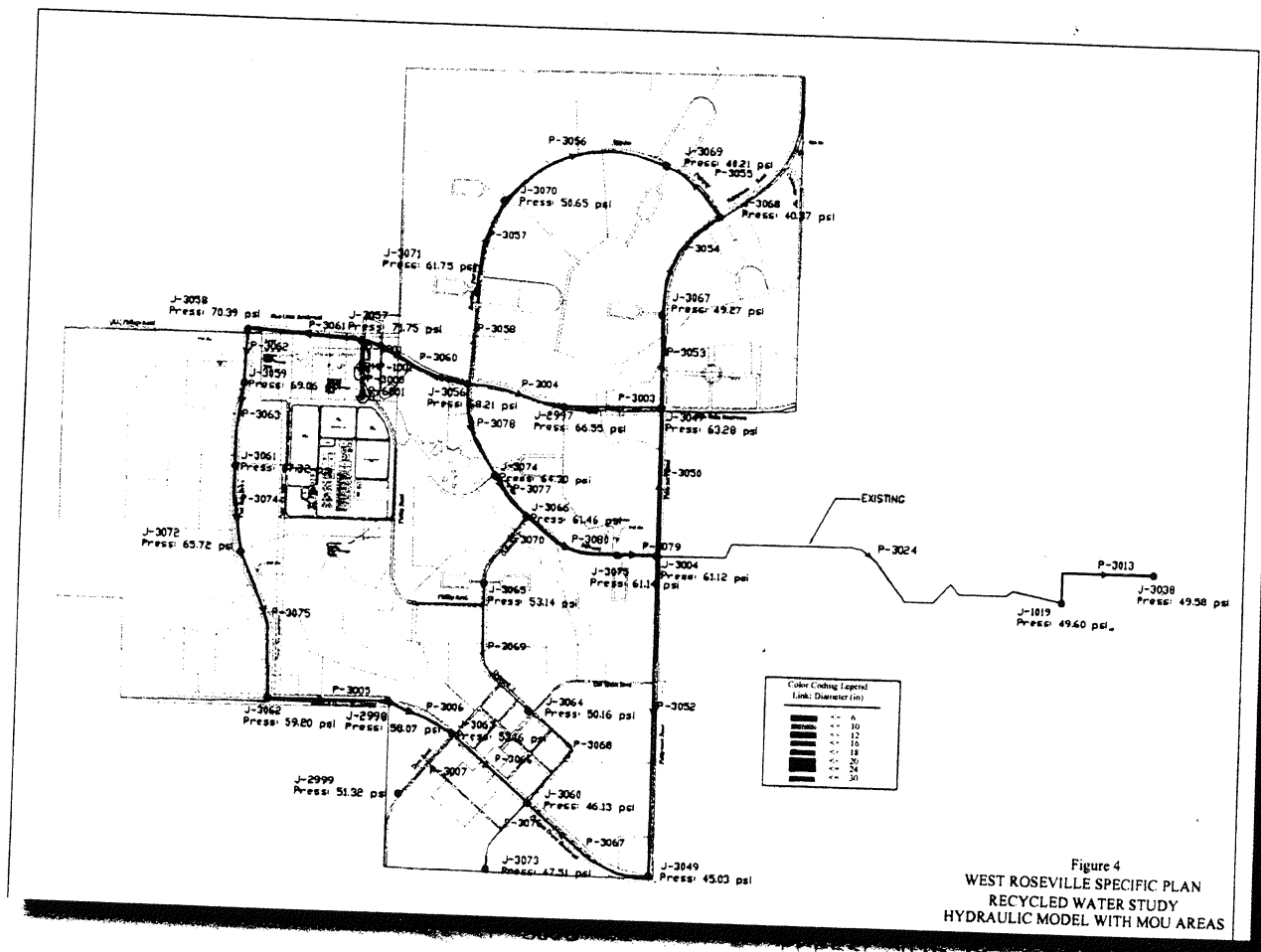

Appendix R
Utilities Technical Memoranda

Recycled Water Study for West Roseville Specific Plan Area (Fiddymont Ranch/Westpark Properties)



May 21, 2003

Recycled Water Study
For
West Roseville Specific Plan Area
(Fiddymment Ranch/Westpark Properties)

May 21, 2003

Prepared By



HydroScience Engineers, Inc.

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RECYCLED WATER STUDY

Introduction

This West Roseville Specific Plan (WRSP) recycled water system study was prepared by HydroScience Engineers, Inc. (HSe), in support of the Master Water Study for the West Roseville Specific Plan Area, prepared by Wood-Rodgers. The purpose of this study is to evaluate proposed recycled water users, demands, supplies, facility requirements, and operational requirements. This information is developed to a conceptual level, based on available information from the current level of planning. This report focuses primarily on the WRSP Area, consisting of Fiddymont Ranch and Westpark properties. However, preliminary information is included for MOU Transition Areas 1 and 2 where feasible.

Background

Several studies, evaluations, and technical memoranda have been prepared in recent years to plan existing and future recycled water facilities in the City of Roseville. Background information is used from many of these studies, as described below. To the best extent possible, this current study uses methodologies and results from previous studies to maintain consistency with documents already accepted by the City.

Recycled Water Distribution System Feasibility Study

HSe prepared a *Recycled Water Distribution System Feasibility Study* (Feasibility Study) for the City of Roseville in April 2000. Methodologies were developed and used in the Feasibility Study to estimate recycled water demands based on irrigated acreage and evapotranspiration data. The Feasibility Study reviewed the existing recycled water distribution system, supplied by the Dry Creek WWTP. In addition, the study developed several phased expansion projects for the City's recycled water system. This included phased expansions to be built both before and after completion of construction of the new Pleasant Grove WWTP. The Feasibility Study was prepared before any information regarding the WRSP area was available. The phases included in the Feasibility Study are summarized below:

Phase I

This included the existing recycled water system as of April 2000. The existing system provided service to Sun City Roseville (golf course, streetscapes, parks), Woodcreek Oaks Golf Course, Junction Boulevard Streetscapes, and Elliot Park. A unique feature of this system is that it operates at a relatively low pressure. A pressure of approximately 30 psi is required at the service connection at Sun City Roseville to ensure proper operation of a booster pump station at that site. An existing recycled water pump station at the Dry Creek WWTP supplies this system.

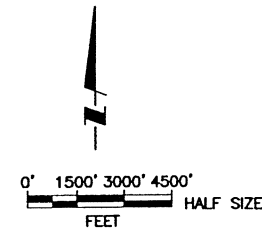
Phase II

Phase II is a proposed expansion to the system, prior to completion of the Pleasant Grove WWTP. This expansion adds a storage tank, pump station, and distribution pipeline to provide recycled water to the Diamond Oaks Golf Course and several other customers along the way. The new portion of the distribution system served by the new pump station operates under a pressure range of 50 – 60 psi. Thus, this phase creates a “high” pressure zone, served by the new pump station, and a “low” pressure zone, served by the existing pump station at the Dry Creek WWTP. The two zones are interconnected by a pressure reducing valve (PRV). It is important to note this two pressure zone system, as it affects any future connections to the system from the proposed WRSP system. In addition, this phase provides supply of recycled water to the West Placer CFD #1 via a gravity pipeline. Construction of this phase was completed in 2002.

Phase III

Phase III expands the system further to include all customers that were identified as feasible in the Feasibility Study. This phase would be constructed by approximately 2005, after completion of the Pleasant Grove WWTP. The Phase III project included a cumulative total annual demand of approximately 4,300 acre-feet per year (AFY). The Phase III project required that new and existing pipelines be constructed and/or utilized to convey recycled water from the Pleasant Grove WWTP to the storage tank that was constructed in Phase II. The water balance prepared for the Phase III project required that approximately 2,333 gallons per minute of recycled water would be pumped from the Pleasant Grove WWTP to the new storage tank between the hours of 12:00 am and 6:00 am to meet the tank fill requirements to provide service during peak demand periods.

The recommended Phase III project from the Feasibility Study is shown on **Figure 1**. Note that this project includes a new 20-inch diameter pipeline from the Pleasant Grove WWTP to the existing sewer pump station #5 along Fiddymont Road. In addition, the project would utilize an existing 18-inch diameter sewer force main to convey the water from pump station #5 to the storage tank. It was not envisioned that pump station #5 would be used to pump recycled water. The existing force main would be disinfected and converted to a recycled water main after sewer pump station #5 is abandoned as a result of construction of the new sewer interceptor to the Pleasant Grove WWTP.



CITY OF ROSEVILLE

RECYCLED WATER DISTRIBUTION SYSTEM

FEASIBILITY STUDY

APRIL 2000

LEGEND:

XXX = CUSTOMER ID
YYY = IRRIGATION DEMAND (AFY)
022 DEL WEBB CUSTOMERS (CUSTOMER 022)

— NEW RECYCLED WATER PIPELINE
- - - EXIST RECYCLED WATER PIPELINE
... CITY LIMITS

Color Coding Legend
Link: Diameter (in)

6
8
10
12
16
18
20
24
30

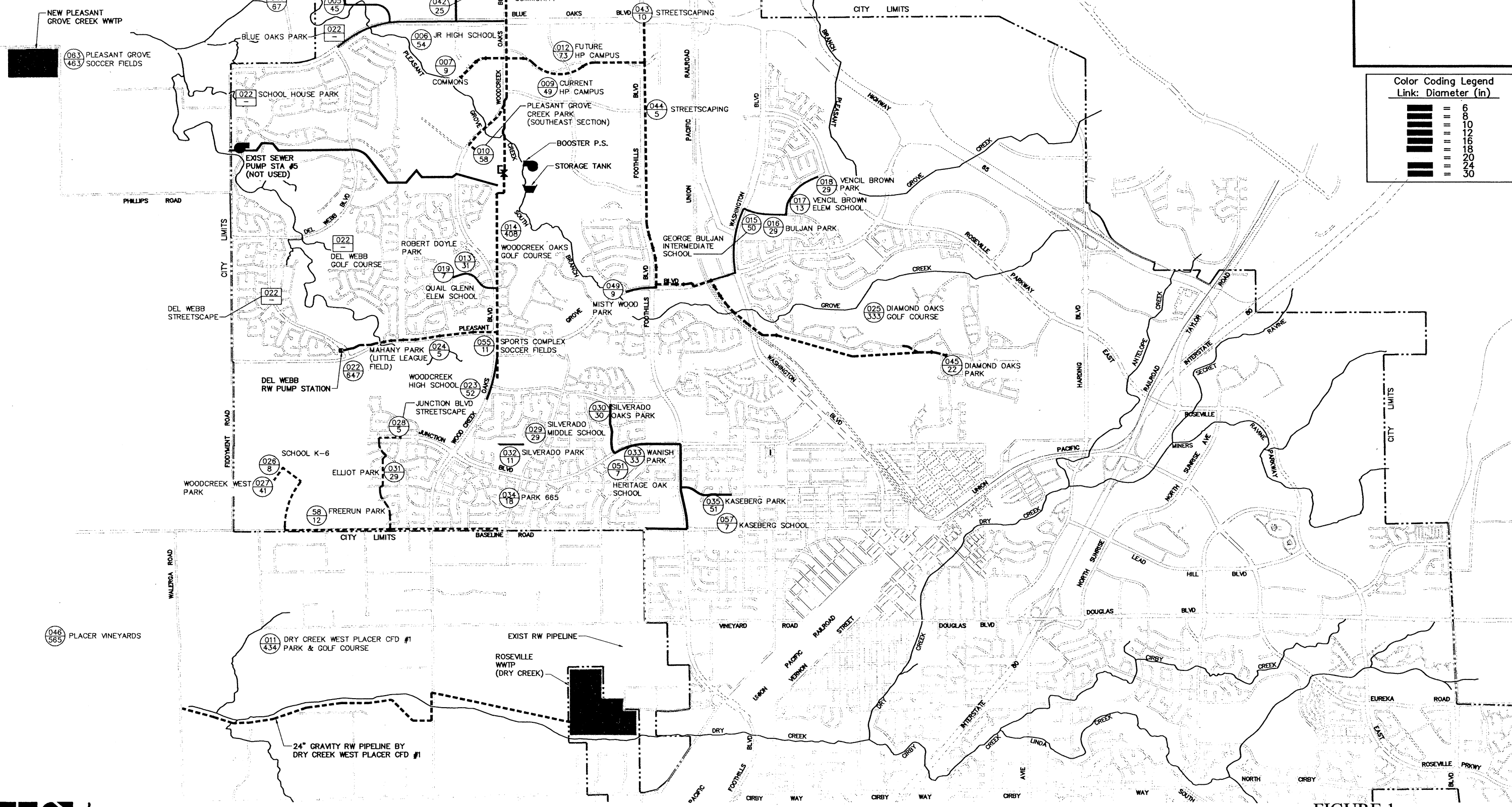


FIGURE 1
RECOMMENDED PHASE III PROJECT
FROM FEASIBILITY STUDY (APRIL 2000)

HSe Technical Memorandum #1 - Pleasant Grove WWTP Recycled Water Pump Station Design Parameters

In August 2000, the City asked HSe to prepare a technical memorandum to determine design parameters for a recycled water pump station at the new Pleasant Grove WWTP. The technical memorandum evaluated a scenario where the Pleasant Grove WWTP would be the sole source of water for filling the tank for operation of the Phase III project. This scenario was not evaluated in the Feasibility Study. This scenario would give the City flexibility to operate the system if recycled water is unavailable from the Dry Creek WWTP. For this tank fill scenario, the technical memorandum recommends a pump station at the PGWWTP with a capacity of approximately 6,400 gpm at a total dynamic head (TDH) of 105 feet. In addition, for this flow rate, the technical memorandum recommended 24-inch diameter pipeline from the PGWWTP to the existing sewer pump station #5. This scenario also utilized the existing 18-inch sewer force main from sewer pump station #5 to the storage tank. This scenario did not consider retrofitting the sewer pump station. Subsequently, the pump station at the Pleasant Grove WWTP was designed and constructed per the recommendations of Technical Memorandum #1. The 24-inch diameter pipeline recommended in the Technical Memorandum is larger than the 20-inch recommended in the Feasibility Study because the Technical Memorandum considered a flow scenario that was not considered in the Feasibility Study, as described above.

City Recycled Water Supply and Power Plant Demand Estimates

Subsequent to preparation of the Feasibility Study, Enron proposed construction of a 750 – 900 Megawatt power plant adjacent to the new Pleasant Grove WWTP. It was assumed that this power plant would be constructed by approximately 2005. No phasing of the power plant construction was proposed or discussed.

Enron developed estimates of average day and peak day water consumption for cooling purposes at the proposed power plant. These estimates were provided to the City. The City then developed preliminary estimates of recycled water supply available from the Pleasant Grove WWTP to assess the City's capacity to supply recycled water to the facility for cooling purposes. Several alternative supply scenarios were developed by the City. These scenarios varied the wastewater generation unit factor from 200 gallons per day per equivalent dwelling unit (gpd/EDU) to 260 gpd/EDU. In addition, the scenarios varied the rate of growth between 75 percent and 100 percent of that projected in the engineers report used for revenue projections. Four separate supply estimates were prepared by combining the variations described above.

Montgomery Watson Harza Technical Memoranda

Montgomery Watson Harza (MWH) prepared several technical memoranda in support of the WRSP Master Water Study. These technical memoranda evaluate the City's water demand unit

factors based on an analysis of metered water use and land use information. The memoranda revise and reduce the unit factors developed in a previous report prepared by Spink in 1993.

The memoranda also evaluate recycled water demands in support of developing alternative supplies of water. *Task 7 – Water Supply Strategy* (November 2002) evaluates recycled water demand under three scenarios: “normal use”, “semi-aggressive use”, and “aggressive use”. “Normal use” includes typical applications of recycled water for golf course, parks, schools, and publicly landscaped areas. “Semi-aggressive” use extends the use of recycled water to commercial, industrial, and multi-family open space areas. “Aggressive use” would extend the use to all residential outdoor uses. MWH used the “normal use” scenario to estimate demands for the existing City and the “semi-aggressive” scenario to estimate demands for the WRSP area. MWH estimated the maximum “existing City” demand to be approximately 3,000 AFY. In addition, they estimated the WRSP area demand to be 1,100 AFY, with an additional 800 AFY for the MOU transition areas 1 and 2.

Note that “existing City” demand per the MWH memorandum is defined as the buildout recycled water demand in all other areas of Roseville, besides the WRSP or MOU transition areas. Thus, “existing City” demand includes future recycled water demands in existing and planned portions of the City that are not yet built or connected.

Reconciliation of “Existing City” Demand Estimates

As noted above, MHW technical memorandum Task 7 estimates the ultimate demand for the “existing City” (not including WRSP and MOU transition areas) to be approximately 3,000 AFY. This demand used in the MHW memorandum was developed in coordination with City staff. However, the Feasibility Study estimated a Phase III ultimate demand of 4,306 AFY. The difference in the estimates for ultimate demand in the “existing City” is due to partly to the fact that the Feasibility Study Phase III ultimate demand included some customers that are now counted within the WRSP area, not the “existing City” area. Also, an assumption was made, during preparation of the MWH technical memoranda, that some of the recycled water customers estimated in the Feasibility Study will not be connected. In order to complete the hydraulic and water balance analysis in this Study, these differences must be reconciled. The City has indicated that an “existing City” ultimate recycled water demand of approximately 3,000 AFY should be used for planning purposes. A set of customers that could be deleted from the Feasibility Study Phase III customer set to result in an “existing City” ultimate demand of approximately 3,000 AFY is described below.

The Phase III project in the Feasibility Study included estimates for “existing City” recycled water demands for two customers in the area that is now described as the WRSP area (Pleasant Grove Soccer Fields, 463 AFY; Fiddymment Pistachio Farm, 67 AFY). All recycled

water demands in this area are now counted as WRSP recycled water demands, based on the land use map for the WRSP area. Thus, the recycled water demands estimated in the Feasibility Study for customers in this area should no longer be counted as “existing City” customers. This results in a reduction of 530 AFY from the Feasibility Study Phase III ultimate demand for existing City customers. Note that the WRSP includes a regional park that will include recreational facilities such as soccer fields. Also, the land use map for WRSP includes other parks, commercial, and HDR land uses that will have recycled water demands. The demands previously estimated for Pleasant Grove Soccer Fields and Fiddymment Pistachio Farm are captured in the recycled water customer demands estimated based on the land use map for the WRSP area. However, these demands are now counted as WRSP demands, not “existing City” demands, since “existing City” demands only include demands outside of the WRSP and MOU transition areas.

Another potential deletion is the future Placer Vineyards development. If this customer were deleted, total “existing City” demand would be reduced an additional 565 AFY. Also, the City may not connect a number of existing schools and parks due to retrofit costs and/or difficulties. These include Quail Glen Elementary School, Robert Doyle Park, Woodcreek High School, Silverado Middle School and Park, Silverado Oaks Park, Wanish Park, Heritage Oak School, Kaseberg Park and School, Buljan Park and School, and Vencil Brown Park and School. Eliminating these customers reduces the “existing City” demand another 388 AFY.

For purposes of analysis of hydraulic and water supply balances, we have deleted the following customers from the Feasibility Study Phase III customer set to result in an “existing City” demand that is comparable to the demand estimated in the MWH technical memoranda:

- Pleasant Grove Soccer Fields
- Fiddymment Pistachio
- Placer Vineyards

Deleting these customers results in an “existing City” ultimate demand of 3,211 AFY. This demand is similar to the “existing City” ultimate demand estimate from the MWH technical memoranda.

Planning Criteria

In this section, engineering criteria are described for the following purposes:

- Estimating average, peak day and peak hour recycled water demands; and
- Sizing of pipelines, reservoirs, and pump stations during hydraulic modeling.

The criteria described below for estimating demands is similar to the criteria used in the Feasibility Study for estimating recycled water demands. Demands are calculated using estimated irrigated surface areas, evapotranspiration rates, and precipitation data. This procedure is described below.

Estimated Irrigated Surface Area

Total surface areas for each customer were obtained from a draft land use map dated April 28, 2003, referred to as Admin Draft 3A. However, not all surface area for each customer will be irrigated. For example, parks will include sidewalks. High density residential areas will include buildings and walkways. Thus, factors were applied to the total surface areas to estimated *irrigated* surface areas. These factors are different for each land use and are described in **Table 1** below.

Table 1 • Irrigated Surface Area Factors

Land Use Type	Irrigated Surface Area Factor (Ratio of Total Surface Area to Irrigated Surface Area)
Parks, including paseos Public/Quasi Public	0.90
(schools, churches, fire station)	0.50
High Density Residential	0.40
Community Commercial, Business Professional, Light Industrial	0.30

The factor used for estimated irrigated surface areas for parks accounts for sidewalks and other hard-scaped areas that would not be irrigated. Note that it is expected that the some regional parks in WRSP will remain oak woodland and will not be irrigated. However, the City requested that the engineer assume that all parks are irrigated for purposes of estimating demands. The factor used for estimating irrigated surface areas for public/quasi public land uses was calculated by reviewing aerial photographs of existing schools in Roseville located adjacent to parks. It is assumed that this school/park configuration is representative of the planned configuration at the WRSP area. The factor for estimating irrigated surface areas for CC/BP/LI is an estimated based on other studies recently prepared for Sacramento County.

The factor used for estimating irrigated surface areas for high density residential land uses was determined by reviewing ratios of irrigated to total areas at several apartment complexes that use recycled water in Dublin, California. These apartment complexes were built recently, and the grounds at these complexes were designed to use recycled water. Thus, it is assumed that the ratio of irrigated to total surface area for these apartment complexes in Dublin is

representative of the HDR land uses in WRSP. Note that the factors shown in **Table 1** were used only to estimate the percentage of *irrigated* surface area based on a *total* surface area. These irrigated surface areas were then used, along with evapotranspiration data specific to Roseville, to estimate recycled water demands. No climatological data specific to Dublin was used to estimate recycled water demands.

In addition to the land uses above, irrigated areas were estimated for streetscapes using lengths calculated from the land use map and typical widths for landscape medians and parkways provided by Wood-Rodgers.

Evapotranspiration Rates

Evapotranspiration rates (ET) are a measure of water usage by a particular crop and are a function of net solar radiation, air temperature, wind speed, and vapor pressure. Evapotranspiration rates for a specific crop in a specific location are calculated on a monthly basis by the following equation:

$$ET = ET_o(k_c)$$

where:

- ET_o = Normal year reference crop evapotranspiration rate for a given geographic location (California Department of Water Resources (DWR), California Irrigation Management Information System (CIMIS) database).
- k_c = Crop coefficient for a given crop (DWR Leaflets).

For this study, reference crop evapotranspiration rates (ET_o) for the City of Roseville were obtained from the DWR CIMIS database. Crop coefficients for cool weather turf grasses were obtained from University of California, Division of Agriculture and Natural Resources Leaflet 21427. Calculated ET rates and irrigation demands are shown in **Table 2**.

Precipitation Data

Annual precipitation data for the Sacramento area was obtained from the California DWR. Annual rainfall values from 1850 through 1998 were averaged to obtain typical annual rainfall data. A breakdown of rainfall by month was calculated using typical monthly rainfall percentages (DWR Bulletin No. 113-3).

Estimated Unit Irrigation Demands

Typical monthly unit irrigation demands for turf grasses are summarized in **Table 2** and were calculated using the following formula:

$$ID = \frac{[ET - Pe_p] l_r}{e_i}$$

where:

- ID* = Irrigation demand in inches.
- ET* = $(ET_0)(k_c)$ = Evapotranspiration for turf grasses in Roseville.
- P* = Average precipitation, DWR.
- e_p* = Precipitation irrigation efficiency, 0.8. Assumes 20% of rainfall during growing season is lost to evaporation, runoff, etc.
- l_r* = Loss Rate, 1.1. This assumes that approximately 10 percent of the applied water passes through the grass root zone and is lost.
- e_i* = Irrigation efficiency, 0.8 - 0.9 depending on season. This assumes that 10 – 20 percent of the applied irrigation water is lost to evaporation.

As shown in **Table 2**, the total annual unit irrigation demand for grasses is estimated at 43.4 inches. A peak monthly irrigation demand of 9.2 inches is projected for July. The irrigation season is approximately seven months long (April through October). No irrigation demands are projected for November through March when it is anticipated that local precipitation will satisfy landscape irrigation requirements.

Table 2 • Typical Local Irrigation Demands

Month	ET-Turf Grass (inches)	P ^a (inches)	Irrigation Demand (inches)	Irrigation Demand (feet)
January	0.88	3.57	0.0	0.00
February	1.36	3.24	0.0	0.00
March	2.48	2.45	0.6	0.04
April	3.76	1.52	3.3	0.27
May	4.96	0.71	5.7	0.48
June	6.16	0.24	8.0	0.67
July	6.80	0.02	9.2	0.77
August	5.84	0.04	8.0	0.67
September	4.48	0.24	5.8	0.48
October	2.96	0.97	2.8	0.24
November	1.28	1.68	0.0	0.00
December	0.80	3.63	0.0	0.00
Average			3.6	0.30
Total	41.76	18.31	43.4	3.62

^a Typical precipitation for Sacramento area based on annual average, 1850 – 1998, DWR.

Calculation of Average Day, Peak Day, and Peak Hour Demands

Average Day Irrigation Demands

The *average day demand* for a given customer is defined as the total annual water usage divided by the number of days in a year (365). Thus, *average day demand* is equivalent to what a customer's flow rate would be if water were delivered evenly, 24 hours a day, 365 days a year. *Average day demands* are calculated (in acre-feet per year) by multiplying the irrigated surface area (in acres) by the average unit demand of 0.3 feet presented in **Table 2** above.

Peak Day Demands

Peak day flows are estimated by applying peak factors to calculated *average day demands*. Peak day flow rates account for seasonal variations due to weather and growing conditions. Based on the data shown in **Table 2**, the average monthly irrigation demand over the year is 3.6 inches. However, the peak monthly irrigation demand occurs in July and is 9.2 inches. Thus, the monthly peak demand factor is $9.2/3.6 = 2.5$. It is assumed that *peak day demand* is essentially the same as peak monthly irrigation demand for facility planning purposes. This is reasonable because not all customers will be irrigating on the same day. It is further assumed that "true" peak day irrigation demand conditions (all customers irrigating on the same day) would occur so rarely that the cost of providing facilities to meet these demands is not justified. Therefore, a *peak day demand* factor of 2.5 times *average day demand* is assumed.

Peak hour delivery demands for irrigation systems are a function of the length of daily irrigation periods. A peak delivery factor of 2.67 times *peak day demand* was used to estimate peak delivery demands, assuming a 9-hour per day irrigation cycle ($24 \text{ hours} / 9 \text{ hours} = 2.67$). These unit peak factors are consistent with the information presented in the Feasibility Study.

The hourly peaking factor assumes that irrigation demands are uniform over the 9-hour daily irrigation period. Actual peaking requirements can be managed during program implementation by emphasizing water management and staggering irrigation periods between customers. A summary of peaking factors assumed for landscape irrigation in this study is provided below:

$$\begin{array}{lll} \text{Peak Day Demand} & = & 2.5 \times \text{Average Day Demand} \\ \text{Peak Hour Delivery Demand} & = & 2.67 \times \text{Peak Day Demand} \\ & & \text{or} \\ & & 6.68 \times \text{Average Day Demand} \end{array}$$

Modeling Criteria

The following criteria are used for purposes of hydraulic modeling and analysis of storage requirements:

- Minimum dynamic pressure (under peak hour conditions): 40 psi
- Maximum static or dynamic pressure: 75 psi
- Minimum pipeline diameter: 6-inches

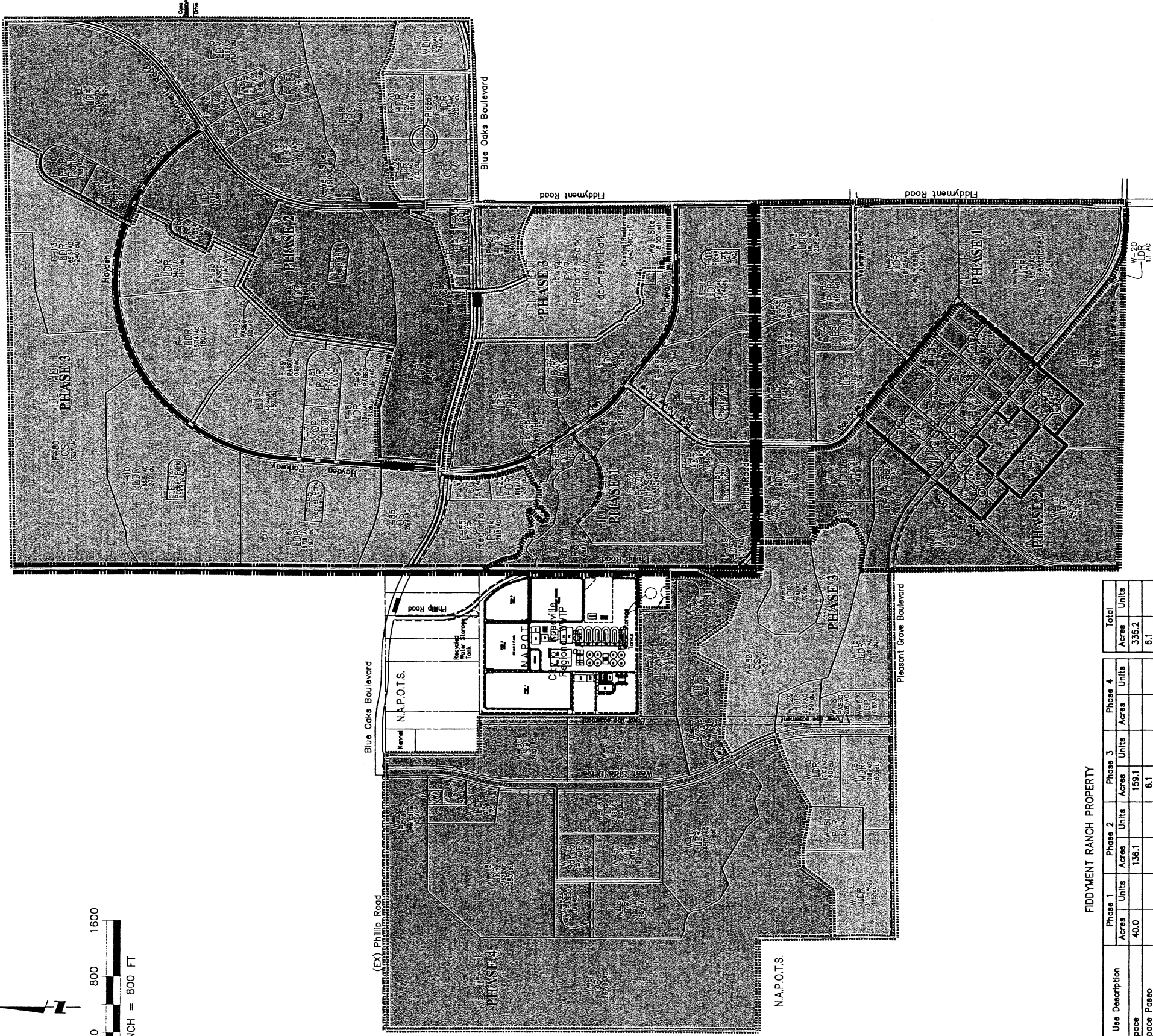
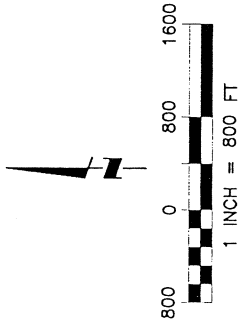
- Hazen-Williams “C” value: 130
- Desirable velocity: 3 – 5 ft/sec
- Maximum velocity: 7 ft/sec

Note that the minimum and maximum pressure criteria for this study are lower than the criteria used in the Feasibility Study. The Feasibility Study used a minimum dynamic pressure of 50 psi and a maximum pressure of 100 psi for the “high” pressure zone (see discussion above under Background). These criteria could be achieved in this study as well. However, the City prefers to maintain recycled water system pressures lower than potable water pressures in the same area. As a result, we have lowered the minimum pressure for the recycled water system from 50 psi to 40 psi. Also, we have lowered the maximum pressure criteria from 100 psi to 75 psi. This adjustment sets the pressure criteria for the recycled water system below similar criteria for the potable water system in the WRSP area. Note that dynamic pressures vary depending on demands. Since diurnal and seasonal demand patterns are different for the recycled water and potable water systems, there may be times of the day or periods of the year when recycled water pressures are higher than potable water pressures.

It was determined that at the current level of detail, extended period simulations are not required. As a result, the system is modeled at peak hour demands only.

Phasing Criteria

Phases described in this study are based on a draft phasing map dated May 7, 2003. This map is based on the land use map dated April 28, 2003 and referred to as “Admin Draft 3A”. This map shows four separate phases for the WRSP area, not including the MOU transition areas. **Figure 2** shows the phases that are represented on the land use map. It is assumed that Phase 1 will be completed in the year 2005, with each subsequent phase completed every five years. This results in all four phases completed by year 2020. It is further assumed that the MOU Transition areas would be completed by year 2030.



FIDDYMMENT RANCH PROPERTY

Zoning	Land Use Description	Phase 1		Phase 2		Phase 3		Phase 4		Total	
		Acres	Units	Acres	Units	Acres	Units	Acres	Units	Acres	Units
OS	Open Space	40.0		136.1		159.1				335.2	
OS-P	Open Space Paseo					6.1				6.1	
PR	Park	51.8		13.7		129.7				195.2	
PR	Pocket Parks	7.2		6.0		6.2				19.4	
P/QP	Public/Quasi-Public	57.7		8.1		8.7				74.5	
LDR	Low Density Residential	187.1	688	284.9	865	365.3	1,234			837.3	2,767
MDR	Medium Density Residential	17.3	174	37.0	185					54.3	359
HDR	High Density Residential	52.2	710	11.2	198	6.9	136			70.3	1,044
CC	Community Commercial	15.4		9.3		5.4				30.1	
BP	Business Professional	9.1								9.1	
R/W	Road Right-of-Way	26.8		10.0		10.1				46.9	
	Subtotal	484.6	1,552	496.3	1,248	717.5	1,370			1,698.4	4,170

WESTPARK PROPERTY

Zoning	Land Use Description	Phase 1		Phase 2		Phase 3		Phase 4		Total	
		Acres	Units	Acres	Units	Acres	Units	Acres	Units	Acres	Units
OS	Open Space	5.2				77.2		287.0		349.4	
OS-P	Open Space Paseo	3.8				3.7		0.9		8.4	
PR	Park	8.2		7.9		12.1		14.1		42.3	
P/QP	Public/Quasi-Public	15.1		19.9				30.0		65.0	
LDR	Low Density Residential	120.4	545	148.7	614	99.1	331	149.1	585	517.3	2,075
LDR(A)	Low Density Residential (Age Restricted)	145.9	710							145.9	710
MDR	Medium Density Residential					20.6	160	21.9	165	42.5	325
HDR	High Density Residential					8	150	9.0	175	17.0	325
BP	Business Professional					10.5				10.5	
CC	Community Commercial							4.0		4.0	
LI	Light Industrial							74.2		74.2	
IND	General Industrial							34.3		34.3	
R/W	Road Right-of-Way	23.4		5.5		9.9		12.3		51.1	
VC-MDR	Medium Density Residential			46.1	380					46.1	380
VC-HDR	High Density Residential			22.4	405					22.4	405
VC-CC	Community Commercial			14.4	40					14.4	40
VC-P/R	Park			13.6						13.6	
VC-P/QP	Public/Quasi-Public			10.9						10.9	
VC-R/W	Road Right-of-Way			13.3		24.1	641	616.8	925	13.3	
	Subtotal	323	1,255	302.7	1,439	241.1	641	616.8	925	1,483.6	4,260

Total Combined	787.6	2,807	799	2,687	958.6	2,011	616.8	925	3,162	8,430
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Figure 2
WEST ROSEVILLE SPECIFIC PLAN
RECYCLED WATER STUDY
DRAFT PHASING PLAN

Recycled Water Customers and Demands

Recycled water customers and demands are evaluated in this section.

Customer Base

In addition to the criteria listed above, other assumptions used to evaluate the customer base are listed below:

- Semi-aggressive recycled water use, per MWH Technical Memorandum Task 7. Includes parks, golf courses, schools, publicly landscaped areas, commercial, industrial, and multi-family users.
- “Open space” constitutes “natural areas” and will not be irrigated.
- Recycled water will be used to irrigate streetscapes along RW alignments in arterial roads only. Based on information provided by Wood-Rodgers, irrigation demands are estimated for streetscapes along portions of Blue Oaks Boulevard, Hayden Parkway, Fiddymont Road, Pleasant Grove Boulevard, Westpark Drive, and “Collector Road A”. In addition, streetscape demands are estimated for unnamed arterial roads with recycled water pipelines in the MOU transition areas.
- “Multi-family users” include all HDR land uses.
- “Commercial” uses are for irrigation of common areas.

It is our understanding that the “multi-family” open space uses included in the “semi-aggressive” recycled water use scenario described in MWH Technical Memorandum Task 7 was limited to high-density residential land uses. This would typically include apartment buildings where all irrigated areas are under the control of the property management. MWH also considered an “aggressive use” demand scenario, which would include all irrigation demands, including those within medium density and lower density residential land uses. However, based on discussions with the City, MWH determined that the “aggressive use” scenario was unlikely due to cost and permitting issues. As a result, the “aggressive use” scenario was dropped from further discussion in the final MWH TM Task 7. Wood Rodgers and HydroScience were instructed to use the “semi-aggressive” recycled water use approach in this study.

The actual types of structures that will be constructed within the medium density residential land use are not known at this time. The City has indicated that condominiums and/or brownstones could be constructed within the medium density land use areas. These types of structures could have commonly irrigated landscaped areas. Recycled water demands could be estimated for these uses. This would create a recycled water demand use scenario somewhere in between the “semi-aggressive” and “aggressive” approaches considered in the MWH technical memoranda. However, since these condominiums and/or brownstones would also likely include private ownership of individual units and irrigated patio areas that would be controlled by the private owners, including this type of recycled water customer would likely increase the cost and

complexity of the recycled water distribution system, monitoring, reporting, and permitting requirements. This is similar to the conclusion reached during preparation of the MWH technical memoranda for the “aggressive” use scenario. As a result, we have not included recycled water demands for any commonly irrigated areas within the medium density residential land uses.

Customer Demands

Customer demands are shown in **Table 3** and **Figure 3**. Average annual, average day, peak day, and peak hour demands are included. Demands and customers are sorted and totaled by phase. Totals are shown with and without streetscape demands. Totals with streetscape demands are used for analysis of facility requirements and available supply. Totals without streetscape demands are provided for purposes of measuring offsets from demand estimated by the MWH technical memoranda, since streetscape demands were not included in MWH estimates.

Comparison with MWH Demands from Technical Memoranda

The total annual demand estimated above for the WRSP area, not including streetscapes, is approximately 1,500 AFY. This is higher than the demand of 1,100 AFY estimated in the MWH technical memorandum. The MWH demand for recycled water use was preliminary, based on total water usage factors and did not include a detailed analysis of each customer type. In addition, it is not clear whether the recycled water demands estimated in the MWH report included irrigation of streetscapes. The estimates presented in this study are based on a more detailed analysis of each customer and land use. Therefore, the recycled water demands estimates prepared in this study are considered more refined and are used for the remainder of this analysis.

Table 3
Recycled Water Customer Demands

ID	Phase	Number	Customer Name	Land Use Type	Total Site Area ¹ (Acres)	% of Site Area Irrigated ²	Site Area Irrigated (Acres)	Annual Demand (AFY)	Average Day Demand (GPD)	Peak Day Demand (GPD)	Peak Hour Demand (GPM)
1	109	CC 2	Community Commercial	Community Commercial	2	0.30	0.60	2.17	1,939	4,848	8.98
1	110	HDR 9.7	High density residential	High density residential	9.7	0.40	3.88	14.05	12,539	31,348	58.05
1	111	CC 13.4	Community Commercial	Community Commercial	13.4	0.30	4.02	14.55	12,992	32,479	60.15
1	112	HDR 12.1	High density residential	High density residential	12.1	0.40	4.84	17.52	15,642	39,104	72.41
1	113	HDR 13.6	High density residential	High density residential	13.6	0.40	5.44	19.69	17,581	43,951	81.39
1	122	Park 6.0	Park	Park	6	0.90	5.40	19.55	17,451	43,628	80.79
1	124	HDR 16.8	High density residential	High density residential	16.8	0.40	6.72	24.33	21,717	54,293	100.54
1	129	Regional Park 45.8	Park	Park	45.8	0.90	41.22	149.22	133,212	333,029	616.72
1	130	High School 53	Public/Quasi-Public	Public/Quasi-Public	53	0.50	26.50	95.93	85,641	214,102	396.48
1	131	Fire Station 3.1	Public/Quasi-Public	Public/Quasi-Public	3.1	0.50	1.55	5.61	5,009	12,523	23.19
1	133	BP 9.1	Business Prof./Light Industrial	Business Prof./Light Industrial	9.1	0.30	2.73	9.88	8,823	22,057	40.85
1	137	Park 8.2	Park	Park	8.2	0.90	7.38	26.72	23,850	59,625	110.42
1	143	School 10	Public/Quasi-Public	Public/Quasi-Public	10	0.50	5.00	18.10	16,159	40,397	74.81
1	173	Pocket Park 5	Park	Park	2.4	0.90	2.16	7.82	6,981	17,451	32.32
1	174	Pocket Park 6	Park	Park	2.4	0.90	2.16	7.82	6,981	17,451	32.32
1	175	Pocket Park 7	Park	Park	2.4	0.90	2.16	7.82	6,981	17,451	32.32
1	176	P/QP 1.6	Public/Quasi-Public	Public/Quasi-Public	1.6	0.50	0.80	2.90	2,585	6,463	11.97
1	183	Paseo 2.3	Paseo	Paseo	2.3	0.90	2.07	7.49	6,690	16,724	30.97
1	184	Paseo 1.5	Paseo	Paseo	1.5	0.90	1.35	4.89	4,363	10,907	20.20
1		Streetscapes ³	Streetscape	Streetscape	65.2	0.44	28.8	104.25	93,071	232,679	430.89
Phase 1 subtotal (without streetscapes)					215	0.58	126	456	407,133	1,017,831	1,885
Phase 1 subtotal (with streetscapes)					281	0.55	155	560	500,204	1,250,610	2,316
2	100	Park 7.8	Park	Park	7.8	0.90	7.02	25.41	22,687	56,717	105.03
2	101	School 8.1	Public/Quasi-Public	Public/Quasi-Public	8.1	0.50	4.05	14.66	13,088	32,721	60.59
2	102	CC 4.4	Community Commercial	Community Commercial	4.4	0.30	1.32	4.78	4,266	10,665	19.75
2	103	CC 4.9	Community Commercial	Community Commercial	4.9	0.30	1.47	5.32	4,751	11,877	21.99
2	104	HDR 5.5	High density residential	High density residential	5.5	0.40	2.20	7.96	7,110	17,774	32.92
2	105	HDR 5.7	High density residential	High density residential	5.7	0.40	2.28	8.25	7,368	18,421	34.11
2	106	Park 5.9	Park	Park	5.9	0.90	5.31	19.22	17,160	42,901	79.45
2	135	Park 7.9	Park	Park	7.9	0.90	7.11	25.74	22,978	57,444	106.38
2	136	Middle School 19.9	Public/Quasi-Public	Public/Quasi-Public	19.9	0.50	9.95	36.02	32,156	80,389	148.87
2	139	Park 4	Park	Park	4	0.90	3.60	13.03	11,634	29,086	53.86
2	140	Church 10.9	Public/Quasi-Public	Public/Quasi-Public	10.9	0.50	5.45	19.73	17,613	44,032	81.54
2	141	Park 9.6	Park	Park	9.6	0.90	8.64	31.28	27,922	69,805	129.27
2	142	HDR 12.4	High density residential	High density residential	12.4	0.40	4.96	17.96	16,029	40,073	74.21
2	170	Pocket Park 3a	Park	Park	3	0.90	2.70	9.77	8,726	21,814	40.40
2	172	Pocket Park 3b	Park	Park	3	0.90	2.70	9.77	8,726	21,814	40.40
2	182	Paseo 1.1	Paseo	Paseo	1.1	0.90	0.99	3.58	3,199	7,999	14.81
2	186	CC 7.2a	Community Commercial	Community Commercial	7.2	0.30	2.16	7.82	6,981	17,451	32.32
2	187	CC 7.2b	Community Commercial	Community Commercial	7.2	0.30	2.16	7.82	6,981	17,451	32.32
2	192	Paseo 2	Paseo	Paseo	0	0.90	0.00	0.00	0	0	0.00
2	193	HDR 10	High density residential	High density residential	10	0.40	4.00	14.48	12,927	32,317	59.85
2		Streetscapes ³	Streetscape	Streetscape	22.2	0.44	9.7	34.98	31,232	78,081	144.59

Table 3
Recycled Water Customer Demands

Phase	ID	Customer Name	Land Use Type	Total Site Area ¹ (Acres)	% of Site Area Irrigated ²	Site Area Irrigated (Acres)	Annual Demand (AFY)	Average Day Demand (GPD)	Peak Day Demand (GPD)	Peak Hour Demand (GPM)
Phase 2 subtotal (without streetscapes)										
3	107	School 8.7	Public/Quasi-Public	139	0.56	78	283	252,301	630,762	1,168
Phase 2 subtotal (with streetscapes)										
3	108	Park 8.9	Park	161	0.55	88	318	283,533	708,832	1,313
3	109	Regional Park 29.8	Park	8.7	0.50	4.35	15.75	14,058	35,145	65.08
3	110	CC 5.4	Community Commercial	8.9	0.90	8.01	29.00	25,886	64,715	119.84
3	111	HDR 6.9	High density residential	29.8	0.90	26.82	97.09	86,875	216,687	401.27
3	112	Regional Park 91	Park	5.4	0.30	1.62	5.86	5,235	13,088	24.24
3	113	Park 12.1	Park	6.9	0.40	2.76	9.99	8,920	22,299	41.29
3	114	Pocket Park 1	Park	91	0.90	81.90	296.48	264,678	661,695	1,225.36
3	115	Pocket Park 3	Park	12.1	0.90	10.89	39.42	35,193	87,984	162.93
3	116	Paseo 2.6	Paseo	3.2	0.90	2.88	10.43	9,307	23,268	43.09
3	117	BP 10.5	Business Prof./Light Industrial	3	0.90	2.70	9.77	8,726	21,814	40.40
3	118	HDR 8	High density residential	2.6	0.90	2.34	8.47	7,562	18,906	35.01
3	119	Paseo 1.1	Paseo	10.5	0.30	3.15	11.40	10,180	25,450	47.13
3	120	Paseo 3.0	Paseo	8	0.40	3.20	11.58	10,342	25,854	47.88
3	121	Paseo 0.9	Paseo	1.1	0.90	0.99	3.58	3,199	7,999	14.81
3	122	Paseo 1.1	Paseo	3	0.90	2.70	9.77	8,726	21,814	40.40
3	123	Streetscapes ³	Streetscape	0.9	0.90	0.81	2.93	2,618	6,544	12.12
3	124	Phase 3 subtotal (without streetscapes)		1.1	0.90	0.99	3.58	3,199	7,999	14.81
3	125	Phase 3 subtotal (with streetscapes)		39.5	0.46	18.2	65.88	58,817	147,043	272.30
4	126	Park 14.1	Park	196	0.80	156	565	504,504	1,261,261	2,336
4	127	School 7.9	Public/Quasi-Public	236	0.74	174	631	563,322	1,408,304	2,608
4	128	IND 34.3	Light Industrial	14.1	0.90	12.69	45.94	41,011	102,526	189.86
4	129	LI 35.9	Light Industrial	7.9	0.50	3.95	14.30	12,765	31,913	59.10
4	130	LI 38.3	Light Industrial	34.3	0.30	10.29	37.25	33,254	83,136	153.96
4	131	HDR 9	High density residential	35.9	0.30	10.77	38.99	34,806	87,014	161.14
4	132	CC 4	Community Commercial	38.3	0.30	11.49	41.59	37,133	92,831	171.91
4	133	Paseo 0.9	Paseo	9	0.40	3.60	13.03	11,634	29,086	53.86
4	134	Streetscapes ³	Streetscape	4	0.30	1.20	4.34	3,878	9,695	17.95
4	135	Phase 4 subtotal (without streetscapes)		0.9	0.90	0.81	2.93	2,617.70	6,544.24	12.12
4	136	Phase 4 subtotal (with streetscapes)		26.1	0.45	11.7	42.44	37,888	94,721	175.41
4	137	MOU 1	MOU 1	144	0.38	55	198	177,098	442,746	820
4	138	MOU 2	MOU 2	170	0.39	67	241	214,987	537,467	995
Totals MOU 1 (without streetscapes)										
MOU 1	145	Park 10	Park	10	0.90	9.00	32.58	29,086	72,714	134.66
MOU 1	146	HDR 20	High density residential	20	0.40	8.00	28.96	25,854	64,634	119.69
MOU 1	147	CC 13.6	Community Commercial	13.6	0.30	4.08	14.77	13,185	32,964	61.04
MOU 1	148	BR/LI 39.4	Business Prof./Light Industrial	39.4	0.30	11.82	42.79	38,199	95,497	176.85
MOU 1	149	Streetscapes ³	Streetscape	18.2	0.46	8.4	30.37	27,112	67,779	125.52
Totals MOU 1 (with streetscapes)										
MOU 1	150	CC 10	Community Commercial	83	0.40	33	119	106,324	265,809	492
MOU 1	151	School 10	Public/Quasi-Public	101	0.41	41	149	133,435	333,588	618
MOU 2	152	Park 10	Park	10	0.30	3.00	10.86	9,695	24,238	44.89
MOU 2	153	MOU 2	MOU 2	10	0.50	5.00	18.10	16,159	40,397	74.81
MOU 2	154	MOU 2	MOU 2	10	0.90	9.00	32.58	29,086	72,714	134.66

Table 3
Recycled Water Customer Demands

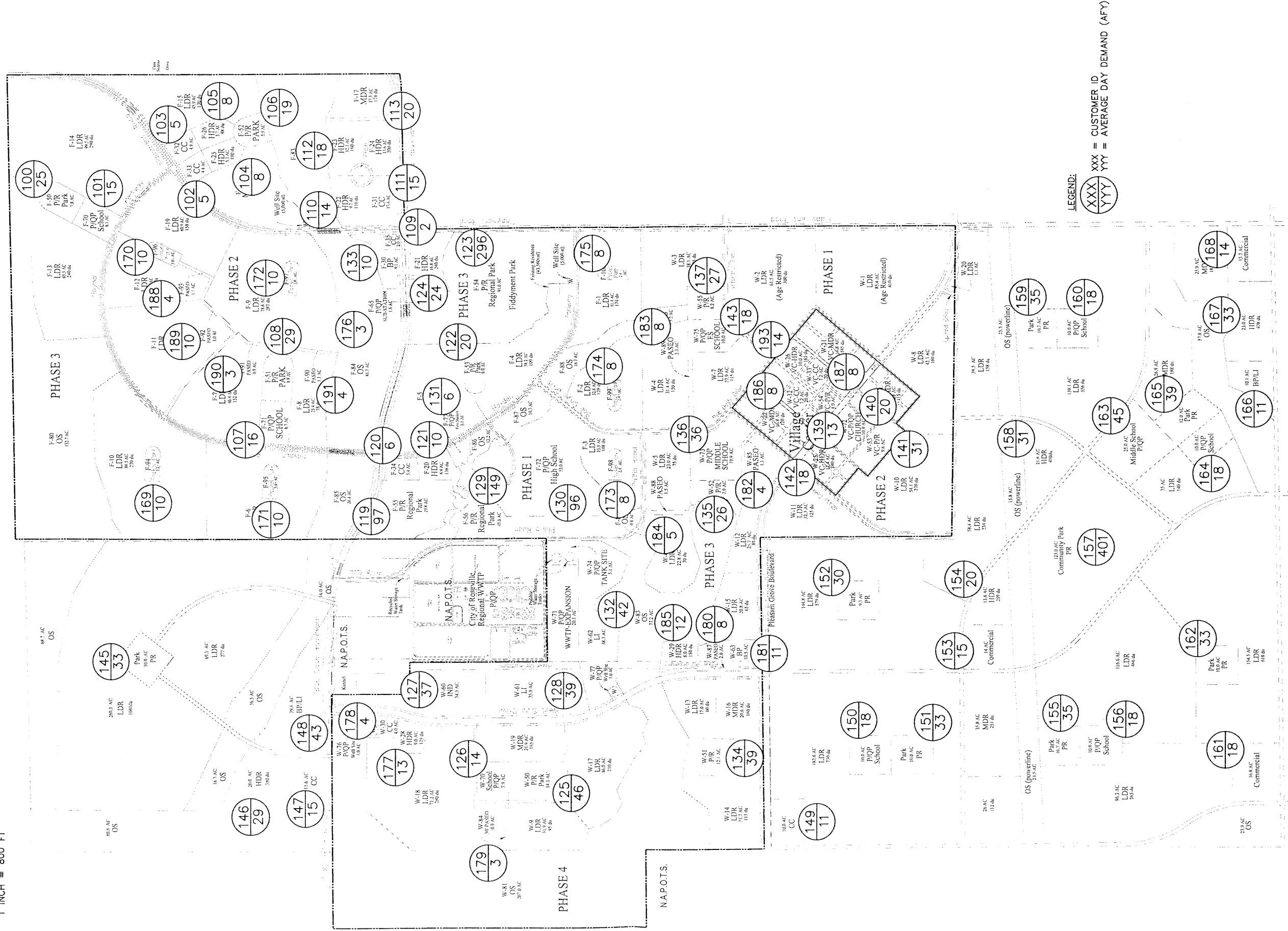
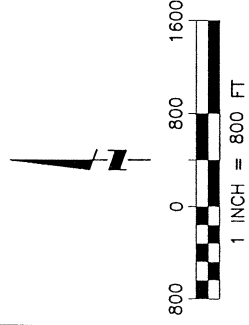
Phase	ID Number	Customer Name	Land Use Type	Total Site		% of Site		Site Area Irrigated (Acres)	Annual Demand (AFY)	Average Day Demand (GPD)	Peak Day Demand (GPD)	Peak Hour Demand (GPM)
				Area ¹ (Acres)	Area Irrigated ²	Area	Irrigated ²					
MOU 2	152	Park 9.3	Park	9.3		0.90	8.37	30.30	27,050	67,624		125.23
MOU 2	153	CC 14	Community Commercial	14		0.30	4.20	15.20	13,573	33,933		62.84
MOU 2	154	HDR 13.6	High density residential	13.6		0.40	5.44	19.69	17,581	43,951		81.39
MOU 2	155	Park 10.7	Park	10.7		0.90	9.63	34.86	31,121	77,804		144.08
MOU 2	156	School 10	Public/Quasi-Public	10		0.50	5.00	18.10	16,159	40,397		74.81
MOU 2	157	Community Park 123	Park	123		0.90	110.70	400.73	357,752	894,379		1,656.26
MOU 2	158	HDR 21.6	High density residential	21.6		0.40	8.64	31.28	27,922	69,805		129.27
MOU 2	159	Park 10.7	Park	10.7		0.90	9.63	34.86	31,121	77,804		144.08
MOU 2	160	School 10	Public/Quasi-Public	10		0.50	5.00	18.10	16,159	40,397		74.81
MOU 2	161	CC 16.8	Community Commercial	16.8		0.30	5.04	18.24	16,288	40,720		75.41
MOU 2	162	Park 10	Park	10		0.90	9.00	32.58	29,086	72,714		134.66
MOU 2	163	Middle School 25	Public/Quasi-Public	25		0.50	12.50	45.25	40,397	100,991		187.02
MOU 2	164	School 10	Public/Quasi-Public	10		0.50	5.00	18.10	16,159	40,397		74.81
MOU 2	165	Park 12	Park	12		0.90	10.80	39.10	34,903	87,257		161.59
MOU 2	166	BPLI 10.1	Business Prof/Light Industrial	10.1		0.30	3.03	10.97	9,792	24,480		45.33
MOU 2	167	HDR 23	High density residential	23		0.40	9.20	33.30	29,732	74,330		137.65
MOU 2	168	CC 13.2	Community Commercial	13.2		0.30	3.96	14.34	12,798	31,994		59.25
MOU 2		Streetscapes ³		37.9		0.46	17.6	63.55	56,737	141,843		262.67
Totals MOU 2 (without streetscapes)				373		0.65	242	877	782,530	1,956,324		3,623
Totals MOU 2 (with streetscapes)				411		0.63	260	940	839,267	2,098,167		3,885

Table 3
Recycled Water Customer Demands

Phase	ID	Customer Name	Land Use Type	Total Site Area ¹ (Acres)	% of Site Area Irrigated ²	Site Area Irrigated (Acres)	Annual Demand (AFY)	Average Day Demand (GPD)	Peak Day Demand (GPD)	Peak Hour Demand (GPM)
MOU Transition Areas Only Total (without streetscapes)										
				456	0.60	275	996	888,853	2,222,133	4,115
MOU Transition Areas Only Total (with streetscapes)										
				512	0.59	301	1,090	972,702	2,431,756	4,503
WRSP Area Only Total (without streetscapes)										
				695	0.60	415	1,502	1,341,036	3,352,590	6,209
WRSP Area Only Total (with streetscapes)										
				847	0.57	483	1,750	1,562,045	3,905,113	7,232
WRSP and MOU Transition Areas Total (without streetscapes)										
				1,151	0.60	690	2,498	2,229,889	5,574,723	10,324
WRSP and MOU Transition Areas Total (with streetscapes)										
				1,359	0.58	784	2,839	2,534,748	6,336,869	11,735
Units				acres			AFY	GPD	GPD	GPM
Units				acres			AFY	GPD	GPD	GPM

Footnotes

1. "Total Site Area" is the total area (in acres) of each recycled water customer site, as shown on the Admin Draft 3A land use map (see Figures 2 and 3). For all land use areas, including those not irrigated by recycled water, see the matrix on Figure 2.
2. "% of Site Area Irrigated" is the percentage of the "Total Site Area" that is assumed to be landscaped and irrigated with recycled water. Assumed percentages are described in the text of the report text. Percentages for streetscapes were calculated based on typical rights-of-way (ROW) widths, median widths, and parkway widths.
3. Recycled water demands for streetscapes were calculated for the landscaped portions of arterial ROWs that contain recycled water pipelines. Landscaping along other roads is not included. It is assumed that the landscaped portion of ROWs will be installed in the same phase as the land uses adjacent to the ROW. Where different phases are shown on both sides of the same ROW, it is assumed that the landscaping will be installed during the earliest of the two phases.



LEGEND:
XXX = CUSTOMER ID
YYY = AVERAGE DAY DEMAND (AFY)

Figure 3
WEST ROSEVILLE SPECIFIC PLAN
RECYCLED WATER STUDY
MARKET ASSESSMENT MAP

Unlike the MWH estimates for recycled water, the MWH estimates for *total* water use presented in the technical memoranda do include detailed breakdowns of water use by land use type. In addition, MWH *total* water use estimates are based partly on actual City water usage data. These estimates account for all water use, including irrigation, but do not distinguish between potable water use and recycled water use. The recycled water demand estimates prepared in this study can be compared against the MWH total water use estimates (by land type) as a check on reasonableness. **Table 4** presents this comparison. The comparison shows good correlation between the recycled water demands estimated in this study for park land use and the total water demand estimates presented in the MWH technical memoranda for the same land uses. It would be expected that nearly all of the water demand for this land use type would be for irrigation and would be met with recycled water supply. In addition, the comparison indicates that between 25 and 50 percent of the total water use for high density residential, commercial, industrial, and public/quasi public land uses would be met by recycled water. The percentage of total demand associated with irrigation at these types of land uses would vary from site to site. However, the irrigation demand estimates (recycled water demands) for these land uses appears reasonable when compared to the total water demand estimates for these land uses.

Note that the “pocket park” areas are counted in the residential land use categories in the Specific Plan and the MWH technical memoranda. Thus, the water demands estimated by MWH for the pocket parks are contained within MWH residential land use demands, not the MWH park land use demands. As a result, recycled water demands calculated for the pocket parks in this study are not included in **Table 4** for comparison with the MWH park land use demands. Similarly, the paseos are classified as open space in the MWH technical memoranda. Similarly, recycled water demands for the paseos estimated in this study are not included in **Table 4** for comparison with the MWH park land use demands. However, pocket parks and paseos will be irrigated with recycled water, and demands are included for these customers in **Table 3**.

Table 4
Percent Recycled Water Demand

Land Use Type	Annual Recycled Water Demand (AFY)	Total Water		% of Total Water Demand Met with Recycled Water
		Demand from MWH Task 7 (AFY)	Demand Met with Recycled Water	
Community Commercial / Business Professional	74	270	0.27	
High Density Residential	159	517	0.31	
Industrial	118	329	0.36	
Park (without pocket parks)	818	824	0.99	
Park (with pocket parks)	881			
Paseos	47			
Public / Quasi Public	223	503	0.44	
Streetscapes	248			
WRSP Total (not including ROW demands)	1,502			
WRSP Total (including ROW demands)	1,750			

Recycled Water Supply

The availability of recycled water supply to the WRSP area is a function of recycled water production, pumping capacity, storage, and existing or priority demands. These parameters are analyzed in this section. Supply and demand must be considered in both the existing City system (Dry Creek WWTP) and the future City system (PGWWTP).

Recycled Water Supply at Dry Creek WWTP

The City prepared recycled water supply estimates when evaluating capacity to supply recycled water to a proposed power plant (Enron). The method used by the City in that analysis is also used to calculate DCWWTP recycled water supply estimates for the years that correspond to phasing of WRSP, as described in the Planning Criteria section.

Equivalent dwelling units (EDUs) for the existing City are estimated in an engineers report that was prepared for the purpose of estimating sewer connection revenues and is considered conservative. Wastewater flow generation was estimated assuming a flow of 200 gallons per day (average) per EDU. Note that this is significantly lower than the flow generation factor of 260 gpd/EDU used in the City's Wastewater Master Plan. However, the lower unit factor results in an estimate of approximately 15 mgd average annual flow to the Dry Creek WWTP. This is similar to adjusted measured flows. As a result, this scenario is considered realistic. In addition, using the lower flow generation factor yields conservative estimates of wastewater generation (on the low side), which becomes recycled water supply. The percentage of the split in flow between the Dry Creek and Pleasant Grove WWTPs is derived from the City's Sewer Master Plan. The estimated recycled water supply at the Dry Creek WWTP is shown in **Table 5**. Average dry weather flow is also shown, since average dry weather flow is representative of flow available during the peak irrigation season.

Existing City Ultimate Recycled Water Demand

The "existing City" ultimate recycled water demand used in this study is 3,211 AFY and includes the customer set described in the Background section of this report. This includes buildout recycled water demands for all areas of the City, other than the WRSP and MOU Transition areas. This "existing City" ultimate demand is similar to the "existing City" ultimate demand of 3,000 AFY developed in the MWH technical memoranda.

Table 5
Dry Creek Wastewater Treatment Plant
Recycled Water Supply

Phase Completion	Year	Total Existing City		Existing City to DCWWTP	
		EDUs	Average Annual Flow (mgd)	Percent to DCWWTP	Average Annual Flow (mgd)
0	2002	75,837	15.17	66.7%	10.1
1	2005	88,269	17.65	68.3%	12.1
1 - 2	2010	101,754	20.35	54.7%	11.1
1 - 3	2015	112,094	22.42	54.6%	12.2
1 - 4	2020	119,069	23.81	54.6%	13.0
1 - 4 and					
MOU Areas	2030	131,019	26.20	54.6%	14.3
					13.2

Comparison of Existing City Demand to Existing City Supply from DCWWTP

This “existing City” annual demand of 3,211 AFY results in a peak day demand of approximately 7.2 mgd. When compared to the supply available as shown in **Table 5**, it is apparent that the DCWWTP produces enough recycled water by year 2005 to meet this demand. However, due to the low pressure requirement of the existing recycled water system supplied by Dry Creek WWTP (see Background section), the comparison of supply to demand in the Dry Creek WWTP system must include an evaluation of pumping capacity at the Dry Creek WWTP recycled water pump station. The existing City recycled water model was run using the “existing City” ultimate recycled water demand of 3,211 AFY. The model was run using an “extended period simulation” that calculates hourly hydraulic results over a 24-hour period. The model simulates hourly peak flow conditions during the peak irrigation season. The model results indicated that the Dry Creek WWTP recycled water pump station cannot meet the fill requirements for the existing tank in the Dry Creek system, under this ultimate flow scenario, due to the limited head condition imposed by the low pressure requirement. As a result, approximately 700 gpm of constant supply is required from the Pleasant Grove WWTP to the storage tank in the Dry Creek system during peak season conditions. With the added continuous supply of 700 gpm from Pleasant Grove WWTP, the storage tank could meet the hourly peaking requirements simulated in the model.

Recycled Water Supply at Pleasant Grove WWTP

Using the same method described above to estimate recycled water supply from the Dry Creek WWTP, flows from the existing City to the Pleasant Grove WWTP were estimated. In addition, contributing wastewater flows were estimated from the WRSP phased area as well. These estimated demands are shown in **Table 6**. The same unit factor used to estimate wastewater generation in the existing City (200 gpd per EDU) was used to estimate the wastewater generation in the WRSP area.

Table 6
Pleasant Grove Wastewater Treatment Plant
Recycled Water Supply

Phase Completion	Year	Total Existing City		Existing City To PGWWTP		West Roseville Specific Plan		Total Flow To PGWWTP	
		EDUs	Average Annual Flow (mgd)	Percent to PGWWTP	Average Annual Flow (mgd)	DUs from Phasing Plan	Average Annual Flow (mgd)	Average Annual Flow (mgd)	Average Dry Weather Flow (mgd)
0	2002	75,837	15.17	33.3%	5.1	0	0.0	5.1	4.7
1	2005	88,269	17.65	31.7%	5.6	2,807	0.6	6.2	5.7
1 - 2	2010	101,754	20.35	45.3%	9.2	5,494	1.1	10.3	9.5
1 - 3	2015	112,094	22.42	45.4%	10.2	7,505	1.5	11.7	10.7
1 - 4	2020	119,069	23.81	45.4%	10.8	8,430	1.7	12.5	11.5
1 - 4 and MOU Areas	2030	131,019	26.20	45.4%	11.9	15,453	3.1	15.0	13.8

Footnotes

1. Wastewater generation for WRSP calculated using unit flow factor of 200 gpd per DU.

Power Plant Demands

Enron provided recycled water demand estimates to the City. Enron anticipated that the power plant would have a capacity of 750 – 900 Megawatts. At the time of preparation of this report, it is believed that the Enron plant originally envisioned will not be constructed. As a result, this recycled water study does not assess the recycled water supply and demand requirements for the original facility envisioned by Enron. However, it is possible that a smaller facility may be constructed sometime in the future. The City of Roseville is currently considering constructing a power plant with a capacity of 100 – 150 Megawatts. The City expects the power plant would be constructed by 2005 or 2006.

For purposes of completing this study, two scenarios are considered and assessed in this study: no power plant and 150 Megawatt power plant. 150 Megawatts is the largest plant envisioned by the City. Also, it is assumed that the power plant would be online in 2005, which is the earliest date projected by the City. It is assumed that the recycled water demand for a 150 Megawatt power plant would be 20 percent of the demand estimated by Enron for the 750 Megawatt power plant previously proposed ($150 \text{ Megawatts} / 750 \text{ Megawatts} = 0.20$). The demands assumed for these two scenarios are summarized in **Table 7** below.

Table 7 • Power Plant Demand Scenarios

Scenario	Total Annual Demand (AFY)	Peak Day Demand (MGD)
Original Enron Plant (not evaluated)	5,562	7.26
Scenario 1: No Power Plant	0	0
Scenario 2: 150 Megawatt Power Plant	1,112	1.45

Comparison of Supply and Demand at Pleasant Grove WWTP

Tables 8 and 9 present a comparison of supply and demand at the Pleasant Grove WWTP system for both annual average and peak day conditions. First the total availability of recycled water supply from the Pleasant Grove WWTP is shown. Then the supplementary demand required at the Dry Creek WWTP is subtracted, and the remainder is shown as the availability of recycled water to the WRSP area. The final column shows the excess recycled water supply available to other City projects, such as a power plant project, after the WRSP demands and system losses are subtracted. As shown in **Tables 8 and 9**, adequate supply of recycled water is available to the WRSP project during all phases, annually and during the peak month. In addition, adequate supply of recycled water is available for other City projects (annually and during peak month), such as a 150 Megawatt power plant.

Table 8
Water Supply and Demand Comparisons (Average Day Conditions)

Phases Completed ¹	Estimated Year	Total Average Annual Supply From PGWWTP ² (MGD)	Average Annual Supplement To Dry Creek Tank ³ (MGD)	Average Annual Supply Available To WRSP ⁴ (MGD)	Average Annual Demand At		2% System Losses At WRSP (AFY) (MGD)	Average Annual Supply Available For Other City Projects	
					WRSP ⁵ (MGD)	Demand At WRSP ⁵ (MGD)		WRSP (AFY) (MGD)	(MGD)
1	2005	6.2	0.40	5.75	0.50	0.01			5.24
1 and 2	2010	10.3	0.40	9.92	0.78	0.02			9.12
1, 2, and 3	2015	11.7	0.40	11.27	1.35	0.03			9.90
1, 2, 3, and 4	2020	12.5	0.40	12.09	1.56	0.03			10.49
1, 2, 3, 4, and MOU Areas	2030	15.0	0.40	14.58	2.53	0.05			11.99

Footnotes

- Each row in this table corresponds to estimated average day conditions at the time of completion of the phases indicated. This table reflects supply and demand conditions on an annual basis.
- "Total Average Annual Supply From PGWWTP" is obtained from Table 6 (see column "Average Annual Flow" under heading "Total Flow To PGWWTP").
- "Average Annual Supplement to Dry Creek Tank" is calculated by dividing the estimated peak day requirement of 700 gpm (1.0 mgd) by the peak day factor of 2.5.
- "Average Annual Supply Available To WRSP" is calculated by subtracting the "Average Annual Supplement To Dry Creek Tank" from the "Total Average Annual Supply From PGWWTP".
- "Average Annual Demand At WRSP" includes streetscapes and is obtained from Table 3. See the "Average Day Demand" subtotals for each phase (with streetscapes) in Table 3. For example, the Average Annual Demand of 1.56 MGD shown for completed phases 1 through 4 is the sum of the "Average Day Demand" subtotals (with streetscapes) for each of the four phases, expressed in units "MGD".

Table 9
Water Supply and Demand Comparisons (Peak Day Conditions)

Phases Completed ¹	Estimated Year	Total Peak Day Supply From		Peak Day Demand to Dry Creek Tank ³ (MGD)	Peak Day Supply Available to		Peak Day Demand At	2% System Loss at		Peak Day Supply Available For Other City Projects (MGD)
		PGWWTP ² (MGD)			WRSP ⁴ (MGD)			WRSP ⁵ (MGD)		
1	2005	5.7		1.0	4.7		1.25	0.03		3.4
1 - 2	2010	9.5		1.0	8.5		1.96	0.04		6.5
1 - 3	2015	10.7		1.0	9.7		3.37	0.07		6.3
1 - 4	2020	11.5		1.0	10.5		3.91	0.08		6.5
1 - 4 and MOU Areas	2030	13.8		1.0	12.8		6.34	0.13		6.3

Footnotes

- Each row in this table corresponds to estimated peak day conditions at the time of completion of the phases indicated. This table reflects supply and demand conditions during the peak irrigation season.
- "Total Peak Day Supply From PGWWTP" is obtained from Table 6 (see column "Average Dry Weather Flow" under heading "Total Flow To PGWWTP"). "Average Dry Weather Flow" is used because peak irrigation conditions occur when WWTP flows correspond to dry weather conditions.
- "Peak Day Demand to Dry Creek Tank" is the continuous flow of 700 gpm to the Dry Creek Tank during the peak season. It is assumed that this flow occurs continuously over a 24-hour period during the peak season.
- "Peak Day Supply Available To WRSP" is calculated by subtracting the "Peak Day Supplement To Dry Creek Tank" from the "Total Peak Day Supply From PGWWTP".
- "Peak Day Demand At WRSP" includes streetscapes and is obtained from Table 3. See the "Peak Day Demand" subtotals for each phase (with streetscapes) in Table 3. For example, the Peak Day Demand of 3.91 MGD shown for completed phases 1 through 4 is the sum of the "Peak Day Demand" subtotals (with streetscapes) for each of the four phases, expressed in units "MGD".

WRSP Operational Storage Requirements

Hourly water balances (**Tables 10 and 11**) were used to estimate operational storage requirements to meet hourly peak flow rates for each phase at the WRSP. First, hourly recycled water production flow rates were calculated for each phase of WRSP, in gallons per minute, by applying diurnal peaking factors to the average dry weather flow rates shown in **Table 9** for the Pleasant Grove WWTP. The diurnal curve used in this study is the same diurnal curve used in the Feasibility Study. This diurnal curve was developed from Dry Creek WWTP influent flow data, under dry weather conditions. Next, other City demands, such as the hourly tank fill requirements at the power plant and the Dry Creek system, were subtracted from the hourly recycled water production flow rates. The differences are shown in the water balances as the "supply" hourly flow rates available to WRSP.

Peak hour demand estimates are shown in **Table 3**. In the water balances shown in **Tables 10 and 11**, the peak hour demand flow rates for each phase were applied during a 9-hour irrigation period starting at 9:00 pm and ending at 6:00 am (same as in Feasibility Study). In addition, peak hour demand flow rates for each phase were adjusted to account for the assumed 2 percent distribution system loss factor (see Criteria). The 2 percent distribution system loss factor was calculated by multiplying the peak day demand by 0.02, and then averaging the result over 24 hours. The sum of all of the peak hourly "demand" flow rates is equivalent to the peak day demand (plus 2 percent loss factor) shown in **Table 9** for each phase.

As highlighted in **Tables 10 and 11**, for each phase there is a "deficit period" during which the recycled water demand exceeds the recycled water supply. The difference between the total "demand" and the total "supply" during this period represents the amount of recycled water that must be supplied by an operational storage facility. A 30 percent safety factor was added to the total required storage volume to account for fluctuations in the irrigation cycle. **Tables 10 and 11** also show the volume of water in the storage tank for each hour of the water balance.

The water balance was prepared for two scenarios: no power plant scenario and 150 Megawatt power plant scenario. Each scenario is described below.

No Power Plant Scenario

Under the No Power Plant scenario, it was assumed that the Pleasant Grove WWTP would first provide the supplementary peak day demand of 700 gpm required at the Dry Creek Tank, as estimated previously in this study. This flow rate would be provided continuously over a 24-hour period during seasonal peak conditions. In the water balance for this scenario, 700 gpm is subtracted from the hourly recycled water supply flow rates to account for this demand. The remainder of the recycled water supply would be available to meet demands at WRSP. The water balance and storage requirements for the No Plant Scenario are shown in **Table 10**.

Estimates of required operational storage vary from 0.28 to 1.22 million gallons for Phases 1 through 4. When the estimated demands for the MOU area are added to the demands for Phases 1 through 4, the estimated required volume for operational storage is 3.14 million gallons. For purposes of this study and for sizing of conveyance facilities, it is assumed that the storage required to meet MOU peak demands will be added at the same storage site used for Phases 1 through 4 of the WRSP. Sequencing of the construction of storage facilities for the various phases and MOU area is not considered in this study but will be considered in future phasing plans.

150 Megawatt Power Plant Scenario

For this scenario, it was assumed that the City would first provide the supplementary peak day demand of 700 gpm to the Dry Creek Tank, as described above for the No Power Plant scenario. In addition, it was assumed that the City would provide a continuous supply of 1,008 gpm to the 150 Megawatt power plant to meet the estimated peak day demand of 1.45 MGD. The remainder of the recycled water supply would be available to meet demands at WRSP. The water balance and storage requirements for WRSP under this scenario are shown in **Table 11**. Estimates of required operational storage for the WRSP vary from 0.65 to 1.70 million gallons for Phases 1 through 4. When the estimated demands for the MOU area are added to the demands for Phases 1 through 4, the estimated total required volume for operational storage is 3.85 million gallons. For purposes of this study and for sizing of conveyance facilities, it is assumed that the storage required to meet MOU peak demands will be added at the same storage site used for Phases 1 through 4 of the WRSP. Sequencing of the construction of storage facilities for the various phases and MOU area is not considered in this study but will be considered in future phasing plans.

The storage capacity requirements estimated above do not include any storage required at the power plant. It is assumed that the power plant would construct its own storage tank to meet its operational peaking requirements. The volume of storage required at the power plant to meet its hourly peaking requirements depends on the operational characteristics of the future power plant, which are unknown at this time.

Table 10
WRSP Operational Storage Evaluation
(No Power Plant Scenario)

Adjustments to Supply
Constant Flow to Dry Creek System Storage Tank:
Constant Flow to Power Plant Storage Tank:

-700 gpm
0 gpm

Hour	Phase 1			Phase 1 - 2			Phase 1 - 3			Phase 1 - 4			Phase 1 - 4 and MOU		
	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)
12:00 AM	3,185	2,333	279,307	5,817	3,656	269,547	6,669	6,283	949,352	7,186	7,286	1,217,923	8,757	11,823	2,730,040
1:00 AM	2,737	2,333	279,307	5,067	3,656	269,547	5,821	6,283	921,634	6,278	7,286	1,157,455	7,669	11,823	2,480,780
2:00 AM	2,123	2,333	266,676	4,035	3,656	269,547	4,655	6,283	823,932	5,030	7,286	1,022,099	6,172	11,823	2,141,710
3:00 AM	1,536	2,333	218,832	3,051	3,656	233,251	3,541	6,283	659,427	3,839	7,286	815,261	4,743	11,823	1,716,913
4:00 AM	1,117	2,333	145,836	2,347	3,656	154,760	2,746	6,283	447,207	2,988	7,286	557,363	3,722	11,823	1,230,882
5:00 AM	977	2,333	64,456	2,113	3,656	62,203	2,481	6,283	219,081	2,704	7,286	282,445	3,382	11,823	724,440
6:00 AM	1,172	17	133,759	2,441	27	207,043	2,852	47	387,406	3,101	54	465,256	3,859	88	950,670
7:00 AM	1,871	17	244,982	3,613	27	269,547	4,178	47	635,257	4,519	54	733,167	5,559	88	1,278,956
8:00 AM	2,765	17	279,307	5,114	27	269,547	5,874	47	949,352	6,335	54	1,110,004	7,737	88	1,737,874
9:00 AM	3,967	17	279,307	7,130	27	269,547	8,154	47	949,352	8,774	54	1,223,928	10,662	88	2,372,330
10:00 AM	5,085	17	279,307	9,005	27	269,547	10,275	47	949,352	11,044	54	1,223,928	13,384	88	3,139,238
11:00 AM	5,448	17	279,307	9,614	27	269,547	10,964	47	949,352	11,781	54	1,223,928	14,288	88	3,139,238
12:00 PM	5,253	17	279,307	9,286	27	269,547	10,593	47	949,352	11,394	54	1,223,928	13,792	88	3,139,238
1:00 PM	4,722	17	279,307	8,395	27	269,547	9,585	47	949,352	10,306	54	1,223,928	12,499	88	3,139,238
2:00 PM	4,191	17	279,307	7,505	27	269,547	8,578	47	949,352	9,228	54	1,223,928	11,207	88	3,139,238
3:00 PM	3,716	17	279,307	6,708	27	269,547	7,677	47	949,352	8,264	54	1,223,928	10,050	88	3,139,238
4:00 PM	3,352	17	279,307	6,098	27	269,547	6,988	47	949,352	7,526	54	1,223,928	9,165	88	3,139,238
5:00 PM	3,045	17	279,307	5,582	27	269,547	6,404	47	949,352	6,902	54	1,223,928	8,417	88	3,139,238
6:00 PM	2,933	17	279,307	5,395	27	269,547	6,192	47	949,352	6,675	54	1,223,928	8,145	88	3,139,238
7:00 PM	3,073	17	279,307	5,629	27	269,547	6,457	47	949,352	6,959	54	1,223,928	8,485	88	3,139,238
8:00 PM	3,492	17	279,307	6,333	27	269,547	7,253	47	949,352	7,810	54	1,223,928	9,506	88	3,139,238
9:00 PM	3,911	2,333	279,307	7,036	3,656	269,547	8,048	6,283	949,352	8,661	7,286	1,223,928	10,526	11,823	3,061,432
10:00 PM	4,051	2,333	279,307	7,270	3,656	269,547	8,313	6,283	949,352	8,945	7,286	1,223,928	10,866	11,823	3,004,037
11:00 PM	3,827	2,333	279,307	6,895	3,656	269,547	7,889	6,283	949,352	8,491	7,286	1,223,928	10,322	11,823	2,913,985
Total (MG)	4.65	1.28		8.49	2.00		9.73	3.43		10.48	3.98		12.77	6.46	MG
Deficit Period ³ (MG)	0.35	0.56		0.45	0.66		1.15	1.88		1.68	2.62		3.97	6.38	MG
Supply req. from storage (MG):			0.21			0.21			0.73			0.94			2.41
30% safety factor (MG):			0.06			0.06			0.22			0.28			0.72
Total Storage (MG):			0.28			0.27			0.95			1.22			3.14

Footnotes

- "Supply" hourly flow rates are calculated by subtracting the flow rates listed under "Adjustments to Supply" from the estimated hourly production rates at the Pleasant Grove WWTP (based on average dry weather conditions and the Roseville diurnal curve).
- "Demand" hourly flow rates include the peak hour flow rates shown in Table 3 plus an adjustment for the 2 percent loss factor. The sum of the demand hourly flow rates equals the peak day demand plus the loss factor shown in Table 9.
- "Deficit period" is the period during which the hourly demand exceeds the hourly supply. This period is shaded and boxed in each of the demand columns.
- "Storage Volume" indicates the volume of water in the tank at the hour indicated, up to the full storage capacity of the tank (tank full condition).

Table 11
WRSP Operational Storage Evaluation
(150 Megawatt Power Plant Scenario)

Adjustments to Supply
Constant Flow to Dry Creek System Storage Tank:
Constant Flow to Power Plant Storage Tank:

-700 gpm
-1,008 gpm (1.45 MGD)

Hour	Phase 1			Phase 1 - 2			Phase 1 - 3			Phase 1 - 4			Phase 1 - 4 and MOU		
	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)	Supply (gpm)	Demand (gpm)	Storage Vol. (gallons)
12:00 AM	2,175	2,333	641,862	4,808	3,656	554,558	5,661	6,283	1,353,826	6,177	7,286	1,629,350	7,749	11,823	3,195,921
1:00 AM	1,728	2,333	605,533	4,058	3,656	554,558	4,813	6,283	1,265,603	5,270	7,286	1,508,378	6,660	11,823	2,886,157
2:00 AM	1,113	2,333	532,315	3,027	3,656	516,831	3,646	6,283	1,107,397	4,022	7,286	1,312,519	5,163	11,823	2,486,583
3:00 AM	526	2,333	423,884	2,042	3,656	420,031	2,533	6,283	882,389	2,830	7,286	1,045,176	3,735	11,823	2,001,281
4:00 AM	107	2,333	290,302	1,339	3,656	281,035	1,738	6,283	609,665	1,979	7,286	726,774	2,714	11,823	1,454,747
5:00 AM	0	2,333	150,314	1,105	3,656	127,975	1,473	6,283	321,035	1,696	7,286	391,352	2,374	11,823	887,800
6:00 AM	163	17	159,031	1,433	27	212,310	1,844	47	428,856	2,093	54	513,659	2,850	88	1,053,526
7:00 AM	861	17	209,667	2,605	27	366,971	3,169	47	616,203	3,511	54	721,066	4,551	88	1,321,309
8:00 AM	1,756	17	313,961	4,105	27	554,558	4,866	47	905,344	5,326	54	1,037,399	6,728	88	1,719,723
9:00 AM	2,957	17	490,357	6,121	27	554,558	7,146	47	1,331,271	7,766	54	1,500,103	9,654	88	2,233,674
10:00 AM	4,075	17	651,361	7,997	27	554,558	9,266	47	1,391,152	10,035	54	1,695,859	12,375	88	3,030,916
11:00 AM	4,438	17	651,361	8,606	27	554,558	9,955	47	1,391,152	10,773	54	1,695,859	13,260	88	3,821,226
12:00 PM	4,243	17	651,361	8,278	27	554,558	9,584	47	1,391,152	10,376	54	1,695,859	12,784	88	3,847,135
1:00 PM	3,712	17	651,361	7,387	27	554,558	8,577	47	1,391,152	9,298	54	1,695,859	11,491	88	3,847,135
2:00 PM	3,181	17	651,361	6,496	27	554,558	7,570	47	1,391,152	8,220	54	1,695,859	10,198	88	3,847,135
3:00 PM	2,706	17	651,361	5,699	27	554,558	6,668	47	1,391,152	7,255	54	1,695,859	9,042	88	3,847,135
4:00 PM	2,342	17	651,361	5,090	27	554,558	5,979	47	1,391,152	6,518	54	1,695,859	8,157	88	3,847,135
5:00 PM	2,035	17	651,361	4,574	27	554,558	5,396	47	1,391,152	5,894	54	1,695,859	7,409	88	3,847,135
6:00 PM	1,923	17	651,361	4,386	27	554,558	5,184	47	1,391,152	5,667	54	1,695,859	7,136	88	3,847,135
7:00 PM	2,063	17	651,361	4,621	27	554,558	5,449	47	1,391,152	5,951	54	1,695,859	7,477	88	3,847,135
8:00 PM	2,482	17	651,361	5,324	27	554,558	6,244	47	1,391,152	6,802	54	1,695,859	8,497	88	3,847,135
9:00 PM	2,901	2,333	651,361	6,027	3,656	554,558	7,040	6,283	1,391,152	7,653	7,286	1,695,859	9,518	11,823	3,708,825
10:00 PM	3,041	2,333	651,361	6,262	3,656	554,558	7,305	6,283	1,391,152	7,936	7,286	1,695,859	9,858	11,823	3,590,926
11:00 PM	2,818	2,333	651,361	5,887	3,656	554,558	6,880	6,283	1,391,152	7,482	7,286	1,695,859	9,314	11,823	3,440,389
Total (MG)	3.20	1.28		7.04	2.00		8.28	3.43		9.03	3.98		11.32	6.46	MG
Deficit Period ³ (MG)	0.34	0.84		0.45	0.88		1.19	2.26		1.32	2.62		3.43	6.38	MG
Supply req. from storage (MG):			0.50			0.43			1.07			1.30			2.96
30% safety factor (MG):			0.15			0.13			0.32			0.39			0.89
Total Storage (MG):			0.65			0.55			1.39			1.70			3.85

Footnotes

1. "Supply" hourly flow rates are calculated by subtracting the flow rates listed under "Adjustments to Supply" from the estimated hourly production rates at the Pleasant Grove WWTP based on average dry weather conditions and the Roseville diurnal curve).
2. "Demand" hourly flow rates include the peak hour flow rates shown in Table 3 plus an adjustment for the 2 percent loss factor. The sum of the demand hourly flow rates equals the peak day demand plus the loss factor shown in Table 9.
3. "Deficit period" is the period during which the hourly demand exceeds the hourly supply. This period is shaded and boxed in each of the demand columns.
4. "Storage Volume" indicates the volume of water in the tank at the hour indicated, up to the full storage capacity of the tank (tank full condition).

System Description and Hydraulic Modeling

The system was modeled using Cybernet version 3.5 and AutoCAD 2000. Pipeline alignments were located in arterial roads to provide a backbone distribution system to the customers shown in **Figure 3**. One storage reservoir was modeled at the proposed tank site just north of the Pleasant Grove WWTP. In addition, a single pump station was modeled immediately downstream of the modeled storage reservoir. The storage reservoir would be a tank or series of tanks that equal the required storage volume. It is assumed that the pump station will also be located at the proposed reservoir site. This pump station would pressurize the distribution system for the WRSP and MOU Transition Areas. This pump station is separate from any pumping capacity already constructed at the PGWWTP. It is assumed that the City would use the existing pump station at the PGWWTP to pump recycled water to the WRSP storage tank and to any other storage tanks for other projects, such as a power plant.

The hydraulic model was run under peak hourly flow conditions. Minimum pipeline diameters were selected that achieve the pressure and velocity criteria described previously in this study. Capacity was provided in the backbone distribution system to convey the required 700 gpm from the PGWWTP to the intersection of Fiddymont and Del Webb Boulevard, near the existing Sewer Pump Station 5. Elevations were selected for each junction node using a preliminary topography map provided by Wood Rodgers. The model was run under two demand scenarios: WRSP with MOU transition areas and WRSP without MOU transition areas. Each scenario is described below.

WRSP With MOU Transition Areas Model Scenario

For this scenario, demands were included for all customers shown in **Table 3**, including the MOU transition areas. Pipelines were not included for the MOU transition areas; however, MOU transition area demands were located at corresponding boundary junction nodes.

The hydraulic model for WRSP (including demands for the MOU area) is shown on **Figure 4**. Pipeline diameters are color-coded. In addition, pressures at junction nodes are annotated. The system was modeled using a pump with a design point of 11,900 gpm at a pump head of 171 feet. This pumping capacity is adequate to provide the required 700 gpm to the storage tank at the Dry Creek system, once the City interconnects the systems by converting the existing 18-inch sewer force main described previously. Under peak hour flow conditions, junction node pressures vary from approximately 40 psi to 70 psi.

This model represents the recycled water distribution system that would be constructed by the end of Phase 4. The pipelines in this system would have capacity for the future MOU recycled water demands. In addition, the pump station shown in the model would have capacity to supply the future MOU area. However, **Figure 4** does not represent phased construction. It is expected

that construction of recycled water facilities would be phased in accordance with the project phases. In addition, it is expected that storage and pumping facilities could be constructed in phases as well. Some facilities, such as the pipeline from the plant to the storage tank and pump station, would likely be constructed out of phase with the rest of the project, as required to convey water to the early phases of the project. Phased construction of pipeline, pumping, and storage facilities will be addressed in a separate phasing plan.

Pipeline Diameters Affected By Dry Creek Tank Fill Requirement

As described above, the model includes a constant flow of 700 gpm to the existing City storage tank in the Dry Creek system. This flow affects the size of the pipelines shown in Hayden Parkway (Pipes P-3078, P-3077, P-3080, and P-3079 on **Figure 4**). With the 700 gpm demand included, the required diameter is 24-inch for pipelines in Hayden Parkway between Blue Oaks Boulevard and Bob Doyle Drive (pipes P-3078 and P-3077), and 18-inch for pipelines in Hayden Parkway between Bob Doyle Drive and Fiddymont Road (pipes P-3080 and P-3079). However, if the 700 gpm demand is not included, the 24-inch diameter pipelines in Hayden Parkway can be reduced to 20-inch diameter pipelines, and the 18-inch diameter pipelines in Hayden Parkway can be reduced to 16-inch diameter.

WRSP Without MOU Transition Areas Model Scenario

This scenario represents a hypothetical recycled water system without the MOU transition area demands. This scenario is provided to allow development of incremental costs that are associated with the MOU Transition areas. This scenario is shown of **Figure 5**. This scenario was modeled using a pump with a design point of 11,900 gpm at a pump head of 148 feet.

TECHNICAL MEMORANDUM



MWH

MONTGOMERY WATSON HARZA

Subject: Task 1 – Unit Water Demand Factor Revision

Date:

November 6, 2002

Prepared By: Ping Chen

File Number: 1510935

Reviewed By: Marshall Davert

INTRODUCTION

BACKGROUND

The City of Roseville (City) is considering whether to provide water service to urban growth areas along the western boundary of the City. In particular, the City is considering delivery of water to the West Roseville Specific Plan (WRSP) area and the “City of Roseville/Placer County Memorandum of Understanding Transition Area” (together referred to as the “MOU area”). These areas are outside the existing City limits.

Before obligating itself to providing water service to the MOU area, the City desires to evaluate its ability to provide long-term, reliable water supplies to this area while maintaining service to its existing (and future) customers within the City limits. In addition, the cost of delivering water supplies to the MOU Area must not negatively impact the City’s existing ratepayers.

City Environmental Utilities (EU) staff and MWH completed a preliminary evaluation of potential water supply alternatives in February 2002. The results of the evaluation were presented to the Roseville City Council. The preliminary evaluation identified a range of water supply alternatives that could potentially provide the City with the ability to provide long-term, reliable water supplies to the MOU area while maintaining service to its existing and future customers within the City limits. Based on the results, the City Council directed staff to more fully develop and evaluate the most promising alternatives, and to return with a recommended course of action.

Previous water supply planning in the City has been based on unit water demand factors, maximum day and peak hour demand factors, and total water demand provided in the *General Plan Update Water System Study* (Spink, August 1993). These factors were modified in the preliminary evaluation based on a limited amount of new data. The new data apparently indicate estimates of water demand in both the City and the MOU Area based on demand factors from the Spink study can be reduced. The consequence of such a reduction is that the existing surface water contract entitlements of the City would be sufficient to provide a portion of the water supplies needed to serve the MOU area. However, revision of demand factors does not create new water supply. Prudence dictates that a portion of the “supplies” derived through revision of the unit demand factors is kept in reserve as a safety factor to protect against the inherent uncertainty of such estimates.

MEMORANDUM OBJECTIVES

The objectives of this memorandum are: 1) to compare the unit water demand factors calculated for the City based on new data with unit water demand factors of agencies with similar water use characteristics (including water districts in Sacramento County, Placer County, and the Central Valley of California), and 2) to recommend revised unit water demand factors for use in completing the water supply investigation for the MOU area.

MEMORANDUM OVERVIEW

This memorandum is organized into six sections:

- **INTRODUCTION** - provides background information and an overview of the memorandum.
- **PREVIOUS WORK** - summarizes the unit water demand factors presented in the Spink study and the revised factors estimated utilizing recently collected data.
- **COMPARISON OF WATER DEMAND FACTORS** - presents a comparison of the revised unit water demand factors against factors gathered from areas with similar water use characteristics.
- **METHODOLOGY** - presents the procedure applied to analyze the data and to estimate revised unit water demand factors.
- **RESULTS AND CONCLUSIONS** - summarizes the results of the analysis.
- **RECOMMENDATIONS** - summarizes the information presented in the memorandum and recommends revised unit demand factors for use in completing the water supply investigation for the MOU area.

PREVIOUS WORK

Previous work has been conducted to estimate the City's unit water demand factors (see the Spink study and work completed by MWH in the aforementioned preliminary evaluation). In both cases, land use based unit water demand factors were calculated on either a gallons per day per acre (gpd/ac) or gallons per day per equivalent residential dwelling unit (gpd/DU) basis.

The data indicate the unit water demand factors included in Spink study likely overestimate current City water use. This is thought to be principally a consequence of the impact of the implementation of water conservation measures in post-1992 home construction.

Table 1 summarizes unit water demand factors by land use category for both the Spink study and the preliminary evaluation completed in February 2002. In comparison to the Spink study, the more recent data show a reduction in water use in every land use category except "Business Professional", "Railroad Yard", and "Public". The data in the residential categories show at least a 25-percent decrease in every category except in one of the "High Density" categories and one of the "Low Density" categories. In the latter two categories, the decreases in the estimated unit water demand factors still exceed 10 percent.

Significant decreases in the "Industrial" categories may be attributed to water conservation and greater weighting of economic considerations used in the design of industrial processes requiring water. The decrease in the "Light Industrial" may have resulted from an increase in operational changes on-site (e.g., self-storage) introduced since completion of the Spink report. The increase in the "Business Professional" category may be the result of more medical offices with a higher average water use than typical professional buildings. The decreases in the "Schools" and "Parks" categories may be attributable to improved irrigation practices and economic considerations.

COMPARISON OF WATER DEMAND FACTORS

The MWH evaluation indicated that the unit water demand factors included in the Spink study could be reduced. Because the MWH study was based on limited data, however, these estimates will require refinement as additional data become available. The water supply strategy developed for the MOU area addresses the need for such refinement by insuring that redundant sources of water supply are available if the anticipated water savings reflected in the revised unit demand factors do not materialize.

When unit water demand factors are available in nearby areas, these data are often used to develop alternative unit water demand factors. In this memorandum, nearby areas used for comparative purposes

TASK 1 – UNIT WATER DEMAND FACTOR REVISION

included Sacramento County water purveyors ¹, Zone 40 of the Sacramento County water Agency, Zone 1 of the Placer County Water Agency (PCWA), and a number of cities located in the Central Valley of California with similar water use characteristics.

Table 1. Comparison of Unit Water Demand Factors

Land Use Category		MWH Evaluation Average Annual Unit Water Demand Factor	Spink Study Average Annual Unit Water Demand Factor	Percent Difference
		(gpd/DU)	(gpd/DU)	
Residential	LDR (< 3.5 DU/ac)	818	922	-11%
	LDR (3.5 to 5.0 DU/ac)	560	760	-26%
	LMDR (>5.0 to 6.0 DU/ac)	515	685	-25%
	LMDR (>6.0 to 8.0 DU/ac)	438	566	-23%
	MDR (>8.0 to 12.0 DU/ac)	324	425	-24%
	HDR (>12.0 to 16.0 DU/ac)	218	310	-30%
	HDR (>16.0 DU/ac)	165	190	-13%
Commercial		(gpd/ac)	(gpd/ac)	
	Commercial/Retail	2,294	2,678	-14%
	Business Professional	3,207	2,678	20%
	Light Industrial	1,203	2,678	-55%
	Industrial	2,597	3,124	-17%
	Railroad Yard	131	122	7%
	Elementary Schools	2,143	3,881	-45%
	High Schools	2,788	4,571	-39%
	Public (Fire Station, etc)	2,249	2,000	12%
	Park/Recreation	2,377	3,881	-39%

Source: City of Roseville Department of Utilities, Evaluation of Water System Capacity, TM 1- Water Demand Evaluation (MWH, February 2002)

Abbreviations:

LDR – Low Density Residential
 LMDR – Low-Medium Density Residential
 MDR – Medium Density Residential
 HDR – High Density Residential

¹ In 1995, a study to estimate the annual water demand within the Sacramento countywide area was conducted to support the *Sacramento Area Water Forum*. This report provided a comprehensive evaluation of Sacramento county-wide current and projected land use, and correlated unit water demand estimates to those land uses (Boyle, May 1995).

SACRAMENTO COUNTY WATER PURVEYORS

Table 2 summarizes the unit water demand factors for each land use category for water purveyors within Sacramento County. The land use categories are grouped into “residential” and “commercial” in the same manner as in the Spink and MWH studies. The table is incorporated from the Boyle report with some modifications. These modifications include:

- Land use categories such as “Rural Estate”, “Agriculture”, and “Vacant” which are not applicable to the City of Roseville or have a value of zero have been removed from the original table in Boyle report.
- The water use information for some water purveyors (in particular, the Elk Grove Water Works, Orange Vale Water Company, the Rio Linda/Elverta Community Water District, and San Juan Water District (formerly San Juan Suburban Water District) have been removed. Unit water demand factors for these agencies were determined to be equivalent to the unit water demand factor averages of the other urban water agencies evaluated in the Boyle report.
- The unit water demand factors in **Table 2** are normalized to account for the system loss.

To facilitate comparison of unit water demand factors, the factors for each region were converted to acre-feet per acre (af/ac).

ZONE 40 OF THE SACRAMENTO COUNTY WATER AGENCY

A similar water demand study was conducted in Zone 40 (an area that includes the urban study areas of Sunrise, White Rock, Vintage Park, County Creek, Calvine/Power Inn, Laguna, and Grantline/99). The unit water demand factors evaluated in that study were based on the same land use categories as in the Boyle report. To avoid excessive weight being placed on Zone 40 when calculating the average, the unit water demand factors of one representative area (Sunrise) were incorporated into **Table 2**.

ZONE 1 OF THE PLACER COUNTY WATER AGENCY (PCWA)

PCWA used two sets of unit water demand factors to capture the difference between new and old construction and landscaping practices. The factors in PCWA’s Lower Zone 1 are more comparable to the City since both reflect more recent home construction.

To provide a uniform basis of comparison, the PCWA land use categories were regrouped to match the land uses categories in the Boyle study (see **Table 3**). Units have been converted from gpd/DU to acre-feet per acre per year for residential land uses, and gpd/ac to acre-feet per acre per year for commercial and industrial land uses. In addition, PCWA residential factors were based on net acreage rather than gross acreage; thus, a 25-percent downward adjustment in PCWA residential factors was made.

OTHER CENTRAL VALLEY CITIES

Unit water demand factors for other cities in the Central Valley of California are included in the **Table 2** under the heading “Central Valley Average”. The cities used included: Modesto, Fairfield, Manteca, Stockton, and Sacramento. The average unit water demand factors are presented in **Table 2**.

METHODOLOGY

Statistical tools were used to analyze the data presented in **Table 2**. First, the mean and standard deviation were calculated for each land use category group (see **Table 2**). Unit water demand factors from the Spink study and the MWH evaluation were excluded from the calculation. To minimize the influence of large areas, arithmetic averages were calculated rather than area-weighted averages.

Unit water demand factors for each land use category were then divided into several ranges of standard deviation intervals. The frequency of occurrence within each interval was calculated by land use type. The frequency of occurrence for each land use category was plotted against the unit water demand factor to construct histograms for each unit water demand factor (see **Figures 1 through 10** located at the end

of this memorandum). Values for the mean, mean minus one standard deviation, and mean plus one standard deviation are noted on each figure.

In addition, the unit water demand factors from the Spink study and the MWH evaluation are indicated on each figure except the “Mixed Land Uses” and Urban Development Area” land use categories. This information was used to evaluate the proposed revised unit water demand factors. In addition, the land use categories in the Spink study and MWH evaluation were normalized to match the Boyle report in Table 4.

RESULTS AND CONCLUSIONS

Revised unit water demand factors were developed based on the data presented in Figures 1 through 10. As shown in the figures, the unit water demand factors for most areas fall within the range of the “mean minus σ ” and the “mean plus σ ” (where σ is the standard deviation). Comparison of the histograms with the unit water demand factors from the Spink study and MWH evaluation resulted in three principal observations.

OBSERVATION 1

In the “Single Family – Low Density” land use (see Figure 1) and “Multi Family – Medium Density” land use (see Figure 2) categories, both the MWH evaluation unit water demand factors are within one standard deviation of the mean. Unit water demand factors within that range are presumed to have a higher confidence level than that outside the range. Therefore, it would be defensible to utilize the unit water demand factors from the MWH evaluation for the “Single Family – Low Density” and “Multi Family – Medium Density” land use categories.

OBSERVATION 2

In the “Commercial and Office”, “Industrial”, and “Public Recreation” land use categories (see Figures 4, 5, and 7, respectively), both the Spink study and MWH evaluation unit water demand factors are within one standard deviation of the mean. In the “Public Recreation” land use category, the MWH evaluation unit water demand factor is lower than the mean value; the Spink study factor is higher. Therefore, using the mean value of the land use category is presumed to have a higher confidence level than selecting either individual factor.

For the of “Commercial and Office” and “Industrial” land use categories, the unit water demand factors in the Spink study and MWH evaluation are both less than the mean values. In this case, use of the average of the Spink study and MWH evaluation factors is recommended.

OBSERVATION 3

In land use categories “Multi Family – High Density”, “Public Quasi-Public, Cemetery, and Miscellaneous”, and “Rights-of-Way” (see Figures 3, 6, and 8, respectively), both the Spink study and MWH evaluation unit water demand factors fall outside the one standard deviation of the mean range. This comparison suggests the City’s water use is different than nearby areas. For these land use categories, use of the average of the Spink study and MWH evaluation factors is recommended.

The mean value of the land use category is used for the “Mixed Land Uses” and “Urban Development Area” land use categories (see Figures 9 and 10) because of the unavailability of the unit water demand factors in the Spink study.

TASK 1 – UNIT WATER DEMAND FACTOR REVISION

Table 2. Comparison of Unit Water Demand Factors by Land Use Category (af/ac)

Area	Single Family Low Density	Multi Family Medium Density	Multi Family High Density	Commercial & Office	Industrial	Public, Quasi-Public, Cemetery & Misc	Public Recreation	Right of Way	Mixed Land Uses	Urban Develop Area	System Loss (%)
Sacramento Suburban (formerly Arcade)	3.27	4.20	4.66	3.50	6.84	1.17	4.89	0.23	2.63	2.63	5.0
Arden Cordova Water Service Company	3.79	4.87	5.41	4.23	4.23	0.34	2.20	0.27	2.68	2.68	7.0
Carmichael	2.70	3.47	3.86	5.01	5.66	0.96	2.59	0.19	2.54	2.54	1.5
California-American Water Company (formerly Citizens Utilities Company of California)	3.54	4.55	5.05	6.11	6.10	1.27	4.80	0.25	2.73	2.73	9.3
Citrus Heights	2.97	3.81	4.23	2.91	6.22	0.70	3.14	0.21	2.53	2.53	1.0
Del Paso Manor	1.93	2.47	2.75	9.60	2.68	0.69	2.73	0.13	2.58	2.58	3.0
Fair Oaks	3.16	4.06	4.51	4.19	6.61	0.30	3.55	0.22	2.75	2.75	10.0
Florin County	2.72	3.51	3.89	2.93	3.02	0.98	4.09	0.19	2.65	2.65	6.0
City of Folsom	2.72	4.88	5.42	1.64	2.42	0.19	3.13	0.27	2.69	2.69	7.5
Fruitridge Vista	3.45	4.44	4.93	3.70	7.25	1.24	5.18	0.25	2.69	2.69	7.5
City of Galt	3.40	4.38	4.86	2.85	3.88	1.21	4.09	0.25	2.69	2.69	7.5
Sacramento Suburban (formerly Northridge)	3.07	3.95	4.39	3.61	0.33	0.55	0.76	0.21	2.68	2.68	7.0
Rancho Murieta CSD	3.22	4.13	4.60	1.22	1.22	0.66	0.86	0.22	2.71	2.71	8.5
Arden Park Vista (SCWA)	3.06	3.93	4.38	3.68	3.16	1.10	4.60	0.22	2.69	2.69	7.5
Tokay Park	3.01	3.87	4.30	3.23	6.31	1.08	4.52	0.22	2.69	2.69	7.5
Sunrise	3.11	3.98	4.43	2.96	2.91	1.12	3.72	0.26	2.70	n/a	7.5
Central Valley Average	2.15	3.25	3.25	2.08	2.36	1.71	2.01	n/a	n/a	n/a	0.0
Lower Zone 1 of PCWA	3.00	4.86	4.66	2.81	3.28	2.81	3.88	n/a	2.81	n/a	0.0
City of Roseville (Spink)	3.78	5.59	2.90	3.00	3.23	3.32	4.35	0.14	n/a	n/a	0.0
City of Roseville (MWH)	2.99	4.25	2.51	2.81	2.07	2.57	2.66	0.15	n/a	n/a	2.0
Minimum:	1.93	2.47	2.75	1.22	0.33	0.19	0.76	0.13	2.53	2.53	n/a
Maximum:	3.79	4.88	5.42	9.60	7.25	1.71	5.18	0.27	2.75	2.75	n/a
Average:	3.01	4.03	4.42	3.68	4.14	1.00	3.37	0.22	2.67	2.66	n/a
Standard Deviation:	0.46	0.61	0.68	1.87	2.09	0.60	1.31	0.03	0.07	0.07	n/a

TASK 1 – UNIT WATER DEMAND FACTOR REVISION

Table 3. Comparison of Land Use Categories between PCWA and Boyle Study

	Placer County Water Agency	Corresponding Land Use Category in Boyle Report
Residential	Rural (>10 ac/DU)	Rural Estate
	Rural (1 to 10 ac/DU)	Rural Estate
	Low Density (<1.0 DU/ac)	Single Family Low Density
	Low Density (1.0 to <2.0 DU/ac)	Single Family Low Density
	Low Density (2.0 to <3.0 DU/ac)	Single Family Low Density
	Low Density (3.0 to <4.0 DU/ac)	Single Family Low Density
	Medium Density (4.0 to <5.0 DU/ac)	Multi Family Medium Density
	Medium Density (5.0 to <7.0 DU/ac)	Multi Family Medium Density
	Medium Density (7.0 to <10.0 DU/ac)	Multi Family Medium Density
	High Density (10.0 to <16.0 DU/ac)	Multi Family High Density
	High Density (16.0 to <21.0 DU/ac)	Multi Family High Density
Commercial	Commercial/Office/Professional	Commercial and Office
	Tourist/Resort Commercial	Commercial and Office
	Business Park/Industrial	Commercial and Office
	Public Facility	Public, Quasi-Public, Cemetery & Misc
	Schools	Public, Quasi-Public, Cemetery & Misc
	Greenbelts (irrigated)	Public Recreation
	Open Space	Vacant
	Urban Reserve	Mixed Land Uses
	Parks	Public Recreation
	Streets	Right of Way
	Mixed Use	Mixed Land Uses
	Fair Grounds	Public, Quasi-Public, Cemetery & Misc
	Golf Courses	Public Recreation
	Lake	Vacant
	Riparian Drainage	Vacant
	Agriculture	---
	Church	Public, Quasi-Public, Cemetery & Misc

Table 4. Comparison of Land Use Categories

	Spink Study and MWH Evaluation	Corresponding Land Use Category in Boyle Report
Residential	LDR (<3.5 DU/ac)	Single Family Low Density
	LDR (<3.5 to 5.0 DU/ac)	Single Family Low Density
	LMDR (>5.0 to 6.0 DU/ac)	Multi Family Medium Density
	LMDR (>6.0 to 8.0 DU/ac)	Multi Family Medium Density
	MDR (>8.0 to 12.0 DU/ac)	Multi Family Medium Density
	HDR (>12.0 to 16.0 DU/ac)	Multi Family High Density
	HDR (>16.0 DU/ac)	Multi Family High Density
Commercial	Commercial/Retail	Commercial and Office
	Business Professional	Commercial and Office
	Light Industrial	Commercial and Office
	Industrial	Public, Quasi-Public, Cemetery & Misc
	Railroad Yard	Public, Quasi-Public, Cemetery & Misc
	Elementary Schools	Public Recreation
	High School	Vacant
	Public (Fire Stations, etc)	Mixed Land Uses
	Parks/Recreation	Public Recreation

RECOMMENDATIONS

Recommended revised unit water demand factors (in af/ac) for use in completing the water supply investigation for the MOU area are presented in Table 5. The principal results are the percentage changes shown in the right-most column of the table. These percentage changes were applied to the unit water demand factors in gpd/DU and gpd/ac found in the original Spink study. Those factors were then applied to updated land use categories for the City and the MOU area (see Table 6).

Use of the revised unit water demand factors decrease the City's projected water demands relative to the projected water demands utilizing the unit water demand factors presented in the Spink study. Of note, factors recommended for the "Single Family – Low Density" and "Multi Family – Medium Density" land use categories decrease the projected water demands in those land use categories by 21 percent and 24 percent, respectively.

Projected water demands in other land use categories will also be reduced. The recommended revised unit water demand factors are typically less than those found in the Spink study, but greater than those from the MWH evaluation. The percentage reductions range from 3 to 23 percent. In the "Right of Way" land use category, the Spink study and MWH evaluation yielded similar results. Thus, the unit water demand factor does not change appreciably, although a positive percentage change is shown.

Table 5. Comparison of Unit Water Demand Factors (af/ac)

Boyle Report Land Use Category		Spink Study	MWH Evaluation	Recommended Revised Factor	Percent Difference between Revised and Spink Study
Residential	Single Family Low Density	3.78	2.99	2.99	-21%
	Multi Family Medium Density	5.59	4.25	4.25	-24%
	Multi Family High Density	2.90	2.51	2.71	-7%
Commercial	Commercial and Office	3	2.81	2.91	-3%
	High-rise Regional Office	n/a	n/a	n/a	n/a
	Industrial	3.23	2.07	2.65	-18%
	Public, Quasi-public, Cemetery & Misc	3.32	2.57	2.95	-11%
	Public Recreation	4.35	2.66	3.37	-23%
	Vacant	n/a	n/a	n/a	n/a
	Right of Way	0.14	0.15	0.145	4%
	Mixed Land Uses	n/a	n/a	2.67	n/a
	Urban Development Area	n/a	n/a	2.66	n/a

The percentage changes shown on **Table 5** were used to recalculate the unit water demand factors from the Spink study in gpd/DU and gpd/ac. The revised unit demand factors are shown are **Table 6**.

Table 7 summarizes the estimated annual water demands from the City and the MOU area utilized in development of the water supply strategy. The revised unit water demand factors were applied to estimate all future water demand within the MOU area. For the City, however, the unit water demand factors from the Spink study were applied to areas constructed prior to 1992. The revised unit water demand factors were applied only to areas constructed after 1992 (including projected future construction).

TASK 1 – UNIT WATER DEMAND FACTOR REVISION

Table 6. Comparison of Unit Water Demand Factors (gpd/DU and gpd/ac)

Land Use Category		Spink Study Unit Water Demand Factors	Recommended Percent Change from Spink Study	Recommended Revised Unit Water Demand Factors
Residential	LDR (< 3.5 DU's/Ac)	922 gpd/DU	-21 %	<i>728 gpd/DU</i>
	LDR (3.5 to 5.0 DU's/Ac)	760 gpd/DU	-21%	<i>600 gpd/DU</i>
	LMDR (>5.0 to 6.0 DU's/Ac)	685 gpd/DU	-24%	<i>521 gpd/DU</i>
	LMDR (>6.0 to 8.0 DU's/Ac)	566 gpd/DU	-24%	<i>430 gpd/DU</i>
	MDR (>8.0 to 12.0 DU's/Ac)	425 gpd/DU	-24%	<i>323 gpd/DU</i>
	HDR (>12.0 to 16.0 DU's/Ac)	310 gpd/DU	-7%	<i>288 gpd/DU</i>
	HDR (>16.0 DU's/Ac)	190 gpd/DU	-7%	<i>177 gpd/DU</i>
Commercial/Other	Commercial/Retail	2,678 gpd/ac	-3%	<i>2,598 gpd/ac</i>
	Business Professional	2,678 gpd/ac	-3%	<i>2,598 gpd/ac</i>
	Light Industrial	2,678 gpd/ac	-3%	<i>2,598 gpd/ac</i>
	Industrial	3,124 gpd/ac	-18%	<i>2,562 gpd/ac</i>
	Railroad Yard	122 gpd/ac	-11%	<i>109 gpd/ac</i>
	Elementary Schools	3,881 gpd/ac	-11%	<i>3,454 gpd/ac</i>
	High Schools	4,571 gpd/ac	-11%	<i>4,068 gpd/ac</i>
	Public (Fire Station, etc)	2,000 gpd/ac	-11%	<i>1,780 gpd/ac</i>
	Park/Recreation	3,881 gpd/ac	-23%	<i>2,988 gpd/ac</i>
	Open Space/Major ROW	-	+4%	-
	Vacant/Unassigned	-	+4%	-

Table 7. Estimated Average Annual Water Demands based on Revised Unit Demand Factors

Land Use Category		City of Roseville (AF/year)		West Roseville Specific Plan		MOU Areas (AF/year)	
				West Roseville Specific Plan Only (AF/year)	Combined with City (AF/year)	MOU Areas Only (AF/year)	MOU Areas Combined with City (AF/year)
		Estimated Existing Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand
Residential	LDR (< 3.5 DU's/Ac)	4,943	5,903	4,010	9,913	4,010	9,913
	LDR (3.5 to 5.0 DU's/Ac)	8,222	13,524	501	14,025	3,903	17,427
	LMDR (>5.0 to 6.0 DU's/Ac)	2,880	3,301	-	3,301	-	3,301
	LMDR (>6.0 to 8.0 DU's/Ac)	1,594	2,030	390	2,420	746	2,776
	MDR (>8.0 to 12.0 DU's/Ac)	401	761	-	761	-	761
	HDR (>12.0 to 16.0 DU's/Ac)	32	115	333	448	333	448
	HDR (>16.0 DU's/Ac)	1,347	1,948	184	2,132	507	2,455
Commercial/Other	Commercial/Retail	2,323	4,929	256	5,185	463	5,392
	Business Professional	987	2,267	14	2,281	160	2,427
	Light Industrial	858	4,120	329	4,449	329	4,449
	Industrial	1,599	3,002	-	3,002	-	3,002
	Railroad Yard	87	72	-	72	-	72
	Elementary Schools	648	573	253	826	520	1,093
	High Schools	408	597	246	843	246	843
	Public (Fire Station, etc)	1,199	1,290	4	1,294	4	1,294
	Park/Recreation	4,628	6,176	824	7,000	1,447	7,623
	Open Space/Major ROW	-	-	-	-	-	-
	Vacant/Unassigned	-	-	-	-	-	-
Sub-Total		32,155	50,608	7,344	57,952	12,668	63,276
System Losses (2%)		638	1,012	147	1,159	254	1,266
TOTAL:		32,794	51,620	7,491	59,111	12,922	64,542

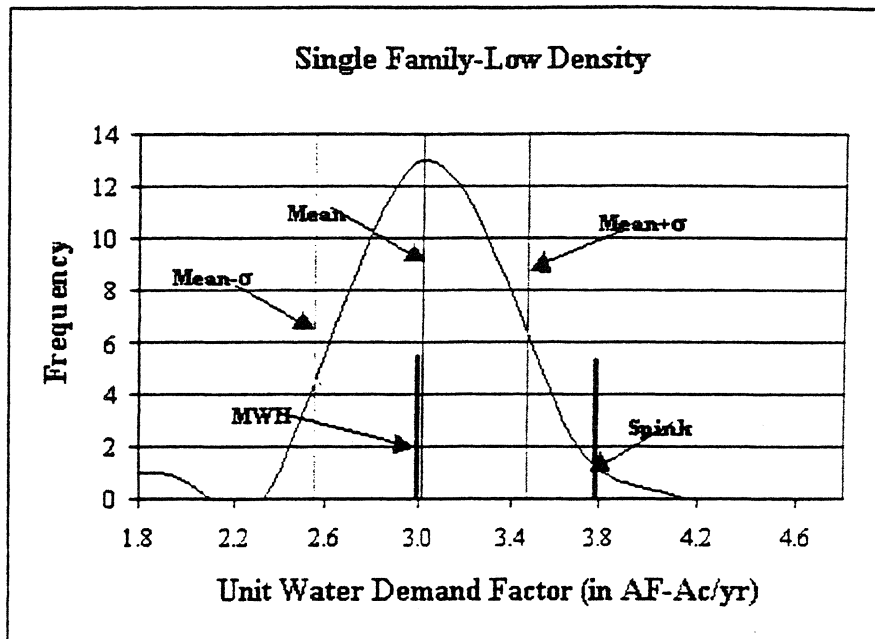


Figure 1. Histogram of Single Family – Low Density

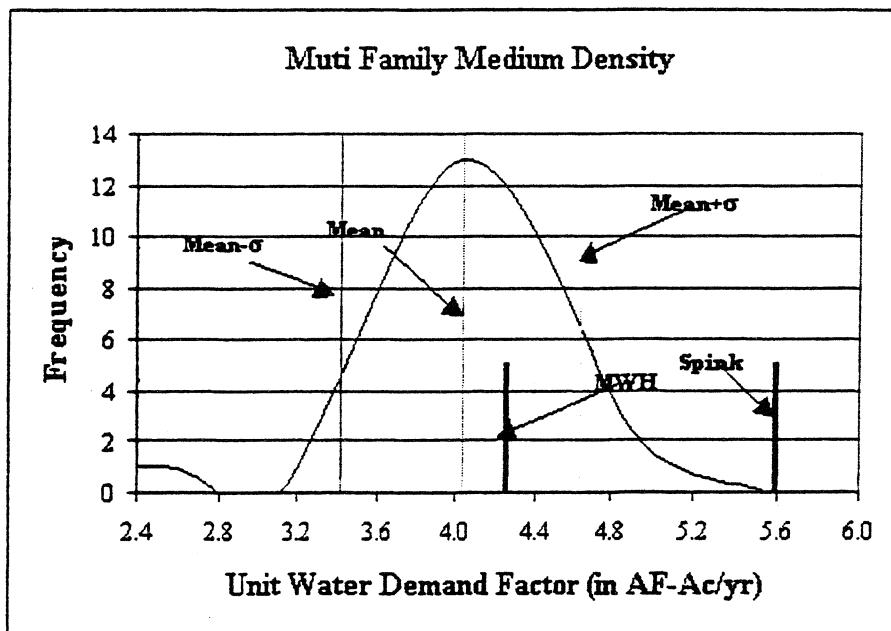


Figure 2. Histogram of Multi Family – Medium Density

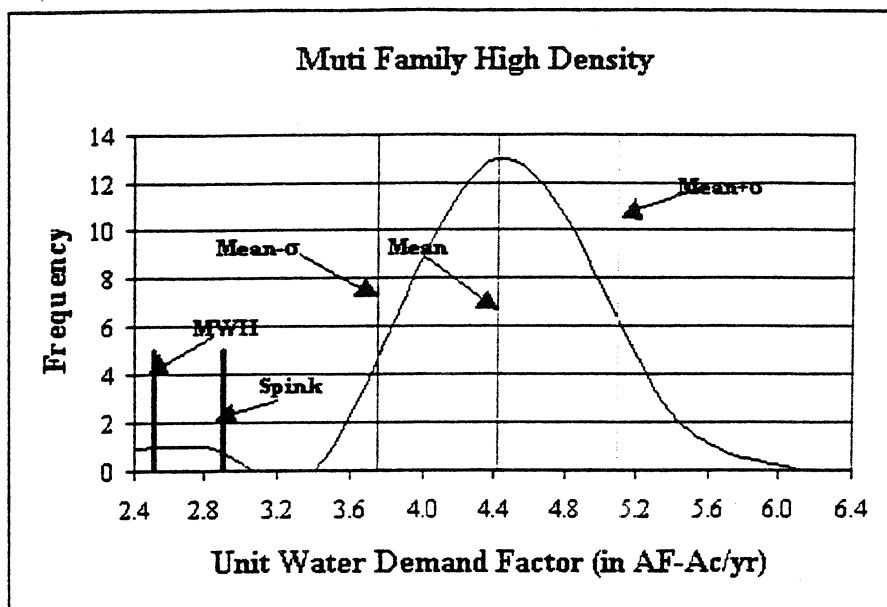


Figure 3. Histogram of Multi Family – High Density

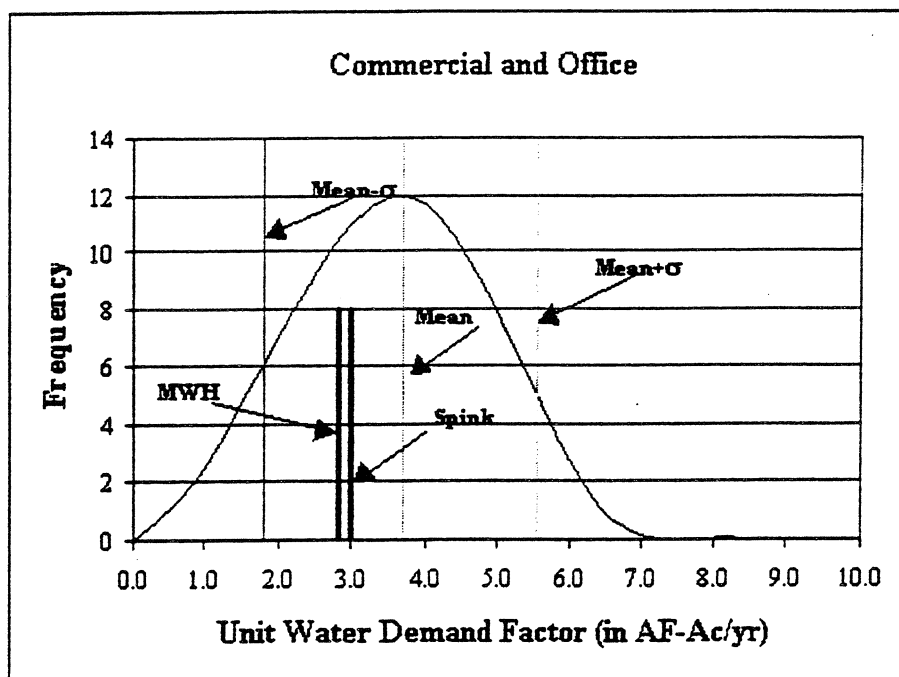


Figure 4. Histogram of Commercial and Office

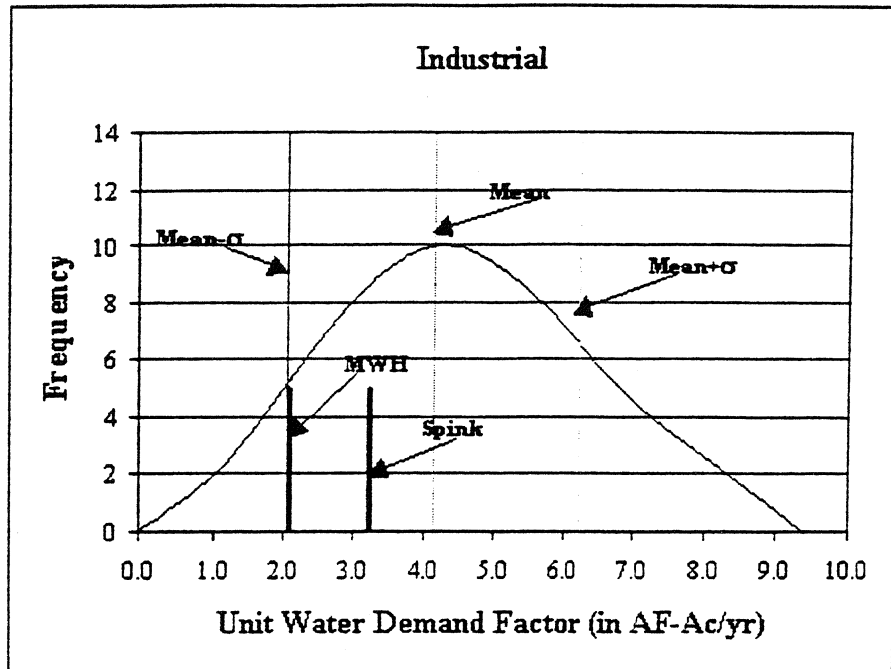


Figure 5. Histogram of Industrial

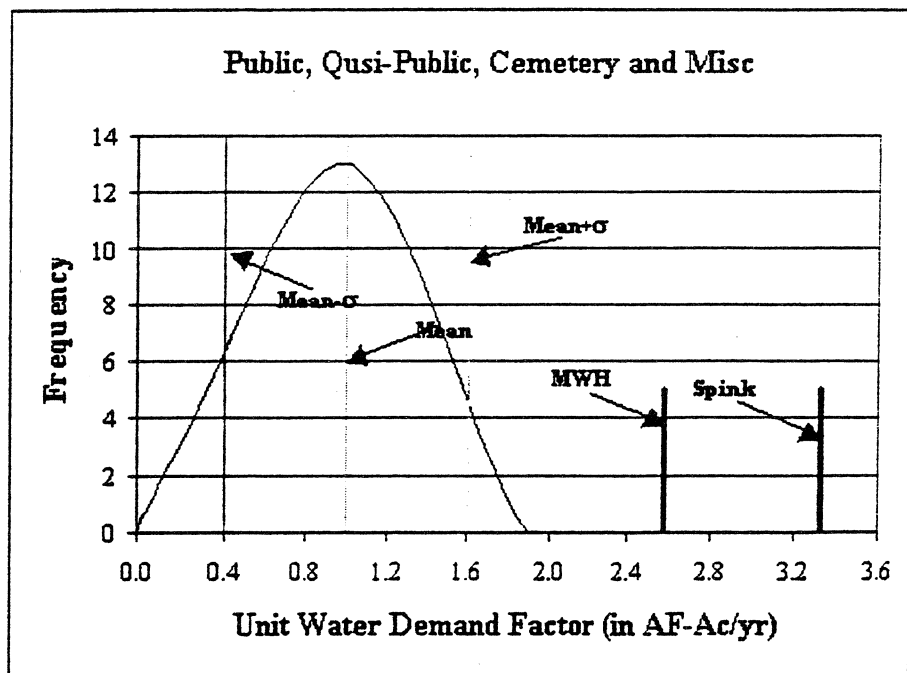


Figure 6. Histogram of Public, Quasi-Public, Cemetery, and Miscellaneous

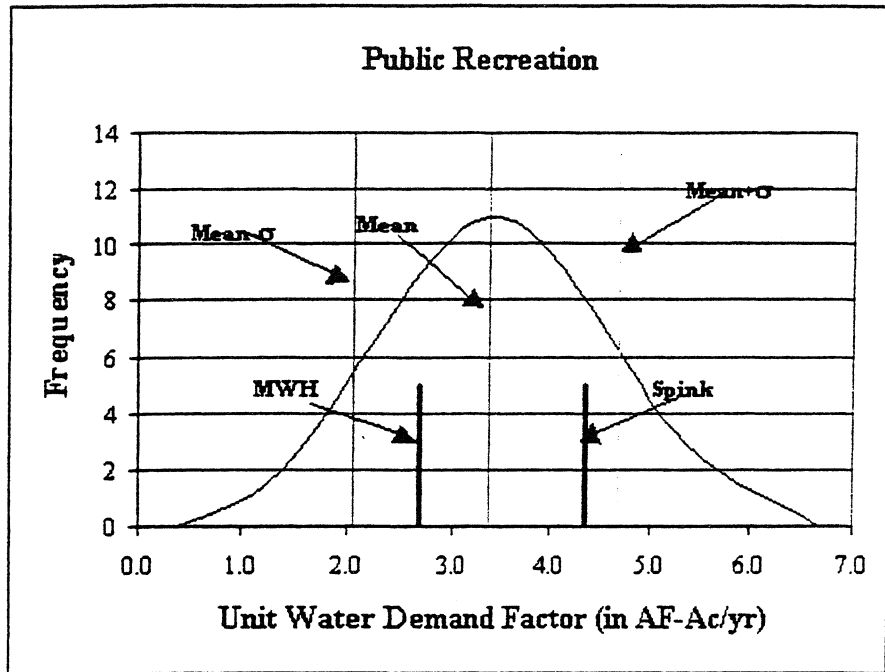


Figure 7. Histogram of Public Recreation

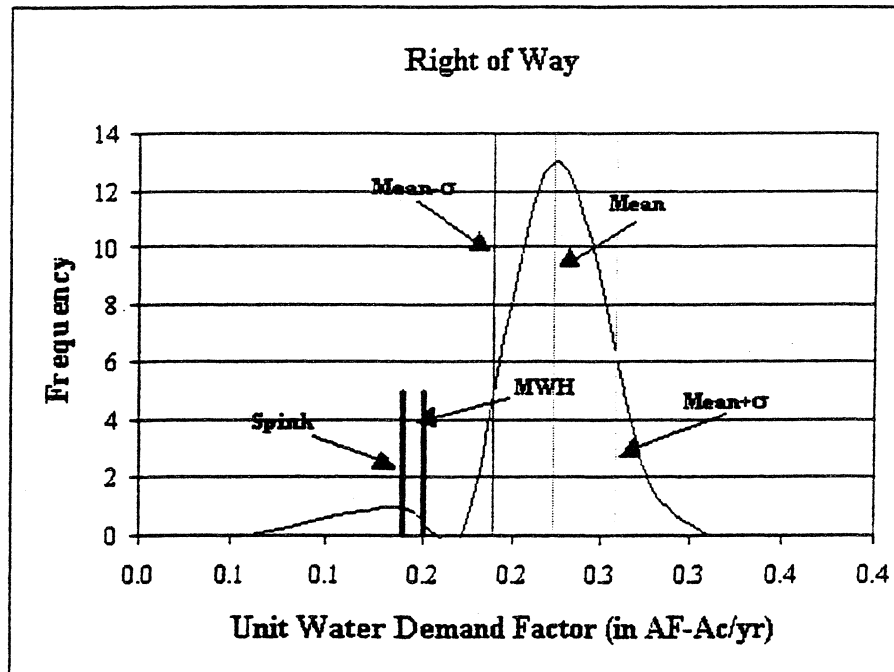


Figure 8. Histogram of Right of Way

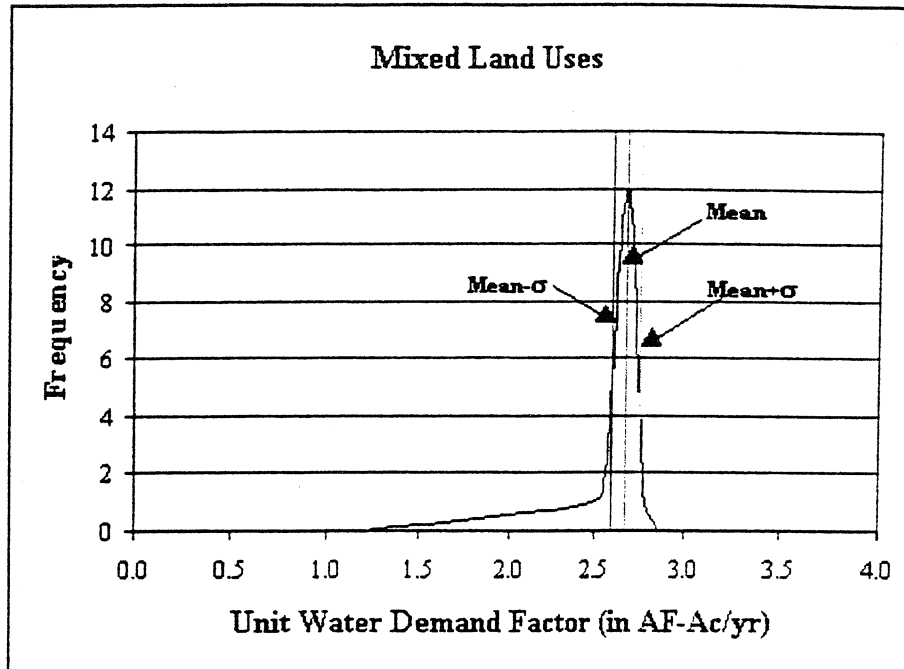


Figure 9. Histogram of Mixed Land Uses

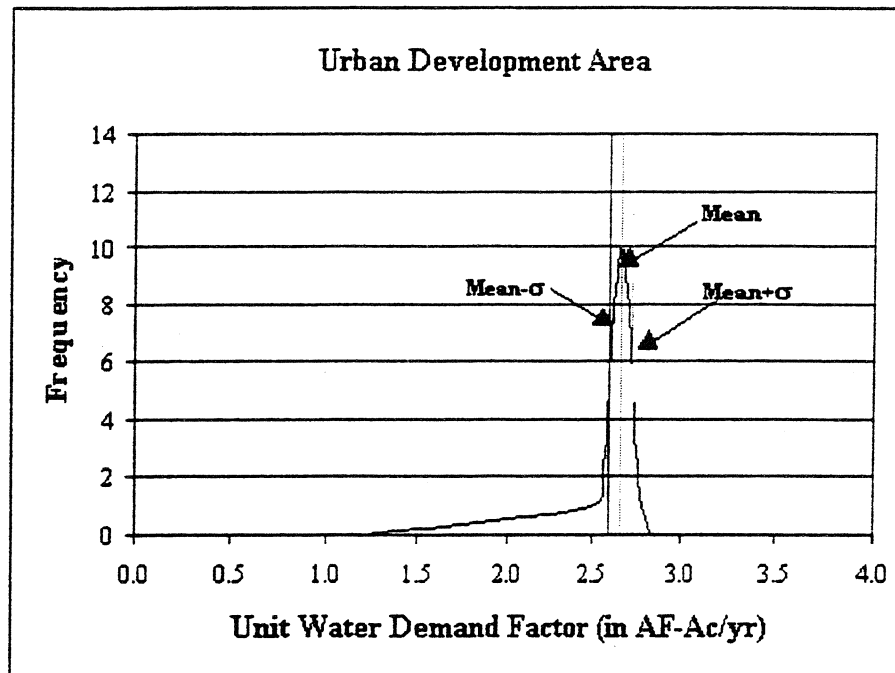


Figure 10. Histogram of Urban Development Area

TECHNICAL MEMORANDUM 3



Subject: Wastewater Evaluation of Urban Growth Areas **Date:** December 4, 2001

Prepared by: John Buttz **File Number:** 1510935

Reviewed by: Art O'Brien/City of Roseville

SUMMARY

Wastewater Treatment: The wastewater flow from the Urban Growth Areas outside of the original Wastewater Master Plan service area totals 5.15 mgd (average dry weather flow(ADWF)), of which 4.12 mgd originates in the Roseville/County MOU Area. The logical expansion increments of the Pleasant Grove and Dry Creek Wastewater Treatment Plants WWTP are 3.0 mgd (ADWF) and 6.0 mgd (ADWF), respectively. Therefore, it appears that either (1) both plants will need to be expanded or (2) significant additional work will need to be done to allow the Pleasant Grove WWTP to be expanded above 3.0 mgd.

Wastewater Conveyance: It appears that wastewater from the western and southern portions of the MOU area will need to be pumped to reach either the Pleasant Grove or Dry Creek WWTPs.

CONTENTS OF TECHNICAL MEMORANDUM

This TM summarizes the results of analyses conducted in support of the study objectives. The TM is organized into the following sections:

- Introduction
- Summary of 1996 Master Plan and Subsequent EIRs
- Wastewater Flow Estimates for Urban Growth Areas
- Treatment Plant Analysis
- Conveyance Analysis
- Recommendations for Further Work
- Appendix A—Background Information for Wastewater Evaluation

INTRODUCTION

This Technical Memorandum No. 3 (TM 3) provides a planning-level analysis of wastewater demands in various urban growth areas within and outside of the existing Roseville Wastewater Treatment Service Area, as defined in the 1996 Roseville Wastewater Treatment Service Area Master Plan (Montgomery Watson, 1996). These urban growth areas include (see Figure 1):

- Sunset Ranchos (undergoing annexation to the City of Rocklin)
- Sunset Industrial Area
- The urban growth area west of the City of Roseville covered by a Memorandum of Understanding between the City of Roseville and Placer County (termed the MOU Area). The MOU area includes the following developments: Fiddymont Ranch, West Park, MOU Transition Area (divided in this report into a northern and southern area), and Westpark. A portion of the Westpark area lies outside the MOU Area, and is identified separately in the analysis.
- Sewer Management District No. 3 (SMD 3) of Placer County
- Clover Valley Lakes

OBJECTIVES OF TECHNICAL MEMORANDUM

The objectives of this TM were to:

- (1) Assess, at a planning level, the net increase or decrease of the wastewater generated from these urban growth areas as compared to the estimates made in the original 1996 Wastewater Master Plan.
- (2) Make a preliminary determination of the likely wastewater treatment plant (Pleasant Grove Creek WWTP or Dry Creek WWTP) to receive any increased flows, and identify potential requirements for additional treatment capacity.
- (3) Make preliminary comments on the potential impacts on the wastewater transmission system.

SUMMARY OF 1996 MASTER PLAN AND EIRS

The 1996 Master Plan established the baseline for assessing wastewater service for the urban growth areas. Several criteria were established in the Master Plan that will be used in this assessment, namely (1) establishment of a wastewater service area, (2) wastewater generation factors, and (3) treatment plant capacity.

Wastewater Service Area

In the 1996 Master Plan, a number of various alternatives and growth scenarios were analyzed. Ultimately, the following were adopted:

- Alternative 2 was selected for treatment facilities expansion, which involved constructing the new Pleasant Grove WWTP and expanding the existing Dry Creek WWTP.

- Growth Scenario 2 were chosen. Scenario 2 included growth in approved General Plan areas (at the time of the Master Plan preparation) plus additional growth as a result of development of Roseville's urban reserve and development of two annexation areas.
- The City of Lincoln ultimately chose to build its own new treatment facilities and is not included in the Roseville system service area.

The wastewater service area that results from these assumptions is shown in Figure 1. These assumptions (Alternative 2, Growth Scenario 2, and the City of Lincoln not included) resulted in an estimated ultimate capacity requirement of 21 mgd at the Pleasant Grove WWTP and 25 mgd at the Dry Creek WWTP.

Wastewater Generation Factors

The 1996 Wastewater Master Plan established wastewater flow generation factors for various types of land uses. These factors are summarized in Table 1 and will be used in this report in estimating wastewater flows from urban growth areas. As shown, the 1996 Master Plan developed separate factors for the transmission (pipeline) system and the wastewater treatment plants.

Table 1
Recommended Unit Flow Factors

Service Area	Transmission System Analysis	Regional WWTP Analysis
Residential (gpd/edu) ^a	400	260
Commercial (gpad) ^b	1,600	1,040
Light Industry (gpad)	1,600	1,040
Heavy Industry (gpad)	2,500	1,560
Public (gpad)	1,600	1,040
Hydraulic Peaking Factor	2.3	2.5

a. gallons per day per equivalent dwelling unit

b. gallons per acre per day

Treatment Plant Capacities

As part of the 1996 Master Plan and subsequent EIR work, various capacity criteria were established for the Pleasant Grove and Dry Creek Wastewater Treatment Plants. In addition,

each plant has a permitted capacity established in its National Pollutant Discharge Elimination System (NPDES) permit. These capacities are summarized in Table 2.

Table 2
Summary of Roseville Treatment Plant Capacities
(all figures in mgd, average dry weather flow)

Criteria	Dry Creek WWTP	Pleasant Grove WWTP
Current Capacity of Physical Facilities	18	12 ^a
Current NPDES Permitted Capacity	18	12
Capacity Covered by Existing EIR	25	21
Potential Expansion Capacity	54 ^b	24

a. Currently under construction.

b. 1996 Master Plan estimated that this capacity could be achieved within the existing Dry Creek WWTP site.

WASTEWATER FLOW ESTIMATES FOR URBAN GROWTH AREAS

Using these unit flow factors, wastewater flow estimates were made for each of the urban growth areas. Because different unit flow factors exist for the transmission system and the wastewater treatment plants, two sets of wastewater flow estimates were made. These estimates are summarized in Tables 3 and 4, and are discussed below for each urban growth area. The wastewater flow from the MOU area (shown in Figure 1) totals 4.12 mgd (ADWF).

Sunset Ranchos

As shown in Figure 1, the Sunset Ranchos area is totally contained within the 1996 Wastewater Master Plan service area. However, additional planning for this area has occurred, and it was necessary to compare the current planned land use and resulting wastewater generation to the 1996 estimate. The current plans for Sunset Ranchos are documented in a recent EIR prepared by the City of Rocklin ("Northwest Rocklin Annexation (Sunset Ranchos), Draft EIR, SCH No.

99102012”, prepared for the City of Rocklin by EIP Associates, October 2001) (see Appendix A for excerpt).

As shown in Tables 3 and 4, the resulting current estimated flow from Sunset Ranchos is slightly less than the previous estimate.

Sunset Industrial Area

As shown in Figure 1, a portion of the Sunset Industrial Area is contained within the 1996 Wastewater Master Plan service area, while a portion (west of Fiddymment Road and north of Athens Avenue) is outside the service area. Only the portion outside of the service area was analyzed in this report. The most recent land use estimates for this area are contained in the “Sunset Industrial Area Collection System Master Plan,” prepared for the Placer County Facility Services and Planning Department by Harold Welborn & Associates (December 1999) (see excerpt in Appendix A).

Two items regarding the Sunset Industrial Area land outside of the master plan service area require special note (see Tables 3 and 4):

- The Welborn report identified that wastewater from the portion of the Sunset Industrial Area north of Athens Avenue could potentially go the Lincoln Wastewater Treatment Plant. While no final decision has been made regarding this, this area is shown as a separate line item in the tables.
- The “public” land in the Sunset Industrial Area outside of the Master Plan service area consists of two areas (154 acres and 310 acres) (see Appendix A). Both of these areas are part of the existing or future Western Regional Landfill property. The Welborn report established a flow factor for this landfill property of 220 gpd/acre, based on actual flow measurements. This factor was applied to the 154 and 310 acre areas. (All other “public” lands in Tables 3 and 4 still use the Master Plan figure of 1,040 gpd/acre.)

Fiddymment Ranch

Current land use planning information on the next three areas discussed—Fiddymment Ranch, Westpark, and the MOU Transition Areas—was provided by David Wade of Westpark Associates (916-774-3400) in the form of GIS maps and linked land use tables (see Appendix A).

A portion of the Fiddymment Ranch area, the Village of Blue Oaks Phase 1, was included in the 1996 Wastewater Master Plan service area. Therefore, only the area of Fiddymment Ranch outside of the Village of Blue Oaks Phase 1 was included in the wastewater flow calculations.

Westpark

The western boundary of the MOU area divides the Westpark area into two sections. Therefore, the Westpark area is shown as two line items in Tables 3 and 4—one within the MOU area and one outside.

MOU Transition Areas—North and South

The remainder of the MOU area is termed the Transition Area. Because this Transition Area consists of two distinct geographic areas, these areas have been labeled the MOU Transition Area North and MOU Transition Area South and analyzed separately.

To facilitate the analysis of gravity wastewater conveyance (presented below), the existing topography of the MOU areas was plotted (see **Figure 2**) using USGS data. Using that data, a ridge line was identified through MOU Transition Area South that represents the logical dividing line between areas that could gravity flow to the Pleasant Grove WWTP and the Dry Creek WWTP. MOU Transition Area South was then subdivided into a “North Basin” and a “South Basin”, and separate flow estimates were made for each basin.

SMD 3

The SMD 3 area lies on the eastern edge of the 1996 Wastewater Master Plan service area. Current plans for this area call for only 600 residential units to contribute to the South Placer Regional System (and ultimately to the Roseville system) at ultimate build-out (per Warren Tellefson of Placer County, see Appendix A).

Clover Valley Lakes

The Clover Valley Lakes area, with a total of approximately 573 acres, lies outside of the 1996 Wastewater Master Plan service area. Local wastewater collection for this area is handled by the South Placer Municipal Utilities District (SPMUD). SPMUD also has a wastewater service area adjacent to the Clover Valley Lakes area and within its 1996 Wastewater Master Plan service area. SPMUD has analyzed the actual density of development within the 1996 service area, and has determined that it has developed at a density of approximately 5 to 6 units per acre, as compared to the approximately 10 units per acre assumed in the 1996 Master Plan. Given this lower density of development, SPMUD has determined that the overall SPMUD wastewater generation (from both Clover Valley Lakes and the area within the 1996 service area) will be less than the SPMUD flow estimated in the 1996 Master Plan (per Richard Stein of SPMUD, see Appendix A). Because no additional flow above and beyond the 1996 Master Plan is predicted for Clover Valley Lakes, it has not been further analyzed or presented in Tables 3 and 4.

TREATMENT PLANT ANALYSIS

The additional wastewater treatment flows shown in Table 3 will ultimately need to be handled at either the Pleasant Grove or Dry Creek WWTPs, and may impact the available the capacity at each plant. In this section, an analysis of the potential impacts on the plants is presented, based on the plant capacity assumptions presented in Table 2.

Potential Additional Flow to Pleasant Grove WWTP

The Pleasant Grove WWTP is currently under construction. This first phase of construction will provide 12 mgd of average dry weather flow (ADWF) capacity. The EIR prepared for the project covers a total capacity of 21 mgd (ADWF).

One logical expansion of the Pleasant Grove WWTP would be to construct a mirror image of the first phase of construction, which would result in a total capacity of 24 mgd (ADWF). This would provide an additional 3 mgd of capacity. Such a project would require additional CEQA documentation and an NPDES permit revision. Both of these items would likely require analysis of impacts of the increased discharge on receiving water quality. Providing capacity beyond 24 mgd would require significant improvements and/or a major change in the expansion project. Therefore, a logical target for additional flow to the Pleasant Grove WWTP would be 3.0 mgd (ADWF).

Dry Creek WWTP

The Dry Creek WWTP has a current capacity of 18 mgd. The current EIR addresses 25 mgd of capacity. In the 1996 Master Plan, various alternative expansion plans were analyzed for the Dry Creek WWTP, including incremental expansions of 6 mgd and a maximum total capacity of 54 mgd (ADWF), all of which could be handled within the existing Dry Creek site. Therefore, a logical target for additional flow to the Dry Creek WWTP would be incremental expansion of 6 mgd, which would bring the total flow to 24 mgd, within the current EIR analysis.

Possible Treatment Scenarios

First Scenario—Limit Pleasant Grove WWTP to Additional 3.0 mgd: Given that the Pleasant Grove WWTP has a lower logical expansion flow (3.0 mgd) than the Dry Creek WWTP (6.0 mgd), one treatment scenario would be to target 3.0 mgd (ADWF) from the Urban Growth Areas to the Pleasant Grove WWTP, and send the remainder to the Dry Creek WWTP. The logical contributors (see Figure 1 and Table 3) to Pleasant Grove WWTP would be those located north and closest to the plant:

Sunset Ranchos	-0.15 mgd
Fiddymment Ranch—Outside MP	0.52 mgd
Sunset Industrial—Outside MP, north	0.85 mgd
Sunset Industrial—Outside MP, south	0.07 mgd
MOU North	0.51 mgd
Westpark	<u>1.35 mgd</u>
Total	3.15 mgd

This total is slightly above the 3.0 mgd target, but is close enough to be considered viable for further consideration. The remaining flows would go to the Dry Creek WWTP:

MOU South (north basin)	1.11 mgd
MOU South (south basin)	0.73 mgd
SMD 3	<u>0.16 mgd</u>
Total	2.00 mgd

If the portion of Sunset Industrial north of Athens Avenue did go to the Lincoln WWTP, then a significant portion of the MOU South (north basin) could go to the Pleasant Grove WWTP. The advantage of this scenario is that it would take maximum advantage of the logical expansions of

the two WWTPs and would minimize pumping. The disadvantage is that, if the northern portion of Sunset Industrial goes to Pleasant Grove WWTP, the MOU South (north basin) flows would need to be pumped to the Dry Creek WWTP.

Second Scenario—Maximize Gravity Flow: The second scenario would be to maximize gravity flow to each plant by using the ridge line through MOU Transition Area South (indicated in Figure 2) to apportion flows to the two plants. All areas north of the ridge line would flow to the Pleasant Grove plant; all areas south would go to the Dry Creek plant. This yields the following flow to the Pleasant Grove WWTP:

Sunset Ranchos	-0.15 mgd
Fiddymment Ranch—Outside MP	0.52 mgd
Sunset Industrial—Outside MP, north	0.85 mgd
Sunset Industrial—Outside MP, south	0.07 mgd
MOU North	0.51 mgd
Westpark	1.35 mgd
MOU South (north basin)	<u>1.11 mgd</u>
Total	4.26 mgd

The remaining flows would go to the Dry Creek WWTP:

MOU South (south basin)	0.73 mgd
SMD 3	<u>0.16 mgd</u>
Total	0.89 mgd

The advantage of this scenario is that it would minimize pumped flows, although some pumping would still be needed to both plants, as discussed in the next section.

CONVEYANCE ANALYSIS

The wastewater transmission flows from the Urban Growth Areas will need to be conveyed to the appropriate wastewater treatment plant. It is the City of Roseville's goal to have this routing occur via gravity flow, i.e., to avoid construction of pump stations and force mains if at all possible.

The analysis of gravity conveyance was completed using the topography illustrated in Figure 2. The analysis was completed using the following steps (see Table 5):

- Representative spot elevations were identified at the low points in five representative locations.
- Straight line distances were estimated from each of the locations to the wastewater treatment plant to which it might drain by gravity.
- Assumptions were made of minimum cover over the pipe at its upstream end (5 feet) and the upstream pipe diameter (12 inches).

- Pipe slopes would vary from approximately 0.0025 ft/ft at the upstream to approximately 0.0007 ft/ft at the downstream, larger end. An average pipe slope of 0.0016 ft/ft was assumed.

These assumptions were used to calculate a downstream pipe invert at the associated wastewater treatment plant. These calculated inverts were compared to the actual connection points available at each plant:

- **Pleasant Grove WWTP:** Two 36-inch diameter connection points have been provided at the Pleasant Grove WWTP influent junction structure for future trunk lines, such as might come from the urban growth areas, one at invert elevation 69.00 ft and one at invert elevation 73.75 ft. Neither of these connection points has yet been assigned to other influent trunks.
- **Dry Creek WWTP:** One of the main gravity influent lines at the Dry Creek WWTP appears to be a 42-inch diameter line with an invert elevation of approximately 104.0 ft (Sheet 47, Dry Creek WWTP Design Drawings, Dewante & Stowell, August 1974).

The results shown in Table 5 are summarized below:

- **MOU North:** This calculated invert is approximately 12 feet below the lowest Pleasant Grove WWTP connection point, and would indicate the need for pumping.
- **Westpark:** This calculated invert is approximately 2.6 feet below the lowest Pleasant Grove WWTP connection point, and would indicate the need for pumping.
- **Fiddymment Ranch:** This calculated invert is approximately 7.4 feet above the lowest Pleasant Grove WWTP connection point, and would indicate that this area could gravity flow to the Pleasant Grove WWTP. However, siphons would be needed under Pleasant Grove Creek to serve the northern part of Fiddymment Ranch.
- **MOU South (North Basin):** This calculated invert is approximately 5.2 feet below the lowest Pleasant Grove WWTP connection point, and would indicate the need for pumping.
- **MOU South (South Basin):** This calculated invert is approximately 65 feet below the Dry Creek WWTP connection point, and would indicate the need for pumping.

It should be noted that these calculations were done for the lowest points in each of these Urban Growth Areas; there are significant portions of some of these areas that are higher in elevation and could gravity flow. However, it appears likely that some pumping will be needed in portions of all of these areas.

Conveyance for the remaining Urban Growth Areas not addressed in Table 5 was addressed in the following manner:

- **Sunset Ranchos:** Conveyance for the Sunset Ranchos area was already addressed in the 1996 Master Plan. This area will gravity flow to the Pleasant Grove WWTP.
- **Sunset Industrial:** Conveyance service for the Sunset Industrial area was addressed as part of the Pleasant Grove Trunk Sewer design.

- **SMD 3:** Conveyance service for SMD 3 will occur through the existing Roseville regional system, and was addressed in the 1996 Master Plan.

RECOMMENDATIONS FOR FURTHER WORK

The following recommendations are made for further work:

- Confirm specific needs for the 21 mgd currently targeted for the Pleasant Grove WWTP, to confirm required capacity. This confirmation could be done by determining actual lands uses and development densities within the existing wastewater service area.
- To fully assess the transmission system, a dynamic hydraulic model should be created of the existing and proposed future pipelines and pump stations. The actual development densities discussed above would serve as inputs into the model. The model could then be calibrated using targeted flow monitoring.

APPENDIX A

**BACKGROUND INFORMATION FOR
WASTEWATER EVALUATION**

Table 3
Treatment Plant Wastewater Flow Estimates for Urban Growth Areas

Area	Acreage by Land Use Type						Residential EDUs	Res. Density (EDUs/acre) [d]	Flow [mgd] [a]			Comments
	Commercial	Light Industry	Heavy Industry	Public [c]	Resid- ential	Open Space/Ag			Weather	Peak		
Sunset Ranchos (Master Plan) [j]	231	16	0	27	763	339	4,549	6.0	1.47	3.87	Current plans (per 2001 EIR) indicate less flow than planned in VWT Master Plan.	
Sunset Ranchos (2001 EIR) [e]	43.5	0	0	140	919.6	193.2	4,337	4.7	1.32	3.30		
Sunset Ranchos-Net Change									-0.15	-0.37		
Fiddymant Ranch-Inside MP [i]	21.1	0	0	91.7	741	233.6	2,879	3.9	N/A	N/A		
Fiddymant Ranch-Outside MP [i]	0	0	0	189.2	210	43.7	1,257	6.0	0.52	1.31		
Sunset Industrial-Outside, North of Alliers Avenue [g]	0	786.3	0	164	0	1805	2545.3	N/A	0.85	2.13		
Sunset Industrial-Outside, South of Alliers Avenue [g]	0	0	0	310	0	1593	1903	N/A	0.07	0.17		
Westpark-Within MOU [h]	33.7	58.7	81.9	100.1	725.1	253.9	1234.4	5.0	1.25	3.11		
Westpark-Outside of MOU [h]	1.1	0	0	3.3	108.1	33.3	145.8	3.5	0.10	0.25		
MOU North	52.4	0	0	10.3	326.7	206.5	695.9	5.2	0.51	1.27		
MOU South (north basin) [j]	24.0	0	0	182	701.7	88.5	986.2	4.9	1.11	2.77		
MOU South (south basin) [j]	40.1	0	0	93.7	439.9	81.7	655.4	5.2	0.73	1.82		
SMD 3	N/A	N/A	N/A	N/A	N/A	N/A	600	N/A	0.16	0.39	Per Warren Tellefson, Placer County.	
TOTAL									5.15	19.82		

N/A = Not applicable or available.

a. Assuming the following criteria from Table 6, Section 2, of the Wastewater Master Plan:

Hydraulic peaking factor 2.5

Dry Weather Flow Generation Factors:

Residential	260 gpd/acre
Commercial	1040 gpd/acre
Light Industry	1040 gpd/acre
Heavy Industry	1560 gpd/acre
Public	1040 gpd/acre
Open Space and Agricultural	0 gpd/acre

(220 gpd/acre for Sunset Industrial Area, see note "c")

b. Total acres of entire area for Sunset Ranchos and SMD 3. Residential acres for others. All acreages scaled using GIS mapping.
c. Includes parks and schools. The Sunset Industrial Area public space is entirely existing or future Western Regional Landfill property, with an assumed flow generation factor of 220 gpd/acre, based on actual flows measured at the landfill (per "Sunset Industrial Area Collection System Master Plan," Harold Welborn & Associates, December 1999).

d. Using residential acreage, where available.

e. From "Northwest Rocklin Annexation (Sunset Ranchos) Draft EIR," EIP Associates (for City of Rocklin), October 2001

f. A portion of Fiddymant Ranch, The Village of Blue Oaks Phase 1, was "inside" the original Master Plan service area.

g. The "outside" entry only includes the area of Fiddymant Ranch outside of the Village of Blue Oaks Phase 1.

h. Only includes area outside of existing wastewater service area-north of Alliers Avenue and west of Fiddymant Road.

i. Remaining area inside of wastewater service area was covered by the Wastewater Master Plan.

j. The western boundary of the MOU area divides the Westpark area into two sections. The area west is outside of the MOU area.

k. Sunset Ranchos area is shown as Basin 4-C in the 1995 Master Plan. See Section 11, Appendix A, Scenario 2, page 47.

l. MOU South area is crossed by a ridge that divides into a north basin, that could gravity flow to Pleasant Grove WWTP,

and a south basin that could gravity flow to Dry Creek WWTP.

Table 4
Conveyance System Wastewater Flow Estimates for Urban Growth Areas

Area	Acreage by Land Use Type						Flow (mgd) [a]			Comments
	Commercial	Light Industry	Heavy Industry	Public [c]	Residential	Open Space/Ag	Residential EDUs/acre [d]	Average Dry Weather	Peak	
Sunset Ranchos (Master Plan) [i]	231	16	0	27	763	339	4,549	2.26	5.19	Current plans (per 2001 EIR) indicate less flow than planned in WW Master Plan.
Sunset Ranchos (2001 EIR) [e]	43.5	0	0	140	919.5	193.2	4,337	2.03	4.67	
Sunset Ranchos--Net Change								-0.23	-0.53	
Fiddymont Ranch--Inside MP [f]	21.1	0	0	91.7	741	233.6	2,879	N/A	N/A	
Fiddymont Ranch--Outside MP [f]	0	0	0	189.2	210	43.7	1,257	0.81	1.85	
Sunset Industrial--Outside, North of Athens Avenue (goes to Lincoln WWTP) [g]	0	786.3	0	154	0	1605	2545.3	N/A	2.97	
Sunset Industrial--Outside, South of Athens Avenue (goes to Pleasant Grove WWTP) [g]	0	0	0	310	0	1693	1803	0.07	0.16	
Westpark--Within MOU [h]	33.7	58.7	61.9	100.1	726.1	253.9	3,650	1.92	4.42	
Westpark--Outside of MOU [h]	1.1	0	0	3.3	108.1	33.3	374	0.16	0.36	
MOU North	52.4	0	0	10.3	326.7	206.5	1,698	0.78	1.79	
MOU South (north basin) [i]	24.0	0	0	192	701.7	88.5	986.2	1.70	3.92	
MOU South (south basin) [i]	40.1	0	0	93.7	439.9	81.7	2,269	1.12	2.59	
SMD 3	N/A	N/A	N/A	N/A	N/A	N/A	600	N/A	0.55	Per Warren Tellefson, Placer County.
TOTAL								7.87	27.94	

N/A = Not applicable or available.

a. Assuming the following criteria from Table 6, Section 2, of the Wastewater Master Plan:

Hydraulic peaking factor

Dry Weather Flow Generation Factors:

Residential	400 gpd/edu
Commercial	1600 gpd/acre
Light Industry	1600 gpd/acre
Heavy Industry	2500 gpd/acre
Public	1600 gpd/acre
Open Space and Agricultural	0 gpd/acre

(220 gpd/acre for Sunset Industrial Area, see note "c")

b. Total acres of entire area for Sunset Ranchos and SMD 3. Residential acres for others. All acreages scaled using GIS mapping.
c. Includes parks and schools. The Sunset Industrial Area public space is entirely existing or future Western Regional Landfill property, with an assumed flow generation factor of 220 gpd/acre, based on actual flows measured at the landfill (per "Sunset Industrial Area Collection System Master Plan," Harold Welborn & Associates, December 1999).

d. Using residential acreage, where available.

e. From "Northwest Rocklin Annexation (Sunset Ranchos) Draft EIR," EIP Associates (for City of Rocklin), October 2001

f. A portion of Fiddymont Ranch. The Village of Blue Oaks Phase 1, was "inside" the original Master Plan service area.

The "outside" entry only includes the area of Fiddymont Ranch outside of the Village of Blue Oaks Phase 1.

g. Only includes area outside of existing wastewater service area--north of Athens Avenue and west of Fiddymont Road.

Remaining area inside of wastewater service area was covered by the Wastewater Master Plan.

h. The western boundary of the MOU area divides the Westpark area into two sections. The area west is outside of the MOU area.

i. Sunset Ranchos area is shown as Basin 4-C in the 1996 Master Plan. See Section 11, Appendix A, Scenario 2, page 47.

j. MOU South area is crossed by a ridge that divides into a north basin, that could gravity flow to Pleasant Grove WWTP,

and a south basin that could gravity flow to Dry Creek WWTP.

Table 5
Gravity Flow Calculations for Representative Urban Growth Areas

Assumptions and Calculations	Urban Growth Area and Associated WWTP (a)				
	MOU North (PG WWTP)	Westpark (PG WWTP)	Fiddymont Ranch (PG WWTP)	MOU South (North Basin) (PG WWTP)	MOU South (South Basin) (Dry Creek WWTP)
Assumptions:					
Lowest Existing Ground Elevation at Upstream End, ft	75	80	90	85	80
Distance to WWTP, miles	1.4	0.9	0.9	1.8	4.2
Assumed Cover at Upstream End, ft	5	5	5	5	5
Assumed Pipe Diameter at Upstream End, inches	12	12	12	12	12
Assumed Average Pipe Slope, ft/ft	0.0016	0.0016	0.0016	0.0016	0.0016
Calculated Pipe Invert Elevation at WWTP, ft	57.2	66.4	76.4	63.8	38.5
Actual Connection Point Elevation at WWTP, ft	69.00 and 73.75	69.00 and 73.75	69.00 and 73.75	69.00 and 73.75	104.0
Conclusion regarding ability to gravity flow vs. pump	Pump	Pump	Gravity	Pump	Pump

Notes:
a. Urban Growth Areas that lie lowest in elevation (furthest west) relative to the WWTPs were analyzed.

TECHNICAL MEMORANDUM



MWH

MONTGOMERY WATSON HARZA

Subject: Task 7: Water Supply Strategy

Date: April 10, 2003

Prepared By: Marshall Davert

File Number: 1510935

Reviewed By:

INTRODUCTION

BACKGROUND

The City of Roseville (City) is considering whether to provide water service to urban growth areas (outside the existing City limits) along the western boundary of the City. In particular, the City is considering delivery of water to the West Roseville Specific Plan (WRSP) area and the "City of Roseville/Placer County Memorandum of Understanding Transition Area" (Transition area). Together these areas are referred to as the "MOU area".

Two questions must be answered before the City can accept the obligation of providing water service to the MOU area. First, does the City have available supplies to provide long-term, reliable water service to the MOU area while maintaining service to its existing (and future) customers within the City limits? Second, if such water supplies are available, can they be delivered without negatively affecting the City's existing ratepayers?

A preliminary evaluation was completed in February 2002. That evaluation identified a range of water supply alternatives that in aggregate could provide the City with the ability to provide long-term, reliable water supplies to the MOU area while maintaining service to its existing (and future) customers within the City limits. The investigation did not address impacts to existing ratepayers.

Based on the results of the preliminary investigation, the City Council directed City Environmental Utilities (EU) staff to more fully develop and evaluate the most promising alternatives, and to return with a recommended course of action.

OBJECTIVE OF THIS MEMORANDUM

The primary objective of this memorandum is to develop and describe a water supply strategy for meeting projected water demands within the City's existing service area, the WRSP area, and, ultimately, the entire MOU area.

MEMORANDUM OVERVIEW

Previous memoranda provided estimates of existing and projected water demands for both the City and the MOU area and identified alternatives for potentially meeting those demands. This memorandum begins with a summary of the principal results of those memoranda. Following that summary are descriptions of the water supply alternatives identified by EU staff for more thorough analysis. These descriptions include discussion of the operational and physical aspects of specific water supply alternatives. The intent is that the descriptions provide sufficient detail to support the WRSP environmental document. The memorandum concludes with a discussion of the potential timing and sequencing of alternatives.

WATER SUPPLY SETTING

CURRENT AND PROJECTED WATER DEMANDS

The preliminary evaluation provided estimates of current and projected water demands within both the existing City boundaries and the MOU area. Three “levels” of water demand were considered: 1) the City only, 2) the City plus the WRSP area, and 3) the City plus the entire MOU Area. These estimated water demands provide the basis for evaluating potential water supply alternatives and for determining the facilities required to make those alternative supplies available.

The *General Plan Update Water System Study* (Spink, August 1993) served as the City’s initial basis for the estimates of water demand. “Revised” estimates of current and projected water demands were determined utilizing recently gathered water meter information. The new data indicate that unit water demands for the majority of land use categories in the City have decreased relative to the estimates used in the 1993 Spink study by almost 25 percent. The primary reason for this decline has been attributed to improved water conservation.

Table 1 presents the land use categories and total water demand for the City’s existing service area, the WRSP area, and the entire MOU Area. The projected water demands include that portion of the City served with supplies contracted from the San Juan Water District (namely, Doctor’s Ranch and the Foothills Business Park). **Table 1** presents water demands based on the revised unit demand factors.

Table 1. Estimated Average Annual Water Demands based on Revised Unit Demand Factors

Land Use Category		City of Roseville (AF/year)		West Roseville Specific Plan		Entire MOU Area	
				West Roseville Specific Plan (WRSP) Only (AF/year)	WRSP Combined with City (AF/year)	MOU Area Only (AF/year)	MOU Area Combined with City (AF/year)
		Estimated Existing Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand	Estimated Ultimate Demand
Residential	LDR (< 3.5 DU's/Ac)	4,943	5,903	1,523	7,426	1,523	7,426
	LDR (3.5 to 5.0 DU's/Ac)	8,222	13,524	2,339	15,863	5,741	19,265
	LMDR (>5.0 to 6.0 DU's/Ac)	2,880	3,301	228	3,529	228	3,529
	LMDR (>6.0 to 8.0 DU's/Ac)	1,594	2,030	214	2,244	570	2,600
	MDR (>8.0 to 12.0 DU's/Ac)	401	761	157	918	157	918
	HDR (>12.0 to 16.0 DU's/Ac)	32	115	229	344	229	344
	HDR (>16.0 DU's/Ac)	1,347	1,948	211	2,159	534	2,482
Commercial/Other	Commercial/Retail	2,323	4,929	95	5,024	302	5,231
	Business Professional	987	2,267	57	2,324	203	2,470
	Light Industrial	858	4,120	258	4,378	258	4,378
	Industrial	1,599	3,002	98	3,100	98	3,100
	Railroad Yard	87	72	-	72	-	72
	Elementary Schools	648	573	211	784	478	1,051
	High Schools	408	597	242	839	242	839
	Public (Fire Station, etc)	1,199	1,290	-	1,290	-	1,290
	Park/Recreation	4,628	6,176	1,042	7,218	1,665	7,841
	Open Space/Major ROW	-	-	-	-	-	-
	Vacant/Unassigned	-	-	-	-	-	-
Sub-Total		32,155	50,608	6,904	57,512	12,228	62,836
System Losses (2%)		638	1,012	138	1,150	245	1,257
TOTAL:		32,794	51,620	7,042	58,662	12,473	64,093

Use of the revised unit water demand factors results in an estimated ultimate water demand for the City of 51,620 AF/year (see **Table 1**). The estimated ultimate water demand for the existing City plus the WRSP area is 58,662 AF/year. The estimated ultimate water demand for the existing City plus the MOU area is 64,093 AF/year.

TASK 7 – WATER SUPPLY STRATEGY

The City's current maximum surface water diversion from Folsom Lake under the Water Forum Agreement (WFA) is 55,700 AF/year. This is also the total volume of water for which the City is currently planning to provide on a reliable basis. This volume is 4,080 AF/year greater than the existing City's revised projected water demand shown on **Table 1** of 51,620 AF/year. As will be discussed later in this memorandum, the intent of the City is to make this water available for use in the MOU area.

The projected deficiency in the City's current water supply, assuming the entire MOU area is annexed into the City, is 8,393 AF/year (64,093 AF/year minus 55,700 AF/year). The projected deficiency in the City's current water supply, assuming only the WRSP area develops, is 2,962 AF/year (58,662 AF/year minus 55,700 AF/year).

CITY'S EXISTING AND POTENTIAL WATER SUPPLY ALTERNATIVES

City's Existing Water Supplies

The City currently has three surface water contract entitlements for diversions from the American River totaling 62,800 AF/year: 1) a 30,000-AF/year contract with the Placer County Water Agency (PCWA) supplied from the Middle Fork Project (MFP); 2) a 32,000-AF/year contract with the United States Bureau of Reclamation (USBR) for a Central Valley Project (CVP) supply; and 3) an 800-AF/year contract with the San Juan Water District for delivery to the City's service area utilizing a portion of San Juan's PCWA contract water supply (also provided from the MFP).

The MFP supply is derived from reservoirs on the Middle Fork of the American River operated by PCWA for purposes of power generation for the Pacific Gas & Electric (PG&E) Company, as well as for water supply. The MFP supply is assumed to be 100 percent reliable (absent a catastrophic event) in all hydrologic year types. The City's CVP contract provides for a diversion from Folsom Lake. This water is considered to be less reliable than the MFP water and is subject to up to 25% deficiencies in "dry years" in accordance with CVP shortage provisions.

The WFA provides a framework for future surface water and groundwater supplies in the region through the year 2030. The City's WFA specifies allowable surface water diversions based on unimpaired inflows into Folsom Lake. Diversions by the City are restricted in dry years with the objective of supporting environmental needs in the lower American River. In particular, the City is obligated to provide water for instream flows in the lower American River to the confluence with the Sacramento River under certain hydrologic conditions. This water is made available through re-operation of the MFP by PCWA. The principal consequence of this obligation is that the availability and reliability for diversions by the City out of Folsom Lake are impacted under certain hydrologic conditions.

Under the WFA, the maximum surface water diversion by the City in wet/average years is limited to 55,700 AF/year. In critically dry years, the maximum diversion is limited to 39,800 AF/year¹. In below average to dry years, the City may divert an amount between 55,700 and 39,800 AF/year based on unimpaired inflow into Folsom Lake. **Figure 1** shows the percentage of years a given amount of American River surface water is available to the City over 70 years of historical hydrology (based on WFA restrictions). **Figure 1** indicates that 55,700 AF/year will be available to the City in about 83 percent of the years. As a consequence, in 17 percent of the years the City must develop supplemental supplies potentially totaling up to 15,900 AF/year to make up for dry-year and critically dry-year deficiencies. The City's current strategy includes the development of up to 3,000 AF/year of recycled water supplies (for non-potable use), development of up to 7,400 AF/year of sustainable groundwater

¹ The wet/average-year volume includes the 800 AF/year supply contracted from the San Juan Water District for service to Doctor's Ranch and the Foothills Business Park. That supply is not available in the critically dry years.

supplies, and the implementation of up to 5,500 AF/year of additional conservation efforts, including rationing, during severe drought (this represents a 10% reduction in water use).

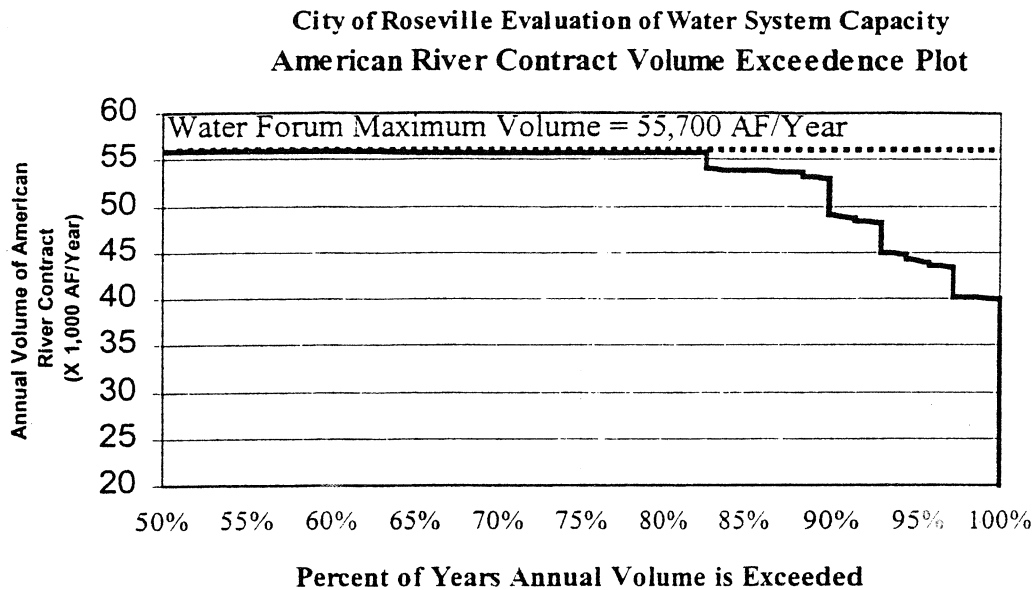


Figure 1. American River Contract Volume Exceedance Based on WFA

The total volume of American River water available for diversion by the City in a given year is also dependent on hydrologic availability; that is, the WFA provides for only a **potential** maximum diversion. In wet/normal years, the WFA maximum of 55,700 AF/year will typically control. In dry and critically dry years, however, it is likely that CVP deficiency criteria will control surface water availability for the City. **Figure 2** indicates that CVP deficiencies will slightly decrease the availability of surface water supplies to the City versus the WFA. CVP shortages govern in approximately 30 percent of the years, leaving 55,700 AF/year available for diversion by the City in about 63 percent of the years (versus the 83 percent “potential” availability provided for in the WFA).

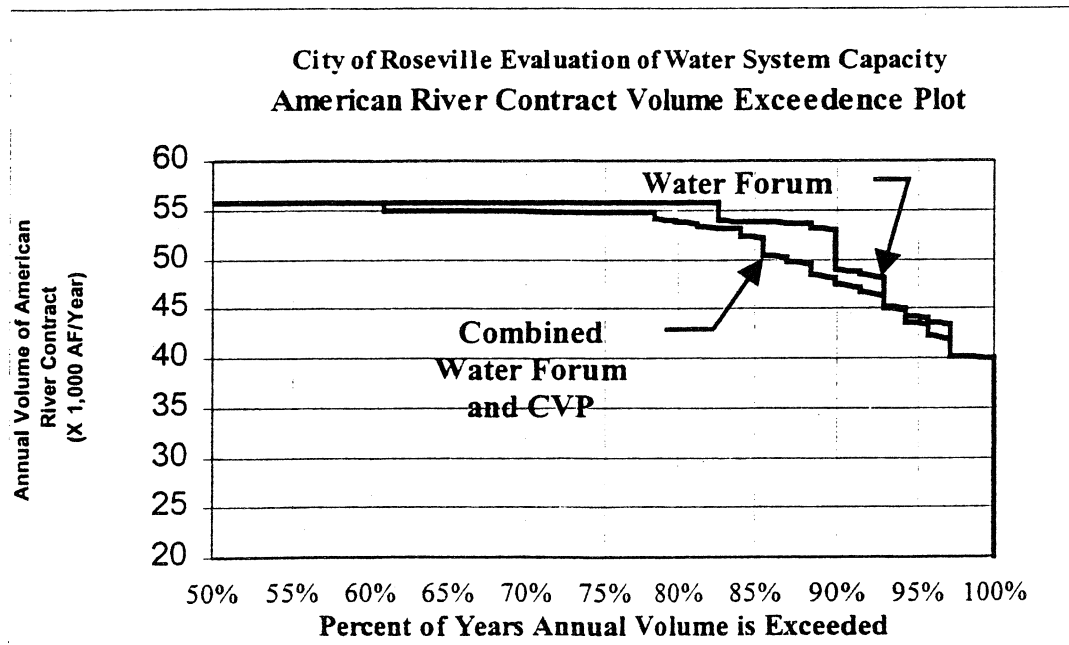


Figure 2. American River Contract Volume Exceedance with CVP Shortages

TASK 7 – WATER SUPPLY STRATEGY

Note, however, that even with the anticipated reduction in estimated water demands, the revised ultimate water demand projection for the City and the entire MOU area is 64,093 AF/year. If only the WRSP develops, the demand is 58,662 AF/year. These demands exceed both the City's available dry-year surface water supply of 39,800 AF/year and the wet/average-year available surface water supply of 55,700 AF/year.

Thus, if the entire MOU area develops, the City must implement its current plan to provide for up to 15,900 AF/year of supplemental supplies in critically dry years and develop an additional 8,393 AF/year of supplemental supplies (64,093 AF/year minus 55,700 AF/year). Similarly, if only the WRSP area develops, the City must develop 2,962 AF/year of supplies (58,662 AF/year minus 55,700 AF/year) in addition to the planned 15,900 AF/year of supplemental supplies.

Potential Water Supply Alternatives under Investigation

The preliminary investigation identified five potential supplemental water supply alternatives for augmenting the City's existing water supplies with the objective of serving the WRSP and MOU areas:

- Re-allocation of a portion of the 55,700 AF/year “wet/average year” water supply previously earmarked for the City's existing customers made available through recalculation and revision of the unit water demand factors.
- An additional surface water contract entitlement from the San Juan Water District (San Juan)
- Recycled water supplies made available for non-potable use
- A potential future delivery of surface water from a diversion from the Sacramento River
- Sustainable groundwater supplies for use in “drier” and “driest” years. [NOTE: The City's “Guiding Principles” require the use of groundwater result in no net impact to the basin. Consequently, this alternative may include making a groundwater supply available by the annual fallowing or permanent retirement of agricultural lands currently irrigated with groundwater and/or implementation of an aquifer storage and recovery (ASR) program.]

In addition to these five “wet/average year” water supply alternatives, the water supply strategy includes implementation of extraordinary water conservation efforts, including rationing, in the “drier” and “driest” years. The objective of these efforts is to reduce water demands by an additional 5 percent during drought. Such efforts parallel the City's existing WFA that requires a 10 percent reduction in water use during drought.

Results from the preliminary evaluation indicate that none of the identified potential supplemental supplies can entirely meet the anticipated additional water demands associated with the entire MOU area. However, a number of potential combinations of these supplemental supply sources will likely provide enough supply to meet those demands. The challenge for the City is one of timing. That is, the City must be assured that as the water demand associated with MOU area increases over time, the specific supplemental water supplies intended to meet that demand are available and operational.

The five water supply alternatives listed above are described in the sections that follow. Operational and physical aspects of the alternatives are discussed. The memorandum concludes with a discussion of several timing and sequencing strategies for ensuring that the City always has adequate supplies available to meet anticipated demands.

POTENTIAL WATER SUPPLY ALTERNATIVES

UNIT WATER DEMAND FACTOR REVISION

Previous water supply planning in the City has been based on unit water demands, total water demand, and maximum day and peak hour demand factors provided in the *General Plan Update Water System*

Study (Spink, August 1993). These factors were modified in the preliminary evaluation based on a limited amount of new data.

The new data indicate current estimates of water demand in both the City and the MOU area based on demand factors from the Spink study can be reduced (see **Table 1**). The consequence of such a reduction is that the existing surface water contract entitlements of the City are sufficient to provide a portion of the water supplies needed to serve the MOU area without negatively impacting service to its existing (and future) customers within the City limits. In particular, the City's current maximum surface water diversion from Folsom Lake under the WFA is 55,700 AF/year. This volume is 4,080 AF/year greater than the existing City's revised projected water demand shown on **Table 1** of 51,620 AF/year. This water can be made available to the WRSP and the remainder of the MOU area to meet a portion of the projected water demand associated with each area.

Field data were collected to confirm the unit demand factors for the purpose of estimating existing and ultimate water demands within the City and the MOU area. This information will be used to support the policy decision required by the City Council to make the water supply freed up by the revision of the unit water demand factors available to the MOU area.

CONTRACT ENTITLEMENT FROM THE SAN JUAN WATER DISTRICT (SAN JUAN)

San Juan Water District (San Juan) has an existing contract entitlement for up to 25,000 AF/year from PCWA for use within Placer County. Certain conditions of that contract allow a portion of that entitlement to be delivered to the MOU Area (at least on an interim basis) if that supply is not needed to meet demands within San Juan's Granite Bay service area in Placer County. In preliminary discussions, representatives of San Juan have indicated a willingness to contract for delivery to the City of up to 3,200 AF/year of raw water from this entitlement. Representatives of the City and San Juan are conducting negotiations.

Under the anticipated arrangement with San Juan, the City would take delivery of raw surface water out of Folsom Dam at the City's water treatment plant pursuant to San Juan's PCWA contract entitlement. Subsequent to treatment, the water would be conveyed through the City's water transmission and distribution system to the MOU Area. Hydraulic modeling conducted for the preliminary analyses indicated that under certain conditions the City's existing conveyance system has adequate capacity to deliver water to the MOU Area without negatively impacting existing customers. Under other conditions, system hydraulic improvements may be required (for example, additional conveyance or pumping capacity).

Given that San Juan's contract entitlement with PCWA allows delivery of a portion of that entitlement to the City and the likelihood the City currently has sufficient capacity to convey that supply to the MOU area, this supplemental supply can be assumed to be immediately available upon the signing of a contract between the City and San Juan.

There are two principal issues associated with this supplemental supply. First, because of San Juan's WFA, this supply will be available to the City in wet years only. Consequently, a supplemental supply will be required to replace this entitlement in dry years. Second, the duration of the availability of this entitlement must be determined. San Juan's current contract with PCWA has a 25-year duration. Clear renewal conditions are required if the City is to rely on this supply.

RECYCLED WATER SUPPLIES

Recycled water supplies could be made available for non-potable use from either the existing Dry Creek or future Pleasant Grove wastewater treatment plants. The City's *Reclaimed Water Master Plan* will provide the basis for this evaluation. Three recycled water use scenarios were evaluated in the preliminary investigation: a "normal use" scenario, an "aggressive use" scenario, and a "semi-aggressive use" scenario.

TASK 7 – WATER SUPPLY STRATEGY

The “normal use” scenario considered only the more typical applications of recycled water: parks, golf courses, schools, and publicly landscaped areas. The “normal use” scenario assumed 3,000 AF/year of recycled water use in the existing City service area (consistent with the *Reclaimed Water Master Plan*). For purposes of this memorandum, “normal use” of recycled water was assumed for the existing City.

For the WRSP area and MOU area, however, “semi-aggressive” use of recycled water was assumed. The “semi-aggressive use” scenario assumes “normal use” as the base, but extends potential deliveries to commercial and industrial users, and to multi-family open space areas. This scenario results in the assumed use of approximately 2,638 AF/year of recycled water use in the entire MOU area, with about 1,526 AF/year of that demand assumed to occur within the WRSP area.

The “aggressive use” scenario extends the use of recycled water to meet all outdoor irrigation requirements (including residential) and industrial water demands. This scenario assumes 6,400 AF/year of recycled water use within the MOU area. Recycled water use within the existing City is maintained at 3,000 AF/year. Because initial discussions indicated that implementation of the “aggressive use” scenario is highly unlikely because of cost and permitting issues, it was dropped from further discussion.

The exact timing of the availability of recycled water supplies for delivery to the MOU is not currently known. That timing is dependent upon implementation of the recycled water program identified in the *Reclaimed Water Master Plan* and the availability of recycled supply after the proposed power generating facility has been served. However, given the anticipated rate of increase in water demand over time associated with the MOU area, the likely immediate availability of a contract entitlement from San Juan, and the availability of at least some amount of conserved water, it is likely that recycled water supplies will be available to meet a portion of the non-potable demand in the MOU area as that demand materializes.

PROPOSED SACRAMENTO RIVER DIVERSION

The City has surface water contract entitlements with the CVP and PCWA for reliable sources of surface water supply diverted from Folsom Lake. The City is also investigating an opportunity to receive surface water diverted from the Sacramento River. The City anticipates potential delivery of approximately 7,100 AF/year of treated surface water supply from this project with a maximum day delivery rate of 10.0 million gallons per day (mgd). [NOTE: As described earlier in this memorandum, the City has surface water contract entitlements totaling 62,800 AF/year (a 32,000 AF/year CVP supply plus a 30,000 AF/year contract with PCWA plus an 800 AF/year contract with San Juan). However, the City’s diversions from Folsom Lake are limited by its WFA to 55,700 AF/year. The City’s intent is to pursue delivery of the remaining 7,100 AF/year (62,800 AF/year minus 55,700 AF/year) from the Sacramento River. The source of this supply could be either the City’s CVP or PCWA contract entitlements.]

The USBR began preparation of a feasibility study, an environmental document, and preliminary design for the proposed project in August 2002. That study is being conducted pursuant to Public Law (PL) 106-554, Appendix D, Section 103, which authorizes the Secretary of the Interior to conduct a feasibility study for a Sacramento River, California, diversion project that is consistent with the WFA, and that considers:

- Consolidation of the several diversions of Natomas Mutual Water Company (Natomas) and upgrading fish screens at the consolidated diversion
- The diversion of 35,000 AF/year of water by PCWA
- The diversion of 29,000 AF/year of water for delivery to the Northridge Water District (now the Sacramento Suburban Water District, or SSWD).
- An inter-tie between the consolidated diversion and the Northridge pipeline that delivers water from Folsom Lake

TASK 7 – WATER SUPPLY STRATEGY

- The potential to accommodate additional diversions of water from the Sacramento River, subject to additional negotiation and agreement among WFA signatories and potentially affected parties upstream on the Sacramento River. [NOTE: As the project has developed, these additional components of the project have come to include: a diversion of up to 7,100 AF/year of a CVP supply to the City of Roseville (likely an exchange for PCWA MFP water on the American River); a diversion of up to 100.0 mgd for the delivery to the City of Sacramento; surface water treatment and storage facilities with a capacity of 228.0 mgd for diversion and delivery to PCWA, SSWD, the City of Roseville and the City of Sacramento; and pipeline systems to deliver treated water to (and interconnect) the existing water distribution facilities of PCWA, SSWD, the City of Roseville, and the City of Sacramento.]

The study will evaluate the feasibility of a Sacramento River Diversion described in the PL 106-554 except for Natomas' diversion consolidation and fish screen upgrade, which is currently being studied under a separate effort. Requirements stipulated in the PL 106-554 for the authorized feasibility study include:

- The study shall include the development of a range of reasonable options, an environmental evaluation, and consultation with federal and State resource management agencies regarding potential impacts and mitigation measures.
- Subject to the availability of appropriations, the Secretary of the Interior is also authorized and directed to provide grants to support local habitat management planning efforts undertaken as part of the consultation required in the feasibility study.
- The study shall be performed in coordination with CALFED efforts.
- The study results will be submitted to the Committee on Resources of the United States House of Representatives and to the Committee on Energy and Natural Resources of the United States Senate within 24 months after the funding is appropriated.

Congress directed the Secretary of the Interior to conduct a feasibility study for a Sacramento River diversion project that was consistent with the WFA. The coequal objectives of the WFA were: (1) provide a reliable and safe water supply for the economic health and planned development of the lower American River basin through the year 2030; and (2) preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

Prior to the Water Forum, Reclamation and local agencies completed the American River Water Resources Investigation (ARWRI). The objectives of the ARWRI were to identify future water needs in Sacramento, Sutter, El Dorado, Placer and San Joaquin counties, and to formulate alternatives to meet those needs.

The study will be tiered off two previously completed programmatic studies: the ARWRI and the Water Forum Agreement. The planning objectives of the study include:

- Provide adequate future water supply (year 2030 level) to western Placer and northern Sacramento counties to accommodate planned community growth.
- Reduce future direct diversions from the American River to preserve lower American River environmental and aesthetic values.
- Reduce overdraft of the groundwater basin underlying western Placer and northern Sacramento counties to increase the health of the groundwater basin.
- Increase water supply reliability for all beneficial uses of American River water and indirectly, increase water supply reliability for beneficial uses of the groundwater basin under western Placer and northern Sacramento counties.

TASK 7 – WATER SUPPLY STRATEGY

These planning objectives are consistent to the objectives of the Water Forum and the ARWRI; however, the study will include a more focused study area, scope, and analyses of project-level details. The anticipated completion schedule for this study effort is three years. Final design and construction of this project would begin subsequent to that effort. Current estimates anticipate that a Sacramento River diversion would be operational by about the year 2010.

GROUNDWATER EXTRACTION AND IMPACT MITIGATION

GROUNDWATER EXTRACTION

The use of groundwater during dry years is part of the City's current water supply planning. As discussed previously, the City's WFA includes the extraction of up to 7,400 AF/year of groundwater during the "drier" and "driest" Water Forum hydrologic year types. The City's current plan is to make those groundwater resources available to its existing customers.

The City also intends to consider the use of groundwater resources to meet water demand within the WRSP and MOU areas during dry years. Such use of groundwater is not explicitly considered in the WFA. Consequently, the City intends to implement measures to mitigate for any potential impacts to the groundwater basin resulting from the extraction of groundwater to meet demands within the WRSP and MOU areas.

IMPACT MITIGATION

Two potential mitigation measures are currently being contemplated: 1) an in-lieu groundwater banking program accomplished through the annual or permanent fallowing of lands currently under irrigation, or 2) an aquifer storage and recovery (ASR) program.

Fallowing or Permanent Retirement of Irrigated Lands

A dry-year or permanent groundwater supply could be made available by the annual fallowing or permanent retirement of agricultural lands currently irrigated with groundwater. In particular, the Reasons Farms property is being evaluated from a physical standpoint to estimate the potential yield of such an in-lieu groundwater banking program.

Aquifer Storage and Recovery (ASR)

As part of its existing water supply plan, the City plans to construct five groundwater extraction wells within its existing service over the next ten years: Diamond Creek (under construction), Sun City, Hewlett Packard, Woodcreek North, and Woodcreek West. These five wells will serve as backup for the City's water distribution system, which relies primarily on treated surface water diverted from Folsom Lake.

The City is also contemplating use of these groundwater wells on a conjunctive use basis or for integration into an aquifer storage and recovery (ASR) program. The City is currently moving forward with a demonstration project at the Diamond Creek well to evaluate the feasibility of using their planned wells for injection and storage of treated surface water. The principal purpose of the demonstration project is to evaluate opportunities to store treated water in the groundwater basin underlying Placer County by direct injection during wet years for extraction to supplement the City's surface water supply during dry years. Such a program could also be exercised seasonally. The principal areas of investigation include: water rights and contract entitlements; regulatory and institutional issues; and hydrogeologic and water quality issues.

Injection and storage would occur during wet weather years and during off-peak production periods. Stored water would increase the reliability of the City's water supply during dry years. In addition, stored water could be used for peak shaving during high demand periods. The ultimate sources (and mix) of surface water supplies adopted in the over-all water supply strategy will affect the requirements of (and potentially necessity for) an ASR program. Based upon the outcome of the demonstration

project, a full-scale ASR program may be developed. The timing of the pilot study and the planned evaluation is such that the results of that effort may not be available for up to 18 months. However, the City is attempting to identify elements of the ASR demonstration project work plan that could be accelerated.

POTENTIAL SEQUENCING AND TIMING OF ALTERNATIVES

Ultimately, each of the water supply alternatives will be evaluated in detail to establish the likelihood and timing of operational availability. The intent is to then develop an implementation schedule that sequences the operational start-up of specific projects in such a way that the City can obligate itself to making deliveries to the WRSP and MOU areas without putting its existing ratepayers at risk. That sequencing would ensure that the City is never obligated to deliver a water supply it could not deliver with a high probability in perpetuity. An underlying assumption in these analyses is that the City's current service area is "whole" and that any supplemental water supplies developed are for the purpose of serving the MOU area.

For purposes of this memorandum, the year 2005 is the operational start date for water deliveries to the MOU area. Water demands in both the City and the MOU area are assumed to increase linearly to the year 2030, at which time it is assumed that each will achieve the projected ultimate water demand.

Figures 3 and 4 illustrate the water demands and potential water supplies (in both wet and dry years) for both the WRSP and entire MOU areas, respectively. As demand increases, increments of water supply associated with the supplemental water supplies become operational on an as-needed basis. Based on current understanding of the likely timing of availability, the supplemental water supplies are assumed to become operational in the following order:

- A contract entitlement for 3,200 AF/year of raw surface water from San Juan.
- A "normal" to "semi-aggressive" recycled water supply of approximately 2,638 AF/year to the entire MOU area, with the delivery of approximately 1,526 AF/year to the WRSP area (after delivery to the proposed power generating facility).
- An allocation of 2,316 AF/year of conserved water from the existing City (out of the anticipated total volume of 4,080 AF/year) to the WRSP area. The remaining 1,764 AF/year will be reserved for the remainder of the MOU area.
- In dry years, up to 2,848 AF/year of groundwater extraction will be required to meet demands in the WRSP area. Mitigation for such groundwater extraction would be provided either by annual fallowing or permanent retirement of agricultural lands currently irrigated with groundwater, or through implementation of an ASR program.
- A diversion from the Sacramento River for up to 7,100 AF/year. The Sacramento River diversion will be required for development of the entire MOU area (see **Figure 4**). If the Sacramento River Diversion is not implemented, up to 2,555 AF/year of groundwater must be extracted in wet years and up to 5,135 AF/year of groundwater must be extracted in dry years. It is unlikely that annual fallowing or permanent retirement of agricultural lands currently irrigated with groundwater would provide adequate mitigation in such a case. In addition, without the Sacramento River Diversion, there would be insufficient surface water supplies available for implementation of an ASR program (i.e., there would not be any surface water available to bank).

The figures indicate that both the contract entitlement from San Juan and the delivery of recycled water are required to meet the anticipated water demands. The contract entitlement from San Juan is assumed to be implemented immediately. Recycled water is assumed available by the year 2010. The figures also indicate that a combination of groundwater extraction and implementation of a diversion from the Sacramento River will be required for development of the entire MOU area.

**Figure 3: Water Supply Strategy
for WRSP Area**

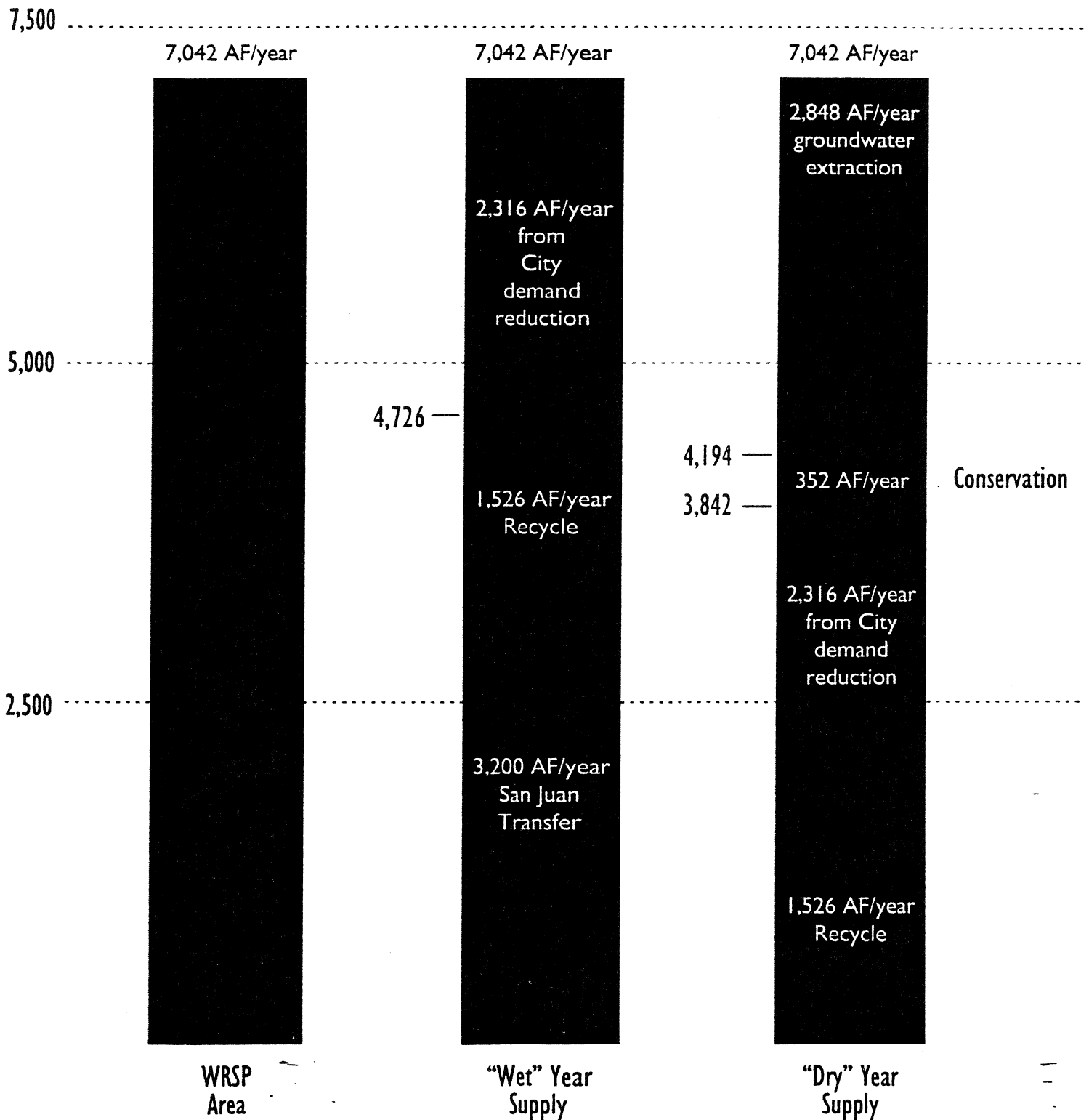
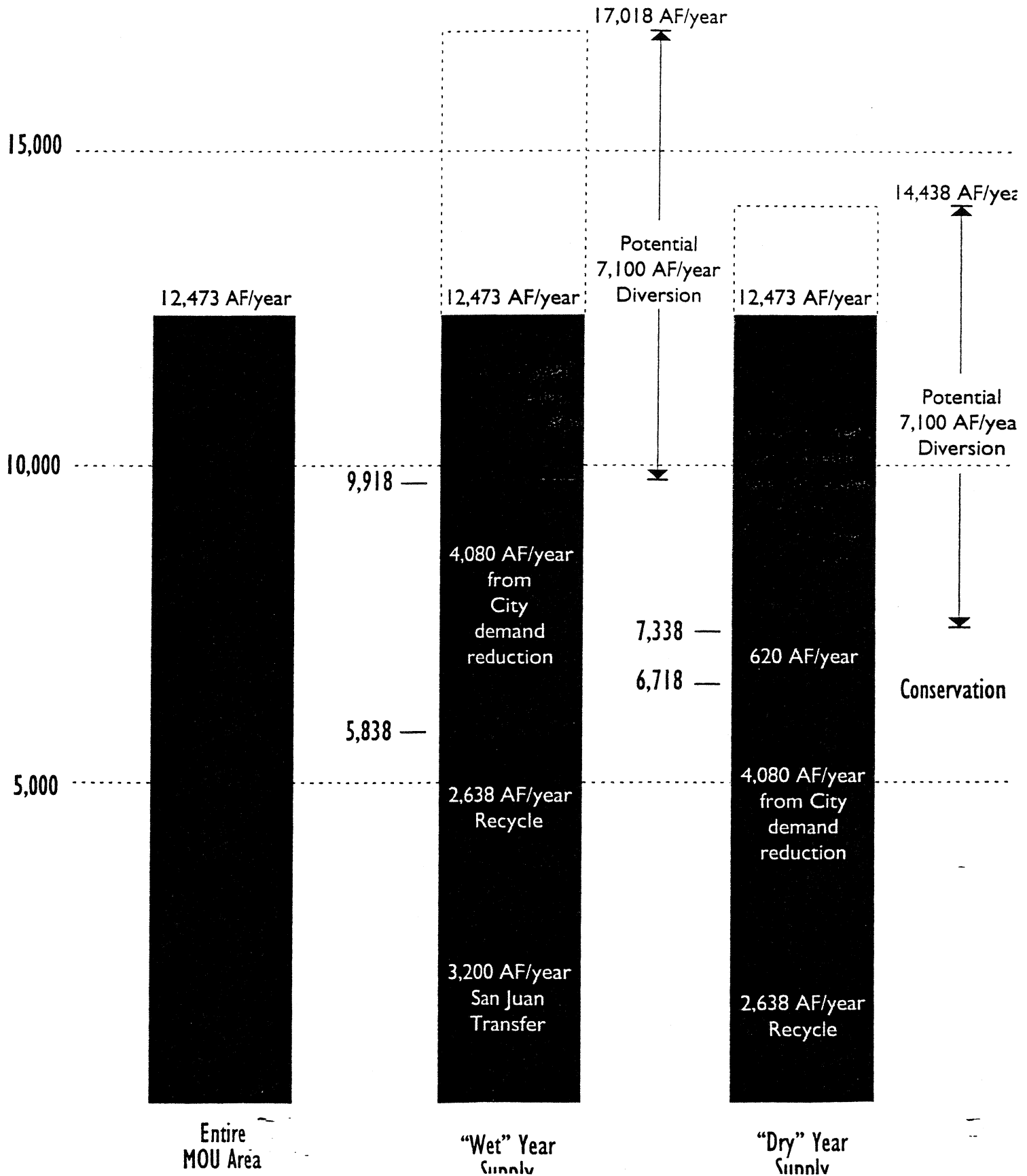


Figure 4: Water Supply Strategy for MOU Area





DRAFT PROJECT MEMORANDUM

Project Name: Capacity and Regulatory Compliance Assessment
Date: July 17, 2003
Client: City of Roseville
Project Number: 4600A.1B
Prepared By: Jeff Berlin
Reviewed By: Steve McDonald
Subject: Assessment of Future Regulatory and Annexation Scenarios
Distribution: Derrick Whitehead, Art O'Brien

The purpose of this Project Memorandum (PM) is to assess several future annexation scenarios for the City of Roseville's Pleasant Grove Wastewater Treatment Plant (PGWWTP). Three scenarios will be evaluated: 1) a base case assuming growth to existing build-out estimates and compliance with anticipated future permit requirements, 2) the annexation of the West Roseville Specific Plan (WRSP) area and additional wastewater flow, and 3) the annexation of the total Sphere of Influence (SOI) area and additional wastewater flow. The two annexation scenarios involve areas that were not covered by the 1996 Wastewater Master Plan Environmental Impact Report (EIR).

The PGWWTP was project at build-out to have an average dry weather flow (ADWF) of 20.7 million gallons per day (mgd), equal to the flows from the service area defined in the 1996 Wastewater Master Plan EIR. The first phase of construction is 12 mgd. As PGWWTP is not yet operational, actual rated treatment process capacity and performance are not available.

1.0 ANNEXATION SCENARIOS

Two separate annexation scenarios are proposed. The total SOI area annexation includes the area defined as the WRSP annexation.

1.1 West Roseville Specific Plan Annexation

The additional wastewater flow generated by the annexation of the WRSP area is 1.7 mgd, resulting in an expected build-out ADWF of 22.4 mgd. The flow increase is based on a wastewater flow of 260 gallons per day per equivalent dwelling unit (gpd/EDU) and treatment flow unit factors presented in the 1996 Master Plan. Peak day wet weather flow (PWWF) and peak hour wet weather flow (PHWWF) for PGWWTP is calculated based on factors of 2.5 and three times the ADWF, respectively. The WRSP annexation would increase the expected PWWF to 56 mgd and expected PHWWF to 67.2 mgd.

1.2 Total Sphere of Influence Annexation

The additional wastewater flow generated by the annexation of the remaining SOI area is 2.3 mgd, resulting in a total flow increase of 4.0 mgd for the total SOI area. The flow increase is based on a wastewater flow of 260 gpd/EDU and treatment flow unit factors presented in the 1996 Master Plan. The total expected build-out ADWF would be 24.7 mgd. The total SOI annexation would increase the expected PWWF to 61.8 mgd and expected PHWWF to 74.1 mgd.

Table 1 summarizes the anticipated flows for each annexation scenario.

Table 1 Expected Wastewater Flowrates Capacity and Regulatory Compliance Assessment City of Roseville			
Scenario	ADWF⁽¹⁾ (mgd)	PWWF⁽²⁾ (mgd)	PHWWF⁽³⁾ (mgd)
Current	12	30	36
Build-out	20.7 ⁽⁴⁾	51.8	63
Annexation of West Roseville Specific Plan (WRSP)	22.4 ⁽⁵⁾	56.0	67.2
Annexation of Total Sphere of Influence (Including the WRSP Area)	24.7 ⁽⁵⁾	61.8	74.1
Notes: 1) Average dry weather flow. 2) Peak day wet weather flow. 3) Peak hour wet weather flow. 4) Flow from service areas described in 1996 Wastewater Master Plan Environmental Impact Report. 5) Source: City of Roseville.			

2.0 BASE CASE SCENARIO - FUTURE PERMIT REQUIREMENTS

PGWWTP is permitted by the Central Valley Regional Water Quality Control Board (RWQCB) NPDES Permit 5-00-075. This permit is similar to NPDES Permit 5-00-164 for the City of Roseville's Dry Creek Wastewater Treatment Plant (DCWWTP), as they were both based on effluent data from DCWWTP. Both of these permits were issued prior to the final California Toxics Rule (CTR) and Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (State Implementation Policy, or SIP).

2.1 Vacaville Permit Requirements

The City of Vacaville was among the first dischargers to effluent-dominated waterbodies (EDWs) to have a renewed permit following the CTR and SIP. That permit was appealed to the State Water Resources Control Board (SWRCB), which remanded several aspects of Vacaville's permit back to the RWQCB. Nonetheless, the City of Vacaville is pursuing litigation for several unfavorable permit requirements.

Some of the most stringent requirements of Vacaville's permit were upheld by the SWRCB. They include the requirement for tertiary treatment, prohibition of primary/secondary blending for high wet weather flows, and low effluent limits for trihalomethanes (THMs). THMs are disinfection by-products formed during chlorination. The SWRCB did anticipate the possible need for case-by-case exceptions for THM requirements for EDW dischargers, and noted its willingness to assist. Additionally, the Vacaville permit includes a performance-based mass limit for mercury, pending development of a Total Maximum Daily Load (TMDL) for the Delta. The SWRCB also determined that a Basin Plan Amendment (BPA) must be adopted to dedesignate beneficial uses applied to Vacaville via the "tributary rule". Receiving water limits include temperature, pH, dissolved oxygen (DO), and turbidity.

The City of Roseville, along with other dischargers, is currently working with the RWQCB on a Basin Plan Amendment (BPA) for receiving water pH and turbidity requirements. The BPA revisions will allow EDW dischargers to comply with receiving water requirements for pH and turbidity.

2.2 Impact of Vacaville Permit

PGWWTP's NPDES permit is scheduled to be renewed in 2005. The operation of PGWWTP and monitoring of its unique effluent characteristics, coupled with the implementation of the CTR and SIP in developing NPDES permits, are likely to result in revised permit requirements. Water-quality based effluent limits (WQBELs) may be required for those constituents identified as having the reasonable potential to cause or contribute to an excursion above applicable water quality criteria. PGWWTP must meet effluent limits at the end-of-pipe, as Pleasant Grove Creek is an EDW with no dilution credit.

PGWWTP already utilizes tertiary treatment and is not designed to blend primary and secondary effluent during wet weather events. PGWWTP receiving water limits are similar to those in the Vacaville permit. The PGWWTP site includes space for the installation of cooling units, if necessary to meet temperature requirements. Therefore, the potential impact of the CTR and SIP on future PGWWTP permits is best determined through a Reasonable Potential Analysis (RPA). A preliminary RPA has been conducted as part of this PM. The preliminary RPA compares maximum effluent and receiving water data to stringent water quality criteria from the CTR.

Although the PGWWTP process includes tertiary filtration, not all CTR constituents may be reduced to levels below applicable criteria. Constituents with the potential to require new effluent limits include metals, cyanide, THMs, and possibly other trace organic compounds. THMs are volatile and the cascade aeration process may reduce their concentrations. However, increased flowrates may result in shorter disinfection contact times and higher chlorine doses to meet coliform limits.

Additional requirements for non-CTR constituents may also be necessary. These include nutrients, aluminum, iron, salts, electroconductivity (EC), and additional pesticides. Provision 4 in the current PGWWTP NPDES permit requires a study of the potential impact of nitrate, aluminum, salts (expressed as EC), and the gasoline additive MTBE. This study will be conducted after discharge begins, and may address issues related to these constituents.

2.3 Preliminary Reasonable Potential Analysis

As PGWWTP is not yet operational, monitoring data for effluent concentrations of CTR constituents is not available. For the purposes of this study, it is assumed that DCWWTP effluent data is equivalent to future PGWWTP monitoring results. A brief review of DCWWTP effluent data was conducted as a preliminary RPA.

Monthly 13267 monitoring data for DCWWTP for 2002 was compiled. Based on preliminary review of the data, reported November 2002 effluent concentrations for aluminum, mercury, and silver were disregarded as outliers. The three values greatly exceeded average concentrations and were disregarded as not representative of the expected PGWWTP effluent concentrations. The causes of the outliers were not reviewed as part of this study, as the goal was to use representative data. However, the RWQCB may eventually require an additional effluent limit for silver based on the November 2002 data. After removing these values, maximum effluent concentrations were compared to the lowest applicable water quality criteria. Where applicable, metals criteria were calculated using the minimum effluent hardness of 60 mg/L.

Maximum reported DCWWTP effluent values for cyanide, mercury, chlorodibromomethane, and dichlorobromomethane exceeded CTR criteria. Maximum reported concentrations for aluminum and chloroform exceeded National Ambient Water Quality Criteria. As a result, the RPAs for DCWWTP and PGWWTP will most likely require effluent limits for THMs and aluminum. The plants already have effluent limits for cyanide. If PGWWTP concentrations for these constituents are similar, treatment process modifications may be necessary to meet new effluent limits.

Table 2 lists maximum effluent concentrations and the lowest applicable criteria for these constituents.

Table 2 Dry Creek WWTP Effluent Data Capacity and Regulatory Compliance Assessment City of Roseville		
Constituent	Maximum Effluent Concentration ⁽¹⁾ (ug/L)	Lowest Applicable Criterion ⁽²⁾ (ug/L)
Aluminum	380	87 ⁽³⁾
Chlorodibromomethane	3.7	0.41
Chloroform	40	5.7 ⁽³⁾
Dichlorobromomethane	16	0.56
Cyanide	11	5.2
Mercury	0.069	0.05
Notes: 1) Data source: 13267 monitoring for 2002. 2) California Toxics Rule Criteria. 3) National Ambient Water Quality Criterion.		

The required aluminum effect study may address aluminum requirements. One potential modification may be to the coagulation process, in which alum is added prior to filtration. An alternative coagulant may be necessary to meet an aluminum limit. Additional source control may also be required to decrease effluent concentrations of aluminum and mercury.

If effluent limits for cyanide and THMs are not achievable, interim limits will be established based on plant performance. Many other dischargers are faced with similar limits. Optimization of chlorination, dechlorination, and cascade aeration may not be sufficient to remove THMs. Ultimately, it may be necessary to change from hypochlorite to ultraviolet (UV) disinfection, eliminating the production of chlorinated disinfection by-products.

A comprehensive RPA will be conducted prior to the NPDES permit reissuance. Prior to submitting data results to the RWQCB, a thorough data quality review should be conducted to ensure representative monitoring data.

2.4 Mercury Mass Loading

A combined mercury mass limit of 1.71 pounds per year (lbs/yr) is included in the DCWWTP and PGWWTP permits. This limit is based on average annual DCWWTP mercury loading from 1996-1999, with a 20% allowance for variance. The performance-based limit is a running 12-month allowable loading, in which non-detect values are assumed to be one-half the detection limit. The development of the interim mass limit did not use "ultra-clean" analytical techniques for mercury. Ultra-clean techniques generally result in more accurate, lower mercury concentration readings. Subsequent data analysis will use these techniques to better estimate actual mercury mass loadings. A final effluent limit for mercury may then be established.

In general, DCWWTP mercury concentrations for 2002 were lower than those used to develop the mercury mass limit. However, excluding the November outlier, the average concentration was 0.0154 ug/L. Total mercury loading for 2002 was calculated as approximately 0.55 lbs, in compliance with the 1.71 lbs/yr mass limit. Increasing flows may result in elevated mercury mass loads and the potential

for non-compliance. Emphasis on ultra-clean techniques and proper quality control will be necessary if the interim mercury limit stays constant with increased wastewater flows.

Table 3 details potential decreases in allowable mercury concentrations with increased wastewater flows. Excluding the outlier value, 3 out of the 11 mercury data points for DCWWTP in 2002 exceeded the allowable average mercury concentration for any PGWWTP flow scenario.

Table 3 Allowable Mercury Concentrations Capacity and Regulatory Compliance Assessment City of Roseville				
Scenario	PGWWTP ADWF⁽¹⁾ (mgd)	DCWWTP ADWF (mgd)	Combined ADWF (mgd)	Allowable Hg Concentration^(2,3) (ug/L)
Current	12	18	30	.0187
Build-out	20.7	24.9	45.6	.0123
Annexation of West Roseville Specific Plan (WRSP)	22.4	24.9	47.3	.0119
Annexation of Total Sphere of Influence (Including WRSP)	24.7	24.9	49.6	.0113
Notes: 1) Average dry weather flow. 2) Average mercury concentration, based on the combined mass limit of 1.71 pounds per year. 3) For comparison purposes, the annual average mercury concentration for DCWWTP in 2002 was 0.0154 ug/L, excluding the outlier November value. This value would currently be in compliance with the permitted mass limit. With increased flows, the current average mercury concentration would most likely result in non-compliance with the mass limit.				

3.0 TREATMENT PLANT CAPACITY

3.1 Approach

There are two key considerations involved in an evaluation of the overall PGWWTP capacity: process considerations (ability to meet treatment requirements in the NPDES permit) and hydraulic considerations (ability to convey peak flows through the plant). The potential expansion capacity of PGWWTP was assessed to determine if the current design is sufficient to treat flows from the two annexation scenarios.

3.2 Process Capacity

Since design of PGWWTP, there have been slight changes in influent wastewater characteristics. The influent total suspended solids (TSS) concentration has increased from 220 milligrams per liter (mg/L) to an average of 260 mg/L, while influent ammonia concentrations have dropped from 40 mg/L to an average of 25 mg/L. Influent biochemical oxygen demand (BOD) has remained near the design value of 160 mg/L. These changes are based on daily influent data at DCWWTP from January 2002 through April 2003. The potential impact of these changes on plant capacity takes on an added significance in light of the potential annexations.

The impact of additional dry weather flow and the changes in influent characteristics were analyzed with Carollo's plant process model, *Biotran*™. The model evaluated the process capacities for the different treatment systems to determine if the current treatment plant design will effectively treat increased ADWF. As PGWWTP is not yet operational, the model utilized design parameters and was

not specifically calibrated to actual operational data.

The analytical model leads to the conclusion that the plant will have sufficient capacity to treat the expected additional dry weather flows from either annexation scenario. Some minor process adjustments were necessary to accommodate the revised influent characteristics and additional flows. For the total SOI area annexation, the mixed liquor suspended solids concentration (MLSS) was increased from the design level of 3500 mg/L to 3800 mg/L. The clarifier safety factor with all units in service was decreased to 2.3 from the design level of 2.5. There would also be an increase in weir loading rate. Once the plant is operational, the model can be calibrated against operational data to better determine necessary process adjustments before the next plant expansion. The future expansion may require a slight increase in process unit size to match the original design criteria.

Treatment requirements for nonconventional pollutants were not considered for this review of process capacity.

3.3 Hydraulic Capacity

The original design of PGWWTP was based on a peak hydraulic capacity of 63 mgd through the effluent storage basins to meet the anticipated PHWWF. The total SOI area annexation is anticipated to increase PHWWF to 74.1mgd, a greater flow than the PGWWTP hydraulic design can accommodate. The hydraulic capacity bottleneck is at the effluent storage basins piping. The addition of more effluent storage basins, piping, and intermediate flow structures concurrent with the next phase of plant expansion should be able to accommodate the increased PHWWF. The existing plant facilities were designed for a peak flow of 36 mgd. Therefore, by mirroring the process units at expansion, hydraulic capacity of 72 mgd can be achieved, provided effluent storage and conveyance modifications are evaluated and implemented.

A more detailed analysis will be necessary to ascertain specific design modifications which may potentially increase the hydraulic capacity of PGWWTP. This detailed analysis is beyond the scope of this study.

4.0 EFFLUENT STORAGE CAPACITY

The annexation scenarios may necessitate additional effluent storage basin capacity to minimize flooding of Pleasant Grove Creek during peak wet weather flows. Current effluent storage facilities are designed based on storing the build-out peak day wet weather flow (PWWF), estimated at 2.5 times the ADWF. Effluent storage capacity in three onsite ponds is 51.8 million gallons, equal to the PWWF from service areas defined in the 1996 Wastewater Master Plan EIR. Increased storage capacity would be necessary to store the additional PWWF under either annexation scenario.

Three potential options to add effluent storage capacity include 1) increasing the capacity of on-site storage ponds by raising the storage basin levees, 2) utilizing downstream storage in the planned City of Roseville Retention Basin Project, and 3) adding additional on-site storage space at PGWWTP. Increasing levee height above six feet of storage depth may result in additional permitting and structural requirements, as the levee may thus be considered a dam. The planned Retention Basin identified 207 acre-feet of storage dedicated to PGWWTP effluent storage, equal to 67.5 million gallons.

The WRSP annexation would increase PWWF by an estimated 4.2 mgd. The expected PWWF for the total SOI area annexation would be 61.8 mgd. The total SOI area annexation would increase PWWF by an estimated 10 mgd. The increased flows correspond to an increase in storage volume equal to 2.2 or 5.1 acres, respectively, at a depth of six feet.

5.0 CONCLUSIONS

This draft PM finds that PGWWTP will have sufficient capacity to treat additional dry weather flows generated by both annexation scenarios. Treatment capacity has been defined as a function of a model that has not been calibrated to the facility, as the plant is not operational. The current hydraulic design cannot accommodate anticipated peak flows as a result of the annexation scenarios. Potential piping and flow equalization modifications, along with storage within the collection system, may be required to handle increased PHWWF.

Table 4 summarizes the conclusions of this PM in a matrix format.

Table 4 PGWWTP Annexation Conclusion Matrix Capacity and Regulatory Compliance Assessment City of Roseville						
Scenario	Meet Current Permit	Meet Future Permit	Sufficient Process Capacity	Sufficient Hydraulic Capacity	Sufficient Effluent Storage	Sufficient Site Space
Current	Yes	Unknown ⁽¹⁾	Yes	Yes	Yes	Yes
Build-out	Yes	Unknown ⁽¹⁾	Yes	Yes	Yes	Yes
Annexation of West Roseville Specific Plan	Yes	Unknown ⁽¹⁾	Yes ⁽²⁾	Most Likely ⁽³⁾	No ⁽⁴⁾	No ⁽⁶⁾
Annexation of Total Sphere of Influence (Including WRSP)	Yes	Unknown ⁽¹⁾	Yes ⁽²⁾	Most Likely ⁽³⁾	No ⁽⁵⁾	No ⁽⁶⁾
Notes: 1) Future permit requirements will likely be more stringent than the current permit. New effluent limits for nonconventional pollutants such as trihalomethanes and aluminum may not be attainable with current treatment processes, regardless of flowrate. 2) Minor process adjustments necessary based on <i>Biotran</i> ™ model results. 3) Peak hour wet weather flows (PHWWF) anticipated under annexation scenarios exceed the 63 mgd hydraulic capacity. Potential hydraulic modifications concurrent with the second phase of plant expansion can increase wet weather hydraulic capacity. 4) Will be necessary to provide additional storage capacity of 2.2 acres. 5) Will be necessary to provide additional storage capacity of 5.1 acres. 6) Additional site space will be required to accommodate storage and likely to meet future permit requirements.						

5.1 Water Quality

Since future permit requirements will likely be more stringent than current standards, equivalent or better water quality will be provided. The next generation of NPDES permits for DCWWTP and PGWWTP may feature additional effluent limits for aluminum, cyanide, chlorodibromomethane, chloroform, and dichlorobromomethane.

5.2 Process Capacity

A preliminary review of design considerations and plant process modeling was conducted. The model demonstrates that the potential expansion of PGWWTP has sufficient dry weather process capacity to accommodate the proposed annexation scenarios, with minor process adjustments.

Treatment requirements for nonconventional pollutants were not considered. Stringent limits for nonconventional pollutants may be required by new regulations. Neither the 1996 EIR nor the

treatment plant design considered meeting effluent limits for these nonconventional pollutants. Although water quality given either annexation scenario will be equivalent or better than required by the 1996 EIR and current NPDES permit, the current treatment plant design may not be able to achieve future requirements for nonconventional pollutants.

5.3 Hydraulic Capacity

PGWWTP has insufficient hydraulic capacity to meet PHWWF from either annexation scenario. Potential hydraulic modifications concurrent with the second phase of plant expansion and storage within the collection system may increase wet weather hydraulic capacity. A more detailed analysis to determine specific measures to increase hydraulic capacity is beyond the scope of this study.

5.4 Effluent Storage Capacity

The use of effluent storage capacity in the proposed downstream Retention Basin or expansion of on-site storage may be necessary to handle peak wet weather events.

5.5 Future Facility Requirements

Future permit requirements may necessitate additional treatment along with treatment modifications. Chlorine disinfection may need to be converted to ultraviolet disinfection. If additional treatment for nonconventional pollutants is required, conceivable alternatives include wetlands treatment, microfiltration (MF), ultrafiltration (UF), or reverse osmosis (RO).

It is estimated that additional site area will be necessary to accommodate the storage capacity required for the increased flows. The existing 100 acres was planned for the current process trains and effluent storage requirements. The additional acreage would be required for additional effluent storage basins, potentially required additional treatment processes, and any potential increase in process trains resulting from increased flows and the availability of actual plant operational data.

Additional future acreage requirements for these facilities are estimated in Table 5. These acreage requirements are preliminary, and are based on planning level facility footprint estimates.

Table 5 Estimated Acreage Required for Additional Treatment Capacity and Regulatory Compliance Assessment City of Roseville	
Treatment Process	Estimated Additional Area Required (acres)
Additional Effluent Storage (Annexation of West Roseville Specific Plan)	2.2 ⁽¹⁾
Additional Effluent Storage (Annexation of Total Remaining Sphere of Influence)	5.1 ⁽¹⁾
Microfiltration	1
Ultrafiltration	2
Reverse Osmosis	3 ⁽²⁾
Notes: 1) Assumes a water depth of 6 feet. 2) Reverse osmosis area includes area necessary for microfiltration, as microfiltration treatment may be required prior to the reverse osmosis process.	

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Additional hydraulic modifications to meet potential PHWWF conditions may also be necessary.

5.6 Potential Costs

Potential costs for advanced treatment are based on an ADWF of 24.7 mgd, including the entire total SOI annexation scenario. Project costs include 45% for engineering, administrative, legal, and contingency costs. UV costs are based on dosage necessary to disinfect conventional multi-media filtration effluent and assume existing contact basins will be retrofitted as necessary. Connection fee increases are based on debt financing at 6% interest over a period of 20 years. Service charge increases are based on operations and maintenance (O&M) costs and annualized project costs.

Table 6 summarizes potential additional treatment costs.

Table 6 Estimated Additional Treatment Costs for PGWWTP Capacity and Regulatory Compliance Assessment City of Roseville				
Treatment Process	Project Cost^(1,2) (\$)	O & M Cost^(1,2,3) (\$/month)	Connection Fee Increase (\$/EDU)⁽⁴⁾	Service Charge Increase (\$/EDU/month)⁽⁴⁾
Ultraviolet Disinfection	\$ 17,500,000	\$ 40,000	\$ 325	\$ 2.00
Microfiltration	60,000,000	400,000	1000	10.00
Reverse Osmosis	110,000,000	900,000	2000	20.00
Notes: 1) Costs assume an average dry weather flow of 24.7 mgd, including all annexation scenarios. 2) Source: Advanced Treatment Cost Estimates by Steve McDonald. ENRCCI = 7800, San Francisco, June 2003. 3) Operations and maintenance. 4) Preliminary cost estimates per equivalent dwelling unit (EDU). Assumes 260 gallons per day per EDU and debt financing at an interest rate of 6% over a 20-year period.				

