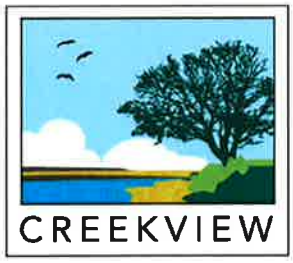
APPENDIX H-2
ATTACHMENT 4:

CREEKVIEW RECYCLED WATER MASTER PLAN

CREEKVIEW SPECIFIC PLAN



Recycled Water Study
Final Report

Prepared For:

Granite Bay Development

City of Roseville/Placer County, CA

November 30, 2010

Prepared By:

MacKay & Somps
ENGINEERS PLANNERS SURVEYORS
5142 Franklin Drive, Suite B, Pleasanton, CA 94588 (925) 225-0690

Table of Contents

Tables

Figures

Appendices

I. INTRODUCTION

Study Purpose and Objectives

The purpose of this Recycled Water Study (Study) is to define parcels to be served by recycled water, calculate demands, and properly size the recycled water supply system to and the distribution system within the Creekview Specific Plan Area (CSP) to meet the City of Roseville's (City) recycled water infrastructure operating goals.

The primary objective of this Study is to set forth the recycled water infrastructure requirements of the CSP. This Study, in part, satisfies the need to provide sufficient information on the recycled water demands and conveyance system to assist in the review and approval of the improvement plans within the CSP.

Study Area

The CSP guides the development of approximately 501.3 acres located north of Blue Oaks Boulevard in northwest Roseville. The CSP location and project vicinity are shown on **Figure 1-1**. The CSP is a distinctive residential community with a broad range of residential housing types and densities. The centerpiece of the CSP is Pleasant Grove Creek, surrounded by a residential land-use pattern with supporting community commercial, commercial mixed use, parks, and open space. The CSP is planned to implement smart growth strategies and low-impact development practices to create a sustainable community. This includes implementation of water conservation measures which include turf limitations. Details of the water conservation measures are provided within a separate study.

The pre-development physical setting consists of flat to gently rolling terrain with surface elevations ranging from approximately 75 to 100 feet relative to mean sea level (msl) over 4,000 feet horizontal. An unnamed branch of Pleasant Grove Creek is located in the northern portion of the site and Pleasant Grove Creek traverses the plan area diagonally. The site also contains clusters of seasonal drainages and wetland areas dispersed throughout the site.

The West Roseville Specific Plan (WRSP) is located east and south of a portion of the CSP. East of the CSP, the Fiddyment Farm community of the WRSP includes open space low-density residential uses. The planned extension of Blue Oaks Boulevard forms the southern boundary of the CSP. The Roseville Energy Park and Pleasant Grove Wastewater Treatment Plant are located south of the CSP. An open space preserve is located south of the CSP and west of West Side Drive, within the WRSP.

Lands to the north of the CSP are grasslands and portions are used for limited agricultural uses. The Brookfield Amoruso Ranch Study Area (Brookfield) being considered by the City is located north of the CSP.

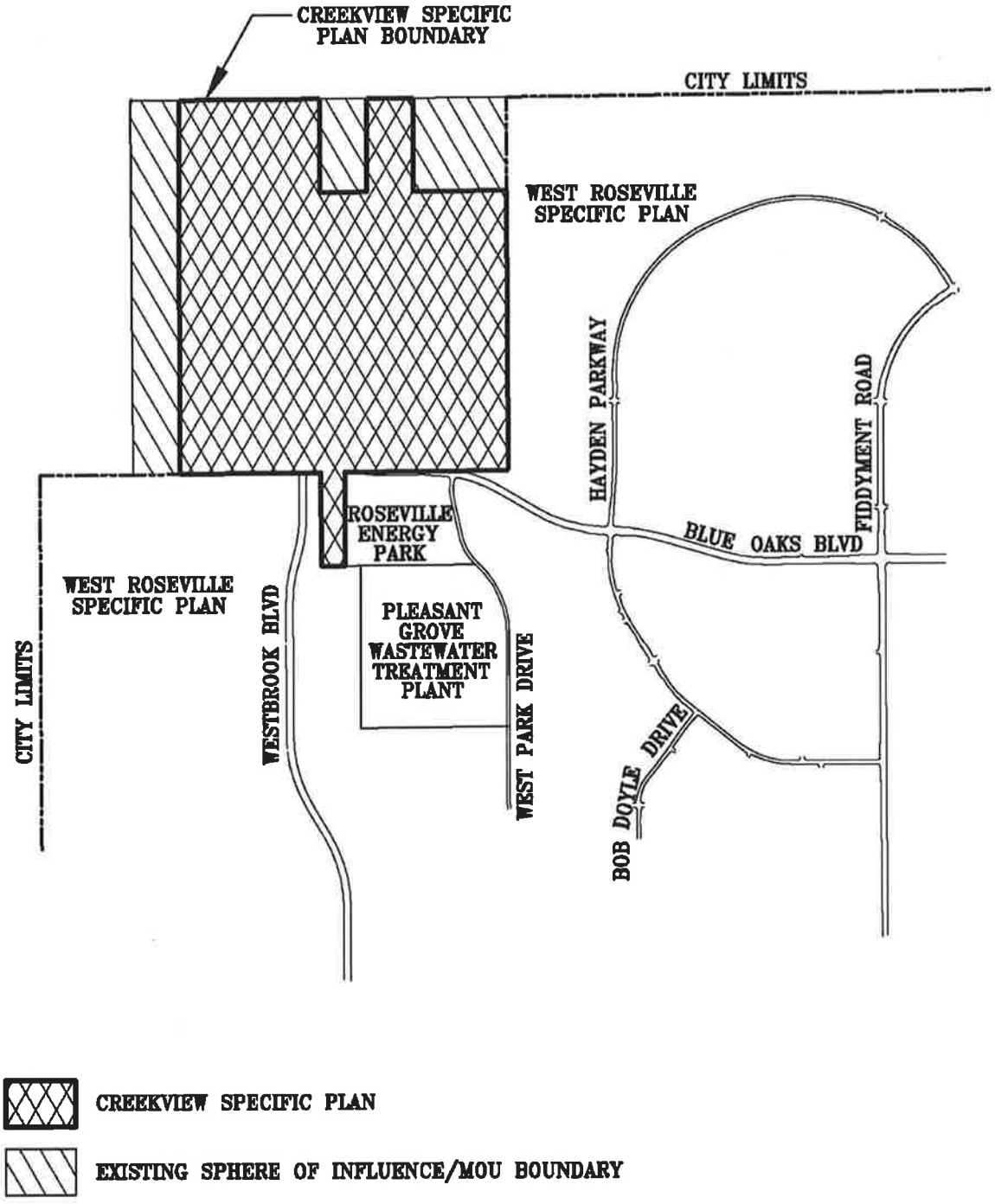


Figure 1-1 Location Map

Lands west of the CSP are owned by the City of Roseville and known as the City's Panhandle property. West of the Panhandle property is the City's Reason Farms site that provides existing and planned open space, recreation amenities, and storm water retention facilities.

Study Process

This Study determines the parcel demands for recycled water (RW) and analyzes the hydraulics of the proposed recycled water supply and distribution infrastructure. The methodology used for hydraulic modeling in this study conforms to the methodology and criteria used by the City's Environmental Utilities Department. The City's current Design Standards (January, 2010), were used as a guide for the development of a hydraulic model used to adequately size the proposed CSP recycled water infrastructure.

Within the CSP boundary is an Urban Reserve parcel known as Harris-Urban Reserve (UR). The UR is not currently participating in the Creekview Specific Plan but this Study includes assumed demands for the area.

This Study analyzes two alternative scenarios that account for potential future recycled water demands:

- Scenario 1: A build-out scenario is investigated that includes future potential demands from the CSP, Brookfield and Urban Reserve areas, should these areas develop as a City of Roseville project. This scenario verifies that the proposed infrastructure will accommodate the build-out demands in accordance with the design requirements.

- Scenario 2: A CSP stand alone scenario is investigated for a comparison of infrastructure needed to support the CSP.

The study also investigates infrastructure requirements for storage and transmission of recycled water. Storage tank sizing and site and pump facility layout are investigated at the WRSP RW tank site along with the infrastructure required to transmit recycled water from the tank farm to the CSP area.

Background

During the preparation of this study a West Roseville Recycled Water Focus Study was developed by RMC (RMC Study) for the City to determine supply alternatives in the urban growth areas adjacent to the northern part of Roseville. This evaluation modeled future demands to update the City's regional model and to determine if a distributed storage option or a centralized storage option would support the region. The RMC analysis indicated that a centralized facility located at the City's existing recycled water storage and pump station site located with the WRSP could meet regional demands.

II. IRRIGATION DEMAND PROJECTIONS

This section details the criteria used in this Study for estimating irrigation demands. The criteria described in this section are consistent with the methods used in the Recycled Water Study for West Roseville Specific Plan Area (WRSP Study) dated May 21, 2003.

Irrigation Demands

The WRSP study developed an irrigation demand pattern based on local evapotranspiration rates, precipitation data and irrigation demand patterns. Results of this pattern are shown on **Table 2-1** and are adopted in this study.

Table 2-1 Typical Irrigation Demand Pattern in Sacramento Area

Month	ET-Turf Grass (inches)	Monthly Precipitation (inches)	Monthly Irrigation Demand (1) (inches)	Monthly 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	6.8	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	0.8	3.63	0.0	0.00
Average	3.48	1.53	3.6	0.30
Total	41.76	18.31	43.4	3.62

1. Demands from Table 4-1 of Recycled Water Distribution System Feasibility Study, April 2000.

As shown in **Table 2-1**, the total annual unit irrigation demand for turf grasses is estimated at 43.4 inches. A peak monthly irrigation demand of 9.2 inches is projected for July. November through February demand values were considered to be zero due to the assumption that irrigation demands are met from the available rainfall.

Recycled Water Customers

The customers to be served by the recycled water system include those with land uses designated as park, streetscape, paseo, school, public/quasi public, commercial, and high density residential. The recycled water will be used only for irrigation purposes.

Estimated Irrigated Surface Area

Total surface area for each recycled water customer within the CSP was obtained from the Conceptual Land Use Plan, **Figure 2-1.** The service area for Brookfield was based on information available at the time of this study which included land use information obtained from the City. The Brookfield demands are based on the October 26, 2010 land use plan.

Irrigated surface area factors were utilized to calculate recycled demands. The factors are based on land use categories and are used to account for buildings, sidewalks, and other hard-scaped areas that will not be irrigated. The factors represent the percentage of the total surface area (shown as a decimal) that will require irrigation. These factors are different for each land use and are described in **Table 2-2.**

Table 2-2 Irrigated Surface Area Factors

Land Use Type	Irrigated Surface Area Factors[1] (Ratio of Irrigated Surface Areato Total Surface Area)
Park/Paseo/Streetscape[2]	0.90
School/Public/Quasi Public	0.50
High Density Residential	0.40
Commercial/Light Industrial	0.30

1. The irrigated surface area factor is consistent with the WRSP Recycled Water Study (May 2003).
2. Streetscape areas were estimated based on the current alignment of arterial and collector streets.

The Urban Reserve Parcel 90, as shown in **Figure 2-1**, is not currently participating in the CSP. For the purposes of the CSP infrastructure studies, land use designations in the Harris-Urban Reserve have been assigned in order to determine infrastructure needs in the future. See **Appendix A** for Irrigation Demand Projections.

Average Day Demands

The average day demand (ADD) for a given customer is defined as the total annual irrigation 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 at a steady rate, 24 hours a day, 365 days a year. Average day demands are calculated (in gallons per day) by multiplying the irrigated surface area (in acres) by the average annual irrigation demand of 3.62 feet presented in **Table 2-1** and converting units.

Peak Day Demands

The peak day demand (PDD) is defined as the typical flow rate during the seasonal period of greatest demand. July generally has the greatest irrigation demands in the Roseville area. The maximum monthly irrigation demand of 9.2 inches occurs during the month of July. **Table 2-1** shows that the average monthly irrigation demand for the year is 3.6 inches; therefore the peak day demand factor is 9.2/3.6 = 2.55. Peak day demands are estimated by applying the peak factor of 2.55 to the calculated average day demand and are shown in **Appendix A** in gallons per day (GPD).

Figure 2-1 Conceptual Land Use Plan

Peak Hour Demands

The peak hour demand (PHD) is assumed to be equal to peak day demand volume projected over the irrigation duration. The PHD is obtained by multiplying the PDD by the peak hour demand peaking factor, which is a function of irrigation duration. Assuming a 9-hour irrigation duration (9:00 p.m. to 6:00 a.m.), the peak hour demand peaking factor is 2.7 (24 hr/9 hr). PHD are shown in **Appendix A** in gallons per minute (gpm).

Operational Demands

Irrigation patterns vary from customer to customer. Land use, total irrigation area, irrigation system design, length of irrigation time, and other factors impact how a site is irrigated. A system operational factor is used for the PHD to account for the irrigation system irregularities. A factor of 1.5 times the PHD is used to determine the operational demands to account for the variations used by landscape architects in the design of their irrigation systems. This operational demand allows the City to plan infrastructure to provide the landscape architects flexibility in the design of irrigation systems. Operational demands are shown in **Appendix A** in gpm.

The operational demand peaking factor is only applied to the PHD for sizing of the distribution system and is not applied to the PHD for sizing of the pump station and tank.

Summary of Project Irrigation Demand Estimates

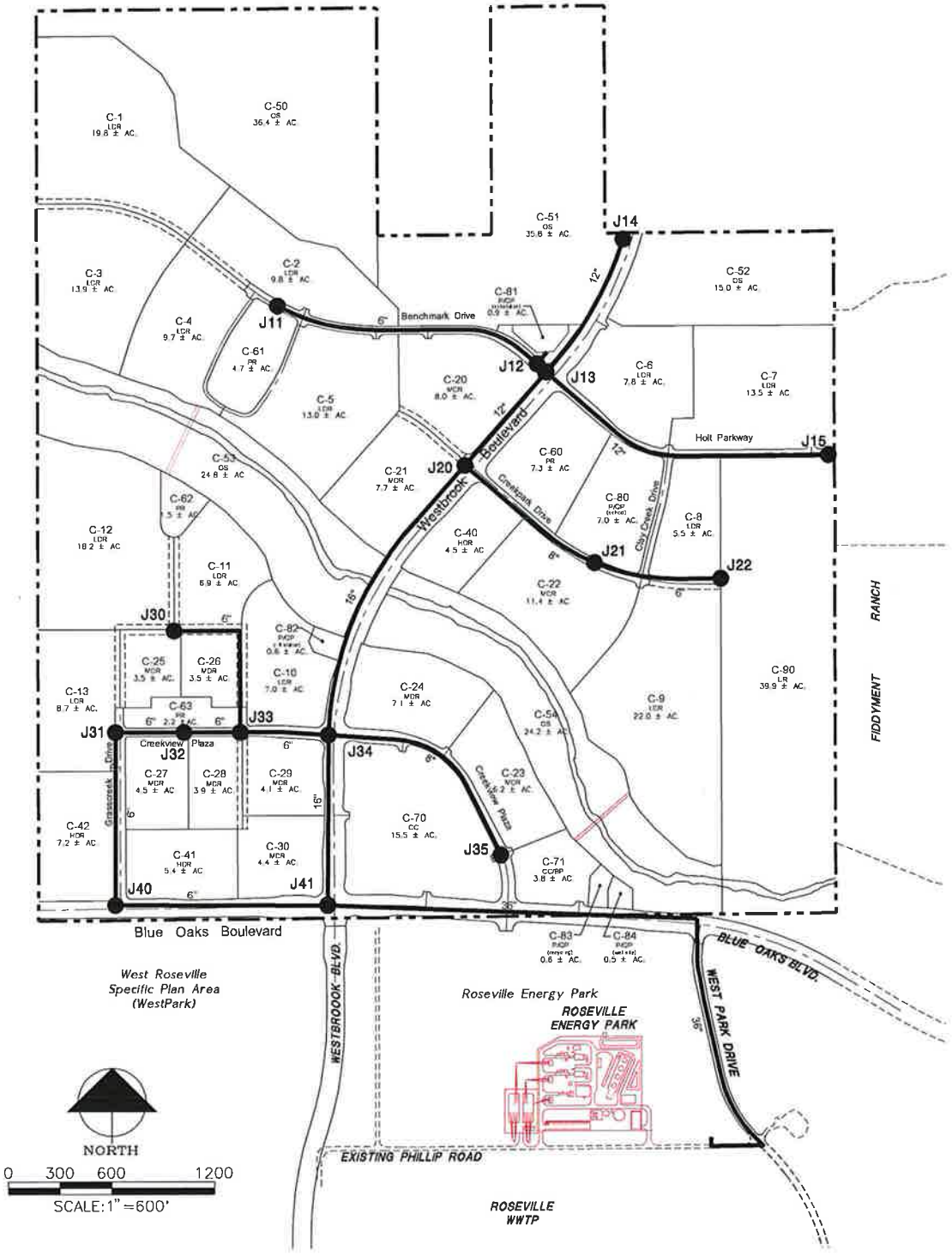
Table 2-3 shows the estimated irrigation demands that were calculated for CSP and the adjacent Brookfield property. A complete set of demand projections is located in **Appendix A.** The General Water System Layout for the CSP is shown in **Figure 2-2.**

Table 2-3 Summary of Irrigation Demand Projections

Development	Project Size (ac)	Total Site Area[1] (ac)	Total Irrigated Area[2] (ac)	Annual Demand[3] (afy)	Peak Day Demand[3] (mgd)	Peak Hour Demand[3] (gpm)	Operational Demand[3] (gpm)
CSP	461	93.4	55.7	201	0.457	845	1,268
UR	40	14.5	4.7	17	0.038	71	107
Brookfield	674	108	51	205	0.466	864	1,296

1. Total Site Area is the sum of all the recycled water customer sites (park, streetscape, paseo, school, public/quasi public, commercial, light industrial, and high density residential), including those areas that do not require water for irrigation (buildings, pavement, etc.)
2. Total Irrigated Area is the total sum of all areas that are assumed to require water for irrigation.
3. Demands do not include system losses estimated at 2%.

The demands for the CSP project have been updated in this Study with the current land use plan dated October 26, 2010.



PROPOSED
RECYCLED WATER
CREEKVIEW

Exhibit 2-2
General System Layout

MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1100

11-29-2010 1:40pm Mike Brill P:\18431\WATERMODEL RECYCLED\EXH-RECYCLEDWATER20100726.DWG

III. SERVICE DESCRIPTION AND CRITERIA

Proposed recycled water transmission mains and distribution facilities are to be designed to provide required flow deliveries while maintaining acceptable service pressures to all customers within the CSP. A description of the proposed recycled water system and the City of Roseville's operating goals and facility sizing requirements are discussed in this section.

System Description

The backbone pipes of the CSP recycled water system are shown in **Figure 2-2** along major arterial and collector street alignments. Pipe sizes shown are those required to accommodate the demands of Scenario 1, build-out of CSP, UR and Brookfield supplied from a single source, the WRSP RW Tank and Pump Station site.

The transmission main that delivers RW from the WRSP RW site to the CSP is located in West Park Drive and Blue Oaks Blvd. and consists of a 36" diameter pipe. The 36" pipe size is in accordance with the RMC Study. See **Appendix B** for a conceptual layout of the future tank site expansion and 36" transmission main route.

Per the RMC Study the residual pressure at the intersection of Westbrook Blvd. and Blue Oak Blvd. is 93 psi (301' hgl). The model applies the 301 hgl to modeling scenarios, full build-out and CSP stand alone.

System Criteria

The City of Roseville will be responsible for the operation and maintenance of the offsite recycled water facilities for service to the CSP. Onsite recycled water utilities downstream of billing meters will be maintained by the individual customer. The City has developed minimum operating goals to be used in the planning of new recycled water distribution systems. The goals help ensure adequate pressure and flow are available to serve recycled water customers on a daily basis. The goals used in this study for the backbone recycled water pipelines are listed in **Table 3-1**.

Table 3-1 Recycled Water Transmission Line Operating Goals

Condition	Goal
Minimum residual pressure at System PHD	60 psi
Maximum residual pressure over the Irrigation Period	100 psi
Maximum pipe velocity	5.0 fps
Maximum head loss per 1000 lf of pipe	5.0 ft.

Recycled Water Supply

The City of Roseville will only commit to providing a supply of recycled water equal to the amount of wastewater that is generated by a site during July Average Dry Weather Flow (ADWF) conditions. If a site's July day demand exceeds the committed supply, the difference may be met with supplemental supplies, which may include additional available recycled water, untreated groundwater, or potable water supplies.

An analysis of committed supplies vs. irrigation demands are developed in the following **Tables 3-2** to **3-4**. The ADWF generated from the CSP project area are identified in **Table 3-2**. Data was obtained from the CSP Master Sewer Study.

Table 3-2 Available Recycled Water Supply

Location	Sewer Effluent ADWF (MGD)	Annual Flow (AFY)	Committed RW Supply (AF/mo.)
CSP	0.37	414	34.5
UR	0.063	71	5.9
Total	0.433	485	40.4

Table 3-3 Summarizes the recycled water demands that are detailed in **Appendix A** Irrigation Demand Projections.

Table 3-3 Recycled Water Demands Without Conservation

Location	Acres	Acres Served by RW	Annual Demand (AFY)	Peak (July) Demand (MGD)	Peak Demand (AF/mo.)
CSP	461.4	55.7	201	0.457	42.7
UR	39.9	4.68	17	0.038	3.5
Total	501.3	60.4	218	0.495	46.2

Monthly CSP recycled water demands are compared with the available recycled water supply in **Tables 3-4 and 3-5**. **Table 3-4** compares committed supply versus recycled water demands if no water conservation measures are implemented while **Table 3-5** compares supply versus reduced demands resulting from implementation of water conservation measures. Monthly demands are determined as a ratio of monthly irrigation demands to total irrigation demands. Monthly irrigation demands are found in **Table 2-1**.

Table 3-4 CSP Irrigation Demands Versus Recycled Water Supply Without Conservation

Month	Irrigation Demand w/o Conservation (AF)	Committed Recycled Water Supply (AF)	Surplus Supply (AF)	Supplemental Demand Required (Y/N)
January	0	34.5	34.5	N
February	0	34.5	34.5	N
March	2.22	34.5	32.3	N
April	14.99	34.5	19.5	N
May	26.65	34.5	7.9	N
June	37.20	34.5	-2.7	Y
July	42.75	34.5	-8.2	Y
August	37.20	34.5	-2.7	Y
September	26.65	34.5	7.9	N
October	13.33	34.5	21.2	N
November	0	34.5	34.5	N
December	0	34.5	34.5	N
Total (AFY)	201.0			

Per the CSP Water Conservation Plan there is a potential recycled water savings of 79 AFY resulting in a total irrigation demand of 122 AFY (201 – 79 = 122) in the CreekView specific area.

Table 3-5 CSP Irrigation Demands Versus Recycled Water Supply With Conservation

Month	Irrigation Demand With Conservation (AF)	Committed Recycled Water Supply (AF)	Surplus Supply (AF)	Supplemental Demand Required (Y/N)
January	0	34.5	34.5	N
February	0	34.5	34.5	N
March	1.35	34.5	33.2	N
April	9.10	34.5	25.4	N
May	16.18	34.5	18.4	N
June	22.58	34.5	12.0	N
July	25.95	34.5	8.6	N
August	22.58	34.5	12.0	N
September	16.18	34.5	18.4	N
October	8.09	34.5	26.5	N
November	0	34.5	34.5	N
December	0	34.5	34.5	N
Total (AFY)	122.0			

With the implementation of water conservation measures reducing irrigation demand, a supplemental water supply will not be required for the Creekview Specific Plan. The available recycled water supply will support the irrigation demands.

Recycled Water Storage

Each site is required to have storage facilities capable of storing one peak day (July) of recycled water demand. The City's existing facility will be expanded to meet the needs of the region including CSP and Brookfield. A conceptual site layout for an additional recycled water tank at the existing facility is shown in **Appendix B**. The required storage volume required for the CSP and Brookfield are identified in **Table 3-6**.

Table 3-6 Recycled Water Storage Volumes

Location	PDD (gpd)	2% System Loss (gpd)	Required Storage (MG)	With 20% Operating Buffer (MG)
CSP	456,565	9,131	0.47	0.56
UR	38,387	768	0.04	0.05
Brookfield	466,454	9,329	0.48	0.57
Total			0.98	1.18

An operational storage volume of 1MG is required to support the CSP, UR and Brookfield. The actual storage tank size may be larger due to minimum operating levels in the pump station. An operating buffer of 20% is required to utilize the operational storage volume resulting in a total required volume of 1.2MG.

The Sierra Vista Communities has also investigated the expansion of the existing tank site. Per the Sierra Vista Recycled Water Master Plan dated June 2009 their required storage volume is 2.8MG. Therefore the total storage volume required to support Sierra Vista, Creekview, UR and Brookfield is 4MG.

Using the same tank sizing constraints developed by the Sierra Vista Study, a 4MG tank would have a 160' tank diameter. This tank size is shown in the conceptual tank site layout in **Appendix B**. Conceptual Tank sizing constraints as follows:

- Maximum tank height water level of 32'
- Minimum tank level of 5'

The expanded pump station would be expected to meet the following peak flow demands in addition to any other plan areas such as Sierra Vista:

- CSP plus UR and Brookfield 1816 gpm PHD
- UR alone 73 gpm PHD
- CSP alone 862 gpm PHD

These pump rates include 2% system losses.

Depending on the phasing of the CSP site in relationship to the development of other plan areas the expansion of the pump station improvements could simply replace existing pumps with larger pumps to meet the CSP demands or construct a new pump station to meet regional demands.

IV. HYDRAULIC MODEL RESULTS AND CONCLUSIONS

This section presents the modeling scenarios and results for the recycled water backbone system.

Assumptions

The following are assumptions used in the hydraulic model for the recycled water study.

- A Hazen William's "C" factor of 130 was used to represent the new recycled water pipes.
- Minimum pipeline diameter of 6 inches.
- System modeled as a steady-state.
- Operational Demand flows increased by 2% to account for system losses.
- The hydraulic grade line at the intersection of Blue Oaks Blvd and Westbrook Blvd. was assumed 301' elevation based on the RMC Study. A fixed head reservoir was placed at the existing pump station set at an hgl of 301.3' to simulate 301' at the intersection.
- The build-out scenario inclusive of the CSP, UR and Brookfield assume the transmission main size located between pump station and CSP conforms to the RMC study at 36" diameter.

Modeling Scenarios and Results

A hydraulic model was developed using WaterCAD software. The results from the hydraulic model were reviewed to help ensure the City's standards were met for the sizing of facilities. Model scenarios were created for two alternatives to review the infrastructutre required for serving the CSP and Brookfield developments.

The system was modeled for peak hour demands with the operational variance factor plus 2% system losses.

Summary of Results

Table 4-1 summarizes the model results for the alternatives analyzed in this study. Hard copy results for the analysis are located in **Appendix C.**

Table 4-1 Recycled Water System Modeling Results

Alternative	Operational Demand [1] (gpm)	Minimum Pressure (psi)	Maximum Pressure (psi)	Maximum Velocity (ft/s)
Alternative 1 CSP w/ Brookfield & UR	2,724	83	95	4.9
Alternative 2 CSP only	1,293	78	88	3.6

1. All demands include 2% system losses.

Conclusion

The recycled water system presented in this Study can adequately supply recycled water with a 1.5 operational variance factor to the CSP while maintaining 60 psi during peak hour demands and without exceeding 5fps pipe velocity.

The proposed pipe infrastructure required to convey recycled water under the two scenarios are tabulated in **Table 4-2** and shown in **Appendix G**.

Table 4-2 Recycled Water System Pipe Size Results

Pipe Size	Scenario 1 CSP, UR, Brookfield	Scenario 2 CSP
6"	7,043	6,602
8"	2,788	3,508
12"	3,437	8,589
16"	2,822	-
36"	3,978	-
Total	20,068	18,699

Pipe lengths shown in Table 4-2 are used for modeling purposes and are an approximate representation of site requirements. Actual lengths may vary slightly.

Although the 36" transmission main on Blue Oaks Blvd and West Park Drive is oversized for the demands of scenario 1, the 36" this main will be constructed to meet future regional demands and therefore included in the modeling. Other onsite water mains meet operating goals as well as conform to the RMC Study's recommended pipe sizes.

Pipe sizes evaluated in scenario 2 meet the needs of the CSP as a stand alone project and are used for comparison purposes. The transmission main located between the pump station and CSP would consist of 3,978' of 12" pipe for the purpose of scenario 2. Pipe length quantities of pipes P21 and P114 as seen in Appendix C have been removed from the summary totals in Table 4-2 under scenario 2; they are not needed to support Brookfield or the UR.

The West Roseville RW Pump Station has adequate room for expansion of the tank and pumping facilities. The expansion can also accommodate regional needs with the inclusion of the Sierra Vista Specific Plan such as a 4MG storage tank and new pump station facilities.

Appendix A

Irrigation Demand Projections

Creekview Recycled Water Demands

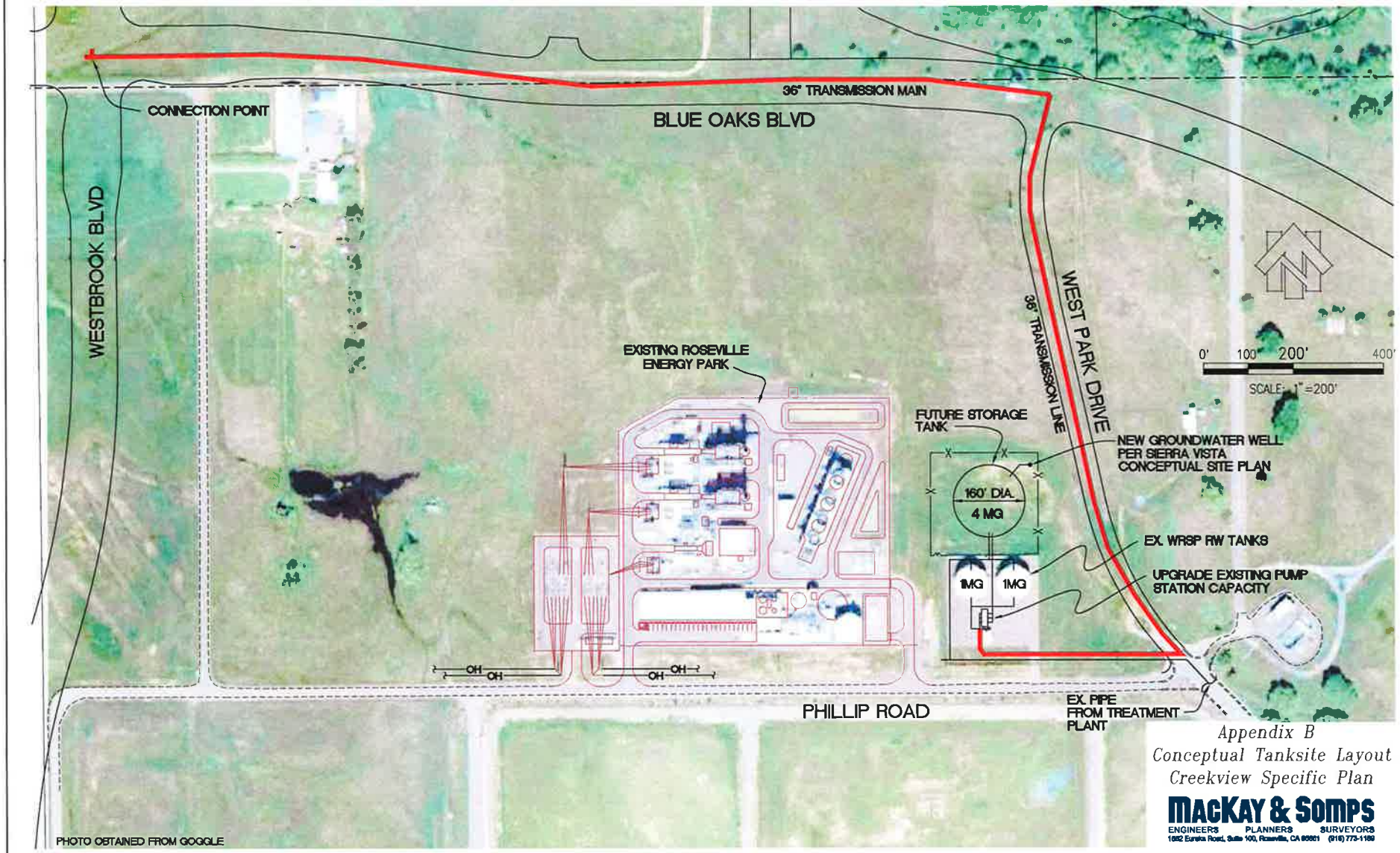
Demand Node ID	Parcel	Land Use Type	Site Area[1] (AC)	% of Site Area Irrigated[2]	Site Area Irrigated[3] (AC)	Annual Demand[4] (AFY)	Average Day Demand[5] (GPD)	Peak Day Demand[6] (GPD)	Peak Hour Demand[7] (GPM)	Operational Demand[10] (GPM)	Total Opperational plus 2% (GPM)
J11	61	Park	4.7	90%	4.23	15.2	13,595	34,666	64.2	96.3	98.2
J13	81	Public/Quasi Public	0.9	40%	0.36	1.3	1,157	2,950	5.5	8.3	
		Streetscape / Paseo[8]	16.0	90%	14.40	51.8	46,280	118,014	218.5	327.8	342.7
J20	40	High Density Residential	4.5	20%	0.90	3.2	2,892	7,376	13.7	20.6	21.0
J21	60	Park	7.3	90%	6.57	23.7	21,115	53,844	99.7	149.6	
	80	School	7.0	40%	2.80	10.1	8,999	22,947	42.5	63.8	217.6
J30	62	Park	1.5	90%	1.35	4.9	4,339	11,064	20.5	30.8	31.4
J32	63	Park	2.2	90%	1.98	7.1	6,363	16,227	30.0	45.0	45.9
J34	82	Public/Quasi Public	0.6	40%	0.24	0.9	771	1,967	3.6	5.4	
		Streetscape / Paseo[8]	15.7	90%	14.13	50.9	45,412	115,801	214.4	321.6	333.5
J35	70, 71	Commercial Mixed Use	19.3	30%	5.79	20.8	18,608	47,451	87.9	131.9	
	83	Public/Quasi Public	0.6	40%	0.24	0.9	771	1,967	3.6	5.4	
	84	Public/Quasi Public	0.5	40%	0.20	0.7	643	1,639	3.0	4.5	144.6
J40	42	High Density Residential	7.2	20%	1.44	5.2	4,628	11,801	21.9	32.9	
	41	High Density Residential	5.4	20%	1.08	3.9	3,471	8,851	16.4	24.6	58.6
Creekview Total			**93.4**		**55.7**	**201**	**179,045**	**456,565**	**845**	**1,268**	**1,293**
		Urban Reserve									
J22[9]	90	High Density Residential	11.9	20%	2.38	8.6	7,649.03	19,505.02	36.10	54.2	
	90	Park	1.1	90%	0.99	3.6	3,182	8,113	15.0	22.5	
	90	Streetscape	1.5	90%	1.31	4.7	4,223	10,769	19.9	29.9	108.6
Urban Reserve Total			**14.5**		**4.68**	**17**	**15054**	**38387**	**71**	**107**	**109**
Total Creekview plus Urban Reserve			**107.9**		**60.39**	**217**	**194,099**	**494,952**	**916**	**1,375**	**1,402**
J14		**Brookfield**				**205**	**182,923**	**466,454**	**864**	**1,296**	**1,322**
Total Creekview, Urban Reserve plus Brookfield						**422**	**377,022**	**961,406**	**1,780**	**2,670**	**2,724**

Footnotes:

1. Total Site Area is the total surface area (in acres) of each non-potable water customer's site, including those areas that do not require water for irrigation (buildings, pavement, ect).
2. % of Site Area Irrigated is the percentage of the Total Site Area that is assumed to be irrigated with non-potable water (Park/Paseo/Streetscape=90%, Public/Quasi Public/School=40%, High Density Residential=20%, and Commercial/CMU=30%).
3. Site Area Irrigated is the area of each site that is assumed to be irrigated. Site Area Irrigated (ac) = Total Site Area (ac) X % of Site Area Irrigated.
4. Annual Demand is the total annual water usage. Annual Demand (ac-ft/yr) = Site Area Irrigated (ac) X Annual Irrigation Demand (ac-ft/acre/yr). Annual Irrigation Demand for the City of Roseville area assumed to be 3.6 ac-ft/acre/yr.
5. Average Day Demand (ADD) is the average daily irrigation demand. ADD (gal/day) = Annual Demand (ac-ft/yr) X (43560 sqft/ac) X (7.481 gal/cuft) X (1 year/365 days).
6. Peak Day Demand (PDD) is assumed to take place in July when the monthly irrigation demand is 9.1 inches. The PDD Peaking Factor is calculated by dividing the monthly irrigation demand for July by the average monthly irrigation demand: 9.1/3.6 = 2.55. Thus, PDD (gal/day) = 2.55 X ADD (gal/day).
7. Peak Hour Demand (PHD) is assumed to be equal to Peak Day Demand volume projected over the irrigation duration. Thus, PHD (gal/min) = PDD (gal/day) X (1 day/1440 min) X (24hr/9hr).
8. The Total Site Area for streetscapes and paseos was assumed to be 31.7 acres for the Creekview development. The demand for streetscapes in Creekview was applied/distributed to J13 and J34 demand junctions in the hydraulic model.
9. The Urban Reserve (P-90) is assumed to contain 11.9 acres of high density residential and 1.1 acres of parks. The Total Site Area for streetscapes was assumed to be 1.46 acres.
10. Operational Demand includes a 1.5 factor to account for the variance found in landscape irrigation

Appendix B

Conceptual Tank Site Layout



Appendix B
Conceptual Tanksite Layout
Creekview Specific Plan

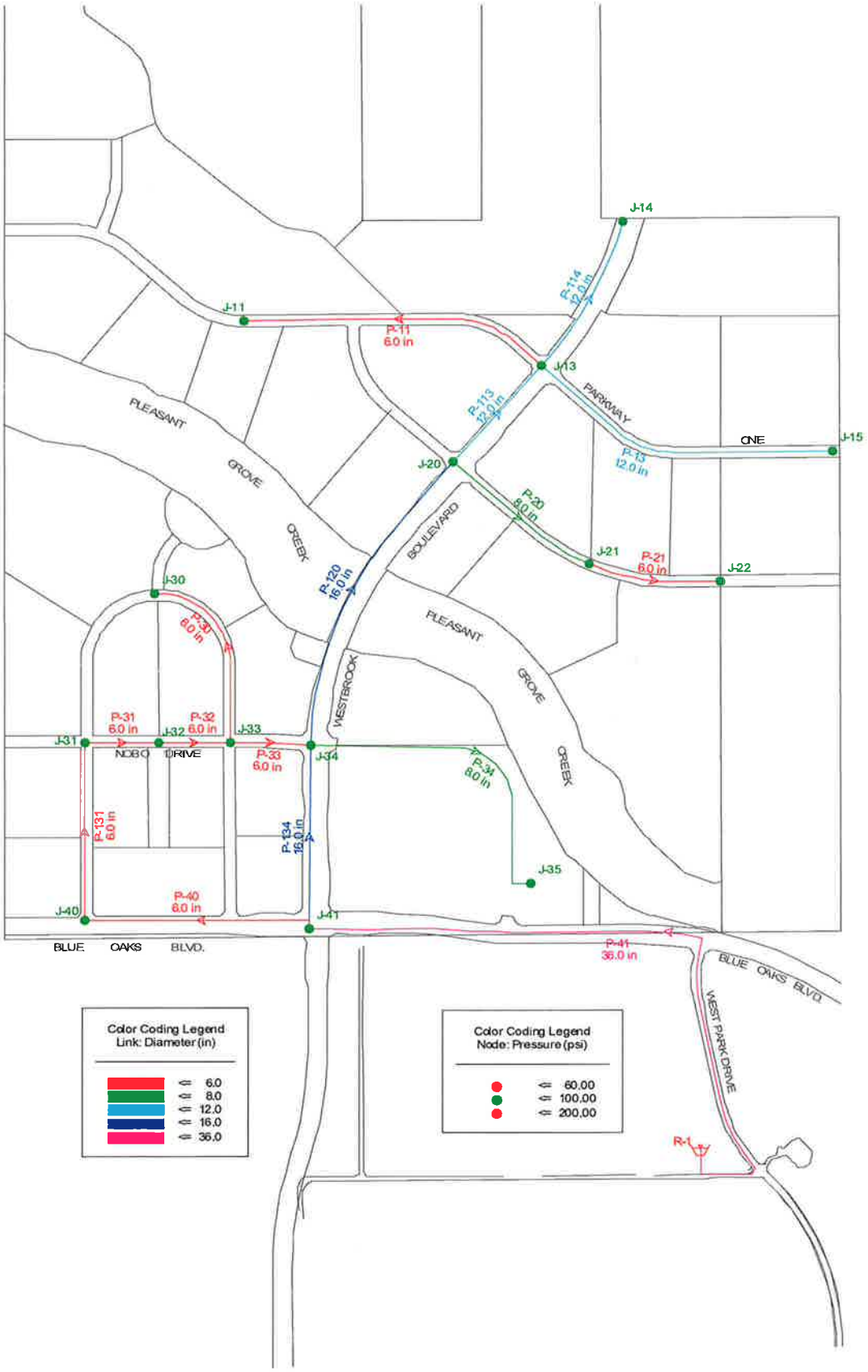
MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1682 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1150

09-16-2010 2:18pm Greg Jordan P:\18431\WATERMODEL RECYCLED\TANK SITE.DWG

Appendix C

Recycled Water System Layouts

Scenario: Demand w Brookfield & UR



MacKay & Somps Civil Engineers, Inc.
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

Appendix D

Model Output

Alternative 1 Output

CSP Plus Brookfield

Scenario: Demand w Brookfield & UR
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-11	85.00	Zone	Demand	102.40	Fixed	286.17	87.03
J-13	86.00	Zone	Demand	292.40	Fixed	288.04	87.42
J-14	83.00	Zone	Demand	1,322.00	Fixed	284.10	87.01
J-15	96.00	Zone	Demand	0.00	Fixed	288.04	83.09
J-20	92.00	Zone	Demand	21.40	Fixed	293.01	86.97
J-21	92.00	Zone	Demand	232.30	Fixed	290.64	85.94
J-22	95.00	Zone	Demand	109.00	Fixed	289.74	84.25
J-30	78.00	Zone	Demand	31.40	Fixed	297.25	94.86
J-31	86.00	Zone	Demand	0.00	Fixed	297.84	91.65
J-32	82.00	Zone	Demand	31.40	Fixed	297.52	93.24
J-33	79.00	Zone	Demand	19.40	Fixed	297.38	94.48
J-34	80.00	Zone	Demand	282.10	Fixed	297.38	94.05
J-35	80.00	Zone	Demand	200.10	Fixed	295.67	93.31
J-40	90.00	Zone	Demand	49.70	Fixed	298.63	90.26
J-41	86.00	Zone	Demand	16.70	Fixed	301.00	93.02

Scenario: Demand w Brookfield & UR
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpm)	Velocity (ft/s)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-11	1,725.00	6.0	130.0	Open	102.40	1.16	1.88	1.09
P-13	1,789.00	12.0	130.0	Open	0.00	0.00	0.00	0.00
P-20	949.00	8.0	130.0	Open	341.30	2.18	2.37	2.49
P-21	741.00	6.0	130.0	Open	109.00	1.24	0.91	1.22
P-30	1,070.00	6.0	130.0	Open	-31.40	0.36	0.13	0.12
P-31	399.00	6.0	130.0	Open	-86.68	0.98	0.32	0.80
P-32	399.00	6.0	130.0	Open	-55.28	0.63	0.14	0.35
P-33	442.00	6.0	130.0	Open	-4.48	0.05	0.00	0.00
P-34	1,839.00	8.0	130.0	Open	200.10	1.28	1.71	0.93
P-40	1,279.00	6.0	130.0	Open	136.38	1.55	2.37	1.85
P-41	3,978.00	36.0	130.0	Open	2,710.30	0.85	0.30	0.08
P-113	720.00	12.0	130.0	Open	1,716.80	4.87	4.97	6.90
P-114	928.00	12.0	130.0	Open	1,322.00	3.75	3.94	4.25
P-120	1,803.00	16.0	130.0	Open	2,079.50	3.32	4.37	2.42
P-131	988.00	6.0	130.0	Open	86.68	0.98	0.79	0.80
P-134	1,019.00	16.0	130.0	Open	2,557.22	4.08	3.62	3.55

Alternative 2 Output

CSP Only

Scenario: CSP Demand
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Demand (gpm)	Pattern	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-11	85.00	Zone	Demand	102.40	Fixed	275.56	82.44
J-13	86.00	Zone	Demand	292.40	Fixed	277.44	82.83
J-14	83.00	Zone	Demand	0.00	Fixed	277.44	84.12
J-15	96.00	Zone	Demand	0.00	Fixed	277.44	78.50
J-20	92.00	Zone	Demand	21.40	Fixed	279.79	81.25
J-21	92.00	Zone	Demand	232.30	Fixed	278.63	80.74
J-22	95.00	Zone	Demand	0.00	Fixed	278.63	79.45
J-30	78.00	Zone	Demand	31.40	Fixed	281.71	88.13
J-31	86.00	Zone	Demand	0.00	Fixed	282.23	84.90
J-32	82.00	Zone	Demand	31.40	Fixed	281.95	86.51
J-33	79.00	Zone	Demand	19.40	Fixed	281.84	87.76
J-34	80.00	Zone	Demand	282.10	Fixed	281.84	87.33
J-35	80.00	Zone	Demand	200.10	Fixed	280.13	86.59
J-40	90.00	Zone	Demand	49.70	Fixed	282.92	83.47
J-41	86.00	Zone	Demand	16.70	Fixed	285.09	86.14

Scenario: CSP Demand
Steady State Analysis
Pipe Report

Label	Length (ft)	Diameter (in)	Hazen-Williams C	Control Status	Discharge (gpm)	Velocity (ft/s)	Pressure Pipe Headloss (ft)	Headloss Gradient (ft/1000ft)
P-11	1,725.00	6.0	130.0	Open	102.40	1.16	1.88	1.09
P-13	1,789.00	12.0	130.0	Open	0.00	0.00	0.00	0.00
P-20	949.00	8.0	130.0	Open	232.30	1.48	1.16	1.22
P-21	741.00	6.0	130.0	Open	0.00	0.00	0.00	0.00
P-30	1,070.00	6.0	130.0	Open	-31.40	0.36	0.13	0.12
P-31	399.00	6.0	130.0	Open	-80.47	0.91	0.28	0.70
P-32	399.00	6.0	130.0	Open	-49.07	0.56	0.11	0.28
P-33	442.00	6.0	130.0	Open	1.73	0.02	0.00	0.00
P-34	1,839.00	8.0	130.0	Open	200.10	1.28	1.71	0.93
P-40	1,279.00	6.0	130.0	Open	130.17	1.48	2.17	1.70
P-41	3,978.00	12.0	130.0	Open	1,279.30	3.63	15.91	4.00
P-113	720.00	8.0	130.0	Open	394.80	2.52	2.35	3.27
P-114	928.00	6.0	130.0	Open	0.00	0.00	0.00	0.00
P-120	1,803.00	12.0	130.0	Open	648.50	1.84	2.05	1.14
P-131	988.00	6.0	130.0	Open	80.47	0.91	0.69	0.70
P-134	1,019.00	12.0	130.0	Open	1,132.43	3.21	3.25	3.19

MacKay & Somps Civil Engineers, Inc.
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666