APPENDIX F

RECYCLED WATER MASTER PLAN

Brookfield Residential

Amoruso Ranch Specific Plan Area

April 2016

Recycled Water Master Plan

Prepared for:

Brookfield Residential

Prepared by:

Kimley»Horn

Brookfield Residential

Amoruso Ranch Specific Plan Area

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Prepared By:

Kimley»Horn

Kimley»Horn

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INTRODUCTION

The Amoruso Ranch Specific Plan (ARSP) Area Recycled Water Master Plan (Plan) has been prepared at the request of Brookfield Residential Properties, Inc. (Brookfield) to meet the City of Roseville's (City) requirements and in support of the ARSP process.

RECYCLED WATER MASTER PLAN PURPOSE

The purpose of this Plan includes the following:

- Identify potential customers/parcels that will utilize recycled water for irrigation purposes.
- Calculate the anticipated recycled water system demands under varying scenarios.
- Identify and size the recycled water system infrastructure facilities to meet the projected demands.

The items listed above will be completed in accordance with the operating goals and objectives of the City of Roseville.

ARSP AREA LOCATION AND DESCRIPTION

Project Vicinity

The ARSP Area consists of approximately 694.4 acres located in the northwest edge for the City of Roseville. Prior to the Specific Plan's adoption, the plan area was recognized as a logical growth extension for the City. The Specific Plan Area is bounded on the southwest by the Al Johnson Wildlife Area, to the west by the Gleason property, to the south by the Creekview Specific Plan Area, to the east by the future proposed Placer Ranch Specific Plan Area and to the north by the existing Toad Hills Ranches #1 area and unincorporated Placer County. The project vicinity is shown on Figure 1.

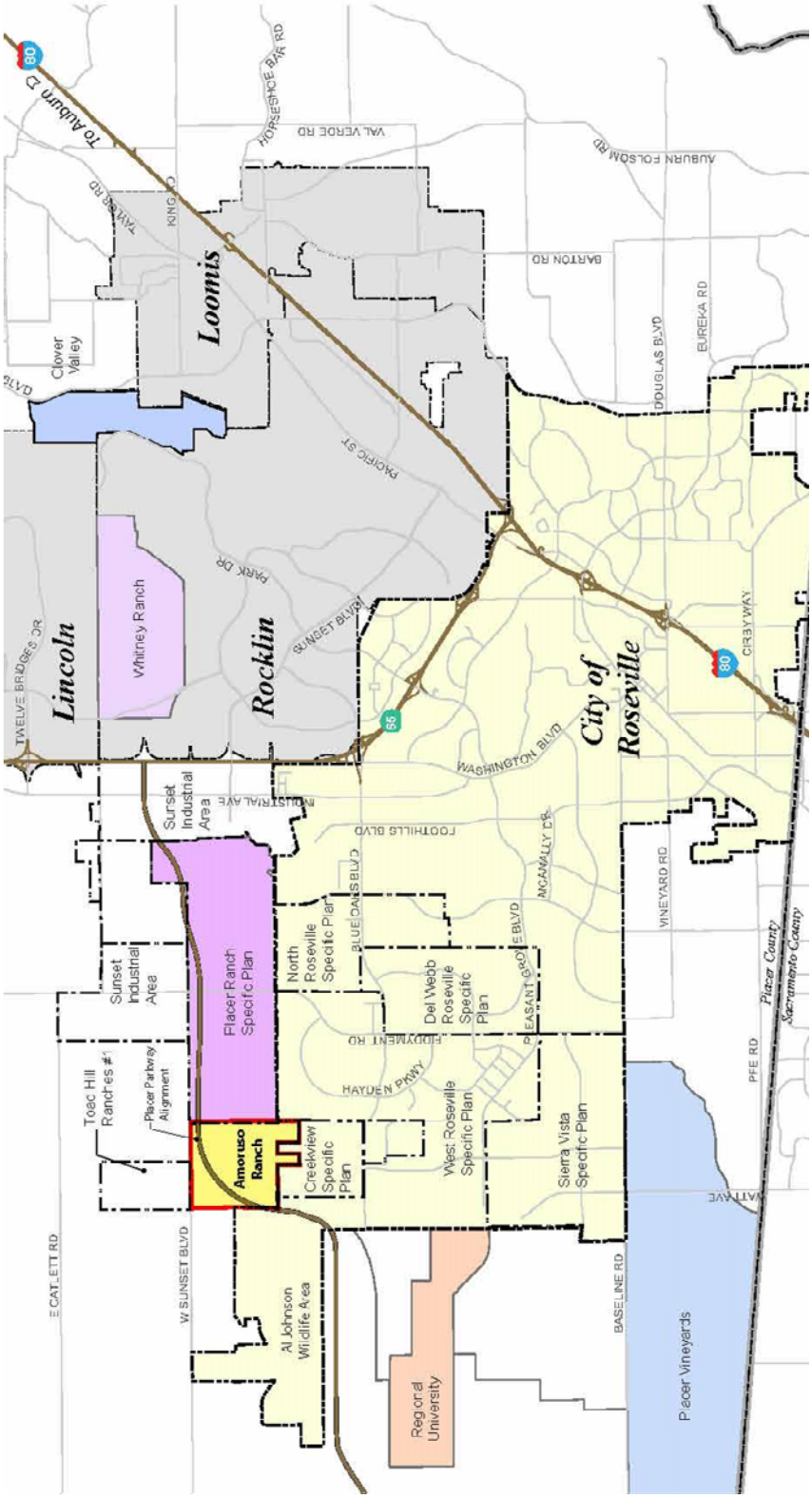

Figure 1 – Amoruso Ranch Specific Plan Area Project Vicinity

As noted on Figure 1, the Creekview Specific Plan Area (Creekview) lies directly to the south of the ARSP Area. The recycled water supply to the ARSP Area will be from just south of Blue Oaks Boulevard, from the City of Roseville's Pleasant Grove Wastewater Treatment Plant. The supply serving the ARSP will come through infrastructure within Creekview. This Plan references the *"Creekview Specific Plan Recycled Water Study, Final Report, prepared for Granite Bay Development, dated: November 30, 2010, prepared by MacKay & Somps."*

Pre-Development Conditions

In the pre-development conditions the ARSP Area was used as a cattle ranch and for irrigated crops. The primary use was open grazing land, but included a small ranch house and out buildings. The land is gently rolling terrain generally trending to the west and south. Minor drainages flow in a radial pattern from a slight rise in the north east quadrant of the property. The elevation changes from approximately 115 feet to 71 feet gently from the northeast down to the southwest.

The site vegetation is generally limited to short, seasonal grasses. There are several oak trees located along University Creek and a number of non-native trees located around the former ranch house. Wetland conditions and their associated flora and fauna are located in small areas typically along the drainage corridors and in flats along the southern boundary. Figure 2 highlights the ARSP Area pre-development conditions.

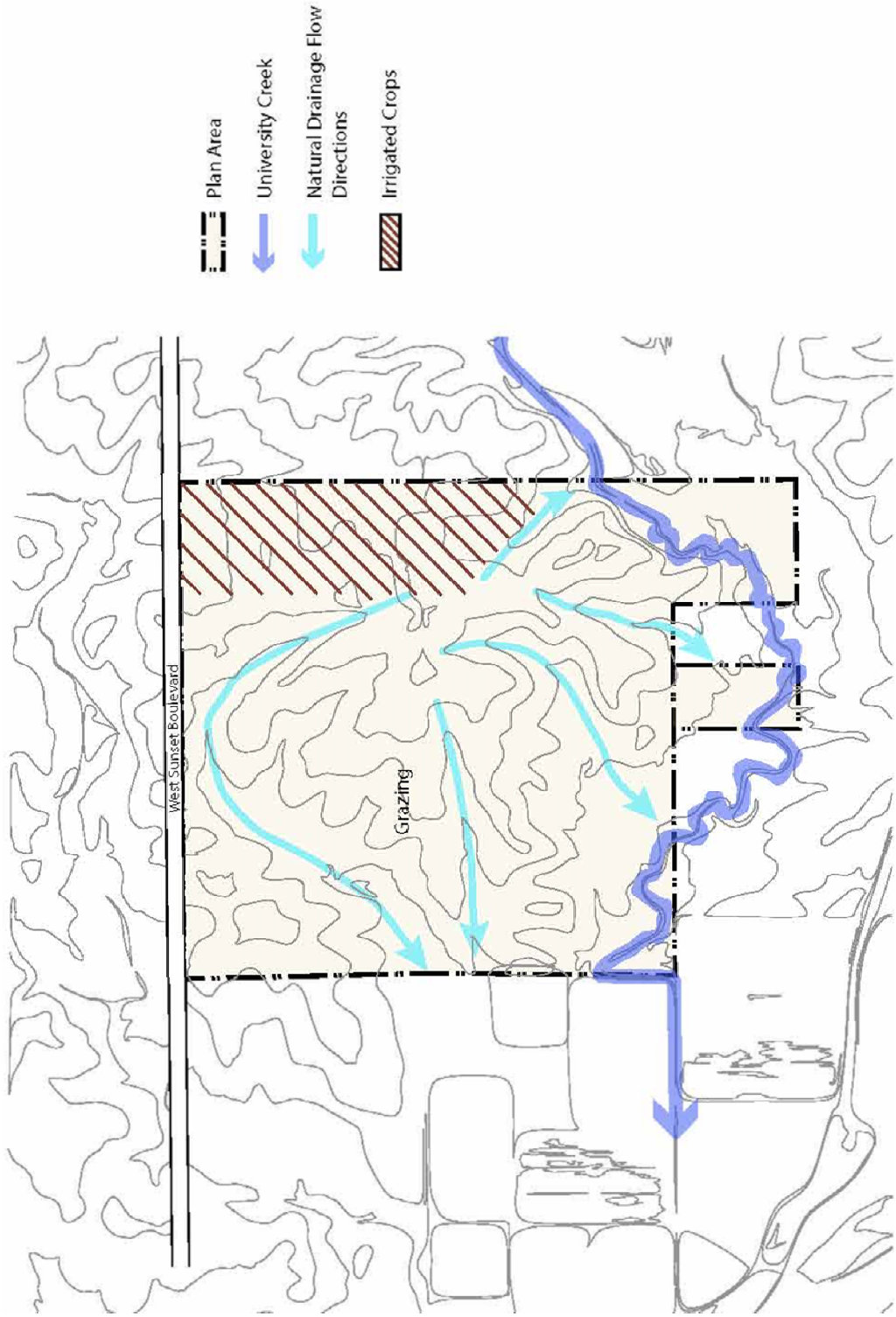

Figure 2 – ARSP Area Pre-Development Conditions

ARSP Area Development Opportunities and Constraints

The proposed ARSP Area land use plan is influenced by several factors, including the physical setting, land use and circulation conditions, and public policies. Two significant aspects that influence the development of the land plan are described below and depicted on Figure 3.

Placer Parkway

The proposed Placer Parkway will be a dominant feature that sweeps through the ARSP Area. Interchanges at Fiddyment Road and Santucci Boulevard will provide access to the ARSP Area.

Open Space and Resources Preservation

The ARSP Area will support open space and resource preservation by providing permanent open space. In combination with the 1,700-acre open space afforded by the City of Roseville Al Johnson Wildlife Area, this open space provides connectivity with open space within the Creekview Specific Plan Area, and lands to the east of the ARSP Area.

The Amoruso Ranch Specific Plan will provide an open space corridor that includes a pedestrian and bike path linkage between this major open space area and the City's regional trail system. In addition, the corridor will provide a permanent preservation area for wetland resources.

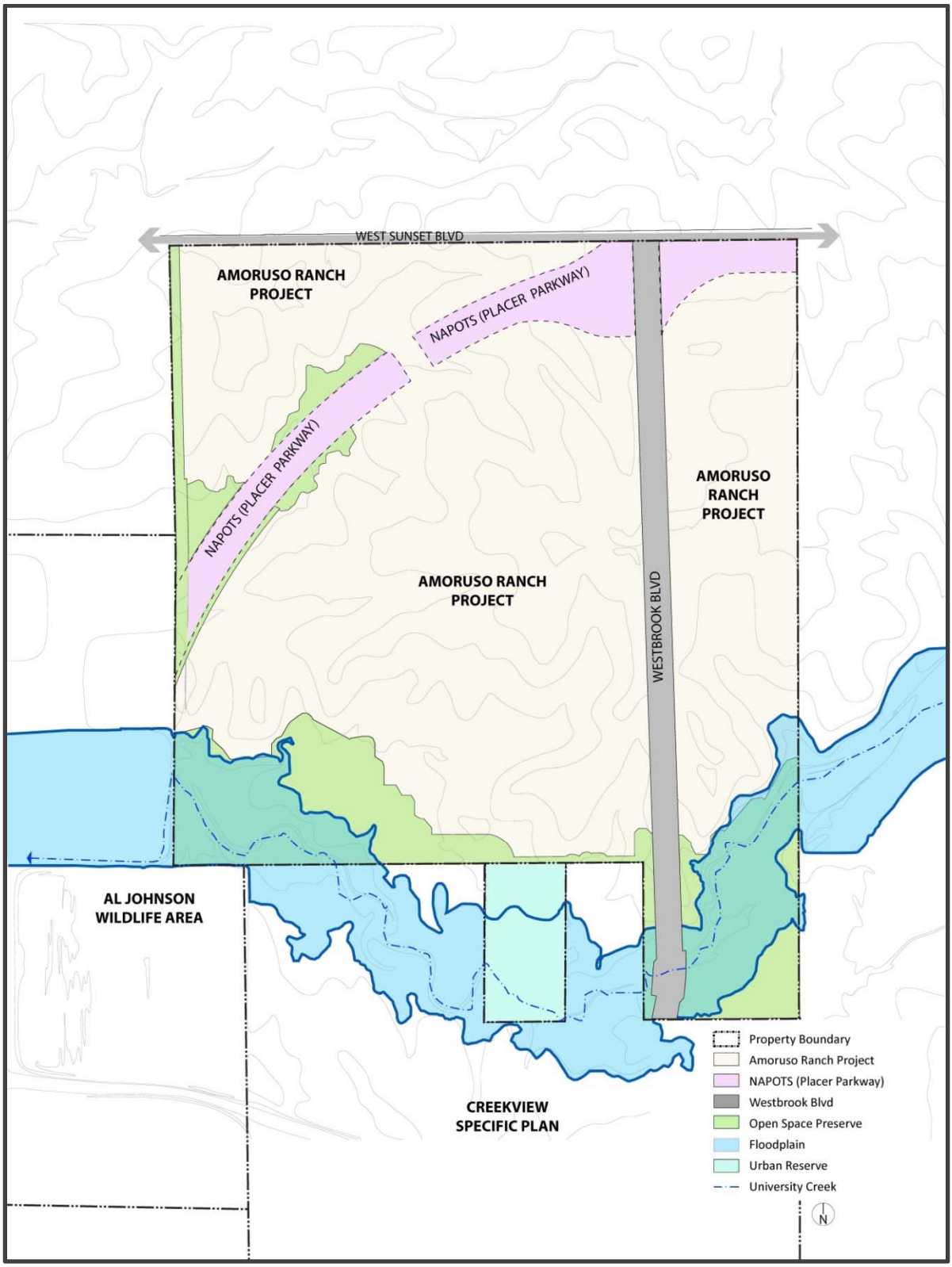

Figure 3 – ARSP Area Opportunities and Constraints

ARSP Area Land Use Plan

The ARSP Area provides for a mix of land uses to achieve the desired community form and objectives. These land use designations include low-, medium- and high density residential uses; commercial and office uses; which in some cases are sited with one another and/or with residential uses; public and quasi-public uses for the schools and civic activities such as a fire station; parks and open space uses; and an urban reserve.

At buildout, the ARSP Area will provide for 2,827 dwelling units, it adds approximately 51 acres of commercial retail and office land uses, and provides approximately 22-acres of parks and 146-acres of open space. The ARSP Area Land Use Plan is shown in Figure 4.

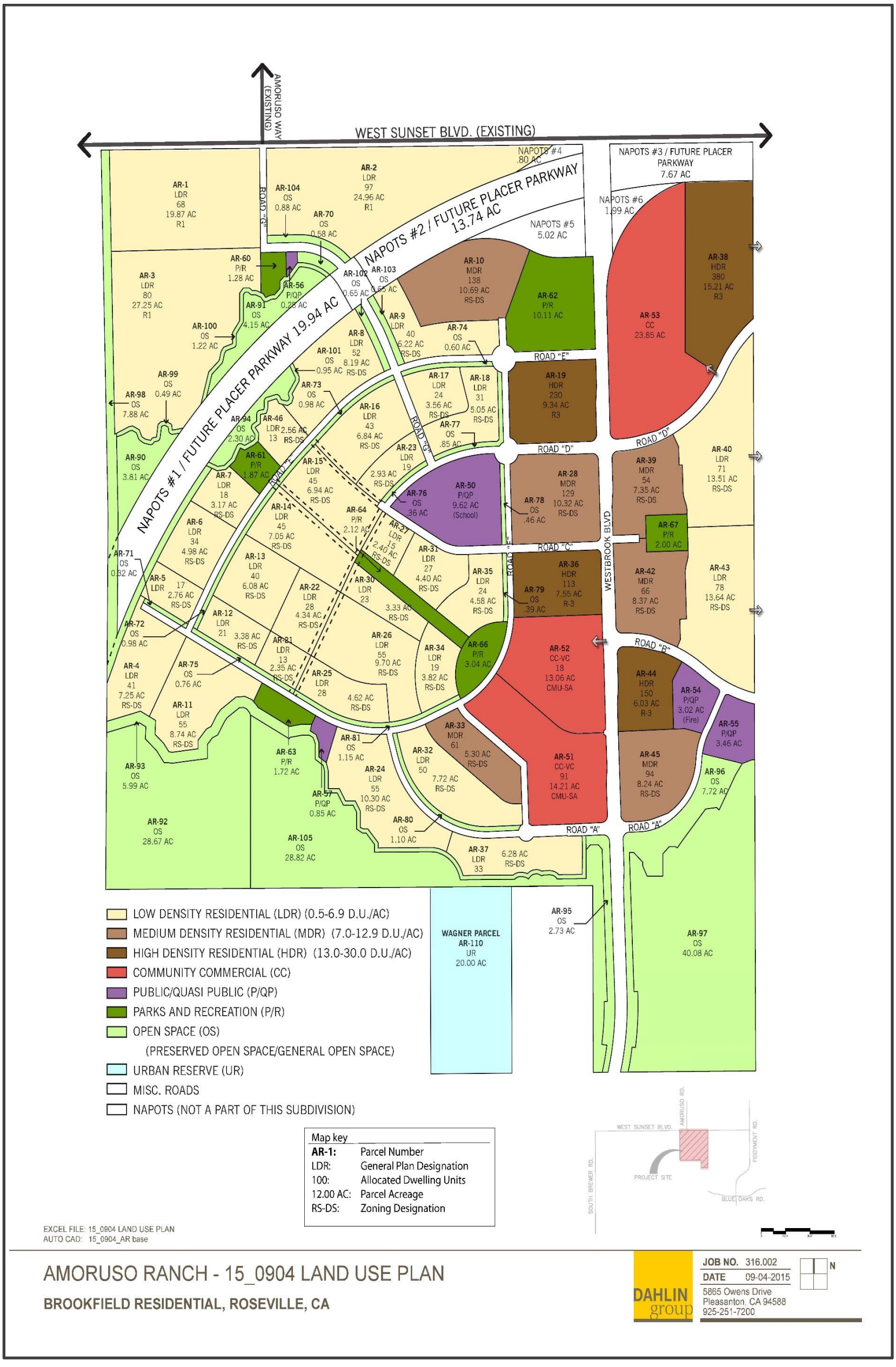

Figure 4 – ARSP Area Land Use Plan

RECYCLED WATER STUDY PROCESS

This Plan identifies the parcels and projected demands for recycled water to meet the irrigation demands. The infrastructure needed to serve the ARSP Area recycled water demands is identified, including sizing of the facilities. The methodology that has been utilized for the evaluation and sizing of the recycled water facilities is consistent with the criteria established by the City of Roseville's Environmental Utilities Department (EU). The City's current Design Standards (January 2013) were utilized as a guide for development of the hydraulic model for adequately sizing the infrastructure.

As previously noted, this Plan builds upon and is consistent with the recycled water master plan that was developed for Creekview. Recently the City completed a study for the recycled water system within the west Roseville area. The West Roseville Recycled Water Focus Study, dated August 2010, was developed by RMC (RMC Study) for the City to determine supply alternatives for the urban growth areas adjacent to the northern portion of the City. The RMC Study modeled future demands as a means of updating the City's regional recycled water system hydraulic model. As part of the RMC Study, storage options were evaluated and considered two options:

- Distributed storage within the different urban growth areas/specific plan areas; or
- Centralized storage to support the supply and demands of the region.

The RMC Study concluded that a centralized facility located at the City's existing recycled water storage and pump station site, located within the West Roseville Specific Plan, could support regional recycled water demands.

This Plan also incorporates the irrigation criteria established by The Recycled Water Study for West Roseville Specific Plan Area (WRSP Study), which was completed in May 2003 and also utilized by Creekview.

PROJECTED IRRIGATION DEMANDS

This section of the Plan provides estimates of the projected irrigation demands within the ARSP Area. As noted previously, similar criteria utilized in previous studies was applied in development of the projected recycled water irrigation demands for the ARSP Area.

In order to determine the demands that can be accommodated by the recycled water system, it is necessary to establish the baseline water use within the overall ARSP Area.

BASELINE WATER USE ESTIMATION

The calculation of the baseline water use estimation was established based on the land use designations, developed as part of the ARSP Area Land Use Plan shown on Figure 4.

The baseline water use for the project was established using the City's standard water use factors, as developed for the City by MWH in 2006. The City of Roseville employs standard demand factors for residential land uses of varying densities, as well as standard demand factors for commercial/other land uses. The residential demands are presented as gallons per day (GPD) per dwelling unit (DU), and the commercial/other demands are presented as GPD per acre. The City's demand factors are listed in Table 1.

Table 1
Amoruso Ranch Specific Plan
Recycled Water Master Plan
City of Roseville Water Demand Factors

Land Use Category	Average Day Demand
Residential GPD/DU	
< 3.5 DU / Acre	728 GPD/DU
> 3.5 to 5 DU / Acre	600 GPD/DU
> 5 to 6 DU / Acre	521 GPD/DU
> 6 to 8 DU / Acre	430 GPD/DU
> 8 to 12 DU / Acre	323 GPD/DU
> 12 to 16 DU / Acre	288 GPD/DU
> 16 DU / Acre	177 GPD/DU
Non-Residential GPD/Acre	
Commercial / Retail	2598 GPD/Acre
Business Professional	2598 GPD/Acre
Light Industrial	2598 GPD/Acre
Industrial	2562 GPD/Acre
Railroad Yard	109 GPD/Acre
Elementary School	3454 GPD/Acre
High School	4068 GPD/Acre
Public (Fire Station, etc)	1780 GPD/Acre
Park / Recreation	2988 GPD/Acre
Open Space / ROW	0 GPD/Acre
Vacant	0 GPD/Acre

Utilizing the City's demand factors, the estimated annual water use within the ARSP Area has been calculated. Table 2 includes a summary of the estimated baseline water demands. Consistent with previous similar analyses completed by the City, a factor for water system losses has not been included.

Table 2
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Overall Water Use Factors and Demands (Potable[1] and Recycled)

Land Use	Land Use Abbreviation/ Zoning	Total Area (Acres)	Dwelling Unit Count	Water Use Factor	Daily Demand (GPD)	Annual Demand (AFY)	Annual Demand with 2% (AFY) [2]
Low Density Residential	LDR	248.77	1,302	Varies	660,175	739.5	754.3
Medium Density Residential	MDR	50.27	542	Varies	178,561	200.0	204.0
High Density Residential	HDR	38.13	873	Varies	167,064	187.1	190.9
Community Commercial - Village Center – Residential	CMU-SA (Commercial Mixed-Use - Special Area)	Included On Next Line	109	288	31,392	35.2	35.9
Community Commercial - Village Center – Non-Residential	CMU-SA (Commercial Mixed-Use - Special Area)	27.27	-	2,598	70,847	79.4	80.9
Community Commercial	CC (Community Commercial)	23.85	-	2,598	61,962	69.4	70.8
Open Space (Paseos)	OS	10.71	-	2,988	32,001	35.8	36.6
Open Space (General)	OS	37.24	-	0	0	0	0
Open Space (Preserve)	OS	97.58	-	0	0	0	0
Parks & Recreation	PR	22.14	-	2,988	66,154	74.1	75.6
Public / Quasi Public (school)	P/QP (School)	9.62	-	3,454	33,227	37.2	38.0
Public / Quasi Public (Fire Station & Utility Site)	P/QP	7.61	-	1,780	13,546	15.2	15.5
Urban Reserve	UR	20.00	1	728	728	0.8	0.8
Rights-of-Way	ROW	52.04	-	0	0	0	0
Not a Part of This Subdivision	NAPOTS	49.16	-	0	0	0	0
Total		**694.4**	**2,827**	**-**	**1,315,659**	**1,473.7**	**1,503.2**

[1] For additional information on the ARSP Water System, refer to Amoruso Ranch Specific Plan Area Water Master Plan, dated October 2015
[2] Demand accounts for 2% system losses.

TURF IRRIGATION DEMAND PROJECTIONS

Previous studies identified local irrigation demand patterns taking into consideration local evapotranspiration (ET) rates, historic precipitation data and historic irrigation demands. The conclusions from the previous efforts resulted in the preparation of the following Typical Irrigation Demand Pattern in the Sacramento Area, presented in Table 3, on a monthly basis.

Table 3
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Typical Irrigation Demand Pattern in the Sacramento Area

Month	ET Turf Grass (in.)	Monthly Precipitation (in.)	Monthly Irrigation Demand (in.)	Monthly Irrigation Demand (ft.)
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**

As indicated in Table 3, the total annual irrigation demand for turf grasses is estimated to be 43.4 inches, or 3.62 feet. The peak monthly demand occurs in July with 9.2 inches of projected irrigation demand. Four months, January, February, November and December

have irrigation demands of zero as it is assumed that the irrigation demands are met through precipitation.

POTENTIAL RECYCLED WATER CUSTOMERS

Recycled water use within the ARSP Area is specifically limited to irrigation demands of non-single family residential units, with the exception of residential units that have common area landscaping (limited to High Density Residential (HDR) parcels). As a result, the recycled water use areas within the ARSP Area will include the following land use designations consistent with those included in Table 2:

- High Density Residential (HDR)
- Community Commercial – Village Center – Non-Residential (CMU)
- Community Commercial (CC)
- Parks & Recreation (PR)
- Street Side "Paseos" (OS)
- Public/Quasi-Public (Including School) (P/QP)
- Main Roadway Rights-of-Way (ROW)

It should be noted that at the current time it is not planned to take recycled water infrastructure to the north past the future Placer Parkway. Therefore, the park and road side "paseo" north of Placer Parkway are proposed to be served from the potable water system and have not been accounted for in the recycled water demands.

ESTIMATED IRRIGATION SURFACE AREA

In order to develop the initial projections for recycled water irrigation demands within the ARSP Area, the projected irrigation surface area was identified. The surface area estimation is based on utilizing the ARSP Area Land Use Plan, shown in Figure 4. The estimated irrigation surface area factors were utilized to calculate the initial projections for irrigation demand. The factors listed in Table 4 are based on the land use categories and represent the percentage of total surface area that will be landscaped and irrigated, accounting for buildings and hardscape improvements that will not require irrigation.

Table 4
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Irrigated Surface Area Factors

Land Use Category	Irrigated Surface Area Factor (% AC)[1]
High Density Residential (HDR)	0.40
Commercial – Village Center (CMU)	0.30
Community Commercial (CC)	0.30
Parks & Recreation (PR)	0.90
Street Side "Paseos" (OS)	0.90
Public/Quasi-Public (P/QP) (School)	0.50
Public/Quasi-Public (P/QP) (Other)	0.50
Rights-of-Way (ROW)	0.90 [2]

ESTIMATED TOTAL IRRIGATION DEMAND

The estimated total irrigation demand for the ARSP Area has been developed utilizing the information presented previously within this Plan. The estimated irrigation demand for the ARSP Area is shown in Table 5. Demand factors shown in Table 5 are discussed in the subsequent sections of this Plan.

It should be noted that the calculation of irrigation demands assumes the utilization of turf area and the equivalent irrigation rates. Utilizing the turf area assumption provides the most conservative approach for sizing of the recycled water infrastructure, as it typically represents the highest irrigation demand for landscaped areas. Additional work completed for the ARSP Project includes a Water Conservation Plan (dated September 2015) that seeks to reduce overall potable and recycled water demands within the ARSP Area by a minimum of 20%. The Water Conservation Plan relies heavily on the conversion of turf areas to other types of low water consumption vegetation.

[1] The irrigated surface area factor is consistent with the WRSP Recycled Water Study (May 2003)
[2] See note 11 in Table 5

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Table 5
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Recycled Water Demands

Note	Parcel	Land Use Type	Total Site Area (AC)[1]	% of Site Irrigated[2]	Site Area Irrigated (AC)[3]	Annual Demand (AFY)[4]	Average Day Demand (GPD)[5]	Peak Day Demand (GPD)[6]	Peak Hour Demand (GPM)[7]	Operational Demand (GPM)[8]	Operational Demand with 2% (GPM)[9]	Operational Demand with 2% and ROW (GPM)[10]
High Density Residential (HDR)												
	AR-19	HDR	9.34	40	3.7	13.4	12,007	30,738	57	85	87	99
	AR-36	HDR	7.55	40	3.0	10.9	9,706	24,847	46	69	70	80
	AR-38	HDR	15.21	40	6.1	21.9	19,553	50,056	93	139	142	162
	AR-44	HDR	6.00	40	2.4	8.6	7,713	19,746	37	55	56	64
Community Commercial Village Center (CMU)												
	AR-51	CMU	14.21	30	4.3	15.3	13,701	35,074	65	97	99	113
	AR-52	CMU	13.06	30	3.9	14.1	12,592	32,235	60	90	91	104
Community Center (CC)												
	AR-53	CC	23.85	30	7.2	25.8	22,995	58,868	109	164	167	190
Parks & Recreation (PR)												
	AR-60*	PR	0	90	0.0	0.0	0	0	0	0	0	0
	AR-61	PR	1.87	90	1.7	6.1	5,409	13,847	26	38	39	45
	AR-62	PR	10.11	90	9.1	32.8	29,243	74,862	139	208	212	242
	AR-63	PR	1.72	90	1.5	5.6	4,975	12,736	24	35	36	41
	AR-64	PR	2.12	90	1.9	6.9	6,132	15,698	29	44	44	51
	AR-66	PR	3.04	90	2.7	9.8	8,793	22,510	42	63	64	73
	AR-67	PR	2.00	90	1.8	6.5	5,785	14,810	27	41	42	48
Public/Quasi-Public (P/QP)												
School	AR-50	P/QP	9.62	50	4.8	17.3	15,459	39,574	73	110	112	128
Fire Stat.	AR-54	P/QP	3.02	50	1.5	5.4	4,853	12,424	23	35	35	40
Public Fac.	AR-55	P/QP	3.46	50	1.7	6.2	5,560	14,234	26	40	40	46

Note	Parcel	Land Use Type	Total Site Area (AC)[1]	% of Site Irrigated[2]	Site Area Irrigated (AC)[3]	Annual Demand (AFY)[4]	Average Day Demand (GPD)[5]	Peak Day Demand (GPD)[6]	Peak Hour Demand (GPM)[7]	Operational Demand (GPM)[8]	Operational Demand with 2% (GPM)[9]	Operational Demand with 2% and ROW (GPM)[10]
Lift Station	AR-56*	P/QP	0	50	0.0	0.0	0	0	0	0	0	0
Lift Station	AR-57	P/QP	0.85	50	0.4	1.5	1,366	3,497	6	10	10	11
Street Side Paseos – Roadway Adjacent (OS)												
	AR-70*	OS	0	90	0.0	0.0	0	0	0	0	0	0
	AR-71	OS	0.32	90	0.3	1.0	926	2,370	4	7	7	8
	AR-72	OS	0.98	90	0.9	3.2	2,835	7,257	13	20	21	23
	AR-73	OS	0.98	90	0.9	3.2	2,835	7,257	13	20	21	23
	AR-74	OS	0.60	90	0.5	1.9	1,735	4,443	8	12	13	14
	AR-75	OS	0.76	90	0.7	2.5	2,198	5,628	10	16	16	18
	AR-76	OS	0.36	90	0.3	1.2	1,041	2,666	5	7	8	9
	AR-77	OS	0.85	90	0.8	2.8	2,459	6,294	12	17	18	20
	AR-78	OS	0.46	90	0.4	1.5	1,331	3,406	6	9	10	11
	AR-79	OS	0.39	90	0.4	1.3	1,128	2,888	5	8	8	9
	AR-80	OS	1.10	90	1.0	3.6	3,182	8,145	15	23	23	26
	AR-81	OS	1.15	90	1.0	3.7	3,326	8,515	16	24	24	28
	AR-102	OS	0.65	90	0.6	2.1	1,880	4,813	9	13	14	16
	AR-103	OS	0.65	90	0.6	2.1	1,880	4,813	9	13	14	16
	AR-104*	OS	0	90	0.0	0.0	0	0	0	0	0	0
Rights-of-Way[11]												
	-	ROW	10.41	90	9.4	33.7	30,111	77,084	143	214	218	-
TOTAL	**-**	**-**	**147**	-	**76**	**272**	**242,708**	**621,334**	**1,151**	**1,726**	**1,760**	**1,760**

1 “Total Site Area” – the total site area includes the entire customer site not just the portion to be landscaped.
2 “% of Site Irrigated” – this is the percentage of the site that is landscaped and proposed to be irrigated with recycled water. The value is obtained from Table 4.
3 “Site Area Irrigated” – this is the calculated acreage of landscaped area proposed to be irrigated. The value is obtained by multiplying the Total Site Area by the landscape coverage factor from Table 4.
4 “Annual Demand” – This is the annual irrigation water demand expressed in acre-feet per year. Calculated by multiplying the irrigated area by the annual irrigation demand factor of 3.6 AF/AC/YR.
5 “Average Day Demand” – This is the average daily irrigation demand converted from AFY to gallons-per-day.
6 “Peak Day Demand” – Based on historic data the peak day demand occurs in July and is estimated at 9.2 inches. Calculated by multiplying the ADD by 2.56. 2.56 is obtained by the ratio of 9.2 over 3.6.
7 “Peak Hour Demand” – This is the peak day demand volume projected over a 9 hour irrigation period. Calculated by multiplying the PDD by the ratio of (24 hr/9 hr) and converting from gallons-per-day to gallons-per-minute.
8 “Operational Demand” – This is the PHD multiplied by a factor of 1.5 to account for operational flexibilities.
9 The “Operational Demand” flows include a surcharge of 2% to account for system losses.
10 Total ROW Demand distributed by parcel as a weighted average based on irrigated site area.
11 Rights-of-Way acreage is based on 20% of the total acreage of the backbone roads, Westbrook Blvd. and Roads B and D (52.04 acres).
* Irrigation demands for AR-56, AR-60, AR-70 and AR-104 will be provided with domestic water and not recycled water.

Note: All values presented in the table above are rounded and based on non-rounded calculations of the “Total Site Acreage” and “% of Site Irrigated”

The initial irrigation demands and sizing of the recycled water system infrastructure will be developed based on the conservative estimates for turf demand. Following the initial sizing of the infrastructure, a discussion of the potential impacts on the system with the implementation of the water conservation measures that are discussed in the Water Conservation Plan is presented.

ESTIMATED IRRIGATION DEMAND FACTORS

In order to develop the hydraulic model and size of the infrastructure for the recycled water system serving the ARSP Area it is necessary to determine a series of recycled water demand factors. These factors include the following:

- Average Day Demands
- Peak Day Demands
- Peak Hour Demands
- Operational Demands

Average Day Demands

The Average Day Demands (ADD) for each specific application are defined as the total annual irrigation water usage divided by the annual number of days in one year (365). This calculation provides results in the estimated flow rate serving each use if the recycled water were supplied on a continual basis over the entire year (24-hours per day over 365 days). The ADD for each use are calculated by multiplying the calculated irrigated surface area (in acres) by the average annual irrigation demand of 3.62 feet that was identified as part of Table 3.

Peak Day Demands

The Peak Day Demands (PDD) for each specific application are defined as the typical irrigation demand flow rate during the seasonal period of highest demand. As shown in Table 3, this typically occurs during the month of July. The maximum monthly irrigation demand during July is 9.2 inches, while the average monthly demand is 3.6 inches. As a result, the PDD is calculated by multiplying the ADD by the factor of 2.56 (9.2/3.6).

Peak Hour Demands

The Peak Hour Demands (PHD) for each specific application are defined as the PDD volume applied over the duration of irrigation within a given day. The PHD are obtained by multiplying the PDD by the peak hour demand peaking factor. The assumed duration of irrigation within the City is 9:00 p.m. to 6:00 a.m. or 9 hours. The peaking factor is calculated by the ratio of assumed irrigation duration within one 24-hour day, which results in a factor of 2.7 (24 hrs/9 hrs).

Operational Demands

There are several factors that influence the use of recycled water for irrigation on any specific site. These factors include the following:

- Specific land use
- Total irrigation area
- Type of irrigation system
- Irrigation system water application duration
- Seasonal variations
- Operation and maintenance preferences

As a result, the City applies a recycled water operational demand factor to the system to account for these system variations and to allow flexibility in the design and operation of the individual systems. The operational demand factor allows the City to plan their infrastructure knowing that variations in the design, duration and operation of the irrigations systems will result. The City has established an operational demand factor of 1.5 times the PHD. It should be noted that the operational demand factor is only applied to the sizing of the distribution system and not the sizing of the system storage volume.

Summary of Irrigation Demands

Table 6 provides a summary of the irrigation demands for the ARSP Area.

Table 6
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Summary of Irrigation Demands

Development	Total Acreage (AC)	Total Recycled Water Site Acreage (AC)	Total Recycled Water Irrigated Acreage (AC)	Annual Demand (AFY)	Peak Day Demand (GPD)	Peak Hour Demand (gpm)	Operational Demand (gpm)
Amoruso Ranch Specific Plan Area	694.4	147	76	272	621,334	1,151	1,726

Table 6 indicates an estimated operational irrigation demand for the ARSP Area of approximately 1,726 gpm. It is important to note that the recycled water irrigation demand value of 1,726 gpm is conservative for two reasons: 1) the base assumptions consider the irrigation application rates for all turf grass which is the highest agronomic demand value; and 2) reductions in the irrigation demand for water conservation factors discussed in a related study for ARSP have not been factored in at this point.

RECYCLED WATER SYSTEM INFRASTRUCTURE

The recycled water system that will be designed to serve the ARSP Area will include transmission and distribution facilities, connecting with the infrastructure within the Creekview Specific Plan Area directly south of the ARSP Area. The system facilities will be designed to provide adequate recycled water system pressures to the recycled water irrigation use sites. This section of the Plan discusses the facility sizing, operating requirements and compliance with the City's criteria.

SYSTEM DESCRIPTION

The recycled water system serving the ARSP Area connects to the City's overall recycled water system within Westbrook Boulevard at the point of transition between Creekview and the ARSP. The recycled water model developed for Creekview includes Node J14 that serves as the point of connection.

The backbone infrastructure serving the ARSP Area is shown on Figure 5. The transmission and distribution mains are located within the major arterial and collector roads to supply the projected recycled water use sites. Preliminary pipe sizes are shown on Figure 5. These pipe sizes were determined through the hydraulic model analyses completed as part of this Plan.

In general, the system is described as follows:

- The point of connection with the Creekview recycled water system is in Westbrook Boulevard at the southern point of the ARSP Project.
- A backbone pipeline is located within Westbrook Boulevard.
- Recycled water pipelines heading to the east from Westbrook Boulevard are located within Roads "A" and "D". These pipes are currently oversized for the ARSP recycled water demands and are sized for the future connections into Placer Ranch Area consistent with the regional system identified in previous studies completed for the City of Roseville.
- A looped piping system is located within the main street network, south of the future Placer Parkway, to serve the various potential recycled water customers throughout the development, including the parks, paseos, commercial centers, etc.

SYSTEM DESIGN CRITERIA

The City will be the owner and operator of the recycled water system, including responsibility for all operation and maintenance functions up to the meters for each individual customer. Onsite facilities, downstream of the individual site meters will be the responsibility of the customer.

The City has developed a set of criteria for the design of new recycled water transmission and distribution systems. The primary objectives of establishing the criteria are to ensure the system is capable of operating with adequate flows and pressures to serve the recycled water customers on a daily basis. The City has established criteria for minimum and maximum operating pressures, maximum pipe velocity and maximum headloss with the piping system. The criteria are summarized in Table 7.

Table 7
Amoruso Ranch Specific Plan
Recycled Water Master Plan
City Operational Criteria

Condition	Operating Value
Minimum Residual Pressure at System PHD	60 psi
Maximum Residual Pressure over Irrigation Period	100 psi
Maximum Pipe Velocity	5.0 fps
Maximum Headloss per 1,000 Feet of Pipe	5.0 ft

RECYCLED WATER SUPPLY

The City's policy is to commit to serving recycled water at the volumes identified and agreed to in this Recycled Water Master Plan. If at a future date, a land use change is applied for which results in an increase in the recycled water demands, the City shall not be obligated to serve the incremental increase in demands over what is identified in this Recycled Water Master Plan. A revised Recycled Water Master Plan will be required for approval by the City prior to any agreement to serve these incremental recycled water demands. Any agreement to serve would be dependent on available recycled water supplies at the time of the request.

We have performed an analysis of the committed supplies for the ARSP Area in comparison to the irrigation demands for the project. The comparison of volumes and rates cross references the wastewater master plan prepared for the ARSP that includes an Average Dry Weather Flow (ADWF) from the Amoruso Ranch Project of 0.554 MGD. Table 8 presents the committed available recycled water supply values for the ARSP Area.

Table 8
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Available Recycled Water Supply

Wastewater Effluent (ADWF) (MGD)	Wastewater Annual Flow (AFY)	Committed Recycled Water Supply (AF/month)
0.554	621	51.8

Table 9 includes a summary of the recycled water demands for the ARSP Area including estimated peak demand values. The values in Table 9 will be compared with values in Table 8 to predict if a source of supplemental supply will be required to meet the recycled water irrigation demands within the ARSP Area.

Table 9
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Recycled Water Demands

Acres Served by Recycled Water (AC)	Annual Demand (AFY)	Peak Demand (July) (MGD)	Peak Demand (AF/month)
76	272	0.621	58.2[1]

A comparison of the monthly recycled water irrigation demands for the ARSP Area can be compared against the available committed recycled water supply available from the City. Table 10 is the comparison.

[1] Value obtained by multiplying July Peak Demand by (1/12) x (365) x 3.079 to convert from million gallons per day to acre-feet per month.

Table 10
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Comparison of Recycled Water Supplies and Demands

Month	Irrigation Demand (AF)	Committed Recycled Water Supply (AF)	Surplus Supply (AF)	Supplemental Supply Required (Y/N)
January	0.0	51.8	51.8	N
February	0.0	51.8	51.8	N
March	3.0	51.8	48.8	N
April	20.3	51.8	31.5	N
May	36.1	51.8	15.7	N
June	50.3	51.8	1.5	N
July	57.9	51.8	- 6.1	Y
August	50.3	51.8	1.5	N
September	36.1	51.8	15.7	N
October	18.0	51.8	33.8	N
November	0.0	51.8	51.8	N
December	0.0	51.8	51.8	N
Total	**272**	-	-	-

Based on the discussions within the Water Conservation Plan prepared for the ARSP Area there is the potential of reducing the recycled water irrigation demands through the application of a series of water conservation measures. The estimated irrigation demand that could be reduced through water conservation (related to non-residential irrigation water conservation measures, front yard irrigated area water efficiencies for HDR parcels, and Smart Irrigation Controller water efficiencies for HDR, parks and paseos) is approximately 49 AFY. Through implementation of the water conservation measures, the demand for recycled water for irrigation purposes within the ARSP Area is reduced from 272 AFY to 223 AFY.

Table 11 provides a similar summary as Table 10, however it assumes that the water conservation measures have been implemented and the reduction in irrigation demands have been realized.

Table 11
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Comparison of Recycled Water Supplies and Demands with Conservation

Month	Irrigation Demand (AF)	Committed Recycled Water Supply (AF)	Surplus Supply (AF)	Supplemental Supply Required (Y/N)
January	0.0	51.8	51.8	N
February	0.0	51.8	51.8	N
March	2.5	51.8	49.3	N
April	16.6	51.8	35.2	N
May	29.6	51.8	22.2	N
June	41.3	51.8	10.5	N
July	47.4	51.8	4.4	N
August	41.3	51.8	10.5	N
September	29.6	51.8	22.2	N
October	14.8	51.8	37.0	N
November	0.0	51.8	51.8	N
December	0.0	51.8	51.8	N
Total	**223**	-	-	-

As shown in Table 10 and Table 11, the demand for recycled water within the ARSP Area can be met with the available supply from the project. Based on the projected numbers in the Tables there is one month, July, where the supply would be at a deficit to the demand and that would only occur under the scenario where conservation efforts were not met.

RECYCLED WATER STORAGE AND PUMPING

The issue of recycled water storage to serve the ARSP Area was addressed as part of the Creekview Recycled Water Master Plan. Within that document the storage of recycled water to serve both Creekview and ARSP was proposed to be located at a site adjacent to the City's existing Energy Park just north of Phillip Road at the intersection with West Park Drive. The following is an excerpt (page 11) from the *"Creekview Recycled Water Study Final Report, dated November 30, 2010, prepared by MacKay & Somps, for Granite Bay Development*":

> *"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. …An operational storage volume of 1MG is required to support the CSP, UR and Brookfield (Creekview Specific Plan, Urban Reserve and Amoruso Ranch). 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 operational demand comparison with the Creekview Recycled Water Master Plan indicates an operational demand of 1,296 gpm (Table 2-3 of the Creekview Recycled Water Master Plan) as compared to 1,726 gpm within this Study, resulting in a difference of 430 gpm.

The reservoir sizing contemplated to serve this region of the City is a 1.0-1.2 million gallon tank. The recycled water demands identified for ARSP differ from those identified within the Creekview Master Plan (a variation of 430 gpm) and would require an additional 0.2 million gallon of reservoir capacity (see Table 12). Therefore, an approximately 1.4 million gallon tank appears reasonable for planning purposes.

Table 12
Amoruso Ranch Specific Plan
Recycled Water Master Plan
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
CSP UR	38,387	768	0.04	0.05
Brookfield	621,334	12,427	0.64	0.77
Total	**-**	**-**	**1.15**	**1.38**

It is recommended that an additional regional evaluation of the recycled water system should be conducted to confirm the recommended reservoir capacity. This is especially true when considering Sierra Vista Specific Plan Area. As stated in the Creekview Recycled Water Study (page 12):

> *"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 2.8 MG. Therefore the total storage volume required to support Sierra Vista, Creekview, UR and Brookfield is 4.2 MG."*

In addition, the previous analyses completed as part of both Creekview and Sierra Vista identified an expansion to the recycled water pumping station to meet peak flow demands. Phasing of the pump station will be dependent on the sequence of development. A copy of the conceptual site plan developed as part of the Creekview Recycled Water Master Plan is included within Appendix C.

HYDRAULIC MODELING ANALYSIS

This section of the Plan presents a summary of the assumptions utilized in the hydraulic modeling analyses, discusses the hydraulic modeling scenarios and presents the conclusions developed from review of the model analyses data.

HYDRAULIC MODEL ASSUMPTIONS

The following are the assumptions that were utilized in the preparation and analysis of the hydraulic models for the proposed recycled water system serving the ARSP Area:

- The minimum pipeline diameter for modeling purposes is 6-inches.
- The recycled water system was modeled under steady-state conditions.
- A Hazen-Williams Coefficient "C" Factor of 130 was utilized. This represents a typical value for new pipe.
- The Operational Demand flows include a surcharge of 2% to account for system losses.
- The Hydraulic Grade Line (HGL) of the system at the point of connection with Creekview was assumed to be 201 feet, the reservoir height.

MODELING SCENARIOS

A system hydraulic model for the ARSP recycled water system was developed utilizing WaterCAD software. Both model input and output data were reviewed for consistency with City criteria and design standards. The system was modeled from the point of connection with the Creekview system. The system was modeled at PHD with consideration of the Operational Demands and the 2% increase to account for system losses.

MODELING RESULTS

Based on the system configuration and piping layout recommended for the ARSP recycled water system, the results of the hydraulic model runs were compared with the standards and criteria established by the City of Roseville. Table 12 presents a summary of the results. The results when compared to the City standards indicate that the system as configured conforms to the standards and meets the requirements of both the City and the project.

Table 13
Amoruso Ranch Specific Plan
Recycled Water Master Plan
Model Results

Operational Demand with 2% (GPM)	Minimum Service Pressure (PSI)	Maximum Service Pressure (PSI)	Maximum Pipeline Velocity (fps)
1,760	64.5	86.9	4.99

CONCLUSIONS

Based on the information contained within this Plan and the results of the hydraulic modeling, the following conclusions have been attained:

- The recycled water system identified within this Master Plan can adequately serve the potential recycled water demands within the ARSP Area.
- The system, as identified, meets the minimum criteria established by the City of Roseville for recycled water systems.
- Recycled water demands within the ARSP Area can be met with the committed supply generated by the ARSP Project.
- The recycled water system identified within this master plan is consistent with the previous work completed for both the Creekview project directly to the south of the ARSP Area and the City's regional recycled water system planning documents.
- The expansion of the West Roseville Recycled Water Pump Station and Reservoir site, as recommended within the Creekview Recycled Water Master Plan, will adequately meet the needs of the ARSP Project.

References

MacKay & Somps. 2010. *Creekview Specific Plan Recycled Water Study*. November.

RMC Water and Environment. 2010. *West Roseville Recycled Water Focused Study Technical Memorandum*. August.

MWH. 2006. *TM 1 - Unit Water Demand Factor Verification and Water Demand Evaluation and Update*. September.

Hydroscience Engineers Inc. 2003. *Recycled Water Study for West Roseville Specific Plan Area (Fiddyment Ranch/Westpark Properties)*. May.

Amoruso Ranch Specific Plan Area

Recycled Water Master Plan

Appendix A

Pipe Output Table
Junction Node Table

Scenario: Base
Current Time Step: 0.000Hr
FlexTable: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)	Notes
103	P-39	212	J-34	J-35	8.0	Ductile Iron	130.0	0	0.00	0.000	-
97	P-36	159	J-31	J-32	8.0	Ductile Iron	130.0	0	0.00	0.000	-
108	P-42	60	J-22	J-37	6.0	Ductile Iron	130.0	3	0.04	0.000	-
78	P-25	181	J-23	J-24	6.0	Ductile Iron	130.0	-8	0.09	0.000	-
109	P-43	53	J-37	J-23	6.0	Ductile Iron	130.0	-8	0.09	0.000	-
95	P-35	313	J-30	J-31	8.0	Ductile Iron	130.0	38	0.24	0.000	-
51	P-11	492	J-10	J-11	6.0	Ductile Iron	130.0	32	0.36	0.000	-
93	P-34	333	J-29	J-30	8.0	Ductile Iron	130.0	78	0.50	0.000	-
49	P-10	606	J-9	J-10	6.0	Ductile Iron	130.0	54	0.62	0.000	-
74	P-23	384	J-21	J-22	6.0	Ductile Iron	130.0	66	0.75	0.000	-
88	P-31	14	J-11	J-28	6.0	Ductile Iron	130.0	-74	0.84	0.001	-
91	P-33	526	J-3	J-29	8.0	Ductile Iron	130.0	142	0.91	0.000	-
111	P-44	54	J-24	J-38	6.0	Ductile Iron	130.0	-88	1.00	0.001	-
101	P-38	390	J-33	J-34	8.0	Ductile Iron	130.0	162	1.03	0.001	-
112	P-45	435	J-38	J-25	6.0	Ductile Iron	130.0	-98	1.11	0.001	-
89	P-32	799	J-28	J-12	6.0	Ductile Iron	130.0	-98	1.11	0.001	-
55	P-13	615	J-12	J-13	6.0	Ductile Iron	130.0	-121	1.37	0.001	-
57	P-14	37	J-13	J-14	6.0	Ductile Iron	130.0	-129	1.46	0.002	-
59	P-15	1,113	J-14	J-15	6.0	Ductile Iron	130.0	-129	1.46	0.002	-
120	P-50	127	J-15	J-41	6.0	Ductile Iron	130.0	-154	1.75	0.002	-
72	P-22	592	J-20	J-21	6.0	Ductile Iron	130.0	159	1.81	0.002	-
106	P-41	75	J-36	J-20	6.0	Ductile Iron	130.0	159	1.81	0.002	-
121	P-51	455	J-41	J-16	6.0	Ductile Iron	130.0	-165	1.88	0.003	-
68	P-20	25	J-18	J-19	6.0	Ductile Iron	130.0	168	1.91	0.003	-
105	P-40	420	J-19	J-36	6.0	Ductile Iron	130.0	168	1.91	0.003	-
63	P-17	119	J-16	J-17	6.0	Ductile Iron	130.0	-183	2.08	0.003	-
66	P-19	704	J-9	J-18	6.0	Ductile Iron	130.0	188	2.14	0.003	-
99	P-37	511	J-5	J-33	8.0	Ductile Iron	130.0	353	2.25	0.003	-
82	P-27	539	J-25	J-26	6.0	Ductile Iron	130.0	-202	2.29	0.004	-
39	P-5	669	J-4	J-5	12.0	Ductile Iron	130.0	952	2.70	0.002	-
47	P-9	105	J-8	J-9	6.0	Ductile Iron	130.0	243	2.76	0.005	-
37	P-4	710	J-3	J-4	12.0	Ductile Iron	130.0	1,007	2.86	0.003	-
45	P-8	1,276	J-7	J-8	6.0	Ductile Iron	130.0	257	2.92	0.006	-
43	P-7	300	J-6	J-7	8.0	Ductile Iron	130.0	500	3.19	0.005	-
118	P-49	570	J-40	J-6	8.0	Ductile Iron	130.0	500	3.19	0.005	-
35	P-3	1,320	J-2	J-3	12.0	Ductile Iron	130.0	1,149	3.26	0.003	-
85	P-29	28	J-26	J-27	6.0	Ductile Iron	130.0	-316	3.58	0.009	-
114	P-46	279	J-17	J-39	8.0	Ductile Iron	130.0	-572	3.65	0.006	-
115	P-47	1,960	J-39	J-2	8.0	Ductile Iron	130.0	-598	3.82	0.007	-
117	P-48	79	J-5	J-40	8.0	Ductile Iron	130.0	599	3.83	0.007	-
86	P-30	611	J-27	J-17	6.0	Ductile Iron	130.0	-389	4.41	0.013	-
31	P-1	23	R-1	J-1	12.0	Ductile Iron	130.0	1,747	4.96	0.007	-
33	P-2	1,737	J-1	J-2	12.0	Ductile Iron	130.0	1,747	4.96	0.007	-

Scenario: Base
Current Time Step: 0.000Hr
FlexTable: Junction Table

ID	Label	Notes	Elevation (ft)	Demand Collection	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
30	J-1	-	83.00	<Collection: 0 items>	0	283.84	86.9
32	J-2	-	92.27	<Collection: 0 items>	0	271.47	77.5
34	J-3	-	97.53	<Collection: 0 items>	0	267.14	73.4
38	J-5	-	101.47	<Collection: 0 items>	0	263.77	70.2
40	J-6	-	98.71	<Collection: 0 items>	0	260.33	69.9
46	J-9	-	91.98	<Collection: 0 items>	0	250.59	68.6
56	J-14	-	82.08	<Collection: 0 items>	0	252.11	73.6
62	J-17	-	84.38	<Collection: 0 items>	0	255.84	74.2
67	J-19	-	94.92	<Collection: 0 items>	0	248.15	66.3
69	J-20	-	93.77	<Collection: 0 items>	0	246.82	66.2
75	J-23	-	96.14	<Collection: 0 items>	0	245.17	64.5
96	J-32	-	89.13	<Collection: 0 items>	0	266.81	76.9
102	J-35	-	103.73	<Collection: 0 items>	0	262.17	68.5
116	J-40	AR-19	101.13	<Collection: 1 item>	100	263.21	70.1
77	J-24	AR-36	94.33	<Collection: 1 item>	80	245.17	65.3
100	J-34	AR-38	102.99	<Collection: 1 item>	162	262.17	68.9
90	J-29	AR-44	93.49	<Collection: 1 item>	64	266.88	75.0
71	J-21	AR-50	95.14	<Collection: 1 item>	93	245.35	65.0
81	J-26	AR-51	87.59	<Collection: 1 item>	114	247.72	69.3
79	J-25	AR-52	90.28	<Collection: 1 item>	104	245.65	67.2
98	J-33	AR-53	101.60	<Collection: 1 item>	191	262.41	69.6
92	J-30	AR-54	90.53	<Collection: 1 item>	40	266.83	76.3
94	J-31	AR-55	90.72	<Collection: 1 item>	38	266.81	76.2
119	J-41	AR-57	83.22	<Collection: 1 item>	11	254.25	74.0
87	J-28	AR-61	87.45	<Collection: 1 item>	24	250.33	70.5
42	J-7	AR-62	97.23	<Collection: 1 item>	243	258.81	69.9
58	J-15	AR-63	83.04	<Collection: 1 item>	25	253.96	73.9
50	J-11	AR-64	88.75	<Collection: 1 item>	105	250.32	69.9
73	J-22	AR-65	96.62	<Collection: 1 item>	63	245.17	64.3
84	J-27	AR-66	88.52	<Collection: 1 item>	73	247.96	69.0
36	J-4	AR-67	102.65	<Collection: 1 item>	55	265.31	70.4
54	J-13	AR-71	83.13	<Collection: 1 item>	8	252.05	73.1
52	J-12	AR-72	86.65	<Collection: 1 item>	23	251.14	71.2
48	J-10	AR-73	90.75	<Collection: 1 item>	23	250.38	69.1
44	J-8	AR-74	92.21	<Collection: 1 item>	14	251.15	68.8
60	J-16	AR-75	83.87	<Collection: 1 item>	18	255.46	74.2
104	J-36	AR-76	94.98	<Collection: 1 item>	9	247.00	65.8
65	J-18	AR-77	96.26	<Collection: 1 item>	20	248.22	65.7
107	J-37	AR-78	96.39	<Collection: 1 item>	11	245.17	64.4
110	J-38	AR-79	93.73	<Collection: 1 item>	9	245.22	65.5
113	J-39	AR-80	86.20	<Collection: 1 item>	26	257.65	74.2

Amoruso Ranch Specific Plan Area

Recycled Water Master Plan

Appendix B

Figure 5: ARSP Recycled Water Pipe Network

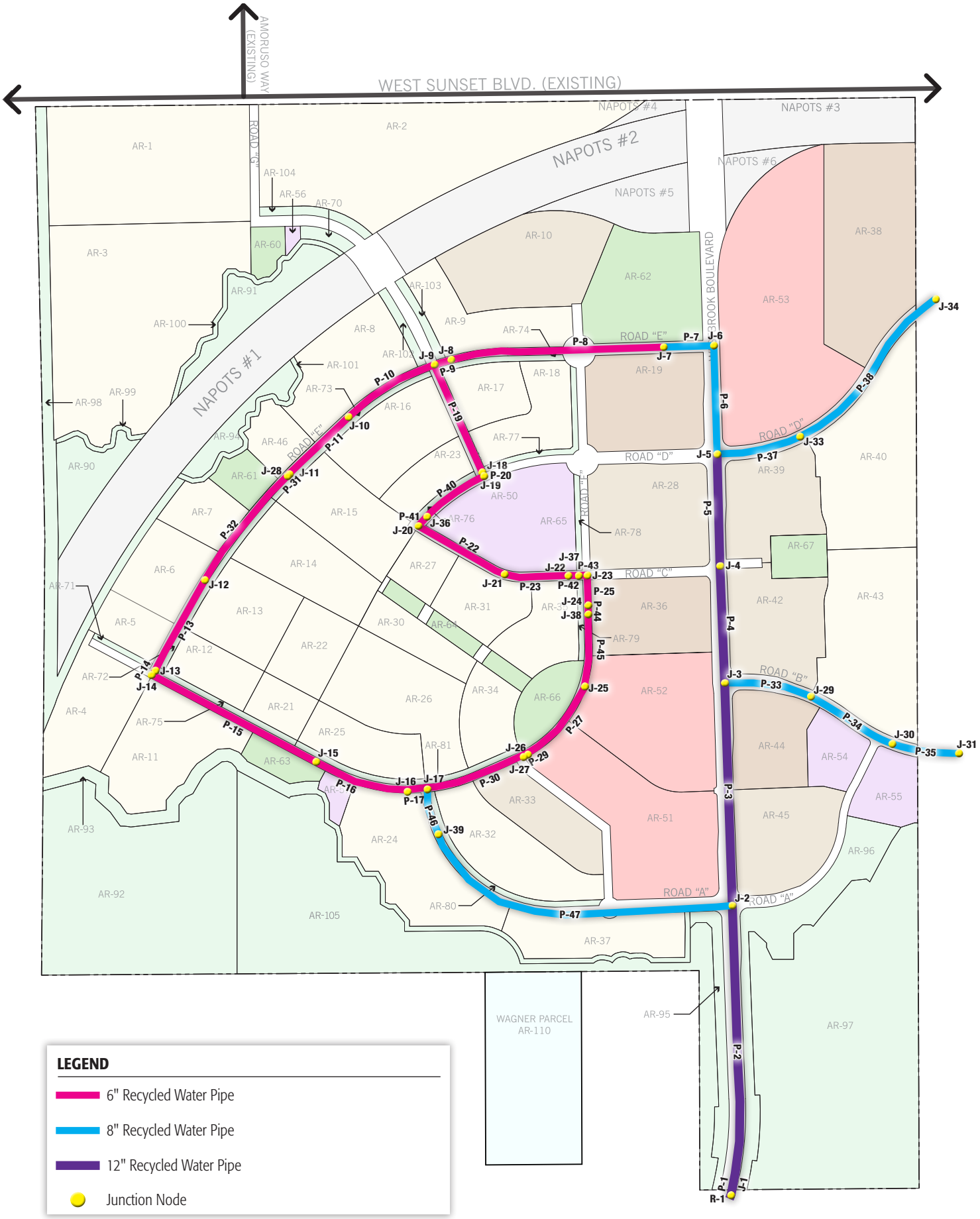

Figure 5: Amoruso Ranch *(Recycled Water Pipe Network)*

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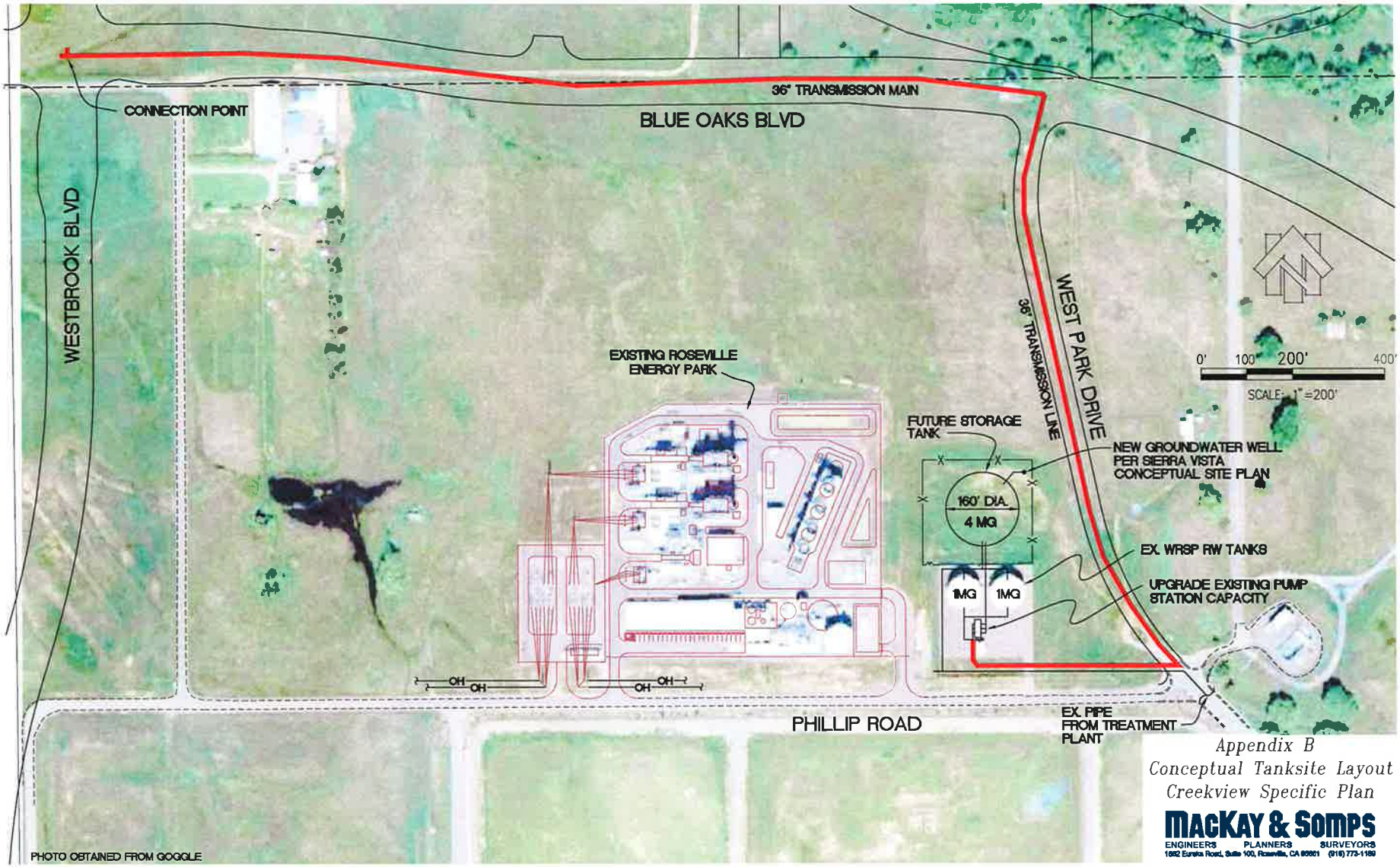
Amoruso Ranch Specific Plan Area

Recycled Water Master Plan

Appendix C

Conceptual Tank Site Layout
Creekview Specific Plan



Appendix B
Conceptual Tanksite Layout
Creekview Specific Plan

MacKay & Somps
ENGINEERS PLANNERS SURVEYORS
1682 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1159

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

Kimley»Horn

555 Capitol Mall, Suite 300
Sacramento, CA 95814
Phone: 916.858.5800

www.kimley-horn.com