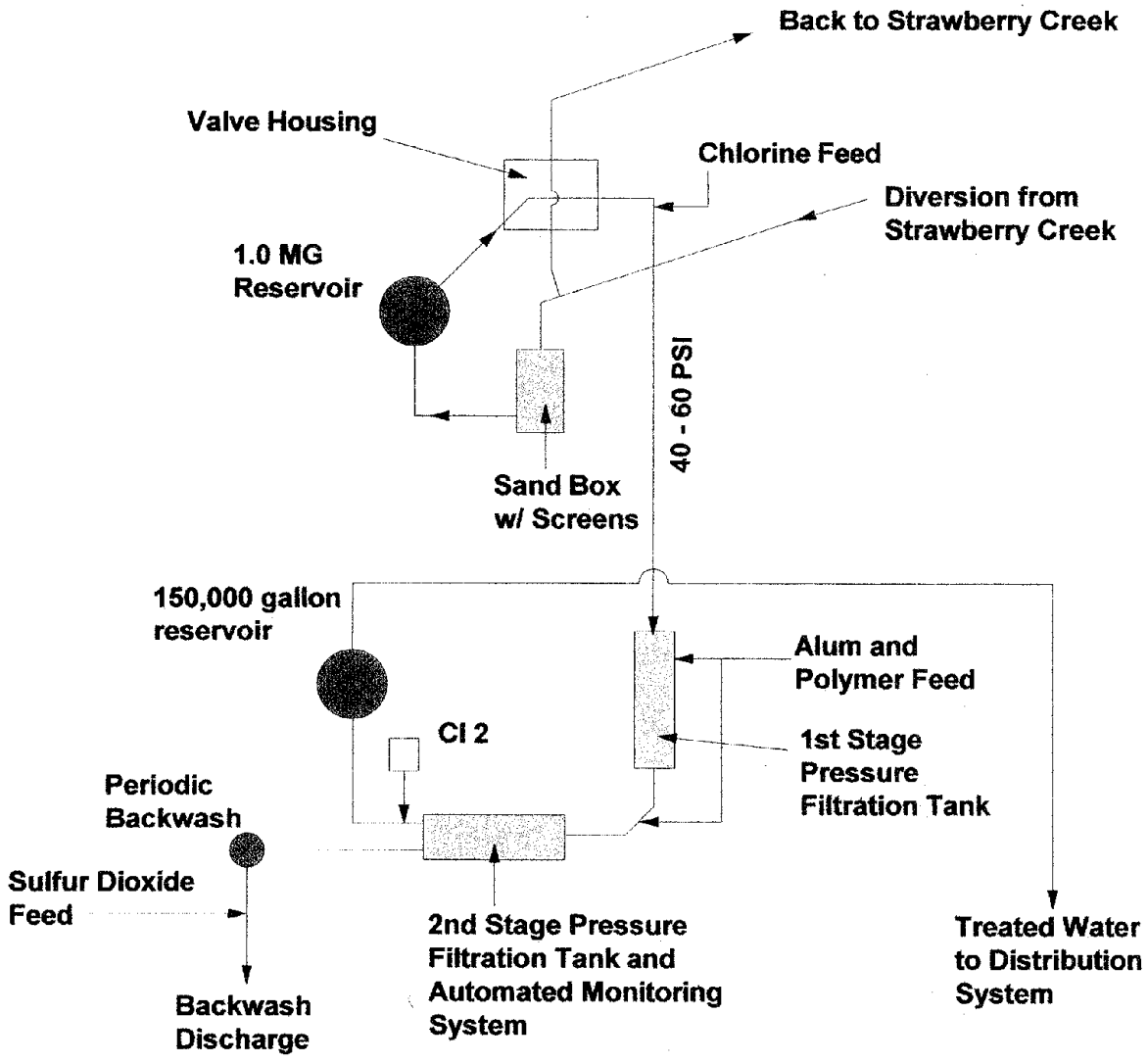


Plate 3-6



Arrowhead Springs
Preliminary Surface Water Treatment System for Strawberry Creek

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SECTION 4
WASTEWATER

4.01 GENERAL

The present structures within the Study Area are being provided Wastewater collection, conveyance, treatment and disposal by facilities on-site. The treatment is through an Imhoff Tank style treatment plant that provides primary treatment and the effluent is discharged into adjacent ponds for evaporation/percolation. The discharge from this plant is under Board Order No. 86-100, issued by the Santa Ana Regional Water Quality Control Board. The Board Order will allow a discharge of up to 300,000 gallons per day. This plant has served the hotel and support structures for many years, but the capacity of the tank and type of effluent provided will not comply with the size and style of development proposed.

It is planned to convey the raw wastewater to a treatment facility in the southerly part of the project area where the influent will operate by gravity and not require electrical energy to lift it to the plant. It may be necessary to install wastewater lift stations due to the mountainous terrain the project is situated. The plant is proposed to provide an effluent capable meeting the requirements for unrestricted use.

The nearest existing wastewater facilities are southerly and below the proposed development, belonging to the City of San Bernardino. The sewers are of minimum diameter and do not have adequate capacity to provide service to the development. A second alternate to a wastewater system would be on-sire disposal. The current policy of the Santa Ana Regional Water Quality Control Board is to allow properties with septic tanks and underground disposal systems to be constructed at a density of no more than two single-family homes per acre. The development of Arrowhead Springs will require significant higher densities; therefore, the use of on-site disposal is not practical.

The study area will be within the service area of the revised service area of the Del Rosa Mutual Water Company and the West Twin Creek Water Company, which is the total property of the Arrowhead Development.

4.02 WASTEWATER QUANTITIES

The amount of wastewater to be generated from the development is a function of the number of people and the amount of wastewater discharged by each person, the amount of commercial area to be constructed. The criteria used to develop the quantity of wastewater, follows.

DESIGN CRITERIA
(Daily Contributions)

Contribution per person	100 gallons
Occupancy per dwelling unit	3.2 people
Equivalent Dwelling Unit (EDU)	640 gallons per day

The summation of the above criteria will result in an average daily discharge over on an annual basis. During the day, the flows will vary with higher and lesser flows than the average daily flow. The higher flows are computed as "Peak Flows" and calculated by a factor that is dependent on the average daily flow at that point in the collection system. The least flow is calculated as fifty (50) percent of the average daily flow. The peak flow is calculated, based on the following table:

PEAKING FACTORS

Average Daily Flow (MGD)	Peaking Factor
0.00-0.01	4.0
0.05	3.4
0.10	3.2
0.20	3.0
0.30	2.8
0.50	2.7
0.80	2.6
1.00	2.5
1.50	2.4

As may be seen above, the larger the flow, the lesser the peaking factor will be.

The single-family unit, or residence, with an occupancy of 3.2 people, will contribute 320 gallons of wastewater per day.

To place all land uses within the Arrowhead Springs Development on an equal design basis, the domestic water requirements have been converted to "Equivalent Dwelling Units" in Table 3-1, Section 3 herein. With wastewater quantities closely following the domestic water requirements, the Equivalent Dwelling Units developed for domestic water, they will be used for determining wastewater quantities. A summary of the "Equivalent Dwelling Units" as shown on Table 3-1 herein is shown below:

SUMMARY OF EQUIVALENT DWELLING UNITS

Residential	1,238
Commercial	355
Hotel/Conference Center	1,188
TOTAL	2,781

The quantity of wastewater to be generated by the study area is estimated as follows:

2,781 EDU x 320 gallons per day per EDU, average daily flow = 889,920 gpd or 0.90 million gallons per day.

4.03 WASTEWATER COLLECTION SYSTEM

A wastewater collection system will consist of a network of interceptor, collector, lateral and service connection sewers all designed and constructed in accordance with the Sanitary Design and Construction Standards of the Arrowhead Springs Development serving agency. In general, most of the areas will conduct wastewater in sewers by gravity flow. Most likely, there will be areas in the mountainous terrain where a wastewater lift station will be required. This lift station will collect the gravity flow in a receiving chamber and pumps will lift the wastewater to the elevation where it can flow by gravity to the wastewater treatment plant.

A general layout of the collection system and wastewater treatment plant is shown on Plate 4-1.

Sewers will be constructed within paved roads where available and only within easements when necessary for structure service. All sewers and manholes shall be available for immediate access by maintenance people and equipment. This is necessary for routine maintenance and emergency conditions. All federal, state and local safety conditions including OSHA shall be designed into the wastewater system and all safety orders followed.

The wastewater collection system will be constructed in phases as development progresses within the phasing of the project. The collection system will commence in the lower part of the development where the wastewater treatment plant will be located. Please refer to Plate 4-1 for the schematic collection system and treatment plant location.

4.04 WASTEWATER TREATMENT

The ultimate wastewater flows have been estimated at 0.9 million gallons per day, average daily flow (MGD, ADF) when the project is fully constructed and occupied. Within this Section, the following items will be discussed:

- Develop design parameters for wastewater loadings for wastewater treatment plant (WWTP) design;
- Describe spray irrigation effluent requirements;
- Describe WWTP treatment process and required redundancy in the design;
- Describe WWTP phasing according to the absorption schedule from development phasing;
- Describe the spray irrigation process of effluent reuse and provide effluent parameter limitations;

- Calculate the area required for spray irrigation reuse and describe the necessary spray irrigation reuse infrastructure;
- Recommend a wet weather wastewater influent storage volume;
- Describe other design considerations such as noise abatement, odor control, power requirements and lighting.

The concept for treatment and effluent disposal is to treat the wastewater sufficiently to obtain an effluent, which will meet Title 22, California Code of Regulations.

WASTEWATER LOADINGS

In addition to wastewater flows, wastewater influent loading is necessary for the design of the wastewater treatment plant. The standards for calculating biochemical oxygen demands (BOD) and total suspended solids (TSS) for residential development are listed below in Table 4-1:

Table 4-1
Design Criteria For Wastewater Influent Loading
Residential Developments

Parameter	Influent Design Value
Biological Oxygen Demand (BOD)	12 lbs/day/1000 ft3 of Unit Volume (300 mg/l)
Total Suspended Solids	12 lbs/day/1000 ft3 of Unit Volume (300 mg/l)

In addition to the residential development, a planned hotel, commercial and recreational areas are planned and the units design values have been increased to reflect this development.

EFFLUENT REQUIREMENTS FOR SPRAY IRRIGATION

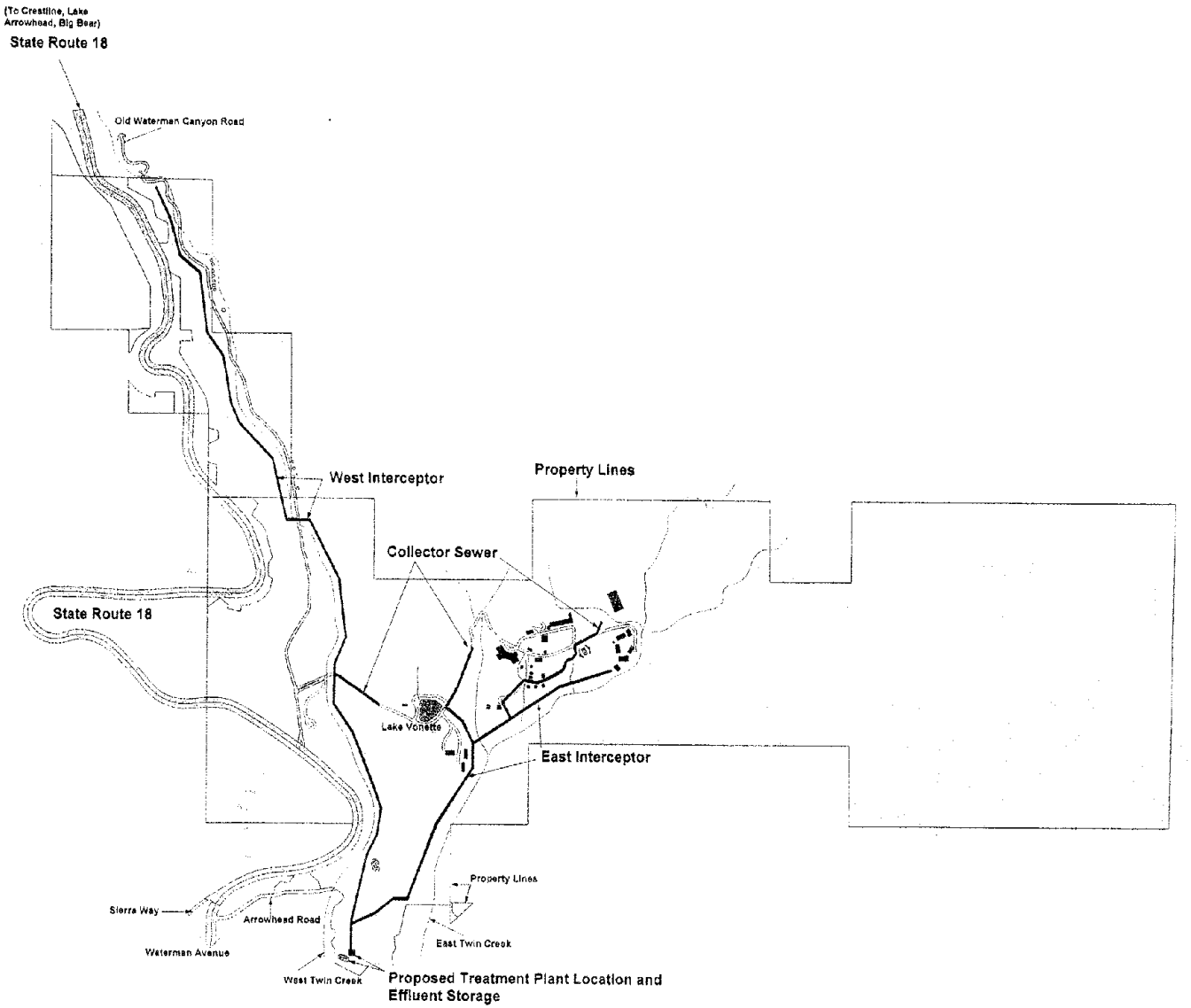
Effluent requirements for treated wastewater are under the jurisdiction of several state and local agencies. Federal and California state law for reuse water are outlined in the California Water Code. The State of California Department of Health Services (DOHS) has mandated reuse water quality standards under Section 13521 of the Porter-Cologne Act. DOHS has developed comprehensive reuse regulations that establish treatment processes, water quality criteria and treatment reliability requirements to ensure public health and safety. These regulations are listed in the California Code of Regulations (DDR) Title 22. The Santa Ana Regional Water Quality Control Board (SARWQCB) is responsible for enforcing these regulations to the wastewater producers and users.

Effluent will be reused by spray irrigation methods on common areas of the development including parks, golf course, open areas and aesthetic plantings. This type of effluent is described as Landscape Irrigation in Title 22, Article 4. Since the effluent will be reused

in close proximity of human contact and habitation, a tertiary effluent will be used for spray irrigation.

Tertiary treated wastewater shall be at all times adequately disinfected, oxidized, coagulated, clarified and filtered. Effluent limitations are listed in Table 4-2 below:

Plate 4-1



SCHEMATIC WASTEWATER COLLECTION SYSTEM

LEGEND

- Interceptor Sewer
- Collector Sewers
- Treatment Plant

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Table 4-2
Effluent Limitations For Spray Irrigation
Landscape Irrigation

Parameter	Effluent Design Value
Median Number of Coliform Organisms	2.2 per 100 milliliters as determined from the bacteriological results of the 7 days for which the analysis have been completed.
Number of Coliform Organisms	23 per 100 milliliters in any sample
Biological Oxygen Demand (BOD)	5 mg/l
Total Suspended Solids (TSS)	5 mg/l
Turbidity	2 NTU
Nitrogen	10 mg/l (current) 5 mg/l (future)
Chlorine Residual	5 mg/l

The proposed WWTP will be designed to meet these limitations.

WASTEWATER TREATMENT PROCESS AND REDUNDANCY

a. General

The treatment process being considered for this project is a Micro filtrate membrane bioreactor, or commonly called micro filtration. This process was considered because of the compact nature of the plant and reasonably simple maintenance and operation to provide the quality of effluent for unrestricted irrigation. Typically, the entire process can be housed within a structure whose architecture will fit into the neighborhood and contain sound and odor control. The process units can be constructed in phases to accommodate the progress of development and construction.

b. Treatment Process

An influent lift station will place wastewater at an elevation to enter the Headworks which will contain influent fine screens with a minimum 3/8" opening and an aerated grit chamber prior to entering the nitrification/de-nitrification chamber.

A SymBio™ Basin will be provided to receive the screened influent and perform simultaneous nitrification/de-nitrification using nicotinamide adenine dinucleotide (NADH) concentration level monitoring. The basin will have a fine bubble aeration

system with a dedicated blower equipped with a variable frequency drive (VFD). The operating dissolved oxygen (DO) will be in the range of 0.2-0.6 ppm. There will be a mechanical mixer to avoid settling at low flow/loading conditions. The treated water from the basin will be fed to the membrane bioreactor (MBR).

The MBR will be designed to operate at high MLSS (15,000-20,000 mg/l TSS) and with design flux rates at 15 gallons per square foot per day with peaks of 30 gallons per square foot per day for periods of 6-12 hours. Mixed liquor will be pumped using re-circulation pumps to the SymBio™ Basin at a rate of 2Q.

The membrane cassettes will incorporate integrated diffused air systems.

The MBR will contain stacked membrane cassettes with flat panel membrane cartridges with an average porosity of 0.4 microns. The bottom diffuser case will support the membrane case and house a coarse-bubble aeration system.

Bubbles generated by the blower are emitted at the diffuser and channeled upward between each of the membrane cartridges as they rise to the surface. The channeled bubbles accomplish three important objectives by providing adequate oxygen to maintain design MLSS (cell respiration), scouring the membranes to prevent fouling, and creating a pressure gradient between the top and bottom of the membrane unit.

The pressure gradient created by the rising bubbles induces an upward cross-flow of mixed liquor over the membranes (0.5 m/s). The liquor is filtered as it flows across the membrane due to trans-membrane pressure gradient created by liquid head above the permeate header or by pump.

The flux, or filter rate per area, is directly proportional to the trans-membrane pressure difference which is roughly equal to the liquid head above the permeate header for gravity applications. In most cases, approximately two (2) feet of head is required to meet the design flow conditions and an additional head is required to accommodate the design peak flow rate. Since equalization will take place within the nitrification/de-nitrification basin and the MBR, the flux rates will be controlled using flow control valves.

Over time the side water depth to overcome flow resistance due to membrane fouling increases. At a given depth, the unit (or individual cassettes) must be taken offline and the membranes flushed. Once cleaned, the water depth returns to its original level.
On average, it is necessary to chemically treat a membrane unit every six months. The membrane units are cleaned in-place by injecting, or pouring, a dilute solution of bleach or oxalic acid into the permeate line. The cassettes are cleaned in-place and should take about two hours to complete. The chemical used to clean the membrane depends on the substrate treated in the MBR. For organic substrates bleach is used and for inorganic substrates, oxalic acid.

Effluent will flow to the tertiary filters and disinfection units and after disinfection, the effluent will accumulate in an effluent basin where it will be pumped to a place of use.

The treatment plant will have redundancy where if any unit fails, there is a standby unit that will automatically come online. There will be standby generator (s) ready to provide electrical energy if the normal power source fails. An operator will automatically be notified if any unit (s) fail or the effluent or process requires attention. During wet weather, there may be a time where the effluent must be stored rather than used for irrigation. A thirty (30) day storage facility is required. In this case, a storage facility to hold 33,000,000 million gallons, or 101.26 acre-feet of effluent must be provided. Normally this is done in an open pond nearby the treatment plant so the effluent can be reclaimed and put to irrigation use.

A flow diagram for the treatment process is shown on Plate 4-2.

4.05 WASTEWATER COLLECTION

A wastewater collection system will be constructed to collect sewage from the various structures throughout the development and conduct the raw sewage in closed conduits through house connection sewers, lateral sewers, main sewers and interceptor sewers to the treatment plant. The sewers will be designed with a minimum flow of 2-feet per second at minimum flow to prevent sedimentation and solids from falling out and a maximum of 10 feet per second to prevent scouring of the sewers. When constructed, all sewers will be tested for tightness with air and manholes tested with water to minimize leakage into the surrounding soil.

Only when absolutely necessary will wastewater lift stations be allowed to be constructed and only then when no alternative solution is available. The wastewater will be received in a chamber and allowed to accumulate until a pre determined level is reached and then the wastewater will be pumped to a higher elevation, allowing it to flow by gravity. The mechanical units of the lift station will be located above ground and have a secondary source of energy to pump the sewage if the primary source of energy or the pump on-call does not operate. The switch over must be instantaneous without delays. At the same time, a SCADA System will notify an on-duty wastewater operator for immediate action.

The use of low spots such as an inverted siphon is discouraged. To simply maintain a shallower depth of the sewer by installing such a device, will not be a reason for its installation. Close attention to design of the sewers will be necessary to minimize the possibility of overflows, spills and stoppages that could contaminate the watersheds, streams and visual aesthetics of the adjacent areas.

4.06 PERMITTING

The planning for the wastewater effluent is to use the water for irrigation. There are areas of potential use on the property such as:

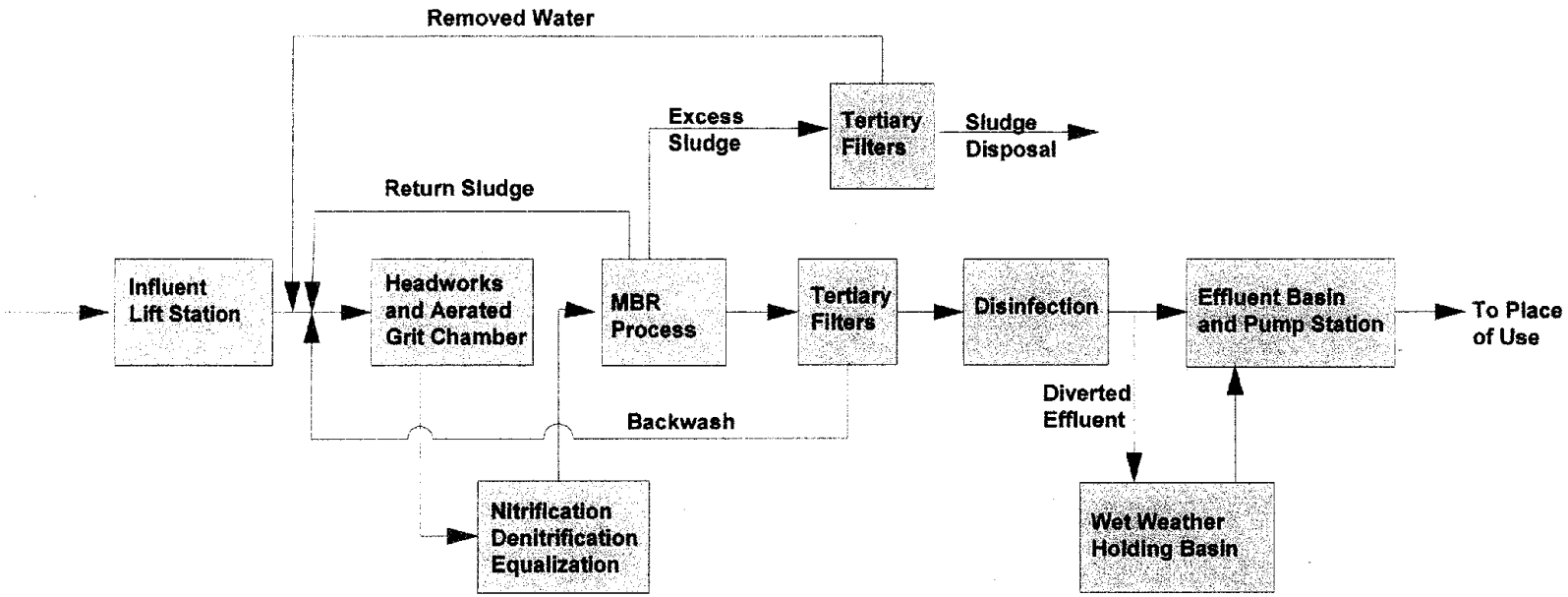
- Golf Course
- Landscapes
- Roadscapes
- Parks Open Space

- Natural Open Space
- Low combustion fuel areas for perimeter fire protection

There appears to be adequate area that will require regular irrigation, which will utilize the effluent produced and additional water from the properties. Within Section 5, entitled Irrigation Water, the water requirements will be examined and quantities determined.

With the use of the effluent for irrigation, there will be no discharge of the effluent and therefore, no Report of Waste Discharge will be required from the Santa Ana Regional Water Quality Control Board. What will be required will be an approval of an "Engineering Report for the Production, Distribution and Use of Recycled Water". The approval will be from the State of California, Department of Health Services, Drinking Water Division, and consulting to the Health Services will be the Santa Ana Regional Water Quality Control Board, Santa Ana Region and the Recycled Water Unit of the Technical Branch, State of California, department of Health Services, Drinking Water Division. The Environmental Impact Report for the project which includes the treatment plant will be approved with the Specific Plan and the other approvals will come from:

- Site approval for the treatment plant site by the City of San Bernardino
- Engineering Report for the Production, Distribution and use of Recycled Water by the State Department of Health Services
- Wastewater Treatment Plant Permit from the South Coast Air Quality Control District
- There will be other permits require for hazardous material handling, storm water containment and similar items.



SCHEMATIC FLOW DIAGRAM
Wastewater Treatment Plant
Arrowhead Springs

Consulting Services
July 2004

Plate 4-2

SECTION 5
IRRIGATION WATER

5.01 GENERAL

Irrigation Water will be provided through four separate sources; (1) recycled water from the wastewater treatment plant; (2) stream flows on the property; (3) wells from San Bernardino Basin; and (4) "Steam Cave Well". The wastewater will be a constant flow, increasing as the development occurs. In the early stages of development, the waters from Waterman Creek (West Twin Creek) will be used to supply the irrigation needs. This water will be diverted from the stream and allowed to settle prior to use. As water from the wastewater treatment plant becomes available, it will be mixed with the stream flows and used. During the development period of the Arrowhead Springs Project, the quantity of effluent will increase, as the properties are occupied. Supplemental water will be provided from a redundancy well in the San Bernardino Basin. Water for use in irrigating the "low combustible fuel areas" surrounding the existing developed area is provided by "Steam Cave Well".

5.02 IRRIGATION REQUIREMENTS

Irrigation is proposed to take place on the following areas:

- Golf Course
- Parks
- Selected Open Space
- Landscapes
- Roadscapes
- Low Combustion Fuel Fire Breaks

The golf course is proposed as a championship sized course and the irrigated area is estimated at 199 acres. Of this area, 100 acres are estimated to be irrigated with the remaining area in lakes, hardscapes and the like. With this area under irrigation, the initial quantity is estimated to be 780 acre-feet annually, based upon an 80 acre course in the general area requiring 625 acre feet. Water requirements vary with the weather being the principal reason causing the growth to increase or decline with precipitation and temperature. The following table 5-1 shows the annual deviations of water requirements:

Table 5-1
Golf Course
Irrigation Water Demands
Based on
780 Acre-Feet Annually

Month	Use Factor	Irrigation Demand (Ac. Ft.)	Daily Requirement (Million Gallons)
January	0.029	22.6	0.238
February	0.039	30.4	0.354
March	0.064	49.9	0.524
April	0.095	74.1	0.805
May	0.129	100.6	1.058
June	0.136	106.1	1.152
July	0.154	120.1	1.262
August	0.132	103.0	1.083
September	0.096	74.9	0.814
October	0.067	52.3	0.550
November	0.036	28.1	0.305
December	0.023	17.9	0.182

The irrigation of areas other than the golf course will be from non-potable water, the same as the golf course. There will be some integration of the two systems for the sake of simplicity and redundancy, so that both areas will have the benefit of all waters available. The actual areas of irrigation have yet to be specifically designed and delineated so that an accurate area of land can be computed. Areas such as the lawns and ornamental planting around such facilities as hotels, office buildings, commercial areas, parks, common spaces, roadscapes and other public and private areas can be irrigated and the domestic water saved. We have estimated the landscaped area, deducting the golf course at 250 acres.

To serve this 250 acre irrigation area, we estimate that an annual application of five feet (5') of irrigation water. This results in a quantity of 1,250 acre feet annually.

The area to be maintained as a low combustible fuel area has not been clearly established. The irrigation of this area will not be a continuous application, but only when natural moisture is not present for plant growth and maintenance. For this fuel break, we estimate an area 200 feet in width with a length of 10,000 feet. The golf course in many areas will act as a fuel break, reducing the designated area. The estimated water application is 2.0 feet annually. This will convert to a quantity of 12.3 acre-feet of water annually. Much of this will depend upon the plant species used and the natural precipitation in the area. The low combustible fuel area is proposed to be irrigated only with stream water since domestic water will be taken from Coldwater Canyon and Strawberry Creek. The water application period is presently proposed to be during the months from June through November. This six month period would require an even application of about two (2) acre feet per month except when a fire may threaten the area, then extra water application for a

short period may be called for.

The annual application rate for the 1,250 acre feet of irrigation water will be similar to the golf course and the following Table 5-2 illustrates the application rate.

Table 5-2
General Irrigation
1,250-Acre Feet Per Year

Month	Use Factor	Irrigation Demand (Ac. Ft.)	Daily Requirement (MGD)
January	0.029	36.25	0.381
February	0.039	48.75	0.567
March	0.064	80.00	0.841
April	0.095	118.75	1.290
May	0.129	161.25	1.695
June	0.136	170.00	1.847
July	0.154	192.50	2.024
August	0.132	165.00	1.734
September	0.096	120.00	1.304
October	0.067	83.75	0.880
November	0.036	45.00	0.489
December	0.023	28.75	0.302

To understand the total irrigation water requirements and the estimated distribution of monthly deviations in annual average estimated requirements, the combined totals are summarized. The golf course, general irrigation and low combustible fuel areas are shown in Table 5-3 and summarized so that the necessary ultimate water source is known.

Table 5-3
Summary of Irrigation Demands
(Shown in Million Gallons per Day)

Month	Golf Course	General Irrigation	Fire Break	Total
January	0.238	0.381	-0-	0.619
February	0.354	0.567	-0-	0.921
March	0.524	0.841	-0-	1.365
April	0.805	1.290	-0-	2.095
May	1.058	1.695	-0-	2.753
June	1.152	1.847	0.022	3.021
July	1.262	2.024	0.022	3.308
August	1.083	1.734	0.022	2.839
September	0.814	1.304	0.022	2.140

October	0.550	0.880	0.022	1.452
November	0.305	0.489	0.022	0.816
December	0.182	0.302	-0-	0.484

The maximum daily irrigation water requirement is shown for the average day of July for a quantity of 3.308 million gallons. The average quantity will be increased by fifteen percent (15 %) to account for any increase in any one day. This results in an estimated requirement of 3.08 million gallons for the highest daily requirement and this is the quantity that the water source must be designed for.

During the construction period, particularly during the earthwork period early on, water will be required for compaction and dust control. Depending upon the amount of earth moved, the water quantity needed will vary. We can anticipate a need of about 500,000 gallons per day but this can change.

5.03 IRRIGATION WATER SOURCE

There will be two sources of irrigation water, recycled wastewater and stream flow. Upon completion of the project and occupancy has occurred, we would expect a recycled water flow of eighty five percent (85%) of the designed flow or 0.765 million gallons per day. Waterman Canyon Creek (West Twin Creek) will be the surface water source with the diversion point being at the historic West Twin Creek Water Company diversion. Domestic water will be diverted from East Twin Creek, Coldwater Creek and Strawberry Creek. Historically, the hotel received drinking water from Coldwater Creek and irrigation from Strawberry Creek with the Del Rosa Mutual Water Company diversion point downstream.

Initially, there will be little or no wastewater to be recycled for use. The treatment plant must be permitted, designed, constructed and tested along with the completion of the " Engineering Report for the Production, Distribution and Use of Recycled Water" must be processed through the State Department of Health Services, Drinking Water Division. Site approvals and a completed EIR, covering the Treatment Plant must be certified. If the treatment plant EIR is included with the Specific Plan, the processing of the treatment plant permitting will take a minimum of 12 months and more like 18 months if all goes well.

There is a Preliminary Absorption Schedule for the Arrowhead Properties, which is quite aggressive, showing a build-out within three and one-half years after start of construction. The first six (6) months of construction will include infrastructure implementation and it will require the construction of the domestic water system source of supply, distribution reservoirs, pipelines and fire hydrants prior to the delivery of combustible building materials to the site. At the same time and possibly lagging some, the construction of the wastewater treatment plant must be completed. For both the domestic water system and the wastewater system, the facilities will be constructed in phases to complement the construction of habitable structures. The Preliminary Absorption Schedule is shown on Plate 5-1. If we assume a straight line occupancy over the three (3) year construction period, the generation of recycled wastewater will be as shown below in Table 5-4.

Table 5-4
Preliminary Recycled Wastewater Generation Schedule

Year 1.....296,640 gpd
Year 2.....593,280 gpd
Year 3.....889,920 gpd

The average annual flows within West Twin Creek, (Waterman Canyon Creek) have averaged 2,491 acre-feet per year. There have been years when the flows have been higher and much lower. There have been years such as 1961 when West Twin Creek discharged only 192 acre-feet of water. The deficiency of water must be made up from other sources such as wells in the San Bernardino Basin. The 2030 acre-feet of irrigation water required less the 997 acre-feet of recycled water, leaves 1,033 acre-feet to be produced from stream flow, wells or a combination of both. In normal years, the stream can provide adequate water but during low flow periods, alternate water sources must be made available.

The irrigation areas will have ponds and reservoirs for redundancy within the water source system. There will be a redundancy well within the San Bernardino Basin to provide water to the domestic water system. Water could be produced from this well and distributed through the irrigation system to make up any deficiencies

5.04 IRRIGATION WATER DISTRIBUTION

The water produced from the various sources must be accumulated and distributed to the places of use. The water must be available for "on-demand" use at any time at any location within the development. There must be redundancy within the system to provide a continuous source of usable water. The stream flows must have the deleterious material removed by screening or filtration so the water, may be applied by sprinklers. The well and recycled water will not require this process. To collect the irrigation water sources so they may be distributed to the proper places of use, the following description and Plate No. 5-2 will delineate this plan:

- Collect the water sources from West Twin Creek, East Twin Creek (Del Rosa Mutual Diversion, Recycled Water from the wastewater treatment plant and any needed water from the redundancy well in the San Bernardino Basin. This collection point will be an existing pond proposed for irrigation uses and not used today for that purpose.
- Allow water to irrigate areas down gradient from this pond.
- A booster station at this pond will lift the water to two reservoirs at the same elevation, one with a capacity of 1.5 million gallons and the other 0.75 million gallons. The booster station would have a capacity of 3,100 gallons per minute.
- The areas down gradient from these reservoirs would be furnished water, including the golf course and its lakes.
- The runoff within the drainages to Coldwater Creek and Strawberry Creek would be controlled so no runoff would leave the irrigation area and reach those streams.

- At the 0.75 million gallon reservoir, there will be a booster station with a capacity of 800 gallons per minute to lift the water to another 0.75 million gallon reservoir at the upper end of the development.
- There is, an existing warm water well known as the "Steam Cave Well" which can be used to irrigate the "low combustible fuel area" on the northerly and easterly areas surrounding the existing developed area to inhibit or slow wildfires from reaching the development.

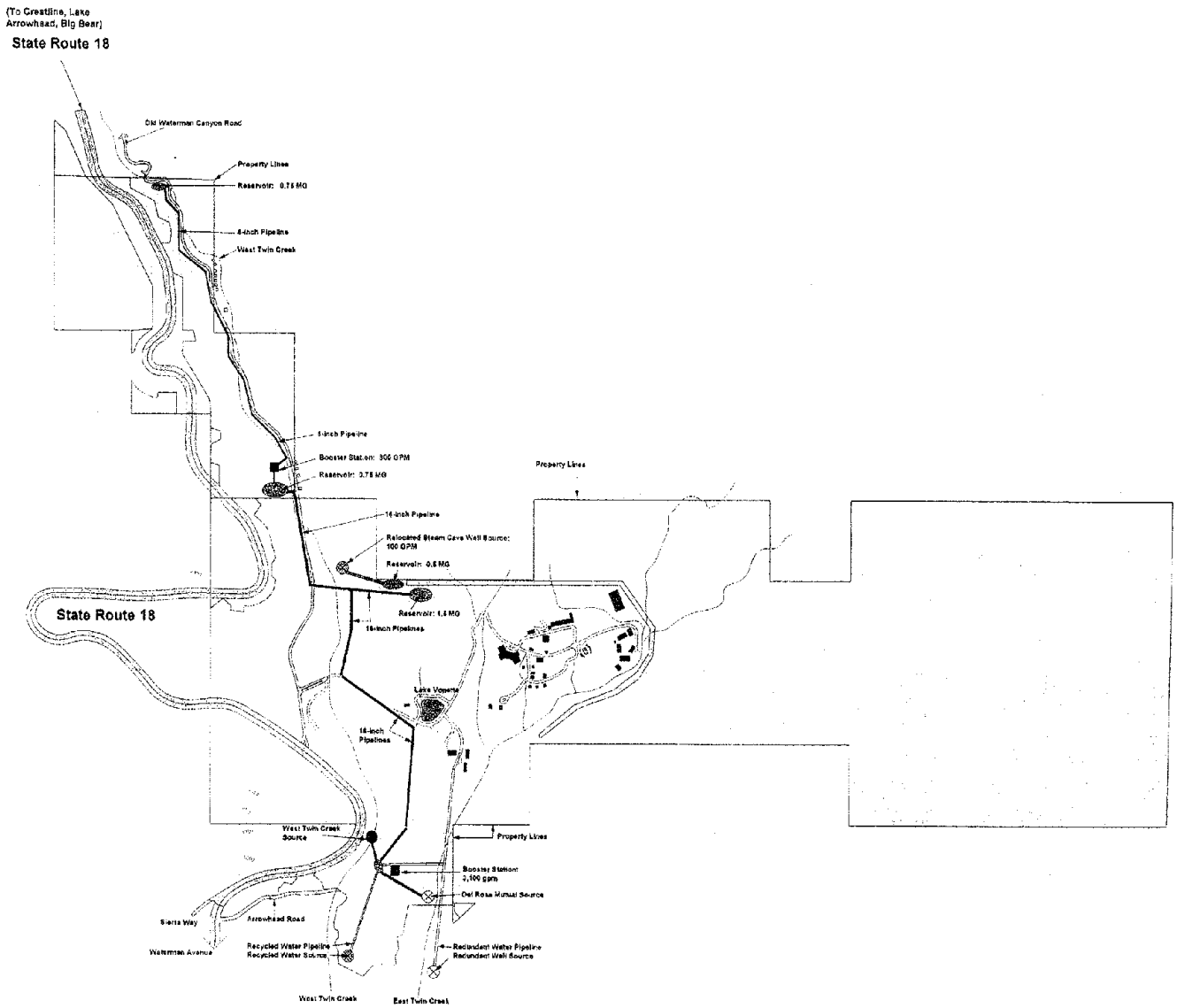
The pipelines for irrigation will be located in roads and rights of ways in which domestic water is located. To distinguish one conduit from the other, the State Department of Health Services, Drinking Water Section calls for pipelines carrying recycled water to be colored "Purple". Where non-potable water is being carried and does not have any recycled water, the international color for non-potable water will be used. This non-potable pipeline color is yellow.

As the development occurs there are most likely changes to the irrigation areas and requirements that will modify the facilities and changes will occur. This is a backbone system that can adapt to those changes and is flexible enough to remain viable.

Within the system, there is one day of storage for gravity flow without the need from the golf course lakes and other water features within the project. The non-potable water system for the irrigation of the low combustible fuel area has a reservoir of 0.50 million gallons capacity that will contain about 22 days of use. This will allow heavier watering if a fire approaches or if the power is out at the well, there is ample water for use.

PLATE 5-1
ABSORPTION SCHEDULE

Plate 5-2



BACKBONE IRRIGATION SYSTEM

LEGEND

- Recycled Water Source
- Recycled Water Pipeline
- Stream Flow Diversions
- Stream Flow and Combined Water Pipelines
- Booster Station
- Reservoir
- Redundant Water Pipeline
- Steam Cave Well
- Non-Potable Pipeline
- Non-Potable Reservoir
- Low Combustible Fuel Area to be Irrigated
- Del Rosa Mutual Water Source

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ARROWHEAD SPRINGS PROPERTY

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