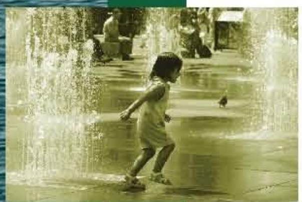
APPENDIX E

WATER SUPPLY ASSESSMENT



Amoruso Ranch Specific Plan Water Supply Assessment

Prepared for

City of Roseville

May 2016

415-12-15-24

WEST YOST ASSOCIATES

consulting engineers

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Water Supply Assessment

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James P. Connell

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List of Acronyms and Abbreviations

af	Acre-Feet
af/yr	Acre-Feet Per Year
ASR	Aquifer Storage and Recovery
CEQA	California Environmental Quality Act
City	City of Roseville
CVP	Central Valley Project
EIR	Environmental Impact Report
gpd/DU	Gallons Per Day Per Dwelling Unit
GMP	Groundwater Management Plan
HDR	High Density Residential
LDR	Low Density Residential
MFP	American River Middle Fork Project
OCAP	Operations Criteria and Plan
PCWA	Placer County Water Agency
PG&E	Pacific Gas & Electric Company
Proposed Project	Amoruso Ranch Specific Plan
SB 221	California State Senate Bill 221 of 2001 (California Government Code Section 66473.7)
SB 610	California State Senate Bill 610 of 2001 (California Water Code Sections 10910 Through 10915)
SIA	Sunset Industrial Area
SJWD	San Juan Water District
SOI	Sphere of Influence
SPWA	South Placer Wastewater Authority
USBR	U.S. Bureau of Reclamation
UWMP	Urban Water Management Plan
WPWMA	Western Placer Waste Management Authority
WSA	Water Supply Assessment

EXECUTIVE SUMMARY

The proposed Amoruso Ranch Specific Plan Project (Proposed Project), if approved, would be constructed on property to the northwest of, but to be annexed into, the City of Roseville (City). An Environmental Impact Report (EIR) is being prepared for the Project. The purpose of this Water Supply Assessment (WSA) is to support the Environmental Impact Report (EIR) for the Proposed Project and to perform the evaluation required by Water Code sections 10910 through 10915 in connection with the City's Proposed Project. This WSA is not intended to reserve water, or to function as a "will serve" letter or any other form of commitment to supply water (see Water Code section 10914). The provision of water service will continue to be undertaken in a manner consistent with applicable City policies and procedures, consistent with existing law.

This WSA includes discussion of the projected potable and recycled water demands of the Proposed Project (Section 2), determinations required under applicable regulations (Section 3), the City and Placer County Water Agency (PCWA) water service areas (Section 4), the City and PCWA projected potable and recycled water demands through the year 2035 (Section 5), and the City and PCWA projected water supply sources and reliability through the year 2035 (Section 6). This WSA also documents the plan to ensure that sufficient water supplies will be available to serve the Proposed Project and the other planned development in the City water service area through the planning period (Section 7). Finally, the water supply assessment approval process (Section 8) and additional information in support of the California Environmental Quality Act (CEQA) process (Section 9) are discussed.

The projected potable water demand and supplies documented in this WSA are based on the City's adopted 2010 Urban Water Management Plan (UWMP), the PCWA 2010 UWMP, and additional documents provided by the City and PCWA. Water Code section 10910(c)(4) states that:

> "*…the water supply assessment for the project shall include a discussion with regard to whether the total projected water supplies, determined to be available by the city or county for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses.*"

Based on the technical analyses described in this WSA, the City finds that this requirement is not met. Therefore, the City is proposing to contract with PCWA to provide the necessary additional surface water and associated treatment of water supplies to serve the Proposed Project. Documentation of the availability of this water to be allocated is provided in this WSA. The City and PCWA do find that, with the additional allocation, the City's revised total projected water supplies will meet the above requirement from Water Code section 10910(c)(4), as documented in this WSA.

1.0 INTRODUCTION

The Proposed Project, if approved, would be constructed on property northwest of, and to be annexed into, the City. The purpose of this Water Supply Assessment is to support the EIR for the Proposed Project. Key topics covered in this introduction include:

- Legal Requirements for the Water Supply Assessment
- Need for and Purpose of Water Supply Assessment
- Water Supply Assessment Preparation, Format and Organization

1.1 Legal Requirements for the Water Supply Assessment

California Senate Bill 610 (SB 610) and Senate Bill 221 (SB 221) amended state law, effective January 1, 2002, to improve the link between information on water supply availability and certain land use decisions made by cities and counties. SB 610 and SB 221 were companion measures that sought to promote more collaborative planning between local water suppliers and cities and counties. Both statutes require that detailed information regarding water availability be provided to the city and county decision-makers prior to approval of large development projects. The purpose of providing such information is to ensure that prudent water supply planning has been conducted, and that planned water supplies are adequate to meet existing demands, anticipated demands from approved projects, and the demands of proposed projects.

SB 610 amended California Water Code sections 10910 through 10915 to require agencies responsible for land use decisions:

1. To identify the public water purveyor(s) that may supply water for a proposed development project; and
2. To request a WSA from the identified water purveyor(s).

The City is the identified water purveyor for the Proposed Project. The purpose of the WSA is to demonstrate the sufficiency of the purveyor's water supplies to satisfy the water demands of the proposed project, while still meeting the water purveyor's obligations with regard to existing and planned future uses. Water Code sections 10910 through 10915 delineate the specific information that must be included in the WSA.

SB 221 amended State law (California Government Code section 66473.7) to require that approval by a city or county of certain residential subdivisions[1] requires an affirmative written verification of sufficient water supply. SB 221 was intended as a fail-safe mechanism to ensure that collaboration on finding the needed water supplies to serve a new large residential subdivision occurs before construction begins.

[1] Per Government Code Section 66473.7(a)(1) subdivision means a proposed residential development of more than 500 dwelling units.

1.2 Need for and Purpose of Water Supply Assessment

The purpose of this WSA is to perform the evaluation required by Water Code Sections 10910 through 10915 in connection with the City's Proposed Project. This WSA is not intended to reserve water, or to function as a "will serve" letter or any other form of commitment to supply water (see Water Code section 10914). The provision of water service will continue to be undertaken in a manner consistent with applicable City policies and procedures, consistent with existing law.

1.3 Water Supply Assessment Preparation, Format and Organization

The format of this WSA is intended to clearly delineate compliance with the specific requirements for a WSA, per Water Code sections 10910 through 10915. This WSA includes the following sections:

- Section 1: Introduction
- Section 2: Description of Proposed Project
- Section 3: Required SB 610 Determinations
- Section 4: City of Roseville and PCWA Water Service Area
- Section 5: City of Roseville and PCWA Water Demands
- Section 6: City of Roseville and PCWA Water Supplies
- Section 7: Determination of Water Supply Sufficiency Based on the Requirements of SB 610
- Section 8: Water Supply Assessment Approval Process
- Section 9: Additional Material to Support CEQA Analyses
- Section 10: References

Relevant citations of Water Code sections 10910 through 10915 are included throughout this WSA to demonstrate compliance with the specific requirements of SB 610.

2.0 DESCRIPTION OF PROPOSED PROJECT

A general description of the Proposed Project location, proposed land uses, projected water demand, and proposed water supply is provided below.

2.1 Proposed Project Location

The location of the Proposed Project in relation to the current City Limits is shown on Figure 2-1. The Proposed Project is located outside the existing City limits and consists of approximately 694-acres that includes 20 acres of urban reserve.

Historically, the parcel had been used as a cattle ranch. The primary use was open grazing land, but included a small ranch house and outbuildings. An agricultural well is located on site and was used for rice farming on a portion of the site.

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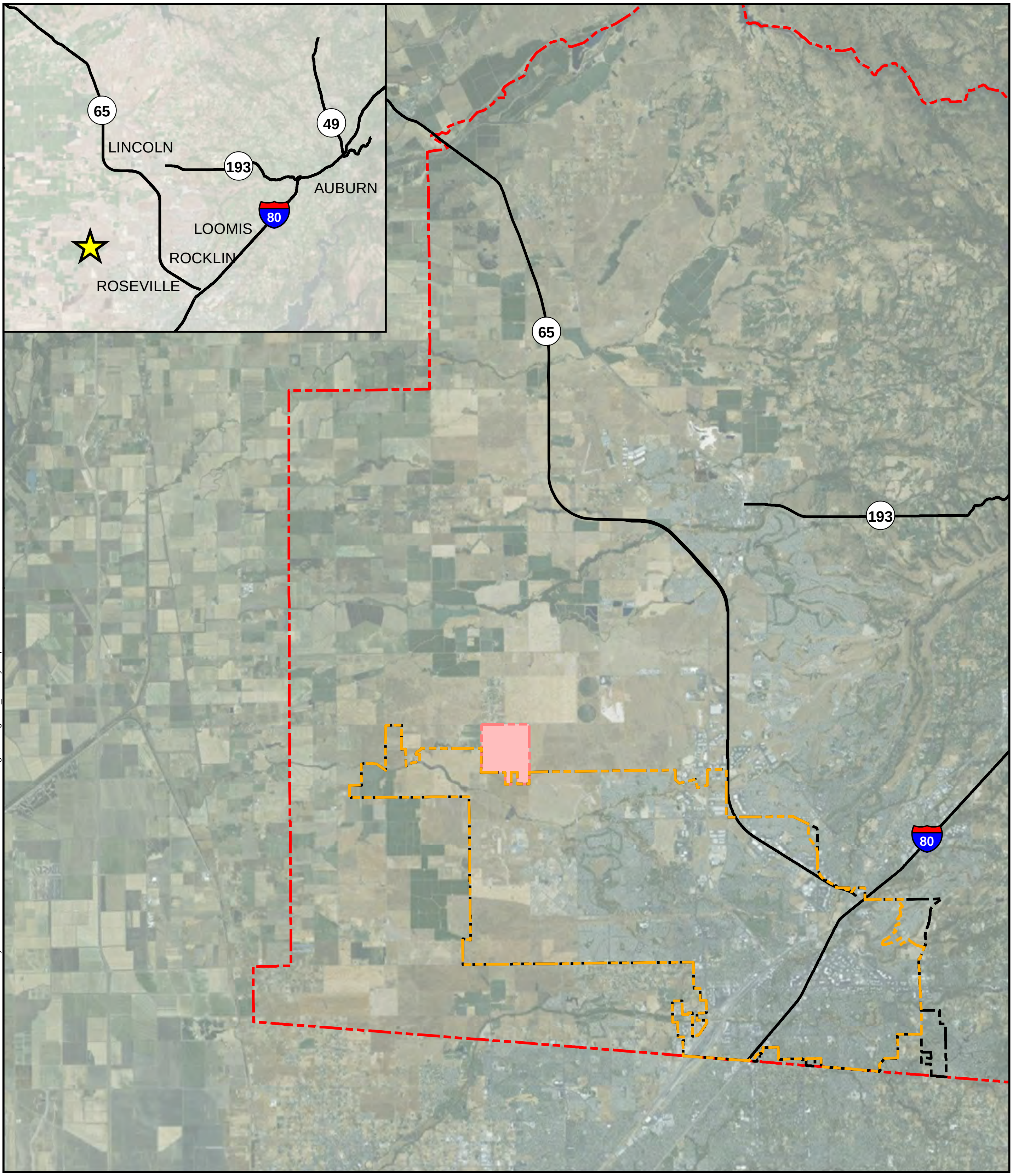

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Symbology

- Amoruso Ranch Project Location
- Roseville Water Service Area
- Roseville City Limits
- Placer County

N

0 7,500 15,000

Scale in Feet

Figure 2-1

Proposed Project Vicinity

City of Roseville
Water Supply Assessment
for Amoruso Ranch

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The land is gently rolling terrain, with the elevation decreasing from the northeast to the southwest. Minor drainages flow in a radial pattern from a slight rise in the northeast quadrant of the property. 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 associated flora and fauna are located in small areas typically along the drainage corridors and in flats along the southern boundary.

To the north is agricultural land and the existing Amoruso Estates, a rural subdivision of two to five acre parcels. To the northeast, approximately one mile away, is the Placer County Regional Landfill operation. The City of Lincoln Sphere of Influence (SOI) extends south to approximately one-mile north of the Proposed Project.

To the east of the Proposed Project is another potential development area known as Placer Ranch. Placer Ranch is comprised of 2,213 acres, and, if approved, would be comprised of both residential and non-residential land uses. This project was under review by the City of Roseville, but the development application for Placer Ranch was withdrawn as of September 22, 2015. East of Fiddyment Road, encompassing a portion of the Placer Ranch project area, is the existing Sunset Industrial Area. Placer County is currently updating the master plan for that area.

To the southwest of the Proposed Project is the Al Johnson Wildlife Area project planned by the City of Roseville. The City will develop the Al Johnson Wildlife Area as a major storm water detention facility and future open space recreation facility. In addition, west of the project area is an active cattle ranch (Gleason property).

Immediately south of the Proposed Project is the Creekview Specific Plan area, and the existing City of Roseville corporate boundary. The Creekview project consists of 2,011 residential units, an elementary school and parks and open space. Access and infrastructure connections to serve the Proposed Project will be through the Creekview Specific Plan area.

The Proposed Project consists of a mixture of residential, commercial and mixed-use areas, with supporting public facilities, including parks and schools. The project will require an approval by the Placer County Local Agency Formation Commission of an annexation to the City of Roseville.

2.2 Proposed Land Uses

Proposed land uses for the Proposed Project are shown in Figure 2-2 and summarized in Table 2-1. The goal of the Proposed Project is to provide a livable community where housing, recreation, education, retail and employment opportunities are integrated into an urban village. This village is envisioned as a contemporary version of a small walkable town, where walking and biking to recreation opportunities and to perform everyday errands such that automobile use can be minimized.

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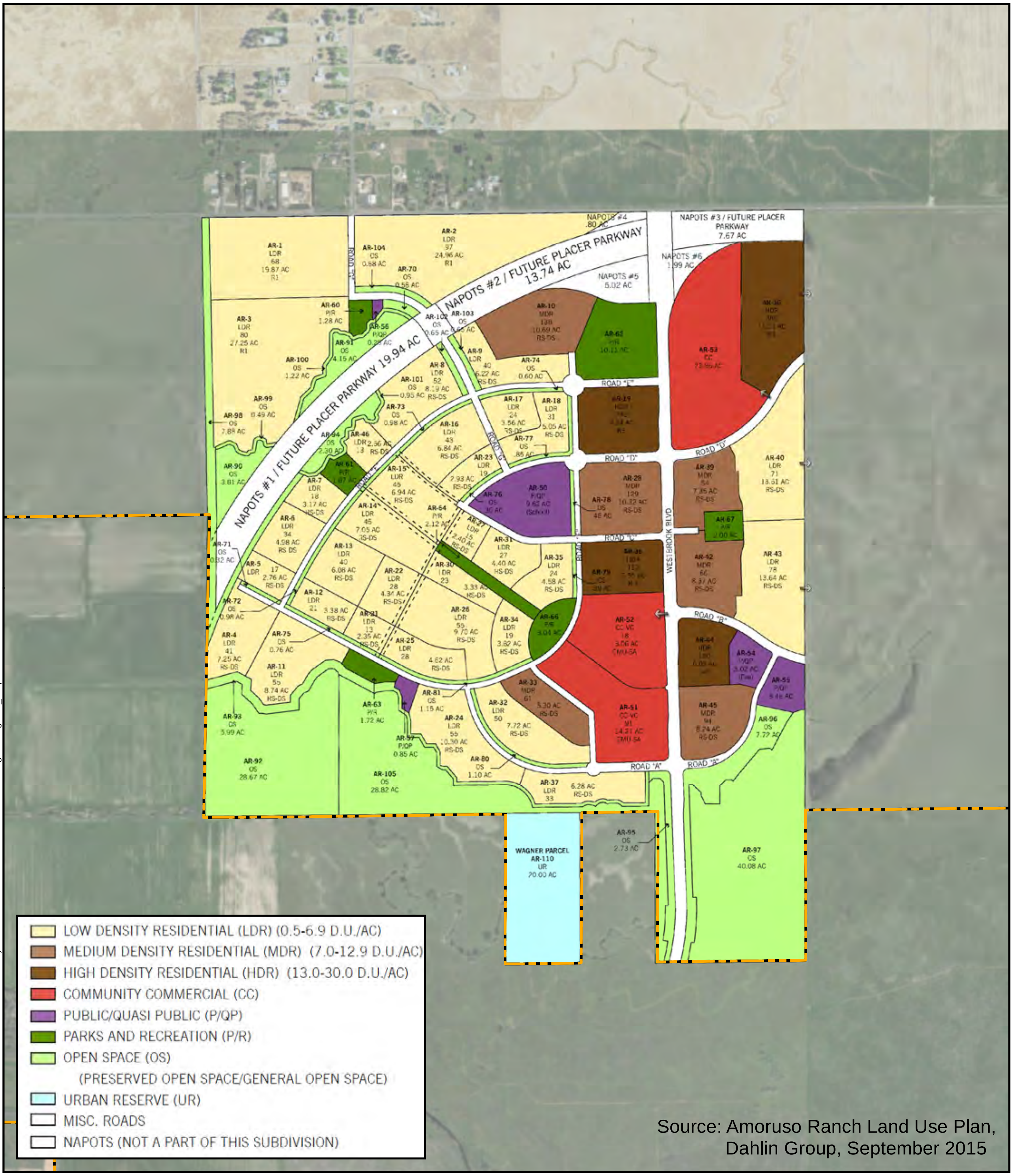

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Symbology

Roseville Water Service Area

Roseville City Limits

0 600 1,200

Scale in Feet

Figure 2-2

Proposed Land Uses for Proposed Project

City of Roseville
Water Supply Assessment
for Amoruso Ranch

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The Proposed Project includes up to 2,827 residential dwelling units, with housing types including low density residential (LDR), medium density residential (MDR), and high density residential (HDR). Non-residential land uses include 145 acres set aside for permanent open space; 22 acres for parks; 17 acres of public/quasi-public uses (elementary school, substation, well site, and recycling drop off areas); and 27 acres for a mixed use commercial (commercial, office, residential) village center. One non-participating parcel is located on the south end of the site and is referred to as the Wagner Property. It is proposed that this parcel be designated for urban reserve, and would be annexed as part of the Proposed Project.

Table 2-1. Proposed Land Uses for the Proposed Project[(a)]

Proposed Land Use	Land Use Abbreviation	Amoruso Ranch Specific Plan Land Use, Acres	Dwelling Units
Low Density Residential/Single Family	LDR	248.77	1,302
Medium Density Residential/Single Family	MDR	50.27	542
High Density Residential/Multi-Family	HDR	38.13	873
Community Commercial – Village Center	CMU-SA	27.27	109
Community Commercial	CC	23.85	—
Open Space (Paseos)	OS	10.71	—
Open Space (General)	OS	37.24	—
Open Space (Preserve)	OS	97.58	—
Parks and Recreation	PR	22.14	—
Public/Quasi-Public (School)	P/QP	9.62	—
Public/Quasi-Public (Fire Station and Utility)	P/QP	7.61	—
Urban Reserve (Wagner Ranch)	UR	20.00	—
Road Right-of-Way, etc.	ROW	52.04	—
Not a Part of this Subdivision	NAPOTS	49.16	—
Total Proposed Project		694.39	2,827

(a) Land Use area and Development Intensity as included in Table 3 of the Water Conservation Master Plan, Kimley Horn, September 2015.

2.3 Proposed Project Projected Water Demand

Water use factors and assumptions, and the projected water demand for the Proposed Project, were based on the Amoruso Ranch Water Master Plan (Kimley Horn, February 2015, Appendix A), Water Conservation Plan (Kimley Horn, September 2015, Appendix B), and Recycled Water Master Plan (Kimley Horn, September 2015, Appendix C) and are described below. City standard land use based water use factors shown in Table 2-2 were applied to the proposed land uses shown in Table 2-1 to develop total water demands.

Table 2-2. City of Roseville Unit Water Demand Factors

Residential Land Use Categories	Unit Demand Factor, gpd/DU
LDR1 (<3.5 DUs / Acre)	728
LDR2 (3.5 to 5 DUs / Acre)	600
LMDR1 (>5.0 to 6.0 DUs / Acre)	521
LMDR2 (>6.0 to 8.0 DUs / Acre)	430
MDR (>8.0 to 12.0 DUs / Acre)	323
HDR1 (>12.0 to 16.0 DUs / Acre)	288
HDR2 (>16.0 DUs / Acre)	177
Non Residential Land Use Categories	**Unit Demand Factor, gpd/AC**
Community Commercial / Retail	2,598
Business Professional	2,598
Light Industrial	2,598
Industrial	2,562
Railyard	109
Elementary School	3,454
High School	4,069
Pubic / Quasi-Public	1,780
Parks	2,988
Open Space / Right of Way	0

The Proposed Project total water demand projection is shown in Table 2-3. As shown in that table, the total water demand is 1,503 acre-feet per year (af/yr), based on the City's water demand factors and an assumed water loss factor of 2 percent. The total water demand was then modified to account for proposed potable and recycled water conservation measures and recycled water use, as shown in Table 2-4. The result is a projected net potable water demand of approximately 1,067 af/yr using a projected recycled water use of approximately 272 af/yr and potable water conservation of approximately 165 af/yr.

Table 2-3. Amoruso Ranch Total Water Demand Projection[a]						
Land Use	Abbreviation/Zoning	Total Area, acres	Dwelling Unit Count	Water Use Factor, gpd/du or gpd/acre	Daily Water Demand, gpd	Annual Water Demand, af/yr
Residential						
< 3.5 DU / Acre	LDR1		148	728	107,744	120.7
> 3.5 to 5 DU / Acre	LDR2		116	600	69,600	78.0
> 5 to 6 DU / Acre	LMDR1		401	521	208,921	234.0
> 6 to 8 DU / Acre	LMDR2		757	430	325,510	364.6
> 8 to 12 DU / Acre	MDR		155	323	50,065	56.1
> 12 to 16 DU / Acre	HDR1		380	288	109,440	122.6
> 16 DU / Acre	HDR2		760	177	134,520	150.7
Subtotal - Residential		337.17	2,717		1,005,800	1,126.6
Non-Residential						
Community Commercial - Village Center Non-Residential	CMU-SA	27.27		2,598	70,847	79.4
Community Commercial - Village Center Residential	CMU-SA		109	288	31,392	35.2
Community Commercial	CC	23.85		2598	61,962	69.4
Elementary Schools	P/QP (School)	9.62		3,454	33,227	37.2
Public (Fire Station, Utility, etc.)	P/QP	7.61		1,780	13,546	15.2
Parks & Recreation	PR	22.14		2,988	66,154	74.1
Open Space (Paseos)	OS	10.71		2,988	32,001	35.8
Open Space (General)	OS	37.24		0	-	-
Open Space (Preserve)	OS	97.58		0	-	-
Rights-of-Way	ROW	52.04		0	-	-
Not a Part of This Subdivision	NAPOTS	49.16		0	-	-
Urban Reserve	UR	20.00	1	728	728	0.8
Subtotal Non-Residential		357.22	110.00		309,859	347.09
Total Metered Water Demand		694.39	2,827		1,315,659	1,473.7
Unaccounted for System Losses (2%)						29.5
Total Water Demand						1,503.2

[a] From Amoruso Ranch Water Master Plan, Kimley Horn, February 2015.

Table 2-4. Amoruso Ranch Specific Plan Projected Water Demand at Buildout, af/yr

Land Use Type	Total Annual Water Demand[a]	Potable Water Conservation[b]			Recycled Water Use			Net Potable Water Demand[e]
		Modified Turf	Smart Irrigation Timers	Insta-Hot Water	Base Recycled Water Use[c]	Recycled Water Conservation[b]	Net Recycled Water Use[d]	
Residential								
Low Density Residential	432.7	41.4	67.2	5.6	-	-	-	318.5
Medium Density Residential	420.7	11.2	18.2	7.7	-	-	-	383.7
High Density Residential	273.3	-		9.6	54.8	15.7	39.1	208.9
Subtotal Residential	1,126.6	52.6	85.4	22.8	54.8	15.7	39.1	911.0
Mixed Use and Urban Reserve								
Community Commercial - Village Center - Residential	35.2	-	-	0.9	-	-	-	34.2
Urban Reserve (Wagner Property)	0.8	-	-	0.0	-	-	-	0.8
Subtotal Mixed Use and Urban Reserve	36.0	-	-	0.9	-	-	-	35.1
Non-Residential								
Community Commercial - Village Center Non-Residential	79.4	-	-	-	29.4	-	29.4	50.0
Community Commercial	69.4	-	-	-	25.8	-	25.8	43.6
Open Space (Paseos)	35.8	0.8	0.8	-	30.1	10.5	19.6	4.1
Open Space (General)	-	-	-	-	-	-	-	-
Open Space (Preserve)	-	-	-	-	-	-	-	-
Parks & Recreation	74.1	0.7	0.7	-	67.7	23.3	44.4	5.0
Elementary Schools	37.2	-	-	-	17.3	-	17.3	19.9
Public (Fire Station, Utility, etc.)	15.2	-	-	-	13.1	-	13.1	2.1
Rights-of-Way[f]	-	-	-	-	33.7	-	33.7	(33.7)
Subtotal Non-Residential	311.1	1.5	1.5	-	217.1	33.8	183.3	91.0
Total Metered Demand	1,473.7	54.1	86.9	23.7	271.9	49.5	222.4	1,037.1
Unaccounted for System Losses (2%)	29.5							29.5[g]
Total Water Supply Required	1,503.2	54.1	86.9	23.7	271.9	49.5	222.4	1,066.6

(a) See Table 2-3.

(b) From Amoruso Ranch Water Conservation Plan, Kimley Horn, September 2015.

(c) From Amoruso Ranch Recycled Water Master Plan, Kimley Horn, September 2015.

(d) Base Recycled Water Use minus Recycled Water Conservation.

(e) Total Annual Water Demand minus Potable Water Conservation and Base Recycled Water Use.

(f) Total Annual Water Demand for Rights-of-Way is included in all other land use types and not itemized, but recycled water demand for Rights-of-Way is itemized. Therefore, the Net Potable Water Demand for Rights-of-way results in a negative value.

(g) System Loss is based on Total Annual Water Demand.

2.4 Projected Water Supply for Proposed Project

The water demands for the Proposed Project will be served using the City's existing and future portfolio of potable and non-potable (recycled) water supplies, as discussed below. As documented herein, the City does not have sufficient water supply contracts in place to serve the Proposed Project. For projects where existing City water supply contracts are inadequate, the City's General Plan Land Use Element, on page II-52, states:

> "Any development proposal west of Roseville that does not have a sufficient supply of surface water shall secure additional supplies above what the City currently has available. Development proposals shall also provide financial assistance to incorporate the new source of supply into the City's water supply portfolio (surface water, groundwater and recycled water); and development proposals shall include measures to reduce water demand by implementing the use of conservation best management practices, recycled water and other off-sets."

Therefore, this provision requires the Proposed Project proponents to seek additional sources of surface water supplies. PCWA has determined that it has sufficient water supplies to serve the Proposed Project. The City and PCWA intend to enter into an agreement such that PCWA will wholesale potable water to serve the Proposed Project.

3.0 REQUIRED DETERMINATIONS

The following determinations must be made, pursuant to SB 610.

3.1 Does SB 610 apply to the Proposed Project?

Water Code sections 10910 and 10912 state:

> *10910 (a) Any city or county that determines that a project, as defined in Section 10912, is subject to the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) under Section 21080 of the Public Resources Code shall comply with this part.*
>
> *10912 (a) "Project" means any of the following:*
>
> *(1) A proposed residential development of more than 500 dwelling units.*
>
> *(2) A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space.*
>
> *(3) A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.*
>
> *(4) A proposed hotel or motel, or both, having more than 500 rooms.*
>
> *(5) A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.*

(6) A mixed-use project that includes one or more of the projects specified in this subdivision.

(7) A project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500-dwelling unit project.

Based on the following, SB 610 does apply to the Proposed Project.

1. The City of Roseville has determined that the Proposed Project is subject to the CEQA and that an EIR is required.
2. The Proposed Project, with its proposed 2,827 residential dwelling units, and other non-residential land uses, meets the definition of a "Project" as specified in Water Code section 10912(a) paragraph (1) as defined for residential development.

The Proposed Project has not been the subject of a previously adopted WSA and has not been included in an adopted WSA for a larger project. Therefore, according to Water Code section 10910(a), a WSA is required for the Proposed Project.

3.2 Does SB 221 apply to the Proposed Project?

In 2001, SB 221 amended State law to require that approval by a city or county of certain residential subdivisions requires an affirmative written verification of sufficient water supply. Per California Government Code section 66473.7(a)(1), a subdivision means a proposed residential development of more than 500 dwelling units. The Proposed Project, with its proposed 2,827 residential dwelling units, is therefore subject to the requirements of SB 221.

3.3 Who is the identified public water system?

Water Code sections 10910 and 10912 state:

10910(b) The city or county, at the time that it determines whether an environmental impact report, a negative declaration, or a mitigated negative declaration is required for any project subject to the California Environmental Quality Act pursuant to Section 21080.1 of the Public Resources Code, shall identify any water system that is, or may become as a result of supplying water to the project identified pursuant to this subdivision, a public water system, as defined by Section 10912, that may supply water for the project

10912 (c) "Public water system" means a system for the provision of piped water to the public for human consumption that has 3,000 or more service connections…

As shown on Figure 2-1, the Proposed Project is not currently located within the City of Roseville City Limits. The property is proposed to be annexed into the City limits as part of the approval process. The City's water system service area includes all areas within the City Limits as they are annexed into the City. Therefore, the City is the identified public water system for the Proposed Project.

3.4 Does the City have an adopted Urban Water Management Plan (UWMP) and does the UWMP include the projected water demand for the Proposed Project?

Water Code section 10910 states:

> *10910(c)(1) The city or county, at the time it makes the determination required under Section 21080.1 of the Public Resources Code, shall request each public water system identified pursuant to subdivision (b) to determine whether the projected water demand associated with a proposed project was included as part of the most recently adopted urban water management plan adopted pursuant to Part 2.6 (commencing with Section 10610).*

The City's most recently adopted UWMP (the City's 2010 UWMP) was adopted in August 2011 and is incorporated by reference into this WSA[2]. The City's 2010 UWMP included existing and projected water demands for existing and projected future land uses to be developed within the City's General Plan SOI through the year 2035. The water demand projections in the City's 2010 UWMP included existing City water demands (as of 2010), plus projected water demands for future developments, but did not include water demand projections for the Proposed Project because the Proposed Project was not yet part of the City's development planning process. Therefore, the City will contract with PCWA to provide additional water to serve the Proposed Project, as described in Section 6.

PCWA's most recently adopted UWMP (PCWA's 2010 UWMP) was adopted in June 2011[3]. PCWA's 2010 UWMP included existing and projected water demands for existing and projected future land uses to be developed within the PCWA water service area, which encompasses the entire Placer County area. The water demand projections in PCWA's 2010 UWMP included existing PCWA water demands (as of 2010), plus projected water demands for future developments. The Proposed Project was not specifically included in PCWA's UWMP, but the demand projections in that document do include sufficient capacity to accommodate the Proposed Project. A technical memoranda, described below, provides greater detail on the volume of water and the area that has been included in the PCWA 2010 UWMP.

The City's and PCWA's ability to meet the projected water demands for the Proposed Project is described in Section 7.0 of this WSA.

[2] City of Roseville 2010 Urban Water Management Plan, August 2011.

[3] Placer County Water Agency 2010 Urban Water Management Plan, Adopted June 16, 2011, prepared by Tully & Young.

4.0 CITY OF ROSEVILLE AND PCWA WATER SERVICE AREAS

Because the Proposed Project will be served from the City's water system, but with water to be provided by PCWA, brief descriptions of both the City's and PCWA water service areas are included in this section.

4.1 City of Roseville Water Service Area

The City of Roseville is located approximately 16 miles northeast of Sacramento and has an estimated population of 128,382 residents (as of January 1, 2015). Roseville incorporated on April 10, 1909 and is a charter city operating under a City Manager-Council form of government.

Roseville is bordered on the east by the City of Rocklin and Granite Bay and on the south by the Sacramento County line and the Dry Creek West Placer Community Plan Area. The north and west city boundaries are bordered by mostly undeveloped and unincorporated Placer County land that has the potential for future development and annexation.

As documented in the City's 2010 UWMP, projections for population, employment, and dwelling units within the City's water service area were completed for buildout as part of the City's General Plan. Those projections are only for the current City of Roseville Water Service Area boundary, including the newly annexed Sierra Vista and Creekview Specific Plan areas.

According to the City's 2010 UWMP, most of the residents within the City Limits are served by the City's water system. There are a few small areas within the City that are served by Placer County Water Agency, San Juan Water District (SJWD), and Citrus Heights Water District.

The City's water service area is currently divided into six pressure zones. With the exception of Pressure Zone 4, which utilizes pressure reducing stations, all other pressure zones (Pressure Zones 1, 2, 3, and 5) are either served by gravity, require boosting, or are served by adjacent water agencies that have sufficient pressure to serve these areas. The Proposed Project area would be located in City Pressure Zone 4. As noted above, the Proposed Project is located north of and outside the City's existing City limits, but is expected to be annexed into the City as part of the land use approval process.

There are two primarily residential areas on the east side of the City that are within the incorporated City limits but are not within the Water Service Area boundary. Department of Finance and Roseville General Plan estimates for dwelling units were adjusted to account for areas within the City limits but outside the City Water Service Area boundary.

The historical and projected water service area populations are summarized in Table 4-1.

Table 4-1. Historical and Projected Population for City of Roseville Water Service Area	
Calendar Year	Estimated Population[(a)]
1995	56,026
2000	77,627
2005	95,143
2010	114,078
2015	122,946
2020	135,317
2025	160,938
2030	166,021
2035	168,718

(a) Data from City's 2010 UWMP, Tables 2.6 (2010-2035), 3.2 (1995, 2000), and 3.3 (2005). Updated value from City staff for 2015.

4.2 PCWA Water Service Area

As documented in PCWA's 2010 UWMP, PCWA is a public water agency that provides untreated, treated, and irrigation water directly and indirectly to wholesale and retail customers throughout Placer County and a portion of Sacramento County.

PCWA's Eastern Water System provides groundwater to the Martis Valley area of Placer County adjacent to the City of Truckee. This service area is also designated as PCWA Zone 4.

The area served by the Western Water System extends from the community of Alta on the east, down the Interstate 80 corridor, to the Sutter and Sacramento county lines on the west and south. The service area includes retail treated water deliveries to the communities of Alta, Monte Vista, Applegate, Colfax, Auburn, Loomis and Rocklin and much of the surrounding unincorporated areas. PCWA also provides wholesale treated water to the City of Lincoln, California American Water Company for use in their franchise area west of Roseville and south of Baseline Road, and to several relatively small mutual water companies throughout PCWA's western service area.

In addition to treated water service, PCWA provides irrigation water through its extensive canal system to individual customers, and untreated water for treatment and resale by other retail water purveyors, including the City of Roseville. Irrigation water comprises about two-thirds of PCWA's Western Water System deliveries.

The Western Water System is a financial and operational amalgamation of four separate systems acquired or developed over time. Each of these underlying systems is designated as a PCWA Zone; numbered 1, 2, 3 and 5.

PCWA also provides untreated water from its Middle Fork American River Project into Folsom Lake for delivery to the SJWD, the City of Roseville, and Sacramento Suburban Water District (SSWD), each of which are required to prepare their own UWMPs. Deliveries to these customers are grouped under the general term of "Sales to Other Agencies." PCWA's Place of Use for its Middle Fork American River Project water rights extends outside of the PCWA/Placer County boundary and includes groundwater recharge areas in northern Sacramento County that are partially overlain by the San Juan Water District and the SSWD.

5.0 CITY OF ROSEVILLE AND PCWA WATER DEMANDS

Water Code section 10910 states:

> *10910(c)(2) If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d), (e), (f), and (g).*

The descriptions provided below for the City's and PCWA's water demands have been primarily taken from the City's 2010 UWMP, which was adopted in August 2011, and PCWA's 2010 UWMP, which was adopted in June 2011. As indicated above, the Proposed Project was not included in the City's 2010 UWMP, but the demand projections in PCWA's 2010 UWMP include sufficient capacity to accommodate the Proposed Project.

The following topics are covered in this section:

- City of Roseville Existing and Projected Water Demand
- PCWA Existing and Projected Water Demand
- Dry Year Water Demand

5.1 City of Roseville Existing and Projected Water Demand

The projected total (potable and recycled) water demand for the City at buildout, based on the 2015 HPCO WSA[4], without and with the ARSP water demands is shown in Table 5-1. The projected future total water demand in 5-year increments through 2035 and at buildout, without and with the ARSP, is shown in Table 5-2.

5.2 PCWA Existing and Projected Water Demand

The projected untreated water demand for wholesale water supply customers located within the PCWA western area (Zones 1 and 5), including the City are shown in Table 5-3.

[4] Hewlett Packard/Campus Oaks Rezone and Master Plan Project Water Supply Assessment, Municipal Consulting Group, June 2015.

Table 5-1. General Plan Buildout Total Water Demands with Amoruso Ranch Specific Plan

Land Use Type	Demand, AFY		
	Without ARSP[(a)]	ARSP[(b)]	With ARSP
Low Density Residential	26,714	433	27,147
Medium Density Residential	8,712	421	9,133
High Density Residential	3,838	273	4,111
Commercial	7,341	184	7,525
Commercial Business Park	2,494	-	2,494
Industrial	1,526	-	1,526
Light Industrial	2,933	-	2,933
Public/Quasi Public	1,236	15	1,251
Parks and Paseo	6,835	110	6,945
Rail Road	70	-	70
Schools	2,110	37	2,147
Open Space	-	-	-
Urban Reserve	4	1	5
Subtotal (w/o losses)	63,813	1,474	65,287
2% for Losses	1,276	29	1,306
Subtotal (w/losses)	65,089	1,503	66,592
Remove Corporate Centers Reserve	(313)	-	(313)
Water Conservation Reduction (SVSP)	(729)	-	(729)
Water Conservation Reduction (CSP)	(205)	-	(205)
Water Conservation Reduction (WSP)	(178)	-	(178)
Water Conservation Reduction (Pearl Creek Apts)	(5)	-	(5)
Water Conservation Reduction (WP Phase 4)	(133)	-	(133)
Water Conservation Reduction (Fiddyment Ranch SPA 3)	(370)	-	(370)
Water Conservation Reduction (HPCO)	(75)	-	(75)
Water Conservation Reduction (ARSP)[(c)]	-	(214)	(214)
Total Water Demand	63,081	1,289	64,370

(a) Table 5 of Hewlett Packard/Campus Oaks Rezone and Master Plan Project Water Supply Assessment, Municipal Consulting Group, June 2015.

(b) Total Annual Water Demand from Table 2-4.

(c) Sum of Modified Turf, Smart Irrigation Timers, and Insta-Hot Water from Table 2-4.

Table 5-2. Projected Future Water Demand, af/yr							
	2015[(a)]	2020	2025	2030	2035	Buildout (w/out ARSP)	Buildout (w/ ARSP)
Potable Water Demand[(b)]	39,342	37,097	39,416	41,908	44,771	57,418	58,456
Potable Water System Unaccounted-for System Losses[(c)]	787	742	788	838	895	1,172	1,201
Total Potable Water Demand[(d)]	40,129	37,839	40,204	42,746	45,666	58,590	59,657
Total Recycled Water Demand[(d)]	2,216	2,722	3,071	3,481	3,653	4,491	4,713
Total Water Demand	47,957	52,164	58,051	59,904	61,625	63,081	64,370

(a) Demand for 2015 is a projected value assuming no demand reductions (see footnote c). With Stage 3 demand reductions, the City's actual 2015 total water use was 22,991 af/yr.

(b) Potable water demand is Total Potable Water Demand minus Potable Water System Unaccounted-for System Losses.

(c) Unaccounted-for system losses are assumed to be 2 percent of Total Potable Water Demand.

(d) Based on Table 10 of Hewlett Packard Campus Oaks Water Supply Assessment for 2015 through 2035; HPCO WSA page 22 for Buildout w/out ARSP; Buildout w/ ARSP includes values from Table 2-4. All values assume no demand reductions (Normal Year).

Table 5-3. PCWA Untreated Water Demand for Western Area Wholesale Customers, af/yr[(a)]

Wholesale Customer	2015	2020	2025	2030	2035	2040	Buildout
San Juan Water District	14,967	15,652	16,370	16,411	17,941	19,470	21,000
San Juan Water District to City of Roseville[(b)]	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Sacramento Suburban Water District[(c)]	29,000	29,000	29,000	29,000	29,000	29,000	29,000
City of Roseville[(d)]	10,000	20,000	30,000	30,000	30,000	30,000	30,000
Normal Year Total	57,967	68,652	79,370	79,411	80,941	82,470	84,000

(a) Based on PCWA 2010 UWMP, Table 4-9.
(b) Deliveries from SJWD to Roseville are zero in Single Dry and Multi-Dry years.
(c) PCWA deliveries to SSWD are zero in Single Dry and Multi-Dry years.
(d) City of Roseville demand values represent the contracted volume.

The water supply to SSWD effectively goes to zero during dry years when the unimpaired flow into Folsom Reservoir is less than 1.6 million acre-feet (af). Similarly, flow deliveries to Roseville from SJWD also go to zero during dry years when the unimpaired flow into Folsom Reservoir is less than 950,000 af, although this restriction does not affect deliveries from PCWA to SJWD.

Prior to 2010, the City's contract with PCWA provided for 10,000 af, with options for an additional 20,000 af. In 2010, the City exercised the options and entered a new consolidated contract with PCWA. This contract identified an agreed-upon increase in the contract quantity over the next several years, capping at 30,000 acre-feet annually after July 1, 2024. Between now and July 2024, the contract has several incremental steps that do not directly correspond to the 5-year planning increments of this UWMP. For purposes of long-term planning, PCWA has represented the City's contracted volume as the demand shown in Table 5-3.

In addition to wholesale customers, PCWA provides retail water service to meet other water demands within western Placer County. Total projected demand for all PCWA water supply types and customers in the Western Area are summarized in Table 5-4. The values for Zone 1 wholesale untreated in Table 5-4 match the Normal Year Total in Table 5-3.

Because the planning horizon assumed by the land-planning authorities throughout the County is not always consistent (e.g., projections vary from 2030 to 2050), future land-planning updates may identify growth in the Western Area not currently contemplated. To accommodate this potential additional demand, PCWA has established a placeholder "buffer" value of 10,000 af of annual demand beginning in 2040. This value is also shown in Table 5-4 as a separate line item.

Table 5-4. PCWA Summary of Normal Year Western Area Water Demands, af/yr[a]

Water Type by Zone	2015	2020	2025	2030	2035	2040	Buildout
Zone 1 Water Demands							
Retail Treated	32,166	33,854	36,039	38,238	41,309	44,400	69,701
Irrigation	56,295	56,295	56,295	56,295	56,295	56,295	56,295
Wholesale Treated	16,515	20,944	25,374	29,805	31,608	33,410	35,213
Wholesale Untreated[b]	57,967	68,652	79,370	79,411	80,941	82,470	84,000
Subtotal Zone 1 Demand	162,944	179,745	197,078	203,749	210,152	216,575	245,209
Zone 5 Demand	11,038	9,483	7,928	6,373	4,803	3,263	1,699
Zone 1 and 5 Buffer	--	--	--	--	--	10,000	10,000
Total Western Area Demand	173,981	189,228	205,005	210,122	214,955	229,838	256,908

(a) From PCWA 2010 UWMP, Table 4-10, with math corrected for 2040 and Buildout conditions.
(b) From Table 5-3.

In 2012, PCWA prepared a memorandum (2012 PCWA Memo[5] in Appendix D) further clarifying the demand projections documented in the PCWA 2010 UWMP. In the 2012 PCWA Memo, Table 7 indicates that the projected water demand for the Sunset Industrial Area (SIA) was 12,701 af/yr (8,086 af/yr in Zone 1 and 4,615 af/yr in Zone 5). This demand was projected to be served through the Zone 1 Retail Treated Water Demand found in Table 4-10 of the PCWA 2010 UWMP, and shown in Table 5-4 above. At that time, the Proposed Project had not been included in the SIA water demand projection.

In 2015, PCWA prepared a memorandum (2015 PCWA Memo[6] in Appendix E) documenting the revised water demand projections for the SIA and indicating that, because the revised water demand projections for the SIA are lower than projected for the PCWA 2010 UWMP, the projected potable water demand of the Proposed Project is now considered to be part of the water demand projected for the SIA. This reasoning is summarized in Table 5-5, which is based on the 2015 PCWA Memo.

[5] Memorandum - PCWA demand development information, from Greg Young of Tully & Young to Placer County Water Agency, May 11, 2012.

[6] Memorandum – Sunset Industrial Area Water Allocation, from Brian Rickards and Tony Firenzi of PCWA to Michele Kingsbury of PCWA and Kelye McKinney of City of Roseville, November 25, 2015.

Table 5-5. Comparison of PCWA 2010 UWMP Demand Projections and Revised Projections for Sunset Industrial Area[a]

Planning Area	Area, acres	Dwelling Units	Existing and Projected Annual Water Demand, af/yr	Existing and Projected Total Annual Water Demand with Losses, af/yr[b]
Revised SIA Projection, 2015				
Existing SIA	490	—	1,300	1,404
Formica Plant[c]	209	—	455	491
Existing WPWMA[d]	314	—	48	52
Future Industrial	1,122	—	2,352	2,540
Future Public (WPWMA)	70	—	157	169
Future Landfill (WPWMA)	553	—	9	10
SIA Undevelopable	3,346	—	—	—
Placer Ranch Specific Plan[e]	2,213	5,400	4,500	4,860
Amoruso Ranch Specific Plan[f]	674	2,785	1,100	1,188
Total Revised SIA Projection, 2015	8,991	8,185	9,921	10,714
SIA Water Demand Projection from PCWA 2010 UWMP[g]	8,100	—	11,760	12,701
Difference (Revised minus PCWA 2010 UWMP)	891[h]	8,185	-1,839	-1,987

[a] Based on 2015 PCWA Memo, Table 2-3 and 2-4, and 2012 PCWA Memo Table 7.
[b] Includes an 8 percent unaccounted-for system loss factor.
[c] The Formica plant closed in 2006, but the property retains the entitlement to 455 af/yr water use (491 af/yr including 8 percent unaccounted-for system losses).
[d] WPWMA = Western Placer Waste Management Authority
[e] The application for Placer Ranch Specific Plan has recently been withdrawn.
[f] Proposed Project. Note that projected potable water demand in the 2015 PCWA Memo is greater than projected in Table 2-4 of this WSA.
[g] Sunset Industrial Area (SIA) as documented in 2012 PCWA Memo.
[h] Formica Plant and Proposed Project had not been included in previous SIA planning documents.

As indicated in Table 5-5, the revised water demand projection for the SIA, including the Formica Plant and the Proposed Project, is 1,987 af/yr less than had been included in the PCWA 2010 UWMP. Much of the difference is caused by the determination that a large portion of the SIA planning area cannot be developed. The reasons for the determination of portions of the SIA being unavailable for development vary. Some of the land is already developed, other land is assumed to be undevelopable due to the higher cost of wetlands mitigation, and the remainder is allocated to right-of-way for the planned Placer Parkway and for other purposes.

5.3 Dry Year Water Demand

The City currently has a Water Shortage Contingency Plan in place, as described in Section 5 of the City's 2010 UWMP. The City's Water Shortage Contingency Plan describes five stages of short-term water demand reduction measures that would be required during years when potable water supply is reduced. The water shortage stages, and their respective anticipated reduction in potable water demand, are shown in Table 5-6.

Table 5-6. Water Shortage Contingency Plan Projected Demand Reduction[a]

Water Shortage Stage Description	Projected Demand Reduction, percent
Baseline Water Conservation	0
Stage 1 Drought	10
Stage 2 Drought	20
Stage 3 Drought	30
Stage 4 Drought	40
Stage 5 Drought	50

[a] See Table 5.3 and Appendix H of the City's 2010 Urban Water Management Plan.

The City entered a Drought Stage 3 in May 2015, which was precipitated by a State-wide mandate for water conservation. Specifically, a 28 percent demand reduction target relative to 2013 water usage was imposed by the State.

The projected future water demand shown above in Table 5-2 included continued implementation of the City's existing water conservation program, and is based on future normal hydrologic years. Any demand reduction requirements in dry years will be based on available water supplies being insufficient to meet projected demand.

6.0 CITY OF ROSEVILLE AND PCWA WATER SUPPLIES

Key topics addressed in this section include:

- Regulatory Background
- Roseville Existing and Projected Potable Water Supplies
- Roseville Existing and Projected Non-Potable Water Supplies
- PCWA Existing and Projected Potable Water Supplies
- PCWA Existing and Projected Non-Potable Water Supplies

6.1 Regulatory Background

Water Code section 10910 states:

> *10910(c)(2) If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d), (e), (f) and (g).*
>
> *10910(d)(1) The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts.*
>
> *10910(d)(2) An identification of existing water supply entitlements, water rights, or water service contracts held by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall be demonstrated by providing information related to all of the following:*
>
> *(A) Written contracts or other proof of entitlement to an identified water supply.*
>
> *(B) Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system.*
>
> *(C) Federal, state, and local permits for construction of necessary infrastructure associated with delivering the water supply.*
>
> *(D) Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply.*

> *10910(e) If no water has been received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts, the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall also include in its water supply assessment pursuant to subdivision (c), an identification of the other public water systems or water service contract-holders that receive a water supply or have existing water supply entitlements, water rights, or water service contracts, to the same source of water as the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has identified as a source of water supply within its water supply assessments.*

It is anticipated that water supply for the Proposed Project would be made available through an agreement between the City and PCWA for treated surface water. The Proposed Project would also use recycled water supplies provided from the City. The City and PCWA are currently developing an agreement whereby PCWA will wholesale treated surface water to the City in sufficient volume to meet all water supply needs and at a level of reliability to serve the Proposed Project during normal, dry and multiple dry year conditions. The availability of surface water from PCWA to serve the Proposed Project is documented later in this section.

Proponents of the Proposed Project will provide their proportionate share of required funding to the City for the acquisition and delivery of treated potable and recycled water supplies to the Proposed Project area. This arrangement will be outlined within the Development Agreement between the project landowners and the City. The Development Agreement will be completed and approved as part of the City's formal land use actions.

The summaries of the City and PCWA water supplies provided below have been taken, for the most part, from the City's 2010 UWMP, which was adopted in August 2011, and the PCWA 2010 UWMP, which was adopted in June 2011.

6.2 Roseville Existing and Projected Potable Water Supplies

The City currently receives potable water supplies from Folsom Lake, and is also developing a groundwater supply to be used in drier and driest years when surface water supplies are insufficient to meet overall potable water demands. Key topics of interest described herein include:

- Surface Water from Folsom Lake
- Surface Water Reliability
- Additional Planned Future Potable Water Supplies
- Groundwater Supply

6.2.1 Surface Water from Folsom Lake

Folsom Lake has been the primary source of water for the City since 1971. Through the Folsom Lake Municipal and Industrial intake, the City receives untreated water from the U.S. Bureau of Reclamation (USBR) and from PCWA. Additionally, through this same delivery point, the City receives a normal/wet year water supply from SJWD. The untreated surface water is delivered to the City's Barton Road Water Treatment Plant. The City also maintains interties with PCWA, SJWD, the California American Water Company, SSWD, and the Citrus Heights Water District. These interties allow existing distribution systems to be used to deliver treated water between purveyors in the event of water treatment plant or conveyance system disruptions. The City's three surface water contract entitlements for American River water total 66,000 af/yr, as summarized in Table 6-1. Additionally, the City, as part of the Water Forum, has agreed to limit its diversions off of the American River 58,900 af/yr during Normal/Wet Years and to between 54,900 af/yr and 39,800 af/yr in Drier and Driest Years. This is further described below.

Table 6-1. City of Roseville Surface Water Contracts, af/yr[(a)]

Contracted Water Supply	Contract Amount, af/yr
USBR (Central Valley Project Supply)	32,000
PCWA (Middle Fork Supply)	30,000
SJWD (Middle Fork Supply)[(b)]	4,000
Total Contracted Supplies	66,000
Diversion Limitations Per Water Forum Agreement:	
Normal/Wet Years	58,900
Drier and Driest Years (Critically Dry)	Ranges from 54,900 to 39,800

(a) American River diversion limitations as outlined in the City's Water Forum Agreement. From City's UWMP Table 4.1.
(b) San Juan Water District is only available as a normal/wet year supply, thus it is not available in drier or driest years.

The Sacramento Water Forum is a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments working together to balance two co-equal objectives:

- To provide a reliable and safe water supply for the Sacramento region's long-term growth and economic health; and
- To preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

The City, along with several other Sacramento-area water suppliers are signatory to the January 2000 Water Forum Agreement which includes Purveyor Specific Agreements. The Water Forum Agreements provide the framework for how water resources, including surface water and groundwater supplies would be used in the region, through the year 2030. The City's Purveyor Specific Agreement includes limitations on City surface water diversions from the American River under various hydrologic conditions. The Water Forum categorized water years into three types, all of which are defined in terms of the projected March through November unimpaired flow into Folsom Reservoir. These hydrologic year types are defined as follows:

- Normal/Wet Years: When the projected unimpaired flow into Folsom Reservoir is greater than or equal to 950,000 af
- Drier Years: When the projected unimpaired flow into Folsom Reservoir is between 400,000 af and 950,000 af
- Driest Years: When the projected unimpaired flow into Folsom Reservoir is less than 400,000 af

Although Roseville's water contract entitlements total 66,000 af/yr, the City's diversions from the American River are limited by the WFA in normal/wet years, drier and driest years. In normal/wet years, the City has agreed to limit surface water diversions from the American River to 58,900 af/yr. In driest years (also called critically dry years), the maximum diversion from the American River is limited to 39,800 af/yr. In drier years, the City may divert an amount between 39,800 and 54,900 af/yr from the American River, depending on the unimpaired flow into Folsom Lake.

It is important to note that during the drier and driest years, the City agreed to have PCWA release an additional 20,000 af/yr of water down the American River on the City's behalf through re-operation of PCWA's American River Middle Fork Project (MFP). This 20,000 af/yr of water is not part of the City's contracted supply of 66,000 af/yr. The intent of MFP re-operational releases during drier and driest years is to mitigate environmental impacts resulting from increased diversions above 1995 baseline levels.

Table 6-2 below, shows how the City intends to make use of its current water supply contracts over time.

Table 6-2. City of Roseville Surface Water Contracts, af/yr

Contracted Water Supply	2015	2020	2025	2030	2035+
USBR (Central Valley Project supply)	32,000	32,000	32,000	32,000	32,000
PCWA (Middle Fork supply)	15,000	20,000	30,000	30,000	30,000
SJWD (Middle Fork supply)[a]	4,000	4,000	4,000	4,000	4,000
Total Contracted Supplies	51,000	56,000	66,000	66,000	66,000

[a] San Juan Water District is only available as a Normal or wetter year supply.

6.2.2 Surface Water Reliability

Tables 5.6 and 5.7 of the City's 2010 UWMP provide the basis for the City's water use projections through 2030. Because of the water supply uncertainty arising from the current drought, however, a more conservative approach to water supply reliability is provided in this WSA. The anticipated reliability of the surface water supplies in Normal, Single Dry, and Multi-Dry hydrologic conditions, as a percentage of contracted volume, is shown in Table 6-3. Those same results are expressed as volumes in Table 6-4. For purposes of this WSA, the WFA definitions of normal/wet, drier, and driest years will be used as surrogates for the SB 610 required definitions of Normal, Single Dry, and Multi-Dry hydrologic conditions.

Table 6-3. City of Roseville Surface Water Supply Reliability, Percent of Contracted Amount[(a)]

Contracted Water Supply	Normal Year	Single Dry Year[(b)]	Multiple Dry Years[(c)]		
			Year 1	Year 2	Year 3
USBR (Central Valley Project supply)	100	25[(d)]	75	75	50
PCWA (Middle Fork supply)	100	100	100	100	100
SJWD (Normal year only – Middle Fork supply)[(e)]	100	—	—	—	—

(a) See Table 6-1.
(b) Minimum American River diversion as outlined in the City's Water Forum Agreement is 39,800 af/yr (See City 2010 UWMP Table 5.11). PCWA 2010 UWMP assumes full delivery of 30,000 af/yr in Single Dry Years. Although the City's 2010 UWMP assumed total American River water supply would match the WFA, the actual lowest historical allocation of USBR supply was 25% in 2015, which would not provide for the full WFA volume as shown in Table 6-1.
(c) Based on the 1990-1992 historical hydrologic conditions.
(d) Lowest historical allocation was 25% in 2015.
(e) SJWD is available only as a normal or wetter year supply.

Table 6-4. City of Roseville Surface Water Supply Reliability, af/yr

Contracted Water Supply	Normal Year	Single Dry Year[(a)]	Multiple Dry Years[(b)]		
			Year 1	Year 2	Year 3
USBR (Central Valley Project supply)	32,000	8,000	24,000	24,000	16,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000
SJWD (Normal year only – Middle Fork supply)[(c)]	4,000	—	—	—	—
Total Surface Water Supply Available	66,000	**38,000**	54,000	**54,000**	46,000
WFA Limitation Based on Hydrologic Record	**58,900**	39,800	**51,394**	58,900	**45,426**

(a) Minimum American River diversion as outlined in the City's Water Forum Agreement is 39,800 af/yr (See City 2010 UWMP Table 5.11). PCWA 2010 UWMP assumes full delivery of 30,000 af/yr in Single Dry Years. USBR supplies vary and reached a minimum of 8,000 af/yr in 2015. Total 2015 supplies were therefore 38,000 af/yr, which is less than the WFA allowed American River diversions in critical dry years. Bold text denotes which factor (surface water supply availability or Water Forum diversion limitations) drives available water supply.
(b) Based on the 1990-1992 historical hydrologic conditions. Unimpaired inflows during these years are used as the basis for determining water availability based on the WFA.
(c) SJWD is available only as a normal or wetter year supply.

As noted in Table 6-4 by the bolded supply values, either total surface water supply availability or Water Forum diversion limitations drive available water reliability. For example, in a Normal Year condition, the City currently has 66,000 af/yr of water supply contracts, but the City's WFA limits diversion from the American River to 58,900 af/yr. Therefore, in a Normal Wet Year the Water Forum drives City supplies. Comparatively, in a Single Dry Year, where it is assumed the City could receive up to a 75 percent reduction in its Central Valley Project (CVP) contracted supply (as seen during 2015), surface water allocations (38,000 af/yr) drive supplies over the City's WFA that would limit surface water diversions to 39,800 af/yr.

Based on the historical hydrologic record the Water Forum used for their analysis (and for the WFA restrictions), the 58,900 af/yr contract surface water supply is assumed to be available to the City in about 83 percent of the years. In the remaining 17 percent of years, supply quantities ranging from 54,900 af/yr to 39,800 af/yr of surface water would be available per the WFA or between 54,900 af/yr to 38,000 af/yr based on potential CVP water supply allocations. Thus, in drier and driest years; demands will be reduced through increased conservation measures and supplemental supplies (groundwater or other supplies) potentially totaling up to 20,900 af/yr (the difference between the normal/wet year supply and the single dry year supply allocation) would be needed to make up for the deficiencies in drier or critically dry years.

6.2.3 Additional Planned Future Potable Water Supplies

To serve the Proposed Project, the City will contract with PCWA to provide a new wholesale treated water supply. Currently, the City is planning to acquire from PCWA up to 1,500 af/yr (see Table 6-5).

In addition to obtaining new supplies from PCWA's future Ophir water treatment plant, the City is evaluating the possibility of participating with other water suppliers in a regional water supply project from the Sacramento River. Participation in a Sacramento River project would provide increased water supply and supply reliability for the City through the addition of a new surface water diversion point that is not on the American River. However, for purposes of this assessment, future supply from a Sacramento River project is not included.

A summary of the City's existing and additional planned future potable water supplies during hydrologic Normal, Single Dry, and Multiple Dry Years, including the full contracted volumes and the proposed wholesale water supply from PCWA to serve the Proposed Project, is shown in Table 6-5. PCWA has plans to construct a new Ophir water treatment plant which will be the source for this new supply. Planning for the Ophir facility is currently underway. It is likely to be available by 2025, however for purposes of this document the supply is not shown to be available until 2030.

6.2.4 Groundwater Supply

Water Code section 10910 states:

> *10910(f) If a water supply for a proposed project includes groundwater, the following additional information shall be included in the water supply assessment.*
>
> *10910(f)(1) A review of any information contained in the urban water management plan relevant to the identified water supply for the proposed project.*

Table 6-5. City of Roseville Projected Surface Water Contract and Supply Reliability During Hydrologic Normal, Single Dry, and Multiple Dry Years[(a)]

Wholesale Sources	Projected Volume, af/yr					
	2015	2020	2025	2030	2035	Buildout
Existing and Planned Sources of Water - Contracted Volume, af/yr						
U.S. Bureau of Reclamation (CVP supply)	32,000	32,000	32,000	32,000	32,000	32,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000	30,000
PCWA (Water to Serve Proposed Project)	-	-	-	1,500	1,500	1,500
San Juan Water District	4,000	4,000	4,000	4,000	4,000	4,000
Total	66,000	66,000	66,000	67,500	67,500	67,500
Normal Year Water Supplies, af/yr - 58,900 af/yr (Water Forum Diversion Limitation, Table 6-4)						
U.S. Bureau of Reclamation (CVP supply)	32,000	32,000	32,000	32,000	32,000	32,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000	30,000
PCWA (Water to Serve Proposed Project)	-	-	-	1,500	1,500	1,500
San Juan Water District	4,000	4,000	4,000	4,000	4,000	4,000
Total	66,000	66,000	66,000	67,500	67,500	67,500
Single Dry Year Water Supplies, af/yr - 38,000 af/yr (Surface Water Allocation, Table 6-4)						
U.S. Bureau of Reclamation (CVP supply)[(b)]	8,000	8,000	8,000	8,000	8,000	8,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000	30,000
PCWA (Water to Serve Proposed Project)	-	-	-	1,500	1,500	1,500
San Juan Water District[(c)]	-	-	-	-	-	-
Total	38,000	38,000	38,000	39,500	39,500	39,500
Multi-Dry Year Water Supplies, First Year, af/yr - 51,394 af/yr (Water Forum Diversion Limitation, Table 6-4)						
U.S. Bureau of Reclamation (CVP supply)[(d)]	24,000	24,000	24,000	24,000	24,000	24,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000	30,000
PCWA (Water to Serve Proposed Project)	-	-	-	1,500	1,500	1,500
San Juan Water District	-	-	-	-	-	-
Total	54,000	54,000	54,000	55,500	55,500	55,500
Multi-Dry Year Water Supplies, Second Year, af/yr - 54,000 af/yr (Surface Water Allocation, Table 6-4)						
U.S. Bureau of Reclamation (CVP supply)	24,000	24,000	24,000	24,000	24,000	24,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000	30,000
PCWA (Water to Serve Proposed Project)	-	-	-	1,500	1,500	1,500
San Juan Water District	-	-	-	-	-	-
Total	54,000	54,000	54,000	55,500	55,500	55,500
Multi-Dry Year Water Supplies, Third Year, af/yr - 45,426 af/yr (Water Forum Diversion Limitation, Table 6-4)						
U.S. Bureau of Reclamation (CVP supply)	16,000	16,000	16,000	16,000	16,000	16,000
PCWA (Middle Fork supply)	30,000	30,000	30,000	30,000	30,000	30,000
PCWA (Water to Serve Proposed Project)	-	-	-	1,500	1,500	1,500
San Juan Water District	-	-	-	-	-	-
Total	46,000	46,000	46,000	47,500	47,500	47,500

[(a)] Includes additional supply to serve Proposed Project.
[(b)] Adjusted from City's 2010 UWMP to account for actual 2015 allocation of 25%.
[(c)] No supply in Single and Multi-Dry hydrologic conditions.
[(d)] See Table 6-4.

> *10910(f)(2) A description of any groundwater basin or basins from which the proposed project will be supplied. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), of the efforts being undertaken in the basin or basins to eliminate the long term overdraft condition.*
>
> *10910(f)(3) A detailed description and analysis of the amount and location of groundwater pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), for the past five years from any groundwater basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historical use records.*
>
> *A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), from any basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historical use records.*
>
> *10910(f)(4) An analysis of the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project.*
>
> *A water assessment shall not be required to include the information required by this paragraph if the public water system determines, as part of the review required by paragraph (1), that the sufficiency of groundwater necessary to meet the initial and projected water demand associated with the project was addressed in the description and analysis required by paragraph (4) of subdivision (b) of Section 10631.*

Because of the expected reliability of the 1,500 af/yr PCWA water supply, the water supply for the Proposed Project will not include groundwater. However, the use of groundwater is part of the City of Roseville's long-term water supply strategy, to be potentially used as a back-up supply during dry years or for increased operational flexibility.

In August 2007, the Cities of Roseville and Lincoln, along with PCWA and the California American Water Company, completed the Western Placer Groundwater Management Plan (GMP). The GMP was prepared in an effort to maintain a safe, sustainable and high-quality groundwater resource to meet backup, emergency and peak demands within a zone of the North American River Groundwater sub-basin.

The City has recently adopted an aquifer storage and recovery (ASR) program, under which treated surface water can be injected into the aquifer during wet times (normal / wet years or during the rainy season), and withdrawn when the City needs additional water supplies. Uses include augmenting surface water supplies during droughts or to shave peak water demand periods, like those that occur during summer months. In 2013, the City received an operational permit from the Central Valley Regional Water Quality Control Board for the ASR program. The land use plan for the Proposed Project includes a dedicated groundwater well that will also be equipped to function as an ASR well so that the City has full operational flexibility.

The City currently operates six-groundwater wells, which are capable of delivering approximately 15,970 af/yr (1,650 gpm per well) if run continuously. A more realistic production amount is 40 af/day (1,500 gpm per well) over limited time frames to augment the water supply. The wells are primarily used as a backup water supply, thus improving water supply reliability. The City has plans to expand its groundwater well network to include ten additional groundwater well sites that have been identified. Once constructed, the City's groundwater facilities (16 wells) are projected to deliver of up to 106.07 af/day (6.63 af/day per well) or 38,715 af/yr, if run on a continuous basis.

6.3 Roseville Existing and Projected Non-Potable Water Supplies

The City of Roseville, along with the South Placer Municipal Utility District and Placer County, formed the South Placer Wastewater Authority (SPWA). SPWA was created in 2000 to oversee funding for regional wastewater and recycled water infrastructure. The City owns and operates two regional wastewater treatment facilities on behalf of the regional partners. These treatment facilities are the Dry Creek wastewater treatment plant and the Pleasant Grove wastewater treatment plant. Both plants produce Title 22 quality effluent that is available for recycled water applications. Recycled water for the Proposed Project will be obtained from the Pleasant Grove wastewater treatment plant.

Recycled water supply for the Proposed Project was not included in the City’s 2010 UWMP; however, as documented in the Proposed Project’s Recycled Water Master Plan, sufficient wastewater flow will be generated by the project in each month to satisfy the projected recycled water demands, assuming the proposed recycled water conservation practices listed in Table 2-4 are put into practice. Recycled water is expected to be available in all hydrologic year types.

The City has no other planned future sources of non-potable and recycled water except as described above.

6.4 PCWA Existing and Projected Potable Water Supplies

PCWA uses surface water as its primary supply. PCWA also produces a limited amount of groundwater for use in Zone 4, and may produce groundwater in dry hydrologic conditions to meet demands in the Zone 1 service area. As described in PCWA's 2010 UWMP, PCWA's primary surface water supplies consist of MFP water from the American River, water purchased from Pacific Gas & Electric Company (PG&E) from the Yuba and Bear Rivers, and Central Valley Project water from the American River. PCWA also uses a limited amount of surface water from small creeks under pre-1914 water rights. Historically, PCWA has purchased surplus water from the South Sutter Water District for service to PCWA Zone 5 customers under Nevada Irrigation District's water rights. Accordingly, the following topics are discussed below:

- American River Middle Fork Project
- Pacific Gas and Electric Contracts
- Central Valley Project
- Impacts of Water Forum Agreement
- Groundwater
- Additional Planned Future Potable Water Supplies

A summary of PCWA's existing and additional planned future potable water supplies during hydrologic Normal, Single Dry, and Multiple Dry Years, including the full contracted volumes, is shown in Table 6-6. The water supply source for the Proposed Project will be the Middle Fork Project, which is projected to have 100 percent reliability in all hydrologic conditions, as shown in Table 6-6. American River Middle Fork Project

The MFP began operation in 1967 and primarily provides a water supply to PCWA wholesale customers that are currently able to take delivery from Folsom Reservoir. PCWA's MFP water right allows it to divert water from the American River at both Auburn and Folsom Lake for irrigation, domestic, municipal, industrial, and recreational purposes. PCWA has signed an agreement with the USBR limiting its diversions under these permitted rights to 120,000 af/yr. PCWA may divert water directly from the American River between November and June and also re-divert water released from its MFP reservoirs during the remainder of the year.

6.4.1 Pacific Gas and Electric Contracts

PCWA has two water supply contracts with PG&E, which provide options to purchase up to 125,400 af/yr for irrigation and domestic purposes. The underlying rights for the PG&E supply are PG&E's pre-1914 appropriative rights to water in the Yuba and Bear Rivers, which were established prior to the time that PG&E developed hydroelectric facilities throughout the Yuba and Bear River watersheds.

Table 6-6. PCWA Projected Potable Water Supply Reliability During Hydrologic Normal, Single Dry, and Multiple Dry Years[(a)]

Wholesale Sources	Projected Volume, af/yr				
	2015	2020	2025	2030	2035
Existing and Planned Sources of Water - Contracted Volume, af/yr					
Pacific Gas & Electric	100,400	100,400	100,400	100,400	100,400
Middle Fork Project	120,000	120,000	120,000	120,000	120,000
Central Valley Project	-	31,000	31,000	31,000	31,000
Pre-1914 Appropriative Water Rights	3,400	3,400	3,400	3,400	3,400
Total	223,800	254,800	254,800	254,800	254,800
Normal Year Water Supplies, af/yr					
Pacific Gas & Electric	100,400	100,400	100,400	100,400	100,400
Middle Fork Project	120,000	120,000	120,000	120,000	120,000
Central Valley Project	-	31,000	31,000	31,000	31,000
Pre-1914 Appropriative Water Rights	3,400	3,400	3,400	3,400	3,400
Total	223,800	254,800	254,800	254,800	254,800
Single Dry Year Water Supplies, af/yr					
Pacific Gas & Electric[(b)]	50,200	50,200	50,200	50,200	50,200
Middle Fork Project[(c)]	120,000	120,000	120,000	120,000	120,000
Central Valley Project[(d)]	-	23,250	23,250	23,250	23,250
Pre-1914 Appropriative Water Rights[(e)]	1,700	1,700	1,700	1,700	1,700
Total	171,900	195,150	195,150	195,150	195,150
Multi-Dry Year Water Supplies, First Year, af/yr					
Pacific Gas & Electric	75,300	75,300	75,300	75,300	75,300
Middle Fork Project	120,000	120,000	120,000	120,000	120,000
Central Valley Project	-	23,250	23,250	23,250	23,250
Pre-1914 Appropriative Water Rights	1,700	1,700	1,700	1,700	1,700
Total	197,000	220,250	220,250	220,250	220,250
Multi-Dry Year Water Supplies, Second Year, af/yr					
Pacific Gas & Electric	75,300	75,300	75,300	75,300	75,300
Middle Fork Project	120,000	120,000	120,000	120,000	120,000
Central Valley Project	-	23,250	23,250	23,250	23,250
Pre-1914 Appropriative Water Rights	1,700	1,700	1,700	1,700	1,700
Total	197,000	220,250	220,250	220,250	220,250
Multi-Dry Year Water Supplies, Third Year, af/yr					
Pacific Gas & Electric	75,300	75,300	75,300	75,300	75,300
Middle Fork Project	120,000	120,000	120,000	120,000	120,000
Central Valley Project	-	23,250	23,250	23,250	23,250
Pre-1914 Appropriative Water Rights	1,700	1,700	1,700	1,700	1,700
Total	197,000	220,250	220,250	220,250	220,250

[(a)] Based on PCWA 2010 UWMP Table 3-8 and supply reduction discussion in PCWA 2010 UWMP text.

[(b)] Assumes 50% supply reduction in Single Dry Years, and 25% supply reduction in Multi-Dry Years.

[(c)] Assumes no supply reduction in Single Dry Years or Multi-Dry Years. Proposed Project will be served from the Middle Fork water supply.

[(d)] Assumes 25% supply reduction in Single Dry Years and in Multi-Dry Years.

[(d)] Assumes 50% supply reduction in Single Dry Years and Multi-Dry Years due to lack of flow in streams.

6.4.2 Central Valley Project

PCWA has a CVP water contract with the USBR for delivery of no more than 35,000 af/yr. This long-term renewal contract provides an indication of the reliability of the CVP water supply by stating that, for modeling purposes, the average quantity of water made available to PCWA in the most recent five years was 32,000 af/yr. According to the agreement, the CVP water may be used for municipal and industrial purposes. PCWA's point of diversion for CVP water is Folsom Dam, but it has taken minimal amounts of CVP water to date.

The current CVP contract expired in 2011. A Long Term Renewal Contract is awaiting formal approval by the USBR.

6.4.3 Water Forum Agreement

PCWA approved the *Memorandum of Understanding for the Water Forum Agreement* in the year 2000. The WFA has two stated objectives: (1) to provide a reliable and safe water supply for the region's economic health and planned development to the year 2030, and (2) to preserve the fish, wildlife, recreational, and aesthetic values of the lower American River. Under the WFA, PCWA has agreed to limit its annual diversions of MFP water to 35,500 af in Normal Years. In normal years, PCWA will also divert and use 35,000 af from the Sacramento and/or Feather Rivers if exchanges of equal amounts can be made with others. If PCWA is unable to develop a diversion from the Sacramento and/or Feather Rivers, the Water Forum members will negotiate with PCWA to find a mutually agreeable solution.

In the drier and driest years, when Folsom Reservoir inflow is less than 950,000 af, PCWA agreed to divert and use 35,500 af from the American River. The WFA commits PCWA to additional releases of water from MFP reservoirs to mitigate for additional diversions at its Auburn and Folsom Lake points of diversion above WFA baseline volumes.[7] The releases are made on a sliding scale basis and begin when projected March through November Folsom inflow is 950,000 af or less, and PCWA diversions increase above the baseline volumes. The releases are only made if there is a water transfer agreement in place with an entity that can divert the water for beneficial use below the confluence of the American and Sacramento Rivers. The maximum additional volume potentially released for Water Forum purposes in the driest year on record (1977) at PCWA's maximum use of MFP water is 47,000 af. PCWA will also divert and use 35,000 af from the Sacramento and/or Feather River if it can secure exchanges as described under normal conditions.

6.4.4 Groundwater

PCWA does not plan on using groundwater to provide water to the City of Roseville and is not proposing to use groundwater to serve the Proposed Project.

[7] PCWA's baseline volume is 8,500 af/yr. The City of Roseville's baseline volume is 19,800 af/yr.

PCWA has historically produced a limited quantity of groundwater. Historical pumping by PCWA in western Placer County has been limited to pumping for Bianchi Estates (Zone 2) and for the Sunset Industrial Area. Pumping for Bianchi Estates ceased in 2004, and since that time, PCWA has served Bianchi Estates with surface water under PCWA's PG&E and MFP water supplies. PCWA maintains the Sunset Industrial well, though it has not been used for several years due to customer concerns regarding water quality related to industrial use.

PCWA has historically produced groundwater for Zone 4 in eastern Placer County, and continues to do so. Zone 4 is physically separate from the water service area that includes the City of Roseville, the Proposed Project, and the Sunset Industrial Area.

6.4.5 Additional Planned Future Potable Water Supplies

PCWA is pursuing a transfer of a portion of its American River supplies to the Sacramento River, such that it would be able to divert water from the Sacramento River for service in PCWA Zone 1. While PCWA projects that it is possible that water might be available from a Sacramento River diversion by 2020, this potential future water supply source is not included in PCWA's projections of available water supply.

6.5 PCWA Existing and Projected Non-Potable Water Supplies

As documented in its 2010 UWMP, PCWA is projecting a recycled water supply and demand of 9,089 af/yr in its retail service area by 2040, provided by the cities of Lincoln and Roseville. However, recycled water from PCWA is not projected to be a water supply source for the Proposed Project and is therefore not discussed in detail in this WSA.

7.0 DETERMINATION OF WATER SUPPLY SUFFICIENCY BASED ON THE REQUIREMENTS OF SB 610

Water Code section 10910 states:

> *10910(c)(4) If the city or county is required to comply with this part pursuant to subdivision (b), the water supply assessment for the project shall include a discussion with regard to whether the total projected water supplies, determined to be available by the city or county for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses.*

To address this requirement, the following topics are covered in this section:

- Potable Water Supply and Demand
- Recycled Water Supply and Demand

7.1 Potable Water Supply and Demand

The comparison of projected potable water demand and supplies for the 20-year planning period, and at Buildout, is shown in Table 7-1. Depending on the water supply available from USBR, and in accordance with the WFA, potential deficits in water supply will occur in Single Dry Years beginning in 2025 and Multi-Dry Years at Buildout. To alleviate the potential deficits, the City will require short term demand reductions (water conservation) and/or pump groundwater. The City would prefer to not require water conservation greater than 20 percent of Normal Year demands. However, as evident by actions taken by the State Water Resources Control Board in 2015, the City was mandated a 28 percent conservation target during the 2015 water year. To date the City has exceeded this water conservation target.

One potential strategy to alleviate the potential water deficits shown in Table 7-1 is indicated in Tables 7-2 and 7-3. In Table 7-2, water demand reductions of up to 20 percent of Normal Year demands are shown. The remaining deficit would be alleviated by groundwater pumping, as shown in Table 7-3. The City will determine the needed balance between water conservation and groundwater pumping on a case-by-case basis.

Table 7-1. Summary of Potable Water Demand Versus Supply During Hydrologic Normal, Single Dry, and Multiple Dry Years for City of Roseville, af/yr[a]

Hydrologic Condition		Supply and Demand Comparison					
		2015	2020	2025	2030	2035	Buildout
Normal Year							
Available Surface Water Supply		58,900	58,900	58,900	60,400	60,400	60,400
Potable Water Demand without Proposed Project		40,129	37,839	40,204	42,746	45,666	58,590
Proposed Project Demand		0	1,067	1,067	1,067	1,067	1,067
	Potential Surplus (Deficit)	18,771	19,994	17,629	16,587	13,667	743
Single Dry Year							
Available Surface Water Supply		38,000	38,000	38,000	39,500	39,500	39,500
Potable Water Demand without Proposed Project		40,129	37,839	40,204	42,746	45,666	58,590
Proposed Project Demand		0	1,067	1,067	1,067	1,067	1,067
	Potential Surplus (Deficit)	(2,129)	(906)	(3,271)	(4,313)	(7,233)	(20,157)
Multiple Dry Years							
Multiple-Dry Year First Year Supply	Available Surface Water Supply	51,394	51,394	51,394	52,894	52,894	52,894
	Potable Water Demand without Proposed Project	40,129	37,839	40,204	42,746	45,666	58,590
	Proposed Project Demand	0	1,067	1,067	1,067	1,067	1,067
	Potential Surplus (Deficit)	11,265	12,488	10,123	9,081	6,161	(6,763)
Multiple-Dry Year Second Year Supply	Available Surface Water Supply	54,000	54,000	54,000	55,500	55,500	55,500
	Potable Water Demand without Proposed Project	40,129	37,839	40,204	42,746	45,666	58,590
	Proposed Project Demand	0	1,067	1,067	1,067	1,067	1,067
	Potential Surplus (Deficit)	13,871	15,094	12,729	11,687	8,767	(4,157)
Multiple-Dry Year Third Year Supply	Available Surface Water Supply	45,426	45,426	45,426	46,926	46,926	46,926
	Potable Water Demand without Proposed Project	40,129	37,839	40,204	42,746	45,666	58,590
	Proposed Project Demand	0	1,067	1,067	1,067	1,067	1,067
	Potential Surplus (Deficit)	5,297	6,520	4,155	3,113	193	(12,731)

[a] Demands from Table 5-2 and 5-5, Supply from Table 6-4. Note that the demand value for 2015 is based on a projected value, assuming no demand reductions. In 2015, the City actually entered into Stage 3 demand reductions and reduced its total water use by 33 percent compared to 2013 water use. Total actual water use for 2015 was 22,991 af/yr.

Table 7-2. Potential Water Conservation, af/yr (up to 20 percent of Normal Year Demand)					
Hydrologic Condition	2020	2025	2030	2035	Buildout
Normal	-	-	-	-	-
Single Dry	900	3,271	4,313	7,233	11,931
Multi-Dry (Year 1)	-	-	-	-	6,763
Multi-Dry (Year 2)	-	-	-	-	4,157
Multi-Dry (Year 3)	-	-	-	-	11,931

Table 7-3. Potential Groundwater Use to Relieve Remaining Deficit, af/yr					
Hydrologic Condition	2020	2025	2030	2035	Buildout
Normal	-	-	-	-	-
Single Dry	-	-	-	-	8,225
Multi-Dry (Year 1)	-	-	-	-	-
Multi-Dry (Year 2)	-	-	-	-	-
Multi-Dry (Year 3)	-	-	-	-	799

Pursuant to Water Code section 10910(c)(4), and based on the technical analyses described in this Water Supply Assessment, the City finds that the total projected water supplies determined to be available for the Proposed Project during Normal, Single Dry, and Multiple Dry water years during a 20-year projection will meet the projected water demand associated with the Proposed Project, in addition to existing and planned future uses, including agricultural and manufacturing uses.

The City is intending to receive up to 1,500 af/yr of additional PCWA MFP treated water supply to serve the Proposed Project. As documented in PCWA's 2010 UWMP, this water supply source is expected to have full (100 percent) reliability in all hydrologic conditions.

7.2 Recycled Water Supply and Demand

As described in this WSA and in the Proposed Project's Recycled Water Master Plan, approximately 222 af/yr of recycled water supplies will be used to meet the landscape irrigation demands at buildout of the Proposed Project (see Net Recycled Water Demand column in Table 2-4). Although the Proposed Project was not included in the City's 2010 UWMP, the projected average dry weather wastewater flow for the Proposed Project of 51.8 af/month is greater than the Proposed Project's projected maximum month irrigation demand of 47.7 af/month for July at buildout. Therefore, there is sufficient recycled water supply to serve the projected recycled water demand of the Proposed Project, assuming the irrigation water conservation practices described in the Proposed Project's Recycled Water Master Plan and Water Conservation Plan are implemented.

8.0 WATER SUPPLY ASSESSMENT APPROVAL PROCESS

Water Code sections 10910 and 10911 state:

> *10910 (g)(1) Subject to paragraph (2), the governing body of each public water system shall submit the assessment to the city or county not later than 90 days from the date on which the request was received. The governing body of each public water system, or the city or county if either is required to comply with this act pursuant to subdivision (b), shall approve the assessment prepared pursuant to this section at a regular or special meeting.*
>
> *10911 (b) The city or county shall include the water supply assessment provided pursuant to Section 10910, and any information provided pursuant to subdivision (a), in any environmental document prepared for the project pursuant to Division 13 (commencing with Section 21000) of the Public Resources Code.*

The Roseville City Council must approve this WSA at a regular or special meeting. Furthermore, the City must include this WSA in the Draft EIR being prepared for the Project.

The purpose of SB 610 is to document the plan to provide potable water to proposed developments. As described above, the Project Proponents have developed a plan to acquire additional water supply from PCWA to serve the Proposed Project.

SB 221 applies to residential subdivisions of over 500 dwelling units and requires that the water supplier (the City) provide a written verification that the water supply for the project is sufficient, prior to issuance of the final permits. Because the Project includes 2,827 residential dwelling units, it is subject to the requirements of SB 221 (Government Code section 66473.7).

9.0 ADDITIONAL MATERIAL TO SUPPORT CEQA ANALYSES

SB 610 requires an analysis of water supply impacts of the proposed Amoruso Ranch development for a range of hydrologic conditions. The City, in preparing EIRs for proposed projects, expands the range of hydrologic conditions to include "what if" scenarios to determine water conservation requirements and potential groundwater use during severe dry periods. In addition, the City has conducted analyses of the potential for USBR supply reductions under the USBR CVP Operations Criteria and Plan (OCAP).

The following topics are addressed in this section:

- Surface Water Delivery Scenarios
- Demand Reduction Scenarios
- Balancing Water Supplies and Demands
- Groundwater Supplies

9.1 Surface Water Delivery Scenarios

As discussed in section 6.1.1 above, under the WFA, the availability of untreated surface water to the City equals 58,900 af/yr in normal years, and ranges from 39,800 to 54,900 af/yr in drier and driest years. In addition, the proposed project would bring up to 1,500 af/yr of additional treated PCWA water, in all hydrologic year types, that is not currently available to the City.

In addition to WFA limitations, the City's CVP supplies with USBR are subject to shortage provisions. In severe droughts the shortage provisions could result in City supplies falling below the lowest WFA limitations. If USBR calls for shortages in excess of 73 percent of the contracted USBR total of 32,000 af/yr, then available untreated surface water availability would fall below the WFA threshold of 38,900 af/yr. In 2015, USBR CVP allocation to the City was 25 percent of historical use, or nearly 25 percent of the City's full contracted amount. For this analysis, five different delivery scenarios from USBR CVP supplies are considered: 100 percent, 75 percent, 50 percent, 25 percent, and zero percent. The total amount of surface water available under each of these scenarios for both existing and buildout conditions is summarized in Table 9-1.

Table 9-1. Available Water Supplies, af/yr, Existing and Buildout Conditions

Source	Time Frame	Percent Availability of USBR CVP Supply				
		100%	75%	50%	25%	0%
USBR Raw Water	Existing and Buildout	32,000	24,000	16,000	8,000	0
PCWA Raw Water	Existing and Buildout	30,000	30,000	30,000	30,000	30,000
PCWA Treated Water	Buildout Only	1,500	1,500	1,500	1,500	1,500
Total, Existing	Existing	62,000	54,000	46,000	38,000	30,000
Total, Buildout	Buildout	63,500	55,500	47,500	39,500	31,500

9.2 Demand Reduction Scenarios

As discussed in section 5.3 above, demand reduction scenarios from 10 to 50 percent (Stage 1 through Stage 5) are allowed by the City's Municipal Code, depending on the severity of drought conditions. The relationship between water demands and available surface water supplies is summarized in Table 9-2 for existing conditions and in Table 9-3 for buildout conditions. It should be noted that the indicated combinations of demand reductions and supply availability become increasingly improbable toward the lower left and upper right corners of the tables. For example, it is highly unlikely that a 50 percent demand reduction would ever be imposed in a normal water year, or that no demand reduction would be imposed in a year when USBR CVP deliveries were reduced to zero.

Table 9-2. Water Supplies versus Demands, Existing Demand Conditions

Demand Condition	Potable Water Demand, af/yr	Supply Surplus, af/yr				
		100% of CVP	75% of CVP	50% of CVP	25% of CVP	0% of CVP
Normal	40,129[a]	21,871	13,871	5,871	–2,129	–10,129
Stage 1: 10% Reduction	36,116	25,884	17,884	9,884	1,884	–6,116
Stage 2: 20% Reduction	32,103	29,897	21,897	13,897	5,897	–2,103
Stage 3: 30% Reduction	28,090	33,910	25,910	17,910	9,910	1,910
Stage 4: 40% Reduction	24,077	37,923	29,923	21,923	13,923	5,923
Stage 5: 50% Reduction	20,065	41,936	33,936	25,936	17,936	9,936
Total Available Supply	--	62,000	54,000	46,000	38,000	30,000

(a) Note that the demand value for Existing Conditions is based on a projected value, assuming no demand reductions. In 2015, the City actually entered into Stage 3 demand reductions and reduced its total water use by 33 percent compared to 2013 water use. Total actual water use for 2015 was 22,991 af/yr.

Table 9-3. Water Supplies versus Demands, Buildout Demand Conditions (with Project)

Demand Condition	Potable Water Demand, af/yr	Supply Surplus, af/yr				
		100% of CVP	75% of CVP	50% of CVP	25% of CVP	0% of CVP
Normal	59,657	3,843	-4,157-	-12,157-	-20,157-	-28,157-
Stage 1: 10% Reduction	53,691	9,809	1,809	-6,191-	-14,191-	-22,191-
Stage 2: 20% Reduction	47,725	15,775	7,775	-225-	-8,225-	-16,225-
Stage 3: 30% Reduction	41,760	21,740	13,740	5,740	-2,260-	-10,260-
Stage 4: 40% Reduction	35,794	27,706	19,706	11,706	3,706	-4,294-
Stage 5: 50% Reduction	29,828	33,672	25,672	17,672	9,672	1,672
Total Available Supply	--	63,500	55,500	47,500	39,500	31,500

9.3 Balancing Water Supplies and Demands

The balancing of water supplies and demands in any given year can be achieved through some combination of surface water usage, recycled water usage, groundwater usage, and demand reduction. The specific untreated surface water supply delivery scenarios under consideration in this analysis include the following:

- Normal: Conditions in a normal water year
- WFA-Max: Dry year conditions with maximum WFA deliveries (54,900 af/yr)
- WFA-Mid: Dry year conditions with midpoint WFA deliveries (46,900 af/yr)
- WFA-Min: Dry year conditions with minimum WFA deliveries (38,900 af/yr)
- 2015 Delivery: Dry year conditions with 2015 25% CVP allocation (38,000 af/yr)
- Zero USBR: Dry year conditions with zero CVP allocation (30,000 af/yr)

The buildout potable water demands shown in Table 9-3 are depicted graphically in Figure 9-1, along with the maximum anticipated recycled water usage, with the remainder being met through demand reduction. The results in Figure 9-1 are based on the assumption of zero groundwater usage.

With the addition of the proposed project up to 1,500 af/yr of treated surface water would become available to the City, and an estimated recycled water volume 4,713 af/yr would also be available to meet city-wide water demands. Assuming both of these sources are put to full use, the demand reductions needed (in the absence of groundwater usage) are depicted in Figure 9-2. As indicated in the figure, Stage 1 demand reductions would be adequate for the WFA-Max scenario, and Stage 2 reductions would be adequate for the WFA-Mid scenario. For the more severe delivery curtailment scenarios (WFA-Min, 2015 Delivery, and Zero USBR), demand reductions of Stage 4 or 5 would be needed in the absence of groundwater supplies.

It should be noted, however, that the implementation of demand reductions is a highly imprecise proposition. Stage 2 reductions should be readily achievable in severe drought conditions, but beyond that, it is difficult to predict the effectiveness of demand reduction measures. If it is assumed that demand reduction measures beyond Stage 2 could not be guaranteed, then it would be necessary to use groundwater to make up any demand deficits. Accordingly, Figure 9-3 shows the amount of groundwater that would be needed if demand reductions were implemented preferentially to groundwater usage, but were limited to Stage 2 demand reductions. As indicated in the figure, groundwater volumes in excess of 16,000 af/yr would be needed to meet demands in a zero USBR delivery year with Stage 2 demand reductions in force.

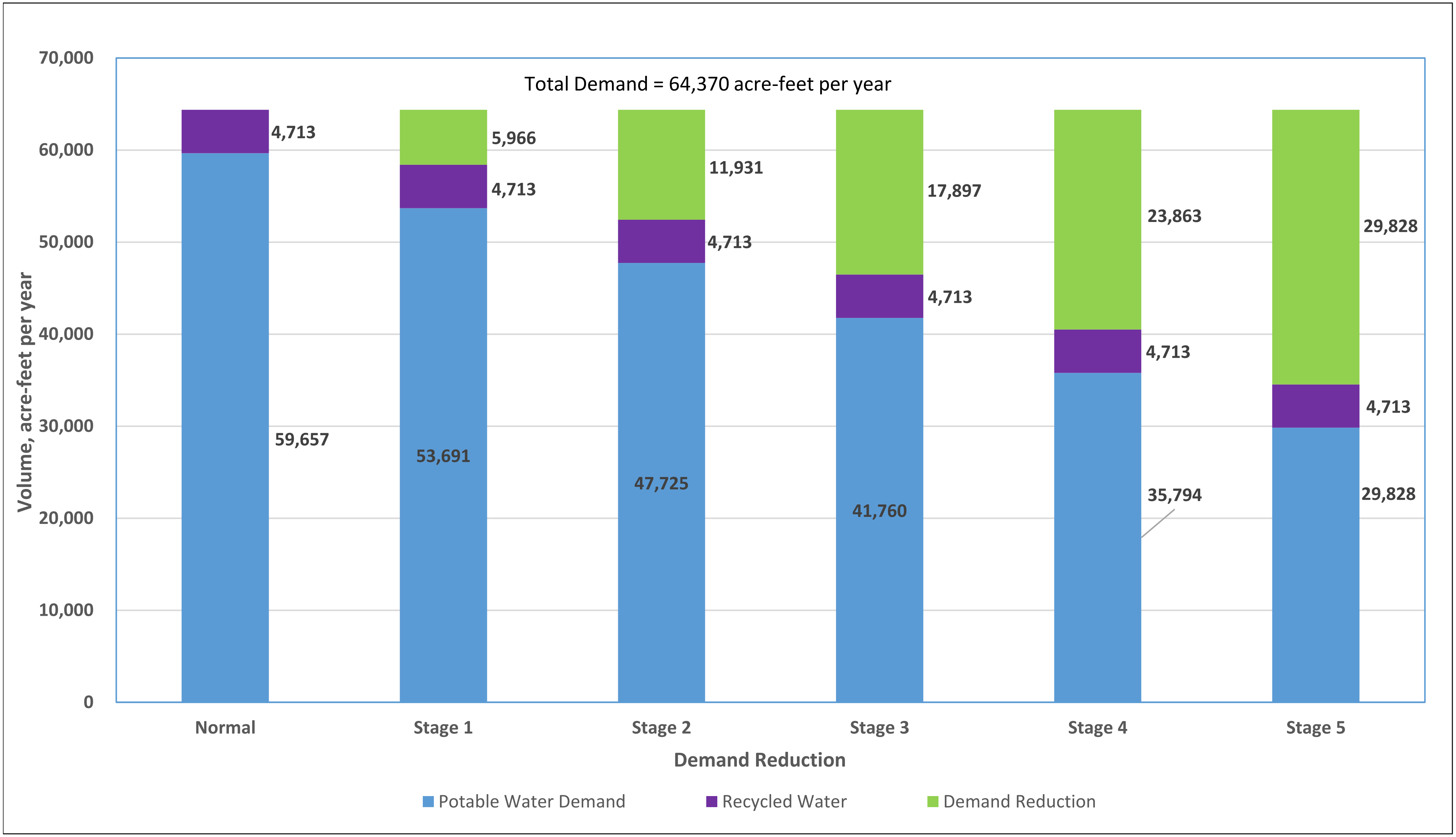

Figure 9-1

Potable Water Demands for Varying Demand Reduction Stages, Buildout Demand Conditions

City of Roseville
Water Supply Assessment
for Amoruso Ranch Specific Plan

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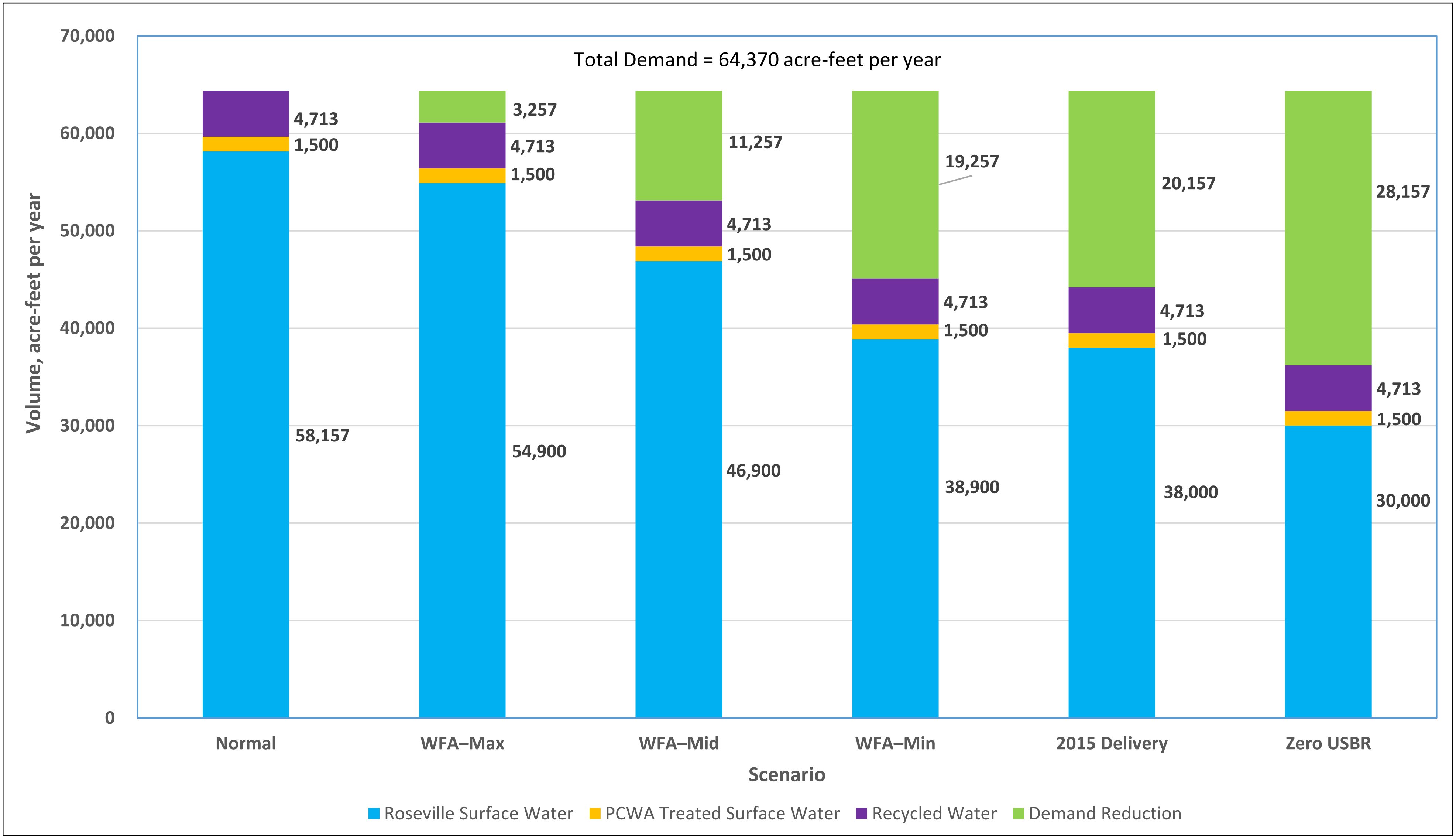

Figure 9-2

Demand Reductions Needed for Varying Water Supply Scenarios, Buildout Demand Conditions, No Groundwater

City of Roseville
Water Supply Assessment
for Amoruso Ranch Specific Plan

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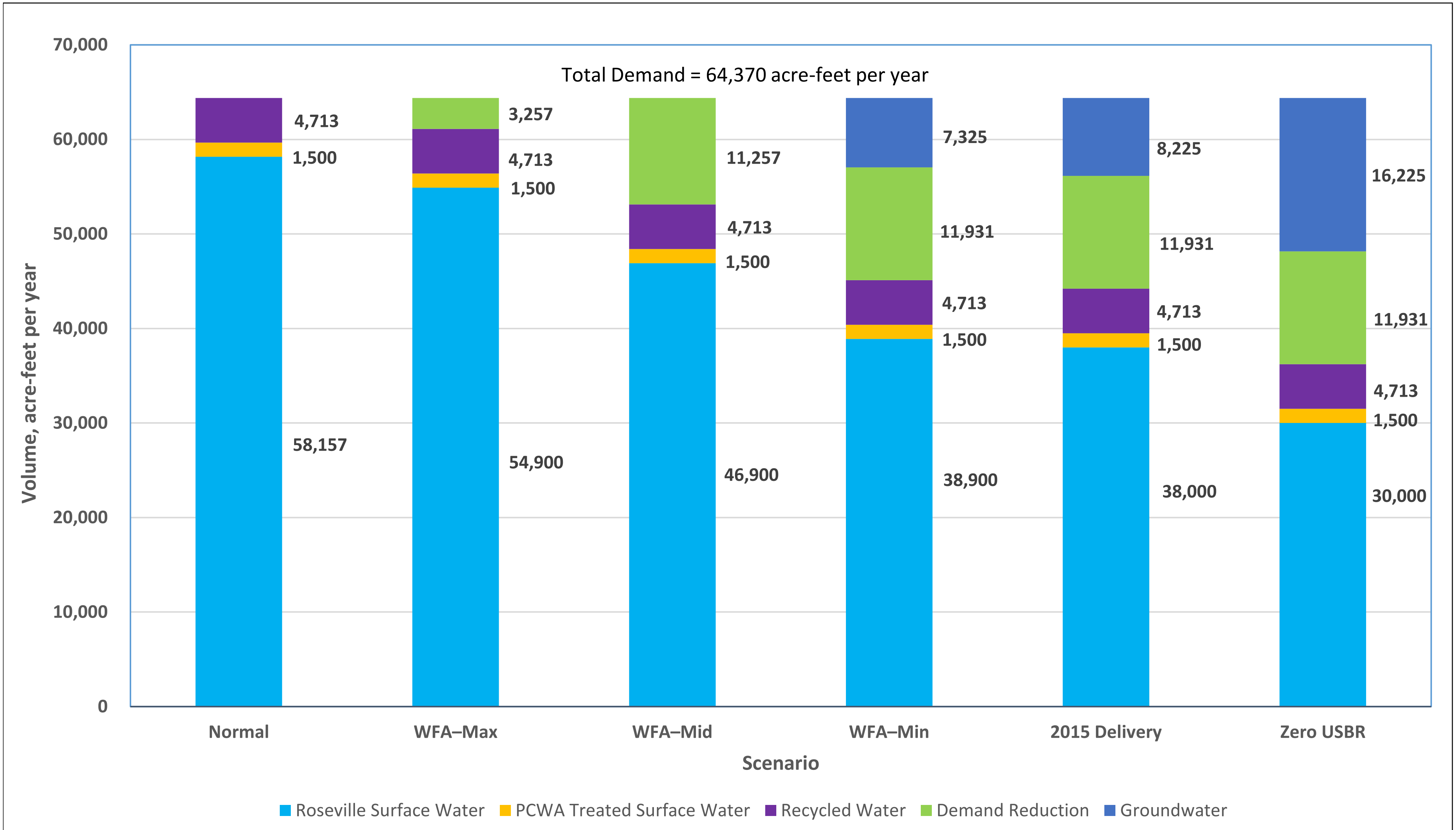

Figure 9-3

Groundwater Required for Varying Water Supply Scenarios, Buildout Demand Conditions, Maximum Reductions: Stage 2

City of Roseville
Water Supply Assessment
for Amoruso Ranch Specific Plan

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9.4 Groundwater Supplies

As show on Figure 9-3, groundwater required to meet build out water demands range from 0 af/yr to as much as 16,225 af/yr if USBR were to issue a complete shortage of the City's CVP supplies. It is important to note that Figure 9-3 represents single-event scenarios. In support of the CEQA analysis this section further evaluates the number of years in which groundwater could be needed based upon historic regional hydrologic records.

9.4.1 Groundwater Needs under USBR CVP OCAP and Life of the Proposed Project

In its 2015 Hewlett Packard/Campus Oaks Rezone & Master Plan Project Water Supply Assessment (HPCO WSA) (see Appendix F), the City analyzed USBR supply reliability under the USBR CVP OCAP. The analyses indicate that the USBR water supply would be less reliable than provided for in the WFA (expanding the numbers of years when some cut-back in water supply from USBR would occur), although minimum delivery under OCAP is expected to be the same as the minimum WFA supply of 38,900 af/yr.

The HPCO WSA also provides a detailed analysis of the number of years in which groundwater could be needed based upon historic hydrologic records for the American River. The analysis indicates that at buildout of the City groundwater would be required under the CVP OCAP scenario in 10 out of 100 years in volumes ranging from 0 af/yr in a single year to as much as 16,805 af/yr in a single year. The analysis also shows that over a 100-year period, the life of the project, a total of 51,227 af of groundwater would be needed. Because a new water supply, available in all hydrologic year types, is being added to the city's water supply portfolio with this project (1,500 af/yr of PCWA treated water supply), the volume of groundwater needed over the life of the Proposed Project is expected to be nearly the same or slightly less than documented within the HPCO WSA.

10.0 REFERENCES

City of Roseville 2010 UWMP, August 2011.

Placer County Water Agency 2010 UWMP, June 2011.

Amoruso Ranch Specific Plan Area - Water Master Plan, Kimley Horn, February 2015.

Amoruso Ranch Specific Plan Area - Recycled Water Master Plan, Kimley Horn, September 2015.

Amoruso Ranch Specific Plan Area - Water Conservation Master Plan, Kimley Horn, September 2015.

Memorandum from Brian Rickards and Tony Firenzi (PCWA) to Michele Kingsbury (Placer County) and Kelye McKinney (City of Roseville), Subject: Sunset Industrial Area Water Allocation, November 25, 2015.

Memorandum from Greg Young (Tully & Young) to Placer County Water Agency, Subject: PCWA demand development information, May 11, 2012.

Hewlett-Packard/Campus Oaks Rezone & Master Plan Project Water Supply Assessment, Municipal Consulting Group, June 2015.

APPENDIX A

Amoruso Ranch Specific Plan Area - Water Master Plan

Brookfield Residential

Amoruso Ranch Specific Plan Area

February 2016

Water Master Plan

Prepared for:
Brookfield Residential

Prepared by:
Kimley-Horn

Brookfield Residential

Amoruso Ranch Specific Plan Area

Water Master Plan

Prepared By:

Kimley»Horn

Kimley»Horn

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Appendix E – Technical Memorandum entitled *"ARSP Potable Water Hydraulic Modeling,"* dated February 3, 2016, by HydroScience Engineers

Appendix F – Water Master Plan Exhibit

INTRODUCTION

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

WATER MASTER PLAN PURPOSE

The purpose of this master plan study is to provide preliminary design and analysis for the domestic (potable) water system that will serve the Amoruso Ranch Specific Plan Area. The information presented herein builds on the 2010 Creekview Potable Master Plan (MacKay & Somps) that conveys flows between the ARSP distribution system and the Westside Tank and Pump Station site. The following items are presented:

- The anticipated water system demands under various scenarios, including fire flows.
- A piping distribution network that meets the projected demands based on the ARSP land use designations.
- The anticipated reservoir storage capacity requirements based on the anticipated ARSP water demands

The results and conclusions of the water modeling are based only on serving the ARSP Area. The ARSP Area will be served through a single point of connection extending from the Creekview Specific Plan area along the extension of Westbrook Boulevard. Future connections and distribution to any adjacent planning areas are considered when sizing pipes at the ARSP boundary, but no flows other than the ARSP demands are included.

ARSP AREA LOCATION AND DESCRIPTION

Project Vicinity

The ARSP Area consists of approximately 694.4-acres located in the northwest edge of the City of Roseville; this total includes the 20 acre Wagner Parcel. Prior to the Specific Plan's adoption, most of the Plan Area was within the City's Sphere of Influence and was recognized as a logical growth extension for the City. The Specific Plan Area is bounded on the west by the Al Johnson Wildlife Area, 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 Hill Ranches #1 area. The ARSP project vicinity is shown on Figure 1.

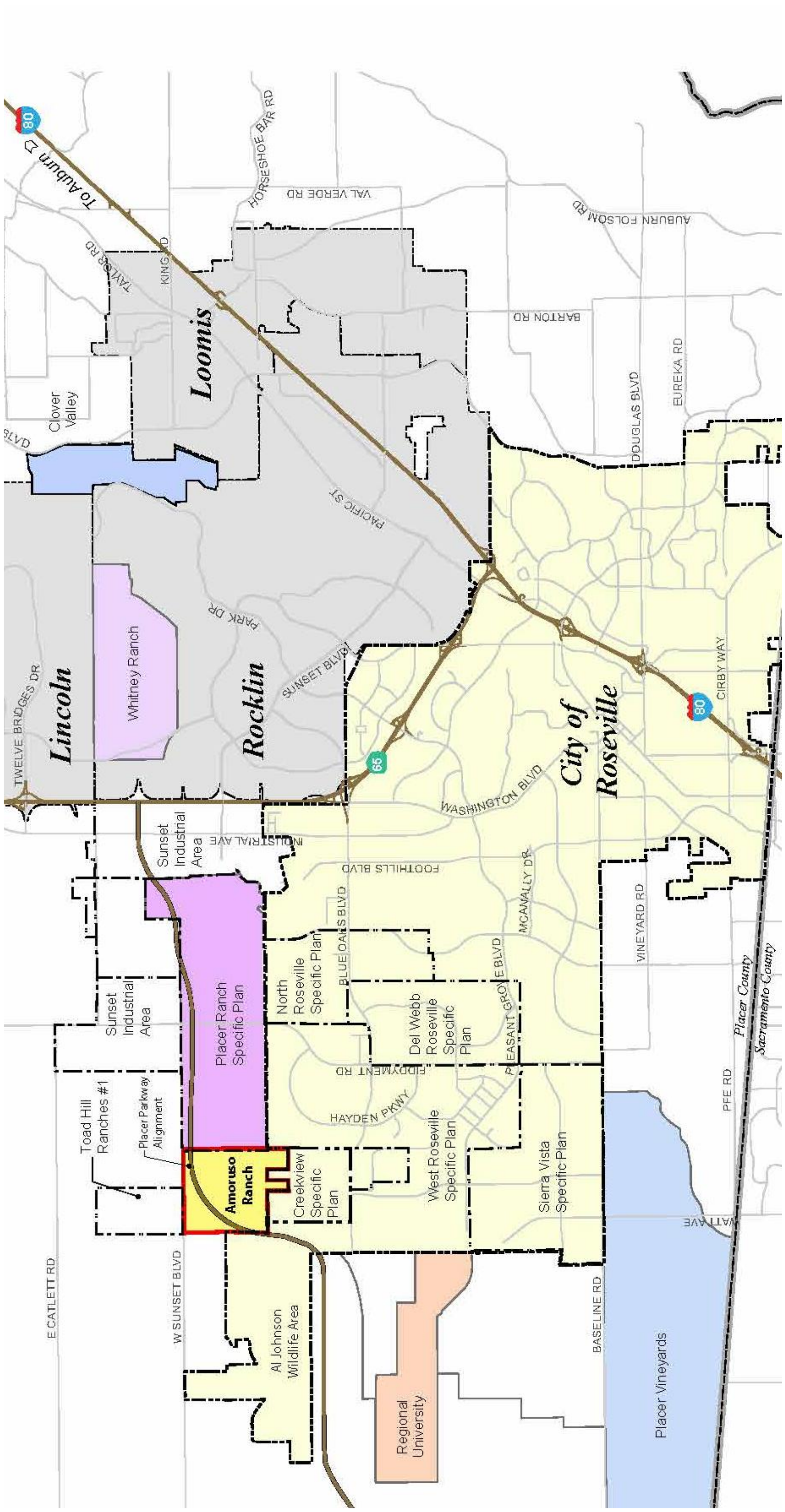


Figure 1 – Amoruso Ranch Specific Plan Area Project Vicinity

Pre-Development Conditions

In the pre-development conditions the ARSP Area was used as a cattle ranch. 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 northeast quadrant of the property. The elevation changes 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.

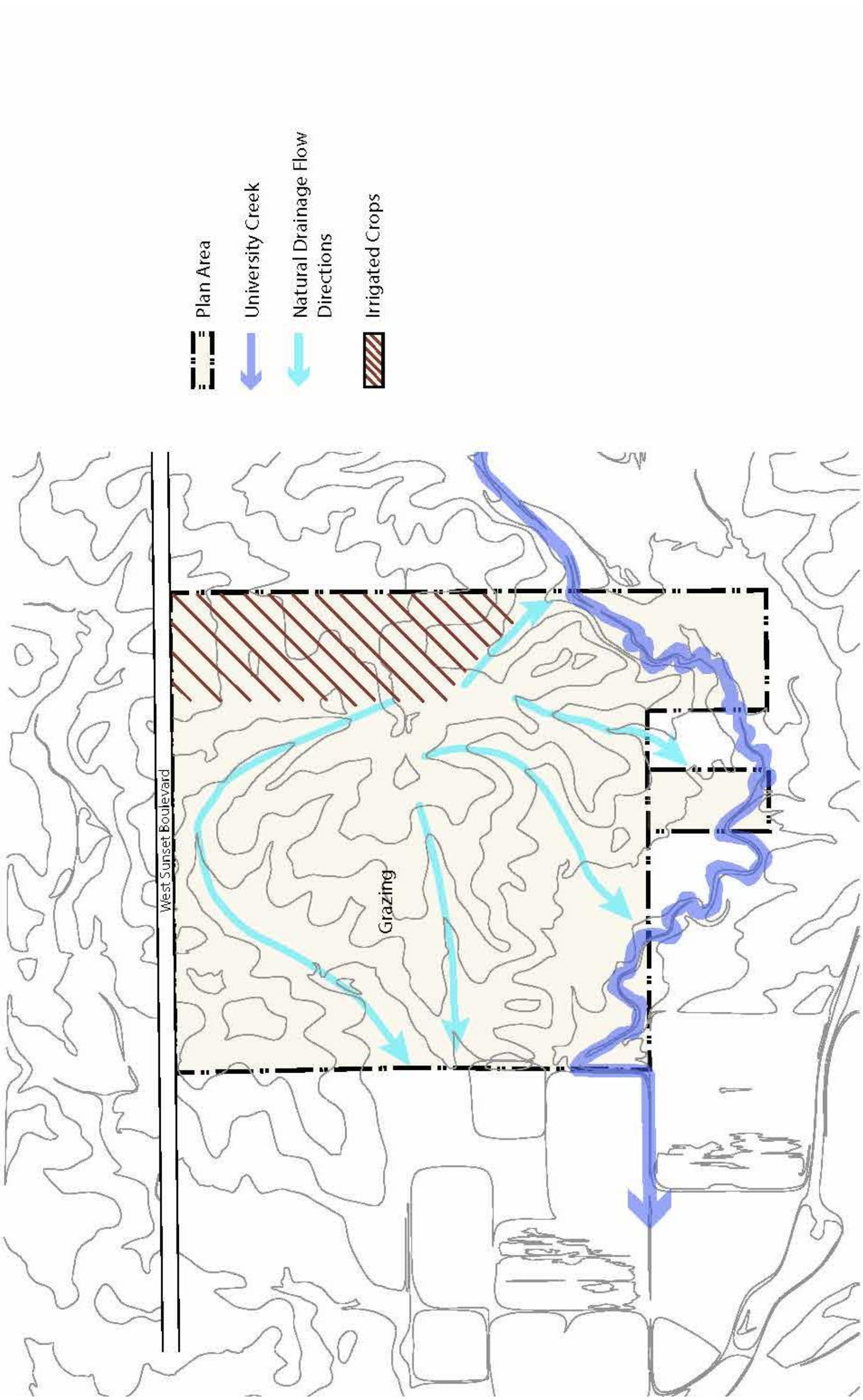


Figure 2 – ARSP Area Pre-Development Conditions

ARSP Area Development Opportunities and Constraints

The proposed ARSP Area land use plan is influenced by several factors, including the physical setting, planning policies, circulation conditions, and the boundary conditions. Two significant aspects of the Brookfield plan area are described below and depicted in 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 Resource 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, the Brookfield open space provides connectivity to 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.

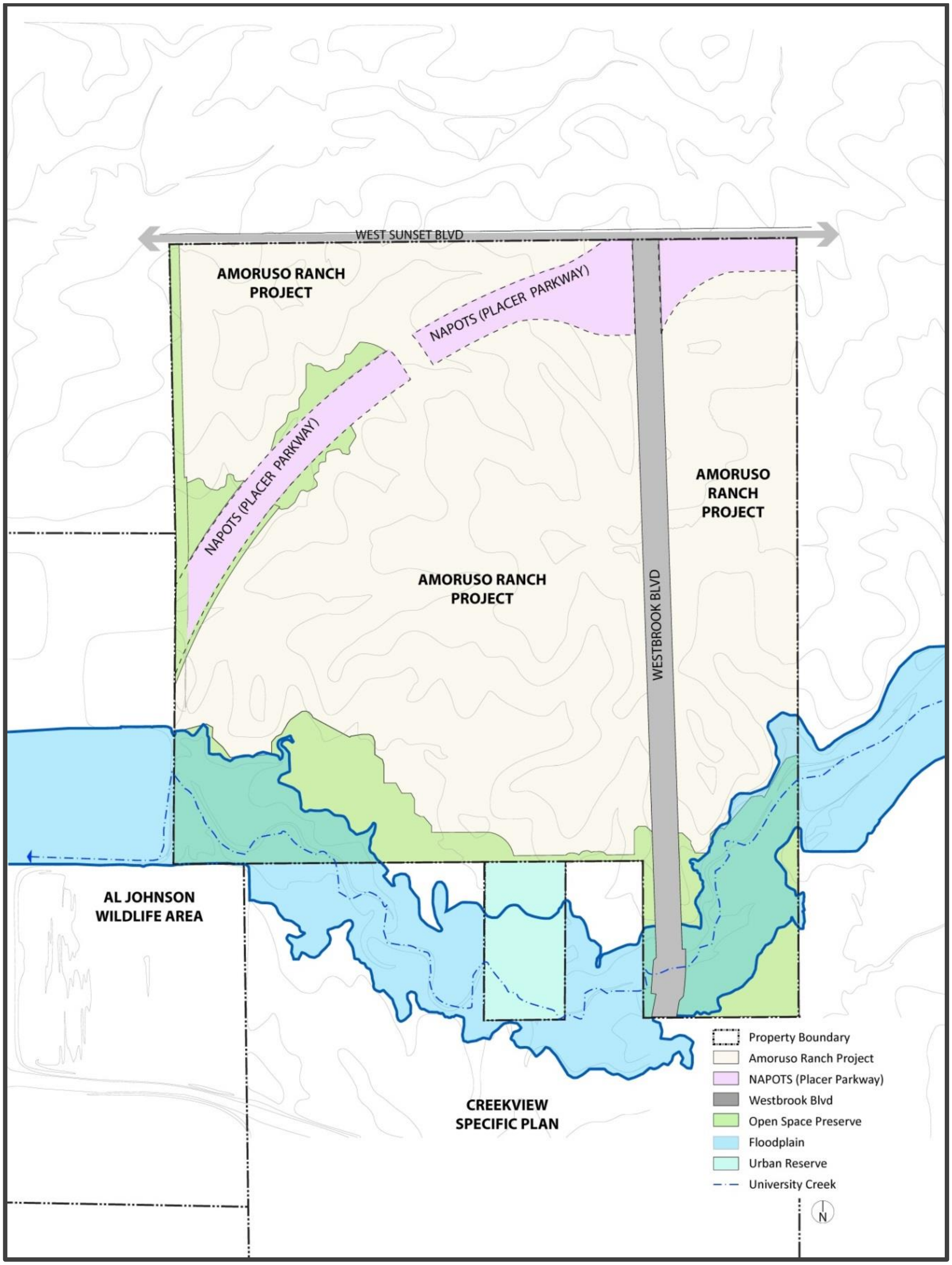


Figure 3 – ARSP Area Opportunities and Constraints

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, adds approximately 51 acres of commercial retail and office land uses, and provide approximately 22-acres of parks and 146-acres of open space. The ARSP Area Land Use Plan is shown in Figure 4.

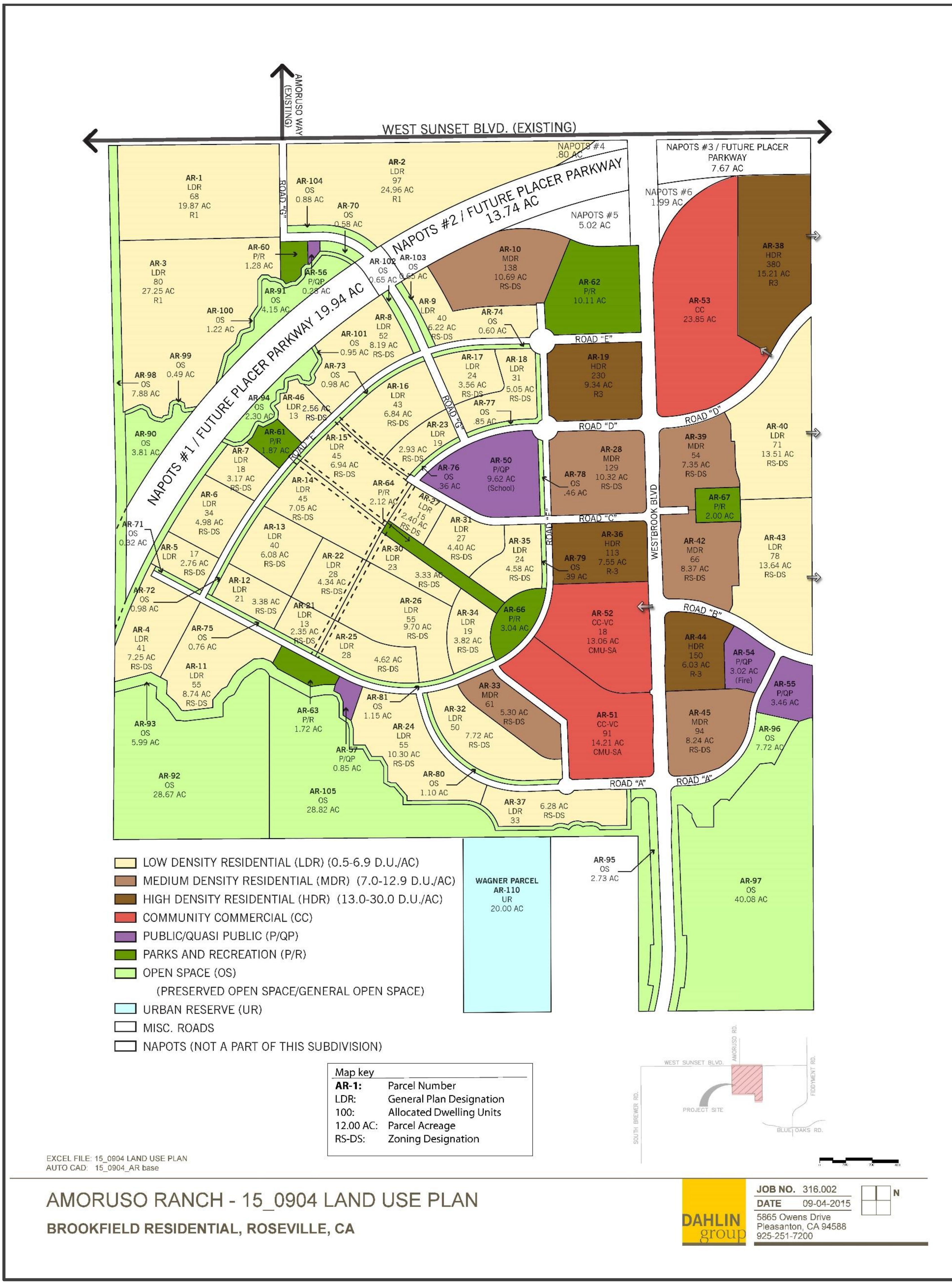


Figure 4 – ARSP Area Land Use Plan

WATER STUDY PROCESS

This Plan analyzes the hydraulics of the proposed water infrastructure necessary to serve the ARSP site. The methodology used for the hydraulic modeling in this Plan conforms to that used by the City of Roseville Environmental Utilities Department. Using the City's current design criteria and standards, a hydraulic model has been developed to size the ARSP Area's water infrastructure. The City intends to incorporate the results of this study into their overall "built-out" model to determine any impacts to the City's existing water system.

ARSP Land Use and Demand Projections

As noted above, the ARSP Area is proposed to be divided into multiple parcels with a variety of land uses including residential, commercial mixed use, open space, schools, and parks. The proposed land use areas and their corresponding unit demands are used to calculate the potable water demand.

Each land use corresponds to a water demand based on unit factors as designated by the City of Roseville. The City of Roseville water demand factors are presented below in Table 1.

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

General Plan Land Use Category	Average Day Demand
Residential (GPD/DU)[1,2]	
LDR1: < 3.5 DU / Acre	728 GPD/DU
LDR2: > 3.5 to 5 DU / Acre	600 GPD/DU
LMDR1: > 5 to 6 DU / Acre	521 GPD/DU
LMDR2: > 6 to 8 DU / Acre	430 GPD/DU
MDR: > 8 to 12 DU / Acre	323 GPD/DU
HDR1: > 12 to 16 DU / Acre	288 GPD/DU
HDR2: > 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

[1] City of Roseville Planning Department land use designations for residential are as follows:
Low Density Residential (LDR): 0.5 – 6.9 DU's / Acre
Medium Density Residential (MDR): 7.0 – 12.9 DU's / Acre
High Density Residential (HDR): 13.0 DU's / Acre and above

[2] See Table 3 for water demand projections based on water land use categories and City of Roseville planning land use categories.

Table 2 presents the summary of the projected overall water use for the ARSP Area based on the designated land uses shown on Figure 4.

Table 2
Amoruso Ranch Specific Plan
Water Master Plan
Overall Water Use Factors and Demands

Land Use	Planning Land Use Abbreviation/ Zoning	Total Area (Acres)	Dwelling Unit Count	Water Use Factor	Daily Demand (GPD)	Annual Demand (AFY)	Annual Demand with 2% (AFY) [1]
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] Demand accounts for 2% system losses.

Table 3 incorporates information from both Tables 1 and 2 to generate an average daily demand for each type of land use. The average daily demand incorporates a 2% increase in the calculated value, as recommended by the City of Roseville, to account for typical miscellaneous system losses. Table 3 also presents the residential land uses that correspond to the planning designations that are consistent with the Specific Plan document. It should be noted that there is not a direct correlation between the planning designations/densities and those utilized for water system planning. The water system planning densities are further subdivided than those utilized for Specific Plan purposes and are shown in Table 3 in the Land Use column.

Table 3
Amoruso Ranch Specific Plan
Water Master Plan
Water Demand Projections

Land Use	Planning Land Use[1]	Total Area (Acres)	Dwelling Unit Count	Unit Demands	Average Daily Demand with 2% (gpm)	Average Annual Demand with 2% (AFY)
LDR1: < 3.5 DU's/Acre	LDR	47.12	148	728 gpd/DU	76.3	123.1
LDR2: > 3.5 to 5.0 DU's/Acre	LDR	28.82	116	600 gpd/DU	49.3	79.5
LMDR1: > 5.0 to 6.0 DU's/Acre	LDR	73.31	401	521 gpd/DU	148.0	238.7
LMDR2: > 6.0 to 8.0 DU's/Acre[2]	LDR	99.52	637	430 gpd/DU	194.0	313.0
LMDR2: > 6.0 to 8.0 DU's/Acre[2]	MDR	15.72	120	430 gpd/DU	36.6	59.0
MDR: >8.0 to 12.0 DU's/Acre	MDR	13.54	155	323 gpd/DU	35.5	57.2
HDR1: >12.0 to 16.0 DU's/Acre[2]	MDR	21.01	267	288 gpd/DU	54.5	87.9
HDR1: >12.0 to 16.0 DU's/Acre[2]	HDR	7.55	113	288 gpd/DU	23.1	37.2
HDR2: >16.0 DU's/Acre	HDR	30.58	760	177 gpd/DU	95.3	153.7
Commercial / Retail (Commercial)	CMU/CC	51.12	0	2,598 gpd/acre	94.1	151.7
Commercial / Retail (Residential)	CMU-SA	-	109	288 gpd/DU	22.2	35.9
Elementary Schools	P/QP	9.62	0	3,454 gpd/acre	23.5	38.0
Public (Fire Station, Utility, etc)	P/QP	7.61	0	1,780 gpd/acre	9.6	15.5
Park/Recreation	PR	22.14	0	2,988 gpd/acre	46.9	75.6
Open Space (General)	OS	37.24	0	0 gpd/acre	0	0
Open Space (Paseos)	OS	10.71	0	2,988 gpd/acre	22.7	36.6
Open Space (Preserve)	OS	97.58	0	0 gpd/acre	0	0
Rights-of-Way	ROW	52.04	0	0 gpd/acre	0	0
Not a Part of this Subdivision	NAPOTS	49.16	0	0 gpd/acre	0	0
Urban Reserve	UR	20.00	1	728 gpd/DU	0.5	0.8
Totals		**694.4**	**2,827**	**-**	**931.9**	**1,503.2**

1. City of Roseville Planning Department land use designations for residential are as follows:
   Low Density Residential (LDR): 0.5 – 6.9 DU's / Acre
   Medium Density Residential (MDR): 7.0 – 12.9 DU's / Acre
   High Density Residential (HDR): 13.0 DU's / Acre and above
2. This water land use category includes two City planning land use categories.

The total average day demand with assumed system losses is estimated to be 932 gallons per minute (1,503 AFY). The unit demands listed in Table 3, account for all water use and are not adjusted to account for planned recycled water demands. The demands contained in this report include provisions to supply the recycled water demands with potable water in case the recycled water system is temporarily not operational. The demands also do not assume reduction for inclusion of water conservation measures. Recycled water demands and system information for the ARSP can be found in the Amoruso Ranch Specific Plan Area Recycled Water Master Plan.

Distribution of the water demands based on the land use designations have been developed for use in the water system model.

Peaking Factors

The Maximum Day Demands and the Peak Hour Demands are developed from the Average Day Demands by using the City of Roseville's peaking factors. These peaking factors are used to simulate system-operating scenarios and analyze the water distribution piping network.

Maximum Day Demands (MDD) are developed by applying the MDD peaking factor (2.0) to the Average Day Demand (ADD) estimates. The maximum day demand estimates are used to size the supply mains and to determine the required supply production rates. The 2.0 peaking factor is consistent with the City of Roseville Design Standards published in January of 2013.

The Peak Hour Demand (PHD) is used to size large transmissions mains, pumps, and storage reservoirs. Peak Hour Demands are developed by applying the PHD peaking factor (1.7) to the MDD. Transmission mains are sized to handle instantaneous peak flows that may occur over shorter periods of time in order to maintain velocities within the City's pipe design criteria. The 1.7 peaking factor is consistent with the City of Roseville Design Standards published in January of 2013.

Using these peaking factors and the ADD estimates, a steady state analysis was performed for the MDD and PHD system demands. These demands account for 2% system losses and the results are presented in Appendix C. Table 4 below summarizes the total system demands for each scenario.

Table 4
Amoruso Ranch Specific Plan
Water Master Plan
Water System Scenario Demands

Scenario	Water Demand (gpm)
Average Day Demand	932
Maximum Day Demand (ADD x 2.0)	1,864
Peak Hour Demand (MDD x 1.7)	3,169
Maximum Day Demand plus 2,000 gpm Fire Flow	3,864
Maximum Day Demand plus 2,500 gpm Fire Flow	4,364
Maximum Day Demand plus 4,000 gpm Fire Flow	5,864
Maximum Day Demand plus 4,500 gpm Fire Flow	6,364

SERVICE REQUIREMENTS

Proposed facilities within the ARSP are intended to provide and maintain an acceptable level of service. For this Plan, it is anticipated that the ARSP will be served by a connection through the Creekview Specific Plan Area and by an onsite groundwater well. The groundwater well would be located within a “P/QP” parcel (AR-55). The well is proposed to meet dry year water needs when surface water supplies are limited and for emergency purposes.

System Criteria

The City has developed minimum operating goals to be used in the planning of backbone water facilities. One criterion is maximum pipe velocity, which the City requires to be no more than 5 feet per second (fps) for ADD conditions and 6 fps for MDD and PHD operating conditions. The minimum and maximum system pressure criteria used for transmission main sizing, which help ensure that the distribution systems are not undersized, are listed in Table 5 below.

Table 5
Amoruso Ranch Specific Plan
Water Master Plan
Water Supply Pressure Design Criteria

Scenario	Pressure Criteria
Average Day Demand	Minimum = 50 psi
	Maximum = 100 psi
Maximum Day Demand plus Fire Flow	Minimum = 20 psi (at source node)
	Minimum = 50 psi (elsewhere)

Water Supply Criteria

Water is anticipated to be supplied to the site through the Creekview Specific Plan area via existing City water infrastructure in Westbrook Boulevard. Refer to Figure 8, which schematically shows the proposed water facility main lines for the project. Figures 9 and 10 included within Appendix B include the detailed system layouts from the hydraulic modeling analysis.

Fire Flow Requirements

Water distribution systems must be sized to provide adequate fire flows at minimum residual pressures that meet or exceed flows specified by the California Fire Code (CFC) and local fire jurisdictions. The distribution system for ARSP is sized to provide adequate fire flows at the City-prescribed residual pressures and that also meet the minimum flows required by the California Fire Code (CFC) and the City of Roseville Fire Department. The City's fire flow requirements by land use are shown in Table 6 below and assume that all buildings (residential and non-residential) are to have sprinkler systems installed throughout.

Table 6
Amoruso Ranch Specific Plan
Water Master Plan
Fire Flow Requirements

Land Use	Fire Flow (gpm)	Residual Pressure (psi)	Required Duration (hrs)
Residential[1]	2,000	20	2
Multi-Family[2]	2,500	20	3
Commercial/Office/Industrial	4,000	20	4
School	4,000[3]	20	4

1. 1,500 gpm is the requirement for residential areas having primarily one-story single-family dwellings on average size lots. However, 2,000 gpm is used in this Study to provide flexibility for the construction of potentially large dwelling units (up to 6,200 sf per the CFC).
2. 2,500 gpm is allotted for multi-family areas where all structures are sprinklered.
3. 4,000 gpm is the requirement, but 4,500 gpm is used in this study (modeling).

Groundwater Well Facilities

The City utilizes ground water supplies during dry years and during emergency events only when surface water supplies are limited. The onsite well, which is shown on Figure 9 (AR-55, J-101), is anticipated to have a minimum total supply capacity of approximately 1,800 gpm. The actual yield at the proposed well site will need to be confirmed though drilling an exploratory well to determine the aquifer capacity and water quality. The proposed ARSP onsite groundwater well will provide emergency potable water supply from the groundwater basin.

Reservoir and Pump Sizing Criteria

The ARSP water storage is provided by planned facilities in the West Roseville Specific Plan (WRSP) Area at the City's future Westside Tank and Pump Station site. These facilities will be designed to provide sufficient storage and pumping capacity to serve ARSP's storage needs as part of a centralized water supply for several specific plan areas.

Reservoir sizing is composed of operational demand, fire protection demand, and any emergency demand. The operational and emergency components are calculated based upon a percentage of the system's MDD. The fire protection demand is based on the largest volume of fire flow required in a system over a select period of time, typically four hours. The operational storage needed is 25% of the MDD, while the emergency storage is 50% of the MDD. The City of Roseville has allowed groundwater sources to account for up to 25% MDD, 467 gpm, to offset the emergency storage needs.

The operational storage need for ARSP is the Maximum Day Demand of 1,864 gpm. Table 7 details the total storage requirements for ARSP.

Table 7
Amoruso Ranch Specific Plan
Water Master Plan
Reservoir Sizing Criteria[1,2]

Category	Equation	Volume (gal)	Volume (MG)
Operational	(25%) x (1,864 gpm) x (1,440 min/day)	671,040	0.68
Fire Protection	(4,500 gpm) x (4 hours) x (60 min/hr)	1,080,000[3]	1.08
Emergency	(25%) x (1,864 gpm) x (1,440 min/day)	671,040	0.68
Total Volume		2,422,080	2.43

1. Operational and emergency MDD includes 2% for system losses.
2. Emergency storage is 50% of MDD, but 50% of that emergency volume can be supplied from groundwater sources, resulting in a tank storage capacity requirement of 25% of MDD.
3. Fire protection capacity is also accounted for in the Creekview analysis, therefore, actual ARSP capacity per Creekview Water Master Plan is approximately 1.34 MG (Creekview and ARSP (3.52 MG) – Creekview (2.18 MG) = ARSP (1.34 MG) .

The above calculations result in a need for approximately 2.5 million gallons of potable water storage for ARSP as a stand-alone project. It should be noted that based on the Creekview Water Master Plan (page 11*): "A total of 2.2 million gallons (MG) of treated water storage will be required to provide adequate needs to the CSP and 3.5 MG to provide for the needs of the CSP and Brookfield."*

In subsequent discussions with the City, it was identified that the calculations within the Creekview Water Master Plan identified a single fire flow capacity of 1.08 MG for both Creekview and the ARSP Area. The City has requested that each specific plan area account for a fire flow capacity (combined total fire flow capacity 2.16 MG). Therefore, the total required storage for the ARSP Area is approximately 2.5 MG and a combined storage capacity of 4.7 MG for both Creekview and the ARSP Area.

The City is currently designing the Westside Tank and Pump Station facility and plans to integrate the overall storage capacity requirements into the proposed regional facility. The location of the regional water storage and pumping facility is shown on Figure 5.

Figure 5- Regional Water Facilities Location Plan

WATER SUPPLY OPTION

The ARSP has identified two water supply options that could be implemented to provide the surface water needed for the project. Those options range from:

1. Use of City supplies, if available;
2. Use of Placer County Water Agency (PCWA) Water.

Each option will be briefly discussed, with focus on infrastructure needs for each option.

Option 1 – Use of City Supplies, If Available

At some future date, the City may determine that there is enough water available to serve the ARSP from existing supplies. Roseville, along with the rest of the State, is mandated to reduce water demands by 20% by the year 2020. To date, the City has been successful in reducing usage but that has been paired with a local drought and downturns in the economy. The City is currently evaluating their current demand factors to determine if they still accurately represent citywide usage.

Under Option 1, the City would use existing and/or planned infrastructure to treat and deliver water to the specific plan area. Infrastructure located in the Creekview Specific Plan (under construction now) would need to be extended to ARSP's southern border to convey treated water to a point where the plan can connect to the system. Local storage will be constructed by the City and funded through the City's Water Connection Fee, which is collected at building permit issuance.

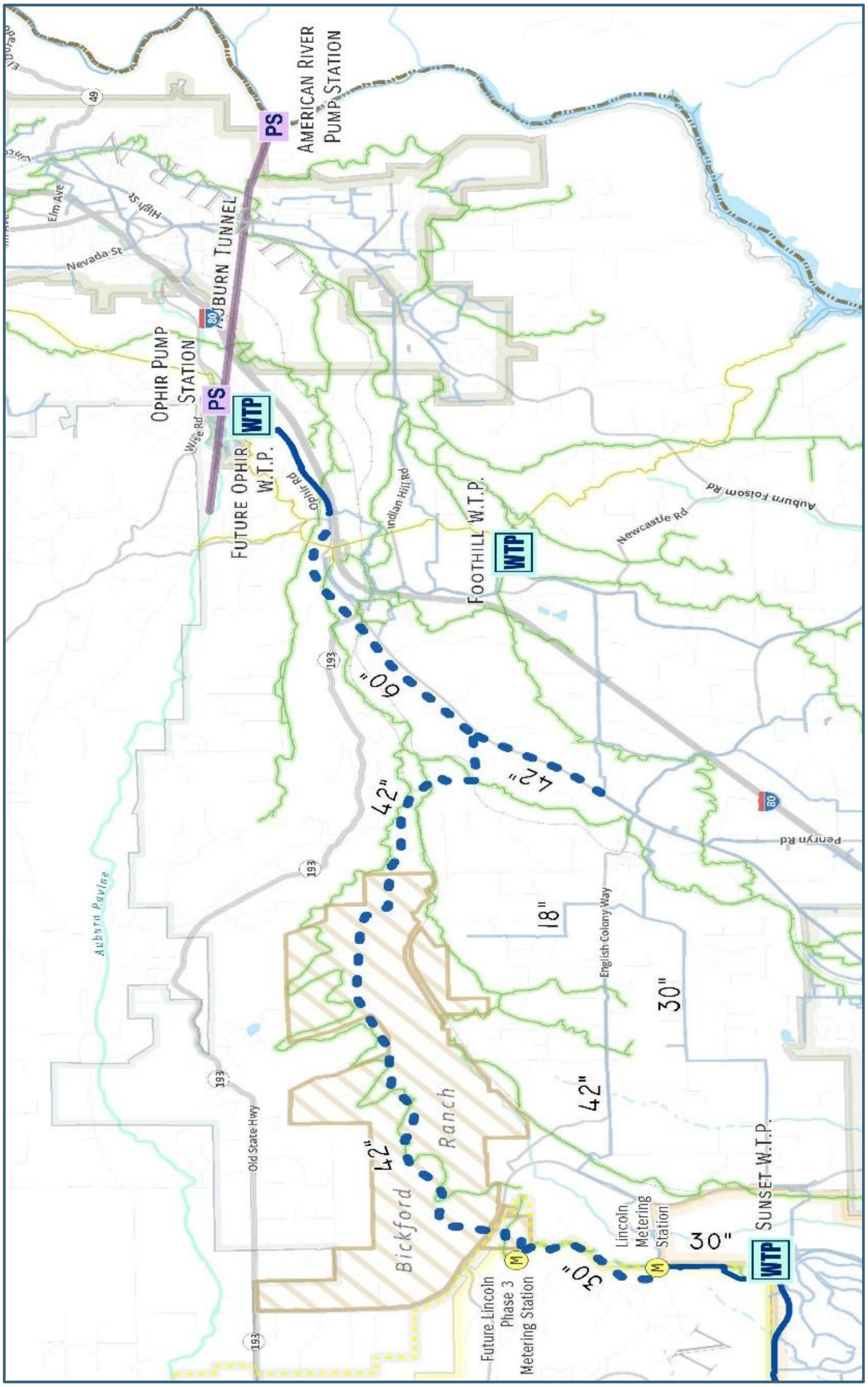
Option 2 – Use of Placer County Water Agency Water

Placer County Water Agency (PCWA) water can be accessed in two different ways. First, through a wholesale agreement with PCWA, where they treat and transport surface water to the northern boundary of the City (see Figures 6&7). From that point, City infrastructure will convey water down Industrial Boulevard to Blue Oaks Boulevard and then use backbone infrastructure to transport wholesale surface water to the plan area. PCWA has the ability to introduce 10 million gallons per day (mgd) of treated water at the Tinker Intertie through the City to the southwest corner of the distribution system (Baseline and Watt).

The second opportunity to use PCWA water involves an agreement with PCWA to deliver raw water to the City of Roseville Water Treatment Plant. Because the City of Roseville does not have sufficient treatment plant capacity to meet Max Day Demands (MDD) of the City at build out and to meet the ARSP demands, this alternative requires the use of aquifer storage and recovery (ASR). Using ASR to bank treated PCWA surface water during shoulder (off peak) months of the year (in the spring and fall) to "shave" peak deliveries during peak months extends existing infrastructure. Most of the treatment and transmission facilities are in place to accomplish this mode of operation, one or two wells may be needed in the ASRP to allow for redundancy while meeting the peak demands. There is adequate capacity to treat and move the water through the City's existing system when necessary if peaks are shaved with ASR.

Agency treatment plant and transmission capacity is limited, but a capital improvement plan is being developed that includes the timeline and budget to construct system wide facilities.

During the interim period, capacity in the City's water treatment plant on Barton Road, and transmission facilities are available to serve the specific plan. Roseville has not reached build out, which results in existing infrastructure having interim capacity available for use. The City and PCWA are working on an agreement to allow for interim use of the City's system.



M - Metering Station

Figure 6
Water Supply Infrastructure
Ophir Treatment and Transmission Facilities

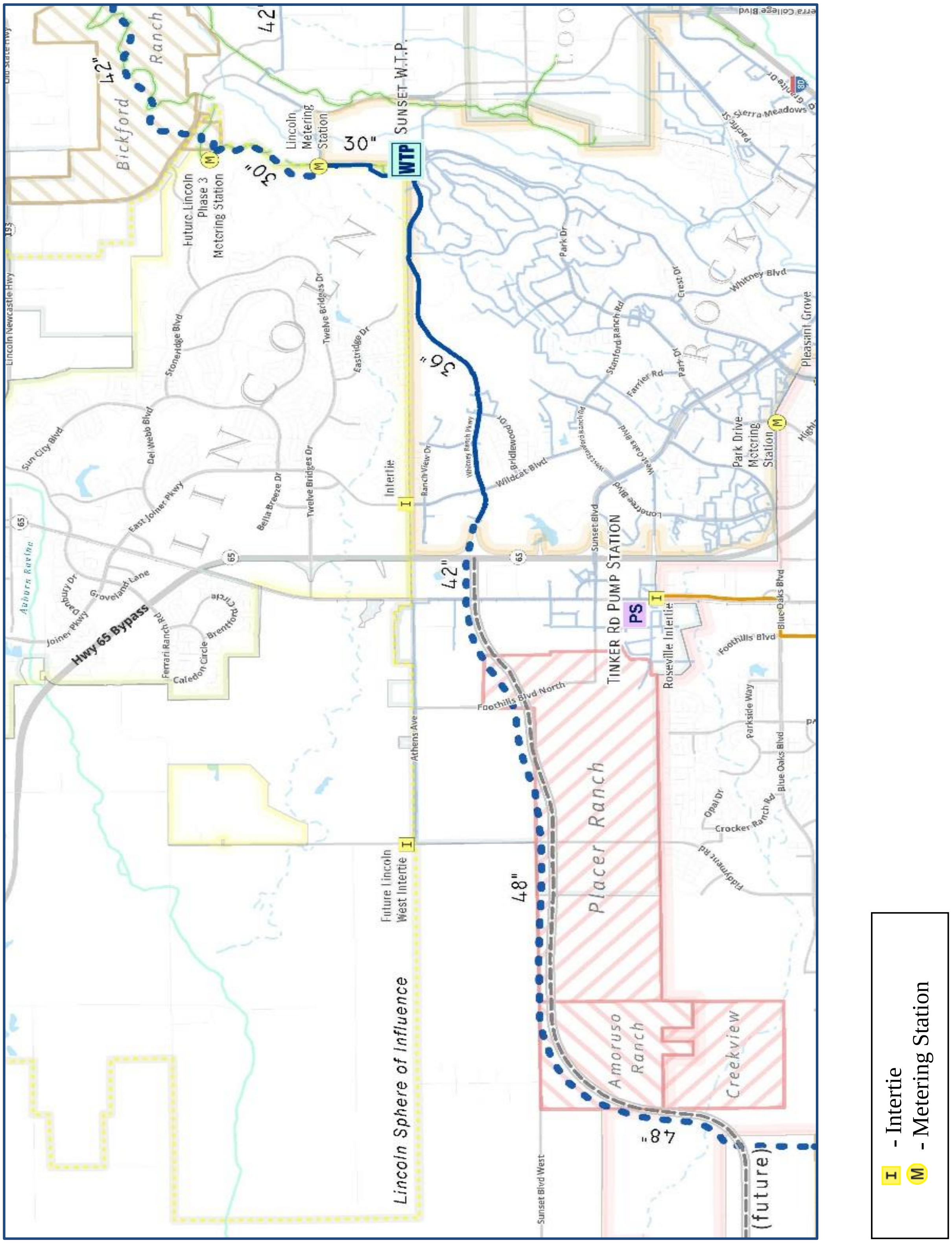


Figure 7
Water Supply Infrastructure
Sunset WTP and Tinker Road Pump Station

PCWA Water Connection with City of Roseville System

At the request of the City of Roseville, a study was conducted by West Yost Associates on bringing the PCWA water into the City of Roseville system. The purpose of the analysis was to determine any potential system impacts, and resultant recommended improvements, to PCWA's Lower Zone 1 water system from serving the City of Roseville 2.7 million gallons per day.

Working with PCWA's hydraulic model, West Yost completed the analysis and a copy of their Technical Memorandum entitled "PCWA Distribution System Analysis for Amoruso Ranch Specific Plan," dated January 22, 2016 is included in Appendix D.

The recommendations contained within the referenced technical memorandum include the following:

1. A new self-contained pump, adjacent to the existing Tinker Pump Station, capable of delivering 2.7 mgd at a similar discharge head to the current 10 mgd pump station;

2. A new pipeline connection into the existing fluoride feeder station or construct a new feeder station inside the new pump building; and

3. Construct approximately 800-feet of 24-inch diameter pipeline along Tinker Road.

These proposed improvements are shown on Figure 1 of the referenced technical memorandum included in Appendix D.

HYDRAULIC MODEL RESULTS

Water Service to ARSP

With the ARSP Area being located adjacent to existing City limits and within the City's Sphere of Influence boundaries, annexing the ARSP into the City's incorporated boundary is currently being pursued. The City will be the water purveyor for the ARSP Area upon development. The City will own, operate and maintain the storage, transmission and distribution system within the ARSP Area.

System Description

The ARSP potable water transmission system has been designed in a looped system following the major arterial and collector street alignments. The pipe diameter sizes range in size from 12 inches to 24 inches. It also includes one groundwater well for back up and emergency services. Figure 8 displays the general water system layout.

Hydraulic Modeling

The software used in this study was developed by Haestad Methods Inc. under trademark WaterCAD Version 8i. The computer modeling methodologies applied herein incorporate a combination of energy and mass balance iterations including the application of Bernoulli's equation with the Hazen-Williams method for determination of frictional head loss. Directional flow distribution is determined by applying the Hardy-Cross Method.

The WaterCAD software provides a module for testing fire flow and zone pressures at each node in the model. The fire flow data is sampled at each node representing the tee supplying a fire hydrant. WaterCAD tests each zone by applying the available fire flow at hydrant tee locations. Nodes are tested to verify that the available fire flow is greater than the total needed fire flow and the calculated residual pressures are above the designated minimum zone pressure. All nodes satisfying the fire flow constraints are labeled as "true" in the Fire Flow Report (Appendix C), while nodes that fail the fire flow constraints are labeled as "false."

The results of the fire flow analysis are reviewed for the fire flow scenario that produces the worst-case scenario pressure results. The worst-case node is then individually analyzed to check for system wide constraints such as maximum pipe velocities.

The following assumptions were made during the hydraulic modeling:

- The City's existing facilities will accommodate the ARSP water demands
- A Hazen William's "C" value of 130 was used for all pipe
- The connection to the Creekview Specific Plan pipe was modeled as a fixed head reservoir with a fixed hydraulic grade line.
- Maximum flows to Brookfield from the Creekview point of connection is given by the Creekview model for MDD+2% with a fire flow of 4,500 gpm.

The following scenarios were modeled under a steady-state analysis in order to duplicate the operational behavior of the system under various demand scenarios. These included:

- Average Day Demands (models the system under average daily water use)
- Maximum Day Demand (models the system under maximum daily water use)
- Peak Hour Demand (models the system under peak hour water use)
- Fire Flow (models the system under maximum daily water use with an additional fire flow demand)

Fire flow scenarios represent the most critical scenario. Four (4) fire flow demands were ran on the entire system and nine (9) crucial system nodes were analyzed based on the corresponding planned area land use to ensure the resulting fire flow analysis satisfied the requirements listed in Table 5 and 6. These results accounted for the 2% system losses applied to the maximum daily demand. Refer to Appendix C for the fire flow results.

City-Wide Hydraulic Modeling

In addition to hydraulic modeling of the proposed ARSP water system, it was necessary to model the entire City of Roseville system to determine any potential constraints that might result from the addition of the ARSP water system to the existing and currently proposed City of Roseville system.

HydroScience Engineers provided a series of modeling services for the city-wide system due to their familiarity with the City's current hydraulic model and work with adjacent developments.

The services provided by HydroScience as part of this project included the following:

1. Converting the existing Amoruso Ranch Specific Plan (ARSP) potable water hydraulic model into Infowater and integrating it into the City potable water hydraulic model;
2. Running the nine scenarios specified by the City for the current, interim, and buildout conditions during both summer drought, fall drought, and normal year conditions;
3. Evaluating water infrastructure requirements for ARSP; and
4. Providing model output reports and/or figures showing the required infrastructure.

Initially it was envisioned that the modeling would be prepared under two buildout scenarios:

1. With the Placer Ranch Specific Plan; and
2. Without the Placer Ranch Specific Plan (PRSP).

Following initiation of the project, the developers of the PRSP decided that they would no longer pursue their project for entitlement. Thus, ARSP was evaluated based on City current, interim, and buildout conditions without the inclusion of PRSP. This methodology was consistent with standard City practices since the water system for the ARSP would be required to operate without the benefit and additional pipeline connections through the PRSP area.

The city-wide hydraulic modeling analysis is presented within the Technical Memorandum entitled "ARSP Potable Water Hydraulic Modeling," dated February 3, 2016, by HydroScience Engineers included with Appendix E of this report. As part of the work completed by

HydroScience there were nine distinct scenarios evaluated as part of the modeling. They include the following:

1. 2015 – Normal
2. 2015 – Drought - Summer
3. 2015 – Drought - Fall
4. 2035 – Normal
5. 2035 – Drought - Summer
6. 2035 – Drought - Fall
7. 2065 – Normal
8. 2065 – Drought - Summer
9. 2065 – Drought - Fall

The conclusion reached from the City-wide modeling analyses listed above is:

> *"Potable water was able to be delivered to ARSP within the City's required criteria for this evaluation for pressure and velocity during each scenario. Thus, no upgrades to City infrastructure are required due to pressure drops or increased velocity directly associated with the addition of ARSP demands. However, there are operational considerations to be made by the City specific to each scenario"* as detailed in the technical memorandum within Appendix E.

Hydraulic Modeling Results

A detailed model analysis specific to the ARSP development area was performed to provide a comparison of infrastructure requirements needed to support the full build-out of the ARSP demands. A summary of the results for pressure and velocities is shown in Table 8. Table 9 includes results for preliminary sizing of the transmission mains for the project. Appendix B includes the water system layouts and Appendix C includes the hydraulic model run results as generated by the modeling program.

Table 8
Amoruso Ranch Specific Plan
Water Master Plan
Summary of Results[1]

Scenario	Minimum Pressure (psi)	Maximum Pressure (psi)	Maximum Velocity (fps)
Average Day Demand	59.6	69.5	0.71
Maximum Day Demand	59.3	69.5	1.42
Peak Hour Demand	58.7	69.5	2.42
Max Day + Fire Flow at Node 46[2]	58.1	63.8	5.76

1. Results include 2% system losses
2. Node 46 analyzed with highest fire flow demand (4,500 gpm). Refer to Appendix C for all other nodes tested in the system.

Based on the stated assumptions and results presented in Table 8, the water transmission mains satisfy the minimum design criteria. The proposed water infrastructure can adequately supply water to Brookfield while maintaining 50 psi within the ARSP during maximum day and peak hour demands and satisfying the minimum fire flow criteria. Results for the ARSP hydraulic model analysis are presented in the Appendix. The proposed pipe infrastructure required to convey water throughout the ARSP is tabulated in Table 9.

Table 9
Amoruso Ranch Specific Plan
Water Master Plan
Water System Approximate Pipe Size and Lengths

Pipe Size	Pipe Length (ft)
12”	15,700
16”	6,700
24”	8,100
Total	**30,500**

The pipe lengths shown in Table 9 are used for modeling purposes and are an approximate representation of the actual site requirements. The final design and actual lengths may vary slightly.

Kimley»Horn

References

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

Amoruso Ranch Specific Plan Area

Water Master Plan

Appendix A

Water Demands by Land Use Parcel (AR)

Brookfield Water Demand Summary

Parcel #	Land Use	Acres	Units	Density	Unit Demand Factor	Demand Unit	Avg. Day Demand (gpd)	Avg. Day Demand (gpm)	Avg. Annual Demand (AF/yr)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
1	LDR	19.87	68	3.42	728	gpd/du	49,504	34.4	55.5	68.8	116.9
2	LDR	24.96	97	3.89	600	gpd/du	58,200	40.4	65.2	80.8	137.4
3	LDR	27.25	80	2.94	728	gpd/du	58,240	40.4	65.2	80.9	137.5
4	LDR	7.25	41	5.66	521	gpd/du	21,361	14.8	23.9	29.7	50.4
5	LDR	2.76	17	6.16	430	gpd/du	7,310	5.1	8.2	10.2	17.3
6	LDR	4.98	34	6.83	430	gpd/du	14,620	10.2	16.4	20.3	34.5
7	LDR	3.17	18	5.68	521	gpd/du	9,378	6.5	10.5	13.0	22.1
8	LDR	8.19	52	6.35	430	gpd/du	22,360	15.5	25.0	31.1	52.8
9	LDR	6.22	40	6.43	430	gpd/du	17,200	11.9	19.3	23.9	40.6
10	MDR	10.69	138	12.91	288	gpd/du	39,744	27.6	44.5	55.2	93.8
11	LDR	8.74	55	6.29	430	gpd/du	23,650	16.4	26.5	32.8	55.8
12	LDR	3.38	21	6.21	430	gpd/du	9,030	6.3	10.1	12.5	21.3
13	LDR	6.08	40	6.58	430	gpd/du	17,200	11.9	19.3	23.9	40.6
14	LDR	7.05	45	6.38	430	gpd/du	19,350	13.4	21.7	26.9	45.7
15	LDR	6.94	45	6.48	430	gpd/du	19,350	13.4	21.7	26.9	45.7
16	LDR	6.84	43	6.29	430	gpd/du	18,490	12.8	20.7	25.7	43.7
17	LDR	3.56	24	6.74	430	gpd/du	10,320	7.2	11.6	14.3	24.4
18	LDR	5.05	31	6.14	430	gpd/du	13,330	9.3	14.9	18.5	31.5
19	HDR	9.34	230	24.63	177	gpd/du	40,710	28.3	45.6	56.5	96.1
21	LDR	2.35	13	5.53	521	gpd/du	6,773	4.7	7.6	9.4	16.0
22	LDR	4.34	28	6.45	430	gpd/du	12,040	8.4	13.5	16.7	28.4
23	LDR	2.93	19	6.48	430	gpd/du	8,170	5.7	9.2	11.3	19.3
24	LDR	10.30	55	5.34	521	gpd/du	28,655	19.9	32.1	39.8	67.7
25	LDR	4.62	28	6.06	430	gpd/du	12,040	8.4	13.5	16.7	28.4
26	LDR	9.70	55	5.67	521	gpd/du	28,655	19.9	32.1	39.8	67.7
27	LDR	2.40	15	6.25	430	gpd/du	6,450	4.5	7.2	9.0	15.2
28	MDR	10.32	129	12.50	288	gpd/du	37,152	25.8	41.6	51.6	87.7
30	LDR	3.33	23	6.91	430	gpd/du	9,890	6.9	11.1	13.7	23.4
31	LDR	4.40	27	6.14	430	gpd/du	11,610	8.1	13.0	16.1	27.4
32	LDR	7.72	50	6.48	430	gpd/du	21,500	14.9	24.1	29.9	50.8
33	MDR	5.30	61	11.51	323	gpd/du	19,703	13.7	22.1	27.4	46.5
34	LDR	3.82	19	4.97	600	gpd/du	11,400	7.9	12.8	15.8	26.9
35	LDR	4.58	24	5.24	521	gpd/du	12,504	8.7	14.0	17.4	29.5
36	HDR	7.55	113	14.97	288	gpd/du	32,544	22.6	36.5	45.2	76.8
37	LDR	6.28	33	5.25	521	gpd/du	17,193	11.9	19.3	23.9	40.6
38	HDR	15.21	380	24.98	177	gpd/du	67,260	46.7	75.3	93.4	158.8
39	MDR	7.35	54	7.35	430	gpd/du	23,220	16.1	26.0	32.3	54.8
40	LDR	13.51	71	5.26	521	gpd/du	36,991	25.7	41.4	51.4	87.3
42	MDR	8.37	66	7.89	430	gpd/du	28,380	19.7	31.8	39.4	67.0
43	LDR	13.64	78	5.72	521	gpd/du	40,638	28.2	45.5	56.4	96.0
44	HDR	6.03	150	24.88	177	gpd/du	26,550	18.4	29.7	36.9	62.7
45	MDR	8.24	94	11.41	323	gpd/du	30,362	21.1	34.0	42.2	71.7
46	LDR	2.56	13	5.08	521	gpd/du	6,773	4.7	7.6	9.4	16.0
50	P/QP	9.62			3454	gpd/ac	33,227	23.1	37.2	46.1	78.5
51	CC-VC		91	6.40	288	gpd/du	26,208	18.2	29.4	36.4	61.9
51	CC-VC	14.21			2598	gpd/ac	36,918	25.6	41.4	51.3	87.2
52	CC-VC		18	1.38	288	gpd/du	5,184	3.6	5.8	7.2	12.2
52	CC-VC	13.06			2598	gpd/ac	33,930	23.6	38.0	47.1	80.1
53	CC	23.85			2598	gpd/ac	61,962	43.0	69.4	86.1	146.3

54	P/QP	3.02			1780	gpd/ac	5,376	3.7	6.0	7.5	12.7
55	P/QP	3.46			1780	gpd/ac	6,159	4.3	6.9	8.6	14.5
56	P/QP	0.28			1780	gpd/ac	498	0.3	0.6	0.7	1.2
57	P/QP	0.85			1780	gpd/ac	1,513	1.1	1.7	2.1	3.6
60	P/R	1.28			2988	gpd/ac	3,825	2.7	4.3	5.3	9.0
61	P/R	1.87			2988	gpd/ac	5,588	3.9	6.3	7.8	13.2
62	P/R	10.11			2988	gpd/ac	30,209	21.0	33.8	42.0	71.3
63	P/R	1.72			2988	gpd/ac	5,139	3.6	5.8	7.1	12.1
64	P/R	2.12			2988	gpd/ac	6,335	4.4	7.1	8.8	15.0
66	P/R	3.04			2988	gpd/ac	9,084	6.3	10.2	12.6	21.4
67	P/R	2.00			2988	gpd/ac	5,976	4.2	6.7	8.3	14.1
70	OS (Paseo)	0.58			2988	gpd/ac	1,733	1.2	1.9	2.4	4.1
71	OS (Paseo)	0.32			2988	gpd/ac	956	0.7	1.1	1.3	2.3
72	OS (Paseo)	0.98			2988	gpd/ac	2,928	2.0	3.3	4.1	6.9
73	OS (Paseo)	0.98			2988	gpd/ac	2,928	2.0	3.3	4.1	6.9
74	OS (Paseo)	0.60			2988	gpd/ac	1,793	1.2	2.0	2.5	4.2
75	OS (Paseo)	0.76			2988	gpd/ac	2,271	1.6	2.5	3.2	5.4
76	OS (Paseo)	0.36			2988	gpd/ac	1,076	0.7	1.2	1.5	2.5
77	OS (Paseo)	0.85			2988	gpd/ac	2,540	1.8	2.8	3.5	6.0
78	OS (Paseo)	0.46			2988	gpd/ac	1,374	1.0	1.5	1.9	3.2
79	OS (Paseo)	0.39			2988	gpd/ac	1,165	0.8	1.3	1.6	2.8
80	OS (Paseo)	1.10			2988	gpd/ac	3,287	2.3	3.7	4.6	7.8
81	OS (Paseo)	1.15			2988	gpd/ac	3,436	2.4	3.8	4.8	8.1
90	OS (General)	3.81			0	gpd/ac					
91	OS (General)	4.15			0	gpd/ac					
92	OS (Preserve)	28.67			0	gpd/ac					
93	OS (General)	5.99			0	gpd/ac					
94	OS (General)	2.30			0	gpd/ac					
95	OS (General)	2.73			0	gpd/ac					
96	OS (General)	7.72			0	gpd/ac					
97	OS (Preserve)	40.08			0	gpd/ac					
98	OS (General)	7.88			0	gpd/ac					
99	OS (General)	0.49			0	gpd/ac					
100	OS (General)	1.22			0	gpd/ac					
101	OS (General)	0.95			0	gpd/ac					
102	OS (Paseo)	0.65			2988	gpd/ac	1,942	1.3	2.2	2.7	4.6
103	OS (Paseo)	0.65			2988	gpd/ac	1,942	1.3	2.2	2.7	4.6
104	OS (Paseo)	0.88			2988	gpd/ac	2,629	1.8	2.9	3.7	6.2
105	OS (Preserve)	28.82			0	gpd/ac					
110	UR	20.00	1	0.1	728	gpd/du	728	0.5	0.8	1.0	1.7
	NAPOTS	49.16			0	gpd/ac					
	ROW	52.04			0	gpd/ac					
				Subtotal			1,315,659	914	1,474	1,827	3,106
				2% System Loss			26,313	18	29	37	62
				Total			**1,341,972**	**932**	**1,503**	**1,864**	**3,169**

Amoruso Ranch Specific Plan Area

Water Master Plan

Appendix B

Figure 8 – ARSP Water System Pipe Network
Figure 9 – ARSP Water System Junction Nodes
Figure 10 – ARSP Water System Pipe Layout
Recycling Center and Well Site Concept

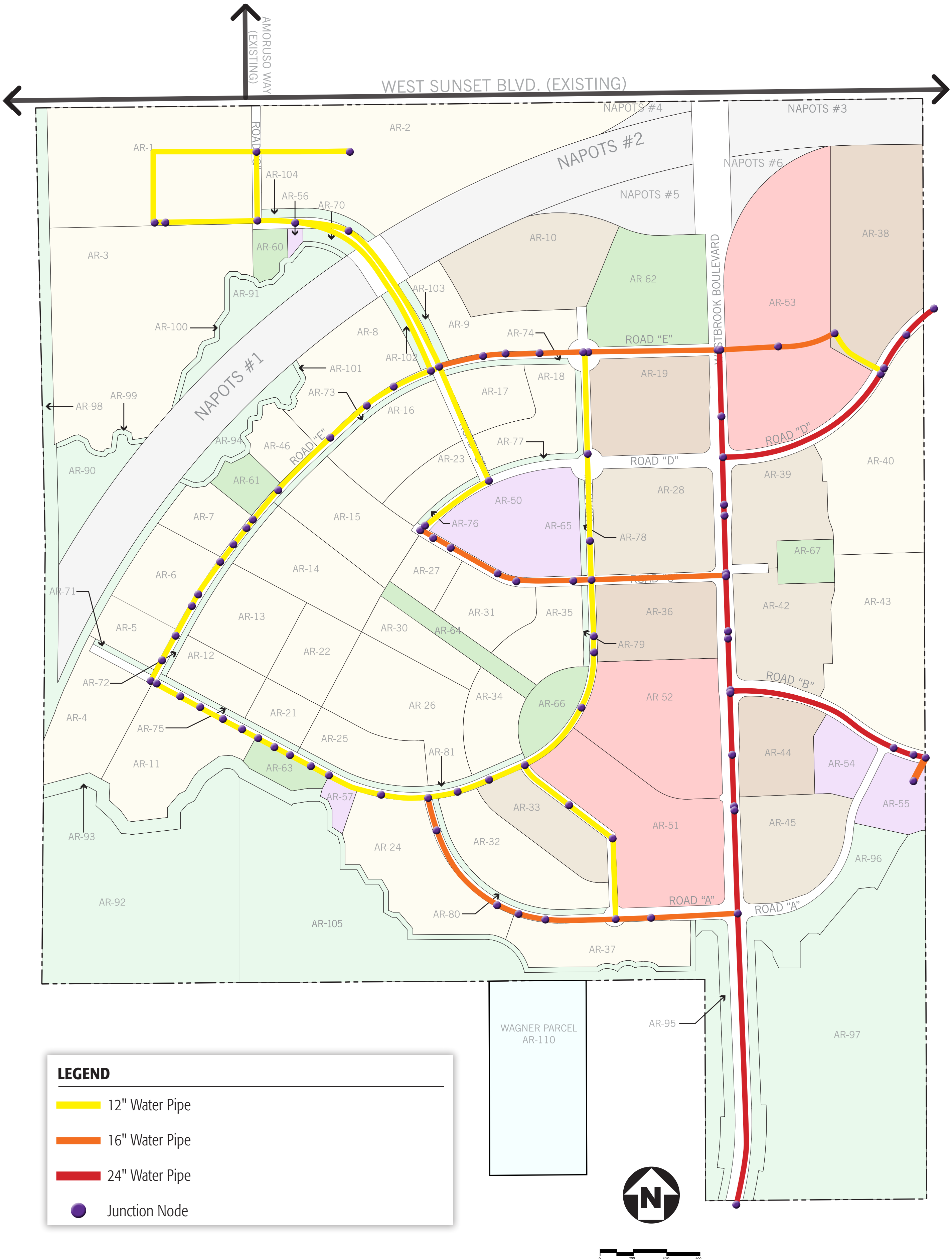


Figure 8: Amoruso Ranch *(Water System Pipe Network)*

Kimley»Horn

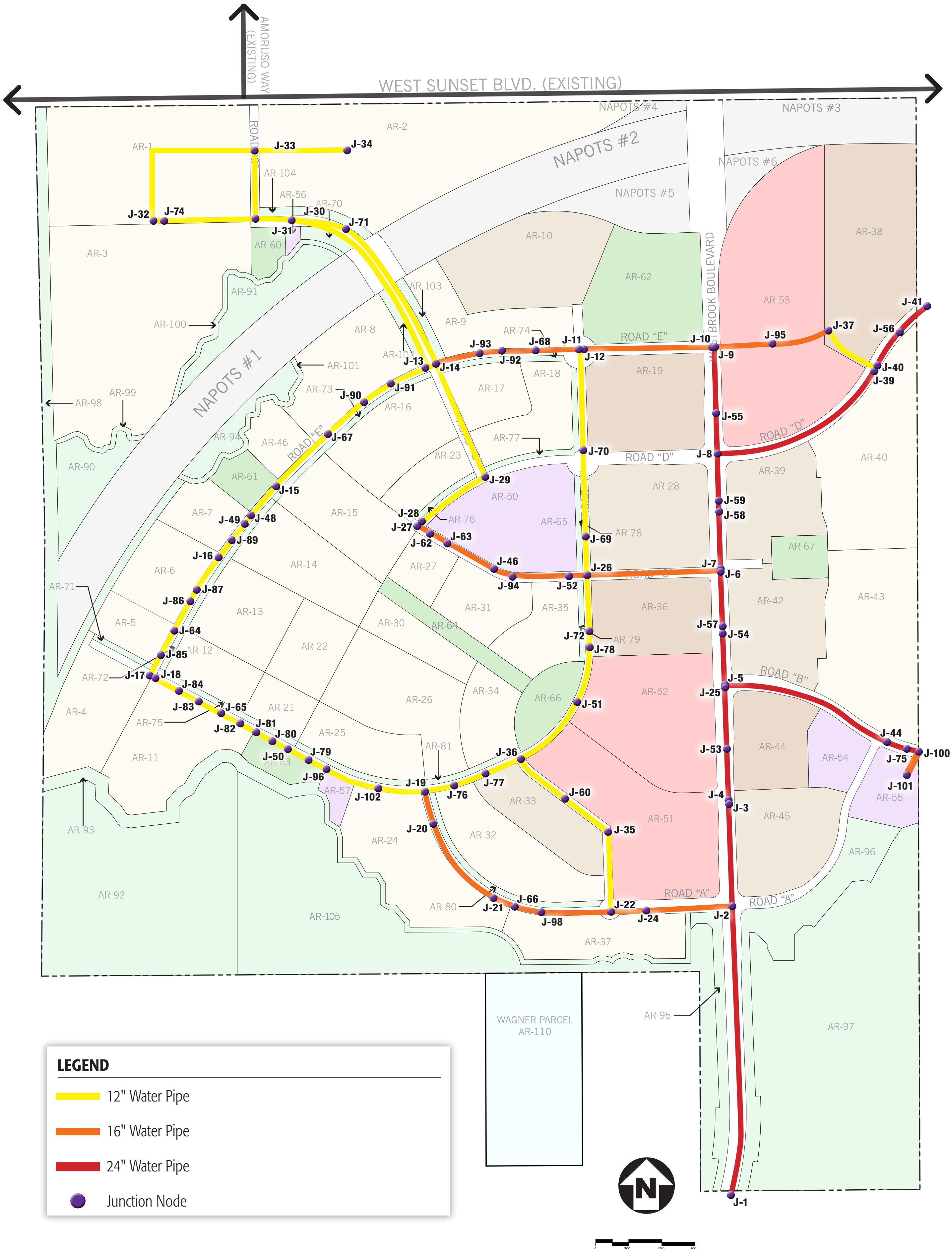


Figure 9: Amoruso Ranch *(Water System Junction Nodes)*

Kimley»Horn

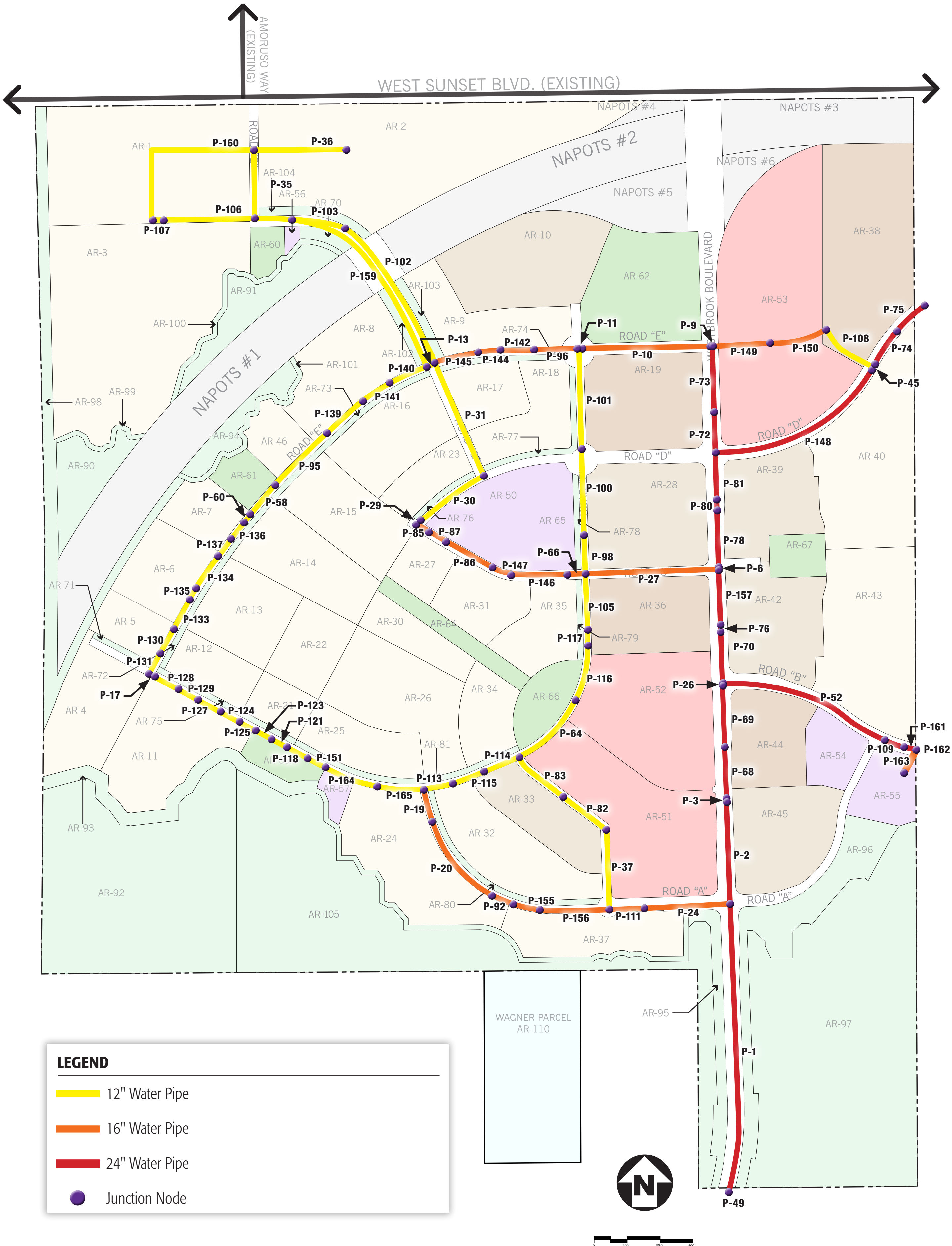
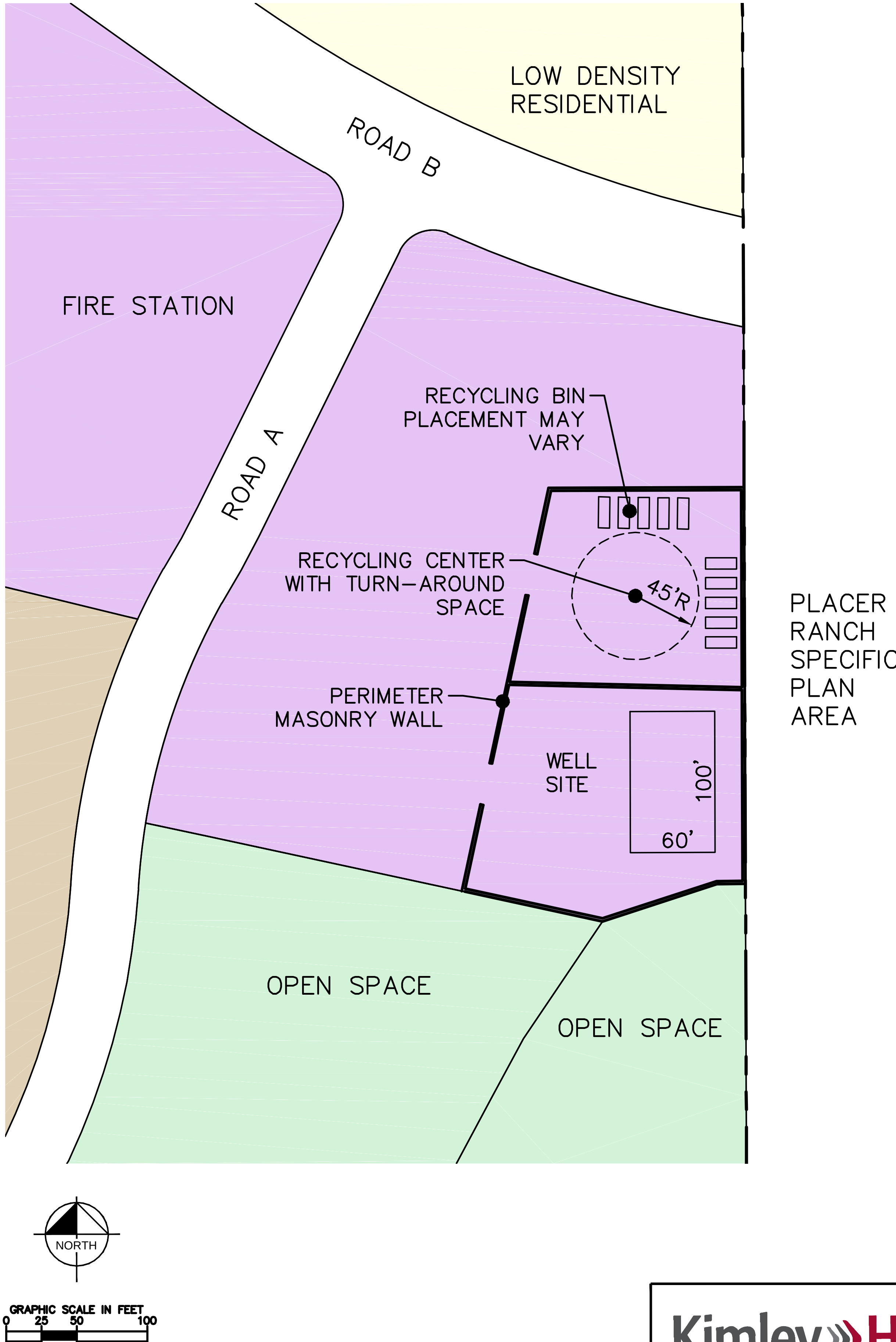


Figure 10: Amoruso Ranch *(Water System Pipe Layout)*

Kimley»Horn



Kimley»Horn

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Amoruso Ranch Specific Plan Area

Water Master Plan

Appendix C

Modeling Results

Scenario: Average Day Demand
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
28	J-1		82.49	0	243.07	69.5
29	J-2		92.27	0	242.93	65.2
31	J-3	AR-51	94.47	44	242.9	64.2
33	J-4	AR-45	94.6	21	242.9	64.2
35	J-5		97.53	0	242.87	62.9
37	J-6		102.47	0	242.85	60.7
39	J-7	AR-67	102.54	4	242.85	60.7
41	J-8		101.47	0	242.85	61.2
43	J-9		98.66	0	242.84	62.4
45	J-10	AR-62	98.37	21	242.84	62.5
47	J-11	AR-18	95.22	9	242.82	63.9
49	J-12	AR-10	95.15	28	242.82	63.9
51	J-13		91.87	0	242.8	65.3
53	J-14		91.99	0	242.8	65.2
55	J-15	AR-15	88.34	13	242.77	66.8
57	J-16	AR-14	86.23	13	242.77	67.7
59	J-17	AR-71	82.07	1	242.78	69.5
61	J-18	AR-04	82.21	15	242.78	69.5
63	J-19		84.4	0	242.86	68.6
65	J-20	AR-24	86.46	20	242.86	67.7
67	J-21	AR-31	91.2	8	242.87	65.6
69	J-22		89.78	0	242.89	66.2
73	J-24	AR-37	90.58	12	242.9	65.9
76	J-25	AR-52	97.4	27	242.87	62.9
79	J-26		96.1	0	242.84	63.5
81	J-27	AR-76	93.83	1	242.82	64.5
83	J-28	AR-23	95.23	6	242.82	63.9
85	J-29		94.85	0	242.81	64
88	J-30	AR-56	87.87	0	242.78	67
90	J-31	AR-60	87.97	3	242.78	67
92	J-32	AR-01	86.75	34	242.77	67.5
94	J-33		89.79	0	242.77	66.2
96	J-34	AR-02	91.23	40	242.77	65.6
98	J-35		87.98	0	242.87	67
100	J-36		87.4	0	242.86	67.3
105	J-37		102.48	0	242.84	60.7
109	J-39		103.76	0	242.84	60.2
111	J-40	AR-40	103.86	26	242.84	60.1
113	J-41		105.16	0	242.84	59.6
124	J-44	AR-54	90.78	4	242.87	65.8
127	J-45	AR-55	89.13	4	242.87	66.5
130	J-46	AR-50	94.64	23	242.83	64.1
134	J-48	AR-61	86.12	4	242.77	67.8
137	J-49	AR-64	85.93	4	242.77	67.9
140	J-50	AR-63	83.88	4	242.81	68.8
143	J-51	AR-66	89.74	6	242.85	66.2

Scenario: Average Day Demand
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
146	J-52		96.57	0	242.84	63.3
149	J-53	AR-44	95.83	18	242.89	63.6
152	J-54	AR-36	99.73	23	242.86	61.9
155	J-55	AR-19	100.04	28	242.84	61.8
158	J-56	AR-38	104.73	47	242.84	59.8
161	J-57	AR-42	100.07	20	242.86	61.8
164	J-58	AR-27	103.99	4	242.85	60.1
167	J-59	AR-39	104.29	16	242.85	59.9
170	J-60	AR-33	85.92	14	242.86	67.9
174	J-62	AR-26	94.34	20	242.82	64.2
177	J-63	AR-28	93.83	26	242.82	64.5
180	J-64	AR-72	83.48	2	242.78	68.9
183	J-65	AR-75	83.74	2	242.79	68.8
186	J-66	AR-80	88.62	2	242.87	66.7
189	J-67	AR-73 AR-102	90.07	22	242.78	66.1
192	J-68	AR-74 AR-103	94.11	11	242.81	64.3
195	J-69	AR-78	98.44	1	242.84	62.5
198	J-70	AR-77	96.48	2	242.83	63.3
201	J-71	AR-70 AR-104	88.99	16	242.78	66.5
204	J-72	AR-79	92.83	1	242.84	64.9
208	J-74	AR-03	87	40	242.77	67.4
212	J-75	AR-43	90.95	28	242.87	65.7
216	J-76	AR-32	85.25	15	242.86	68.2
219	J-77	AR-34	86.27	8	242.86	67.7
222	J-78	AR-35	91.75	9	242.84	65.4
225	J-79	AR-25	83.28	8	242.82	69
228	J-80	AR-22	84.34	8	242.8	68.6
231	J-81	AR-21	84.54	5	242.8	68.5
234	J-82		84.28	0	242.8	68.6
237	J-83	AR-11	83.17	16	242.79	69.1
240	J-84	AR-12	82.63	6	242.78	69.3
243	J-85	AR-05	83.8	5	242.78	68.8
246	J-86	AR-06	85.87	10	242.77	67.9
249	J-87	AR-13	86.33	12	242.77	67.7
253	J-89	AR-07 AR-46	86.69	41	242.77	67.5
256	J-90	AR-08	91.16	16	242.78	65.6
259	J-91	AR-16	92.01	13	242.79	65.2
262	J-92	AR-09	93.28	12	242.81	64.7
265	J-93	AR-17	92.63	7	242.81	65
268	J-94	AR-30	95.44	7	242.83	63.8
296	J-95	AR-53	100.72	43	242.84	61.5
299	J-96	AR-57	82.66	1	242.82	69.3
307	J-98	AR-110	85.95	1	242.88	67.9
321	J-100		90.34	0	242.87	66
324	J-101		90	0	242.87	66.1
326	J-102	AR-81	83.6	2	242.84	68.9

Scenario: Average Day Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
30	P-1	1740	J-1	J-2	24	Ductile Iron	130	984	0.7
32	P-2	610	J-2	J-3	24	Ductile Iron	130	711	0.5
34	P-3	25	J-3	J-4	24	Ductile Iron	130	667	0.47
40	P-6	13	J-6	J-7	24	Ductile Iron	130	365	0.26
46	P-9	14	J-9	J-10	16	Ductile Iron	130	196	0.31
48	P-10	779	J-10	J-11	16	Ductile Iron	130	175	0.28
50	P-11	16	J-11	J-12	16	Ductile Iron	130	220	0.35
54	P-13	67	J-13	J-14	12	Ductile Iron	130	156	0.44
62	P-17	32	J-17	J-18	12	Ductile Iron	130	60	0.17
66	P-19	200	J-19	J-20	16	Ductile Iron	130	140	0.22
68	P-20	588	J-20	J-21	16	Ductile Iron	130	160	0.25
75	P-24	514	J-24	J-2	16	Ductile Iron	130	274	0.44
78	P-26	14	J-25	J-5	24	Ductile Iron	130	600	0.43
80	P-27	802	J-6	J-26	16	Ductile Iron	130	157	0.25
84	P-29	35	J-27	J-28	12	Ductile Iron	130	75	0.21
86	P-30	460	J-28	J-29	12	Ductile Iron	130	69	0.2
87	P-31	730	J-29	J-13	12	Ductile Iron	130	69	0.2
95	P-35	388	J-30	J-33	12	Ductile Iron	130	59	0.17
97	P-36	285	J-33	J-34	12	Ductile Iron	130	40	0.11
99	P-37	477	J-22	J-35	12	Ductile Iron	130	91	0.26
112	P-45	29	J-39	J-40	24	Ductile Iron	130	72	0.05
119	P-49	62	R-1	J-1	24	Ductile Iron	130	984	0.7
125	P-52	752	J-5	J-44	24	Ductile Iron	130	36	0.03
135	P-58	234	J-15	J-48	12	Ductile Iron	130	33	0.09
138	P-60	51	J-48	J-49	12	Ductile Iron	130	29	0.08
144	P-64	488	J-36	J-51	12	Ductile Iron	130	67	0.19
147	P-66	109	J-26	J-52	16	Ductile Iron	130	151	0.24
150	P-68	304	J-4	J-53	24	Ductile Iron	130	646	0.46
151	P-69	367	J-53	J-25	24	Ductile Iron	130	627	0.44
153	P-70	310	J-5	J-54	24	Ductile Iron	130	564	0.4
156	P-72	239	J-8	J-55	24	Ductile Iron	130	236	0.17
157	P-73	404	J-55	J-9	24	Ductile Iron	130	208	0.15
159	P-74	239	J-40	J-56	24	Ductile Iron	130	47	0.03
160	P-75	221	J-56	J-41	24	Ductile Iron	130	0	0
162	P-76	41	J-54	J-57	24	Ductile Iron	130	541	0.38
165	P-78	345	J-7	J-58	24	Ductile Iron	130	361	0.26
168	P-80	65	J-58	J-59	24	Ductile Iron	130	356	0.25
169	P-81	281	J-59	J-8	24	Ductile Iron	130	340	0.24
171	P-82	324	J-35	J-60	12	Ductile Iron	130	91	0.26
172	P-83	373	J-60	J-36	12	Ductile Iron	130	77	0.22
176	P-85	86	J-62	J-27	16	Ductile Iron	130	76	0.12
178	P-86	318	J-46	J-63	16	Ductile Iron	130	121	0.19
179	P-87	118	J-63	J-62	16	Ductile Iron	130	96	0.15
187	P-92	138	J-21	J-66	16	Ductile Iron	130	168	0.27
191	P-95	440	J-67	J-15	12	Ductile Iron	130	46	0.13

Scenario: Average Day Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
193	P-96	254	J-12	J-68	16	Ductile Iron	130	192	0.31
196	P-98	233	J-26	J-69	12	Ductile Iron	130	56	0.16
199	P-100	516	J-69	J-70	12	Ductile Iron	130	55	0.16
200	P-101	600	J-70	J-11	12	Ductile Iron	130	54	0.15
202	P-102	975	J-13	J-71	12	Ductile Iron	130	76	0.21
203	P-103	277	J-71	J-30	12	Ductile Iron	130	59	0.17
206	P-105	334	J-72	J-26	12	Ductile Iron	130	51	0.14
209	P-106	766	J-31	J-74	12	Ductile Iron	130	56	0.16
210	P-107	66	J-74	J-32	12	Ductile Iron	130	16	0.05
211	P-108	371	J-37	J-39	12	Ductile Iron	130	32	0.09
213	P-109	190	J-44	J-75	24	Ductile Iron	130	33	0.02
215	P-111	210	J-24	J-22	16	Ductile Iron	130	262	0.42
218	P-113	171	J-76	J-19	12	Ductile Iron	130	12	0.03
220	P-114	223	J-36	J-77	12	Ductile Iron	130	11	0.03
221	P-115	200	J-77	J-76	12	Ductile Iron	130	3	0.01
223	P-116	335	J-51	J-78	12	Ductile Iron	130	61	0.17
224	P-117	96	J-78	J-72	12	Ductile Iron	130	52	0.15
226	P-118	141	J-50	J-79	12	Ductile Iron	130	116	0.33
230	P-121	101	J-80	J-50	12	Ductile Iron	130	112	0.32
233	P-123	114	J-81	J-80	12	Ductile Iron	130	104	0.29
235	P-124	131	J-65	J-82	12	Ductile Iron	130	99	0.28
236	P-125	104	J-82	J-81	12	Ductile Iron	130	99	0.28
239	P-127	150	J-83	J-65	12	Ductile Iron	130	97	0.28
241	P-128	164	J-18	J-84	12	Ductile Iron	130	75	0.21
242	P-129	134	J-84	J-83	12	Ductile Iron	130	81	0.23
244	P-130	164	J-64	J-85	12	Ductile Iron	130	54	0.15
245	P-131	139	J-85	J-17	12	Ductile Iron	130	59	0.17
248	P-133	202	J-86	J-64	12	Ductile Iron	130	52	0.15
250	P-134	234	J-16	J-87	12	Ductile Iron	130	30	0.09
251	P-135	79	J-87	J-86	12	Ductile Iron	130	42	0.12
254	P-136	131	J-49	J-89	12	Ductile Iron	130	24	0.07
255	P-137	126	J-89	J-16	12	Ductile Iron	130	17	0.05
258	P-139	290	J-90	J-67	12	Ductile Iron	130	68	0.19
260	P-140	216	J-14	J-91	12	Ductile Iron	130	97	0.27
261	P-141	193	J-91	J-90	12	Ductile Iron	130	84	0.24
263	P-142	198	J-68	J-92	16	Ductile Iron	130	181	0.29
266	P-144	132	J-92	J-93	16	Ductile Iron	130	169	0.27
267	P-145	282	J-93	J-13	16	Ductile Iron	130	162	0.26
269	P-146	336	J-52	J-94	16	Ductile Iron	130	151	0.24
270	P-147	119	J-94	J-46	16	Ductile Iron	130	145	0.23
295	P-148	1118	J-8	J-39	24	Ductile Iron	130	104	0.07
297	P-149	346	J-9	J-95	16	Ductile Iron	130	11	0.02
298	P-150	352	J-95	J-37	16	Ductile Iron	130	32	0.05
300	P-151	122	J-79	J-96	12	Ductile Iron	130	124	0.35
308	P-155	166	J-66	J-98	16	Ductile Iron	130	170	0.27

Scenario: Average Day Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
309	P-156	414	J-98	J-22	16	Ductile Iron	130	170	0.27
316	P-157	327	J-57	J-6	24	Ductile Iron	130	522	0.37
319	P-159	1241	J-14	J-31	12	Ductile Iron	130	59	0.17
320	P-160	1286	J-32	J-33	12	Ductile Iron	130	18	0.05
322	P-161	187	J-75	J-100	24	Ductile Iron	130	4	0
323	P-162	142	J-100	J-45	24	Ductile Iron	130	4	0
325	P-163	152	J-100	J-101	16	Ductile Iron	130	0	0
327	P-164	331	J-96	J-102	12	Ductile Iron	130	125	0.35
328	P-165	285	J-102	J-19	12	Ductile Iron	130	127	0.36

Scenario: Average Day Demand +2%
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
28	J-1		82.49	0	243.07	69.5
29	J-2		92.27	0	242.92	65.2
31	J-3	AR-51	94.47	45	242.89	64.2
33	J-4	AR-45	94.6	22	242.89	64.2
35	J-5		97.53	0	242.87	62.9
37	J-6		102.47	0	242.85	60.7
39	J-7	AR-67	102.54	4	242.85	60.7
41	J-8		101.47	0	242.84	61.2
43	J-9		98.66	0	242.83	62.4
45	J-10	AR-62	98.37	21	242.83	62.5
47	J-11	AR-18	95.22	9	242.81	63.9
49	J-12	AR-10	95.15	28	242.81	63.9
51	J-13		91.87	0	242.79	65.3
53	J-14		91.99	0	242.78	65.2
55	J-15	AR-15	88.34	14	242.76	66.8
57	J-16	AR-14	86.23	14	242.76	67.7
59	J-17	AR-71	82.07	1	242.77	69.5
61	J-18	AR-04	82.21	15	242.77	69.5
63	J-19		84.4	0	242.85	68.6
65	J-20	AR-24	86.46	20	242.85	67.7
67	J-21	AR-31	91.2	8	242.86	65.6
69	J-22		89.78	0	242.88	66.2
73	J-24	AR-37	90.58	12	242.89	65.9
76	J-25	AR-52	97.4	28	242.87	62.9
79	J-26		96.1	0	242.83	63.5
81	J-27	AR-76	93.83	1	242.81	64.5
83	J-28	AR-23	95.23	6	242.81	63.9
85	J-29		94.85	0	242.8	64
88	J-30	AR-56	87.87	0	242.76	67
90	J-31	AR-60	87.97	3	242.77	67
92	J-32	AR-01	86.75	35	242.76	67.5
94	J-33		89.79	0	242.76	66.2
96	J-34	AR-02	91.23	41	242.76	65.6
98	J-35		87.98	0	242.87	67
100	J-36		87.4	0	242.85	67.3
105	J-37		102.48	0	242.83	60.7
109	J-39		103.76	0	242.84	60.2
111	J-40	AR-40	103.86	26	242.84	60.1
113	J-41		105.16	0	242.84	59.6
124	J-44	AR-54	90.78	4	242.87	65.8
127	J-45	AR-55	89.13	4	242.87	66.5
130	J-46	AR-50	94.64	24	242.82	64.1
134	J-48	AR-61	86.12	4	242.76	67.8
137	J-49	AR-64	85.93	4	242.76	67.9
140	J-50	AR-63	83.88	4	242.8	68.8
143	J-51	AR-66	89.74	6	242.84	66.2

Scenario: Average Day Demand +2%
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
146	J-52		96.57	0	242.83	63.3
149	J-53	AR-44	95.83	19	242.88	63.6
152	J-54	AR-36	99.73	23	242.86	61.9
155	J-55	AR-19	100.04	29	242.84	61.8
158	J-56	AR-38	104.73	48	242.84	59.8
161	J-57	AR-42	100.07	20	242.86	61.8
164	J-58	AR-27	103.99	5	242.84	60.1
167	J-59	AR-39	104.29	16	242.84	59.9
170	J-60	AR-33	85.92	14	242.86	67.9
174	J-62	AR-26	94.34	20	242.81	64.2
177	J-63	AR-28	93.83	26	242.81	64.5
180	J-64	AR-72	83.48	2	242.76	68.9
183	J-65	AR-75	83.74	2	242.78	68.8
186	J-66	AR-80	88.62	2	242.87	66.7
189	J-67	AR-73, AR-102	90.07	23	242.77	66.1
192	J-68	AR-74, AR-103	94.11	11	242.8	64.3
195	J-69	AR-78	98.44	1	242.83	62.5
198	J-70	AR-77	96.48	2	242.82	63.3
201	J-71	AR-70, AR-104	88.99	17	242.77	66.5
204	J-72	AR-79	92.83	1	242.83	64.9
208	J-74	AR-03	87	41	242.76	67.4
212	J-75	AR-43	90.95	29	242.87	65.7
216	J-76	AR-32	85.25	15	242.85	68.2
219	J-77	AR-34	86.27	8	242.85	67.7
222	J-78	AR-35	91.75	9	242.83	65.4
225	J-79	AR-25	83.28	9	242.81	69
228	J-80	AR-22	84.34	9	242.79	68.6
231	J-81	AR-21	84.54	5	242.79	68.5
234	J-82		84.28	0	242.79	68.6
237	J-83	AR-11	83.17	17	242.78	69.1
240	J-84	AR-12	82.63	6	242.77	69.3
243	J-85	AR-05	83.8	5	242.77	68.8
246	J-86	AR-06	85.87	10	242.76	67.9
249	J-87	AR-13	86.33	12	242.76	67.7
253	J-89	AR-07, AR-46	86.69	42	242.76	67.5
256	J-90	AR-08	91.16	16	242.77	65.6
259	J-91	AR-16	92.01	13	242.78	65.2
262	J-92	AR-09	93.28	12	242.8	64.7
265	J-93	AR-17	92.63	7	242.8	65
268	J-94	AR-30	95.44	7	242.82	63.8
296	J-95	AR-53	100.72	44	242.83	61.5
299	J-96	AR-57	82.66	1	242.81	69.3
307	J-98	AR-110	85.95	1	242.87	67.9
321	J-100		90.34	0	242.87	66
324	J-101		90	0	242.87	66.1
326	J-102	AR-81	83.6	2	242.83	68.9

Scenario: Average Day Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
30	P-1	1,740	J-1	J-2	24	Ductile Iron	130	1,004	0.71
32	P-2	610	J-2	J-3	24	Ductile Iron	130	725	0.51
34	P-3	25	J-3	J-4	24	Ductile Iron	130	680	0.48
40	P-6	13	J-6	J-7	24	Ductile Iron	130	372	0.26
46	P-9	14	J-9	J-10	16	Ductile Iron	130	200	0.32
48	P-10	779	J-10	J-11	16	Ductile Iron	130	179	0.29
50	P-11	16	J-11	J-12	16	Ductile Iron	130	224	0.36
54	P-13	67	J-13	J-14	12	Ductile Iron	130	159	0.45
62	P-17	32	J-17	J-18	12	Ductile Iron	130	61	0.17
66	P-19	200	J-19	J-20	16	Ductile Iron	130	142	0.23
68	P-20	588	J-20	J-21	16	Ductile Iron	130	163	0.26
75	P-24	514	J-24	J-2	16	Ductile Iron	130	279	0.45
78	P-26	14	J-25	J-5	24	Ductile Iron	130	612	0.43
80	P-27	802	J-6	J-26	16	Ductile Iron	130	160	0.26
84	P-29	35	J-27	J-28	12	Ductile Iron	130	77	0.22
86	P-30	460	J-28	J-29	12	Ductile Iron	130	71	0.2
87	P-31	730	J-29	J-13	12	Ductile Iron	130	71	0.2
95	P-35	388	J-30	J-33	12	Ductile Iron	130	60	0.17
97	P-36	285	J-33	J-34	12	Ductile Iron	130	41	0.12
99	P-37	477	J-22	J-35	12	Ductile Iron	130	93	0.26
112	P-45	29	J-39	J-40	24	Ductile Iron	130	74	0.05
119	P-49	62	R-1	J-1	24	Ductile Iron	130	1,004	0.71
125	P-52	752	J-5	J-44	24	Ductile Iron	130	37	0.03
135	P-58	234	J-15	J-48	12	Ductile Iron	130	33	0.09
138	P-60	51	J-48	J-49	12	Ductile Iron	130	29	0.08
144	P-64	488	J-36	J-51	12	Ductile Iron	130	68	0.19
147	P-66	109	J-26	J-52	16	Ductile Iron	130	154	0.25
150	P-68	304	J-4	J-53	24	Ductile Iron	130	659	0.47
151	P-69	367	J-53	J-25	24	Ductile Iron	130	640	0.45
153	P-70	310	J-5	J-54	24	Ductile Iron	130	575	0.41
156	P-72	239	J-8	J-55	24	Ductile Iron	130	241	0.17
157	P-73	404	J-55	J-9	24	Ductile Iron	130	212	0.15
159	P-74	239	J-40	J-56	24	Ductile Iron	130	48	0.03
160	P-75	221	J-56	J-41	24	Ductile Iron	130	0	0
162	P-76	41	J-54	J-57	24	Ductile Iron	130	552	0.39
165	P-78	345	J-7	J-58	24	Ductile Iron	130	368	0.26
168	P-80	65	J-58	J-59	24	Ductile Iron	130	363	0.26
169	P-81	281	J-59	J-8	24	Ductile Iron	130	347	0.25
171	P-82	324	J-35	J-60	12	Ductile Iron	130	93	0.26
172	P-83	373	J-60	J-36	12	Ductile Iron	130	79	0.22
176	P-85	86	J-62	J-27	16	Ductile Iron	130	77	0.12
178	P-86	318	J-46	J-63	16	Ductile Iron	130	124	0.2
179	P-87	118	J-63	J-62	16	Ductile Iron	130	98	0.16
187	P-92	138	J-21	J-66	16	Ductile Iron	130	171	0.27
191	P-95	440	J-67	J-15	12	Ductile Iron	130	47	0.13

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
193	P-96	254	J-12	J-68	16	Ductile Iron	130	196	0.31
196	P-98	233	J-26	J-69	12	Ductile Iron	130	57	0.16
199	P-100	516	J-69	J-70	12	Ductile Iron	130	57	0.16
200	P-101	600	J-70	J-11	12	Ductile Iron	130	55	0.16
202	P-102	975	J-13	J-71	12	Ductile Iron	130	77	0.22
203	P-103	277	J-71	J-30	12	Ductile Iron	130	60	0.17
206	P-105	334	J-72	J-26	12	Ductile Iron	130	52	0.15
209	P-106	766	J-31	J-74	12	Ductile Iron	130	58	0.16
210	P-107	66	J-74	J-32	12	Ductile Iron	130	16	0.05
211	P-108	371	J-37	J-39	12	Ductile Iron	130	32	0.09
213	P-109	190	J-44	J-75	24	Ductile Iron	130	33	0.02
215	P-111	210	J-24	J-22	16	Ductile Iron	130	267	0.43
218	P-113	171	J-76	J-19	12	Ductile Iron	130	12	0.04
220	P-114	223	J-36	J-77	12	Ductile Iron	130	11	0.03
221	P-115	200	J-77	J-76	12	Ductile Iron	130	3	0.01
223	P-116	335	J-51	J-78	12	Ductile Iron	130	62	0.18
224	P-117	96	J-78	J-72	12	Ductile Iron	130	53	0.15
226	P-118	141	J-50	J-79	12	Ductile Iron	130	118	0.33
230	P-121	101	J-80	J-50	12	Ductile Iron	130	114	0.32
233	P-123	114	J-81	J-80	12	Ductile Iron	130	106	0.3
235	P-124	131	J-65	J-82	12	Ductile Iron	130	101	0.29
236	P-125	104	J-82	J-81	12	Ductile Iron	130	101	0.29
239	P-127	150	J-83	J-65	12	Ductile Iron	130	99	0.28
241	P-128	164	J-18	J-84	12	Ductile Iron	130	76	0.22
242	P-129	134	J-84	J-83	12	Ductile Iron	130	83	0.23
244	P-130	164	J-64	J-85	12	Ductile Iron	130	55	0.16
245	P-131	139	J-85	J-17	12	Ductile Iron	130	60	0.17
248	P-133	202	J-86	J-64	12	Ductile Iron	130	53	0.15
250	P-134	234	J-16	J-87	12	Ductile Iron	130	31	0.09
251	P-135	79	J-87	J-86	12	Ductile Iron	130	43	0.12
254	P-136	131	J-49	J-89	12	Ductile Iron	130	25	0.07
255	P-137	126	J-89	J-16	12	Ductile Iron	130	17	0.05
258	P-139	290	J-90	J-67	12	Ductile Iron	130	70	0.2
260	P-140	216	J-14	J-91	12	Ductile Iron	130	98	0.28
261	P-141	193	J-91	J-90	12	Ductile Iron	130	85	0.24
263	P-142	198	J-68	J-92	16	Ductile Iron	130	185	0.29
266	P-144	132	J-92	J-93	16	Ductile Iron	130	172	0.28
267	P-145	282	J-93	J-13	16	Ductile Iron	130	165	0.26
269	P-146	336	J-52	J-94	16	Ductile Iron	130	154	0.25
270	P-147	119	J-94	J-46	16	Ductile Iron	130	147	0.24
295	P-148	1,118	J-8	J-39	24	Ductile Iron	130	106	0.08
297	P-149	346	J-9	J-95	16	Ductile Iron	130	12	0.02
298	P-150	352	J-95	J-37	16	Ductile Iron	130	32	0.05
300	P-151	122	J-79	J-96	12	Ductile Iron	130	127	0.36
308	P-155	166	J-66	J-98	16	Ductile Iron	130	173	0.28

Scenario: Average Day Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
309	P-156	414	J-98	J-22	16	Ductile Iron	130	174	0.28
316	P-157	327	J-57	J-6	24	Ductile Iron	130	532	0.38
319	P-159	1,241	J-14	J-31	12	Ductile Iron	130	60	0.17
320	P-160	1,286	J-32	J-33	12	Ductile Iron	130	19	0.05
322	P-161	187	J-75	J-100	24	Ductile Iron	130	4	0
323	P-162	142	J-100	J-45	24	Ductile Iron	130	4	0
325	P-163	152	J-100	J-101	16	Ductile Iron	130	0	0
327	P-164	331	J-96	J-102	12	Ductile Iron	130	128	0.36
328	P-165	285	J-102	J-19	12	Ductile Iron	130	130	0.37

Scenario: Max Day Demand
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
28	J-1		82.49	0	243.06	69.5
29	J-2		92.27	0	242.53	65
31	J-3	AR-51	94.47	88	242.43	64
33	J-4	AR-45	94.6	42	242.43	64
35	J-5		97.53	0	242.34	62.7
37	J-6		102.47	0	242.27	60.5
39	J-7	AR-67	102.54	8	242.27	60.5
41	J-8		101.47	0	242.24	60.9
43	J-9		98.66	0	242.22	62.1
45	J-10	AR-62	98.37	42	242.22	62.2
47	J-11	AR-18	95.22	19	242.15	63.6
49	J-12	AR-10	95.15	55	242.15	63.6
51	J-13		91.87	0	242.07	65
53	J-14		91.99	0	242.05	64.9
55	J-15	AR-15	88.34	27	241.98	66.5
57	J-16	AR-14	86.23	27	241.97	67.4
59	J-17	AR-71	82.07	1	242	69.2
61	J-18	AR-04	82.21	30	242	69.1
63	J-19		84.4	0	242.27	68.3
65	J-20	AR-24	86.46	40	242.28	67.4
67	J-21	AR-31	91.2	16	242.33	65.4
69	J-22		89.78	0	242.39	66
73	J-24	AR-37	90.58	24	242.43	65.7
76	J-25	AR-52	97.4	54	242.34	62.7
79	J-26		96.1	0	242.21	63.2
81	J-27	AR-76	93.83	2	242.15	64.2
83	J-28	AR-23	95.23	11	242.15	63.6
85	J-29		94.85	0	242.12	63.7
88	J-30	AR-56	87.87	1	241.98	66.7
90	J-31	AR-60	87.97	5	241.99	66.6
92	J-32	AR-01	86.75	69	241.96	67.2
94	J-33		89.79	0	241.96	65.8
96	J-34	AR-02	91.23	81	241.96	65.2
98	J-35		87.98	0	242.34	66.8
100	J-36		87.4	0	242.27	67
105	J-37		102.48	0	242.22	60.5
109	J-39		103.76	0	242.23	59.9
111	J-40	AR-40	103.86	51	242.23	59.9
113	J-41		105.16	0	242.23	59.3
124	J-44	AR-54	90.78	7	242.34	65.6
127	J-45	AR-55	89.13	9	242.34	66.3
130	J-46	AR-50	94.64	46	242.17	63.8
134	J-48	AR-61	86.12	8	241.97	67.4
137	J-49	AR-64	85.93	9	241.97	67.5
140	J-50	AR-63	83.88	7	242.1	68.5
143	J-51	AR-66	89.74	13	242.24	66

Scenario: Max Day Demand
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
146	J-52		96.57	0	242.2	63
149	J-53	AR-44	95.83	37	242.39	63.4
152	J-54	AR-36	99.73	45	242.3	61.7
155	J-55	AR-19	100.04	57	242.23	61.5
158	J-56	AR-38	104.73	93	242.23	59.5
161	J-57	AR-42	100.07	39	242.3	61.5
164	J-58	AR-27	103.99	9	242.25	59.8
167	J-59	AR-39	104.29	32	242.25	59.7
170	J-60	AR-33	85.92	27	242.3	67.7
174	J-62	AR-26	94.34	40	242.15	64
177	J-63	AR-28	93.83	52	242.16	64.2
180	J-64	AR-72	83.48	4	241.98	68.6
183	J-65	AR-75	83.74	3	242.04	68.5
186	J-66	AR-80	88.62	5	242.34	66.5
189	J-67	AR-73, AR-102	90.07	44	241.99	65.7
192	J-68	AR-74, AR-103	94.11	22	242.12	64
195	J-69	AR-78	98.44	2	242.2	62.2
198	J-70	AR-77	96.48	4	242.18	63
201	J-71	AR-70, AR-104	88.99	33	242	66.2
204	J-72	AR-79	92.83	2	242.22	64.6
208	J-74	AR-03	87	81	241.96	67
212	J-75	AR-43	90.95	56	242.34	65.5
216	J-76	AR-32	85.25	30	242.27	67.9
219	J-77	AR-34	86.27	16	242.27	67.5
222	J-78	AR-35	91.75	17	242.22	65.1
225	J-79	AR-25	83.28	17	242.13	68.7
228	J-80	AR-22	84.34	17	242.09	68.2
231	J-81	AR-21	84.54	9	242.07	68.2
234	J-82		84.28	0	242.06	68.3
237	J-83	AR-11	83.17	33	242.02	68.7
240	J-84	AR-12	82.63	13	242.01	69
243	J-85	AR-05	83.8	10	241.99	68.4
246	J-86	AR-06	85.87	20	241.98	67.5
249	J-87	AR-13	86.33	24	241.97	67.3
253	J-89	AR-07, AR-46	86.69	82	241.97	67.2
256	J-90	AR-08	91.16	31	242.01	65.3
259	J-91	AR-16	92.01	26	242.03	64.9
262	J-92	AR-09	93.28	24	242.1	64.4
265	J-93	AR-17	92.63	14	242.09	64.7
268	J-94	AR-30	95.44	14	242.18	63.5
296	J-95	AR-53	100.72	86	242.22	61.2
299	J-96	AR-57	82.66	2	242.15	69
307	J-98	AR-110	85.95	1	242.35	67.7
321	J-100		90.34	0	242.34	65.8
324	J-101		90	0	242.34	65.9
326	J-102	AR-81	83.6	5	242.21	68.6

Scenario: Max Day Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
30	P-1	1,740	J-1	J-2	24	Ductile Iron	130	1,968	1.4
32	P-2	610	J-2	J-3	24	Ductile Iron	130	1,421	1.01
34	P-3	25	J-3	J-4	24	Ductile Iron	130	1,334	0.95
40	P-6	13	J-6	J-7	24	Ductile Iron	130	730	0.52
46	P-9	14	J-9	J-10	16	Ductile Iron	130	393	0.63
48	P-10	779	J-10	J-11	16	Ductile Iron	130	351	0.56
50	P-11	16	J-11	J-12	16	Ductile Iron	130	440	0.7
54	P-13	67	J-13	J-14	12	Ductile Iron	130	311	0.88
62	P-17	32	J-17	J-18	12	Ductile Iron	130	120	0.34
66	P-19	200	J-19	J-20	16	Ductile Iron	130	279	0.45
68	P-20	588	J-20	J-21	16	Ductile Iron	130	319	0.51
75	P-24	514	J-24	J-2	16	Ductile Iron	130	547	0.87
78	P-26	14	J-25	J-5	24	Ductile Iron	130	1,200	0.85
80	P-27	802	J-6	J-26	16	Ductile Iron	130	314	0.5
84	P-29	35	J-27	J-28	12	Ductile Iron	130	150	0.43
86	P-30	460	J-28	J-29	12	Ductile Iron	130	139	0.39
87	P-31	730	J-29	J-13	12	Ductile Iron	130	139	0.39
95	P-35	388	J-30	J-33	12	Ductile Iron	130	118	0.33
97	P-36	285	J-33	J-34	12	Ductile Iron	130	81	0.23
99	P-37	477	J-22	J-35	12	Ductile Iron	130	182	0.52
112	P-45	29	J-39	J-40	24	Ductile Iron	130	145	0.1
119	P-49	62	R-1	J-1	24	Ductile Iron	130	1,968	1.4
125	P-52	752	J-5	J-44	24	Ductile Iron	130	72	0.05
135	P-58	234	J-15	J-48	12	Ductile Iron	130	65	0.19
138	P-60	51	J-48	J-49	12	Ductile Iron	130	58	0.16
144	P-64	488	J-36	J-51	12	Ductile Iron	130	134	0.38
147	P-66	109	J-26	J-52	16	Ductile Iron	130	303	0.48
150	P-68	304	J-4	J-53	24	Ductile Iron	130	1,292	0.92
151	P-69	367	J-53	J-25	24	Ductile Iron	130	1,255	0.89
153	P-70	310	J-5	J-54	24	Ductile Iron	130	1,128	0.8
156	P-72	239	J-8	J-55	24	Ductile Iron	130	472	0.33
157	P-73	404	J-55	J-9	24	Ductile Iron	130	416	0.29
159	P-74	239	J-40	J-56	24	Ductile Iron	130	93	0.07
160	P-75	221	J-56	J-41	24	Ductile Iron	130	0	0
162	P-76	41	J-54	J-57	24	Ductile Iron	130	1,083	0.77
165	P-78	345	J-7	J-58	24	Ductile Iron	130	721	0.51
168	P-80	65	J-58	J-59	24	Ductile Iron	130	712	0.51
169	P-81	281	J-59	J-8	24	Ductile Iron	130	680	0.48
171	P-82	324	J-35	J-60	12	Ductile Iron	130	182	0.52
172	P-83	373	J-60	J-36	12	Ductile Iron	130	155	0.44
176	P-85	86	J-62	J-27	16	Ductile Iron	130	152	0.24
178	P-86	318	J-46	J-63	16	Ductile Iron	130	243	0.39
179	P-87	118	J-63	J-62	16	Ductile Iron	130	191	0.31
187	P-92	138	J-21	J-66	16	Ductile Iron	130	335	0.54
191	P-95	440	J-67	J-15	12	Ductile Iron	130	92	0.26

Scenario: Max Day Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
193	P-96	254	J-12	J-68	16	Ductile Iron	130	384	0.61
196	P-98	233	J-26	J-69	12	Ductile Iron	130	113	0.32
199	P-100	516	J-69	J-70	12	Ductile Iron	130	111	0.31
200	P-101	600	J-70	J-11	12	Ductile Iron	130	107	0.3
202	P-102	975	J-13	J-71	12	Ductile Iron	130	151	0.43
203	P-103	277	J-71	J-30	12	Ductile Iron	130	118	0.34
206	P-105	334	J-72	J-26	12	Ductile Iron	130	102	0.29
209	P-106	766	J-31	J-74	12	Ductile Iron	130	113	0.32
210	P-107	66	J-74	J-32	12	Ductile Iron	130	32	0.09
211	P-108	371	J-37	J-39	12	Ductile Iron	130	63	0.18
213	P-109	190	J-44	J-75	24	Ductile Iron	130	65	0.05
215	P-111	210	J-24	J-22	16	Ductile Iron	130	523	0.83
218	P-113	171	J-76	J-19	12	Ductile Iron	130	24	0.07
220	P-114	223	J-36	J-77	12	Ductile Iron	130	21	0.06
221	P-115	200	J-77	J-76	12	Ductile Iron	130	5	0.02
223	P-116	335	J-51	J-78	12	Ductile Iron	130	121	0.34
224	P-117	96	J-78	J-72	12	Ductile Iron	130	104	0.29
226	P-118	141	J-50	J-79	12	Ductile Iron	130	231	0.66
230	P-121	101	J-80	J-50	12	Ductile Iron	130	224	0.64
233	P-123	114	J-81	J-80	12	Ductile Iron	130	208	0.59
235	P-124	131	J-65	J-82	12	Ductile Iron	130	198	0.56
236	P-125	104	J-82	J-81	12	Ductile Iron	130	198	0.56
239	P-127	150	J-83	J-65	12	Ductile Iron	130	195	0.55
241	P-128	164	J-18	J-84	12	Ductile Iron	130	150	0.42
242	P-129	134	J-84	J-83	12	Ductile Iron	130	162	0.46
244	P-130	164	J-64	J-85	12	Ductile Iron	130	108	0.31
245	P-131	139	J-85	J-17	12	Ductile Iron	130	119	0.34
248	P-133	202	J-86	J-64	12	Ductile Iron	130	104	0.3
250	P-134	234	J-16	J-87	12	Ductile Iron	130	60	0.17
251	P-135	79	J-87	J-86	12	Ductile Iron	130	84	0.24
254	P-136	131	J-49	J-89	12	Ductile Iron	130	49	0.14
255	P-137	126	J-89	J-16	12	Ductile Iron	130	33	0.09
258	P-139	290	J-90	J-67	12	Ductile Iron	130	136	0.39
260	P-140	216	J-14	J-91	12	Ductile Iron	130	193	0.55
261	P-141	193	J-91	J-90	12	Ductile Iron	130	167	0.48
263	P-142	198	J-68	J-92	16	Ductile Iron	130	362	0.58
266	P-144	132	J-92	J-93	16	Ductile Iron	130	338	0.54
267	P-145	282	J-93	J-13	16	Ductile Iron	130	324	0.52
269	P-146	336	J-52	J-94	16	Ductile Iron	130	303	0.48
270	P-147	119	J-94	J-46	16	Ductile Iron	130	289	0.46
295	P-148	1,118	J-8	J-39	24	Ductile Iron	130	208	0.15
297	P-149	346	J-9	J-95	16	Ductile Iron	130	23	0.04
298	P-150	352	J-95	J-37	16	Ductile Iron	130	63	0.1
300	P-151	122	J-79	J-96	12	Ductile Iron	130	248	0.7
308	P-155	166	J-66	J-98	16	Ductile Iron	130	340	0.54

Scenario: Max Day Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
309	P-156	414	J-98	J-22	16	Ductile Iron	130	341	0.54
316	P-157	327	J-57	J-6	24	Ductile Iron	130	1,043	0.74
319	P-159	1,241	J-14	J-31	12	Ductile Iron	130	118	0.34
320	P-160	1,286	J-32	J-33	12	Ductile Iron	130	37	0.1
322	P-161	187	J-75	J-100	24	Ductile Iron	130	9	0.01
323	P-162	142	J-100	J-45	24	Ductile Iron	130	9	0.01
325	P-163	152	J-100	J-101	16	Ductile Iron	130	0	0
327	P-164	331	J-96	J-102	12	Ductile Iron	130	250	0.71
328	P-165	285	J-102	J-19	12	Ductile Iron	130	255	0.72

Scenario: Max Day Demand +2%
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
28	J-1		82.49	0	243.06	69.5
29	J-2		92.27	0	242.51	65
31	J-3	AR-51	94.47	89	242.41	64
33	J-4	AR-45	94.6	43	242.4	63.9
35	J-5		97.53	0	242.31	62.6
37	J-6		102.47	0	242.24	60.5
39	J-7	AR-67	102.54	8	242.24	60.4
41	J-8		101.47	0	242.2	60.9
43	J-9		98.66	0	242.19	62.1
45	J-10	AR-62	98.37	43	242.19	62.2
47	J-11	AR-18	95.22	19	242.12	63.6
49	J-12	AR-10	95.15	56	242.11	63.6
51	J-13		91.87	0	242.03	65
53	J-14		91.99	0	242.01	64.9
55	J-15	AR-15	88.34	27	241.93	66.5
57	J-16	AR-14	86.23	27	241.93	67.4
59	J-17	AR-71	82.07	1	241.96	69.2
61	J-18	AR-04	82.21	30	241.96	69.1
63	J-19		84.4	0	242.24	68.3
65	J-20	AR-24	86.46	41	242.25	67.4
67	J-21	AR-31	91.2	16	242.3	65.4
69	J-22		89.78	0	242.36	66
73	J-24	AR-37	90.58	24	242.4	65.7
76	J-25	AR-52	97.4	55	242.31	62.7
79	J-26		96.1	0	242.18	63.2
81	J-27	AR-76	93.83	2	242.12	64.2
83	J-28	AR-23	95.23	12	242.11	63.5
85	J-29		94.85	0	242.08	63.7
88	J-30	AR-56	87.87	1	241.94	66.7
90	J-31	AR-60	87.97	5	241.95	66.6
92	J-32	AR-01	86.75	70	241.91	67.1
94	J-33		89.79	0	241.92	65.8
96	J-34	AR-02	91.23	82	241.92	65.2
98	J-35		87.98	0	242.31	66.8
100	J-36		87.4	0	242.24	67
105	J-37		102.48	0	242.19	60.4
109	J-39		103.76	0	242.2	59.9
111	J-40	AR-40	103.86	52	242.2	59.9
113	J-41		105.16	0	242.2	59.3
124	J-44	AR-54	90.78	8	242.31	65.6
127	J-45	AR-55	89.13	9	242.31	66.3
130	J-46	AR-50	94.64	47	242.14	63.8
134	J-48	AR-61	86.12	8	241.93	67.4
137	J-49	AR-64	85.93	9	241.93	67.5
140	J-50	AR-63	83.88	7	242.07	68.4
143	J-51	AR-66	89.74	13	242.21	66

Scenario: Max Day Demand +2%
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
146	J-52		96.57	0	242.17	63
149	J-53	AR-44	95.83	38	242.36	63.4
152	J-54	AR-36	99.73	46	242.27	61.7
155	J-55	AR-19	100.04	58	242.2	61.5
158	J-56	AR-38	104.73	95	242.2	59.5
161	J-57	AR-42	100.07	40	242.27	61.5
164	J-58	AR-27	103.99	9	242.22	59.8
167	J-59	AR-39	104.29	33	242.22	59.7
170	J-60	AR-33	85.92	28	242.27	67.6
174	J-62	AR-26	94.34	41	242.12	63.9
177	J-63	AR-28	93.83	53	242.12	64.2
180	J-64	AR-72	83.48	4	241.94	68.6
183	J-65	AR-75	83.74	3	242	68.5
186	J-66	AR-80	88.62	5	242.31	66.5
189	J-67	AR-73, AR-102	90.07	45	241.95	65.7
192	J-68	AR-74, AR-103	94.11	23	242.09	64
195	J-69	AR-78	98.44	2	242.17	62.2
198	J-70	AR-77	96.48	4	242.14	63
201	J-71	AR-70, AR-104	88.99	33	241.96	66.2
204	J-72	AR-79	92.83	2	242.19	64.6
208	J-74	AR-03	87	82	241.92	67
212	J-75	AR-43	90.95	58	242.31	65.5
216	J-76	AR-32	85.25	30	242.24	67.9
219	J-77	AR-34	86.27	16	242.24	67.5
222	J-78	AR-35	91.75	18	242.19	65.1
225	J-79	AR-25	83.28	17	242.09	68.7
228	J-80	AR-22	84.34	17	242.05	68.2
231	J-81	AR-21	84.54	10	242.03	68.1
234	J-82		84.28	0	242.02	68.2
237	J-83	AR-11	83.17	33	241.98	68.7
240	J-84	AR-12	82.63	13	241.97	68.9
243	J-85	AR-05	83.8	10	241.95	68.4
246	J-86	AR-06	85.87	21	241.93	67.5
249	J-87	AR-13	86.33	24	241.93	67.3
253	J-89	AR-07, AR-46	86.69	84	241.93	67.2
256	J-90	AR-08	91.16	32	241.97	65.2
259	J-91	AR-16	92.01	26	241.99	64.9
262	J-92	AR-09	93.28	24	242.07	64.4
265	J-93	AR-17	92.63	15	242.06	64.6
268	J-94	AR-30	95.44	14	242.14	63.5
296	J-95	AR-53	100.72	88	242.19	61.2
299	J-96	AR-57	82.66	2	242.12	69
307	J-98	AR-110	85.95	1	242.33	67.7
321	J-100		90.34	0	242.31	65.7
324	J-101		90	0	242.31	65.9
326	J-102	AR-81	83.6	5	242.18	68.6

Scenario: Max Day Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
30	P-1	1,740	J-1	J-2	24	Ductile Iron	130	2,008	1.42
32	P-2	610	J-2	J-3	24	Ductile Iron	130	1,450	1.03
34	P-3	25	J-3	J-4	24	Ductile Iron	130	1,360	0.96
40	P-6	13	J-6	J-7	24	Ductile Iron	130	744	0.53
46	P-9	14	J-9	J-10	16	Ductile Iron	130	401	0.64
48	P-10	779	J-10	J-11	16	Ductile Iron	130	358	0.57
50	P-11	16	J-11	J-12	16	Ductile Iron	130	448	0.72
54	P-13	67	J-13	J-14	12	Ductile Iron	130	317	0.9
62	P-17	32	J-17	J-18	12	Ductile Iron	130	122	0.35
66	P-19	200	J-19	J-20	16	Ductile Iron	130	285	0.45
68	P-20	588	J-20	J-21	16	Ductile Iron	130	326	0.52
75	P-24	514	J-24	J-2	16	Ductile Iron	130	558	0.89
78	P-26	14	J-25	J-5	24	Ductile Iron	130	1,224	0.87
80	P-27	802	J-6	J-26	16	Ductile Iron	130	320	0.51
84	P-29	35	J-27	J-28	12	Ductile Iron	130	153	0.43
86	P-30	460	J-28	J-29	12	Ductile Iron	130	142	0.4
87	P-31	730	J-29	J-13	12	Ductile Iron	130	142	0.4
95	P-35	388	J-30	J-33	12	Ductile Iron	130	120	0.34
97	P-36	285	J-33	J-34	12	Ductile Iron	130	82	0.23
99	P-37	477	J-22	J-35	12	Ductile Iron	130	186	0.53
112	P-45	29	J-39	J-40	24	Ductile Iron	130	148	0.1
119	P-49	62	R-1	J-1	24	Ductile Iron	130	2,008	1.42
125	P-52	752	J-5	J-44	24	Ductile Iron	130	74	0.05
135	P-58	234	J-15	J-48	12	Ductile Iron	130	67	0.19
138	P-60	51	J-48	J-49	12	Ductile Iron	130	59	0.17
144	P-64	488	J-36	J-51	12	Ductile Iron	130	136	0.39
147	P-66	109	J-26	J-52	16	Ductile Iron	130	309	0.49
150	P-68	304	J-4	J-53	24	Ductile Iron	130	1,317	0.93
151	P-69	367	J-53	J-25	24	Ductile Iron	130	1,280	0.91
153	P-70	310	J-5	J-54	24	Ductile Iron	130	1,150	0.82
156	P-72	239	J-8	J-55	24	Ductile Iron	130	482	0.34
157	P-73	404	J-55	J-9	24	Ductile Iron	130	424	0.3
159	P-74	239	J-40	J-56	24	Ductile Iron	130	95	0.07
160	P-75	221	J-56	J-41	24	Ductile Iron	130	0	0
162	P-76	41	J-54	J-57	24	Ductile Iron	130	1,104	0.78
165	P-78	345	J-7	J-58	24	Ductile Iron	130	736	0.52
168	P-80	65	J-58	J-59	24	Ductile Iron	130	727	0.52
169	P-81	281	J-59	J-8	24	Ductile Iron	130	694	0.49
171	P-82	324	J-35	J-60	12	Ductile Iron	130	186	0.53
172	P-83	373	J-60	J-36	12	Ductile Iron	130	158	0.45
176	P-85	86	J-62	J-27	16	Ductile Iron	130	155	0.25
178	P-86	318	J-46	J-63	16	Ductile Iron	130	248	0.4
179	P-87	118	J-63	J-62	16	Ductile Iron	130	195	0.31
187	P-92	138	J-21	J-66	16	Ductile Iron	130	342	0.55
191	P-95	440	J-67	J-15	12	Ductile Iron	130	94	0.27

Scenario: Max Day Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
193	P-96	254	J-12	J-68	16	Ductile Iron	130	392	0.63
196	P-98	233	J-26	J-69	12	Ductile Iron	130	115	0.33
199	P-100	516	J-69	J-70	12	Ductile Iron	130	113	0.32
200	P-101	600	J-70	J-11	12	Ductile Iron	130	109	0.31
202	P-102	975	J-13	J-71	12	Ductile Iron	130	154	0.44
203	P-103	277	J-71	J-30	12	Ductile Iron	130	121	0.34
206	P-105	334	J-72	J-26	12	Ductile Iron	130	104	0.3
209	P-106	766	J-31	J-74	12	Ductile Iron	130	115	0.33
210	P-107	66	J-74	J-32	12	Ductile Iron	130	33	0.09
211	P-108	371	J-37	J-39	12	Ductile Iron	130	64	0.18
213	P-109	190	J-44	J-75	24	Ductile Iron	130	66	0.05
215	P-111	210	J-24	J-22	16	Ductile Iron	130	534	0.85
218	P-113	171	J-76	J-19	12	Ductile Iron	130	25	0.07
220	P-114	223	J-36	J-77	12	Ductile Iron	130	22	0.06
221	P-115	200	J-77	J-76	12	Ductile Iron	130	6	0.02
223	P-116	335	J-51	J-78	12	Ductile Iron	130	123	0.35
224	P-117	96	J-78	J-72	12	Ductile Iron	130	106	0.3
226	P-118	141	J-50	J-79	12	Ductile Iron	130	236	0.67
230	P-121	101	J-80	J-50	12	Ductile Iron	130	229	0.65
233	P-123	114	J-81	J-80	12	Ductile Iron	130	212	0.6
235	P-124	131	J-65	J-82	12	Ductile Iron	130	202	0.57
236	P-125	104	J-82	J-81	12	Ductile Iron	130	202	0.57
239	P-127	150	J-83	J-65	12	Ductile Iron	130	199	0.56
241	P-128	164	J-18	J-84	12	Ductile Iron	130	153	0.43
242	P-129	134	J-84	J-83	12	Ductile Iron	130	165	0.47
244	P-130	164	J-64	J-85	12	Ductile Iron	130	111	0.31
245	P-131	139	J-85	J-17	12	Ductile Iron	130	121	0.34
248	P-133	202	J-86	J-64	12	Ductile Iron	130	106	0.3
250	P-134	234	J-16	J-87	12	Ductile Iron	130	61	0.17
251	P-135	79	J-87	J-86	12	Ductile Iron	130	86	0.24
254	P-136	131	J-49	J-89	12	Ductile Iron	130	50	0.14
255	P-137	126	J-89	J-16	12	Ductile Iron	130	34	0.1
258	P-139	290	J-90	J-67	12	Ductile Iron	130	139	0.39
260	P-140	216	J-14	J-91	12	Ductile Iron	130	197	0.56
261	P-141	193	J-91	J-90	12	Ductile Iron	130	171	0.48
263	P-142	198	J-68	J-92	16	Ductile Iron	130	369	0.59
266	P-144	132	J-92	J-93	16	Ductile Iron	130	345	0.55
267	P-145	282	J-93	J-13	16	Ductile Iron	130	330	0.53
269	P-146	336	J-52	J-94	16	Ductile Iron	130	309	0.49
270	P-147	119	J-94	J-46	16	Ductile Iron	130	295	0.47
295	P-148	1,118	J-8	J-39	24	Ductile Iron	130	212	0.15
297	P-149	346	J-9	J-95	16	Ductile Iron	130	23	0.04
298	P-150	352	J-95	J-37	16	Ductile Iron	130	64	0.1
300	P-151	122	J-79	J-96	12	Ductile Iron	130	253	0.72
308	P-155	166	J-66	J-98	16	Ductile Iron	130	347	0.55

Scenario: Max Day Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
309	P-156	414	J-98	J-22	16	Ductile Iron	130	348	0.55
316	P-157	327	J-57	J-6	24	Ductile Iron	130	1,064	0.75
319	P-159	1,241	J-14	J-31	12	Ductile Iron	130	120	0.34
320	P-160	1,286	J-32	J-33	12	Ductile Iron	130	38	0.11
322	P-161	187	J-75	J-100	24	Ductile Iron	130	9	0.01
323	P-162	142	J-100	J-45	24	Ductile Iron	130	9	0.01
325	P-163	152	J-100	J-101	16	Ductile Iron	130	0	0
327	P-164	331	J-96	J-102	12	Ductile Iron	130	255	0.72
328	P-165	285	J-102	J-19	12	Ductile Iron	130	260	0.74

Scenario: Peak Hour Demand
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
28	J-1		82.49	0	243.03	69.5
29	J-2		92.27	0	241.62	64.6
31	J-3	AR-51	94.47	149	241.35	63.5
33	J-4	AR-45	94.6	72	241.34	63.5
35	J-5		97.53	0	241.09	62.1
37	J-6		102.47	0	240.91	59.9
39	J-7	AR-67	102.54	14	240.91	59.9
41	J-8		101.47	0	240.82	60.3
43	J-9		98.66	0	240.79	61.5
45	J-10	AR-62	98.37	71	240.79	61.6
47	J-11	AR-18	95.22	31	240.6	62.9
49	J-12	AR-10	95.15	94	240.59	62.9
51	J-13		91.87	0	240.38	64.3
53	J-14		91.99	0	240.33	64.2
55	J-15	AR-15	88.34	46	240.13	65.7
57	J-16	AR-14	86.23	46	240.12	66.6
59	J-17	AR-71	82.07	2	240.19	68.4
61	J-18	AR-04	82.21	50	240.19	68.4
63	J-19		84.4	0	240.92	67.7
65	J-20	AR-24	86.46	68	240.95	66.8
67	J-21	AR-31	91.2	27	241.07	64.8
69	J-22		89.78	0	241.23	65.5
73	J-24	AR-37	90.58	41	241.34	65.2
76	J-25	AR-52	97.4	92	241.1	62.2
79	J-26		96.1	0	240.75	62.6
81	J-27	AR-76	93.83	3	240.6	63.5
83	J-28	AR-23	95.23	19	240.59	62.9
85	J-29		94.85	0	240.51	63
88	J-30	AR-56	87.87	1	240.15	65.9
90	J-31	AR-60	87.97	9	240.17	65.9
92	J-32	AR-01	86.75	117	240.08	66.3
94	J-33		89.79	0	240.1	65
96	J-34	AR-02	91.23	137	240.08	64.4
98	J-35		87.98	0	241.09	66.2
100	J-36		87.4	0	240.92	66.4
105	J-37		102.48	0	240.79	59.8
109	J-39		103.76	0	240.81	59.3
111	J-40	AR-40	103.86	87	240.81	59.3
113	J-41		105.16	0	240.81	58.7
124	J-44	AR-54	90.78	13	241.09	65
127	J-45	AR-55	89.13	15	241.09	65.7
130	J-46	AR-50	94.64	78	240.65	63.2
134	J-48	AR-61	86.12	13	240.12	66.6
137	J-49	AR-64	85.93	15	240.12	66.7
140	J-50	AR-63	83.88	12	240.47	67.7
143	J-51	AR-66	89.74	21	240.84	65.4

Scenario: Peak Hour Demand
Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
146	J-52		96.57	0	240.73	62.4
149	J-53	AR-44	95.83	63	241.22	62.9
152	J-54	AR-36	99.73	77	241	61.1
155	J-55	AR-19	100.04	96	240.81	60.9
158	J-56	AR-38	104.73	159	240.81	58.9
161	J-57	AR-42	100.07	67	240.99	61
164	J-58	AR-27	103.99	15	240.86	59.2
167	J-59	AR-39	104.29	55	240.86	59.1
170	J-60	AR-33	85.92	47	241	67.1
174	J-62	AR-26	94.34	68	240.6	63.3
177	J-63	AR-28	93.83	88	240.61	63.5
180	J-64	AR-72	83.48	7	240.15	67.8
183	J-65	AR-75	83.74	5	240.3	67.7
186	J-66	AR-80	88.62	8	241.1	66
189	J-67	AR-73, AR-102	90.07	75	240.17	64.9
192	J-68	AR-74, AR-103	94.11	38	240.52	63.3
195	J-69	AR-78	98.44	3	240.72	61.6
198	J-70	AR-77	96.48	6	240.67	62.4
201	J-71	AR-70, AR-104	88.99	56	240.18	65.4
204	J-72	AR-79	92.83	3	240.79	64
208	J-74	AR-03	87	137	240.08	66.2
212	J-75	AR-43	90.95	96	241.09	65
216	J-76	AR-32	85.25	51	240.92	67.4
219	J-77	AR-34	86.27	27	240.92	66.9
222	J-78	AR-35	91.75	30	240.8	64.5
225	J-79	AR-25	83.28	28	240.53	68
228	J-80	AR-22	84.34	28	240.43	67.5
231	J-81	AR-21	84.54	16	240.38	67.4
234	J-82		84.28	0	240.35	67.5
237	J-83	AR-11	83.17	56	240.26	68
240	J-84	AR-12	82.63	21	240.22	68.2
243	J-85	AR-05	83.8	17	240.17	67.7
246	J-86	AR-06	85.87	35	240.13	66.7
249	J-87	AR-13	86.33	41	240.12	66.5
253	J-89	AR-07, AR-46	86.69	140	240.11	66.4
256	J-90	AR-08	91.16	53	240.21	64.5
259	J-91	AR-16	92.01	44	240.26	64.1
262	J-92	AR-09	93.28	41	240.47	63.7
265	J-93	AR-17	92.63	24	240.44	64
268	J-94	AR-30	95.44	23	240.67	62.8
296	J-95	AR-53	100.72	146	240.79	60.6
299	J-96	AR-57	82.66	4	240.59	68.3
307	J-98	AR-110	85.95	2	241.14	67.1
321	J-100		90.34	0	241.09	65.2
324	J-101		90	0	241.09	65.4
326	J-102	AR-81	83.6	8	240.77	68

Scenario: Peak Hour Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
30	P-1	1,740	J-1	J-2	24	Ductile Iron	130	3,346	2.37
32	P-2	610	J-2	J-3	24	Ductile Iron	130	2,416	1.71
34	P-3	25	J-3	J-4	24	Ductile Iron	130	2,267	1.61
40	P-6	13	J-6	J-7	24	Ductile Iron	130	1,240	0.88
46	P-9	14	J-9	J-10	16	Ductile Iron	130	668	1.07
48	P-10	779	J-10	J-11	16	Ductile Iron	130	596	0.95
50	P-11	16	J-11	J-12	16	Ductile Iron	130	747	1.19
54	P-13	67	J-13	J-14	12	Ductile Iron	130	529	1.5
62	P-17	32	J-17	J-18	12	Ductile Iron	130	204	0.58
66	P-19	200	J-19	J-20	16	Ductile Iron	130	475	0.76
68	P-20	588	J-20	J-21	16	Ductile Iron	130	543	0.87
75	P-24	514	J-24	J-2	16	Ductile Iron	130	930	1.48
78	P-26	14	J-25	J-5	24	Ductile Iron	130	2,041	1.45
80	P-27	802	J-6	J-26	16	Ductile Iron	130	533	0.85
84	P-29	35	J-27	J-28	12	Ductile Iron	130	255	0.72
86	P-30	460	J-28	J-29	12	Ductile Iron	130	236	0.67
87	P-31	730	J-29	J-13	12	Ductile Iron	130	236	0.67
95	P-35	388	J-30	J-33	12	Ductile Iron	130	200	0.57
97	P-36	285	J-33	J-34	12	Ductile Iron	130	137	0.39
99	P-37	477	J-22	J-35	12	Ductile Iron	130	310	0.88
112	P-45	29	J-39	J-40	24	Ductile Iron	130	246	0.17
119	P-49	62	R-1	J-1	24	Ductile Iron	130	3,346	2.37
125	P-52	752	J-5	J-44	24	Ductile Iron	130	123	0.09
135	P-58	234	J-15	J-48	12	Ductile Iron	130	111	0.31
138	P-60	51	J-48	J-49	12	Ductile Iron	130	98	0.28
144	P-64	488	J-36	J-51	12	Ductile Iron	130	227	0.64
147	P-66	109	J-26	J-52	16	Ductile Iron	130	515	0.82
150	P-68	304	J-4	J-53	24	Ductile Iron	130	2,196	1.56
151	P-69	367	J-53	J-25	24	Ductile Iron	130	2,133	1.51
153	P-70	310	J-5	J-54	24	Ductile Iron	130	1,917	1.36
156	P-72	239	J-8	J-55	24	Ductile Iron	130	803	0.57
157	P-73	404	J-55	J-9	24	Ductile Iron	130	707	0.5
159	P-74	239	J-40	J-56	24	Ductile Iron	130	159	0.11
160	P-75	221	J-56	J-41	24	Ductile Iron	130	0	0
162	P-76	41	J-54	J-57	24	Ductile Iron	130	1,841	1.31
165	P-78	345	J-7	J-58	24	Ductile Iron	130	1,226	0.87
168	P-80	65	J-58	J-59	24	Ductile Iron	130	1,211	0.86
169	P-81	281	J-59	J-8	24	Ductile Iron	130	1,156	0.82
171	P-82	324	J-35	J-60	12	Ductile Iron	130	310	0.88
172	P-83	373	J-60	J-36	12	Ductile Iron	130	263	0.75
176	P-85	86	J-62	J-27	16	Ductile Iron	130	258	0.41
178	P-86	318	J-46	J-63	16	Ductile Iron	130	413	0.66
179	P-87	118	J-63	J-62	16	Ductile Iron	130	325	0.52
187	P-92	138	J-21	J-66	16	Ductile Iron	130	570	0.91
191	P-95	440	J-67	J-15	12	Ductile Iron	130	157	0.44

Scenario: Peak Hour Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
193	P-96	254	J-12	J-68	16	Ductile Iron	130	653	1.04
196	P-98	233	J-26	J-69	12	Ductile Iron	130	192	0.54
199	P-100	516	J-69	J-70	12	Ductile Iron	130	188	0.53
200	P-101	600	J-70	J-11	12	Ductile Iron	130	182	0.52
202	P-102	975	J-13	J-71	12	Ductile Iron	130	257	0.73
203	P-103	277	J-71	J-30	12	Ductile Iron	130	201	0.57
206	P-105	334	J-72	J-26	12	Ductile Iron	130	173	0.49
209	P-106	766	J-31	J-74	12	Ductile Iron	130	192	0.54
210	P-107	66	J-74	J-32	12	Ductile Iron	130	54	0.15
211	P-108	371	J-37	J-39	12	Ductile Iron	130	107	0.3
213	P-109	190	J-44	J-75	24	Ductile Iron	130	111	0.08
215	P-111	210	J-24	J-22	16	Ductile Iron	130	889	1.42
218	P-113	171	J-76	J-19	12	Ductile Iron	130	42	0.12
220	P-114	223	J-36	J-77	12	Ductile Iron	130	36	0.1
221	P-115	200	J-77	J-76	12	Ductile Iron	130	9	0.03
223	P-116	335	J-51	J-78	12	Ductile Iron	130	206	0.58
224	P-117	96	J-78	J-72	12	Ductile Iron	130	176	0.5
226	P-118	141	J-50	J-79	12	Ductile Iron	130	393	1.12
230	P-121	101	J-80	J-50	12	Ductile Iron	130	381	1.08
233	P-123	114	J-81	J-80	12	Ductile Iron	130	353	1
235	P-124	131	J-65	J-82	12	Ductile Iron	130	337	0.96
236	P-125	104	J-82	J-81	12	Ductile Iron	130	337	0.96
239	P-127	150	J-83	J-65	12	Ductile Iron	130	331	0.94
241	P-128	164	J-18	J-84	12	Ductile Iron	130	254	0.72
242	P-129	134	J-84	J-83	12	Ductile Iron	130	276	0.78
244	P-130	164	J-64	J-85	12	Ductile Iron	130	184	0.52
245	P-131	139	J-85	J-17	12	Ductile Iron	130	202	0.57
248	P-133	202	J-86	J-64	12	Ductile Iron	130	177	0.5
250	P-134	234	J-16	J-87	12	Ductile Iron	130	102	0.29
251	P-135	79	J-87	J-86	12	Ductile Iron	130	143	0.41
254	P-136	131	J-49	J-89	12	Ductile Iron	130	83	0.24
255	P-137	126	J-89	J-16	12	Ductile Iron	130	57	0.16
258	P-139	290	J-90	J-67	12	Ductile Iron	130	232	0.66
260	P-140	216	J-14	J-91	12	Ductile Iron	130	328	0.93
261	P-141	193	J-91	J-90	12	Ductile Iron	130	285	0.81
263	P-142	198	J-68	J-92	16	Ductile Iron	130	615	0.98
266	P-144	132	J-92	J-93	16	Ductile Iron	130	575	0.92
267	P-145	282	J-93	J-13	16	Ductile Iron	130	550	0.88
269	P-146	336	J-52	J-94	16	Ductile Iron	130	515	0.82
270	P-147	119	J-94	J-46	16	Ductile Iron	130	492	0.78
295	P-148	1,118	J-8	J-39	24	Ductile Iron	130	353	0.25
297	P-149	346	J-9	J-95	16	Ductile Iron	130	39	0.06
298	P-150	352	J-95	J-37	16	Ductile Iron	130	107	0.17
300	P-151	122	J-79	J-96	12	Ductile Iron	130	422	1.2
308	P-155	166	J-66	J-98	16	Ductile Iron	130	578	0.92

Scenario: Peak Hour Demand
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
309	P-156	414	J-98	J-22	16	Ductile Iron	130	580	0.92
316	P-157	327	J-57	J-6	24	Ductile Iron	130	1,773	1.26
319	P-159	1,241	J-14	J-31	12	Ductile Iron	130	201	0.57
320	P-160	1,286	J-32	J-33	12	Ductile Iron	130	63	0.18
322	P-161	187	J-75	J-100	24	Ductile Iron	130	15	0.01
323	P-162	142	J-100	J-45	24	Ductile Iron	130	15	0.01
325	P-163	152	J-100	J-101	16	Ductile Iron	130	0	0
327	P-164	331	J-96	J-102	12	Ductile Iron	130	425	1.21
328	P-165	285	J-102	J-19	12	Ductile Iron	130	433	1.23

Scenario: Peak Hour Demand +2%

Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
28	J-1		82.49	0	243.03	69.5
29	J-2		92.27	0	241.56	64.6
31	J-3	AR-51	94.47	152	241.28	63.5
33	J-4	AR-45	94.6	73	241.27	63.5
35	J-5		97.53	0	241.02	62.1
37	J-6		102.47	0	240.83	59.9
39	J-7	AR-67	102.54	14	240.83	59.8
41	J-8		101.47	0	240.74	60.3
43	J-9		98.66	0	240.71	61.5
45	J-10	AR-62	98.37	73	240.7	61.6
47	J-11	AR-18	95.22	32	240.51	62.9
49	J-12	AR-10	95.15	96	240.5	62.9
51	J-13		91.87	0	240.28	64.2
53	J-14		91.99	0	240.23	64.1
55	J-15	AR-15	88.34	47	240.02	65.6
57	J-16	AR-14	86.23	47	240.01	66.5
59	J-17	AR-71	82.07	2	240.08	68.4
61	J-18	AR-04	82.21	51	240.08	68.3
63	J-19		84.4	0	240.84	67.7
65	J-20	AR-24	86.46	69	240.87	66.8
67	J-21	AR-31	91.2	28	241	64.8
69	J-22		89.78	0	241.16	65.5
73	J-24	AR-37	90.58	41	241.27	65.2
76	J-25	AR-52	97.4	94	241.02	62.1
79	J-26		96.1	0	240.67	62.5
81	J-27	AR-76	93.83	3	240.51	63.5
83	J-28	AR-23	95.23	20	240.5	62.9
85	J-29		94.85	0	240.42	63
88	J-30	AR-56	87.87	1	240.04	65.8
90	J-31	AR-60	87.97	9	240.06	65.8
92	J-32	AR-01	86.75	119	239.97	66.3
94	J-33		89.79	0	239.99	65
96	J-34	AR-02	91.23	140	239.97	64.4
98	J-35		87.98	0	241.02	66.2
100	J-36		87.4	0	240.84	66.4
105	J-37		102.48	0	240.71	59.8
109	J-39		103.76	0	240.72	59.3
111	J-40	AR-40	103.86	89	240.72	59.2
113	J-41		105.16	0	240.72	58.7
124	J-44	AR-54	90.78	13	241.02	65
127	J-45	AR-55	89.13	15	241.02	65.7
130	J-46	AR-50	94.64	80	240.56	63.1
134	J-48	AR-61	86.12	13	240.01	66.6
137	J-49	AR-64	85.93	15	240.01	66.7
140	J-50	AR-63	83.88	12	240.37	67.7
143	J-51	AR-66	89.74	22	240.76	65.3

Scenario: Peak Hour Demand +2%

Report: Junction Table

ID	Label	Parcel #	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
146	J-52		96.57	0	240.65	62.3
149	J-53	AR-44	95.83	64	241.16	62.9
152	J-54	AR-36	99.73	78	240.92	61.1
155	J-55	AR-19	100.04	98	240.73	60.9
158	J-56	AR-38	104.73	162	240.72	58.8
161	J-57	AR-42	100.07	68	240.91	60.9
164	J-58	AR-27	103.99	16	240.78	59.2
167	J-59	AR-39	104.29	56	240.77	59
170	J-60	AR-33	85.92	47	240.92	67.1
174	J-62	AR-26	94.34	69	240.51	63.2
177	J-63	AR-28	93.83	89	240.52	63.5
180	J-64	AR-72	83.48	7	240.04	67.7
183	J-65	AR-75	83.74	5	240.2	67.7
186	J-66	AR-80	88.62	8	241.03	65.9
189	J-67	AR-73, AR-102	90.07	77	240.06	64.9
192	J-68	AR-74, AR-103	94.11	39	240.43	63.3
195	J-69	AR-78	98.44	3	240.64	61.5
198	J-70	AR-77	96.48	6	240.58	62.3
201	J-71	AR-70, AR-104	88.99	57	240.08	65.4
204	J-72	AR-79	92.83	3	240.7	64
208	J-74	AR-03	87	140	239.97	66.2
212	J-75	AR-43	90.95	98	241.02	64.9
216	J-76	AR-32	85.25	52	240.84	67.3
219	J-77	AR-34	86.27	27	240.84	66.9
222	J-78	AR-35	91.75	30	240.71	64.4
225	J-79	AR-25	83.28	29	240.44	68
228	J-80	AR-22	84.34	29	240.33	67.5
231	J-81	AR-21	84.54	16	240.28	67.4
234	J-82		84.28	0	240.25	67.5
237	J-83	AR-11	83.17	57	240.15	67.9
240	J-84	AR-12	82.63	22	240.12	68.1
243	J-85	AR-05	83.8	18	240.06	67.6
246	J-86	AR-06	85.87	35	240.02	66.7
249	J-87	AR-13	86.33	41	240.01	66.5
253	J-89	AR-07, AR-46	86.69	142	240	66.3
256	J-90	AR-08	91.16	54	240.11	64.4
259	J-91	AR-16	92.01	45	240.16	64.1
262	J-92	AR-09	93.28	41	240.37	63.6
265	J-93	AR-17	92.63	25	240.34	63.9
268	J-94	AR-30	95.44	24	240.58	62.8
296	J-95	AR-53	100.72	149	240.71	60.6
299	J-96	AR-57	82.66	4	240.5	68.3
307	J-98	AR-110	85.95	2	241.07	67.1
321	J-100		90.34	0	241.02	65.2
324	J-101		90	0	241.02	65.3
326	J-102	AR-81	83.6	8	240.68	68

Scenario: Peak Hour Demand +2%

Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
30	P-1	1,740	J-1	J-2	24	Ductile Iron	130	3,413	2.42
32	P-2	610	J-2	J-3	24	Ductile Iron	130	2,465	1.75
34	P-3	25	J-3	J-4	24	Ductile Iron	130	2,313	1.64
40	P-6	13	J-6	J-7	24	Ductile Iron	130	1,265	0.9
46	P-9	14	J-9	J-10	16	Ductile Iron	130	681	1.09
48	P-10	779	J-10	J-11	16	Ductile Iron	130	608	0.97
50	P-11	16	J-11	J-12	16	Ductile Iron	130	762	1.22
54	P-13	67	J-13	J-14	12	Ductile Iron	130	540	1.53
62	P-17	32	J-17	J-18	12	Ductile Iron	130	208	0.59
66	P-19	200	J-19	J-20	16	Ductile Iron	130	484	0.77
68	P-20	588	J-20	J-21	16	Ductile Iron	130	554	0.88
75	P-24	514	J-24	J-2	16	Ductile Iron	130	949	1.51
78	P-26	14	J-25	J-5	24	Ductile Iron	130	2,081	1.48
80	P-27	802	J-6	J-26	16	Ductile Iron	130	544	0.87
84	P-29	35	J-27	J-28	12	Ductile Iron	130	260	0.74
86	P-30	460	J-28	J-29	12	Ductile Iron	130	241	0.68
87	P-31	730	J-29	J-13	12	Ductile Iron	130	241	0.68
95	P-35	388	J-30	J-33	12	Ductile Iron	130	204	0.58
97	P-36	285	J-33	J-34	12	Ductile Iron	130	140	0.4
99	P-37	477	J-22	J-35	12	Ductile Iron	130	316	0.9
112	P-45	29	J-39	J-40	24	Ductile Iron	130	251	0.18
119	P-49	62	R-1	J-1	24	Ductile Iron	130	3,413	2.42
125	P-52	752	J-5	J-44	24	Ductile Iron	130	126	0.09
135	P-58	234	J-15	J-48	12	Ductile Iron	130	113	0.32
138	P-60	51	J-48	J-49	12	Ductile Iron	130	100	0.28
144	P-64	488	J-36	J-51	12	Ductile Iron	130	232	0.66
147	P-66	109	J-26	J-52	16	Ductile Iron	130	525	0.84
150	P-68	304	J-4	J-53	24	Ductile Iron	130	2,239	1.59
151	P-69	367	J-53	J-25	24	Ductile Iron	130	2,176	1.54
153	P-70	310	J-5	J-54	24	Ductile Iron	130	1,956	1.39
156	P-72	239	J-8	J-55	24	Ductile Iron	130	819	0.58
157	P-73	404	J-55	J-9	24	Ductile Iron	130	721	0.51
159	P-74	239	J-40	J-56	24	Ductile Iron	130	162	0.11
160	P-75	221	J-56	J-41	24	Ductile Iron	130	0	0
162	P-76	41	J-54	J-57	24	Ductile Iron	130	1,877	1.33
165	P-78	345	J-7	J-58	24	Ductile Iron	130	1,251	0.89
168	P-80	65	J-58	J-59	24	Ductile Iron	130	1,235	0.88
169	P-81	281	J-59	J-8	24	Ductile Iron	130	1,179	0.84
171	P-82	324	J-35	J-60	12	Ductile Iron	130	316	0.9
172	P-83	373	J-60	J-36	12	Ductile Iron	130	269	0.76
176	P-85	86	J-62	J-27	16	Ductile Iron	130	263	0.42
178	P-86	318	J-46	J-63	16	Ductile Iron	130	421	0.67
179	P-87	118	J-63	J-62	16	Ductile Iron	130	332	0.53
187	P-92	138	J-21	J-66	16	Ductile Iron	130	581	0.93
191	P-95	440	J-67	J-15	12	Ductile Iron	130	160	0.45

Scenario: Peak Hour Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
193	P-96	254	J-12	J-68	16	Ductile Iron	130	667	1.06
196	P-98	233	J-26	J-69	12	Ductile Iron	130	195	0.55
199	P-100	516	J-69	J-70	12	Ductile Iron	130	192	0.55
200	P-101	600	J-70	J-11	12	Ductile Iron	130	186	0.53
202	P-102	975	J-13	J-71	12	Ductile Iron	130	262	0.74
203	P-103	277	J-71	J-30	12	Ductile Iron	130	205	0.58
206	P-105	334	J-72	J-26	12	Ductile Iron	130	177	0.5
209	P-106	766	J-31	J-74	12	Ductile Iron	130	196	0.55
210	P-107	66	J-74	J-32	12	Ductile Iron	130	55	0.16
211	P-108	371	J-37	J-39	12	Ductile Iron	130	109	0.31
213	P-109	190	J-44	J-75	24	Ductile Iron	130	113	0.08
215	P-111	210	J-24	J-22	16	Ductile Iron	130	907	1.45
218	P-113	171	J-76	J-19	12	Ductile Iron	130	42	0.12
220	P-114	223	J-36	J-77	12	Ductile Iron	130	37	0.1
221	P-115	200	J-77	J-76	12	Ductile Iron	130	9	0.03
223	P-116	335	J-51	J-78	12	Ductile Iron	130	210	0.6
224	P-117	96	J-78	J-72	12	Ductile Iron	130	180	0.51
226	P-118	141	J-50	J-79	12	Ductile Iron	130	401	1.14
230	P-121	101	J-80	J-50	12	Ductile Iron	130	389	1.1
233	P-123	114	J-81	J-80	12	Ductile Iron	130	360	1.02
235	P-124	131	J-65	J-82	12	Ductile Iron	130	344	0.97
236	P-125	104	J-82	J-81	12	Ductile Iron	130	344	0.97
239	P-127	150	J-83	J-65	12	Ductile Iron	130	338	0.96
241	P-128	164	J-18	J-84	12	Ductile Iron	130	259	0.74
242	P-129	134	J-84	J-83	12	Ductile Iron	130	281	0.8
244	P-130	164	J-64	J-85	12	Ductile Iron	130	188	0.53
245	P-131	139	J-85	J-17	12	Ductile Iron	130	206	0.58
248	P-133	202	J-86	J-64	12	Ductile Iron	130	181	0.51
250	P-134	234	J-16	J-87	12	Ductile Iron	130	104	0.3
251	P-135	79	J-87	J-86	12	Ductile Iron	130	146	0.41
254	P-136	131	J-49	J-89	12	Ductile Iron	130	85	0.24
255	P-137	126	J-89	J-16	12	Ductile Iron	130	58	0.16
258	P-139	290	J-90	J-67	12	Ductile Iron	130	237	0.67
260	P-140	216	J-14	J-91	12	Ductile Iron	130	335	0.95
261	P-141	193	J-91	J-90	12	Ductile Iron	130	290	0.82
263	P-142	198	J-68	J-92	16	Ductile Iron	130	628	1
266	P-144	132	J-92	J-93	16	Ductile Iron	130	586	0.94
267	P-145	282	J-93	J-13	16	Ductile Iron	130	561	0.9
269	P-146	336	J-52	J-94	16	Ductile Iron	130	525	0.84
270	P-147	119	J-94	J-46	16	Ductile Iron	130	501	0.8
295	P-148	1,118	J-8	J-39	24	Ductile Iron	130	361	0.26
297	P-149	346	J-9	J-95	16	Ductile Iron	130	40	0.06
298	P-150	352	J-95	J-37	16	Ductile Iron	130	109	0.17
300	P-151	122	J-79	J-96	12	Ductile Iron	130	430	1.22
308	P-155	166	J-66	J-98	16	Ductile Iron	130	589	0.94

Scenario: Peak Hour Demand +2%
Report: Pipe Table

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)
309	P-156	414	J-98	J-22	16	Ductile Iron	130	591	0.94
316	P-157	327	J-57	J-6	24	Ductile Iron	130	1,809	1.28
319	P-159	1,241	J-14	J-31	12	Ductile Iron	130	205	0.58
320	P-160	1,286	J-32	J-33	12	Ductile Iron	130	64	0.18
322	P-161	187	J-75	J-100	24	Ductile Iron	130	15	0.01
323	P-162	142	J-100	J-45	24	Ductile Iron	130	15	0.01
325	P-163	152	J-100	J-101	16	Ductile Iron	130	0	0
327	P-164	331	J-96	J-102	12	Ductile Iron	130	434	1.23
328	P-165	285	J-102	J-19	12	Ductile Iron	130	442	1.25

Scenario: Max Day Demand + 2% + 4,000 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-03, J-25, J-95)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	TRUE	4,000	4,000	4,000	4,000	20	69.4	59.2	J-41	69.5	4.26
J-2	TRUE	4,000	4,000	4,000	4,000	20	63.4	57.7	J-41	65	4.26
J-3	TRUE	4,000	4,000	4,089	4,089	20	62	57.3	J-41	64	4.26
J-4	TRUE	4,000	4,000	4,043	4,043	20	61.9	57.3	J-41	63.9	4.26
J-5	TRUE	4,000	4,000	4,000	4,000	20	60.2	56.9	J-41	62.6	4.26
J-6	TRUE	4,000	4,000	4,000	4,000	20	57.7	56.6	J-41	60.5	4.26
J-7	TRUE	4,000	4,000	4,008	4,008	20	57.7	56.6	J-41	60.4	4.26
J-8	TRUE	4,000	4,000	4,000	4,000	20	57.9	56.3	J-41	60.9	4.26
J-9	TRUE	4,000	4,000	4,000	4,000	20	58.9	56.3	J-41	62.1	4.26
J-10	TRUE	4,000	4,000	4,043	4,043	20	59	56.3	J-41	62.2	5.46
J-11	TRUE	4,000	4,000	4,019	4,019	20	59.5	56.5	J-41	63.6	4.26
J-12	TRUE	4,000	4,000	4,056	4,056	20	59.5	56.5	J-41	63.6	5.34
J-13	TRUE	4,000	4,000	4,000	4,000	20	59.9	56.6	J-41	65	4.45
J-14	TRUE	4,000	4,000	4,000	4,000	20	59.3	56.6	J-41	64.9	9.33
J-15	TRUE	4,000	4,000	4,027	4,027	20	54.6	56.1	J-48	66.5	7.58
J-16	TRUE	4,000	4,000	4,027	4,027	20	54.4	54.8	J-89	67.4	6.87
J-17	TRUE	4,000	4,000	4,001	4,001	20	56.3	56	J-85	69.2	6.77
J-18	TRUE	4,000	4,000	4,030	4,030	20	56.3	56.1	J-85	69.1	6.8
J-19	TRUE	4,000	4,000	4,000	4,000	20	63.6	57.2	J-41	68.3	4.62
J-20	TRUE	4,000	4,000	4,041	4,041	20	62.8	57.2	J-41	67.4	4.68
J-21	TRUE	4,000	4,000	4,016	4,016	20	61.1	57.3	J-41	65.4	4.89
J-22	TRUE	4,000	4,000	4,000	4,000	20	62.7	57.3	J-41	66	5.18
J-24	TRUE	4,000	4,000	4,024	4,024	20	62.7	57.4	J-41	65.7	5.48
J-25	TRUE	4,000	4,000	4,055	4,055	20	60.3	56.9	J-41	62.7	4.26
J-26	TRUE	4,000	4,000	4,000	4,000	20	59.7	56.6	J-41	63.2	4.26
J-27	TRUE	4,000	4,000	4,002	4,002	20	58.7	56.6	J-41	64.2	4.75
J-28	TRUE	4,000	4,000	4,012	4,012	20	57.9	56.6	J-41	63.5	7.83
J-29	TRUE	4,000	4,000	4,000	4,000	20	57.1	56.6	J-41	63.7	6.04
J-30	TRUE	4,000	4,000	4,001	4,001	20	53	52.2	J-34	66.7	7.68
J-31	TRUE	4,000	4,000	4,005	4,005	20	52.9	54.8	J-74	66.6	7.59
J-32	TRUE	4,000	4,000	4,070	4,070	20	51.4	51.6	J-74	67.1	6.51
J-33	TRUE	4,000	4,000	4,000	4,000	20	50.9	50.3	J-34	65.8	7.15
J-34	TRUE	4,000	4,000	4,082	4,082	20	46.1	50.9	J-33	65.2	11.58
J-35	TRUE	4,000	4,000	4,000	4,000	20	61.2	57.3	J-41	66.8	6.66
J-36	TRUE	4,000	4,000	4,000	4,000	20	62.2	57.1	J-41	67	4.32
J-37	TRUE	4,000	4,000	4,000	4,000	20	56.4	56.2	J-41	60.4	4.52
J-39	TRUE	4,000	4,000	4,000	4,000	20	56.5	55.9	J-41	59.9	4.26
J-40	TRUE	4,000	4,000	4,052	4,052	20	56.4	55.9	J-41	59.9	4.26
J-41	TRUE	4,000	4,000	4,000	4,000	20	55.6	55.9	J-56	59.3	4.26
J-44	TRUE	4,000	4,000	4,008	4,008	20	62.7	56.9	J-41	65.6	4.26
J-45	TRUE	4,000	4,000	4,009	4,009	20	63.2	56.9	J-41	66.3	4.26
J-46	TRUE	4,000	4,000	4,047	4,047	20	59.1	56.6	J-41	63.8	5.16
J-48	TRUE	4,000	4,000	4,008	4,008	20	55	55.2	J-49	67.4	7.27
J-49	TRUE	4,000	4,000	4,009	4,009	20	55	55	J-89	67.5	7.2
J-50	TRUE	4,000	4,000	4,007	4,007	20	58.1	57	J-41	68.4	8.04
J-51	TRUE	4,000	4,000	4,013	4,013	20	60.2	57	J-41	66	5.84
J-52	TRUE	4,000	4,000	4,000	4,000	20	59.2	56.6	J-41	63	5.7
J-53	TRUE	4,000	4,000	4,038	4,038	20	61.2	57.1	J-41	63.4	4.26
J-54	TRUE	4,000	4,000	4,046	4,046	20	59.1	56.7	J-41	61.7	4.26
J-55	TRUE	4,000	4,000	4,058	4,058	20	58.4	56.3	J-41	61.5	4.26
J-56	TRUE	4,000	4,000	4,095	4,095	20	55.9	55.7	J-41	59.5	4.26
J-57	TRUE	4,000	4,000	4,040	4,040	20	58.9	56.7	J-41	61.5	4.26
J-58	TRUE	4,000	4,000	4,009	4,009	20	56.9	56.4	J-41	59.8	4.26
J-59	TRUE	4,000	4,000	4,033	4,033	20	56.8	56.4	J-41	59.7	4.26
J-60	TRUE	4,000	4,000	4,028	4,028	20	61.9	57.2	J-41	67.6	6.09

Scenario: Max Day Demand + 2% + 4,000 gpm Fire Flow

Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-03, J-25, J-95)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-62	TRUE	4,000	4,000	4,041	4,041	20	58.6	56.6	J-41	63.9	4.81
J-63	TRUE	4,000	4,000	4,053	4,053	20	59	56.6	J-41	64.2	4.89
J-64	TRUE	4,000	4,000	4,004	4,004	20	55.5	55.1	J-86	68.6	6.4
J-65	TRUE	4,000	4,000	4,003	4,003	20	56.6	57	J-41	68.5	7.38
J-66	TRUE	4,000	4,000	4,005	4,005	20	62.3	57.3	J-41	66.5	4.94
J-67	TRUE	4,000	4,000	4,045	4,045	20	55.6	56.8	J-41	65.7	8.25
J-68	TRUE	4,000	4,000	4,023	4,023	20	59.6	56.5	J-41	64	5.02
J-69	TRUE	4,000	4,000	4,002	4,002	20	57.1	56.6	J-41	62.2	7.89
J-70	TRUE	4,000	4,000	4,004	4,004	20	57	56.6	J-41	63	5.84
J-71	TRUE	4,000	4,000	4,033	4,033	20	53.7	53.7	J-34	66.2	8.11
J-72	TRUE	4,000	4,000	4,002	4,002	20	59.4	56.8	J-41	64.6	7.18
J-74	TRUE	4,000	4,000	4,082	4,082	20	51.4	51.7	J-32	67	6.59
J-75	TRUE	4,000	4,000	4,058	4,058	20	62.6	56.9	J-41	65.5	4.26
J-76	TRUE	4,000	4,000	4,030	4,030	20	62.8	57.2	J-41	67.9	6.42
J-77	TRUE	4,000	4,000	4,016	4,016	20	62.3	57.2	J-41	67.5	6.06
J-78	TRUE	4,000	4,000	4,018	4,018	20	59.6	56.9	J-41	65.1	6.81
J-79	TRUE	4,000	4,000	4,017	4,017	20	59	57	J-41	68.7	8.28
J-80	TRUE	4,000	4,000	4,017	4,017	20	57.5	57	J-41	68.2	7.89
J-81	TRUE	4,000	4,000	4,010	4,010	20	57	57	J-41	68.1	7.71
J-82	TRUE	4,000	4,000	4,000	4,000	20	56.7	57	J-41	68.2	7.56
J-83	TRUE	4,000	4,000	4,033	4,033	20	56.4	56.9	J-41	68.7	7.18
J-84	TRUE	4,000	4,000	4,013	4,013	20	56.4	56.8	J-85	68.9	7.01
J-85	TRUE	4,000	4,000	4,010	4,010	20	55.4	55.8	J-86	68.4	6.6
J-86	TRUE	4,000	4,000	4,021	4,021	20	54.4	54.5	J-87	67.5	6.49
J-87	TRUE	4,000	4,000	4,024	4,024	20	54.2	54.7	J-86	67.3	6.59
J-89	TRUE	4,000	4,000	4,084	4,084	20	54.4	55	J-16	67.2	7.03
J-90	TRUE	4,000	4,000	4,032	4,032	20	56.6	56.7	J-41	65.2	8.78
J-91	TRUE	4,000	4,000	4,026	4,026	20	57.5	56.7	J-41	64.9	9.21
J-92	TRUE	4,000	4,000	4,024	4,024	20	59.7	56.6	J-41	64.4	4.81
J-93	TRUE	4,000	4,000	4,015	4,015	20	59.8	56.6	J-41	64.6	4.69
J-94	TRUE	4,000	4,000	4,014	4,014	20	59	56.6	J-41	63.5	5.28
J-95	TRUE	4,000	4,000	4,088	4,088	20	57.4	56.2	J-41	61.2	4.6
J-96	TRUE	4,000	4,000	4,002	4,002	20	59.9	57.1	J-41	69	8.5
J-98	TRUE	4,000	4,000	4,001	4,001	20	63.7	57.3	J-41	67.7	4.99
J-100	TRUE	4,000	4,000	4,000	4,000	20	62.7	56.9	J-41	65.7	4.26
J-101	TRUE	4,000	4,000	4,000	4,000	20	62.4	56.9	J-41	65.9	6.38
J-102	TRUE	4,000	4,000	4,005	4,005	20	61.6	57.1	J-41	68.6	9.22

Scenario: Max Day Demand + 2% + 2,000 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-16, J-32, J-75)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	TRUE	2,000	2,000	2,000	2,000	20	69.4	59.3	J-41	69.5	2.84
J-2	TRUE	2,000	2,000	2,000	2,000	20	64.4	58.7	J-41	65	2.84
J-3	TRUE	2,000	2,000	2,089	2,089	20	63.2	58.5	J-41	64	2.84
J-4	TRUE	2,000	2,000	2,043	2,043	20	63.1	58.5	J-41	63.9	2.84
J-5	TRUE	2,000	2,000	2,000	2,000	20	61.7	58.4	J-41	62.6	2.84
J-6	TRUE	2,000	2,000	2,000	2,000	20	59.4	58.2	J-41	60.5	2.84
J-7	TRUE	2,000	2,000	2,008	2,008	20	59.4	58.2	J-41	60.4	2.84
J-8	TRUE	2,000	2,000	2,000	2,000	20	59.7	58.1	J-41	60.9	2.84
J-9	TRUE	2,000	2,000	2,000	2,000	20	60.9	58.1	J-41	62.1	2.84
J-10	TRUE	2,000	2,000	2,043	2,043	20	61	58.1	J-41	62.2	3.09
J-11	TRUE	2,000	2,000	2,019	2,019	20	62.1	58.2	J-41	63.6	2.84
J-12	TRUE	2,000	2,000	2,056	2,056	20	62.1	58.2	J-41	63.6	3.04
J-13	TRUE	2,000	2,000	2,000	2,000	20	63.1	58.2	J-41	65	2.84
J-14	TRUE	2,000	2,000	2,000	2,000	20	62.9	58.2	J-41	64.9	5.13
J-15	TRUE	2,000	2,000	2,027	2,027	20	62.6	58.3	J-41	66.5	4.16
J-16	TRUE	2,000	2,000	2,027	2,027	20	63.1	58.3	J-41	67.4	3.87
J-17	TRUE	2,000	2,000	2,001	2,001	20	65	58.3	J-41	69.2	3.69
J-18	TRUE	2,000	2,000	2,030	2,030	20	65	58.3	J-41	69.1	3.71
J-19	TRUE	2,000	2,000	2,000	2,000	20	66.6	58.4	J-41	68.3	2.84
J-20	TRUE	2,000	2,000	2,041	2,041	20	65.8	58.5	J-41	67.4	2.84
J-21	TRUE	2,000	2,000	2,016	2,016	20	63.9	58.5	J-41	65.4	2.84
J-22	TRUE	2,000	2,000	2,000	2,000	20	64.8	58.5	J-41	66	3.02
J-24	TRUE	2,000	2,000	2,024	2,024	20	64.6	58.5	J-41	65.7	3.21
J-25	TRUE	2,000	2,000	2,055	2,055	20	61.7	58.4	J-41	62.7	2.84
J-26	TRUE	2,000	2,000	2,000	2,000	20	61.9	58.3	J-41	63.2	2.84
J-27	TRUE	2,000	2,000	2,002	2,002	20	62.3	58.3	J-41	64.2	2.84
J-28	TRUE	2,000	2,000	2,012	2,012	20	61.6	58.3	J-41	63.5	3.99
J-29	TRUE	2,000	2,000	2,000	2,000	20	61.5	58.3	J-41	63.7	3.13
J-30	TRUE	2,000	2,000	2,001	2,001	20	62.2	58.2	J-41	66.7	4.03
J-31	TRUE	2,000	2,000	2,005	2,005	20	62.2	58.2	J-41	66.6	3.95
J-32	TRUE	2,000	2,000	2,070	2,070	20	62.1	58.2	J-41	67.1	3.42
J-33	TRUE	2,000	2,000	2,000	2,000	20	61	58.2	J-41	65.8	3.77
J-34	TRUE	2,000	2,000	2,082	2,082	20	59.2	58.2	J-41	65.2	5.91
J-35	TRUE	2,000	2,000	2,000	2,000	20	64.9	58.5	J-41	66.8	3.42
J-36	TRUE	2,000	2,000	2,000	2,000	20	65.3	58.4	J-41	67	2.84
J-37	TRUE	2,000	2,000	2,000	2,000	20	59	58.1	J-41	60.4	2.84
J-39	TRUE	2,000	2,000	2,000	2,000	20	58.6	58	J-41	59.9	2.84
J-40	TRUE	2,000	2,000	2,052	2,052	20	58.6	58	J-41	59.9	2.84
J-41	TRUE	2,000	2,000	2,000	2,000	20	57.9	58.2	J-56	59.3	2.84
J-44	TRUE	2,000	2,000	2,008	2,008	20	64.5	58.4	J-41	65.6	2.84
J-45	TRUE	2,000	2,000	2,009	2,009	20	65.1	58.4	J-41	66.3	2.84
J-46	TRUE	2,000	2,000	2,047	2,047	20	62.1	58.3	J-41	63.8	2.84
J-48	TRUE	2,000	2,000	2,008	2,008	20	63.3	58.3	J-41	67.4	4.03
J-49	TRUE	2,000	2,000	2,009	2,009	20	63.4	58.3	J-41	67.5	4
J-50	TRUE	2,000	2,000	2,007	2,007	20	65.1	58.4	J-41	68.4	4.33
J-51	TRUE	2,000	2,000	2,013	2,013	20	64	58.4	J-41	66	2.98
J-52	TRUE	2,000	2,000	2,000	2,000	20	61.6	58.3	J-41	63	3.08
J-53	TRUE	2,000	2,000	2,038	2,038	20	62.5	58.4	J-41	63.4	2.84
J-54	TRUE	2,000	2,000	2,046	2,046	20	60.7	58.3	J-41	61.7	2.84
J-55	TRUE	2,000	2,000	2,058	2,058	20	60.3	58.1	J-41	61.5	2.84
J-56	TRUE	2,000	2,000	2,095	2,095	20	58.2	58	J-41	59.5	2.84
J-57	TRUE	2,000	2,000	2,040	2,040	20	60.5	58.3	J-41	61.5	2.84
J-58	TRUE	2,000	2,000	2,009	2,009	20	58.7	58.2	J-41	59.8	2.84
J-59	TRUE	2,000	2,000	2,033	2,033	20	58.5	58.2	J-41	59.7	2.84
J-60	TRUE	2,000	2,000	2,028	2,028	20	65.7	58.5	J-41	67.6	2.97

Scenario: Max Day Demand + 2% + 2,000 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-16, J-32, J-75)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-62	TRUE	2,000	2,000	2,041	2,041	20	62.1	58.3	J-41	63.9	2.84
J-63	TRUE	2,000	2,000	2,053	2,053	20	62.3	58.3	J-41	64.2	2.84
J-64	TRUE	2,000	2,000	2,004	2,004	20	64.3	58.3	J-41	68.6	3.6
J-65	TRUE	2,000	2,000	2,003	2,003	20	64.6	58.4	J-41	68.5	4
J-66	TRUE	2,000	2,000	2,005	2,005	20	65	58.5	J-41	66.5	2.87
J-67	TRUE	2,000	2,000	2,045	2,045	20	62.3	58.3	J-41	65.7	4.45
J-68	TRUE	2,000	2,000	2,023	2,023	20	62.4	58.2	J-41	64	2.87
J-69	TRUE	2,000	2,000	2,002	2,002	20	60.4	58.2	J-41	62.2	3.97
J-70	TRUE	2,000	2,000	2,004	2,004	20	61	58.2	J-41	63	2.85
J-71	TRUE	2,000	2,000	2,033	2,033	20	62.1	58.2	J-41	66.2	4.25
J-72	TRUE	2,000	2,000	2,002	2,002	20	62.9	58.3	J-41	64.6	3.52
J-74	TRUE	2,000	2,000	2,082	2,082	20	62	58.2	J-41	67	3.46
J-75	TRUE	2,000	2,000	2,058	2,058	20	64.4	58.4	J-41	65.5	2.84
J-76	TRUE	2,000	2,000	2,030	2,030	20	66.2	58.4	J-41	67.9	3.16
J-77	TRUE	2,000	2,000	2,016	2,016	20	65.7	58.4	J-41	67.5	3.13
J-78	TRUE	2,000	2,000	2,018	2,018	20	63.3	58.3	J-41	65.1	3.35
J-79	TRUE	2,000	2,000	2,017	2,017	20	65.5	58.4	J-41	68.7	4.45
J-80	TRUE	2,000	2,000	2,017	2,017	20	64.7	58.4	J-41	68.2	4.25
J-81	TRUE	2,000	2,000	2,010	2,010	20	64.5	58.4	J-41	68.1	4.16
J-82	TRUE	2,000	2,000	2,000	2,000	20	64.5	58.4	J-41	68.2	4.09
J-83	TRUE	2,000	2,000	2,033	2,033	20	64.7	58.4	J-41	68.7	3.9
J-84	TRUE	2,000	2,000	2,013	2,013	20	64.9	58.4	J-41	68.9	3.81
J-85	TRUE	2,000	2,000	2,010	2,010	20	64.2	58.3	J-41	68.4	3.61
J-86	TRUE	2,000	2,000	2,021	2,021	20	63.2	58.3	J-41	67.5	3.7
J-87	TRUE	2,000	2,000	2,024	2,024	20	63	58.3	J-41	67.3	3.74
J-89	TRUE	2,000	2,000	2,084	2,084	20	63	58.3	J-41	67.2	3.93
J-90	TRUE	2,000	2,000	2,032	2,032	20	62.3	58.3	J-41	65.2	4.68
J-91	TRUE	2,000	2,000	2,026	2,026	20	62.3	58.3	J-41	64.9	4.87
J-92	TRUE	2,000	2,000	2,024	2,024	20	62.7	58.2	J-41	64.4	2.84
J-93	TRUE	2,000	2,000	2,015	2,015	20	62.9	58.2	J-41	64.6	2.84
J-94	TRUE	2,000	2,000	2,014	2,014	20	61.9	58.3	J-41	63.5	2.84
J-95	TRUE	2,000	2,000	2,088	2,088	20	59.8	58.1	J-41	61.2	2.84
J-96	TRUE	2,000	2,000	2,002	2,002	20	66	58.4	J-41	69	4.56
J-98	TRUE	2,000	2,000	2,001	2,001	20	66.2	58.5	J-41	67.7	2.91
J-100	TRUE	2,000	2,000	2,000	2,000	20	64.6	58.4	J-41	65.7	2.84
J-101	TRUE	2,000	2,000	2,000	2,000	20	64.6	58.4	J-41	65.9	3.19
J-102	TRUE	2,000	2,000	2,005	2,005	20	66.3	58.4	J-41	68.6	4.94

Scenario: Max Day Demand + 2% + 4,500 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-46)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	TRUE	4,500	4,500	4,500	4,500	20	69.4	59.2	J-41	69.5	4.62
J-2	TRUE	4,500	4,500	4,500	4,500	20	63.1	57.4	J-41	65	4.62
J-3	TRUE	4,500	4,500	4,589	4,589	20	61.6	56.9	J-41	64	4.62
J-4	TRUE	4,500	4,500	4,543	4,543	20	61.5	56.9	J-41	63.9	4.62
J-5	TRUE	4,500	4,500	4,500	4,500	20	59.8	56.4	J-41	62.6	4.62
J-6	TRUE	4,500	4,500	4,500	4,500	20	57.2	56.1	J-41	60.5	4.62
J-7	TRUE	4,500	4,500	4,508	4,508	20	57.2	56.1	J-41	60.4	4.62
J-8	TRUE	4,500	4,500	4,500	4,500	20	57.3	55.7	J-41	60.9	4.62
J-9	TRUE	4,500	4,500	4,500	4,500	20	58.3	55.7	J-41	62.1	4.62
J-10	TRUE	4,500	4,500	4,543	4,543	20	58.4	55.7	J-41	62.2	6.06
J-11	TRUE	4,500	4,500	4,519	4,519	20	58.7	56	J-41	63.6	4.62
J-12	TRUE	4,500	4,500	4,556	4,556	20	58.7	56	J-41	63.6	5.92
J-13	TRUE	4,500	4,500	4,500	4,500	20	58.9	56.1	J-41	65	4.92
J-14	TRUE	4,500	4,500	4,500	4,500	20	58.1	56.1	J-41	64.9	10.39
J-15	TRUE	4,500	4,500	4,527	4,527	20	52.1	53.7	J-48	66.5	8.46
J-16	TRUE	4,500	4,500	4,527	4,527	20	51.6	52.1	J-89	67.4	7.65
J-17	TRUE	4,500	4,500	4,501	4,501	20	53.5	53.3	J-85	69.2	7.53
J-18	TRUE	4,500	4,500	4,530	4,530	20	53.5	53.5	J-85	69.1	7.58
J-19	TRUE	4,500	4,500	4,500	4,500	20	62.6	56.8	J-41	68.3	5.1
J-20	TRUE	4,500	4,500	4,541	4,541	20	61.8	56.8	J-41	67.4	5.18
J-21	TRUE	4,500	4,500	4,516	4,516	20	60.2	56.9	J-41	65.4	5.41
J-22	TRUE	4,500	4,500	4,500	4,500	20	62.1	57	J-41	66	5.73
J-24	TRUE	4,500	4,500	4,524	4,524	20	62.2	57	J-41	65.7	6.06
J-25	TRUE	4,500	4,500	4,555	4,555	20	59.8	56.4	J-41	62.7	4.62
J-26	TRUE	4,500	4,500	4,500	4,500	20	59	56.2	J-41	63.2	4.62
J-27	TRUE	4,500	4,500	4,502	4,502	20	57.6	56.1	J-41	64.2	5.3
J-28	TRUE	4,500	4,500	4,512	4,512	20	56.8	56.1	J-41	63.5	8.79
J-29	TRUE	4,500	4,500	4,500	4,500	20	55.6	56.1	J-41	63.7	6.77
J-30	TRUE	4,500	4,500	4,501	4,501	20	50	49.4	J-34	66.7	8.6
J-31	TRUE	4,500	4,500	4,505	4,505	20	49.9	52.1	J-74	66.6	8.5
J-32	TRUE	4,500	4,500	4,570	4,570	20	47.9	48.2	J-74	67.1	7.28
J-33	TRUE	4,500	4,500	4,500	4,500	20	47.7	47	J-34	65.8	8
J-34	TRUE	4,500	4,500	4,582	4,582	20	41.8	47.7	J-33	65.2	13
J-35	TRUE	4,500	4,500	4,500	4,500	20	59.9	56.9	J-41	66.8	7.47
J-36	TRUE	4,500	4,500	4,500	4,500	20	61.2	56.7	J-41	67	4.77
J-37	TRUE	4,500	4,500	4,500	4,500	20	55.5	55.6	J-41	60.4	5.08
J-39	TRUE	4,500	4,500	4,500	4,500	20	55.8	55.2	J-41	59.9	4.62
J-40	TRUE	4,500	4,500	4,552	4,552	20	55.8	55.2	J-41	59.9	4.62
J-41	TRUE	4,500	4,500	4,500	4,500	20	54.9	55.2	J-56	59.3	4.62
J-44	TRUE	4,500	4,500	4,508	4,508	20	62.2	56.4	J-41	65.6	4.62
J-45	TRUE	4,500	4,500	4,509	4,509	20	62.6	56.4	J-41	66.3	4.62
J-46	TRUE	4,500	4,500	4,547	4,547	20	58.1	56.1	J-41	63.8	5.76
J-48	TRUE	4,500	4,500	4,508	4,508	20	52.3	52.5	J-49	67.4	8.1
J-49	TRUE	4,500	4,500	4,509	4,509	20	52.2	52.3	J-89	67.5	8.02
J-50	TRUE	4,500	4,500	4,507	4,507	20	55.8	55.8	J-80	68.4	8.98
J-51	TRUE	4,500	4,500	4,513	4,513	20	58.9	56.5	J-41	66	6.55
J-52	TRUE	4,500	4,500	4,500	4,500	20	58.4	56.2	J-41	63	6.36
J-53	TRUE	4,500	4,500	4,538	4,538	20	60.7	56.7	J-41	63.4	4.62
J-54	TRUE	4,500	4,500	4,546	4,546	20	58.6	56.3	J-41	61.7	4.62
J-55	TRUE	4,500	4,500	4,558	4,558	20	57.8	55.7	J-41	61.5	4.62
J-56	TRUE	4,500	4,500	4,595	4,595	20	55.2	55	J-41	59.5	4.62
J-57	TRUE	4,500	4,500	4,540	4,540	20	58.4	56.2	J-41	61.5	4.62
J-58	TRUE	4,500	4,500	4,509	4,509	20	56.4	55.9	J-41	59.8	4.62
J-59	TRUE	4,500	4,500	4,533	4,533	20	56.2	55.8	J-41	59.7	4.62
J-60	TRUE	4,500	4,500	4,528	4,528	20	60.6	56.8	J-41	67.6	6.87
J-62	TRUE	4,500	4,500	4,541	4,541	20	57.5	56.1	J-41	63.9	5.37
J-63	TRUE	4,500	4,500	4,553	4,553	20	57.9	56.1	J-41	64.2	5.46
J-64	TRUE	4,500	4,500	4,504	4,504	20	52.6	52.5	J-86	68.6	7.12
J-65	TRUE	4,500	4,500	4,503	4,503	20	54	54.6	J-83	68.5	8.23

Scenario: Max Day Demand + 2% + 4,500 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-46)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-66	TRUE	4,500	4,500	4,505	4,505	20	61.5	56.9	J-41	66.5	5.46
J-67	TRUE	4,500	4,500	4,545	4,545	20	53.4	55	J-15	65.7	9.21
J-68	TRUE	4,500	4,500	4,523	4,523	20	58.7	56	J-41	64	5.56
J-69	TRUE	4,500	4,500	4,502	4,502	20	56.1	56.1	J-41	62.2	8.87
J-70	TRUE	4,500	4,500	4,504	4,504	20	55.8	56.1	J-41	63	6.59
J-71	TRUE	4,500	4,500	4,533	4,533	20	50.9	51.2	J-34	66.2	9.08
J-72	TRUE	4,500	4,500	4,502	4,502	20	58.3	56.4	J-41	64.6	8.09
J-74	TRUE	4,500	4,500	4,582	4,582	20	47.9	48.3	J-32	67	7.37
J-75	TRUE	4,500	4,500	4,558	4,558	20	62	56.4	J-41	65.5	4.62
J-76	TRUE	4,500	4,500	4,530	4,530	20	61.7	56.8	J-41	67.9	7.23
J-77	TRUE	4,500	4,500	4,516	4,516	20	61.2	56.8	J-41	67.5	6.8
J-78	TRUE	4,500	4,500	4,518	4,518	20	58.5	56.4	J-41	65.1	7.67
J-79	TRUE	4,500	4,500	4,517	4,517	20	56.9	56.6	J-41	68.7	9.24
J-80	TRUE	4,500	4,500	4,517	4,517	20	55.1	55.3	J-81	68.2	8.8
J-81	TRUE	4,500	4,500	4,510	4,510	20	54.5	54.9	J-82	68.1	8.61
J-82	TRUE	4,500	4,500	4,500	4,500	20	54.2	54.8	J-65	68.2	8.44
J-83	TRUE	4,500	4,500	4,533	4,533	20	53.7	54.4	J-84	68.7	8.01
J-84	TRUE	4,500	4,500	4,513	4,513	20	53.6	54.3	J-83	68.9	7.81
J-85	TRUE	4,500	4,500	4,510	4,510	20	52.6	53.2	J-86	68.4	7.34
J-86	TRUE	4,500	4,500	4,521	4,521	20	51.5	51.7	J-87	67.5	7.22
J-87	TRUE	4,500	4,500	4,524	4,524	20	51.3	51.9	J-86	67.3	7.33
J-89	TRUE	4,500	4,500	4,584	4,584	20	51.6	52.3	J-16	67.2	7.83
J-90	TRUE	4,500	4,500	4,532	4,532	20	54.8	55.6	J-67	65.2	9.81
J-91	TRUE	4,500	4,500	4,526	4,526	20	56	56.2	J-41	64.9	10.3
J-92	TRUE	4,500	4,500	4,524	4,524	20	58.8	56	J-41	64.4	5.33
J-93	TRUE	4,500	4,500	4,515	4,515	20	58.9	56.1	J-41	64.6	5.19
J-94	TRUE	4,500	4,500	4,514	4,514	20	58.1	56.1	J-41	63.5	5.89
J-95	TRUE	4,500	4,500	4,588	4,588	20	56.7	55.6	J-41	61.2	5.16
J-96	TRUE	4,500	4,500	4,502	4,502	20	57.9	56.7	J-41	69	9.49
J-98	TRUE	4,500	4,500	4,501	4,501	20	62.8	56.9	J-41	67.7	5.52
J-100	TRUE	4,500	4,500	4,500	4,500	20	62.2	56.4	J-41	65.7	4.62
J-101	TRUE	4,500	4,500	4,500	4,500	20	61.6	56.4	J-41	65.9	7.18
J-102	TRUE	4,500	4,500	4,505	4,505	20	60.1	56.7	J-41	68.6	10.3

Scenario: Max Day Demand + 2% + 2,500 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-56, J-60)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	TRUE	2,500	2,500	2,500	2,500	20	69.4	59.3	J-41	69.5	3.2
J-2	TRUE	2,500	2,500	2,500	2,500	20	64.2	58.4	J-41	65	3.2
J-3	TRUE	2,500	2,500	2,589	2,589	20	62.9	58.2	J-41	64	3.2
J-4	TRUE	2,500	2,500	2,543	2,543	20	62.9	58.2	J-41	63.9	3.2
J-5	TRUE	2,500	2,500	2,500	2,500	20	61.4	58	J-41	62.6	3.2
J-6	TRUE	2,500	2,500	2,500	2,500	20	59	57.9	J-41	60.5	3.2
J-7	TRUE	2,500	2,500	2,508	2,508	20	59	57.9	J-41	60.4	3.2
J-8	TRUE	2,500	2,500	2,500	2,500	20	59.3	57.7	J-41	60.9	3.2
J-9	TRUE	2,500	2,500	2,500	2,500	20	60.5	57.7	J-41	62.1	3.2
J-10	TRUE	2,500	2,500	2,543	2,543	20	60.6	57.7	J-41	62.2	3.67
J-11	TRUE	2,500	2,500	2,519	2,519	20	61.5	57.8	J-41	63.6	3.2
J-12	TRUE	2,500	2,500	2,556	2,556	20	61.5	57.8	J-41	63.6	3.61
J-13	TRUE	2,500	2,500	2,500	2,500	20	62.4	57.9	J-41	65	3.2
J-14	TRUE	2,500	2,500	2,500	2,500	20	62.1	57.9	J-41	64.9	6.17
J-15	TRUE	2,500	2,500	2,527	2,527	20	60.9	58	J-41	66.5	4.96
J-16	TRUE	2,500	2,500	2,527	2,527	20	61.3	58	J-41	67.4	4.56
J-17	TRUE	2,500	2,500	2,501	2,501	20	63.2	58	J-41	69.2	4.46
J-18	TRUE	2,500	2,500	2,530	2,530	20	63.2	58	J-41	69.1	4.49
J-19	TRUE	2,500	2,500	2,500	2,500	20	66	58.2	J-41	68.3	3.2
J-20	TRUE	2,500	2,500	2,541	2,541	20	65.2	58.2	J-41	67.4	3.21
J-21	TRUE	2,500	2,500	2,516	2,516	20	63.3	58.2	J-41	65.4	3.34
J-22	TRUE	2,500	2,500	2,500	2,500	20	64.4	58.2	J-41	66	3.55
J-24	TRUE	2,500	2,500	2,524	2,524	20	64.2	58.3	J-41	65.7	3.76
J-25	TRUE	2,500	2,500	2,555	2,555	20	61.4	58	J-41	62.7	3.2
J-26	TRUE	2,500	2,500	2,500	2,500	20	61.4	57.9	J-41	63.2	3.2
J-27	TRUE	2,500	2,500	2,502	2,502	20	61.5	57.9	J-41	64.2	3.2
J-28	TRUE	2,500	2,500	2,512	2,512	20	60.9	57.9	J-41	63.5	4.96
J-29	TRUE	2,500	2,500	2,500	2,500	20	60.6	57.9	J-41	63.7	3.85
J-30	TRUE	2,500	2,500	2,501	2,501	20	60.4	57.9	J-41	66.7	4.94
J-31	TRUE	2,500	2,500	2,505	2,505	20	60.3	57.9	J-41	66.6	4.86
J-32	TRUE	2,500	2,500	2,570	2,570	20	59.9	57.9	J-41	67.1	4.19
J-33	TRUE	2,500	2,500	2,500	2,500	20	59	57.9	J-41	65.8	4.61
J-34	TRUE	2,500	2,500	2,582	2,582	20	56.5	57.9	J-41	65.2	7.33
J-35	TRUE	2,500	2,500	2,500	2,500	20	64.1	58.2	J-41	66.8	4.23
J-36	TRUE	2,500	2,500	2,500	2,500	20	64.7	58.1	J-41	67	3.2
J-37	TRUE	2,500	2,500	2,500	2,500	20	58.4	57.7	J-41	60.4	3.2
J-39	TRUE	2,500	2,500	2,500	2,500	20	58.2	57.5	J-41	59.9	3.2
J-40	TRUE	2,500	2,500	2,552	2,552	20	58.1	57.5	J-41	59.9	3.2
J-41	TRUE	2,500	2,500	2,500	2,500	20	57.4	57.7	J-56	59.3	3.2
J-44	TRUE	2,500	2,500	2,508	2,508	20	64.1	58	J-41	65.6	3.2
J-45	TRUE	2,500	2,500	2,509	2,509	20	64.7	58	J-41	66.3	3.2
J-46	TRUE	2,500	2,500	2,547	2,547	20	61.5	57.9	J-41	63.8	3.36
J-48	TRUE	2,500	2,500	2,508	2,508	20	61.6	58	J-41	67.4	4.77
J-49	TRUE	2,500	2,500	2,509	2,509	20	61.6	58	J-41	67.5	4.74
J-50	TRUE	2,500	2,500	2,507	2,507	20	63.6	58.1	J-41	68.4	5.25
J-51	TRUE	2,500	2,500	2,513	2,513	20	63.2	58.1	J-41	66	3.69
J-52	TRUE	2,500	2,500	2,500	2,500	20	61.1	57.9	J-41	63	3.73
J-53	TRUE	2,500	2,500	2,538	2,538	20	62.2	58.1	J-41	63.4	3.2
J-54	TRUE	2,500	2,500	2,546	2,546	20	60.3	58	J-41	61.7	3.2
J-55	TRUE	2,500	2,500	2,558	2,558	20	59.9	57.7	J-41	61.5	3.2
J-56	TRUE	2,500	2,500	2,595	2,595	20	57.7	57.5	J-41	59.5	3.2
J-57	TRUE	2,500	2,500	2,540	2,540	20	60.2	57.9	J-41	61.5	3.2
J-58	TRUE	2,500	2,500	2,509	2,509	20	58.3	57.8	J-41	59.8	3.2
J-59	TRUE	2,500	2,500	2,533	2,533	20	58.2	57.8	J-41	59.7	3.2
J-60	TRUE	2,500	2,500	2,528	2,528	20	65	58.2	J-41	67.6	3.76

Scenario: Max Day Demand + 2% + 2,500 gpm Fire Flow
Report: Fire Flow (System Results, Fire Flow Demand Analyzed at J-56, J-60)

Label	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Fire Flow (Available) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Residual Lower Limit) (psi)	Pressure (Calculated Residual) (psi)	Pressure (Calculated Zone Lower Limit) (psi)	Junction w/ Minimum Pressure (Zone)	Pressure (Maximum) (psi)	Velocity of Maximum Pipe (ft/s)
J-62	TRUE	2,500	2,500	2,541	2,541	20	61.3	57.9	J-41	63.9	3.2
J-63	TRUE	2,500	2,500	2,553	2,553	20	61.6	57.9	J-41	64.2	3.2
J-64	TRUE	2,500	2,500	2,504	2,504	20	62.5	58	J-41	68.6	4.24
J-65	TRUE	2,500	2,500	2,503	2,503	20	63	58.1	J-41	68.5	4.84
J-66	TRUE	2,500	2,500	2,505	2,505	20	64.5	58.2	J-41	66.5	3.38
J-67	TRUE	2,500	2,500	2,545	2,545	20	60.9	58	J-41	65.7	5.36
J-68	TRUE	2,500	2,500	2,523	2,523	20	61.8	57.9	J-41	64	3.4
J-69	TRUE	2,500	2,500	2,502	2,502	20	59.8	57.9	J-41	62.2	4.95
J-70	TRUE	2,500	2,500	2,504	2,504	20	60.2	57.9	J-41	63	3.6
J-71	TRUE	2,500	2,500	2,533	2,533	20	60.4	57.9	J-41	66.2	5.21
J-72	TRUE	2,500	2,500	2,502	2,502	20	62.2	58	J-41	64.6	4.44
J-74	TRUE	2,500	2,500	2,582	2,582	20	59.8	57.9	J-41	67	4.24
J-75	TRUE	2,500	2,500	2,558	2,558	20	64	58	J-41	65.5	3.2
J-76	TRUE	2,500	2,500	2,530	2,530	20	65.5	58.2	J-41	67.9	3.98
J-77	TRUE	2,500	2,500	2,516	2,516	20	65	58.1	J-41	67.5	3.86
J-78	TRUE	2,500	2,500	2,518	2,518	20	62.5	58	J-41	65.1	4.22
J-79	TRUE	2,500	2,500	2,517	2,517	20	64.2	58.1	J-41	68.7	5.4
J-80	TRUE	2,500	2,500	2,517	2,517	20	63.3	58.1	J-41	68.2	5.15
J-81	TRUE	2,500	2,500	2,510	2,510	20	63	58.1	J-41	68.1	5.05
J-82	TRUE	2,500	2,500	2,500	2,500	20	62.9	58.1	J-41	68.2	4.95
J-83	TRUE	2,500	2,500	2,533	2,533	20	63	58	J-41	68.7	4.72
J-84	TRUE	2,500	2,500	2,513	2,513	20	63.1	58	J-41	68.9	4.61
J-85	TRUE	2,500	2,500	2,510	2,510	20	62.4	58	J-41	68.4	4.36
J-86	TRUE	2,500	2,500	2,521	2,521	20	61.4	58	J-41	67.5	4.36
J-87	TRUE	2,500	2,500	2,524	2,524	20	61.2	58	J-41	67.3	4.41
J-89	TRUE	2,500	2,500	2,584	2,584	20	61.2	58	J-41	67.2	4.65
J-90	TRUE	2,500	2,500	2,532	2,532	20	61.1	57.9	J-41	65.2	5.69
J-91	TRUE	2,500	2,500	2,526	2,526	20	61.3	57.9	J-41	64.9	5.95
J-92	TRUE	2,500	2,500	2,524	2,524	20	62	57.9	J-41	64.4	3.27
J-93	TRUE	2,500	2,500	2,515	2,515	20	62.2	57.9	J-41	64.6	3.2
J-94	TRUE	2,500	2,500	2,514	2,514	20	61.3	57.9	J-41	63.5	3.44
J-95	TRUE	2,500	2,500	2,588	2,588	20	59.3	57.7	J-41	61.2	3.2
J-96	TRUE	2,500	2,500	2,502	2,502	20	64.8	58.1	J-41	69	5.54
J-98	TRUE	2,500	2,500	2,501	2,501	20	65.7	58.2	J-41	67.7	3.42
J-100	TRUE	2,500	2,500	2,500	2,500	20	64.2	58	J-41	65.7	3.2
J-101	TRUE	2,500	2,500	2,500	2,500	20	64.2	58	J-41	65.9	3.99
J-102	TRUE	2,500	2,500	2,505	2,505	20	65.3	58.1	J-41	68.6	6.01

Amoruso Ranch Specific Plan Area

Water Master Plan

Appendix D

Technical Memorandum entitled "PCWA Distribution Analysis for Amoruso Ranch Specific Plan", dated January 22, 2016, by West Yost Associates

WEST YOST ASSOCIATES
25 YEARS 1990–2015

REGISTERED PROFESSIONAL ENGINEER
PATRICK A. JOHNSTON
No. C59028
Exp. 6-30-17
CIVIL
STATE OF CALIFORNIA

MEMORANDUM

DATE:	January 22, 2016	Project No.: 415-12-15-23 SENT VIA: EMAIL
TO:	Kelye McKinney, City of Roseville	
CC:	Tony Firenzi, Placer County Water Agency	
FROM:	Patrick Johnston, PE, RCE #59028 and Polly Boissevain, PE, RCE#36164	
REVIEWED BY:	Charles Duncan, PE, RCE #55498	
SUBJECT:	PCWA Distribution System Analysis for Amoruso Ranch Specific Plan	

At the request of the City of Roseville, West Yost Associates (West Yost) has prepared a hydraulic analysis in support of the water supply assessment and the California Environmental Quality Act analysis that the City of Roseville is preparing for the Amoruso Ranch Specific Plan. The purpose of the analysis is to determine the impacts to the Placer County Water Agency's (PCWA's) Lower Zone 1 water system of providing service to Roseville for Amoruso Ranch at a rate of 2.7 million gallons per day (mgd), and identify new infrastructure improvements required to mitigate those impacts. Separately, the City of Roseville is evaluating impacts to the City of Roseville's water distribution system to determine required infrastructure for the City of Roseville's system.

Currently PCWA has a contract right to deliver up to 10 mgd through the City of Roseville to other water purveyors south of Baseline Road and southwest of the City. Deliveries are made at an interconnection located at the Tinker Pump Station and Reservoir located in the Sunset Industrial sub-pressure zone of the Lower Zone 1 system. Current deliveries are provided to Cal Am at a rate of 2 mgd. With deliveries for Amoruso Ranch, a total of 12.7 mgd would need to be delivered through the intertie, leaving the 10 mgd available for development in west Placer County outside of the City of Roseville.

The analysis was performed using the most recent hydraulic model of the PCWA distribution system. The three scenarios that were run in the model are as follows:

- Existing maximum day demand of 53 mgd, of which 2 mgd is delivered to Cal Am via the Roseville interconnection (Existing Conditions);
- Total maximum day demand of 61 mgd, of which 10 mgd is delivered for west Placer County via the Roseville interconnection (Baseline Scenario); and
- Total maximum day demand of 64 mgd, of which 13 mgd for west Placer County and Amoruso Ranch is delivered via the Roseville Interconnection (Project Scenario).

1777 Botelho Drive, Suite 240 Walnut Creek, CA 94596 Phone 925-949-5800 Fax 925 949-5845 westyost.com

The existing maximum day demand used for the analysis is 53 mgd, based on 2013 maximum day demand conditions for Lower Zone 1. Demands in the hydraulic model were scaled up to match 2013 maximum day demands. For each of the three scenarios above, a demand was added to represent the delivery to the Roseville interconnection.

The model was updated to include a planned 42-inch diameter pipeline for the second and third scenarios. This pipeline starts at the western end of Whitney Ranch Parkway, crosses Highway 65, and ends at Industrial Avenue.

The criteria provided by PCWA for their system include a maximum velocity of 5 feet per second, minimum pressure of 40 pounds per square inch (psi), and no more than a 5 psi drop in pressure from the Baseline Scenario to the Project Scenario.

The Tinker Road Pump Station includes a set of four high-head pumps, a set of four low-head pumps, and a 10 million gallon storage tank. PCWA indicated that the high-head pumps deliver water from the storage tank into the PCWA distribution system from approximately 4 AM until 10 AM to augment system pressures during the high demand period. The low-head pumps deliver water from the PCWA distribution system to the Roseville distribution system at a rate that matches flow leaving the Roseville distribution system instantaneously through use of remote communication systems. The storage is refilled each evening with water from the PCWA distribution system between midnight and 4 AM. Simplified operational parameters were incorporated into the model, using a constant delivery flowrate to the Roseville system, and 4 AM to 10 AM refill of the tank, to create a 72-hour model run for each of the three scenarios mentioned above.

PCWA requested that the distribution system be analyzed downstream from the pressure reducing station at the intersection of Whitney Ranch Parkway and Spring Ranch Drive and the pressure reducing station at the intersection of Sunset Boulevard and Blue Oaks, two of the supplies to the Sunset Industrial pressure zone. The model analysis revealed that it is the 4-hour period when the tank is being refilled in which the lowest pressures in this part of the system occur, with the lowest pressures found along the 14-inch diameter pipeline on Tinker Road that supplies the Tinker Pump Station facility. For the first two scenarios, the pressures remain above 40 psi throughout the area that was analyzed. However, the lowest pressures during the Project Scenario drop below 30 psi during the tank refilling period along Tinker Road only.

West Yost evaluated options for relieving the capacity issues along the 14-inch diameter pipeline on Tinker Road. One option is to extend the tank refilling period and lower the rate at which the tank is refilled. A second option is to install a parallel pipeline along Tinker Road to provide additional capacity. For this second option, it was determined that approximately 800 feet of 24-inch diameter pipeline would be needed. This pipeline is shown on Figure 1. While both options increase the pressure to adequate levels along Tinker Road, the addition of a new pipeline is recommended, since velocities are excessively high in the existing 14-inch diameter pipeline on Tinker Road.

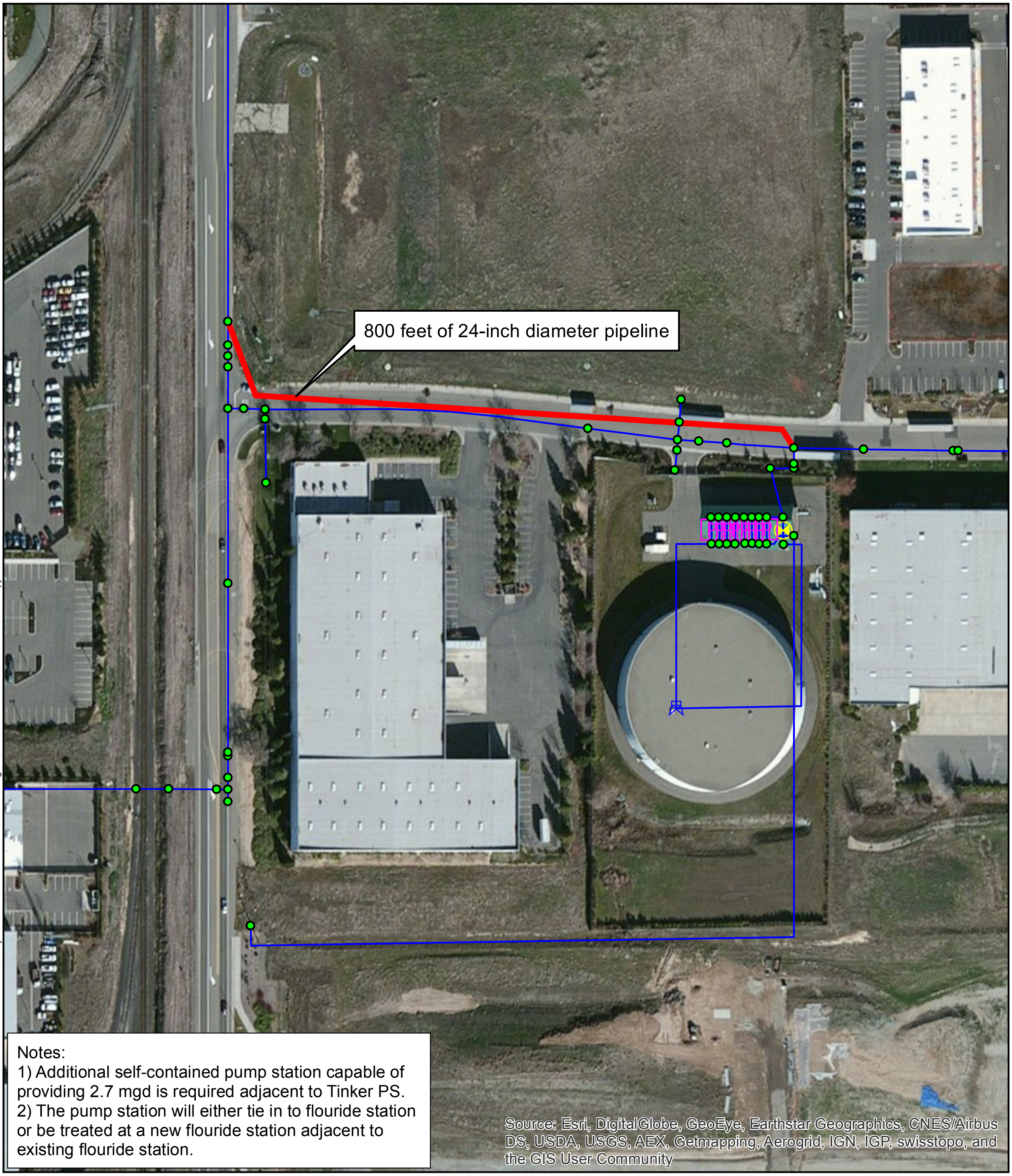
PCWA has indicated that the low-head pumps in the Tinker Road Pump Station are not capable of providing more than the 10 mgd for which they are designed. PCWA indicated that additional pumping capacity will be required in order to provide the additional 2.7 mgd that is being requested for Amoruso Ranch. A subsequent evaluation will be needed to identify a feasible location for the additional pump and necessary mechanical, electrical, building and site improvements.

RECOMMENDATIONS

Based on West Yost hydraulic evaluation using the updated PCWA hydraulic model, PCWA is able to provide the City of Roseville with the 2.7 mgd required for the Amoruso Ranch Specific Plan; however, additional infrastructure will be required. This additional infrastructure includes:

- New, self-contained pump, adjacent to the existing Tinker Pump Station, capable of delivering 2.7 mgd at a similar discharge head to the current 10 mgd pump station;
- New pipeline connection into the existing fluoride feeder station or construct new feeder stations inside new pump building; and
- Construct approximately 800 feet of 24-inch diameter pipeline along Tinker Road.

Once this infrastructure is constructed, PCWA will be able to deliver the additional 2.7 mgd to the City of Roseville.



Notes:
1) Additional self-contained pump station capable of providing 2.7 mgd is required adjacent to Tinker PS.
2) The pump station will either tie in to flouride station or be treated at a new flouride station adjacent to existing flouride station.

Symbology

Pipe

- Existing Pipelines
- Proposed Pipeline

N

0 83.5 167

Scale in Feet

Figure 1

Tinker Road Pump Station Proposed Pipeline in PCWA System

WEST YOST ASSOCIATES

City of Roseville
PCWA System Analysis for
Amoruso Ranch Specific Plan

Amoruso Ranch Specific Plan Area

Water Master Plan

Appendix E

Technical Memorandum entitled
"ARSP Potable Water Hydraulic Modeling",
dated December 15, 2015,
by HydroScience Engineers

Technical Memorandum

HydroScience
Strategic Water Solutions

Sacramento • Berkeley • San Jose • Concord

To: Paul Klein, Kimley Horn

From: Curtis Lam

Reviewed by: Kyle Horn

Subject: ARSP Potable Water Hydraulic Modeling

Date: December 16, 2015

Background

HydroScience Engineers was retained by Kimley Horn to provide the following services.

- Converting the existing Amoruso Specific Plan (ARSP) potable water hydraulic model into Infowater and integrating it into the City/Placer Ranch Specific Plan (PRSP) potable water hydraulic model
- Running the nine scenarios specified by the City for the current, interim, and buildout conditions during both summer drought, fall drought, and normal year conditions.
- Evaluating water infrastructure requirements for ARSP assuming 1) PRSP at buildout and 2) without PRSP.
- Providing Kimley-Horn with model output reports and/or figures showing the required infrastructure.

Following initiation of the project, the developers of the PRSP decided that they would no longer pursue their project for entitlement. Thus, ARSP was evaluated instead based on City current, interim, and buildout conditions without the inclusion of PRSP.

This technical memorandum is intended to summarize the work performed by HydroScience as part of this agreement.

Merging Models

The stand-alone Amoruso Ranch Specific Plan Hydraulic model (created by Kimley Horn) was merged with the City model in order to accurately reflect the planned infrastructure within the ARSP project and provide the City with a complete potable water model.

Water Demands

Water demands for the ARSP were provided by Kimley Horn (**Attachment 1**), and are based on the 15_0504 Land Use Plan (**Attachment 2**) prepared by the Dahlin Group dated May 4, 2015. Based on these water demands, the ARSP totaled 1.34 MGD at buildout, including 2% for system losses. A table of water demands by parcel and a map of the parcels is included in the attached tables.

Through a separate process, water demands for each portion of the City were developed by the Municipal Resource Group (MRG) in conjunction with the City. These water demands were developed by totaling the buildout water demand estimates that have been approved by the City with the assumed and estimated absorption rates for 19 separate areas of the City. An elaborate spreadsheet was prepared that identified buildout, 2035, and 2015 water demands for each specific plan area of the City by year. Copies of these tables can be provided upon request. It should be noted that the MRG analysis yielded a projected buildout demand for the ARSP project of 2.03MGD. For purposes of this analysis, the more conservative MRG demand was used.

HydroScience took these tables and converted the data into inputs to replace the water demands in the City's hydraulic model. The overall data used in the model is attached and summarized below. Water demands by Specific Plan are further detailed in the attachments.

Table 1: Summary of overall water demands

Year	Normal		Drought			
			Summer (July)		Fall (September)	
	AFY	MGD	AFY	MGD	AFY	MGD
2015	35,253	62.94	28,202	50.35	19,798	35.35
2035	45,233	80.76	36,187	64.61	25,403	45.36
2065	56,689	101.22	45,351	80.97	31,837	56.84
Buildout	64,719	115.56	51,775	92.44	36,346	64.90

Notes:
1. MGD is a straight conversion from AFY then multiplied by 2 for MDD
2. Summer represents a 20% reduction from the normal year due to water conservation efforts
3. Fall represents a 22% reduction from Summer demands (Summer is assumed to be July, fall is assumed to be September) based on the Annual Diurnal demand curve provided by the City plus a 10% reduction due to water conservation efforts.

Modeled Scenarios

The City identified multiple time periods and supply/demand conditions, to be modeled as part of the Placer Ranch Specific Plan hydraulic analysis. These scenarios were designed to ensure there is adequate supply available for the project as well as provide the City with a long term city-wide supply/demand picture under 'Normal' and 'Drought' conditions. With the PRSP project on hold, the City required the ARSP hydraulic analysis include these same scenarios. A copy of the modeling scenarios developed for the PRSP project and applied to the ARSP project, and are included as **Attachment 3**. This list of scenarios identified three critical time periods for further consideration, which were as follows:

2015 (existing): This demand scenario represents the current year demands
2035 (Interim): This demand scenario represents the pre-Ophir condition
2065 (Buildout): This demand scenario represents the buildout water condition, though it was noted that the City does not actually top out water demands at buildout. 2065 demands were capped by assumed absorption rates for units.

Each time scenario includes three separate climactic conditions:

Normal: This condition is intended to represent:

1) Maximum demand during the month of July with no water conservation
2) Assumes all normal water deliveries are made without use of interties
3) No use of groundwater
4) Use of recycled water

Drought/Summer: This condition is intended to represent:

1) Maximum demand condition during the month of July with 20% water conservation
2) Assumes the City receives 39,800 AFY from Folsom Lake in accordance with the water forum agreement
3) Maximizes the use of recycled water
4) Maximizes the use of on-site wells
5) Utilizes interties with PCWA and SSWD (Tinker and PFE respectively)

Drought/Fall: This condition is intended to represent:

1) Fall demand condition during the month of September with 10% water conservation
2) Assumes the City is limited to 13 MGD of Folsom Lake supply due to use of barge
3) Maximizes the use of recycled water
4) Maximizes the use of on-site wells
5) Utilizes interties with PCWA and SSWD (Tinker and PFE respectively)

The scenarios modeled for the ARSP were as follows:

- 2015 – Normal
- 2015 – Drought - Summer
- 2015 – Drought - Fall
- 2035 – Normal
- 2035 – Drought - Summer
- 2035 – Drought - Fall
- 2065 – Normal
- 2065 – Drought - Summer
- 2065 – Drought - Fall

Based on the overall water demands calculated by the Municipal Resource Group and the modeling assumptions identified for each scenario above, HydroScience calculated the water demands applicable to each plan area by year and scenario. These demands are detailed in **Attachment 4**. These demands were then input into the City/ARSP hydraulic model in lieu of the existing modeled demands for each of the nine modeling scenarios.

Modeling Considerations

During the execution of the modeling of each scenario, overall and scenario specific assumptions were identified and detailed. All of the detailed modifications not already detailed above are detailed in **Attachment 5**.

Some of the highlights of the modeling edits included:

- Modifying supply adjustments to the Folsom supply pipelines so the supply represented scenario conditions
- Modifying the timer controls for the Zone 2 Pump Station to remove warning errors
- Activating various well pumps for each scenario. Pressure controls (on/off) were added as required.
    - 6 wells for 2015
    - 15 wells for 2035
    - 17 wells for 2065.
- Adjusting SSWD intertie to force it to deliver 6 MGD. Method of demand placement was made to be similar to Tinker, which delivers water as a negative demand.
- Modifying 10 MGD withdrawal by PCWA where required to balance Zone 4 supply with Zone 4 demands
- Activating/deactivating Pleasant Grove Zone 4 to Zone 1 Pump station depending on Zone 4 supply and Zone 4 demands
    - Modifying the design point of the pump to better fit surplus demand in Zone 4
- Turning on or off the West Side Tank and Pump Station and Sierra Vista Tank and Pump Station in the 2035 and 2065 drought scenarios
- Modifying number of pumps in operation and run times for the West Side Tank and Pump Station and Sierra Vista Tank and Pump Station
- Adding in an additional 10 MGD at Tinker for a total of 16 MGD is delivered from PCWA to that location (6 MGD contract and 10 MGD from Ophir)

An electronic copy of the model will be provided to the City by HydroScience for further evaluation.

Summary

Potable water was able to be delivered to ARSP within City standards for pressure during each scenario. Thus, no upgrades to City infrastructure are required due to pressure drops directly associated with the addition of ARSP demands. However, there are significant modifications to the City water model that were specific to each scenario. These modifications include:

- Confirming how water will be delivered into the City. It is recommended that not all of this water enter through Tinker, but rather 10 MGD of this water enter the City through a future Placer Ranch connection. However, 16 MGD can enter the City at Tinker at buildout with some transmission main improvements.
- The WRSP phase #2 well (at Winding Creek Way) does not pump water due to high pressure in the system at this location. It is recommended to either increase the discharge pressure or relocate the well to a different, more efficient location in the City. The current proximity to Tinker diminishes the effectiveness of this well during the drought scenarios.

- Confirm that 6 MGD can be received from Sacramento Suburban Water District. As currently designed/modeled, the pump/control valve responsible for delivering this water to the City system is undersized. The full 6 MGD is not delivered.
- Consider adjusting well discharge pressure setpoints to allow them to deliver their maximum capacity instead of competing against pressures delivered by future Zone 4 pump stations or Zone 1/Zone 4 PRVs.
- HydroScience recommends designing the upgraded Tinker pump station (for the buildout 2065 time period when Ophir is online) for a higher HGL in order to maintain 60+ psi at the Zone 4 PRV's. Additional modeling is recommended to determine HGL and potential new set points for Zone 4 PRV's and Tank/Pump stations.
    - Results of this modeling effort for the 2065 normal year scenario yields pressures in known low pressure areas of Zone 4 as low as 45 psi.

ATTACHMENT 1

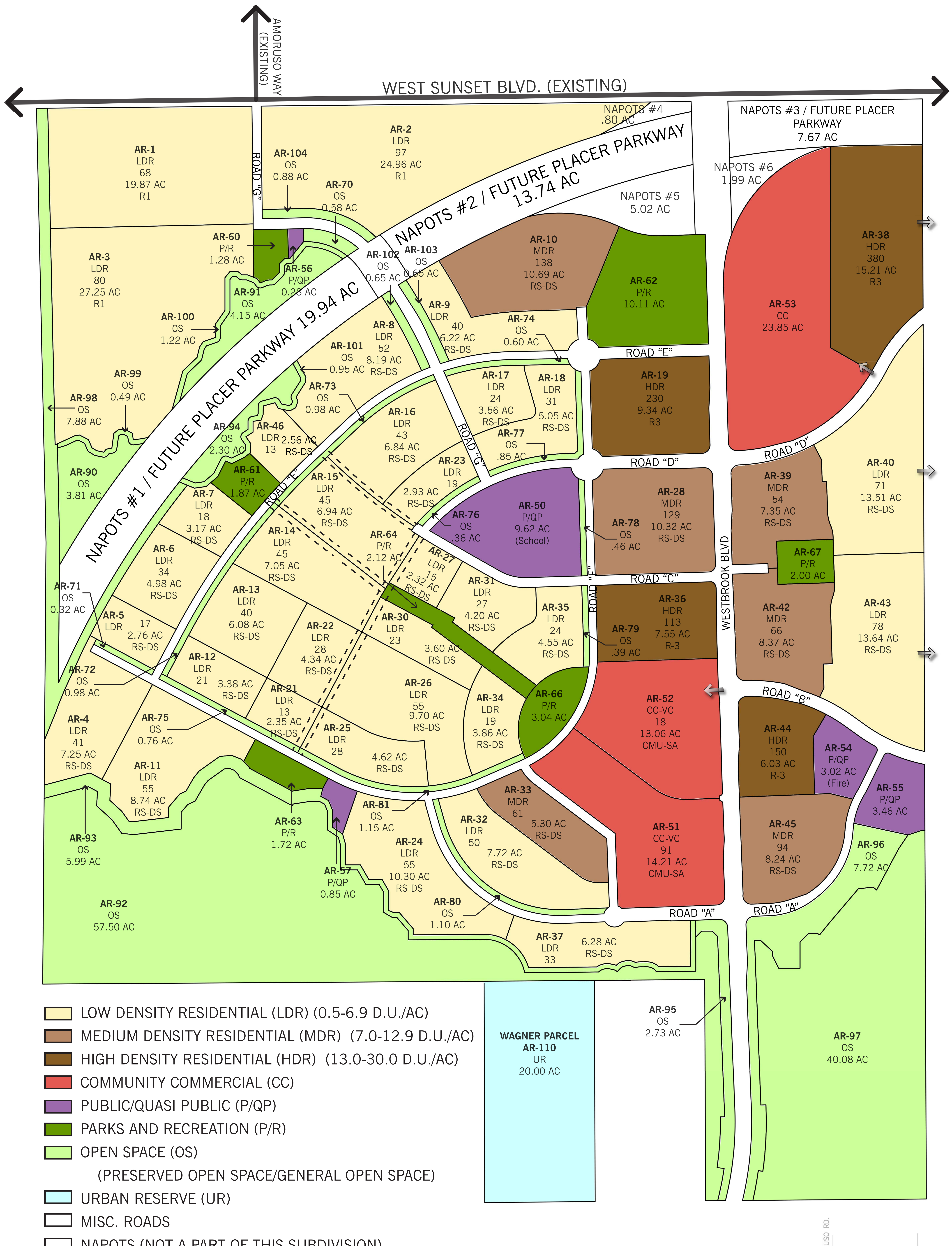
Amoruso Ranch Specific Plan – Water Demands

Brookfield Water Demand Summary

Parcel #	Land Use	Acres	Units	Density	Unit Demand Factor	Demand Unit	Avg. Day Demand (gpd)	Avg. Day Demand (gpm)	Avg. Annual Demand (AF/yr)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
1	LDR	19.87	68	3.42	728	gpd/du	49,504	34.4	55.5	68.8	116.9
2	LDR	24.96	97	3.89	600	gpd/du	58,200	40.4	65.2	80.8	137.4
3	LDR	27.25	80	2.94	728	gpd/du	58,240	40.4	65.2	80.9	137.5
4	LDR	7.25	41	5.66	521	gpd/du	21,361	14.8	23.9	29.7	50.4
5	LDR	2.76	17	6.16	430	gpd/du	7,310	5.1	8.2	10.2	17.3
6	LDR	4.98	34	6.83	430	gpd/du	14,620	10.2	16.4	20.3	34.5
7	LDR	3.17	18	5.68	521	gpd/du	9,378	6.5	10.5	13.0	22.1
8	LDR	8.19	52	6.35	430	gpd/du	22,360	15.5	25.0	31.1	52.8
9	LDR	6.22	40	6.43	430	gpd/du	17,200	11.9	19.3	23.9	40.6
10	MDR	10.69	138	12.91	288	gpd/du	39,744	27.6	44.5	55.2	93.8
11	LDR	8.74	55	6.29	430	gpd/du	23,650	16.4	26.5	32.8	55.8
12	LDR	3.38	21	6.21	430	gpd/du	9,030	6.3	10.1	12.5	21.3
13	LDR	6.08	40	6.58	430	gpd/du	17,200	11.9	19.3	23.9	40.6
14	LDR	7.05	45	6.38	430	gpd/du	19,350	13.4	21.7	26.9	45.7
15	LDR	6.94	45	6.48	430	gpd/du	19,350	13.4	21.7	26.9	45.7
16	LDR	6.84	43	6.29	430	gpd/du	18,490	12.8	20.7	25.7	43.7
17	LDR	3.56	24	6.74	430	gpd/du	10,320	7.2	11.6	14.3	24.4
18	LDR	5.05	31	6.14	430	gpd/du	13,330	9.3	14.9	18.5	31.5
19	HDR	9.34	230	24.63	177	gpd/du	40,710	28.3	45.6	56.5	96.1
21	LDR	2.35	13	5.53	521	gpd/du	6,773	4.7	7.6	9.4	16.0
22	LDR	4.34	28	6.45	430	gpd/du	12,040	8.4	13.5	16.7	28.4
23	LDR	2.93	19	6.48	430	gpd/du	8,170	5.7	9.2	11.3	19.3
24	LDR	10.30	55	5.34	521	gpd/du	28,655	19.9	32.1	39.8	67.7
25	LDR	4.62	28	6.06	430	gpd/du	12,040	8.4	13.5	16.7	28.4
26	LDR	9.70	55	5.67	521	gpd/du	28,655	19.9	32.1	39.8	67.7
27	LDR	2.32	15	6.47	430	gpd/du	6,450	4.5	7.2	9.0	15.2
28	MDR	10.32	129	12.50	288	gpd/du	37,152	25.8	41.6	51.6	87.7
30	LDR	3.60	23	6.39	430	gpd/du	9,890	6.9	11.1	13.7	23.4
31	LDR	4.20	27	6.43	430	gpd/du	11,610	8.1	13.0	16.1	27.4
32	LDR	7.72	50	6.48	430	gpd/du	21,500	14.9	24.1	29.9	50.8
33	MDR	5.30	61	11.51	323	gpd/du	19,703	13.7	22.1	27.4	46.5
34	LDR	3.86	19	4.92	600	gpd/du	11,400	7.9	12.8	15.8	26.9
35	LDR	4.55	24	5.27	521	gpd/du	12,504	8.7	14.0	17.4	29.5
36	HDR	7.55	113	14.97	288	gpd/du	32,544	22.6	36.5	45.2	76.8
37	LDR	6.28	33	5.25	521	gpd/du	17,193	11.9	19.3	23.9	40.6
38	HDR	15.21	380	24.98	177	gpd/du	67,260	46.7	75.3	93.4	158.8
39	MDR	7.35	54	7.35	430	gpd/du	23,220	16.1	26.0	32.3	54.8
40	LDR	13.51	71	5.26	521	gpd/du	36,991	25.7	41.4	51.4	87.3
42	MDR	8.37	66	7.89	430	gpd/du	28,380	19.7	31.8	39.4	67.0
43	LDR	13.64	78	5.72	521	gpd/du	40,638	28.2	45.5	56.4	96.0
44	HDR	6.03	150	24.88	177	gpd/du	26,550	18.4	29.7	36.9	62.7
45	MDR	8.24	94	11.41	323	gpd/du	30,362	21.1	34.0	42.2	71.7
46	LDR	2.56	13	5.08	521	gpd/du	6,773	4.7	7.6	9.4	16.0
50	P/QP	9.62			3454	gpd/ac	33,227	23.1	37.2	46.1	78.5
51	CC-VC		91	6.40	288	gpd/du	26,208	18.2	29.4	36.4	61.9
51	CC-VC	14.21			2598	gpd/ac	36,918	25.6	41.4	51.3	87.2
52	CC-VC		18	1.38	288	gpd/du	5,184	3.6	5.8	7.2	12.2
52	CC-VC	13.06			2598	gpd/ac	33,930	23.6	38.0	47.1	80.1
53	CC	23.85			2598	gpd/ac	61,962	43.0	69.4	86.1	146.3
54	P/QP	3.02			1780	gpd/ac	5,376	3.7	6.0	7.5	12.7
55	P/QP	3.46			1780	gpd/ac	6,159	4.3	6.9	8.6	14.5
56	P/QP	0.28			1780	gpd/ac	498	0.3	0.6	0.7	1.2
57	P/QP	0.85			1780	gpd/ac	1,513	1.1	1.7	2.1	3.6
60	P/R	1.28			2988	gpd/ac	3,825	2.7	4.3	5.3	9.0
61	P/R	1.87			2988	gpd/ac	5,588	3.9	6.3	7.8	13.2
62	P/R	10.11			2988	gpd/ac	30,209	21.0	33.8	42.0	71.3
63	P/R	1.72			2988	gpd/ac	5,139	3.6	5.8	7.1	12.1
64	P/R	2.12			2988	gpd/ac	6,335	4.4	7.1	8.8	15.0
66	P/R	3.04			2988	gpd/ac	9,084	6.3	10.2	12.6	21.4
67	P/R	2.00			2988	gpd/ac	5,976	4.2	6.7	8.3	14.1
70	OS (Paseo)	0.58			2988	gpd/ac	1,733	1.2	1.9	2.4	4.1
71	OS (Paseo)	0.32			2988	gpd/ac	956	0.7	1.1	1.3	2.3
72	OS (Paseo)	0.98			2988	gpd/ac	2,928	2.0	3.3	4.1	6.9
73	OS (Paseo)	0.98			2988	gpd/ac	2,928	2.0	3.3	4.1	6.9
74	OS (Paseo)	0.60			2988	gpd/ac	1,793	1.2	2.0	2.5	4.2
75	OS (Paseo)	0.76			2988	gpd/ac	2,271	1.6	2.5	3.2	5.4
76	OS (Paseo)	0.36			2988	gpd/ac	1,076	0.7	1.2	1.5	2.5
77	OS (Paseo)	0.85			2988	gpd/ac	2,540	1.8	2.8	3.5	6.0
78	OS (Paseo)	0.46			2988	gpd/ac	1,374	1.0	1.5	1.9	3.2
79	OS (Paseo)	0.39			2988	gpd/ac	1,165	0.8	1.3	1.6	2.8
80	OS (Paseo)	1.10			2988	gpd/ac	3,287	2.3	3.7	4.6	7.8
81	OS (Paseo)	1.15			2988	gpd/ac	3,436	2.4	3.8	4.8	8.1
90	OS (General)	3.81			0	gpd/ac					
91	OS (General)	4.15			0	gpd/ac					
92	OS (Preserve)	57.50			0	gpd/ac					
93	OS (General)	5.99			0	gpd/ac					
94	OS (General)	2.30			0	gpd/ac					
95	OS (General)	2.73			0	gpd/ac					
96	OS (General)	7.72			0	gpd/ac					
97	OS (Preserve)	40.08			0	gpd/ac					
98	OS (General)	7.88			0	gpd/ac					
99	OS (General)	0.49			0	gpd/ac					
100	OS (General)	1.22			0	gpd/ac					
101	OS (General)	0.95			0	gpd/ac					
102	OS (Paseo)	0.65			2988	gpd/ac	1,942	1.3	2.2	2.7	4.6
103	OS (Paseo)	0.65			2988	gpd/ac	1,942	1.3	2.2	2.7	4.6
104	OS (Paseo)	0.88			2988	gpd/ac	2,629	1.8	2.9	3.7	6.2
110	UR	20.00	1	0.1	728	gpd/du	728	0.5	0.8	1.0	1.7
	NAPOTS	49.16			0	gpd/ac					
	ROW	52.04			0	gpd/ac					
				Subtotal			1,315,659	914	1,474	1,827	3,106
				2% System Loss			26,313	18	29	37	62
				Total			1,341,972	932	1,503	1,864	3,169

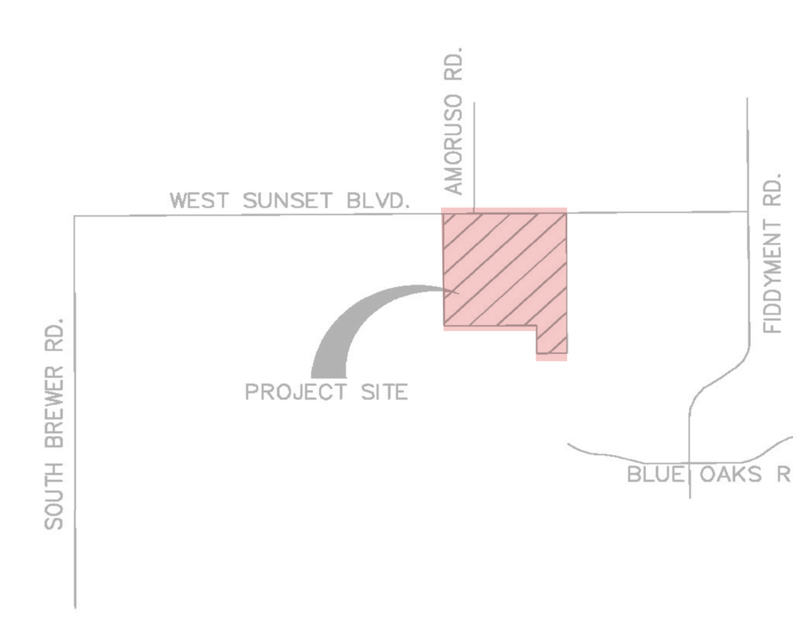
ATTACHMENT 2

Amoruso Ranch Specific Plan – Land Use Plan



Map key

AR-1:	Parcel Number
LDR:	General Plan Designation
100:	Allocated Dwelling Units
12.00 AC:	Parcel Acreage
RS-DS:	Zoning Designation



EXCEL FILE: 15_0504 LAND USE PLAN
AUTO CAD: 15_0504_AR base

AMORUSO RANCH - 15_0504 LAND USE PLAN

BROOKFIELD RESIDENTIAL, ROSEVILLE, CA

DAHLIN group

JOB NO. 316.002
DATE 05-04-2015
5865 Owens Drive
Pleasanton, CA 94588
925-251-7200

N

ATTACHMENT 3

Water Model Scenario Summary Spreadsheet

Time Period	Scenario	Demand		Interties	Zone 4 to Zone 1 PS Active	Groundwater	Surface Water	Water Conservation (%)
		AFY	MGD					
2015	Normal Year	35,253	63	6MGD PCWA @ Tinker -10 MGD PCWA @ Baseline	No	0 Wells 0 MGD	97 MGD 150 CFS Limitation	0%
	Drought Summer	28,202	50	6MGD PCWA @ Tinker 6 MGD SSWD @ PFE -10 MGD PCWA @ Baseline	No	6 Wells ~ 15 MGD	34 MGD Full Lake Accessibility	20%
	Drought Fall	19,798	35	6MGD PCWA @ Tinker 6 MGD SSWD @ PFE	Yes	6 Wells ~ 15 MGD	13 MGD 20 CFS from Barge	10%
2035	Normal Year	45,233	81	6MGD PCWA @ Tinker -10 MGD PCWA @ Baseline	No	0 Wells 0 MGD	97 MGD 150 CFS Limitation	0%
	Drought Summer	36,187	65	6MGD PCWA @ Tinker 6 MGD SSWD @ PFE -10 MGD PCWA @ Baseline	No	15 Wells ~ 37 MGD	35 MGD Full Lake Accessibility	20%
	Drought Fall	25,403	45	6MGD PCWA @ Tinker 6 MGD SSWD @ PFE -10 MGD PCWA @ Baseline	No	15 Wells ~ 37 MGD	13 MGD 20 CFS from Barge	10%
2065	Normal Year	56,689	101	16MGD PCWA @ Tinker (max of 20 MGD = 10 MGD Wheeled + 10 MGD Ophir) -10 MGD PCWA @ Baseline	No	0 Wells 0 MGD	97 MGD 150 CFS Limitation	0%
	Drought Summer	45,351	81	16MGD PCWA @ Tinker (max of 20 MGD = 10 MGD Wheeled + 10 MGD Ophir) 6 MGD SSWD @ PFE -10 MGD PCWA @ Baseline	No	17 Wells ~ 42 MGD	35 MGD Full Lake Accessibility	20%
	Drought Fall	31,837	57	16MGD PCWA @ Tinker (max of 20 MGD = 10 MGD Wheeled + 10 MGD Ophir) 6 MGD SSWD @ PFE -10 MGD PCWA @ Baseline	No	17 Wells ~ 42 MGD	13 MGD 20 CFS from Barge	10%

ATTACHMENT 4

Potable Water Demands per Specific Plan/Planning Area

Normal Year

Plan Area	2015		2035		2065		Build Out Estimate	
	Buidlout (%)	MGD	Buidlout (%)	MGD	Buidlout (%)	MGD	AFY	MGD
Infill	73%	22.63	75%	23.25	85%	26.35	17360.63	31.00
DTSP	25%	0.43	35%	0.61	80%	1.39	971.58	1.73
RGSP	45%	0.14	55%	0.17	85%	0.26	173.71	0.31
SE	93%	2.99	95%	3.05	95%	3.05	1800.12	3.21
NE	75%	3.07	85%	3.47	97%	3.96	2288.88	4.09
SR	45%	1.28	80%	2.27	97%	2.75	1589.64	2.84
NC	60%	4.66	85%	6.60	97%	7.53	4346.03	7.76
HR	50%	1.49	92%	2.74	96%	2.85	1665.42	2.97
NW	93%	12.08	95%	12.34	98%	12.73	7272.90	12.99
DW	85%	5.07	90%	5.37	95%	5.67	3341.14	5.97
NI	25%	2.01	35%	2.82	65%	5.23	4507.02	8.05
CO	0%	0.00	50%	0.52	97%	1.00	578.40	1.03
NR	55%	3.91	90%	6.39	90%	6.39	3979.60	7.11
WR	25%	3.20	50%	6.40	85%	10.88	7169.81	12.80
SV	0%	0.00	35%	2.52	80%	5.77	4036.42	7.21
WB	0%	0.00	45%	0.91	90%	1.82	1133.42	2.02
CV	0%	0.00	30%	0.58	80%	1.55	1086.36	1.94
AR	0%	0.00	30%	0.76	80%	2.03	1418.11	2.53
PR	0%	0.00	30%	0.00	90%	0.00	0.00	0.00
Total	-	62.94	-	80.76	-	101.22	64719.19	115.56

Drought Summer

Plan Area	2015		2035		2065		Build Out Estimate	
	Buidlout (%)	MGD	Buidlout (%)	MGD	Buidlout (%)	MGD	AFY	MGD
Infill	73%	18.10	75%	18.60	85%	21.08	13888.50	24.80
DTSP	25%	0.35	35%	0.49	80%	1.11	777.26	1.39
RGSP	45%	0.11	55%	0.14	85%	0.21	138.97	0.25
SE	93%	2.39	95%	2.44	95%	2.44	1440.09	2.57
NE	75%	2.45	85%	2.78	97%	3.17	1831.10	3.27
SR	45%	1.02	80%	1.82	97%	2.20	1271.71	2.27
NC	60%	3.72	85%	5.28	97%	6.02	3476.82	6.21
HR	50%	1.19	92%	2.19	96%	2.28	1332.34	2.38
NW	93%	9.66	95%	9.87	98%	10.18	5818.32	10.39
DW	85%	4.06	90%	4.30	95%	4.53	2672.91	4.77
NI	25%	1.61	35%	2.25	65%	4.18	3605.61	6.44
CO	0%	0.00	50%	0.41	97%	0.80	462.72	0.83
NR	55%	3.13	90%	5.12	90%	5.12	3183.68	5.68
WR	25%	2.56	50%	5.12	85%	8.71	5735.85	10.24
SV	0%	0.00	35%	2.02	80%	4.61	3229.13	5.77
WB	0%	0.00	45%	0.73	90%	1.46	906.74	1.62
CV	0%	0.00	30%	0.47	80%	1.24	869.09	1.55
AR	0%	0.00	30%	0.61	80%	1.62	1134.49	2.03
PR	0%	0.00	30%	0.00	90%	0.00	0.00	0.00
Total	-	50.35	-	64.61	-	80.97	51775.35	92.44

Drought Fall

Plan Area	2015		2035		2065		Build Out Estimate	
	Buidlout (%)	MGD	Buidlout (%)	MGD	Buidlout (%)	MGD	AFY	MGD
Infill	73%	12.71	75%	13.06	85%	14.80	9749.73	17.41
DTSP	25%	0.24	35%	0.34	80%	0.78	545.64	0.97
RGSP	45%	0.08	55%	0.10	85%	0.15	97.55	0.17
SE	93%	1.68	95%	1.71	95%	1.71	1010.95	1.81
NE	75%	1.72	85%	1.95	97%	2.23	1285.43	2.30
SR	45%	0.72	80%	1.28	97%	1.55	892.74	1.59
NC	60%	2.61	85%	3.70	97%	4.23	2440.73	4.36
HR	50%	0.83	92%	1.54	96%	1.60	935.30	1.67
NW	93%	6.78	95%	6.93	98%	7.15	4084.46	7.29
DW	85%	2.85	90%	3.02	95%	3.18	1876.39	3.35
NI	25%	1.13	35%	1.58	65%	2.94	2531.14	4.52
CO	0%	0.00	50%	0.29	97%	0.56	324.83	0.58
NR	55%	2.19	90%	3.59	90%	3.59	2234.95	3.99
WR	25%	1.80	50%	3.59	85%	6.11	4026.56	7.19
SV	0%	0.00	35%	1.42	80%	3.24	2266.85	4.05
WB	0%	0.00	45%	0.51	90%	1.02	636.53	1.14
CV	0%	0.00	30%	0.33	80%	0.87	610.10	1.09
AR	0%	0.00	30%	0.43	80%	1.14	796.41	1.42
PR	0%	0.00	30%	0.00	90%	0.00	0.00	0.00
Total	-	35.35	-	45.36	-	56.84	36346.30	64.90

ATTACHMENT 5

Hydraulic Modeling Adjustment Log and Notes

General assumptions/modifications:

- The stand-alone ARSP model was merged with the City model to provide one complete model to work from and preserve the work previously done by Kimley Horn
- All modeling was done by creating three child scenarios to the BO_MDD_PZ4_ARSAFIX_ALT_REDUCE base scenario
    - As identified by George Hanson during the Placer Ranch project modeling effort
- These three child scenarios are the 'Normal Year' scenarios
    - 2015 (existing)
    - 2035 (interim)
    - 2065 (buildout).
- Each normal year scenario has 2 child scenarios
    - Summer
    - Fall
- Demands for each scenario are based off of Derrick's spreadsheet and are broken out geographically by specific plan.
    - Summer demands represent a 20% reduction due to water conservation
    - Fall demands represent 78% of the summer demand (yearly demand curve provided by the City/West Yost with the assumption of September as 'Fall'), plus an additional 10% reduction for water conservation
- Water supply was modeled according to Kelye's Dry.xls spreadsheet with the exception being that Placer Ranch was not included (2 less supply wells).
- Anytime supply adjustments were made to the Folsom WTP, the flow control valves were adjusted while keeping the same ratio of flow through the 72inch pipe from the 'New Tank' (60%) and the 42 inch pipe from the 'clear well' (40%).

2015

- 2015_Normal_Year
    - Modified demands to total 62.94MGD
    - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range, also shortened the refill period for tanks 903 and 904).
- 2015_Drought_Summer
    - Modified Demands to total 50.35MGD (total supply approximately = 61MGD thus 10MGD to PCWA @ Baseline left in)
    - WTP set to supply 34MGD
    - 6 wells activated
        - Pressure controls added to Hayden well to turn off when downstream pressure is too high
    - 6MGD SSWD intertie
        - Pump is unable push the full 6MGD into the system (recommend making necessary adjustment)
    - 6MGD PCWA @ Tinker
    - 10MGD out PCWA @ Baseline
    - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range, disabled 2 pumps and modified controls to slow the refill period for tanks 903 and 904).
    - Demand in Z4 (9.6MGD MDD) is greater than supply (8.4MGD) regardless of 10MGD PCWA. No PG Z4 to Z1 pump station.
    - WRSP Tank and pump station is off
- 2015_Drought_Fall
    - Modified Demands to total 35.35MGD (total supply approximately = 40MGD thus 10MGD to PCWA @ Baseline removed)
    - WTP set to supply 13MGD
    - 6 wells activated
        - Pressure controls added to Hayden well to turn off when downstream pressure is too high
    - 6MGD SSWD intertie
        - Pump is assumed to push the full 6MGD into the system (modeled with negative demand similar to Tinker)
    - 6MGD PCWA @ Tinker
    - 10MGD out PCWA @ Baseline=OFF
    - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range, also disabled 2 pumps and modified controls to slow the refill period for tanks 903 and 904).
    - Demand in Z4 (6.4MGD MDD) is less than supply (8.4MGD) with 10MGD PCWA outflow removed. PG Z4 to Z1 pump station is active.
        - Activated PG PZ4 to PZ1 PS and modified pump for a design flow of the excess 2MGD.
        - Set pressure controls such that it would turn off when insufficient PZ4 pressure
    - WRSP Tank and pump station is off

2035

- 2035_Normal_Year
  - Modified demands to total 80.76MGD
  - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range).
- 2035_Drought_Summer
  - Modified Demands to total 64.61MGD (total supply approximately = 82MGD thus 10MGD to PCWA @ Baseline left in)
  - WTP set to supply 35MGD
  - 15 wells activated
    - WRSP Phase #2 @ Winding Creek never pumps due to high pressure in system - Turned off
    - Pressure controls added to Hayden Well and WRSP Phase #3 well.
  - 6MGD SSWD intertie
    - Pump is assumed to push the full 6MGD into the system (modeled with negative demand similar to Tinker)
  - 8.5MGD PCWA @ Tinker (6MGD contract +2.5MGD for Amoruso)
  - 10MGD out PCWA @ Baseline
  - Modified zone 2 pump station controls to remove errors (added pumps when the two timer controlled pumps were pumping out of their range, disabled 2 pumps to slow the refill period for tanks 903 and 904).
  - Demand in Z4 (16.6MGD MDD) + PCWA 10MGD is greater than supply (20.1MGD). No PG Z4 to Z1 pump station.
  - SVSP Tank and Pump station – pump 2 disabled and modified start up time for pump 1
  - WRSP Tank and pump station – active
- 2035_Drought_Fall
  - Modified Demands to total 45.36MGD (total supply approximately = 60MGD thus 10MGD to PCWA @ Baseline active)
  - WTP set to supply 13MGD
  - 15 wells activated
    - Pressure controls added to WRSP Phase 3 well to turn off when downstream pressure is too high
    - WRSP Phase #2 @ Winding Creek never pumps due to high pressure in system - Turned off
  - 6MGD SSWD intertie
    - Pump is assumed to push the full 6MGD into the system (modeled with negative demand similar to Tinker)
  - 8.5MGD PCWA @ Tinker (6MGD contract +2.5MGD for Amoruso)
  - 10MGD out PCWA @ Baseline
  - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range, also disabled 2 pumps and modified controls to slow the refill period for tanks 903 and 904).
  - Demand in Z4 (11.86MGD MDD) +10MGD PCWA outflow is greater than supply (20.1MGD). PG Z4 to Z1 pump station is disabled.
  - WRSP Tank and pump station – pump 2 is off
  - SVSP tank and pump station - disabled

2065

- 2065_Normal_Year
  - Modified demands to total 101.22MGD
  - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range).
  - 16MGD@ Tinker (6MGD Current plus 10MGD Ophir)
    - Didn't do the full 20MGD in order to keep velocities down. Didn't need to up it to get the system to work.
  - SVSP Tank and pump station
    - Modified SV fill valve to shorter fill times
    - Added pump 3 during the peak hour
  - WRSP Tank and pump station
    - Added pump 4 during the peak hour
- 2065_Drought_Summer
  - Modified Demands to total 80.97MGD (total supply approximately = 103MGD thus 10MGD to PCWA @ Baseline left in)
  - WTP set to supply 35MGD
  - 17 wells activated
    - WRSP Phase #2 @ Winding Creek never pumps due to high pressure in system - Turned off
  - 6MGD SSWD intertie
    - Pump is assumed to push the full 6MGD into the system (modeled with negative demand similar to Tinker)
  - 16MGD PCWA @ Tinker (6MGD contract +10MGD from Ophir)
  - 10MGD out PCWA @ Baseline
  - Modified zone 2 pump station controls to remove errors (added pumps when the two timer controlled pumps were pumping out of their range, disabled 2 pumps to slow the refill period for tanks 903 and 904).
  - Demand in Z4 (35.38MGD MDD) + PCWA 10MGD is greater than supply (25.3MGD). No PG Z4 to Z1 pump station.
  - SVSP Tank and Pump station – disabled
- 2065_Drought_Fall
  - Modified Demands to total 56.84MGD (total supply approximately = 81MGD thus 10MGD to PCWA @ Baseline active)
  - WTP set to supply 13MGD
  - 17 wells activated
    - WRSP Phase #2 @ Winding Creek never pumps due to high pressure in system - Turned off
  - 6MGD SSWD intertie
    - Pump is assumed to push the full 6MGD into the system (modeled with negative demand similar to Tinker)
  - 16MGD PCWA @ Tinker (6MGD contract +10MGD from Ophir)
  - 10MGD out PCWA @ Baseline
  - Modified zone 2 pump station controls to remove errors (added pump when the two timer controlled pumps were pumping out of their range, also disabled 2 pumps and modified controls to slow the refill period for tanks 903 and 904).
  - Demand in Z4 (17.8MGD MDD) +10MGD PCWA outflow is greater than supply (25.3MGD). PG Z4 to Z1 pump station is disabled.
  - WRSP Tank and pump station – pump 2 is off
  - SVSP tank and pump station - disabled

ATTACHMENT 6

City of Roseville Figures and Modeling Results Figures

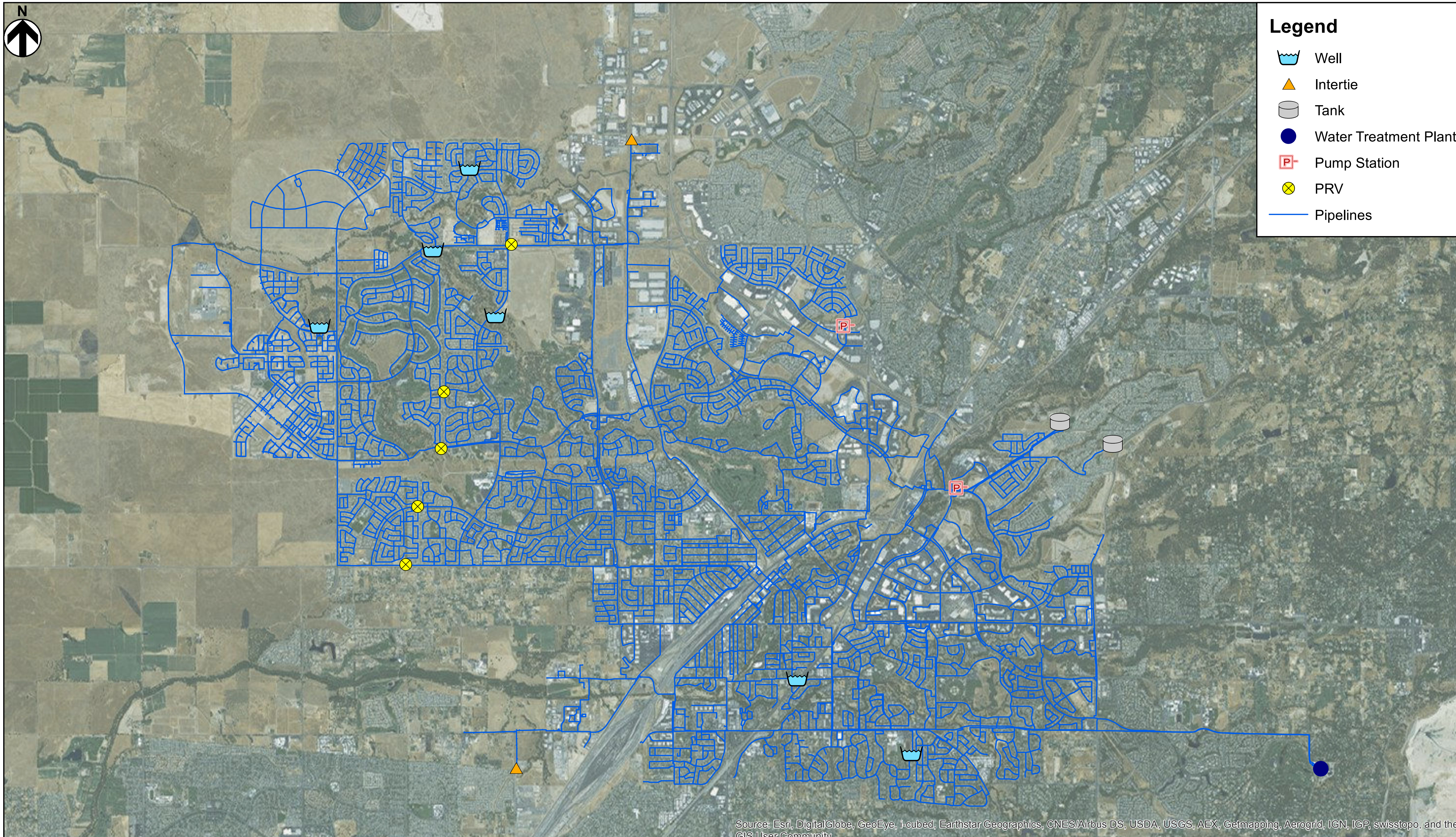


FIGURE 1
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
EXISTING ROSEVILLE CITY SYSTEM

HydroScience

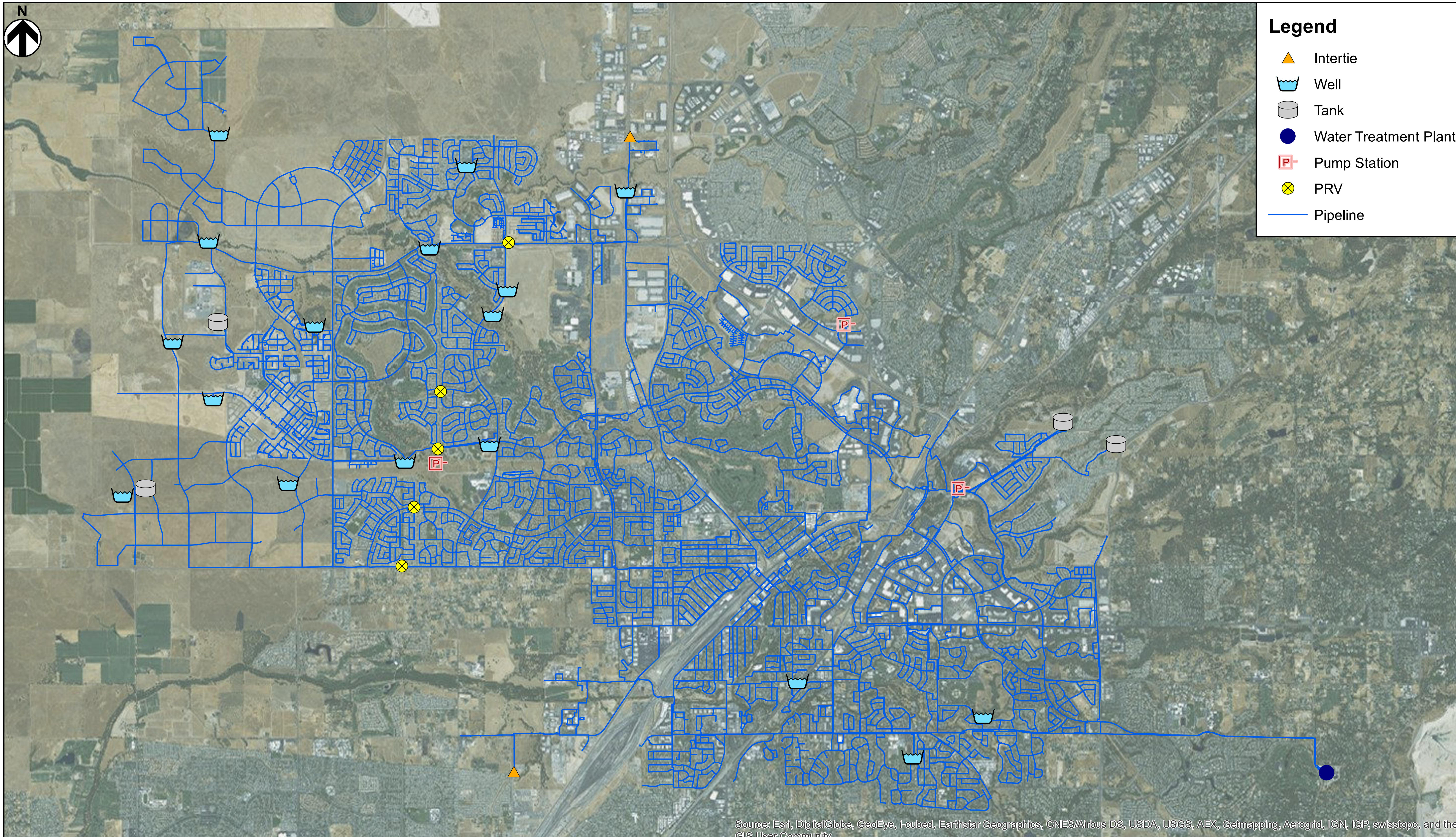


FIGURE 2
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
BUIDLOUT ROSEVILLE CITY SYSTEM

HydroScience

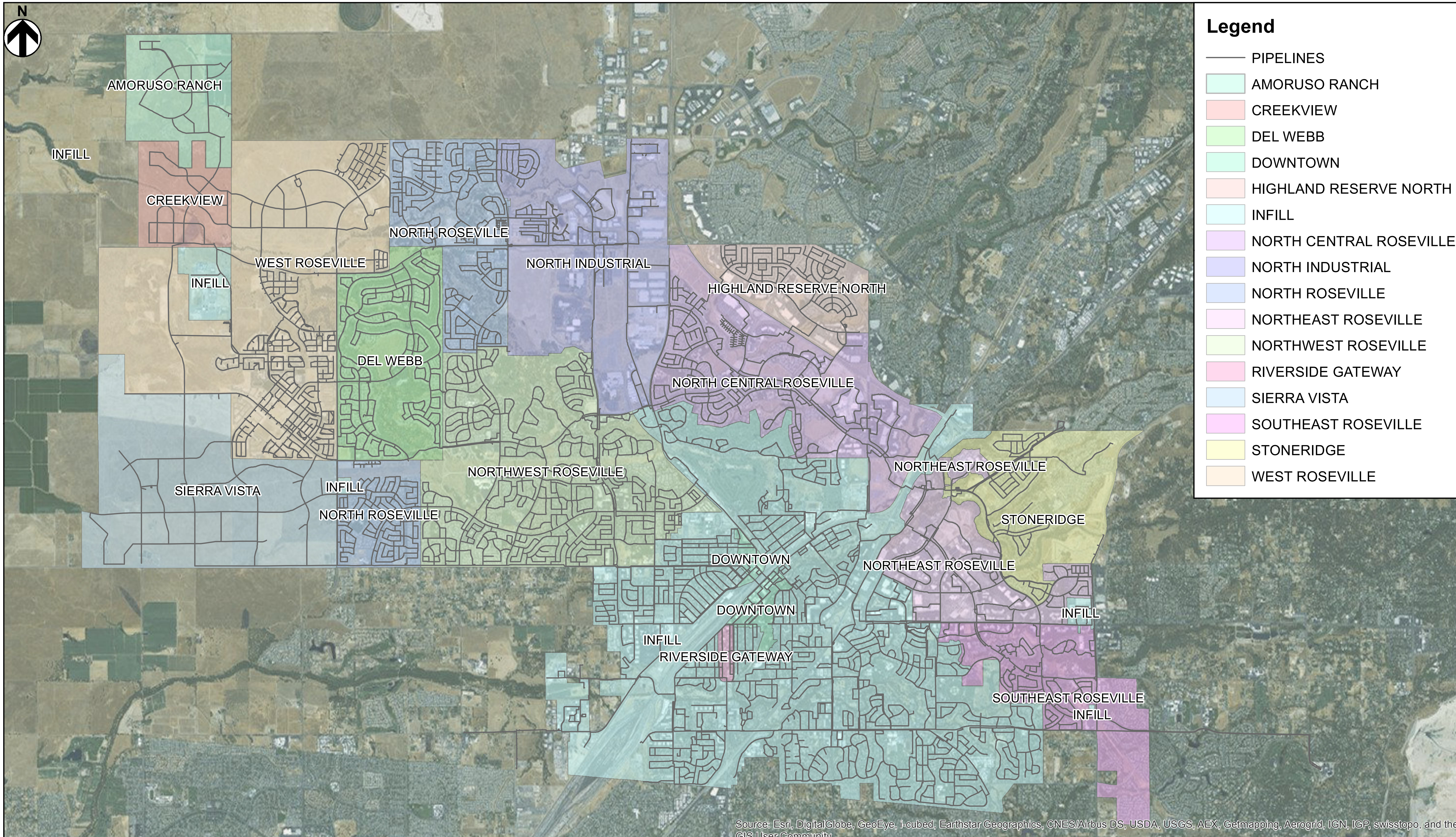
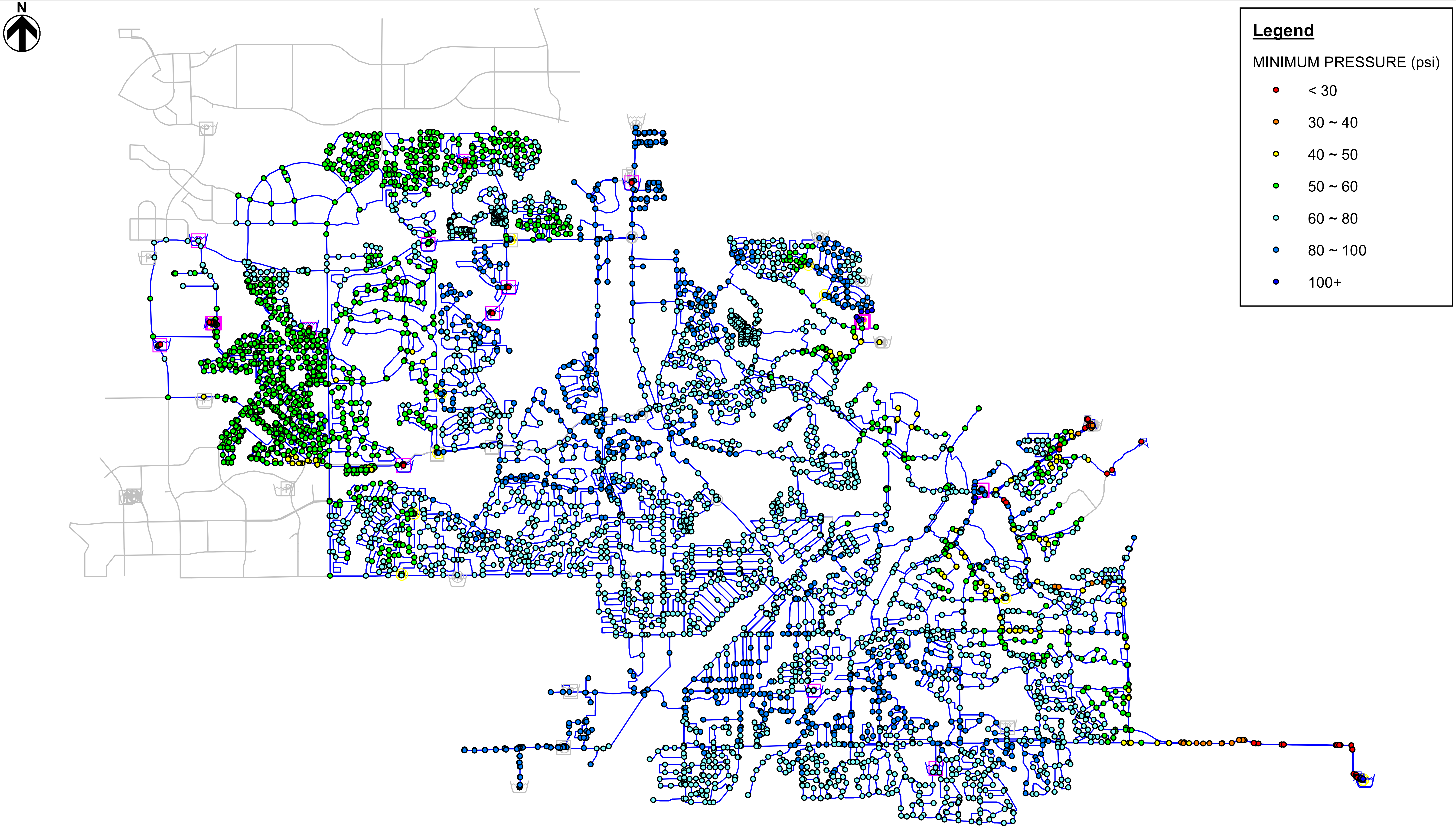


FIGURE 3
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
CITY OF ROSEVILLE SPECIFIC PLANS AND PLANNING AREAS

HydroScience



HydroScience

FIGURE 4
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2015 NORMAL YEAR - MINIMUM PRESSURE

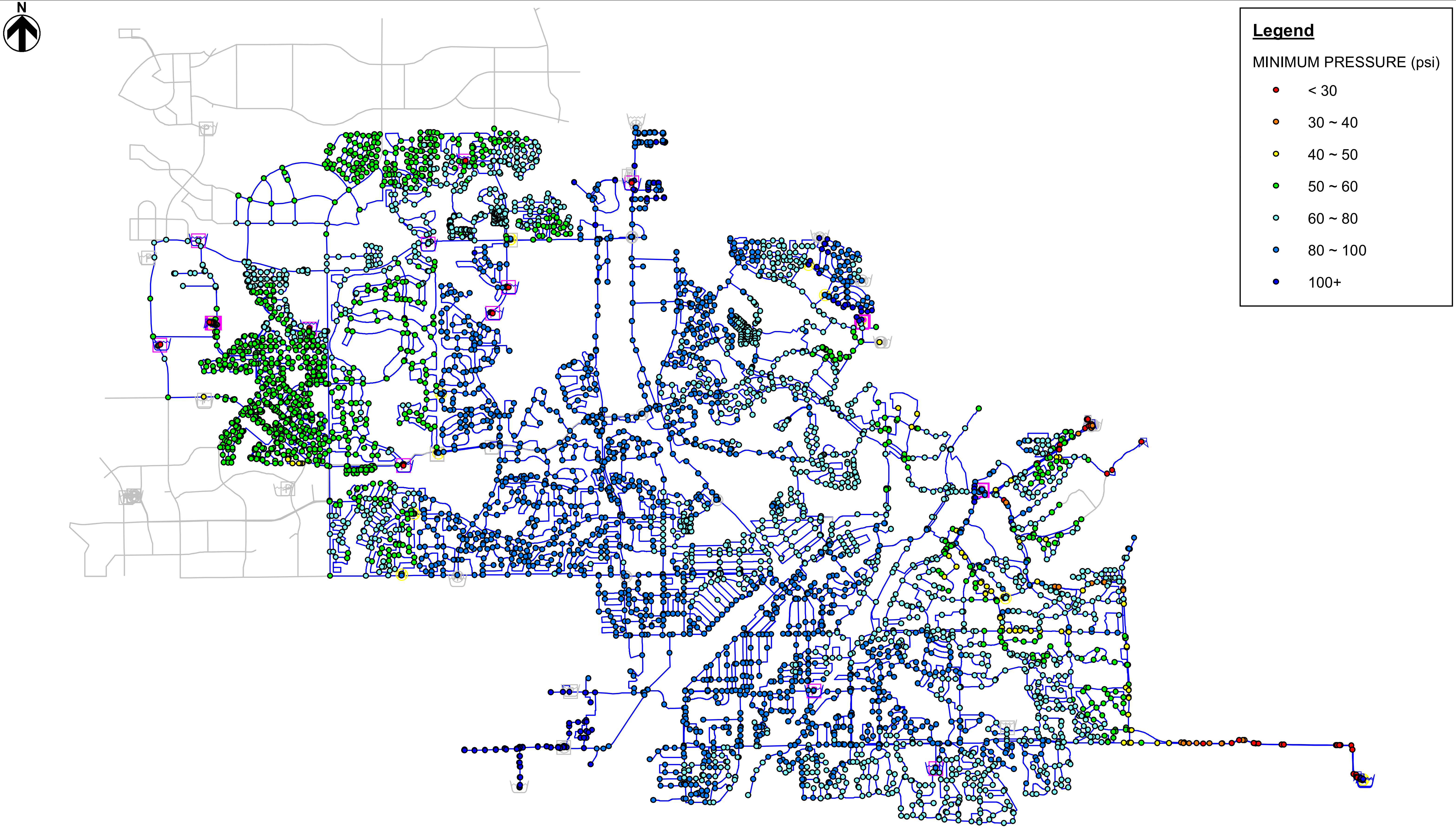


FIGURE 5
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2015 DROUGHT SUMMER- MINIMUM PRESSURE

HydroScience

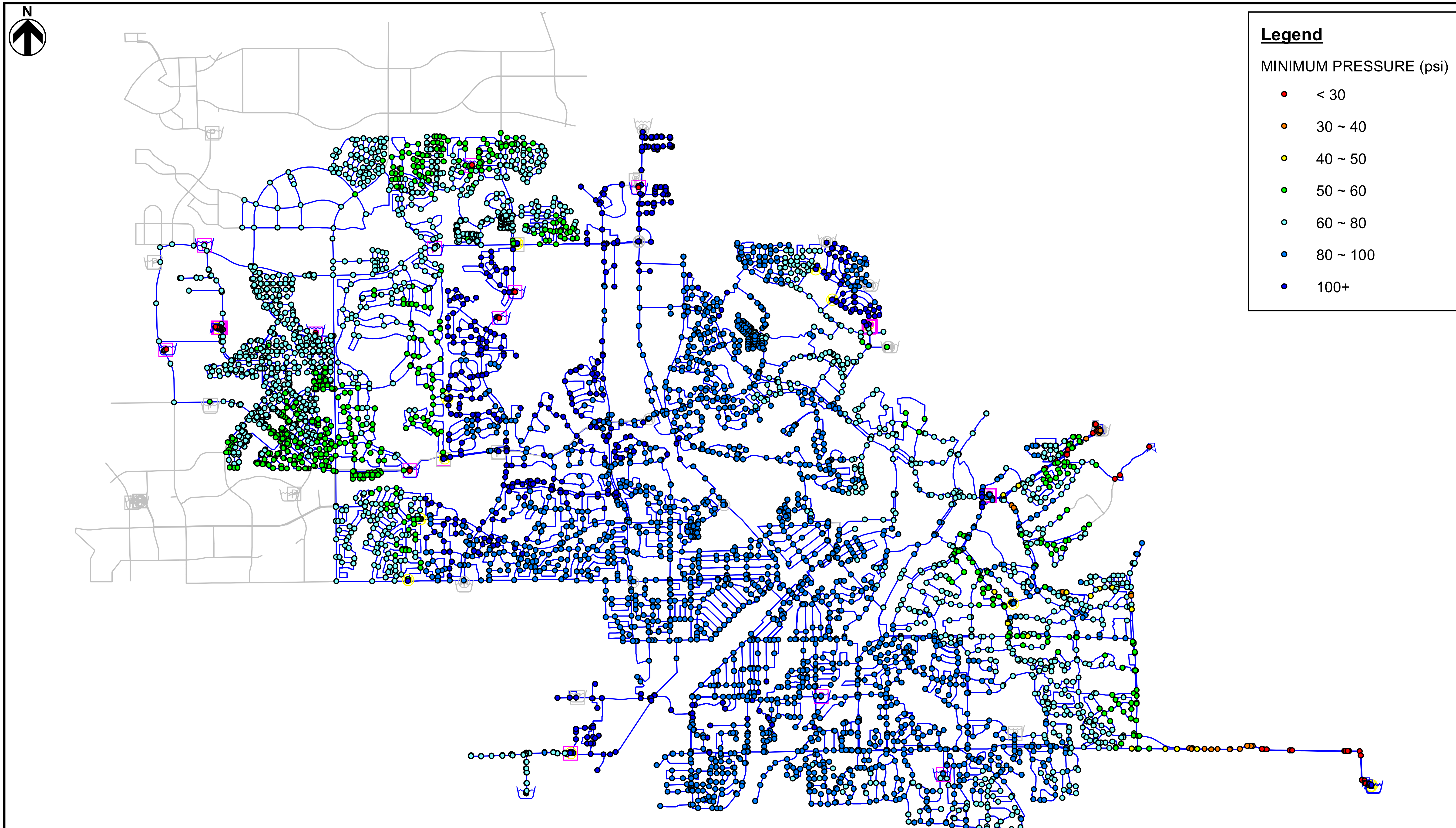


FIGURE 6
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2015 DROUGHT FALL - MINIMUM PRESSURE

HydroScience

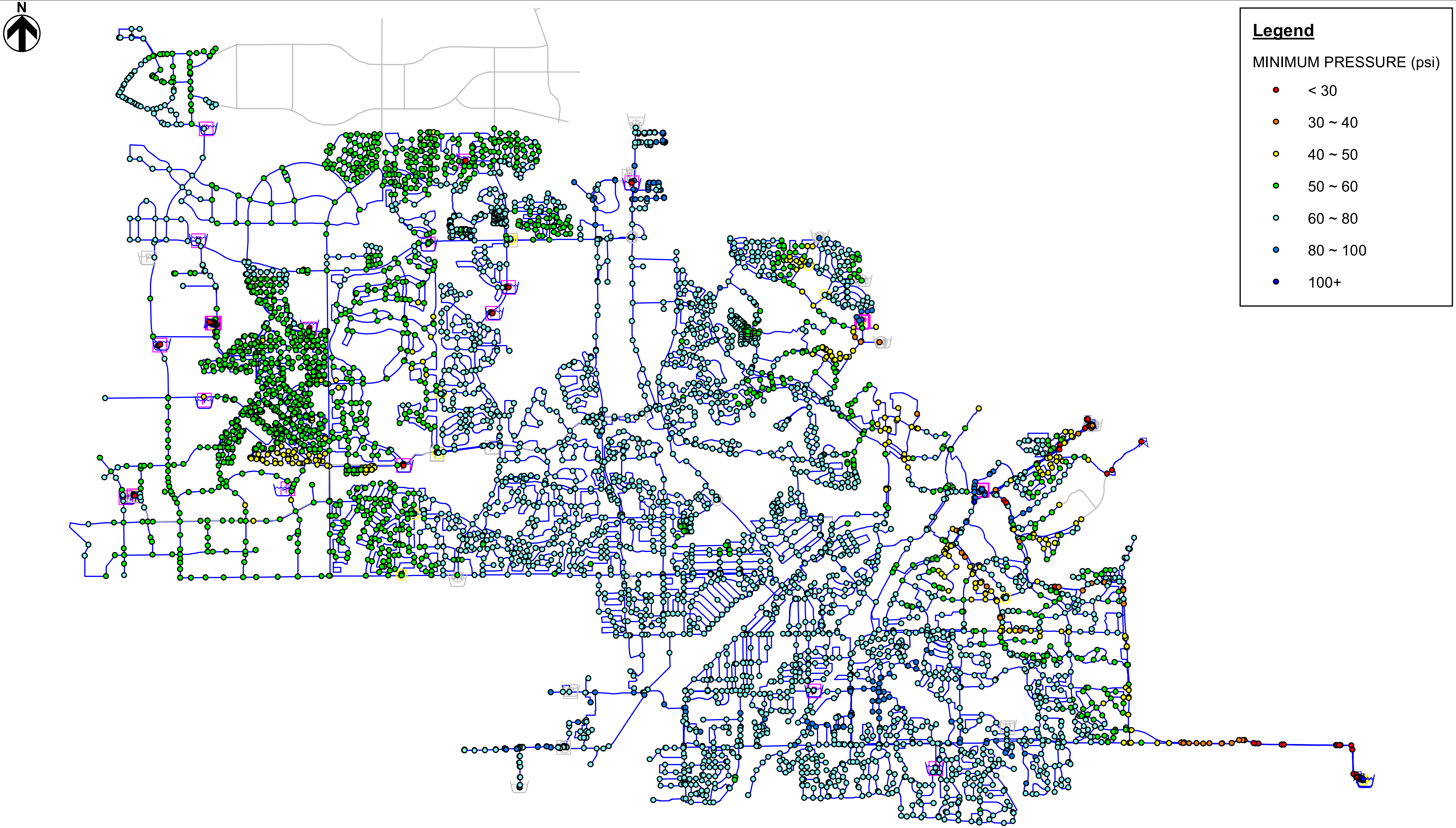


FIGURE 7
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2035 NORMAL YEAR - MINIMUM PRESSURE

HydroScience

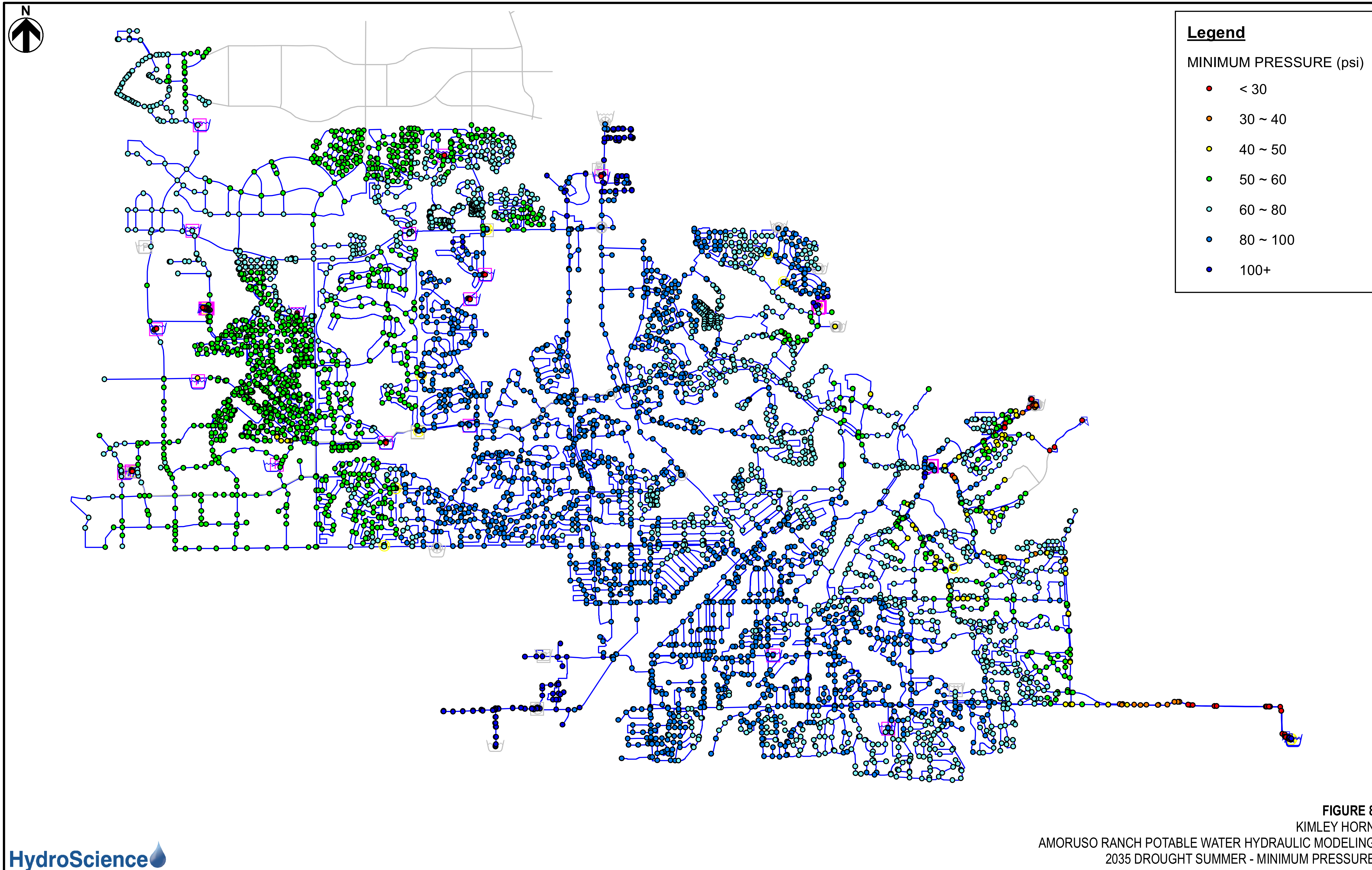
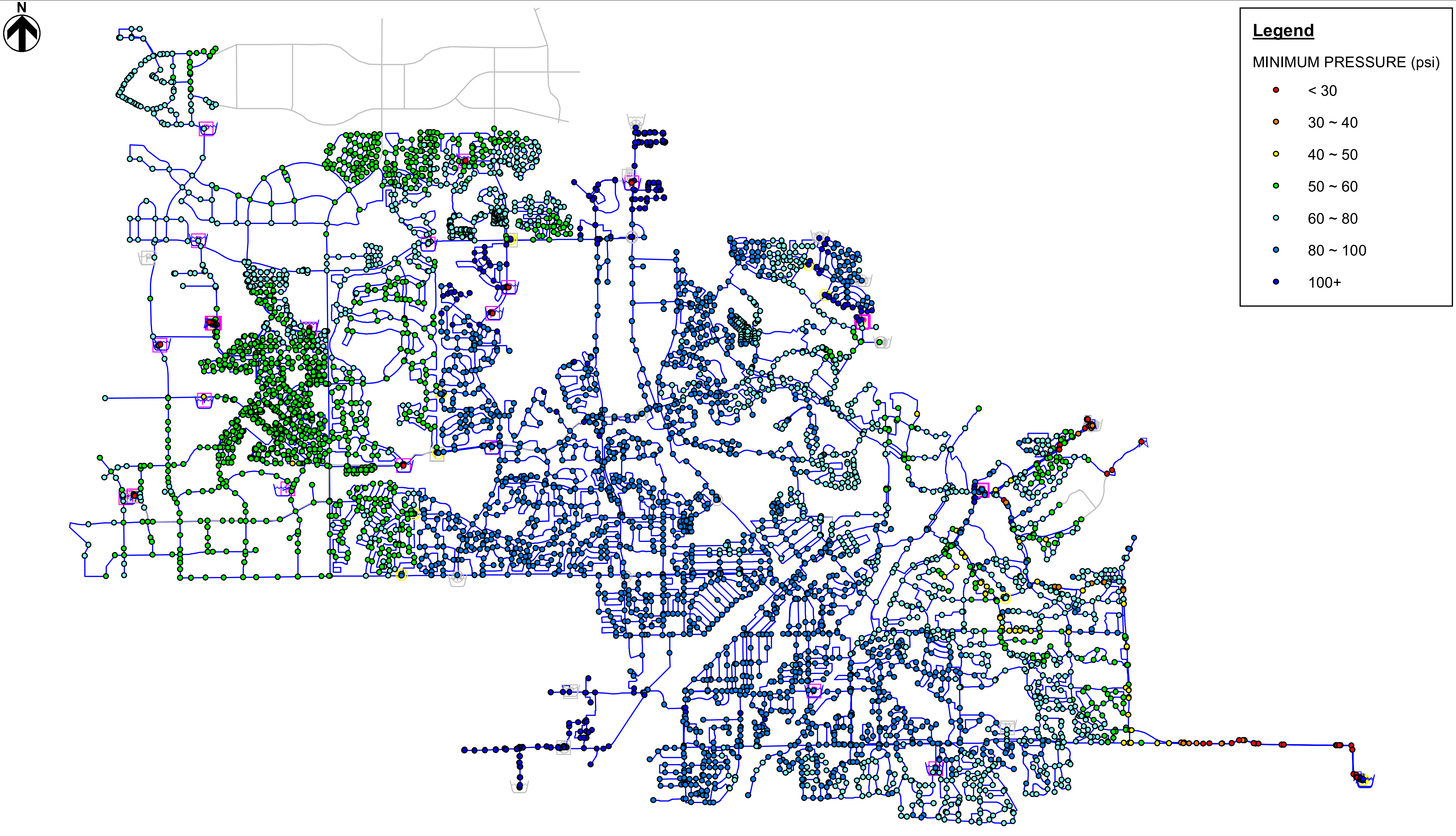


FIGURE 8
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2035 DROUGHT SUMMER - MINIMUM PRESSURE



HydroScience

FIGURE 9
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2035 DROUGHT FALL - MINIMUM PRESSURE

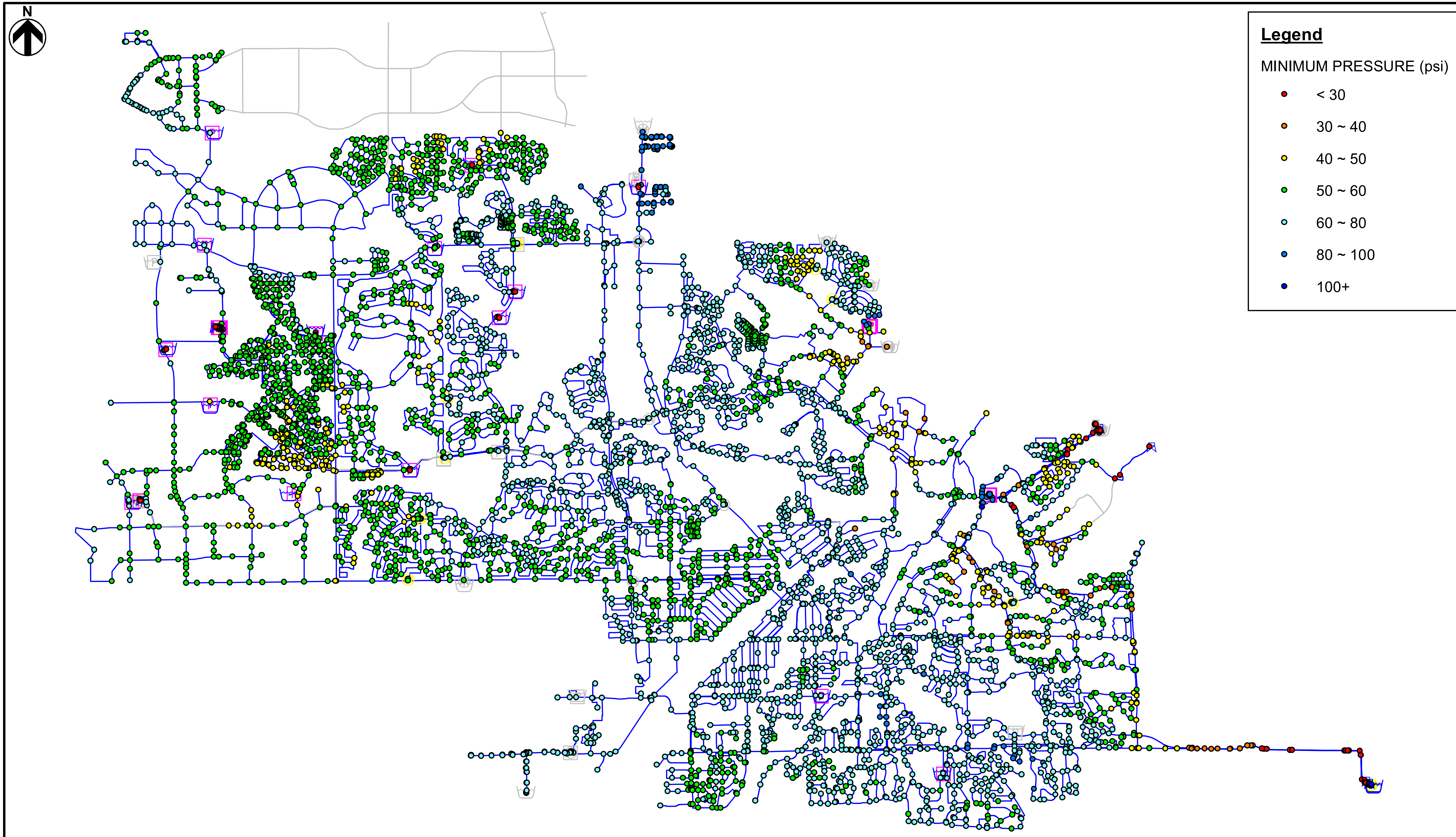


FIGURE 10
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2065 NORMAL YEAR - MINIMUM PRESSURE

HydroScience

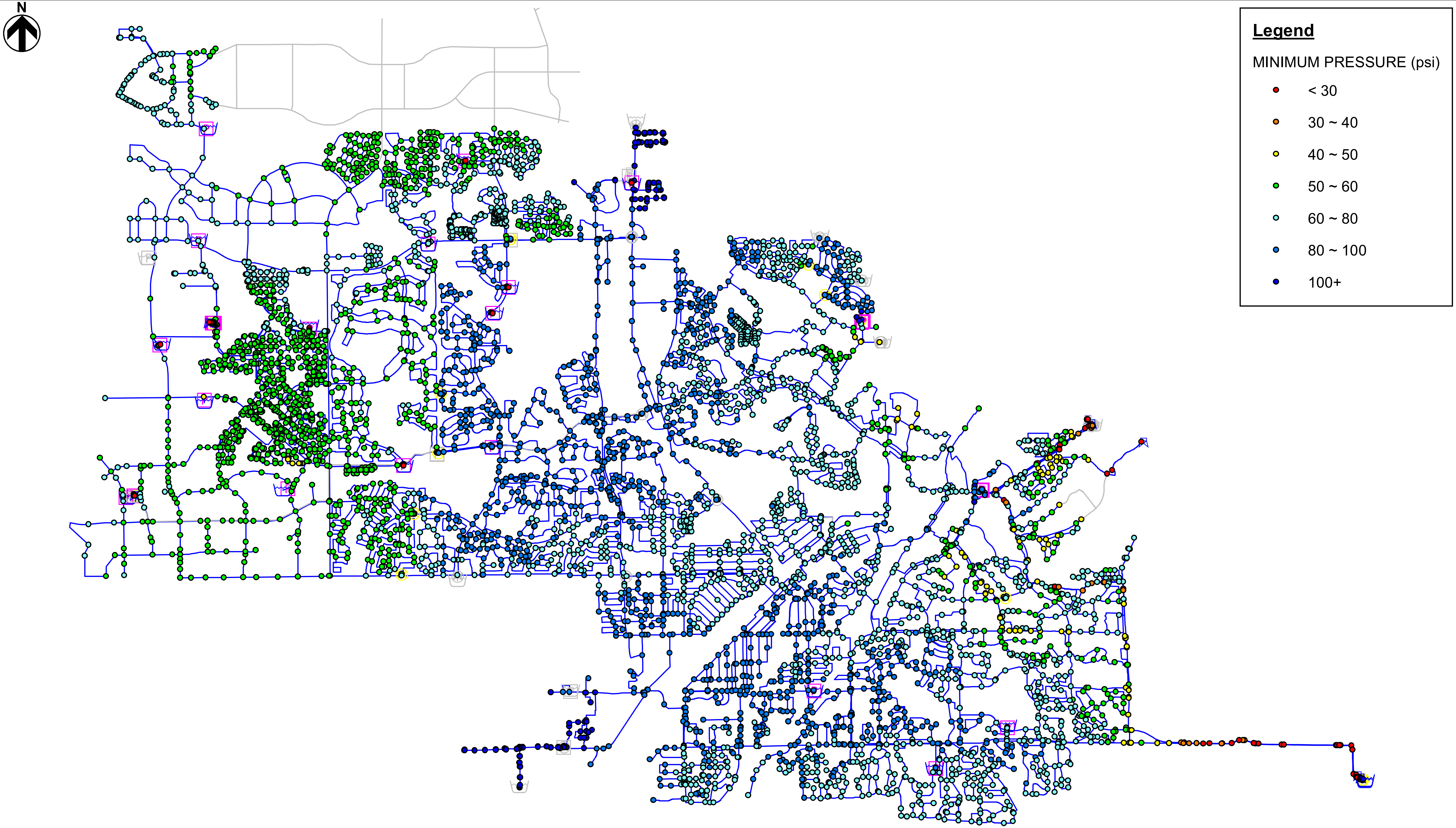


FIGURE 11
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2065 DROUGHT SUMMER - MINIMUM PRESSURE

HydroScience

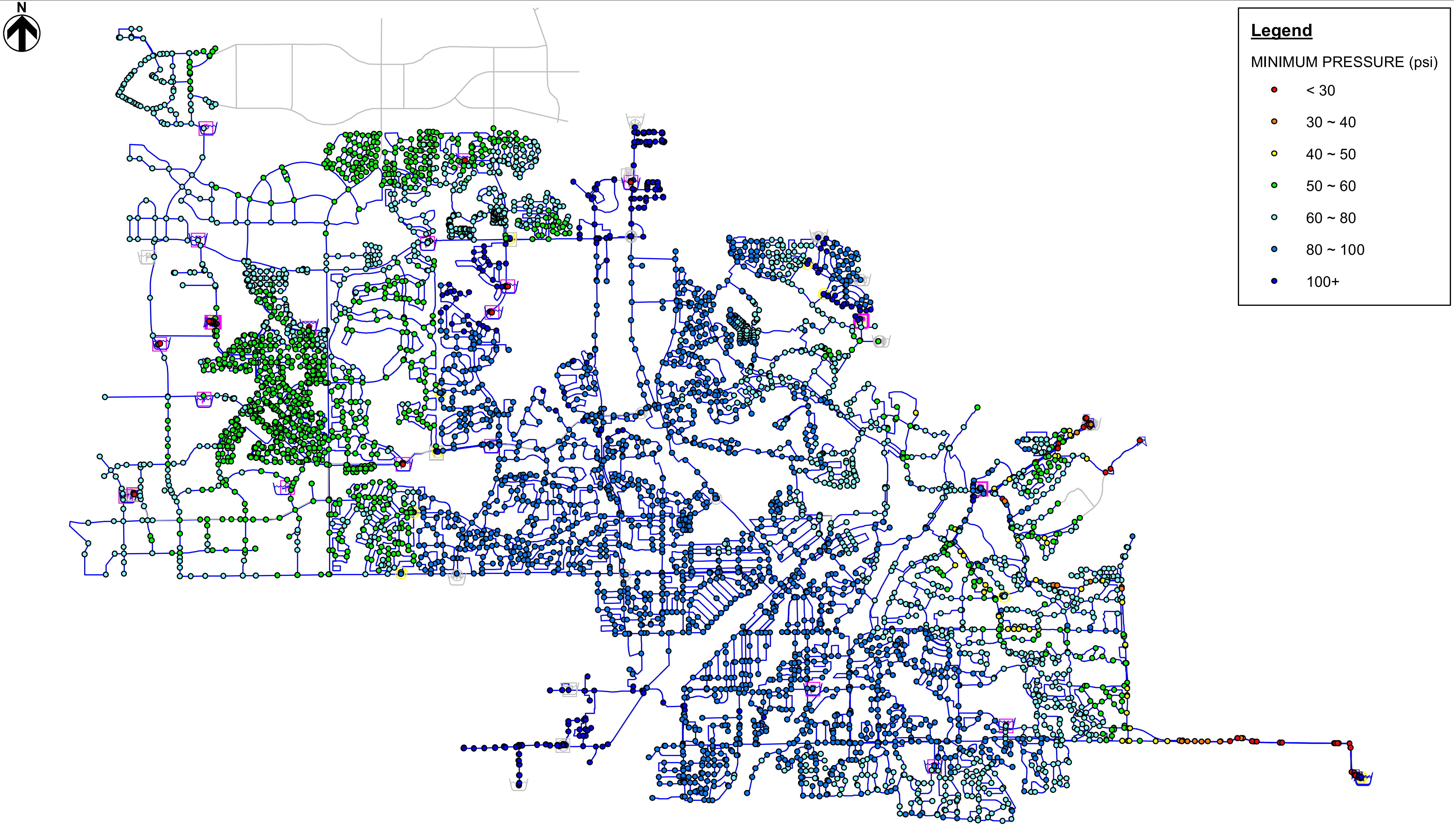


FIGURE 12
KIMLEY HORN
AMORUSO RANCH POTABLE WATER HYDRAULIC MODELING
2065 DROUGHT FALL - MINIMUM PRESSURE

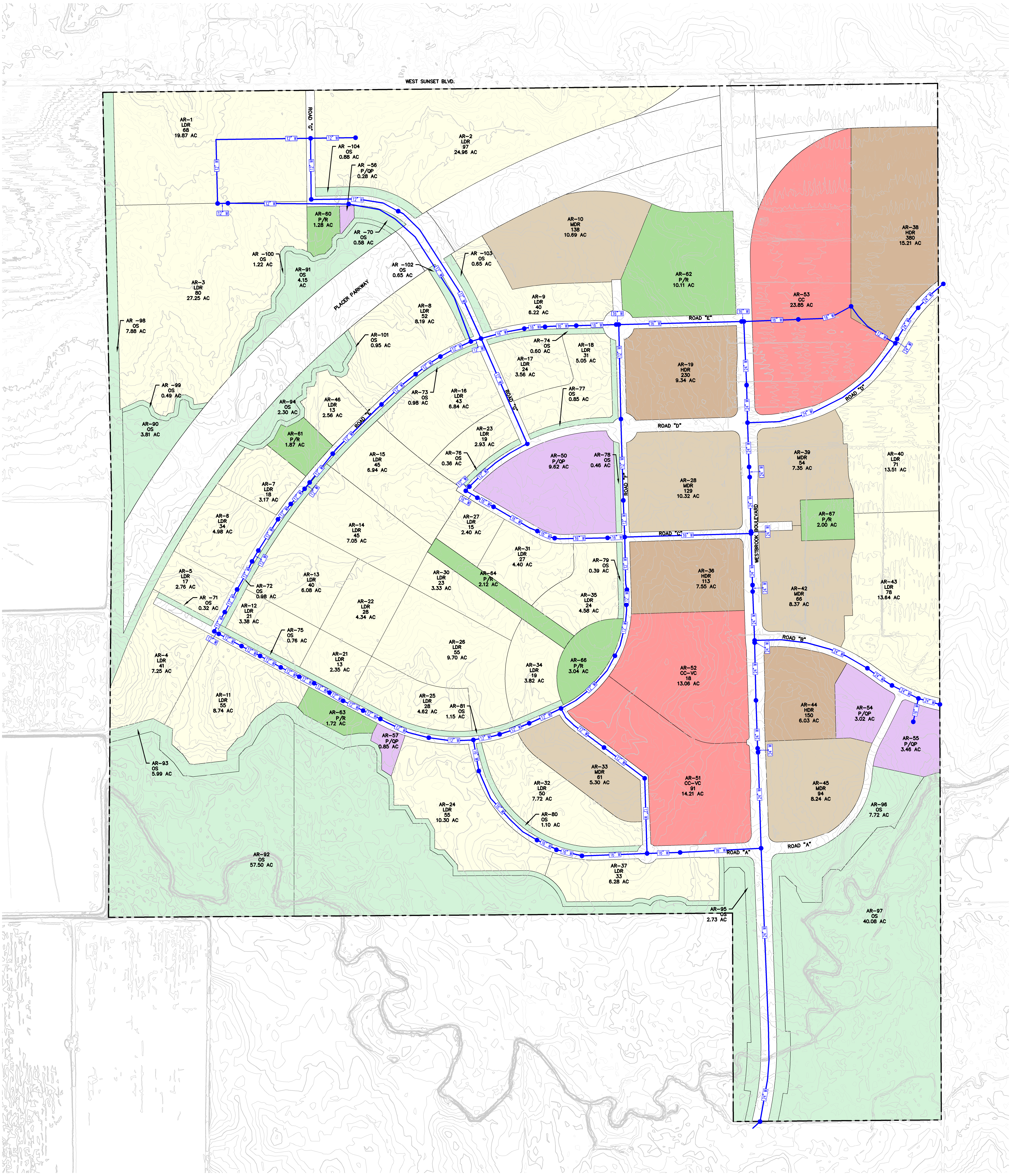
HydroScience

Amoruso Ranch Specific Plan Area

Water Master Plan

Appendix F

Water Master Plan Exhibit



LEGEND:

PROJECT BOUNDARY

WATER LINE

NODE

NORTH

GRAPHIC SCALE

(IN FEET)
1 inch = 200 ft.

AMORUSO RANCH
WATER MASTER PLAN EXHIBIT
APPENDIX F
JANUARY 2016

Kimley»Horn

Jan 26, 2016 – 3:41pm – USER amelia.whittaker
K:\SAC_LDEV\097679001 Amoruso Ranch\UB CADD\Exhibits\Master Plan Exhibits\Water\Water Master Plan Exhibit.dwg

Kimley»Horn

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Sacramento, CA 95833
Phone: 916.858.5800

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APPENDIX B

Amoruso Ranch Specific Plan Area - Water Conservation Master Plan

Brookfield Residential

Amoruso Ranch Specific Plan Area

September 2015

Water Conservation Plan

In Support of Administrative Draft Environmental Impact Report

Prepared for:

Brookfield Residential

Prepared by:

Kimley-Horn

Brookfield Residential

Amoruso Ranch Specific Plan Area

Water Conservation Plan

Prepared By:

Kimley»Horn

Table of Contents

FIGURES

INTRODUCTION

The Amoruso Ranch Specific Plan (ARSP) Area Water Conservation 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.

WATER CONSERVATION PLAN PURPOSE

In February 2008, then California Governor Arnold Schwarzenegger introduced a seven-part comprehensive plan for improving the Sacramento-San Joaquin Delta. As part of this effort, the Governor directed state agencies to develop a plan to reduce statewide per capita urban water use by 20 percent by the year 2020. In February 2010, the State Water Resources Control Board issued the 20x2020 Water Conservation Plan.

As part of the response to the 20x2020 Plan, the City has a requirement that all new specific plan projects incorporate water conservation measures into the overall project design such that the overall water demands (both potable and recycled) are reduced. The City has an overall conservation goal of 20% for potable and irrigation water usage throughout the City.

This Plan presents potentially feasible measures and guidance that can result in a reduction of the projected overall water usage within the ARSP Area, which will contribute towards the City-wide conservation goal. The projected reduction in water use will be established as part of this Plan through a process of: estimating the baseline water demands without conservation measures; identification of potentially feasible conservation measures; and estimation of the resultant water demands with application of the identified conservation measures. This Plan has been developed in conformance with the Water Efficient Landscape Ordinance (WELO) as a minimum.

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.

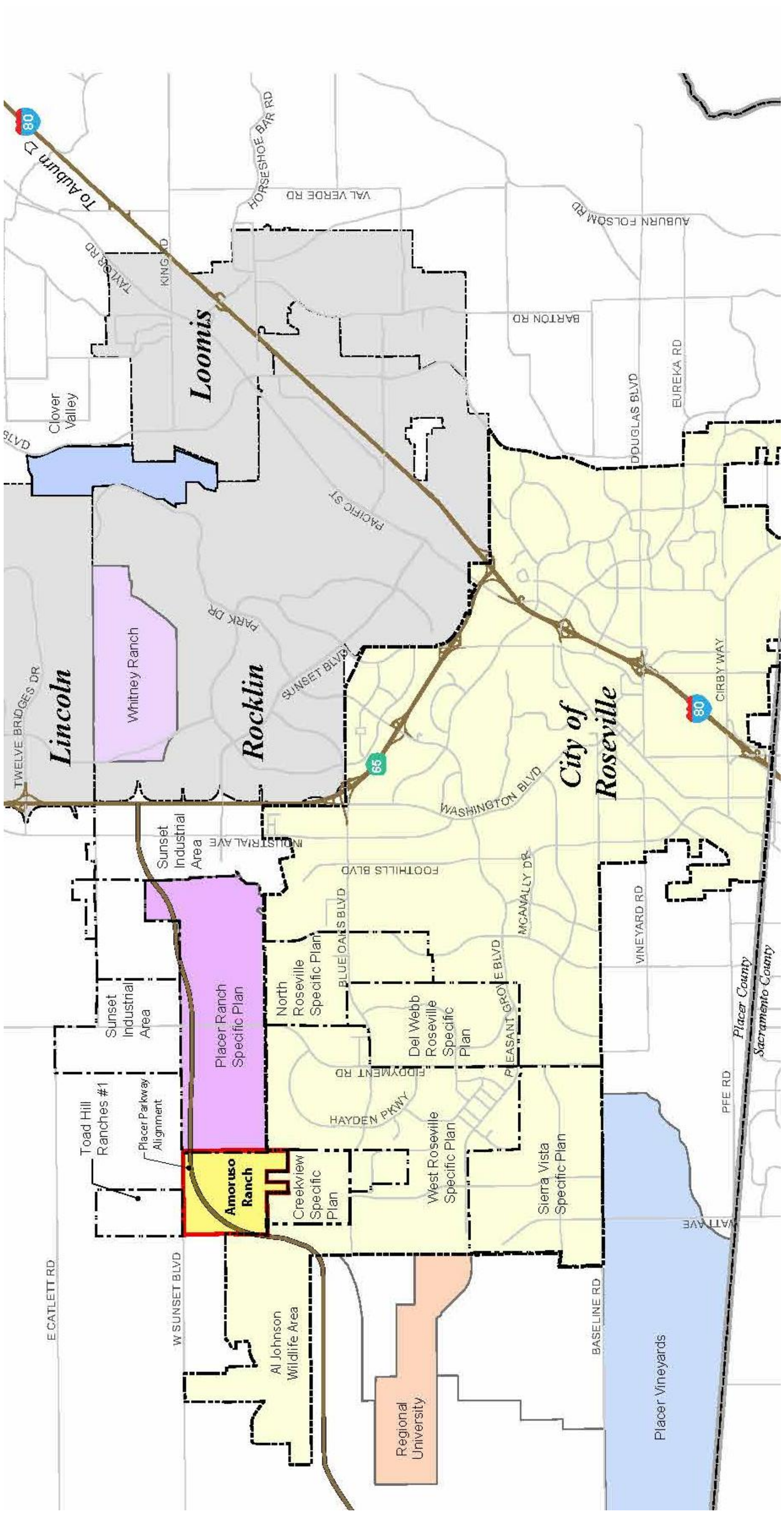

Figure 1 – ARSP Area Project Vicinity

Pre-Development Conditions

The pre-development conditions of the ARSP Area were 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 northeast 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.

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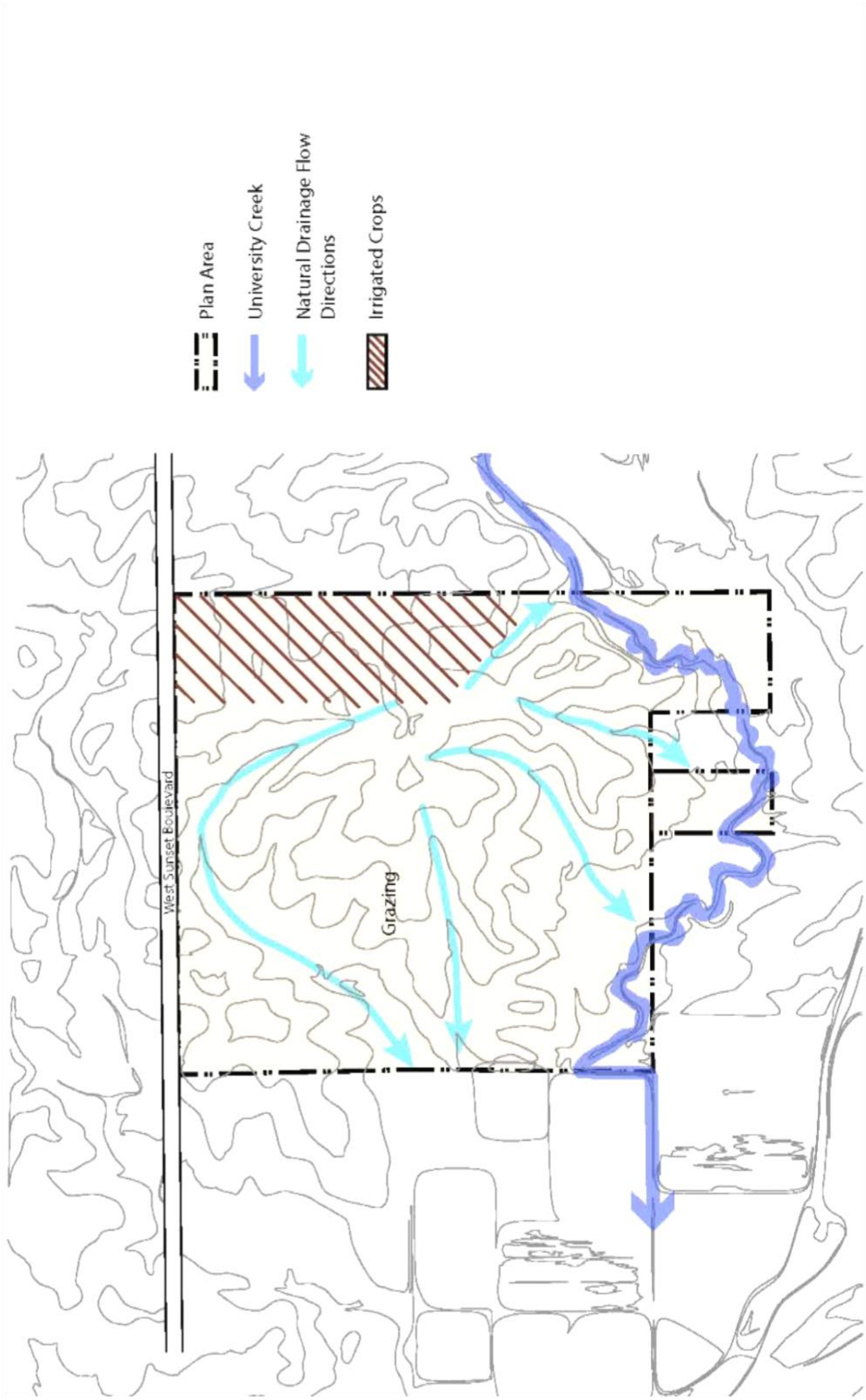

Figure 2 – ARSP Area Pre-Development Conditions

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.

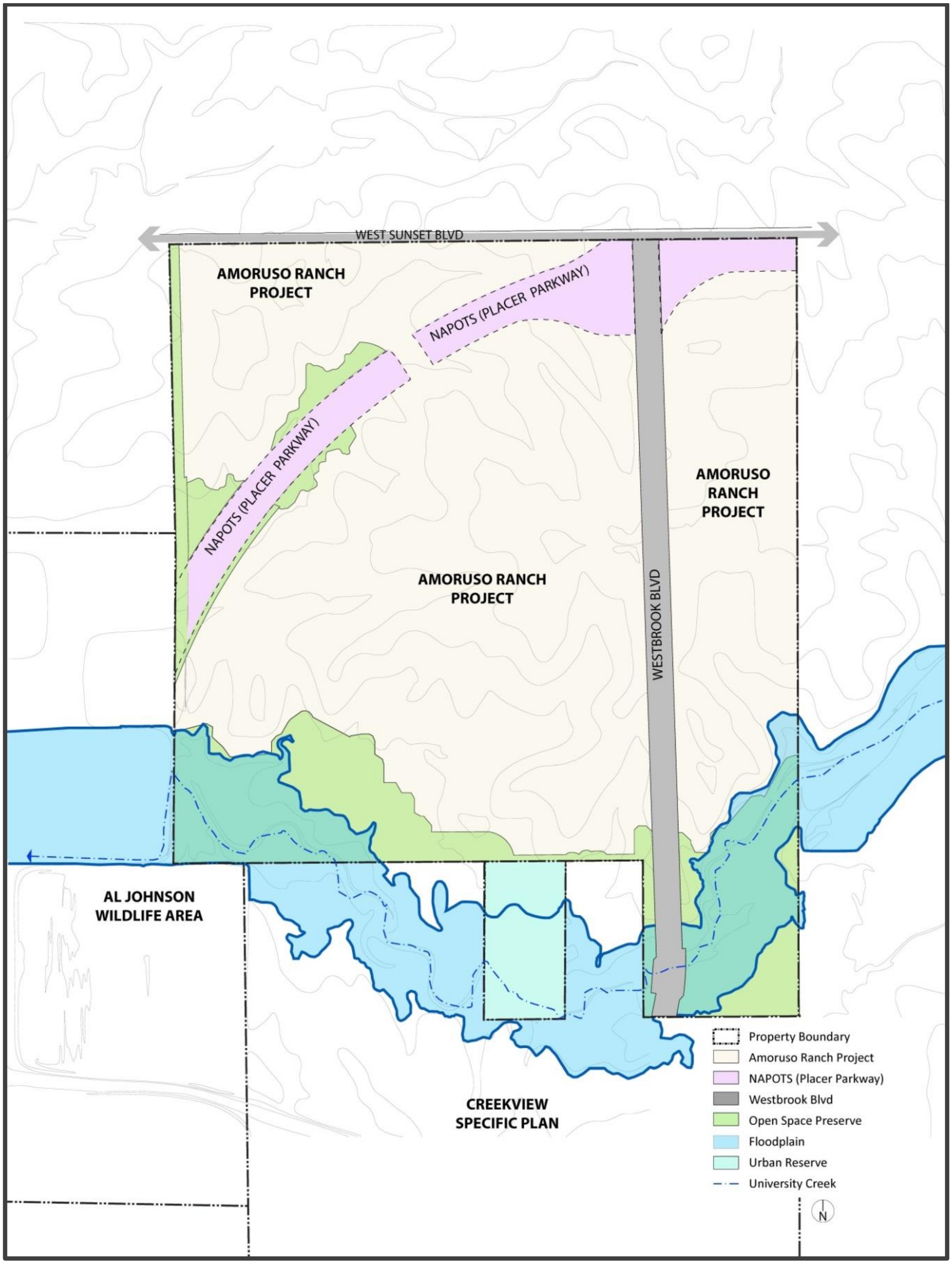

Figure 3 – ARSP Area Opportunities and Constraints

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.

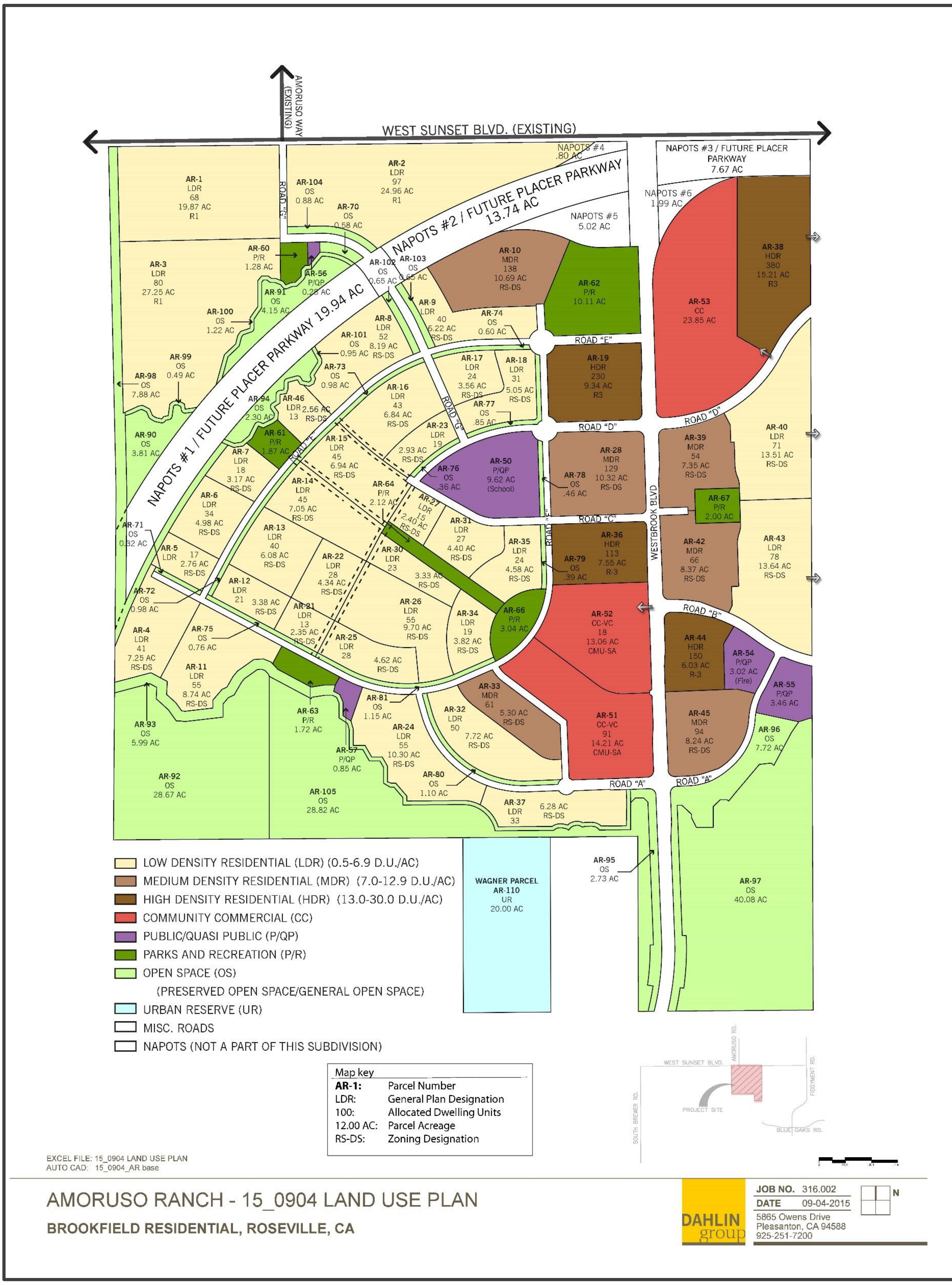

Figure 4 – ARSP Area Land Use Plan

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
Water Conservation Plan
City of Roseville Demand Factors

General Plan Land Use Category	Average Day Demand
Residential GPD/DU	
LDR1: < 3.5 DU / Acre	728 GPD/DU
LDR2: > 3.5 to 5 DU / Acre	600 GPD/DU
LMDR1: > 5 to 6 DU / Acre	521 GPD/DU
LMDR2: > 6 to 8 DU / Acre	430 GPD/DU
MDR: > 8 to 12 DU / Acre	323 GPD/DU
HDR1: > 12 to 16 DU / Acre	288 GPD/DU
HDR2: > 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 for the Low-, Medium- and High-Density Residential units proposed within the ARSP Area have been calculated. The basis of the Low-, Medium- and High-Density Residential water use is presented within Table 2.

Table 2
Amoruso Ranch Specific Plan
Water Conservation Plan
Water Use Estimation – LDR, MDR and HDR

Land Use Category Density	Number of Units	Average Day Demand (GPD/DU)	Total Average Day Demand (GPD)	Total Average Day Demand (AFY)	Total Average Day Demand with 2% (AFY)[1]
LDR1: < 3.5 DU / Acre	148	728	107,744	120.7	123.1
LDR2: > 3.5 to 5 DU / Acre	116	600	69,600	78.0	79.5
LMDR1: > 5 to 6 DU / Acre	401	521	208,921	234.0	238.7
LMDR2: > 6 to 8 DU / Acre	757	430	325,510	364.6	371.9
MDR: > 8 to 12 DU / Acre	155	323	50,065	56.1	57.2
HDR1: > 12 to 16 DU / Acre	380	288	109,440	122.6	125.0
HDR2: > 16 DU / Acre	760	177	134,520	150.7	153.7
Community Commercial - Village Center – Residential	109	288	31,392	35.2	35.9
Urban Reserve	1	728	728	0.8	0.8
Total	**2,827**	**-**	**1,037,920**	**1,162.6**	**1,185.9**

The water use estimation, as established by the City for purposes of water conservation does not distinguish between potable water and recycled water. Table 3 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 in the water conservation calculations. It has, however, been included for informational purposes in both Tables 2 and 3.

[1] Demand accounts for 2% system losses.

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Table 3

Amoruso Ranch Specific Plan

Water Conservation Plan

Water Use Factors and Demands

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)[1]
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] Demand accounts for 2% system losses.

SINGLE FAMILY RESIDENTIAL WATER USE DISTRIBUTION

Single family residential water use for land use designations for Low-, Medium- and High-Density (LDR, MDR and HDR) parcels can be further divided by the use within the home and the landscape irrigation demands outside of the home.

Table 4 represents the typical single family residential water usage that would be attributable to residential units within the land use designation of LDR and MDR. The percentage of total use will have a different distribution for HDR primarily attributable to the reduction in irrigated landscaped area.

Table 4
Amoruso Ranch Specific Plan
Water Conservation Plan
Single Family Residential Water Usage

Residential Use	Percentage of Total[1]
Landscaping	51%
Toilets	13%
Faucets, Cooking, Cleaning	10%
Showers	9%
Clothes Washing	8%
Bath	6%
Toilet Leaks	2%
Dishwasher	1%

Based on historic data the typical split between backyard and front yard irrigation of typical LDR and MDR parcels is approximately sixty-forty, with 60% of the landscape irrigation demand attributable to the backyard and 40% of the landscape irrigation attributable to the front yard. This is the result of typically smaller front yards than backyards along with less

[1] Percentage of total water use was derived from information obtained from the City of Roseville Frequently Asked Questions (FAQ) on the subject of water conservation.

landscape area in the front yard due to driveways and walks. Utilizing this ratio of front yard to backyard irrigation use, results in a further breakdown of the 51% total water use to 20.4% for the front yards and 30.6% for the backyards. The separation of front yard and backyard irrigation demands for LDR and MDR parcels allows analysis and application of different conservation measures between the two distinct areas.

The HDR units typically do not have front yard and backyard irrigation demand; however, there are common area irrigation demands that are attributable to HDR units. Average planning numbers for irrigation demands for HDR units is 20% of the estimated overall water usage. This value is expressed as 20% of the annual irrigation demand and not based on designation of demands split between front and back yard area designations. Table 5 presents a summary of demands based on the assumptions listed above.

Table 5
Amoruso Ranch Specific Plan
Water Conservation Plan
Residential Irrigation Water Demands

Land Use	Annual Demand (AFY)	Annual Demand Front Yard (AFY)	Annual Demand Backyard (AFY)	Annual Total Irrigation Demand (AFY)
Low Density Residential	739.5	150.86	226.29	377.15
Medium Density Residential	200.0	40.80	61.20	102.00
High Density Residential[1]	187.1	N/A	N/A	37.42
Urban Reserve	0.8	0.16	0.24	0.40
Total	**1,127.4**	**191.82**	**287.73**	**516.97**

[1] Demand for HDR parcels was calculated differently from LDR and MDR parcels, as described above. Demand for HDR parcels was not separated into front yard and backyard demand since traditional front and back yards are not present on HDR parcels.

WATER USE REDUCTION STRATEGIES

A series of implementable water use reduction strategies have been identified for the ARSP Area. These strategies are discussed in more detail in the following subsections of this document, including the estimated percentage of water use reduction.

The water use reduction strategies identified for the ARSP Area include:

- Reduction of Residential Turf Areas
- Reduction of Park and Recreation and Common Area Turf (Non-Residential)
- Irrigation Management
- Water Conservation Methods

REDUCTION OF RESIDENTIAL TURF AREAS

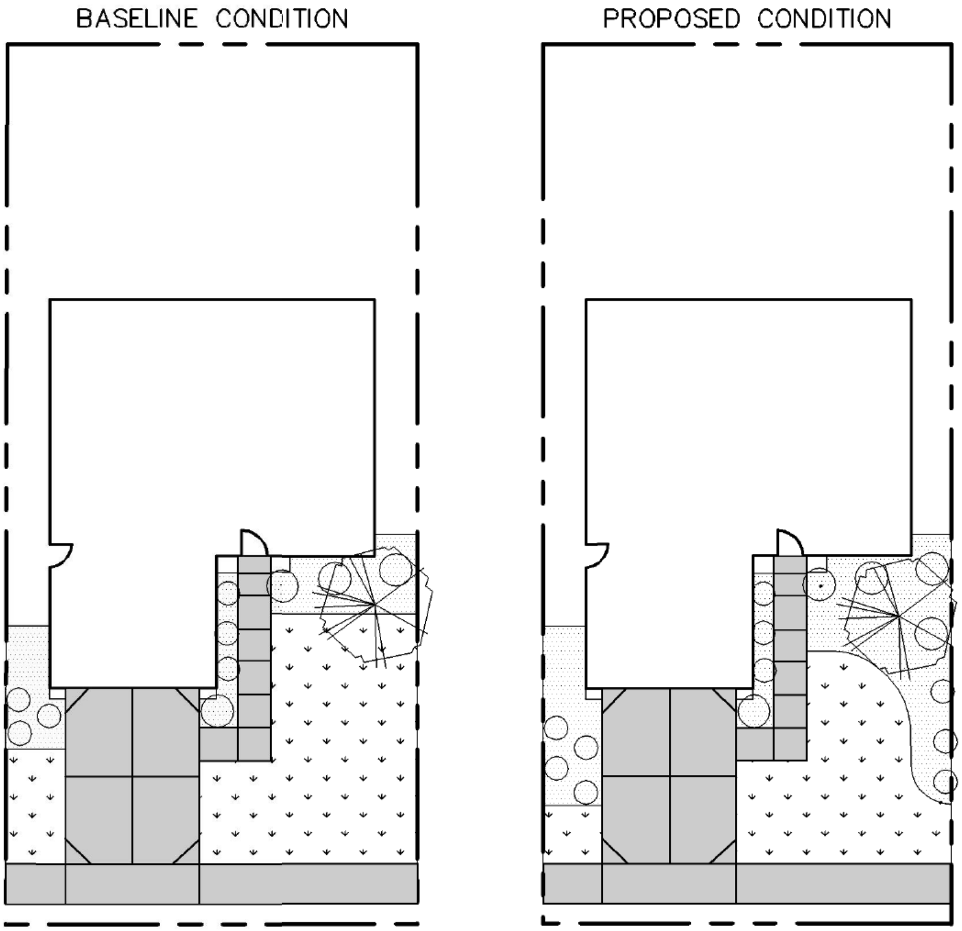
As represented in the previous sections and tables, turf areas account for a significant portion of the water demand of the residential development. In turn, this correlates to one of the greatest opportunities to reduce the projected water demands. The ARSP project will adopt a strategy to encourage the new residential developments to reduce the magnitude of front yard turf areas and plant these areas with vegetation that uses far less water.

The City of Roseville estimates that for a same sized area of turf, in comparison to utilization of low-water consumption vegetation, could result in a savings of up to 70% in the amount of water required. Therefore, 30% of the amount of water would be required for the low consumption vegetation as compared to the lawn area’s water demand.

Low water consumption vegetation, benefits not only from the reduced requirement for uptake by the plants, it also benefits from more efficient landscape irrigation systems. Low water consumption vegetation is typically irrigated by drip systems, as opposed to overhead spray systems for lawn and turf areas.

Typical front yard landscaping generally ranges between 75% and 85% irrigated area. For purposes of this analysis, the low-point of 75% irrigated area has been selected with 70% being lawn area and the remaining irrigated area being lower water using plants and planters.

It is reasonable to reduce irrigated lawn areas from 70% of the typical front yard for LDR and MDR, as well as reduce the common area lawns on HDR, to 42%. This results in an increase of low water consumption vegetation from 5% to 33%. An example of the potential reductions in turf area is shown in Figure 5. The comparisons of water demands for irrigation are shown in Table 6.



AREA	BASELINE	PROPOSED
HARDSCAPE	25%	25%
LANDSCAPE		
–TURF	70%	42%
–LOW WATER PLANTING	5%	33%
TOTAL	100%	100%

HARDSCAPE
TURF
LOW WATER PLANTING

NOTE: NOT TO SCALE

Figure 5 – Front Yard Water Conservation Comparison

Table 6
Amoruso Ranch Specific Plan
Water Conservation Plan
Reduced Landscape Turf Area

Land Use	Front Yard Irrigated Area[1]	Base Condition		Base Condition with Water Conservation	
		Turf Area	Low Water Use Area	Turf Area	Low Water Use Area[2]
LDR, MDR and HDR[3]	75%	70%	5%	42%	33%

Table 7 is a comparison of the water use efficiencies that result from reduction in front yard turf areas. Since assumptions are based on similar reductions in turf areas for LDR, MDR and HDR product types, the water demands have been combined for presentation.

Table 7
Amoruso Ranch Specific Plan
Water Conservation Plan
Front Yard Irrigated Area Water Efficiencies

Land Use	Annual Demand Front Yard (AFY)[4]	New Front Yard Demand (AFY)	Annual Demand Savings (AFY)	Annual Demand Savings (%)	Water System Savings
Residential Properties LDR and MDR	191.82	139.24	52.58	27.4%	Potable
HDR	37.42	27.16	10.26	27.4%	Recycled
Total	**229.24**	**166.40**	**62.84**	**27.4%**	

As an example of how these values were calculated, the calculation for the annual front yard turf demand and the reduced annual front yard demand is presented below.

For the annual front yard turf demand, as calculated for low and medium density residential land uses, 75% of the front yard is landscaped with 70% turf and 5% low water use plantings. Since low water use plantings use 30% of the water required for turf, this 5%

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[1] As a percentage of the front yard.
[2] Includes 5% existing low water use plantings plus 28% new low water use plantings.
[3] Represents the percentage of the entire exterior area for HDR.
[4] Front yard demand from Table 5. HDR is total since there is not a distinction between front and back yards.

area is equal to 1.5% turf area water demand. This results in the following annual front yard demands:

Turf (LDR & MDR):

$$191.82\ AFY * \left(\frac{70\%}{71.5\%}\right) = 187.80\ AFY$$

Low Water Use (LDR & MDR):

$$191.82\ AFY * \left(\frac{1.5\%}{71.5\%}\right) = 4.02\ AFY$$

For the reduced annual front yard demand, as calculated for low and medium density residential uses, reducing the base turf area in the front yards from 70% to 42% and replacing that (equivalent to 28%) with low water use plantings resulted in the following annual demands:

Reduced Demand Equation (LDR & MDR):

$$187.80\ AFY * \left(\frac{42\%}{70\%} + \frac{28\% * 30\%}{70\%}\right) + 4.02\ AFY = 139.24\ AFY$$

The same equations were generated for the HDR parcels as follows:

Turf (HDR):

$$37.42\ AFY * \left(\frac{70\%}{71.5\%}\right) = 36.63\ AFY$$

Low Water Use (HDR):

$$37.42\ AFY * \left(\frac{1.5\%}{71.5\%}\right) = 0.79\ AFY$$

Reduced Demand Equation (HDR):

$$36.63\ AFY * \left(\frac{42\%}{70\%} + \frac{28\% * 30\%}{70\%}\right) + 0.79\ AFY = 27.16\ AFY$$

REDUCTION OF PARK AND RECREATION AND COMMON AREA TURF (NON-RESIDENTIAL)

In addition to the turf areas for residential properties there are additional and significant turf areas throughout a typical development. These areas include the parks, irrigated paseos, commercial centers and school play fields. The estimated turf irrigation demand at each of these uses is as follows:

- It is estimated that parks utilize approximately 98% of their water demand for irrigation and 80% of their irrigated area for turf. This area is assumed to be reduced to 60% with the conversion of turf area (20%) to low water consumption vegetation or other uses.
- For the Roseville area, low water plantings were assumed to use 30% of the water used on turf (a 70% water savings).
- Low water use areas will utilize low volume irrigation systems like a drip or spray system (such as Netafim) designed to achieve a uniformity of 90% rather than an overhead spray irrigation system.
- Paseos are estimated to utilize 100% of their water demand for landscape irrigation. 80% of the paseo area is irrigated turf area. This area is assumed to be reduced to 60% with the conversion of turf area (20%) to low water consumption vegetation or other uses.

Based on these assumptions the water use efficiencies for the parks and paseos have been calculated and are presented in Table 8.

Table 8
Amoruso Ranch Specific Plan
Water Conservation Plan
Non-Residential Irrigated Area Water Efficiencies

Land Use	Annual Water Demand (AFY)[1]	Annual Irrigation Demand (AFY)	Base Turf Area	New Turf Area	Low Water Use Area	New Irrigation Demand (AFY)	Annual Demand Savings (AFY)	Annual Demand Savings (%)	Water System Savings
Parks	74.1	72.62	80%	60%	20%	59.92	12.70	17.5%	Recycled
Paseos	35.8	35.80	80%	60%	20%	29.54	6.26	17.5%	Recycled
Total	**109.9**	**108.42**				**89.46**	**18.96**	**17.5%**	

[1]Annual water demand derived from Table 3.

The new irrigation demand for the Parks is calculated as follows:

$$\frac{72.62\ AFY * 60\%}{80\%} = 54.47\ AFY$$

Demand remaining after turf reduction:

$$72.62\ AFY - 54.47\ AFY = 18.15AFY$$

Low water plants use 30% of turf demand:

$$18.15\ AFY * 30\% = 5.45\ AFY$$

New irrigation demand:

$$54.47\ AFY + 5.45\ AFY = 59.92\ AFY$$

Similarly the new irrigation demand for the Paseos is calculated as follows:

$$\frac{35.80\ AFY * 60\%}{80\%} = 26.85\ AFY$$

Demand remaining after turf reduction:

$$35.80\ AFY - 26.85\ AFY = 8.95\ AFY$$

Low water plants use 30% of turf demand:

$$8.95\ AFY * 30\% = 2.69\ AFY$$

New irrigation demand:

$$26.85\ AFY + 2.69\ AFY = 29.54\ AFY$$

IRRIGATION MANAGEMENT

Smart and centrally located irrigation controllers restrict irrigation to times and rates necessary to maintain landscaping. They account for changes in the demand for water, which varies with weather patterns, seasonal influences and soil moisture content. In the

ARSP, smart irrigation controllers, as defined in WELO, will be required for residential, commercial, and quasi-public parcels subject to turf reduction measures, and centrally controlled irrigation controllers for larger commercial and publicly maintained parcels.

As referenced in previous studies for the City of Roseville, a number of studies have been completed specifically on the conversion to smart irrigation controllers and the resultant water savings. Those studies suggest that water use reductions can be expected between 7% and 41%. This is a wide range of variability. Since ARSP is an entirely new development all significant irrigation applications will employ the use of smart irrigation controllers (per WELO). Therefore, a water use reduction value of 20% has been estimated for purposes of this analysis, consistent with previous analyses completed for similar developments within the City of Roseville. The sample calculation is presented below and the values are summarized in Table 9.

Smart Irrigation Equation:

$$139.24\ AFY * (80\%) = 111.39\ AFY$$

Table 9
Amoruso Ranch Specific Plan
Water Conservation Plan
Smart Irrigation Controller Water Efficiencies

Land Use	Annual Irrigation Demand (AFY)	New Irrigation Demand w/Controller (AFY)	Annual Demand Savings (AFY)	Annual Demand Savings (%)	Water System Savings
Residential Properties (Front)[1]	139.24	111.39	27.85	20%	Potable
Residential Properties (Back)[2]	287.73	230.18	57.55	20%	Potable
Residential Properties (HDR)[3]	27.16	21.73	5.43	20%	Recycled
Parks[4]	59.92	47.94	11.98	20%	Recycled
Paseos[5]	29.54	23.63	5.91	20%	Recycled
Total	**543.59**	**434.87**	**108.72**	**20%**	

[1] Annual irrigation demand derived from Table 7.
[2] Annual irrigation demand derived from Table 5.
[3] Annual irrigation demand derived from Table 7.
[4] Annual irrigation demand derived from Table 8.
[5] Annual irrigation demand derived from Table 8.

WATER CONSERVATION METHODS

There are many water conservation measures that can be implemented throughout the ARSP project. The reality is that a majority of the typical water conservation measures are already required or anticipated to be included in any new projects. These include low flow toilets, low flow shower heads, faucet aerators, etc.

One additional water conservation measure that will be considered for the ARSP project is the inclusion of recirculating hot water systems. Recirculating hot water systems feature a pump on a residential hot water line system which reduces the time necessary to receive hot water at any hot water faucet throughout the home. They provide hot water at the tap immediately upon engaging the hot water faucet, eliminating the waste of water as you wait for the water to transition from the cold water in the pipes to hot water. This type of system can be included on all residential units to generate additional water conservation. The amount of water savings with these systems varies based on the number of times hot water is utilized throughout the day. A typical conservative estimate indicates a water savings of approximately 1.25 gallons per use is saved by having "instant" hot water from the recirculation system. We have estimated that on average this would occur six times per day per residential unit, consistent with previous studies for the City of Roseville.

Re-Circulating Hot Water Equation:

$$2{,}827\ DU * 7.5\,\frac{gal}{day} * \frac{AF}{325851\ gal} * 365\ day/yr = 23.75\ AFY$$

The estimated savings based on the installation of recirculating hot water systems is shown in Table 10.

Table 10
Amoruso Ranch Specific Plan
Water Conservation Plan
Recirculating Hot Water System Water Efficiencies

Land Use	Dwelling Unit Count	Savings per Dwelling Unit (Gal)	Annual Demand Savings (AFY)	Annual Demand Savings (%)	Water System Savings
Residential Units	2,827	7.5	23.75	1.6%	Potable

SUMMARY

A series of water conservation methods have been proposed for implementation as part of the ARSP project. These methods are readily implemented and are consistent with the goals and objectives of the Amoruso Ranch Specific Plan and the City of Roseville.

Table 11 provides a summary of the water conservation measures and their estimated savings in water use. As shown on Table 11, with implementation of all of the measures an estimated conservation of 14.5% of the projected water use would be realized within the ARSP Area.

Table 11
Amoruso Ranch Specific Plan
Water Conservation Plan
Summary of Water Efficiencies

Water Conservation Opportunity	Total Water Demand (AFY)	Potable Water Savings (AFY)	Recycled Water Savings (AFY)	Annual Demand Savings (AFY)	Annual Demand Savings (%)
Residential Properties Irrigation – Front[1]	**1,473.7**	52.58	10.26	62.84	4.3%
Non-Residential (Parks, ROW, School)[2]		0	18.96	18.96	1.3%
Smart Irrigation Controllers[3]		85.40	23.32	108.72	7.4%
Recirculating Hot Water System[4]		23.75	0	23.75	1.6%
Total		**161.73**	**52.54**	**214.27**	**14.5%**

The actual water conservation savings will be dependent on a number of factors including the participation and adherence by the actual homeowners. Constructing the residential units with a number of these measures already integrated (such as the hot water recirculation systems) will be beneficial to achieving the objective.

[1] Annual demand savings derived from Table 7.
[2] Annual demand savings derived from Table 8.
[3] Annual demand savings derived from Table 9.
[4] Annual demand savings derived from Table 10.

For the single family residential land uses there is anticipated to be ongoing outreach by the City to remind and reinforce the need for water conservation. This can include attachments to the water bill, water audits that can be made available to homeowners, the promotion of the City's water conservation website, and the availability of City water conservation staff to respond to specific questions. In addition, outreach can include educating homeowners on how to use and set up smart irrigation controllers along with including the installation and integration into their backyard irrigation system.

Guidance and education for the homeowners with regards to the landscaping of front and backyards will also be part of the overall plan including education in conformance with WELO.

References

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

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APPENDIX C

Amoruso Ranch Specific Plan Area - Recycled Water Master Plan

Brookfield Residential

Amoruso Ranch Specific Plan Area

September 2015

Recycled Water Master Plan

IN SUPPORT OF ADMINISTRATIVE DRAFT ENVIRONMENTAL IMPACT REPORT

Prepared for:

Brookfield Residential

Prepared by:

Kimley»Horn

Brookfield Residential

Amoruso Ranch Specific Plan Area

Recycled Water Master Plan

Prepared By:

Kimley»Horn

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Kimley»Horn

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.

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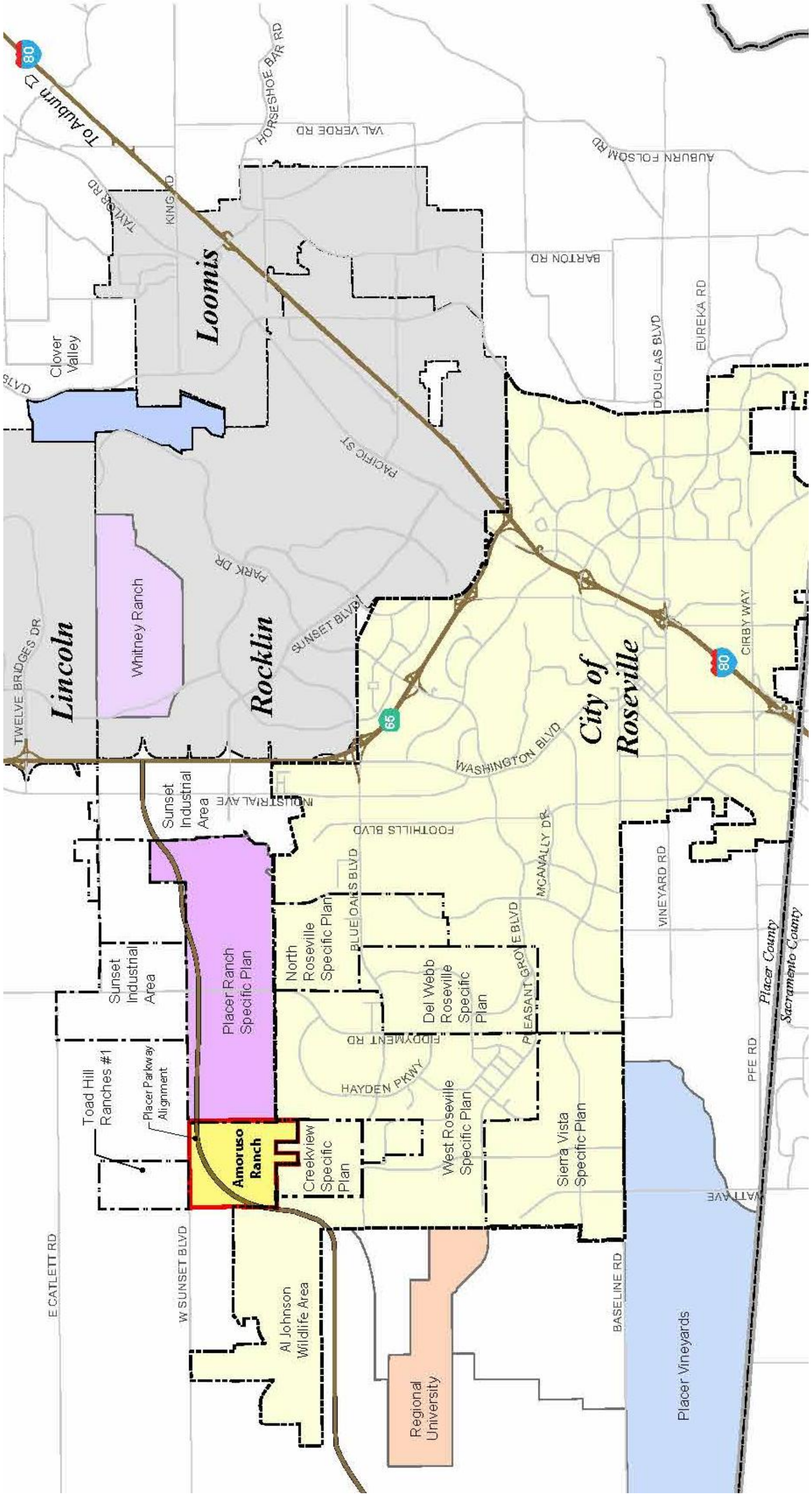

Figure 1 – Amoruso Ranch Specific Plan Area Project Vicinity

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.

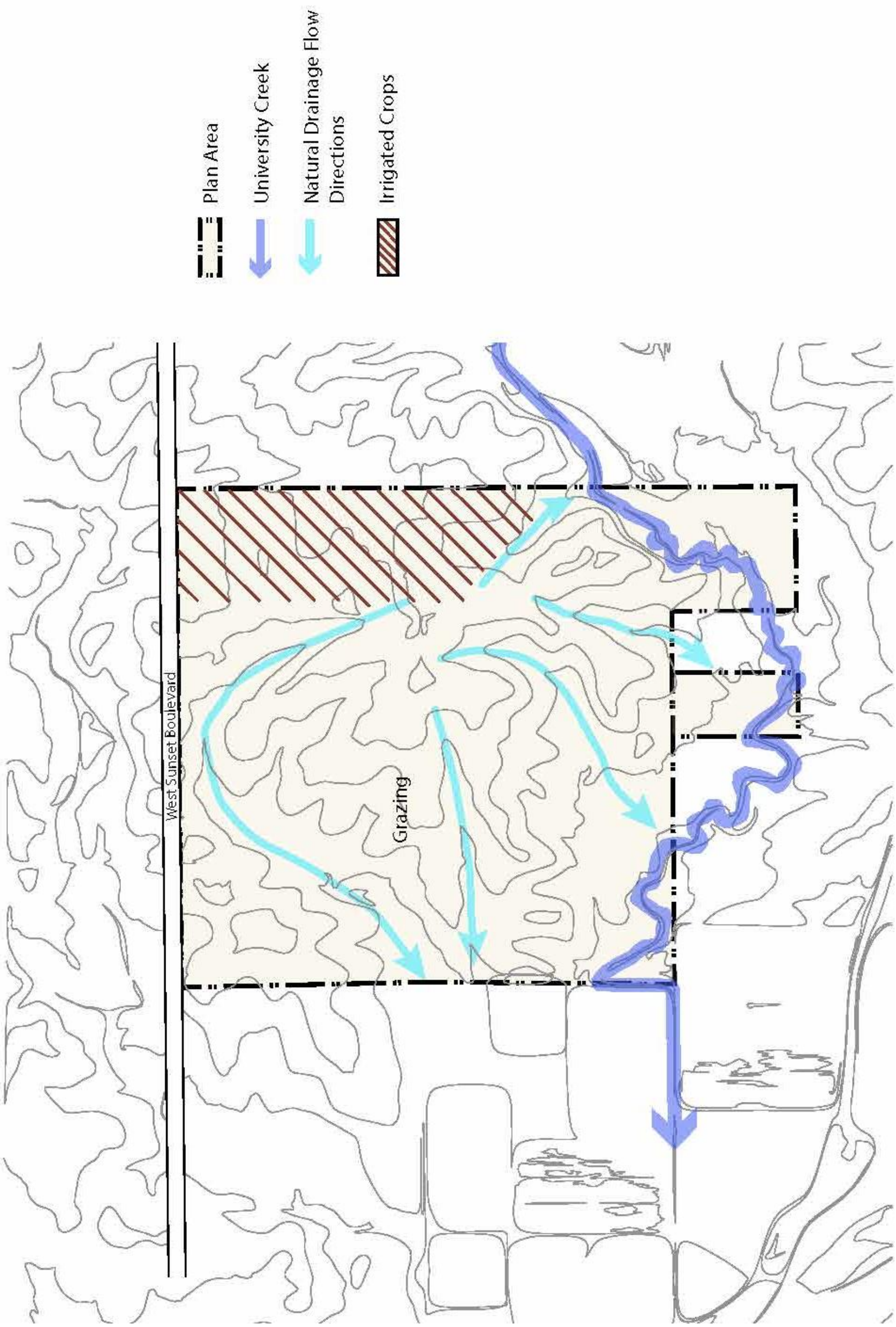

Figure 2 – ARSP Area Pre-Development Conditions

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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.

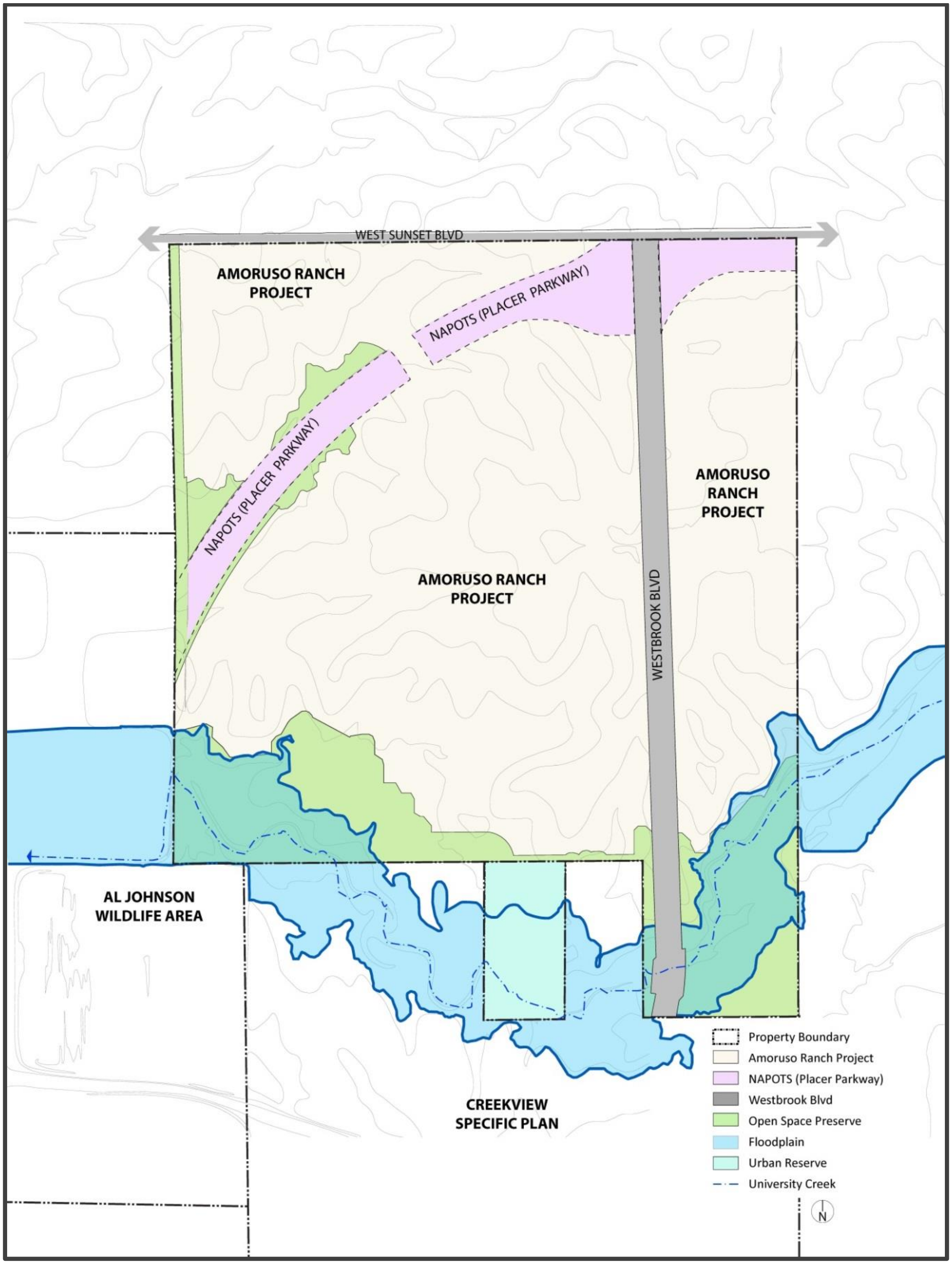

Figure 3 – ARSP Area Opportunities and Constraints

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.

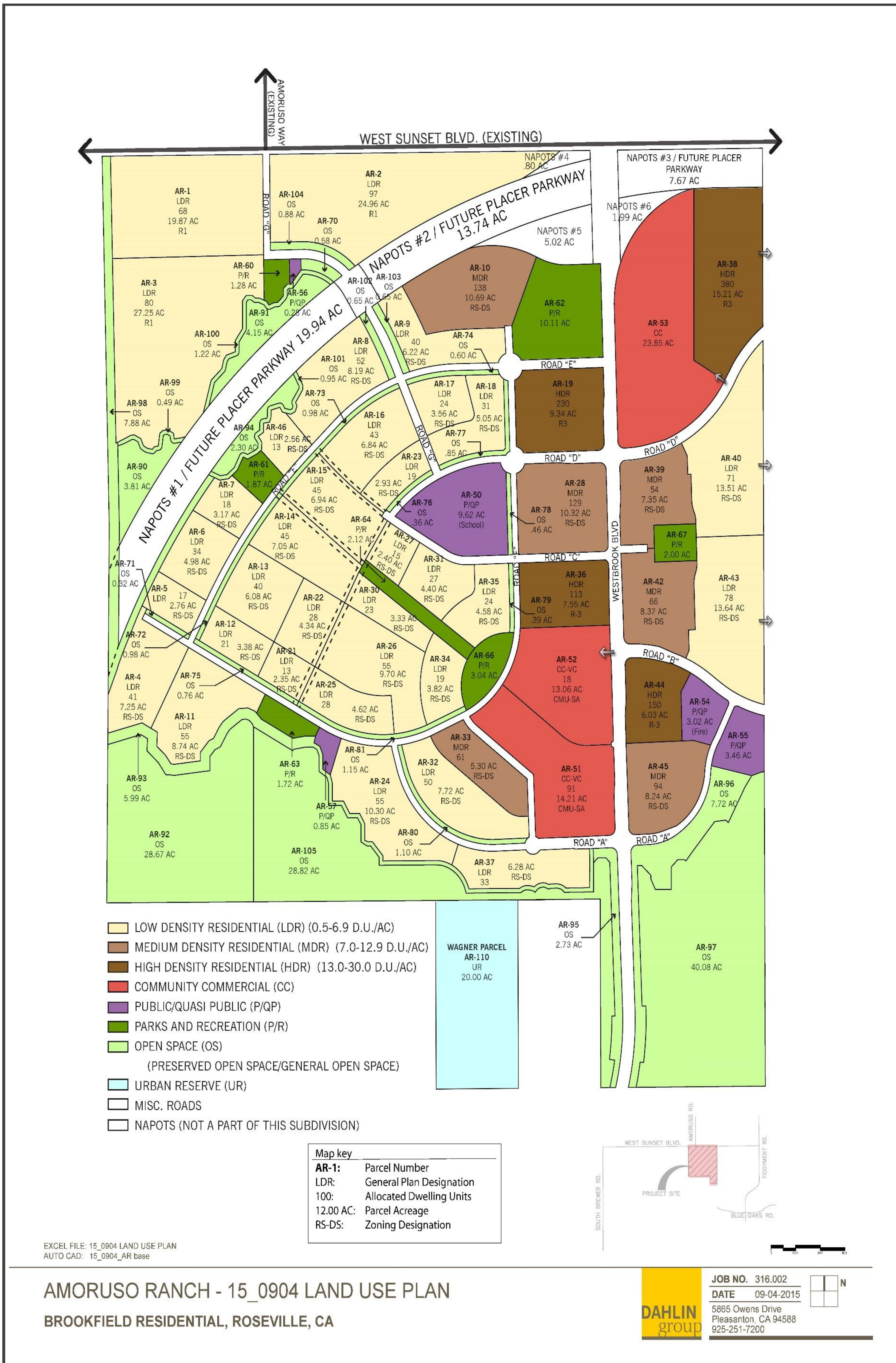

Figure 4 – ARSP Area Land Use Plan

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.

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[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**

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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 52 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 220 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	2.4	51.8	49.4	N
April	16.4	51.8	35.4	N
May	29.2	51.8	22.6	N
June	40.7	51.8	11.1	N
July	46.8	51.8	5.0	N
August	40.7	51.8	11.1	N
September	29.2	51.8	22.6	N
October	14.6	51.8	37.2	N
November	0.0	51.8	51.8	N
December	0.0	51.8	51.8	N
Total	**220**	-	-	-

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

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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.

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Amoruso Ranch Specific Plan Area

Recycled Water Master Plan

Appendix A

Pipe Output Table
Junction Node Table

Amoruso Ranch Specific Plan
Pipe Output

ID	Label	Length (Scaled) (ft)	Start Node	Stop Node	Diameter (in)	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss Gradient (ft/ft)
97	P-36	186	J-31	J-32	8	130	0	0	0
103	P-39	546	J-34	J-35	8	130	0	0	0
95	P-35	433	J-30	J-31	8	130	15	0.1	0
93	P-34	603	J-29	J-30	8	130	31	0.2	0
108	P-42	60	J-22	J-37	6	130	-31	0.36	0
74	P-23	384	J-21	J-22	6	130	32	0.36	0
91	P-33	526	J-3	J-29	8	130	63	0.4	0
78	P-25	181	J-23	J-24	6	130	-40	0.46	0
109	P-43	53	J-37	J-23	6	130	-40	0.46	0
101	P-38	1,172	J-33	J-34	8	130	81	0.52	0
51	P-11	492	J-10	J-11	6	130	47	0.53	0
88	P-31	14	J-11	J-28	6	130	-59	0.67	0
49	P-10	606	J-9	J-10	6	130	65	0.74	0
111	P-44	54	J-24	J-38	6	130	-81	0.92	0.001
89	P-32	799	J-28	J-12	6	130	-84	0.95	0.001
112	P-45	435	J-38	J-25	6	130	-88	1	0.001
55	P-13	615	J-12	J-13	6	130	-102	1.16	0.001
57	P-14	37	J-13	J-14	6	130	-108	1.22	0.001
59	P-15	1,113	J-14	J-15	6	130	-108	1.22	0.001
99	P-37	511	J-5	J-33	8	130	209	1.33	0.001
72	P-22	592	J-20	J-21	6	130	126	1.43	0.002
106	P-41	75	J-36	J-20	6	130	126	1.43	0.002
68	P-20	25	J-18	J-19	6	130	133	1.5	0.002
105	P-40	420	J-19	J-36	6	130	133	1.5	0.002
61	P-16	582	J-15	J-16	6	130	-133	1.51	0.002
66	P-19	704	J-9	J-18	6	130	149	1.69	0.002
82	P-27	539	J-25	J-26	6	130	-158	1.8	0.002
63	P-17	119	J-16	J-17	6	130	-169	1.92	0.003
39	P-5	669	J-4	J-5	12	130	678	1.92	0.001
37	P-4	710	J-3	J-4	12	130	734	2.08	0.001
35	P-3	1,320	J-2	J-3	12	130	797	2.26	0.002
47	P-9	105	J-8	J-9	6	130	214	2.43	0.004
45	P-8	1,276	J-7	J-8	6	130	225	2.55	0.005
85	P-29	28	J-26	J-27	6	130	-234	2.66	0.005
41	P-6	649	J-5	J-6	8	130	469	2.99	0.004
43	P-7	300	J-6	J-7	8	130	469	2.99	0.004
114	P-46	279	J-17	J-39	8	130	-476	3.04	0.005
115	P-47	1,960	J-39	J-2	8	130	-497	3.17	0.005
86	P-30	611	J-27	J-17	6	130	-307	3.49	0.008
31	P-1	23	R-1	J-1	12	130	1,294	3.67	0.004
33	P-2	1,737	J-1	J-2	12	130	1,294	3.67	0.004

Amoruso Ranch Specific Plan
Junction Node Output

Notes	Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
	J-1	83	0	283.91	86.9
	J-2	92.27	0	276.81	79.8
	J-3	97.53	0	274.61	76.6
AR-67	J-4	102.65	56	273.6	74
	J-5	101.47	0	272.78	74.1
	J-6	98.71	0	269.86	74
AR-62	J-7	97.23	244	268.51	74.1
AR-74	J-8	92.21	11	262.55	73.7
	J-9	91.98	0	262.11	73.6
AR-73	J-10	91	18	261.82	74
AR-64	J-11	88.75	106	261.7	74.8
AR-72	J-12	86.65	18	262.3	76
AR-71	J-13	83.13	6	262.97	77.8
	J-14	82.08	0	263.01	78.3
AR-63	J-15	83.04	25	264.35	78.4
AR-75	J-16	83.87	36	265.37	78.5
	J-17	84.38	0	265.7	78.4
AR-77	J-18	96.26	16	260.58	71.1
	J-19	95	0	260.54	71.7
	J-20	93.77	0	259.68	71.8
AR-50	J-21	95.14	94	258.74	70.8
AR-65	J-22	96.62	63	258.69	70.1
	J-23	96.14	0	258.71	70.3
AR-36	J-24	94.33	41	258.74	71.1
AR-52	J-25	90.28	70	259.14	73.1
AR-51	J-26	87.59	76	260.46	74.8
AR-66	J-27	88.52	73	260.6	74.5
AR-61	J-28	87.45	25	261.7	75.4
AR-44	J-29	93.49	32	274.56	78.3
AR-54	J-30	90.53	16	274.55	79.6
AR-55	J-31	91	15	274.54	79.5
	J-32	89.13	0	274.54	80.2
AR-53	J-33	102	128	272.26	73.8
AR-38	J-34	102.99	81	272.19	73.2
	J-35	103.73	0	272.19	72.9
AR-76	J-36	94.98	7	259.8	71.3
AR-78	J-37	96.39	9	258.7	70.2
AR-79	J-38	94	7	258.78	71.4
AR-80	J-39	86.2	21	266.99	78.2

Amoruso Ranch Specific Plan Area

Recycled Water Master Plan

Appendix B

Figure 5: ARSP Recycled Water Pipe Network

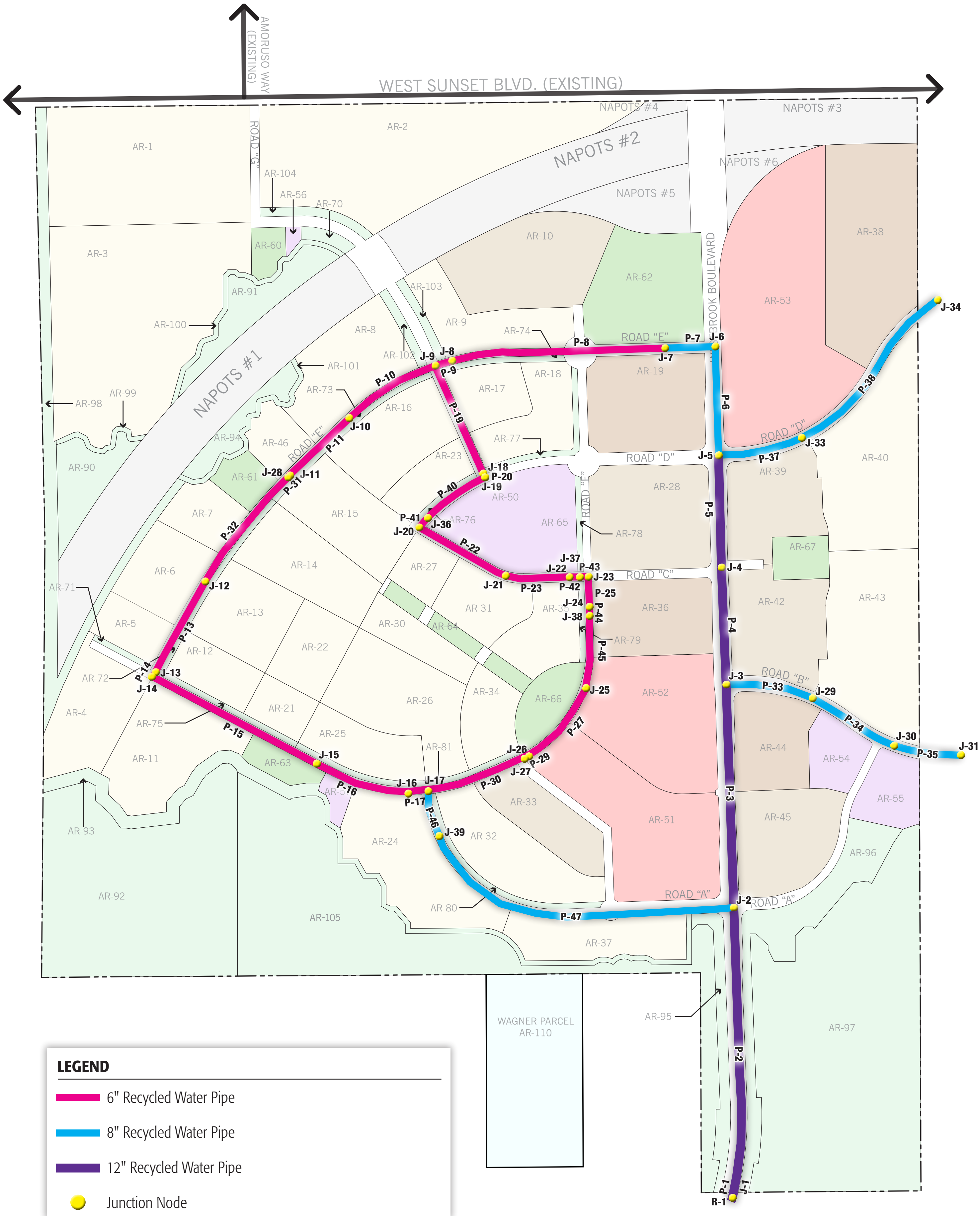


Figure 5: Amoruso Ranch *(Recycled Water Pipe Network)*

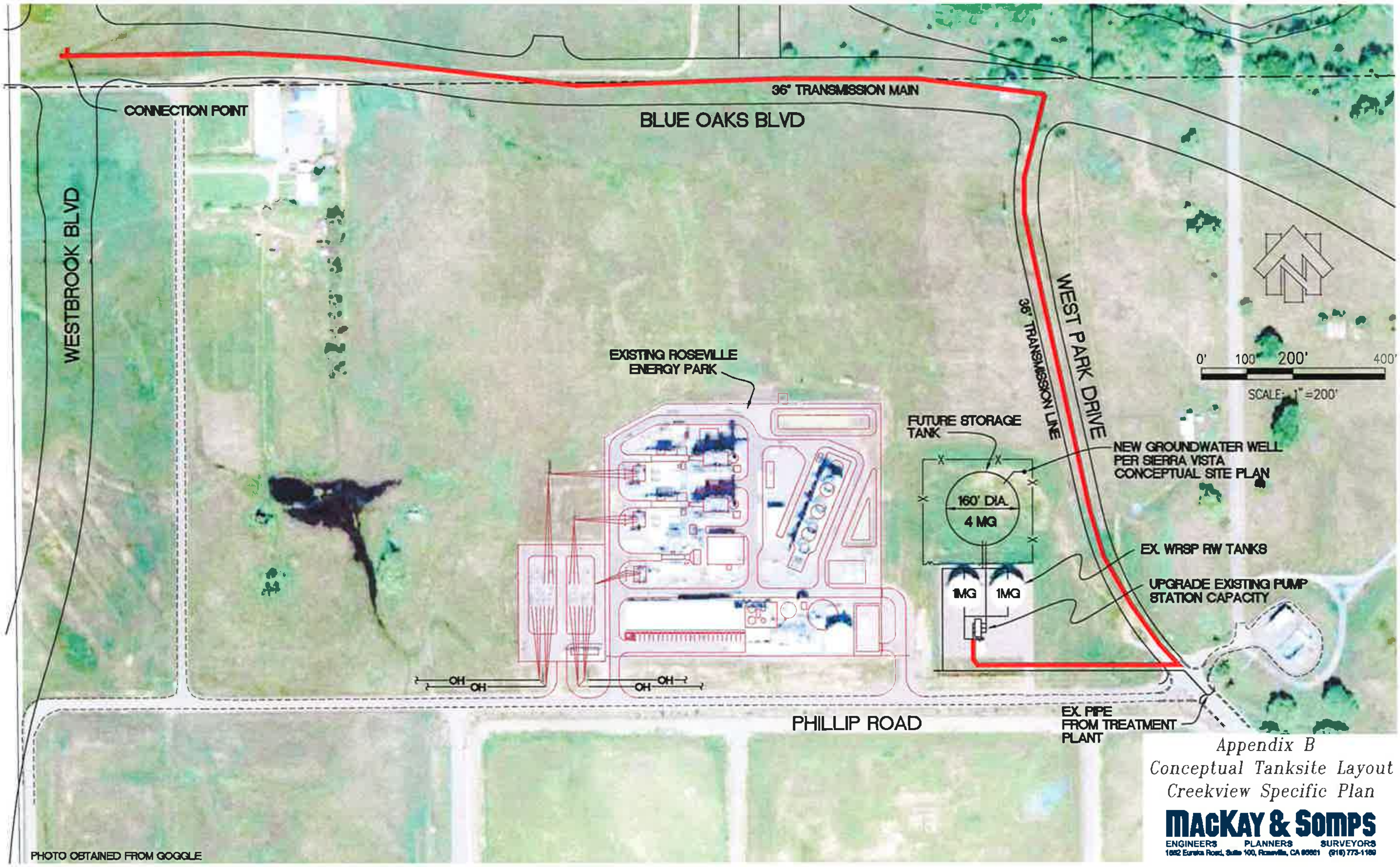
Kimley»Horn

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

1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1189

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

Kimley»Horn

2720 Gateway Oaks Drive, Suite 310
Sacramento, CA 95833
Phone: 916.858.5800

www.kimley-horn.com

APPENDIX D

Memorandum from Greg Young (Tully & Young)
to Placer County Water Agency
Subject: PCWA Demand Development Information, May 11, 2012

Tully & Young
Comprehensive Water Planning

Tully & Young, Inc.
3600 American River Drive, Suite 260
Sacramento, CA 95864

MEMORANDUM

To: Placer County Water Agency

From: Greg Young

Date: May 11, 2012

Subject: PCWA demand development information

The purpose of this memo is to document the following information related to the derivation of PCWA water demands.

- Present a comparison of the City of Lincoln demand factors as used in the City's 2050 General Plan EIR to those recently included in the City's 2010 UWMP and those used by PCWA in its 2010 UWMP for similar retail treated water customers.
- Provide instructive explanation of the Excel workbook used to derive the PCWA water demands that were included in PCWA's 2010 UWMP (accompanied by an electronic copy of the Excel workbook for use in modified scenario analysis).
- Provide a comparison of estimated build-out demand values from the 2006 Integrated Water Resources Plan (IWRP) and the 2010 UWMP, accompanied by explanations of the differences.
- Summarize discussions with the City of Rocklin regarding different future land-use conditions than those included in the 2006 IWRP (in Appendix F, Scenario 2b). This item is intended to specifically address Rocklin's downtown plan, and how proposed denser development will affect water demands.

Each of these is discussed below under separate headings.

1 - Comparison of City of Lincoln Demand Factors

During development of the 2006 Integrated Water Resource Plan, PCWA was unable to obtain from the City of Lincoln water demand factors that PCWA believed appropriately reflected the City's actual and projected use. Our understanding is that the City was in the midst of developing its 2050 General Plan and performing the analysis necessary for the supporting EIR at that time, such that they were not able to provide adequate information to PCWA in a timely manner.

Since that time, the City has prepared and adopted its 2010 UWMP, which includes water demand factors developed based on a recent City meter study (see Appendix B-5 of the City's 2010 UWMP). Notably, these demand factors are lower than factors used for the 2050 General Plan. Though the UWMP only provides demand estimates to 2035, while the General Plan is an estimate at a build-out population, comparisons and contrasts can be made.

Table 1 compares the demand factors used to calculate the build-out water demand for the 2050 General Plan and the factors used to estimate the 2035 demand as presented in the 2010 UWMP. The City is also using the 2010 UWMP demand factors as it moves forward with other planning documents. For comparison, the PCWA demand factors for PCWA's retail customers as used in the 2010 PCWA UWMP for Lower Zone 1 is also provided in Table 1.

Table 1 – Comparison of Water Demand Factors

	Lincoln			PCWA Retail	
Land Use Type	2050 GP EIR (2008)	2010 UWMP (w/ loss factor)		2010 UWMP (w/ loss factor)	
	(Acre-feet/DU or acre)				
	All	Existing	Future	Existing	Future
Country Estates	1.22	0.94	0.85	1.51	0.92
Low Density	0.61	0.51	0.49	0.72	0.53
Medium Density	0.52	0.32	0.29	0.55	0.35
High Density	0.29	0.24	0.22	0.38	0.20
Industrial/Office	2.8	3.11	2.78	2.71	2.39
Commercial	2.8	3.11	2.78	2.71	2.39
Public	5.82	3.44	3.11	3.50	3.08

In all circumstances, except Commercial, Industrial, and Office classifications, the new water demand factors are lower than those used to estimate the General Plan's build-out water demand. In the General Plan, the projected total demand for an estimated population of about 131,500 was about 53,000 acre-feet annually (see Table 5, Appendix F, City of Lincoln General Plan Update EIR). For comparison, the PCWA 2010 UWMP as adopted in June 2011 assumed a build-out demand from Lincoln equal to that in the Village 7 SB 610 Water Supply Assessment (adopted in 2009), which derived its information from the 2050 General Plan EIR. The PCWA UWMP did not attempt to define the City's demands using land-use data, but rather relied upon existing City published and adopted projections.

Using this information and data available in the Lincoln 2010 UWMP, the following points are noted:

- Based on the build-out demand and population from the General Plan, the estimated gallons per capita per day (gpcd) is about 360 gpcd. In contrast, the UWMP's baseline gpcd is shown as 246 gpcd, which is based on actual delivery records and population information. The 2020 target is noted as 197 gpcd. Though the two estimates are at different points in time, a comparative analysis could use the 2020 target gpcd and the build-out population to derive an estimated build-out water demand. Though this demand may be inaccurate, since it is an oversimplified calculation, it demonstrates that the future water demands from the City for PCWA, NID, groundwater and recycled water may not be as high as predicted for the population estimated by the General Plan. The distribution of supplies among PCWA, NID, groundwater and recycled water cannot be derived from this estimate, though. On a conservative basis, PCWA could anticipate all the demand is placed on its supplies. Or, all but about 3,300 acre-feet of NID water is required from PCWA. This assumption would translate to PCWA supplying between 26,000 and 30,000 acre-feet.
    - 131,500 people x 197 gpcd = 30,000 acre-feet (approx.)

- This estimate is further supported by noting that the estimated 2010 population is around 40,000, with a water delivery of about 9,200 acre-feet (City wells and treated surface water delivered by PCWA). For comparison, 2007 through 2009 averaged 10,300 acre-feet. If the population were to triple (approximately 120,000), which is nearing the build-out population, the total deliveries might be expected to also triple. Tripling the 2007 through 2009 average would predict about 31,000 acre-feet.

- The meter study performed for the UWMP assessed data from hundreds of connections for different residential dwelling types. This information demonstrated a lower actual use than was assumed as the General Plan demand factors, even when accounting for system losses. The new factors are likely more representative of actual and future use. Thus, it would be feasible for PCWA to reflect these new values in future updates to the UWMP, which may result in a lower build-out demand estimate for the City.

- The UWMP predicts a 2035 water demand of about 15,500 acre-feet. To meet this demand, an estimated 10,316 acre-feet are anticipated from PCWA (along with 3,286 acre-feet from NID, 1,556 acre-feet of groundwater, and a minor amount of recycled water).

Whether the City may demand the entire 34,000 acre-feet projected in the 2050 General Plan EIR and subsequently in the PCWA UWMP sometime in the future or something less, as could be extrapolated from the City's estimated 2035 demand in its 2010 UWMP, is a matter for additional analysis and dialogue between PCWA and the City. Since the

City's only projected demand at build-out exists in the 2050 General Plan EIR, PCWA should continue to conservatively use the published value until an alternative value is officially adopted by the City. Table 2 provides a comparison of different values from the City's UWMP, the General Plan and PCWA's UWMP. Since the Lincoln UWMP was adopted after the PCWA UWMP, the data for 2015 through 2035 in PCWA's plan reflected the Village 7 SB 610 WSA. The PCWA UMWP could be updated to reflect the recently adopted values up to 2035.

Table 2 – Comparison of Lincoln and PCWA adopted values

	2009	2015	2020	2025	2030	2035	2040	BO
Lincoln UWMP (adopted July 12, 2011)	7,724	8,500	8,695	9,176	9,706	10,316	n/a	n/a
Lincoln General Plan (adopted March 2008)	—	—	—	—	—	—	—	34,000
PCWA UWMP (adopted June 16, 2011	7,724	15,205	19,667	24,129	28,592	30,395	32,197	34,000

The 2010 PCWA UWMP's Table 4-8 could be modified to reflect the more recently adopted Lincoln values. A potential revised table through 2035 is presented below.

Table 3 – Potential Revised 2010 UWMP Table 4-8

(NID water treated by PCWA and delivered to Lincoln is shown separately. Table 4-8 shows the values combined)

(Values in AF/year)	Current	2015	2020	2025	2030	2035
City of Lincoln (PCWA)	7,724	8,500	8,695	9,167	9,706	10,316
City of Lincoln (NID)	1,595	1,395	1,541	2,059	2,630	3,286
Cal-Am Water Company	1,010	985	960	936	912	912
Others	334	326	317	309	301	301
Total	10,663	11,205	11,513	12,471	13,549	14,815

2 - PCWA Demand Calculation Workbook

The calculations and methods for understanding and estimating the Placer County Water Agency (PCWA) water demands are included within one Excel file. The primary Excel workbook includes several unique worksheets as discussed in the following sections. This information is intended to help PCWA's Engineering Department use this Excel workbook to perform varied water demand analyses as they investigate various current and future issues and opportunities affecting PCWA's water management.

Calculations in the Demand Worksheet

The demand worksheets created for the 2010 UWMP contain many interconnecting formulas. This was due to the complex nature of the demands in the PCWA system and the information used to simulate existing use and project future use. Separate calculations were done for each of the demand areas with the majority of the work revolving around the upper and lower Zone 1 service areas, with lower Zone 1 also including the demands of Zone 2 and Zone 5.

The primary table for each zone is found in the sheets titled "Zone # - working demand" with individual tables for Zones 1, 3, and 4. Each of these tables is made up of a number of sections as described in worksheet "Zone 1 – template" which discusses each section of the table. These tables are split into three main column categories: Units, Demand Factors, and Water Demands, where Units is the number of dwelling units or acres of a land classification and Demand Factors are the unit water demand of each land classification over time. Each of these main columns has sub columns for year and one row each for existing and future. Each of the boxes of "Units" is multiplied by its "Demand Factor" to calculate its "Water Demand". The water demands are then totaled to get water demand sub-totals for each demand category (treated retail, raw/untreated retail, treated wholesale, and raw/untreated wholesale) and then summed for each zone's total.

Other tables contribute data to the "working demand" tables, as discussed in the paragraphs that follow. There are essentially 4 main data: existing dwelling units (or acres), existing demand factors, future dwelling units (or acres), and corresponding future demand factors. While there are values for each year, "existing dwelling units" will remain constant while the others will be subject to change over time.

Existing units demand factors will be reduced due to increased efficiency in existing customer water use through mechanisms such as rebate programs for appliances and fixtures, installation of irrigation meters, and redevelopment such as remodels using fixtures in compliance with new plumbing codes. Future dwelling units will increase over time to represent the number of new units at a given future point in time. Future units demand factors will be less than existing demand factors due to new state mandates (e.g. MWELO and the Cal-Green code) and a shift toward higher density developments, which result in fewer square feet available per lot for landscaping).

Zone 1 Demand Development

Zone 1 Units Sheet

The "existing dwelling units" data is derived from the "build out" conditions estimated under Scenario 2b in Appendix F of the 2006 Integrated Water Resources Plan (IWRP). In the demand tables, the "existing dwelling units" are either noted where they are from or are referenced to another worksheet in the Excel file. For Zone 1, the values come from the worksheet titled "Zone 1 Units" with the top section representing the build out values, which are subsequently subdivided in each of the worksheet's following tables. The estimated number of high-density units is derived from the multiunit count from the 2009 sales report and related to the build out quantities from Appendix F. Rural residential and non-residential unit counts are derived from an estimation of area build out completeness on the Appendix F table. For medium density and low density, the existing dwelling unit count is taken from the 2009 Sales Report with rural residential units subtracted. This number is then distributed over an estimation of a ratio of existing dwelling unit types for the upper and lower zones. The estimated distribution of existing dwelling counts is summarized in tables at the bottom of the worksheet.

Future dwelling unit counts are derived for each subsequent 5 year increment by either: 1) applying a growth rate to the existing number of unit for that land classification, or 2) distributing the anticipated total units across time. The first method was applied in the majority of cases where the growth values were believed to be overly optimistic, resulting in too many new dwelling units and a rate of growth that exceeded recent historic rates. As explained later in this section, changing a value on the main zone demand worksheet can vary the rate of growth.

All zones Existing df Sheet

The demand factors for the existing dwelling units are presented in the sheet titled "All zones existing df". The existing factors for the residential dwelling units are from an updated Appendix F table data provided by T. Firenzi in December 2010. The non-residential demand factors reflect the original Appendix F tables. The existing demand factors are reduced to reflect anticipated conservation. These reductions are applied for the 2020 and 2030 values. Values for years ending in 5 are interpolated linearly on the main demand worksheet for each zone. These two 10-year increments were selected as markers to account for on-going conservation activities that will reduce existing customer demand factors. With on-going replacement of fixtures and landscapes over time, these 10-year blocks adequately allow capture of a change such as a further decrease in existing customer demands of 5% from 2020 to 2030.

Z1 future df

The future demand factors for Zone 1 are developed for each demand category on the worksheet titled "Z1 future df". Demand factors are calculated in two parts. First the average indoor demand is gathered from meter data presented at the bottom of the page. The average winter demand is used as the existing indoor demand. This is reduced by ten percent to represent the future indoor demand with new mandates such as the Cal-Green code on indoor water use. Outdoor future demand factors are estimated using estimated lot size for the various land classifications and the allowances under the Model Water Efficient Landscape Ordinance (MWELO). The indoor and outdoor demands are then combined to produce the future dwelling unit demand factors used in the main water demand worksheet.

Resulting Zone 1 Demand

The demand factors and unit counts come together on the worksheet titled " Zone 1 – working demand". The count of future dwelling units for each land classification increases across years by either the percentage in the yellow box at the top of the page or at a linear growth rate, if the unit count would exceed the Appendix F table build out count. The growth method used is indicated in the "Notes:" column on the right of the table. The loss factors are the same as used in the 2008 UWMP update. Non-treated retail demands are addressed at the bottom of the table with stated demands. The exception is Commercial Ag from Zone 5. This demand is estimated to decrease as irrigated agricultural lands give way to increased development west of Lincoln.

Zone 3

Demands for Zone 3 are presented in the worksheet titled "Zone 3 – working demand". The existing dwelling unit numbers are derived from the 2009 Sales Report. Future dwelling units reflect anticipated growth, based on an analysis of historic growth in this Zone. The box in yellow at the top of the page allows the growth rate to be adjusted. The current growth rate is from 15 years of connection count data. Existing demand factors come from the "All zones existing df" page with the same background assumptions as discussed for Zone 1. Future demand factors are estimated to be ten percent more efficient than the 2030 reduced existing demand factor [Note: demand factors are much lower for Zone 3 than even Upper Zone 1 due to very limited landscaping demands and lower ETo rates at these higher elevations. Non-revenue water uses (e.g. system losses) uses the same value as the 2008 UWMP. Sales of treated and untreated water to other entities in Zone 3 is included after the retail treated water demand estimates.

Zone 4

Demands for Zone 4 are presented in the worksheet titled "Zone 4 – working demand". The existing dwelling unit numbers come from a February 23, 2011 email detailing the number of active connections. The current growth rate is used to meet the project dwelling unit number assuming a build out by 2030. Existing demand factors come from the "All zones existing df" page. The demand factors were calculated from historic pumping records and connection data from the February email. Future demand factors are assumed to be five percent more efficient than the 2030 reduced existing demand factor due to the limited reduction potential from the developments already modern homes. Non-revenue water use comes from the 2008 UWMP numbers. Commercial water demand estimates were calculated form the 2009 Sales Report.

Scenario Analysis

To evaluate future water demands under different assumptions than used for the 2010 UWMP, several options exist.

The first step is to click "save as" and save an additional copy with a different title so as to prevent loss of the original calculations.

Direct Changes to "working demand" Worksheets

Any changes can be made in each individual zone working demand worksheet, but will require manually changing individual numbers and will not propagate through all demand uses. This is useful for changing the build out number of a specific demand or future demand of wholesale customers.

For example, there is a large difference between cells O11 and P11 in the Zone 1 working demand table. These represent the 2040 and build out numbers of one of the high-density units. The growth rate required for build out to occur by 2045 greatly exceeds what would be expected based on the number of existing units. If a specific unit project is expected to occur in 2025 and add 1,000 of these units, then this would be most easily changed directly on the demand worksheet in row 11 manually.

As another example, assume more accurate information of future demands is received from a wholesale customer such as Lincoln. This would be changed directly in that customer's row in the water demand rows (rows Y to AF) toward the bottom of each of the working demand spreadsheets.

Growth rates

The top of each of the working demand spreadsheets has a yellow box used to control the growth rate of the land classifications for those that do not exceed the Appendix F build out count prior to 2045. For land classifications where the growth rate would exceed the Appendix F count, values are plotted linearly to prevent exceeding stated build out values.

Growth rates in Zone 3 only uses percent growth, since no build out estimates were available from Appendix F. If a larger growth rate is expected due to a planned industrial installation and resulting area growth then changing the yellow highlighted number at the top of the page will change the whole table. Alternatively, a particular cell in the spreadsheet can be manually changed to reflect an anticipated growth.

Existing Demand Factors

The existing water demand factors can be changed either within the working demand worksheet or in the "All zones existing df" worksheet. On the existing df sheet, the demands are expected to reduce between five and ten percent each decade due to on-going conservation. Numbers in between the decade estimations are interpolated on the demand tables. By changing the estimated conservation for any particular land classification within this worksheet, the demand factors will change in the working demand worksheet as well.

For example, if a specific housing type is expected to not achieve the conservation anticipated, adjusting the value do a different percentage would change all calculations using that demand factor on the demand worksheet. This is useful, as conservation goals for a specific housing type can be varied to help decide where rebate programs or conservation efforts should be focused.

Integration of more accurate housing count numbers

Due to the limited data on customer housing type, many estimates were used to replicate the existing demands in the working demand spreadsheets. Though water demand estimates mimicked the actual demands, it is not certain that the distribution of the dwelling unit counts across the various densities accurately reflects existing conditions. If a survey was done and found the exact number of housing units of a specific class in Zone 1 this number could be integrated into the existing unit number calculations.

The first and most simple way to integrate the information would be to modify values in the "existing" row for each housing density on the given working demand worksheet. Since existing housing unit counts were tied to an existing connection total, the second and more accurate method would be to adjust the distributions in the "Zone 1 Units" table.

If the DU count involves one of the 1 acre or larger lot types then the change would be made in the "Rural Residential and non residential" section of the worksheet. Changing the existing numbers on rows 83 to 86 for the specific areas listed in row 52 would populate though all of the tables and present an updated demand estimate.

Integrate more accurate ratio of units in upper versus lower Zone 1

If a more accurate number of 1 to 10 DU per acre units or total units is calculated for upper and lower Zone 1, then the ratio of currently built units could shift. Changing this ratio in row 139, cells E and F shifts the number of units in each of the upper and lower portions of Zone 1. Simply changing this ratio will maintain all other calculations in the worksheets, as well as keep the actual unit connection count.

3 – Comparison of IWRP and UWMP Demand Projections

The August 2006 Integrated Water Resources Plan (IWRP) provided a detailed analysis of future demands throughout Placer County, including a subset of demands that would likely be placed on PCWA supplies. Summarized in a few different tables, these demand projections have been used as initial values in analyses for the American River Water Rights Extension EIR being undertaken by Entrix. With the adoption of the 2010 UWMP, Entrix published a table for internal use that compared the demand projections of the IWRP with those in the UWMP (see Table 4). An explanation of the differences in the demands was requested at a PCWA team meeting on January 19, 2012.

Table 4 – IWRP and UWMP demand comparison table (prepared by Julie Smith, Entrix, June 2011)

ZONE 1 ONLY	DEMAND (Original Tables) Normal (af/yr)	DEMAND (Original Tables) Single Driest (af/yr)	DEMAND (Admin Draft UWMP) Normal (af/yr)	DEMAND (Admin Draft UWMP) Single Driest (af/yr)[1]
PCWA Retail Customers (Treated)				
Retail Treated			69,701	69,701
Auburn	12,188	12,188		
Rocklin	27,841	27,841		
Loomis/Granite Bay	16,284	16,284		
West Placer	46,852	46,852		
Less: Treated Water Conservation Program	(5,000)	(10,000)		
Subtotal	**98,165**	**93,165**	**69,701**	**69,701**
PCWA Retail Customers (Raw)				
Retail Raw			56,295	56,295
Raw Water	75,000	75,000		
Less: Raw Water Shortage Program	–	(43,592)		
Subtotal	**75,000**	**31,408**	**56,295**	**56,295**
PCWA Wholesale Customers (Treated)				
Wholesale Treated[2]			35,213	35,213
Lincoln[3, 4]	40,943	42,593		
Subtotal	**40,943**	**42,593**	**35,213**	**35,213**
PCWA Wholesale Customers (Raw)				
Roseville[5]	26,095	27,305	30,000	30,000
SJWD	16,415	16,415	21,000	21,000
SJWD to City of Roseville	–	–	4,000	4,000
SSWD[6]	12,168	0	29,000	0
Regional Water Supply Buffer[7]	–	–	10,000	10,000
Subtotal	**54,678**	**43,720**	**94,000**	**65,000**
Total	**268,786**	**210,886**	**255,209**	**226,209**
	Source: Table 9-5 through 9-8 IWRP (Brown and Caldwell, August 2006)		Source: Table 4-10, Admin Draft UWMP (Tully and Young, May 2011)	

Notes:

[1] It is assumed that demands presented in Table 4-10 of the Admin Draft UWMP would remain the same in the single driest year.

[2] UWMP - Wholesale Treated: City of Lincoln, Cal-Am Water Company, and Others (Table 4-8).

[3] Original Tables - Wholesale Treated: City of Lincoln.

[4] Original Tables - City of Lincoln demand for MFP water increases by 1,650 af/yr in dry years due to a corresponding decrease in water deliveries from NID.

[5] Roseville: The City of Roseville demand for MFP water increases by 1,210 af/yr in dry years due to a decrease in CVP deliveries. The MFP water only partially compensates for the loss of CVP water.

[6] SSWD: If not needed to serve PCWA retail and wholesale customers, up to 29,000 af/yr of MFP water may be delivered to SSWD in a wet year. In a dry year, PCWA is contractually restricted from supplying water to SSWD.

[7] 10,000 af/yr regional water supply buffer beginning in 2040 (UWMP Section 4.1.6).

In order to understand the differences, a few points first need to be noted about the values represented in Table 4. Values in the table under the "Demand (original table)" columns were apparently obtained from Tables 9-5 through 9-8 of the IWRP. However, some of the values in the IWRP tables incorrectly reflected values in the IWRP's Appendix F Scenario 2b summary table, while others in Table 4 were inexplicitly modified from the IWRP tables.

Table 5 provides a comparison of (1) the Entrix displayed values in Table 4, (2) the original values from the IWRP, (3) the values that should have been presented in the IWRP (from the Appendix F summary table), and (4) the 2010 UWMP values (as modified to reflect both the Rocklin General Plan, the distribution of total Zone 1 demand among IWRP subareas, and revisions to conservation projections in 2030 for existing customers.

Table 5 – Comparison of IWRP and UWMP values

	Entrix Table	IWRP Table 9-5 to 9-7	IWRP App. F-Scenario 2b Summary Table (treated)	2010 UWMP
Treated Retail				
PCWA	98,165	108,438	96,005	74,508
Auburn	12,188	12,188	11,432	10,580
Rocklin	27,841	27,841	27,821	23,287
Loomis/Granite Bay	16,284	16,284	13,179	12,491
West Placer	46,852	52,125	43,573	28,149
(Entrix conservation)	-5,000			
Raw Retail				
Raw Customers	75,000	75,000	--	57,994
Zone 1	--	60,000	--	56,295
Zone 5	--	15,000	--	1,699
Wholesale Treated				
Lincoln	40,943	44,243	31,584	34,000
Others	--	--	--	4,005
Wholesale Raw				
Roseville	26,095	26,095	58,095	30,000
SJWD	16,415	16,415	16,411	21,000
SJWD to roseville	--	--	--	4,000
SSWD	12,168	29,000	--	29,000
Water Supply Buffer	--	--	--	10,000
Total	268,786	299,191		264,508

Each of the unique entries and the variances is explained below:

Treated Retail

1. Entrix values for Auburn, Rocklin, and Loomis/Granite Bay match those of Table 9-5 of the IWRP. However, Table 9-5 appears to pull the Scenario 1 summary "total" demand instead of the Scenario 2b "treated" demand (the "total" includes groundwater pumping") for each of these areas. The correct values to have reflected in Table 9-5 are shown in the "App F" column in Table 5 above.

2. It is unclear where the Entrix table derived the West Placer value. Table 9-5 of the IWRP shows a different value. However, even the Table 9-5 value does not match any of the Appendix F summary scenarios for "treated" or "total" for this demand area. It is not clear where this value was obtained.

3. The values in the 2010 UWMP are derived by applying new future demand factors to each of the residential and non-residential unit counts (e.g. number of low density dwelling units and acres of commercial), and calculating a resulting demand. A non-revenue water factor was applied to the total estimated demand for each area to account for system losses and other unaccounted for water supplies. As a comparison of the differences in demand factors used for the Appendix F summary table and the UWMP, the medium-density (5.1 to 7 units per acre) value used in the IWRP was developed from existing customer data and assumed to hold constant at build-out. The UWMP assumed that existing customers will reduce their per-unit use due to on-going PCWA conservation efforts, new fixture and appliance standards and other drivers. All future homes will be built using new landscape ordinances and CalGreen building code requirements, further reducing unit demand factors from the conservation value of existing customers. This is illustrated by fact that the IWRP used a value of 400 gpd/DU (0.55 acre-feet/DU) in the Appendix F tables. The UWMP used a build-out demand factor for existing customers of 0.46 acre-feet/DU – approximately 18% less than existing due to conservation – and 0.39 acre-feet/DU for future homes. These factors alone account for the significant variance in the lower portions of Zone 1 (e.g Rocklin and West Placer) where significant new housing is expected.

4. Zone 1 raw water customers represent the "irrigation" customers receiving untreated canal deliveries for general use on the small rural residential acreages (e.g. 1 to 5 acres), which predominate the irrigation customers of Zone 1. Some commercial agriculture also exists in this category. The IWRP provides data for Zone 1 raw water customers in its Table 4-5 – with an average of 60,000 acre-feet for the period 1996 through 2004. The UWMP, calculating irrigation deliveries as the difference between water entering Zone 1 and the other retail and wholesale demands (measured), demonstrated an average of approximately 57,000. Inspecting the downward trend from the IWRP data and the UWMP extended data, the UWMP assumed the 2009 estimate of slightly over 56,000 acre-feet would be the long-term demand through build-out. This is only slightly less than the estimated 60,000 acre-feet assumed by the IWRP.

5. Zone 5 raw water demands represent the needs of commercial agriculture west of Lincoln. The IWRP includes values from 1996 through 2004, with the average being 12,800 acre-feet (although they assume 15,000 acre-feet as the "standard"). In contrast, the UWMP identifies an extended data set that averages 8,900, with

the latest year slightly over 11,000 acre-feet. However, this area is projected to convert from agriculture to housing as part of the westward expansion of Lincoln. The majority of the approximately 4,400 acres currently served with PCWA irrigation water in Zone 5 lie within the Lincoln Sphere of Influence adopted in the City's recent General Plan. As such, the demand for water is anticipated to only be required by about 600 acres of the original 4,400 acres served. Thus, the demand reduces to approximately 1,700 acre-feet. In contrast, the IWRP assumes a continuation of 15,000 acre-feet of demand (even though it also anticipates an increased demand by Lincoln, which essentially will be serving the same area).

6. Lincoln wholesale treated water demands in the UWMP reflect the anticipated demand by the City at its build-out population of 130,000. The City anticipates supplying its residence through a combination of supplies from PCWA, Nevada Irrigation District (NID), groundwater and recycled water. The 34,000 acre-feet represented supply from PCWA (see Lincoln's 2010 UWMP), reflects an estimated need as part of a supply portfolio meet an overall demand of 53,000 acre-feet. Though revised demand factors (as discussed previously in this memo) will lower the build-out demand noticeably, it will not drop below 34,000 acre-feet. Thus, the City still anticipates this demand. In contrast, the IWRP Table 9-5 reflects the "total" value pulled from the Appendix F summary table – a value that includes demands met with NID water, reclaimed water and groundwater. The "treated" value that is of interest to PCWA for Lincoln is 31,584 (the "treated" total minus the NID demand). The Entrix table used the IWRP Table 9-5 value and subtracted a currently supplied amount of 3,300 acre-feet of NID water, netting a value exactly 3,300 acre-feet less than the Table 9-5 value. Since the demand in Lincoln's service area that can be met with NID supplies is expected to increase beyond 3,300 acre-feet as the City grows (the current NID deliveries to Lincoln – provided through PCWA's treatment and delivery facilities – is about 1,600 acre-feet), the subtraction of only 3,300 acre-feet by Entrix appears inconsistent when compared to the Appendix F summary table's Lincoln NID demand value.

7. Both Table 9-5 of the IWRP and the subsequent Entrix table do not reflect other wholesale treated water demands served by PCWA. Cal-Am Water Company and a few homeowner associations currently receive about 1,000 acre-feet and 340 acre-feet, respectfully. According to Cal-Am's 2010 UWMP, PCWA wholesale treated supplies are expected to increase to approximately 3,700 acre-feet. Homeowner association demands may drop slightly. The PCWA UWMP reflects about 4,000 acre-feet of wholesale treated demands, in addition to those of Lincoln. The IWRP does not include this value.

8. Wholesale raw water supplied to the City of Roseville is represented in the UWMP as 30,000 acre-feet, which reflects the terms of the current agreement

between PCWA and the City (the contract caps the amount to 30,000 acre-feet as of July 1, 2024). This value is also reflected in the Roseville 2010 UWMP (see Table 4-1 of the Roseville UWMP). The IWRP Table 9-6 includes a value for "normal" conditions for Middle Fork demands. This value is derived from taking the total Roseville demand in Table 9-5 (65,970 acre-feet), subtracting the Appendix F recycled water supplies (7,875 acre-feet), and subtracting the Roseville CVP supply of 32,000 acre-feet assumed available in normal years. The resulting quantity of 26,095 is represented as the demand on PCWA's Middle Fork Project. This is similar to the 30,000 acre-foot contract cap, but is somewhat arbitrary, since it relies on the significant availability and use of recycled water to reduce MFP demands.

9. Wholesale raw water supplied to San Juan Water District (SJWD) is presented in the UWMP as a combination of 21,000 acre-feet to ultimately be used by SJWD and 4,000 acre-feet to be used by the City of Roseville. SJWD has a contract with PCWA for 25,000 acre-feet, of which it has subcontracted 4,000 acre-feet to serve an area of the City of Roseville. This 4,000 acre-feet is separate from the City of Roseville demands discussed under #8 above. The IWRP's Table 9-5 again uses the "total" supply from the Appendix F summary table, but it is the "treated" value from the Appendix F summary table that is of comparison. That value is 16,411 acre-feet (instead of the 16,415 listed in Table 9-5). Although demand factors used to derive the demands listed in the Appendix F Scenario 2b detailed tables are higher than those used in the UWMP, the UWMP uses the contracted quantity to represent the build-out condition. The SJWD 2010 UWMP describes the PCWA supply as 25,000 acre-feet currently available and continuing to be available to 2030 and beyond (see SJWD UWMP Table 4-9).

10. Wholesale raw water supplied to Sacramento Suburban Water District (SSWD) is listed in Table 9-5 of the IWRP as 29,000 acre-feet. This is consistent with the 2010 UWMP. The Entrix table lists the value as only 12,168, yet includes a footnote that the value could be 29,000 acre-feet. The minimum quantity to be used by SSWD under the contract is 12,000 acre-feet when associated unimpaired flows into Folsom Reservoir are above 1.6 maf (March through November). SSWD portrays the 29,000 acre-feet of PCWA water as 100% reliable and available during normal years (see Table 4-13 in SSWD 2010 UWMP).

11. The PCWA UWMP includes a "water supply buffer" entry to reflect the potential for additional demands that are not currently reflected in the land use plans analyzed in the IWRP (as reflected in the Appendix F Scenario 2b build-out quantities). This additional demand is characterized in the UWMP as providing a buffer to accommodate the fact that several of the land use plans used by the IWRP only extended to 2030. The water supply buffer is reflected in the UWMP as only becoming a need after 2040, which is beyond the required 20-year time

frame of the 2010 UWMP. As the UWMP is updated to reflect new land-use data from various land-use authorities, this value will likely be reflected as demand associated with one of the wholesale treated or retail treated customer areas. The IWRP did not contemplate this potential demand.

3.1 Zone 1 Water Demand by SubArea

Demand factors were based on a number of factors and resulted in unique values for each residential land-use category, with one set for Upper Zone 1 and another for Lower Zone 1. Tully & Young combined landscaping demand estimates with indoor demand and confirmed values with the 2009 sales report data. By separating the indoor and outdoor demand, the future demands for existing units and for yet-to-be-built units was estimated. Indoor demand in units yet-to-be-built will be reduced from existing values due to new plumbing requirements, while existing value will drop slightly over time due to natural attrition and replacement of fixtures and appliances. Outdoor demand follows the same reduction patter as indoor water use, with the state mandated Landscaping Ordinances driving lower demands in yet-to-be-built housing compared to existing housing.

Original water demands in the UWMP were developed to represent the Upper and Lower Zone 1 areas, inclusive, without regard for separate subareas. The "existing" demand representation in the UWMP was developed to match the 2009 sales report demand number, attempting to distribute 2009 single-family and multi-family account data across an array of residential land-use categories. Attempts were not made to discern how the total 2009 residential accounts were spread among the individual subareas used in the 2006 IWRP report.

However, to provide a comparison to subarea build-out demands in the 2006 IWRP, PCWA requested Tully & Young to subdivide the UWMP estimated build-out demand into the subareas used in the 2006 IWRP. Since the 2006 IWRP did not separate "existing" from "build-out" in the dwelling unit counts in Appendix F, an estimate of existing dwelling units within each subarea needed to be made. As a starting point, Tony Firenzi (PCWA) provided Tully & Young with estimated total accounts in each of the subareas. Using these values and further refining to best match the estimated existing demand for Zone 1 in the UMWP, a representative existing condition was developed. **Table 6** includes the existing "percent built" values used.

As a result of the distribution of existing accounts across the subareas and the multiple land-use classifications, the estimated existing demand is slightly different than that represented in the UWMP.

The resulting subarea existing and build-out demands are presented in **Table 7** and compared to the build-out demands of the IWRP.

Table 6 – Current Percent of Buildout[1]

Upper Zone 1	
City of Auburn	98%
City of Auburn (Airport)	32%
Auburn/Bowman CP	46%
Newcastle/Ophir	0%

Lower Zone 1	
Rocklin Area	
City of Rocklin	74%
City of Rocklin (Whitney Ranch)	60%
Sierra Community College	76%
Unincorporated Area - A	87%
Loomis Area	
Towm of Loomis	47%
Bickford Ranch Specific Plan	0%
Granit Bay - PCWA	98%
Horseshoe Bar/Penryn CP	63%
Unincorporated Area - B	0%
Unincorporated Area - C	23%
City of Roseville - PCWA	98%
Western Placer Area	
Sunset Industrial Area (Zone 1)	15%
Sunset Industrial Area (Zone 5)	0%
Dry Creek West (Placer Vineyards)	0%
Curry Creek CP	0%

[1] Data in Table from March 19, 2012 email from Tony Firenzi

Table 7 – Subarea Adjusted Existing and Build-out Demand Comparison Table

	Existing Demand	Buildout IWRP	UWMP with IWRP Land Use	UWMP with General Plan
City of Auburn	4,426	4,774	3,999	4,183
City of Auburn (Airport)	201	675	568	578
Auburn/Bowman CP	2,337	5,454	5,159	5,257
Newcastle/Ophir	0	528	563	563
Upper Zone 1(Auburn)	**6,964**	**11,431**	**10,289**	**10,580**
City of Rocklin	16,155	24,527	17,376	20,933
City of Rocklin (Whitney Ranch)	1,413	3,005	2,043	2,114
Sierra Community College	22	15	23	24
Unincorporated Area - A	216	274	199	216
Rocklin Total (Lower Zone 1 subtotal)	17,806	27,821	19,641	23,287
Towm of Loomis	1,336	2,826	2,930	3,014
Bickford Ranch Specific Plan	0	3,461	1,022	1,022
Granit Bay - PCWA	1,310	548	1,164	1,226
Horseshoe Bar/Penryn CP	2,469	2,711	3,337	3,465
Unincorporated Area - B	0	77	108	108
Unincorporated Area - C	708	2,491	2,890	2,929
City of Roseville - PCWA	796	1,065	677	727
Loomis (Lower Zone 1 subtotal)	6,619	13,179	12,129	12,491
Sunset Industrial Area (Zone 1)	1,412	11,255	8,017	8,086
Sunset Industrial Area (Zone 5)	0	6,042	4,615	4,615
Dry Creek West (Placer Vineyards)	0	13,262	8,657	8,657
Curry Creek CP	0	10,104	6,791	6,791
Wester Palcer (Lower Zone 1 subtotal)	1,412	40,663	28,080	28,149
Lower Zone 1	**25,838**	**81,663**	**59,850**	**63,928**
Total	32,802	93,094	70,139	74,508

4 – Summary of Discussions with City of Rocklin

On March 6, 2012, Tony Firenzi and Greg Young met with planning staff at the City of Rocklin to discuss land-use assumptions used in the 2006 IWRP and changes necessary to understand the water supply impact of the new General Plan's land-use assumptions. As noted during the meeting, the representation of the number of residential and non-residential land-uses in the 2006 IWRP was not based any matching detailed data from the City. Likely, the dwelling unit counts and non-residential acreages included in Appendix F of the 2006 IWRP were derived from the IWRP authors estimating mixes within broadly established land-use planning zones available at the time from the City. The General Plan, which is still under development, includes a more detailed representation of dwelling unit counts and non-residential land-use acreages. Using this updated information, a more accurate estimate of future water demand can be made and compared to the 2006 IWRP estimated demand. Using the estimated distribution of existing land use conditions presented in **Table 6** and the resulting subarea UWMP demand shown in **Table 7**, a comparison can be made between four values: (1) estimated existing demands, (2) the build-out demand estimated by 2006 IWRP, (3) the estimated build-out demand using the 2006 IWRP land use and the 2010 UWMP demand factors, and (4) the estimated build-out demand using the General Plan land use and the 2010 UWMP demand factors. The results are shown in **Table 8**.

Table 8 – Rocklin Demand Comparison

City of Rocklin	Existing Demand	Buildout IWRP*	UWMP with IWRP Land Use	UWMP with General Plan
High density 20.1+ DU/Ac.	0	0	0	0
High density 15.1-20 DU/Ac.	1,933	1,101	844	2,045
High density 10.1-15 DU/Ac.	665	831	622	691
Medium density 7.1-10 DU/Ac.	7,342	11,569	8,615	6,598
Medium density 5.1-7 DU/Ac.	4	7	5	5
Low density 3.1-5 DU/Ac.	9	13	10	11
Low density 1.1-3 DU/Ac.	93	2,161	2,165	4,197
Low density 0.1-1 DU/Ac	13	9	14	14
Rural Residential 1.1-2.3 Ac./DU	1	1	1	1
Rural Residential 2.31-4.6 Ac./DU	6	5	6	7
Rural Residential 4.61-10 Ac.DU	2	1	2	2
Professional Office	400	262	187	510
Commercial	1,652	1735	1,443	2,105
Industrial	1,091	1507	1,297	1,391
Public	1,086	581	510	1,385
Total	14,296	*	15,721	18,963
Total with Loss	**16,155**	**19,783**	**17,376**	**20,933**

* includes loss

APPENDIX E

Memorandum from Brian Rickards and Tony Firenzi (PCWA)
to Michele Kingsbury (Placer County) and Kelye McKinney (City of Roseville),
Subject: Sunset Industrial Area Water Allocation, November 25, 2015

MEMORANDUM

TO: Michele Kingsbury, Placer County

Kelye McKinney, City of Roseville

FROM: Brian Rickards

Tony Firenzi

DATE: November 25, 2015

RE: Sunset Industrial Area Water Allocation

CC: Brian Martin, Consultant to PCWA

Greg Young, Tully & Young

1.0 Introduction

The purpose of this memorandum is to detail the assessment of availability and sufficiency of potable water to serve proposed water demands from future growth anticipated adjacent to and within the Placer County Sunset Industrial Area ("SIA"). Placer County Water Agency ("PCWA"), as part of its retail/wholesale water services within Placer County ("County"), anticipates serving potable water to proposed development projects in this area. More specifically, these projects include the Sunset Industrial Area Master Plan ("SIAMP"), the Placer Ranch Specific Plan ("PRSP") and the Amoruso Ranch Specific Plan ("ARSP"). The SIAMP is being developed by the County while ARSP is under review by the City of Roseville ("City").

Analysis relies upon information available from, but not limited to, PCWA's 2010 Urban Water Management Plan ("UWMP") as adopted on June 16, 2011, the PCWA Integrated Water Resources Plan (IWRP)-finalized in August 2006, a Technical Memorandum from Tully & Young-dated May 11, 2012 and information provided from others as noted herein. This memorandum has also been prepared to support potable water supply infrastructure planning, PCWA's 2015 UWMP, and subsequent Water Supply Assessments for County and City land development projects within the SIA.

1.1 Applicability of Water Code 10910

Section 10912 of the California Water Code ("Water Code") requires the preparation and approval of a Water Supply Assessment ("WSA") for certain development projects. Triggers requiring the preparation of a WSA include residential developments of more than 500 dwelling units, shopping centers or business establishments employing more than 1,000 persons or having more than 500,000 square feet of floor space, commercial office buildings employing more than 1,000 persons or having more than 250,000 square feet of floor space and projects that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project. As detailed below, the water demand of each of these projects exceeds these limits and has been contemplated within PCWA's UWMP, which should fulfill the requirements of the Water Code.

1.2 Proposed Projects' Descriptions

The Sunset Industrial Area ("SIA") is an approximate 8,100-acre area in unincorporated western Placer County. The SIA is bounded to the North by the City of Lincoln, to the East by Highway 65 and the City of Rocklin, to the South by the City of Roseville, and to the west by South Dowd Road and unincorporated Placer County, east of Fiddyment Road. **Figure 1-1** presents the SIA relative to these boundaries.

The 8,100-acre SIA can be split up into 2 subareas for purposes of this report.

- **Sunset Industrial Area Master Plan (SIAMP)**-Currently under master plan development by Placer County, this area consists of approximately 700 acres of existing underdeveloped industrial area. While the County is looking at updating its Sunset Industrial Area Plan, such an update has not been formally approved. Therefore, until such time as the County Board approves a new land use plan and/or zoning designation(s) for the area, the 1997 Land Use Plan is the current plan and is used as the basis for this technical memorandum. With a few exceptions, the SIAMP area is assumed to be developed according to the 1997 Land Use Plan to provide a conservative estimate of buildout water demands. These exceptions are parcels north of Athens Road and the landfill.

  Parcels north of Athens Road have a concentration of wetlands and therefore, are likely to have a higher cost to develop than other parcels and some have been set aside for known mitigation. As shown in **Figure 1-1**, it is assumed that approximately 1,746 acres will not be developed due to constraints and are not included in this water demand estimate.

  The SIAMP includes approximately 935 acres owned by the Western Regional Sanitary LA. Per an internal memo dated July 9, 2015, Western Placer Waste Management Authority (WPWMA) staff is proceeding with future land use planning of their owned parcels. The proposed land use would convert one parcel owned by WPWMA from Industrial to a “landfill module.” This 1997 Land Use Plan is attached herein.

- **Placer Ranch Specific Plan (PRSP)-**The PRSP is a 2,213 acre property located within a portion of the southwest portion of the SIA, south of the SIAMP and immediately north of the City of Roseville boundary. Until recently, a project was proposed in the City of Roseville. That project was formally withdrawn September 22, 2015. The proposed land use plan included approximately 5,400 residential units in a mix of low, medium and high densities. The land use plan also included approximately 9 million square feet of non-residential uses, including commercial, office and industrial uses, elementary and middle school sites, parks and open space. The project hoped to include a 300-acre site to serve as a satellite campus of California State University, Sacramento. Given the project’s location next to existing and planned infrastructure (including three miles of proposed Placer Parkway alignment) and the importance of attracting a California State University, it is likely that development will occur in the future.

The 8,100-acre boundary of the SIA is included within PCWA’s 2010 UWMP. The 2010 UWMP included estimated potable water demands for the SIA of 12,701 acre feet per year (“AFY”) as outlined in a May 11, 2012 technical memo prepared by the consulting firm of Tully & Young. This technical memo is attached herein.

The City of Roseville is processing an annexation request for the ARSP. The ARSP is located within unincorporated Placer County immediately west of the SIA and the PRSP. A brief description of the ARSP follows.

- **Amoruso Ranch Specific Plan (ARSP) -** The ARSP is a 674 acre property located on the south side of West Sunset Boulevard approximately 1.5 miles west of Fiddyment Road. The proposed land use plan includes 2,827 residential units in a mix of low, medium and high density. The land use plan also includes two commercial parcels totaling 55.5 acres, a 7-acre elementary school site, six neighborhood parks and a 6.9-acre fire station/public facilities site. Approximately 140 acres of the site will be set aside as open space preserve.

The County is working on an update to the SIAMP as part of an Opportunities and Constraints Report supporting economic development in western Placer County. PCWA will continue as retail water supplier for the SIAMP area. The City of Roseville is requesting a treated wholesale water supply from PCWA for providing water to the ARSP, and citywide for reliability. This memorandum documents an evaluation of the PCWA 2010 UWMP to document that the 12,701 AFY of water assumed for use within the SIA is sufficient to serve all areas listed above.

The ARSP is not within the area analyzed in the 2010 UWMP; however, this analysis evaluates if the demand of this project can be included within the assumed SIA demand based on latest land use planning and unit demand factors.

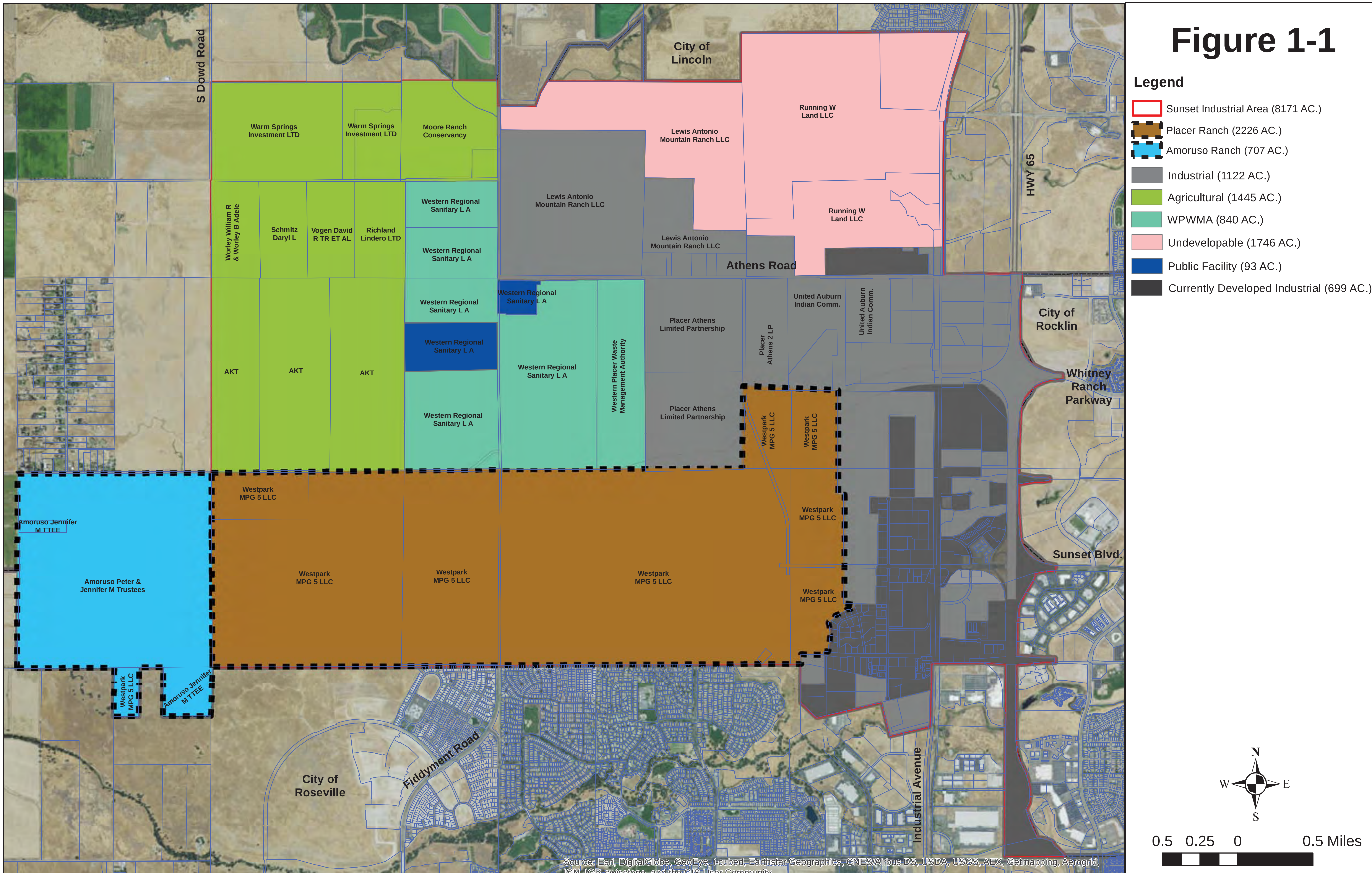

Legend
Sunset Industrial Area (8171 AC.)
Placer Ranch (2226 AC.)
Amoruso Ranch (707 AC.)
Industrial (1122 AC.)
Agricultural (1445 AC.)
WPWMA (840 AC.)
Undevelopable (1746 AC.)
Public Facility (93 AC.)
Currently Developed Industrial (699 AC.)
S Dowd Road
City of Lincoln
Warm Springs Investment LTD
Warm Springs Investment LTD
Moore Ranch Conservancy
Lewis Antonio Mountain Ranch LLC
Running W Land LLC
Lewis Antonio Mountain Ranch LLC
Running W Land LLC
Lewis Antonio Mountain Ranch LLC
HWY 65
Worley William R & Worley B Adele
Schmitz Daryl L
Vogen David R TR ET AL
Richland Lindero LTD
Western Regional Sanitary L A
Western Regional Sanitary L A
Athens Road
Western Regional Sanitary L A
Western Regional Sanitary L A
United Auburn Indian Comm.
United Auburn Indian Comm.
Placer Athens Limited Partnership
Placer Athens 2 LP
City of Rocklin
Western Regional Sanitary L A
AKT
AKT
AKT
Western Regional Sanitary L A
Western Placer Waste Management Authority
Whitney Ranch Parkway
Western Regional Sanitary L A
Placer Athens Limited Partnership
Westpark MPG 5 LLC
Westpark MPG 5 LLC
Westpark MPG 5 LLC
Amoruso Jennifer M TTEE
Westpark MPG 5 LLC
Sunset Blvd.
Westpark MPG 5 LLC
Westpark MPG 5 LLC
Westpark MPG 5 LLC
Amoruso Peter & Jennifer M Trustees
Westpark MPG 5 LLC
Westpark MPG 5 LLC
Westpark MPG 5 LLC
Amoruso Jennifer M TTEE
Fiddyment Road
City of Roseville
Industrial Avenue
N
W
E
S
0.5 0.25 0 0.5 Miles
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 1-1

2.0 Proposed Projects' Water Demand

This section describes the methodology, provides the supporting evidence, and presents the estimated annual water demands for the "Proposed Projects" (Existing Sunset Industrial Area, the SIAMP, the PRSP and the ARSP). Total potable water demand estimates of the Proposed Projects are compared against the volume of water assumed within the PCWA 2010 UWMP (Section 3.0).

2.1 Water Demand Estimates

As detailed in Section 1, the Proposed Projects are either being planned by the County or by the City of Roseville. For the Existing Sunset Industrial Area and the SIAMP, PCWA has provided the estimates of needed water supplies. For those areas being considered for annexation into the City of Roseville (ARSP), or recently considered (PRSP), the City has provided PCWA with estimates for potable water supply needs.

Unique water demand factors developed by PCWA for determining demands for its UWMP were used as the basis for updating the water demand estimates developed by PCWA within this report. A description and summary of these water demand factors follows.

2.2 PCWA Residential and Non-Residential Water Use Demand Factors

The PCWA 2010 UWMP uses both residential and non-residential water unit demand factors for estimating water demands. These unit factors were developed by PCWA based on historic water meter data of actual demands within the PCWA service area. PCWA differentiates residential demands by more than a half dozen housing unit types based upon density to provide for an accurate representation of modern residential development. Unit demand factors are also separated by those for existing homes versus new construction, which takes into account latest regulatory mandates affecting water use.

The Proposed Projects are located within PCWA's Lower Zone 1 service area, with exception of ARSP located within PCWA's Zone 5. **Table 2-1** provides the PCWA demand factor for each residential and non-residential land-use category used to estimate the Proposed Projects' water use. Demand factors for the landfill were established based off historical data, existing water demand equated to 2.05 AF/year per acre for public facility and 0.02 AF/year per acre for general landfill modules. **Table 2-2** provides the PCWA demand factor for each anticipated land use within WPWMA ownership.

Table 2-1 – PCWA Unit Water Demand Factors Applied to Proposed Projects
(Reference Table 4-5 of the 2010 UWMP)

Land Use Category	Existing Customers at Buildout (AF/year per unit)	New Construction
Residential		
High density, 20.1+ DU/Ac.	0.19	0.18
High density, 15.1-20 DU/Ac.	0.30	0.18
High density, 10.1-15 DU/Ac.	0.30	0.20
Medium density, 7.1-10 DU/Ac.	0.40	0.32
Medium density, 5.1-7 DU/Ac.	0.46	0.39
Low density, 3.1-5 DU/Ac.	0.53	0.48
Low density, 3.1-5 DU/Ac. (GB)	1.32	0.86
Low density, 1.1-3 DU/Ac.	0.93	0.84
Low density, 1.1-3 DU/Ac. (GB)	1.36	1.39
Low density, 0.1-1 DU/Ac.	1.15	0.84
Rural Residential, 1.1-2.3 Ac./DU	1.26	0.96
Rural Residential, 2.31-4.6 Ac./DU	0.98	0.77
Rural Residential, 4.61+ Ac./DU	1.08	0.66
Non-Residential		
Professional Office	2.17	2.17
Commercial	2.17	2.17
Industrial	2.62	2.62
Public	2.80	2.80

Table 2-2 – Estimated WPWMA Unit Water Demand Factors

Use	2013 Actual Unit Water Demand Factor (AF/year)	Buildout Unit Water Demand Factor (AF/year)
Public Facility	1.95	2.80
Landfill	0.01	0.02

2.3 Proposed Projects Water Demand Projection

For new County-planned growth areas, such as the SIAMP, proposed land-use details (net acreage) as presented in **Figure 1-1** with the demand factors presented in **Table 2-1**, result in an estimated build-out water demand.

The demand factors presented in **Table 2-1** and **Table 2-2** represent the demand for water at the residential or non-residential customer meter for each category. To fully represent the demand on water resources, non-revenue water also needs to be included. Non-revenue water represents all of the water necessary to deliver to the customer accounts and reflects distribution system leaks, water demands from potentially un-metered uses such as fire protection, hydrant flushing, unauthorized connections, and inescapable inaccuracies in meter readings. In most instances, the predominant source of non-revenue water is from system leaks – the loss from fittings and connections from water sources through treatment plants, tanks, pumping plants, major delivery system back-bone pipelines, and community distribution systems. Because a significant portion of the delivery system used to bring water to the Proposed Projects will be new, non-revenue water is estimated to be 8 percent of production as outlined in PCWA's 2010 UWMP.

2.3.1 Sunset Industrial Area Master Plan Water Demand

As stated earlier, the County is preparing an Opportunities and Constraints Report, combined with land use alternatives, scheduled to be completed sometime in 2016. For preparation of this report, PCWA used the 1997 Land Use Plan within the SIAMP area to develop water demand estimates.

The water demand is not expected to change by a significant amount within developed parcels of the SIAMP. Water demands have changed over the years and 2013 was selected as the base year. 2014 is not considered representative given the State mandates implemented that year to reduce water demands to address state-wide drought conditions. Water meter data for 2013 indicate a water use for the developed parcels within SIAMP of approximately 1,100 acre-feet per year. Due to some parcels being underdeveloped and/or repurposed, a conservative water demand of 1,300 acre-feet per year is used.

A notable vacancy in 2013 was the old Formica Corporation plant, closing its doors in 2006, located at 3500 Cincinnati Avenue. The amount of water entitled to the property, based on capacity purchased, is 455 acre-feet per year.

On July 9, 2015 a staff report was sent to the Board of Directors for the Western Placer Waste Management Authority (WPWMA) announcing potential future uses of the WPWMA property. The memo authorizes staff to proceed with the associated planning and applicable permitting efforts of the identified uses. Although some areas within the metered parcels are proposed to change, little change is expected for future water demand. The additional six parcels will extend the landfill's footprint an additional 619 acres. Landfill water demand factors, as shown in **Table 2-2**, were applied to developable parcels based off of the intended use specified in the July 9, 2015 memorandum. This planned WPWMA expansion is estimated to need **179 acre-feet per year** of water supply (including system losses of 8%).

The eastern portion of the SIAMP has 1,445 acres of designated Agricultural land, which resides in PCWA's Zone 5. Agricultural land in Zone 5 is served either by PCWA's raw water via the Auburn Ravine, or by wells. Due the price of providing treated water, and Auburn Ravine not being in close proximity, it is assumed that all Agricultural land in Zone 5 will remain on groundwater.

Assumptions of the SIAMP are summarized in **Table 2-3.** When combined with PCWA unit water demand factors, the SIAMP is expected to need **4,666 acre-feet per year** of water supply (including system losses of 8%).

Table 2-3 – Water Demand Estimate for SIAMP

(Values in AF/year per unit type) Lower Zone 1	Acreage		Water Demand Factor (AF/year per unit type)	Buildout Demand (AF)	Total Annual Water Demand (AF) (includes 8% loss factor)
	Gross	Net (assumes 80%)			
Non-Residential					
(e) Industrial	**490**	**-**	-	1,300	1,404
(e) Formica Plant	**209**	**-**	-	455	491
(e) WPWMA	**314**	**-**	-	48	52
Industrial	**1,122**	**898**	2.62	2,352	2,540
Public (WPWMA exp.)	**70**	**56**	2.80	157	169
Landfill (WPWMA exp.)	**553**	**443**	0.02	9	10
Unavailable for Development	**3,346**	**3,787**	0.00	0	0
Total Estimated Water Use (AF/Year)					4,666

(e) Indicates existing demand

Once the County has completed their planning efforts and has updated land use plan alternatives, PCWA intends to update the water demand estimates. If needed, PCWA will update this memorandum and incorporate into its 2015 UWMP.

2.3.2 Placer Ranch Specific Plan Water Demand

Because the PRSP had recently been planned in the City, PCWA relied upon potable water demand estimates from the City. City water demand estimates are developed similarly in that, the City uses its own set of water use demand factors which are combined with proposed land use plan details to develop water supply needs. The City estimates a potable water demand need of approximately 4,500 acre-feet per year to serve the Placer Ranch project.

2.3.3 Amoruso Ranch Specific Plan Water Demand

The ARSP is also being planned by the City. PCWA again, has relied upon water use estimates supplied by the City for potable water supply needs for the Amoruso Ranch Specific Plan. The City estimates potable water demand of approximately 1,100 acre-feet annually to serve the ARSP (after conservation and recycled water use have been subtracted from the total demand).

2.4 Proposed Projects' Water Demand Summary

At build-out of the Proposed Projects, a potable water supply of approximately 9,920 acre-feet of water annually is needed; although, this is prior to considerations of any loses for non-revenue water. When considering losses of 8%, approximately 10,714 acre-feet of potable water supplies are needed, as shown in **Table 2-4**.

Table 2-4 –Summary of Proposed Projects' Build-out Water Demands

	Acres	DU	Annual Unit Water Demand (AF)	Total Annual Water Demand (AF) (includes 8% loss factor)
SIAMP	5,945	0	4,320	4,666
Placer Ranch	2,226	5,400	4,500	4,860
Amoruso Ranch	674	2,827	1,100	1,188
Total Estimated Water Use (AF/Year)				10,714

3.0 Water Supply Availability

This section evaluates existing representations of water supply availability as detailed in the PCWA 2010 UWMP to serve the Proposed Projects. As detailed in the UWMP, PCWA demonstrates sufficient water supplies are available during normal, single-dry, and multiple dry years to meet projected build-out water demands of its entire service area. This determination is based upon estimates of future water demand for PCWA's retail and wholesale customers. PCWA future water demands included water use within the SIA as part of its considerations of water supply availability and reliability in its most recent UMWP (2010).

3.1 PCWA's 2010 UWMP Demand Estimate

Water demand information provided in the 2010 UWMP was based upon existing customer data combined with available general plan and other land use documents to estimate the "existing" and "build-out" conditions for each PCWA's retail service areas. Estimated build-out demands for the projects can be met by the equivalent supply values identified for the SIA and SIAMP in the Agency's Urban Water Management Plan. Land use information along with other retail data and assumptions for PCWA's western water system (inclusive of the SIA), are presented in Chapter 4 of the PCWA 2010 UWMP prepared by Tully & Young.

In 2012, Tully & Young also prepared a supplemental technical memo to the 2010 UWMP to further split out the SIA land use from the overall demands included in the UWMP. The technical memo, dated May 11, 2012, included as Attachment A to this report, determined that the Sunset Industrial Area would use 12,701 Acre-feet of water annually at full buildout.

4.0 Conclusion of Sufficiency

Comparing the demand calculations in the PCWA 2010 UWMP estimates with the new Proposed Projects land uses and calculated demands (**Table 2-4**), there is sufficient water supply accounted for in PCWA's 2010 UWMP to serve the Proposed Projects. As detailed in UWMP, PCWA has sufficient water supplies to meet future demands in all conditions. Specifically, the UWMP concludes:

> "*For the planning horizon required for the Urban Water Management Planning Act (2030 for the 2010 Update), and even through 2035, PCWA will be able to fully meet the driest-year demands of all service areas*." (PCWA 2010 UWMP, Chapter 8, p. 8-5)

Therefore, PCWA will have sufficient supply to meet the Proposed Projects' estimated 10,714 AF/Year water demand. The Proposed Projects are predicted to consume about 1,987 acre-feet less per year than PCWA has currently assumed for the area.

APPENDIX A

Tully & Young Technical Memo

Tully & Young
Comprehensive Water Planning

Tully & Young, Inc.
3600 American River Drive, Suite 260
Sacramento, CA 95864

MEMORANDUM

To: Placer County Water Agency

From: Greg Young

Date: May 11, 2012

Subject: PCWA demand development information

The purpose of this memo is to document the following information related to the derivation of PCWA water demands.

- Present a comparison of the City of Lincoln demand factors as used in the City's 2050 General Plan EIR to those recently included in the City's 2010 UWMP and those used by PCWA in its 2010 UWMP for similar retail treated water customers.
- Provide instructive explanation of the Excel workbook used to derive the PCWA water demands that were included in PCWA's 2010 UWMP (accompanied by an electronic copy of the Excel workbook for use in modified scenario analysis).
- Provide a comparison of estimated build-out demand values from the 2006 Integrated Water Resources Plan (IWRP) and the 2010 UWMP, accompanied by explanations of the differences.
- Summarize discussions with the City of Rocklin regarding different future land-use conditions than those included in the 2006 IWRP (in Appendix F, Scenario 2b). This item is intended to specifically address Rocklin's downtown plan, and how proposed denser development will affect water demands.

Each of these is discussed below under separate headings.

1 - Comparison of City of Lincoln Demand Factors

During development of the 2006 Integrated Water Resource Plan, PCWA was unable to obtain from the City of Lincoln water demand factors that PCWA believed appropriately reflected the City's actual and projected use. Our understanding is that the City was in the midst of developing its 2050 General Plan and performing the analysis necessary for the supporting EIR at that time, such that they were not able to provide adequate information to PCWA in a timely manner.

Since that time, the City has prepared and adopted its 2010 UWMP, which includes water demand factors developed based on a recent City meter study (see Appendix B-5 of the City's 2010 UWMP). Notably, these demand factors are lower than factors used for the 2050 General Plan. Though the UWMP only provides demand estimates to 2035, while the General Plan is an estimate at a build-out population, comparisons and contrasts can be made.

Table 1 compares the demand factors used to calculate the build-out water demand for the 2050 General Plan and the factors used to estimate the 2035 demand as presented in the 2010 UWMP. The City is also using the 2010 UWMP demand factors as it moves forward with other planning documents. For comparison, the PCWA demand factors for PCWA's retail customers as used in the 2010 PCWA UWMP for Lower Zone 1 is also provided in Table 1.

Table 1 – Comparison of Water Demand Factors

	Lincoln			PCWA Retail	
Land Use Type	2050 GP EIR (2008)	2010 UWMP (w/ loss factor)		2010 UWMP (w/ loss factor)	
	(Acre-feet/DU or acre)				
	All	Existing	Future	Existing	Future
Country Estates	1.22	0.94	0.85	1.51	0.92
Low Density	0.61	0.51	0.49	0.72	0.53
Medium Density	0.52	0.32	0.29	0.55	0.35
High Density	0.29	0.24	0.22	0.38	0.20
Industrial/Office	2.8	3.11	2.78	2.71	2.39
Commercial	2.8	3.11	2.78	2.71	2.39
Public	5.82	3.44	3.11	3.50	3.08

In all circumstances, except Commercial, Industrial, and Office classifications, the new water demand factors are lower than those used to estimate the General Plan's build-out water demand. In the General Plan, the projected total demand for an estimated population of about 131,500 was about 53,000 acre-feet annually (see Table 5, Appendix F, City of Lincoln General Plan Update EIR). For comparison, the PCWA 2010 UWMP as adopted in June 2011 assumed a build-out demand from Lincoln equal to that in the Village 7 SB 610 Water Supply Assessment (adopted in 2009), which derived its information from the 2050 General Plan EIR. The PCWA UWMP did not attempt to define the City's demands using land-use data, but rather relied upon existing City published and adopted projections.

Using this information and data available in the Lincoln 2010 UWMP, the following points are noted:

- Based on the build-out demand and population from the General Plan, the estimated gallons per capita per day (gpcd) is about 360 gpcd. In contrast, the UWMP's baseline gpcd is shown as 246 gpcd, which is based on actual delivery records and population information. The 2020 target is noted as 197 gpcd. Though the two estimates are at different points in time, a comparative analysis could use the 2020 target gpcd and the build-out population to derive an estimated build-out water demand. Though this demand may be inaccurate, since it is an oversimplified calculation, it demonstrates that the future water demands from the City for PCWA, NID, groundwater and recycled water may not be as high as predicted for the population estimated by the General Plan. The distribution of supplies among PCWA, NID, groundwater and recycled water cannot be derived from this estimate, though. On a conservative basis, PCWA could anticipate all the demand is placed on its supplies. Or, all but about 3,300 acre-feet of NID water is required from PCWA. This assumption would translate to PCWA supplying between 26,000 and 30,000 acre-feet.
    - 131,500 people x 197 gpcd = 30,000 acre-feet (approx.)

- This estimate is further supported by noting that the estimated 2010 population is around 40,000, with a water delivery of about 9,200 acre-feet (City wells and treated surface water delivered by PCWA). For comparison, 2007 through 2009 averaged 10,300 acre-feet. If the population were to triple (approximately 120,000), which is nearing the build-out population, the total deliveries might be expected to also triple. Tripling the 2007 through 2009 average would predict about 31,000 acre-feet.

- The meter study performed for the UWMP assessed data from hundreds of connections for different residential dwelling types. This information demonstrated a lower actual use than was assumed as the General Plan demand factors, even when accounting for system losses. The new factors are likely more representative of actual and future use. Thus, it would be feasible for PCWA to reflect these new values in future updates to the UWMP, which may result in a lower build-out demand estimate for the City.

- The UWMP predicts a 2035 water demand of about 15,500 acre-feet. To meet this demand, an estimated 10,316 acre-feet are anticipated from PCWA (along with 3,286 acre-feet from NID, 1,556 acre-feet of groundwater, and a minor amount of recycled water).

Whether the City may demand the entire 34,000 acre-feet projected in the 2050 General Plan EIR and subsequently in the PCWA UWMP sometime in the future or something less, as could be extrapolated from the City's estimated 2035 demand in its 2010 UWMP, is a matter for additional analysis and dialogue between PCWA and the City. Since the

City's only projected demand at build-out exists in the 2050 General Plan EIR, PCWA should continue to conservatively use the published value until an alternative value is officially adopted by the City. Table 2 provides a comparison of different values from the City's UWMP, the General Plan and PCWA's UWMP. Since the Lincoln UWMP was adopted after the PCWA UWMP, the data for 2015 through 2035 in PCWA's plan reflected the Village 7 SB 610 WSA. The PCWA UMWP could be updated to reflect the recently adopted values up to 2035.

Table 2 – Comparison of Lincoln and PCWA adopted values

	2009	2015	2020	2025	2030	2035	2040	BO
Lincoln UWMP (adopted July 12, 2011)	7,724	8,500	8,695	9,176	9,706	10,316	n/a	n/a
Lincoln General Plan (adopted March 2008)	—	—	—	—	—	—	—	34,000
PCWA UWMP (adopted June 16, 2011	7,724	15,205	19,667	24,129	28,592	30,395	32,197	34,000

The 2010 PCWA UWMP's Table 4-8 could be modified to reflect the more recently adopted Lincoln values. A potential revised table through 2035 is presented below.

Table 3 – Potential Revised 2010 UWMP Table 4-8

(NID water treated by PCWA and delivered to Lincoln is shown separately. Table 4-8 shows the values combined)

(Values in AF/year)	Current	2015	2020	2025	2030	2035
City of Lincoln (PCWA)	7,724	8,500	8,695	9,167	9,706	10,316
City of Lincoln (NID)	1,595	1,395	1,541	2,059	2,630	3,286
Cal-Am Water Company	1,010	985	960	936	912	912
Others	334	326	317	309	301	301
Total	10,663	11,205	11,513	12,471	13,549	14,815

2 - PCWA Demand Calculation Workbook

The calculations and methods for understanding and estimating the Placer County Water Agency (PCWA) water demands are included within one Excel file. The primary Excel workbook includes several unique worksheets as discussed in the following sections. This information is intended to help PCWA's Engineering Department use this Excel workbook to perform varied water demand analyses as they investigate various current and future issues and opportunities affecting PCWA's water management.

Calculations in the Demand Worksheet

The demand worksheets created for the 2010 UWMP contain many interconnecting formulas. This was due to the complex nature of the demands in the PCWA system and the information used to simulate existing use and project future use. Separate calculations were done for each of the demand areas with the majority of the work revolving around the upper and lower Zone 1 service areas, with lower Zone 1 also including the demands of Zone 2 and Zone 5.

The primary table for each zone is found in the sheets titled "Zone # - working demand" with individual tables for Zones 1, 3, and 4. Each of these tables is made up of a number of sections as described in worksheet "Zone 1 – template" which discusses each section of the table. These tables are split into three main column categories: Units, Demand Factors, and Water Demands, where Units is the number of dwelling units or acres of a land classification and Demand Factors are the unit water demand of each land classification over time. Each of these main columns has sub columns for year and one row each for existing and future. Each of the boxes of "Units" is multiplied by its "Demand Factor" to calculate its "Water Demand". The water demands are then totaled to get water demand sub-totals for each demand category (treated retail, raw/untreated retail, treated wholesale, and raw/untreated wholesale) and then summed for each zone's total.

Other tables contribute data to the "working demand" tables, as discussed in the paragraphs that follow. There are essentially 4 main data: existing dwelling units (or acres), existing demand factors, future dwelling units (or acres), and corresponding future demand factors. While there are values for each year, "existing dwelling units" will remain constant while the others will be subject to change over time.

Existing units demand factors will be reduced due to increased efficiency in existing customer water use through mechanisms such as rebate programs for appliances and fixtures, installation of irrigation meters, and redevelopment such as remodels using fixtures in compliance with new plumbing codes. Future dwelling units will increase over time to represent the number of new units at a given future point in time. Future units demand factors will be less than existing demand factors due to new state mandates (e.g. MWELO and the Cal-Green code) and a shift toward higher density developments, which result in fewer square feet available per lot for landscaping).

Zone 1 Demand Development

Zone 1 Units Sheet

The "existing dwelling units" data is derived from the "build out" conditions estimated under Scenario 2b in Appendix F of the 2006 Integrated Water Resources Plan (IWRP). In the demand tables, the "existing dwelling units" are either noted where they are from or are referenced to another worksheet in the Excel file. For Zone 1, the values come from the worksheet titled "Zone 1 Units" with the top section representing the build out values, which are subsequently subdivided in each of the worksheet's following tables. The estimated number of high-density units is derived from the multiunit count from the 2009 sales report and related to the build out quantities from Appendix F. Rural residential and non-residential unit counts are derived from an estimation of area build out completeness on the Appendix F table. For medium density and low density, the existing dwelling unit count is taken from the 2009 Sales Report with rural residential units subtracted. This number is then distributed over an estimation of a ratio of existing dwelling unit types for the upper and lower zones. The estimated distribution of existing dwelling counts is summarized in tables at the bottom of the worksheet.

Future dwelling unit counts are derived for each subsequent 5 year increment by either: 1) applying a growth rate to the existing number of unit for that land classification, or 2) distributing the anticipated total units across time. The first method was applied in the majority of cases where the growth values were believed to be overly optimistic, resulting in too many new dwelling units and a rate of growth that exceeded recent historic rates. As explained later in this section, changing a value on the main zone demand worksheet can vary the rate of growth.

All zones Existing df Sheet

The demand factors for the existing dwelling units are presented in the sheet titled "All zones existing df". The existing factors for the residential dwelling units are from an updated Appendix F table data provided by T. Firenzi in December 2010. The non-residential demand factors reflect the original Appendix F tables. The existing demand factors are reduced to reflect anticipated conservation. These reductions are applied for the 2020 and 2030 values. Values for years ending in 5 are interpolated linearly on the main demand worksheet for each zone. These two 10-year increments were selected as markers to account for on-going conservation activities that will reduce existing customer demand factors. With on-going replacement of fixtures and landscapes over time, these 10-year blocks adequately allow capture of a change such as a further decrease in existing customer demands of 5% from 2020 to 2030.

Z1 future df

The future demand factors for Zone 1 are developed for each demand category on the worksheet titled "Z1 future df". Demand factors are calculated in two parts. First the average indoor demand is gathered from meter data presented at the bottom of the page. The average winter demand is used as the existing indoor demand. This is reduced by ten percent to represent the future indoor demand with new mandates such as the Cal-Green code on indoor water use. Outdoor future demand factors are estimated using estimated lot size for the various land classifications and the allowances under the Model Water Efficient Landscape Ordinance (MWELO). The indoor and outdoor demands are then combined to produce the future dwelling unit demand factors used in the main water demand worksheet.

Resulting Zone 1 Demand

The demand factors and unit counts come together on the worksheet titled " Zone 1 – working demand". The count of future dwelling units for each land classification increases across years by either the percentage in the yellow box at the top of the page or at a linear growth rate, if the unit count would exceed the Appendix F table build out count. The growth method used is indicated in the "Notes:" column on the right of the table. The loss factors are the same as used in the 2008 UWMP update. Non-treated retail demands are addressed at the bottom of the table with stated demands. The exception is Commercial Ag from Zone 5. This demand is estimated to decrease as irrigated agricultural lands give way to increased development west of Lincoln.

Zone 3

Demands for Zone 3 are presented in the worksheet titled "Zone 3 – working demand". The existing dwelling unit numbers are derived from the 2009 Sales Report. Future dwelling units reflect anticipated growth, based on an analysis of historic growth in this Zone. The box in yellow at the top of the page allows the growth rate to be adjusted. The current growth rate is from 15 years of connection count data. Existing demand factors come from the "All zones existing df" page with the same background assumptions as discussed for Zone 1. Future demand factors are estimated to be ten percent more efficient than the 2030 reduced existing demand factor [Note: demand factors are much lower for Zone 3 than even Upper Zone 1 due to very limited landscaping demands and lower ETo rates at these higher elevations. Non-revenue water uses (e.g. system losses) uses the same value as the 2008 UWMP. Sales of treated and untreated water to other entities in Zone 3 is included after the retail treated water demand estimates.

Zone 4

Demands for Zone 4 are presented in the worksheet titled "Zone 4 – working demand". The existing dwelling unit numbers come from a February 23, 2011 email detailing the number of active connections. The current growth rate is used to meet the project dwelling unit number assuming a build out by 2030. Existing demand factors come from the "All zones existing df" page. The demand factors were calculated from historic pumping records and connection data from the February email. Future demand factors are assumed to be five percent more efficient than the 2030 reduced existing demand factor due to the limited reduction potential from the developments already modern homes. Non-revenue water use comes from the 2008 UWMP numbers. Commercial water demand estimates were calculated form the 2009 Sales Report.

Scenario Analysis

To evaluate future water demands under different assumptions than used for the 2010 UWMP, several options exist.

The first step is to click "save as" and save an additional copy with a different title so as to prevent loss of the original calculations.

Direct Changes to "working demand" Worksheets

Any changes can be made in each individual zone working demand worksheet, but will require manually changing individual numbers and will not propagate through all demand uses. This is useful for changing the build out number of a specific demand or future demand of wholesale customers.

For example, there is a large difference between cells O11 and P11 in the Zone 1 working demand table. These represent the 2040 and build out numbers of one of the high-density units. The growth rate required for build out to occur by 2045 greatly exceeds what would be expected based on the number of existing units. If a specific unit project is expected to occur in 2025 and add 1,000 of these units, then this would be most easily changed directly on the demand worksheet in row 11 manually.

As another example, assume more accurate information of future demands is received from a wholesale customer such as Lincoln. This would be changed directly in that customer's row in the water demand rows (rows Y to AF) toward the bottom of each of the working demand spreadsheets.

Growth rates

The top of each of the working demand spreadsheets has a yellow box used to control the growth rate of the land classifications for those that do not exceed the Appendix F build out count prior to 2045. For land classifications where the growth rate would exceed the Appendix F count, values are plotted linearly to prevent exceeding stated build out values.

Growth rates in Zone 3 only uses percent growth, since no build out estimates were available from Appendix F. If a larger growth rate is expected due to a planned industrial installation and resulting area growth then changing the yellow highlighted number at the top of the page will change the whole table. Alternatively, a particular cell in the spreadsheet can be manually changed to reflect an anticipated growth.

Existing Demand Factors

The existing water demand factors can be changed either within the working demand worksheet or in the "All zones existing df" worksheet. On the existing df sheet, the demands are expected to reduce between five and ten percent each decade due to on-going conservation. Numbers in between the decade estimations are interpolated on the demand tables. By changing the estimated conservation for any particular land classification within this worksheet, the demand factors will change in the working demand worksheet as well.

For example, if a specific housing type is expected to not achieve the conservation anticipated, adjusting the value do a different percentage would change all calculations using that demand factor on the demand worksheet. This is useful, as conservation goals for a specific housing type can be varied to help decide where rebate programs or conservation efforts should be focused.

Integration of more accurate housing count numbers

Due to the limited data on customer housing type, many estimates were used to replicate the existing demands in the working demand spreadsheets. Though water demand estimates mimicked the actual demands, it is not certain that the distribution of the dwelling unit counts across the various densities accurately reflects existing conditions. If a survey was done and found the exact number of housing units of a specific class in Zone 1 this number could be integrated into the existing unit number calculations.

The first and most simple way to integrate the information would be to modify values in the "existing" row for each housing density on the given working demand worksheet. Since existing housing unit counts were tied to an existing connection total, the second and more accurate method would be to adjust the distributions in the "Zone 1 Units" table.

If the DU count involves one of the 1 acre or larger lot types then the change would be made in the "Rural Residential and non residential" section of the worksheet. Changing the existing numbers on rows 83 to 86 for the specific areas listed in row 52 would populate though all of the tables and present an updated demand estimate.

Integrate more accurate ratio of units in upper versus lower Zone 1

If a more accurate number of 1 to 10 DU per acre units or total units is calculated for upper and lower Zone 1, then the ratio of currently built units could shift. Changing this ratio in row 139, cells E and F shifts the number of units in each of the upper and lower portions of Zone 1. Simply changing this ratio will maintain all other calculations in the worksheets, as well as keep the actual unit connection count.

3 – Comparison of IWRP and UWMP Demand Projections

The August 2006 Integrated Water Resources Plan (IWRP) provided a detailed analysis of future demands throughout Placer County, including a subset of demands that would likely be placed on PCWA supplies. Summarized in a few different tables, these demand projections have been used as initial values in analyses for the American River Water Rights Extension EIR being undertaken by Entrix. With the adoption of the 2010 UWMP, Entrix published a table for internal use that compared the demand projections of the IWRP with those in the UWMP (see Table 4). An explanation of the differences in the demands was requested at a PCWA team meeting on January 19, 2012.

Table 4 – IWRP and UWMP demand comparison table
(prepared by Julie Smith, Entrix, June 2011)

	DEMAND (Original Tables)		DEMAND (Admin Draft UWMP)	
ZONE 1 ONLY	**Normal (af/yr)**	**Single Driest (af/yr)**	**Normal (af/yr)**	**Single Driest (af/yr)[1]**
PCWA Retail Customers (Treated)				
Retail Treated			69,701	69,701
Auburn	12,188	12,188		
Rocklin	27,841	27,841		
Loomis/Granite Bay	16,284	16,284		
West Placer	46,852	46,852		
Less: Treated Water Conservation Program	(5,000)	(10,000)		
Subtotal	**98,165**	**93,165**	**69,701**	**69,701**
PCWA Retail Customers (Raw)				
Retail Raw			56,295	56,295
Raw Water	75,000	75,000		
Less: Raw Water Shortage Program	–	(43,592)		
Subtotal	**75,000**	**31,408**	**56,295**	**56,295**
PCWA Wholesale Customers (Treated)				
Wholesale Treated[2]			35,213	35,213
Lincoln[3, 4]	40,943	42,593		
Subtotal	**40,943**	**42,593**	**35,213**	**35,213**
PCWA Wholesale Customers (Raw)				
Roseville[5]	26,095	27,305	30,000	30,000
SJWD	16,415	16,415	21,000	21,000
SJWD to City of Roseville	–	–	4,000	4,000
SSWD[6]	12,168	0	29,000	0
Regional Water Supply Buffer[7]	–	–	10,000	10,000
Subtotal	**54,678**	**43,720**	**94,000**	**65,000**
Total	**268,786**	**210,886**	**255,209**	**226,209**
	Source: Table 9-5 through 9-8 IWRP (Brown and Caldwell, August 2006)		Source: Table 4-10, Admin Draft UWMP (Tully and Young, May 2011)	

Notes:
[1] It is assumed that demands presented in Table 4-10 of the Admin Draft UWMP would remain the same in the single driest year.
[2] UWMP - Wholesale Treated: City of Lincoln, Cal-Am Water Company, and Others (Table 4-8).
[3] Original Tables - Wholesale Treated: City of Lincoln.
[4] Original Tables - City of Lincoln demand for MFP water increases by 1,650 af/yr in dry years due to a corresponding decrease in water deliveries from NID.
[5] Roseville: The City of Roseville demand for MFP water increases by 1,210 af/yr in dry years due to a decrease in CVP deliveries. The MFP water only partially compensates for the loss of CVP water.
[6] SSWD: If not needed to serve PCWA retail and wholesale customers, up to 29,000 af/yr of MFP water may be delivered to SSWD in a wet year. In a dry year, PCWA is contractually restricted from supplying water to SSWD.
[7] 10,000 af/yr regional water supply buffer beginning in 2040 (UWMP Section 4.1.6).

In order to understand the differences, a few points first need to be noted about the values represented in Table 4. Values in the table under the "Demand (original table)" columns were apparently obtained from Tables 9-5 through 9-8 of the IWRP. However, some of the values in the IWRP tables incorrectly reflected values in the IWRP's Appendix F Scenario 2b summary table, while others in Table 4 were inexplicitly modified from the IWRP tables.

Table 5 provides a comparison of (1) the Entrix displayed values in Table 4, (2) the original values from the IWRP, (3) the values that should have been presented in the IWRP (from the Appendix F summary table), and (4) the 2010 UWMP values (as modified to reflect both the Rocklin General Plan, the distribution of total Zone 1 demand among IWRP subareas, and revisions to conservation projections in 2030 for existing customers.

Table 5 – Comparison of IWRP and UWMP values

	Entrix Table	IWRP Table 9-5 to 9-7	IWRP App. F-Scenario 2b Summary Table (treated)	2010 UWMP
Treated Retail				
PCWA	98,165	108,438	96,005	74,508
Auburn	12,188	12,188	11,432	10,580
Rocklin	27,841	27,841	27,821	23,287
Loomis/Granite Bay	16,284	16,284	13,179	12,491
West Placer	46,852	52,125	43,573	28,149
(Entrix conservation)	-5,000			
Raw Retail				
Raw Customers	75,000	75,000	--	57,994
Zone 1	--	60,000	--	56,295
Zone 5	--	15,000	--	1,699
Wholesale Treated				
Lincoln	40,943	44,243	31,584	34,000
Others	--	--	--	4,005
Wholesale Raw				
Roseville	26,095	26,095	58,095	30,000
SJWD	16,415	16,415	16,411	21,000
SJWD to roseville	--	--	--	4,000
SSWD	12,168	29,000	--	29,000
Water Supply Buffer	--	--	--	10,000
Total	268,786	299,191		264,508

Each of the unique entries and the variances is explained below:

Treated Retail

1. Entrix values for Auburn, Rocklin, and Loomis/Granite Bay match those of Table 9-5 of the IWRP. However, Table 9-5 appears to pull the Scenario 1 summary "total" demand instead of the Scenario 2b "treated" demand (the "total" includes groundwater pumping") for each of these areas. The correct values to have reflected in Table 9-5 are shown in the "App F" column in Table 5 above.

2. It is unclear where the Entrix table derived the West Placer value. Table 9-5 of the IWRP shows a different value. However, even the Table 9-5 value does not match any of the Appendix F summary scenarios for "treated" or "total" for this demand area. It is not clear where this value was obtained.

3. The values in the 2010 UWMP are derived by applying new future demand factors to each of the residential and non-residential unit counts (e.g. number of low density dwelling units and acres of commercial), and calculating a resulting demand. A non-revenue water factor was applied to the total estimated demand for each area to account for system losses and other unaccounted for water supplies. As a comparison of the differences in demand factors used for the Appendix F summary table and the UWMP, the medium-density (5.1 to 7 units per acre) value used in the IWRP was developed from existing customer data and assumed to hold constant at build-out. The UWMP assumed that existing customers will reduce their per-unit use due to on-going PCWA conservation efforts, new fixture and appliance standards and other drivers. All future homes will be built using new landscape ordinances and CalGreen building code requirements, further reducing unit demand factors from the conservation value of existing customers. This is illustrated by fact that the IWRP used a value of 400 gpd/DU (0.55 acre-feet/DU) in the Appendix F tables. The UWMP used a build-out demand factor for existing customers of 0.46 acre-feet/DU – approximately 18% less than existing due to conservation – and 0.39 acre-feet/DU for future homes. These factors alone account for the significant variance in the lower portions of Zone 1 (e.g Rocklin and West Placer) where significant new housing is expected.

4. Zone 1 raw water customers represent the "irrigation" customers receiving untreated canal deliveries for general use on the small rural residential acreages (e.g. 1 to 5 acres), which predominate the irrigation customers of Zone 1. Some commercial agriculture also exists in this category. The IWRP provides data for Zone 1 raw water customers in its Table 4-5 – with an average of 60,000 acre-feet for the period 1996 through 2004. The UWMP, calculating irrigation deliveries as the difference between water entering Zone 1 and the other retail and wholesale demands (measured), demonstrated an average of approximately 57,000. Inspecting the downward trend from the IWRP data and the UWMP extended data, the UWMP assumed the 2009 estimate of slightly over 56,000 acre-feet would be the long-term demand through build-out. This is only slightly less than the estimated 60,000 acre-feet assumed by the IWRP.

5. Zone 5 raw water demands represent the needs of commercial agriculture west of Lincoln. The IWRP includes values from 1996 through 2004, with the average being 12,800 acre-feet (although they assume 15,000 acre-feet as the "standard"). In contrast, the UWMP identifies an extended data set that averages 8,900, with

the latest year slightly over 11,000 acre-feet. However, this area is projected to convert from agriculture to housing as part of the westward expansion of Lincoln. The majority of the approximately 4,400 acres currently served with PCWA irrigation water in Zone 5 lie within the Lincoln Sphere of Influence adopted in the City's recent General Plan. As such, the demand for water is anticipated to only be required by about 600 acres of the original 4,400 acres served. Thus, the demand reduces to approximately 1,700 acre-feet. In contrast, the IWRP assumes a continuation of 15,000 acre-feet of demand (even though it also anticipates an increased demand by Lincoln, which essentially will be serving the same area).

6. Lincoln wholesale treated water demands in the UWMP reflect the anticipated demand by the City at its build-out population of 130,000. The City anticipates supplying its residence through a combination of supplies from PCWA, Nevada Irrigation District (NID), groundwater and recycled water. The 34,000 acre-feet represented supply from PCWA (see Lincoln's 2010 UWMP), reflects an estimated need as part of a supply portfolio meet an overall demand of 53,000 acre-feet. Though revised demand factors (as discussed previously in this memo) will lower the build-out demand noticeably, it will not drop below 34,000 acre-feet. Thus, the City still anticipates this demand. In contrast, the IWRP Table 9-5 reflects the "total" value pulled from the Appendix F summary table – a value that includes demands met with NID water, reclaimed water and groundwater. The "treated" value that is of interest to PCWA for Lincoln is 31,584 (the "treated" total minus the NID demand). The Entrix table used the IWRP Table 9-5 value and subtracted a currently supplied amount of 3,300 acre-feet of NID water, netting a value exactly 3,300 acre-feet less than the Table 9-5 value. Since the demand in Lincoln's service area that can be met with NID supplies is expected to increase beyond 3,300 acre-feet as the City grows (the current NID deliveries to Lincoln – provided through PCWA's treatment and delivery facilities – is about 1,600 acre-feet), the subtraction of only 3,300 acre-feet by Entrix appears inconsistent when compared to the Appendix F summary table's Lincoln NID demand value.

7. Both Table 9-5 of the IWRP and the subsequent Entrix table do not reflect other wholesale treated water demands served by PCWA. Cal-Am Water Company and a few homeowner associations currently receive about 1,000 acre-feet and 340 acre-feet, respectfully. According to Cal-Am's 2010 UWMP, PCWA wholesale treated supplies are expected to increase to approximately 3,700 acre-feet. Homeowner association demands may drop slightly. The PCWA UWMP reflects about 4,000 acre-feet of wholesale treated demands, in addition to those of Lincoln. The IWRP does not include this value.

8. Wholesale raw water supplied to the City of Roseville is represented in the UWMP as 30,000 acre-feet, which reflects the terms of the current agreement

between PCWA and the City (the contract caps the amount to 30,000 acre-feet as of July 1, 2024). This value is also reflected in the Roseville 2010 UWMP (see Table 4-1 of the Roseville UWMP). The IWRP Table 9-6 includes a value for "normal" conditions for Middle Fork demands. This value is derived from taking the total Roseville demand in Table 9-5 (65,970 acre-feet), subtracting the Appendix F recycled water supplies (7,875 acre-feet), and subtracting the Roseville CVP supply of 32,000 acre-feet assumed available in normal years. The resulting quantity of 26,095 is represented as the demand on PCWA's Middle Fork Project. This is similar to the 30,000 acre-foot contract cap, but is somewhat arbitrary, since it relies on the significant availability and use of recycled water to reduce MFP demands.

9. Wholesale raw water supplied to San Juan Water District (SJWD) is presented in the UWMP as a combination of 21,000 acre-feet to ultimately be used by SJWD and 4,000 acre-feet to be used by the City of Roseville. SJWD has a contract with PCWA for 25,000 acre-feet, of which it has subcontracted 4,000 acre-feet to serve an area of the City of Roseville. This 4,000 acre-feet is separate from the City of Roseville demands discussed under #8 above. The IWRP's Table 9-5 again uses the "total" supply from the Appendix F summary table, but it is the "treated" value from the Appendix F summary table that is of comparison. That value is 16,411 acre-feet (instead of the 16,415 listed in Table 9-5). Although demand factors used to derive the demands listed in the Appendix F Scenario 2b detailed tables are higher than those used in the UWMP, the UWMP uses the contracted quantity to represent the build-out condition. The SJWD 2010 UWMP describes the PCWA supply as 25,000 acre-feet currently available and continuing to be available to 2030 and beyond (see SJWD UWMP Table 4-9).

10. Wholesale raw water supplied to Sacramento Suburban Water District (SSWD) is listed in Table 9-5 of the IWRP as 29,000 acre-feet. This is consistent with the 2010 UWMP. The Entrix table lists the value as only 12,168, yet includes a footnote that the value could be 29,000 acre-feet. The minimum quantity to be used by SSWD under the contract is 12,000 acre-feet when associated unimpaired flows into Folsom Reservoir are above 1.6 maf (March through November). SSWD portrays the 29,000 acre-feet of PCWA water as 100% reliable and available during normal years (see Table 4-13 in SSWD 2010 UWMP).

11. The PCWA UWMP includes a "water supply buffer" entry to reflect the potential for additional demands that are not currently reflected in the land use plans analyzed in the IWRP (as reflected in the Appendix F Scenario 2b build-out quantities). This additional demand is characterized in the UWMP as providing a buffer to accommodate the fact that several of the land use plans used by the IWRP only extended to 2030. The water supply buffer is reflected in the UWMP as only becoming a need after 2040, which is beyond the required 20-year time

frame of the 2010 UWMP. As the UWMP is updated to reflect new land-use data from various land-use authorities, this value will likely be reflected as demand associated with one of the wholesale treated or retail treated customer areas. The IWRP did not contemplate this potential demand.

3.1 Zone 1 Water Demand by SubArea

Demand factors were based on a number of factors and resulted in unique values for each residential land-use category, with one set for Upper Zone 1 and another for Lower Zone 1. Tully & Young combined landscaping demand estimates with indoor demand and confirmed values with the 2009 sales report data. By separating the indoor and outdoor demand, the future demands for existing units and for yet-to-be-built units was estimated. Indoor demand in units yet-to-be-built will be reduced from existing values due to new plumbing requirements, while existing value will drop slightly over time due to natural attrition and replacement of fixtures and appliances. Outdoor demand follows the same reduction patter as indoor water use, with the state mandated Landscaping Ordinances driving lower demands in yet-to-be-built housing compared to existing housing.

Original water demands in the UWMP were developed to represent the Upper and Lower Zone 1 areas, inclusive, without regard for separate subareas. The "existing" demand representation in the UWMP was developed to match the 2009 sales report demand number, attempting to distribute 2009 single-family and multi-family account data across an array of residential land-use categories. Attempts were not made to discern how the total 2009 residential accounts were spread among the individual subareas used in the 2006 IWRP report.

However, to provide a comparison to subarea build-out demands in the 2006 IWRP, PCWA requested Tully & Young to subdivide the UWMP estimated build-out demand into the subareas used in the 2006 IWRP. Since the 2006 IWRP did not separate "existing" from "build-out" in the dwelling unit counts in Appendix F, an estimate of existing dwelling units within each subarea needed to be made. As a starting point, Tony Firenzi (PCWA) provided Tully & Young with estimated total accounts in each of the subareas. Using these values and further refining to best match the estimated existing demand for Zone 1 in the UMWP, a representative existing condition was developed. **Table 6** includes the existing "percent built" values used.

As a result of the distribution of existing accounts across the subareas and the multiple land-use classifications, the estimated existing demand is slightly different than that represented in the UWMP.

The resulting subarea existing and build-out demands are presented in **Table 7** and compared to the build-out demands of the IWRP.

Table 6 – Current Percent of Buildout[1]

Upper Zone 1	
City of Auburn	98%
City of Auburn (Airport)	32%
Auburn/Bowman CP	46%
Newcastle/Ophir	0%
Lower Zone 1	
Rocklin Area	
City of Rocklin	74%
City of Rocklin (Whitney Ranch)	60%
Sierra Community College	76%
Unincorporated Area - A	87%
Loomis Area	
Towm of Loomis	47%
Bickford Ranch Specific Plan	0%
Granit Bay - PCWA	98%
Horseshoe Bar/Penryn CP	63%
Unincorporated Area - B	0%
Unincorporated Area - C	23%
City of Roseville - PCWA	98%
Western Placer Area	
Sunset Industrial Area (Zone 1)	15%
Sunset Industrial Area (Zone 5)	0%
Dry Creek West (Placer Vineyards)	0%
Curry Creek CP	0%

[1] Data in Table from March 19, 2012 email from Tony Firenzi

Table 7 – Subarea Adjusted Existing and Build-out Demand Comparison Table

	Existing Demand	Buildout IWRP	UWMP with IWRP Land Use	UWMP with General Plan
City of Auburn	4,426	4,774	3,999	4,183
City of Auburn (Airport)	201	675	568	578
Auburn/Bowman CP	2,337	5,454	5,159	5,257
Newcastle/Ophir	0	528	563	563
Upper Zone 1(Auburn)	**6,964**	**11,431**	**10,289**	**10,580**
City of Rocklin	16,155	24,527	17,376	20,933
City of Rocklin (Whitney Ranch)	1,413	3,005	2,043	2,114
Sierra Community College	22	15	23	24
Unincorporated Area - A	216	274	199	216
Rocklin Total (Lower Zone 1 subtotal)	17,806	27,821	19,641	23,287
Towm of Loomis	1,336	2,826	2,930	3,014
Bickford Ranch Specific Plan	0	3,461	1,022	1,022
Granit Bay - PCWA	1,310	548	1,164	1,226
Horseshoe Bar/Penryn CP	2,469	2,711	3,337	3,465
Unincorporated Area - B	0	77	108	108
Unincorporated Area - C	708	2,491	2,890	2,929
City of Roseville - PCWA	796	1,065	677	727
Loomis (Lower Zone 1 subtotal)	6,619	13,179	12,129	12,491
Sunset Industrial Area (Zone 1)	1,412	11,255	8,017	8,086
Sunset Industrial Area (Zone 5)	0	6,042	4,615	4,615
Dry Creek West (Placer Vineyards)	0	13,262	8,657	8,657
Curry Creek CP	0	10,104	6,791	6,791
Wester Palcer (Lower Zone 1 subtotal)	1,412	40,663	28,080	28,149
Lower Zone 1	**25,838**	**81,663**	**59,850**	**63,928**
Total	32,802	93,094	70,139	74,508

4 – Summary of Discussions with City of Rocklin

On March 6, 2012, Tony Firenzi and Greg Young met with planning staff at the City of Rocklin to discuss land-use assumptions used in the 2006 IWRP and changes necessary to understand the water supply impact of the new General Plan's land-use assumptions. As noted during the meeting, the representation of the number of residential and non-residential land-uses in the 2006 IWRP was not based any matching detailed data from the City. Likely, the dwelling unit counts and non-residential acreages included in Appendix F of the 2006 IWRP were derived from the IWRP authors estimating mixes within broadly established land-use planning zones available at the time from the City. The General Plan, which is still under development, includes a more detailed representation of dwelling unit counts and non-residential land-use acreages. Using this updated information, a more accurate estimate of future water demand can be made and compared to the 2006 IWRP estimated demand. Using the estimated distribution of existing land use conditions presented in **Table 6** and the resulting subarea UWMP demand shown in **Table 7**, a comparison can be made between four values: (1) estimated existing demands, (2) the build-out demand estimated by 2006 IWRP, (3) the estimated build-out demand using the 2006 IWRP land use and the 2010 UWMP demand factors, and (4) the estimated build-out demand using the General Plan land use and the 2010 UWMP demand factors. The results are shown in **Table 8**.

Table 8 – Rocklin Demand Comparison

City of Rocklin	Existing Demand	Buildout IWRP*	UWMP with IWRP Land Use	UWMP with General Plan
High density 20.1+ DU/Ac.	0	0	0	0
High density 15.1-20 DU/Ac.	1,933	1,101	844	2,045
High density 10.1-15 DU/Ac.	665	831	622	691
Medium density 7.1-10 DU/Ac.	7,342	11,569	8,615	6,598
Medium density 5.1-7 DU/Ac.	4	7	5	5
Low density 3.1-5 DU/Ac.	9	13	10	11
Low density 1.1-3 DU/Ac.	93	2,161	2,165	4,197
Low density 0.1-1 DU/Ac	13	9	14	14
Rural Residential 1.1-2.3 Ac./DU	1	1	1	1
Rural Residential 2.31-4.6 Ac./DU	6	5	6	7
Rural Residential 4.61-10 Ac.DU	2	1	2	2
Professional Office	400	262	187	510
Commercial	1,652	1735	1,443	2,105
Industrial	1,091	1507	1,297	1,391
Public	1,086	581	510	1,385
Total	14,296	*	15,721	18,963
Total with Loss	**16,155**	**19,783**	**17,376**	**20,933**

* includes loss

APPENDIX B

Western Placer Waste Management Authority, Memo dated July 9, 2015

Potential future use of WPWMA property

MEMORANDUM
WESTERN PLACER WASTE MANAGEMENT AUTHORITY

TO: **WPWMA BOARD OF DIRECTORS** DATE: **JULY 9, 2015**

FROM: **KEN GREHM / ERIC ODDO**

SUBJECT: **POTENTIAL FUTURE USE OF WPWMA PROPERTY**

RECOMMENDED ACTION:

Provide direction to staff regarding potential future uses of the WPWMA's property and authorize staff to proceed with the associated planning and applicable permitting efforts of the identified uses.

BACKGROUND:

Over the past year staff has worked to identify the future needs of the WPWMA in terms of addressing anticipated regional growth, changes in applicable regulations, increasing material diversion rates, increasing operational efficiencies and improving compatibility between its operations and current and future neighbors. Based on these efforts, staff has identified a series of potential facility modifications and enhancements which it believes appropriately address the aforementioned issues.

The attached Exhibit A presents an aerial view of the WPWMA's property that includes possible future operations and their associated locations. Generally the identified areas do not represent true estimates of the required operational footprints, instead they represent conceptual "operational zones" that may be necessary to facilitate the identified improvements. The attached Exhibit B provides a brief summary of each of the identified improvements cross-referenced to the number designation shown on Exhibit A. For the purposes of clarity, relatively smaller potential projects (e.g.: modifications to the interior of the MRF, administrative office expansion, changes in landscaping and other water conservation methods, etc.) are not identified on Exhibits A and B but will be included in subsequent planning and permitting efforts.

Given the recent resurgence in development in the region and Placer County's current effort to update the Sunset Industrial Area Plan[1], staff believes it is the appropriate time to begin the planning and permitting efforts associated with these potential facility modifications.

If your Board directs staff to proceed with these efforts, staff will initiate the process of hiring an engineering firm to prepare the necessary technical studies and an environmental firm to prepare the appropriate California Environmental Quality Act (CEQA) documents.

ENVIRONMENTAL CLEARANCE:

Providing direction to staff on the future potential uses of the WPWMA's property and authorizing staff to proceed with efforts associated with the planning, environmental

[1] As reported to your Board at the December 11, 2014 meeting by Mr. Michael Johnson, Placer County Community Resource Development Agency Director.

review and permitting of various projects is not considered a “project” under the CEQA guidelines.

FISCAL IMPACT:

There is no direct fiscal impact associated with the recommended action.

Staff estimates that the costs associated with the planning and permitting efforts could exceed $1 million. While these costs were not included in the FY 2015/16 Preliminary Budget approved by your Board on April 9, 2015, they will be included as part of the FY 2015/16 Final Budget and Financial Forecast scheduled for presentation to your Board later this year.

Specific costs associated with hiring the necessary consulting firms will be presented to your Board at the time staff requests approval of the subject agreements.

ATTACHMENTS: EXHIBIT A – AERIAL MAP OF WPWMA’S PROPERTY WITH POTENTIAL PROJECT LOCATIONS
EXHIBIT B – SUMMARY OF POTENTIAL PROJECTS

KG:EO

PROPOSED LAND USE APPLICATIONS ASSOCIATED WITH POTENTIAL FUTURE USE OF WPWMA PROPERTY

NARRATIVE OF PROPOSED LAND USE APPLICATIONS ASSOCIATED WITH POTENTIAL FUTURE USE OF WPWMA PROPERTY

Overview of Current Facility Operations

The WPWMA's current facility encompasses approximately 320 acres and includes a materials recovery facility (MRF), composting facility and the Western Regional Sanitary Landfill (WRSL). The WPWMA owns approximately 480 acres to west of Fiddyment Road that has been designated as a future landfilling site. (The WPWMA has a Conditional Use Permit for the site but lacks the Solid Waste Facility Permit required for active operations.) The WPWMA also owns approximately 160 acres to the east of the landfill; this area is currently designated as buffer space.

The MRF is currently permitted to accept up to 1,750 tons per day of material; the WRSL is permitted to accept up to 1,900 tons per day. Current daily tonnages are presently below these limits (the current average daily tonnages accepted at the MRF and WRSL are 1,140 tons and 940 tons, respectively.) At present waste generation and recycling rates, the WRSL is expected to have sufficient capacity until 2058.

Growth Projections

WPWMA staff project that the population in its service area (and therefore waste tonnages) will increase by approximately 40 to 45% over the next 20 years. This estimate is greater than the population estimates prepared by SACOG (~30% population growth over the next 20 years). However, based on known and planned regional development projects, staff believes the larger growth estimate is more appropriate for planning purposes.

Based on current observations, staff believes the physical size of the WPWMA's facility is insufficient to safely and efficiently accommodate the anticipated growth in the number of users of the facility. Furthermore, based on recent regulatory, environmental and industry trends, it is likely that additional pressures will put on the WPWMA in the future to increase recovery rates; further reduce off-site environmental impacts to land, air and water; and produce and market alternative forms of energy.

In consideration of these apparent trends, WPWMA staff has begun identifying future uses for its western and eastern properties as well as other possible modifications to its existing facility layout. The following outlines some of these potential concepts.

Potential Opportunities to Modify the WPWMA's Facility to Respond to Future Needs

1. **New composting area**

   A new composting facility could be established to accommodate future growth for the composting of greenwaste as well as other organic materials such as foodwaste and possibly biosolids.

   This new area could include an enclosed area for the receipt and initial processing and composting of materials. Enclosing these operations would help to mitigate the odor potential associated with these materials and operations.

The initial phase of composting operations could be performed utilizing aerated static pile technologies wherein air is continuously introduced into the composting product. This would serve to accelerate the composting process, reduce regulated air emissions and further reduce the potential for odors.

2. New public unloading area with Buyback Center and HHW Facility

The existing public area could be decommissioned and a new, full-service area established to accommodate use of the facility by self-haul customers.

As shown, the new area would have a separate entrance from the original facility with a separate scalehouse complex. Access would likely be at the intersection of Athens and Fiddyment.

This would result in a complete separation between the public and commercial customers (i.e. haulers) thereby improving customer safety and efficiency.

Removing the self-haul traffic from the remainder of the facility would effectively increase the customer loading capacity of the original facility thereby deferring the need for expansion of the original scalehouse complex, entranceway and unloading areas.

3. Non-public access tunnel or overpass between properties

To better facilitate the flow of vehicles and materials between the main WPWMA property and the western expansion area, a multilane tunnel or overpass could be constructed connecting the two properties and limiting the need for operational vehicles to transport materials over public roadways.

Restricting access to the haulers and MRF and landfill operators would help to reduce additional traffic on public roadways and allow for the continued use of the commercial scalehouse operations. Public users would access the site via a separate entrance (see #2).

4. Relocated LFG blower/flare station with CNG fueling station

The landfill gas blower/flare station could be relocated (or a secondary facility constructed) to be closer to the current landfill modules. In addition, an LFG to CNG conversion facility, fast-fill, slow-fill and hauler corporation yard could be located in this area.

This would enable haulers to park vehicles overnight (for slow-fill operations) and/or refuel during the day (via fast-fill operations). Fast-fill operations could also be made accessible to other publically or privately owned natural gas powered vehicles (e.g. city or County-owned vehicles, WPWMA contract operator vehicles, etc.).

It is assumed that future waste vehicle traffic will access the site via the Placer Parkway/Fiddyment exit. This should also serve to reduce WPWMA-bound traffic from the areas around the casino and other future business areas in the Sunset Industrial Area.

5. New landfill modules

Developing new landfill modules on the eastern property presents unique opportunities compared to development of landfill on the western property. Namely, additional capacity could be achieved per acre of land developed as a result of tying into and overlaying existing landfill modules. This would not be possible on the western property unless Fiddyment Road were realigned to the west.

Assuming no increase in overall landfill height and no additional fill over the original, unlined modules (i.e. Modules 1, 2, 10 and 11), the WPWMA may realize a net increase of approximately 50 million cubic yards (MCY) of airspace for a total site capacity of 86 MCY. Based on current growth estimates, this equates to approximately 44 additional years of filling and has an estimated present airspace value of $300 million.

6. Unlined module relocation

Since Modules 1, 2, 10 and 11 were constructed prior to enactment of Federal Subtitle D regulations they did not include a geomembrane liner system. As such, there exists the potential for long-term impacts to subsurface soils and groundwater beneath and adjacent to these modules. Furthermore, no additional fill can be placed directly over these modules, thereby limiting capacity within the currently permitted landfill boundary.

Landfill expansion to the east could provide a potential opportunity to excavate and relocate the materials from these modules to a new, fully lined landfill module at the southern edge of the eastern property.

Relocation of this waste offers several benefits, including:

- Elimination of long-term environmental risks associated with wastes in the unlined areas.
- The current area taken up by these modules could be reclaimed for other operations in the near term and developed into fully lined landfill modules in the future. By matching the excavation and final fill grades of the unlined portion of the landfill to the lined portion, the WPWMA may realize a net increase of 22 MCY of airspace for a total site capacity of ~108 MCY. This equates to approximately 24 additional years of filling and has an estimated present airspace value of $132 million. The estimates of additional site life and airspace value are in addition to the estimates cited under item #5.
- The waste could be relocated to the southeastern-most edge of the WPWMA's property. This filling operation could happen relatively rapidly and allow for the WPWMA to completely close and cap its southernmost boundary so as to minimize the potential impacts associated with landfilling operations to current and future receptors to the south and southeast.

7. Alternative technologies pilot project area

This area could be located near the MRF on the site of the original composting pad. Due to new, more stringent composting regulations, the original compost pond is insufficiently sized for the existing compost area. Additionally, an insufficient area is available to enlarge the pond to the required size. As it may make sense to completely relocate the composting operation in the future (see #1), this area could support one or more pilot-scale facilities (e.g.: AD, pyrolysis, gasification, etc.) that are designed to process materials currently not recovered from the MRF to produce energy and/or fuels, or to further refine other products to make them more marketable in the future.

Establishing an area for pilot studies would allow the WPWMA to evaluate the feasibility of an alternative technology before deciding whether to commit a significant portion of the facility to a full scale, long-term operation.

8. Solar array and/or other alternative energy projects or complimentary manufacturing operations

These areas could be developed to accommodate a solar array or other alternative energy project(s) or operational uses prior to being developed for landfilling.

Alternatively the area could be used to site manufacturing facilities that utilize materials from the MRF (e.g. paper and other fibers, plastics, etc.) as the feedstock for their products or processes. This would help improve the economics of recovering certain materials (and thereby increase diversion rates) as well as provide additional local jobs.

9. Research and Development Center

With plans for multiple universities to be sited in or near the Sunset Industrial Area, there is an opportunity for the WPWMA to partner with one or more of these institutions to establish an R&D type facility focused on solid waste-related issues or waste-to-energy type operations.

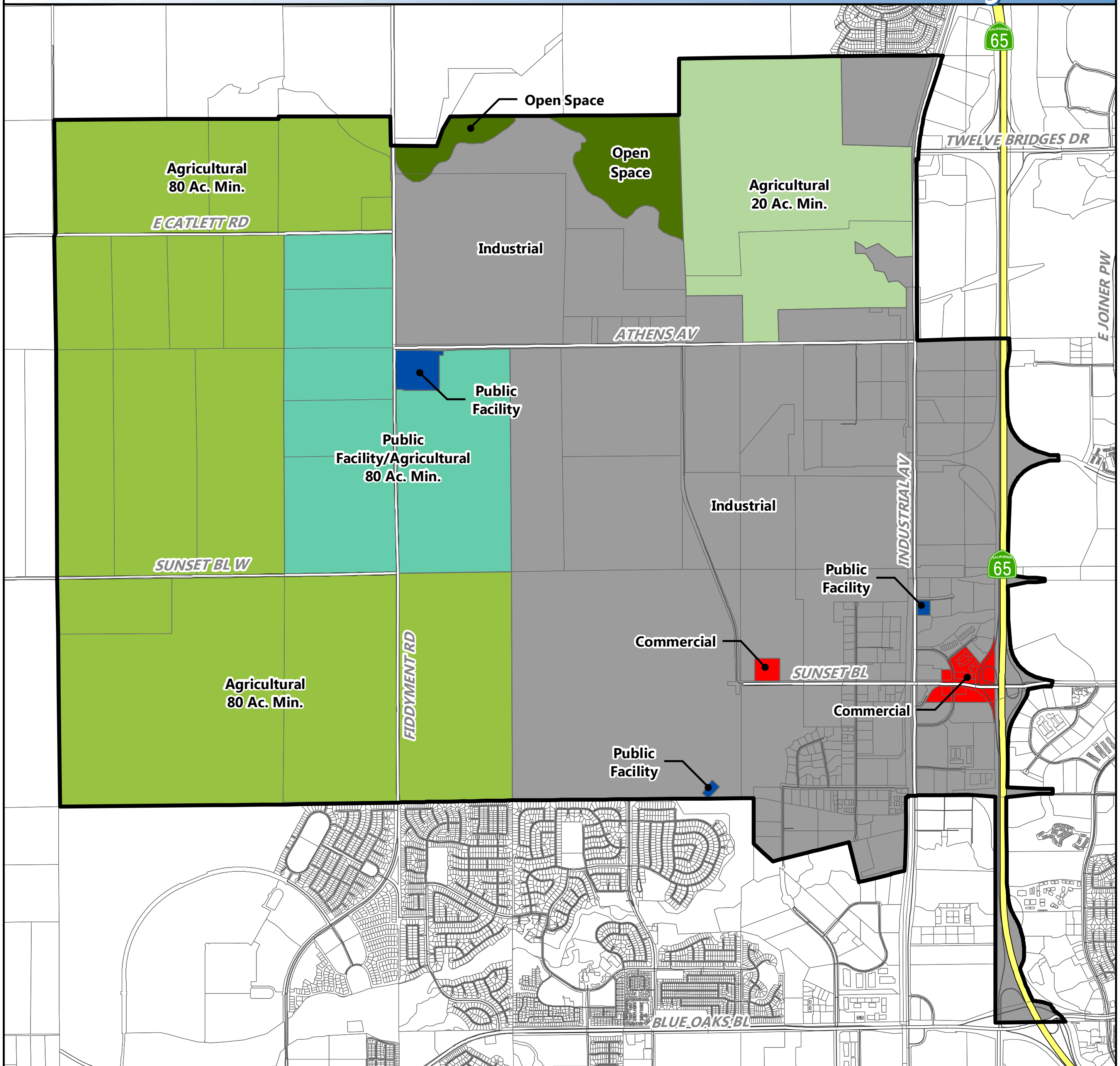
10. Other commercial/industrial uses or buffer space

The area to the south and west of the high voltage power lines could be utilized for non-solid waste related operations and support other commercial uses, remain as an area to apply reclaimed water from the Lincoln Waste Water Treatment Plant or serve as a buffer between the WPWMA's operations and other users.

APPENDIX C

Current Land Use Plan for the Sunset Industrial Area (Approved 1997)

Sunset Industrial Area Land Use Designations



LEGEND

Land Use Designation

- Industrial
- Commercial
- Public Facility
- Public Facility/Agricultural 80 Ac. Min.
- Agricultural 20 Ac. Min.
- Agricultural 80 Ac. Min.
- Open Space
- SIA Plan Area

0 0.25 0.5 0.75 1
Miles

DATA DISCLAIMER:
The features on this map were prepared for geographic purposes only and are not intended to illustrate legal boundaries or supercede local ordinances. Official information concerning the features depicted on this map should be obtained from recorded documents and local governing agencies

APPENDIX F

Hewlett-Packard/Campus Oaks Rezone & Master Plan Project
Water Supply Assessment, Municipal Consulting Group, June 2015

HEWLETT-PACKARD / CAMPUS OAKS
REZONE & MASTER PLAN PROJECT

WATER SUPPLY ASSESSMENT

June 2015

By: Derrick Whitehead, PE

Municipal Consulting Group

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INTRODUCTION

PURPOSE

Senate Bill 610 (SB 610), codified at California Water Code Section 10910 et seq., requires a City or County to request the public water utility to prepare an assessment of the availability of water supplies for certain large development projects. A water supply assessment (WSA) is performed in conjunction with a land-use approval process. The WSA must include an evaluation of the sufficiency of the water supplies over a twenty-year horizon that addresses the availability of the water supply to the utility to meet existing and anticipated future demands, including the demand associated with the project during normal, single-dry and multiple-dry years.

The WSA must identify existing water supply entitlements, water rights, or water service contracts held by the water supplier or relevant to the identified water received in prior years by the public water system. If the public water supplier includes groundwater supplies, the WSA must describe all groundwater basins from which the proposed project will be supplied. For each basin that has not been adjudicated the WSA should indicate whether the California Department of Water Resources has identified the basin as over drafted or has projected that the basin will become over drafted if present management conditions continue. In addition the WSA should provide a detailed description of the efforts being undertaken in the basin to eliminate the long-term over draft condition.

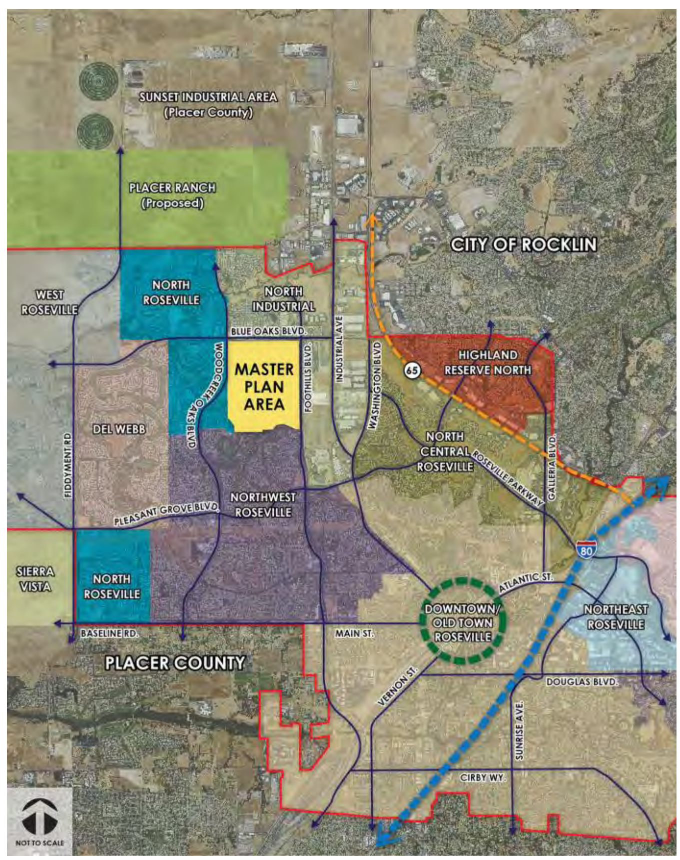


Figure 1- Project Location

If the WSA concludes that additional water supplies are necessary, the public water supplier must submit plans for acquiring additional water supplies including the measures that would be taken to acquire and develop supplies. The future water supply projects and a program discussion based upon proposed methods of financing, estimated costs, information related to federal, state and local permits and the estimated timeframes when the public water system expects to be able to acquire the additional supplies.

PROJECT DESCRIPTION

Hewlett-Packard and BBC Roseville Oaks, LLC have proposed an amendment to the Hewlett-Packard Roseville Campus Master Plan that would reconfigure the land uses and infrastructure on a portion of the Master Plan Area. The Hewlett-Packard Roseville Campus Rezone & Master Plan establishes development regulations for 492.2 acres at the southwest corner of Blue Oaks and Foothills Boulevards within the City of Roseville's North Industrial Planning Area (see **Figure 1**). Originally adopted in June 1996, the Master Plan envisioned a manufacturing and office campus to accommodate Hewlett-Packard's existing and planned operations. Hewlett-Packard has subsequently adjusted its facilities needs for the Roseville campus, divesting its ownership in all but a portion of the Master Plan Area.

The proposed amendment to the Master Plan, the Hewlett-Packard / Campus Oaks Rezone & Master Plan (HPCO) Amendment provides for a mixed-use community on a 375.7-acre portion of the original Master Plan Area (See **Figure 2**). The HPCO Amendment Area is organized into two physically and functionally integrated sub-areas: the Hewlett-Packard Campus accommodating existing and planned light industrial, recreation and related uses (blue area); and Campus Oaks (tan area – the Project) planned for a new mix of tech/business park, office, commercial, residential, park and recreation, open space and public uses. The HPCO Master Plan Amendment supersedes all prior Master Plan requirements for the HPCO Amendment Area.

Figure 2- HPCO Amendment Area

PROJECT SETTING

The HPCO Amendment Area has been designated for development for over 35 years. Surrounded by established employment, commercial and residential uses, the eastern portion of the Amendment Area is partially developed by Hewlett-Packard, one of Roseville's largest employers. The western portion of the Amendment Area, Campus Oaks, is undeveloped consisting primarily of annual grasslands with gently rolling topography that has been highly disturbed over time through bi-annual disk-plowing. The southern portion of Campus Oaks contains a City owned open space/wetland preserve along the South Branch of Pleasant Grove Creek.

PROPOSED PROJECT

The HPCO Master Plan Amendment establishes updated land use and zoning regulations, mobility and infrastructure plans, public services provisions, design guidelines, and development approval processes for the 375.7-acre Amendment Area. The remainder of the larger Master Plan Area will continue to be regulated by the existing Hewlett-Packard Roseville Campus Master Plan.

The HPCO Master Plan Amendment proposes to retain the existing Light Industrial land use designation on a majority of the Hewlett Packard Campus, refining the square footage allocated to the Campus based upon Hewlett-Packard's projected development program. In addition, a City park is proposed on the western edge of the Campus. The existing Light Industrial land use designation on Campus Oaks is proposed to be changed to a mix of light industrial (tech/business park) office, commercial, residential, park and recreation, open space and public uses. The existing City owned wetland preserve will be retained, and will be augmented by additional open space parcels.

The HPCO Master Plan Amendment includes proposed revisions to the mobility and utility systems to accommodate the revised land uses. The mobility system will include a modified grid street pattern that is connected to, and helps to complete, the City's larger roadway network; an interconnected system of paths, sidewalks and bike lanes; and multiple transit stops. HP Way will be constructed as a public roadway through the project site. Other roadway connections will include the extensions of New Meadow Drive from the north, and Painted Desert and Crimson Ridge Drives from the west.

The construction of backbone utility infrastructure will be necessary to accommodate full build-out of the Amendment Area. Water, recycled water, wastewater, drainage, electric, natural gas, and telecommunications infrastructure exist within and/or adjacent to the Amendment Area. Since adoption of the 1996 Master Plan, substantial development and associated infrastructure improvements have been constructed in the vicinity of the Project Area. The Project Amendment accounts for these changed conditions to define an updated and efficient backbone utility infrastructure program.

Proposed land uses within the Project Master Plan Area are summarized in **Table 1**, and illustrated on **Figure 3**.

Figure 3 – HPCO Land Use Plan for Amendment Area

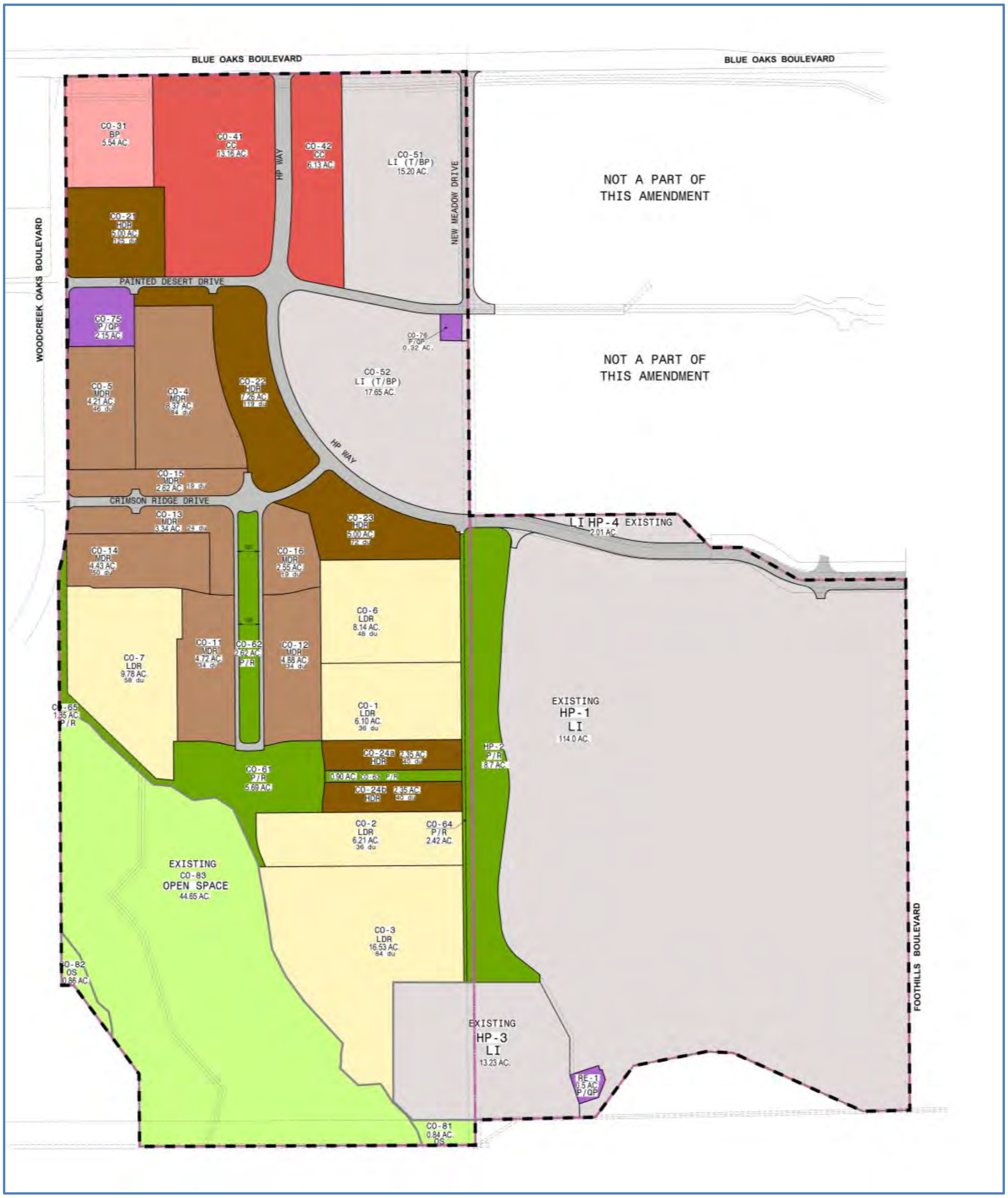


TABLE 1: HPCO Master Plan Amendment Area Land Use Summary

Land Use	Gross Acres	Building Square Feet (sf)					Dwelling Units (du)		
		Existing	Future	Total Capacity	FAR Range	Avg. FAR	Units	du/ac Range	Avg. du/ac
EMPLOYMENT AND COMMERCIAL USES									
Light Industrial (LI)	129.24 ac	593,820sf	606,180 sf	1,200,000	20-50%	31%			
Tech/Business Park (T/BP-LI)	32.85 ac		300,000 sf	300,000 sf	20-40%	21%			
Business Professional (BP)	5.54 ac		60,000 sf	60,000 sf	20-40%	25%			
Community Commercial (CC)	19.29 ac		170,000 sf	170,000 sf	20-40%	20%			
Sub-Total	**186.92 ac**	**593,820sf**	**1,136,180 sf**	**1,730 ,000 sf**		**21%**			
RESIDENTIAL USES									
Low Density (LDR)	46.76 ac						242 du	0.5-6.9	5.2
Medium Density (MDR)	35.60 ac						310 du	7.0-12.9	8.7
High Density (HDR)	21.97 ac						396 du	13.0+	18.0
Sub-Total	**104.33 ac**						**948 du**		**9.1**
PARK, OPEN SPACE AND PUBLIC USES									
Park & Recreation (P/R)	19.44 ac								
Paseo (P/R)	2.25 ac								
Open Space (OS)	46.35 ac								
Public (P/QP)	2.97 ac								
Sub-Total	**71.01 ac**								
Backbone Roads	13.47 ac								
TOTAL	**375.73 ac**	**593,820sf**	**1,136,180 sf**	**1,730,000 sf**		**27%**	**948 du**		**9.1**

NOTE: Existing development consists of Buildings R3 (126,220 sf), R4 (131,190 sf), R5 (158,760 sf) and R6 (177,650 sf).

Baseline Water Use

Municipal Consulting Group developed a water use estimate for the proposed Campus Oaks area. Summaries of residential and non-residential water demands are presented in **Table 2**. Water demands include both potable and recycled water usage in Campus Oaks. Additionally, system losses are accounted for in these calculations.

Table 2 Campus Oaks Rezone Area Proposed Land Uses Water Demand Estimate				
Residential		**Gross Acres**	**Units**	**Annual Demand (AFY)**
	LDR	46.76	242	146.90
	MDR	35.60	310	127.75
	HDR	21.97	396	87.47
	Subtotal:	104.33	948	362.12
Non-Residential				
	Commercial / Business Professional / Lite Industrial	57.68		167.87
	Parks	12.99		43.48
	Open Space	46.35		0.00
	Public Quasi Public	2.47		4.93
	Subtotal:	119.49		216.27
		223.82	948	578.40
Total (AFY)				578.40
System Losses (2%) AFY				11.57
Total System Demand (AFY)				589.97

Notes:

1. Demand factors and annual demands are based on the Campus Oaks Rezone Area – Land Use Plan, dated January 22, 2015 and City of Roseville unit water demand factors.

Calculations of the annual residential water demands are shown in **Table 3A**, and the non-residential demands are shown in **Table 3B**. The bottom of **Table 3B** consolidates the totals for both residential and non-residential demands with system losses. Before applying water conservation and the use of recycled water, the Campus Oaks Area's estimated demand is 590 AFY.

The 2015 HPCO Master Plan would develop approximately 189.88 acres west of the existing Hewlett Packard Campus within the City of Roseville. A summary of the proposed land use designations is graphically illustrated on **Figure 3** and listed in **Tables 2, 3A**, and **3B**.

TABLE 3A
HEWLETT-PACKARD /CAMPUS OAKS
REZONE & MASTER PLAN
CAMPUS OAKS AREA – RESIDENTIAL DEMANDS

Parcel	Land Use	Gross Area (Acres)	Density (du/ac)	DU's (Units)	Demand Factor (gpd/EDU)	Demand (AFY)
Low Density Residential						
CO – 1	LDR	6.10	5.9	36	521.00	21.01
CO – 2	LDR	6.21	5.8	36	521.00	21.01
CO - 3	LDR	16.53	3.9	64	600.00	43.02
CO - 6	LDR	8.14	5.9	48	521.00	28.01
CO - 7	LDR	9.78	5.9	58	521.00	33.85
Sub-Total		46.76		242		146.90
Medium Density Residential						
CO - 4	MDR	8.37	10.0	84	323.00	30.39
CO - 5	MDR	4.69	9.8	46	323.00	16.64
CO - 11	MDR	4.72	7.2	34	430.00	16.38
CO - 12	MDR	4.88	7.0	34	430.00	16.38
CO - 13	MDR	3.34	7.2	24	430.00	11.56
CO - 14	MDR	4.43	11.3	50	323.00	18.09
CO - 15	MDR	2.62	7.3	19	430.00	9.15
CO - 16	MDR	2.55	7.5	19	430.00	9.15
Sub-Total		35.60		310		127.75
High Density Residential (Attached or Detached)						
CO - 21	HDR	5.00	25.0	125	177.00	24.78
CO - 22	HDR	7.26	16.1	119	177.00	23.60
CO - 23	HDR	5.00	14.8	72	288.00	23.23
CO - 24	HDR	4.71	17.0	80	177.00	15.86
Sub-Total		21.97		396		87.47
Total:						362.12
System Losses					2%	7.24
Residential Total:						
		104.33		948.00		369.36

TABLE 3B
CAMPUS OAKS AREA – NON-RESIDENTIAL
HEWLETT PACKARD - CAMPUS OAKS MASTER PLAN

Parcel	Land Use	Gross Area Acre	Average Lot Size/ Product Type	Demand Factor gpd/AC	Demand AFY
Non-Residential					
CO - 31	BP	5.54	Prof Office	2,598.00	16.12
CO - 41	CC	13.16	Commercial	2,598.00	38.30
CO - 42	CC	6.13	Commercial	2,598.00	17.84
CO - 51	BP/LI	15.2	(Tech/Business Park)	2,598.00	44.24
CO - 52	BP/LI	17.65	(Tech/Business Park)	2,598.00	51.37
		57.68			167.87
Parks, Open Space & Public Uses					
CO - 61	P / R	5.70	Park	2,988.00	19.08
CO - 62	P / R	2.62	Park	2,988.00	8.77
CO - 63	P / R	0.9	Paseo	2,988.00	3.01
CO - 64	P / R	2.42	Park	2,988.00	8.10
CO - 65	P / R	1.35	Paseo	2,988.00	4.52
CO - 81	OS	0.84	Park/Preserve	0.00	0.00
CO - 82	OS	0.86	Park/Preserve	0.00	0.00
CO - 83	OS	44.65	Park/Preserve	0.00	0.00
		59.34			43.48
Public					
CO - 75	P/QP	2.15	Fire Station	1,780.00	4.29
CO - 76	P/QP	0.32	Well Site	1,780.00	0.64
		2.47			4.93
Roads					
Roads					
	ROW	10.71		0.00	0.00
Sub-Total					
					216.27
System Losses					
	Campus Oaks			2%	4.33
Non-Residential Adjusted Totals					
	Campus Oaks	130.20			220.60
Residential		104.33			369.36
Non-Residential		130.20			220.60
Total Demand					589.96

As shown on **Figure 3**, Hewlett-Packard / Campus Oaks Rezone & Master Plan Project land use plan includes low, medium, and high density residential uses; community commercial; public/quasi-public; parks and recreation areas, open space, and paseos; landscape corridors; light industrial (tech/business park); and roadways. At build out, the Project would provide approximately 948 dwelling units and generate a population of approximately 2,475 persons, based on the City of Roseville's General Plan assumption of 2.61 persons per household. According to the HPCO Master Plan, the project would accommodate approximately 3.23 million square feet of non-residential development generating approximately 4,500 to 7,500 jobs depending upon the ultimate composition and operations of employment uses.

DESCRIPTION OF THE CITY OF ROSEVILLE SERVICE AREA

The City of Roseville is located in Northern California's Central Valley region, within comfortable driving distance of both the Sierra Nevada Mountains and the Pacific Coast, midway between the cities of Sacramento and Auburn. A mixture of residential, park and recreation, commercial and industrial land uses characterizes the service area.

The City of Roseville's climate is described as mild with abundant sunshine year-round averaging 285 sunny days per year. Total rainfall averages 17.5" with the majority of rain between January and March. Summer months rarely experience precipitation. Peak water demands occur during the summer months.

The City's water service area is currently divided into six pressure zones. With the exception of Pressure Zone 4, where pressure is reduced through pressure reducing stations, all other pressure zones (Pressure Zones 1, 2, 3, and 5) are either serviced by gravity, require boosting or are served by adjacent water agencies that have sufficient capacity to serve these areas. The proposed Master Plan area is located in Pressure Zone 1.

SCOPE OF WATER SUPPLY ASSESSMENT

This WSA discusses historic water supplies and current water supplies that would serve planned future growth within the existing City limits. This information is presented consistent with the requirements of SB-610 and as detailed in Water Code Section 10910-10915, and includes:

- Description of existing and projected water demands
- Description of existing and projected water supply sources including:
  - Groundwater basins, surface water and other sources.
  - Opportunities for exchange or transfers of water on a short-term and long-term basis.
- Plans to acquire additional water supplies if necessary.
- Assessment of the availability of existing and projected water supply sources during normal, single-dry, and multiple-dry years within a 20-year projection.

The WSA for the proposed Hewlett-Packard / Campus Oaks & Master Plan Project contains information derived from several sources including:

- Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan Project Water System Master Plan, April 2015
- Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan Project, Recycled Water System Master Plan, April 2015
- Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan Project, Water Conservation Plan, April 2015
- City of Roseville Urban Water Management Plan, City of Roseville, EU Staff, 2010
- Groundwater Impact Analysis for Proposed Reasons Farms Land Retirement Plan, MWH, June 2003
- PCWA's Integrated Water Resources Plan, Brown and Caldwell, August 2006
- FR SPA3 Specific Plan FEIR, April 16, 2014
- TM-1- Unit Water Demand Factor Verification and Water Demand Evaluation and Update, MWH September 2006
- TM 5a - Market Assessment for Recycled Water Distribution System, RMC, Updated February2008
- Water Forum Agreement Final EIR, November 1999
- West Roseville Specific Plan FEIR, February 2004
- Western Placer County Groundwater Management Plan, August 1, 2007
- Western Placer County Sustainable Yield Analysis (WPSY), prepared by GEI Consultants, dated November 2013.

WATER SUPPLY ASSESSMENT FOR THE HEWLETT-PACKARD / CAMPUS OAKS REZONE & MASTER PLAN PROJECT

California Water Code Sections 10910- 10915 (inclusive) require land use lead agencies: 1) to identify the responsible public water purveyor for a proposed development project, and 2) to request from the responsible purveyor a "Water Supply Assessment" (WSA). The purpose of the WSA is to demonstrate the sufficiency of the purveyors' water supplies to satisfy the water demands of the proposed development project, while still meeting the current and projected water demands of existing customers during the 20-year planning horizon. Water Code Sections 10910- 10915 delineate the specific information that must be included in the WSA.

This WSA is structured so that it clearly shows which section of the Water Code is being addressed by identifying the related section number and title. Additional information is provided where it is useful in the understanding of the proposed project, its water demands, and its corresponding water supplies.

Section 10910(a) Determine if a proposed project is subject to California Environmental Quality Act (CEQA).

The City of Roseville has made the determination that the proposed 2015 Hewlett-Packard / Campus Oaks Rezone & Master Plan Project (HPCO) is subject to CEQA through an amendment to the existing 1996 HPMP.

Section 10910(b) Identify responsible public water system that will or may supply water to the proposed project.

The City of Roseville has been identified as the responsible public water system for the HPCO.

Section 10910(c)(1) Determine if the most recent Urban Water Management Plan (UWMP) includes projected water demand associated with the project.

The 2010 UWMP dated August 2011, which was adopted by City of Roseville's Council Resolution August 17^{th}, 2011, identifies current and projected water supply and demand through 2035 based on General Plan build out. Because the proposed project is an infill project, water demands for the HPCO Master Plan were included in the 2010 UWMP. The 2010 UWMP will not need to be updated to reflect the water demands associated with the proposed project as described herein.

Water Demand

Water demand is the amount of water required to service customers on an average annual basis. The

City measures this amount of water in acre-feet per year (AFY). One acre-foot of water is the volume of water that will cover an acre of land to a depth of one foot and equals 325,828 gallons. Total water demand for build out of the City's existing General Plan, which includes the HPCO Master Plan was developed using the City's unit demand factors and applying those factors to the land uses throughout the City.

Water demands are classified as either potable or non-potable water demands. Potable water is water that is fit for human consumption (drinking water) while non-potable (often recycled water) is used for non-consumptive purposes such as landscape irrigation, manufacturing, and construction as well as many other purposes. Throughout most of the City potable water is used to meet potable and non-potable demands. Potable water demand needs are typically met by surface water supplies and supplemented by groundwater supplies (backup supplies) during emergency or surface water shortage conditions. Recycled water is tertiary treated wastewater that is used for irrigation (primarily on the west side of the City), which offsets the need to use potable water. Net potable demands are calculated by subtracting estimated recycled water demands from the City's total water demand.

The City's unit demand factors are based upon customers' actual metered water use data. The current demand factors were developed in 2002 as part of the West Roseville Specific Plan process. The City conducted an additional study in 2006 to determine if pre-1992 residential units water use characteristics were the same as post-1992. *TM-1 – Unit Water Demand Factor Verification and Water Demand Evaluation and Update by MWH, September 2002* is provided in Appendix 1 and the MWH – TM completed in 2006 is provided as Appendix 2 of this WSA. These factors are provided in **Table 4**.

TABLE 4 WATER DEMAND FACTORS	
Residential Land Use Categories	**Unit Demand Factor (GPD/DU)**
LDR1 (<3.5 DUs / Acre)	728
LDR2 (3.5 to 5 DUs / Acre)	600
LMDR1 (>5.0 to 6.0 DUs / Acre)	521
LMDR2 (6.0 to 8.0 DUs / Acre)	430
MDR (>8.0 to 12.0 DUs / Acre)	323
HDR1 (>12.0 to 16.0 DUs / Acre)	288
HDR2 (>16.0 DUs / Acre)	177
Non Residential Land Use Categories	**Unit Demand Factor (gpd/AC)**
Community Commercial / Retail	2,598
Business Professional	2,598
Light Industrial	2,598
Industrial	2,562
Railyard	109
Elementary School	3,454
High School	4,069
Pubic Quasi-Public	1,780
Parks	2,988
Open Space / Right of Way	0

gpd/DU = gallons per day per dwelling unit
gpd/AC = gallons per day per acre

General Plan Build Out Demands

At build out of the City's current General Plan, water demands are estimated to reach 63,235 AFY. **Table 5** provides a summary of these demands.

TABLE 5 GENERAL PLAN BUILD OUT WATER DEMANDS	
Land Use Type	Demand (AFY)
Low Density Residential	26,551
Medium Density Residential	8,601
High Density Residential	3,750
Commercial	7,173
Commercial Business Park	2,494
Industrial	1,526
Light Industrial	3,588
Public/Quasi Public	1,231
Parks and Paseo	6,792
Rail Road	70
Schools	2,110
Open Space	0
Urban Reserve	4
Sub-Total (w/o losses)	**63,890**
2% for Losses	1,278
Sub-Total (w/losses)	**65,168**
Remove Corporate Centers Reserve	-313
Water Conservation Reduction (SVSP)	-729
Water Conservation Reduction (CSP)	-205
Water Conservation Reduction (WSP)	-178
Water Conservation Reduction (Pearl Creek Apts)	-5
Water Conservation Reduction (WP Phase 4)	-133
Water Conservation Reduction (Fiddyment Ranch SPA 3)	-370
Total Water Demand	**63,235**

HPCO Master Plan Water Demands

The proposed 2015 HPCO Master Plan proposes to develop approximately 189.9 acres Development of the Campus Oaks area would include residential, commercial, business professional, light industrial (tech/business park, open space and park uses requiring treated potable water. The HPCO Master Plan will also use recycled water for irrigation purposes. The total water demand for the Campus Oaks area is summarized on **Table 3A** and **3B**, totaling 590. AFY.

Table 6 identifies the amount of water allocated for the site using the City's current Demand Factors. The overall site has a demand of 1,432 AFY and the Campus Oaks area including the City Open Space area totaled 668 AFY. The 1,432 AFY identified for the entire HP Master Plan.

Table 6 Full Water Demand as Light Industrial Land Use Site For 1996 HPMP			
	Acres	**Demand Factor**	**Water Use AFY**
Existing HP Campus	131.00	2598	381.25
HP Park	9.04	2598	26.31
R-10 Building	57.87	2598	168.42
R-21 Building	59.73	2598	173.83
City OS	44.65	2598	129.95
Hewlett-Packard / Campus Oaks Master Rezone & Master Plan Project (as Light Industrial land use under current master Plan)	189.88	2598	552.61
Total:	492.17		1,432.38

In a letter dated August 27th, 2013 the City attributed 668 AFY of water demand to the Campus Oaks Sub-area (Appendix 3).

> At this point in the assessment, it is safe to say that the City has set aside enough of its current water supply entitlements to meet the estimated water needs for the HPCO.

Tables 3A and **3B** estimate the total amount of water needed for the Campus Oaks Sub-area is 590 AFY, not adjusted to include conservation reductions or the use recycled water for irrigation. At this point in the assessment, one can conclude the City has set aside enough water supply entitlements to meet the estimated water needs for the proposed 2015 HPCO Rezone & Master Plan Project.

The 2015 HPCO Master Plan has included significant water conservation measure in the project. These water Conservation measures include:

- Turf reductions and low water use landscaping in residential front yards, parks, streetscapes and public facility landscaping.
- Smart irrigation controllers for more efficient and effective site irrigation
- Re-circulating hot water systems for residential units.

The Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan, Water System Master Plan June 2015 (included as Appendix 4) and the Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan, Water Conservation Plan dated June 2015 by Municipal Consulting Group (included as Appendix 5) provides the calculations showing the water demands for the HPCO Master Plan and the estimated water saving expected from the conservation measures identified above.

Applying the water conservation strategy used by the City for approval of the Creekview Specific Plan, the HPCO Master Plan could realistically expect to recognize 48 AFY of conserved potable water and an additional 27 AFY of conserved recycled water, totaling 75 AFY (**Tables 7** and **8**). This is approximately 12.6% savings over the standard demand factors by reducing the amount of turf by 28% in the front yards, installing smart irrigation timers on all landscape irrigation systems, and requiring recirculating hot water systems (Insta-Hot) plumbing in all new residential construction.

Using recycled water for landscape irrigation on all non-residential and high-density residential products reduces the demand for treated surface water. After applying conservation measures to recycled water demands the remaining recycled water demand is 82 AFY (**Table 8**). Recognizing 75 AFY (48 AFY Potable Savings, 27 AFY Recycled Saving) as savings plus 82 AFY of recycled water use results in a total water demand reduction of 157 AFY, which is a reduction in demand of 26.60%.

Development of the Campus Oaks area results in a projected potable demand (applying conservation measures and recycled water) of 433 AFY, which is a reduction in total demand of 157 AFY for the project. Subtracting 433 AFY from what was originally allocated to the Campus Oaks Area shows a savings of 235 AFY (668 AFY – 433 AFY) from what has been set-aside for the Campus Oaks portion of the original HP Campus under the current General Plan allocation. At a citywide level, Roseville's existing General Plan build out demand would be reduced from 63,235 AFY (**Table 5)** to 63,000 AFY.

Table 7
Estimate Potable Water Saved
by Implementing Conservation Measures
(AFY)

Residential	Annual Demand (AFY)	Outdoor Demand (AFY)	Modified Turf Savings (AFY)	Smart Timer Savings (AFY)	Insta Hot Savings (AFY)	Total Savings (AFY)
LDR	146.90	74.92	7.76	13.43	2.03	23.22
MDR	127.75	65.15	6.75	11.68	2.60	21.03
HDR	87.47	34.99			3.33	3.33
Subtotal:	362.12	175.06	14.51	25.11	7.96	47.58

Table 8 Estimate Recycled Water Saved by Implementing Conservation Measures (AFY)					
		Original Annual Demand (AFY)	Conservation Measures		Conserved RW (AFY)
			Modified Turf (AFY)	Smart Timer (AFY)	
Residential	HDR	17.49	6.73	2.15	8.88
Non-Residential					
	Parks / Open Space	43.48	10.96	5.64	16.60
	Public Quasi Public	4.93	1.21	0.25	1.46
	Subtotal:	65.90	18.90	8.04	26.94

Section 10910(c)(2) If demands are included in most recent UWMP; incorporate information from the UWMP in the WSA.

As indicated above, the water demand for the project site was included in the City's 2010 UWMP update. Specific information on water demands is provided in response to Section 10910 (c)(1), above and response to Section 10910(c)(3) and 10910(c)(4), below.

Section 10910(c)(3) If demands are NOT included in most recent UWMP, discuss existing system's water supplies available during normal, single dry, and multiple dry years during a 20-year projection to meet project demands, existing system and planned future uses.

Water demands for the project site were included in the City's 2010 UWMP update and are included in the City's long-term water supply projections. **No additional water supply is needed for this project, more specifically, the project results in a reduction in the total water demand for the City.**

Section 10910(c)(4) Discuss projected water supplies available during normal, single dry, and multiple dry years during a 20-year projection versus projected water demand including existing system, and planned future uses.

Water Supply Sources

The City of Roseville has three sources of water supply: 1) surface water, 2) recycled water for irrigation and cooling, and 3) groundwater in dry years or in times of emergency. Each is described herein.

Surface Water

Folsom Lake has been the primary source of water for the City of Roseville since 1971. Through the Folsom Lake Municipal and Industrial (M&I) intake, Roseville receives untreated water from the U.S. Bureau of Reclamation (USBR) and the Placer County Water Agency (PCWA). Additionally, through this same delivery point, the City receives a normal/wet year water supply from San Juan Water District (SJWD). The untreated surface water is delivered to the City's Barton Road Water Treatment Plant. Roseville also maintains interties with PCWA, San Juan Water District (SJWD), the California American Water Company, Sacramento Suburban Water District (SSWD) and the Citrus Heights Water District. Connections between two different water districts are known as interties. This allows existing distribution systems to be used to deliver water between purveyors in the event of water treatment plant or conveyance system disruptions.

The City of Roseville has three surface water contract entitlements for American River water totaling 66,000 acre-feet per year (AFY): a 32,000 AFY contract with the USSR from the Central Valley Project (CVP) supply from Folsom Lake; a 30,000 AFY contract with PCWA supplied from the Middle Fork (American River] Project (MFP); and a 4,000 AFY contract with SJWD. The SJWD contract allows for delivery of a portion of their PCWA contract water supply (also provided from the MFP) to the City's service area. **Table 9** summarizes the City's water supply contracts.

Table 9
City of Roseville - Surface Water Contracts[1]

Contracted Water Supply	Contract Amount (AFY)
USSR (CVP supply)	32,000
PCWA (MFP supply)	30,000
SJWD (wet year only - MFP supply)[2]	4,000
Total Contracted Supplies	66,000
Available Supplies: Normal/Wet Years	
(a) Normal/Wet Years	58,900
(b) Drier and Driest Years (Critically Dry)	Ranges from 54,900 to 39,800

1. American River diversion limitations as outlined in the City's Water Forum Agreement.
2. SJWD is only available as a wet year supply, thus it is not available during a drier or direst year.

The City of Roseville is a signatory to the Water Forum Agreement (WFA), which provides the framework for how future surface water and groundwater supplies will be used in the region, through the year 2030. Although Roseville's water contract entitlements total 66,000 AFY. The City's diversions from the American River are limited by the WFA in Normal/Wet Years, Drier and Driest Years as described below.

The Water Forum categorized water years into three types: 1) Normal or Wet (normal/wet) Years, 2) Drier Years, and 3) Driest Years. These hydrologic year types are defined as follows:

- Normal/Wet Years: When the projected March through November Unimpaired Inflow to Folsom Reservoir is greater than or equal to 950,000 AF;
- Drier Years: When the projected March through November Unimpaired Inflow to Folsom Reservoir is between 950,000 AF and 400,000 AF; and,
- Driest Years: When the projected March through November Unimpaired Inflow to Folsom Reservoir is less than 400,000 AF.

In normal/wet years, the City has agreed to limit surface water diversions from the American River to 58,900 AFY. In driest years, also called critically dry years, the maximum diversion from the American River is limited to 39,800 AFY. In drier years, the City may divert an amount between 54,900 and 39,800 AFY from the American River based on unimpaired flow into Folsom Lake. It is important to note that during the drier and driest years, the City agreed to have PCWA release an additional 20,000 AFY of water down the American River on the City’s behalf through re-operation of their Middle Fork project. This 20,000 AFY of re-op water is not part of the City's contracted supply of 66,000 AFY and is described further herein.

While the WFA limited the City of Roseville diversion from Folsom Lake in driest years to no more then 39,800 AFY, the original goal was to limited diversion to 1995 baseline levels. Roseville’s baseline diversion in 1995 was 19,800 AF. Because the City’s annual demands were projected to increase significantly between 1995 and 2030 it was agreed that it was not feasible to reduce City diversions to 1995 levels. The City agreed under their Water Forum Agreement to offset the river impacts from diverting up to 39,800 AFY during a drier or driest year by facilitating the release of up to an additional 20,000 AF of water (the difference between 39,800 AF and 1995 levels of 19,800 AFY) down the American River. The City has worked with PCWA to orchestrate this additional release in their recently renewed operational contract with the Agency. The operational plan is that during drier and driest years PCWA will release of up to 20,000 AFY of raw water from the Agency’s Middle Fork Project (MFP) down the American River to offset increased diversions above the City’s 1995 demand levels. Increased releases would come either from MFP storage in total or a combination of PCWA contract water and MFP storage. Re-operational releases would not be released as part of normal MFP operations. The intent of MFP re-operational releases during drier and driest years is to mitigate environmental impacts resulting from increased diversions above 1995 baseline levels.

By agreeing to release the same amount of environmental mitigation water down the American River as was diverted to supply new growth in the City, environmental impacts were held to 1995 levels. Those impacts were identified in the WFA EIR and mitigated for increased diversions as outlined in the WF purveyor specific agreement as discussed above.

Based on the historical hydrologic record the Water Forum used for their analysis (and WFA restrictions), the 58,900 AFY contract surface water supply is assumed to be available to the City in about 83 percent of the years. In about 17 percent of the years, supply quantities ranging from 58,900 AFY to 39,800 AFY of surface water would be available per the WFA. Thus, in drier and driest years (e.g. droughts), supplemental supplies potentially totaling up to 19,100 AFY (the difference between the normal/wet year supply and the driest year supply) is needed to make up for the deficiencies in drier or critically dry years.

Recycled Water

The City of Roseville, along with the South Placer Municipal Utility District and Placer County are regional partners in the South Placer Wastewater Authority (SPWA). The SPWA was created in 2000 to oversee funding of regional wastewater and recycled water infrastructure. The City owns and operates two regional wastewater treatment facilities on behalf of its regional partners. These treatment facilities include the Dry Creek wastewater treatment plant (DCWWTP) and the Pleasant Grove wastewater treatment plant (PGWWTP). Both plants produce Title 22 quality effluent that is available for recycled water applications. Recycled water for this project will be provided from the Dry Creek and Pleasant Grove WWTPs.

The City prepared the South Placer Regional Wastewater and Recycled Water Systems Evaluation (Systems Evaluation, June 2007). Chapter 6 of the Systems Evaluation report was developed to assist in the ongoing expansion of the regional water-recycling program. The goal of utilizing recycled water supplies is to promote responsible water supply management by beneficially reusing available tertiary treated wastewater for irrigation and other uses to free up surface water and groundwater supplies for potable uses.

The regional recycled water system currently serves approximately 3,000 AFY of recycled water to parks, streetscapes, and golf course customers both inside and outside of the City limits. Of this amount, approximately 2,040 AFY is for irrigation and industrial customers within the City of Roseville. The City also supplies recycled water for cooling purposes to the Roseville Energy Park. System expansion is planned for more intensive use of recycled water in the western portion of the City as new development is built. Recycled water demands within the City are expected to increase by approximately 2,369 AFY for a total recycled water demand of 4,409 AFY at build out of the City's existing General Plan. One hundred percent (100%) of the recycled water supply is expected to be available in all hydrologic year types.

As documented in the *Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan*, *Recycled Water Master Plan,* the Campus Oaks area net recycled water demands are estimated at 82 AFY under the proposed land use plan. Consideration of the project would increase recycled water usage at build out within the City to 4,491 AFY and would be available to offset surface water needs.

Groundwater

The use of groundwater is part of the City of Roseville's long-term water supply strategy, potentially being used as a back-up supply during dry years or for increased operational flexibility. The City's WFA recognizes the extraction of up to 6,600 AFY of groundwater during the drier and driest year types. The City has expanded their groundwater program by adopting an Aquifer Storage and Recovery (ASR) program. Under the City's ASR program, treated surface water can be injected into the aquifer during wet times (normal / wet years or during the rainy season), and when the City needs additional water supplies the groundwater wells can pump the banked water. Uses include augmenting surface water supplies during droughts or to shave peak water demand periods, like those, which occur during, summer months. Over the past several years the City has been working with the State Regional Water Quality Control Board for the Central Valley Region and other state agencies in developing its ASR program receiving an operational permit in 2013. This program includes injection of potable water taken from the City's distribution system into the aquifer and subsequent extraction and delivery to City water customers. The land use plan for the Campus Oaks area includes a dedicated well. The new well is provided so that groundwater may be available to supplement water supplies during drought conditions. The well will also be equipped to function as an ASR well so that the City has full operational flexibility.

In August 2007, the Cities of Roseville and Lincoln along with PCWA and the California American Water Company (CAW) completed the *Western Placer Groundwater Management Plan* (GMP). The GMP was prepared in an effort to maintain a safe, sustainable and high-quality groundwater resource to meet backup, emergency and peak demands within a zone of the North American River Groundwater Sub-basin.

The City currently operates six-groundwater wells, which are capable of delivering approximately 15,970 AFY (1,650 gpm - per well) if run continuously. A more realistic production amount is 40-AF per day (1,500 gpm – per well) over a shorter time frame to augment the water supply. The wells are primarily used as a backup water supply, having the intent of improving water supply reliability. The City has plans to expand its groundwater well network. Ten (10) additional groundwater well sites have been identified for constructing new wells. Once built, the City's groundwater facilities (16-wells) are projected to deliver of up to 106.07 AF per day (6.63 AF/day per well) or 38,715 AFY if run on a continuous basis. However, it is the City's historical practice is to only use groundwater facilities as a backup supply when surface water supplies are not able to meet demands.

Water Demands

Water demand is the amount of water required to service a customer on an annual basis. The City measures this amount of water in acre-feet per year (AFY). Total water demand for the proposed project was developed using the City's unit demand factors and applying those factors to the proposed land uses of the plan area.

The City's unit demand factors are based upon customer's actual water meter usage. Current demand factors were developed in 2002 as part of the West Roseville Specific Plan process. The City conducted an additional study in 2006 to evaluate pre-1992 residential units-usage compared to post 1992, to determine if water use characteristics were substantially different. This study, verified that the unit demand factors were appropriate for use across the City. These factors were provided previously in **Table 4**.

Water demands are segmented into potable demands and recycled water demands. Potable demands are that component of the total water demand that will be used for public health related activities such as drinking water, indoor use and irrigation when recycled water is not available. Potable water needs are typically met by surface water supplies and supplemented by groundwater supplies as needed. Recycled water is that component of the overall water demand that can be used for non-potable uses like outside irrigation. Potable demands are calculated by subtracting estimated recycled water demands from the total water demand.

Existing and Build Out Water Demand

The City's total water demand in 2013 was 36,232 AFY (34,138 AFY + 2,094 AFY recycled water). At build out of the City's General Plan, water demands are estimated to reach approximately 63,235 AFY of which 4,409 AFY will be met through recycled water supplies.

HPCO Water Demands

Development of the proposed 2015 HPCO Master Plan would include residential, commercial, business professional, and light industrial uses that require water. The potable water demand for the Master Plan was determined using the City's unit demand factors identified in **Table 4** and applying those factors to proposed land uses in the HPCO Master Plan then subtracting recycled water demands and estimated savings from planned water conservation measures. In calculating the needed water supply, a 2% system loss factor is added to the base demand to account for water distribution and treatment losses.

The HPCO has included significant water conservation measures into the project. These water conservation measures include:

- Turf reductions and low water using landscaping in residential front yards
- Smart irrigation controllers for irrigation uses
- Re-circulating hot water systems for residential units.

Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan, Water Conservation Plan dated June 2015 by Municipal Consulting Group, LLP (included as Appendix 5) provides the calculations showing the estimated water saving expected from the proposed conservation measures.

The total water demand for the Campus Oaks Sub-area is estimated to be 433 AFY after applying water conservation reductions and recycled water use of 157 AFY. Comparing the projects net surface water demand (433 AFY) to what was originally allocated for the same area as light industrial land uses (668 AFY), there is a savings of 235 AFY. Overall, build out under the General Plan would be reduced to 63,000 AFY (63,235 AFY – 235 AFY) as described earlier in this section. Total water demands for the City (**Table 5**) and for the project (**Tables 3A** and **3B**) are summarized above.

Water Supply vs. Water Demand

The City of Roseville currently supplies surface water, as its primary source of supply for municipal and industrial uses. The City's policy requires a firm surface water supply be in place that meets or exceeds what is needed to supply the proper amount of water for residents and businesses. Estimates in the 2010 UWMP update show that in normal water years the City of Roseville has sufficient water to meet its customer's needs through 2035 and at City build out. **Table 10** provides a comparison of projected water supplies (potable and recycled water) and projected surface water demand through 2030 and then 5-year increments through build out of the City's existing General Plan adjusted for the project. It is important to note that build-out of the City's General Plan is expected to occur beyond the year 2035.

Table 10
Surface Water Demand vs Water Supply
Current General Plan

Year	Surface Water Demand AFY	Normal/Wet Year Surface Water Available AFY	Net Available Surface Water Supplies AFY	Recycled Water Demand / Supply AFY
2010	28,742	58,900	30,158	2,040
2011	29,917	58,900	28,983	2,058
2012	30,677	58,900	28,223	2,076
2013	34,138	50,938	16,800	2,094
2014	37,134	46,000	8,867	2,112
2015	40,129	38,000	-2,129	2,216
2016	39,714	58,900	19,186	2,321
2017	39,278	58,900	19,622	2,434
2018	38,820	58,900	20,080	2,548
2019	38,340	58,900	20,560	2,661
2020	37,839	58,900	21,061	2,722
2021	38,309	58,900	20,591	2,783
2022	38,783	58,900	20,117	2,850
2023	39,257	58,900	19,643	2,917
2024	39,730	58,900	19,170	2,983
2025	40,204	58,900	18,696	3,071
2026	40,712	58,900	18,188	3,159
2027	41,221	58,900	17,679	3,243
2028	41,729	58,900	17,171	3,327
2029	42,238	58,900	16,662	3,412
2030	42,746	58,900	16,154	3,481
2035	45,666	58,900	13,234	3,653
2040	48,697	58,900	10,203	3,824
2045	51,486	58,900	7,414	3,996
2050	54,142	58,900	4,758	4,167
2055	56,637	58,900	2,263	4,339
Build Out	58,509	58,900	391	4,491

Note: The projected water use is based on the City's demand factors.

In **Table 10**, the years highlighted in light gray are actual demands and available surface water supplies based on allocations received for that year. The dark gray column identifies the total surface water supply available in those years. USBR allocations have been included to provide a frame of reference. The years highlighted in tan are in 5-year increments. Most surface water supplies listed are under normal or wet conditions. In times of drought and water shortage, the urban demand is expected to decrease by a minimum of 10 percent as a result of increased conservation awareness and regulations. Expanding the use of recycled water and if needed, the use of groundwater, supplement existing surface water supplies. It is expected that if supplies were reduced due to shortages consistent with reductions identified in the WFA or the United States Bureau of Reclamation draft M&I Shortage Policy, existing water supplies are sufficient to meet existing and future citywide demands. This is further described herein.

Normal/ Wet Years

Existing Conditions + Project

In 2013, existing citywide water demands were 36,232 AFY (34,138 AFY potable + 2,094 AFY recycled). For purposes of this WSA, existing water demand from 2013 is conservatively used as the basis for existing demands.

As indicated in **Table 2**, the Campus Oaks area will result in a total of 515 AFY of water demand (including implementation of conservation efforts) once constructed. Therefore, build out of the Campus Oaks area plus existing conditions would generate a total demand of 36,747 AFY (36,232 AFY + 515 AFY).

Of this amount, 2,176 AFY (2,094 AFY + 82 AF in project) will be met through recycled water supplies. Therefore, the total potable water demand for the existing development in the City plus build out of the Campus Oaks area is conservatively assumed to be 34,571 AFY (36,747 AFY total existing plus project water demand – 2,176 AFY met through recycled water supplies). The City has contractual supplies of 66,000 AFY (See **Table 9**) under normal year conditions, but is limited by the City's Water Forum Agreement to 58,900 AFY. Available supplies exceed existing plus project water demands by 24,329 AFY.

Build Out Conditions + Project

Assuming build out of the existing City General Plan plus the Project water demands would total 63,000 AFY. When considering build out recycled water supplies of 4,491 AFY the resultant surface water supply need would be 58,509 AFY. This is 391 AFY less than total surface water supply available for the normal / wet year conditions at build out. In normal / wet years when full contracted surface water supplies are available, supplies exceed demand.

Drier and Driest Years

To meet water supply demands during drier and driest years the City may utilize other supplies such as groundwater to augment surface water supplies. Recycled water would continue to be used to offset the use of surface water supplies by meeting irrigation demands that would otherwise use surface water supplies. Groundwater is used to make up any additional water supply shortfall as further described herein.

In drier and driest years, the City will implement the water conservation strategies outlined in the Roseville Municipal Code (RMC). Section 14.09 of the RMC identifies "stages" of conservation designed to achieve a specific amount of reduction in water use to match available supplies for that year. Section 14.09 outlines five drought stages with specific actions a water customer can implement to achieve a 10 to 50 percent water reduction.

Groundwater use has been identified as a method to augment available surface water supplies during drought Stages three through five. The use of groundwater will mitigate the impact of surface water (American River) supply shortfalls. The use of groundwater in drier and driest years is consistent with current City practices and is identified in the General Plan as a backup source of supply to be used in droughts or emergencies.

Existing Conditions + Project

As indicated above, the existing City demand plus the Campus Oaks area would generate a total demand of 36,747 AFY. Recycled water would meet 2,176 AFY of demand leaving 34,571 AFY to be made up from available supplies. This will be the current demand plus project that will be evaluated for drier and driest conditions.

Roseville's Municipal Code identifies 5 different drought stages that may be enacted based on the type of water year being experienced by the City. The intent of the drought stages was to enact conservation measures that would result in increasingly more stringent water use reductions (ex. Stage 1 – 10% reduction to Stage 5 – 50% reduction).

Under the Water Forum Agreement, various conservation actions were identified in the Purveyor Specific Agreement to be put in place during a specific year types. For example, Normal/Wet years, a purveyor would receive their full allocation. During drier years, purveyors agreed to reduce diversion from the river based on other sources of supplies or offsets. Roseville has access to groundwater and contractual supplies from PCWA that are highly reliable.

Drier Years

The range of surface water supply spans between Normal/Wet years of 54,900 AFY to 39,800 AFY based on the unimpaired inflow of the American River.

For analysis 34,571 AFY is the surface water demand (recycled water has already been removed). There are four possible allocations the City could receive from the Bureau 75%, 50%, 25% or 0%. **Table 11** provides a matrix to evaluate different dry year conditions. Two examples will be given.

Table 11
Existing Conditions
Remaining Supply (AFY)
After USBR Contract Allocation
Drought Stage

USBR Supply (32,000 AFY):		75% 24,000	50% 16,000	25% 8,000	0% 0
PCWA Supply (30,000 AFY):		30,000	30,000	30,000	30,000
Available Supply:		54,000	46,000	38,000	30,000
Normal	34,571	19,429	11,429	3,429	-4,571
Stage 1 – 10%	31,114	22,886	14,886	6,886	-1,114
Stage 2 – 20%	27,657	26,343	18,343	10,343	2,343
Stage 3 – 30%	24,200	29,800	21,800	13,800	5,800
Stage 4 – 40%	20,743	33,257	25,257	17,257	9,257
Stage 5 – 50%	17,286	36,715	28,715	20,715	12,715

Example 1 – Dry Year Condition

The US Bureau of Reclamation announces that they will be providing municipal and industrial contractors (like Roseville) north of the Delta a 75% allocation. This means that Roseville would receive 24,000 AF of their annual 32,000 AF contractual supply from USBR. When including the City's PCWA supply, total available supply is 54,000 AF. Unimpaired inflow on the Lower American River is just below 950,000 AF meaning almost a normal year. In this scenario, the City my divert from the American River nearly 54,900 AFY, more than available supplies, Comparing 24,000 AF to the blue column in **Table 11**, there is not enough supply to meet demands using only USBR supplies unless the City declared a Stage 4 drought. Since the City has additional surface water supplies available (PCWA – 30,000 AFY), the City <u>may</u> not need to declare a Stage 1 drought because the City has ample water available to meet the total demand of 34,571 AF with 19,429 AF remaining (54,000 AFY – 34,571 AFY).

Example 2 – Critical Dry Year Condition

The US Bureau of Reclamation announces that they will be providing municipal and industrial contractors (like Roseville) north of the Delta a 25% allocation. This means that Roseville would receive 8,000 AF of their annual 32,000 AF contractual supply. Total available supply is 38,000 AF when considering contract water from PCWA. Unimpaired inflow on the American River is just above 400,000 AF meaning almost a critically dry year and that the City can divert little more than 39,800 AF. Comparing 8,000 AF to the blue column in **Table 11**, there is not enough water to meet demands even if the City declared a Stage 5 drought. Since the City has additional surface water supplies available (PCWA – 30,000 AFY), the City may not need to declare a Stage 1 drought because the City has water available to meet the total demand of 34,571 AF with 3,429 AF remaining.

Note that if the Bureau of Reclamation provides a zero allocation, the City would need to declare a minimum of a Stage 2 drought. Both examples above made the assumption that PCWA supplies were accessible from Folsom Lake.

Critically Dry Years

Table 11 is useful for evaluating Critically Dry Years, but the most extreme condition that the City may experience during a critically dry year is the loss of surface water supply from Folsom Reservoir. If surface water supplies are not available from Folsom Lake, the City would need to declare at a minimum a Stage 3 drought setting demand at 24,200 AF, acquire up to 11,200 AF of surface water through purveyor interties (10 million gallons per day) and supplement remaining demand needs with 13,000 AF of groundwater. The City has always planned on using groundwater as a backup supply for surface water as well as developing the large system intertie between Roseville and PCWA. The City's General Plan and the Urban Water Management Plan both reference the use of groundwater as a backup supply and under *extreme conditions* like the loss of Folsom Lake Water supplies, the groundwater system and system interties are in place to meet customer demands, albeit that the customers will have reduced their demand according to the situation at hand.

Build Out Conditions + Project

To understand the impacts of dry and driest year types on the City's water supply availability, this WSA looks at 100 years of hydrologic record from the American River under two different water delivery patterns (scenarios). The first scenario considers water supply cut backs per the City' WFA (reference **Figure 4**). The second scenario considers reasonably foreseeable USBR water supply cutbacks as a result of current Operations Criteria and Plan (OCAP) discussion.

Drier Years

The range of surface water supply spans between Normal/Wet years of 54,900 AFY to 39,800 AFY based on the unimpaired inflow of the American River.

For analysis 58,509 AFY is the surface water demand (recycled water has already been removed). There are four possible allocations the City could receive from the Bureau 75%, 50%, 25% or 0. **Table 12** provides a matrix to evaluate different dry year conditions. Two examples will be given.

Table 12 Build Out Condition Remaining Supply (AFY) After USBR Contract Allocation Drought Stage					
		75%	50%	25%	0%
USBR Supply (32,000 AFY):		24,000	16,000	8,000	0
PCWA Supply (30,000 AFY):		30,000	30,000	30,000	30,000
Available Supply:		54,000	46,000	38,000	30,000
Normal	58,509	-4,509	-12,509	-20,509	-28,509
Stage 1 – 10%	52,658	1,342	-6,658	-14,658	-22,658
Stage 2 – 20%	46,807	7,193	-807	-8,807	-16,807
Stage 3 – 20%	40,956	13,044	5,044	-2,956	-10,956
Stage 4 – 40%	35,105	18,895	10,895	2,895	-5,105
Stage 5 – 50%	29,255	24,746	16,746	8,746	746

Example 1 – Dry Year Condition

The US Bureau of Reclamation announces that they will be providing municipal and industrial contractors (like Roseville) north of the Delta a 75% allocation. This means that Roseville would receive 24,000 AF of their annual 32,000 AF contractual supply. Total available supply is 54,000 AF. Unimpaired inflow on the Lower American River is just below 950,000 AF meaning almost a normal year. The City cannot meet the base demand using just USBR supplies. Since the City has additional surface water supplies (PCWA – 30,000 AF) available, the City would need to declare a Stage 1 drought to meet the total demand of 52,658 AF with 1,342 AF remaining.

Example 2 – Critical Dry Year Condition

The US Bureau of Reclamation announces that they will be providing municipal and industrial contractors (like Roseville) north of the Delta a 25% allocation. This means that Roseville would receive 8,000 AF of their annual 32,000 AF contractual supply. Total available supply is 38,000 AF. Unimpaired inflow on the American River is just above 400,000 AF meaning almost a critically dry year and that the City can divert little more than 39,800 AF per the Water Forum Agreement. The City cannot meet the base demand using just USBR supplies. Since the City has additional surface water supplies available (PCWA – 30,000 AF), the City would need to declare a Stage 4 drought to meet the total demand of 35,105 AF with 2,895 AF remaining.

To reduce the drought stage the City declares, groundwater can be used to make up the difference. A Stage 3 drought would set demands at 40,956 AF. The water supply would be made up of 38,000 AF of surface water and 2,956 AF of groundwater; to move up to a Stage 2 drought (demands of 46,807 AF), the City would use 38,000 AF of surface water and 8,807 AF of groundwater.

Note that if the Bureau of Reclamation provides a zero allocation, the City could start at a Stage 3 drought (demands of 40,956 AF) and meet demands by using 30,000 AF of surface water and 10,956 AF of groundwater. Both examples used under the build out scenario made the assumption that PCWA supplies were accessible from Folsom Lake.

Critically Dry Years

Table 12 is useful for evaluating Critically Dry Years, but the most extreme condition that the City may experience during a critically dry year is the loss of surface water supply from Folsom Reservoir. If surface water supplies are not available from Folsom Lake, the City would need to declare a drought stage comparable what is needed to meet public health and safety needs. Usually, this is approximately 50% of the overall demand or Stage 5 drought setting demand at 29,255 AF, acquire 11,200 AF (or more) of surface water through purveyor interties and use 18,055 AF of groundwater. This would not overtax the groundwater network anticipated at build out of the City system. Groundwater extraction capacity is estimated at 38,715 AF. This is by far an extreme situation, but the City has developed a backup plan using groundwater to meet customer needs. The City’s General Plan and the Urban Water Management Plan both reference the use of groundwater as a backup supply and under *extreme conditions* like the loss of Folsom Water supplies, the groundwater system and system interties will be in place to meet customer demands, albeit customers may have reduced their demand according to the situation at hand.

For this analysis, not only must we look at available supplies in any given year, the City looks at the potential impacts over a longer-term hydrologic record to understand the potential impacts to the groundwater basin. As such, two water deliver patterns are evaluated over a specified hydrologic period as described below.

Water Forum Agreement Delivery Pattern – 115 Year Hydrologic Record

The City participated in the Water Forum process, a regional stakeholder effort concerned with the protection of the Lower American River ecosystem and providing reliable water supplies for the region. The Water Forum resulted in the development of purveyor specific agreements that outline how purveyors will meet commitments agreed to as part of the Water Forum efforts. The goal of the Water Forum was to provide a safe and reliable water supply through the year 2030, while protecting resources associated with the Lower American River. Roseville's agreement included a limitation of diversion from the American River in both wet and dry years. In wet years the City agreed to limit diversions from its American River supply contracts to no more than 54,900 AFY and no less than 39,800 AFY in driest years. Through its agreement with the San Juan Water District, the City increased its normal year water supplies an additional 4,000 AFY, for a total wet year supply of 58,900 AFY. Water supply contracts and Water Forum limitations are summarized in **Table 9**. Based on over 115 years of historical hydrology (and WFA restrictions), the 58,900 AFY contract surface water supply is assumed to be available to the City in about 83 percent of the years.

In about 17 percent of the years, when drier or driest year conditions exist, quantities from 54,900 AFY to a minimum of 39,800 AFY of surface water would be available per the WFA. Thus, in drought years, supplemental supplies potentially totaling up to 19,100 AFY (the difference between the average wet year supply of 58,900 AFY and the dry year supply) is needed to make up for the dry-year and driest-year deficiencies. **Figure 3** depicts the expected delivery pattern of surface water supplies to the City based upon historic hydrologic data under its WFA. The Water Forum EIR analysis projects full deliveries occur approximately 83 percent of the time.

USBR OCAP Delivery Pattern – Probability Percentage

The OCAP describes the operations of the Central Valley Project in conjunction with the State Water Project (reference Sierra Vista Specific Plan EIR Technical Memorandum: Effects of Changed Water Management Operations on Fisheries and Water Quality Impacts Previously Disclosed in the Water Form Agreement EIR, Robertson-Bryan Inc. and HDR, October 2009, and included as Appendix 6 to this document). This is pertinent to Roseville in that USBR water contracts with the City are delivered per Central Valley Project (CVP) operation plans. The United States Bureau of Reclamation (USBR) operates the CVP while the California Department of Water Resources (DWR) operates the State Water Project (SWP). Both the CVP and the SWP rely on the Sacramento River and the Delta as common conveyance facilities to meet various system demands including water contracts and environmental needs. Reservoir releases and Delta exports must be coordinated so that both the CVP and SWP are able to retain and protect beneficial uses. A Coordinated Operations Agreement (COA) between the CVP and SWP was signed and developed in November 1986.

The COA defines the rights and responsibilities of the CVP and SWP regarding water needs of the Sacramento River system and Delta and includes obligations for in-basin uses, accounting, and real-time coordination of water obligations of the two projects. A CVP/SWP apportionment of 75/25 is implemented to meet in-basin needs under balanced Delta conditions, and a 55/45 ratio is in effect for excess flow conditions. The COA contains considerable flexibility in the manner with which Delta conditions in the form of flow standards, water quality standards, and export restrictions are met.

Updated in 2004, the OCAP provides a detailed description of the coordinated operations of the CVP and SWP based on historical data and serves as a starting point for planning project operations in the future. Under the federal Endangered Species Act (ESA), the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) each produced a formal Biological Opinion analyzing the impact of OCAP Implementation on

ESA listed species. USFWS Biological Opinion (BO) analyzed impacts on delta smelt while the NMFS BO analyzed impacts to other ESA listed species including endangered Sacramento River winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead and threatened Southern Distinct population Segment (DPS) of North American green sturgeon. ESA authorizes USFWS and NMFs to require changes to the OCAP for the protection of federally listed species.

<u>US Fish and Wildlife Service - Biological Opinion</u>

In 2005, USFWS issued a Biological Opinion for an updated OCAP, and concluded that CVP/SWP operations did not jeopardize delta-smelt populations. A federal court following a lawsuit invalidated the Biological Opinion. USFWS was ultimately ordered to revise their Biological Opinion. The court also severely restricted CVP and SWP pumping in the Delta pending the USFWS's completion of the new Biological Opinion. Those restrictions took effect in December 2007.

In December 2008, USFWS released a new Biological Opinion concluding that CVP and SWP operations would jeopardize the continued existence of endangered delta smelt. USFWS further detailed a "reasonable and prudent alternative" to the proposed OCAP protocol that would, it claimed; protect the delta smelt and its habitat from the adverse effects of pumping operations. The "Reasonable and Prudent Alternative" (RPA) would restrict Delta pumping operations and would thus limit deliveries of water to CVP/SWP contractors south of the Delta. In 2009, NOAA's National Marine Fisheries Service (NMFS) also released a Biological Opinion on the revised OCAP and requested changes to protect ESA listed species including endangered Sacramento Rover winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead and threatened Southern Distinct population Segment (DPS) of North American green sturgeon. Both of these Biological Opinions have survived legal challenges, as they were ultimately upheld by the Ninth Circuit Court of Appeals.

<u>National Marine Fisheries – Biological Opinion</u>

In October 2004, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) issued its own Biological Opinion for OCAP, and concluded that CVP/SWP operations were not likely to jeopardize the continued existence of the Sacramento River winter run Chinook salmon, spring run Chinook salmon, and Central Valley steelhead populations. In April, 2008, that Biological Opinion was also invalidated by the same court that heard the delta smelt suit as a result of a separate lawsuit. The court found that NMFS failed to analyze multiple factors and the 2004 Biological Opinion was remanded to NMFS and Reclamation for further consultation.

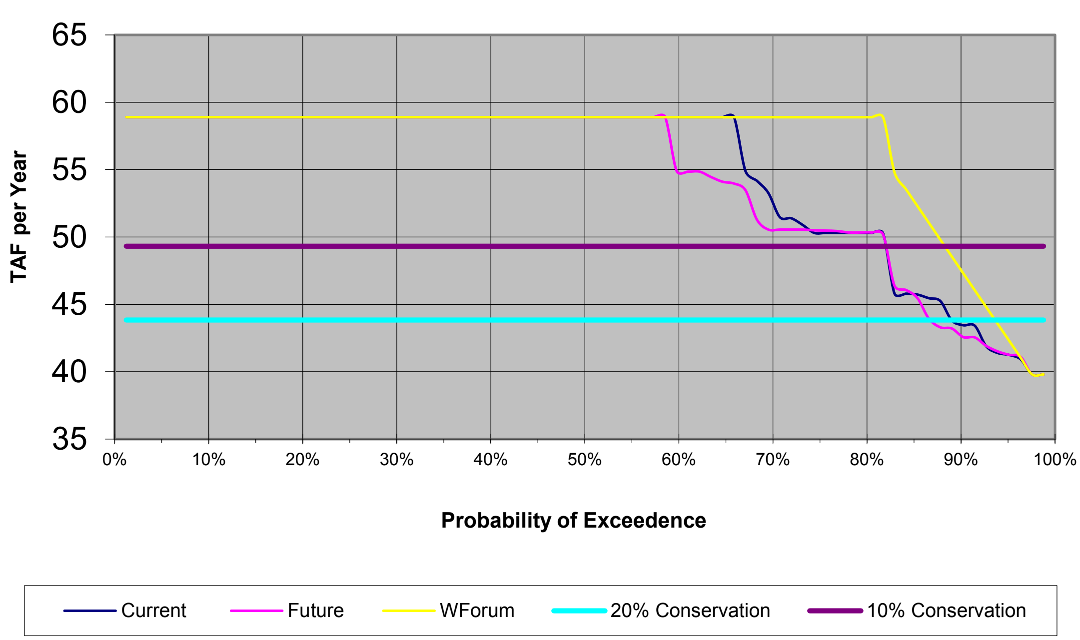
In 2009, NMFS also released a Biological Opinion on the revised OCAP and requested changes to protect ESA listed species including endangered Sacramento Rover winter-run Chinook salmon, threatened Central Valley spring-run Chinook salmon, threatened Central Valley steelhead and threatened Southern Distinct Population Segment (DPS) of North American green sturgeon. A federal court invalidated the Biological Opinions in December 2010; to date an updated OCAP has yet to be finalized.

Biological Opinions CALSIM Modeling

To develop the new biological opinions, both USFWS (smelt) and National Marine Fisheries Service (NMFS) (salmon) utilized a series of model runs from CALSIMII know as Study 7 and Study 8. CALSIM II is a model of California's State Water Project (SWP) and the Federal Central Valley Project (CVP), developed jointly by the California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (USSR). Study 7 evaluated current conditions and Study 8 depicted future conditions as prepared by the Bureau of Reclamation. Neither study contains the assumptions for the (RPAs prescribed in the Biological Opinions. There is an accelerated effort to model the RPAs in CALSIMII by the Bureau; the effort has not been completed yet with the appropriate simulations of the RPA. However, utilizing the model runs used by both USFWS and NMFS identifies the frequency of the deliveries to Roseville.

For purposes of this WSA, Study 8 (future conditions) is used to evaluate possible impacts to Roseville deliveries from the OCAP over a typical 100-year hydrologic record. **Figure 4** depicts the changes in water supply deliveries to the City under OCAP, Study 8 (shown as the magenta colored line) as compared against WFA deliveries (shown as the yellow line) and current delivery patterns (shown by the dark blue line). In addition, **Figure 4** shows total water demand if the City were to conserve water equivalent to a 10% reduction in surface water supplies (purple colored line) or a 20% reduction (aqua colored line).

Figure 4
WF and OCAP Surface Water Delivery Patterns



Under the new OCAP (Study 8) full deliveries of PCWA and USBR contracted supplies are projected to occur fifty-eight (58) percent of the time. Forty-two (42) percent of the time shortages in surface water supplies can be mitigated through implementing water conservation Stages 1 and 2 (between 10% to 20% conservation reduction) that is outlined in Roseville Municipal Code (RMC) Section 14.09. This is the area between the purple 10% line and the aqua 20% line. Eleven (11) percent of the time surface water deliveries will fall below a level where mitigation can be accomplished through 20% conservation efforts and supplemental groundwater supplies could be needed. This is shown as the area below the aqua colored line. In the Water Forum analysis deliveries were projected to fall below the same level only seven (7) percent of the time.

It is important to recognize that while City water supplies (surface, recycled water and groundwater) are sufficient such that only a 20% level of conservation is required, other state actions during drought periods may require increased water reductions. This is evidence by the current 4 year drought the State is experiencing. In 2014, Governor Brown requested a voluntary 20% reduction in water usage. The City of Roseville complied by implementation of a Drought Stage 3. The City achieved a 19.4% reduction in water demands over 2013 levels. Due to continued statewide drought conditions, Governor Browns signed an Executive Order to require a 25% statewide reduction in water usage over 2013 levels. The State Water Resources Control Board developed a tiered structure to define what each water agencies saving target would be. Emergency regulations enacted by the Board identify the City of Roseville's mandatory water savings level at 28% of 2013 City water usage levels.

Supplemental Supplies

In drier and driest years, the City will need to make up the difference between available supplies from the American River and projected demands. This would be done through implementing conservation measures as identified in the RMC and supplementing available supplies with groundwater. As explained earlier, the RMC identifies five drought stages with varying degrees of reduction (10% to 50%). The hydrologic record indicates that there are three (3) critically dry (driest) years and sixteen (16) drier years where City demands would need to be adjusted downward to conform to available surface water supplies under the City's WFA.

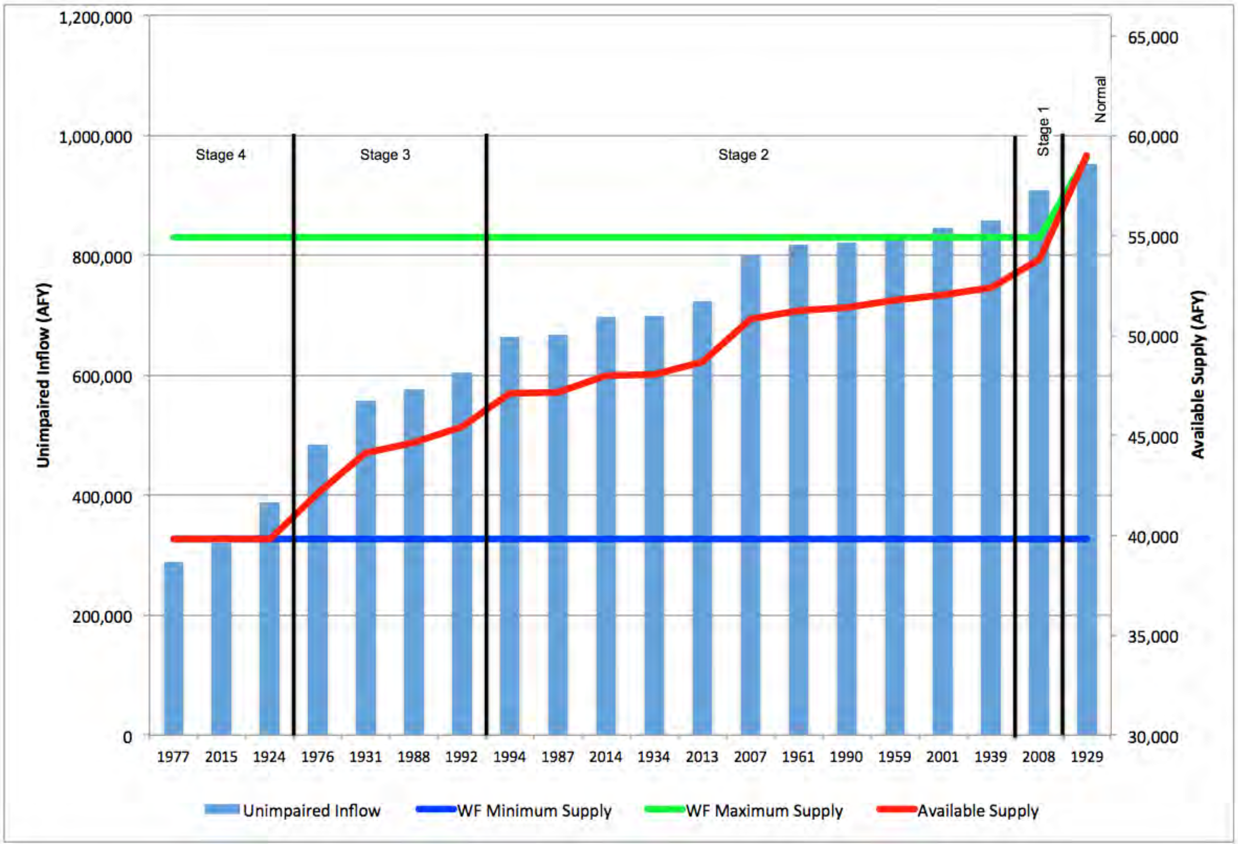
Table 13 depicts the impacts of the Water Forum Agreement and shows estimated surface water shortfalls during historical drier and driest years, assuming City build out demands are equivalent to 58,900 AFY (maximum diversion under the City's WFA). For example in a normal year such as occurred in 1929 there would be no anticipated shortfalls in available surface water supplies to the City. In critically dry (driest) years such as occurred in 1924, 1977 and 2015, the City could need to make up 19,100 AF of water supply. In drier years as the amount of surface water available to the City increases from 39,800 AFY to 54,900 AFY, based upon the unimpaired inflow on the American River, the anticipated shortfall decreases from 19,100 to 0 AFY.

TABLE 13 WATER FORUM AGREEMENT HISTORIC AMERICAN RIVER HYDROLOGIC FLOWS NORMAL, DRY AND DRIEST YEARS						
Year	Year Type	Annual Inflow AFY	Unimpaired Inflow [1] AFY	Available Surface Wtr AFY	Normal BO Demand AFY	Shortfall AFY
1977	Driest	520,190	289,740	39,800	58,900	-19,100
2015	Driest	Estimated	321,000	39800	59800	-19,100
1924	Driest	628,800	388,900	39,800	58,900	-19,100
1976	Drier	598,260	484,060	42,719	58,900	-16,181
1931	Drier	854,600	557,200	45,259	58,900	-13,641
1988	Drier	892,974	576,736	45,938	58,900	-12,962
1992	Drier	989,570	604,927	46,917	58,900	-11,983
1994	Drier	956,228	665,328	49,014	58,900	-9,886
1987	Drier	940,048	667,769	49,099	58,900	-9,801
2014	Drier	904,707	697,590	50,134	58,900	-8,766
1934	Drier	1,084,000	699,700	50,208	58,900	-8,692
2013	Drier	822,330	723,697	51,041	58,900	-7,859
2007	Drier	1,059,150	800,702	53,715	58,900	-5,185
1961	Drier	1,021,670	817,440	54,297	58,900	-4,603
1990	Drier	1,036,113	822,331	54,466	58,900	-4,434
1959	Drier	1,209,420	836,380	54,900	58,900	-4,000
2001	Drier	1,185,375	845,617	54,900	58,900	-4,000
1939	Drier	1,006,140	858,220	54,900	58,900	-4,000
2008	Drier	1,002,162	909,734	54,900	58,900	-4,000
1929	Normal	1,255,100	952,600	58,900	58,900	0

1- Unimpaired inflow is the March through November inflows from the American River into Folsom Reservoir.

Figure 5 graphically shows how the estimated shortfall determined in **Table 13** would be evaluated and placed into corresponding drought stages.

FIGURE 5
SURFACE WATER SUPPLY SHORTFALLS DURING
HISTORIC AMERICAN RIVER HYDROLOGIC DRY AND DRIEST YEAR RECORDS

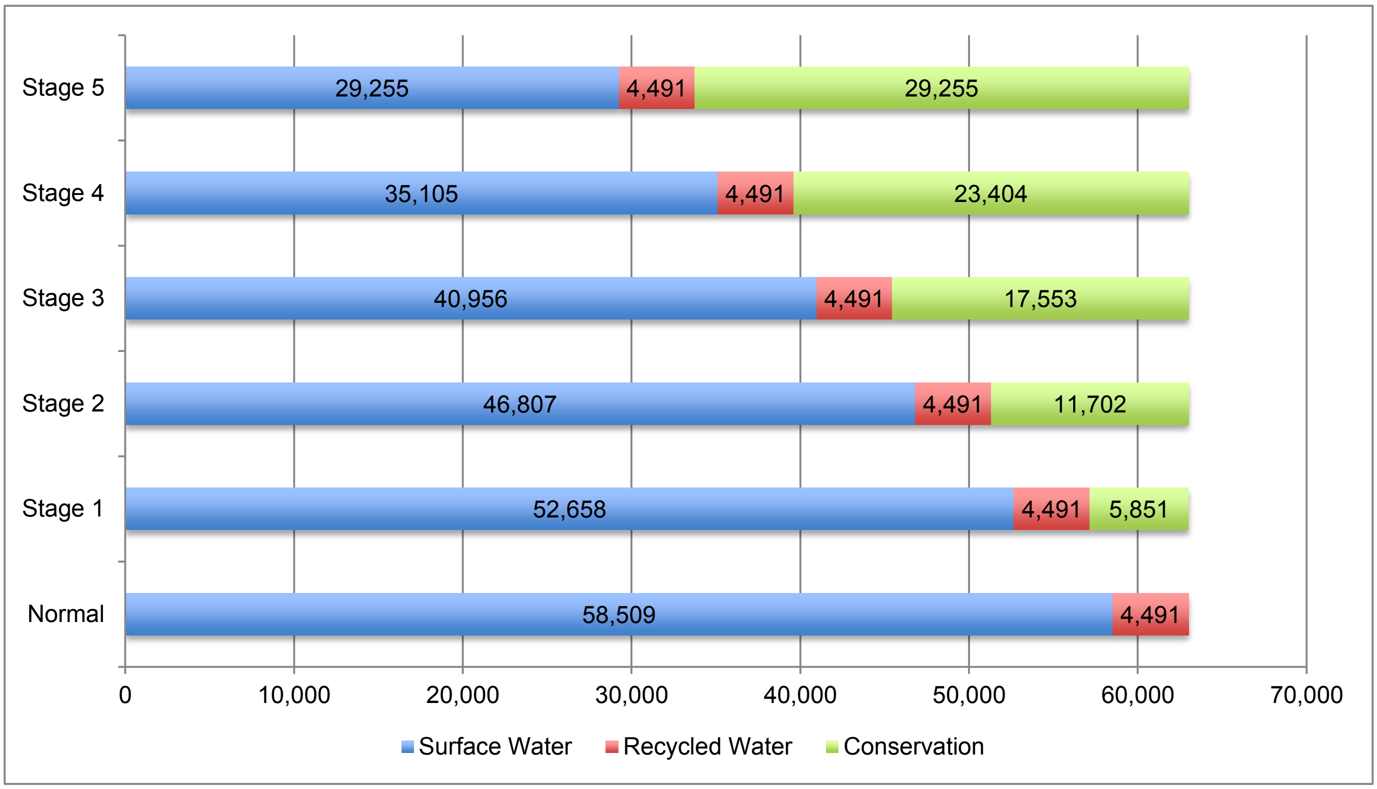


Build out demand for the City General Plan including the HPCO Master Plan is 63,000 AFY. The net potable water demand is 58,509 AFY. This is calculated by subtracting anticipated recycled water usage at build out from the build out water demand (63,000 AFY – 4,491 AFY). This amount is then compared to available surface water supplies. In a normal water year, there is 58,900 AFY available from the American River; available surface water supplies exceed build out potable water demands.

In drier and driest years, the City would need to make up the difference in supplies between 39,800 AFY; the minimum diversion allowed in driest years under the WF and 58,900 AFY; the City's normal year water diversion allowance (0 AFY to 19,100 AFY). This would be done through implementing conservation measures as identified in the RMC and supplementing available supplies with groundwater. As explained earlier, the RMC identifies five drought stages with varying degrees of reduction (10% to 50%). **Table 13** and **Figure 5** compare projected build out demands to available supplies based on 115 years of hydrologic record of the American River. The full history is contained in Appendix 7 to this WSA. The hydrologic record indicates that there were three (3) critically dry (driest) years and sixteen (16) drier years where City demands would need to be adjusted downward to conform to available surface water supplies. By way of example and as shown on **Figure 5** a critically dry year could necessitate the implementation of up to a Stage Four drought to reduce water demands to a level that is comparable with available supplies. Drought Stages One, Two and Three would be required during drier years, depending on the level of shortfall in surface water supplies.

It is important to note that if the City is able to accomplish the recommended reductions in demand through more stringent conservation measures outlined in the Roseville Municipal Code, groundwater may not be needed to supplement supplies. This is depicted in **Figure 6** below.

FIGURE 6
DRY AND DRIEST YEAR SUPPLY SCENARIOS USING 5 STAGES OF WATER CONSERVATION
Build Out Demand Totals 63,000 AFY

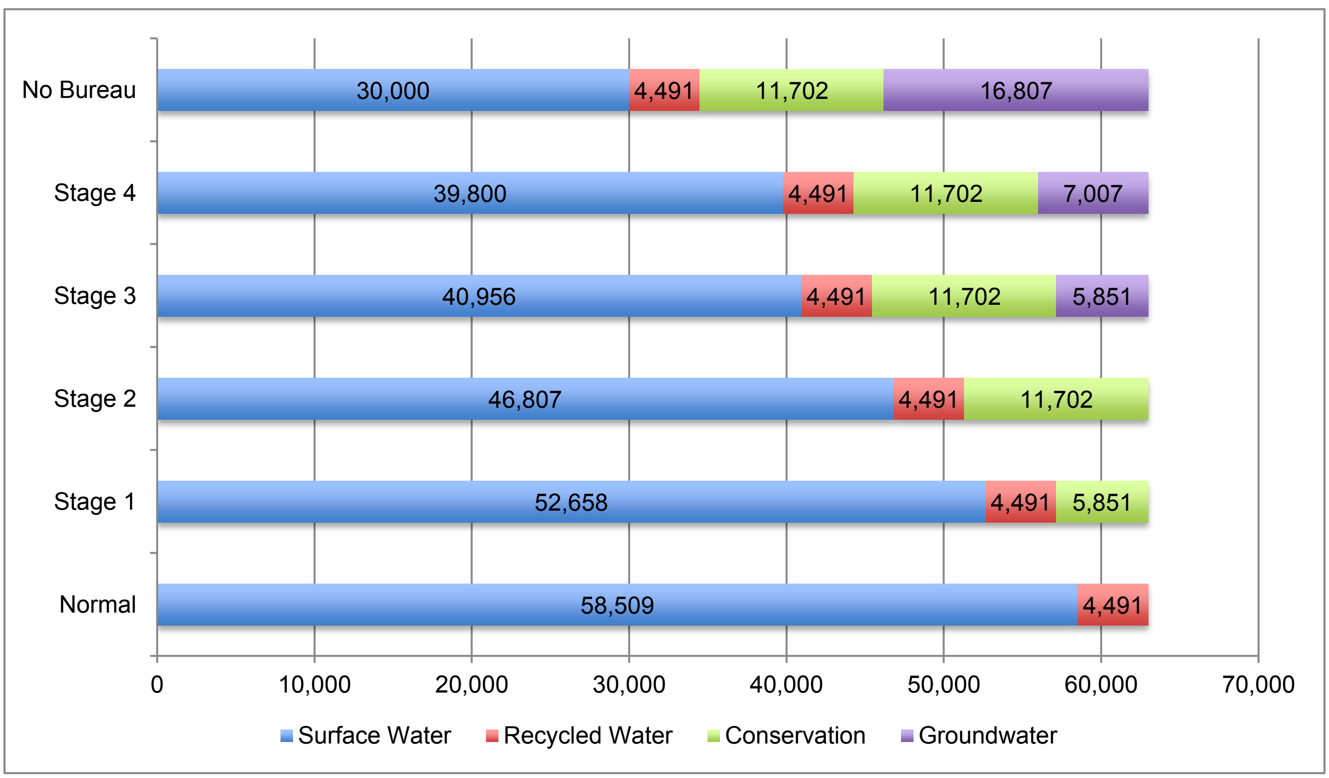


However, to ensure a highly reliable water supply for the City, this WSA assumes only a <u>20</u> percent reduction of surface water demands through conservation (20% of 58,509 AFY = 11,702 AFY). The 115 years of hydrologic data includes the 1977, 1924 and 2015 droughts of record. This record provides a good picture of what could be anticipated as future unimpaired flows in the American River. The record indicates that there would be 19 years out of 115 that would require some level of conservation. Depending on water delivery patterns (WFA or OCAP) the number of years in which groundwater is required is different. Each is described below.

WFA Scenario

Of the 7 years out of 115 when supplemental supplies are required to meet demands and assuming only a 20 percent reduction in water demand through conservation efforts, only 7 years would require groundwater pumping to make up for shortfalls in surface water supplies. Given the City's ability to divert up to 39,800 AFY of surface water under its WFA, only a Stage 4 level of conservation is needed to meet build out demands (assuming both CVP and PCWA supplies are available). The total amount of groundwater extracted over the life of the HPCO Master Plan is based on the need to pump groundwater in only 7 out of 115 years. The offsetting amount of groundwater is 30,680 over time included in the City's base extraction amount. The annual amount groundwater used varies depending on the year type, but ranges from a high of 7,007 AFY to a low of 0 AFY. In the unlikely event that CVP supplies were not allocated in a given year, the City would rely on 3,000 AF of PCWA surface water supplies, 4,491 AF of recycled water supplies, 11,702 AF demand reduction through conservation (conservatively assumed at 20%) and up to 16,807 AF of groundwater supplies as depicted on Figure 7 below.

FIGURE 7
DRIER AND DRIEST YEAR SUPPLY SCENARIO
20% WATER CONSERVATION
Build Out Demand Totals 63,000 AFY



In addition to groundwater to supplement surface water supplies during drought conditions, the City has identified groundwater as a backup supply for the recycled water system to bolster reliability. It is assumed that 11 AFY of groundwater could be required during emergencies such as a plant outage to back up the recycled water system. This is based upon 1.8 million gallons per day for a period of two days. Additionally, it was assumed an emergency could occur once every five years. Thus, for the life of the HPCO Master Plan (assumed to be the hydrologic record of 115 years) up to 220 AF of groundwater could be required, this would result in a total extraction of groundwater over 115 years of 30,900 AF (30,680 AF + 220 AF).

OCAP Scenario

Additional supplies are needed 10 years out of 100 to meet demands, assuming only a 20 percent reduction in water demand through conservation efforts, In other words, it is estimated that in 10 out of a 100 years groundwater pumping would be required to make up for shortfalls in surface water supplies. The total amount of groundwater extracted over the life of the HPCO Master Plan (based on the 100 year hydrologic record and the need to pump groundwater in only 10 of 100 years) would be 51,057 AF. The annual amount varies depending on the year type, but like with the WFA scenario ranges from a high of 7,007 AFY to a low of 0 AFY and as previously depicted in **Figure 7**. An additional 220 AF of groundwater was added during the analysis period of the project (100 years) to supplement recycled water supplies as a backup condition such as a plant outage. Thus for the life of the HPCO Master Plan (assumed to be the hydrologic record of 100 years) under the OCAP Scenario, total extraction of groundwater over 100 years would total 51,227 AF (51,057 AF + 220 AF).

Section 10910(d)(1) Identify existing water supplies for the proposed project.

Existing surface water, recycled water, and groundwater supplies for the City of Roseville are described under Section 10910(c)(4), above.

Section 10910(d)(2)(A) Demonstrate existing water supply entitlements, water rights or water service contracts through written contracts or other proof.

Documentation for water entitlement contracts is contained in Appendix 8. Included are:

- United States Bureau of Reclamation Long-Term water supply No. 14-06-200-3474A
- PWCA Water Supply Contract dated September 1, 2010
- United States Bureau of Reclamation Contract for Conveyance of Non-Project Water between the United States and City of Roseville No. 02-WC-20-2217
- San Juan Water District - Water Supply Contract dated February 7, 2001 for 800 AFY and June 18, 2003 for 3200 AFY.

Section 10910(d)(2)(B) Provide copy of capital outlay program for financing of a water supply that has been adopted by the public water system.

Financing for water supply facilities are included in the City's Capital Improvement Projects (CIP). A list of Capitol Improvement Projects to be constructed over the next five years is provided in the City's annual budget document. Copies of the budget document are available at the City's Finance Department. Financing of these projects is through a combination of connection fees paid on new construction and general obligation bonds. A projected fund balance tied to the Capital Improvement Project schedule is also available at the City's Finance Department.

The Water Utility's 5-year capitol improvement budget is contained in the annual budget book available on line at: http://www.roseville.ca.us/gov/finance/budget.asp. The full CIP can be obtained from the Environmental Utilities Department. The City completed a connection fee update in 2015 which includes the most recent list of projects anticipated through City build out. Recognize that the CIP is an evolving list of projects that changes with land use actions taken by the Council. For example, after the Sierra Vista and Creekview Specific Plan approvals, the CIP needed to be updated to reflect additional capital projects identified in their respective Development Agreements. The next CIP and connection fee update is schedule for some time in 2018.

Section 10910(d)(2)(C) Identify any federal, state, and local permits required for construction of the facilities identified for delivering the water supply to the proposed project.

The majority of the proposed water transmission facilities will be located in proposed City public rights-of-way and with City approved plans. A final list of permit requirements for proposed facilities will be identified after the City's review of the corresponding improvement plans. Likely permit requirements include grading permits, tree permits and other local, state or federal permits identified in the environmental document for the HPCO Master Plan.

At this time, there are no known permits or contracts needed to supply the HPCO Master Plan with utility service. Permits for development are related to onsite improvements, not for expanding treatment or transmission facilities.

Permits in hand:

1) Warren Act Contract with US Bureau of Reclamation
2) ASR General Permit from State Water Resources Control Board
3) Master Reclamation Permit from the Central Valley Regional Water Quality Control Board

The three permits / contracts are in place to use with existing water supply contracts. When excess water is available, the City operates its Aquifer Storage and Recovery (ASR) program. Use of the City's ASR program was not possible without the approval of the General Permit from the State Water Resources Control Board.

Section 10910(d)(2)(D) Identify any necessary regulatory approvals required to convey or deliver the water supply to the proposed project.

Long-term water supply from the CVP is the primary source of water for the City of Roseville. The existing contract was valid through 2011. At this time, the City's CVP contract is on 2-year interim renewals until the Bureau of Reclamation has completed their environmental evaluations necessary to sign long-term contracts. Contract conditions have been negotiated identifying the life of the renewal contract of 40 years. Other contractual provisions of the interim contracts are the same as anticipated in the long-term agreement. Roseville has established the need for the full contract amount of 32,000 AFY. The City is waiting to move complete long-term contract negotiations, and there has been no indication from Bureau staff when negotiations will resume.

Roseville will be the recycled water provider for the HPCO. Roseville staff will work the project proponent to ensure that the Engineering Report is compliant with the City's Master Reclamation Permit. The State Department of Public Health and the Central Valley Regional Water Quality Control Board must review and approve an Engineering Report documenting the proposed use of recycled water within the project area prior to recycled water use within the plan area.

Section 10910(e) Identify other public water system or water contract holders that receive a water supply or have existing water supply entitlements, water rights, or water service contracts, to the same source of water as the public water system for the proposed project.

The City's diversion point for its American River water supply is at Folsom Lake. Other water purveyors with water contracts or water supply entitlements that receive water from the American River include: US Bureau of Reclamation, City of Folsom, San Juan Water District, Fair Oaks Water District, Orange Vale Water Company, Citrus Heights Water District, Sacramento Municipal Utility District, Placer County Water Agency, Folsom State Prison, El Dorado Irrigation District, Carmichael Water District, City of Sacramento, Sacramento Suburban Water District and East Bay Municipal Utility District.

The City of Roseville is a signatory to the Water Forum Agreement. The Water Forum is a Regional Plan developed by the Sacramento Area Water Forum and Foothill Forum Water Group with the objective for safe, reliable, and environmentally sound water supplies from the American River watershed, the source of Roseville contract water. A number of stakeholders were involved in the planning process focusing on a Regional Water

Agreement, which identified the resources needed to meet 2030 water demands. A copy of the Water Forum Agreement is available for review online at http://www.waterforum.org/agreement.cfm.

Section 10910(f)(1) Review any information contained in the UWMP relevant to the identified groundwater supply for the proposed project.

Because the HPCO Master Plan is an infill project, the water demand was included in the 2010 UWMP. The 2010 UWMP includes information pertaining to the local groundwater basin. As identified in the UWMP, the primary source of water supply for the City's service area is surface water from Folsom Lake and recycled water. Although there are no the restrictions on the use of groundwater identified in the Water Forum Agreement groundwater was only projected to be used in times of drought and water shortage, but has been expanded to include operational flexibility with the development of the Aquifer Storage and Recovery Program. Bureau studies estimated that groundwater will only be required in approximately 15 percent of the years. As documented in Section 10910 (c)(3) and (c)(4) above, the City estimates that groundwater may be used in 7 out of a 115 years under the Water Forum Agreement Scenario or up to 12 out of a 100 years under the OCAP Scenario.

Section 10910(f)(2) Describe any groundwater basin from which the proposed project will be supplied. Include information as to whether the Department of Water Resources has identified the basin as over drafted or has projected that the basin will become over drafted.

Portions of Placer, Sutter, and Sacramento counties are situated over the North American sub-basin. The sub-basin is delineated by the Bear River on the north, the Feather River and Sacramento River on the west the American River on the south and the Sierra-Nevada Range on the east. The sub-basin encompasses 351,000 acres (548 square miles), which is part of a much larger groundwater basin that under lays most of the Central Valley of California. Drainage in the sub-basin is west-southwest at an average five percent grade.

The eastern boundary of the sub-basin is a north-south line extending from the Bear River south to Folsom Lake, passing about 2 miles east of Lincoln and is the approximate edge of the alluvial basin, where little or no groundwater flows into or out of the basin from the Sierra Nevada. The western portion of the sub-basin is a flat flood basin for the Bear, Feather, Sacramento, and American Rivers and several small east-side tributaries.

Various geologic formations comprise the water-bearing deposits that underlie the region. These formations include an upper aquifer system consisting of the Riverbank (formerly known as Victor) and Turlock Lake/Laguna (formerly known as Fair Oaks-Laguna Formations), and a lower aquifer system consisting primarily of the Mehrten Formation. These formations are typically composed of lenses of inter-bedded sand, silt, and clay interlaced with coarse-grained stream channel deposits. These deposits form a wedge thickening from east to west at a fairy constant rate to a maximum thickness of 2,000 feet near the Sacramento River.

Groundwater occurs in an unconfined to semi-confined state throughout the region. A confined aquifer state occurs in aquifers that have overlying stratum of low permeability. Groundwater under a confined state is described in terms of its piezometric surface elevation rather than a water surface elevation. The piezometric surface elevation is the elevation of water within a piezometer or well that is screened only in the confined or semi-confined aquifer. The groundwater surface elevation is the elevation of water in an unconfined aquifer. Semi-confinement can occur in local areas, and the degree of confinement typically increases with depth. Groundwater in the Riverbank and Turlock Lake/Laguna Formations is typically unconfined. The deeper Mehrten Formation, a major source of groundwater, exhibits semi-confined conditions.

The California Department of Water Resources (DWR) has not identified the basin as an over drafted basin. Groundwater levels in southwestern Placer County and northern Sacramento County have generally decreased between 1947 through 1997. Many wells experienced declines at a rate of about one and one-half feet per year with some of the largest decreases occurring in the area of McClellan AFB. After 1997 water levels seem to stabilize implying that the basin is in a state of equilibrium. Groundwater levels in Sutter and northern Placer Counties generally have remained stable, although some wells in southern Sutter County have experienced declines.

The groundwater basin has historically been primarily pumped for agricultural purposes, but some urban uses have occurred. The Western Placer Sustainable Yield analysis (WPSY) prepared by GEI Consultants, dated November 2013 indicates that the basin under western Placer has a potential safe yield of 100,000 AFY. Safe yield is defined as the amount of groundwater that can be continuously withdrawn from the basin without having an adverse impact – sometimes referred to as an annual average in acre-feet per year (AFY). The WPSY also estimated average annual agriculture and urban demands in western Placer County have been 100,000 AFY. Under these pumping conditions, the groundwater levels at the southern end of the basin have been stable since 1982 and at the northern end of the basin levels have risen slightly. Stable groundwater levels indicate that groundwater pumping is currently in balance with the natural groundwater recharge rate.

Groundwater elevations have been monitored by DWR for several decades. There are three groundwater wells in the DWR monitoring network in and immediately adjacent to the western edge of the City. One well is located adjacent to Pleasant Grove Boulevard. A second well is east of the WRSP along Kaseberg Creek southeast of the intersection of Fiddyment and Phillip Roads. The third well is located on City-owned land north of the WRSP. Data for the first well indicate rising groundwater elevations since about 1977, which could be attributable to a decrease in agricultural pumping or recharge into a subsurface channel system. In 2002, the groundwater elevation ranged from 45 to 47 feet above mean sea level (msl). The second well, which has not been monitored since 1993, shows almost stable groundwater elevations since about 1980. Reported groundwater elevations in the well in 1993 were 17 to 20 feet msl. The westernmost well has also been stable since about 1980, and decreased agricultural water use in the area suggests water table levels are rising. In

2002, groundwater elevations ranged from a low of 24 feet msl in November to a high of 17 feet msl in April. Bulletin 118 prepared by the California Department of Water Resources identifies eleven groundwater basins as being in a critical condition of overdraft. The North American sub-basin is not one of the eleven basins identified.

These stable groundwater conditions may be attributed to the conversion of agricultural lands to urban uses over the past several decades. With the land conversions pumping demands have decreased, especially for heavy pumping uses, such as rice farming. It is expected that basin pumping demands will continue to decrease over time. According to the IWRP, urban development within the Placer Vineyards, Curry Creek and West of Lincoln study areas alone are estimated to reduce agricultural groundwater pumping demands by 20,000 AFY over time. If these pumping demands are not replaced by other equivalent pumping demands, it is expected to result in improvements to the condition of the basin. There are no existing legal constraints that limit groundwater pumping. In theory, the recent Groundwater Management Act will ultimately lead to limits on the use of the aquifer. In crude terms, the sustainable yield will dictate what can be permitted. This will take many years to work out.

Section 10910(f)(3) Describe the amount and location of groundwater pumped by the public water system for the past five (5) years.

The City extracted 439 AF of groundwater in Phase 1 testing (Sept 2004) and 2,140 AF during Phase 2 testing (Feb 2008). Over the past six years (2008-2014), the City has extracted 296 AF, but has injected 2,603 AF as part of its on going banking program.

Use of groundwater is part of the City of Roseville's current water supply portfolio, with its primary purpose to be used for back-up supplies during dry years or to provide operational flexibility through a conjunctive use program.

Section 10910(f)(4) Describe the amount and location of groundwater projected to be pumped by the public water system from any basin from which the proposed project will be supplied.

The use of groundwater is part of the City of Roseville's current water supply strategy, used for short-term back-up supply during dry years and as an emergency backup for the recycled water system. Based upon the estimated water demand for the HPCO Master Plan, and as shown in **Figure 7**, a maximum of 16,807 AFY of groundwater could be required during a critically dry hydrologic year where USBR supply is not provided. Over the life of the HPCO Master Plan and as described in Section 101910(c)(2) above, under the OCAP Scenario, a total of 51,277 AF of groundwater would be required. This includes groundwater to supplement surface water supplies during drought conditions to meet City plus project build out and 220 AF of groundwater as emergency backup supply for the recycled water system.

Section 10910(f)(5) Analyze the sufficiency of the groundwater from the basin from which the proposed project will be supplied to meet the projected water demand associated with the proposed project.

As indicated in Section 10910(f)(4) above, surface water is the primary source of supply to serve the Master Plan site. During normal/wet year types (86% of the years) groundwater is not required to meet water system demands. During 12% of the years (over a 100 year period and under the OCAP Scenario) up to 7,007 AFY or a lifetime draw of 51,277 AF of groundwater would be extracted from the basin to meet dry year water supply needs and supplemental recycled water demands.

The groundwater basin has historically been pumped by agricultural and urban uses. Over the past several decades, agricultural land has been converted to urban uses. With the land conversions, especially of formerly heavy pumping uses such as rice farming, pumping demands have decreased. It is expected that basin pumping demands will continue to decrease over time. If pumping demands are not replaced by other equivalent pumping demands, it is expected to result in improvements to the condition of the basin. There are no existing legal constraints that limit groundwater pumping and the Western Placer Sustainable Yield analysis (WPSY) prepared by GEI Consultants dated November 2013 indicates the sustainable yield of 100,000 AFY for the western Placer County portion of the basin based on current groundwater level stability at these pumping levels. The recent Groundwater Management Act will ultimately lead to limits on the use of the aquifer. In crude terms, the sustainable yield will dictate what can be permitted. This will take many years to work out.

Table 14 Sub-Basin Sustainable Yield Summary	
Summary of Inflows	
	AFY
Net Percolation	10,852
City of Roseville ASR Injection	158
Un-gaged Watersheds	4,902
Total Inflow form Streams	79,126
Inflow from Sutter County	28,033
Inflow from Sacramento County	5,934
Inflow Summary	**AFY**
Total Inflow (Active Portion of Domain):	129,005
Summary of Outflows	
	AFY
Groundwater Extraction	98,593
City of Roseville ASR Extraction	440
Outflow to Sutter County	15,684
Outflow to Sacramento County	12,954
Outflow Summary	**AFY**
Total Outflow (Active Portion of Domain):	127,671
Change in Storage	
	AFY
Inflow - Outflow	1,334

Table 14, take from the Western Placer County Sustainable Yield analysis reaffirms the fact that the basin is not in an overdraft condition but is annually increasing storage contributions.

Further, a review of potential basin impacts incorporates the results of a groundwater impact analysis prepared by MWH in June 2003 as part of the West Roseville Specific Plan (WRSP) project. This report, MWH Groundwater Impact Report, is included in Appendix 9. The MWH report used the North American River and Sacramento County Combined Integrated Groundwater and Surface Water Model (IGSM) to simulate groundwater conditions. This model was originally developed for the American River Water Resources Investigation (ARWRI) and later updated by the American River Basin Cooperating Agencies for the Regional Water Master Plan.

The groundwater impacts described in the MHW Groundwater Impact Report were defined as the incremental changes between the groundwater conditions corresponding to a baseline condition, which does not include development of the City's WRSP Area and groundwater conditions resulting after the WRSP Area has been developed. The following assumptions were made for the analysis of mitigating the dry-year groundwater use, which assumed fallowing of the City owned Reason Farms property:

- 1,080 acres fallowed,
- 6,483 AFY of groundwater required to meet crop irrigation demand,
- 2,632 AFY of groundwater return by deep percolation of irrigation water,
- Net 3,151 AFY of groundwater recharge "banked" and available for other uses, based strictly on mass balance of water in system. (6,483 AFY – 2,632 AFY for percolation 700 AFY for current cattle ranching operations).

To characterize the impacts to groundwater, this WSA analyzes the most conservative dry year scenario, the OCAP Scenario, when there are more years when supplemental groundwater is required. As previously described, based upon historic American River hydrologic data, it is estimated that under the OCAP, in 12% of the years groundwater could be required to supplement reduced surface water supplies. In 88% of the years, groundwater would not be required. The analysis calculates the volume of water that is "banked" or saved as a result of land retirement from Reason Farms and compares that to the volume of groundwater anticipated to be extracted over the same time period (115 years). This analysis is summarized below.

Using 3,151 AFY of banked groundwater available for beneficial use as a result of land retirement at Reason Farms and applying it over the period of the hydrologic record during which water supplies are not reduced (88 of 100 years), a total 277,288 AF of groundwater would be saved (3,151 AFY x 88 years). The projected groundwater needs for the City over this same time period under the more conservative OCAP scenario (51,277 AF) results in a net storage volume of groundwater of 226,011 AF (277,288 AF – 51,277 AF). This is an average annual groundwater savings of 2,260 AFY over 100 years. Under these conditions the groundwater basin is expected to increase as a result of eliminating rice farming at Reasons Farms even with the City and ARSP's projected groundwater demands. It is also expected that implementation of the City's Aquifer Storage and Recovery program, where treated surface water is stored in the groundwater basin, will likely increase groundwater levels.

Because the proposed project is expected to use less water than that identified as available from groundwater banking, adverse impacts to the groundwater basin are not anticipated. The numbers supporting this conclusion are shown in **Table 15**.

Table 15 Groundwater Needs at Build Out USBR OCAP Dry Year Scenario				
Type of Groundwater Use	GW Demand AFY	Frequency of Occurrence in a 100 Years	Annually Banked AFY	Total AF
Maximum dry year supply to supplement surface water	7,007 to 0	12		51,057
Recycled water emergency backup supply	11	20		220
Total Groundwater Demand				51,277
Banked Groundwater From Reasons Farms		88	3,151	277,288
Net Groundwater Banked				226,011

DETERMINATION OF SUFFICIENCY

The City of Roseville currently uses multiple sources of water, including, surface water, recycled water, and groundwater to serve existing and future customers. Roseville's long-standing policy is not to over allocate their contractual supplies. This means that the City Council will not effectuate a land use action without ensuring that a water supply exists for the proposed project. For projects who's implementation period extends past the 20-year planning horizon, they can be assured that the City has water set aside for the project, with a amount certain based on the adopted land use type for the various parcels.

Based upon the City's total projected water supplies for normal, single-dry, and multiple-dry years over a 20-year projection, as demonstrated by this WSA, the City has sufficient water to meet projected water demands for the Hewlett-Packard / Campus Oaks Mater Rezone & Master Plan Project. .